Feb. 23, 1960

A. E. JOEL, JR

2,925,957

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FIG. 19 FIG. 27 FIG. 37

FIG. 8 READER READER CONN.	FIG. 9 READER READER CONN.	FIG. 10 MOTOR CONTROL ALARM ALARM TIMING AND KEYS	FIG. 11 OFF NORMAL AND START	FIG. 12 OFF NORMAL AND START AND KEYS		
FIG. 14 READING RELAYS "C" "D"	FIG. 15 READING RELAYS "E" "F"	FIG. 16 READER STEP CHK. TRAFFIC REG. CONTROL SKIP ENTRY CONT.	FIG. 17 TAPE IDENTITY PROGRESS CONTROL	FIG. 18 SKIP SPLICE CONTROL		
FIG. 22 TAPE IDENTITY READING PROGRESS	FIG. 23 "E" DIGIT READING TRNSL. AND ASSEMBLING SEL.	FIG. 24 "F" DIGIT READING TRNSL. AND ASSEMBLING SEL.	FIG. 25 TAPE IDENTITY PROGRESS CONTROL	FIG. 26 READER STEP CONTROL LINE COUNT		
FIG. 32 RECORDER PROGRESS	FIG. 33 RECORDER TIME CONNECTOR	FIG. 34 RECORDER TIME CONNECTOR	FIG. 35 HOUR REGISTER CONTROL	FIG. 36 HOUR REGISTER CONTROL		
FIG. 41 DAY REGISTER	FIG. 42 RECORDER REGISTER	FIG. 43 RECORDER REGISTER	FIG. 44 HOUR REGISTER ODD	FIG. 45 HOUR REGISTER EVEN		
FIG. 49 DAY REG. UNITS OUTPUT CONN.	FIG. 50 ASSEMBLING REG. MULTIPLE AND CHECK RELAY CONN.	FIG. 51 HOUR DIFFERENCE CONN.	FIG. 52 HOUR OUTPUT CONN. ODD	FIG. 53 HOUR OUTPUT CONN. EVEN		
FIG. 55 ASSEMBLING REGISTER CHECK RELAYS	FIG. 56 ASSEMBLING REGISTER NO. 99	FIG. 57 ASSEMBLING REGISTER NO. 99	FIG. 58 RECORDER HOUR DAY RESET DAY REGISTER CONTROL	FIG. 59 PERF. CONTR. SPLICE PATT. TIMER WINDOW LOCKOUT CONTROL		
FIG. 61 ANS. DISC. CONN. ASSEMBLING REG. CONN. CONTR. ASSEM. RESTART	FIG. 62 ASSEMBLING REGISTER NO. 00	FIG. 63 ASSEMBLING REGISTER NO. 00	FIG. 64 PERF. LINE COUNT COMMON OUTPUT CONN.	FIG. 65 COMMON CLASS TRANSLATOR		
FIG. 7 READER READER CONN.	FIG. 13 READING RELAYS "A" "B"	FIG. 21 TAPE IDENTITY READING PROGRESS	FIG. 31 DAY PROGRESS	FIG. 40 DAY REGISTER	FIG. 48 DAY REG. TENS OUTPUT CONN.	FIG. 54 ASSEMBLING REGISTER CHECK RELAYS	FIG. 60 DISCONN. DAY TRNSL. "B" ANSWER DAY TRNSL. "B"

FIG. 2

FIG. 1

FIG. 2	FIG. 3	FIG. 6
FIG. 4	FIG. 5	

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FIG. 3

FIG. 19 RECORDER REG. CONTROL STRADDLE CLASS CONTROL	FIG. 20 BILLING INDEX TRANSLATOR SINGLE MESSAGE UNIT FORMULA		FIG. 29 CHARGEABLE TIME TENS TRANSLATOR	FIG. 30 CHARGEABLE TIME UNITS TRANSLATOR
FIG. 27 READER STEP CONTROL LINE COUNT	FIG. 28 MESSAGE UNIT FORMULA CONN. MESSAGE UNIT FORMULA		FIG. 39 MESSAGE UNIT TYPE TRANSLATOR	
FIG. 37 MESSAGE TENS TRANSLATOR	FIG. 38 MESSAGE UNITS TRANSLATOR		FIG. 46 MESSAGE UNIT TYPE TRANSLATOR	FIG. 47 MESSAGE UNIT TYPE TRANSLATOR

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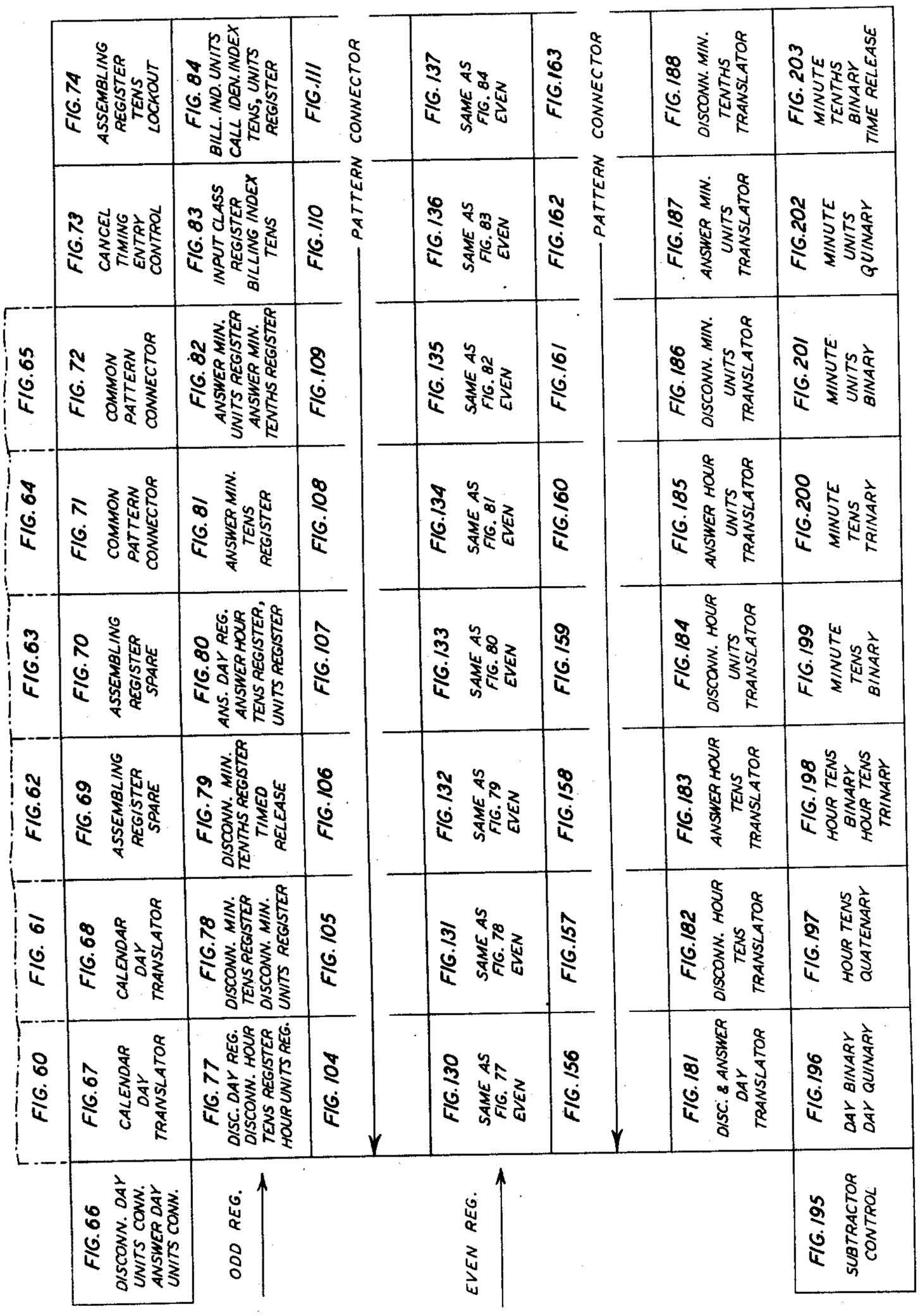

FIG. 4

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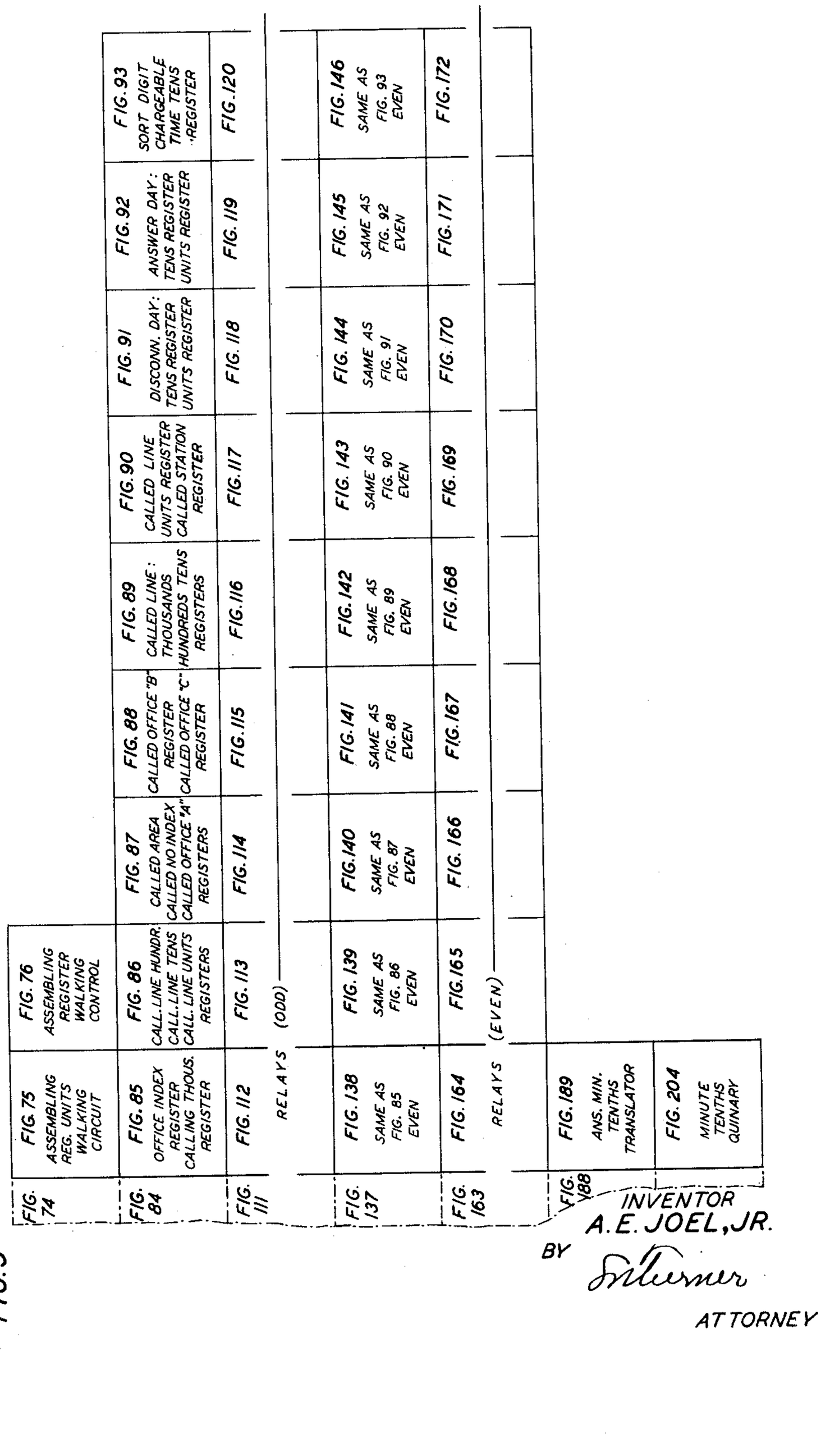

FIG. 5

INVENTOR
A. E. JOEL, JR.
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Silverman
ATTORNEY

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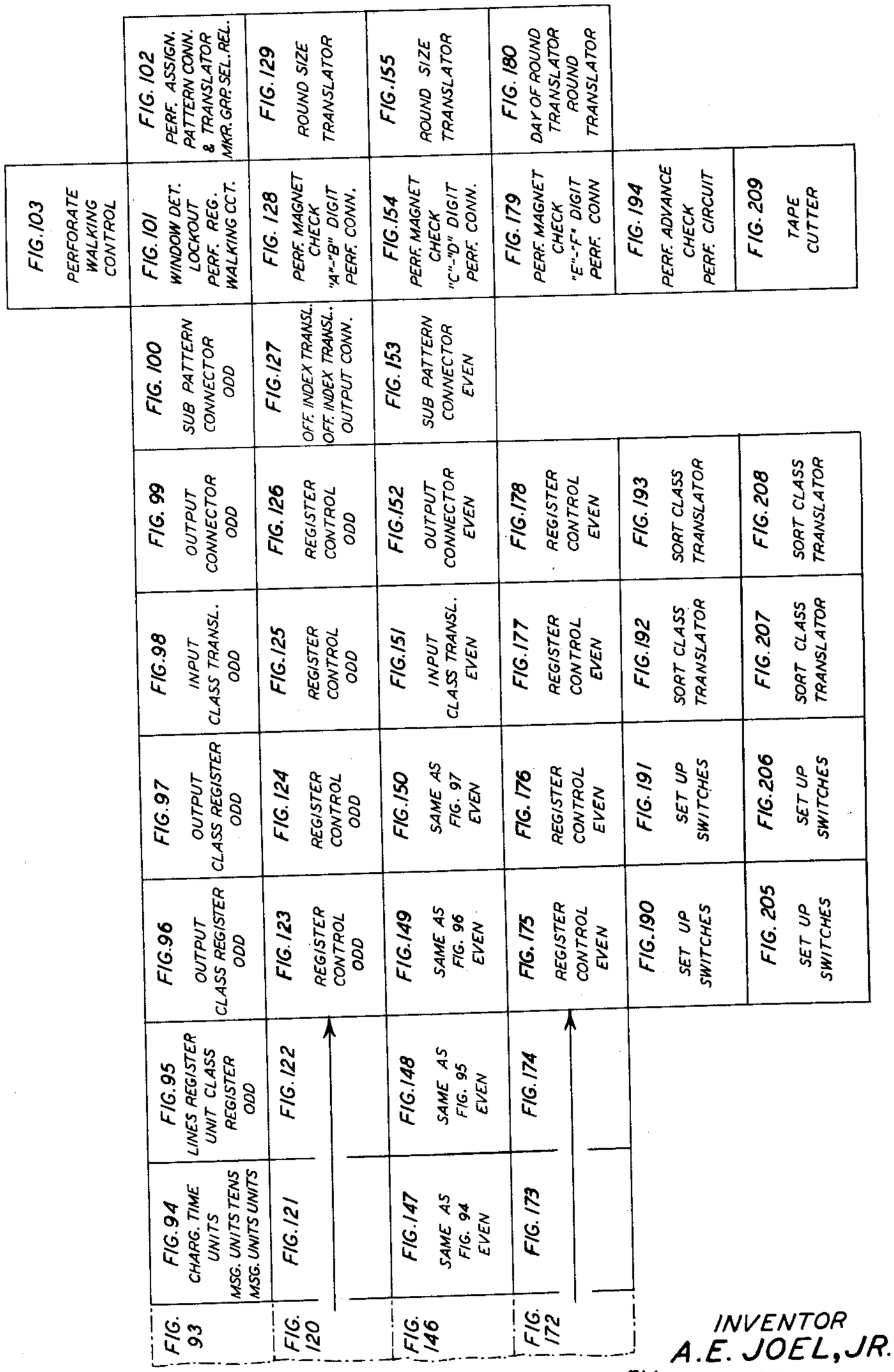

FIG. 6

INVENTOR
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ATTORNEY

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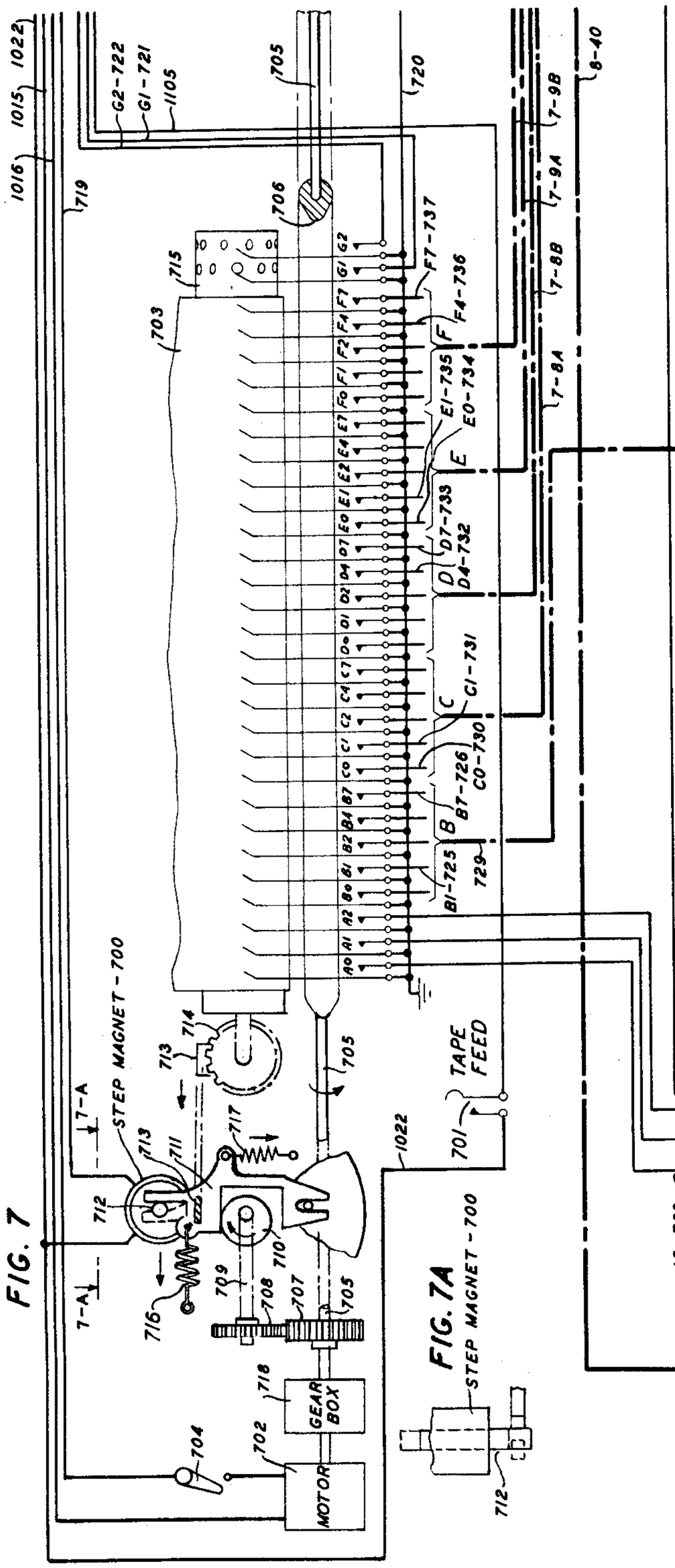
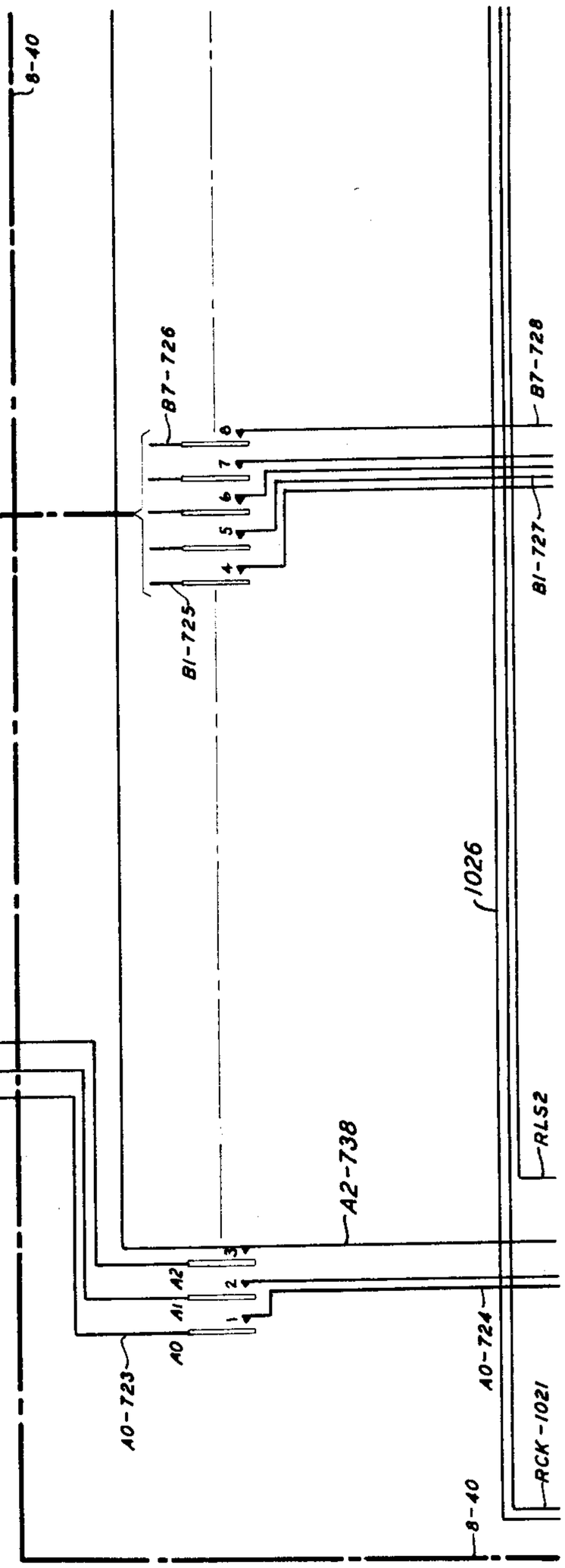


FIG. 7

FIG. 7A



INVENTOR
A. E. JOEL, JR.
BY
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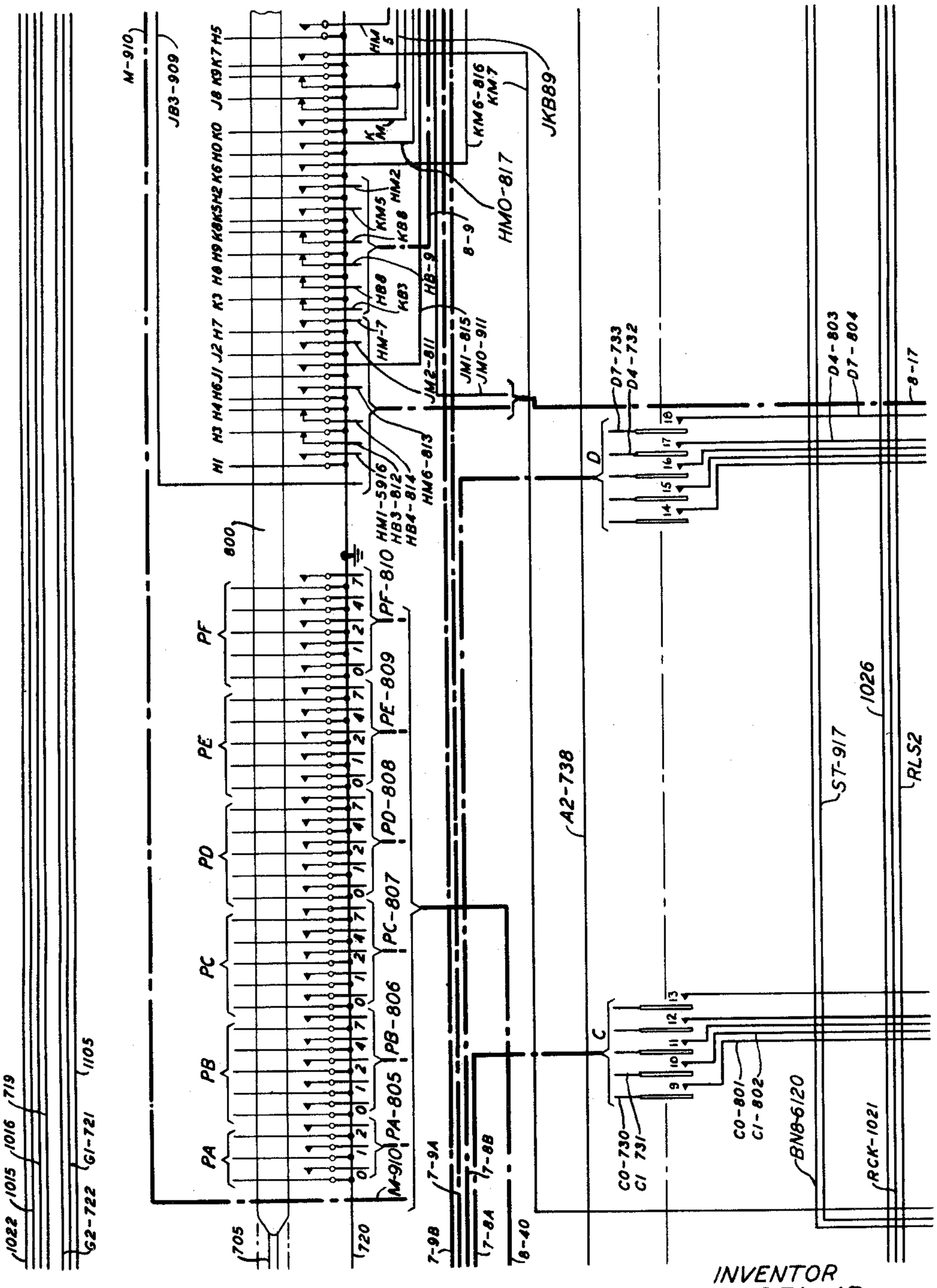

FIG. 8

INVENTOR
A. E. JOEL, JR.
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ATTORNEY

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A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

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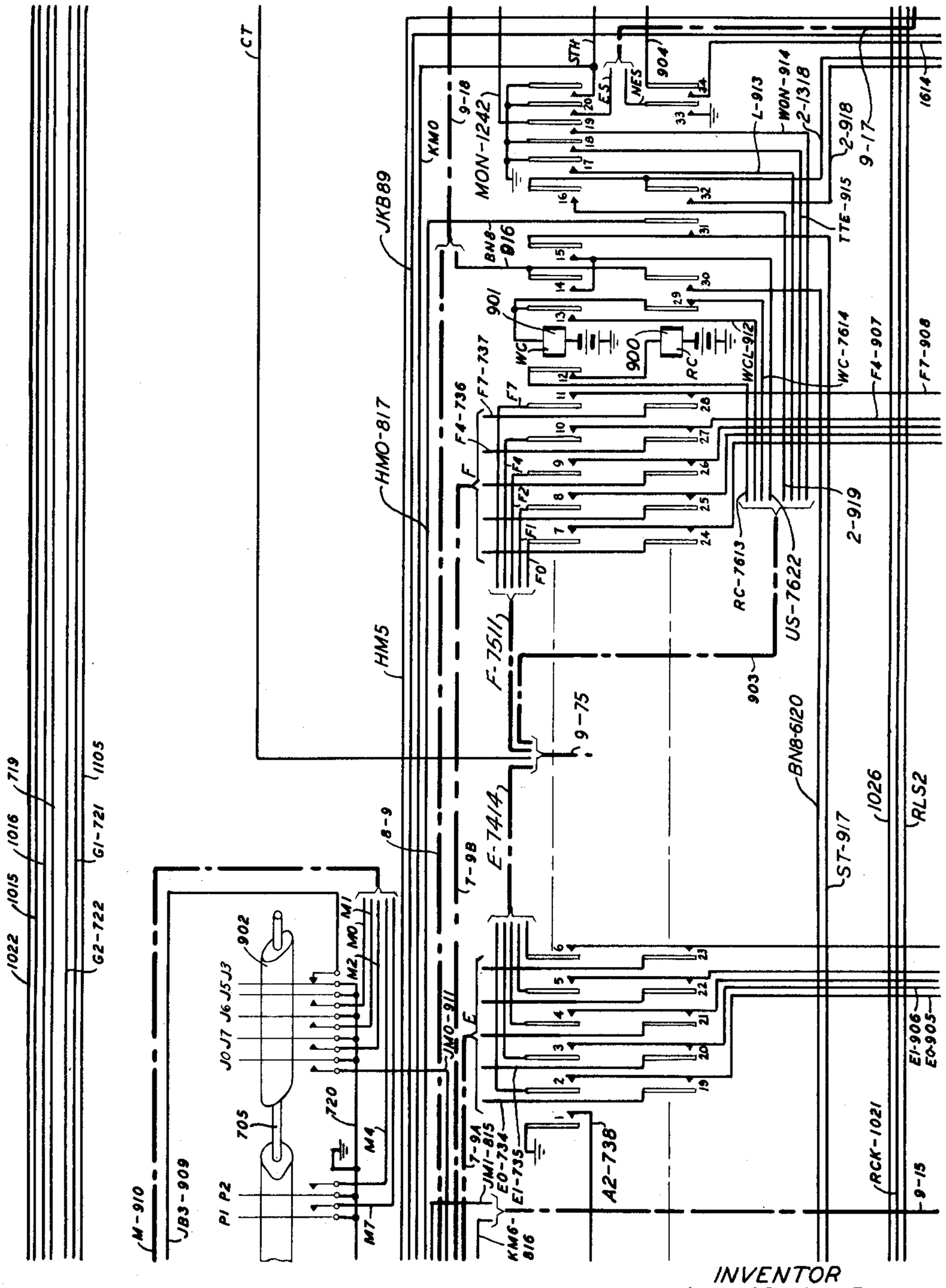

FIG. 9

INVENTOR
A. E. JOEL, JR.
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S. Turner
ATTORNEY

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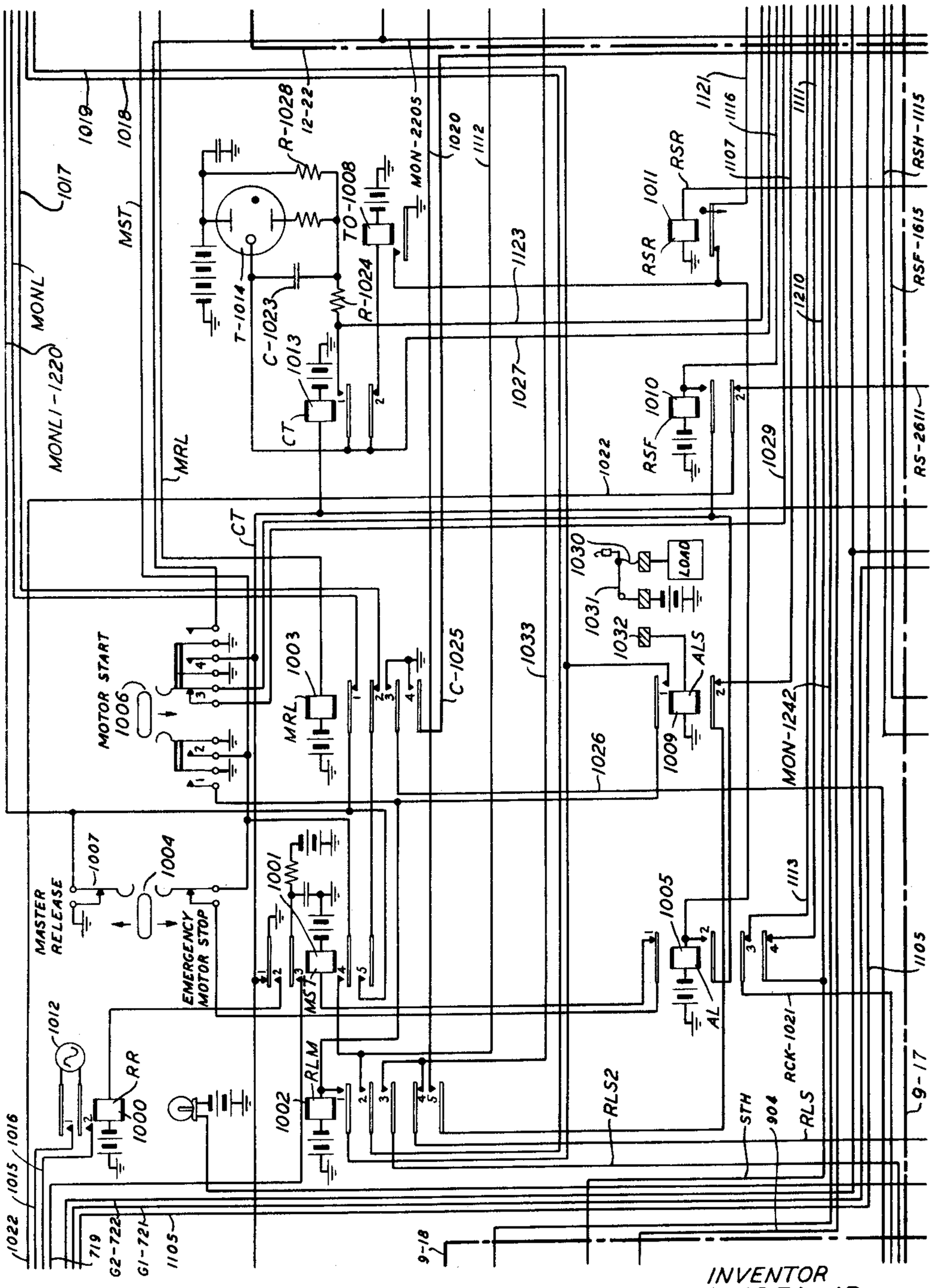

FIG. 10

INVENTOR
A. E. JOEL, JR.
BY Schurmer
ATTORNEY

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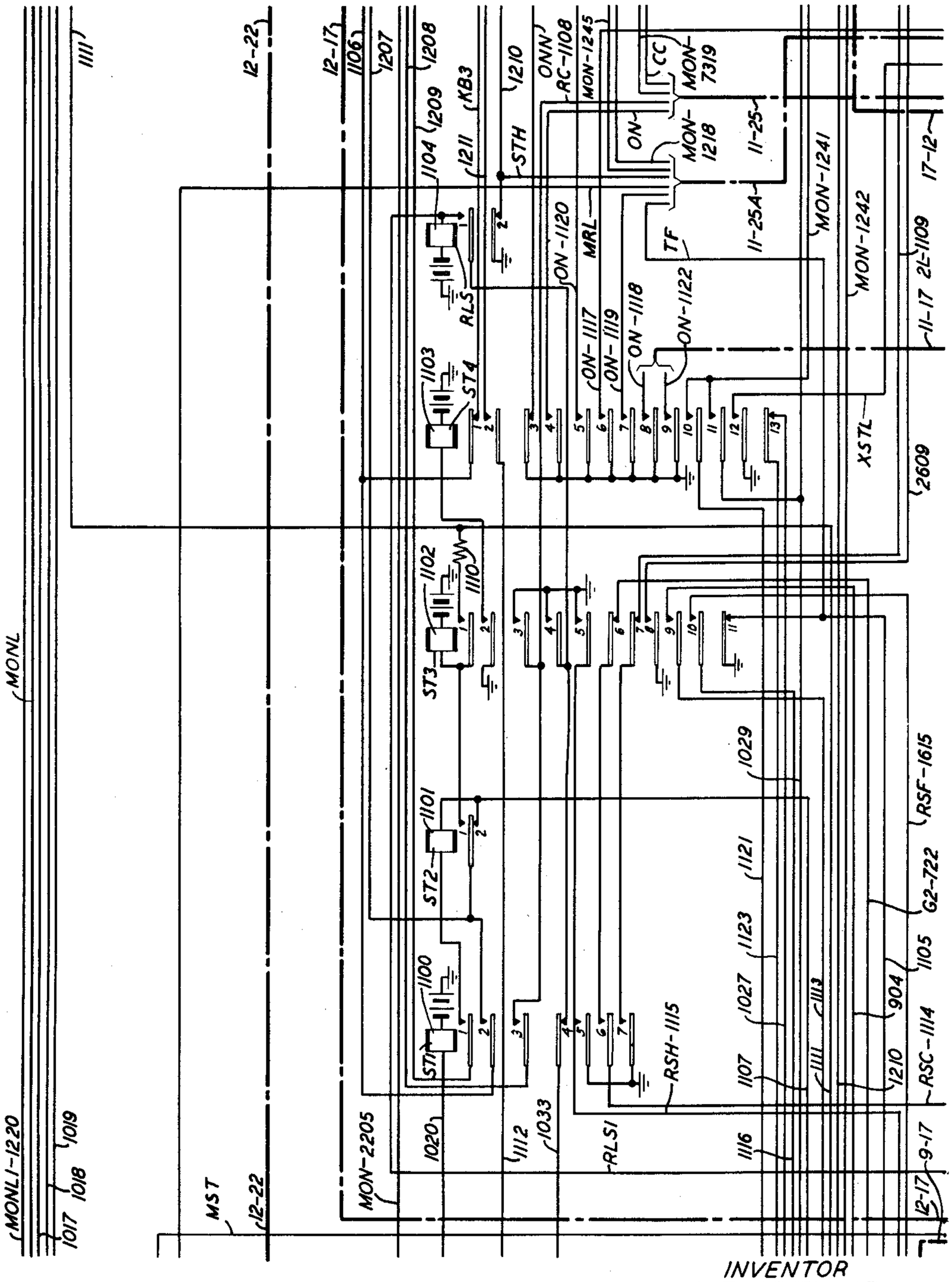

FIG. 11

INVENTOR
A. E. JOEL, JR.
BY Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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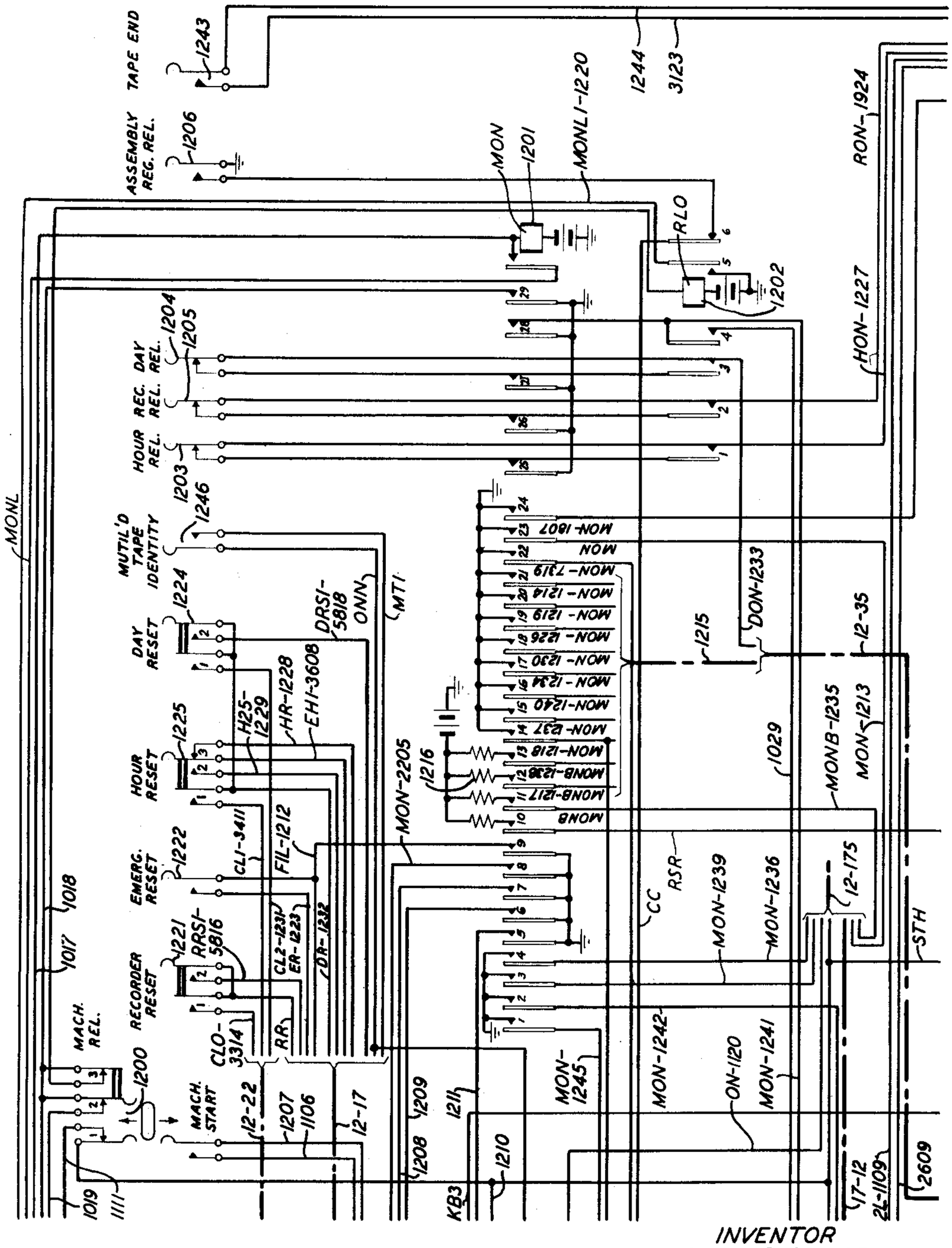

FIG. 12

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

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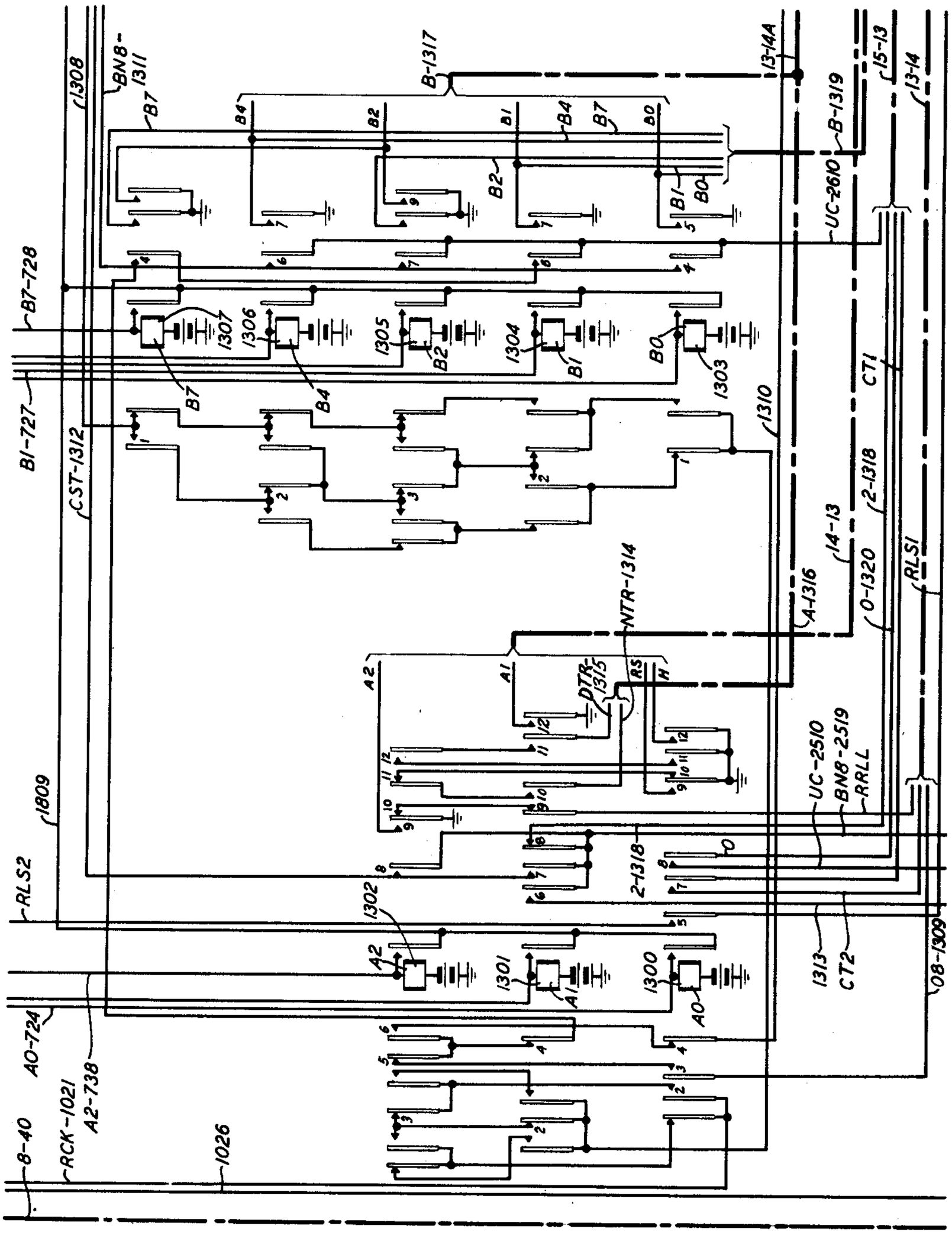

FIG. 13

INVENTOR
A.E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

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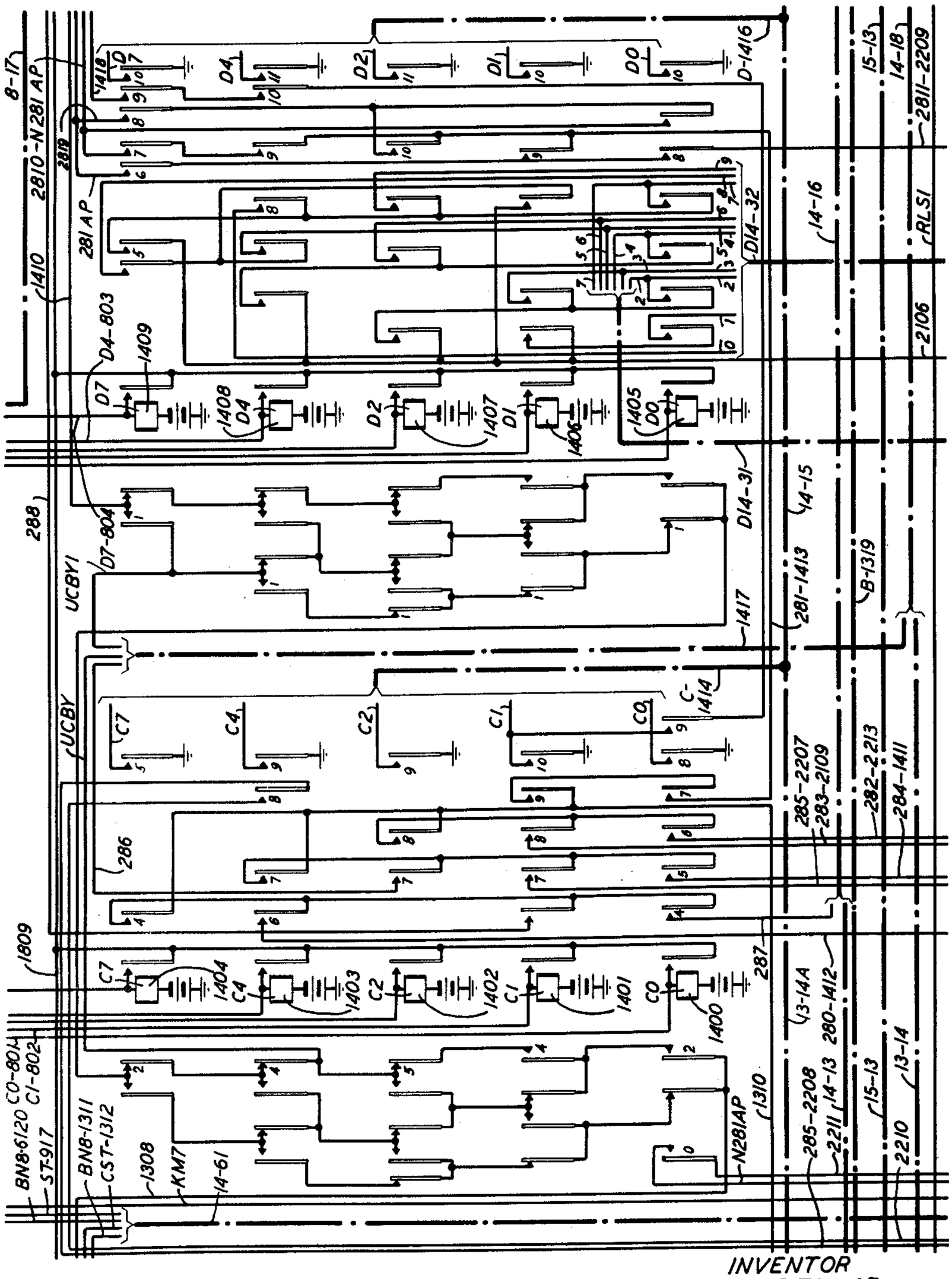

FIG. 14

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

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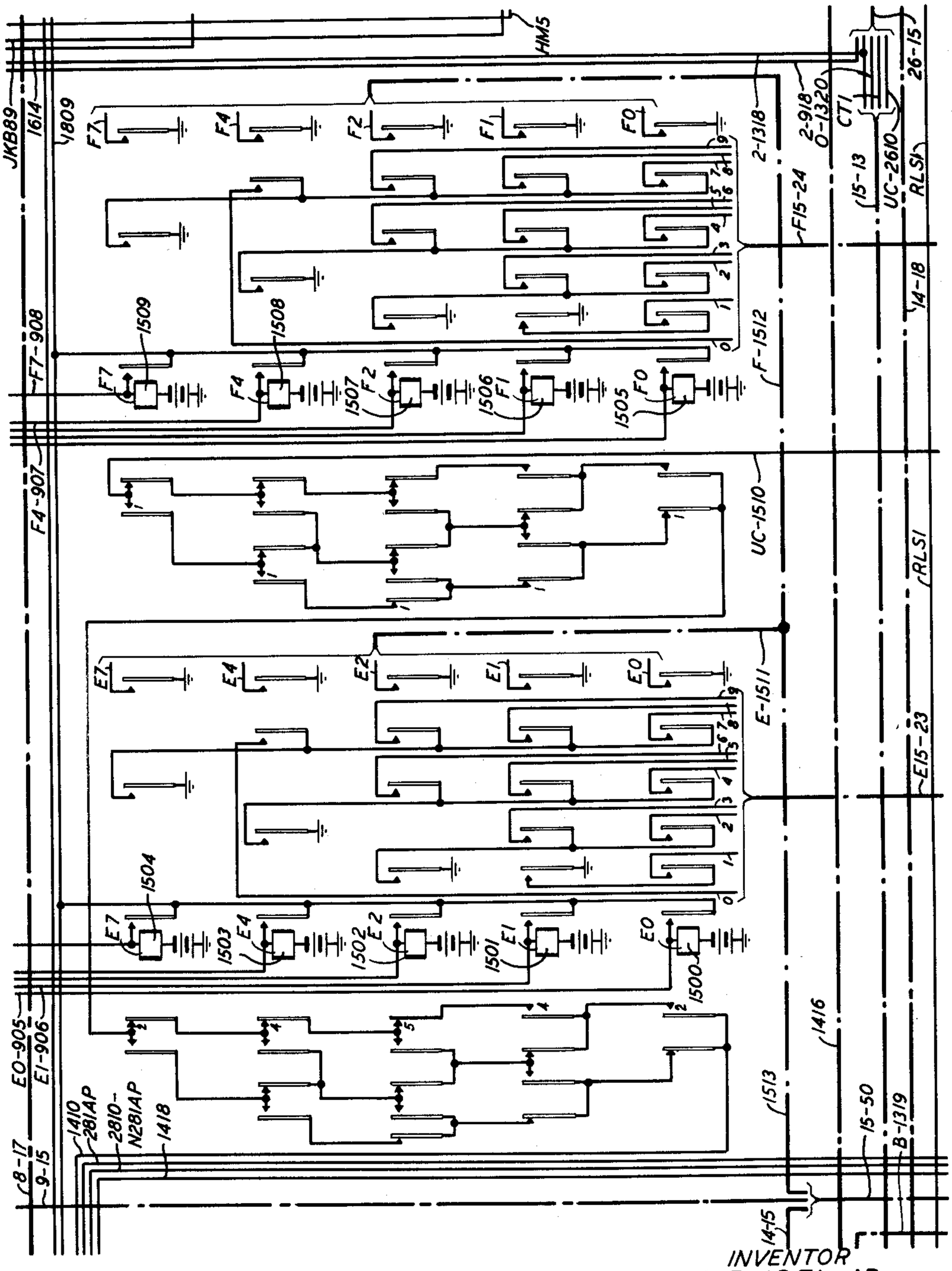

FIG. 15

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

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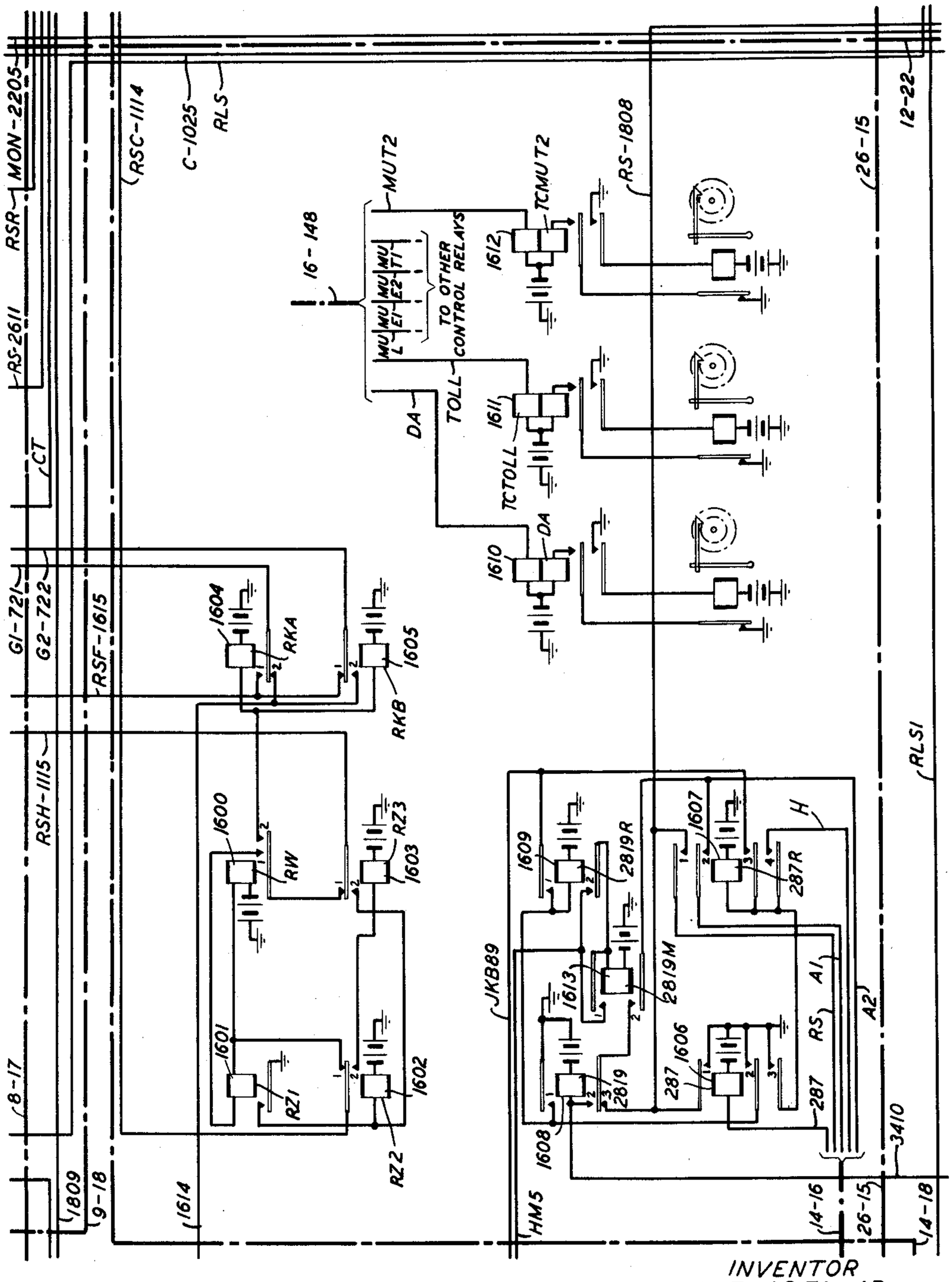

FIG. 16

INVENTOR
A. E. JOEL, JR.
BY
Schlesinger
ATTORNEY

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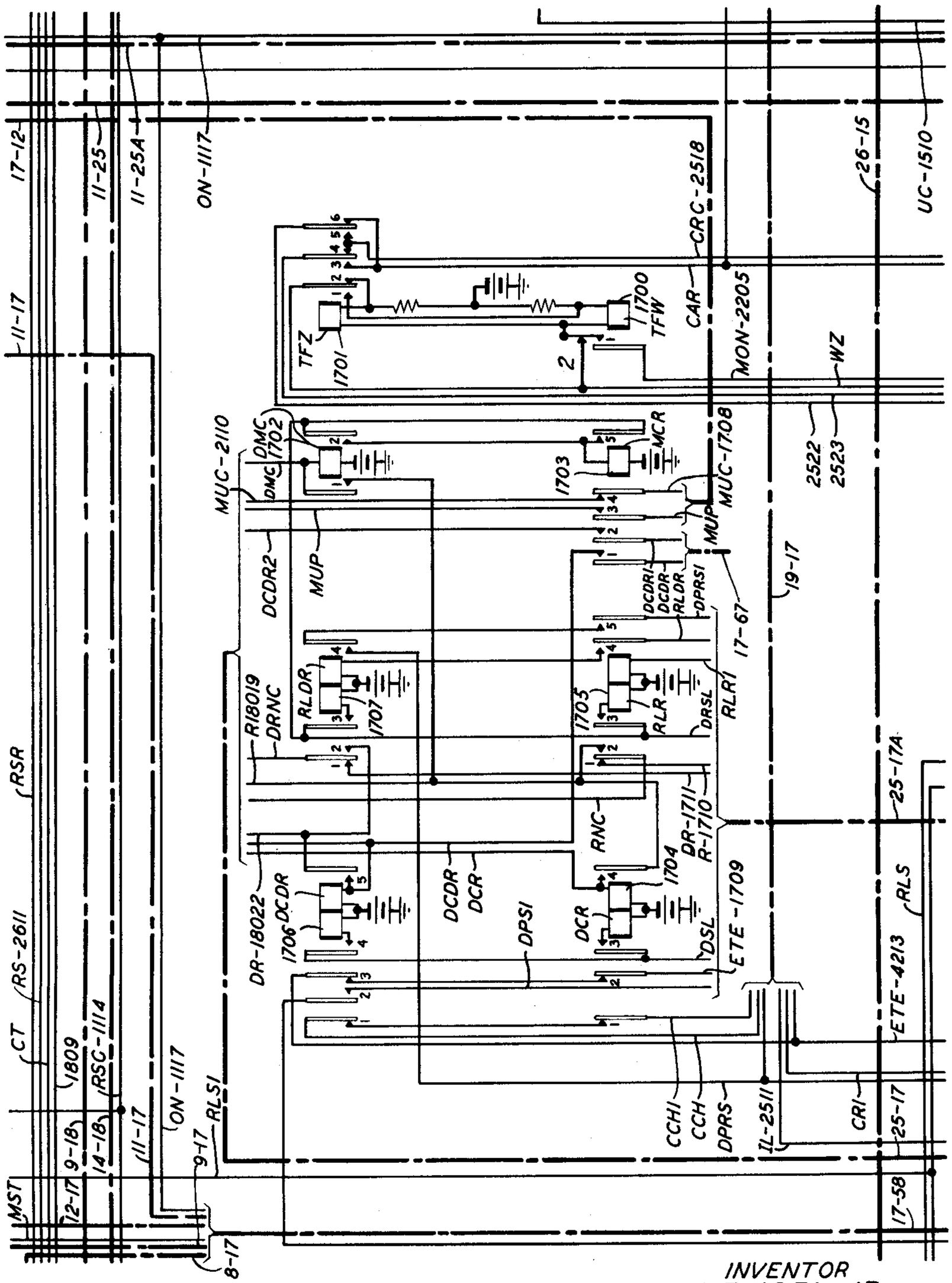

FIG. 17

INVENTOR
A.E.JOEL, JR.
BY
Schlesinger
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

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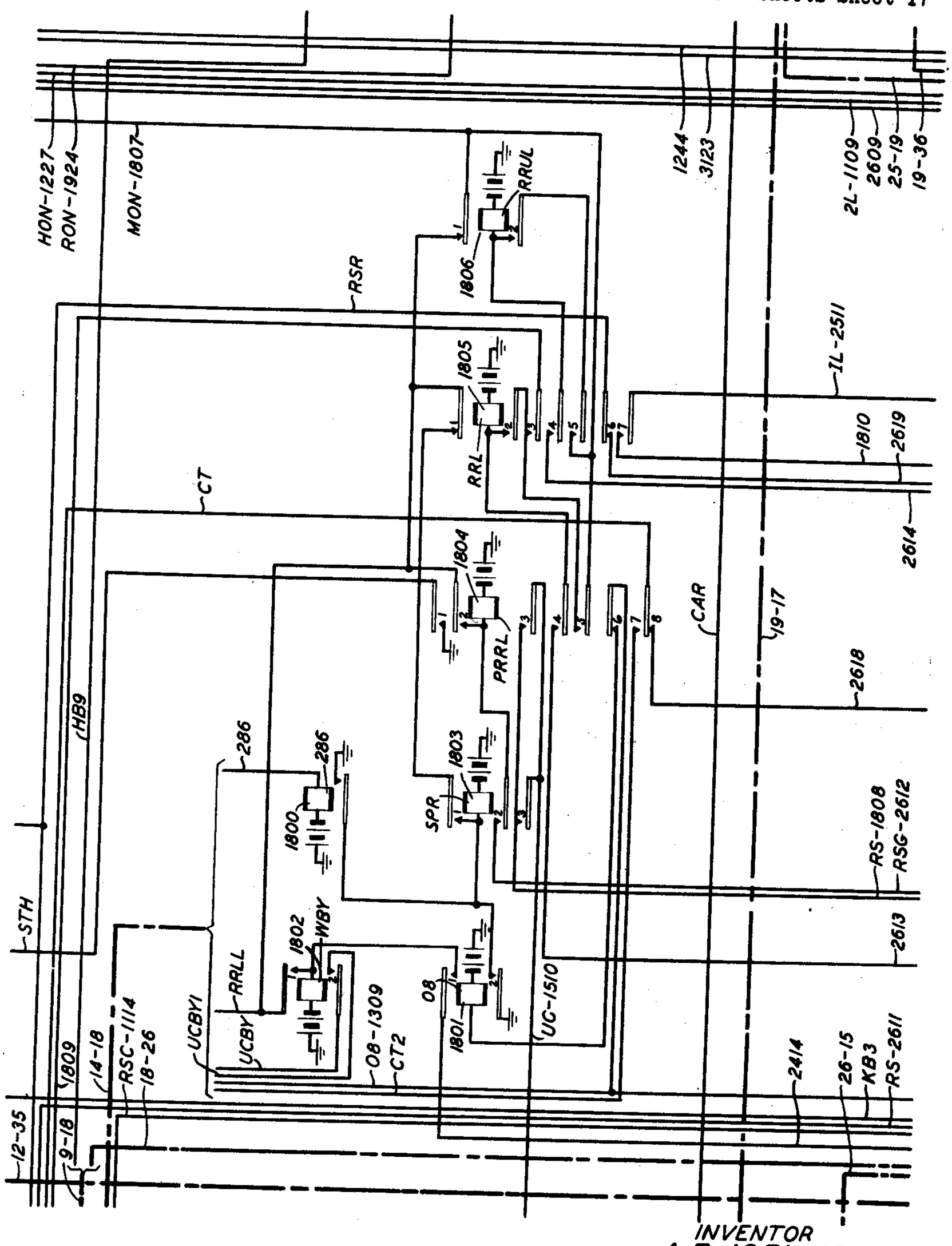

FIG. 18

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

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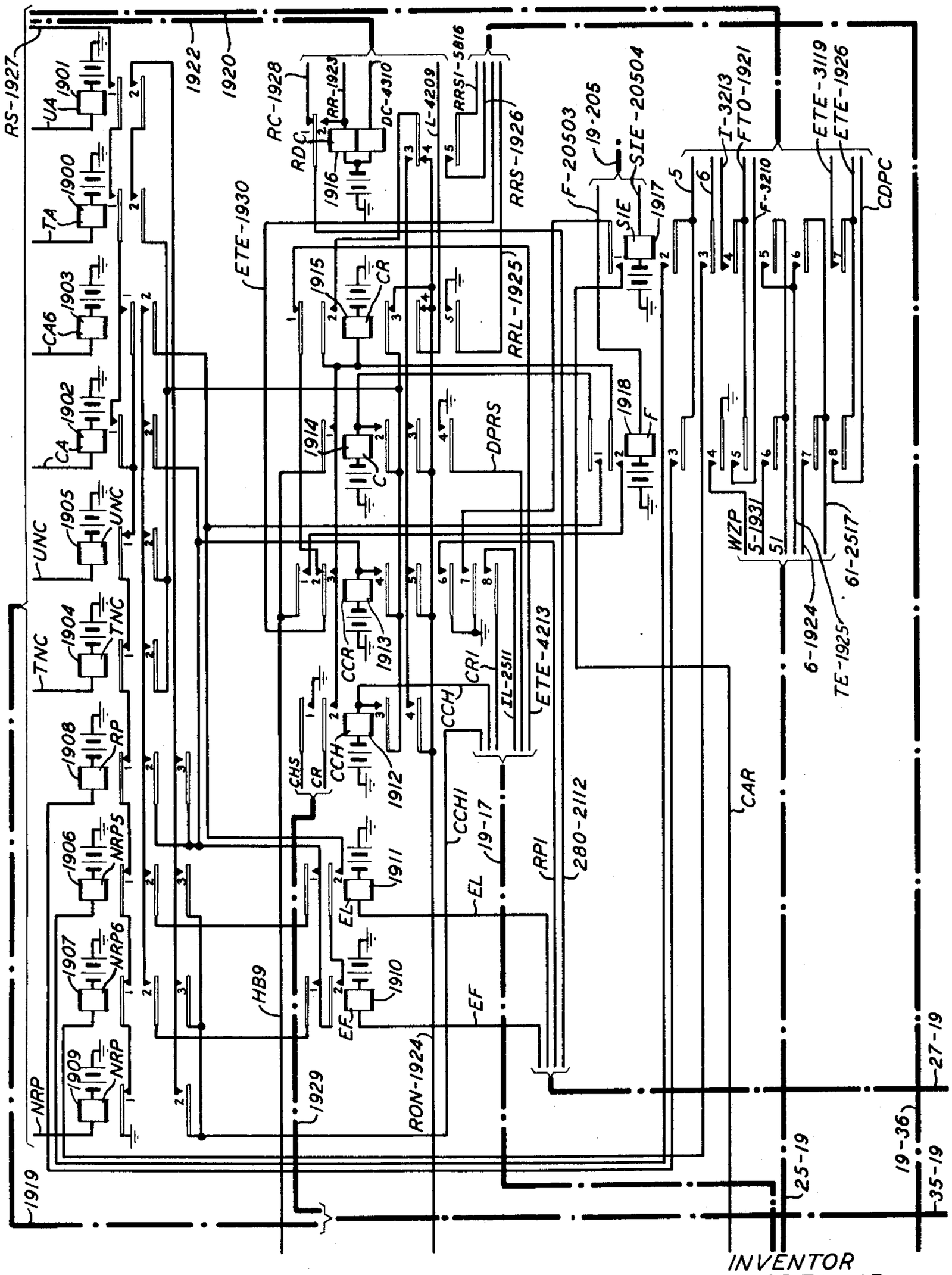

FIG. 19

INVENTOR
A.E. JOEL, JR.
BY
Schlesinger
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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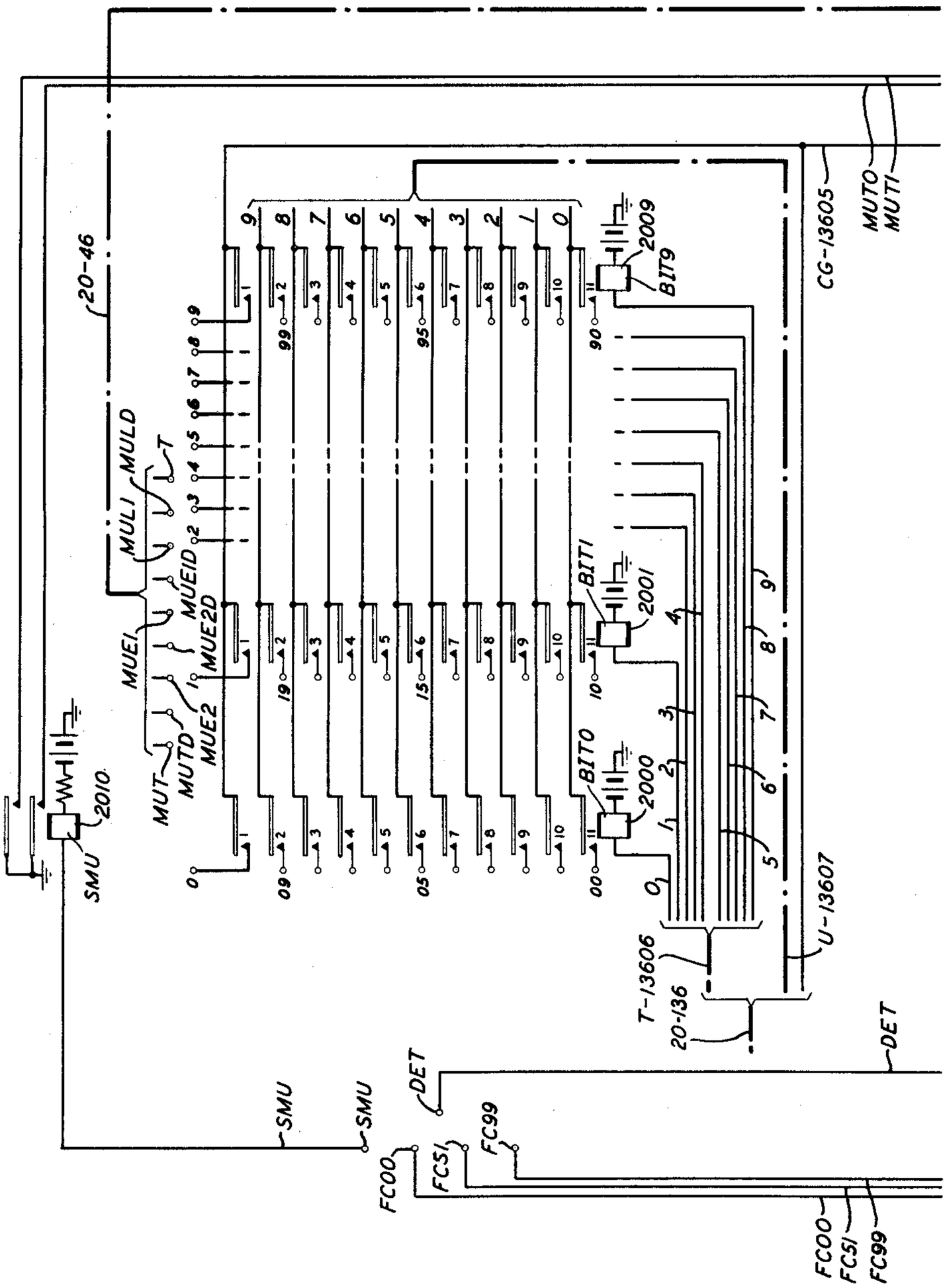

FIG. 20

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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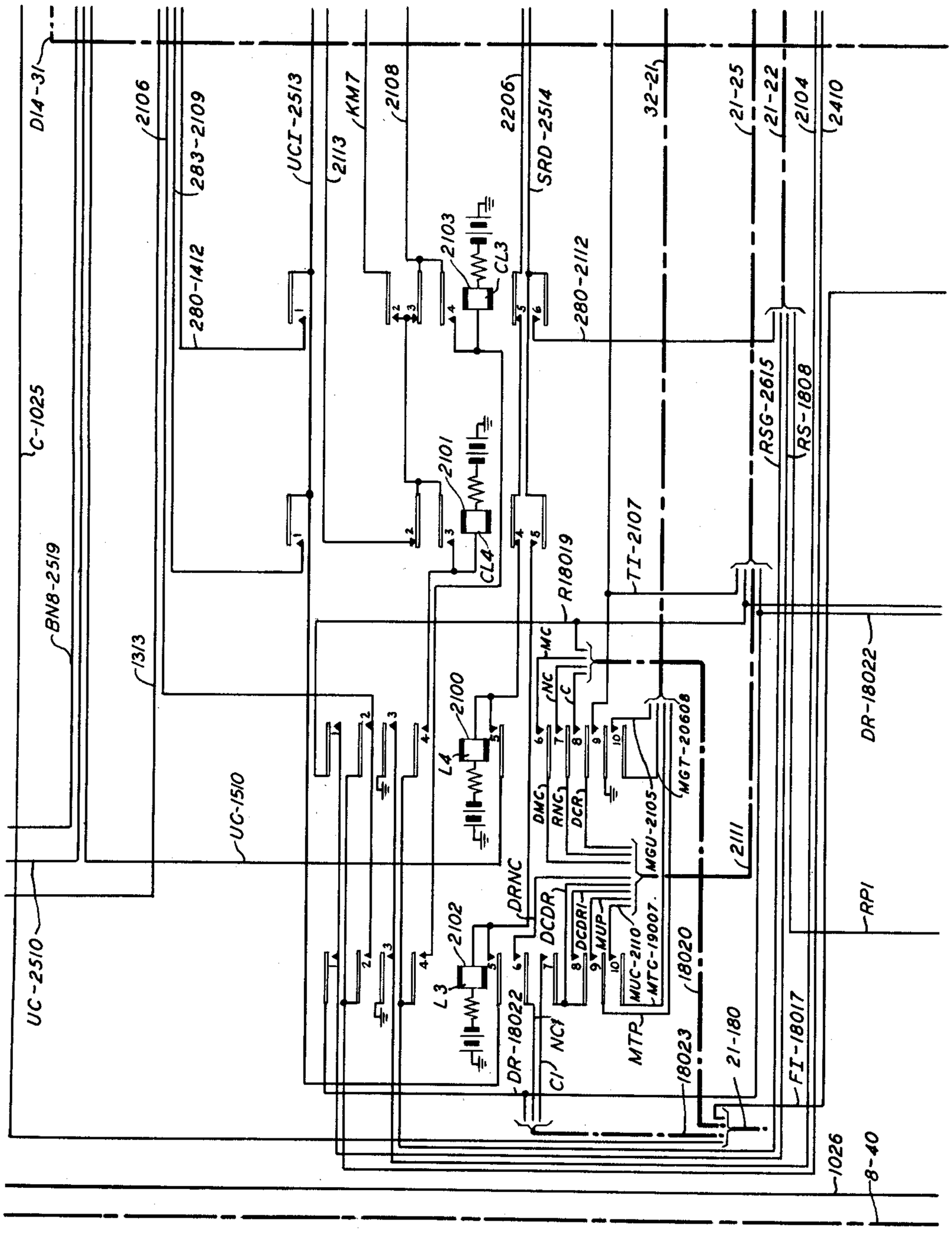

FIG. 21

INVENTOR
A. E. JOEL, JR.
BY
Sklerner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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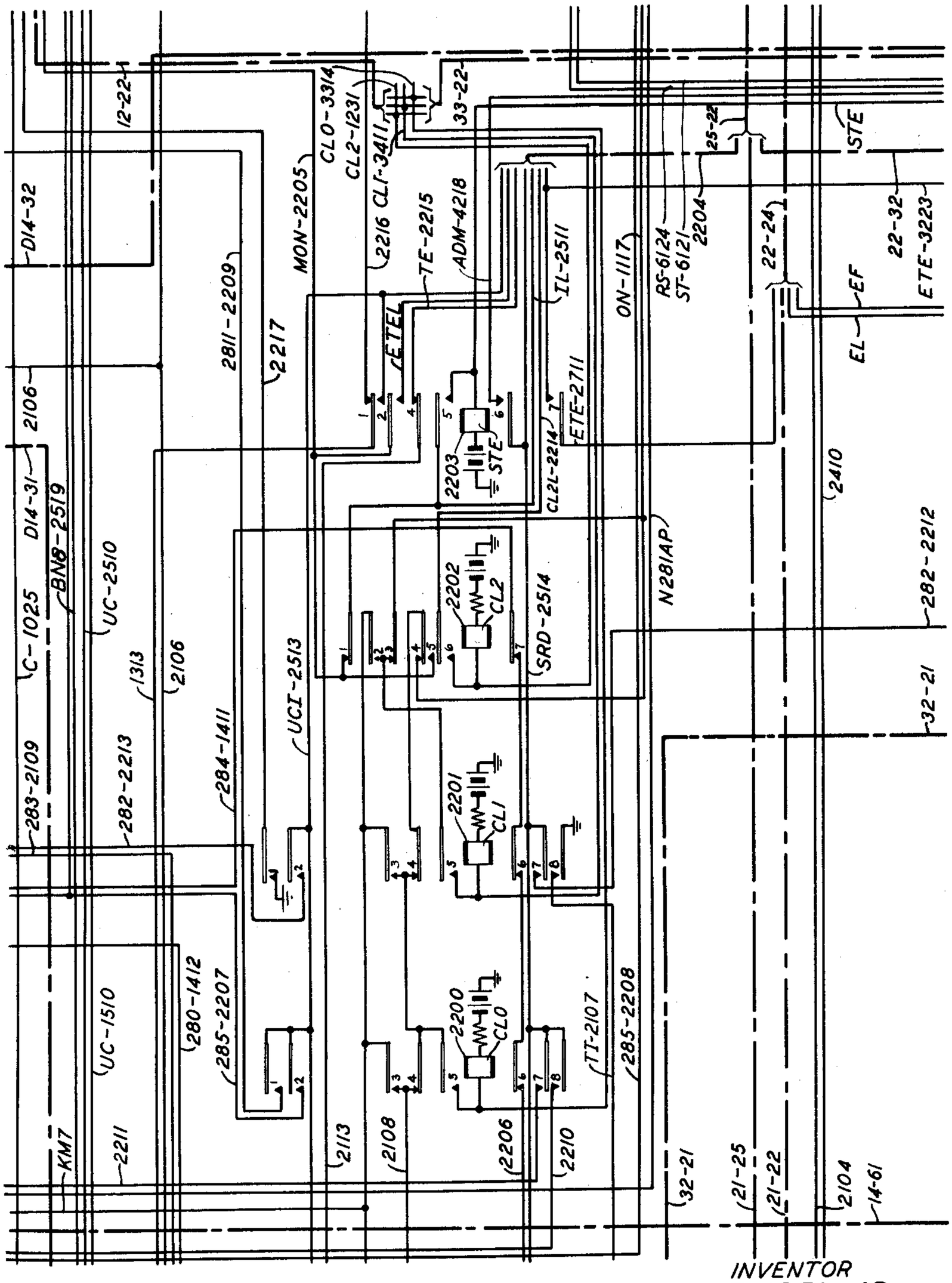

FIG. 22

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

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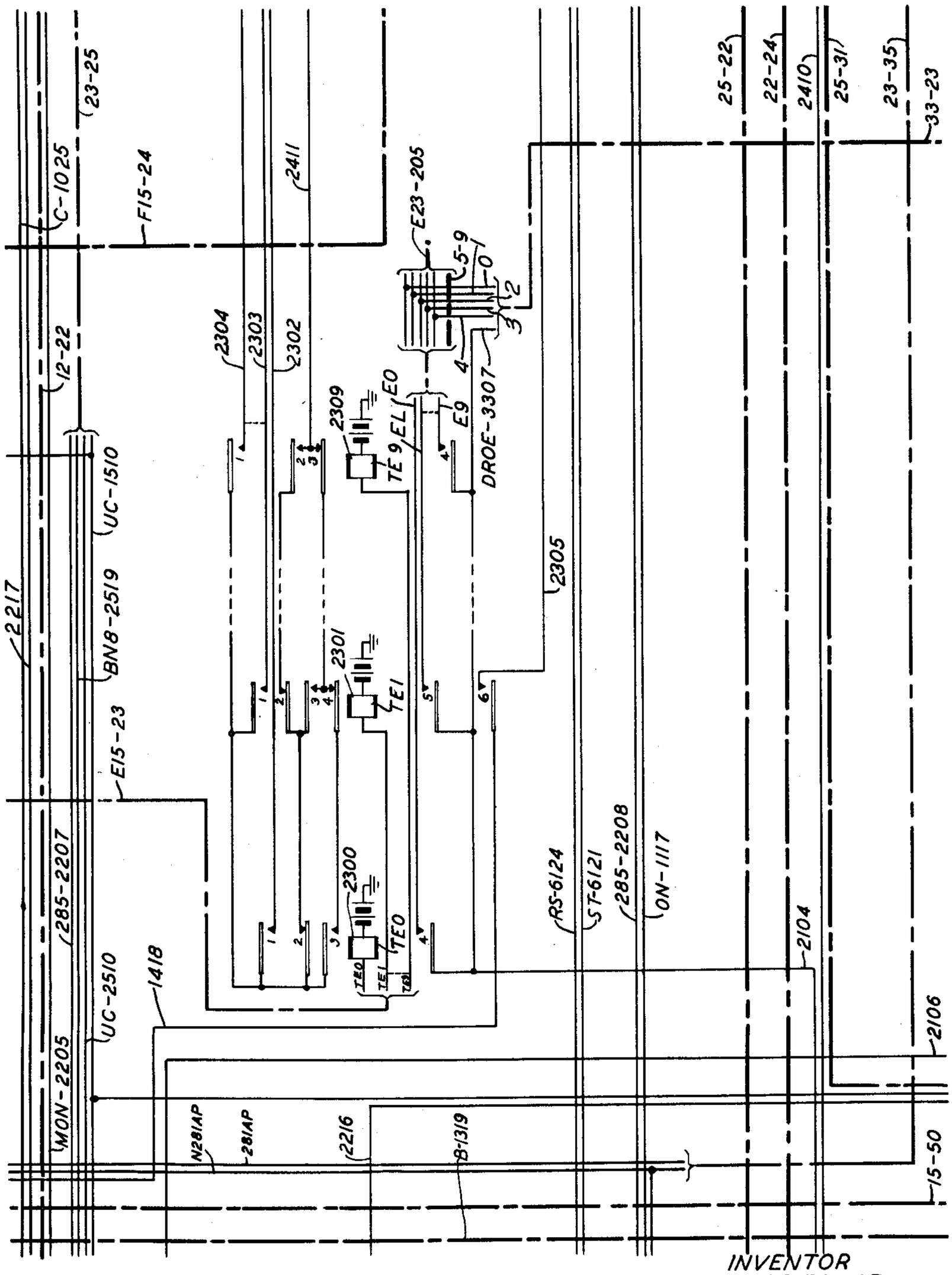

FIG. 23

INVENTOR
A.E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

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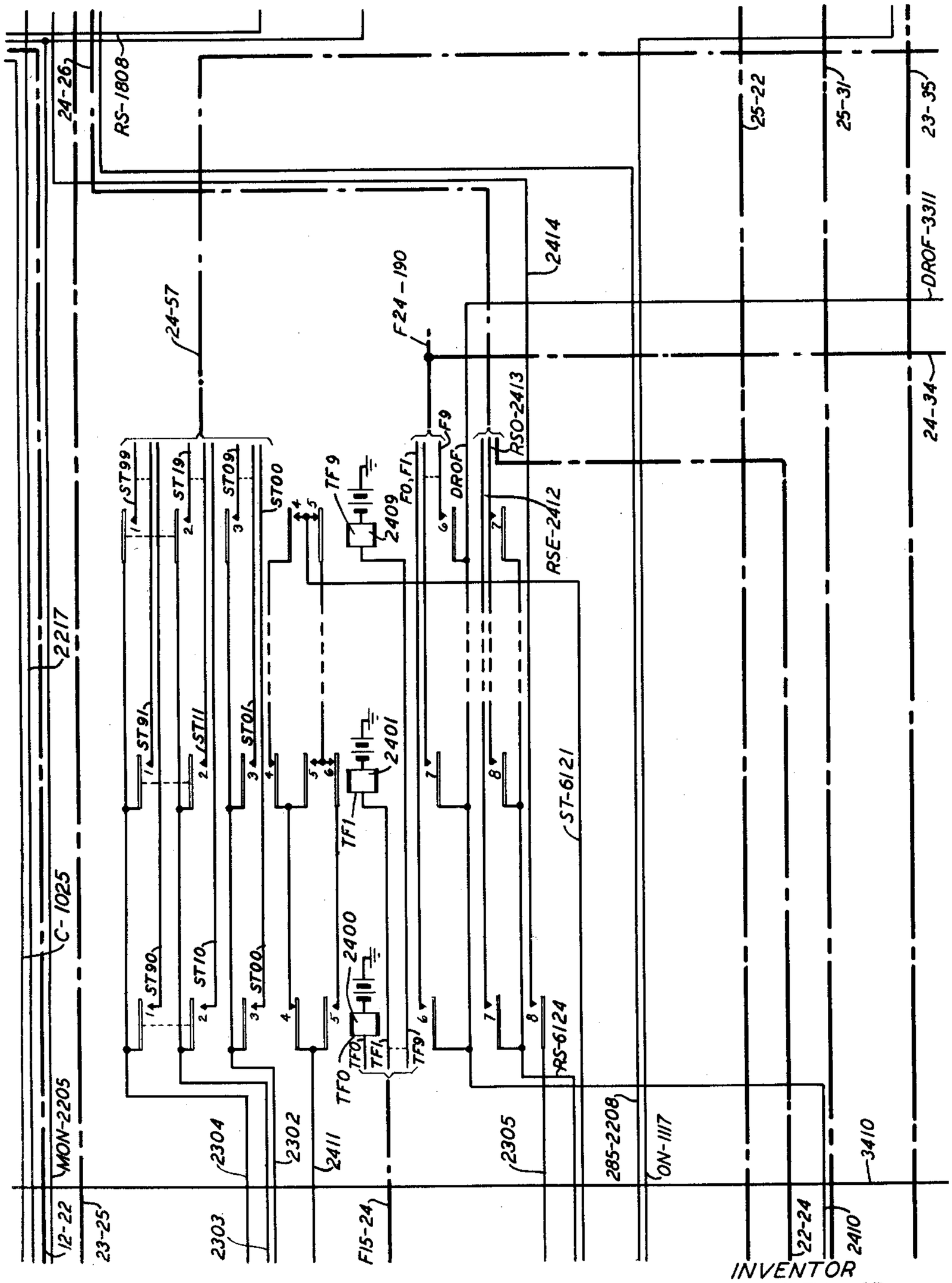

FIG. 24

INVENTOR
A. E. JOEL, JR.
BY
Schlesinger
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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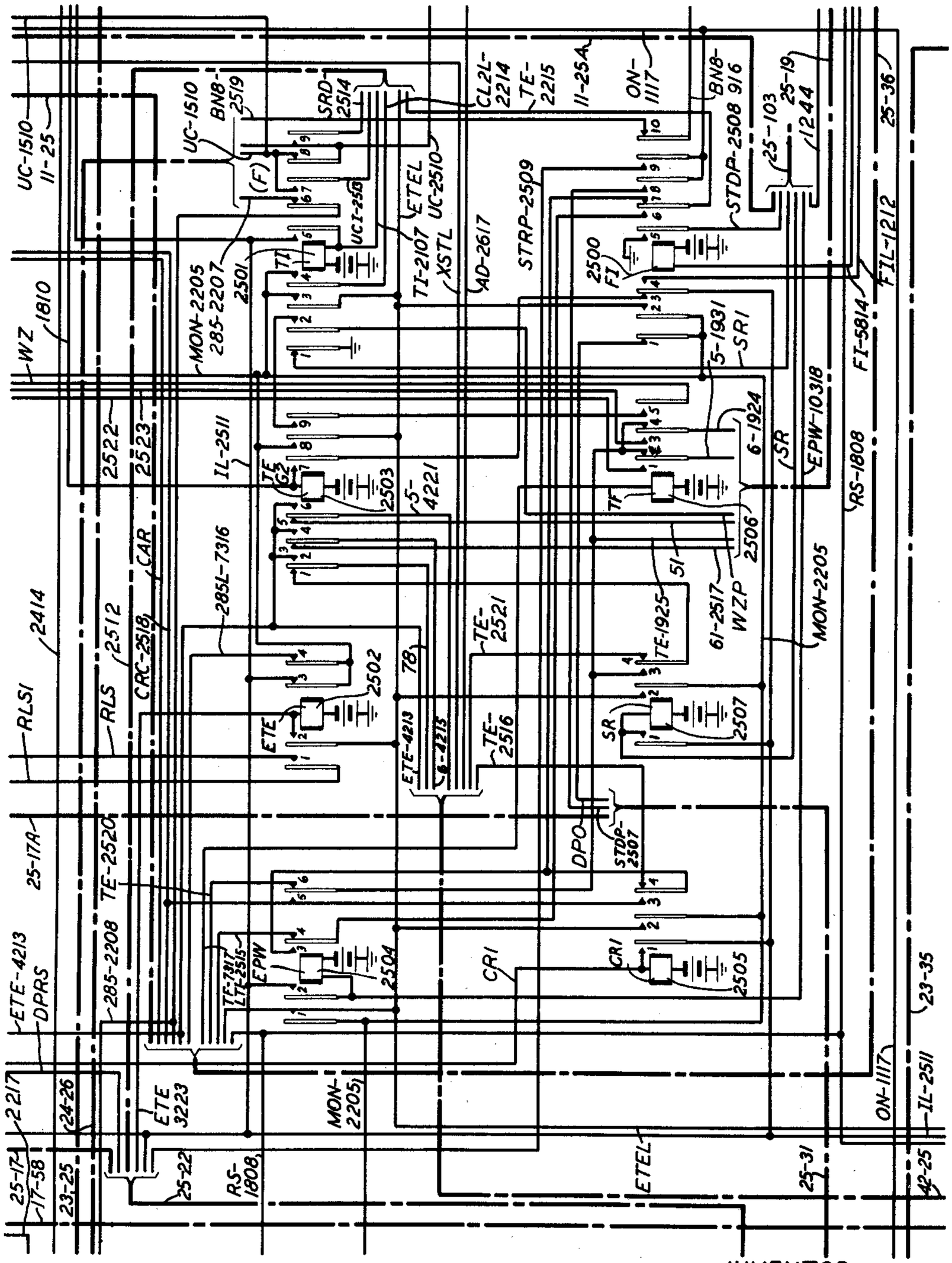

FIG. 25

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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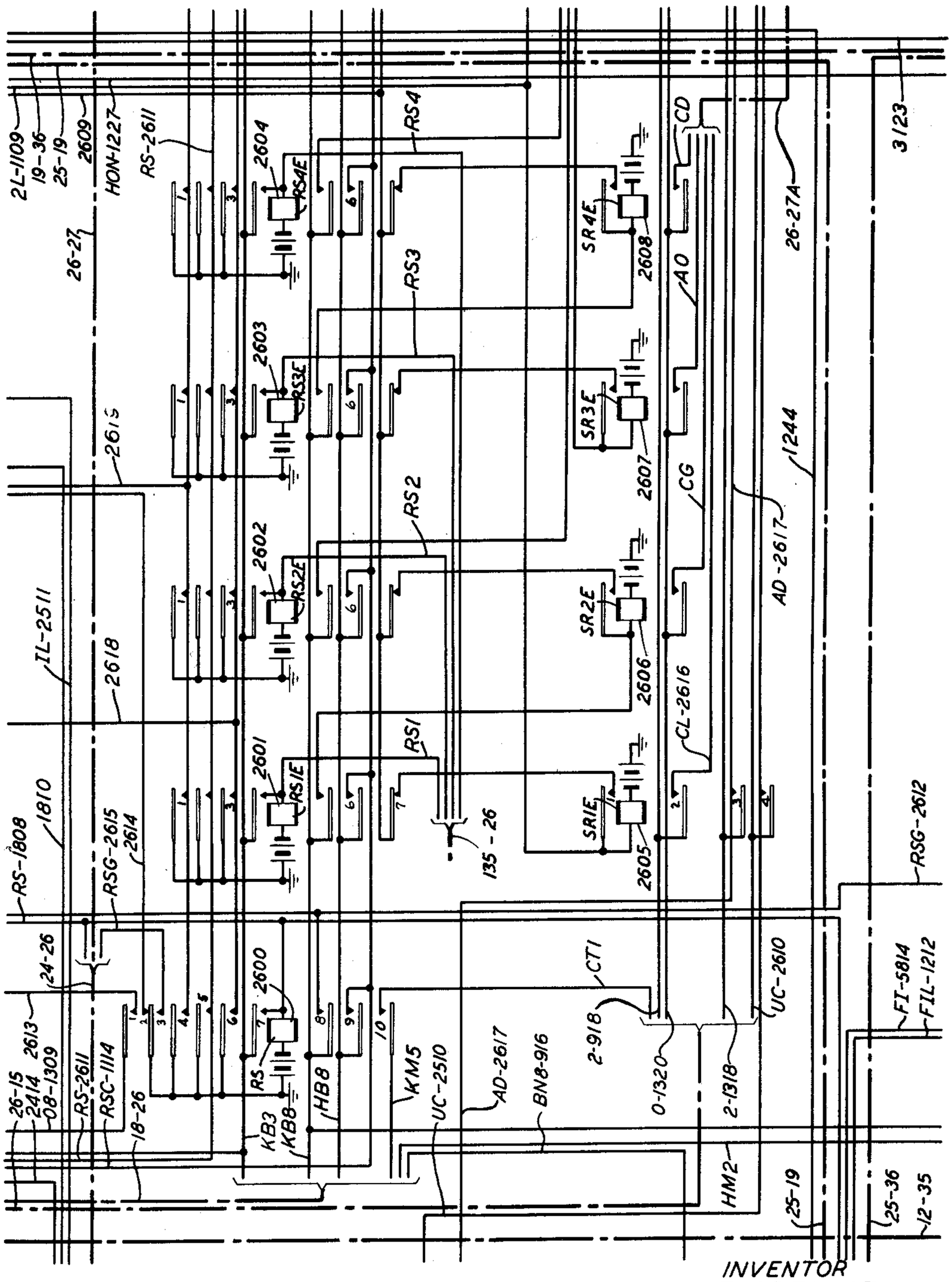

FIG. 26

INVENTOR
A. E. JOEL, JR.
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ATTORNEY

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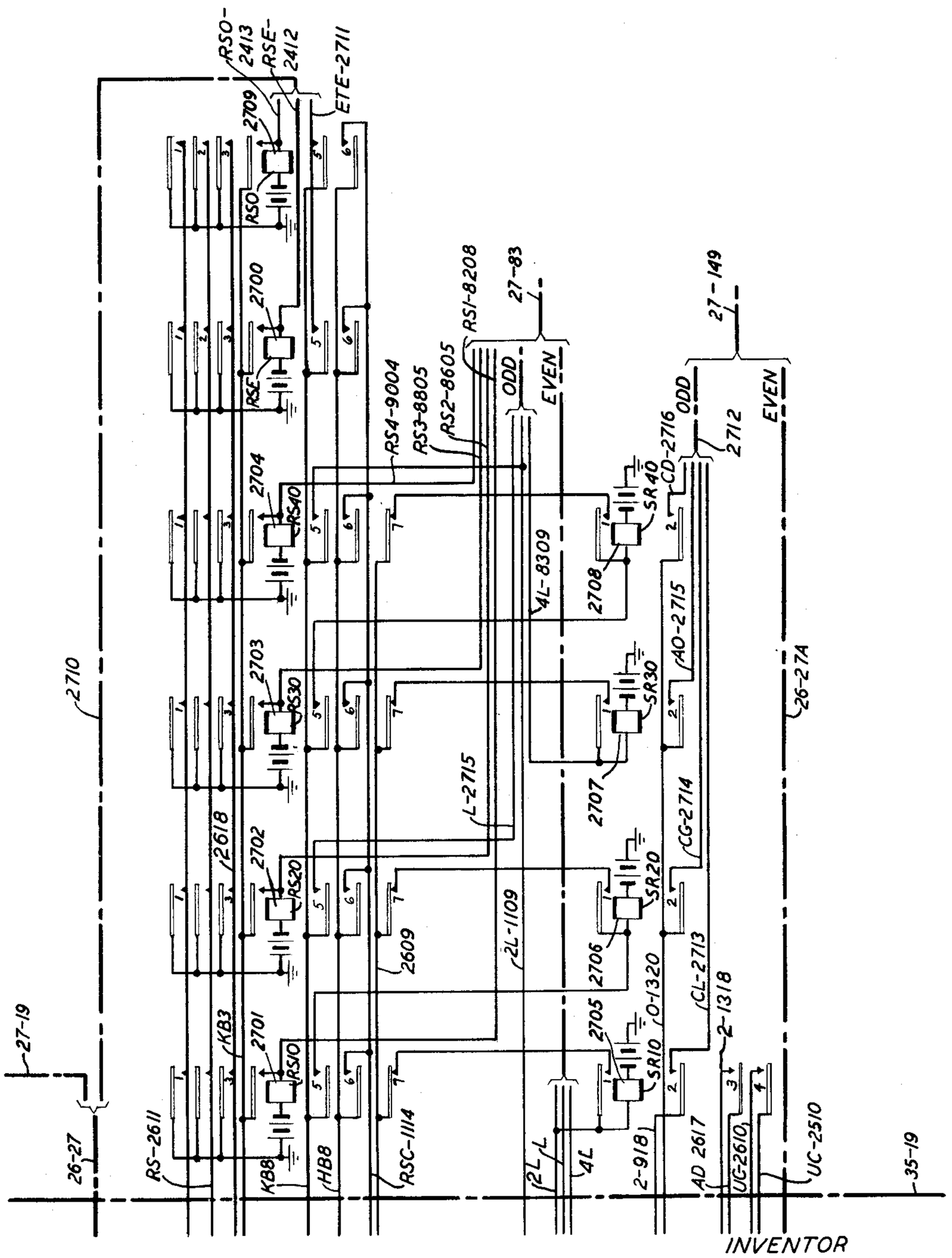

FIG. 27

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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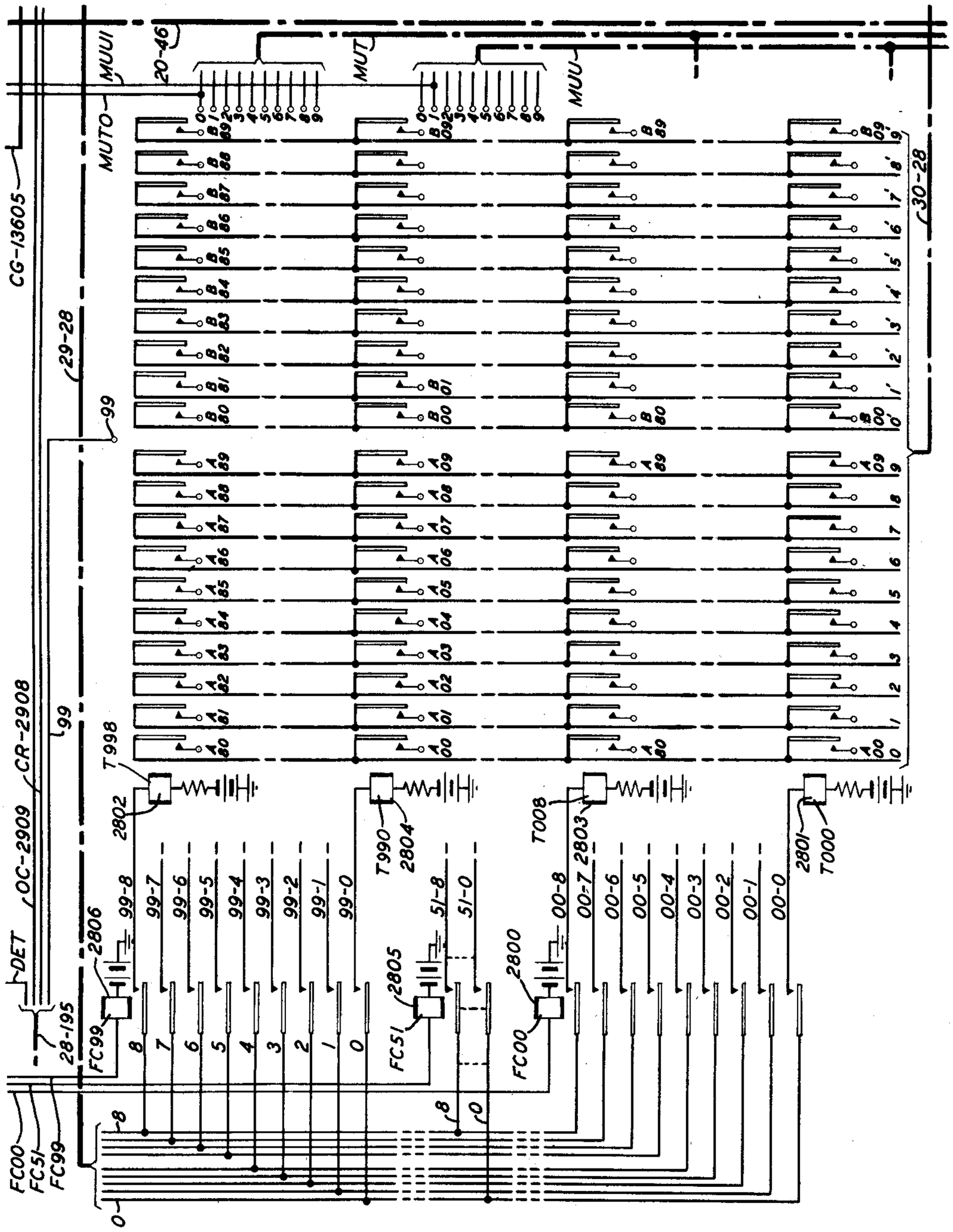

FIG. 28

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

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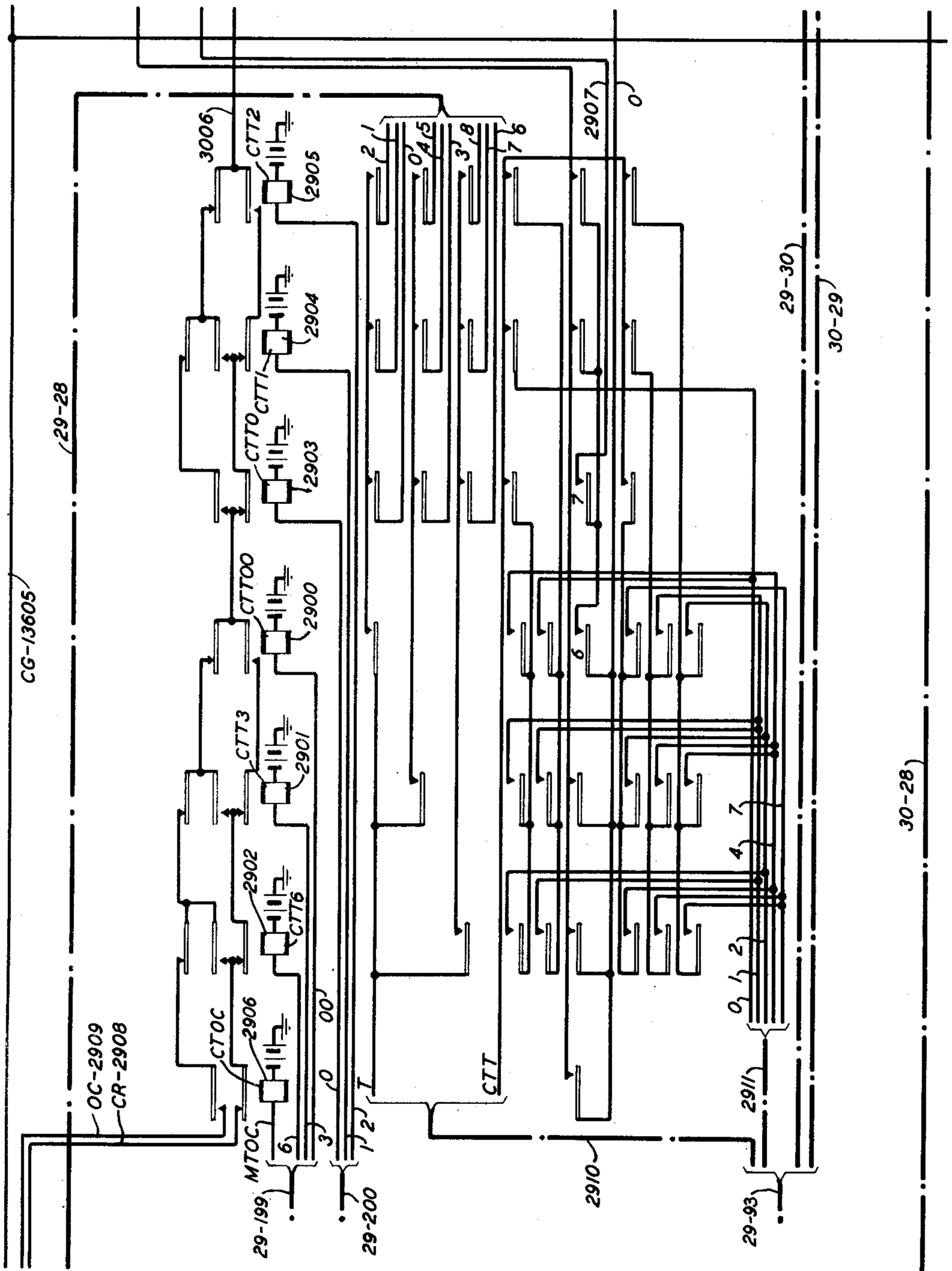

FIG. 29

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

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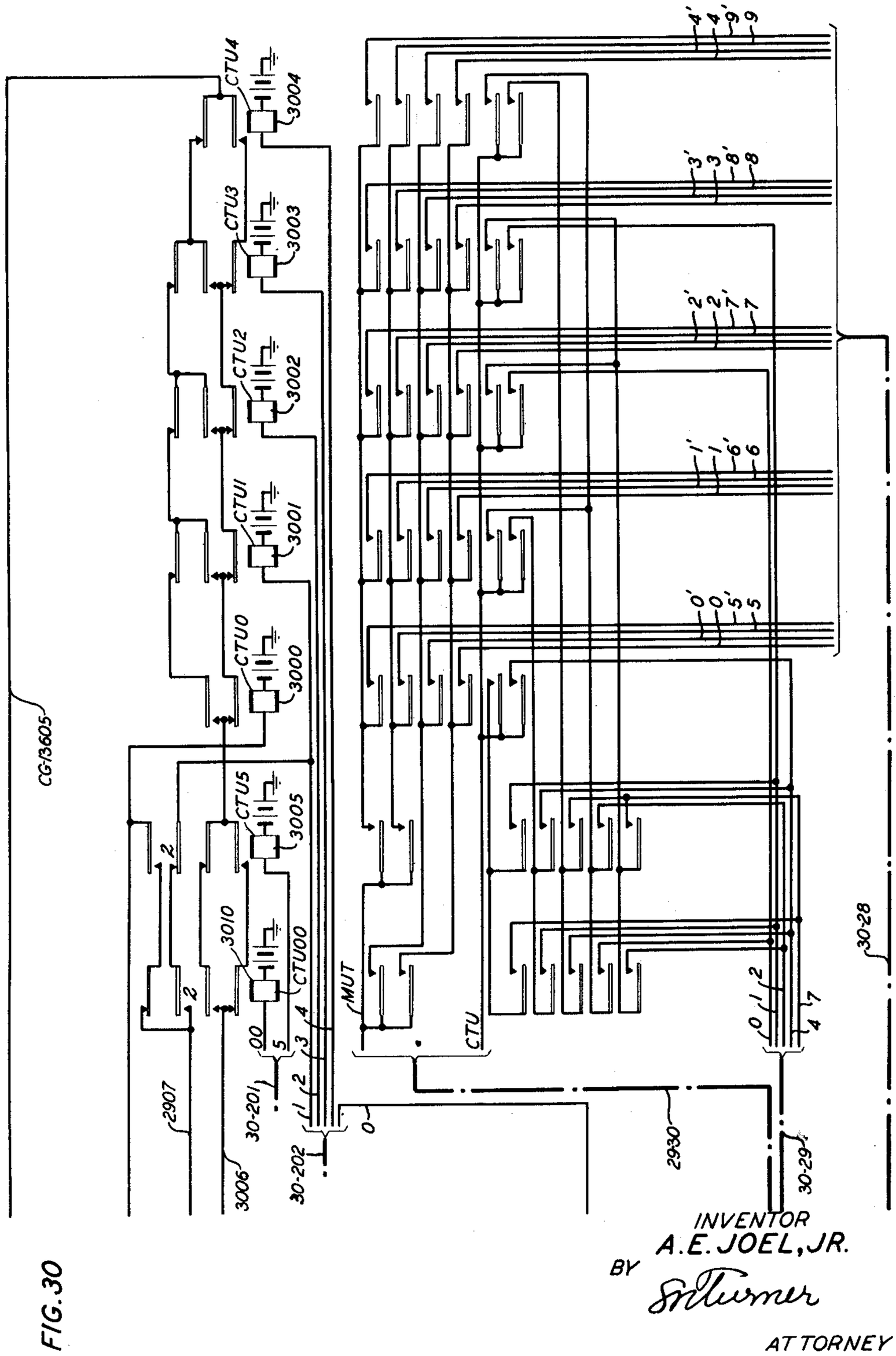

FIG. 30

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

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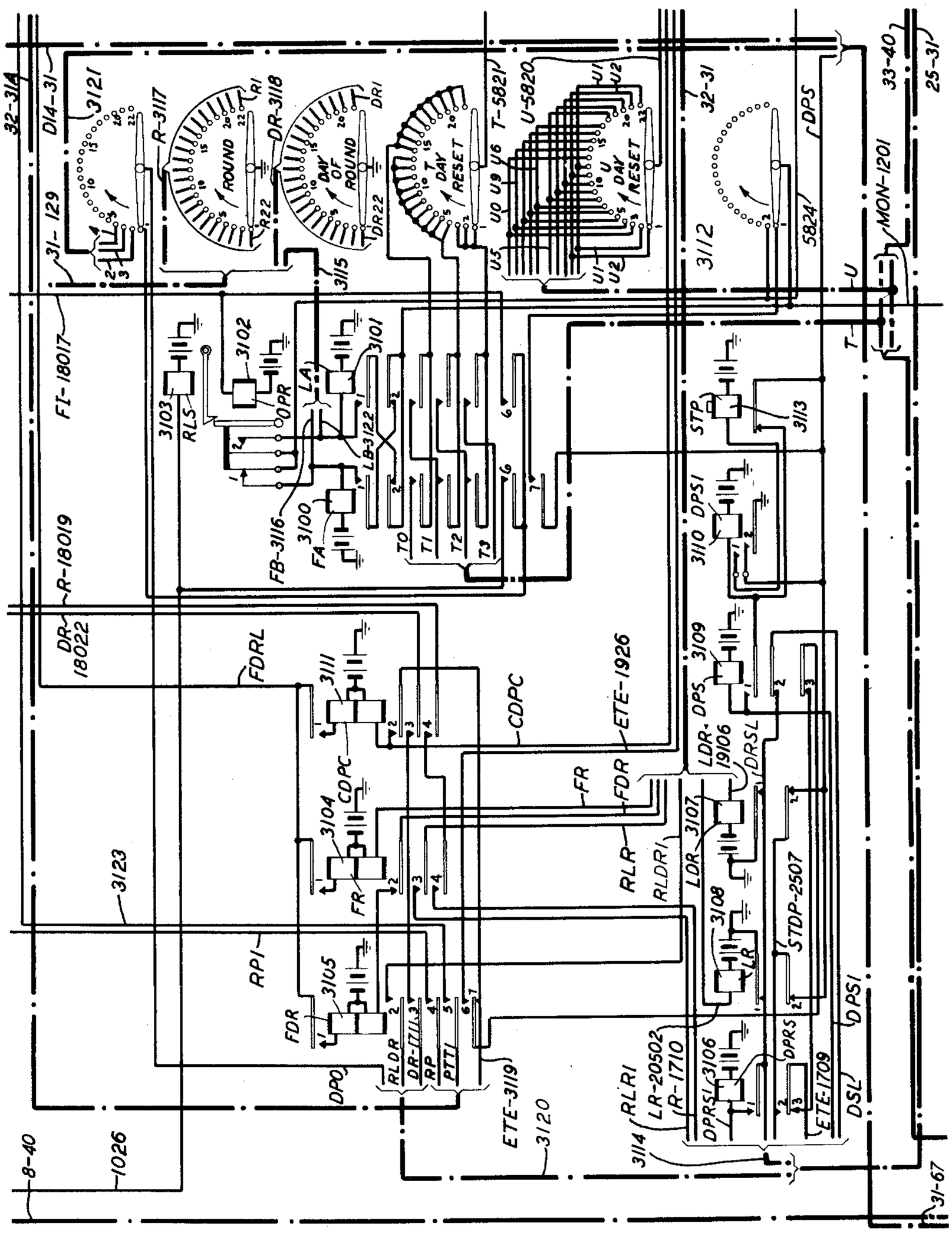

FIG. 31

INVENTOR
A.E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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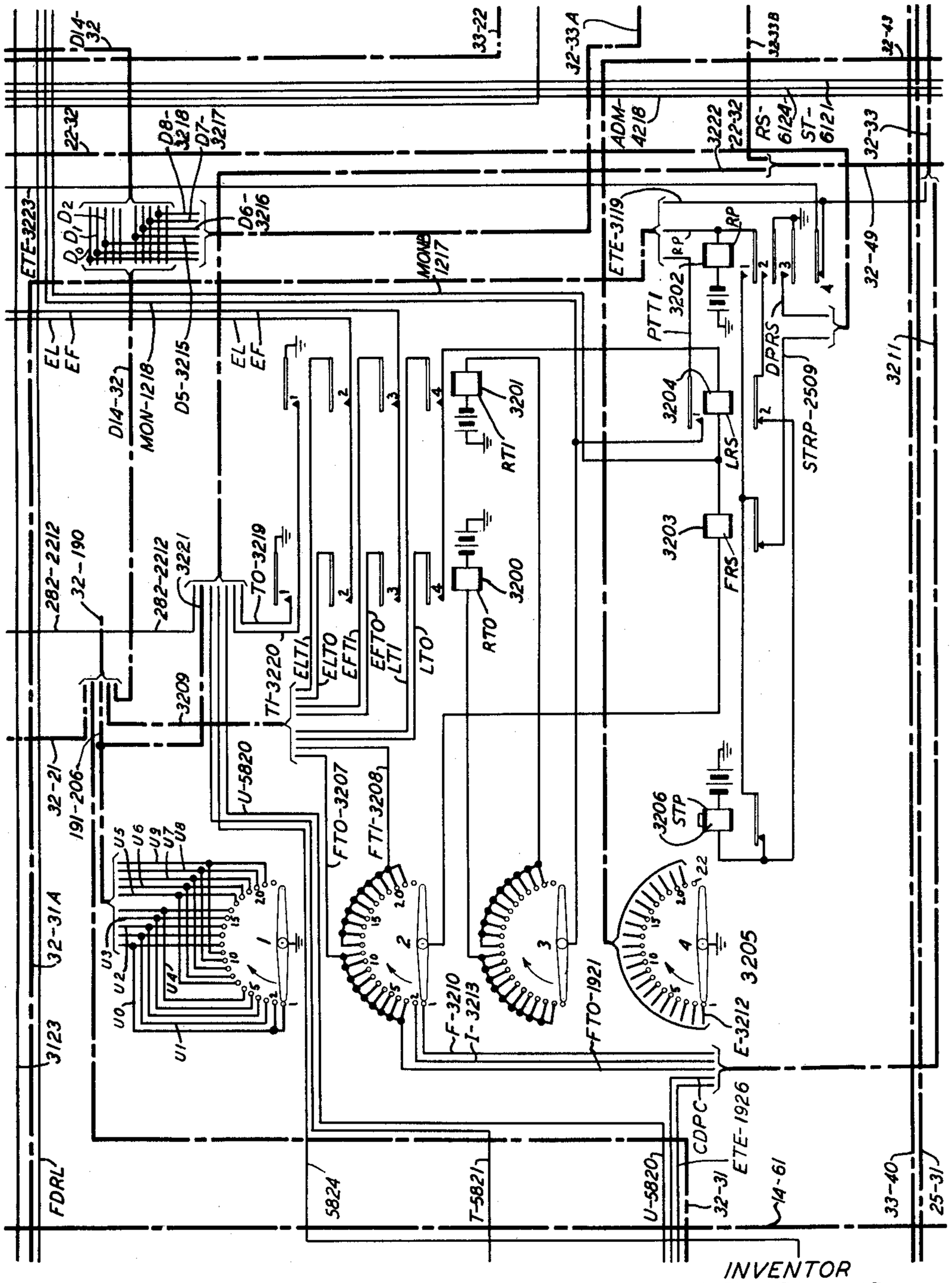

FIG. 32

INVENTOR
A. E. JOEL, JR.
BY
Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

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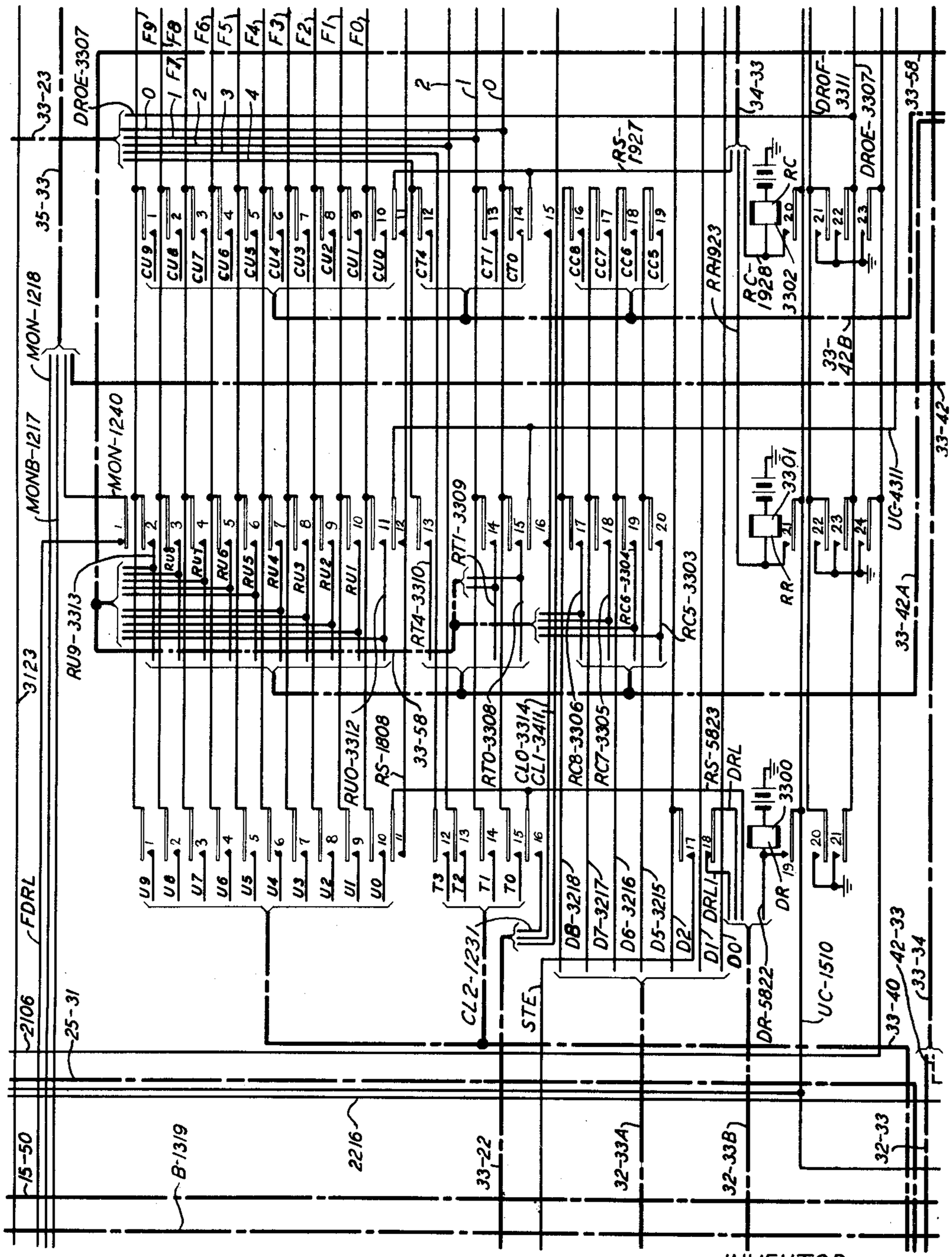

FIG. 33

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

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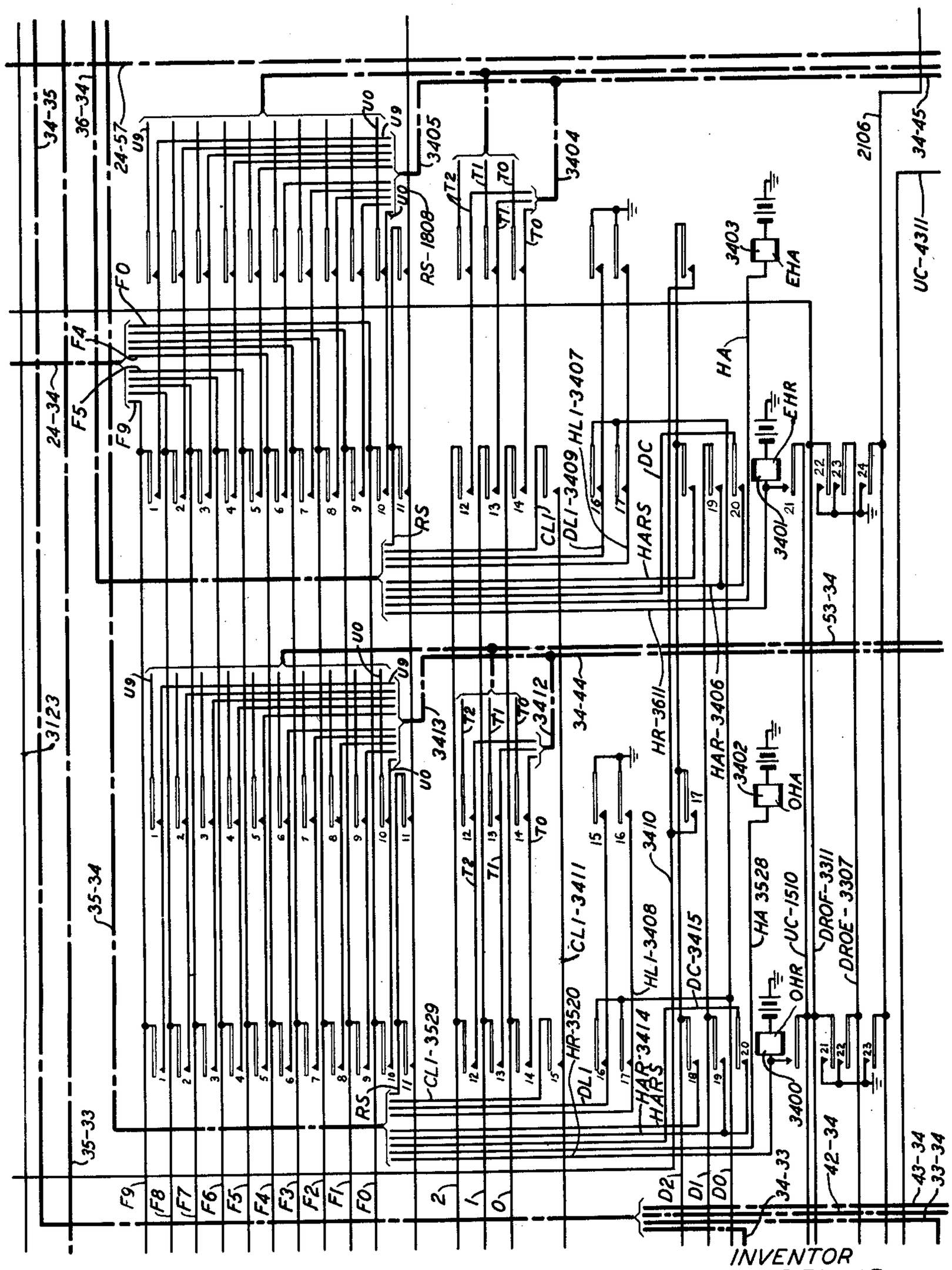

FIG. 34

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

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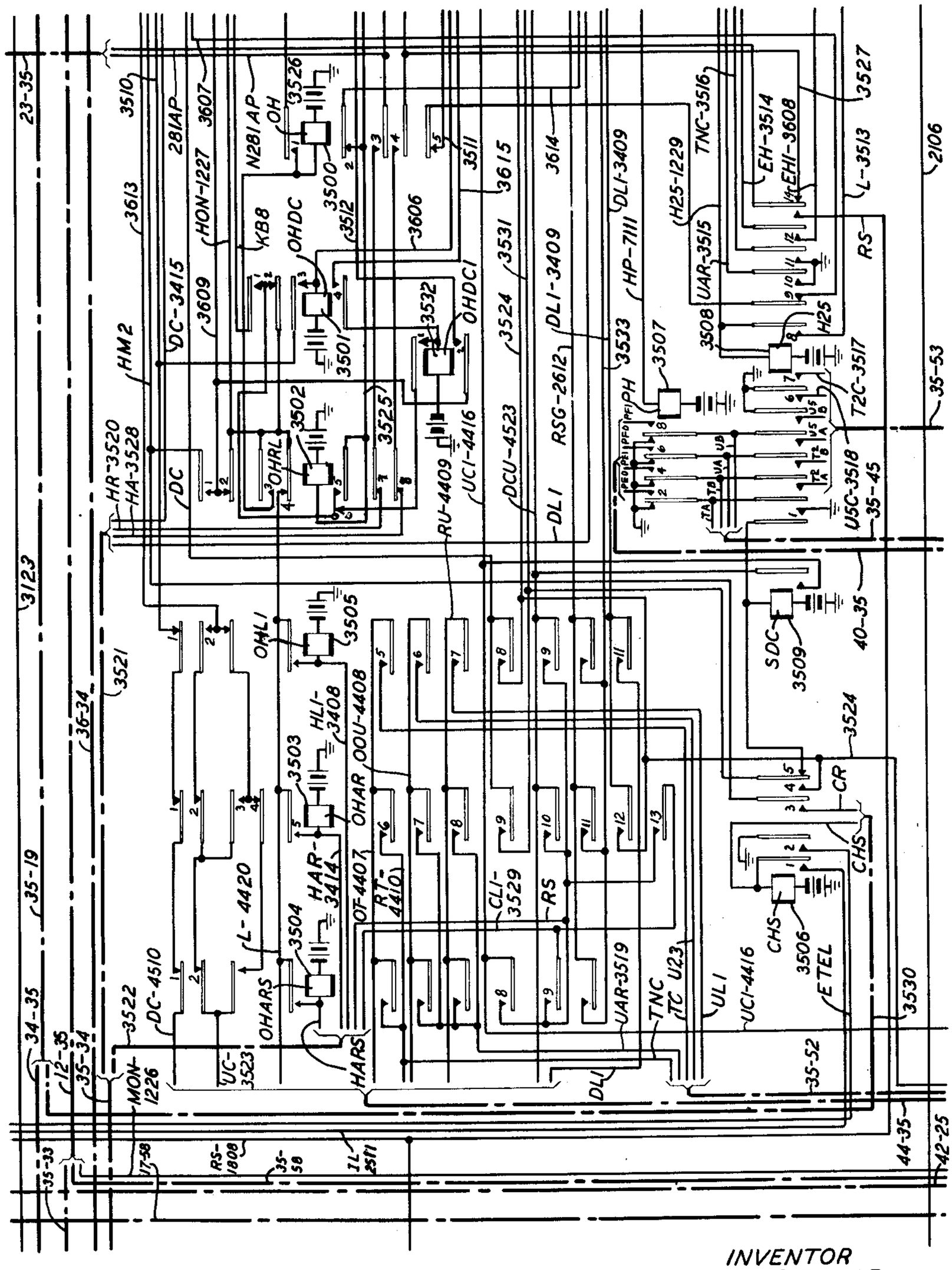


FIG. 35

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 35

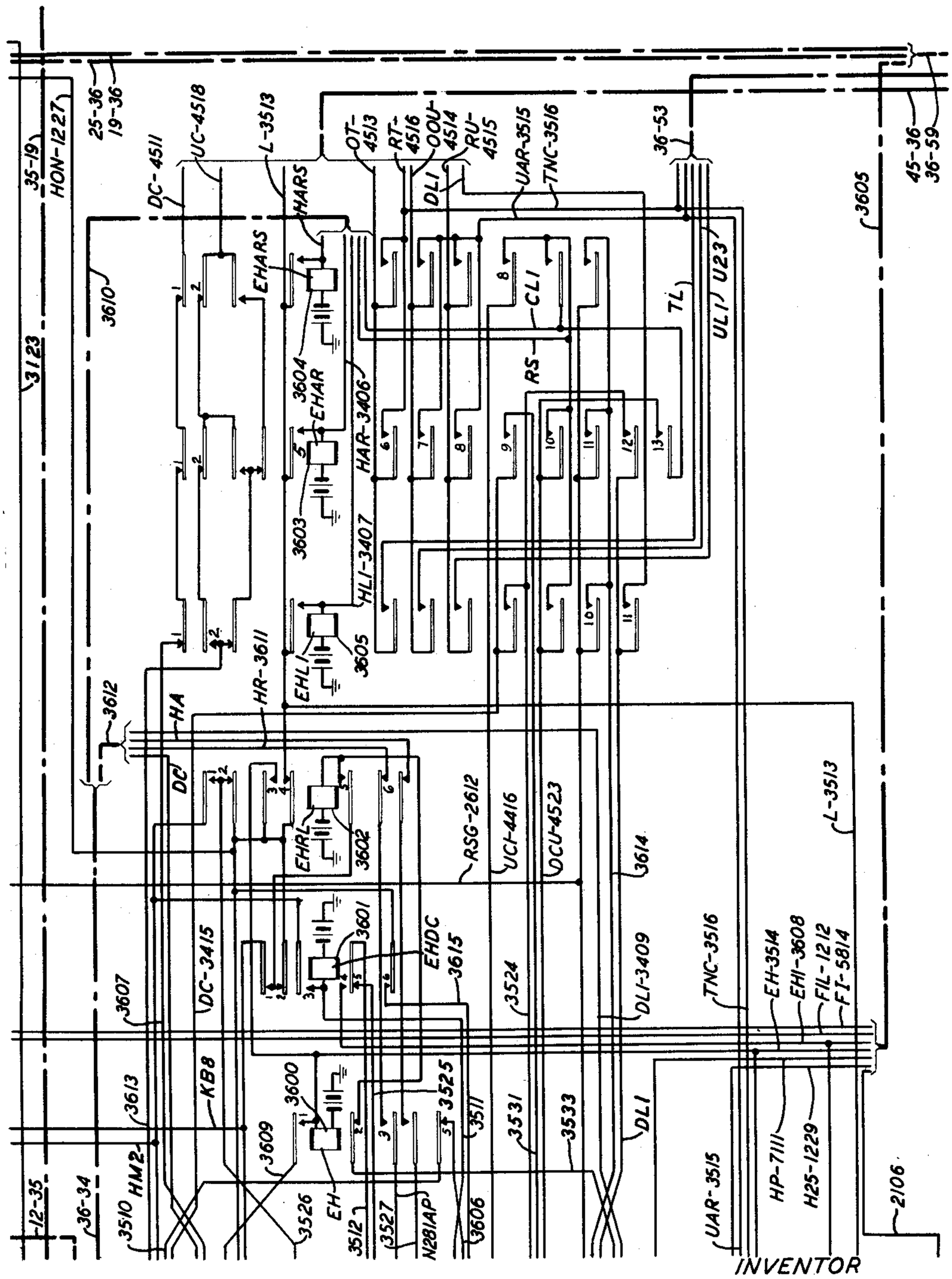


FIG. 36

INVENTOR
A. E. JOEL, JR.
BY Sklerner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 36

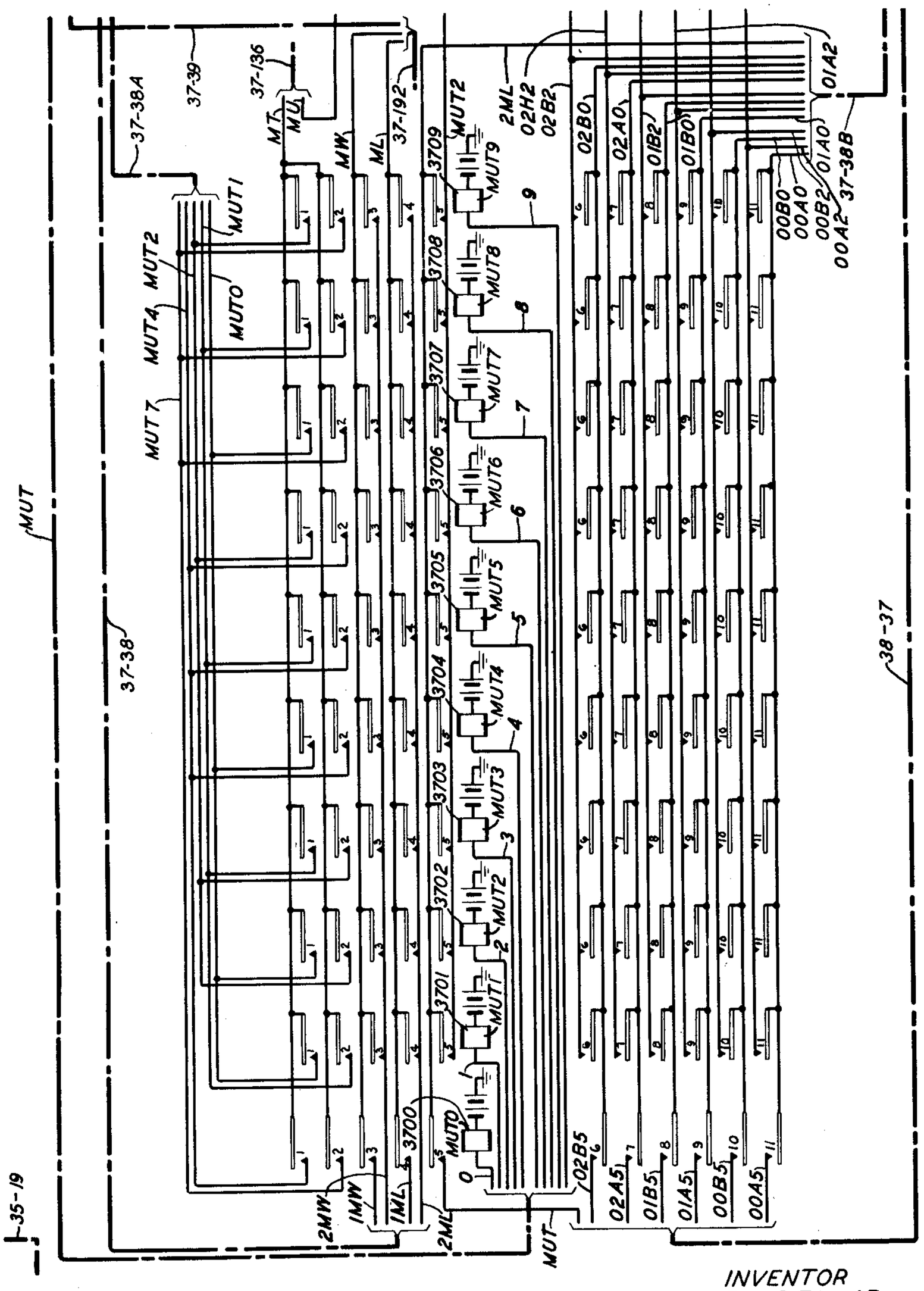


FIG. 37

INVENTOR
A. E. JOEL, JR.
BY Silsmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 37

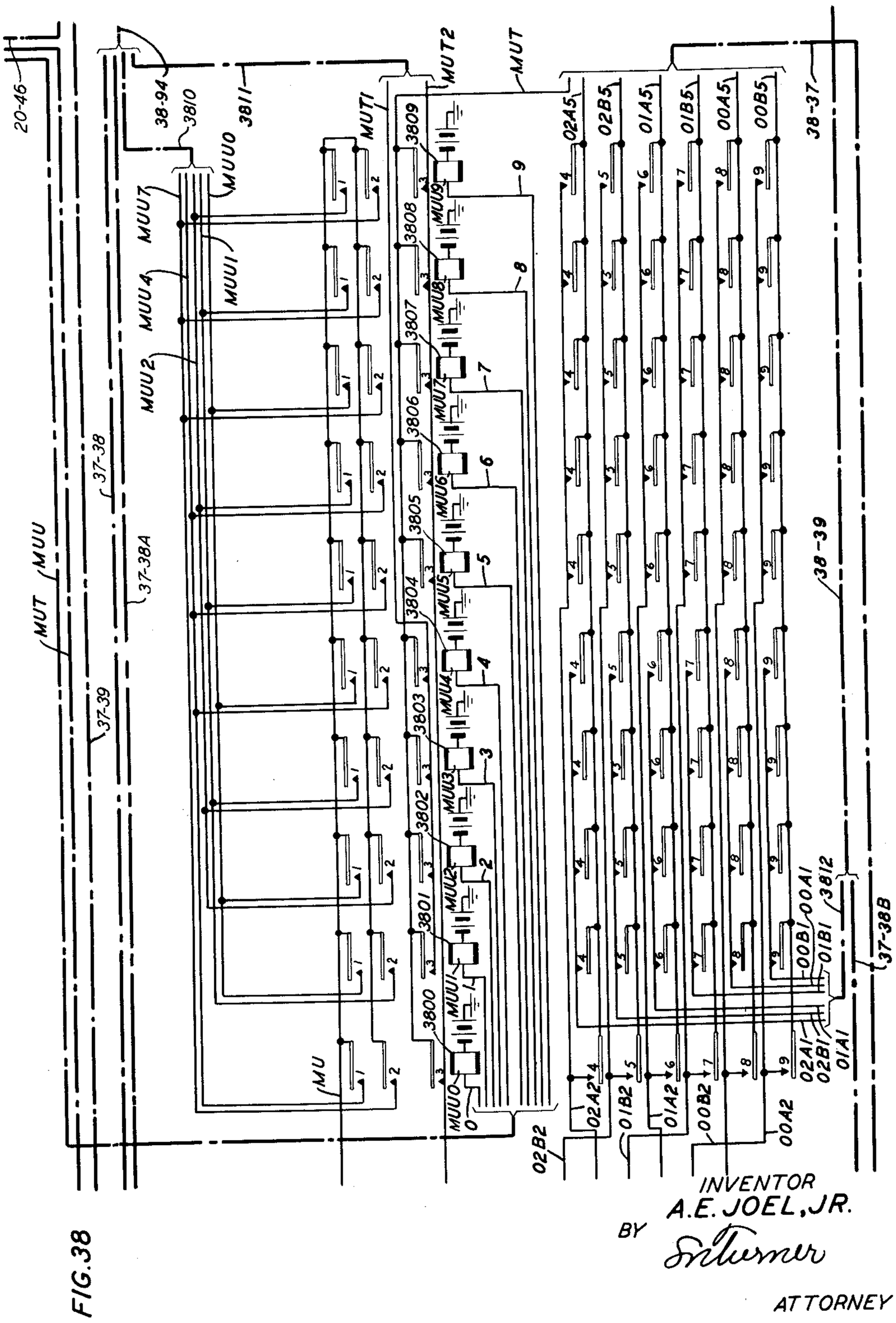


FIG. 38

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 38

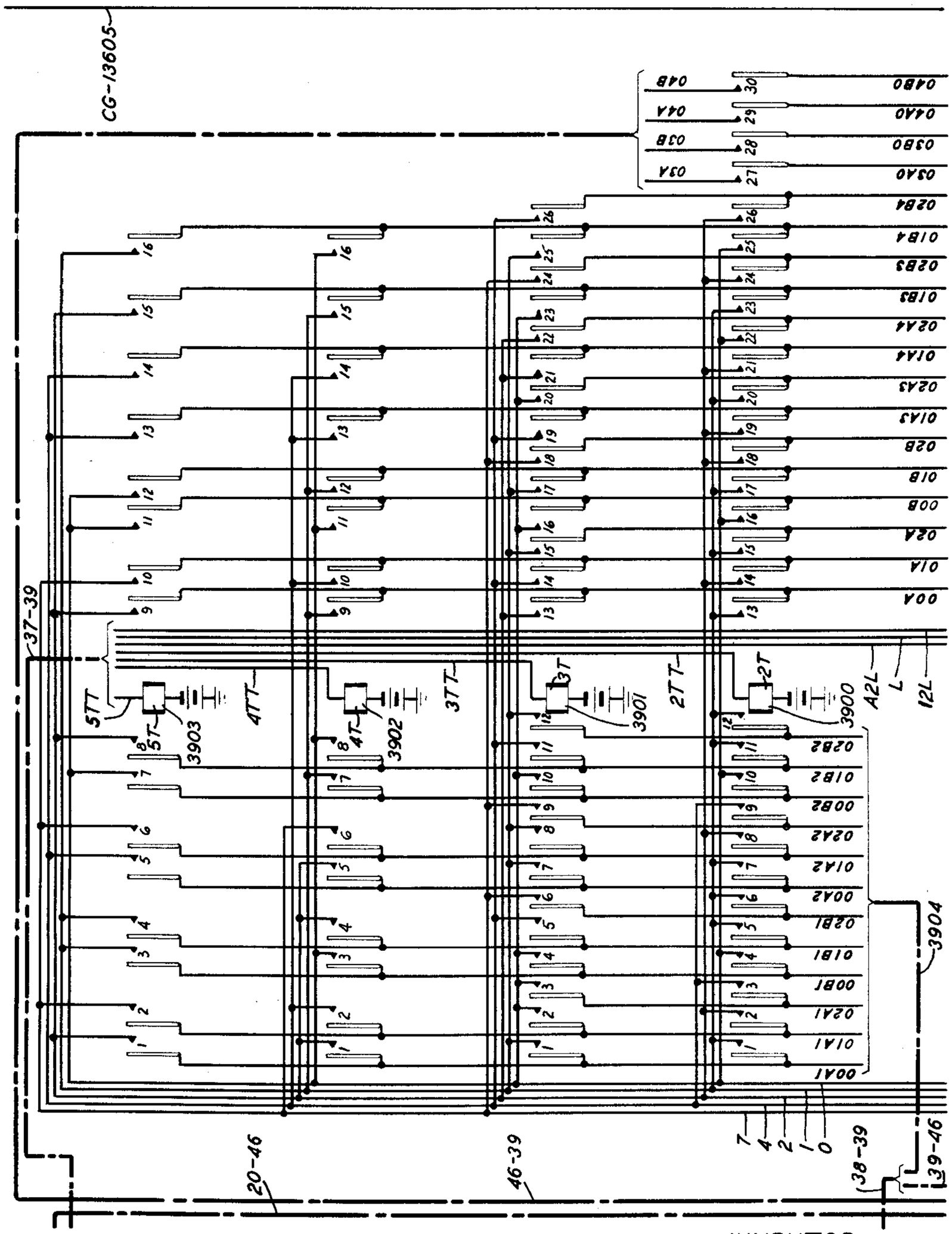


FIG. 39

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 39

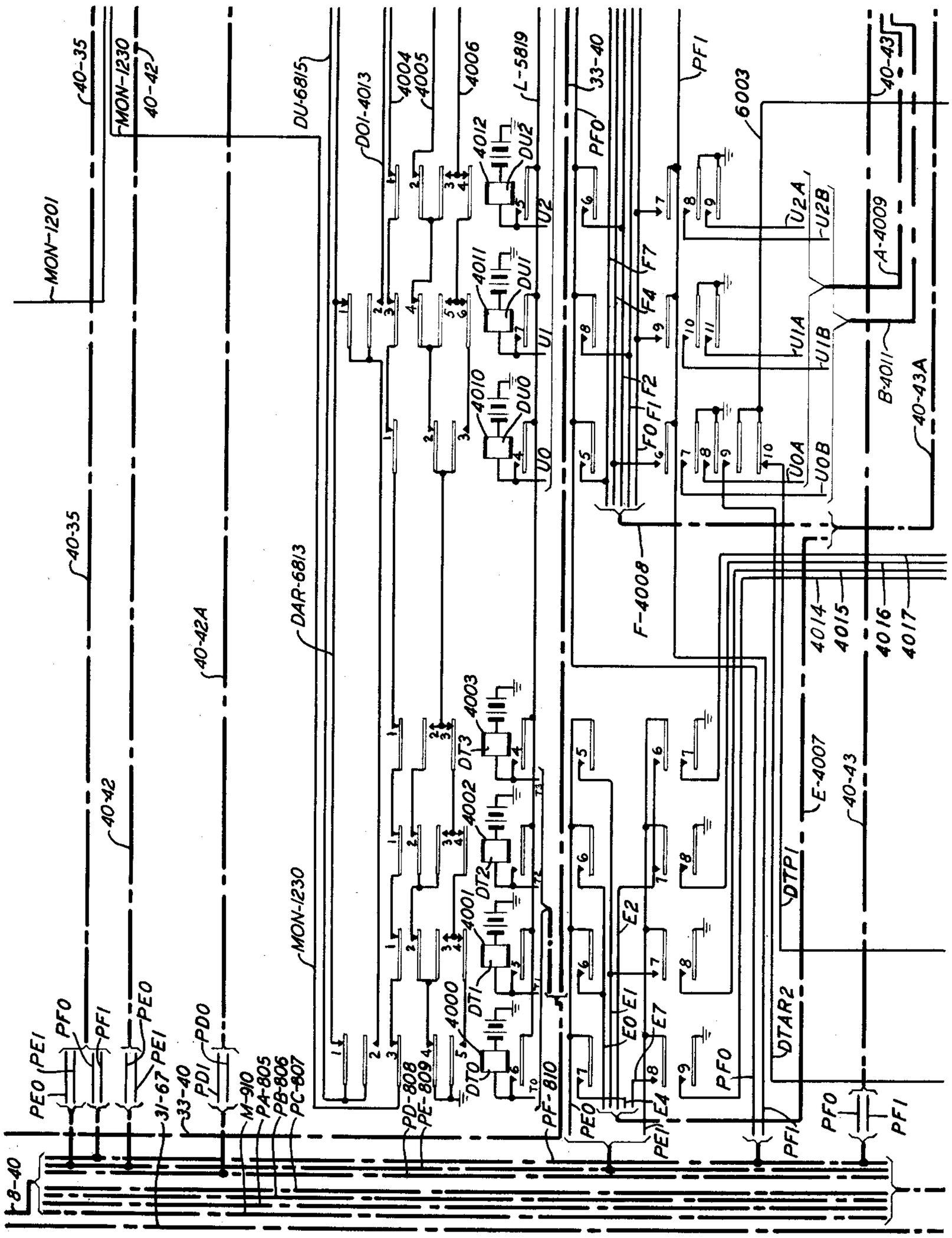


FIG. 40

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 40

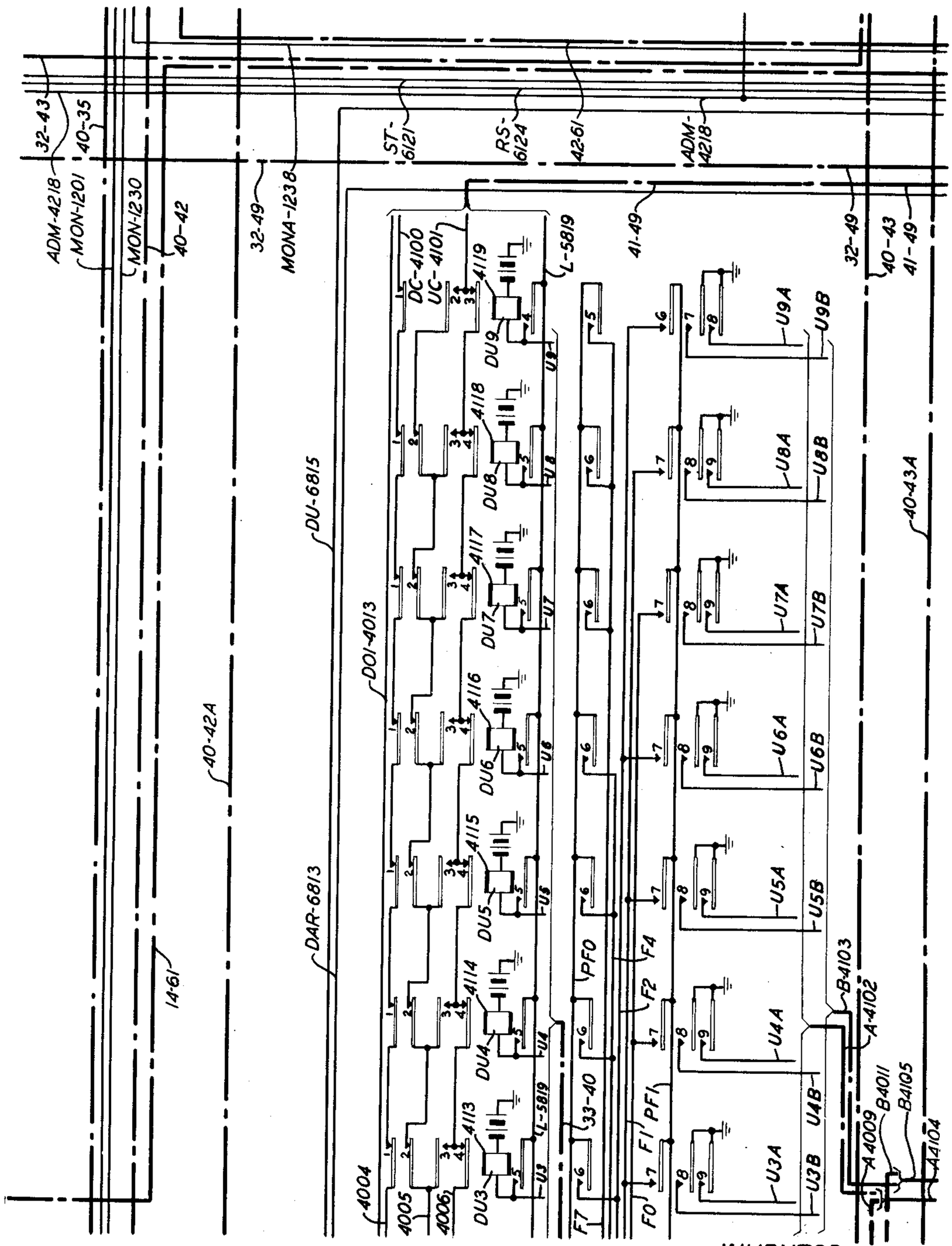


FIG. 41

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 41

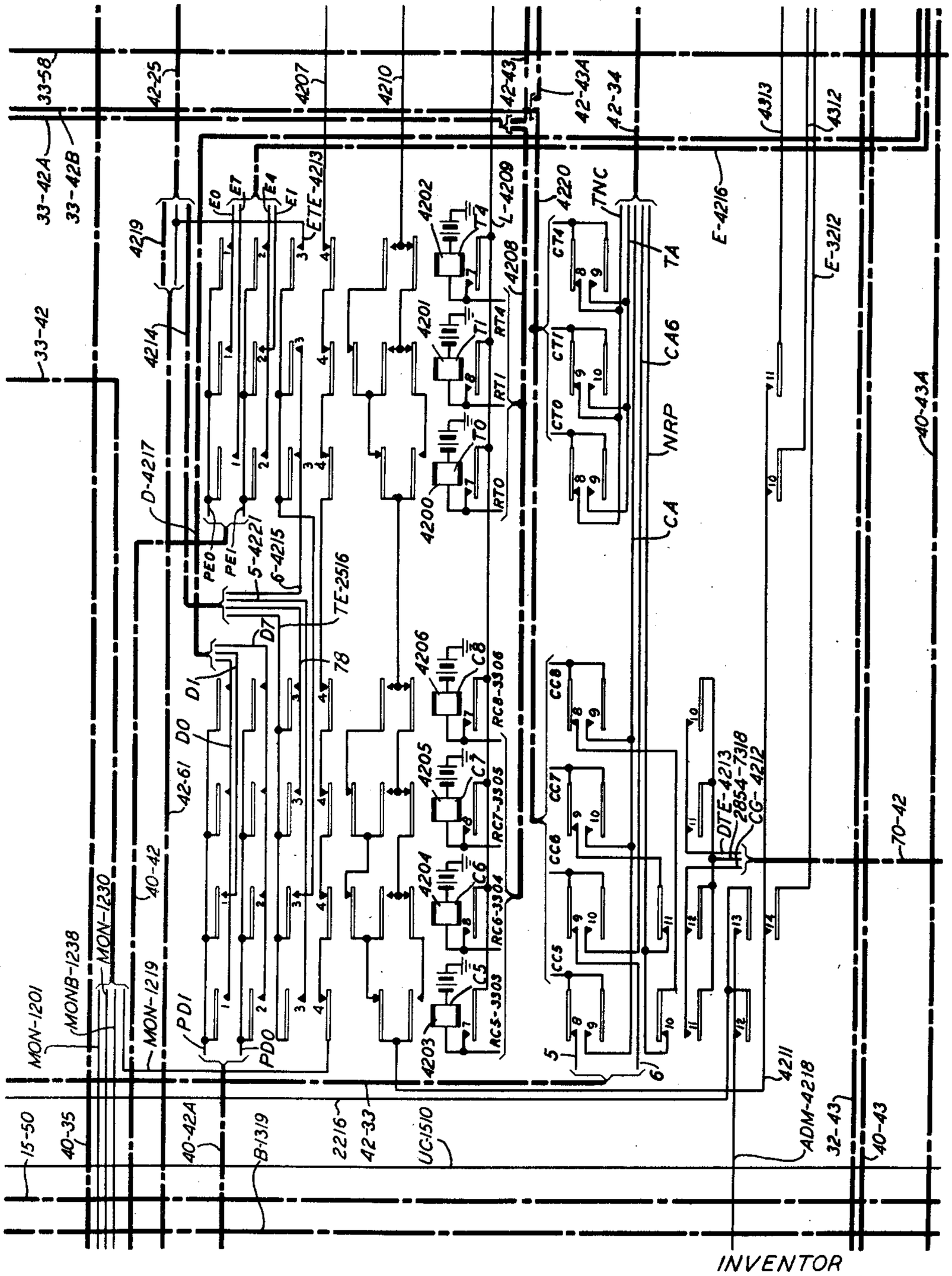


FIG. 42

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 42

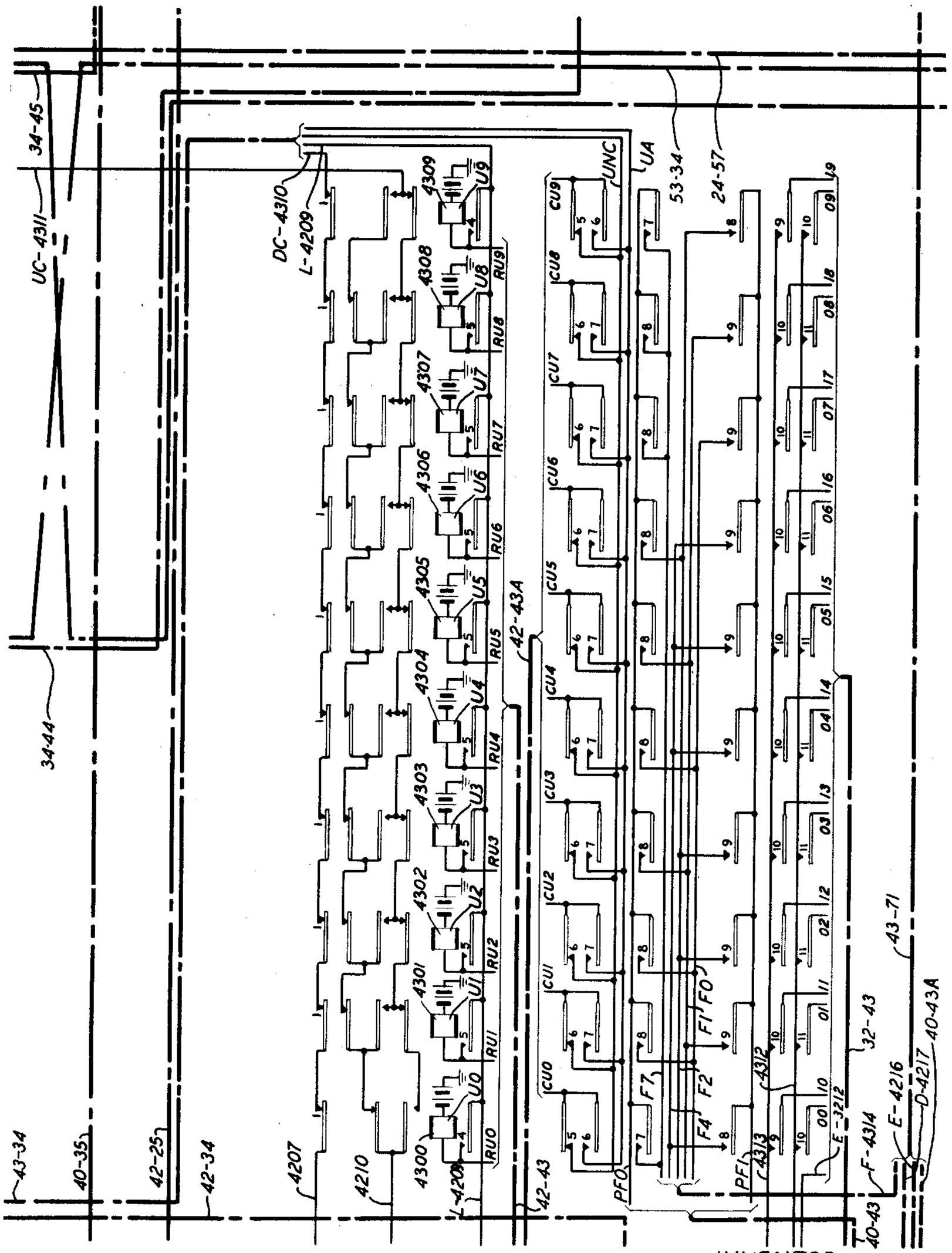


FIG. 43

INVENTOR
A.E. JOEL, JR.
BY
Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 43

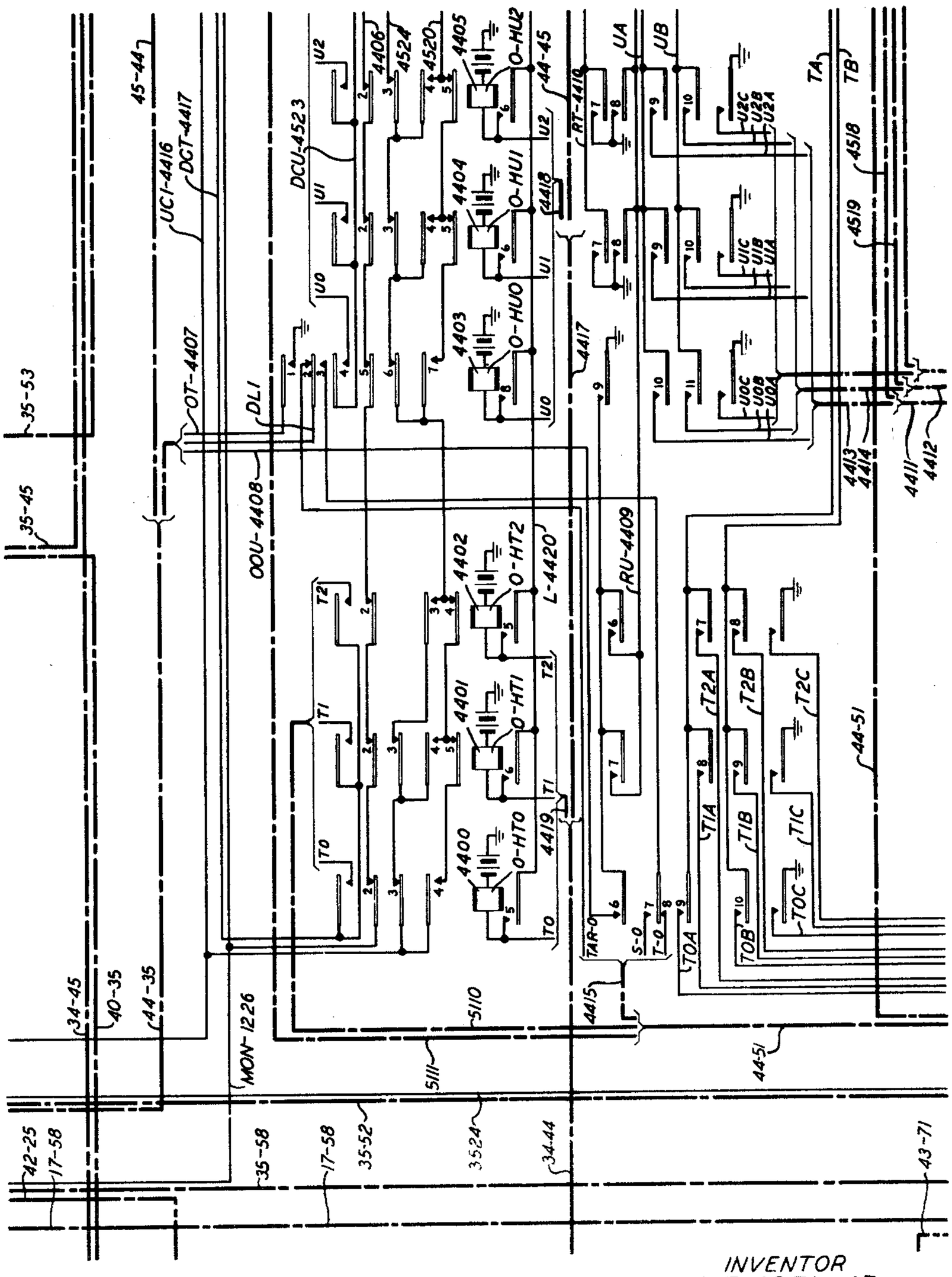


FIG. 44

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 44

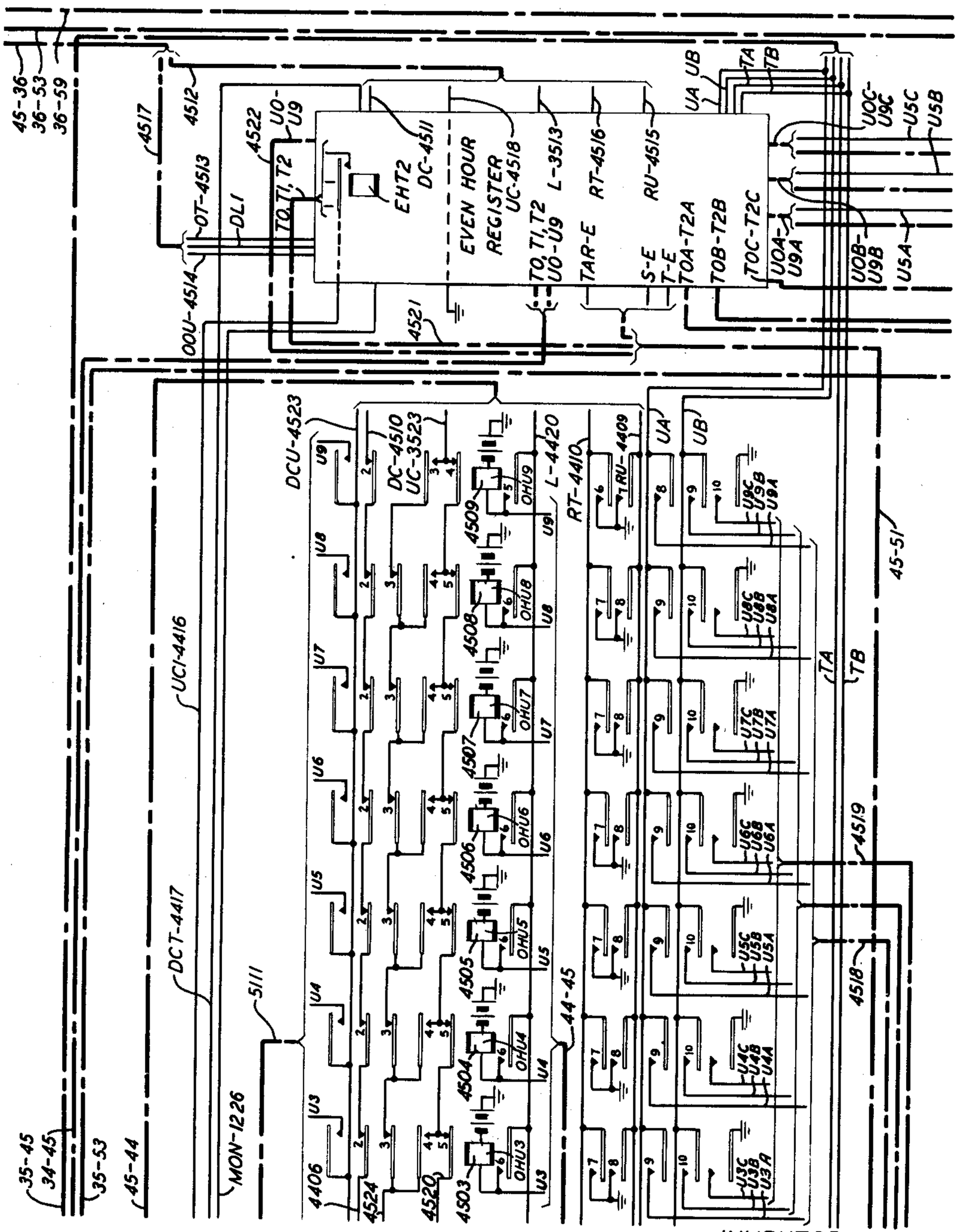


FIG. 45

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 45

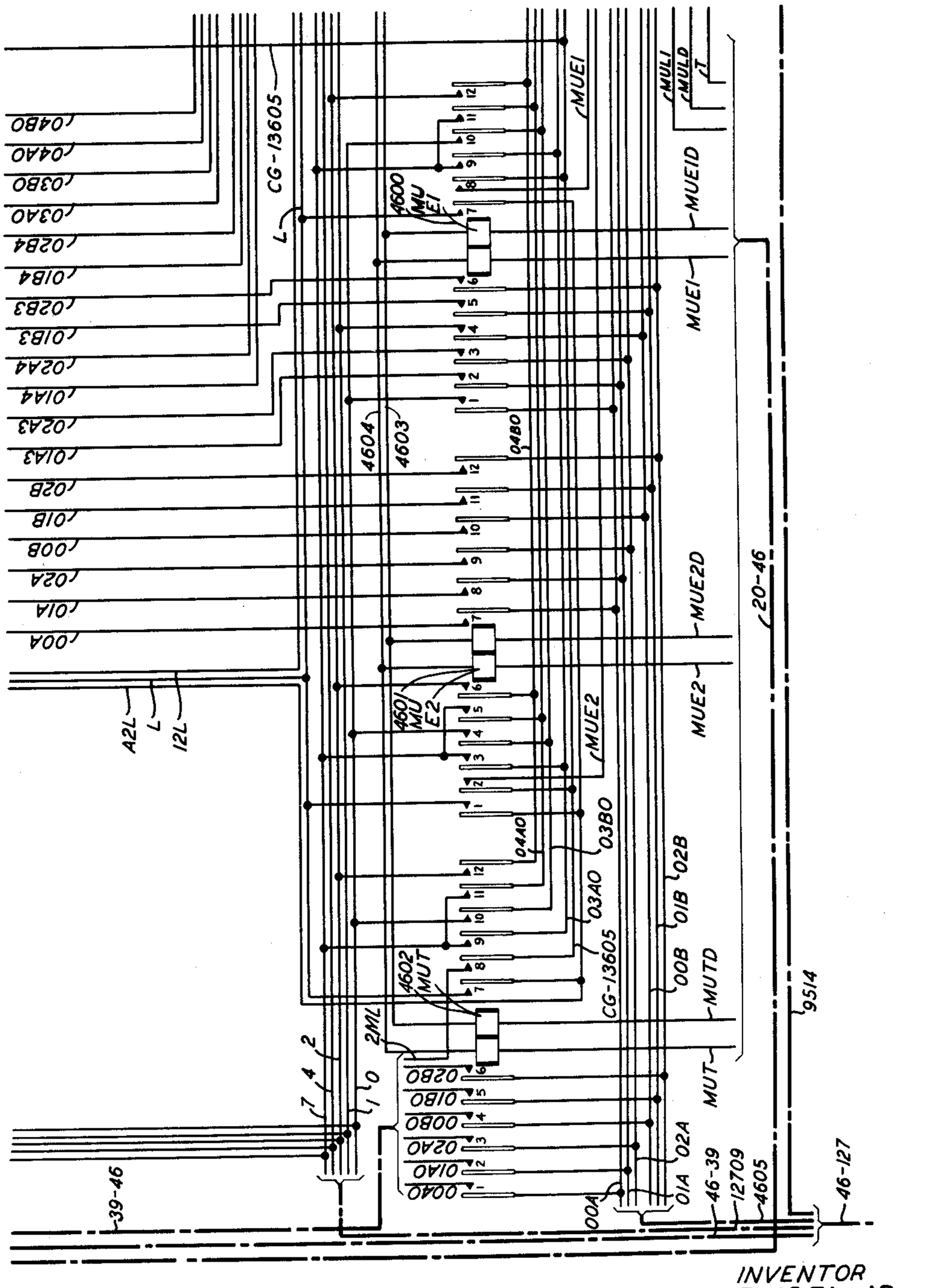


FIG. 46

INVENTOR
A.E. JOEL, JR.
BY
Sturner
ATTORNEY

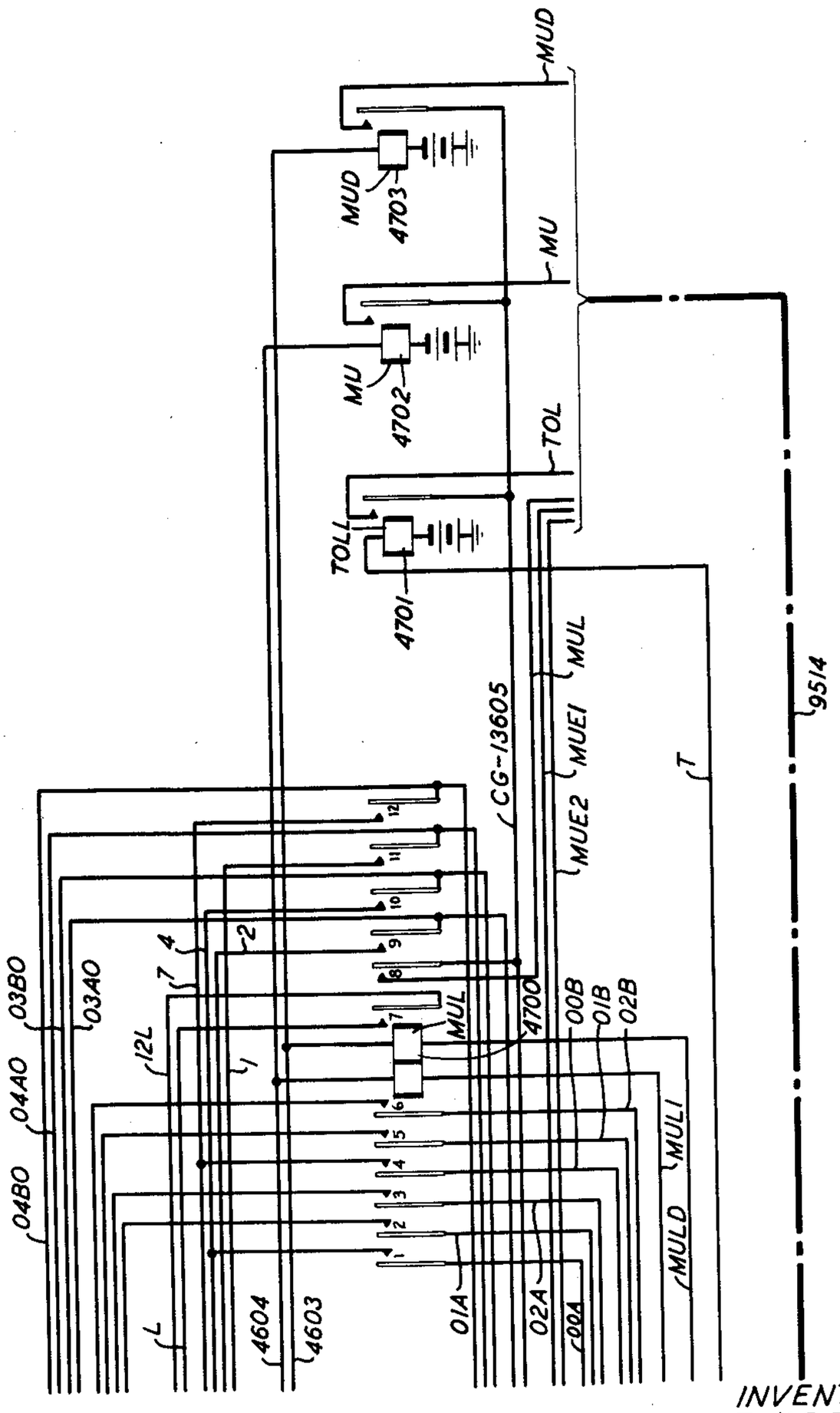


FIG. 47

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 47

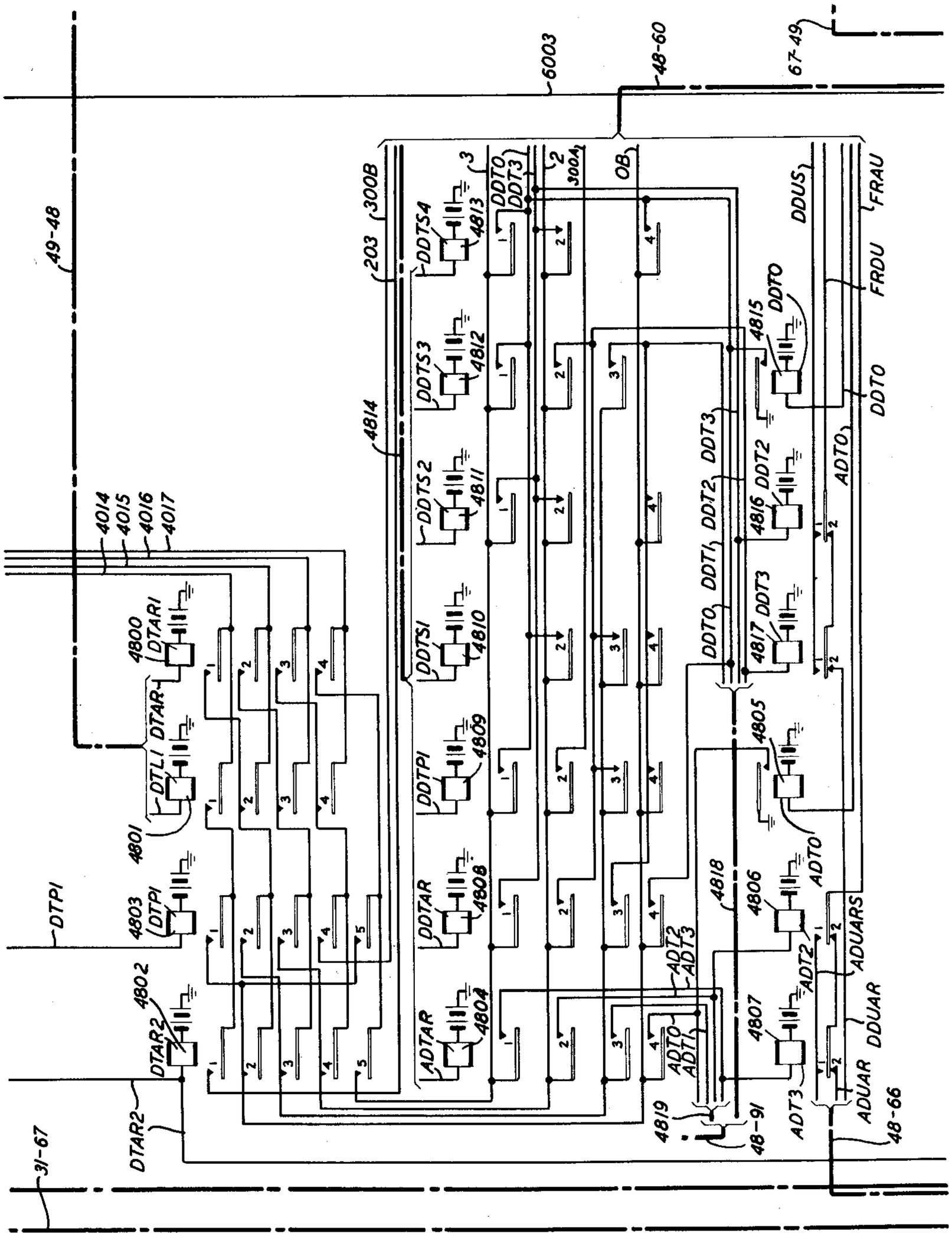


FIG. 48

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 48

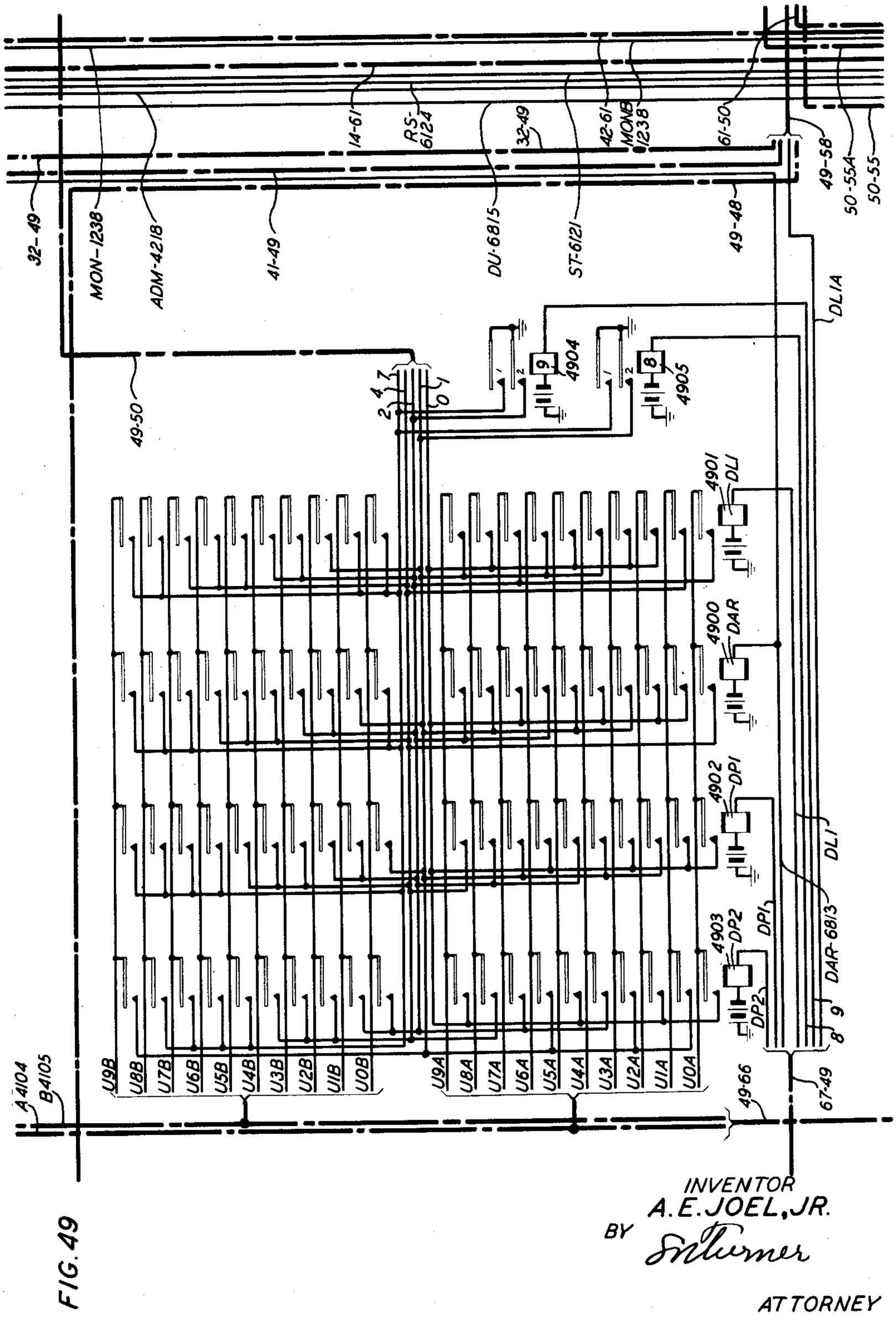


FIG. 49

INVENTOR
A. E. JOEL, JR.
BY Sturmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 49

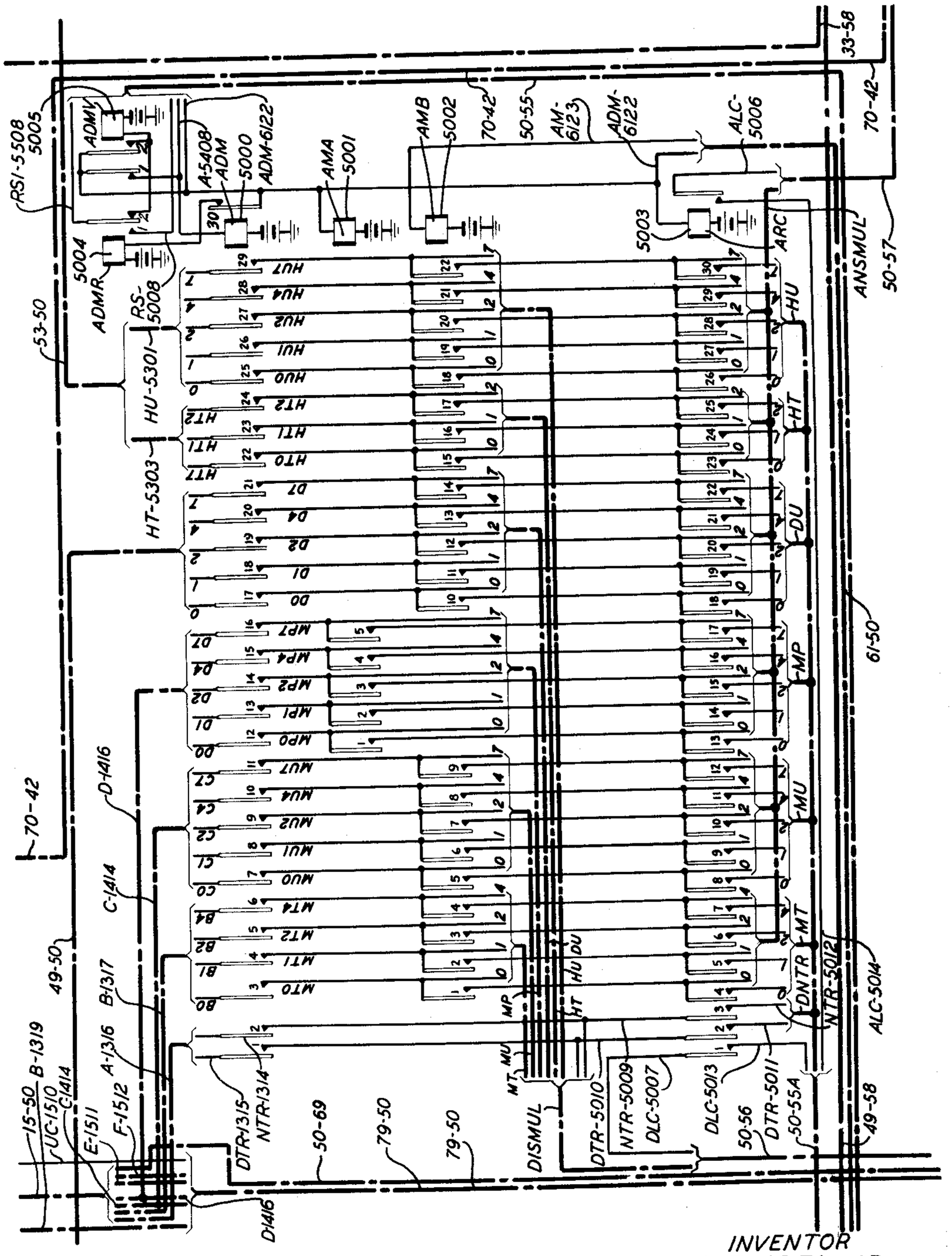


FIG. 50

INVENTOR
A. E. JOEL. JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 50

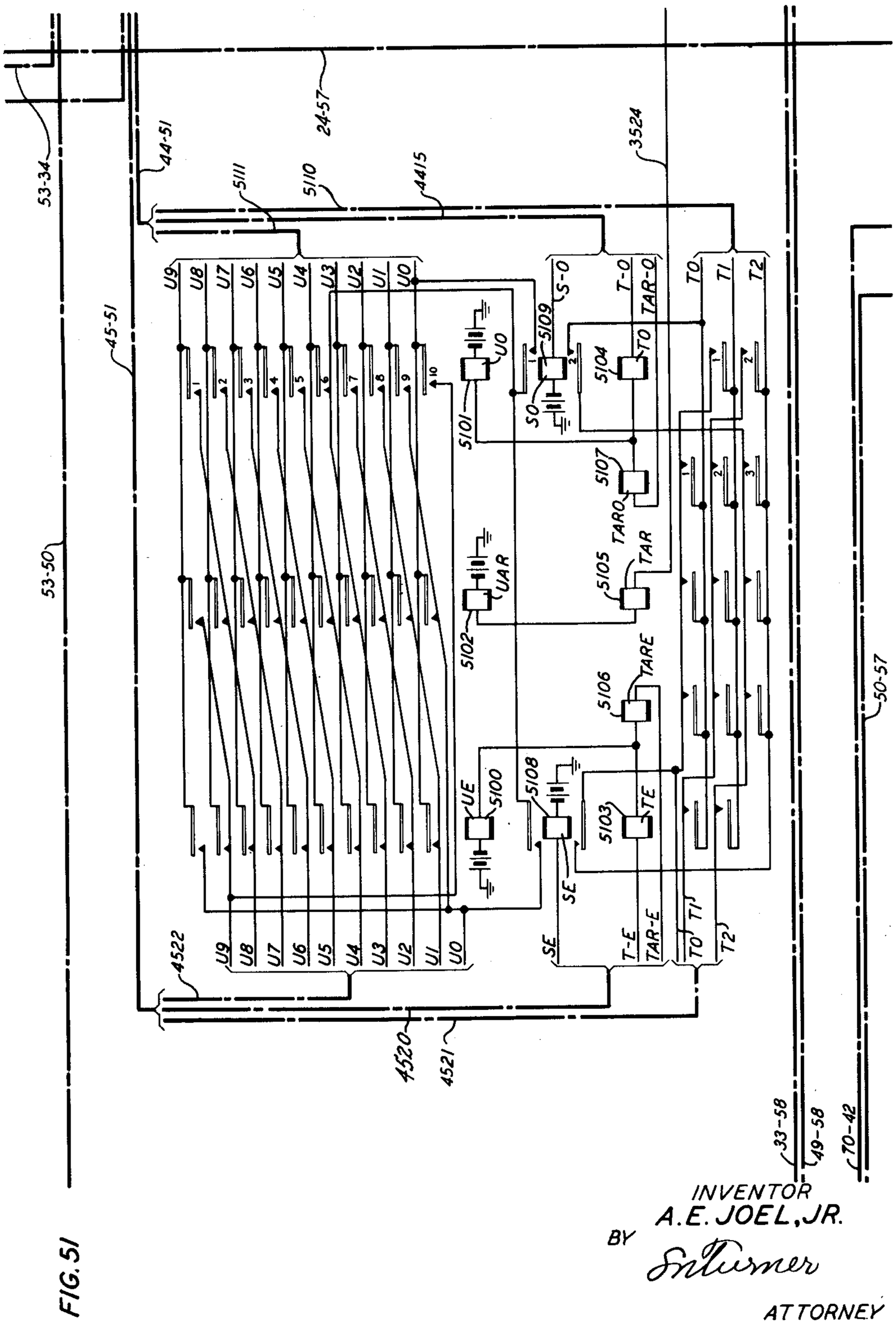


FIG. 51

INVENTOR
A. E. JOEL, JR.
BY
Sklarner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 51

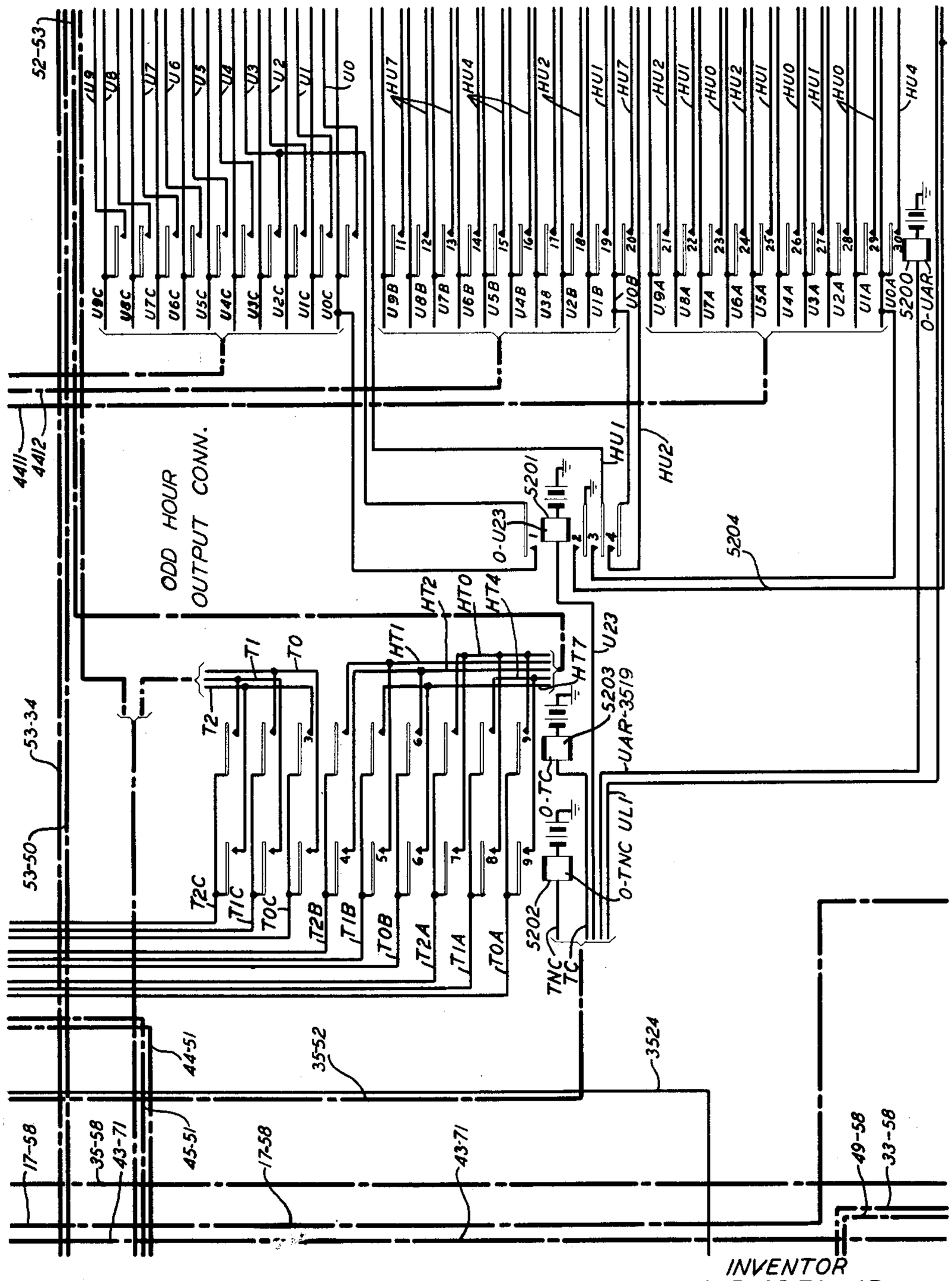


FIG. 52

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 52

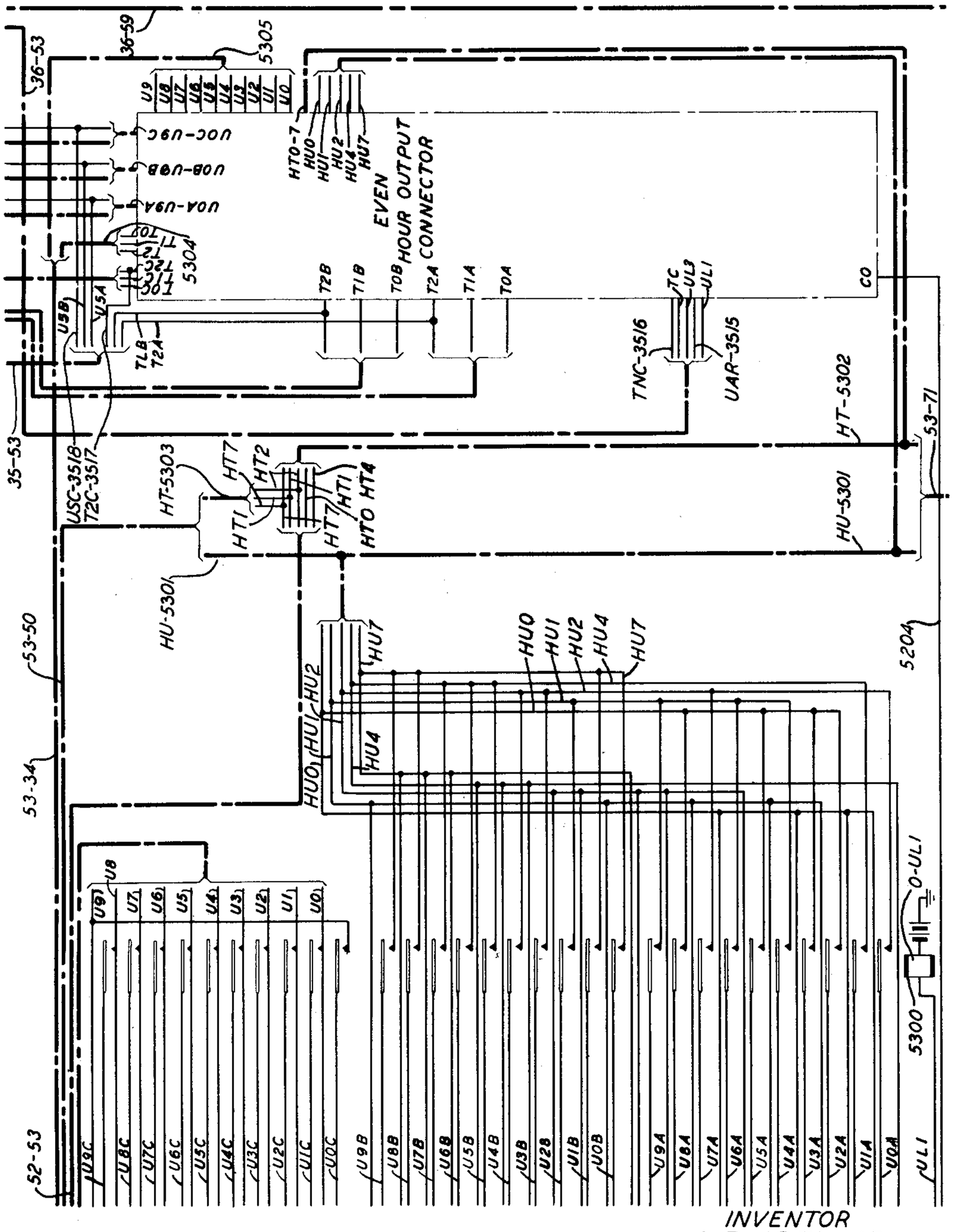


FIG. 53

INVENTOR
A. E. JOEL, JR.
BY Sturmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 53

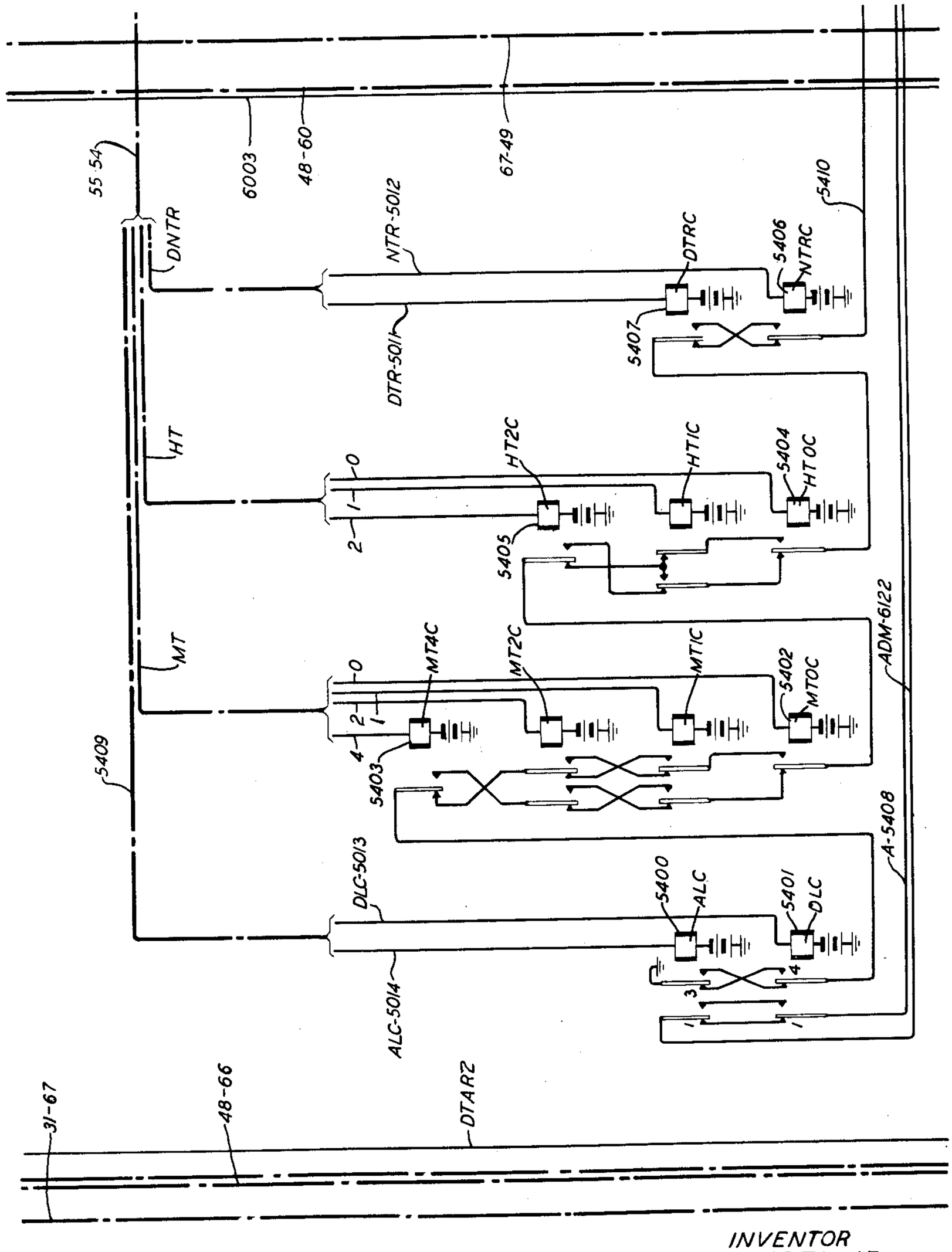


FIG. 54

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 54

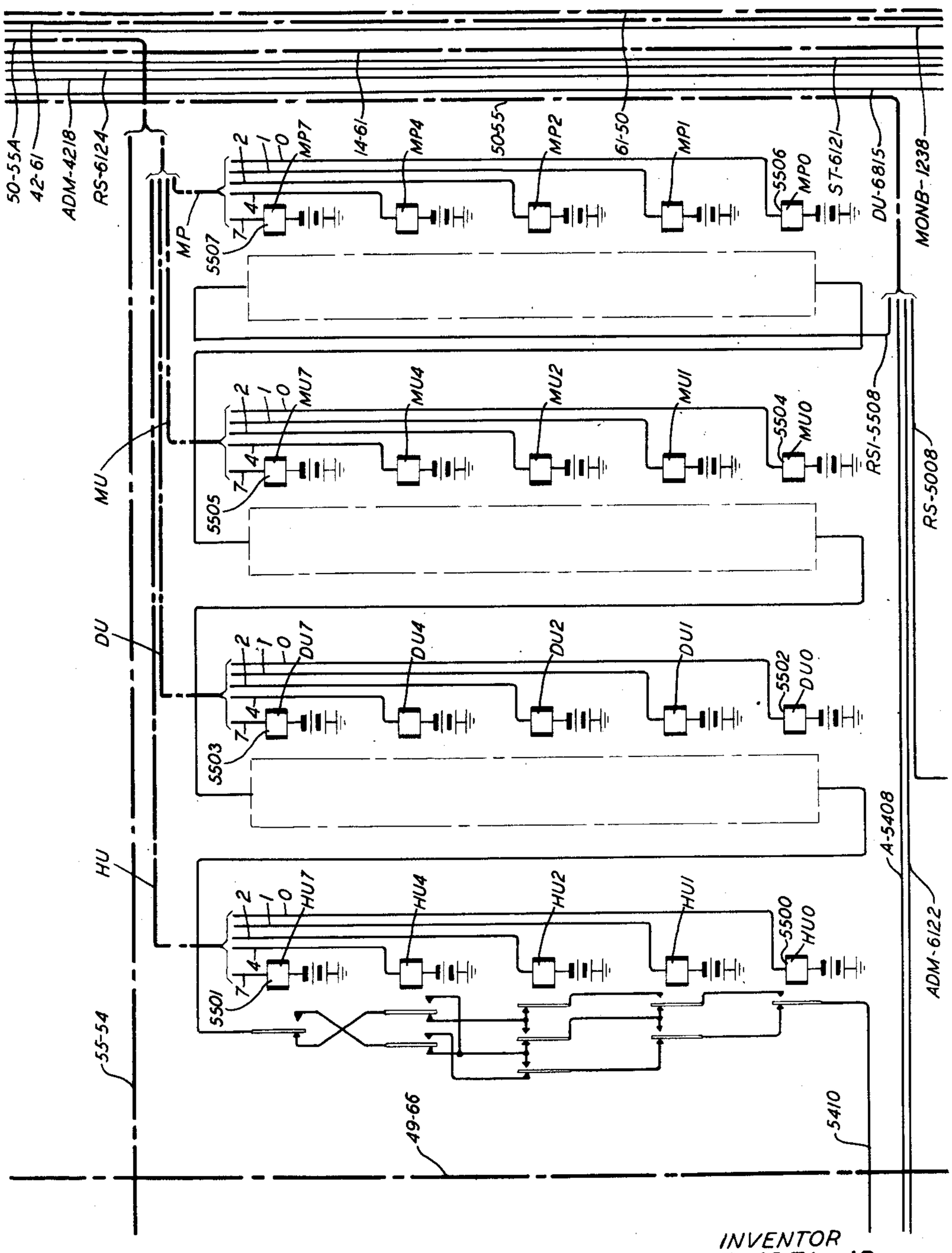


FIG. 55

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 55

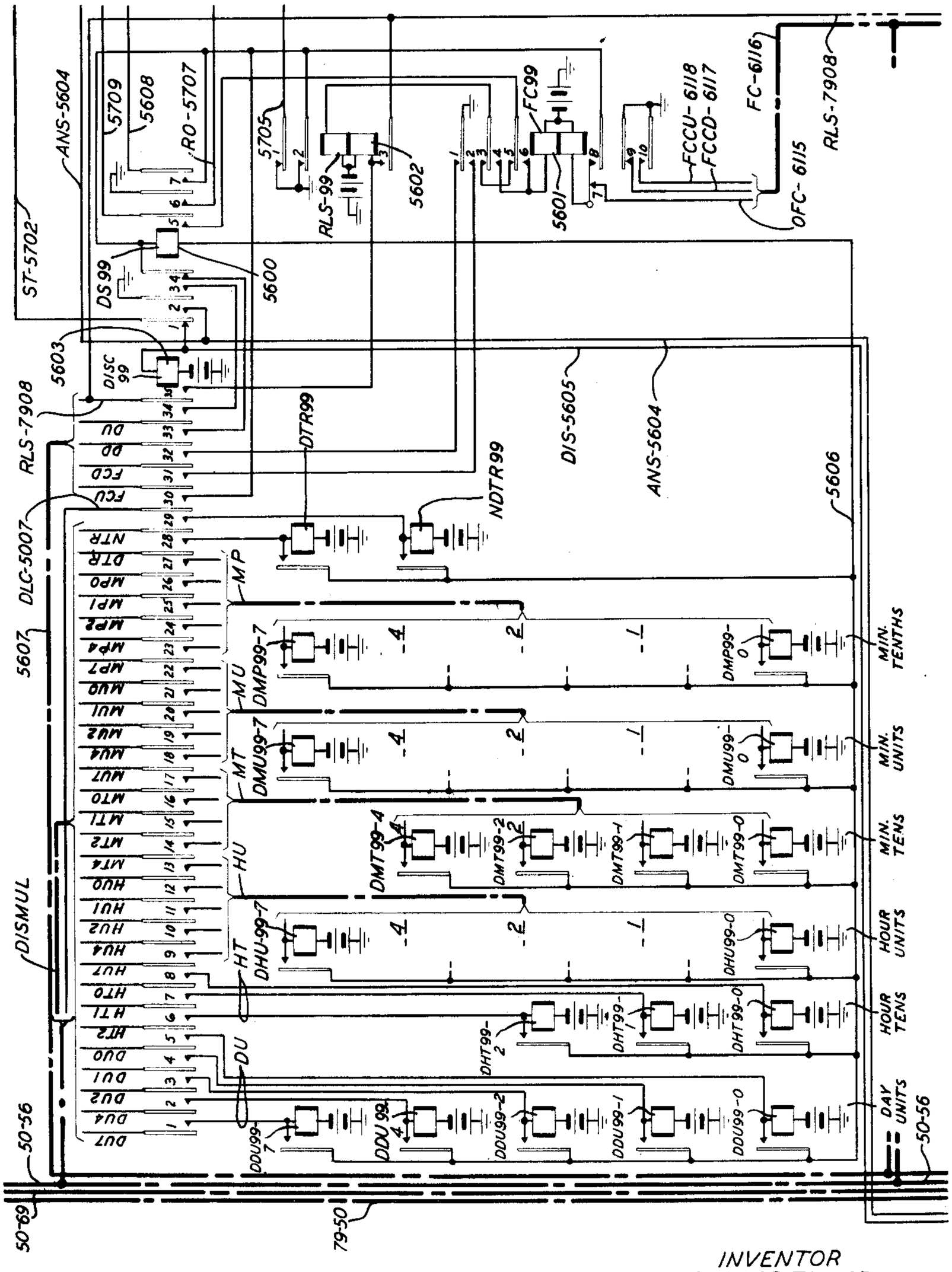


FIG. 56

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 56

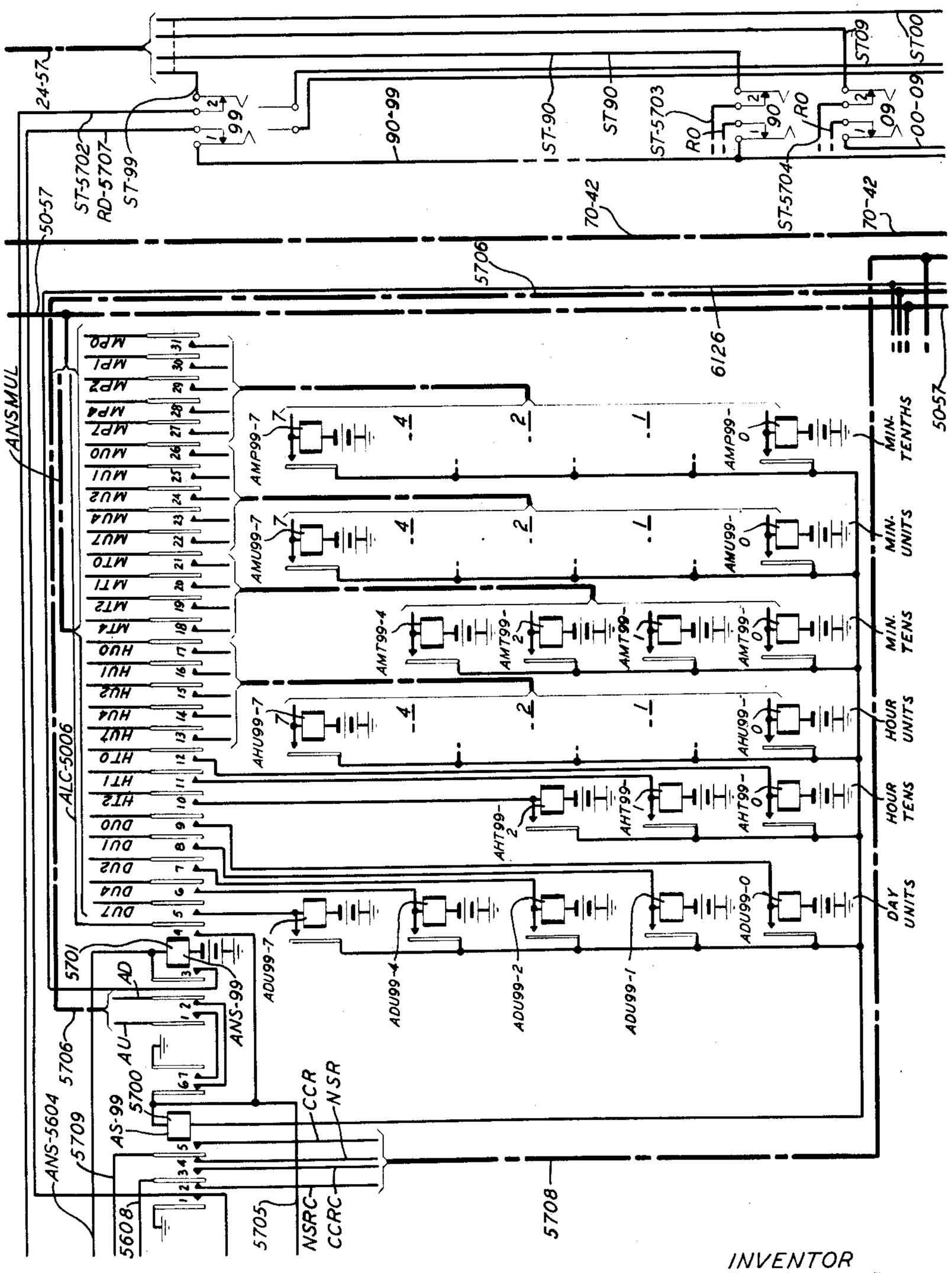


FIG. 57

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 57

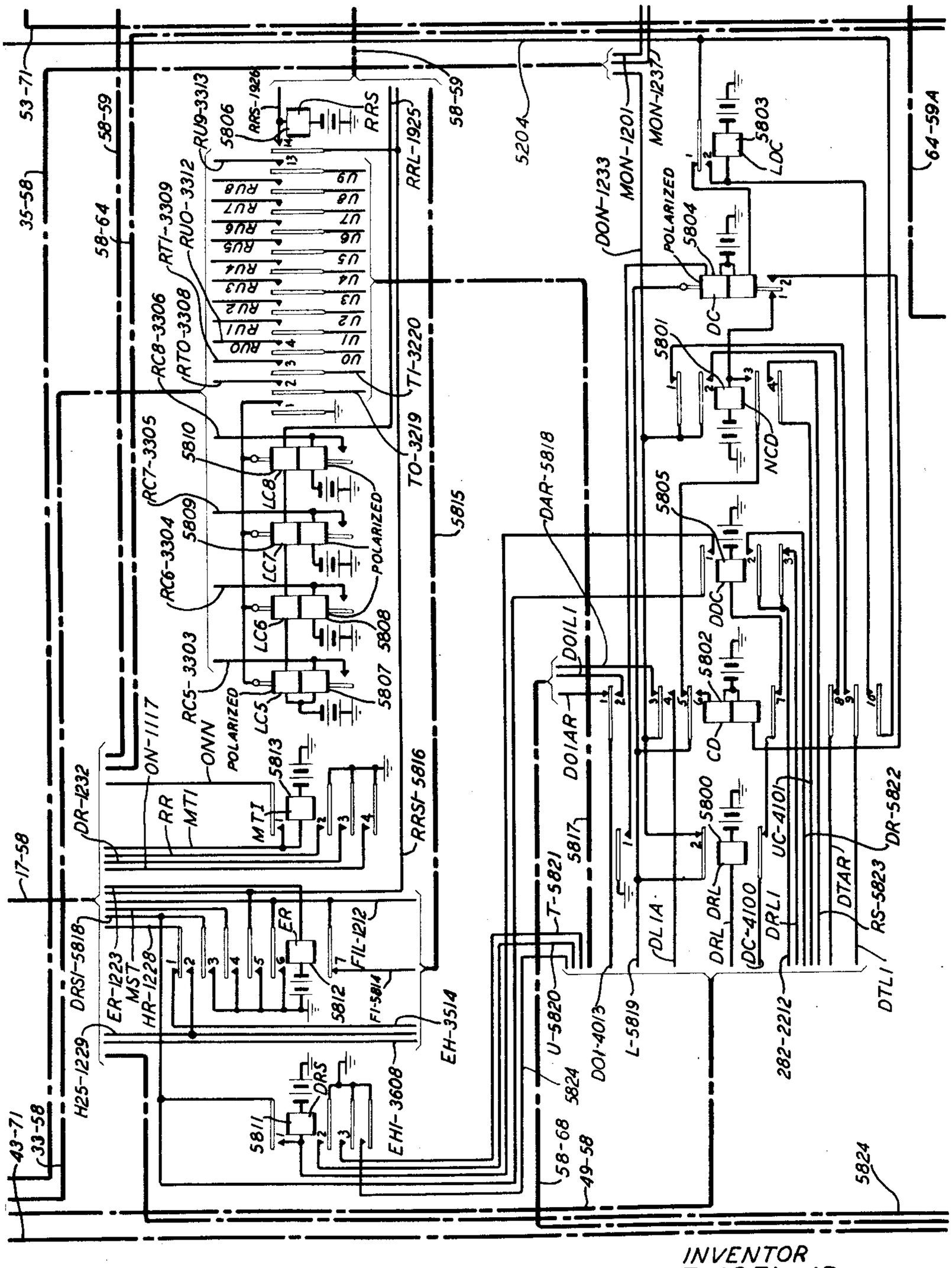


FIG. 58

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 58

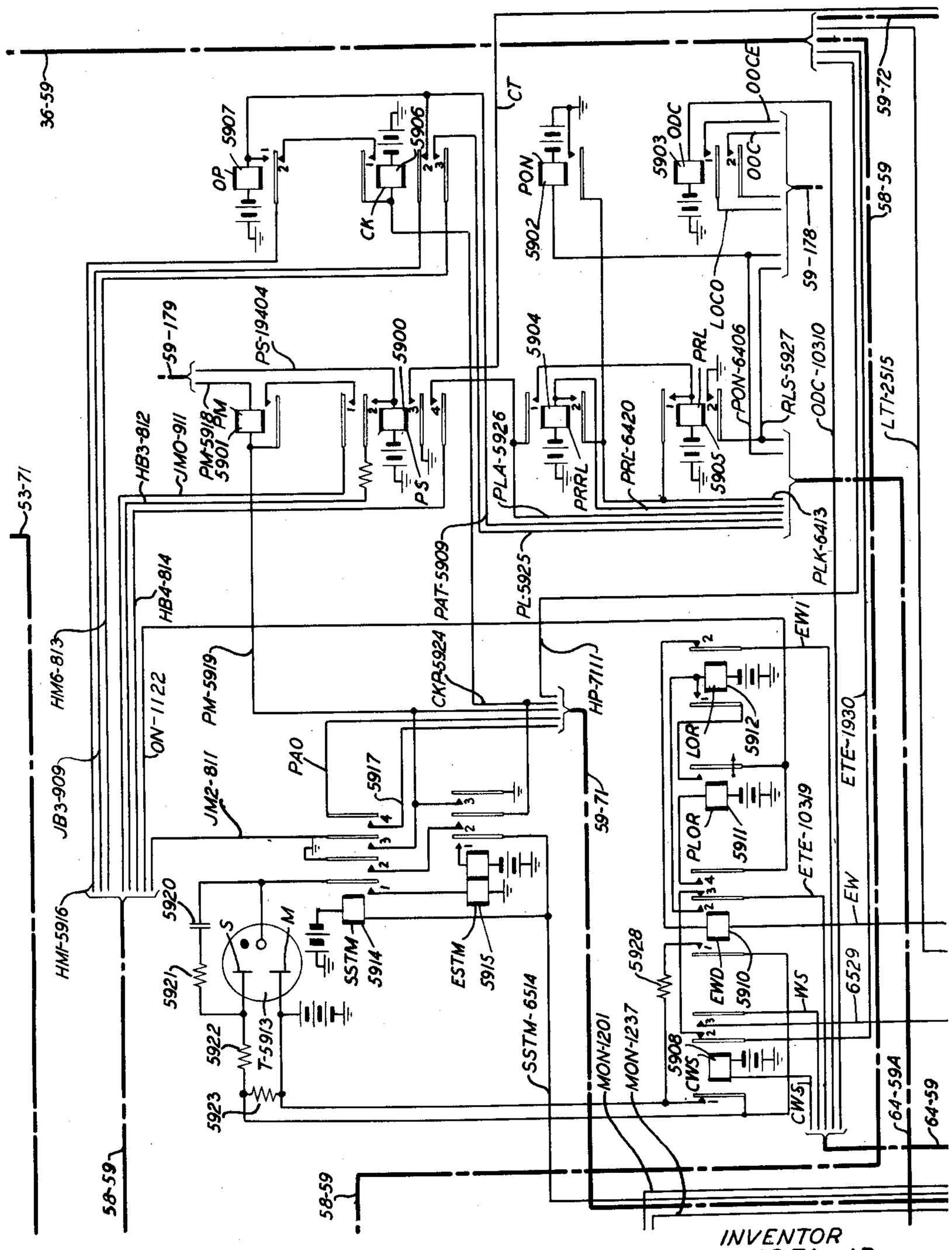


FIG. 59

INVENTOR
A. E. JOEL, JR.
BY
Sol Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 59

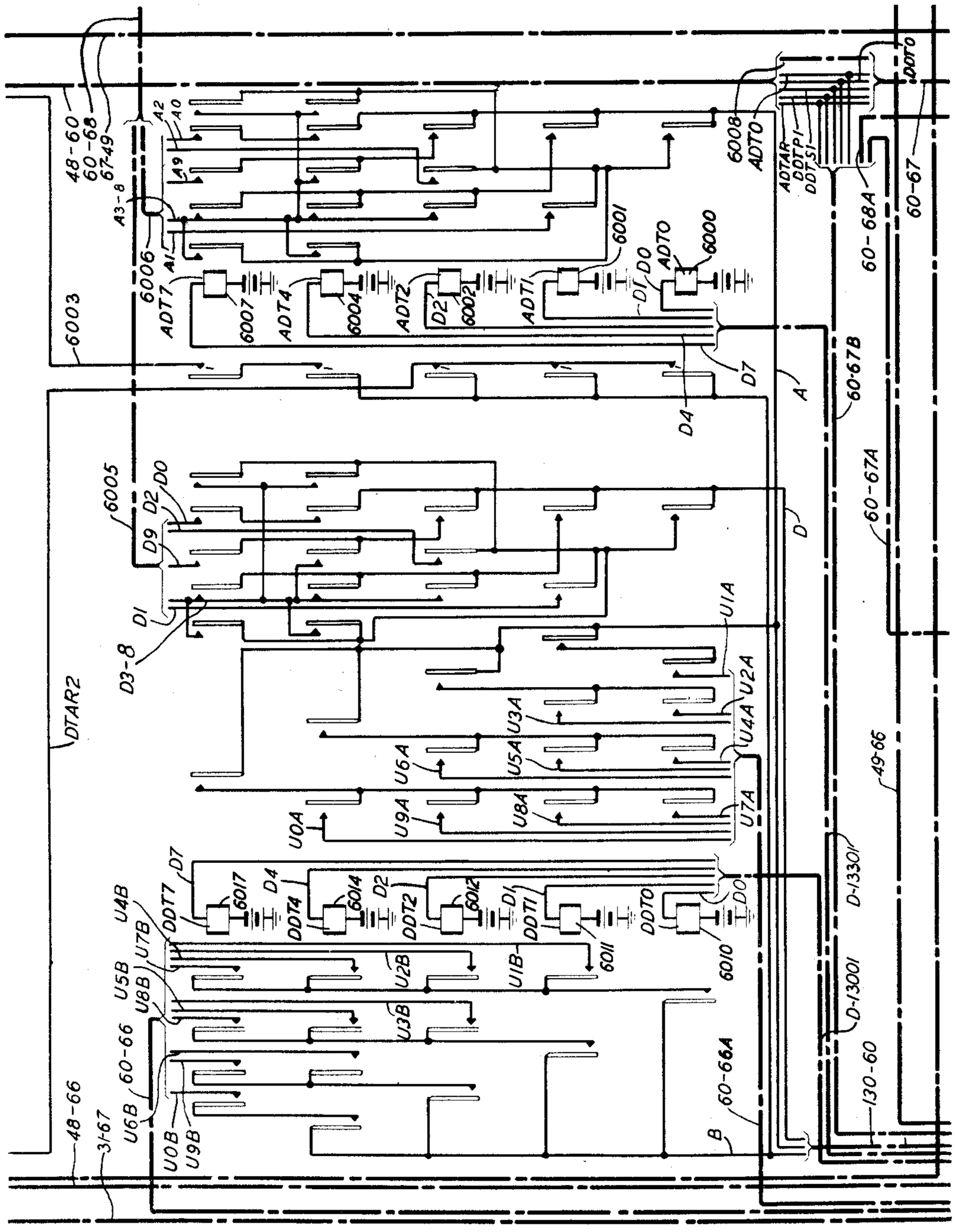


FIG. 60

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 60

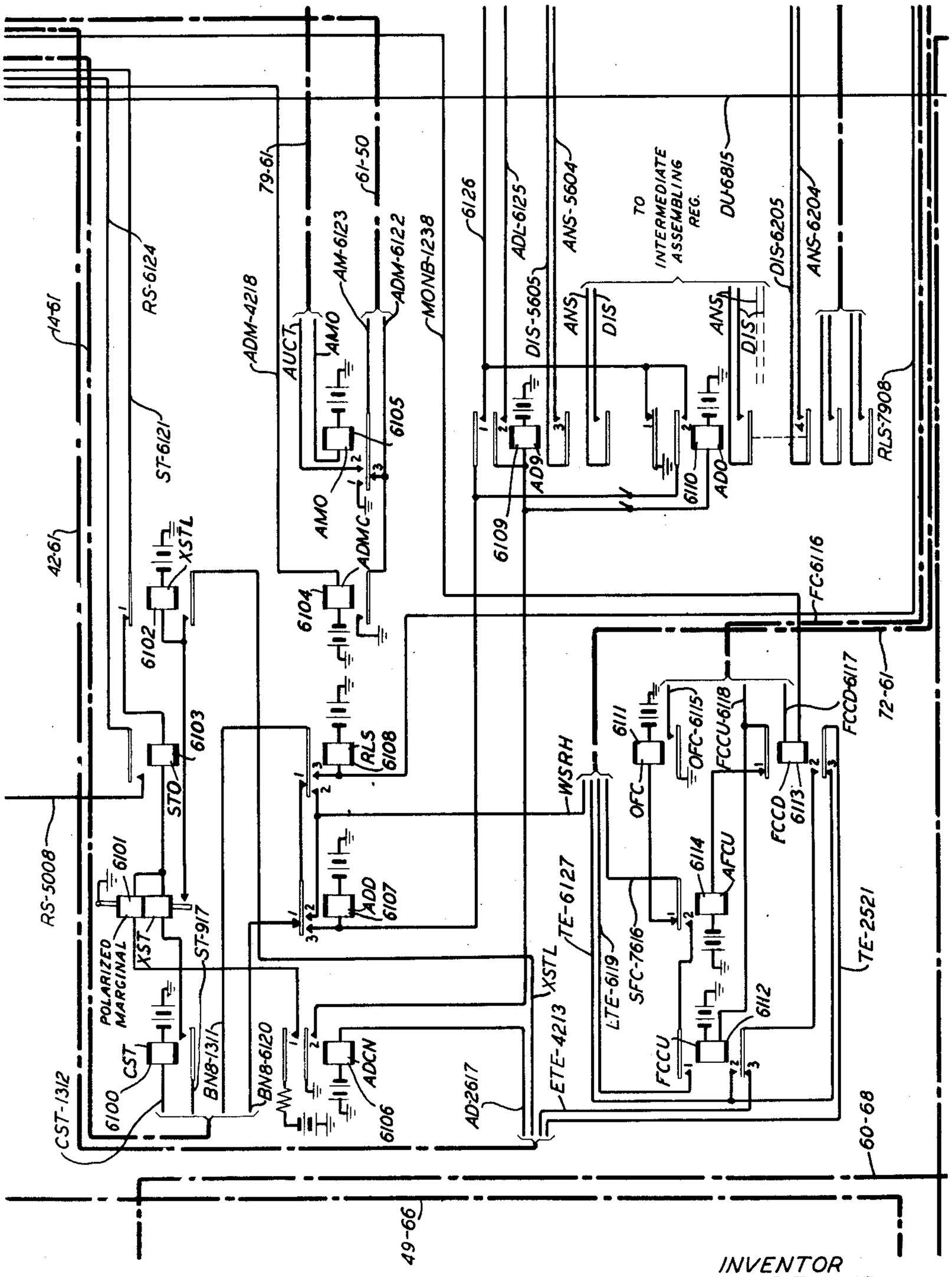


FIG. 61

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 61

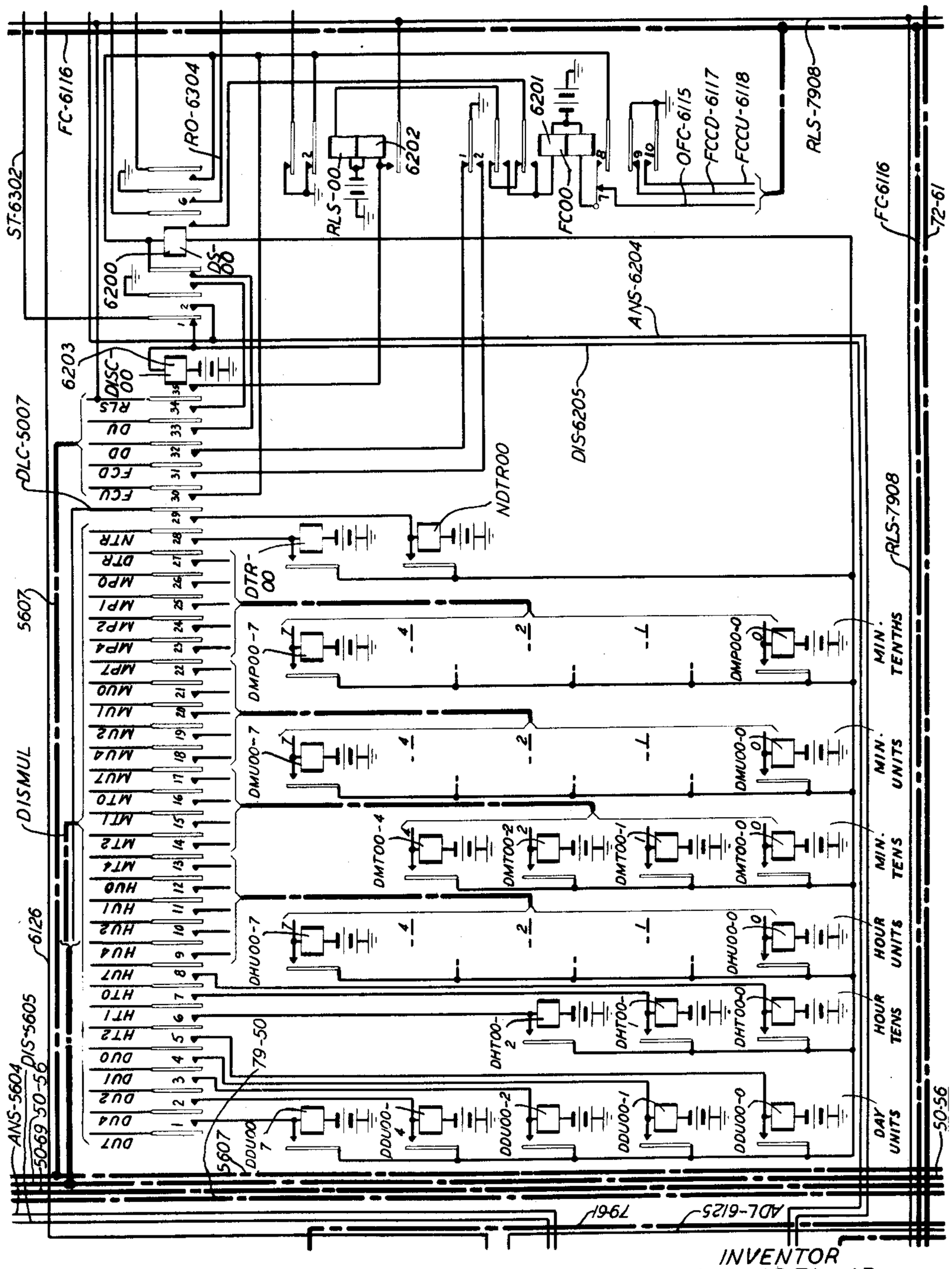


FIG. 62

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 62

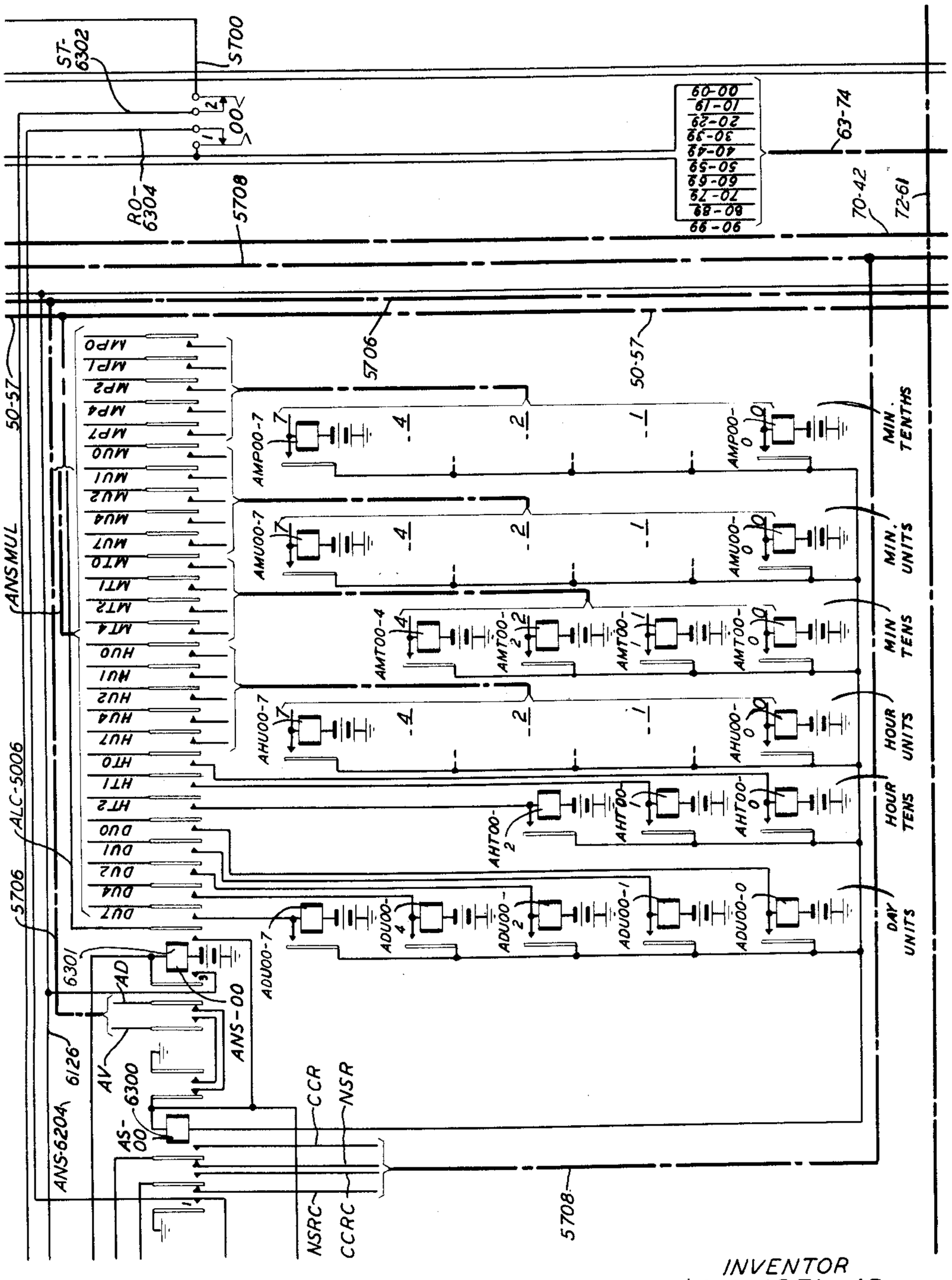


FIG. 63

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 63

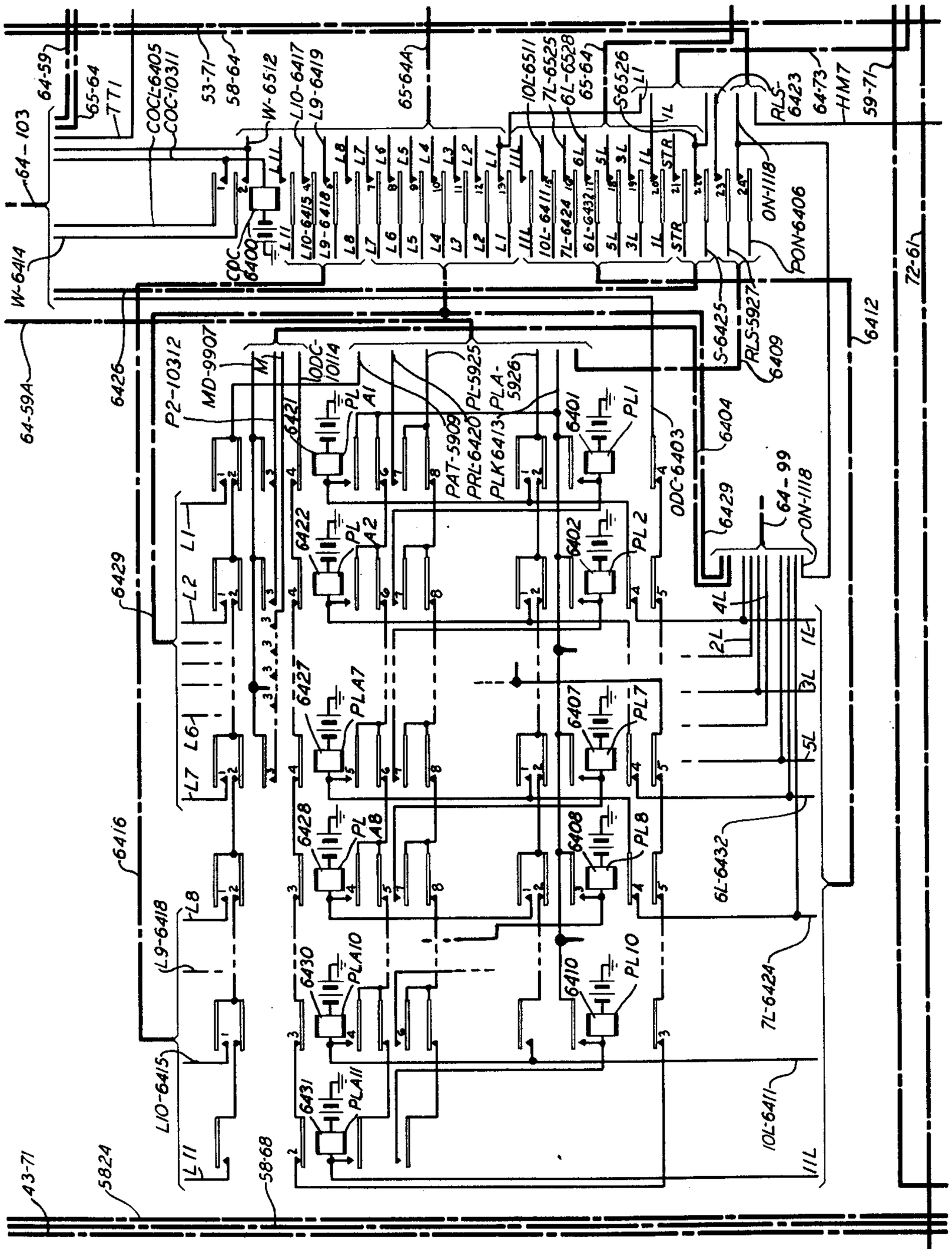


FIG.64

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 64

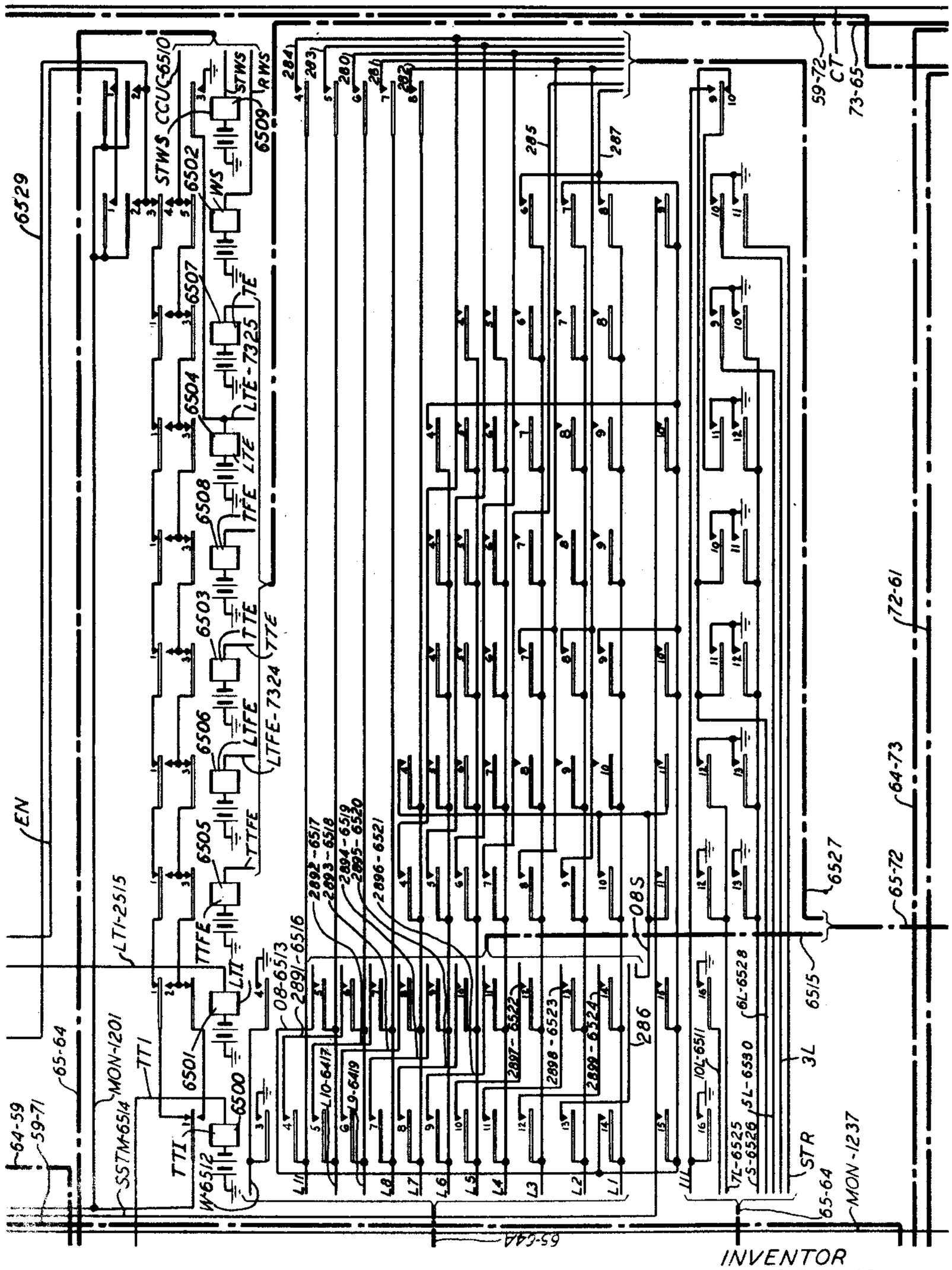


FIG. 65

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 65

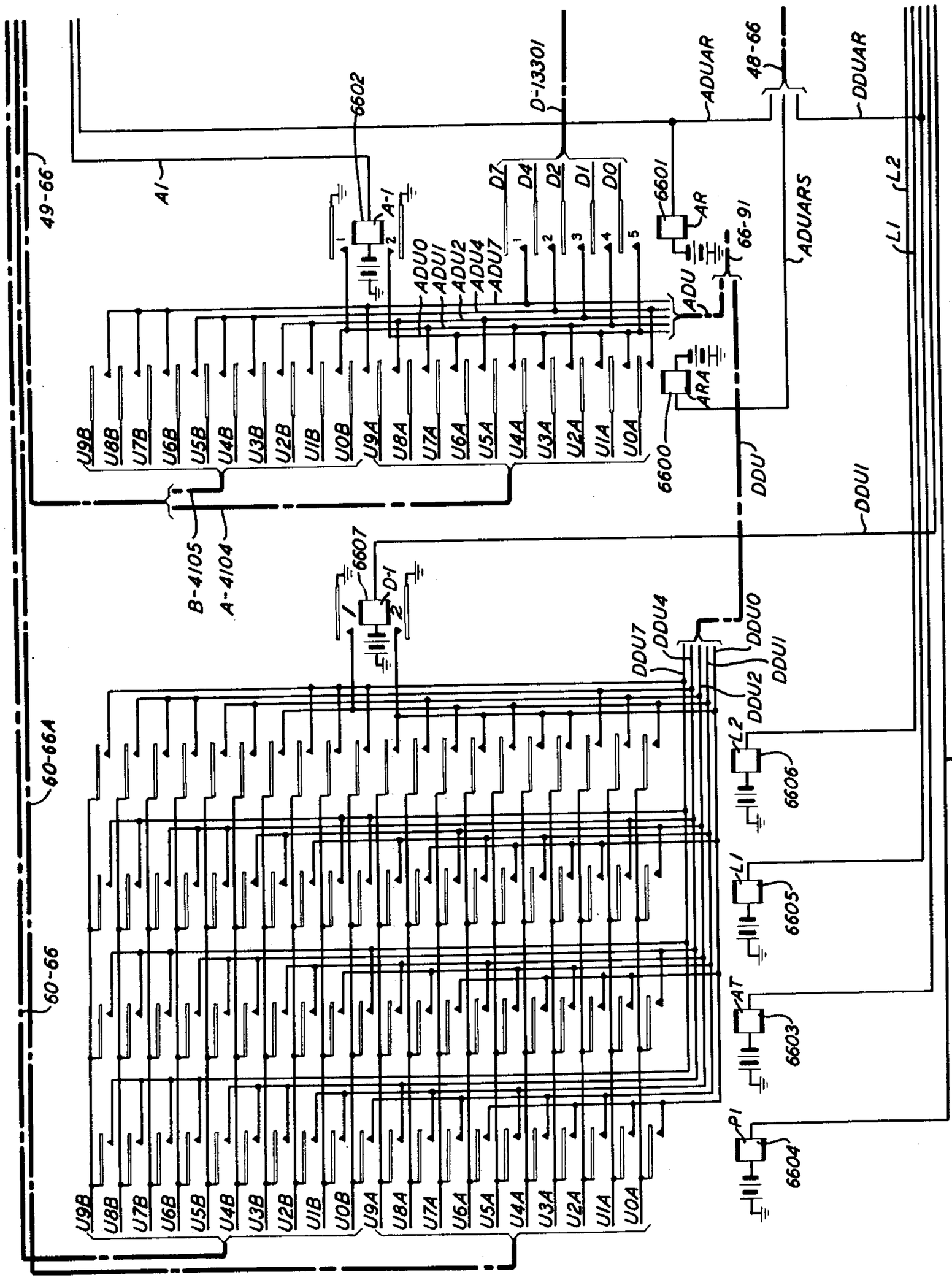


FIG. 66

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 66

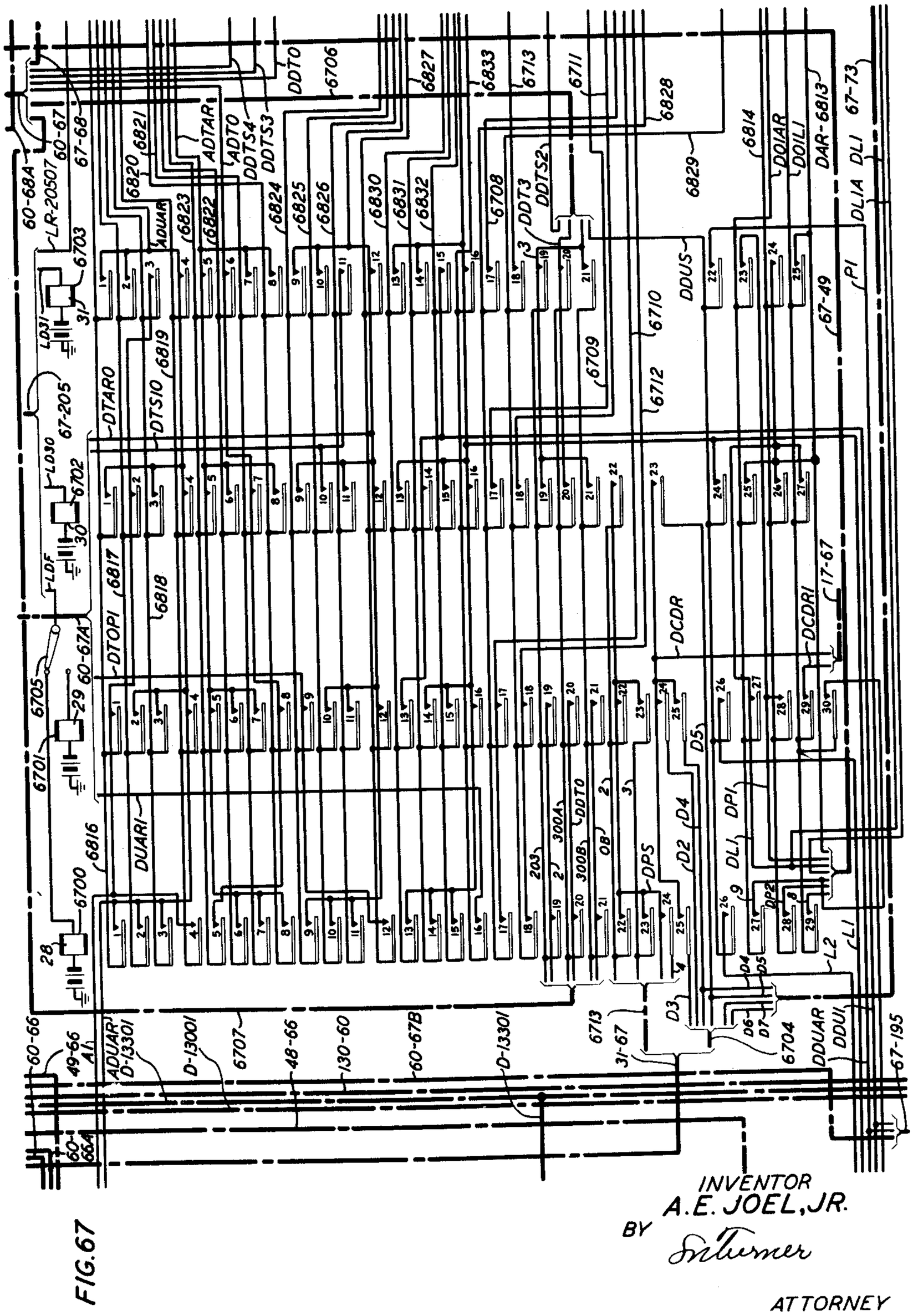


FIG. 67

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 67

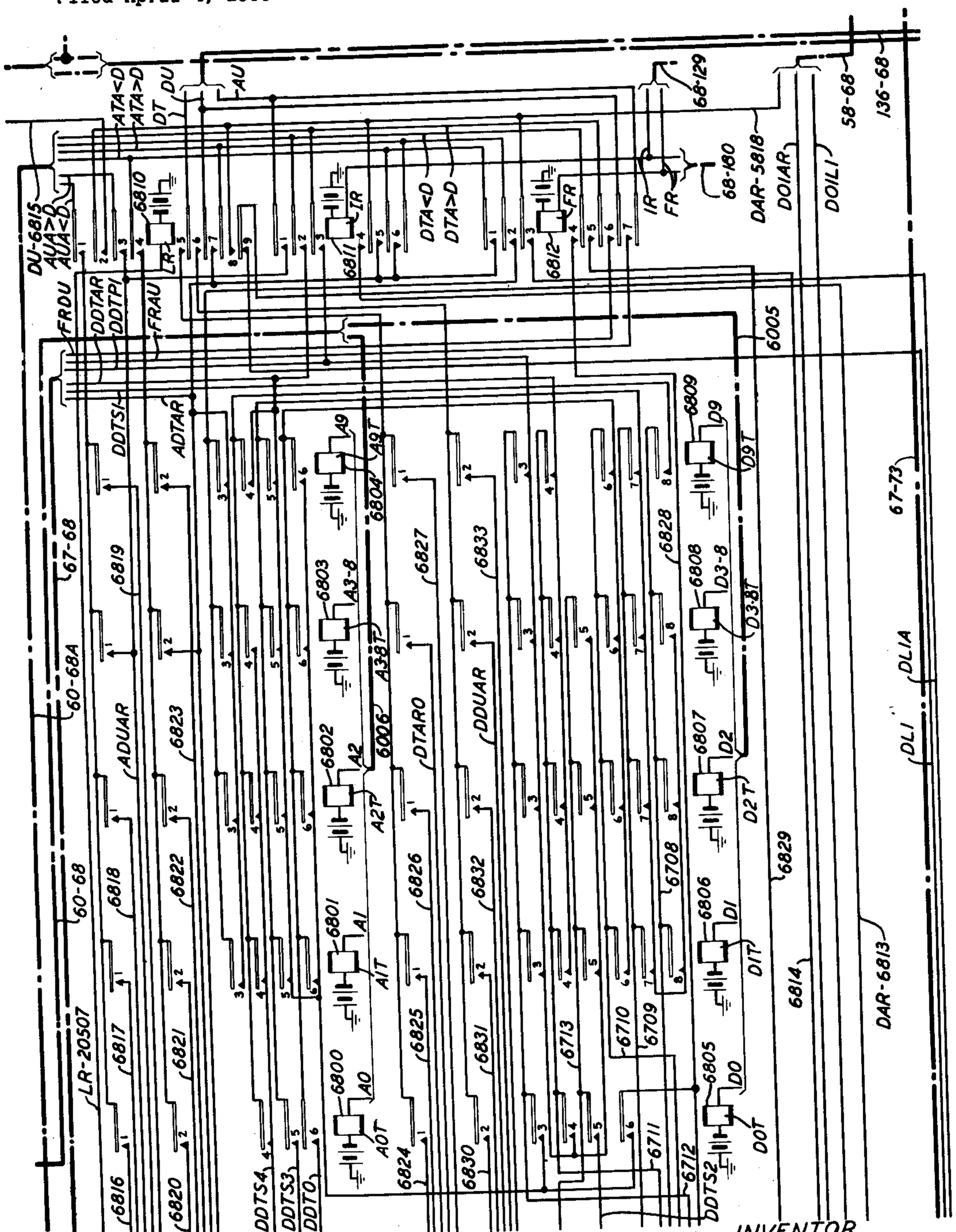


FIG. 68

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 68

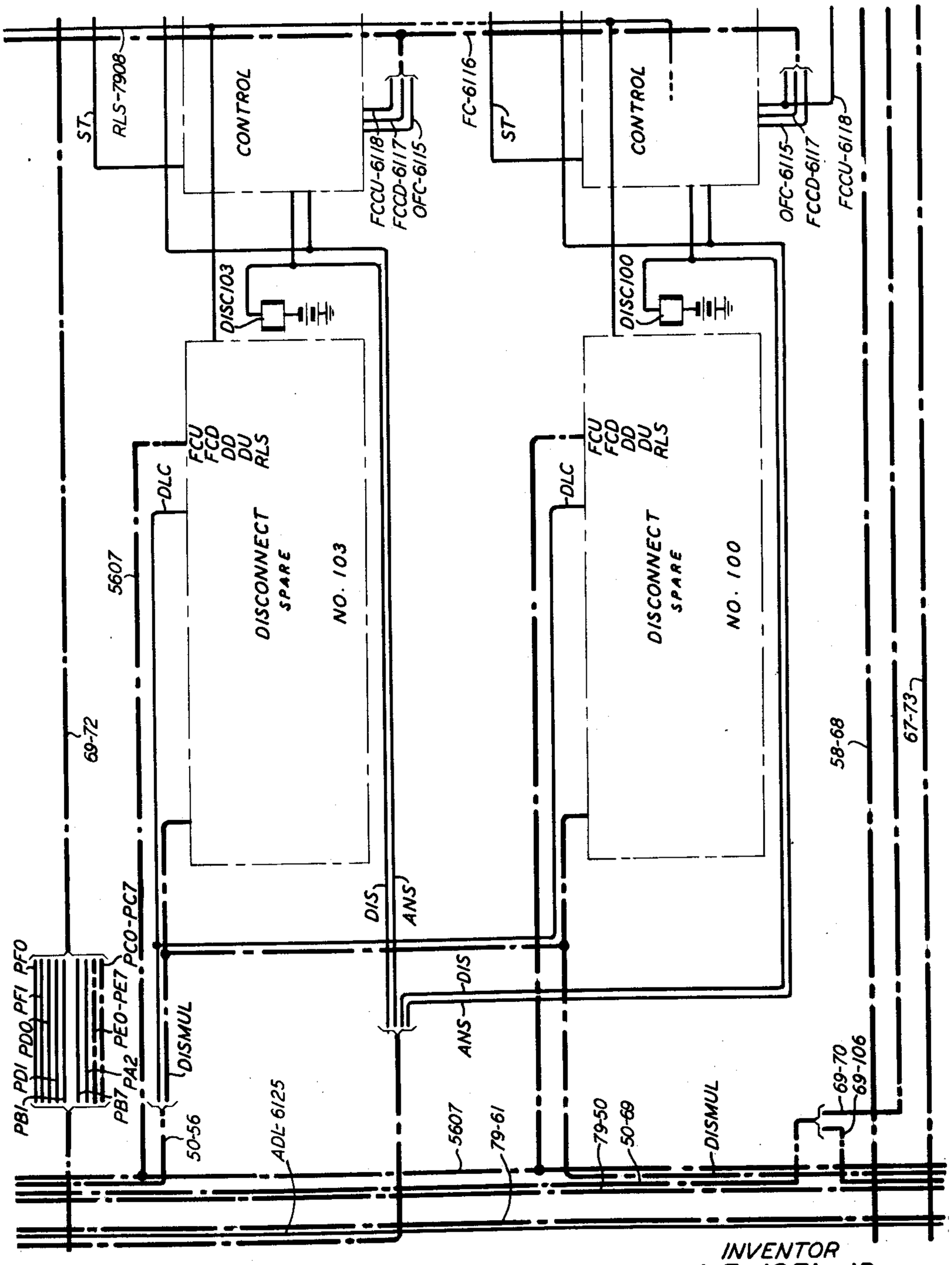


FIG. 69

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 69

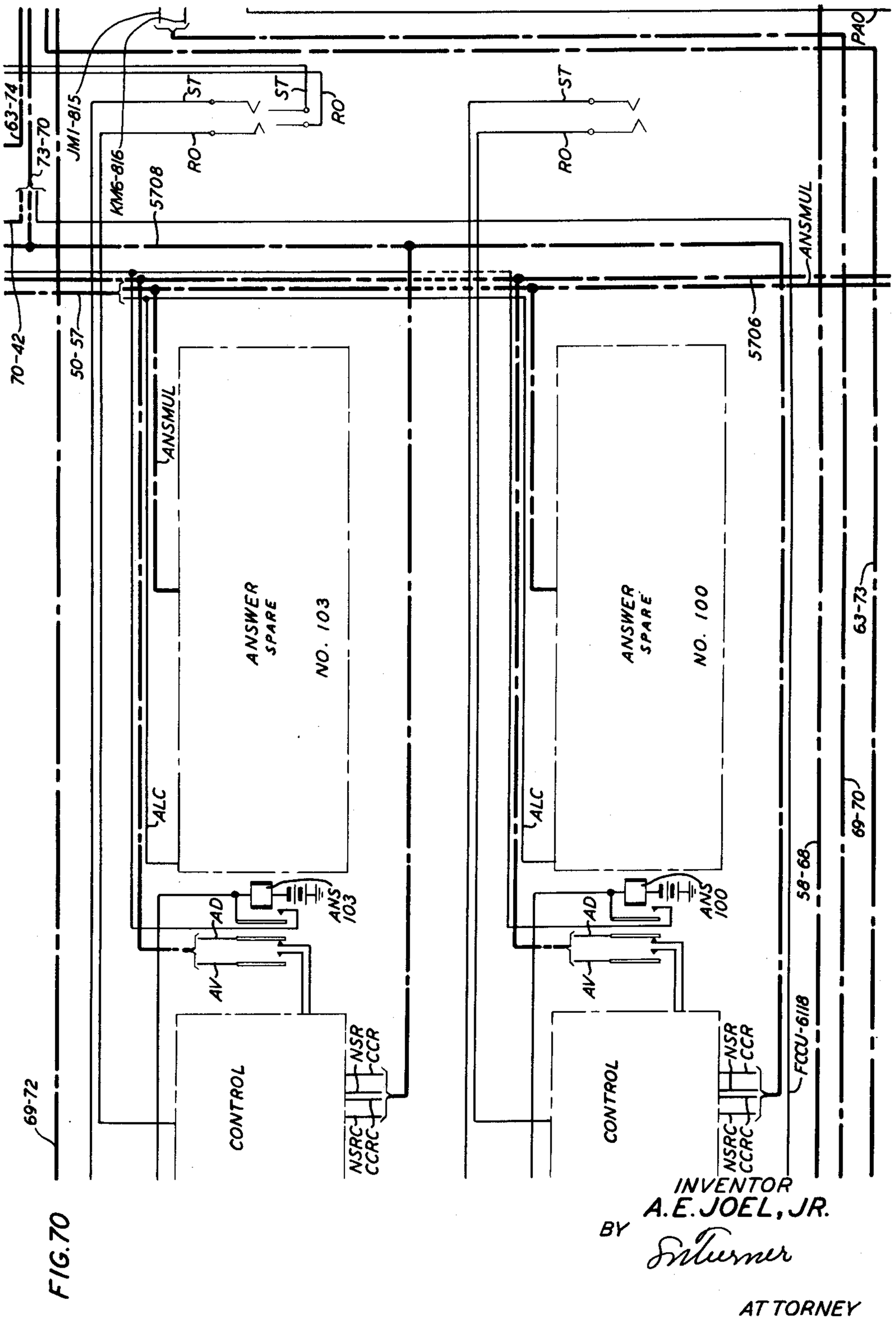


FIG. 70

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 70

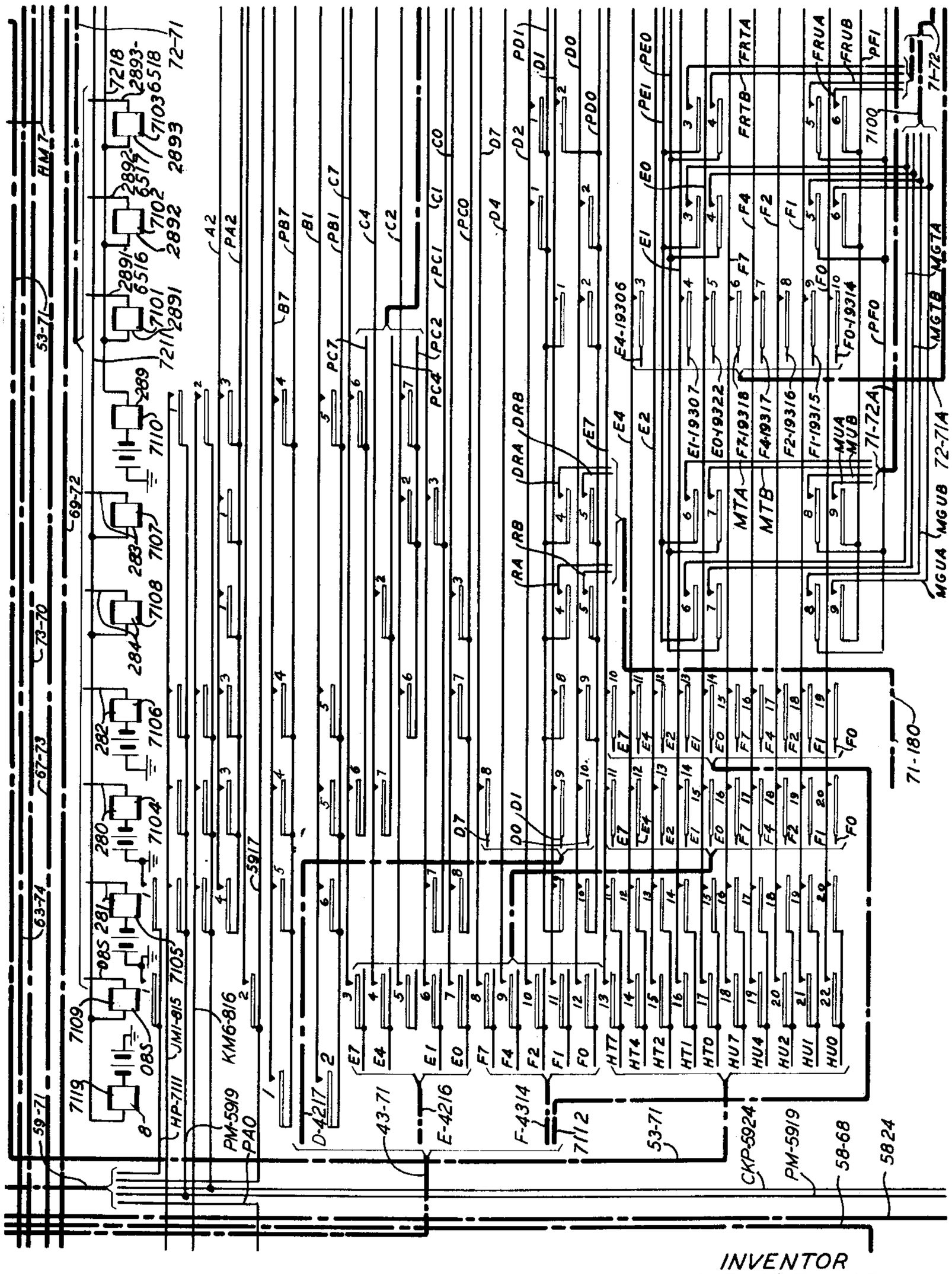


FIG. 71

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 71

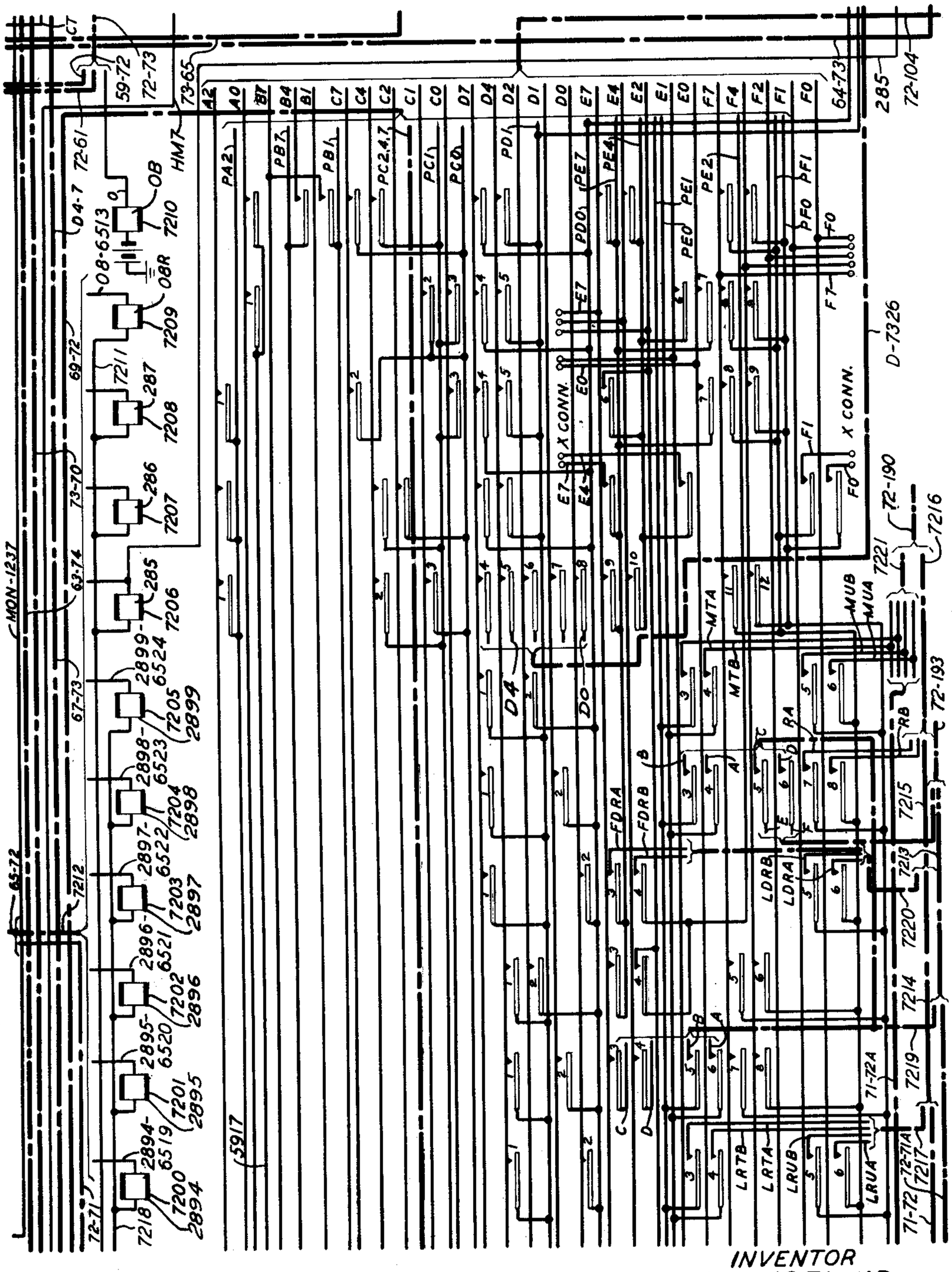


FIG. 72

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 72

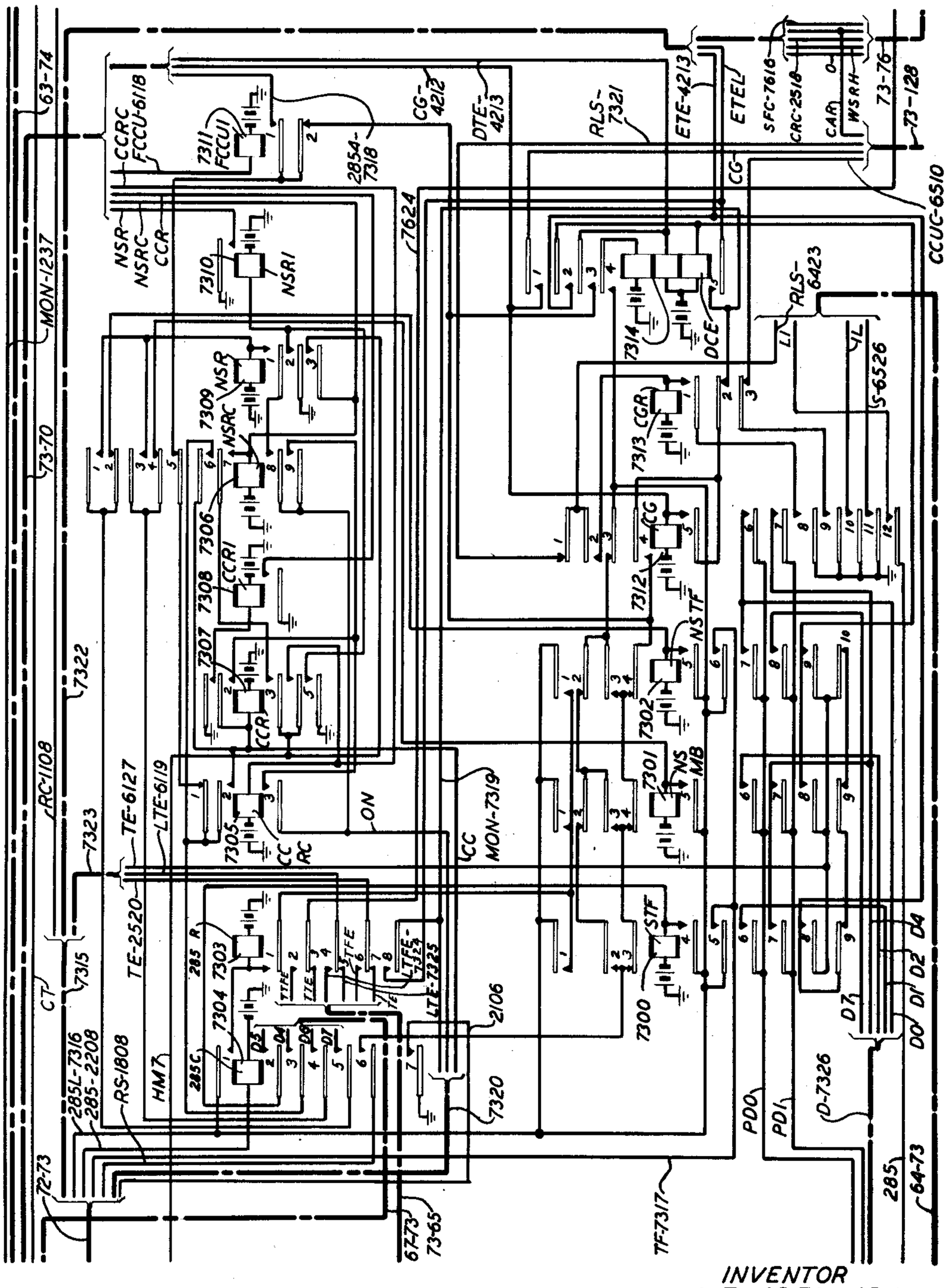


FIG. 73

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 73

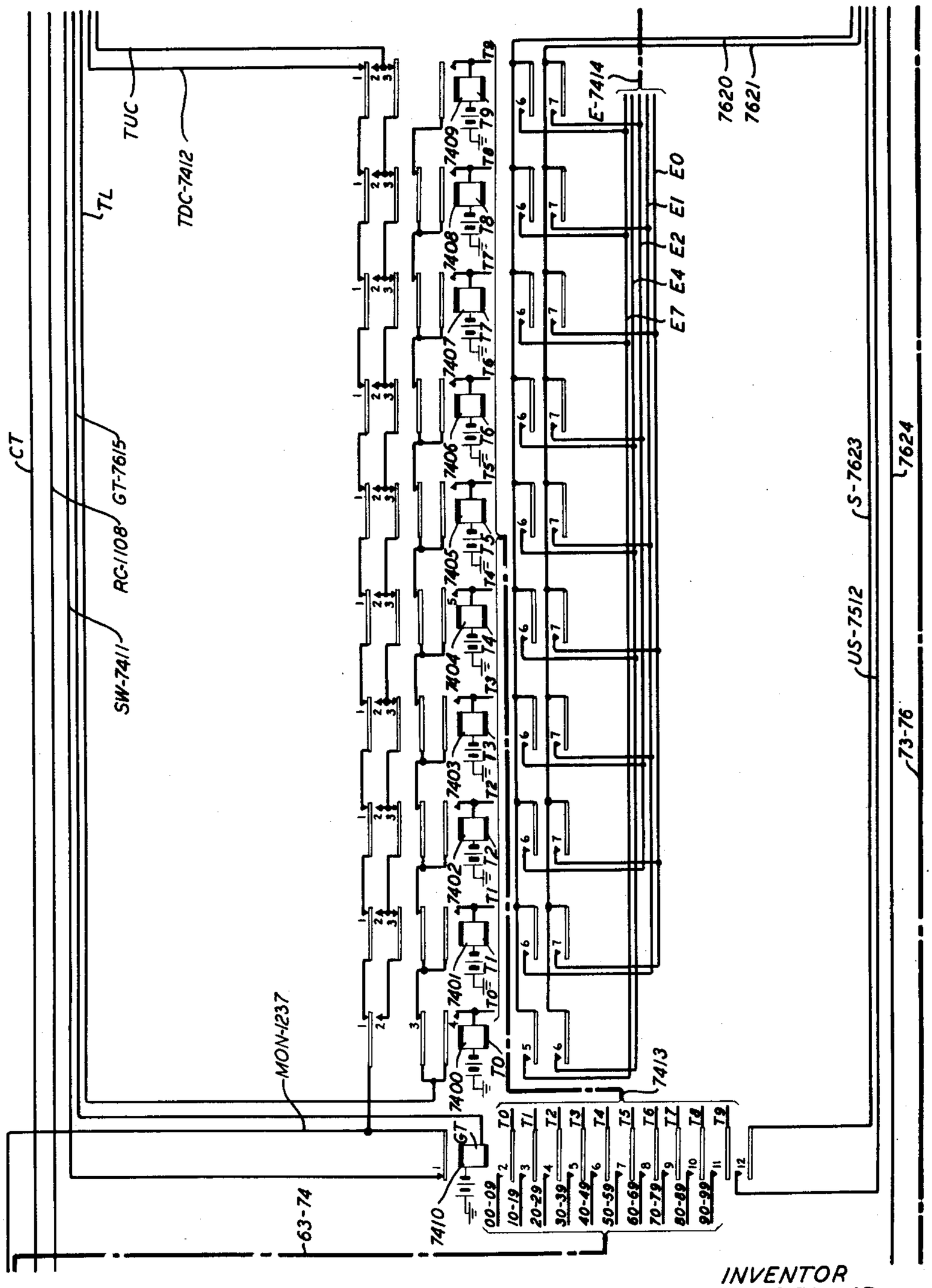


FIG. 74

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 74

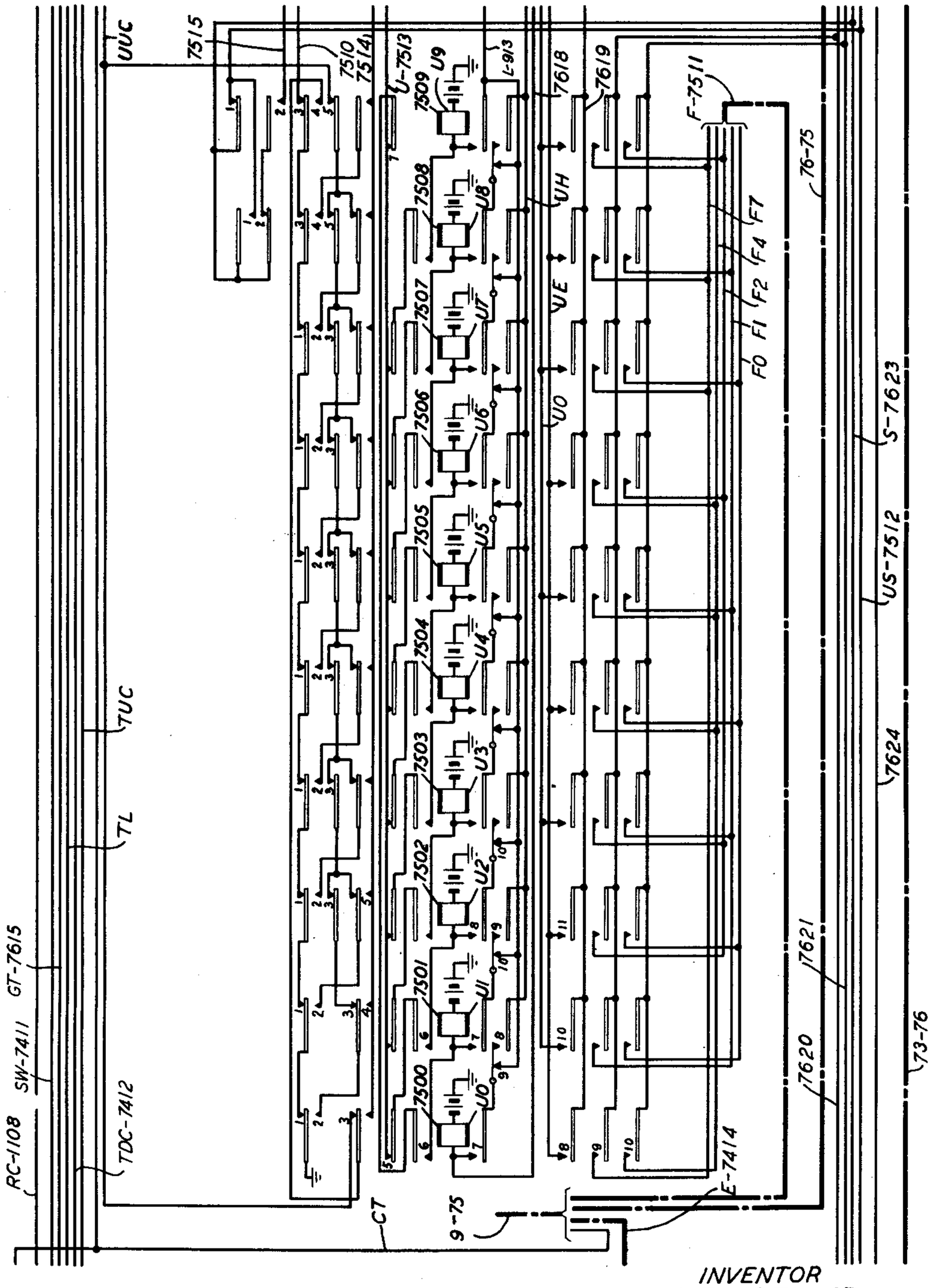


FIG. 75

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 75

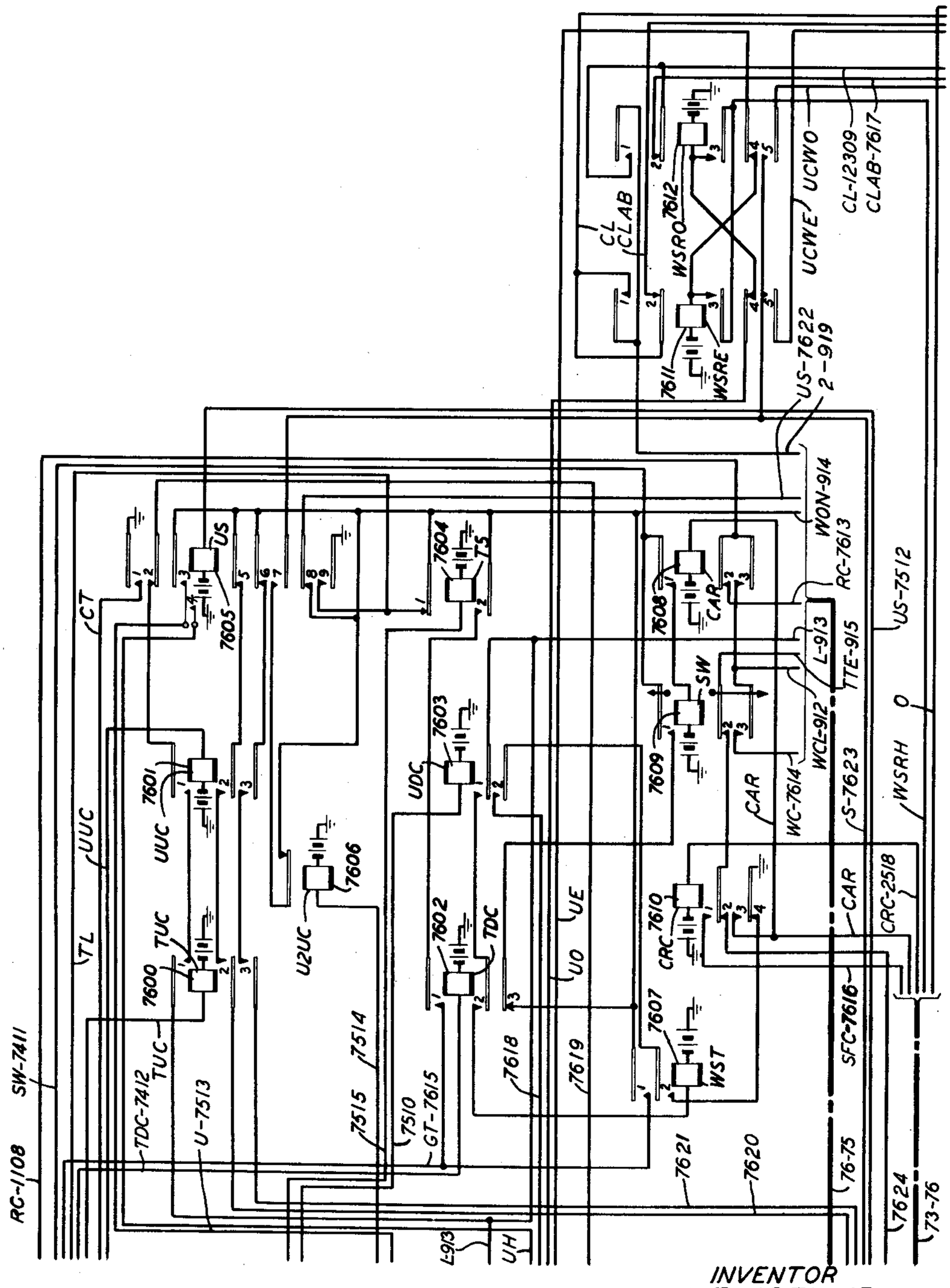


FIG. 76

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 76

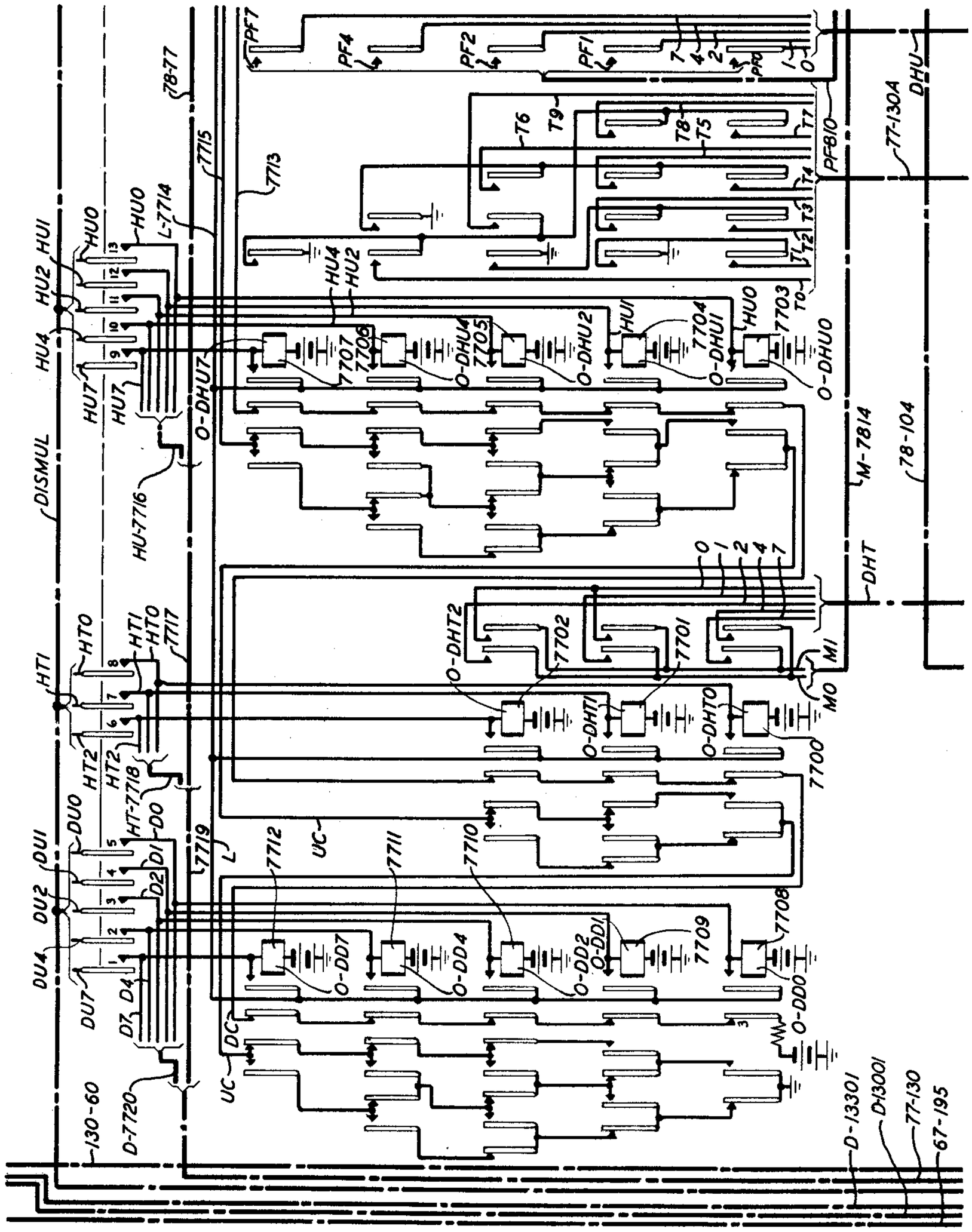


FIG. 77

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 77

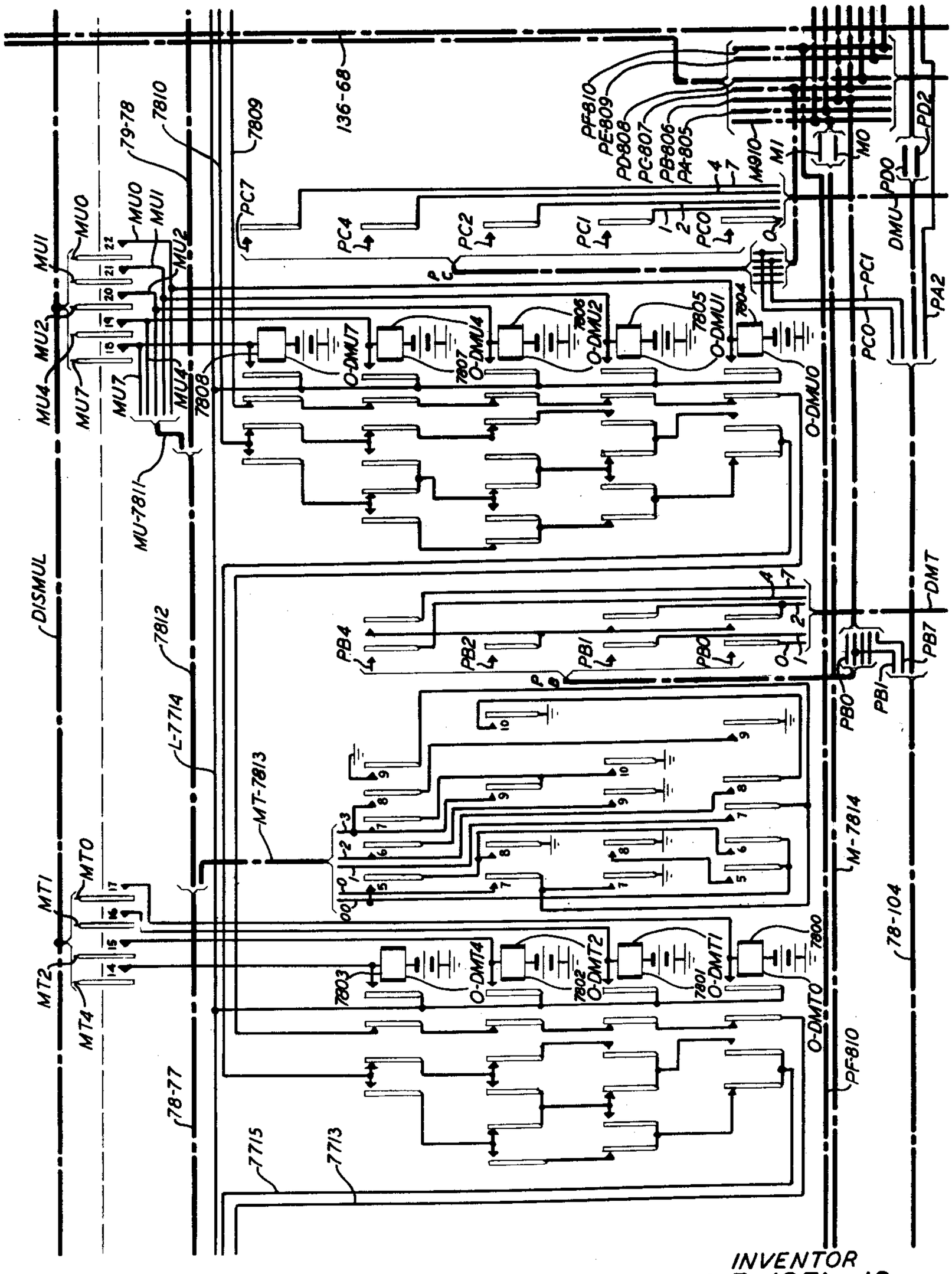


FIG. 78

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 78

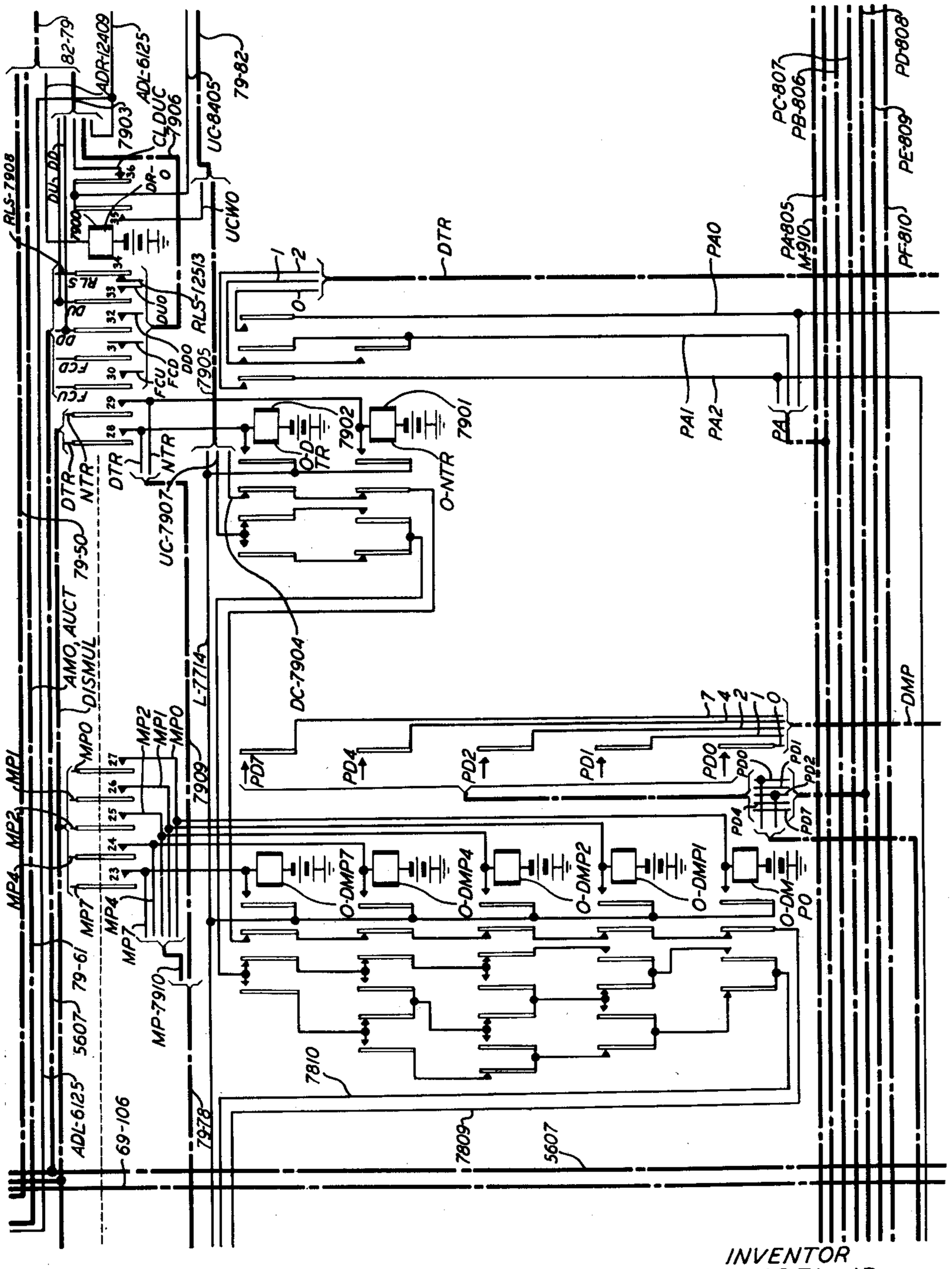


FIG. 79

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 79

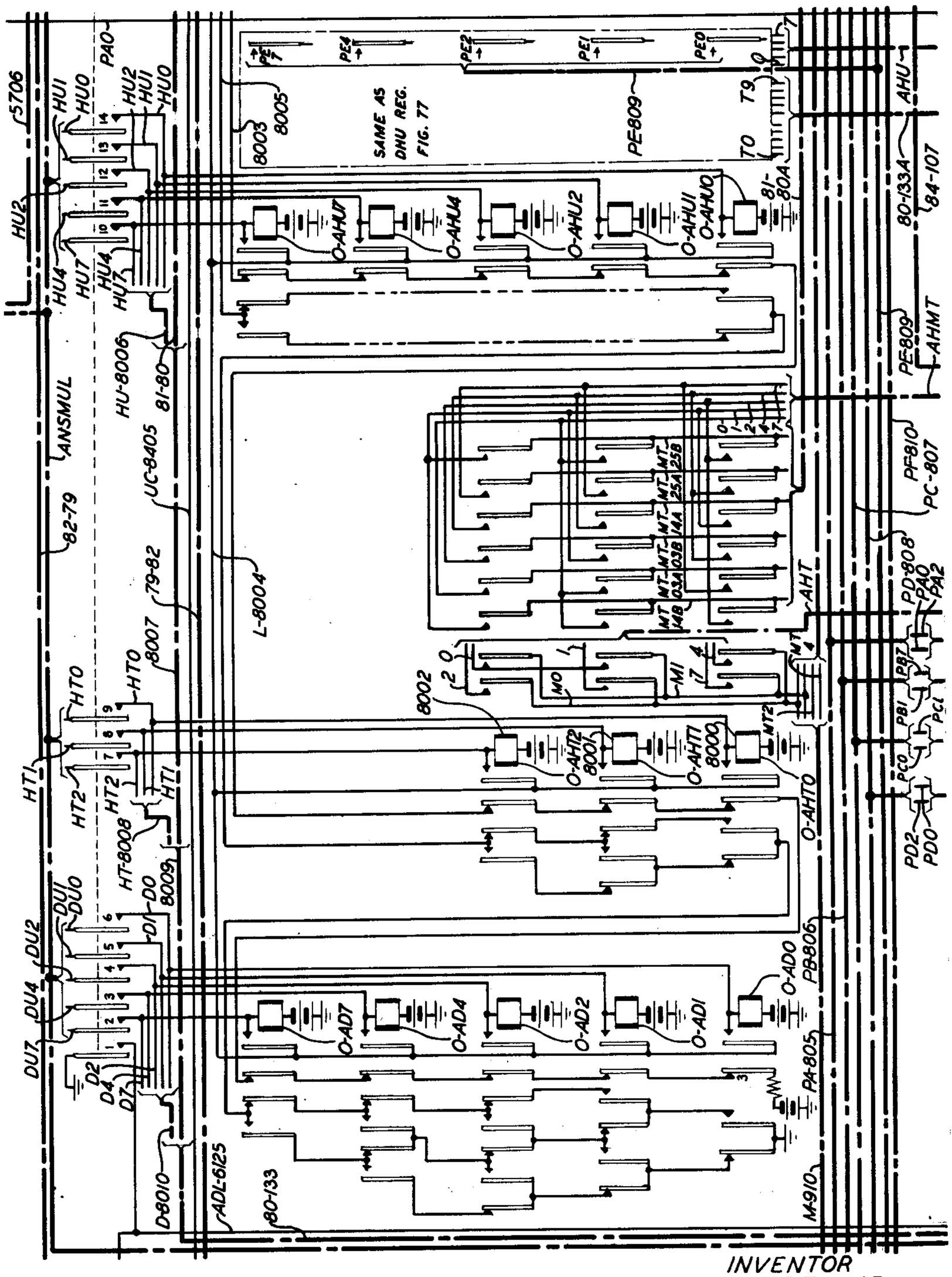


FIG. 80

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 80

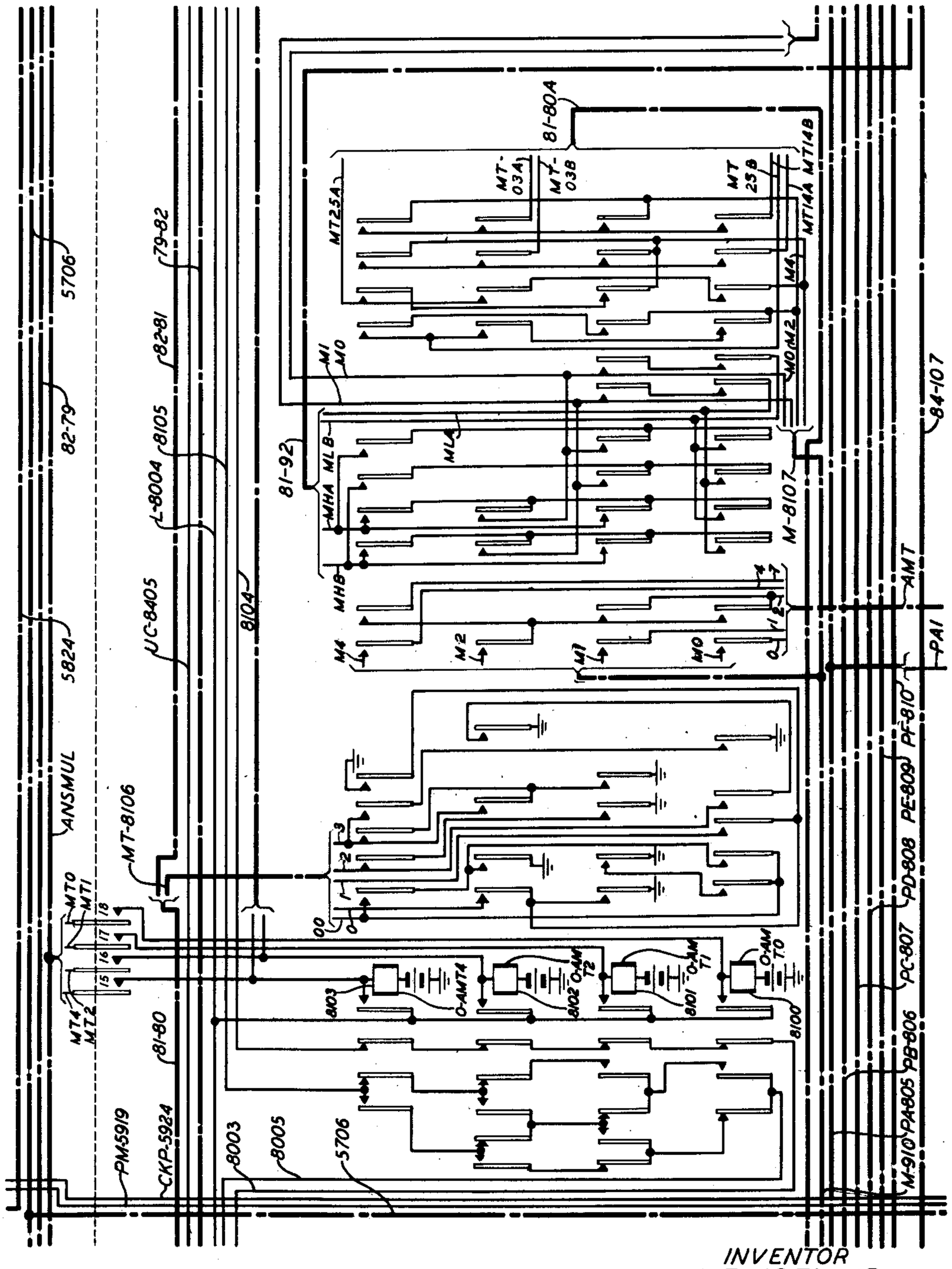


FIG. 81

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 81

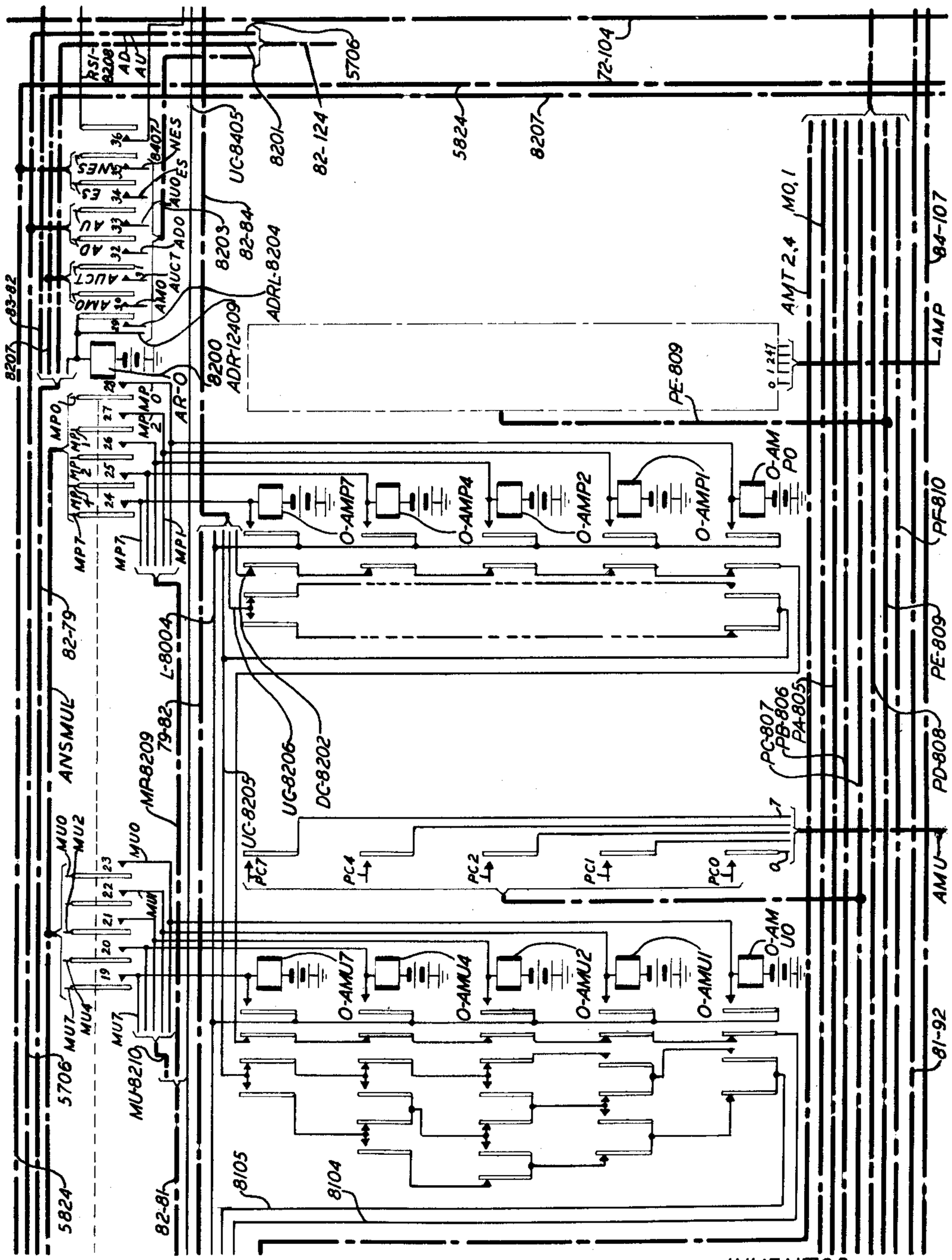


FIG. 82

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 82

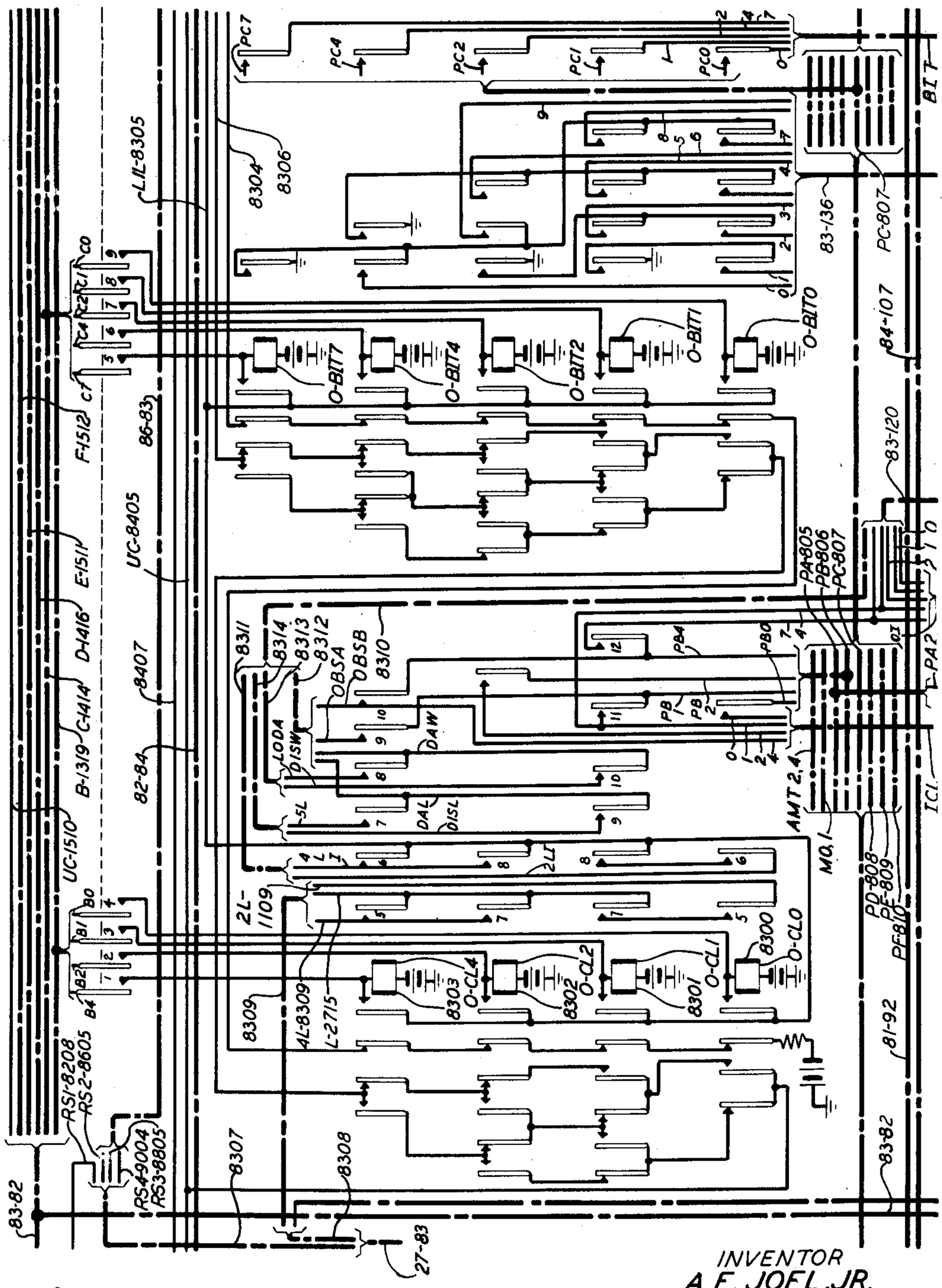


FIG. 83

INVENTOR
A.E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 83

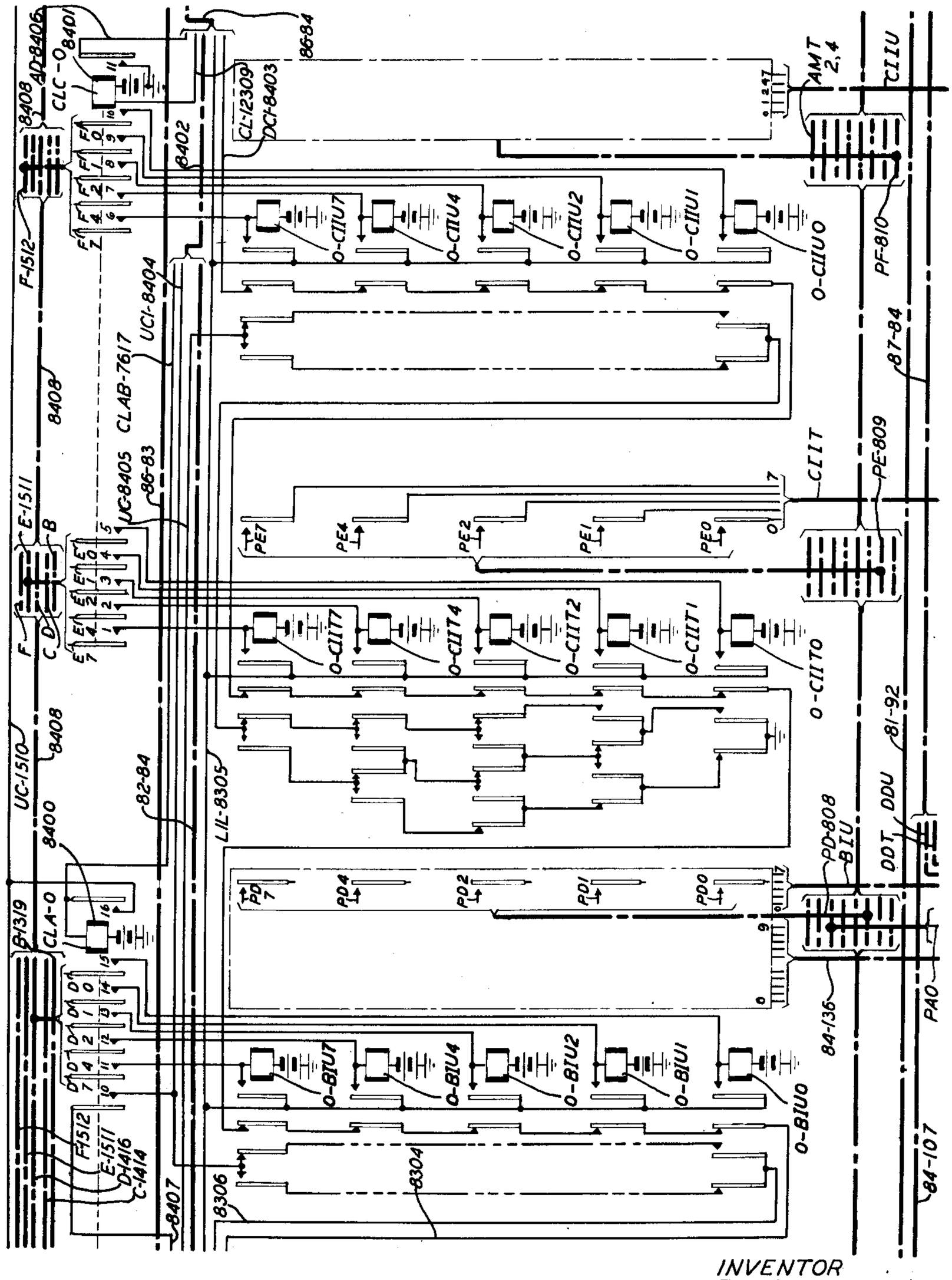


FIG. 84

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 84

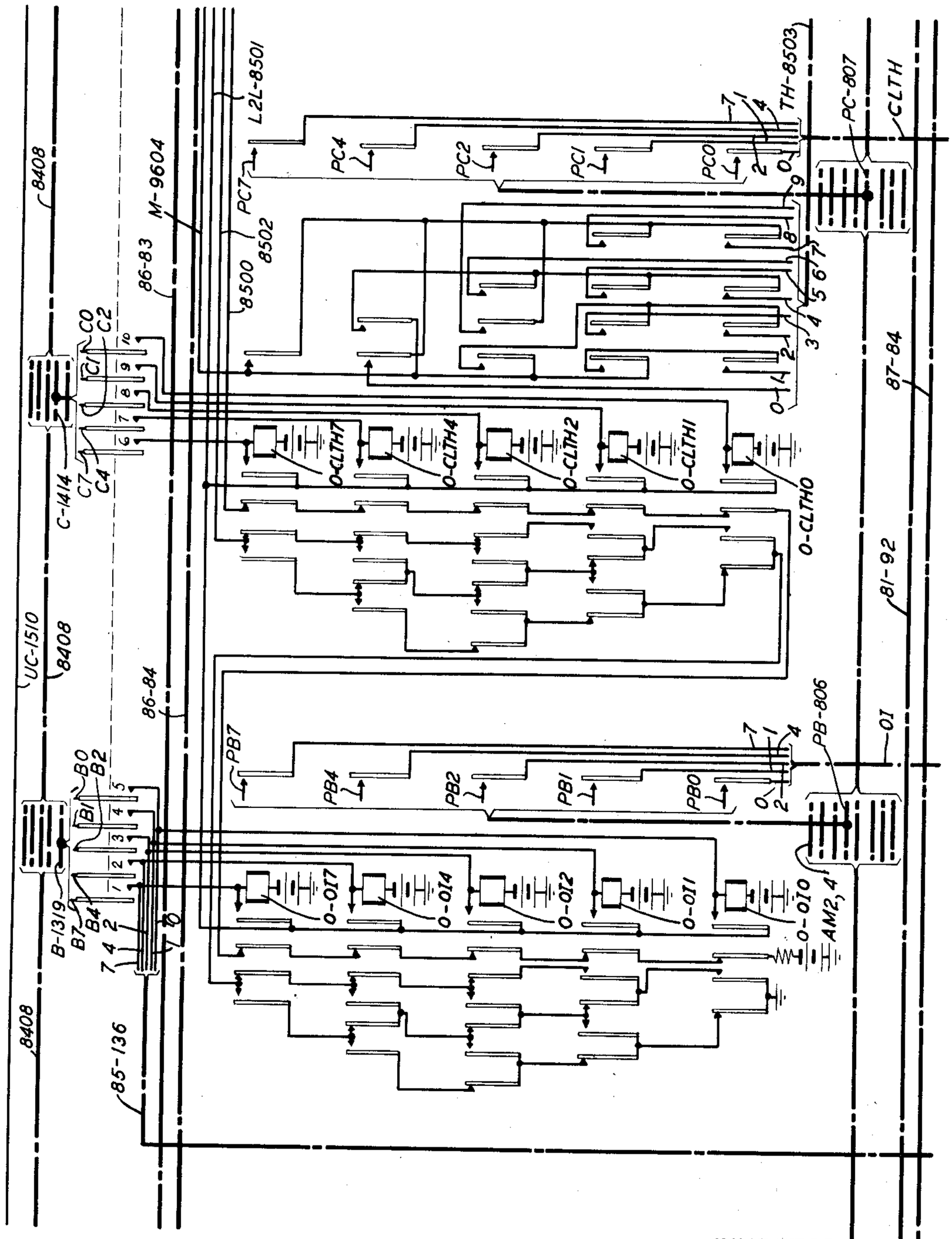


FIG.85

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 85

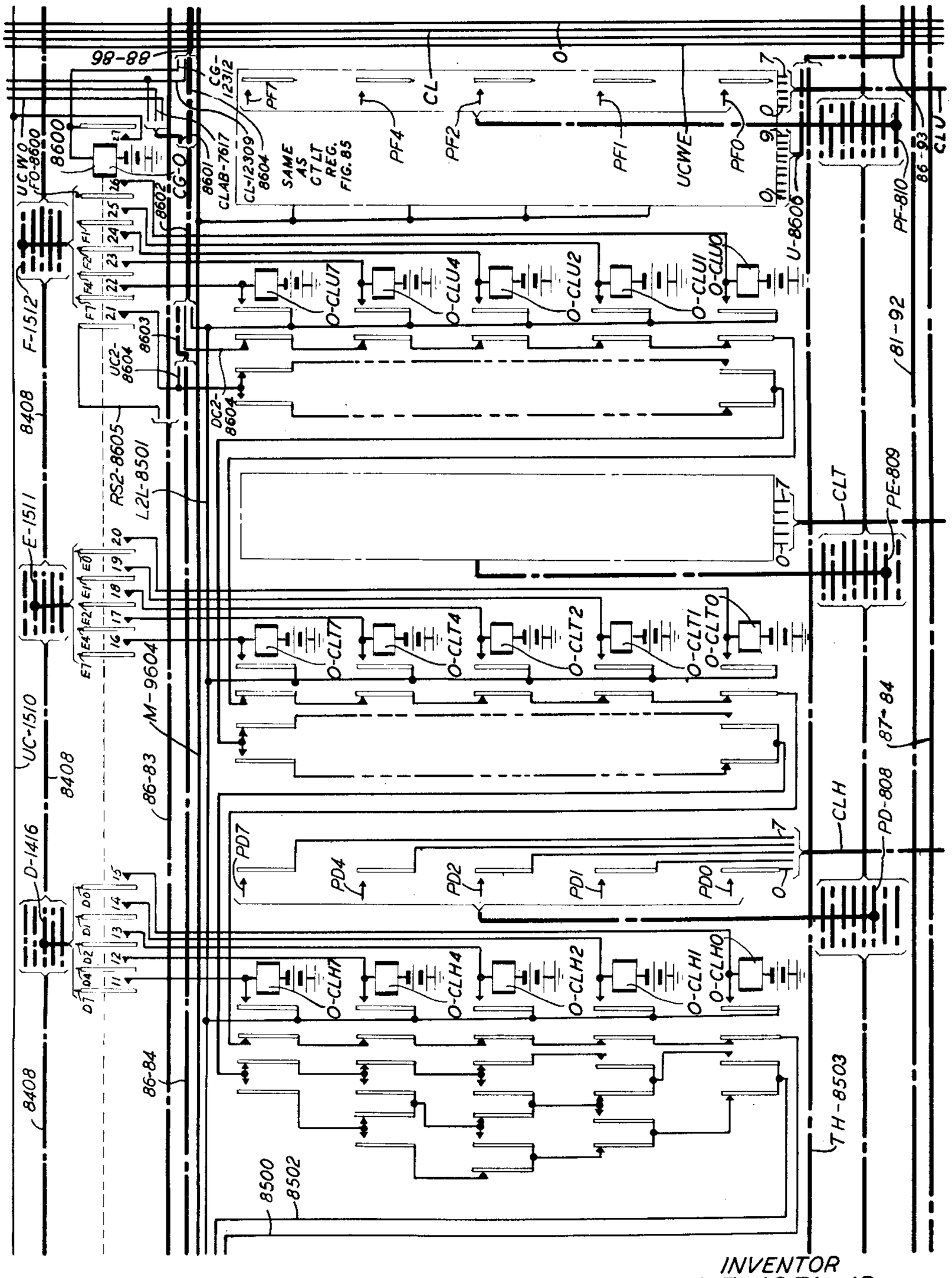


FIG. 86

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 86

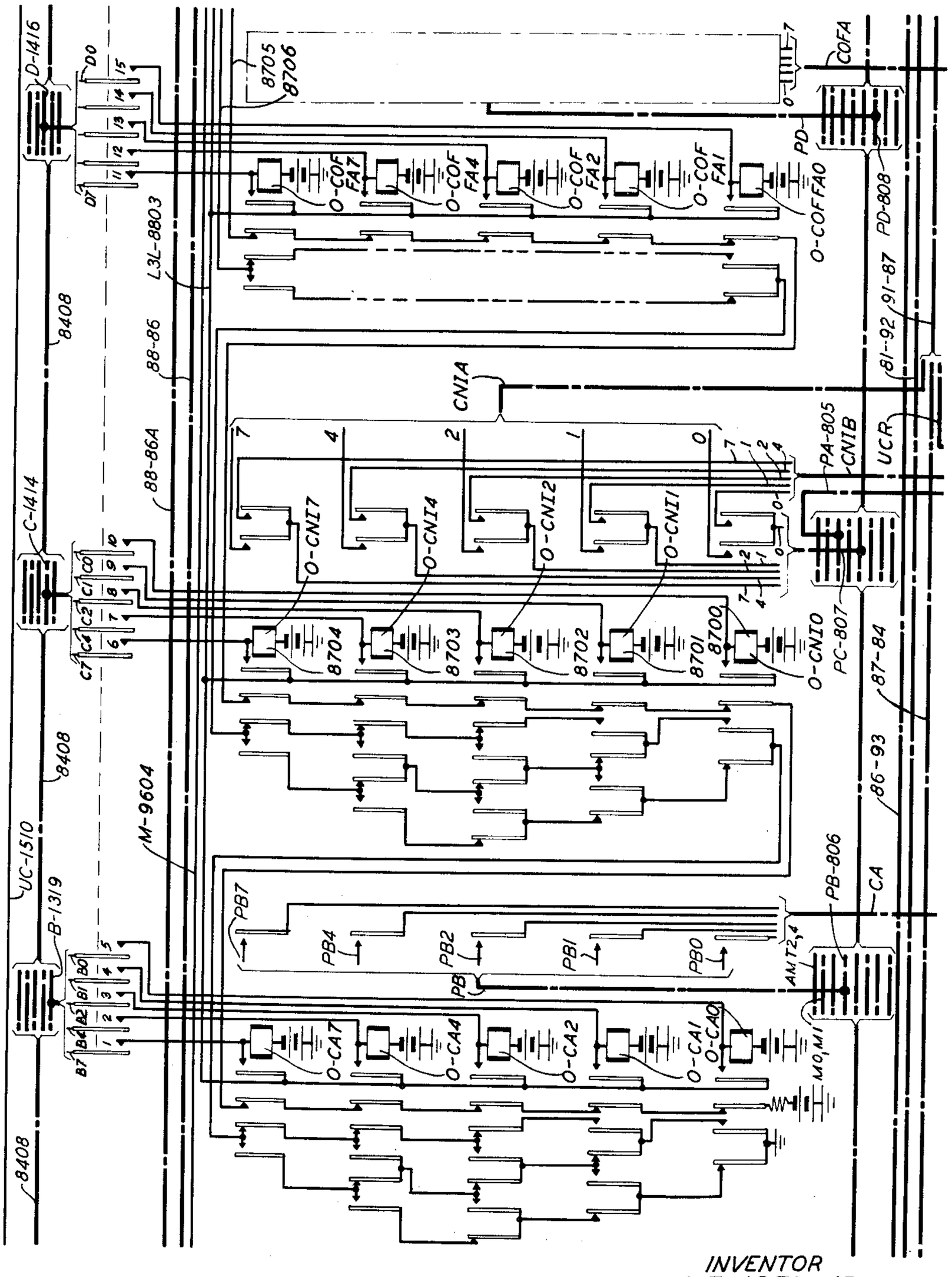


FIG. 87

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 87

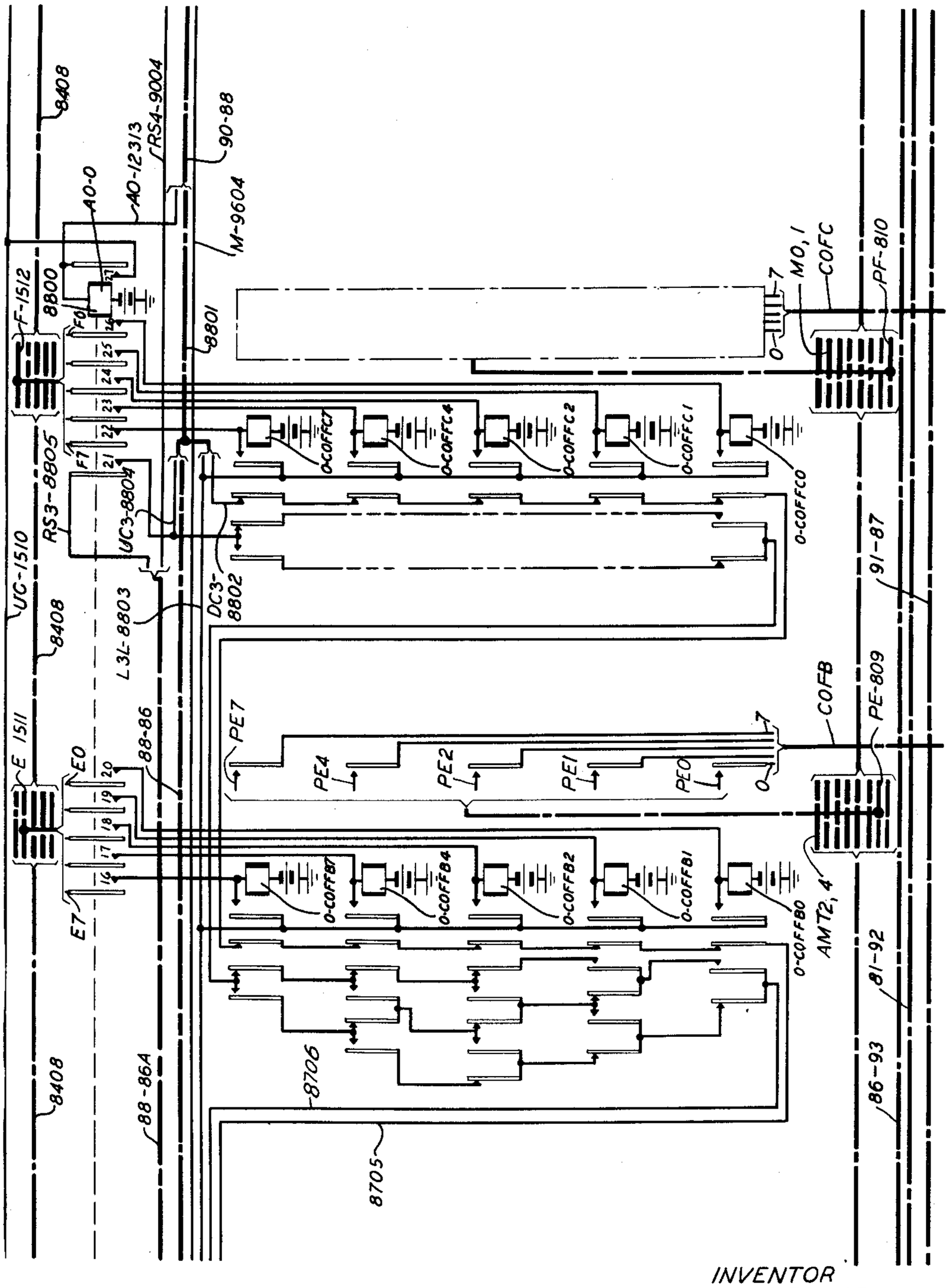


FIG. 88

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 88

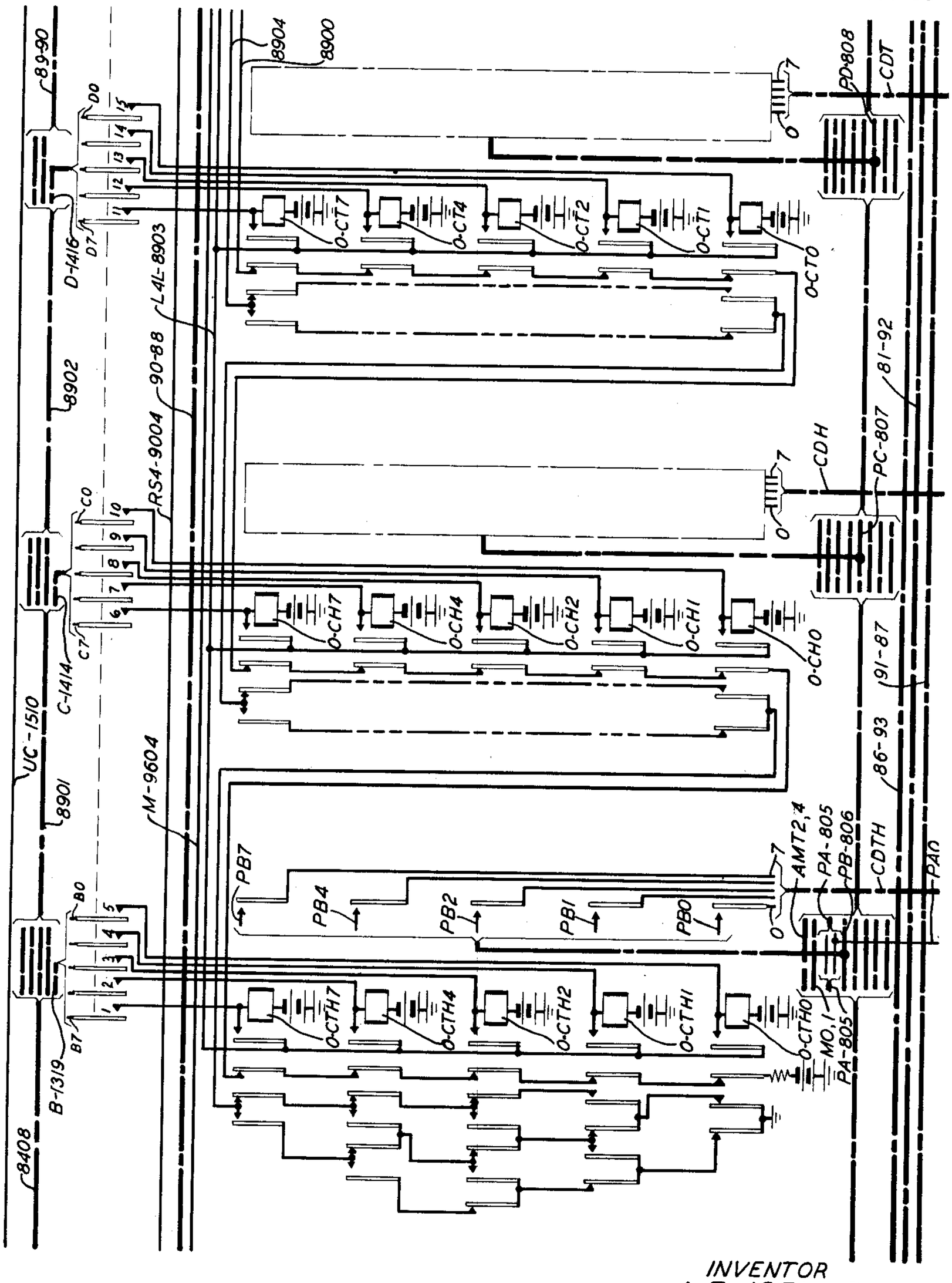


FIG. 89

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 89

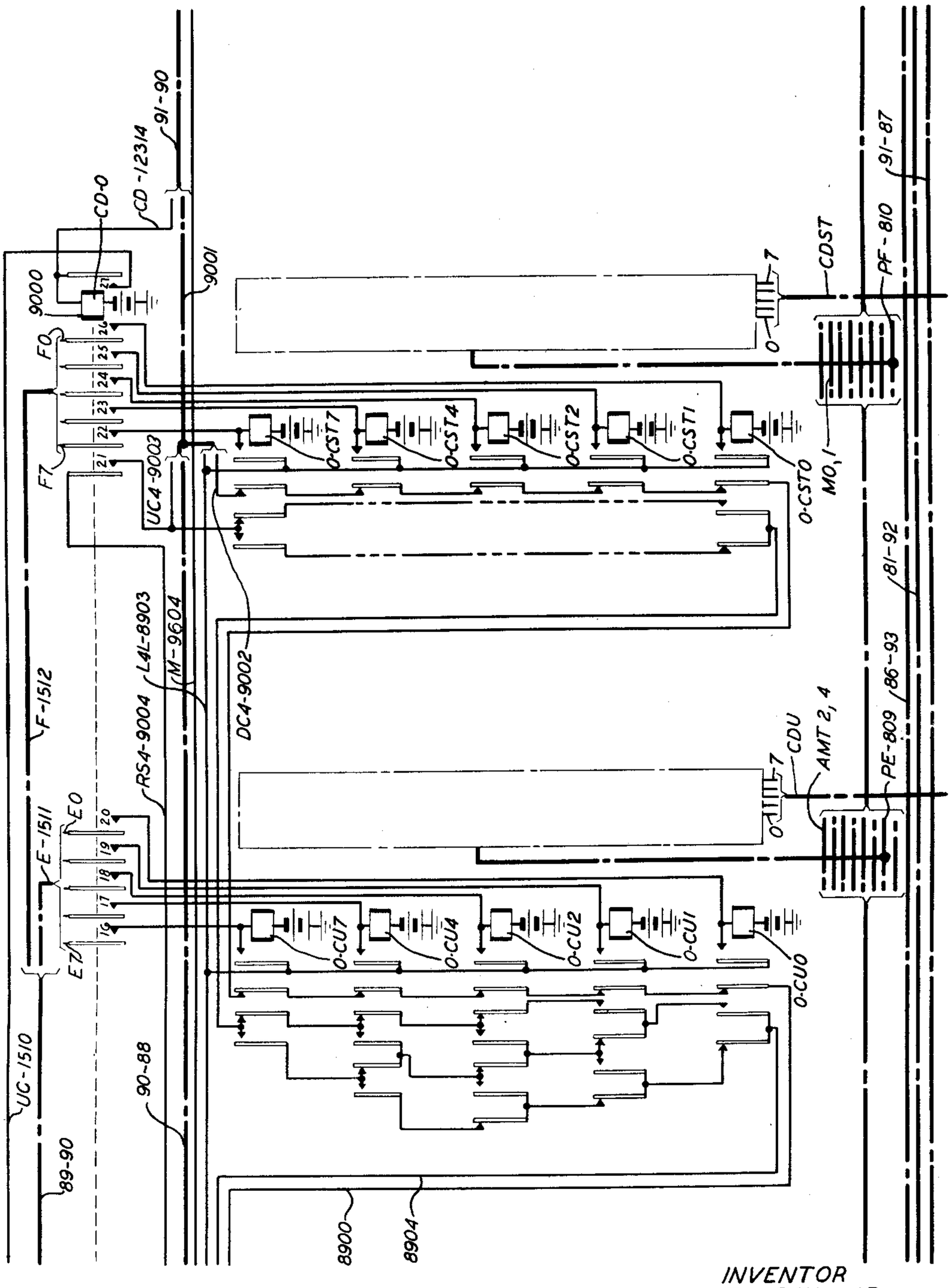


FIG. 90

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 90

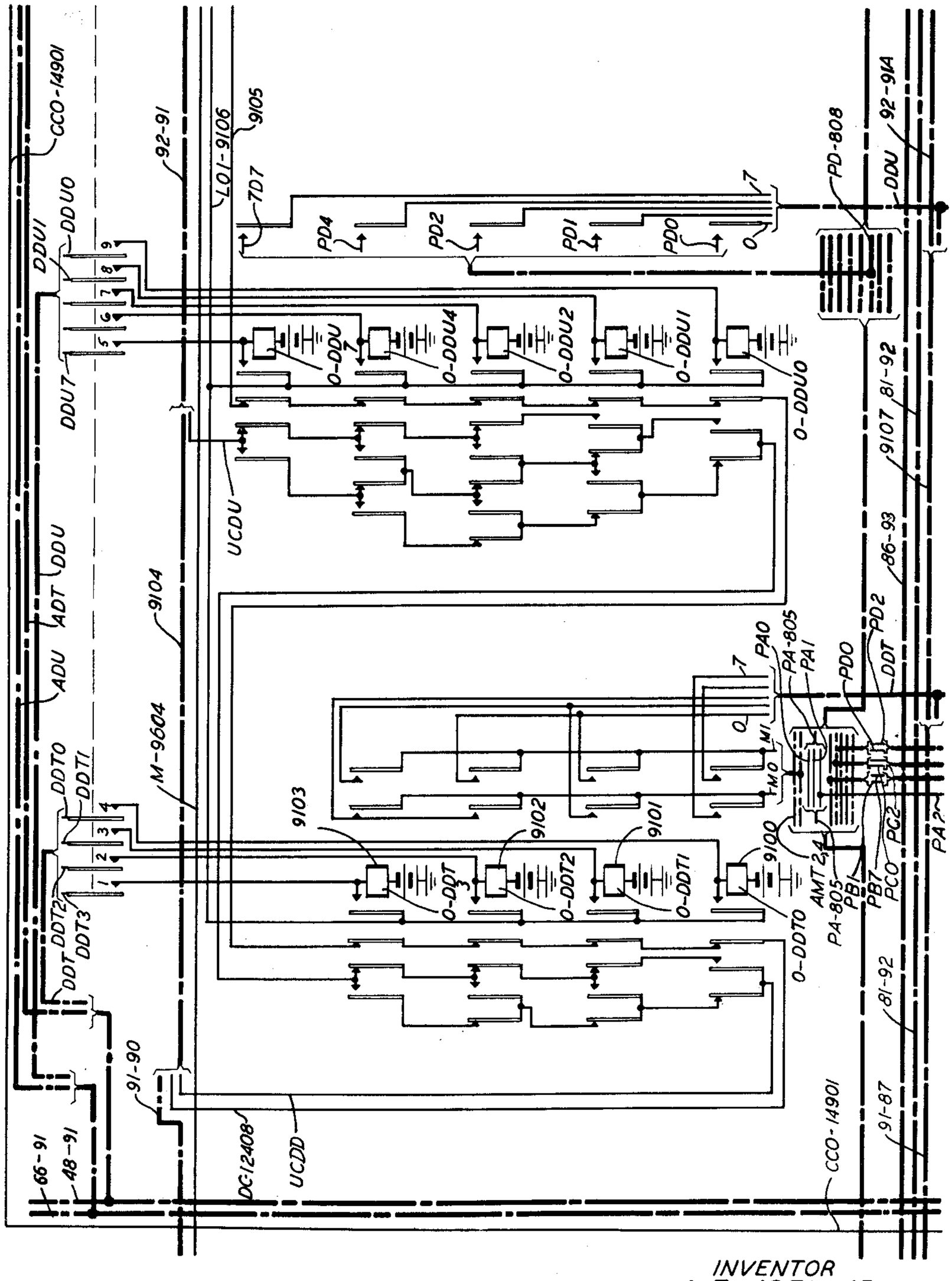


FIG. 91

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 91

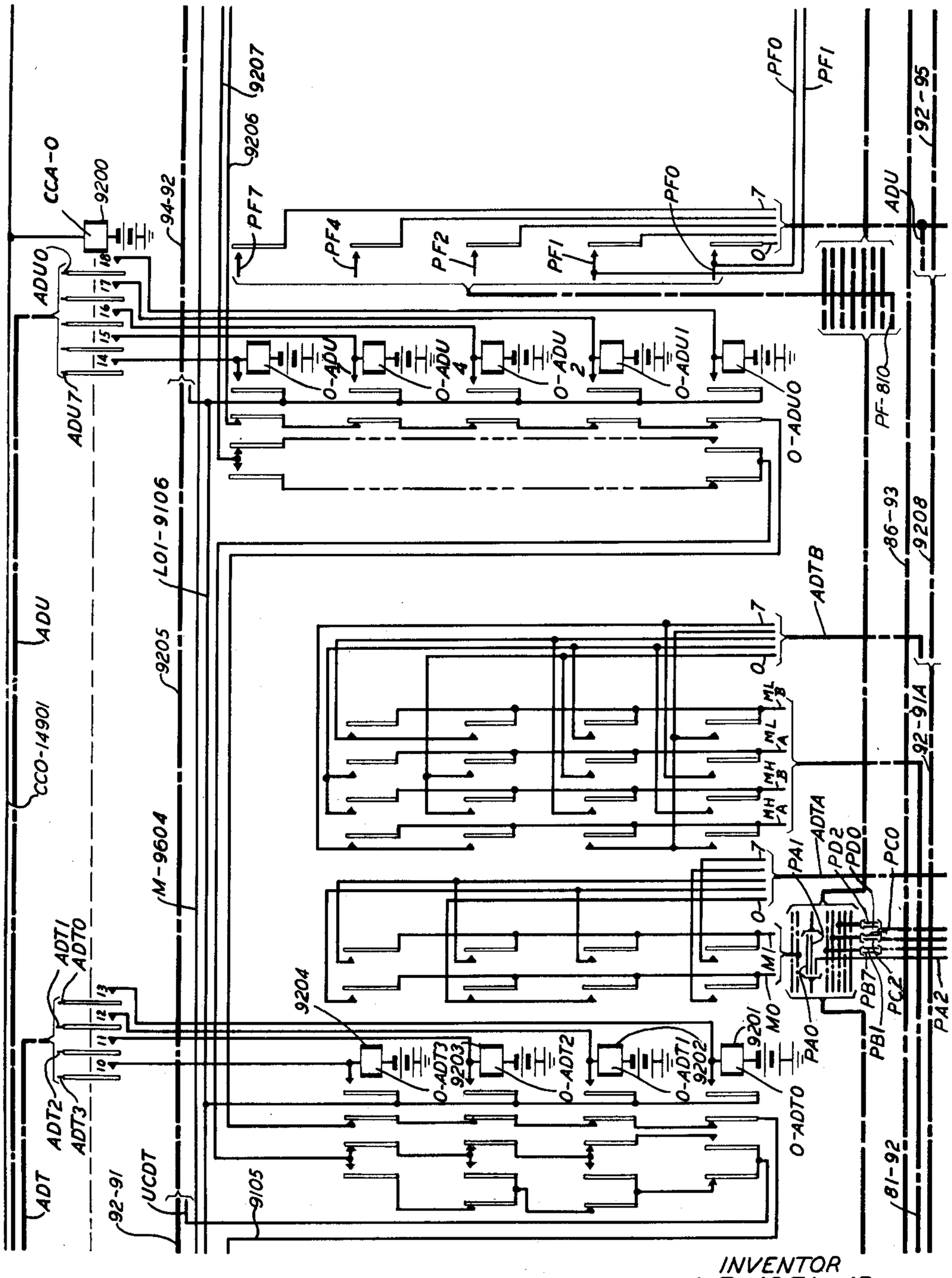


FIG. 92

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 92

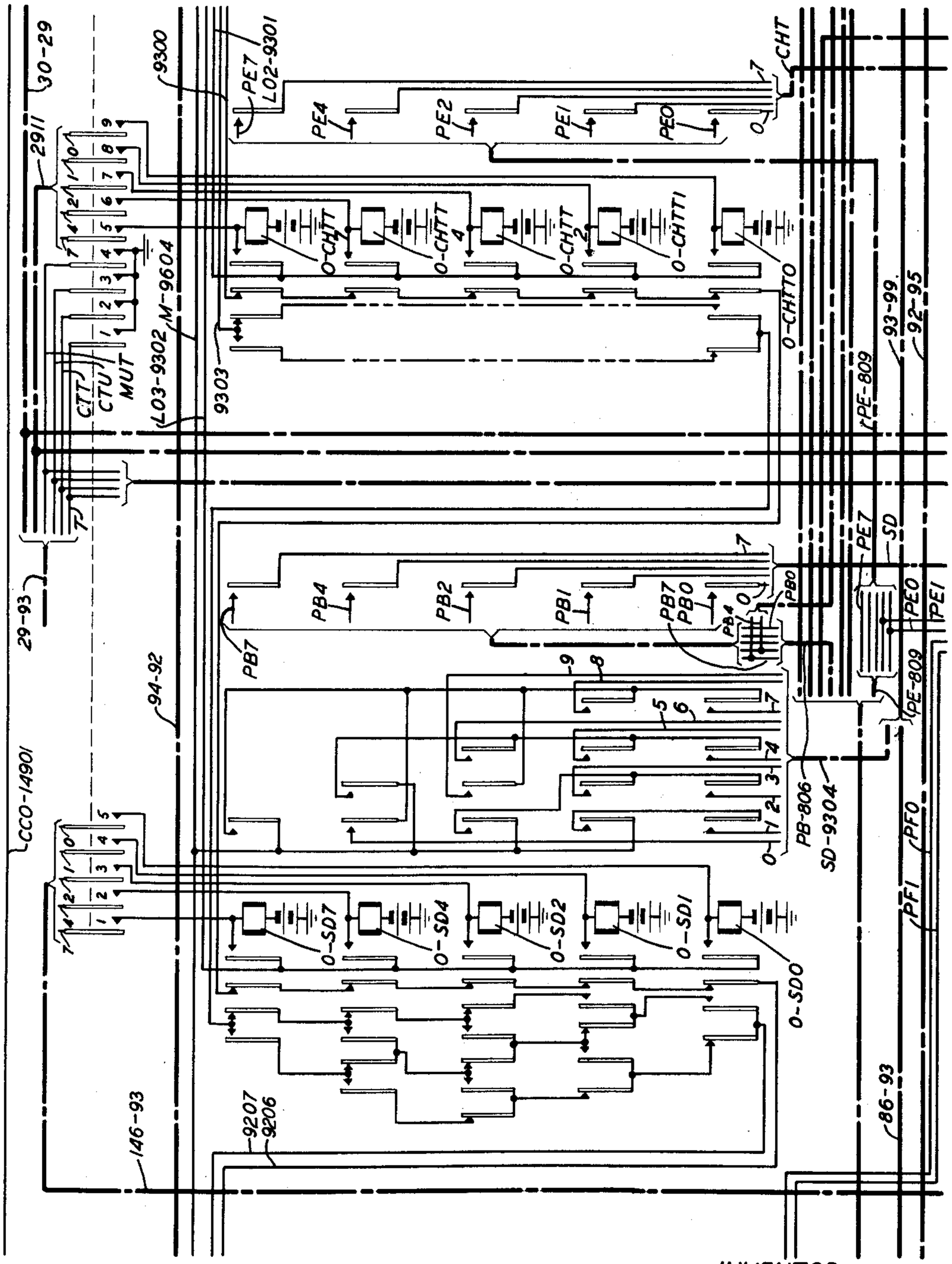


FIG. 93

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 93

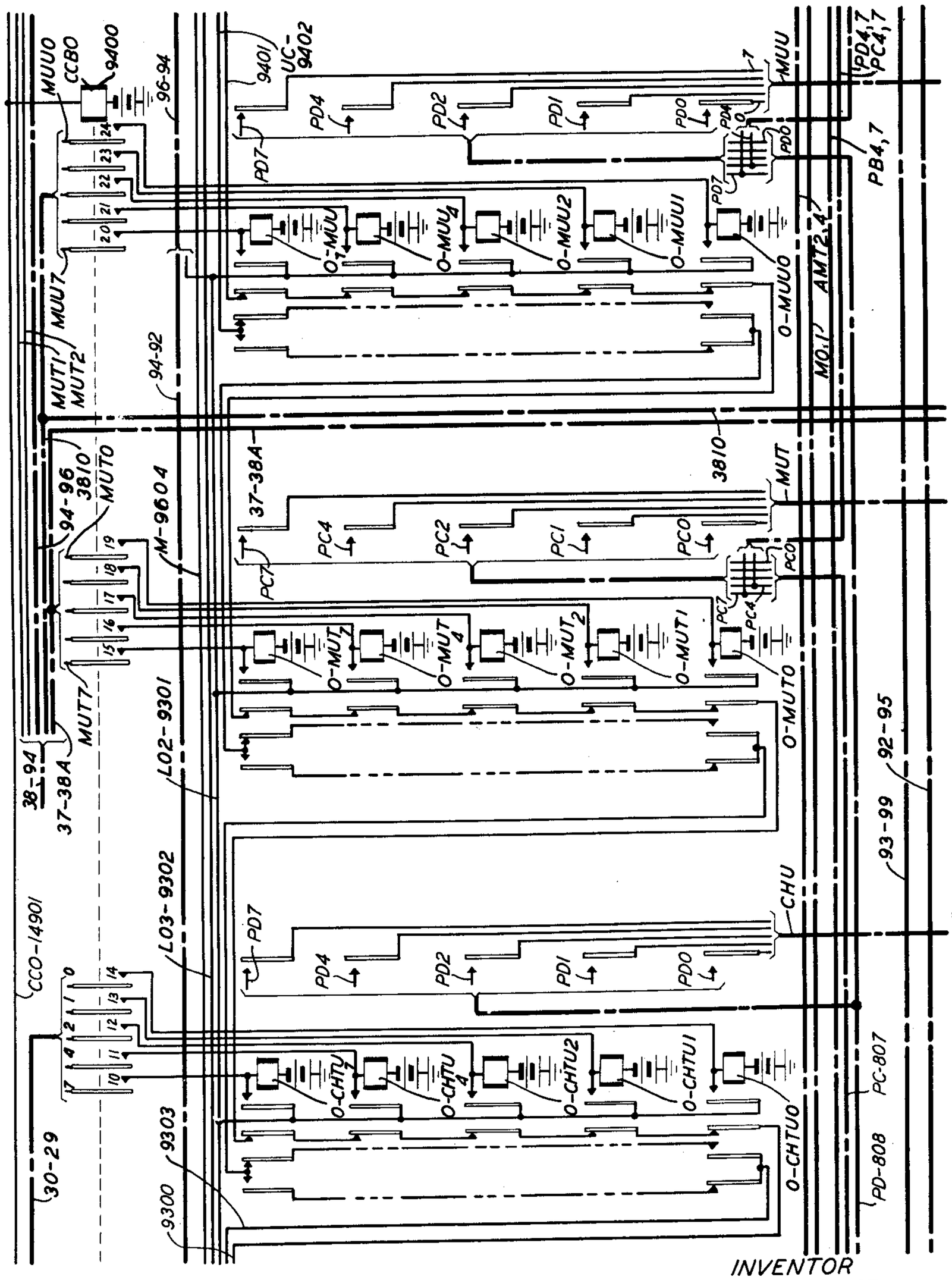


FIG. 94

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 94

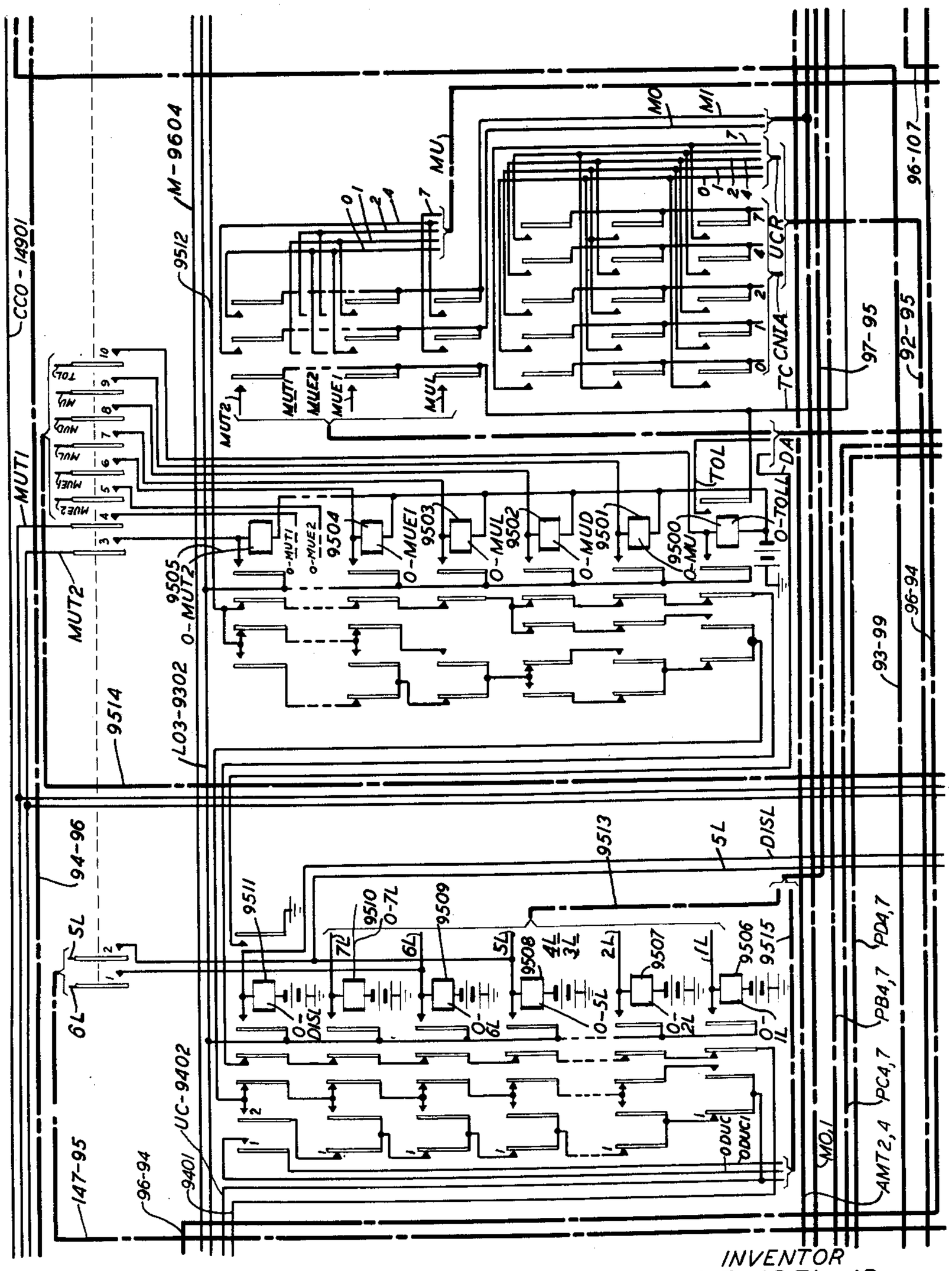


FIG. 95

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 95

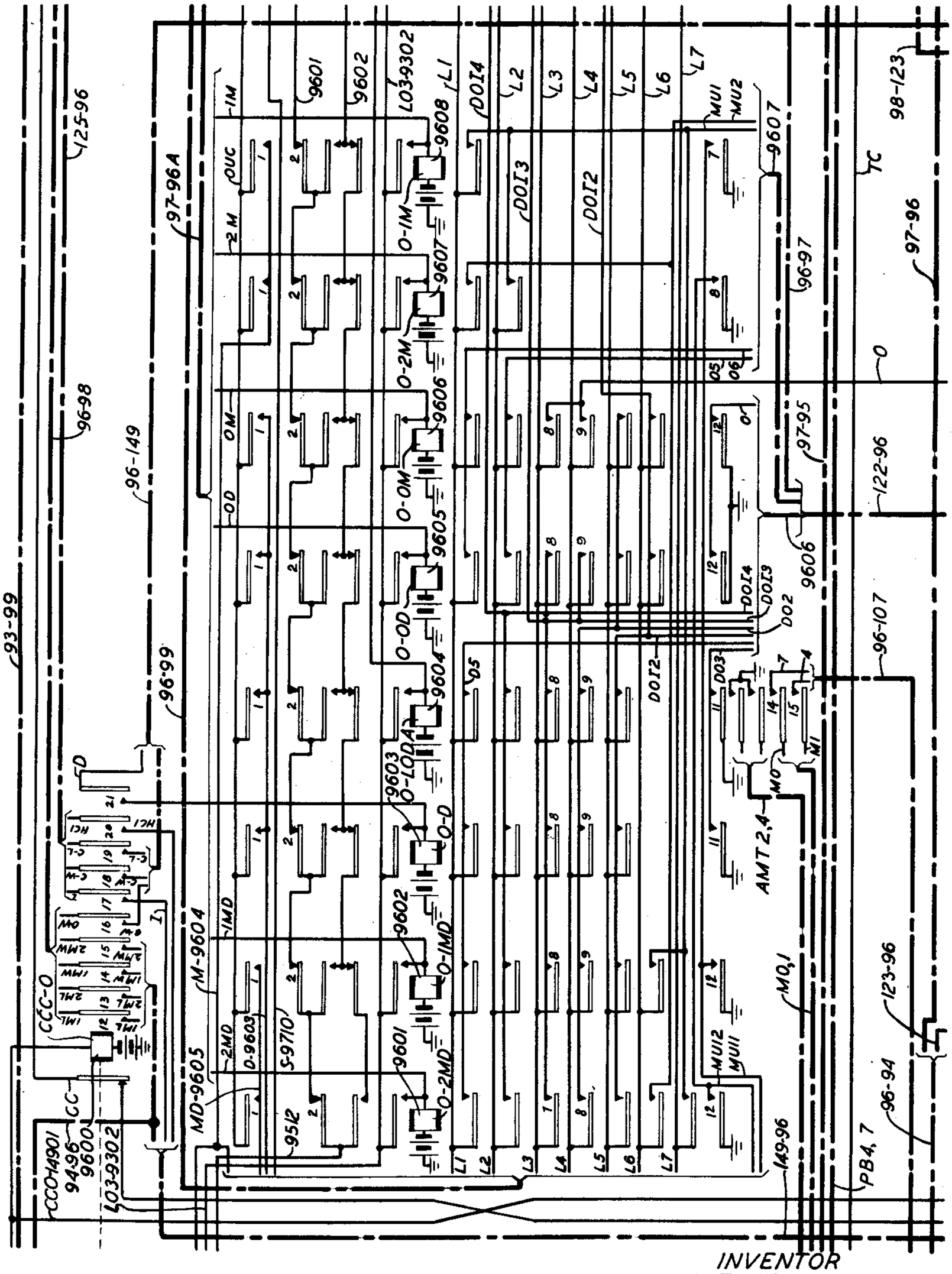


FIG. 96

INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 96

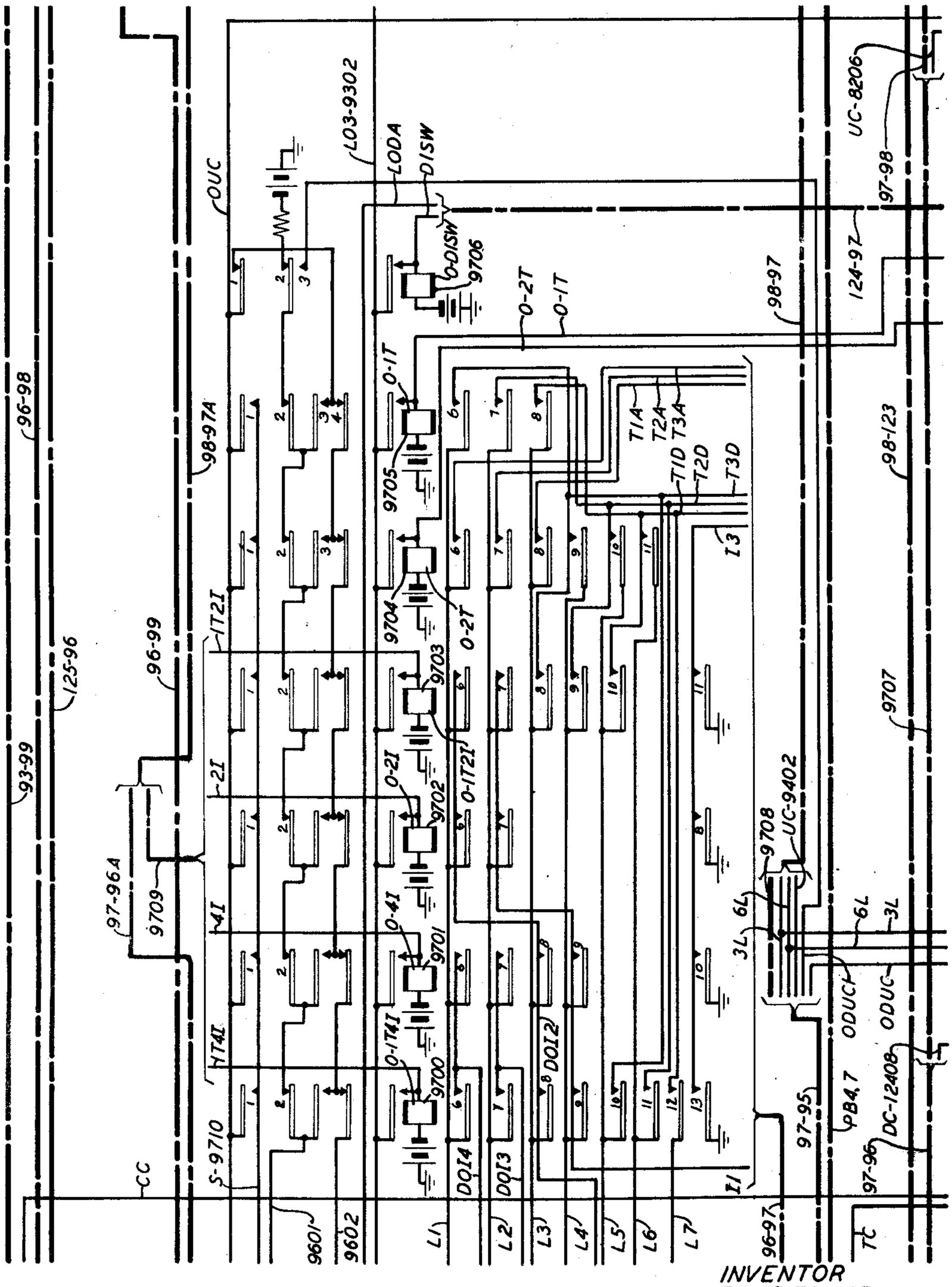


FIG. 97

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 97

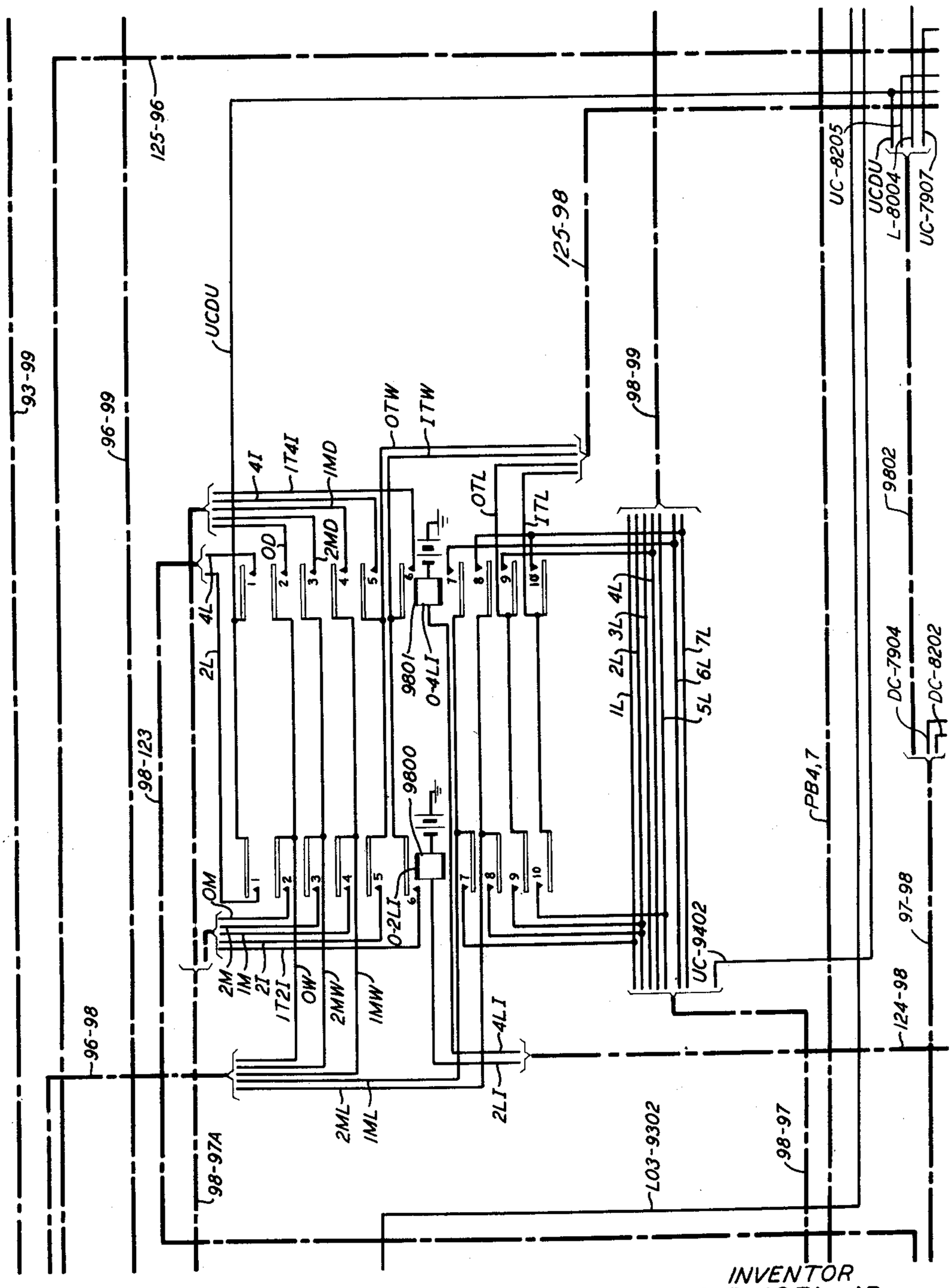


FIG. 98

INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 98

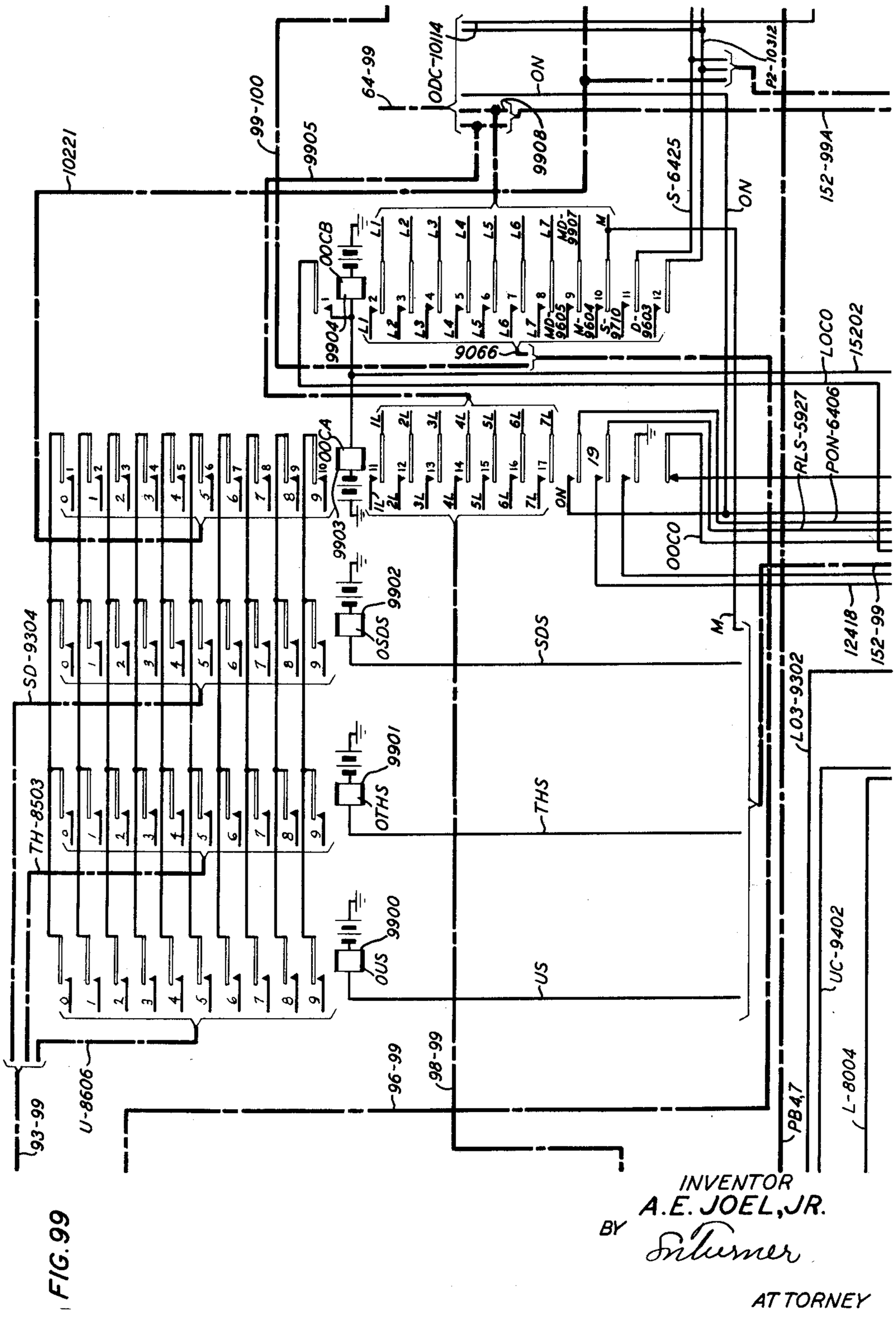


FIG. 99

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 99

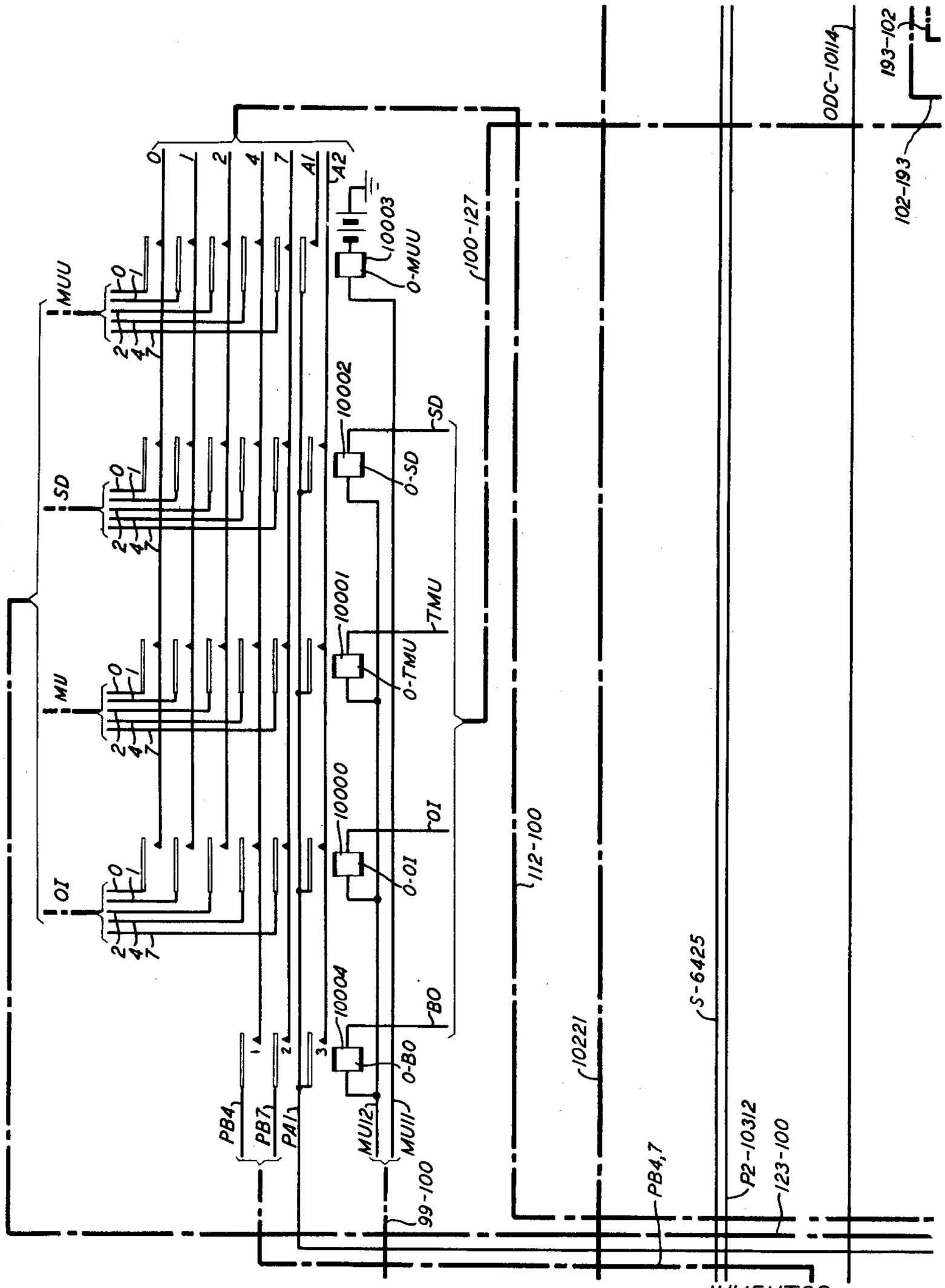


FIG. 100

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 100

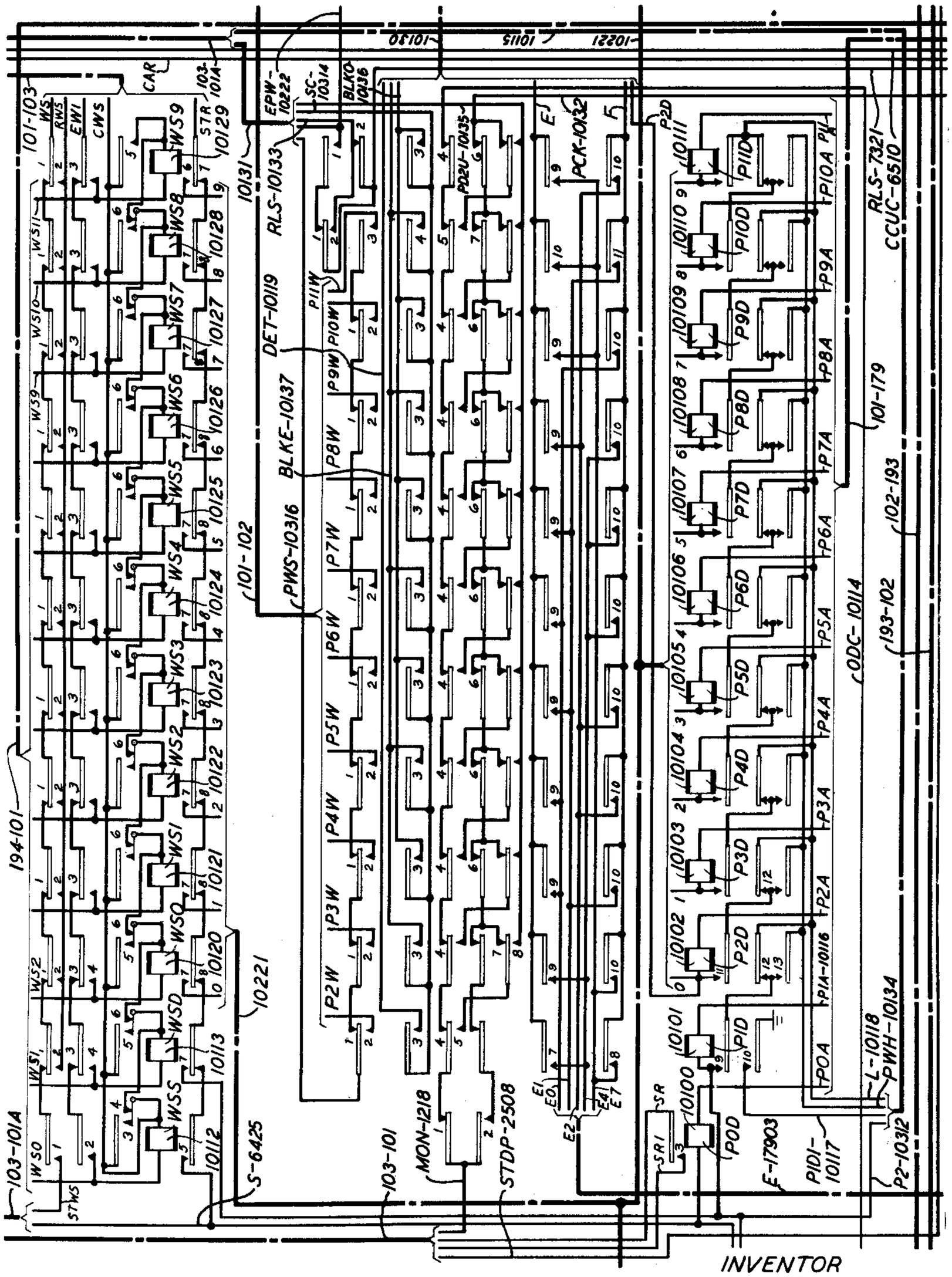


FIG. 101

INVENTOR
A. E. JOEL. JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 101

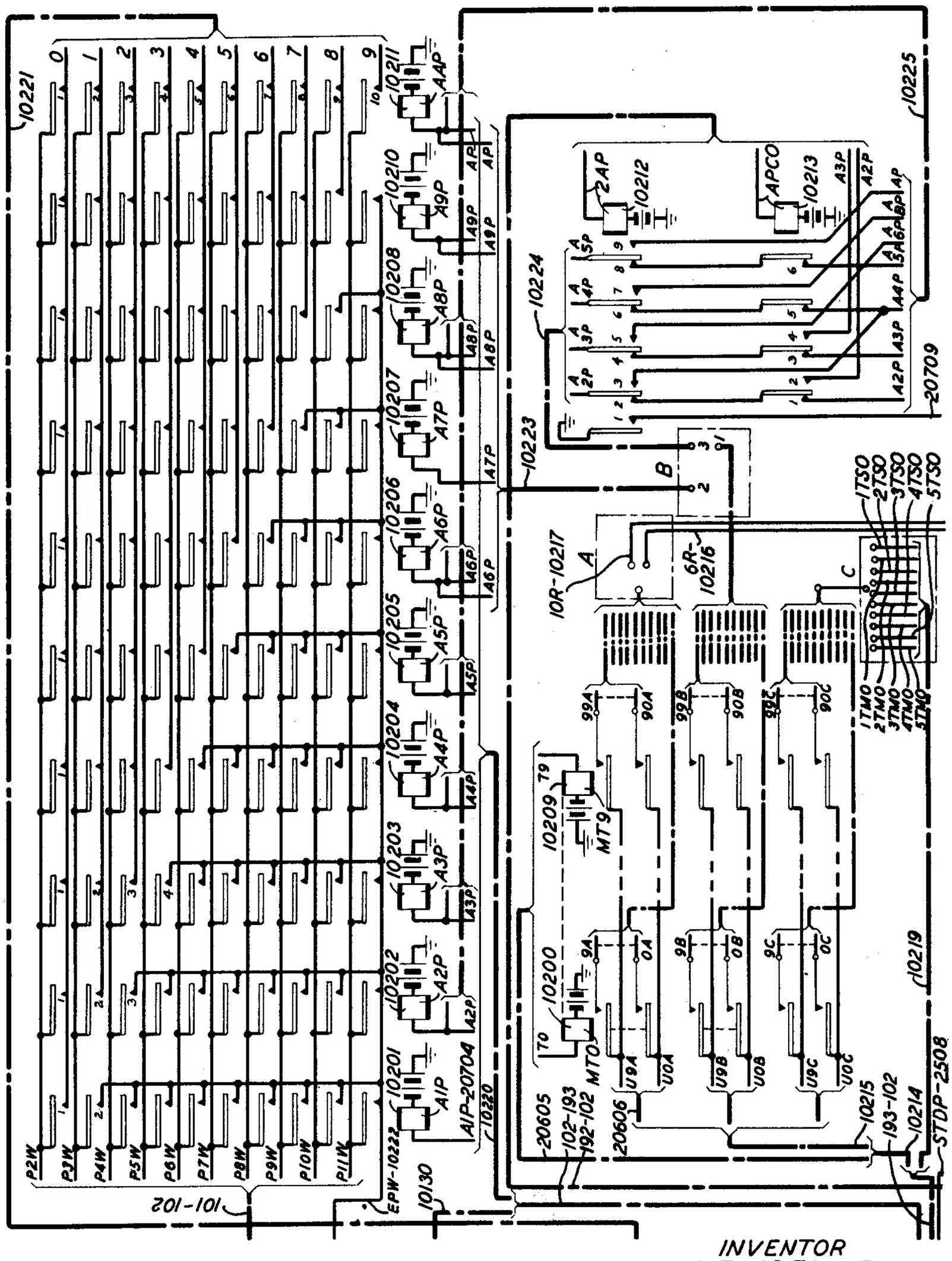


FIG. 102

INVENTOR
A.E. JOEL, JR.
BY Sturmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 102

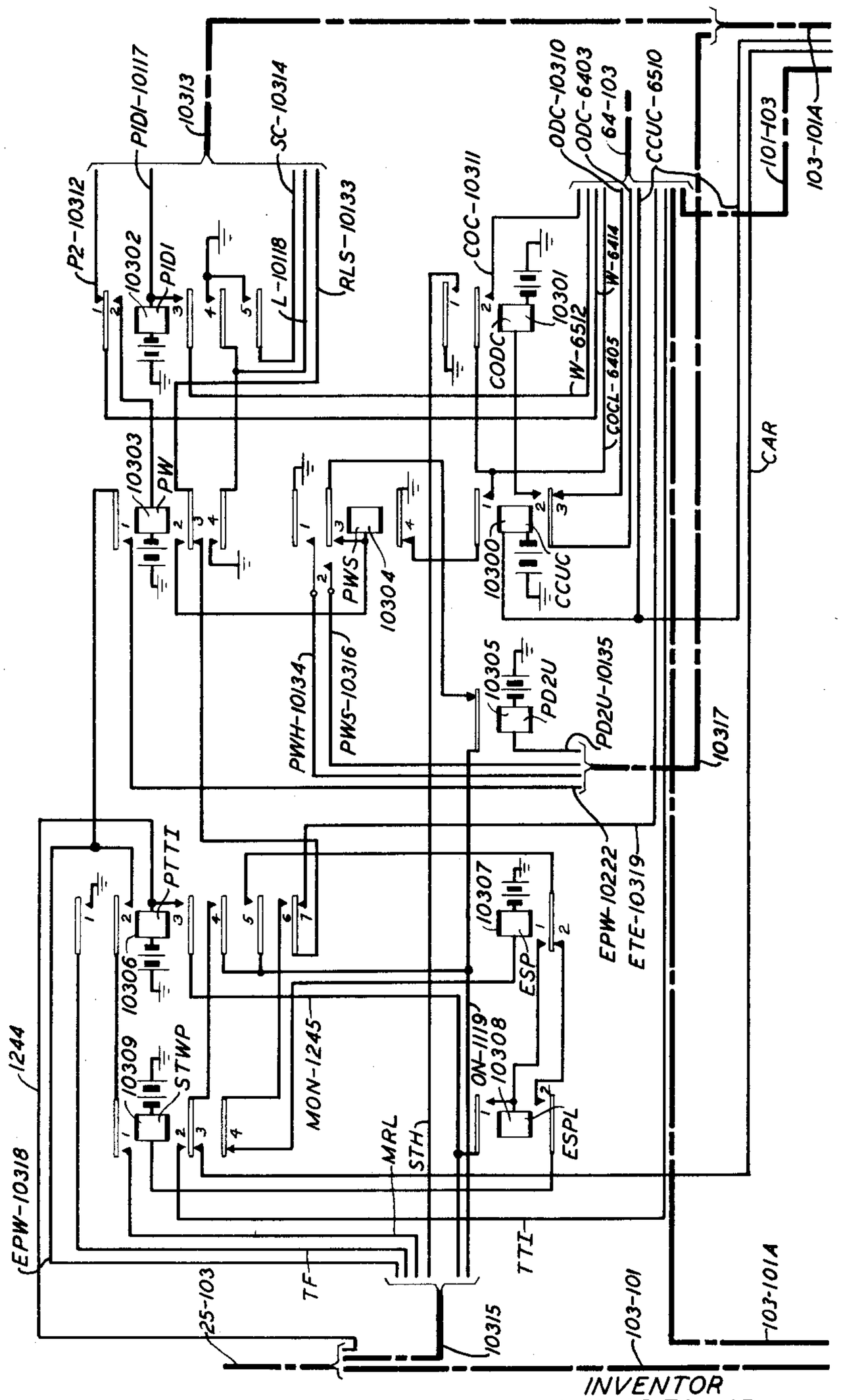


FIG. 103.

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 103

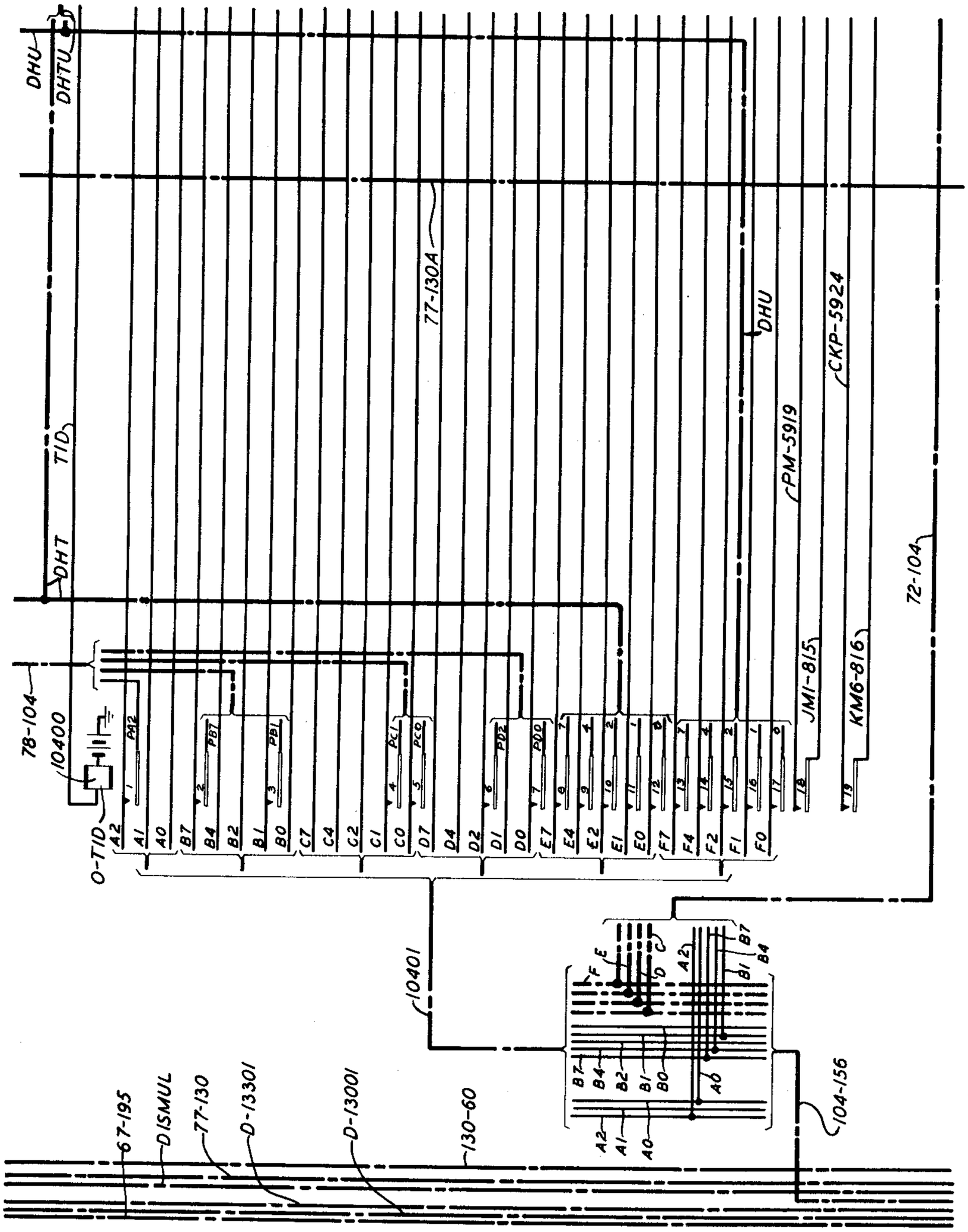


FIG. 104

INVENTOR
A. E. JOEL, JR.
BY Sutherner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 104

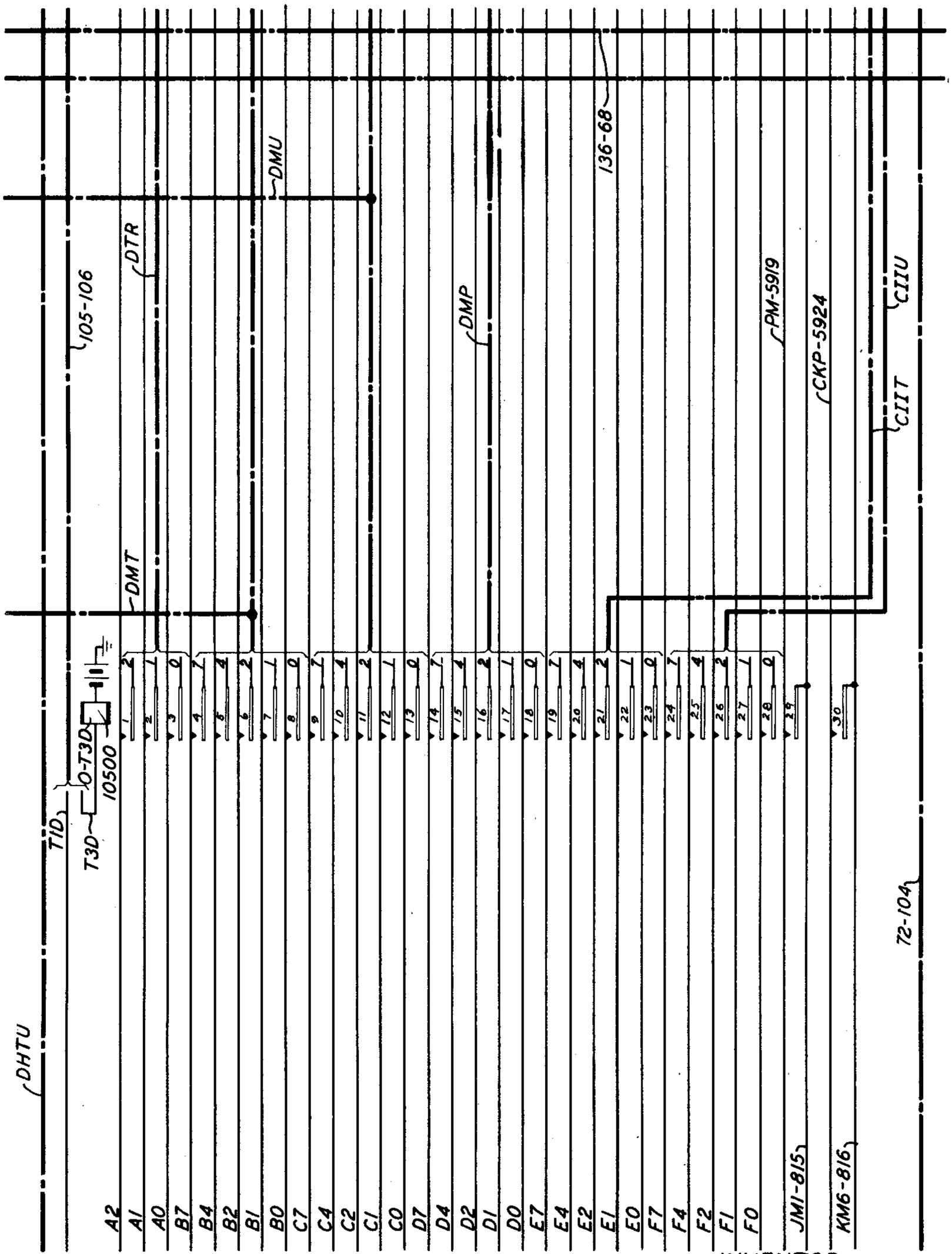


FIG. 105

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 105

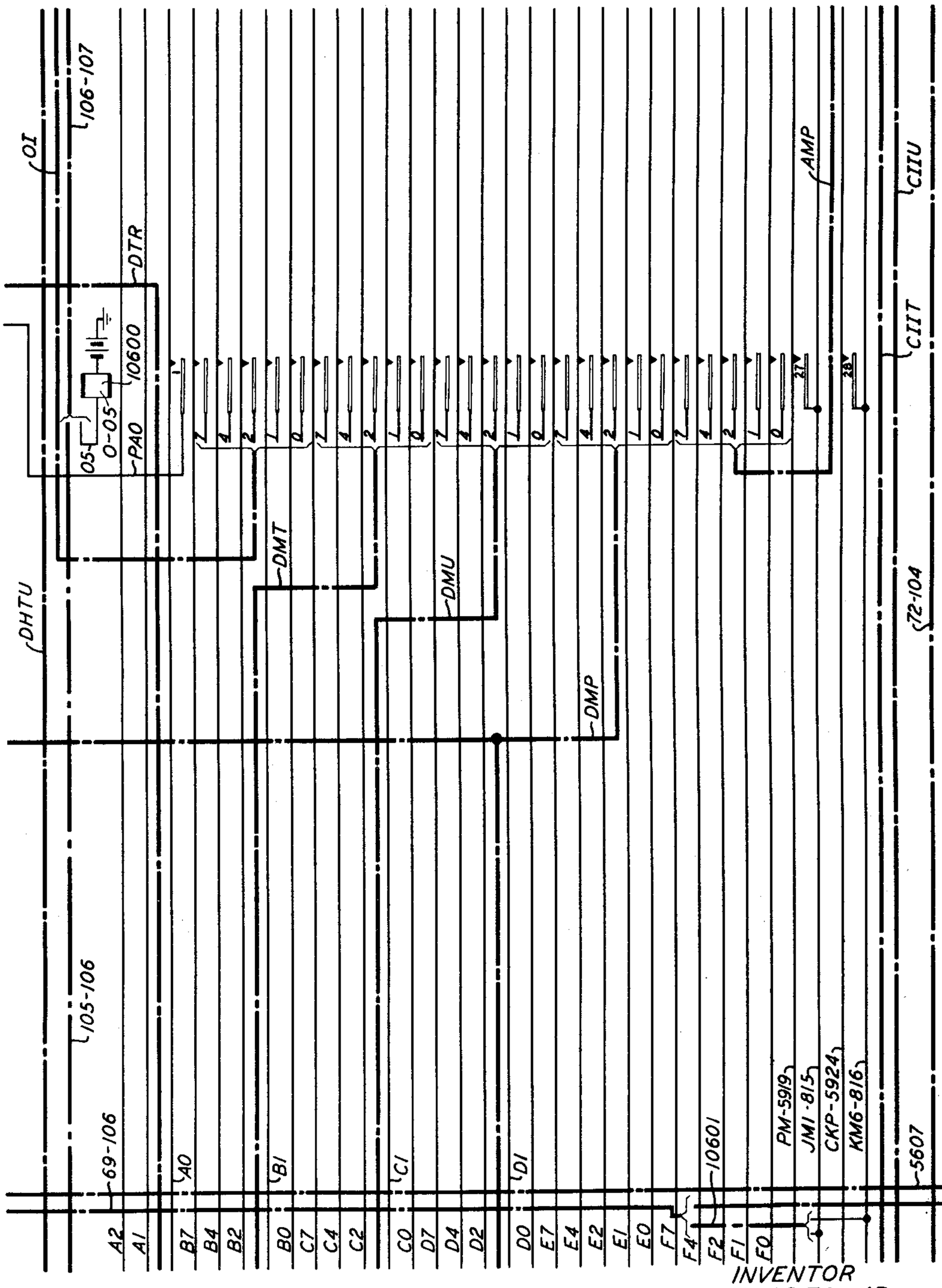


FIG. 106

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 106

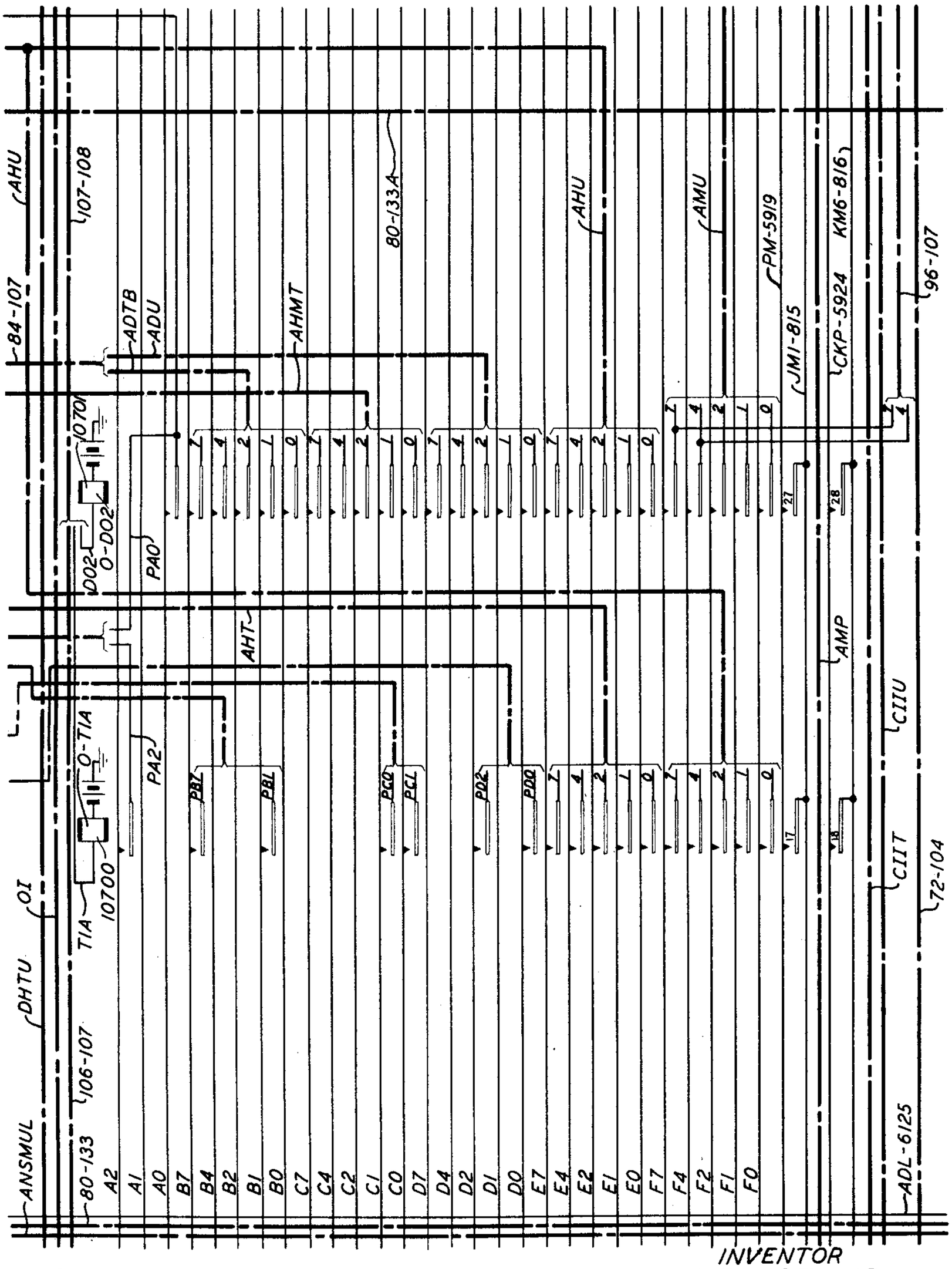


FIG. 107

INVENTOR
A.E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 107

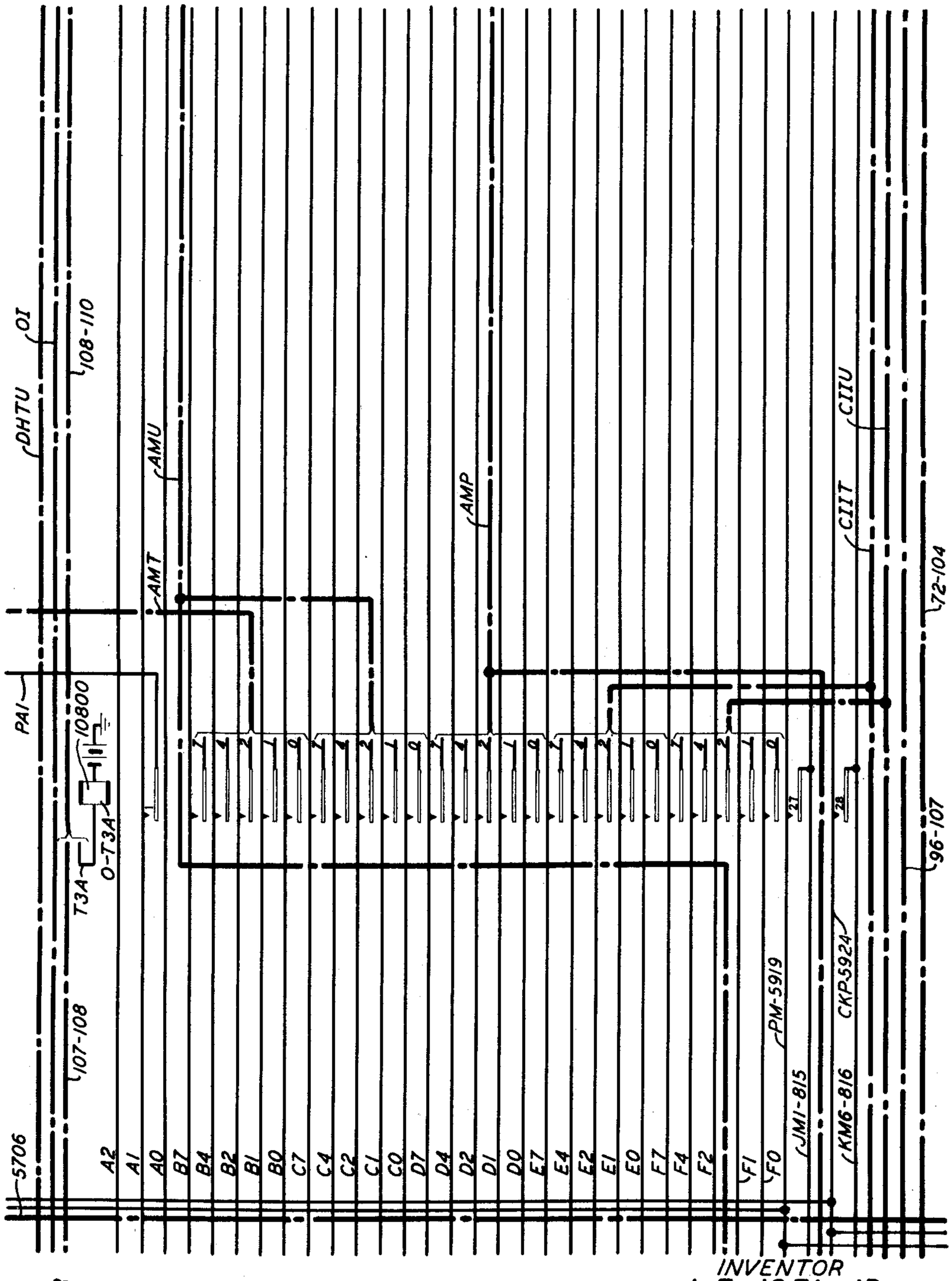


FIG. 108

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 108

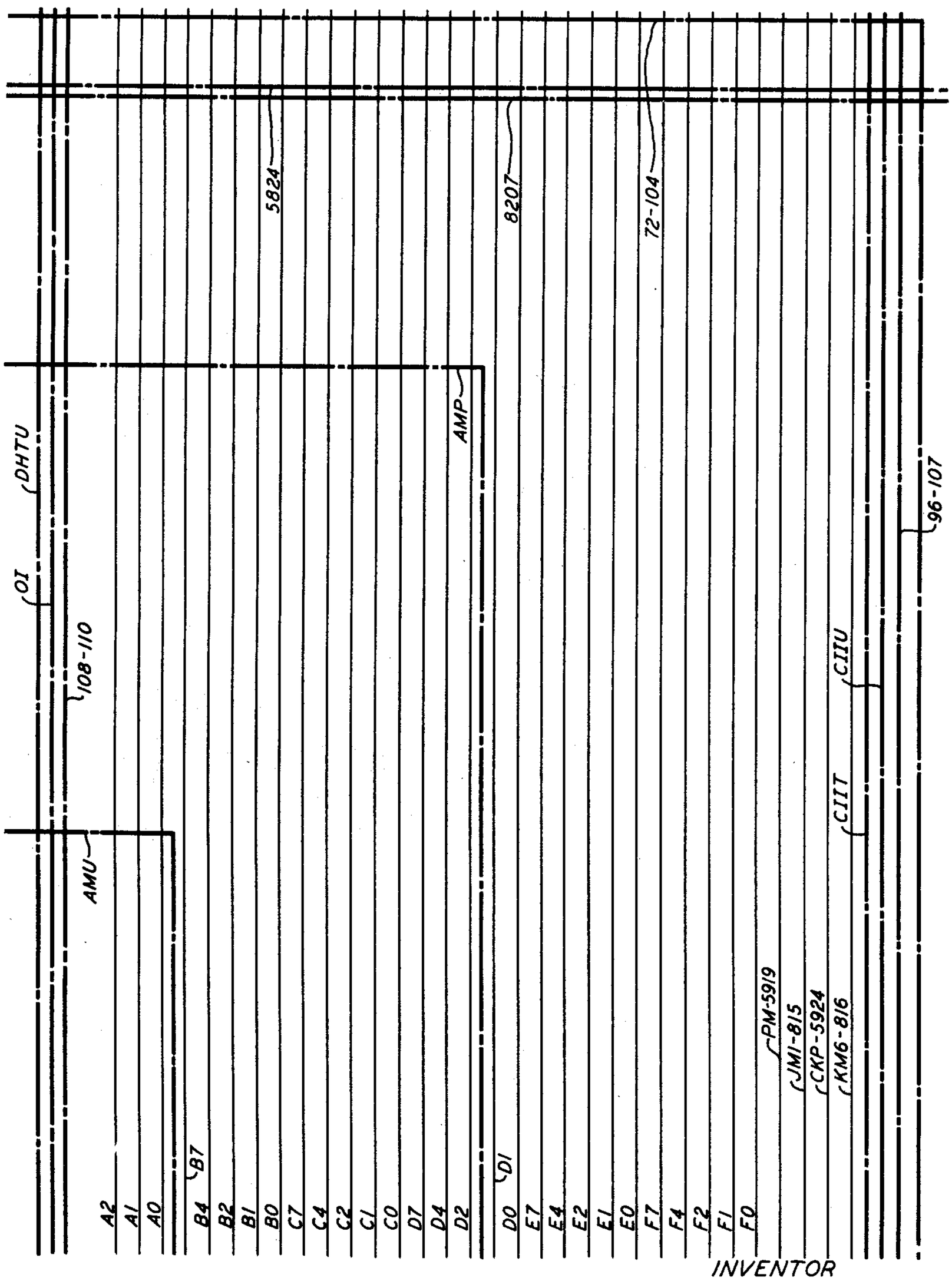


FIG. 109

INVENTOR
A. E. JOEL, JR.
BY Scherner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 109

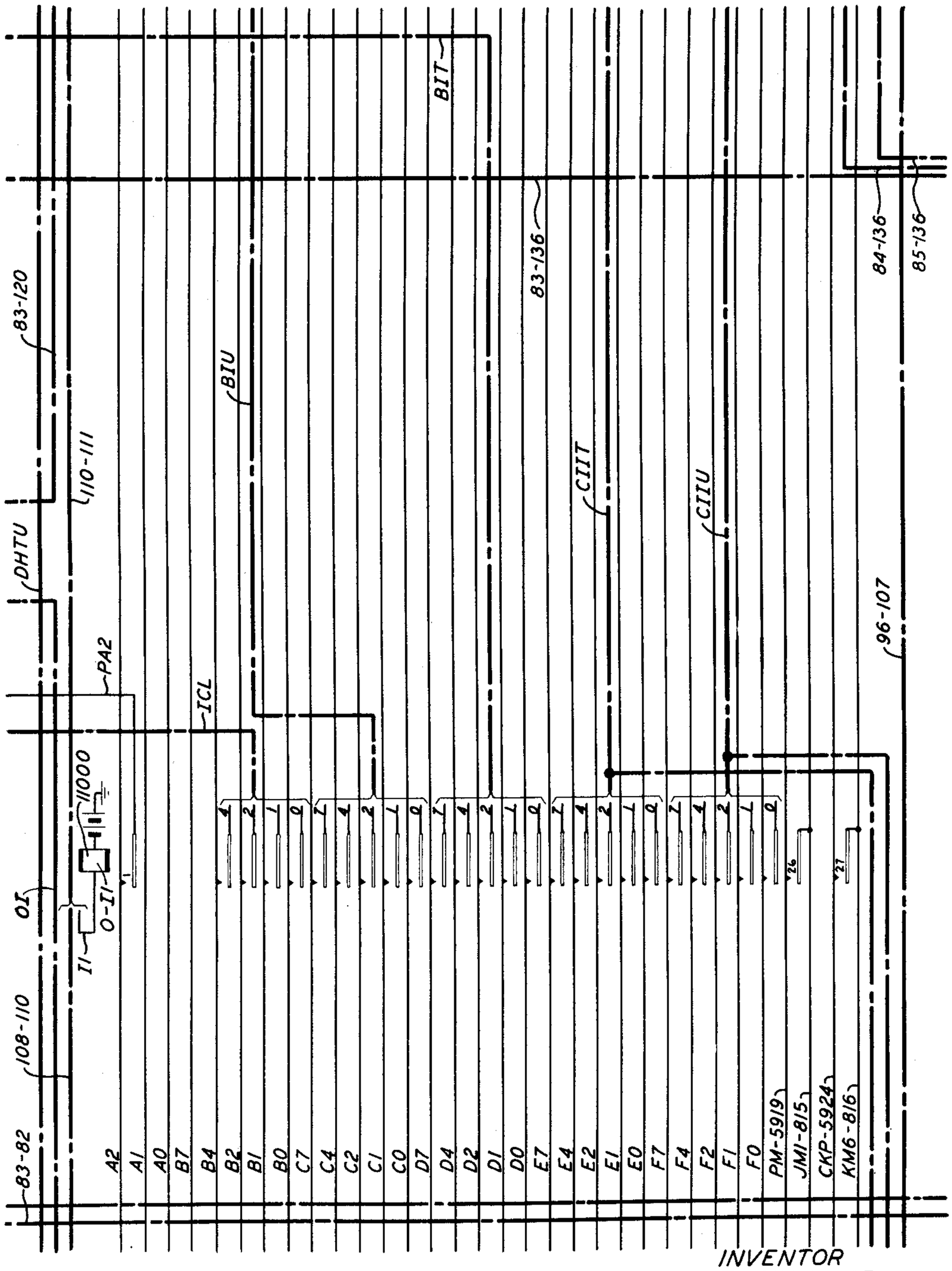


FIG. 110

INVENTOR
A. E. JOEL, JR.
BY Schlesser
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 110

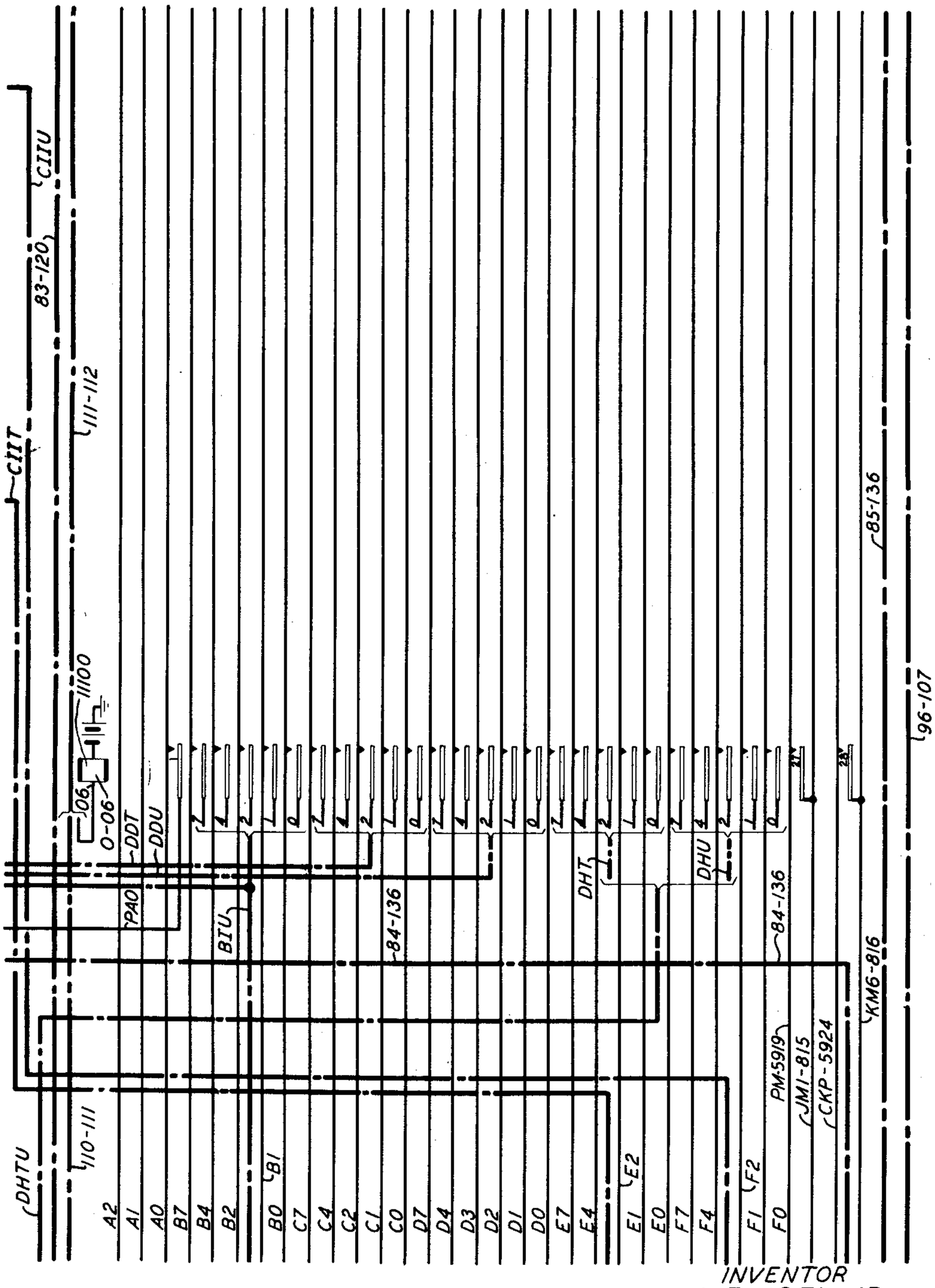


FIG. III

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 111

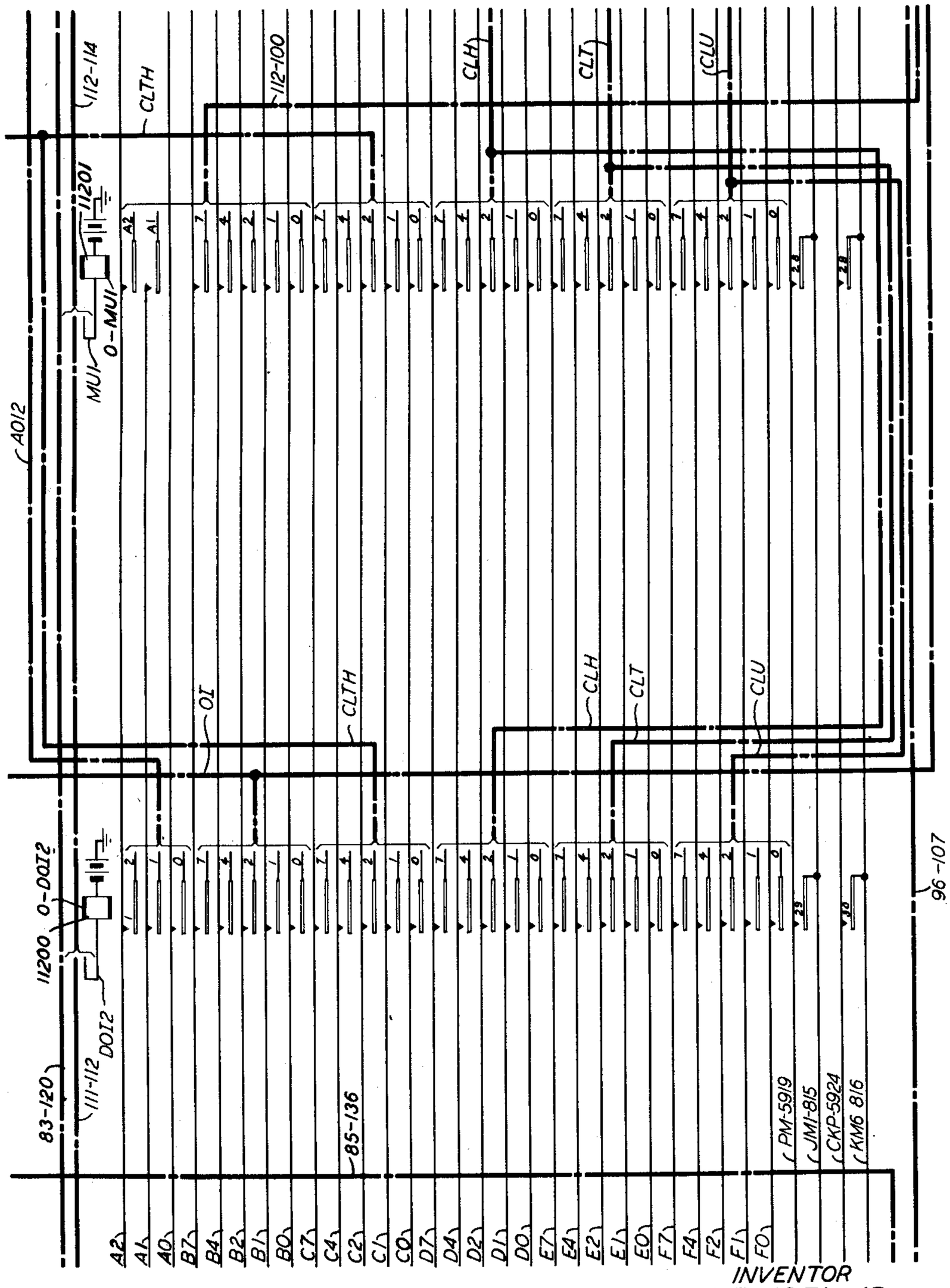


FIG. 112

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 112

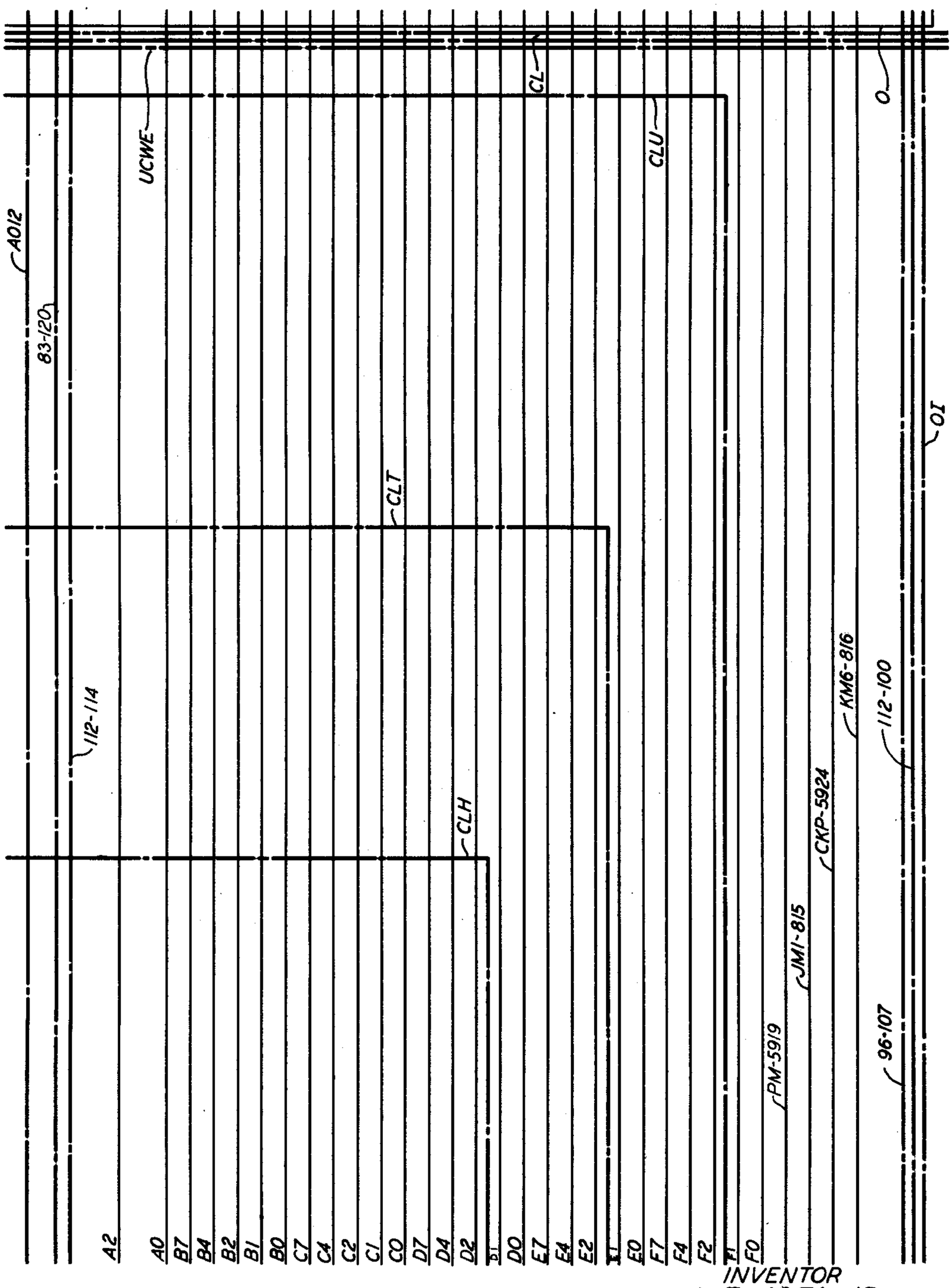


FIG. 113

INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 113

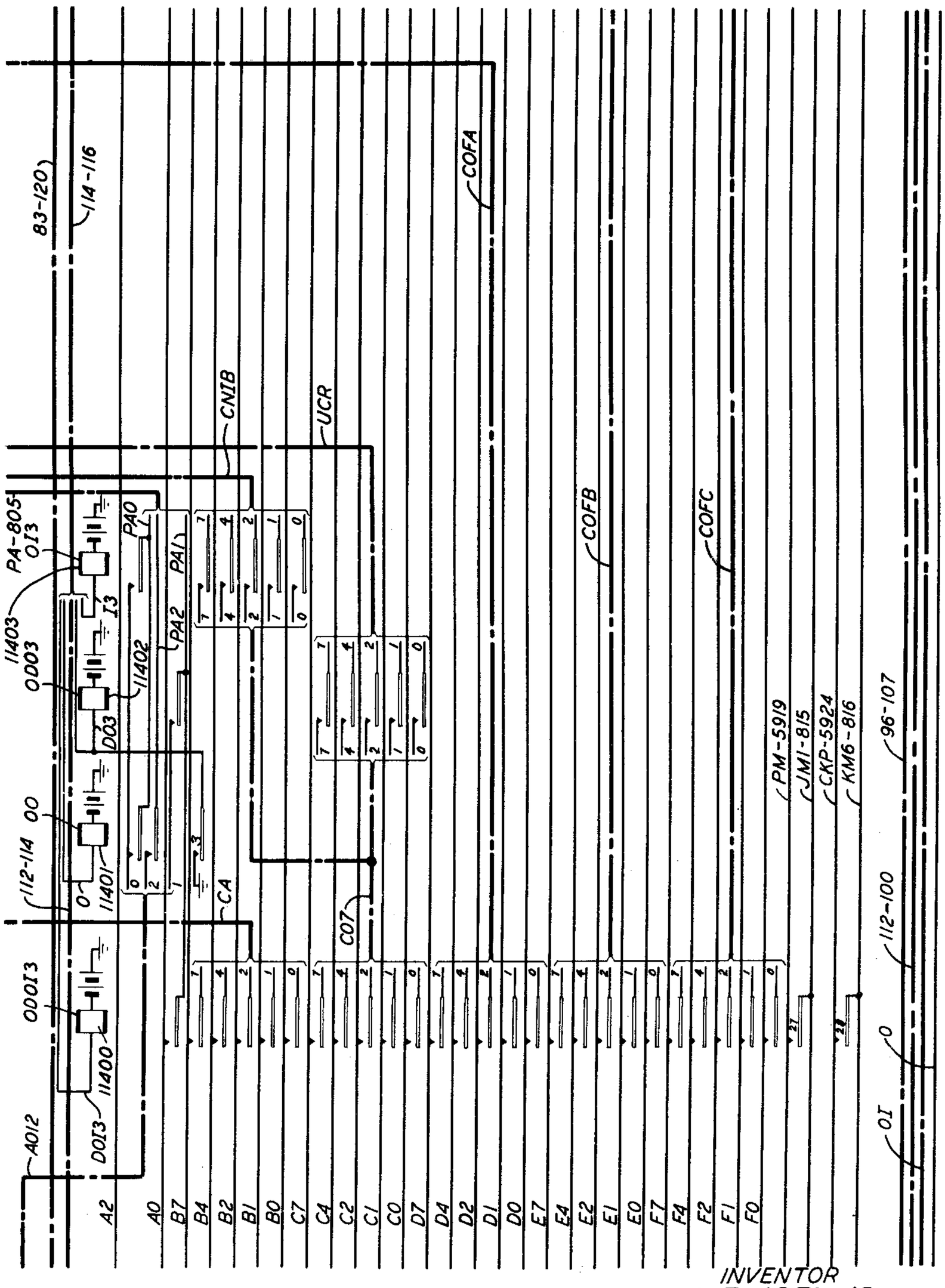


FIG. 114

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 114

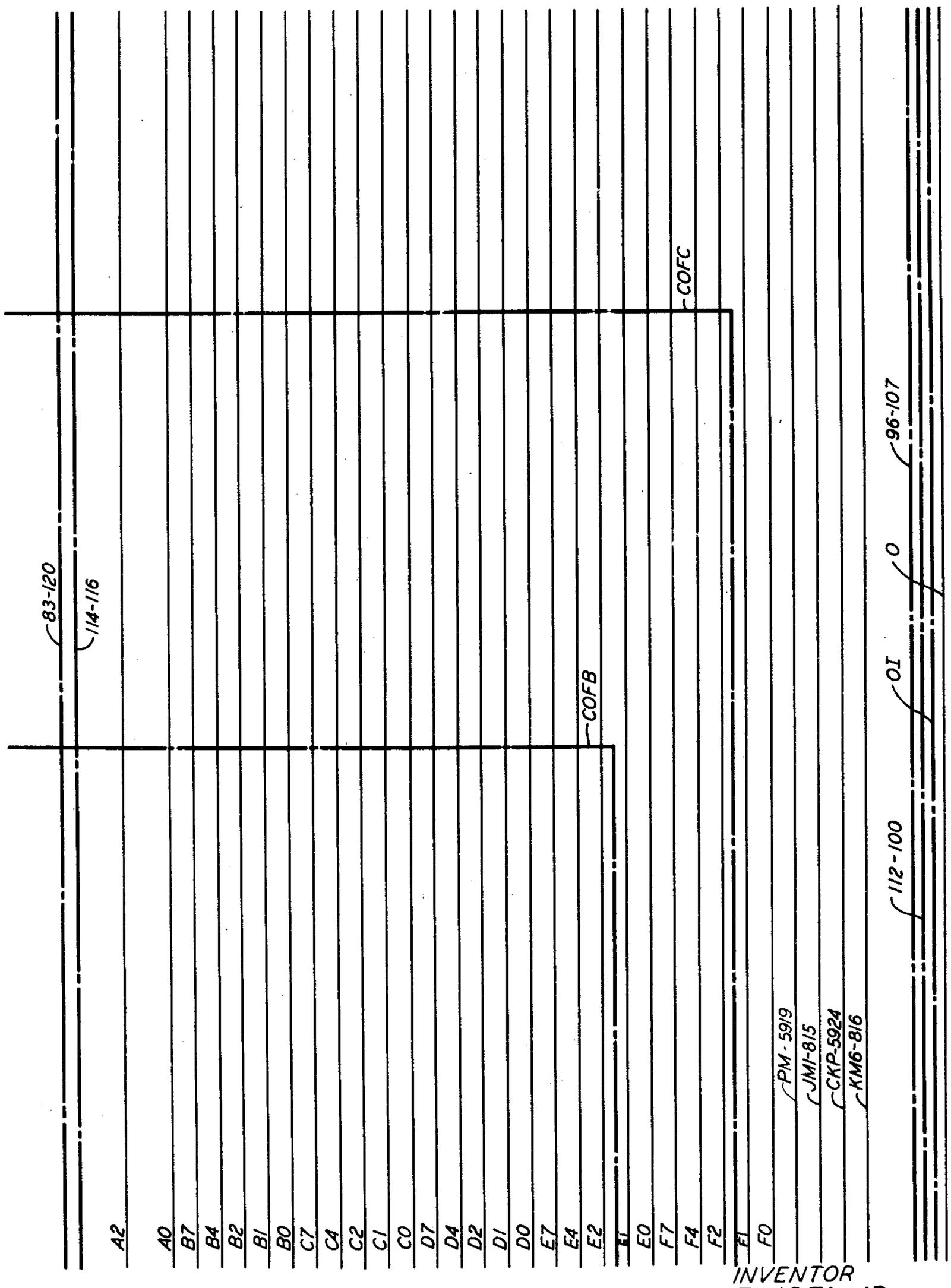


FIG. 115

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 115

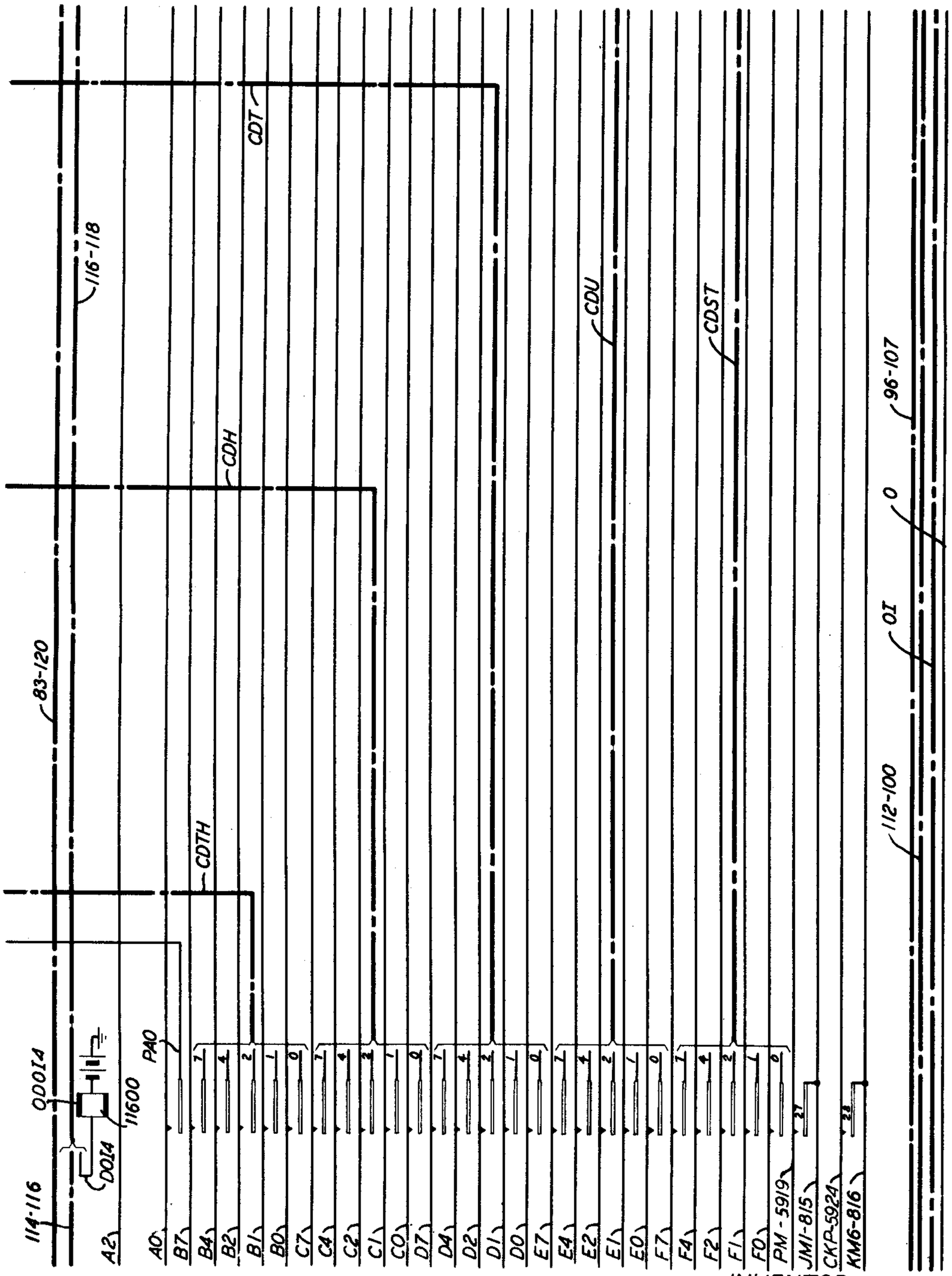


FIG. 116

INVENTOR
A. E. JOEL. JR.
BY
Schurer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 116

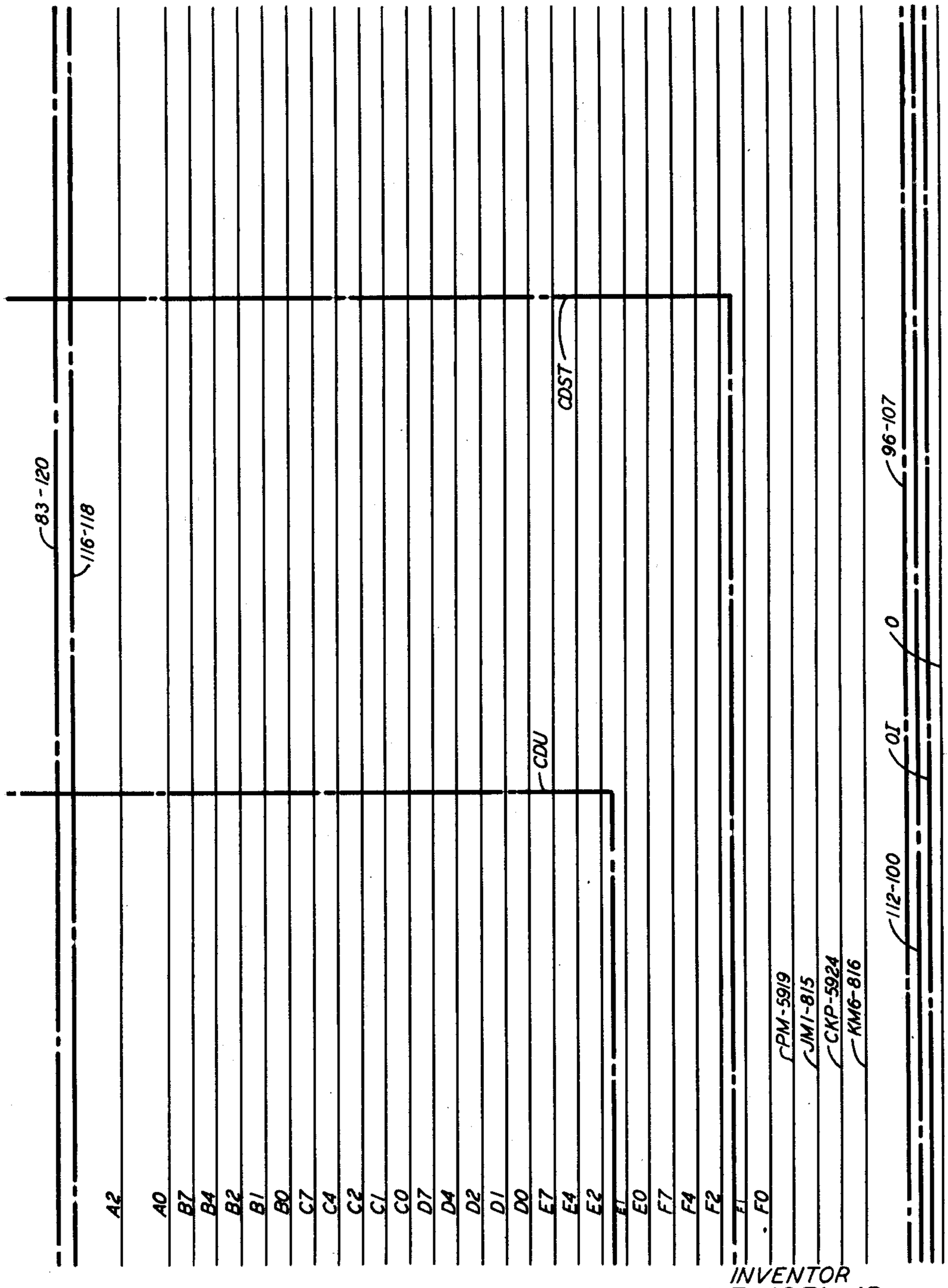


FIG. 117

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 117

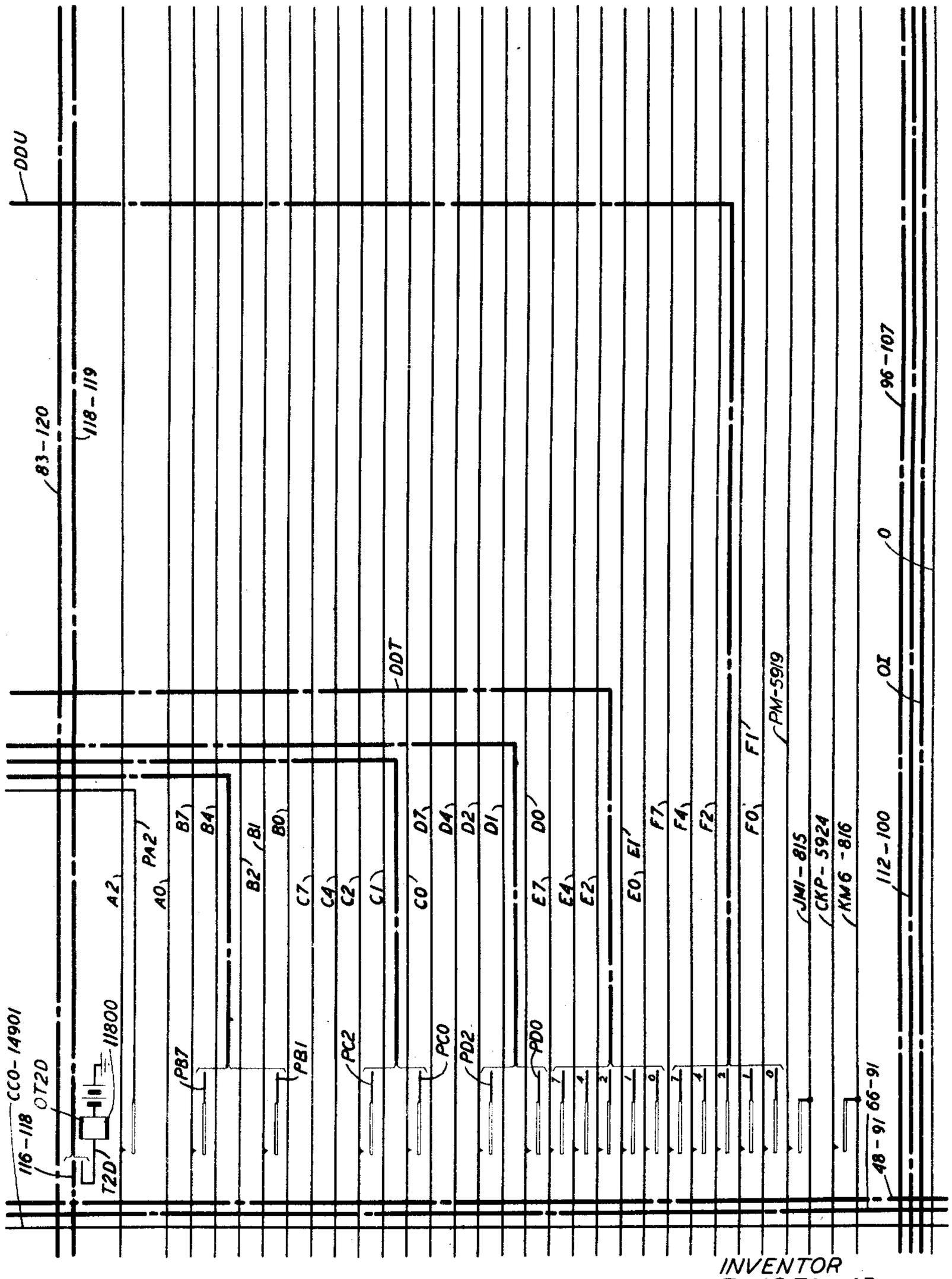


FIG. 118

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 118

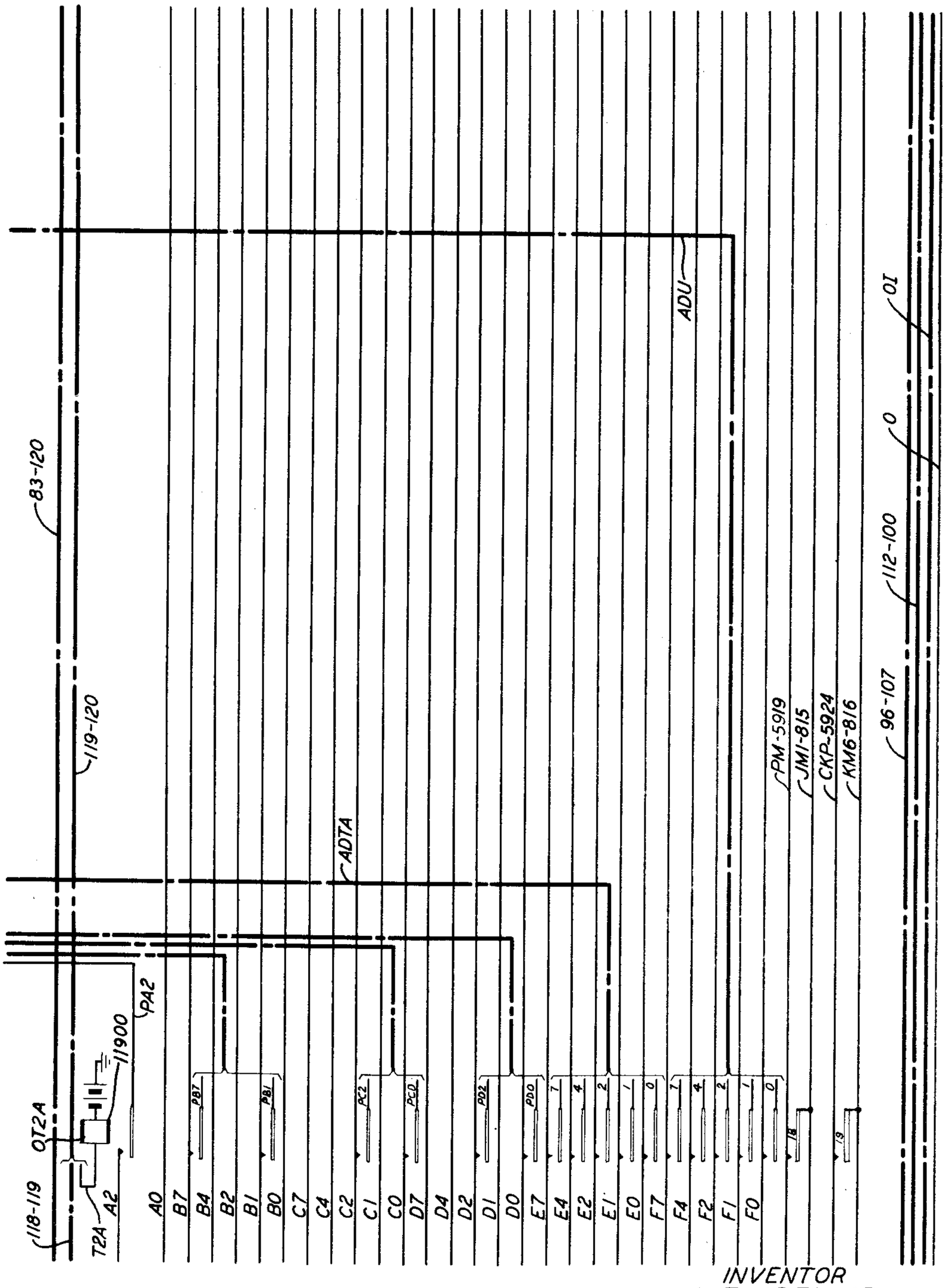


FIG. 119

INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 119

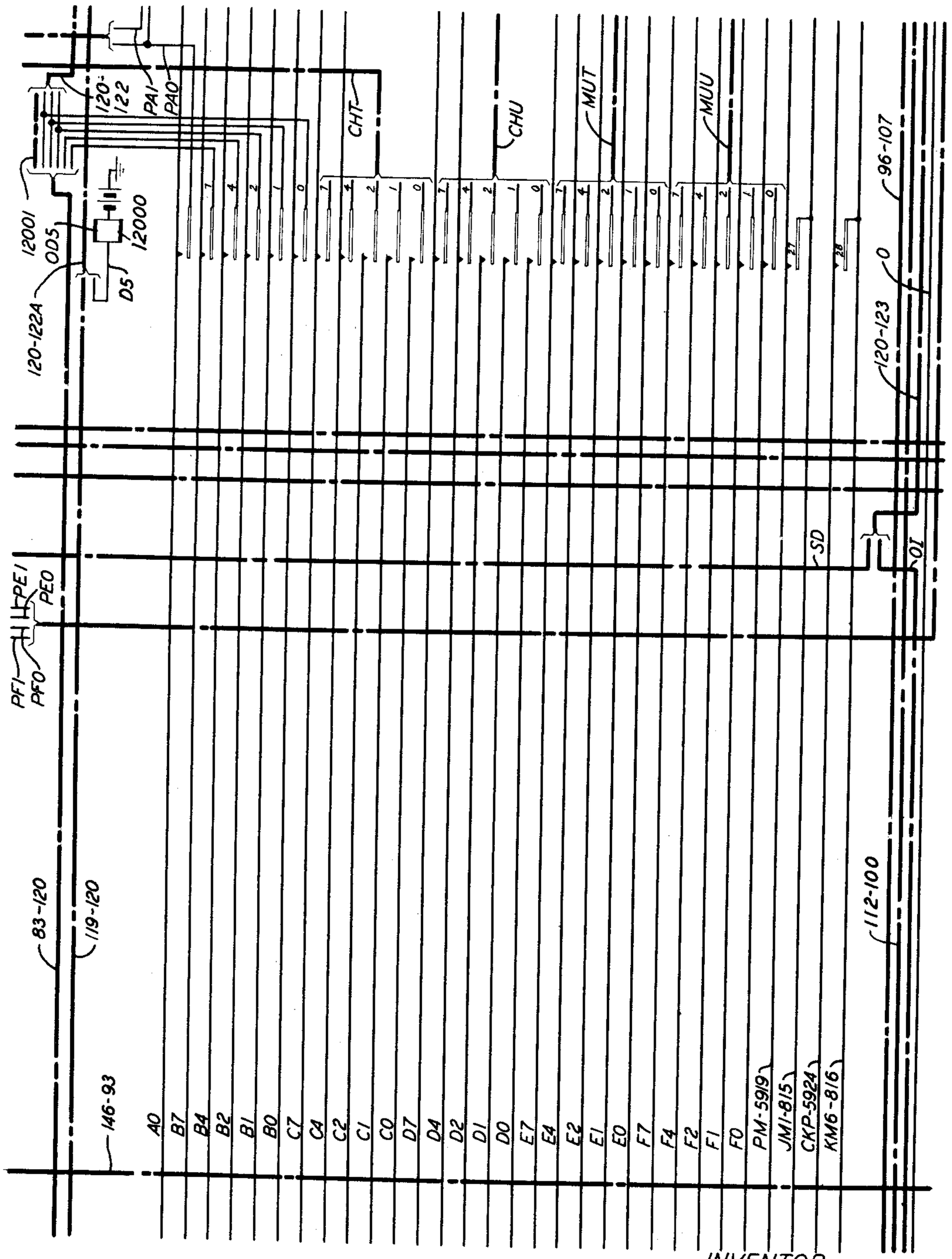


FIG. 120

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 120

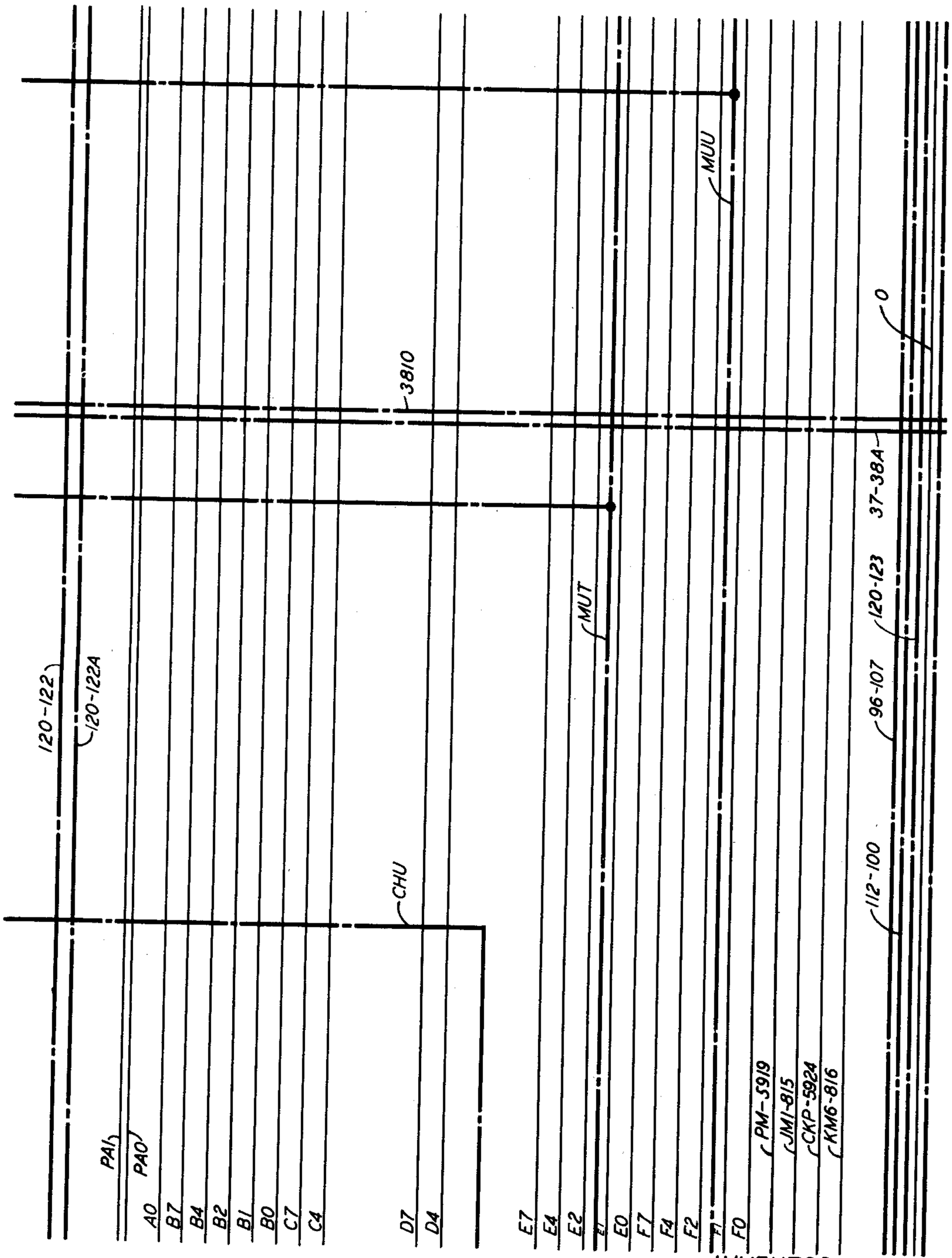


FIG. 121

INVENTOR
A. E. JOEL, JR.

BY Sylturner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 121

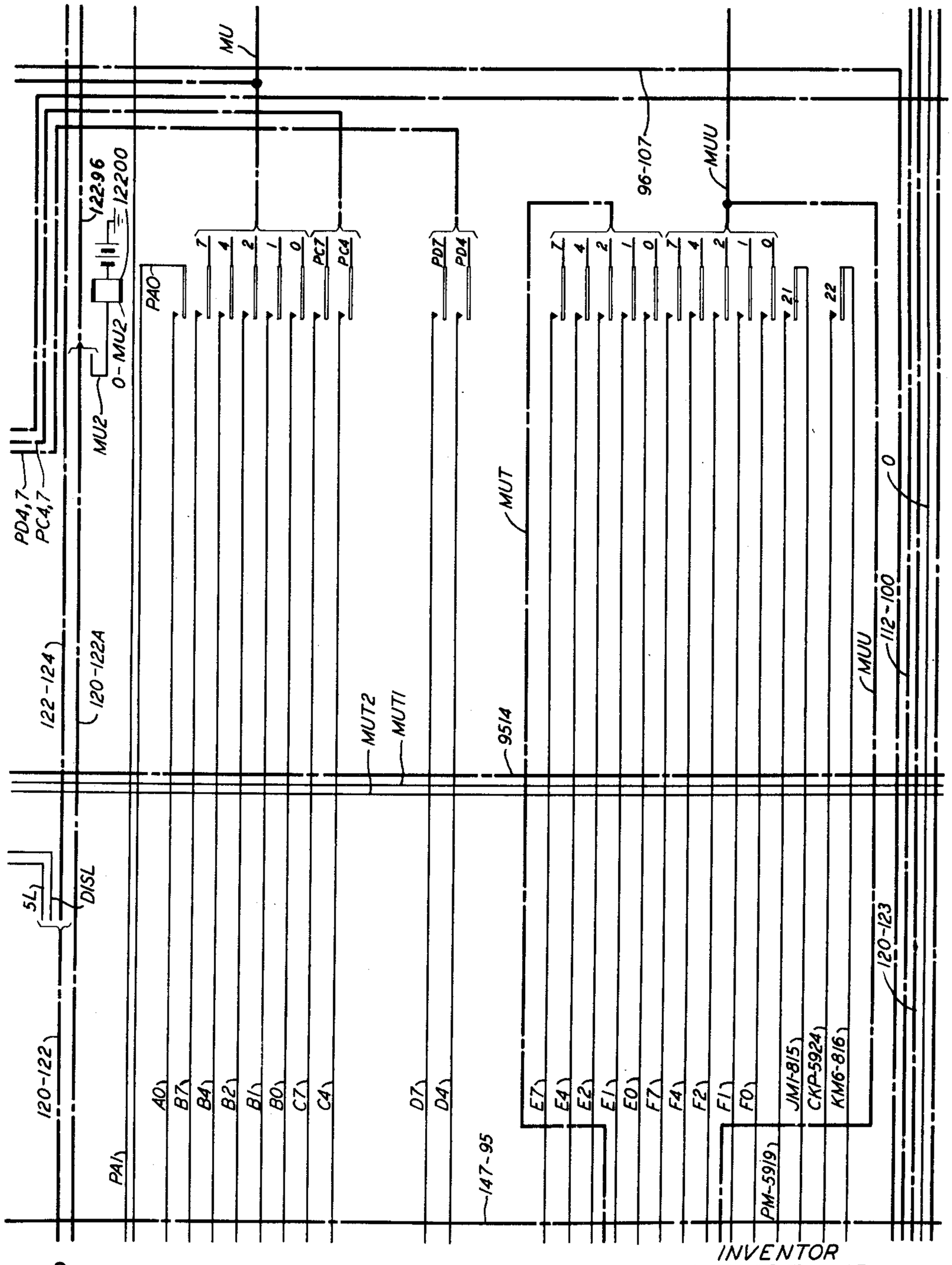


FIG. 122

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 122

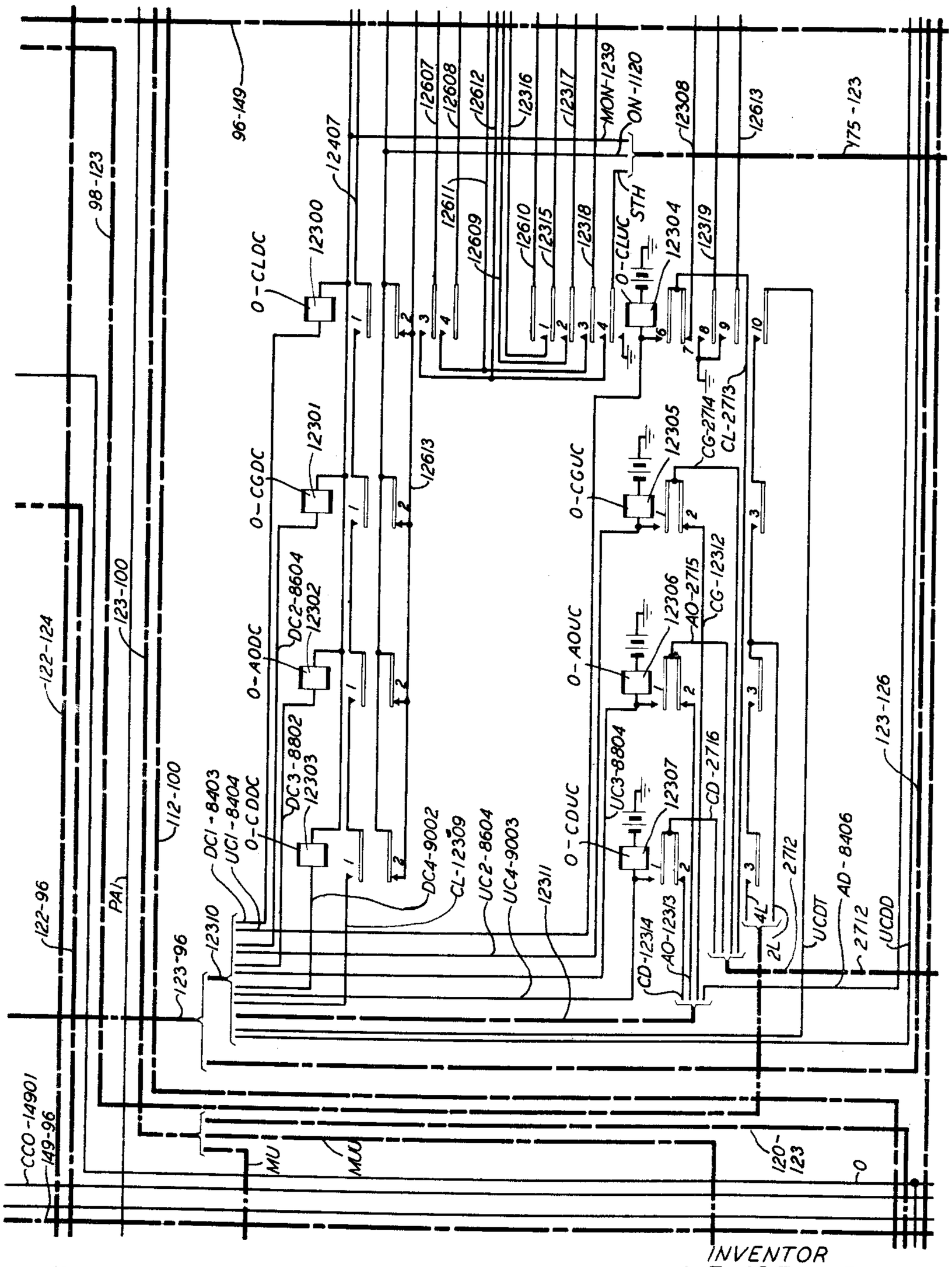


FIG. 123

INVENTOR
A. E. JOEL, JR.

BY F. L. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 123

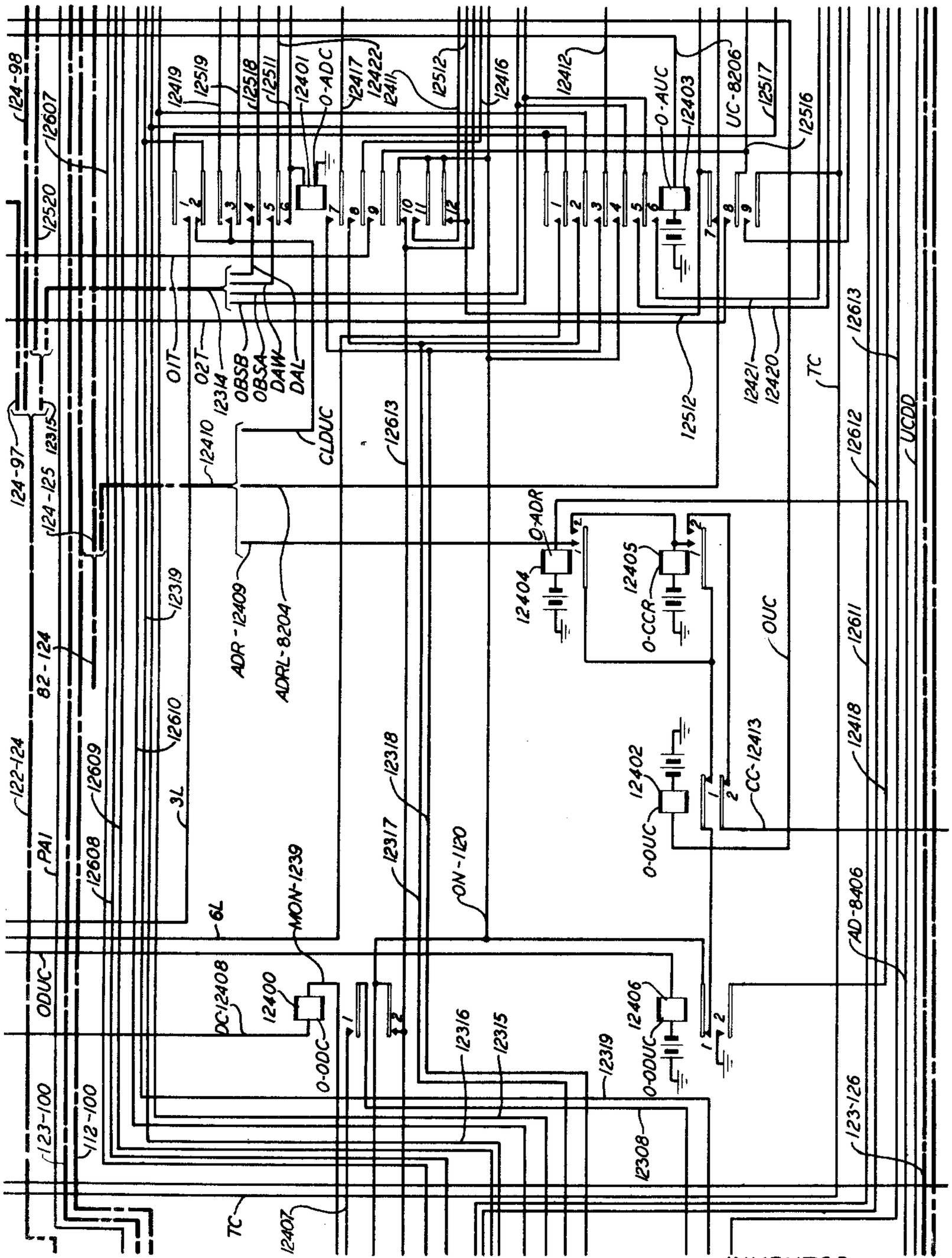


FIG. 124

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 124

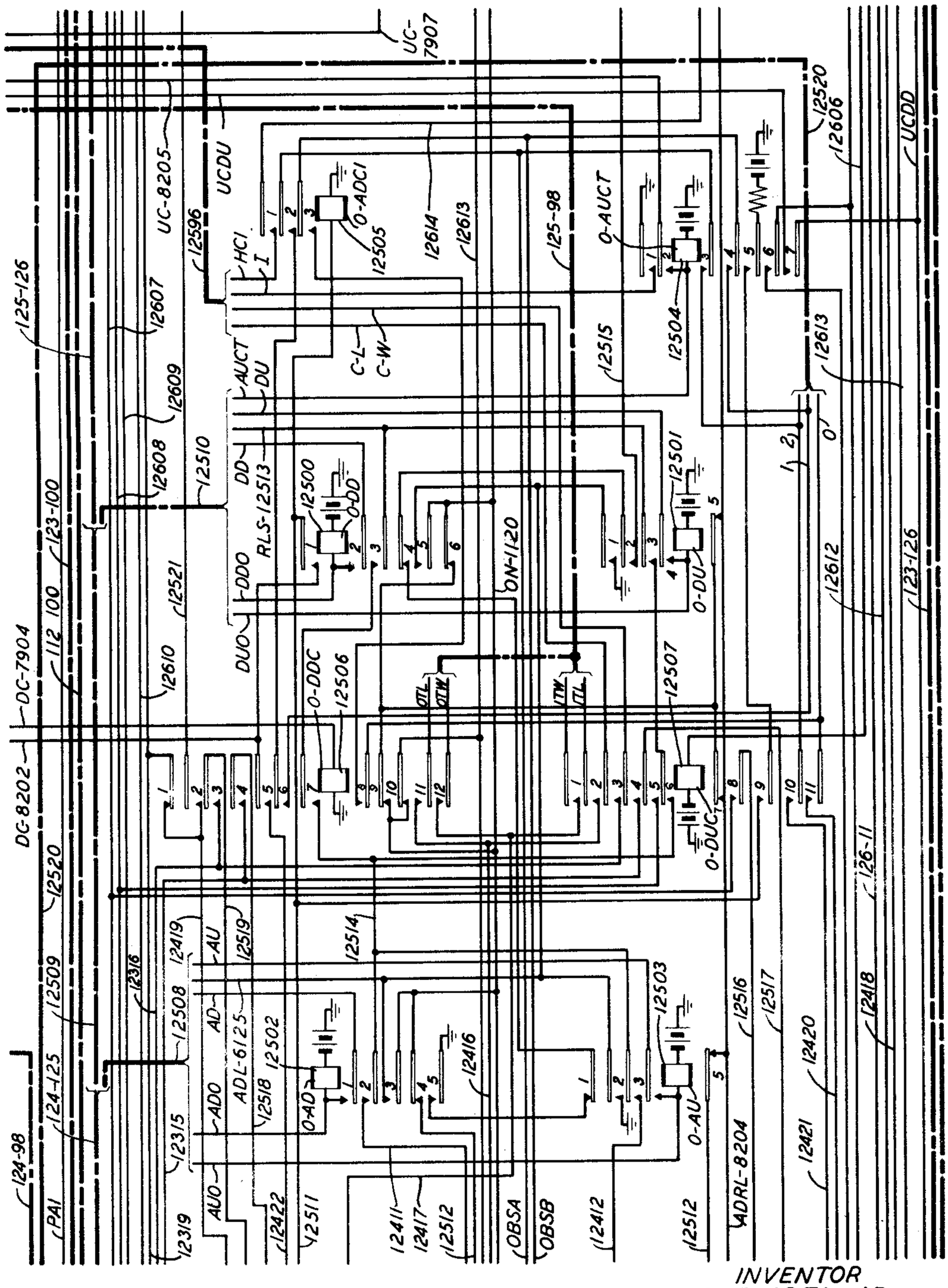


FIG. 125

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 125

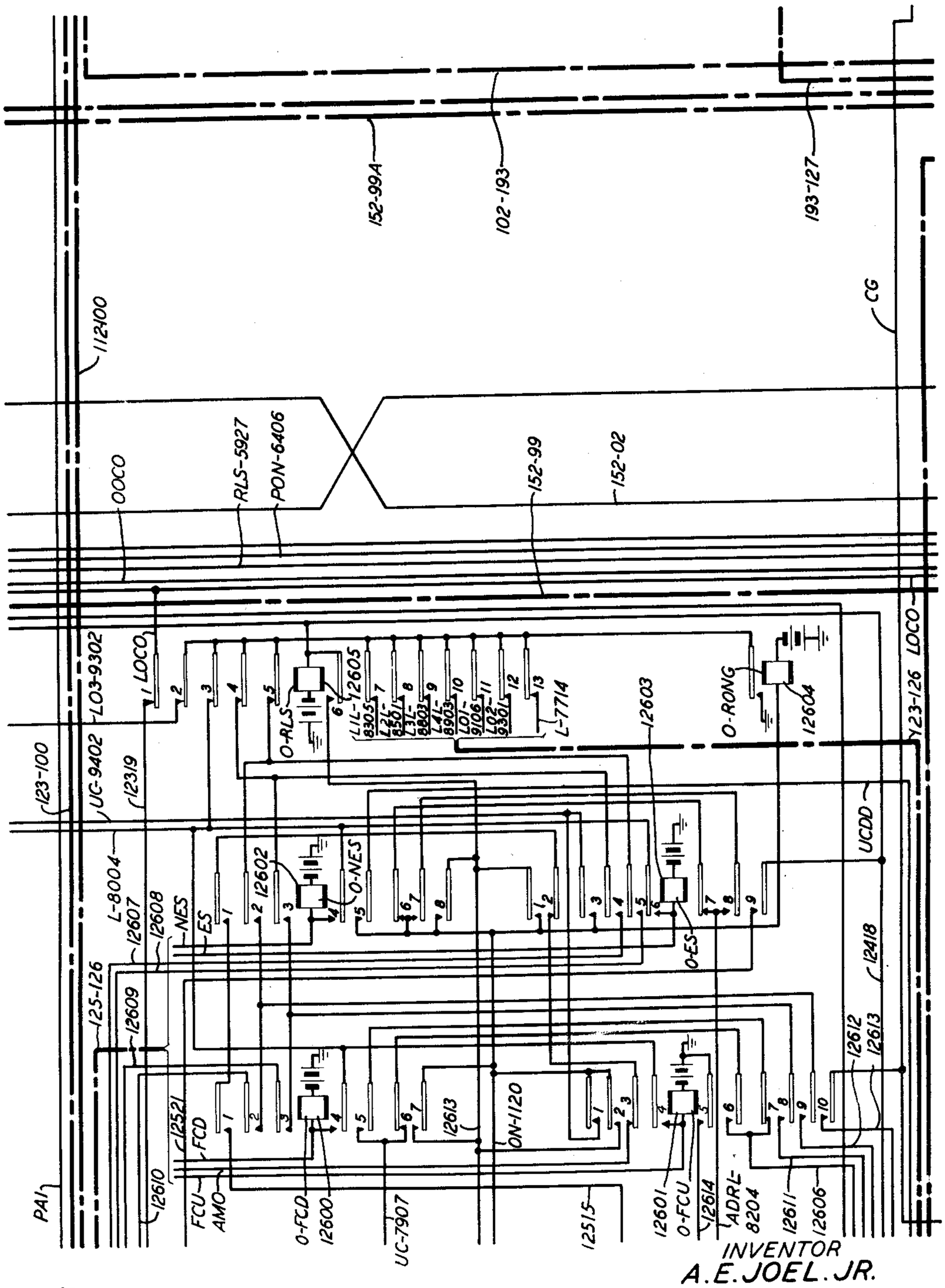


FIG. 126

INVENTOR
A. E. JOEL. JR.
BY Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 126

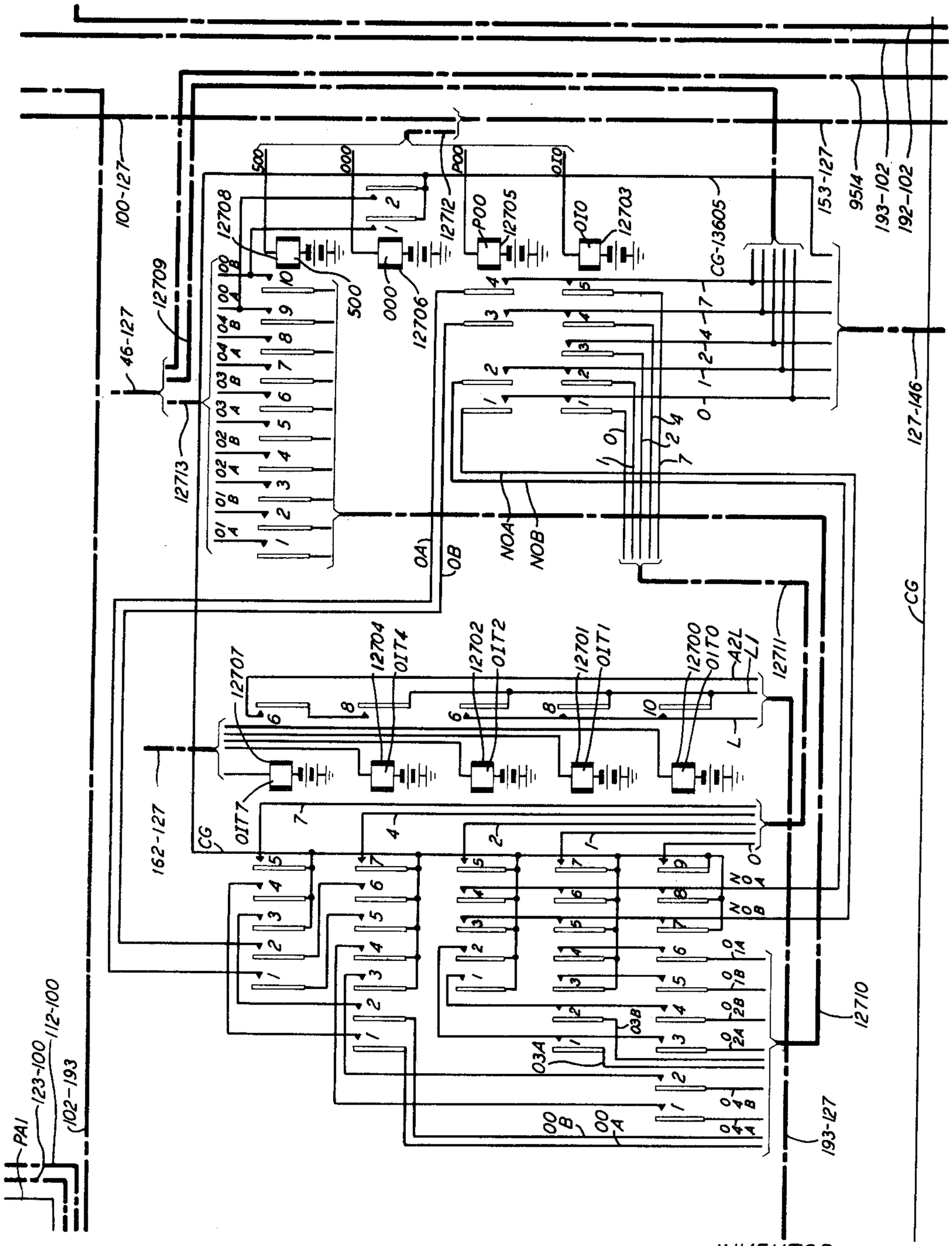


FIG. 127

INVENTOR
A. E. JOEL, JR.
BY Sturmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 127

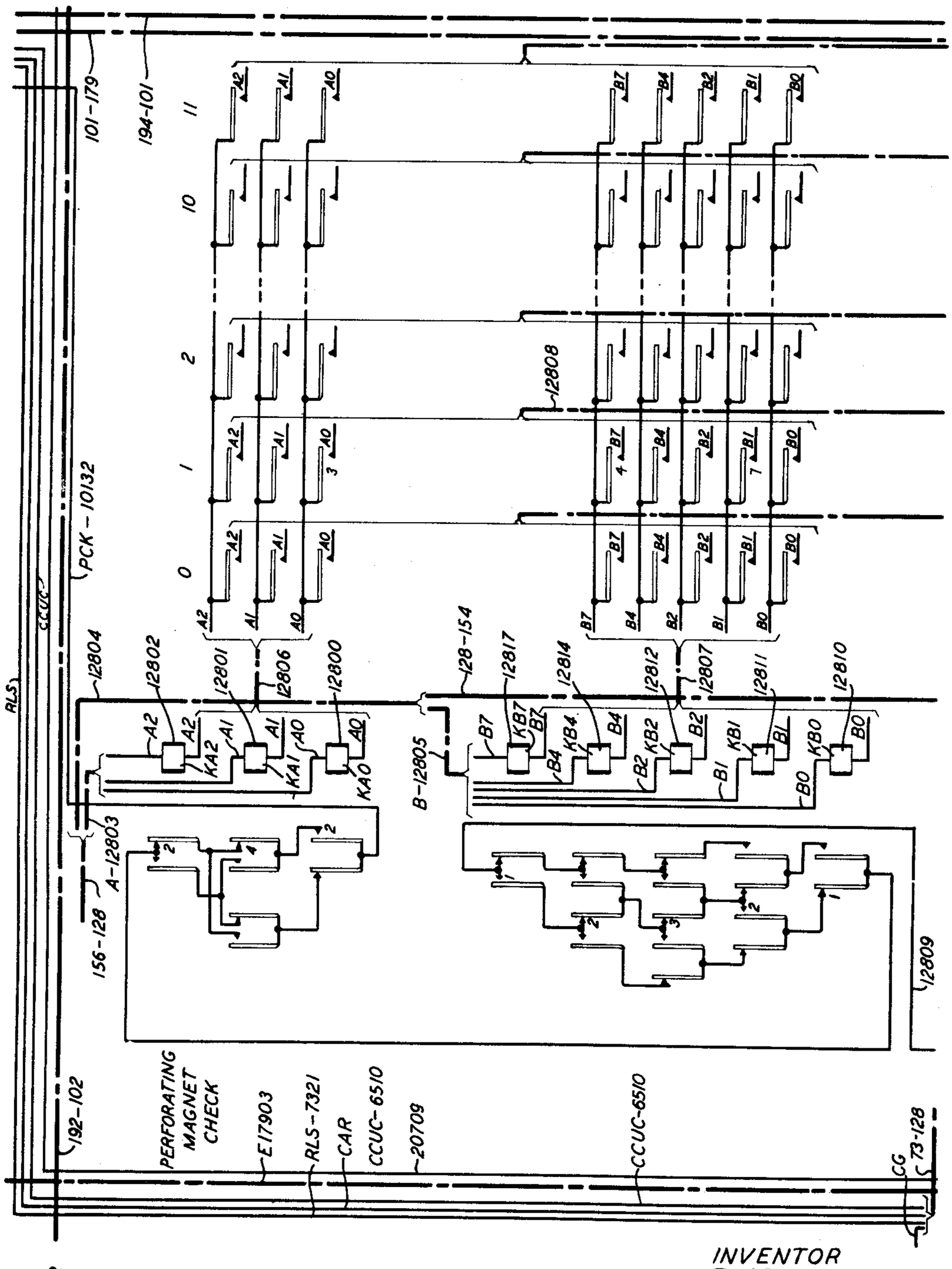


FIG. 128

INVENTOR
A. E. JOEL, JR.
BY Sturner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 128

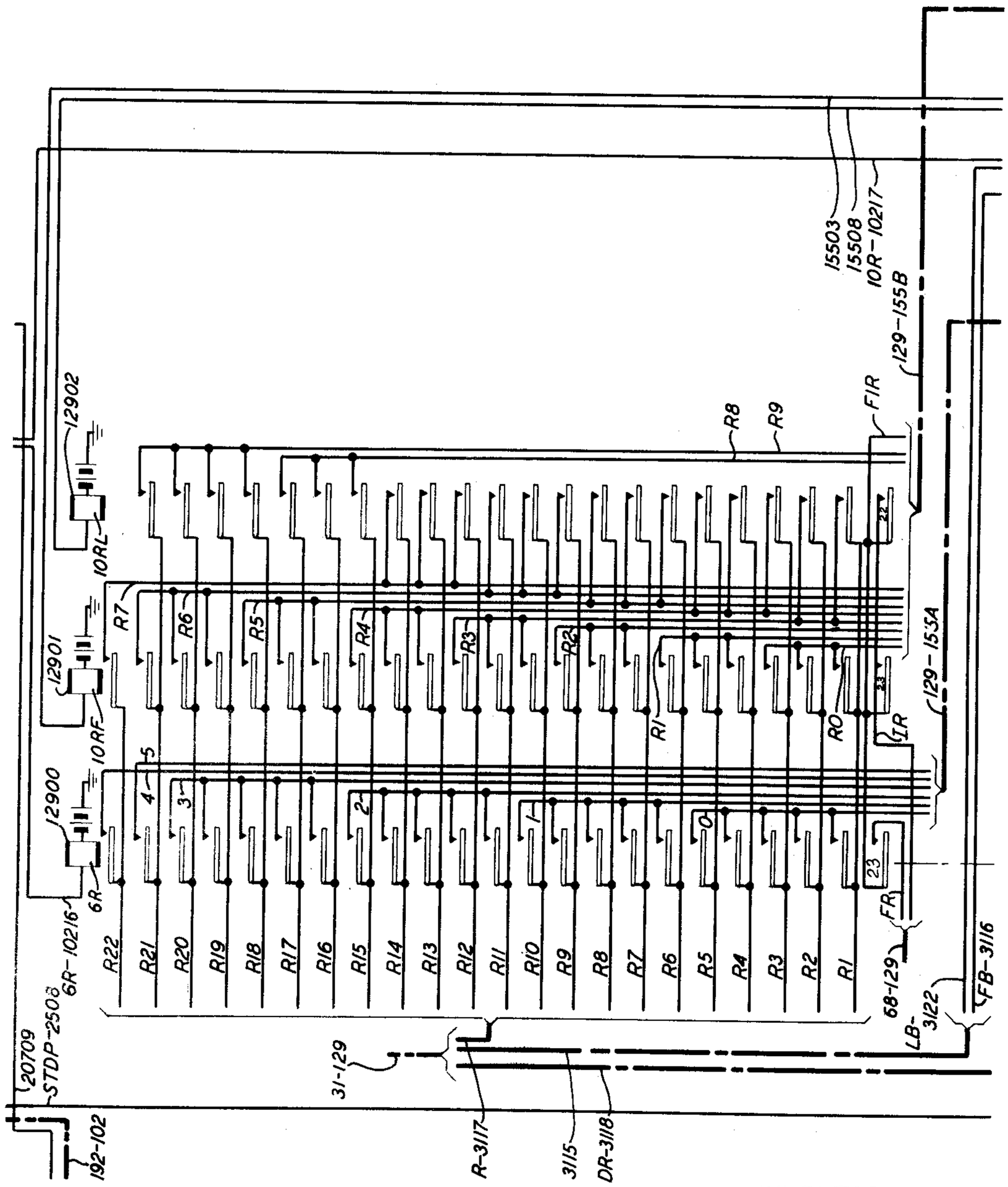


FIG. 129

INVENTOR
A. E. JOEL, JR.
BY
S. Tiesner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 129

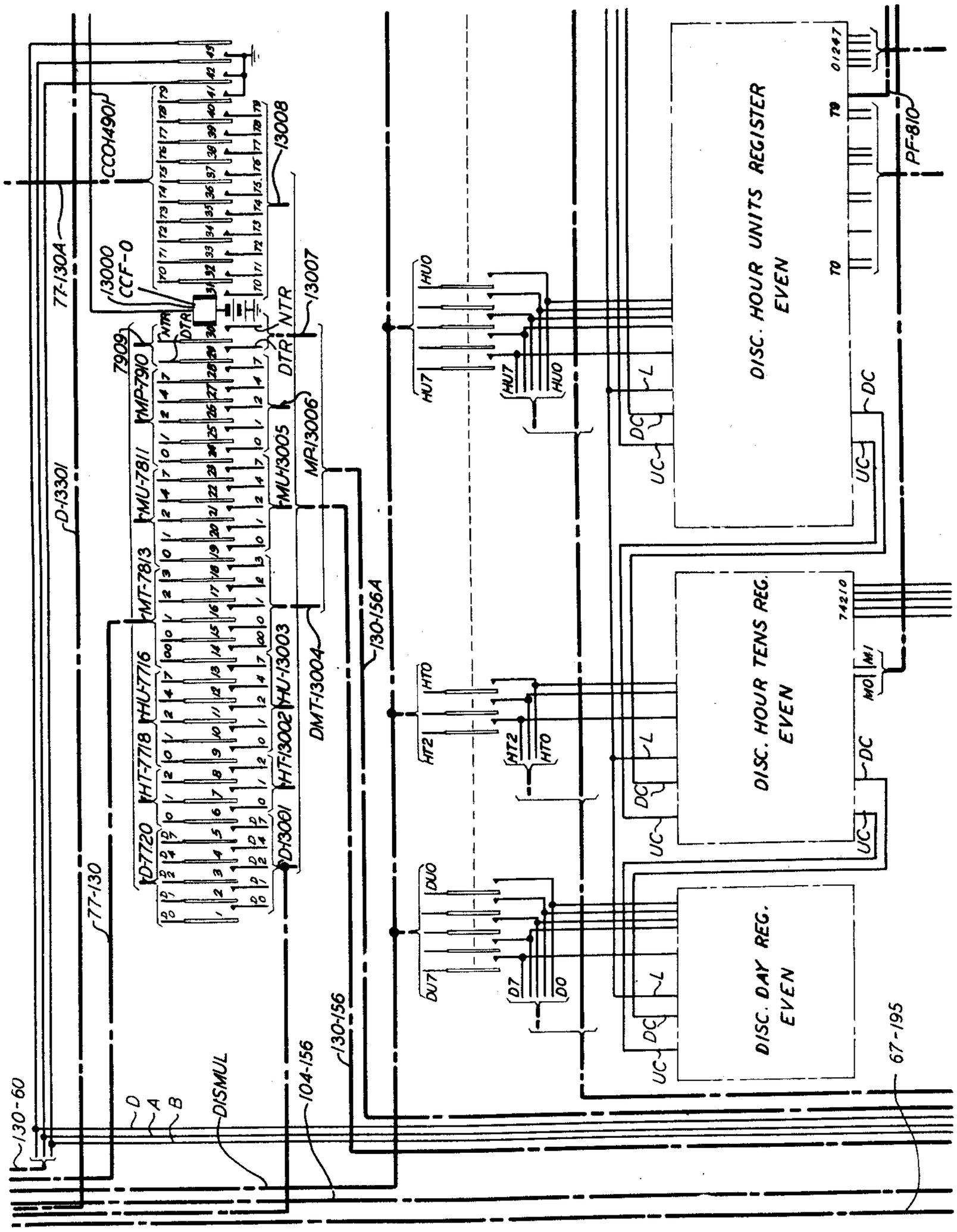


FIG. 130

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 130

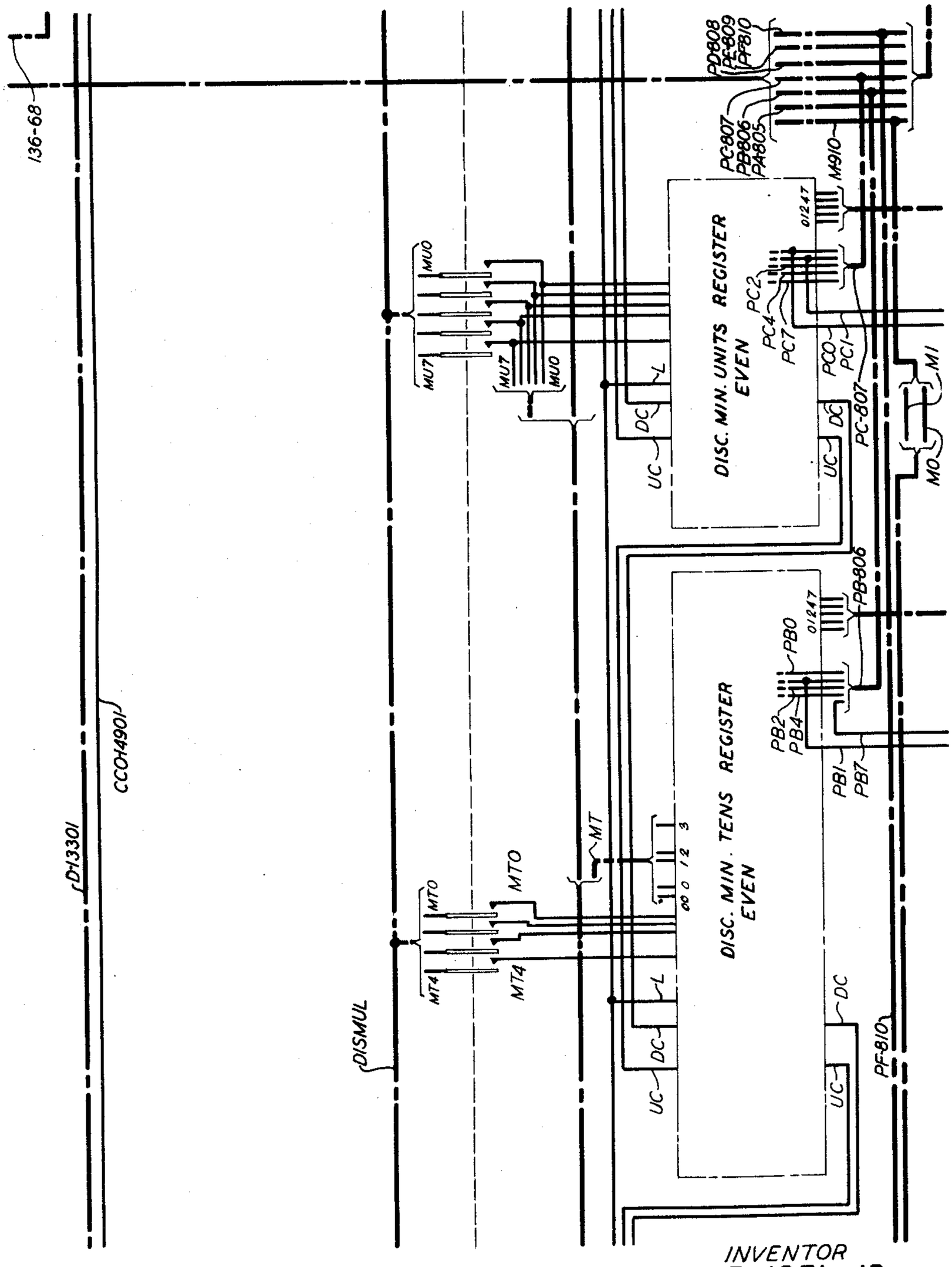


FIG. 131

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 131

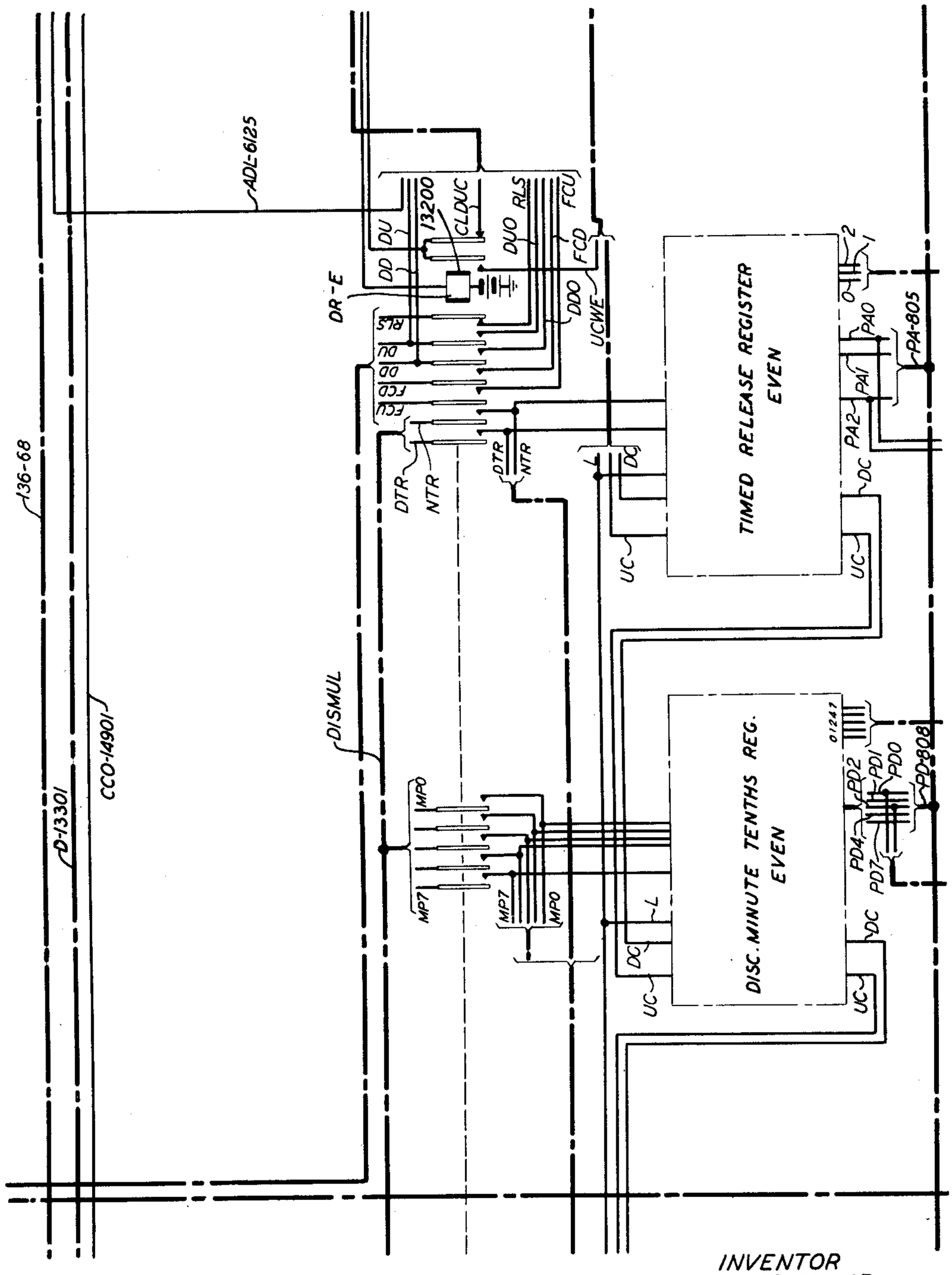


FIG. 132

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 132

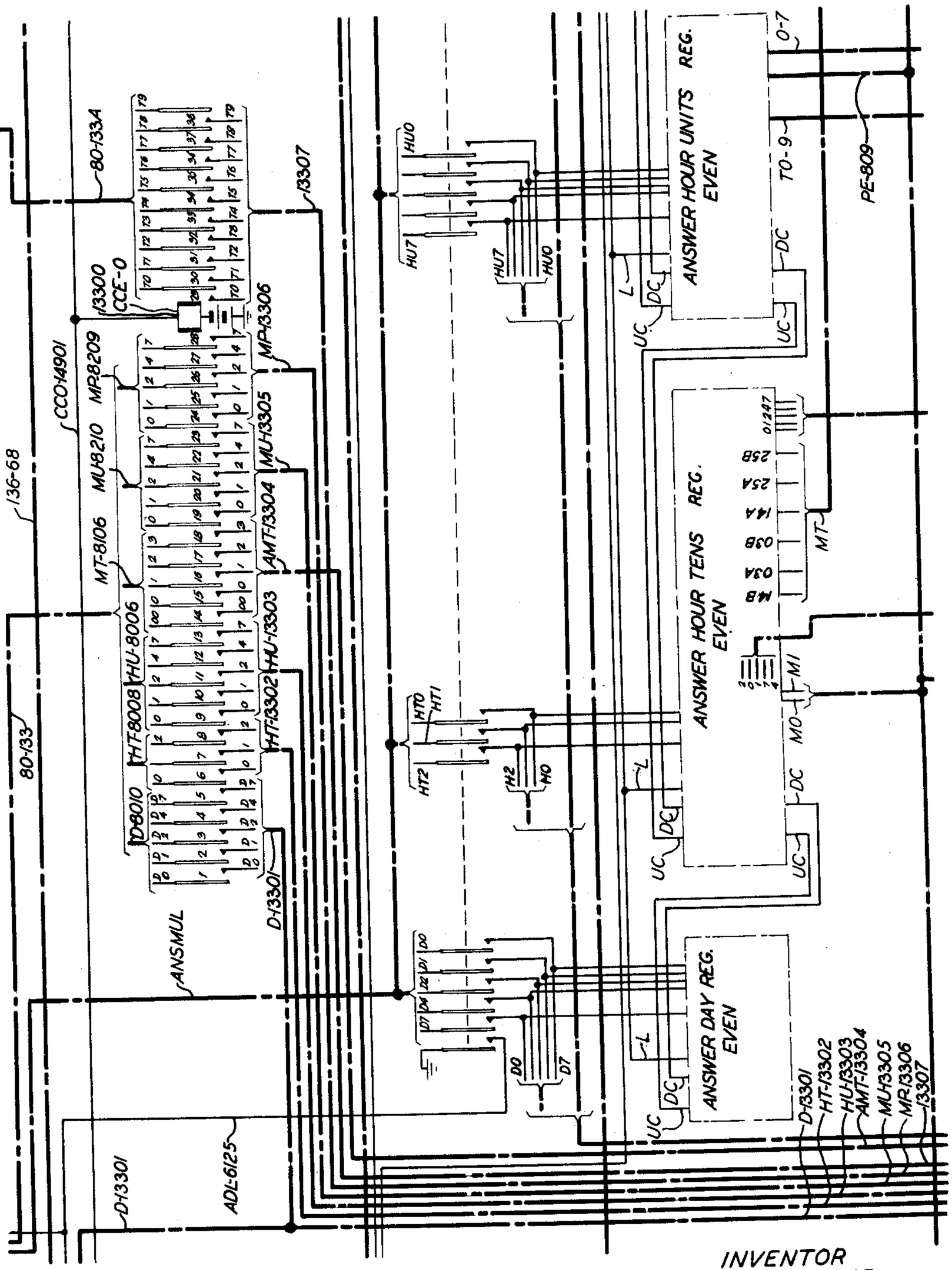


FIG. 133

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 133

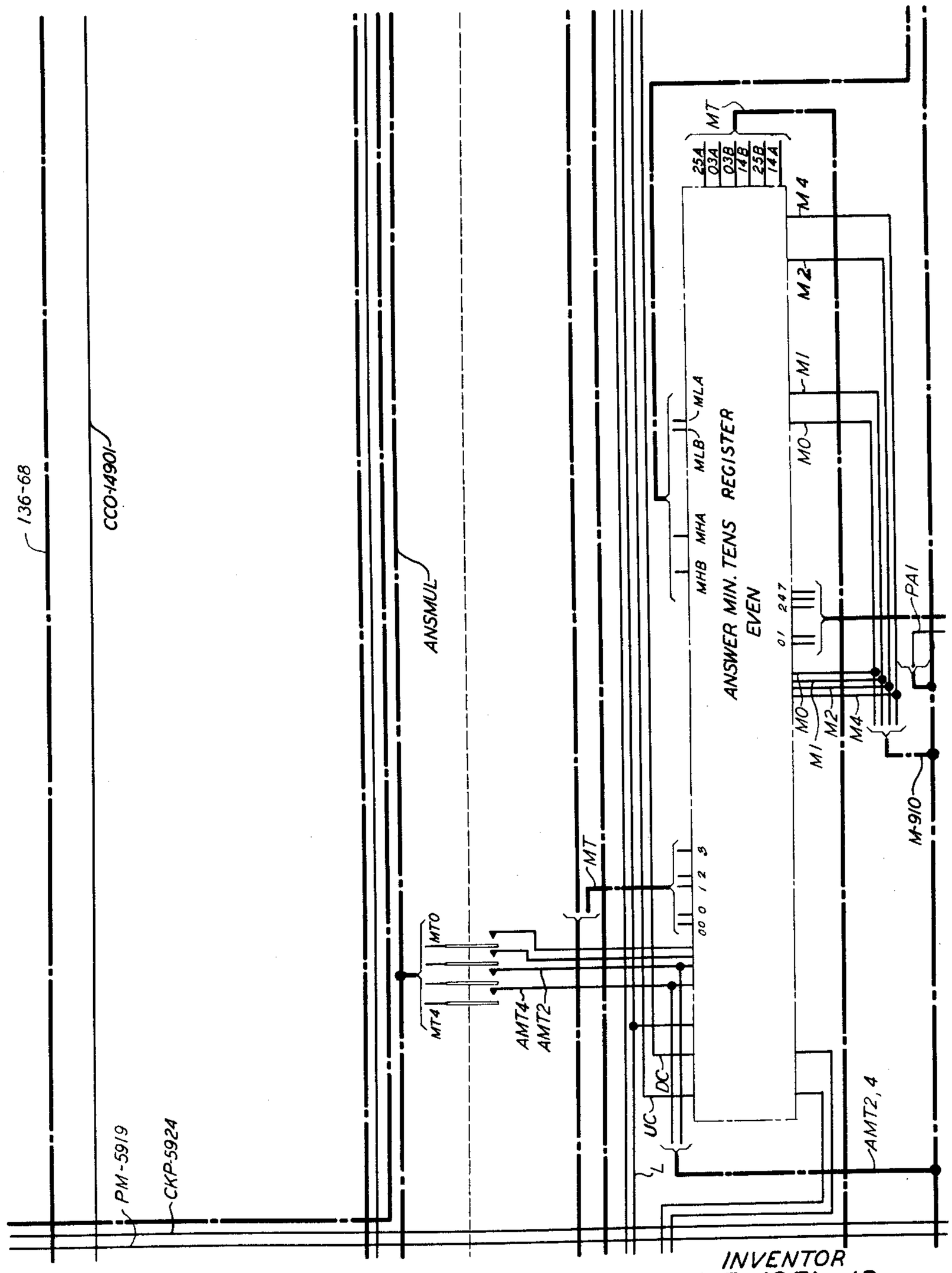


FIG. 134

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 134

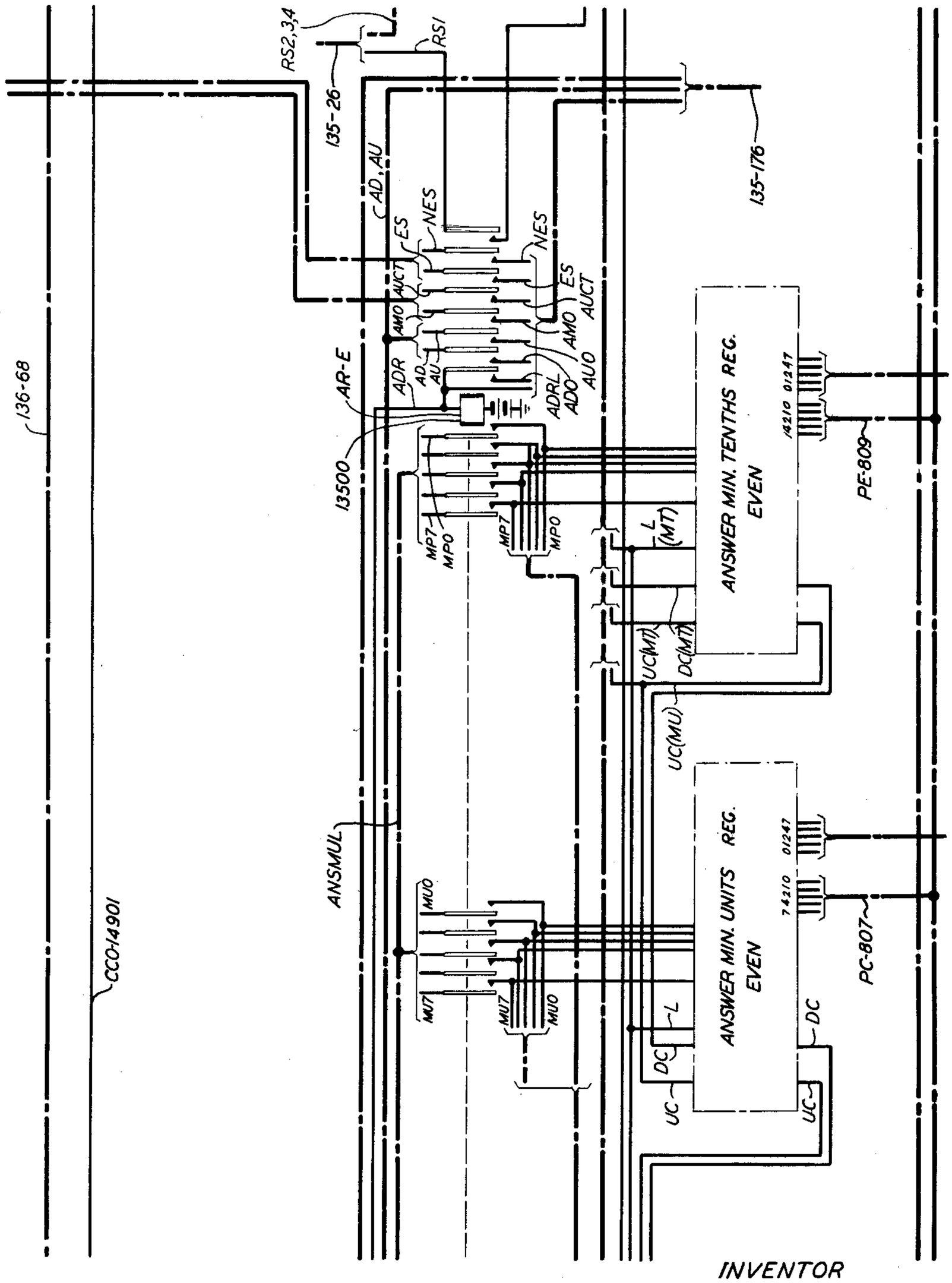


FIG. 135

INVENTOR
A. E. JOEL, JR.
BY Strenner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 135

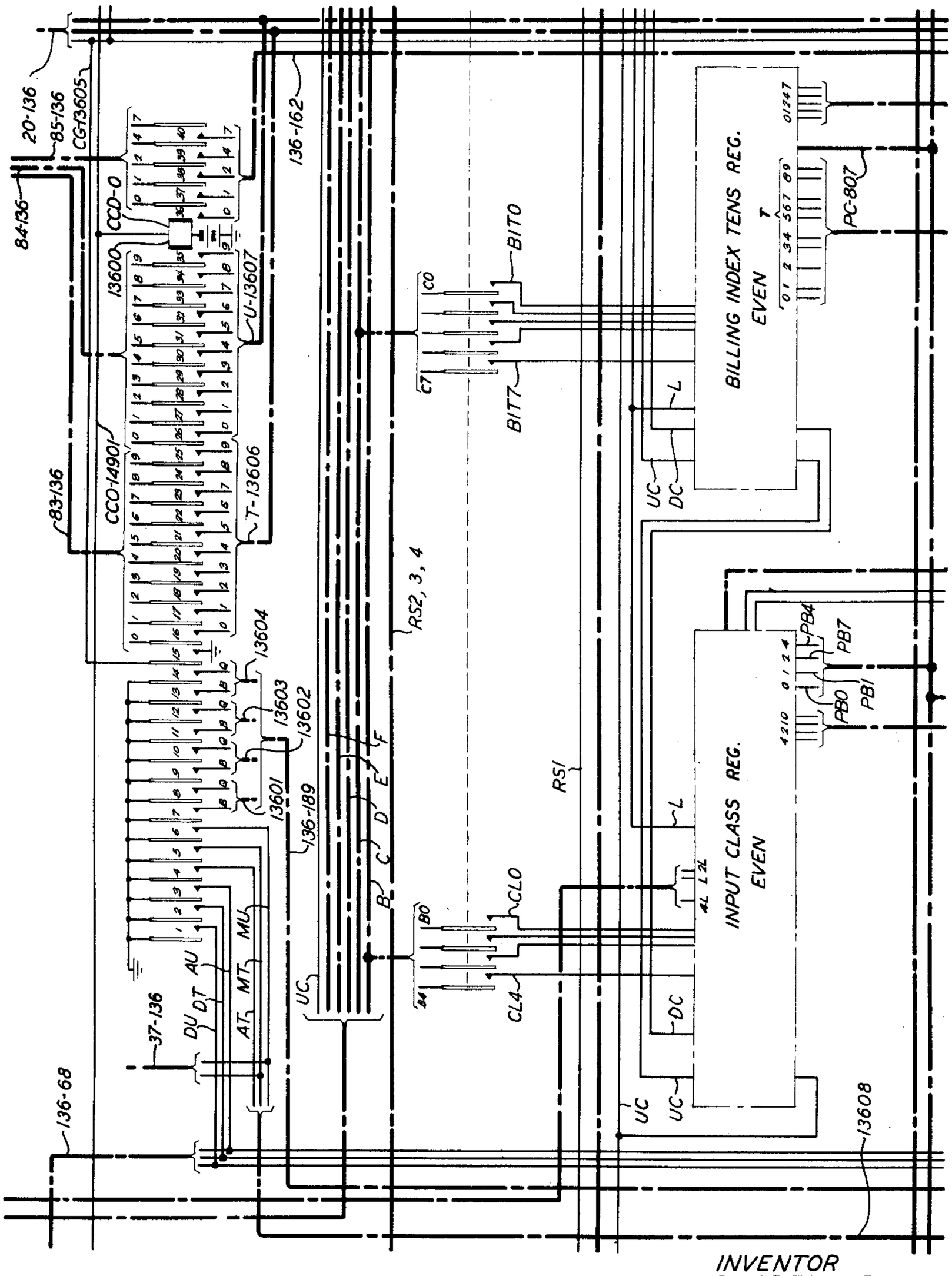


FIG. 136

INVENTOR
A. E. JOEL. JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 136

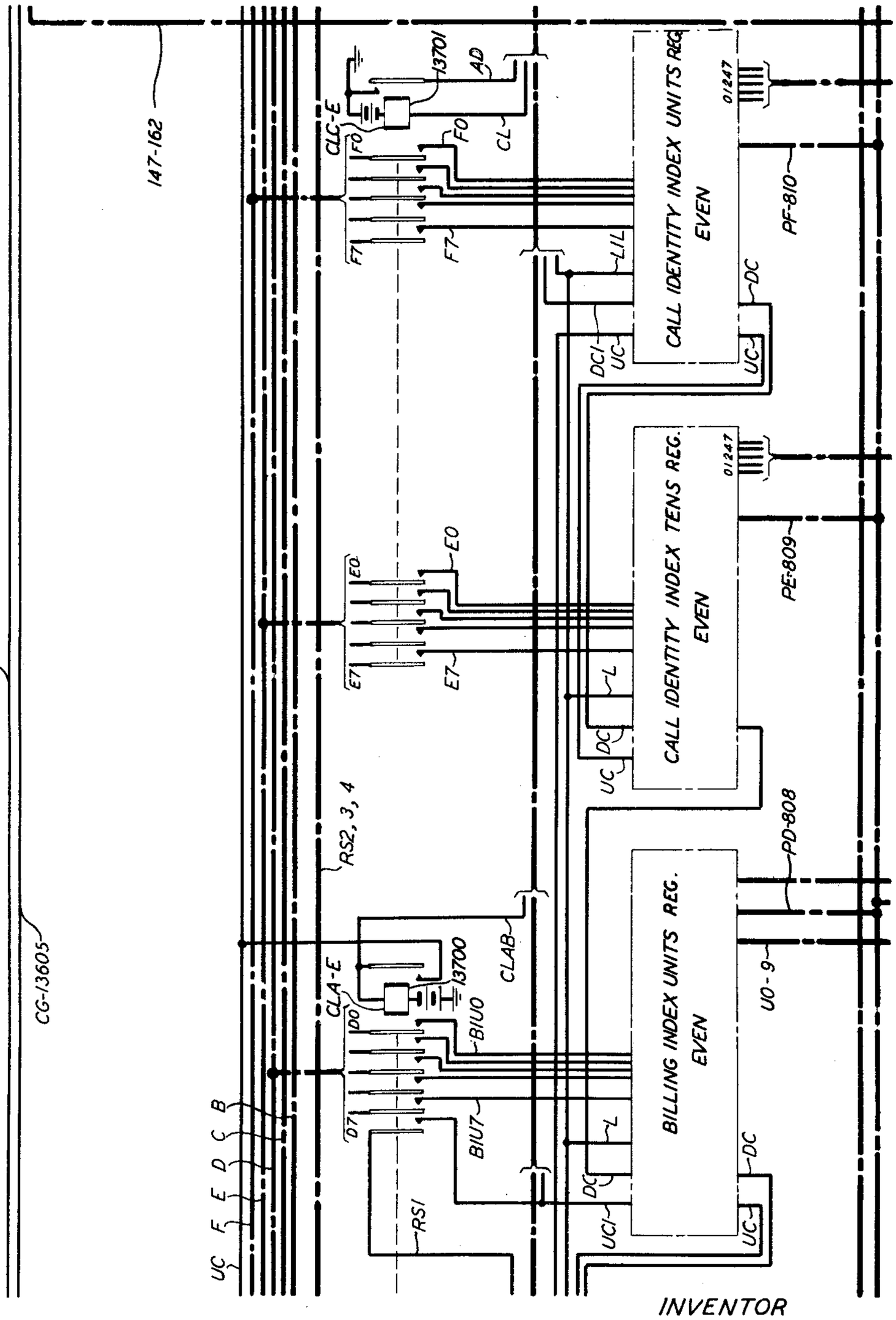


FIG. 137

INVENTOR
A.E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 137

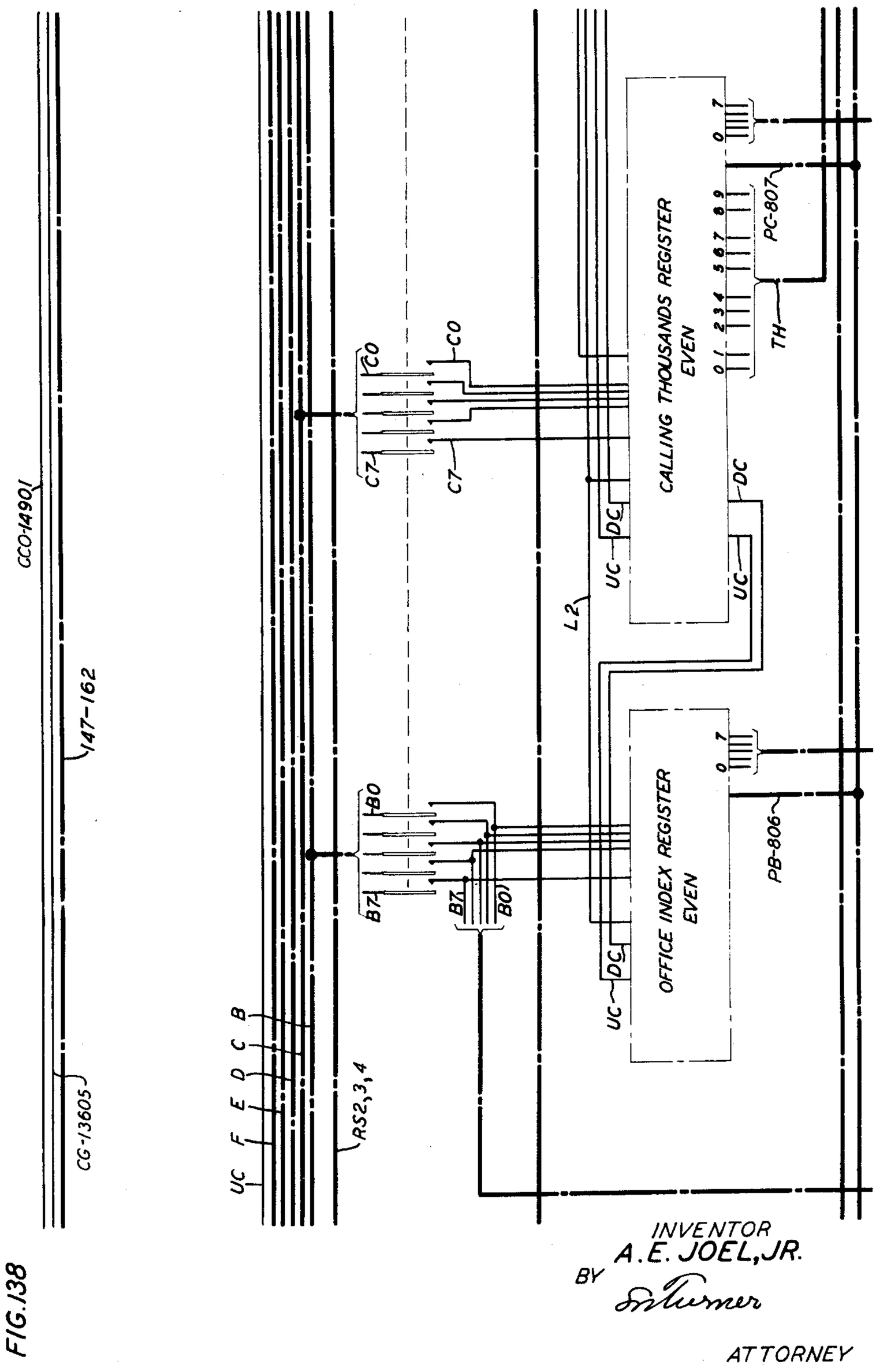


FIG.138

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 138

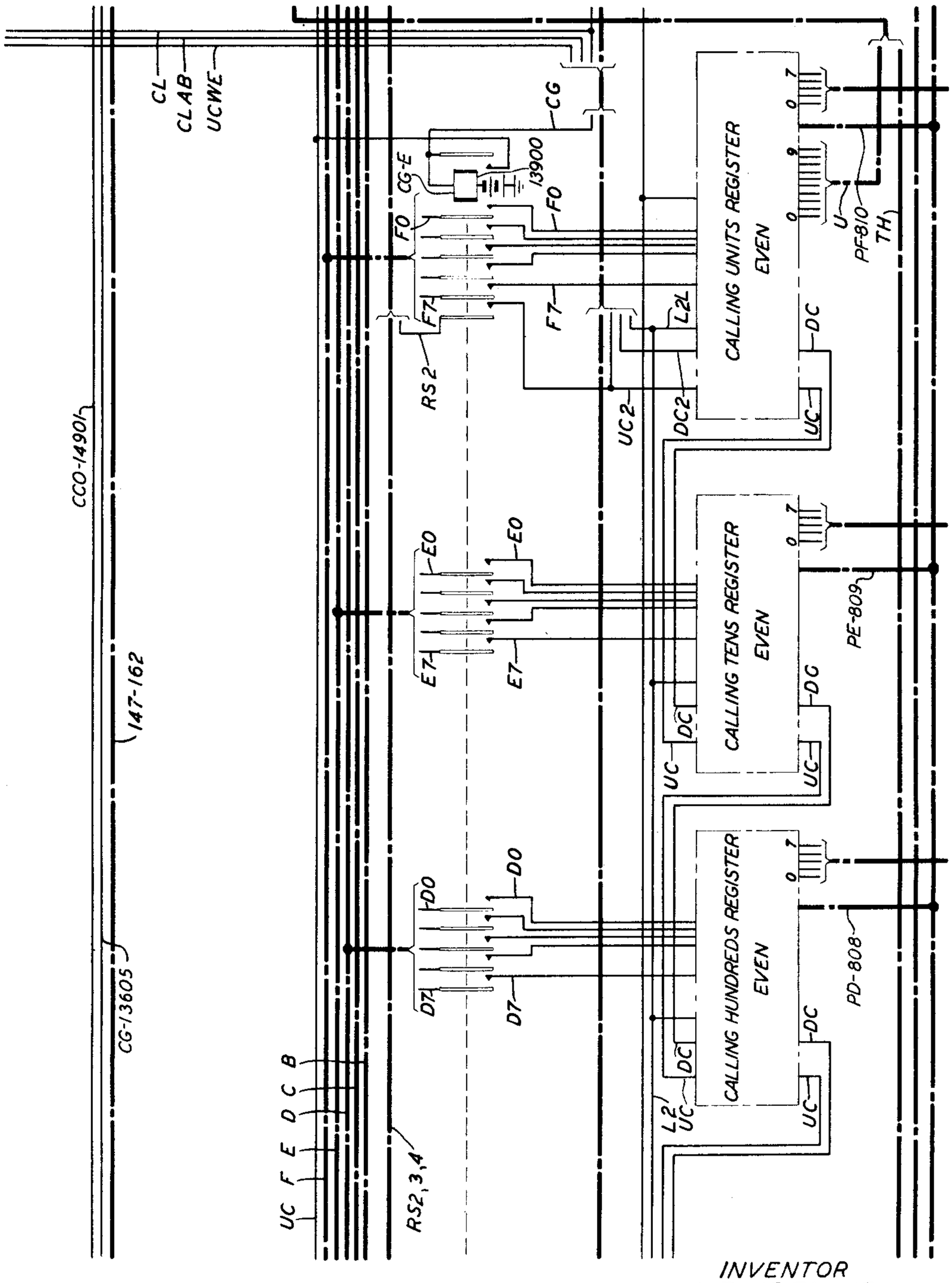


FIG. 139

INVENTOR
A. E. JOEL, JR.
BY Fitzsimmons
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 139

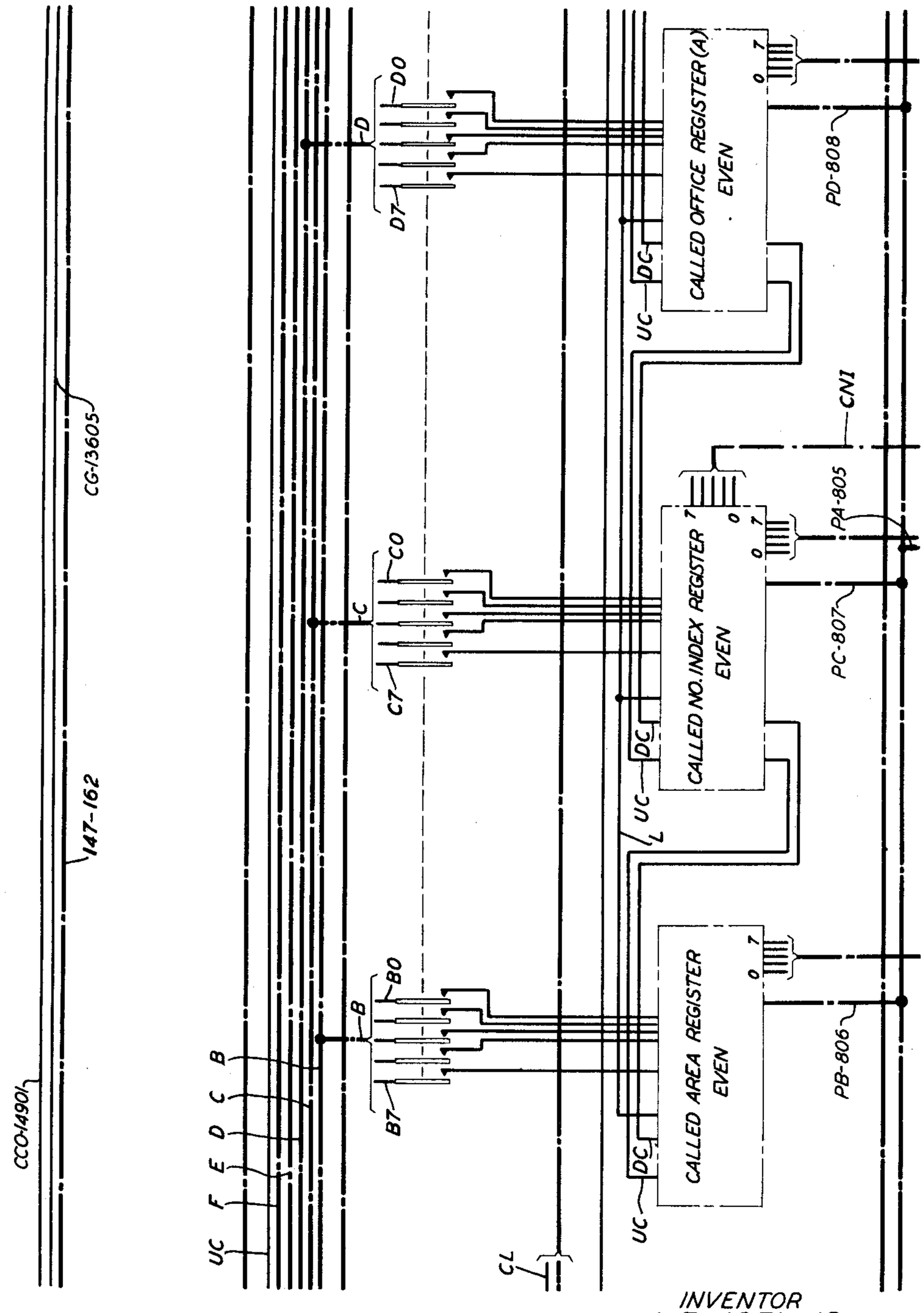


FIG. 140

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 140

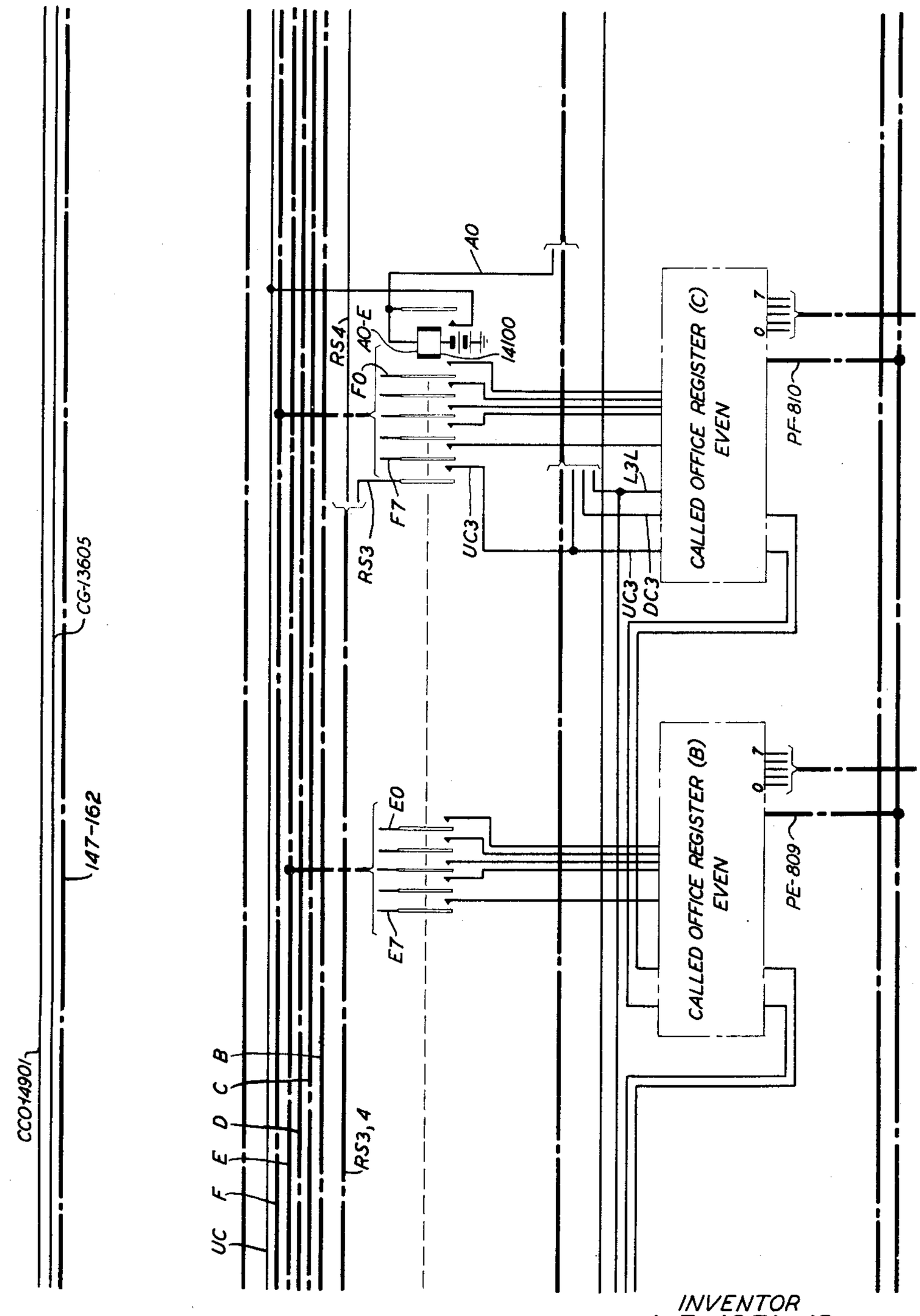


FIG. 141

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 141

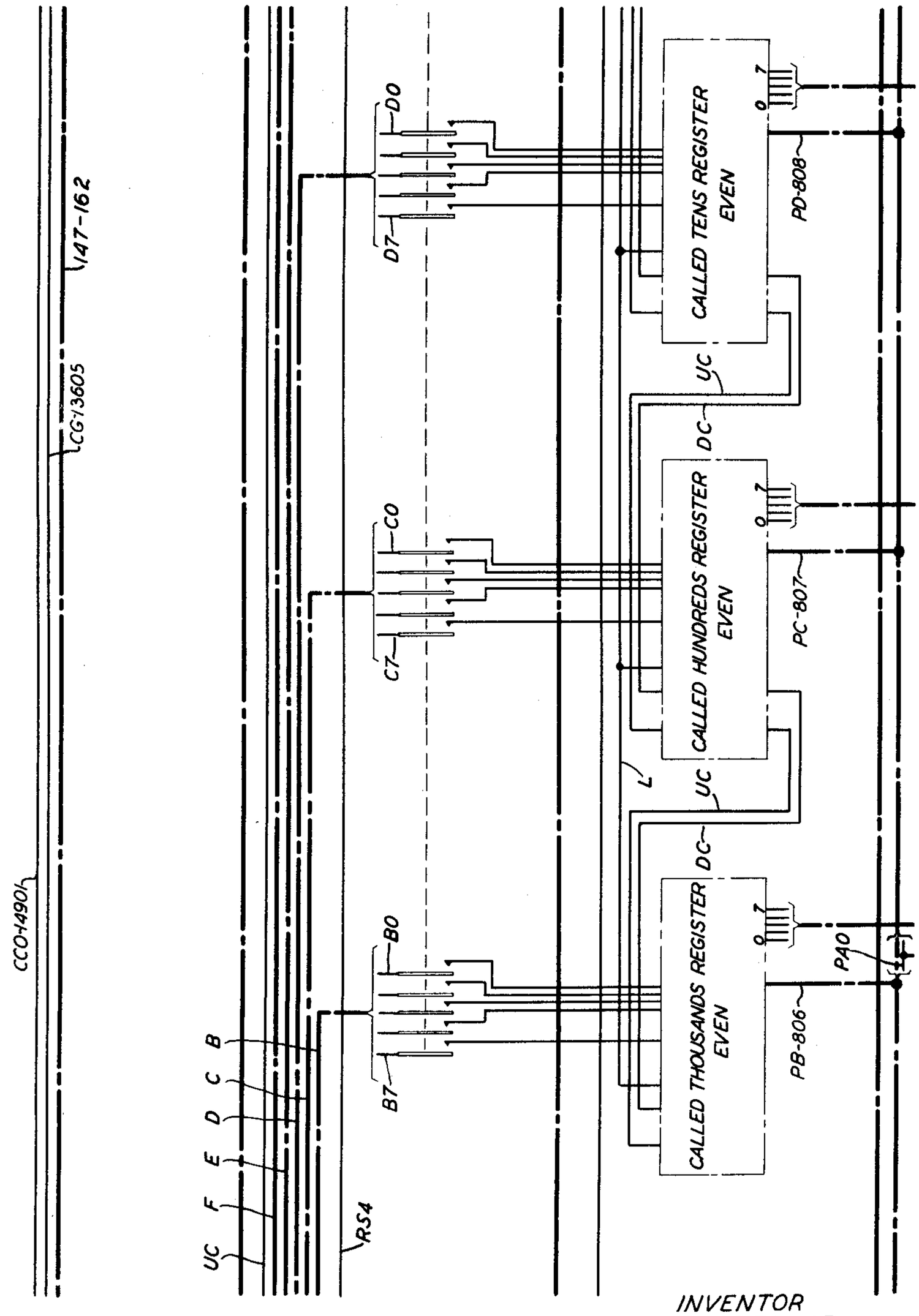


FIG. 142

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 142

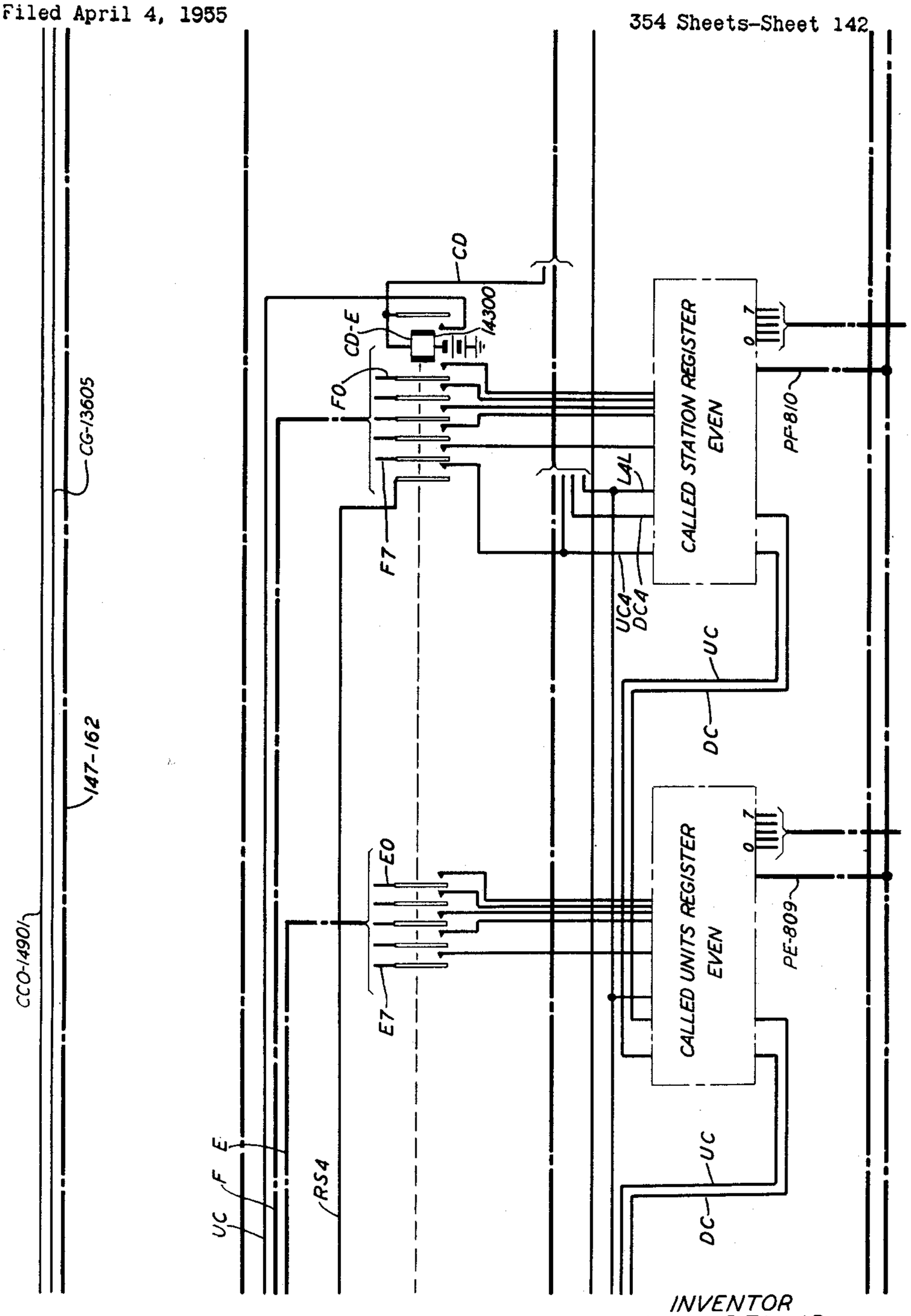


FIG. 143

INVENTOR
A. E. JOEL, JR.
BY S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 143

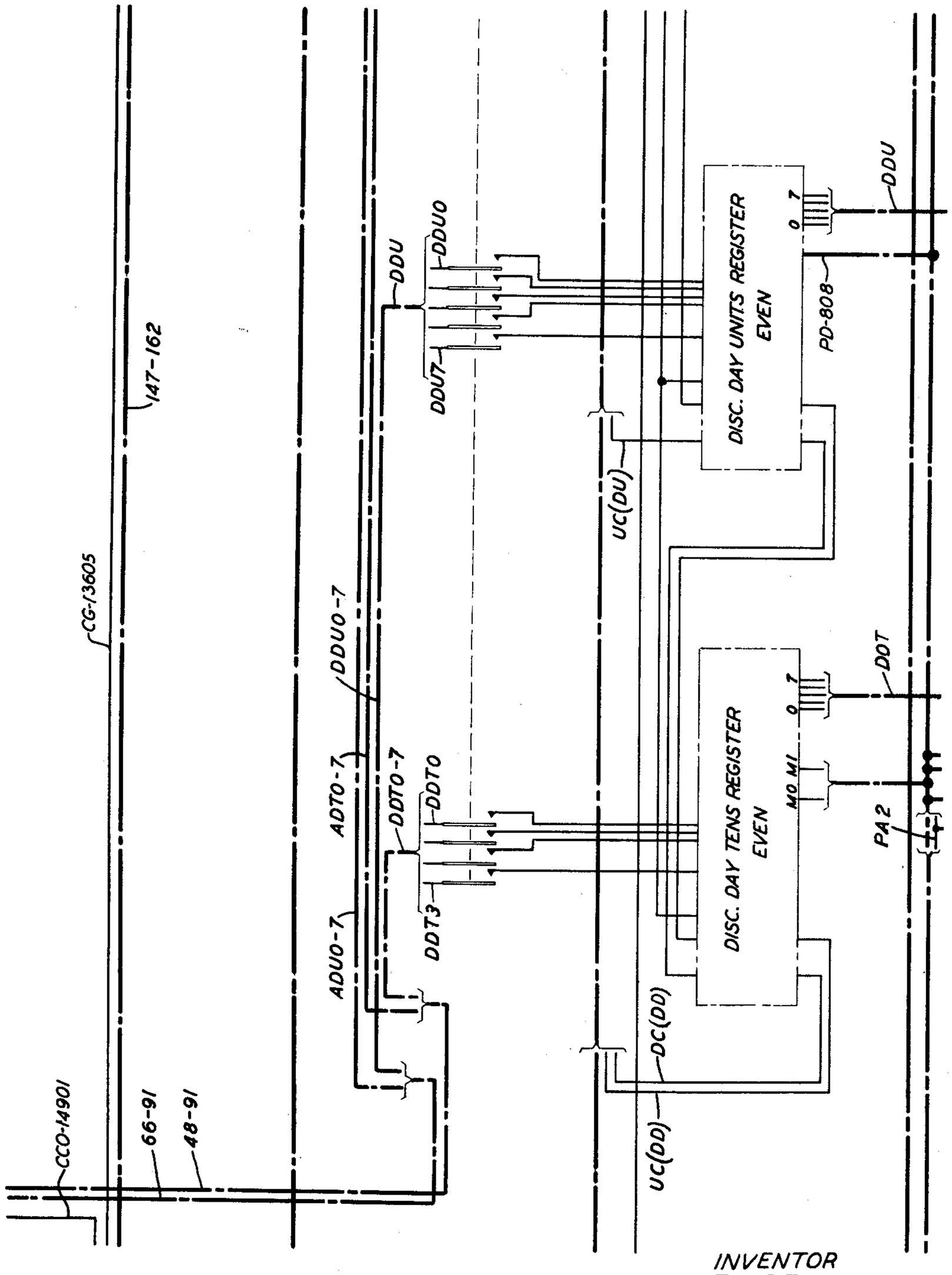


FIG. 144

INVENTOR
A. E. JOEL. JR.
BY
Sr Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 144

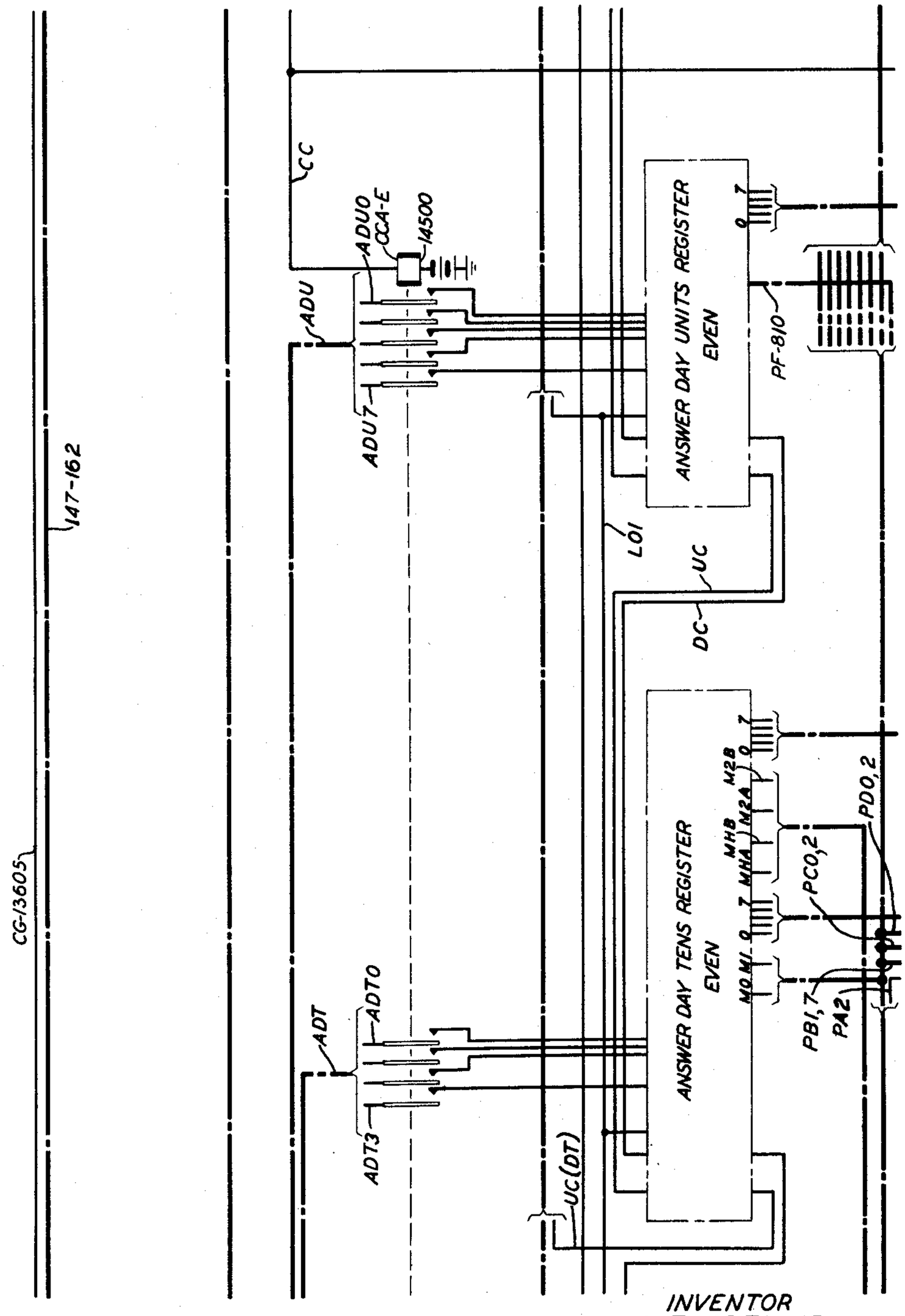


FIG. 145

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 145

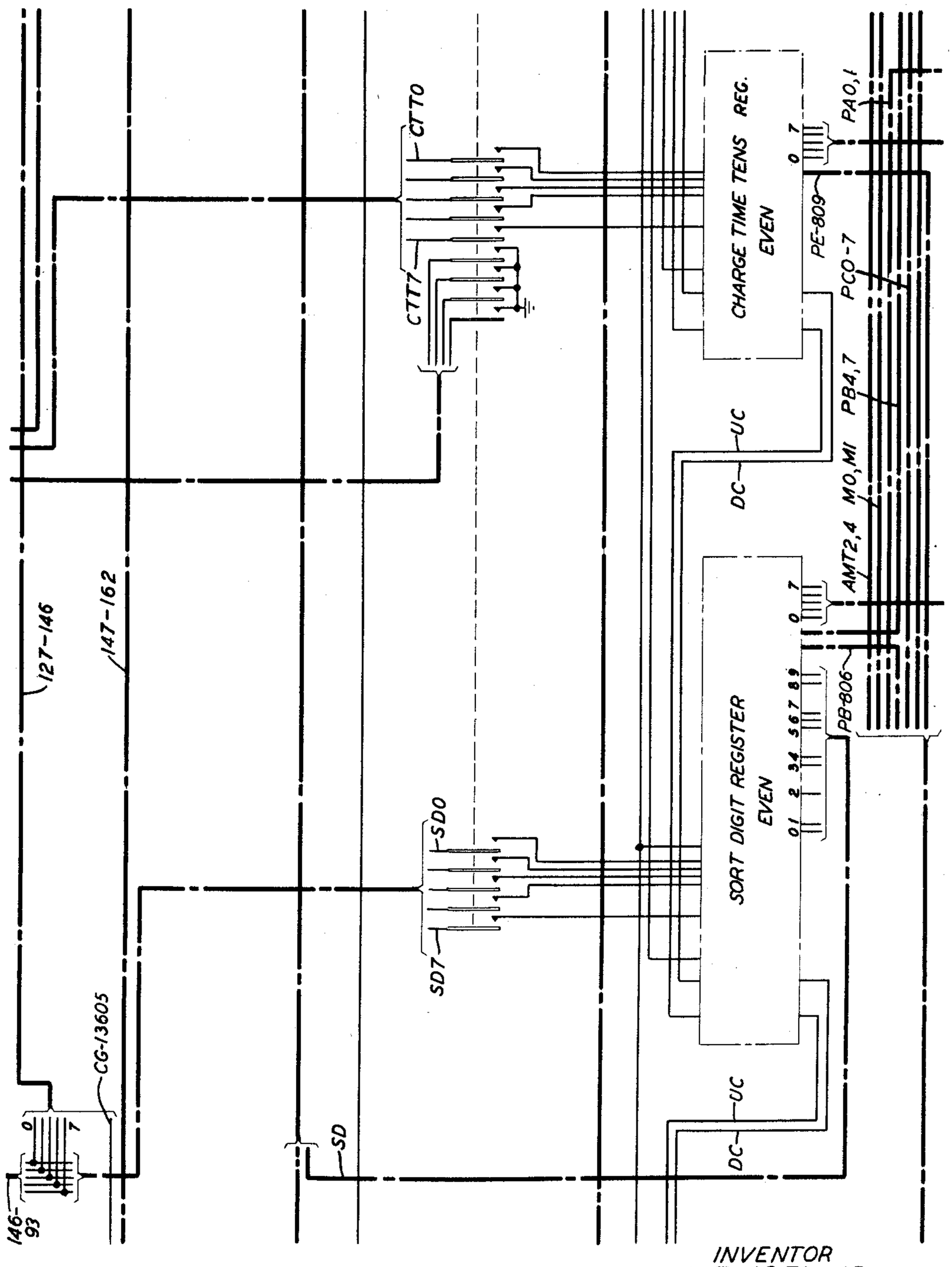


FIG. 146

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 146

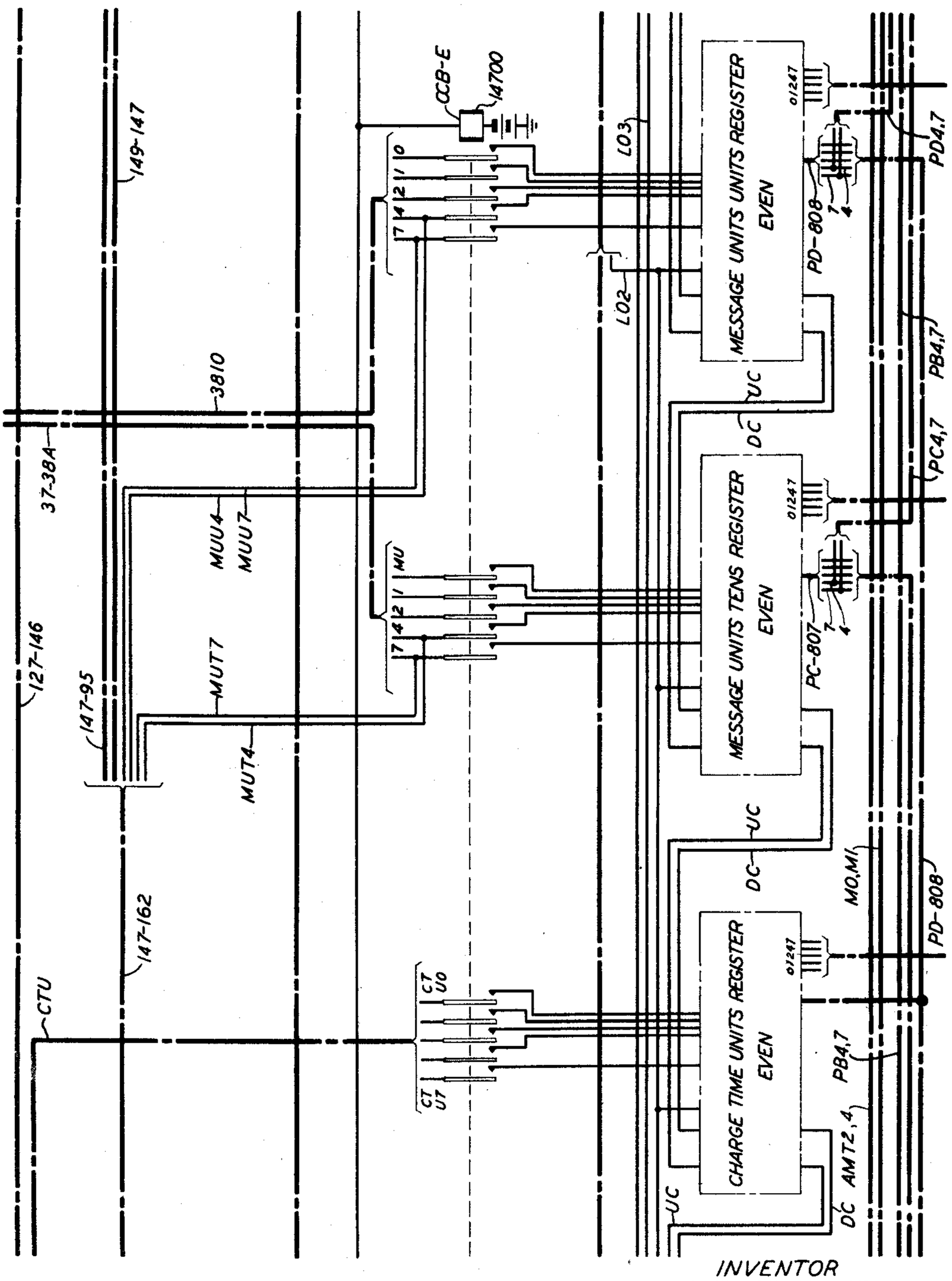


FIG. 147

INVENTOR
A. E. JOEL, JR.
BY
Sol Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 147

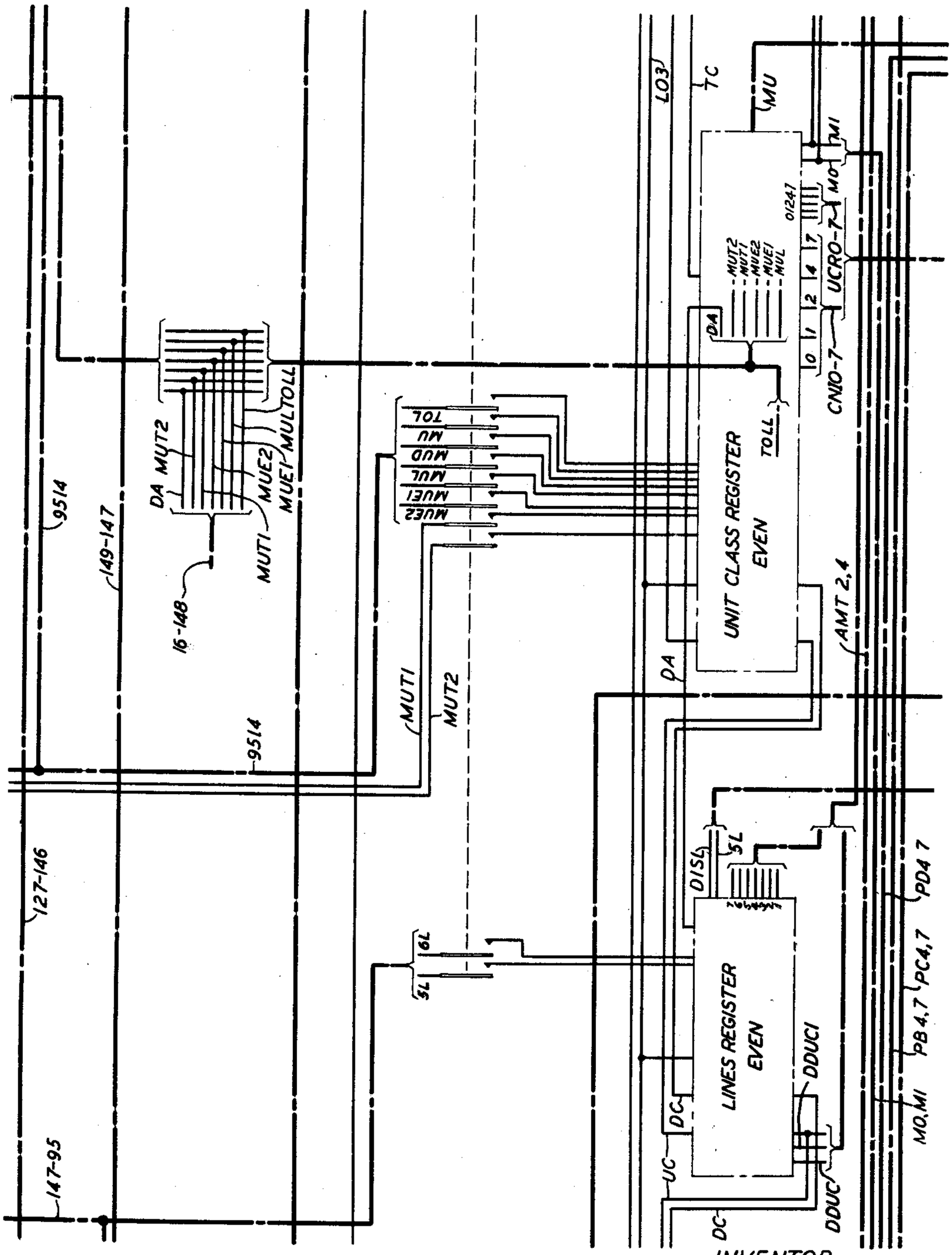


FIG. 148

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 148

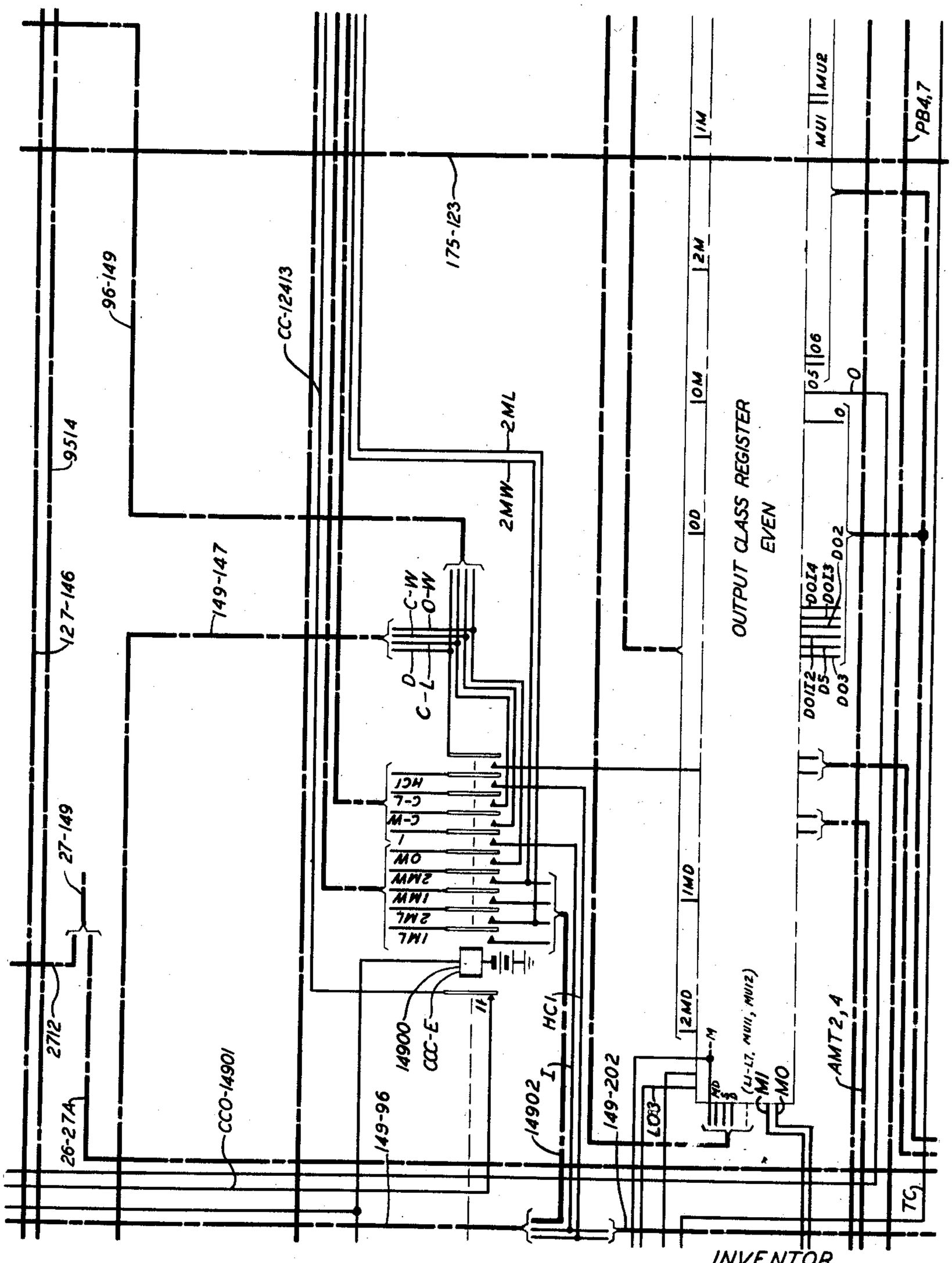


FIG. 149

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 149

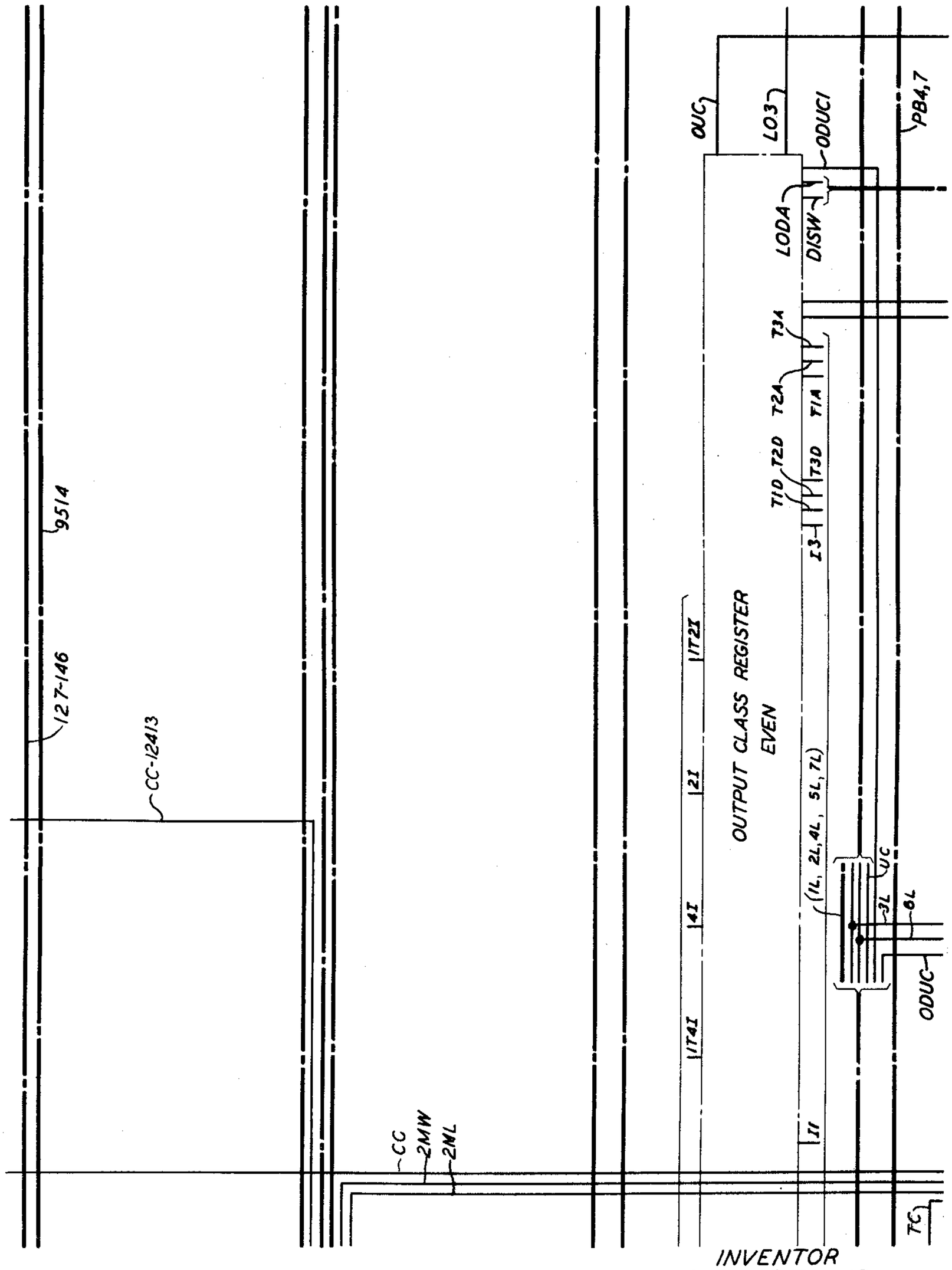


FIG. 150

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 150

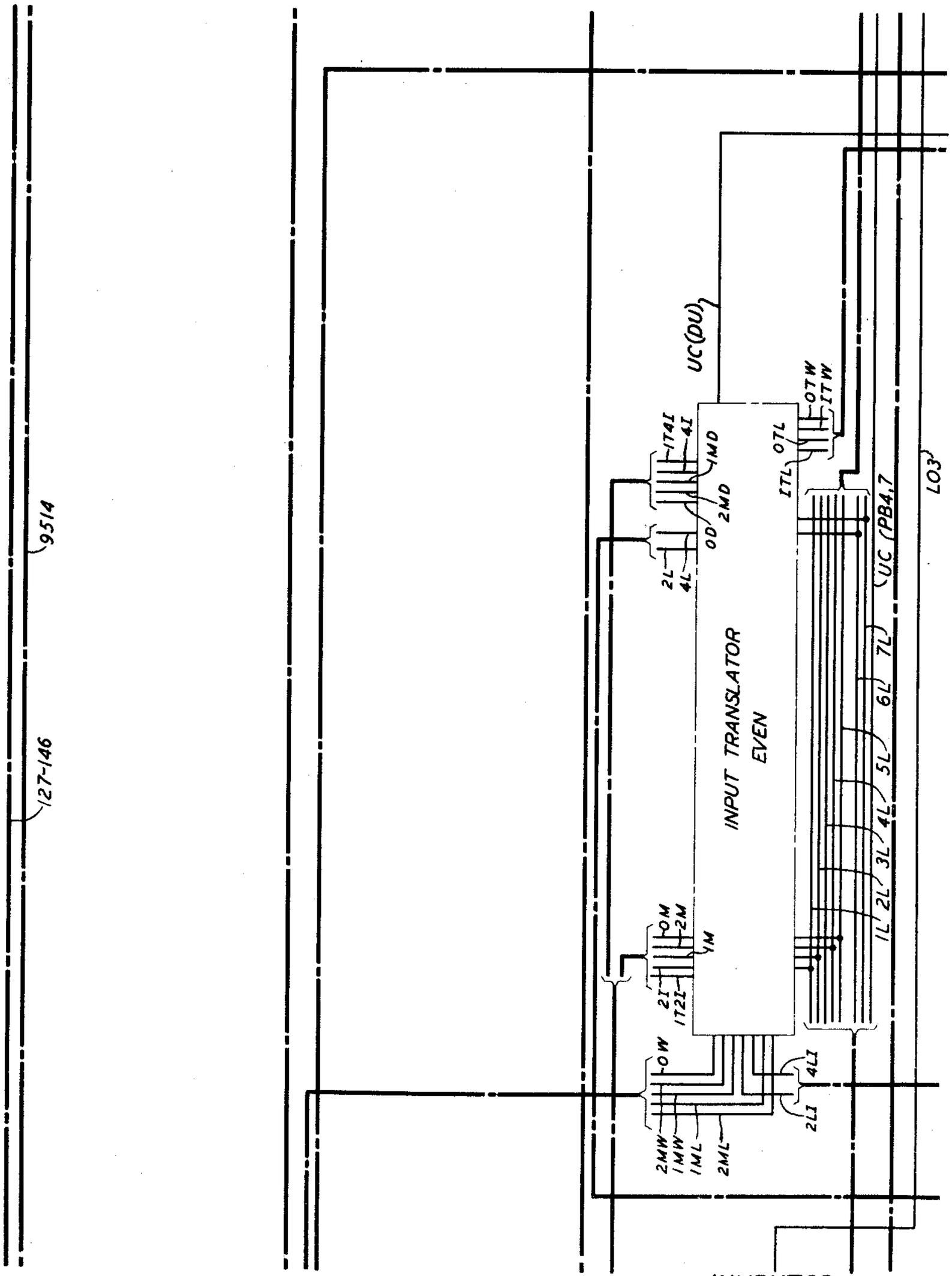


FIG. 151

INVENTOR
A. E. JOEL, JR.
BY
Smith Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 151

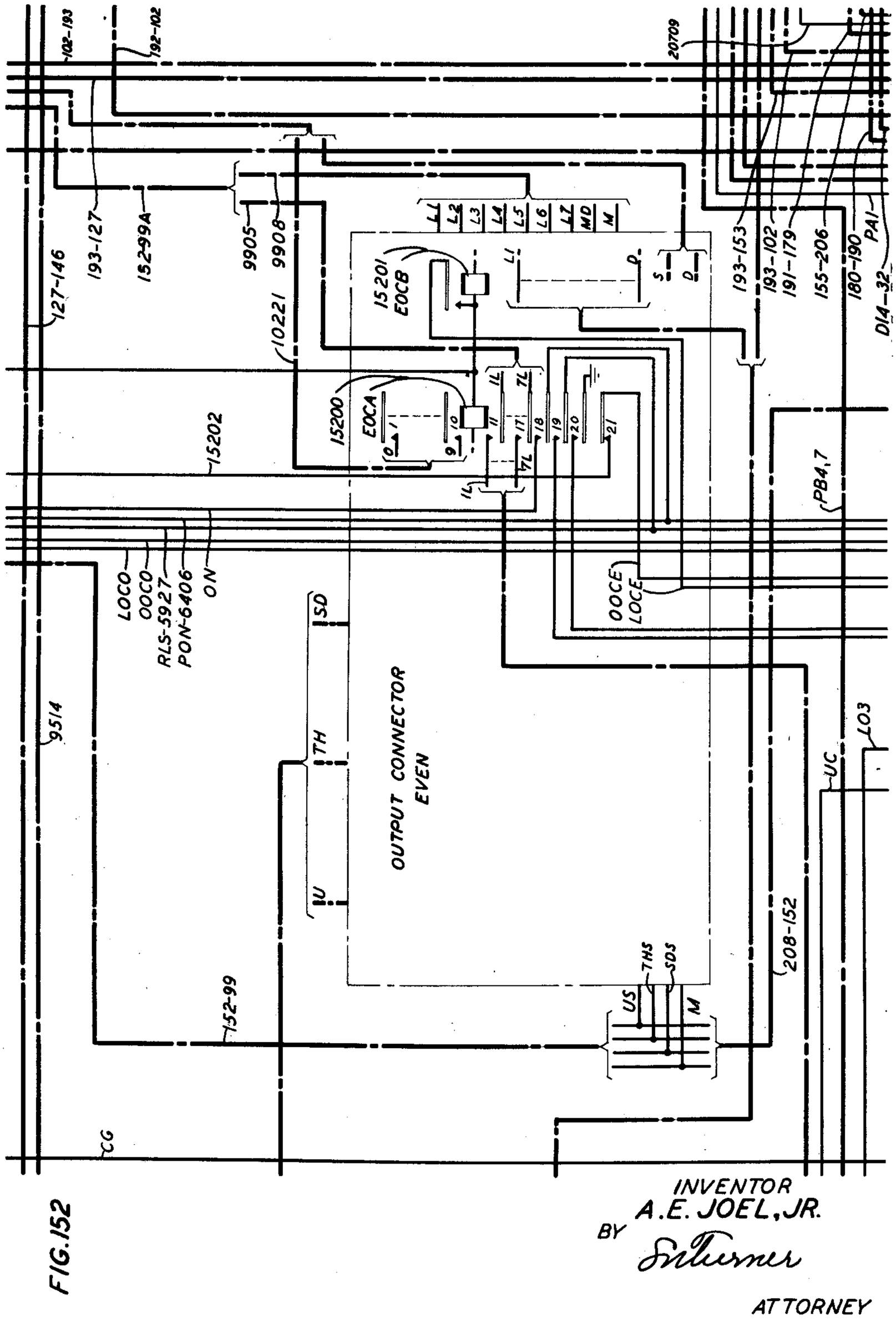


FIG. 152

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 152

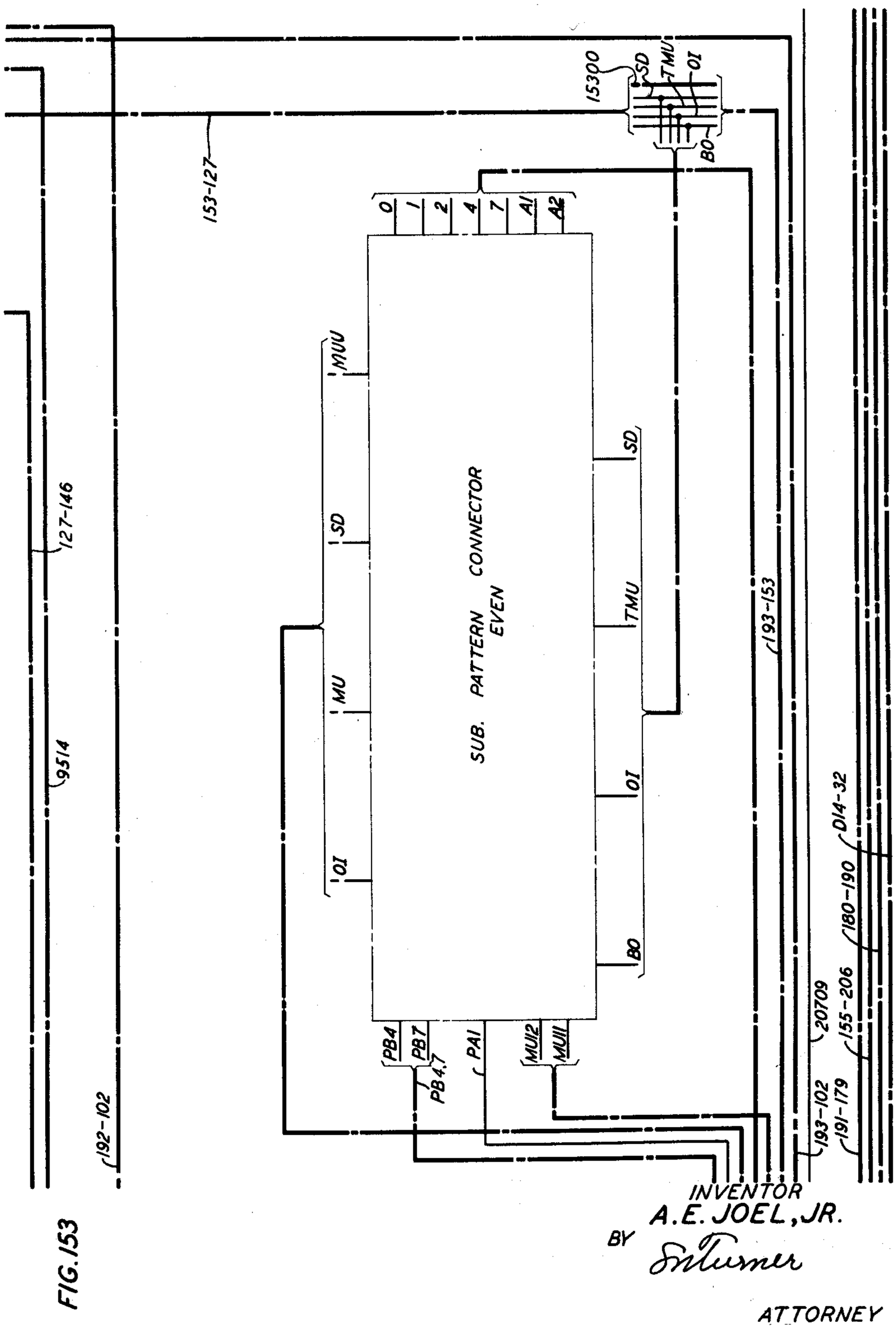


FIG. 153

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 153

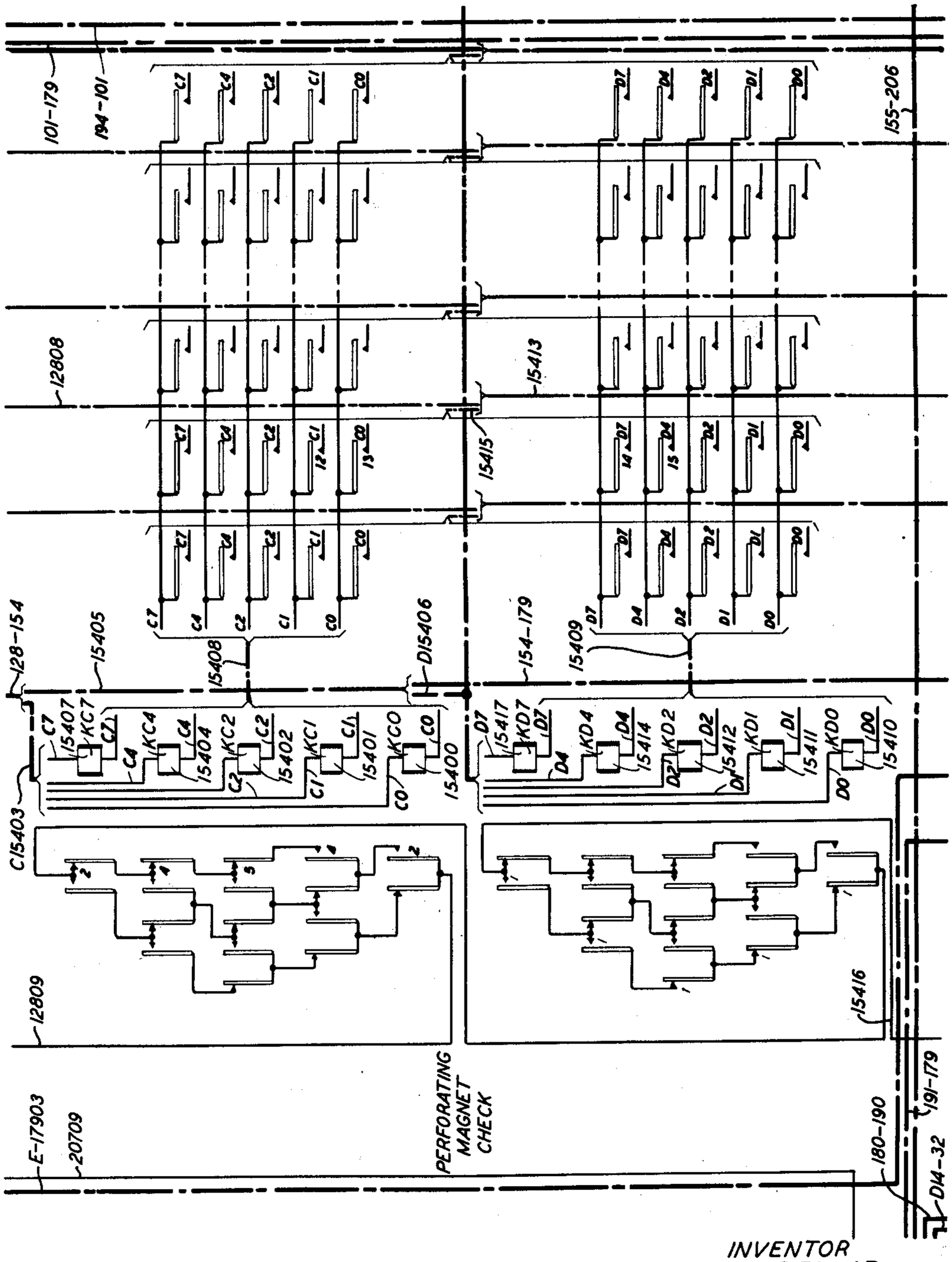


FIG. 154

INVENTOR
A. E. JOEL, JR.
BY S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 154

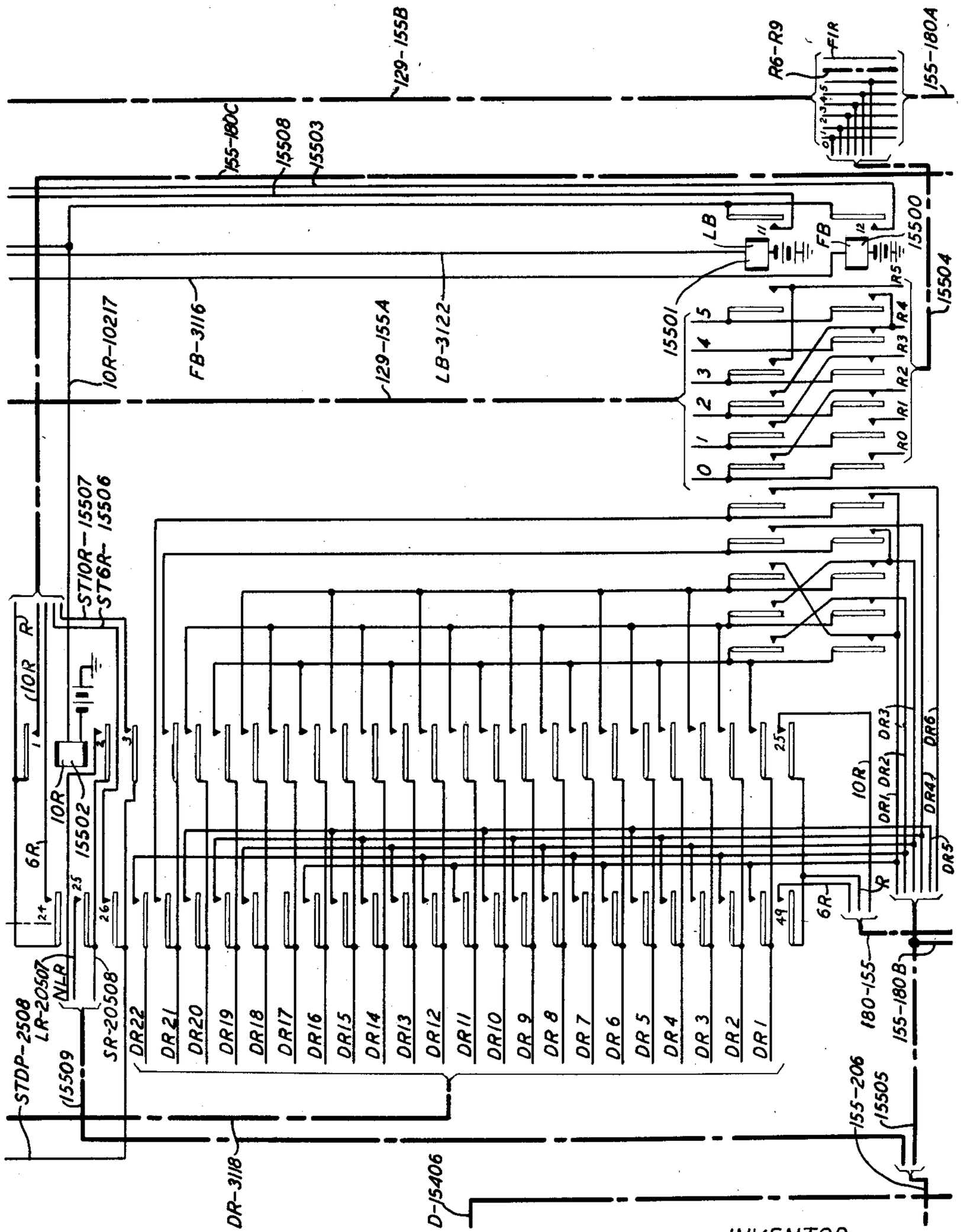


FIG. 155

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 155

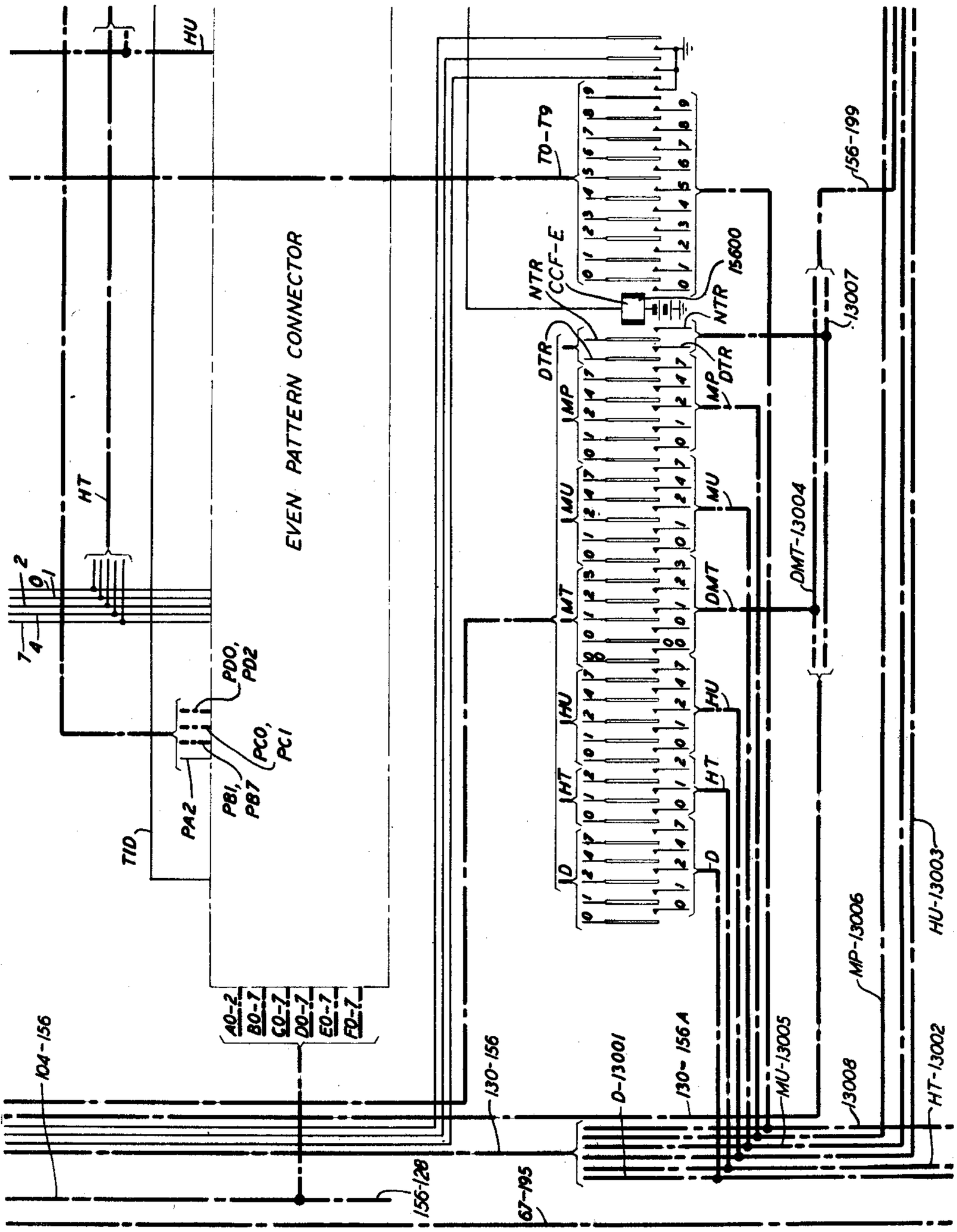


FIG. 156

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 156

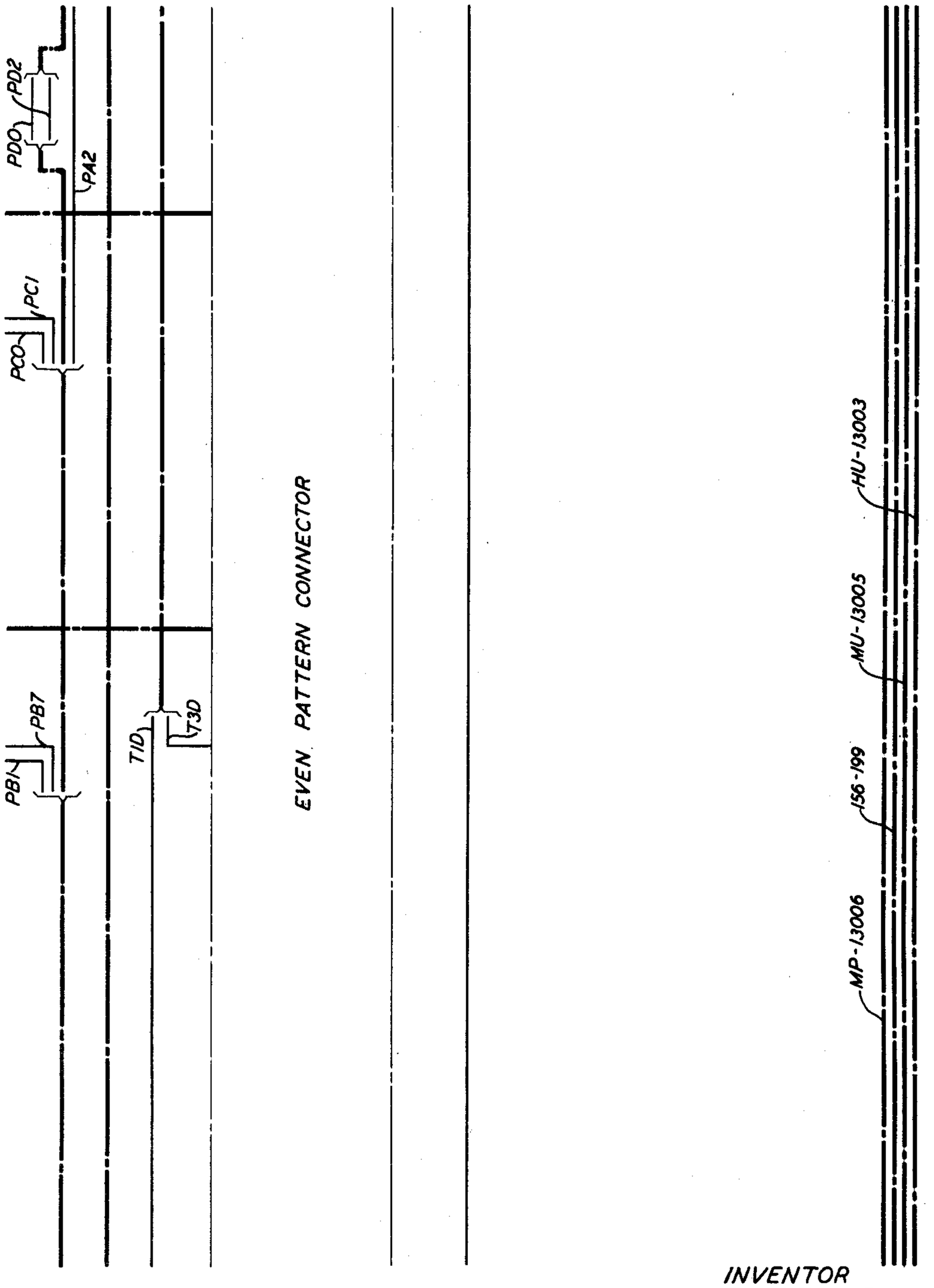


FIG. 157

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 157

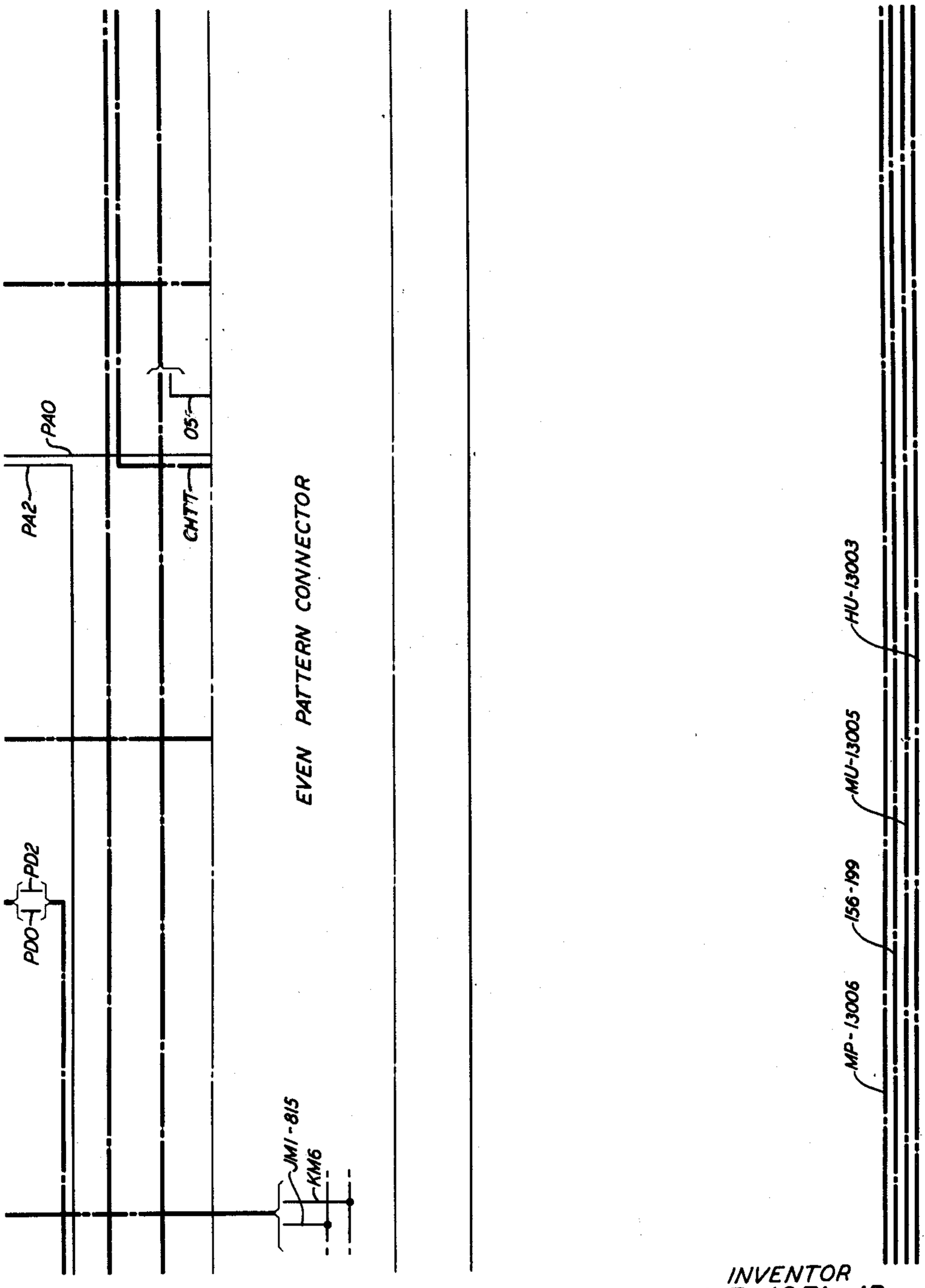


FIG. 158

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 158

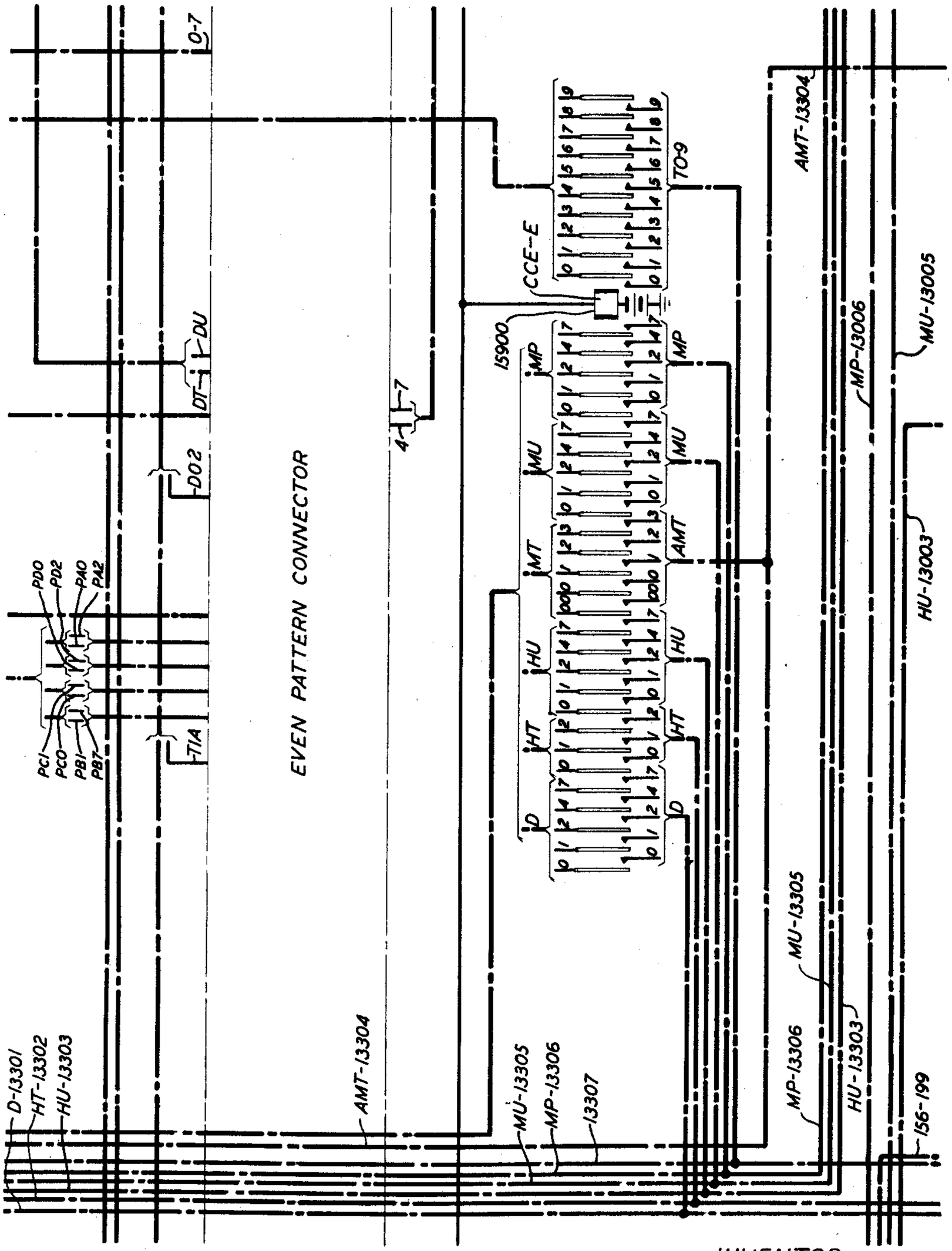


FIG. 159

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 159

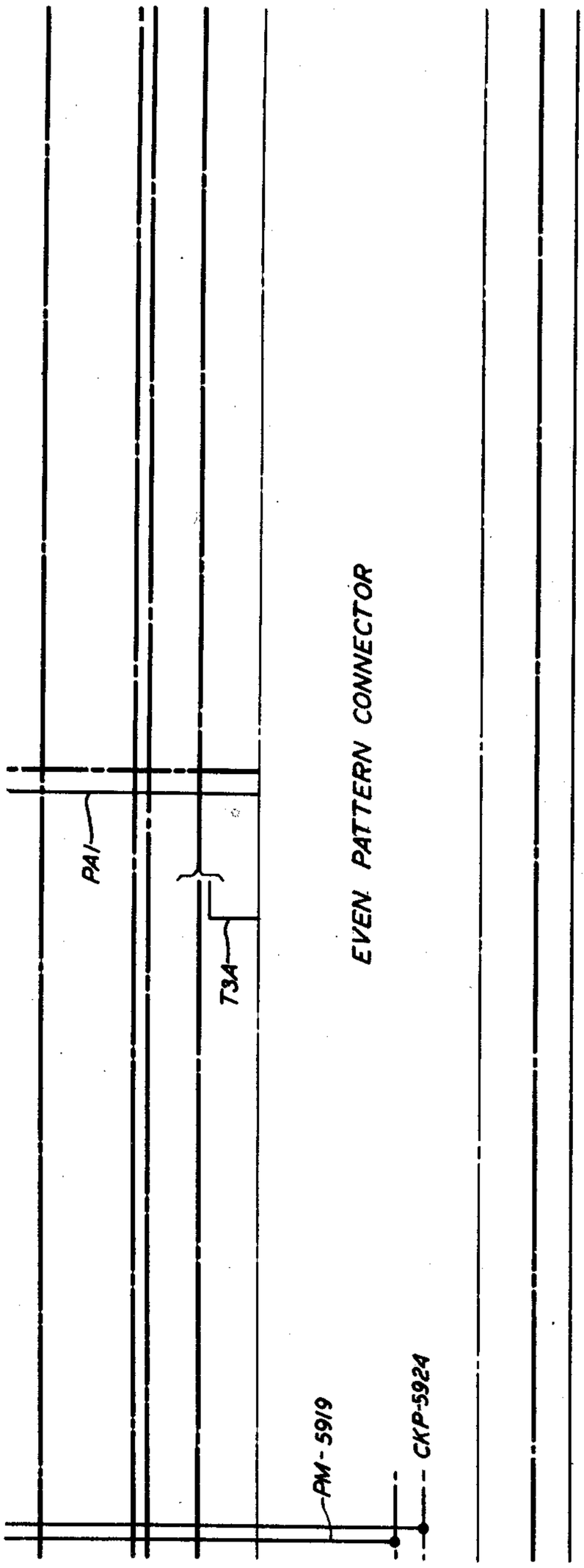
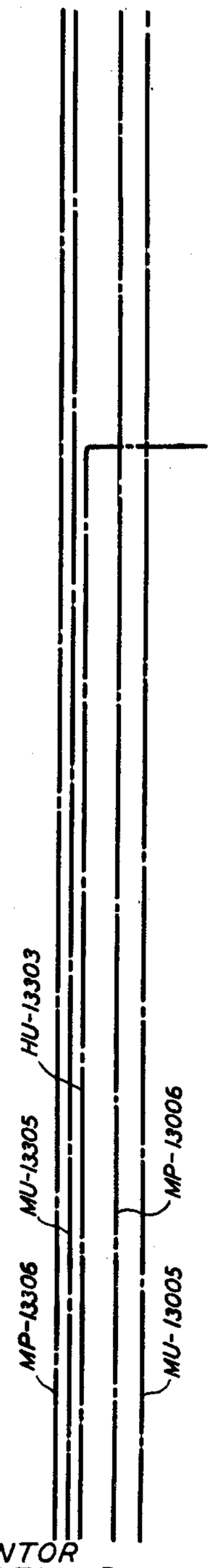


FIG. 160



INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 160

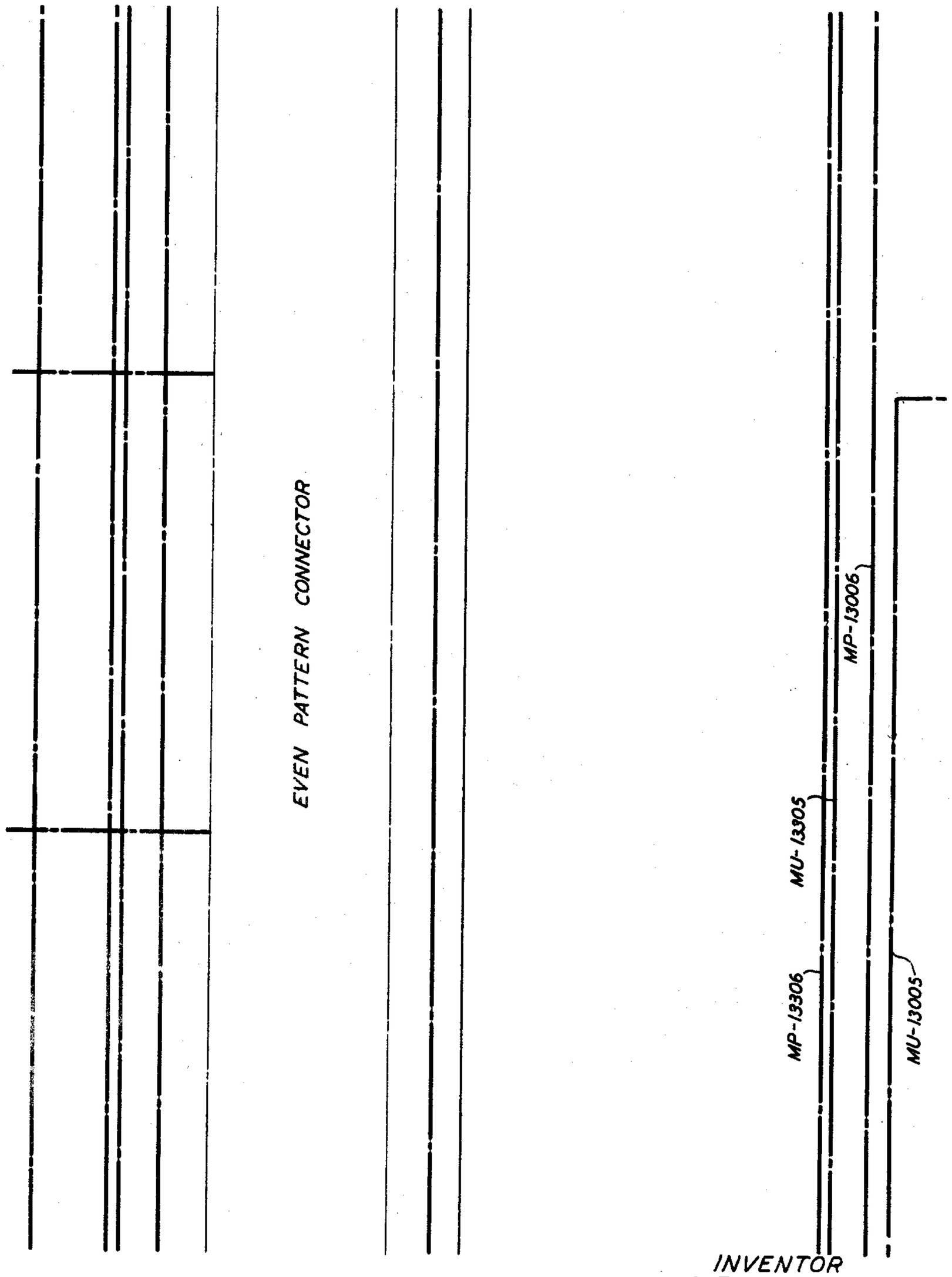


FIG. 161

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 161

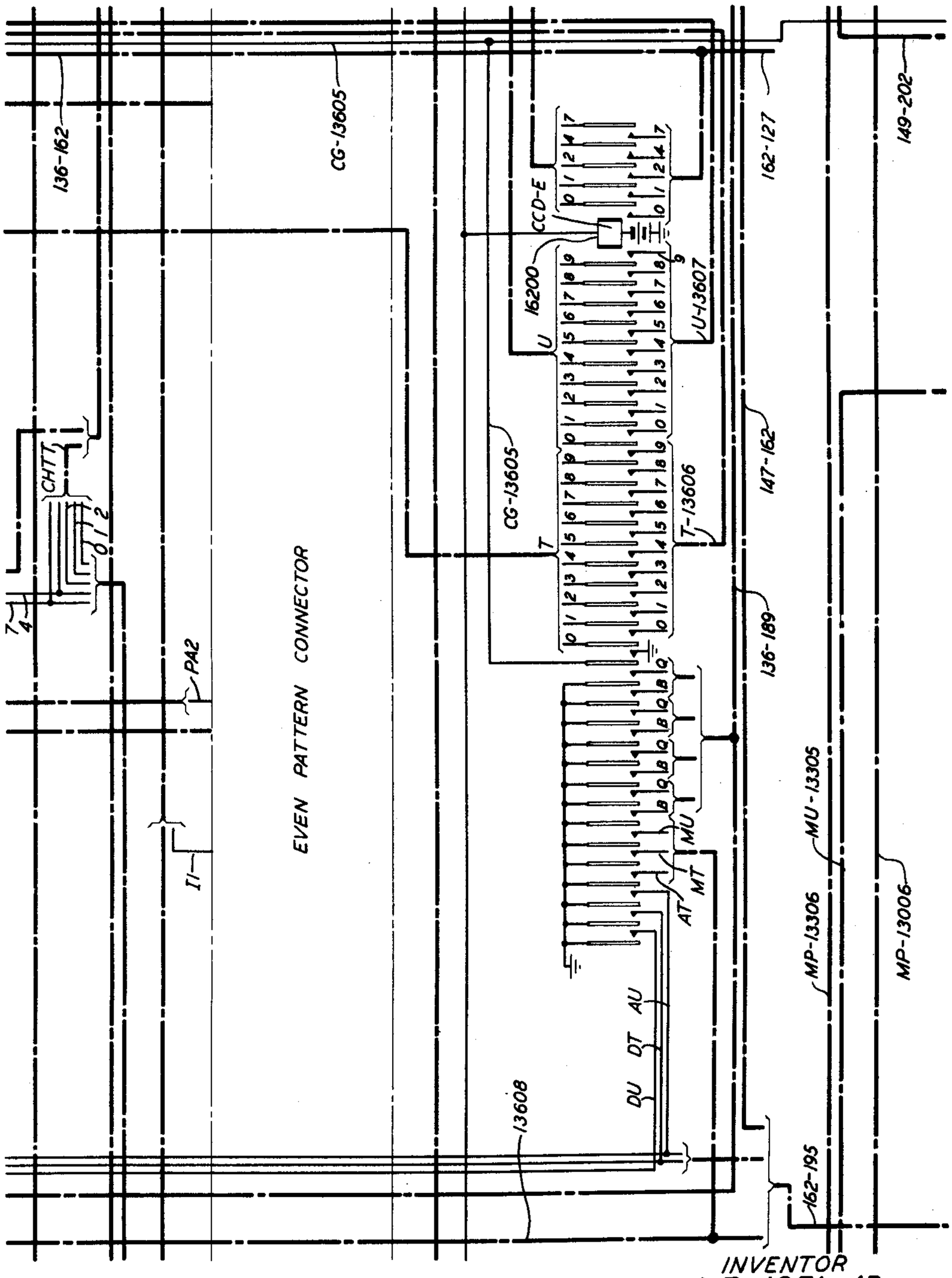


FIG. 162

INVENTOR
A. E. JOEL, JR.
BY Silberner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 162

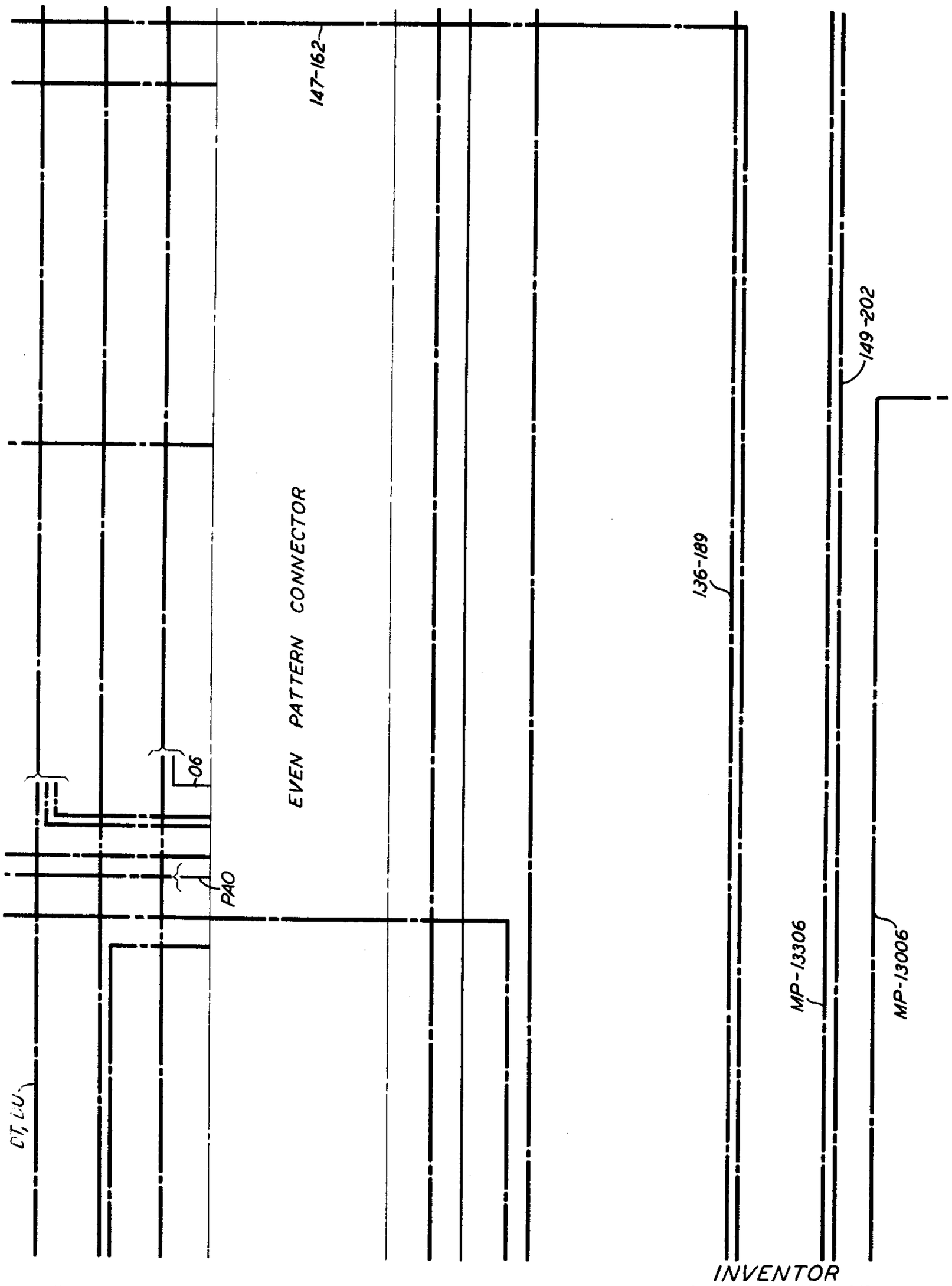


FIG. 163

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 163

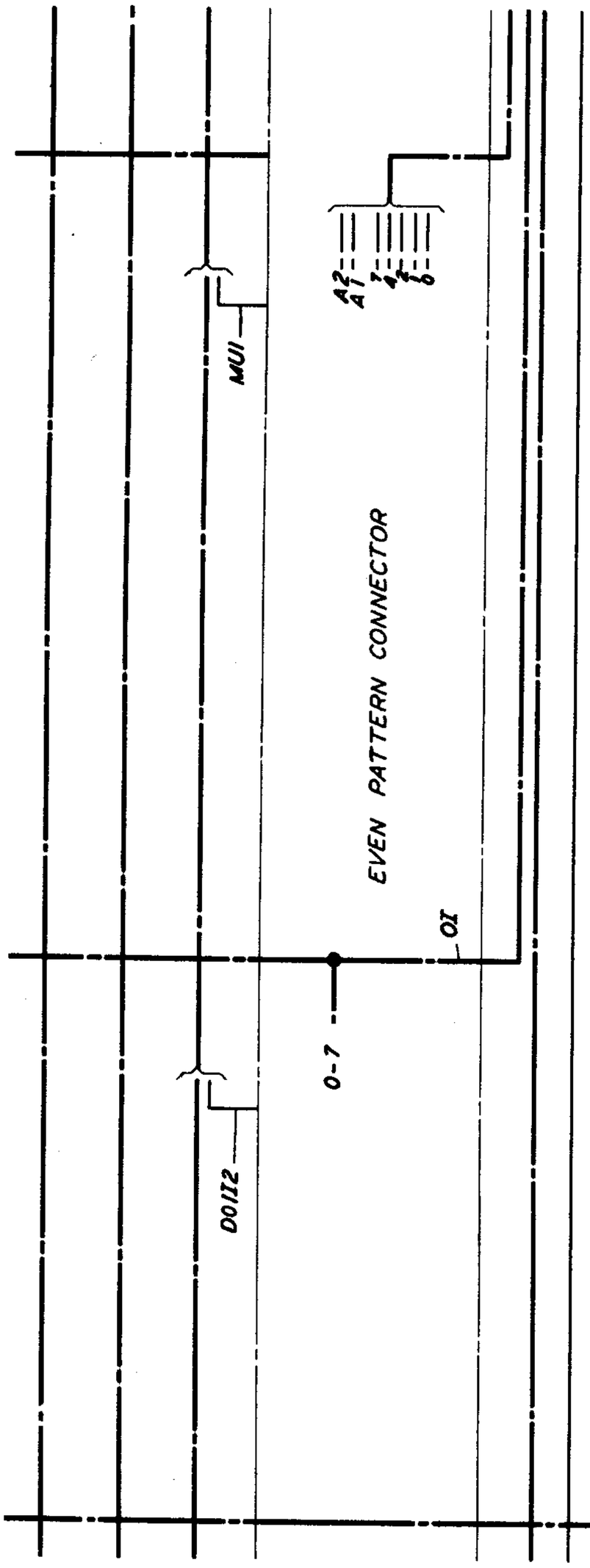
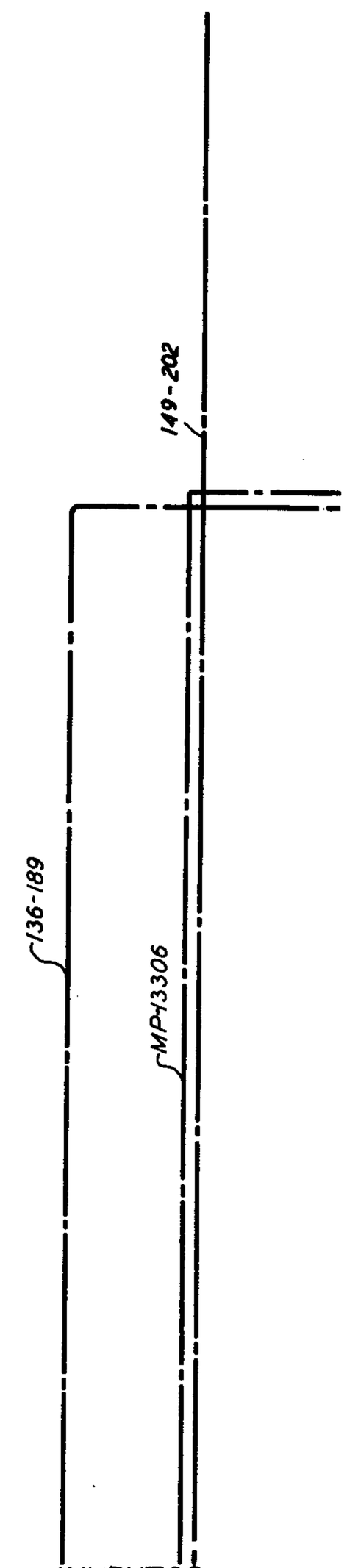


FIG. 164



INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 164

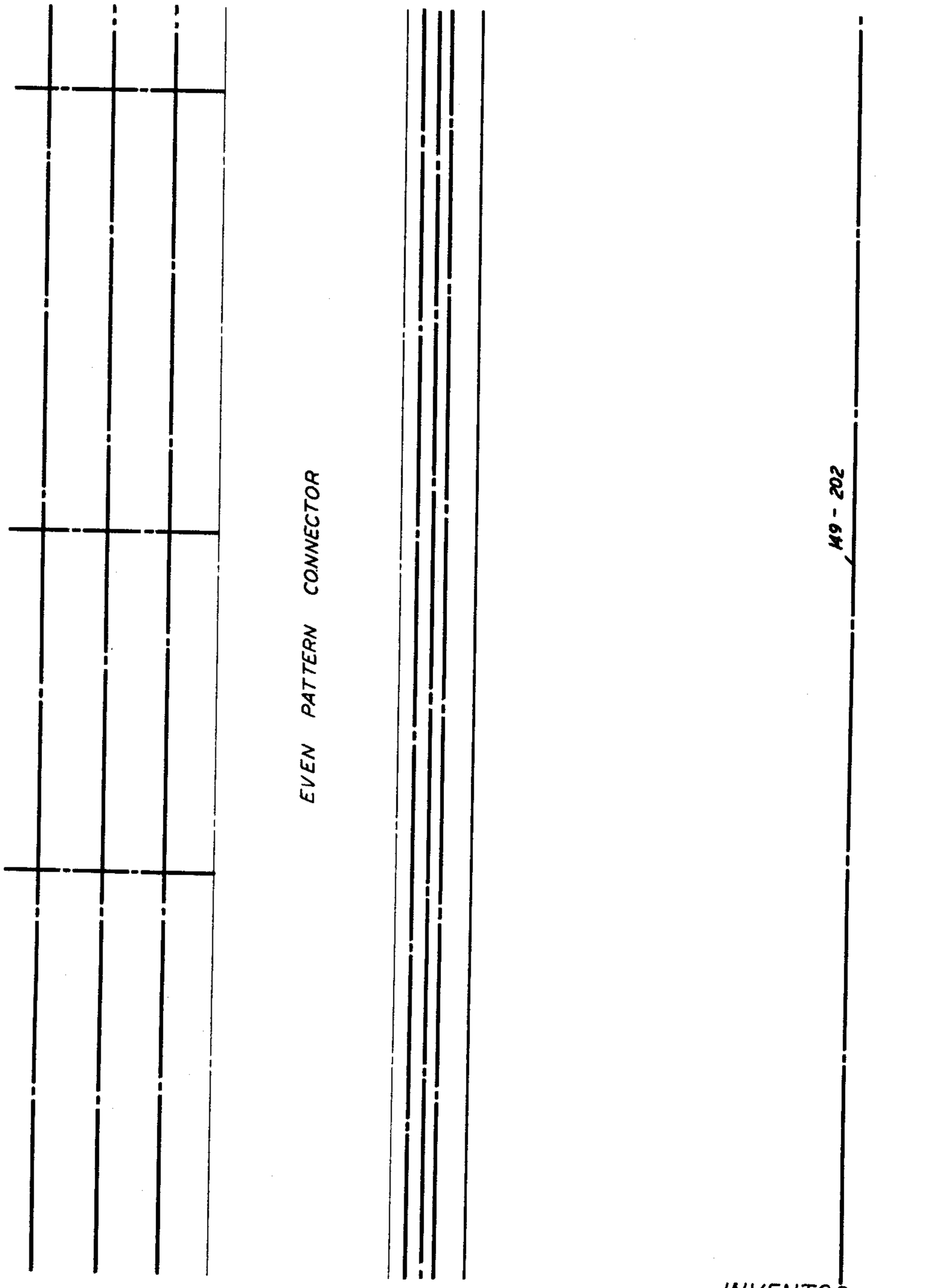


FIG. 165

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 165

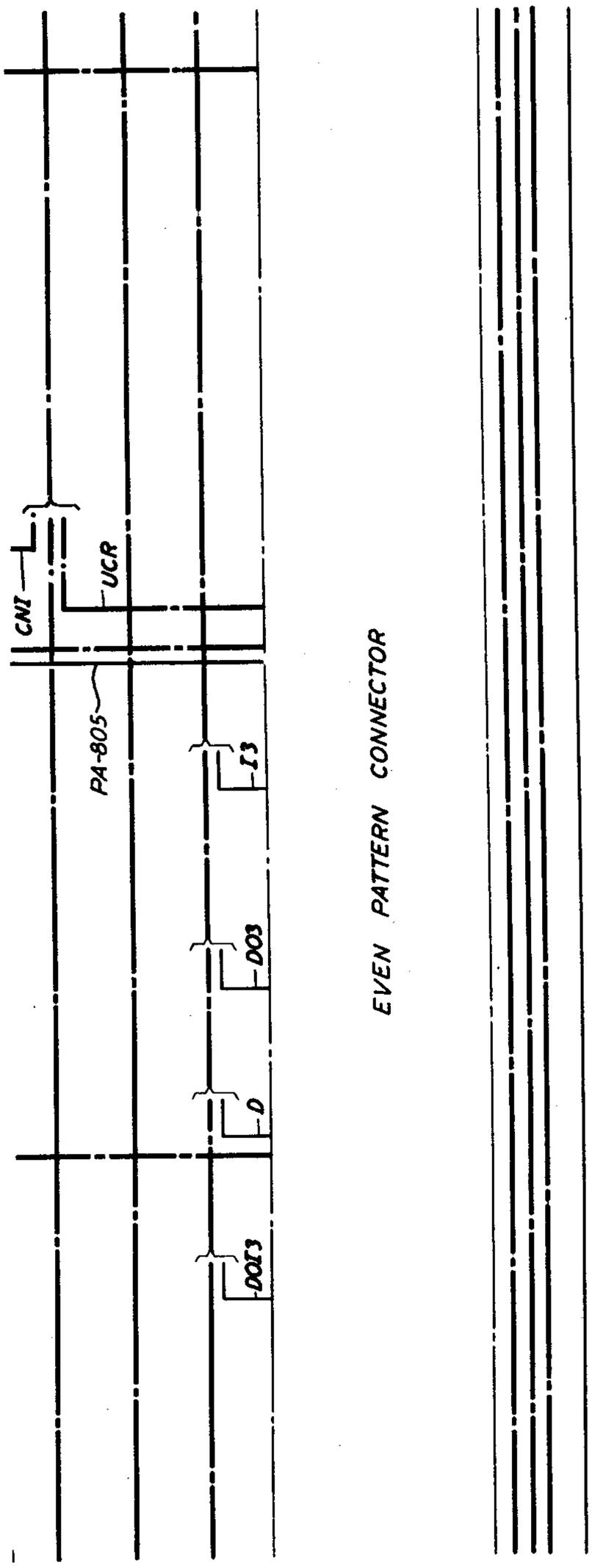


FIG. 166

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 166

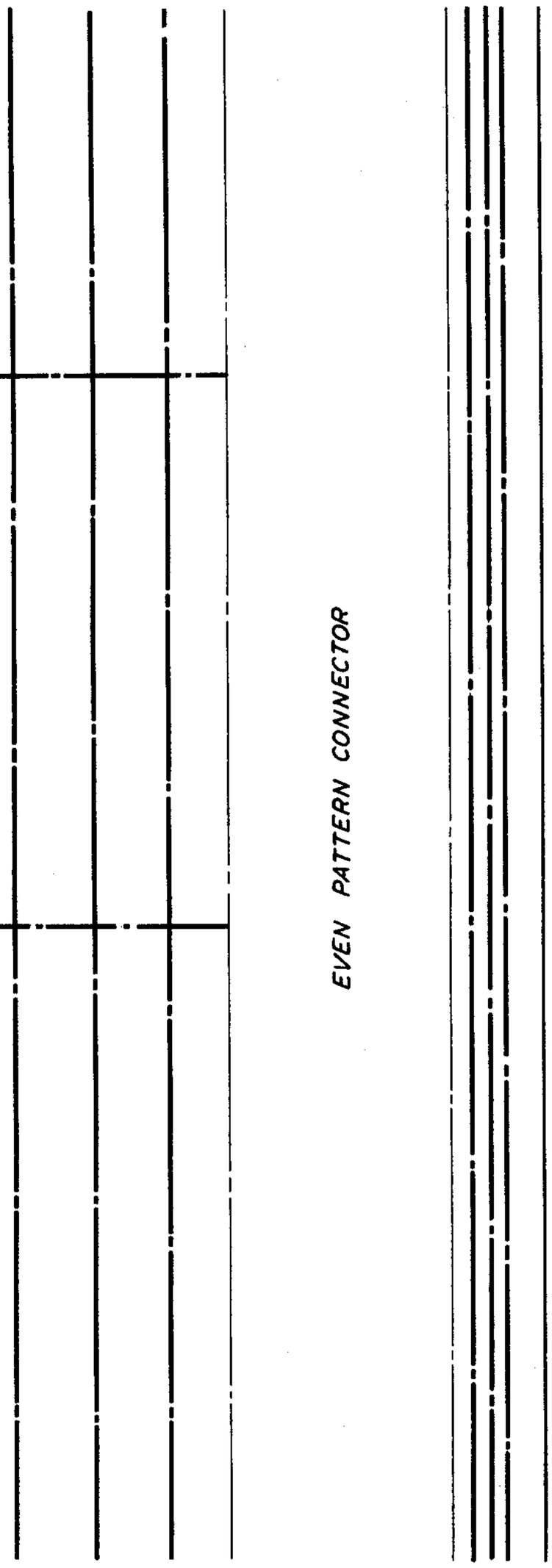


FIG. 167

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 167

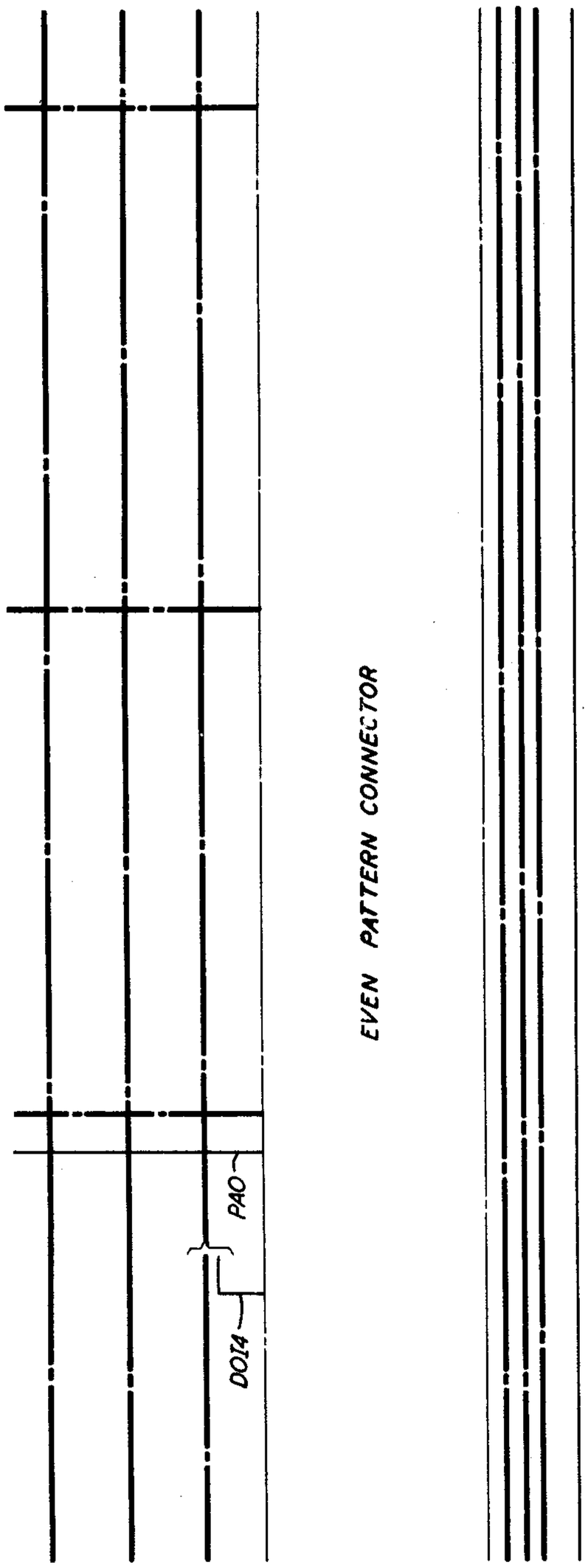


FIG. 168

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 168

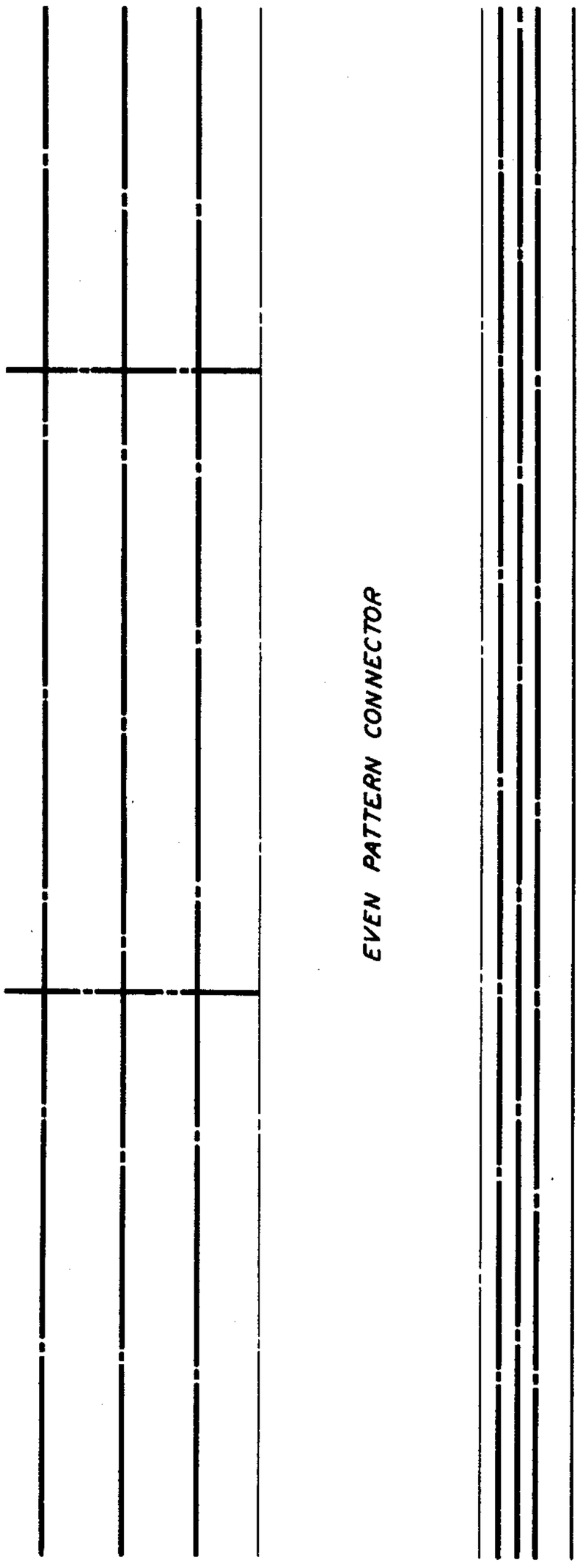


FIG. 169

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 169

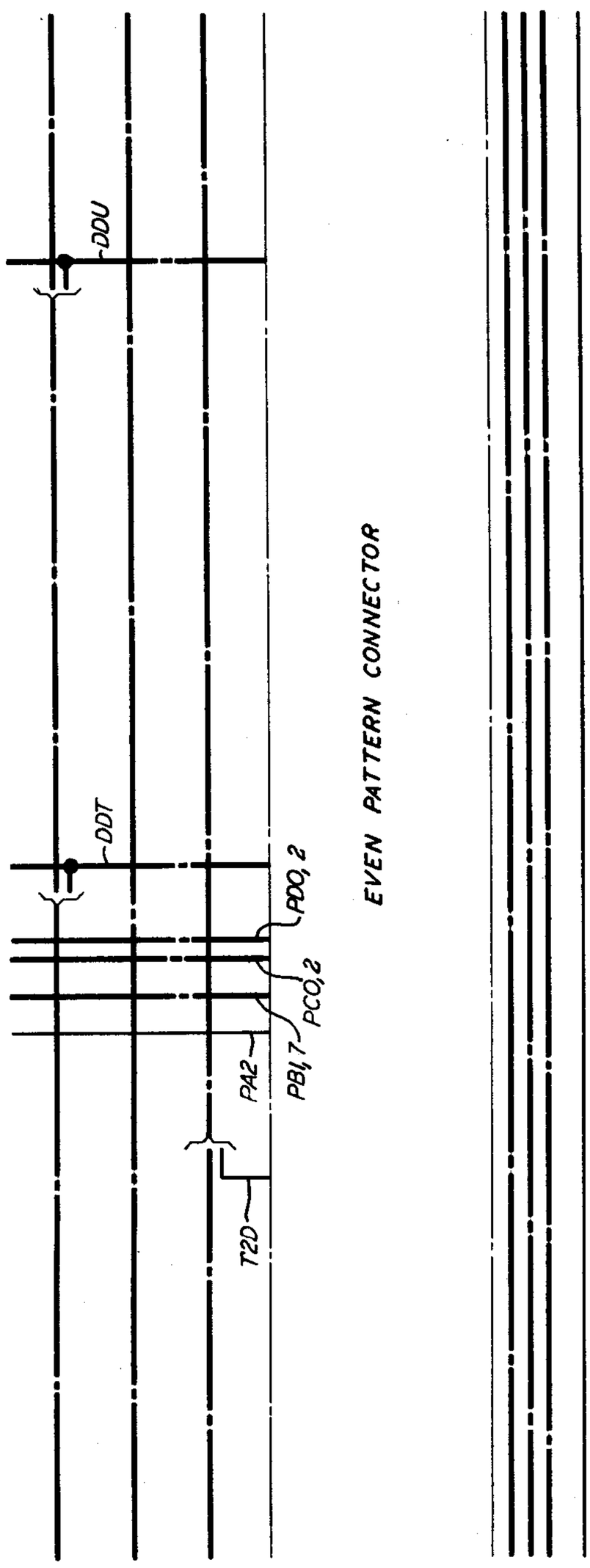


FIG. 170

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 170

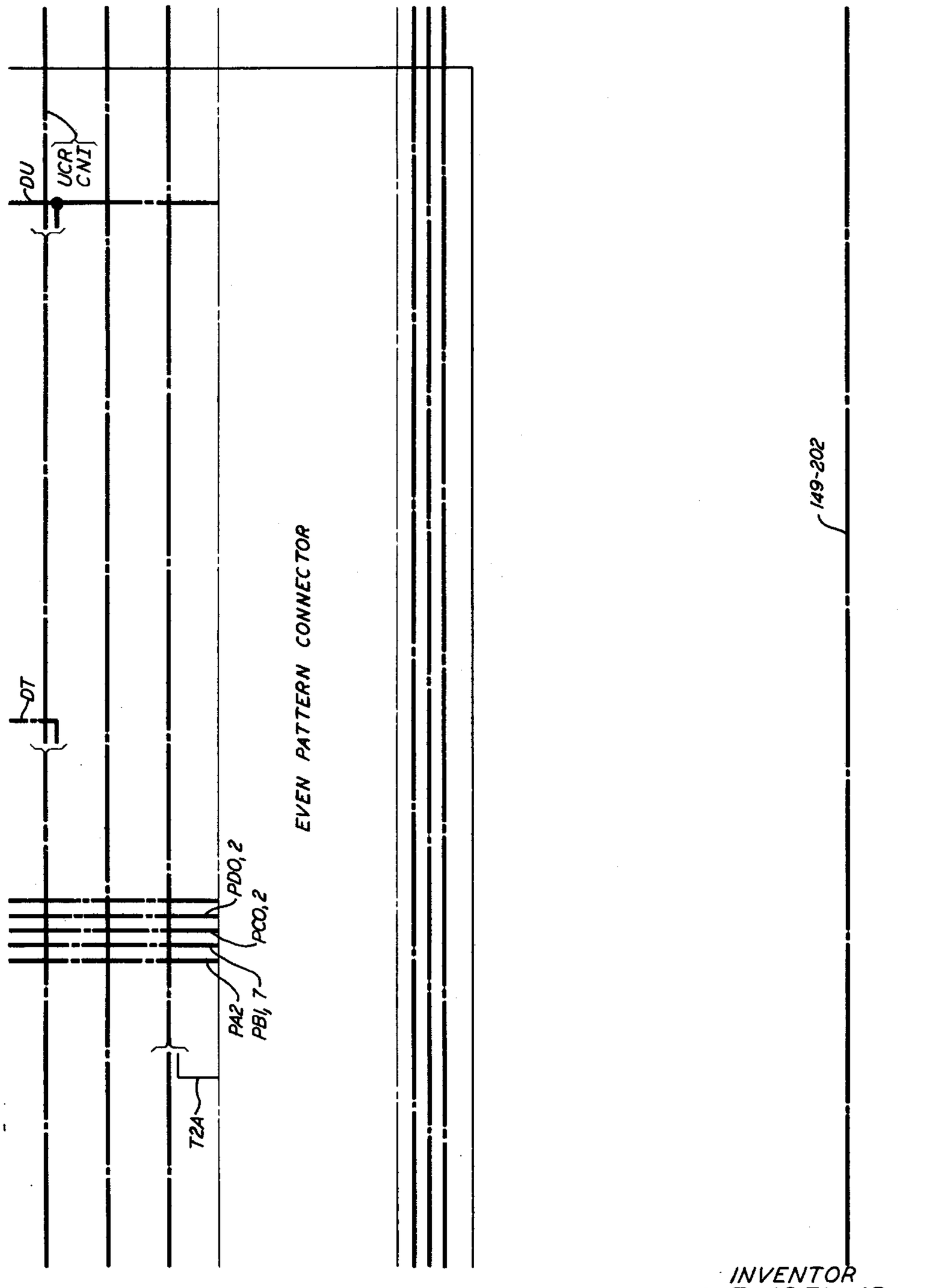


FIG. 171

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 171

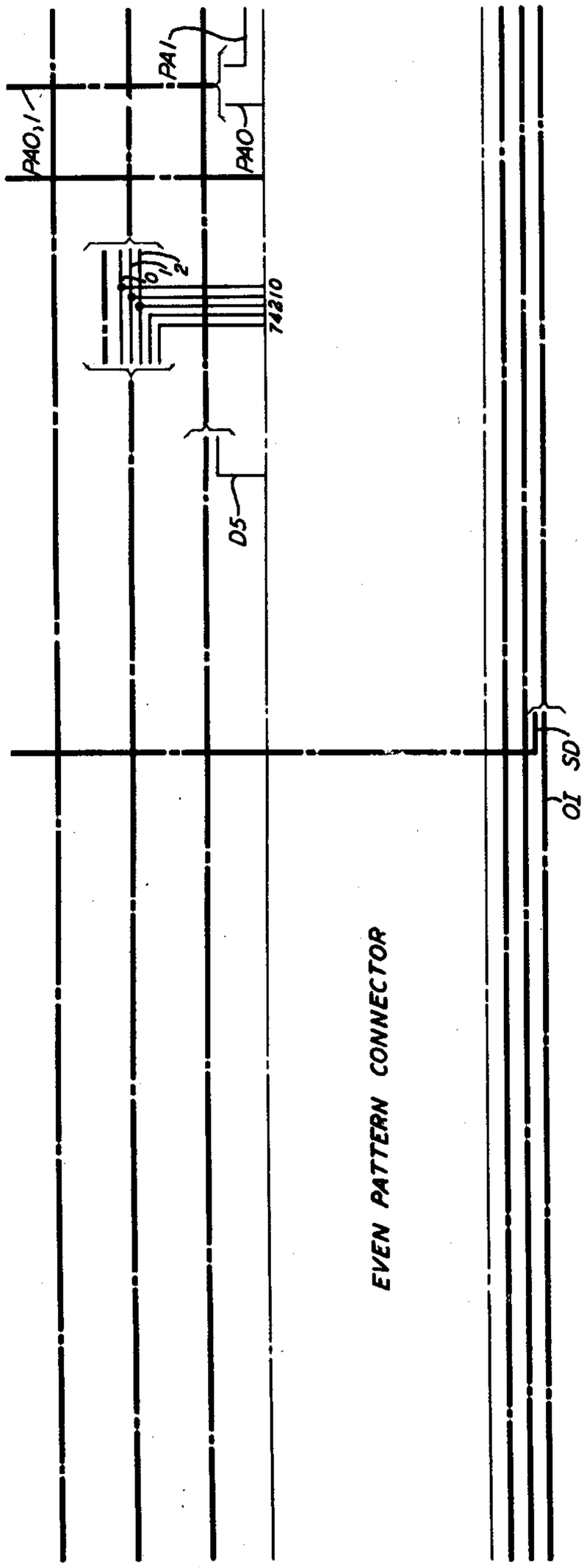


FIG. 172

INVENTOR
A.E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 172

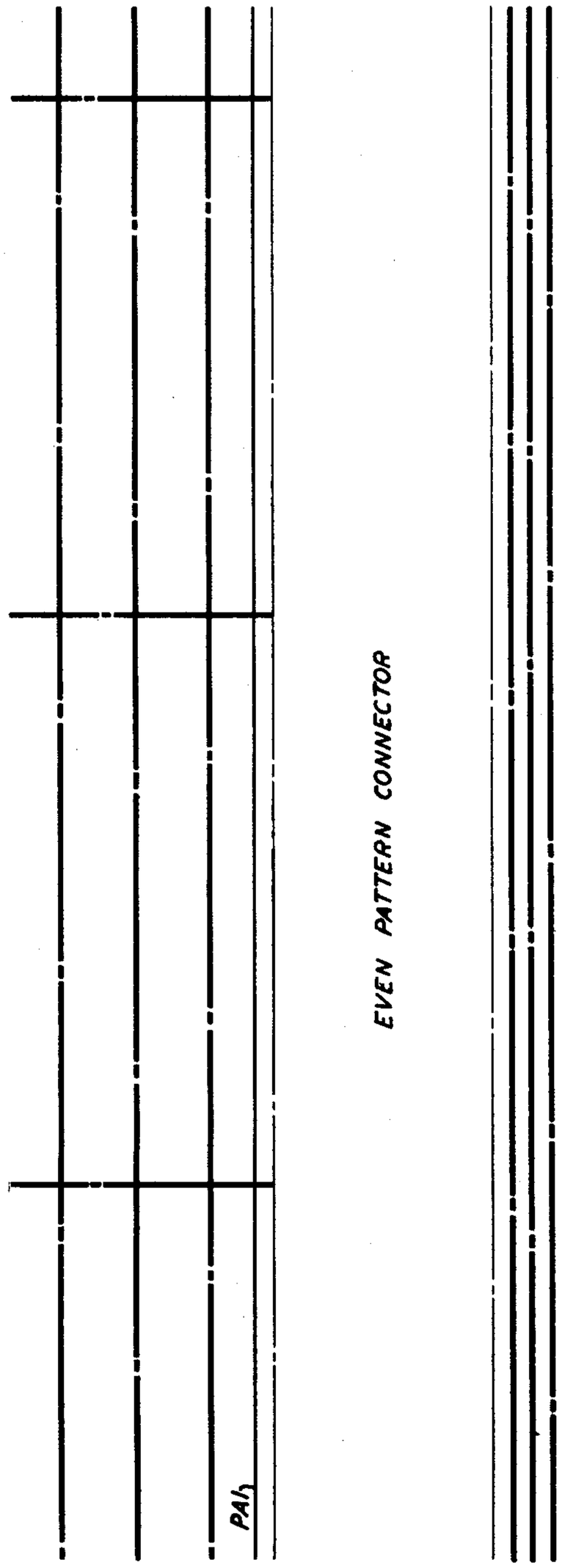


FIG. 173

INVENTOR
A.E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 173

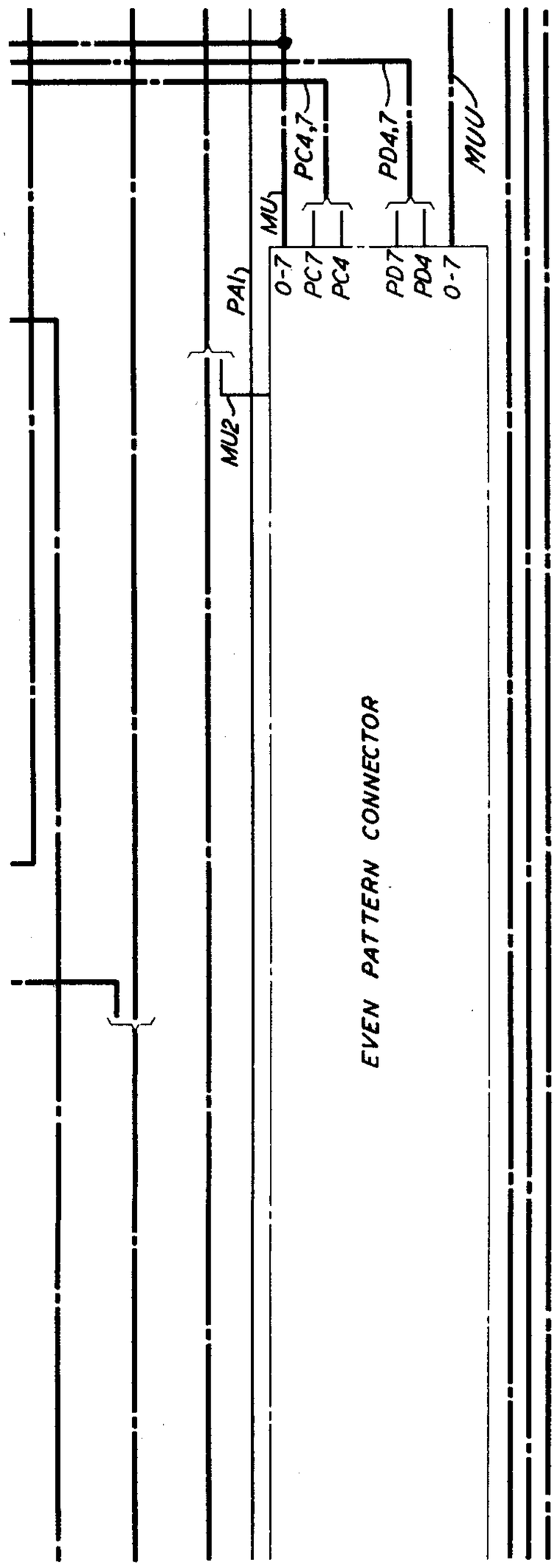


FIG. 174

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 174

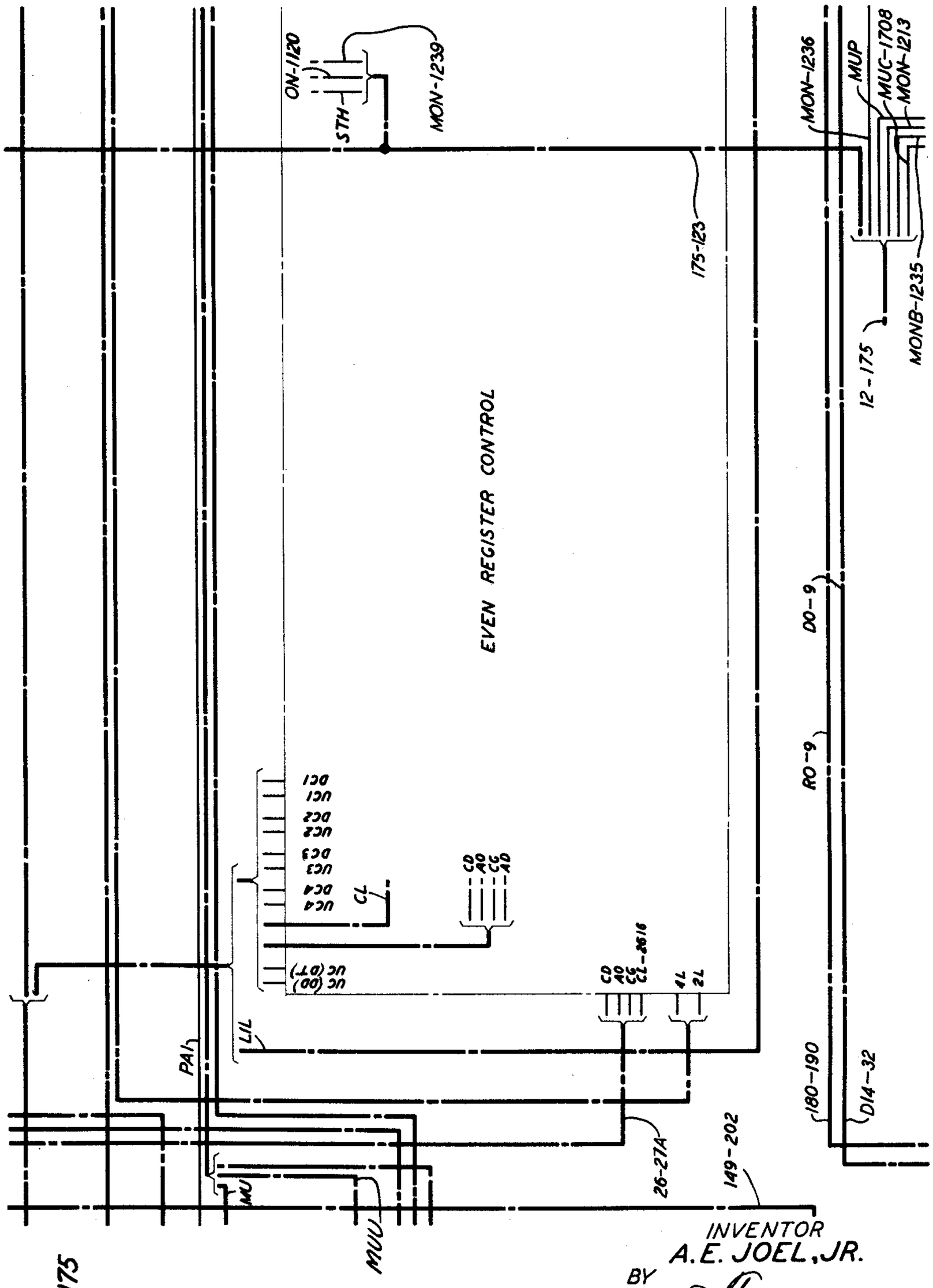


FIG. 175

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 175

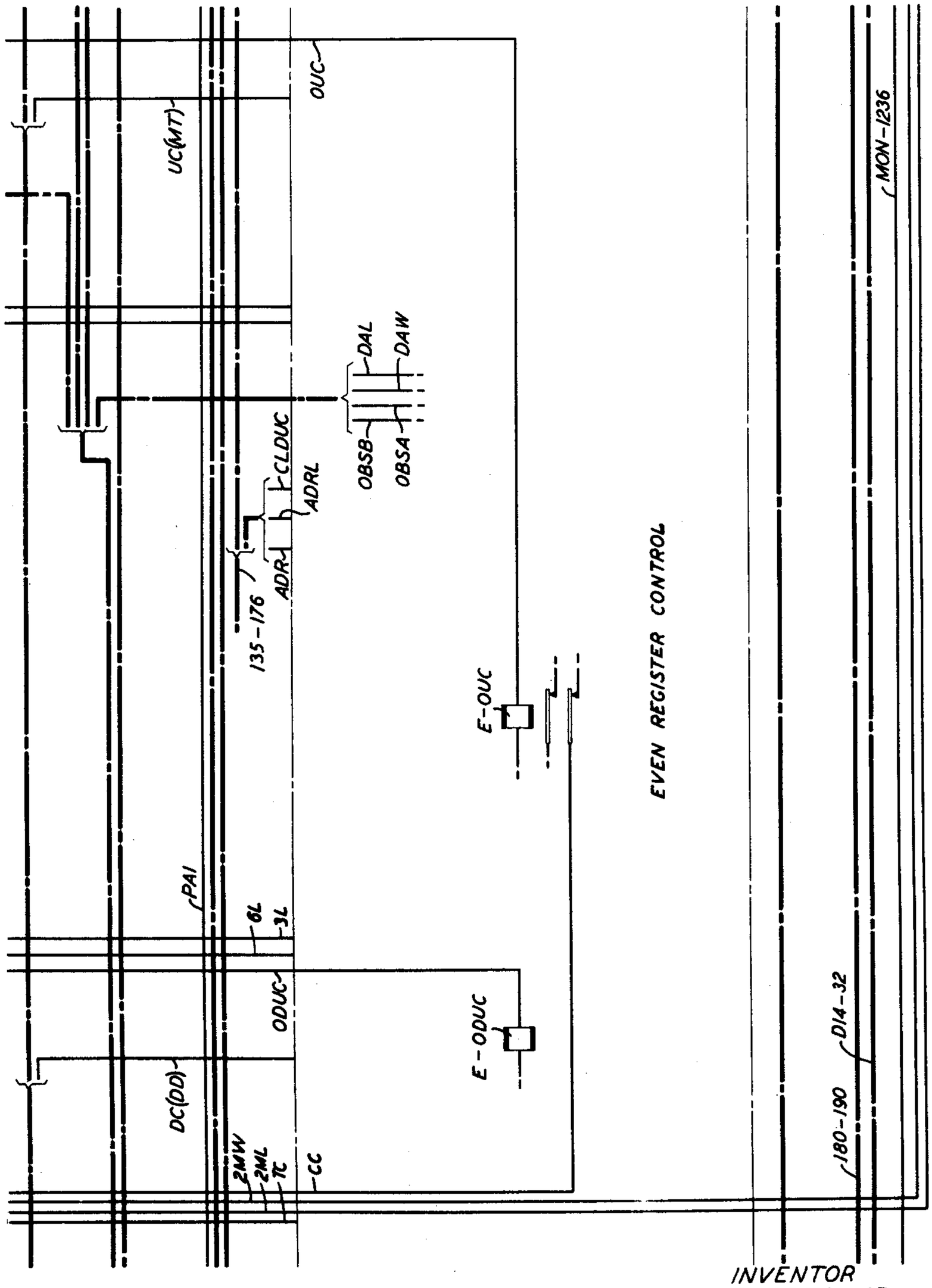


FIG. 176

INVENTOR
A. E. JOEL, JR.
BY
S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 176

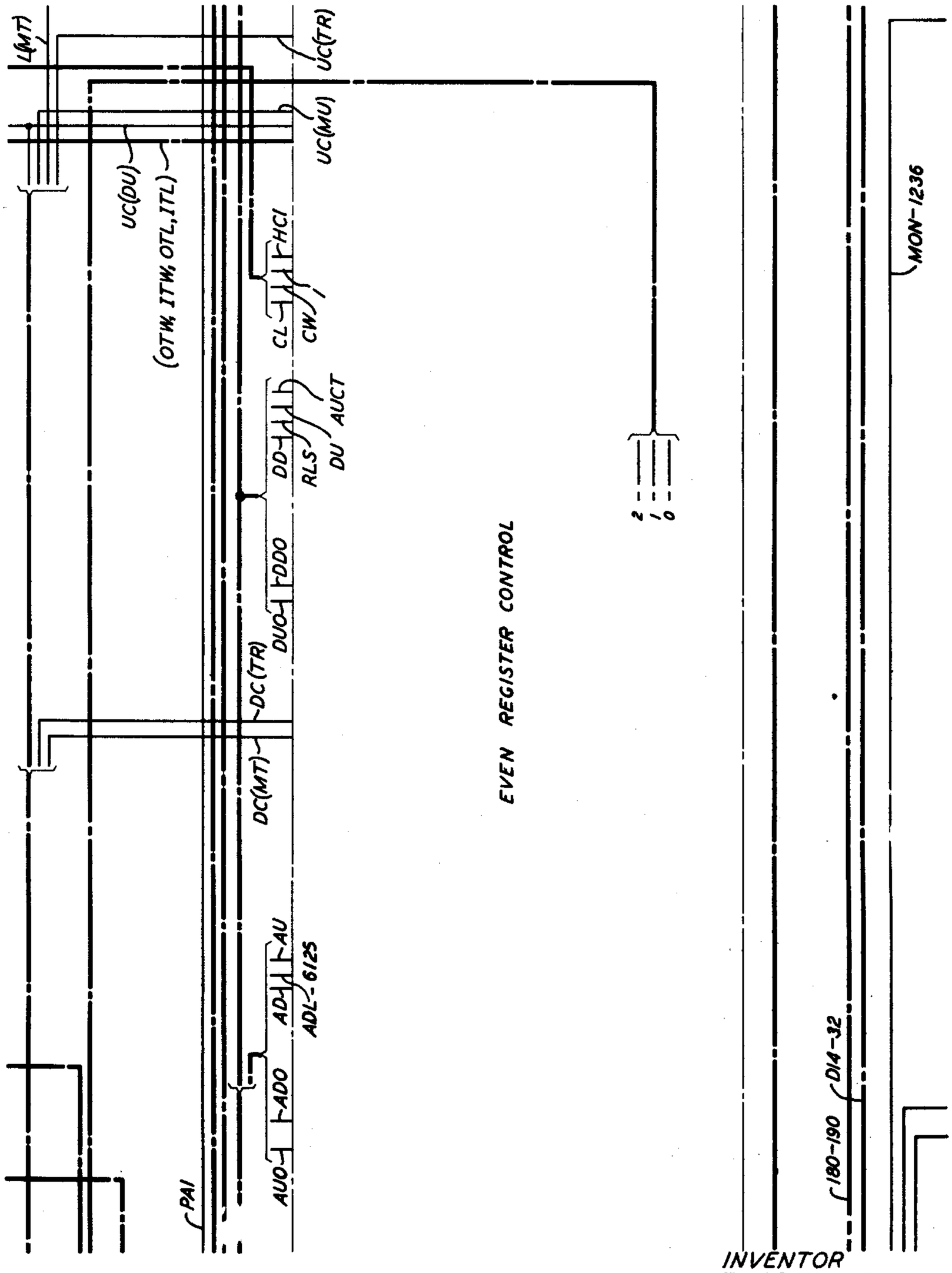


FIG. 177

INVENTOR
A.E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 177

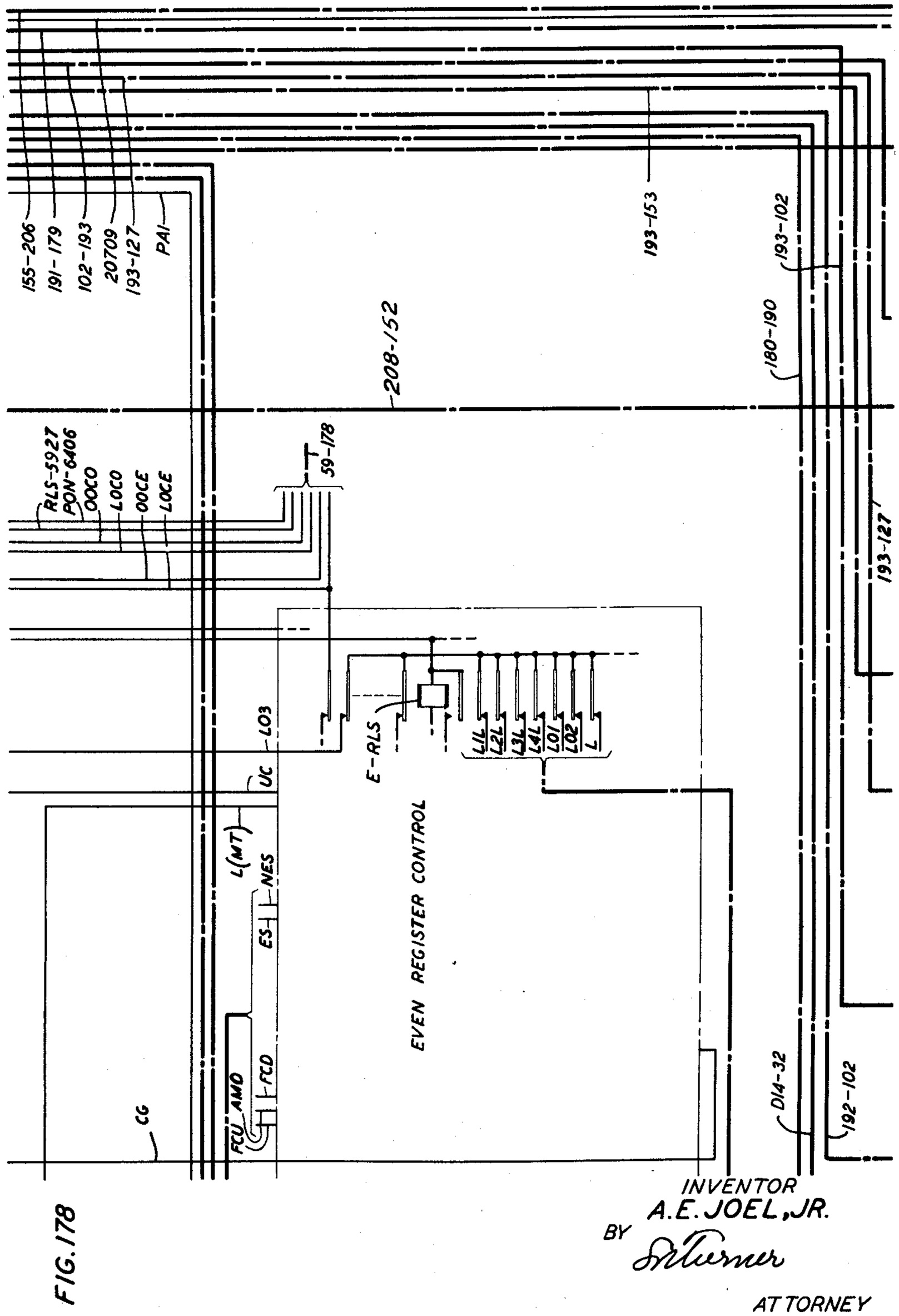


FIG. 178

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 178

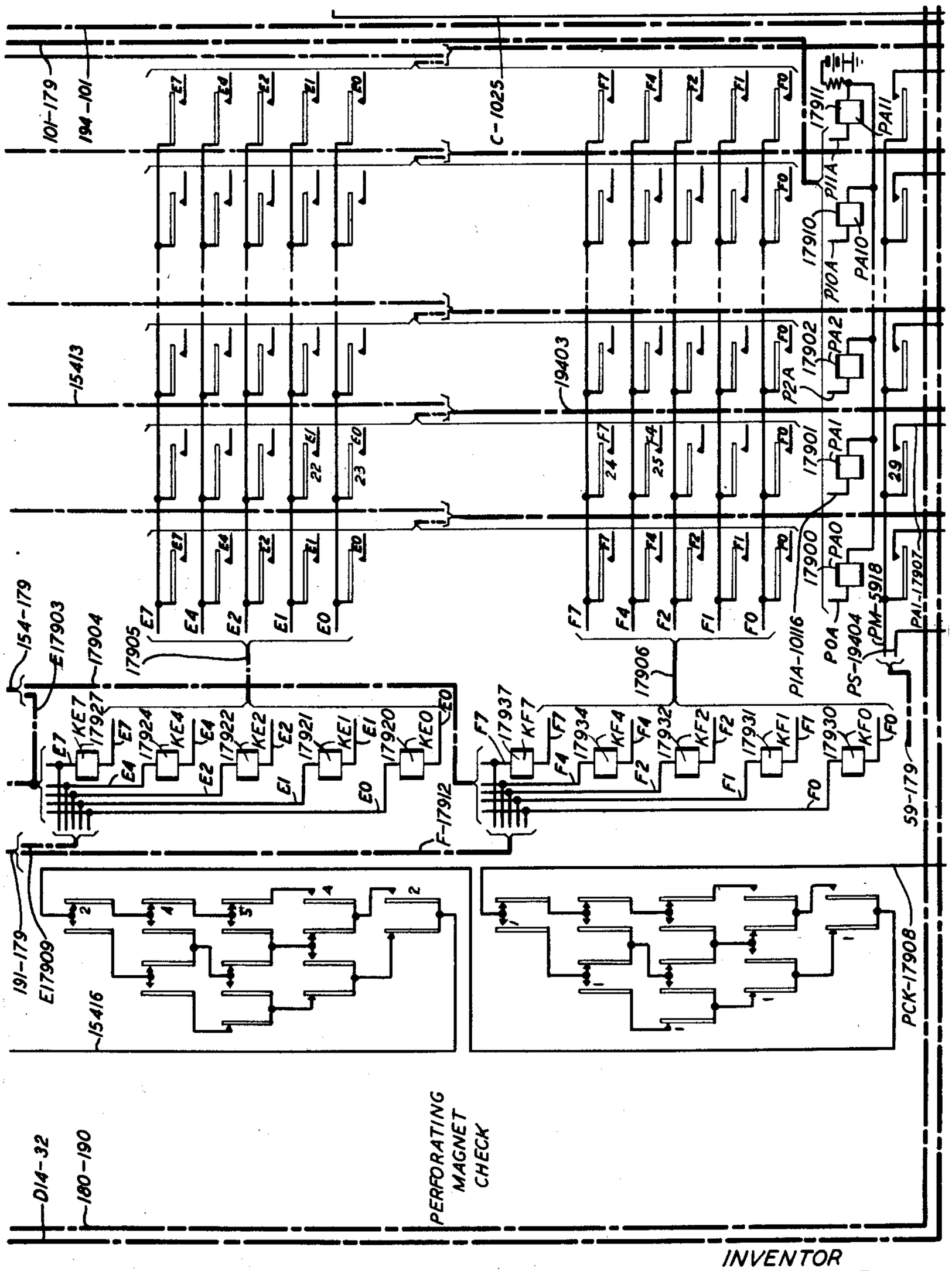


FIG. 179

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 179

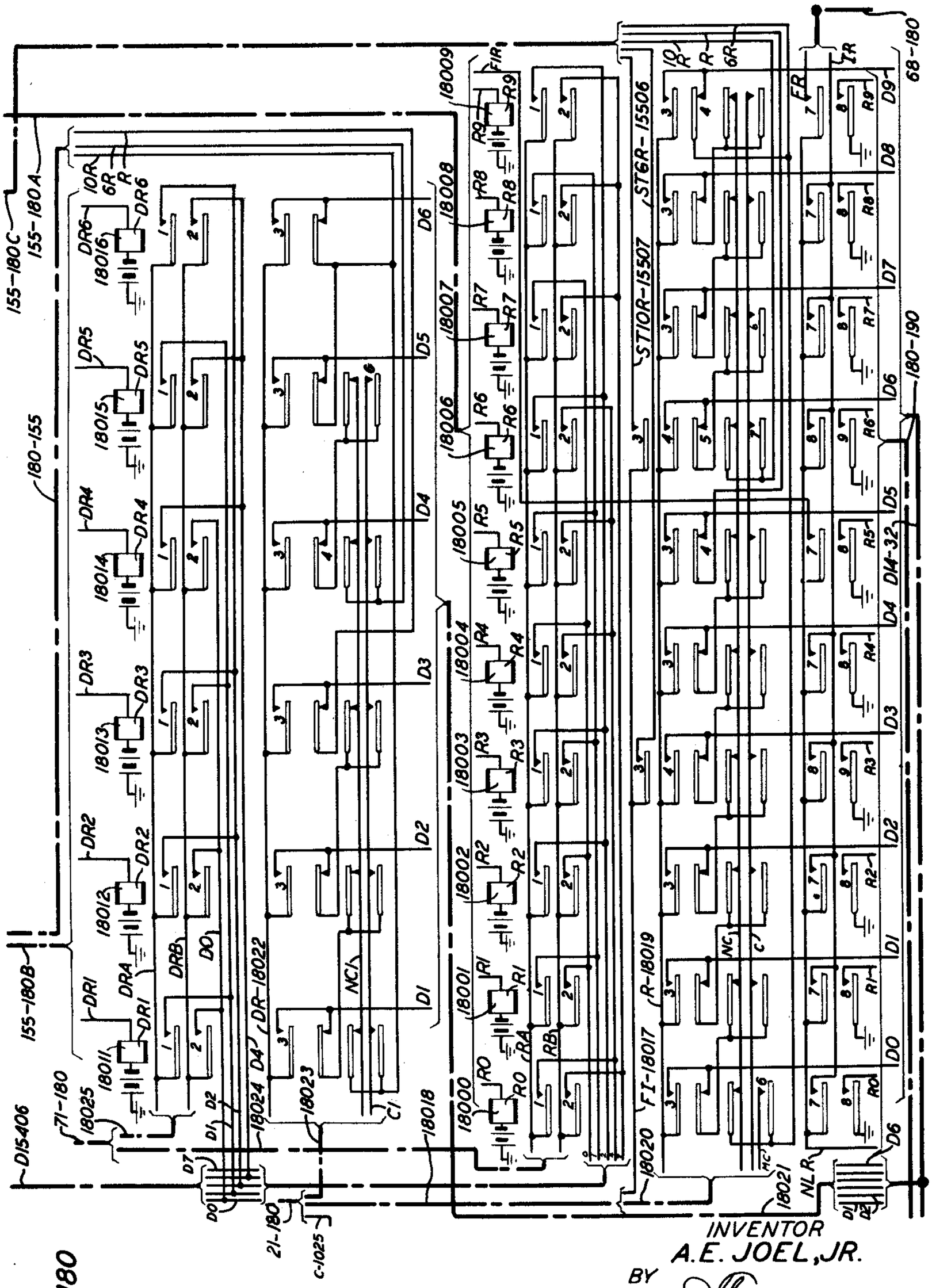


FIG. 180

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 180

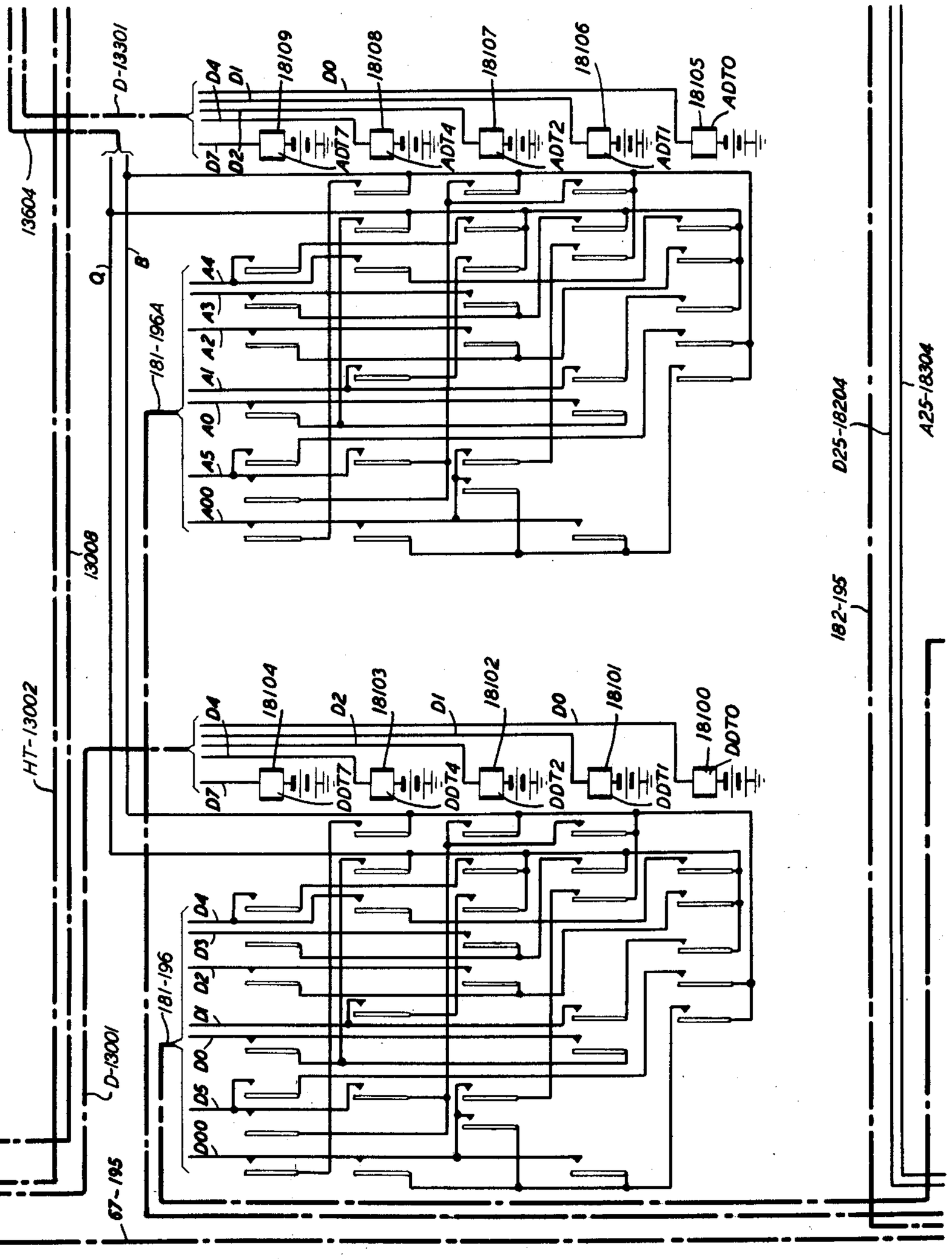


FIG. 181

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 181

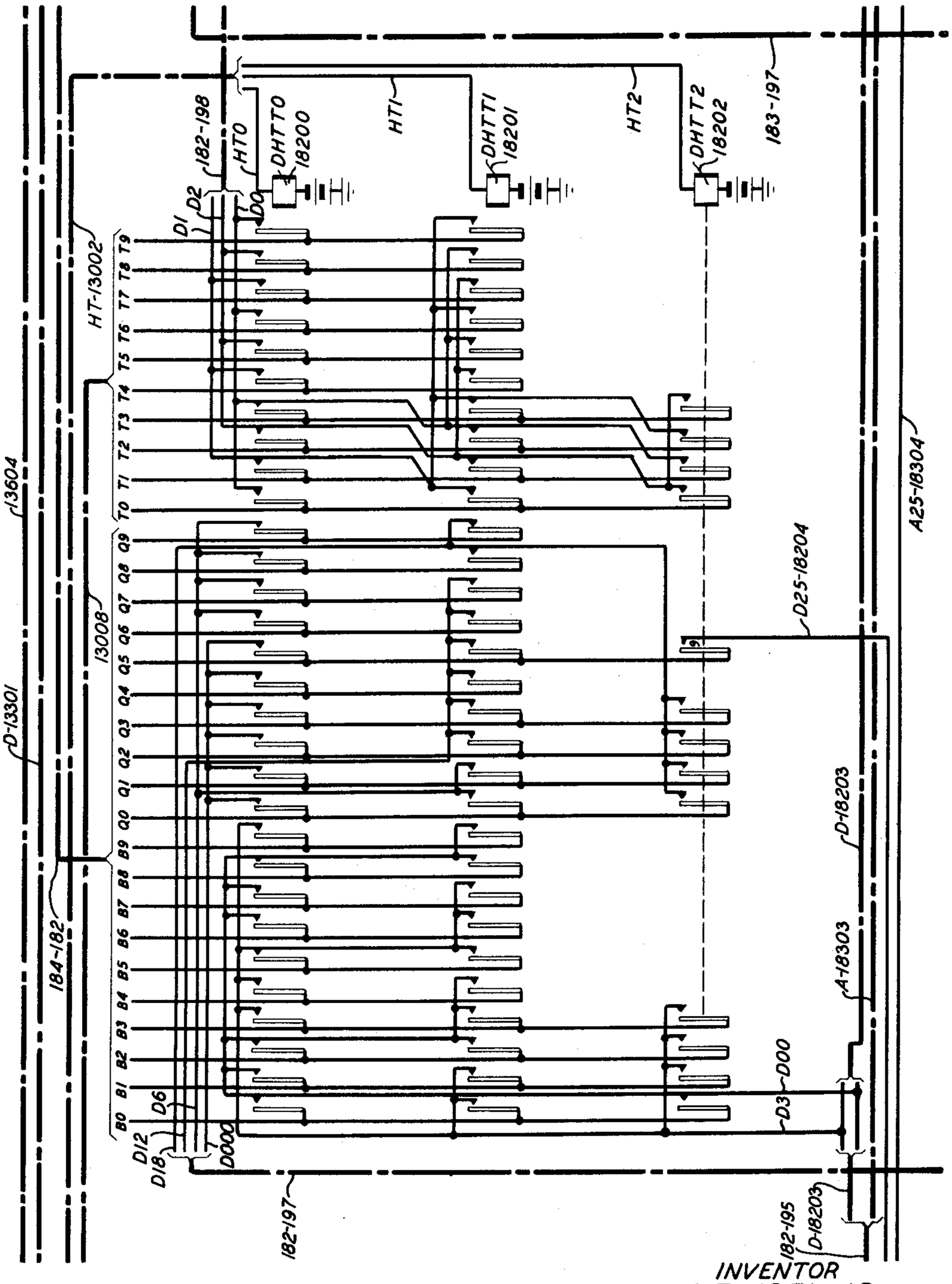


FIG. 182

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 182

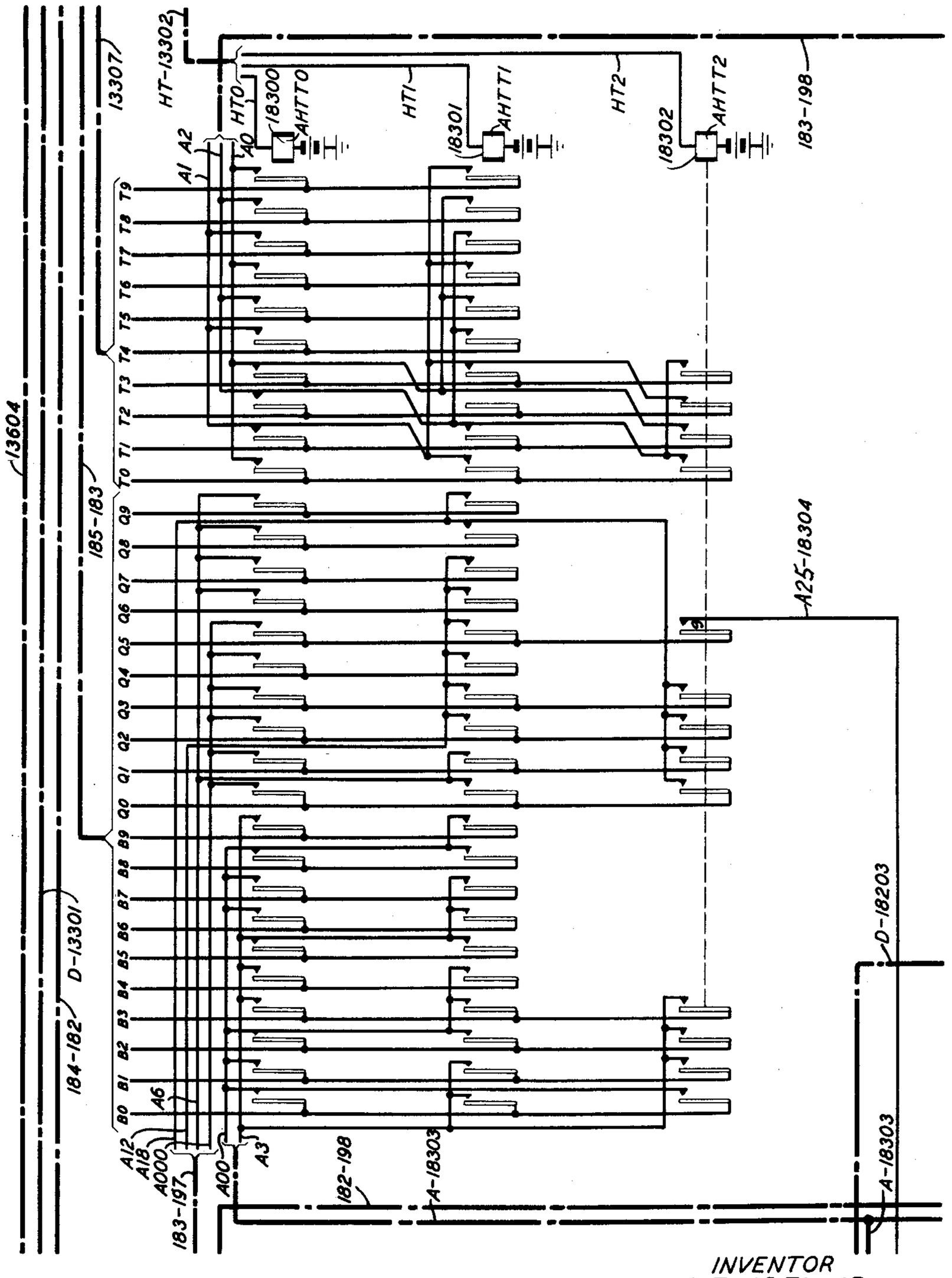


FIG. 183

INVENTOR
A. E. JOEL, JR.
BY
Stlerner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 183

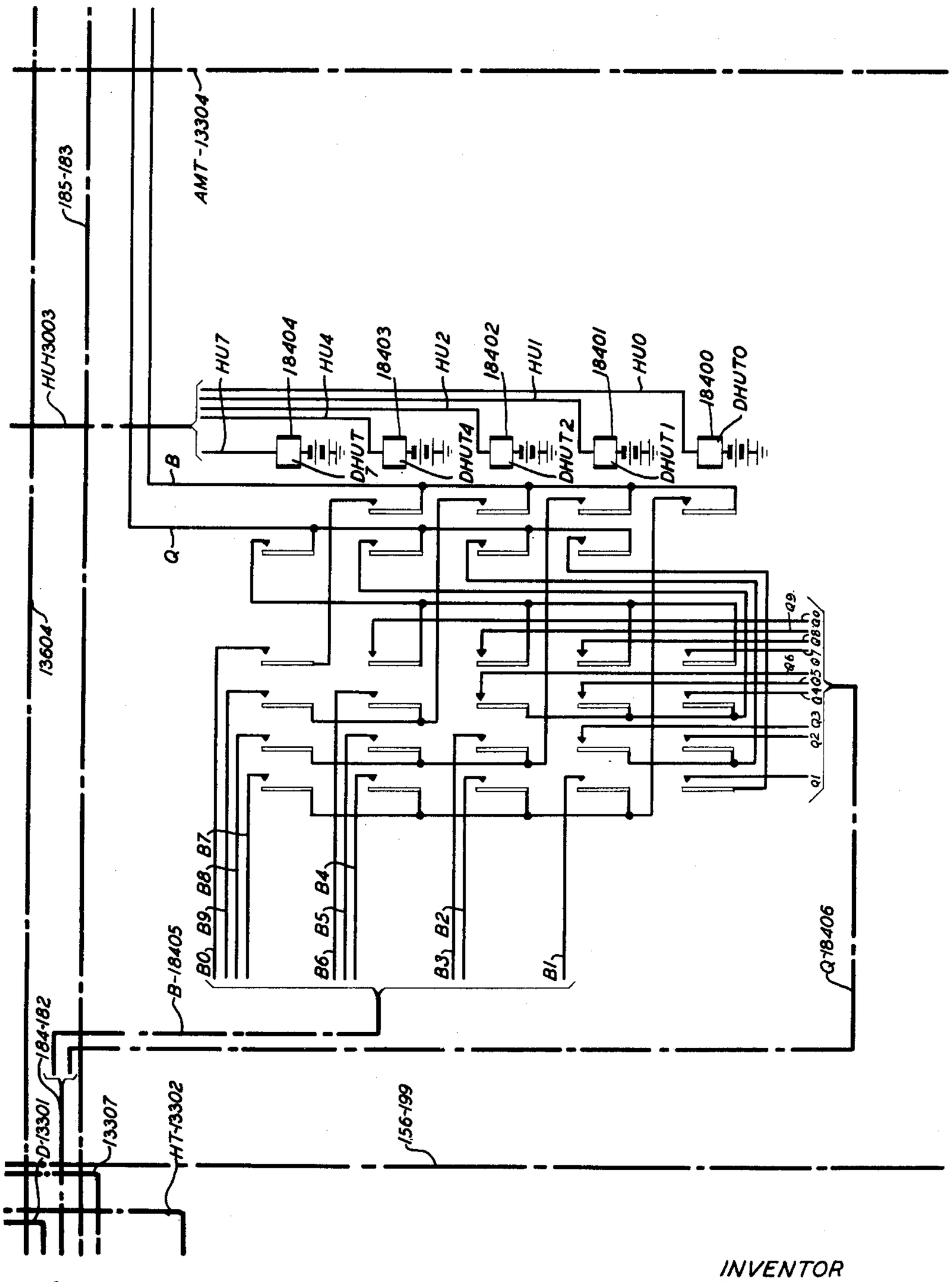


FIG. 184

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 184

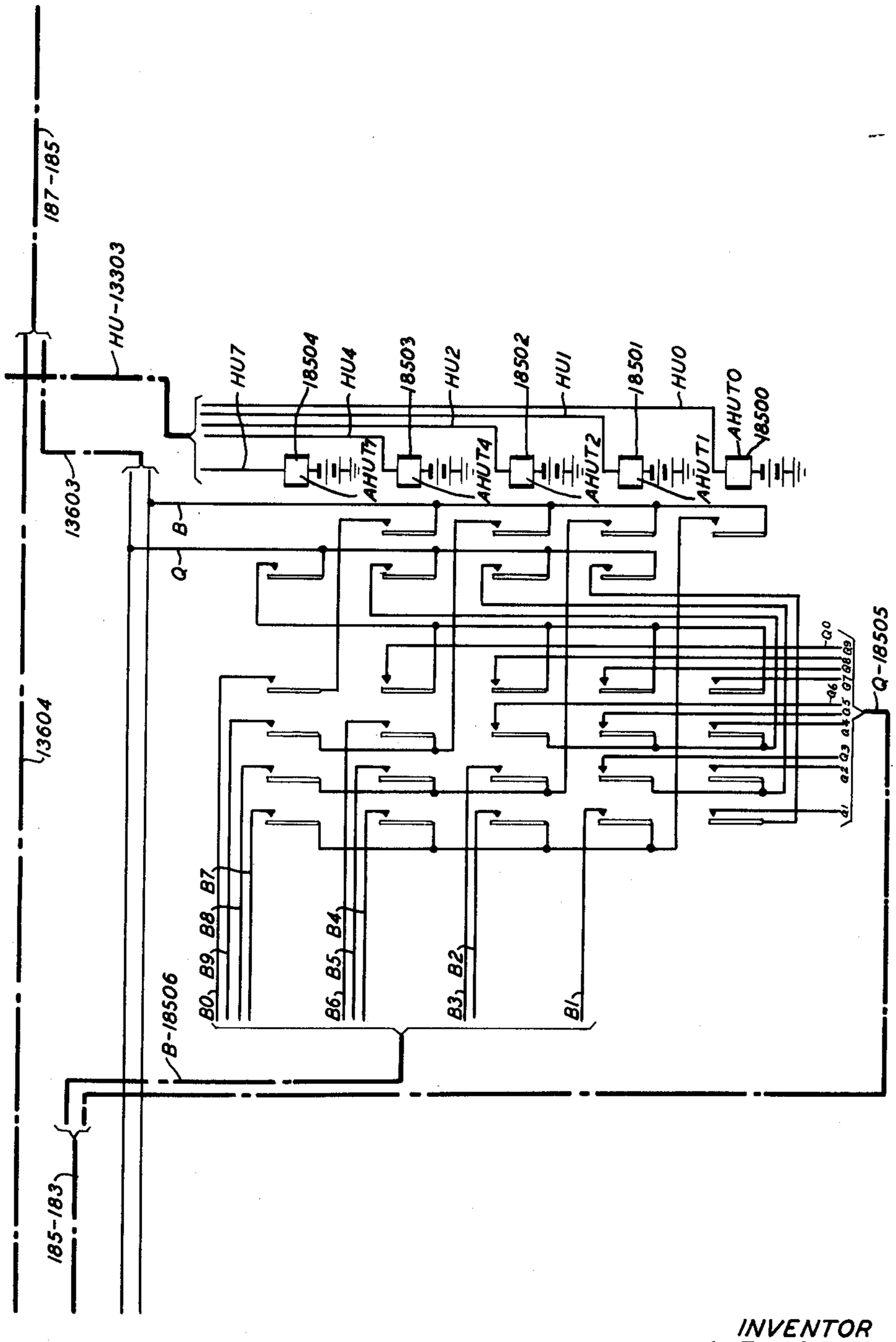


FIG. 185

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

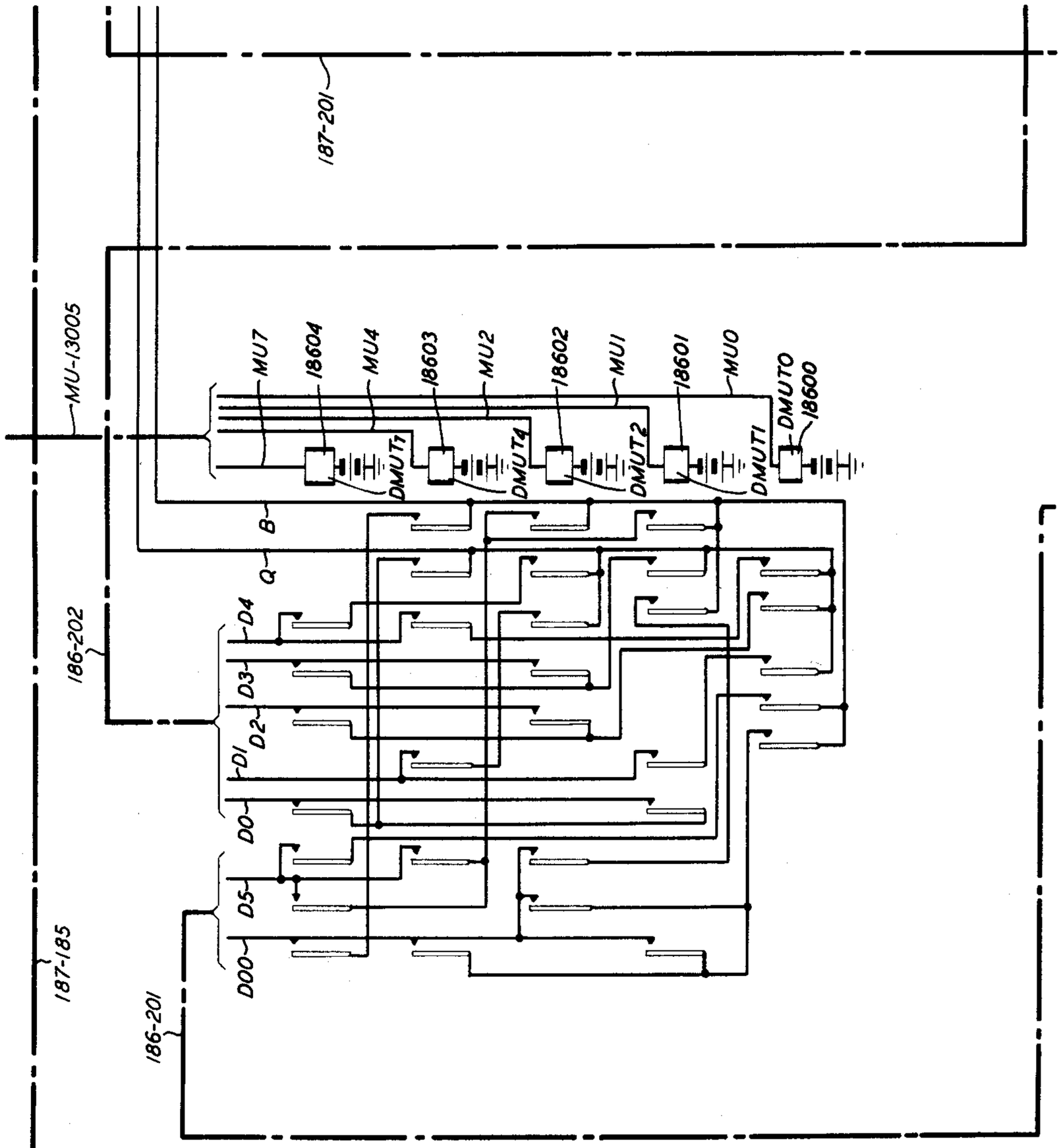


FIG. 186

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 186

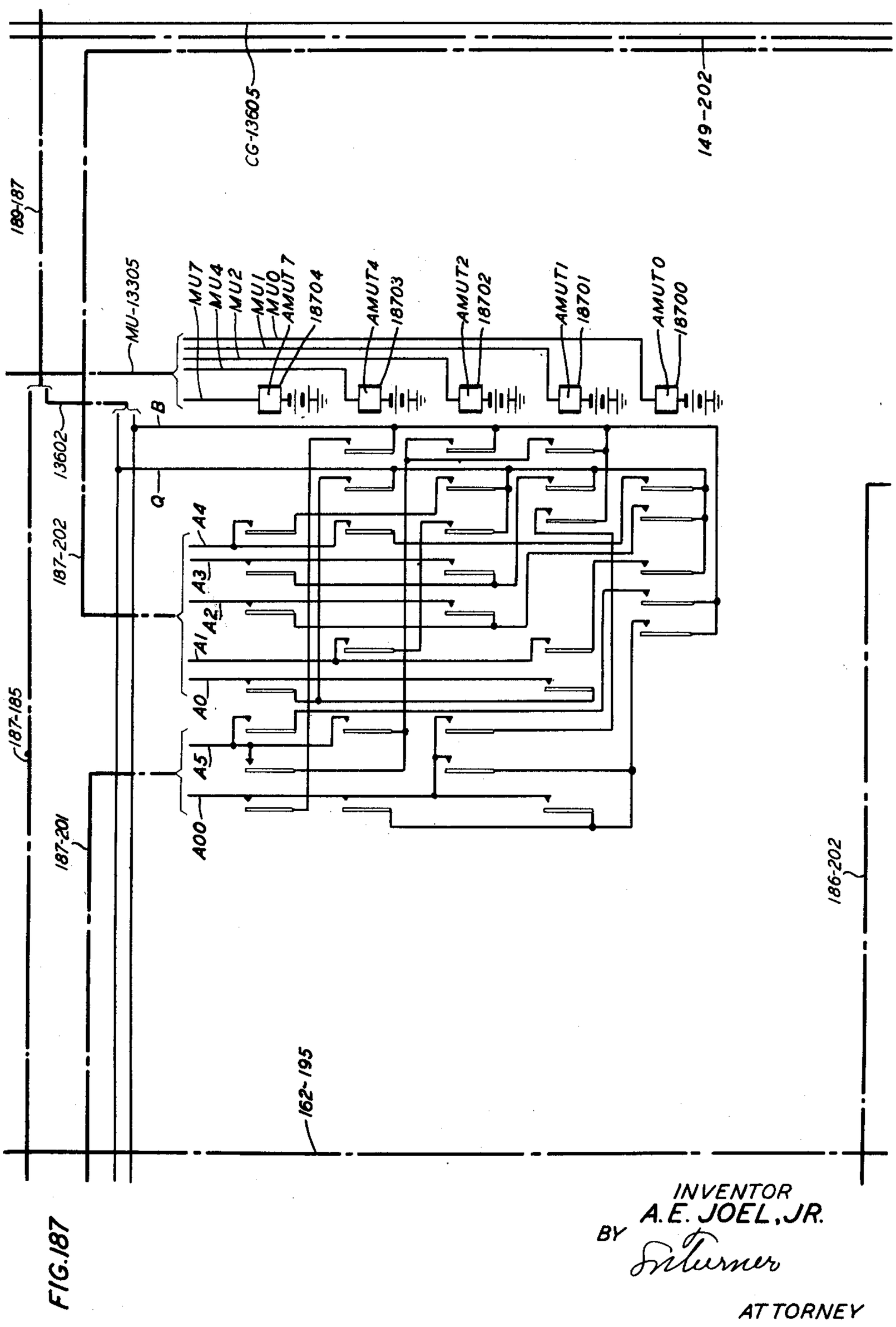


FIG. 187

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 187

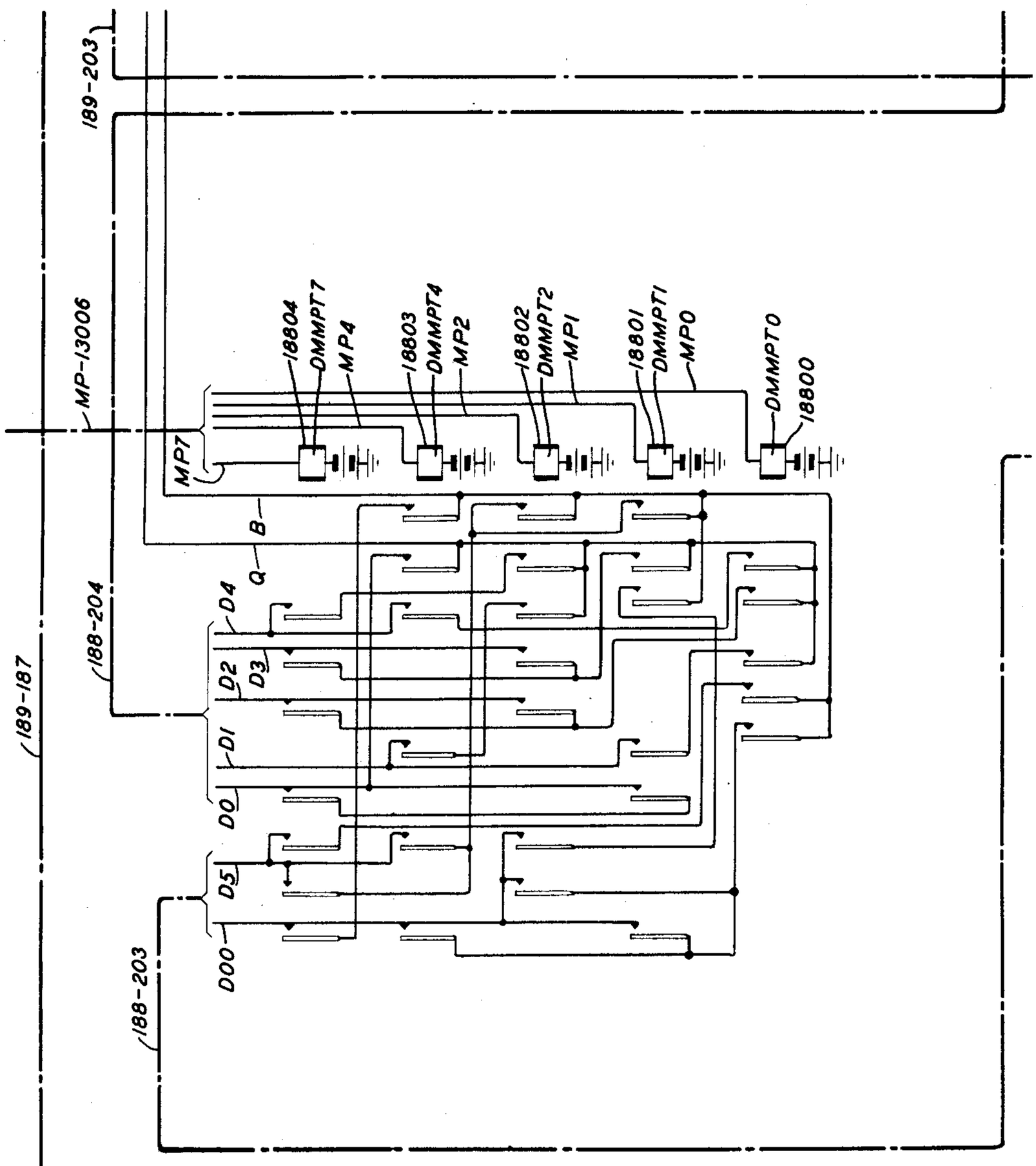


FIG. 188

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 188

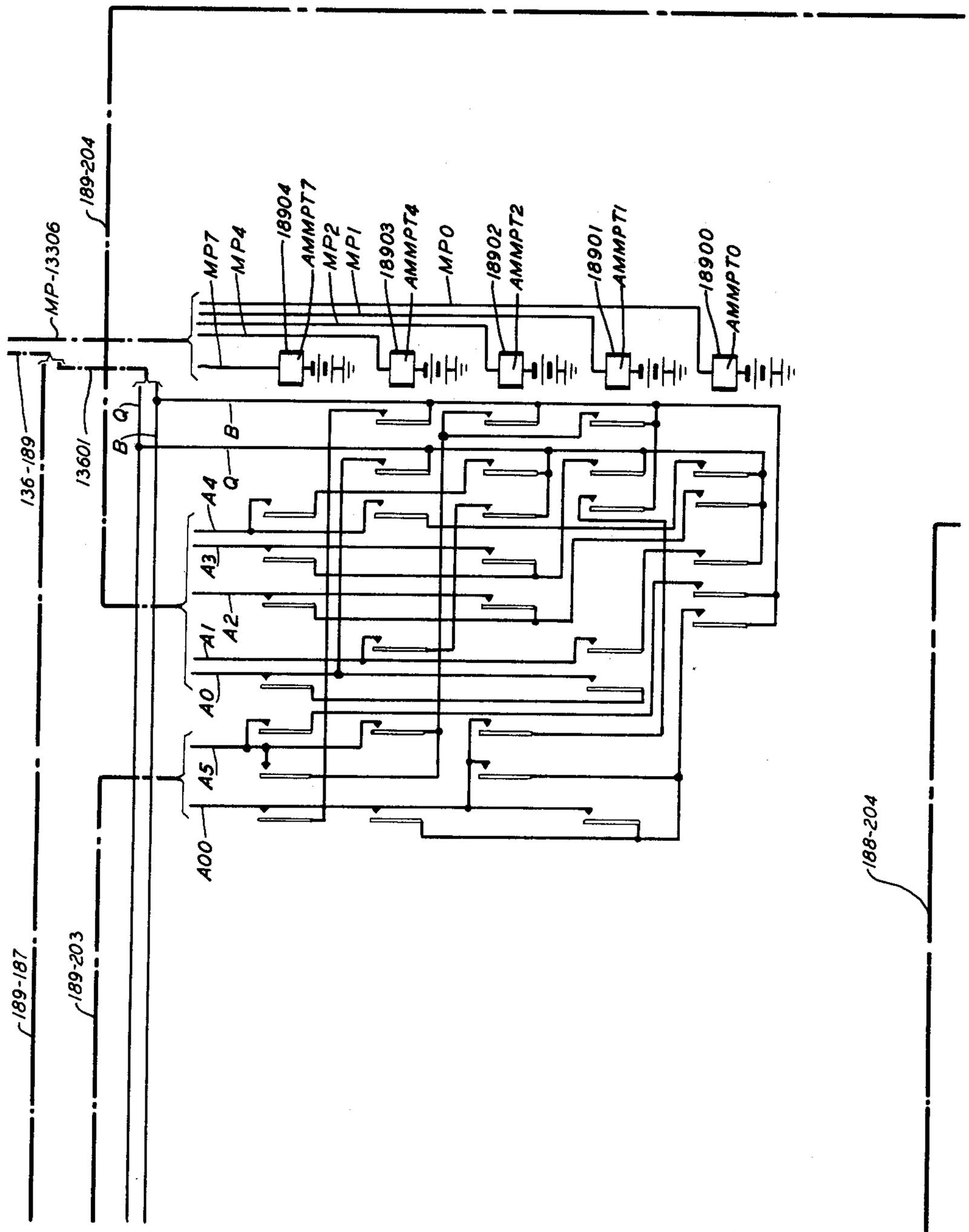


FIG. 189

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 189

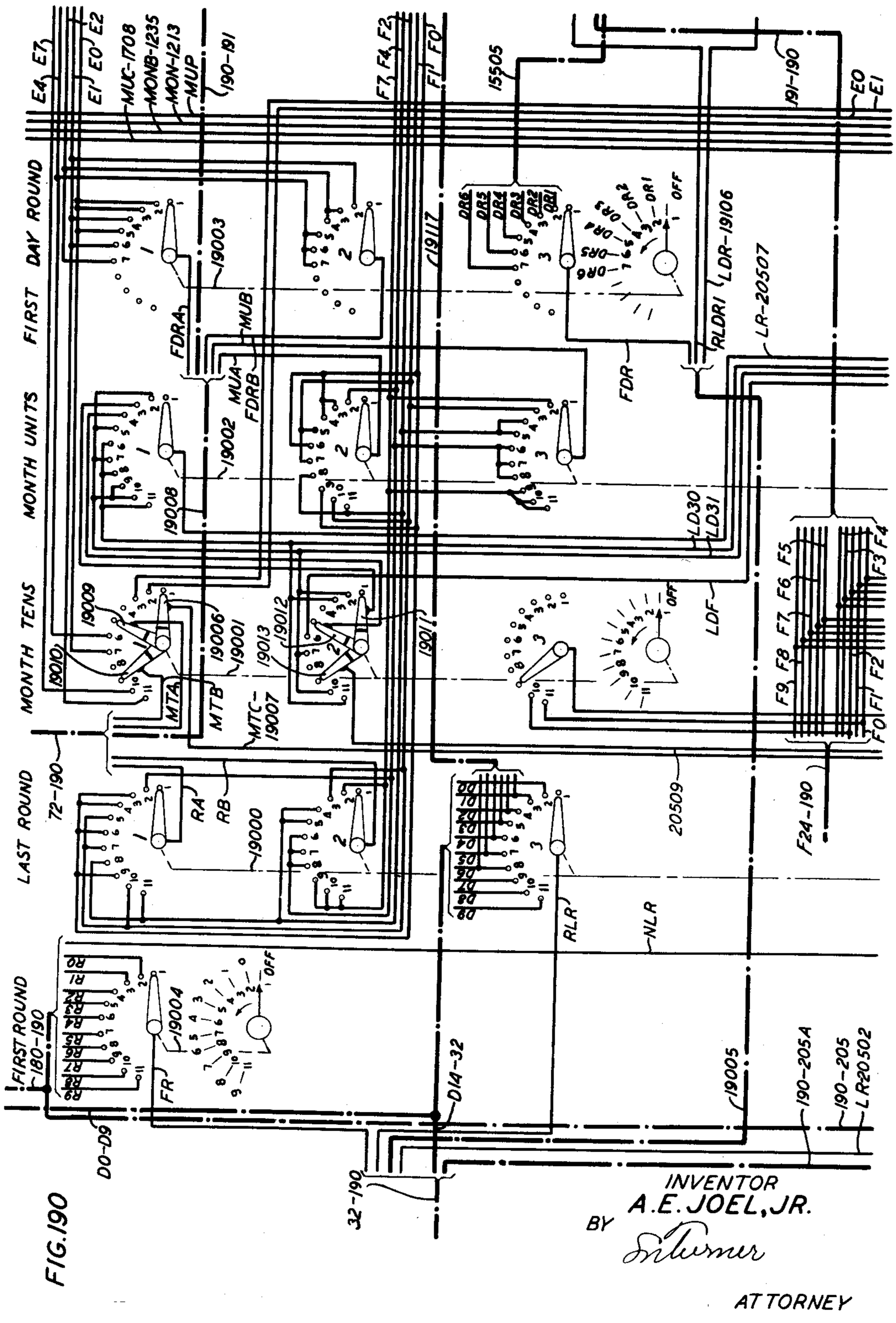


FIG. 190

INVENTOR
A. E. JOEL, JR.
BY
Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 190

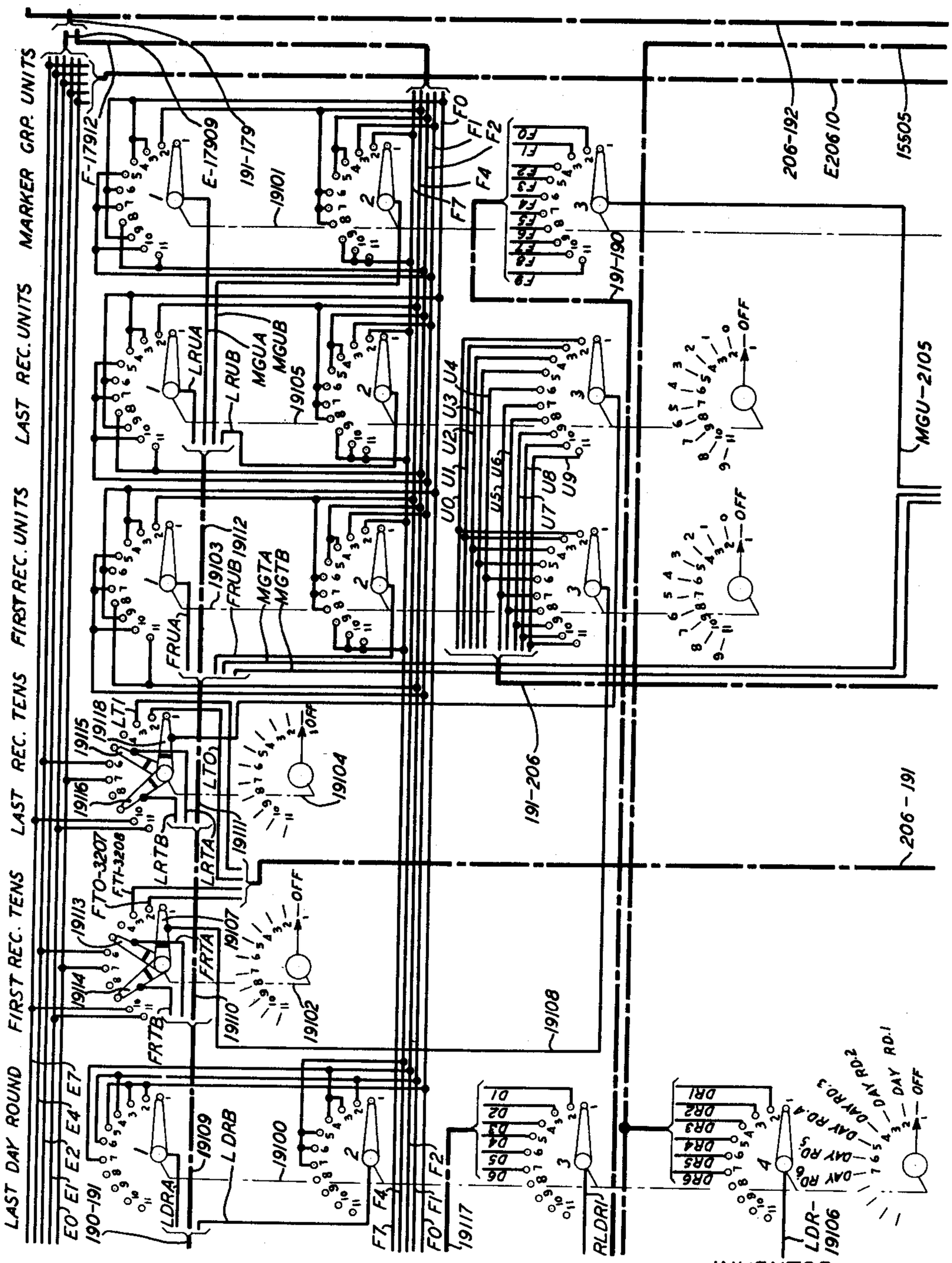


FIG. 191

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 191

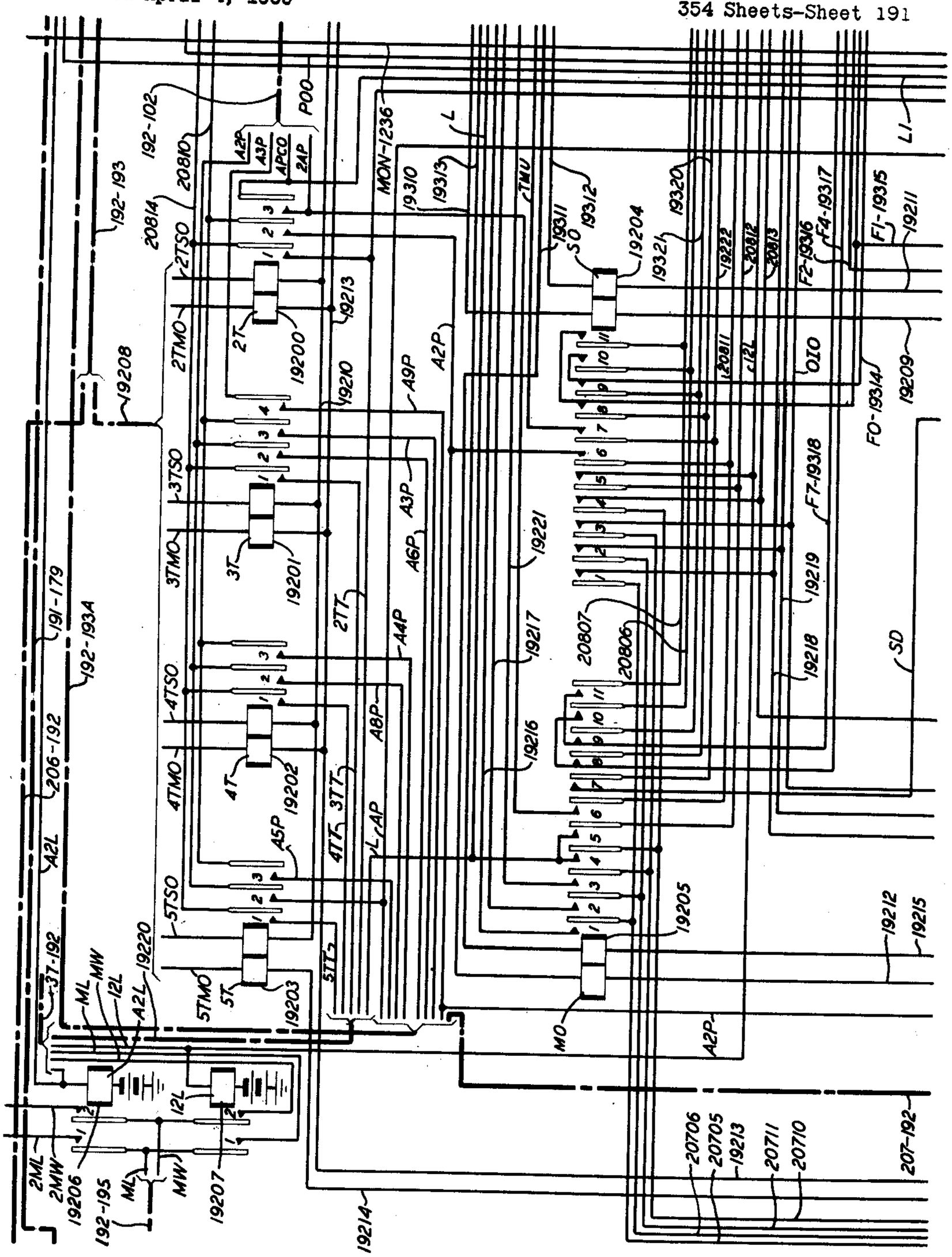


FIG. 192

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 192

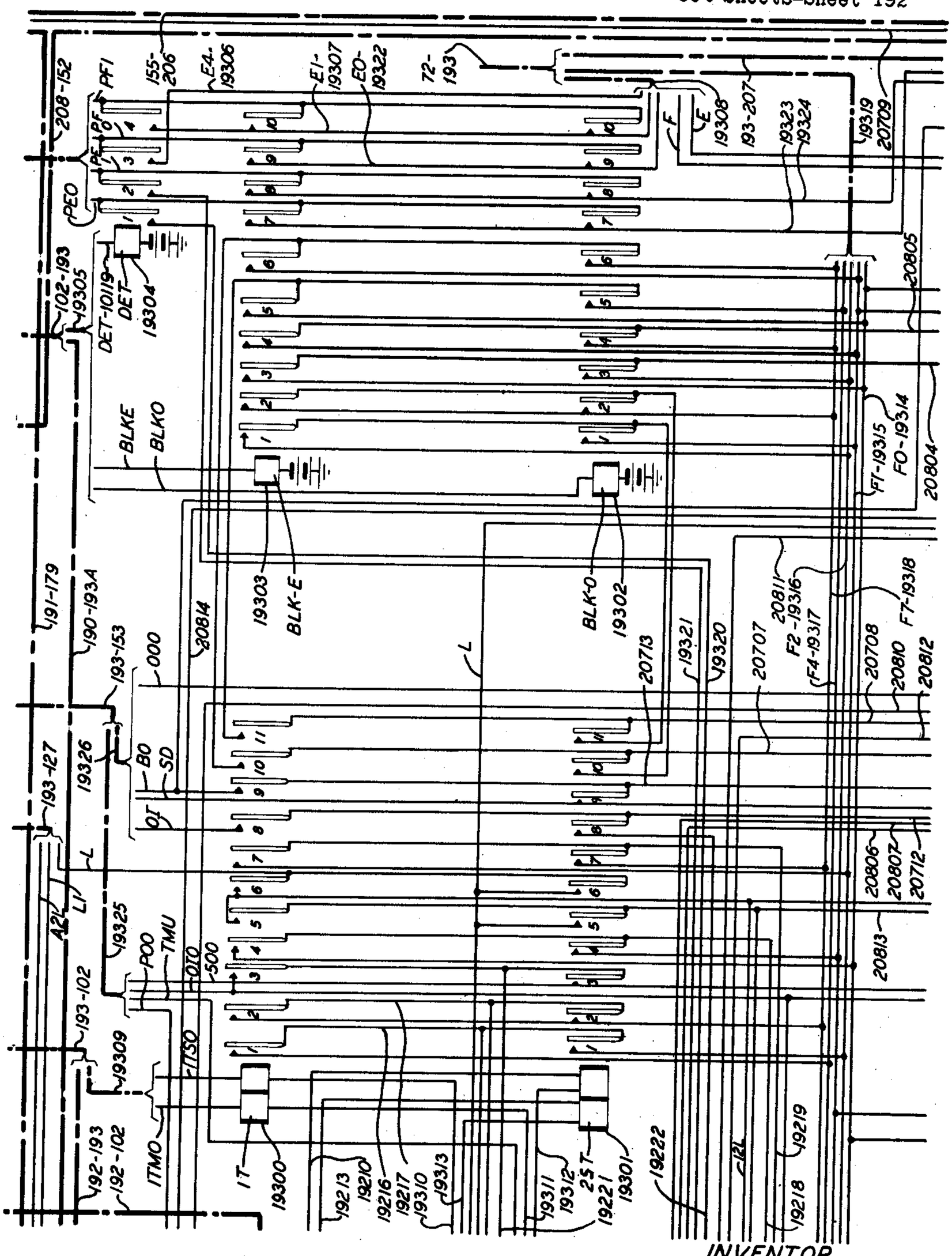


FIG. 193

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 193

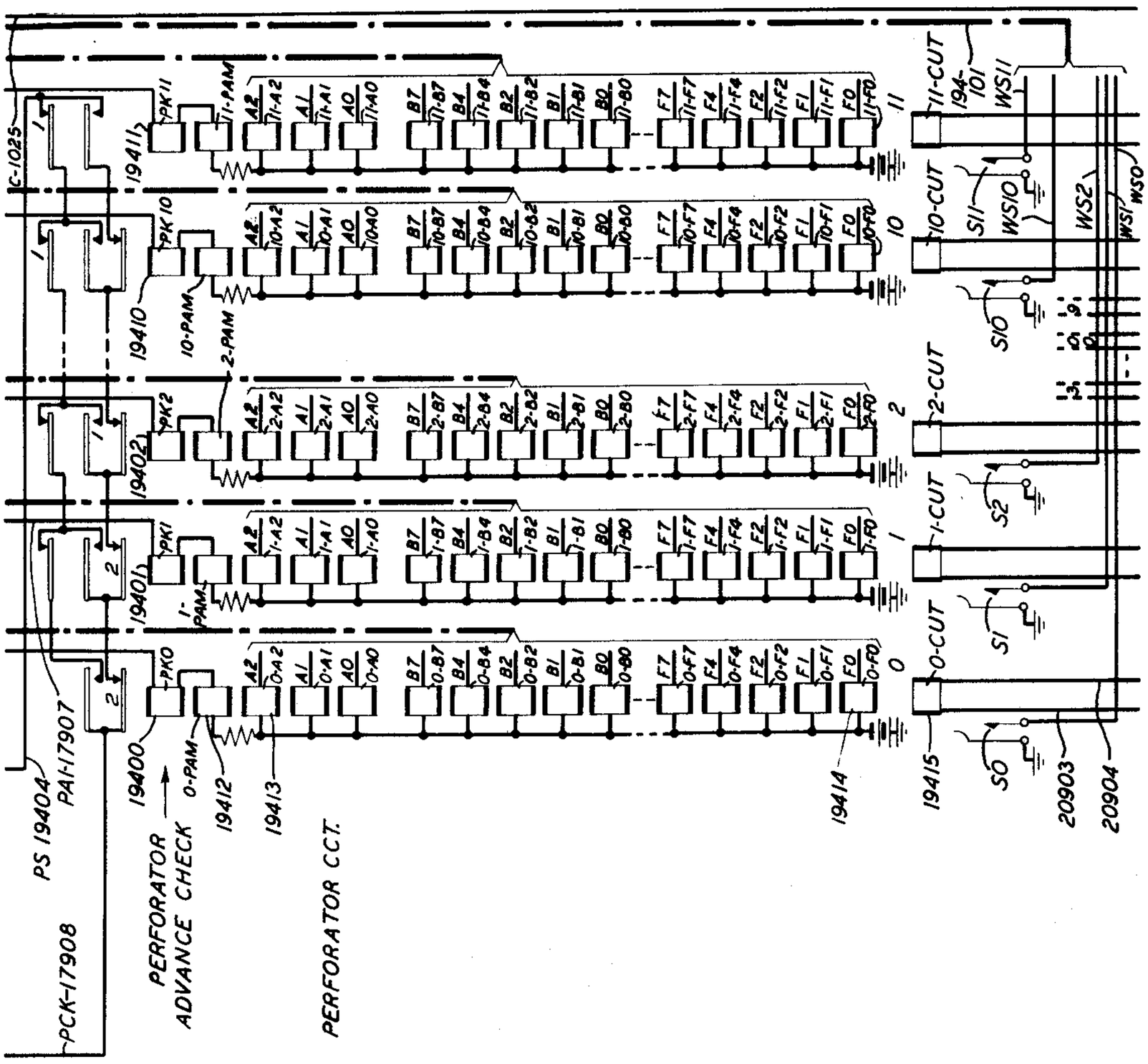


FIG. 194

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR.

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 194

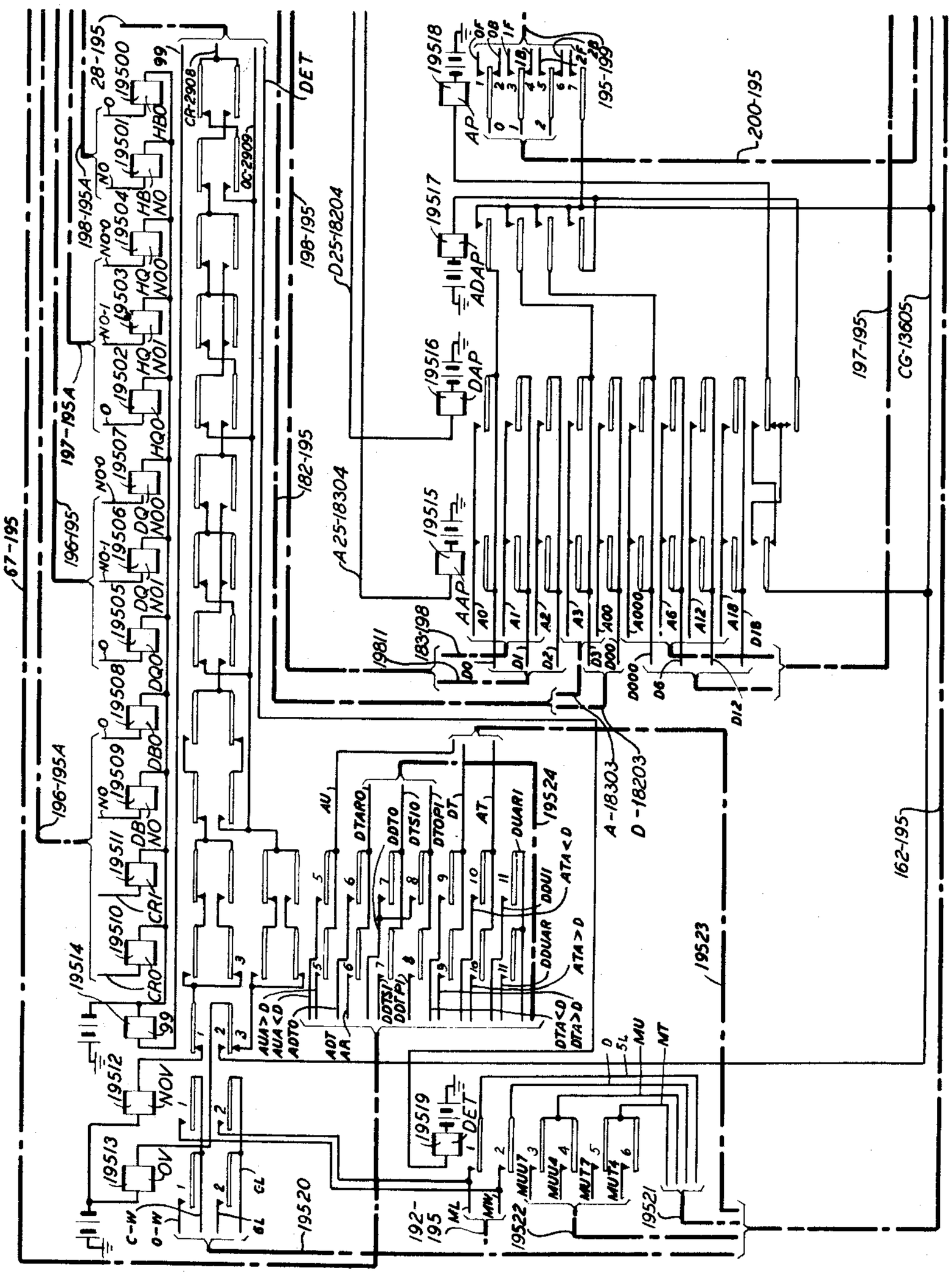


FIG. 195

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 195

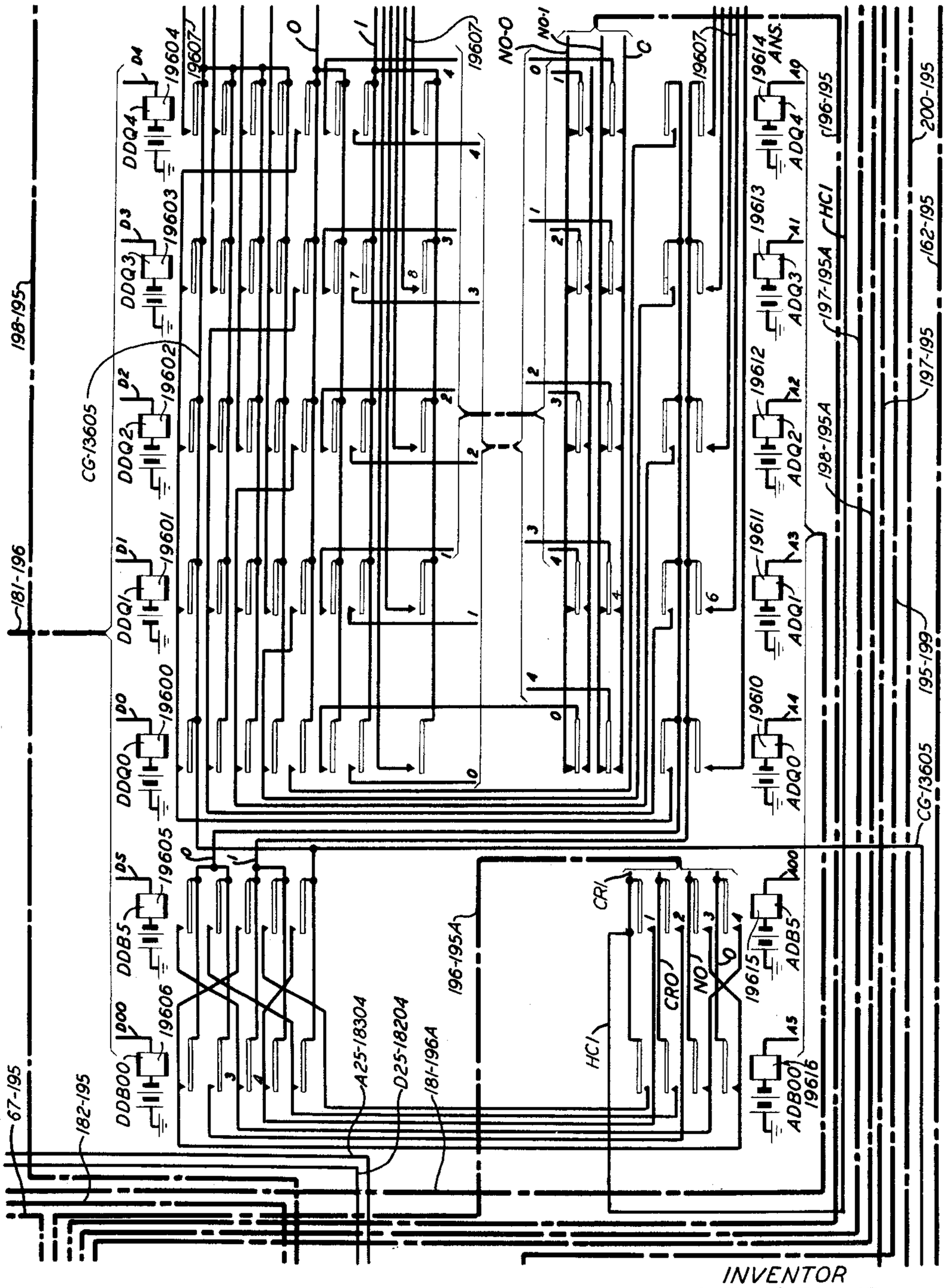


FIG. 196

INVENTOR
A. E. JOEL. JR.
BY Silverman
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 196

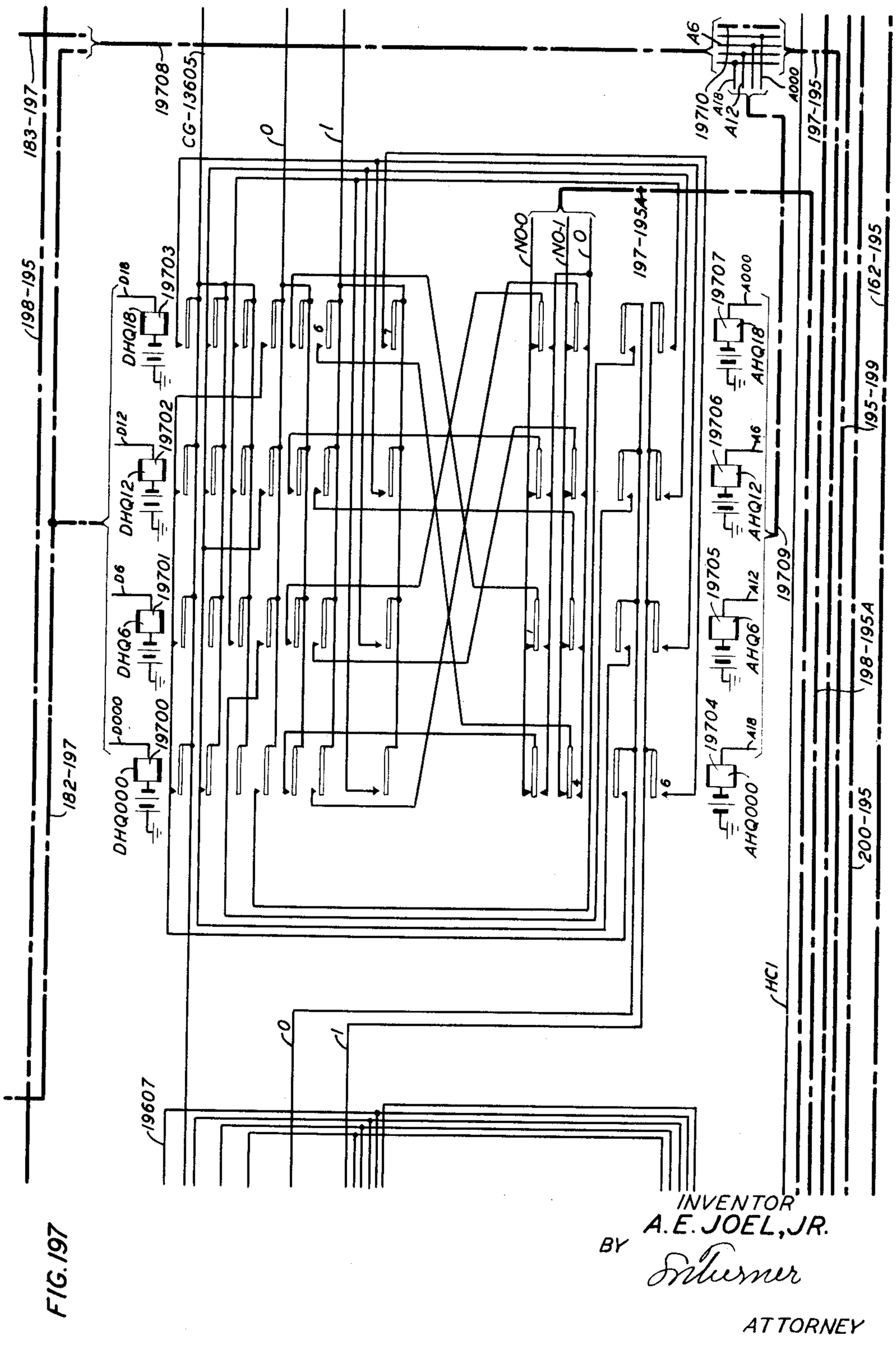


FIG. 197

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 197

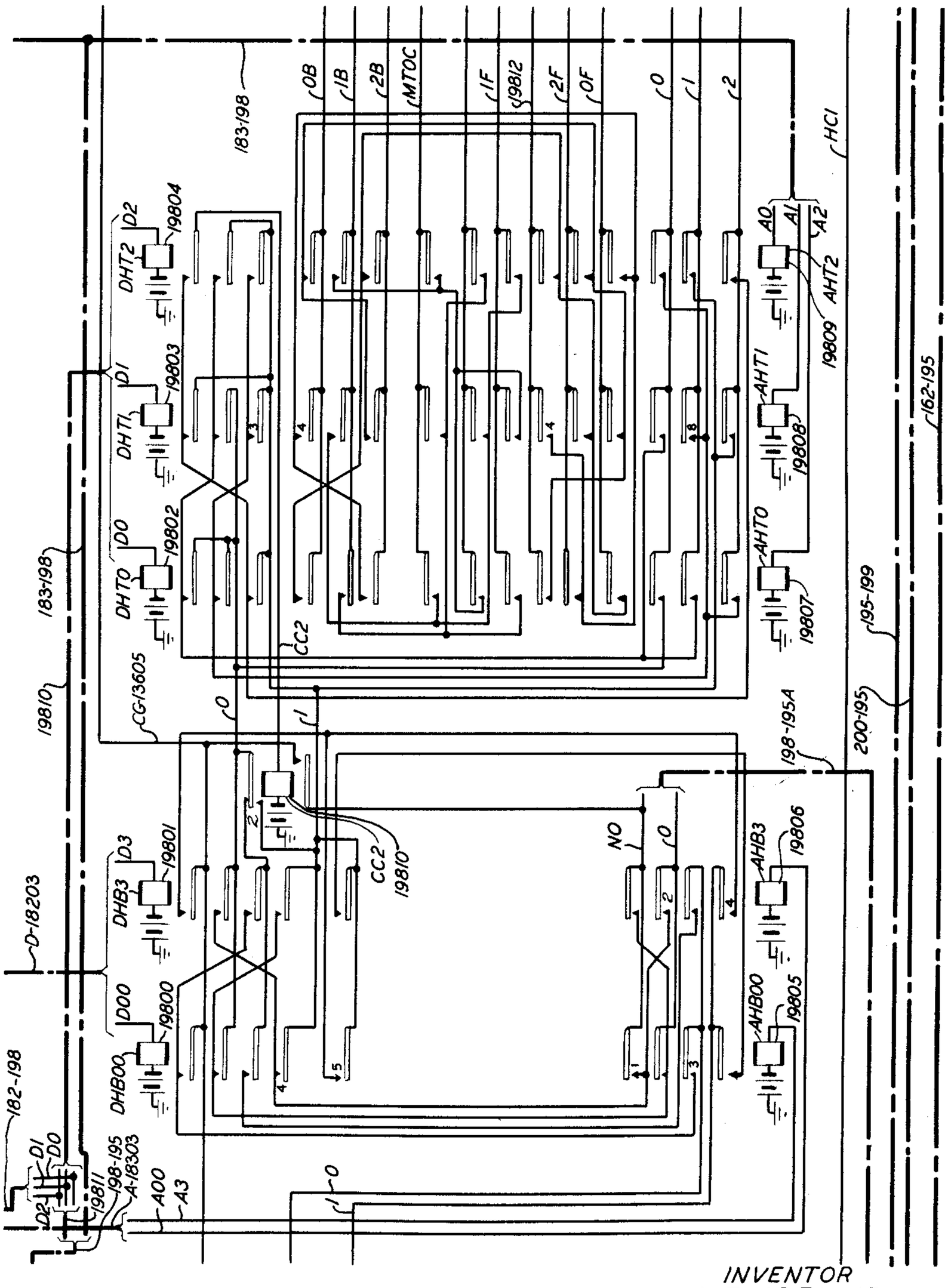


FIG. 198

INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 198

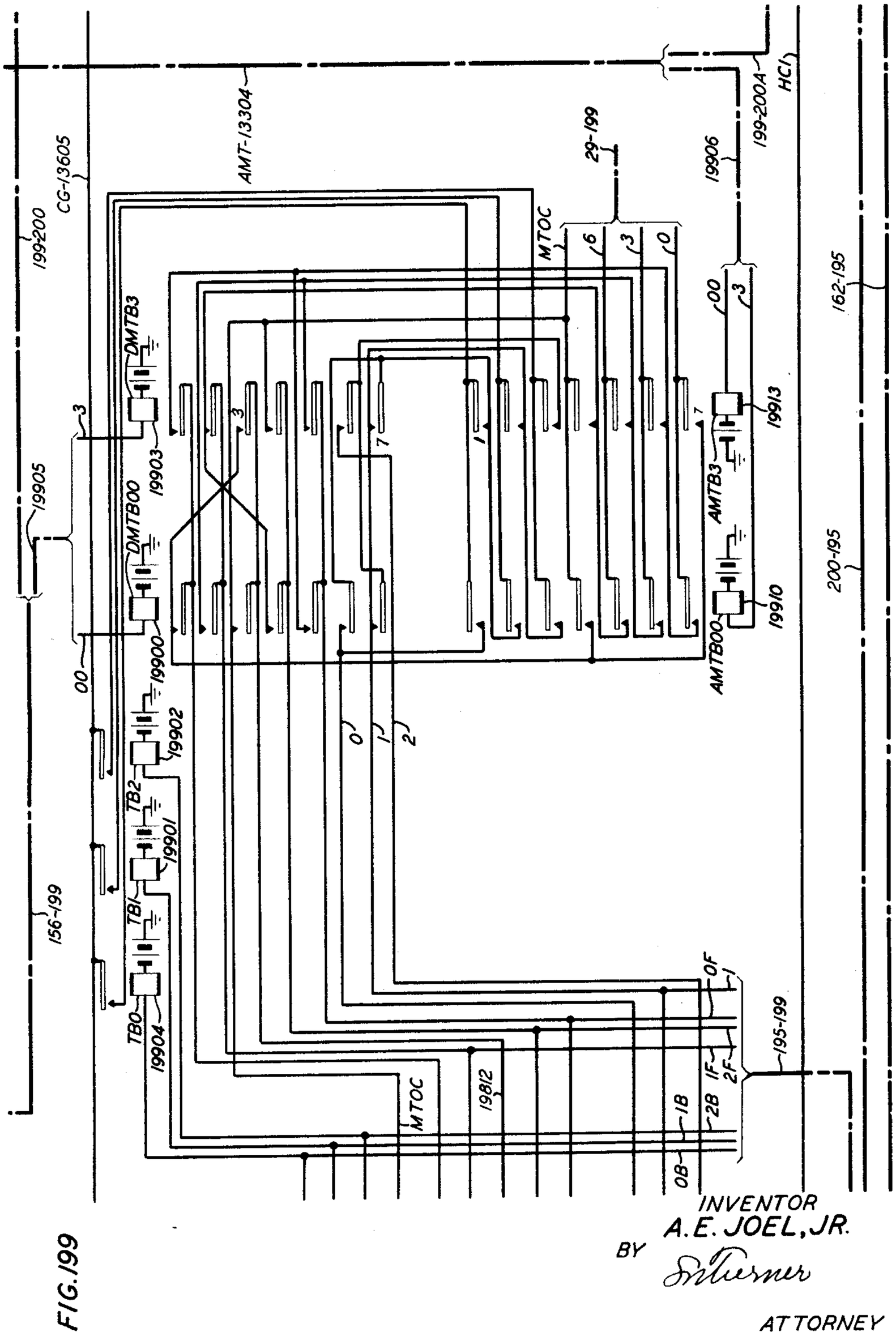


FIG. 199

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 199

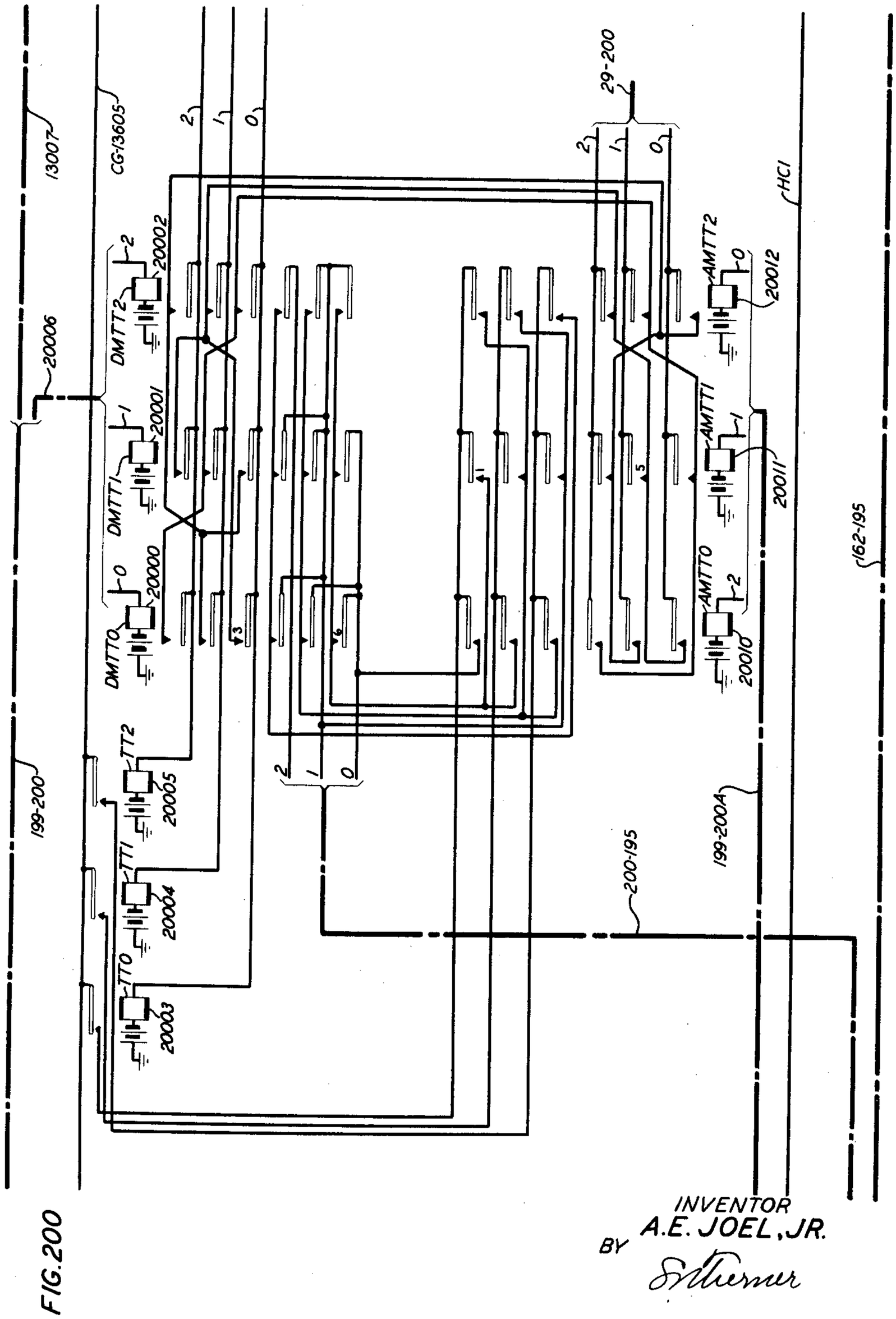


FIG. 200

INVENTOR
A.E. JOEL, JR.
BY S. Thurmer
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 200

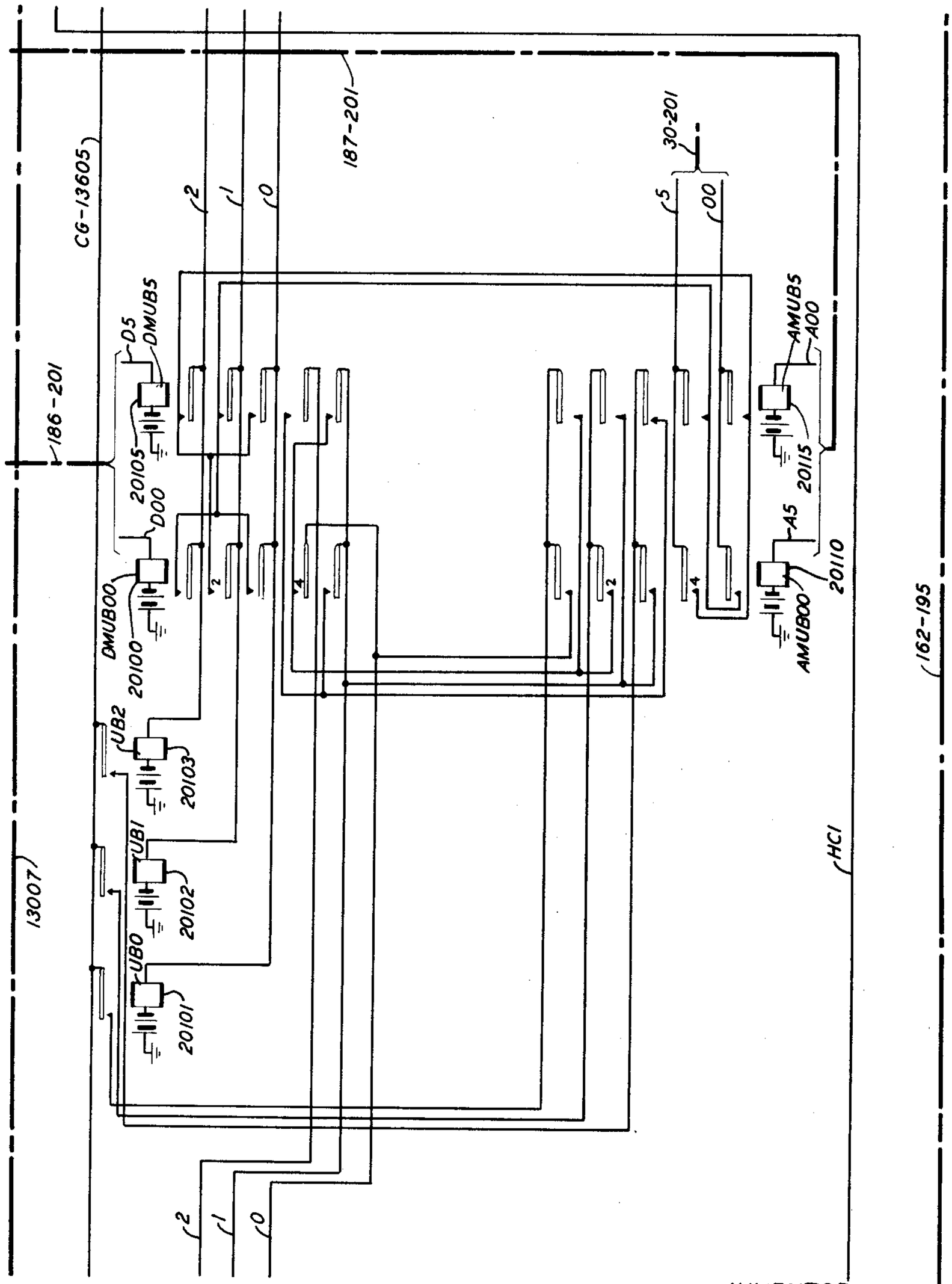


FIG. 201

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 201

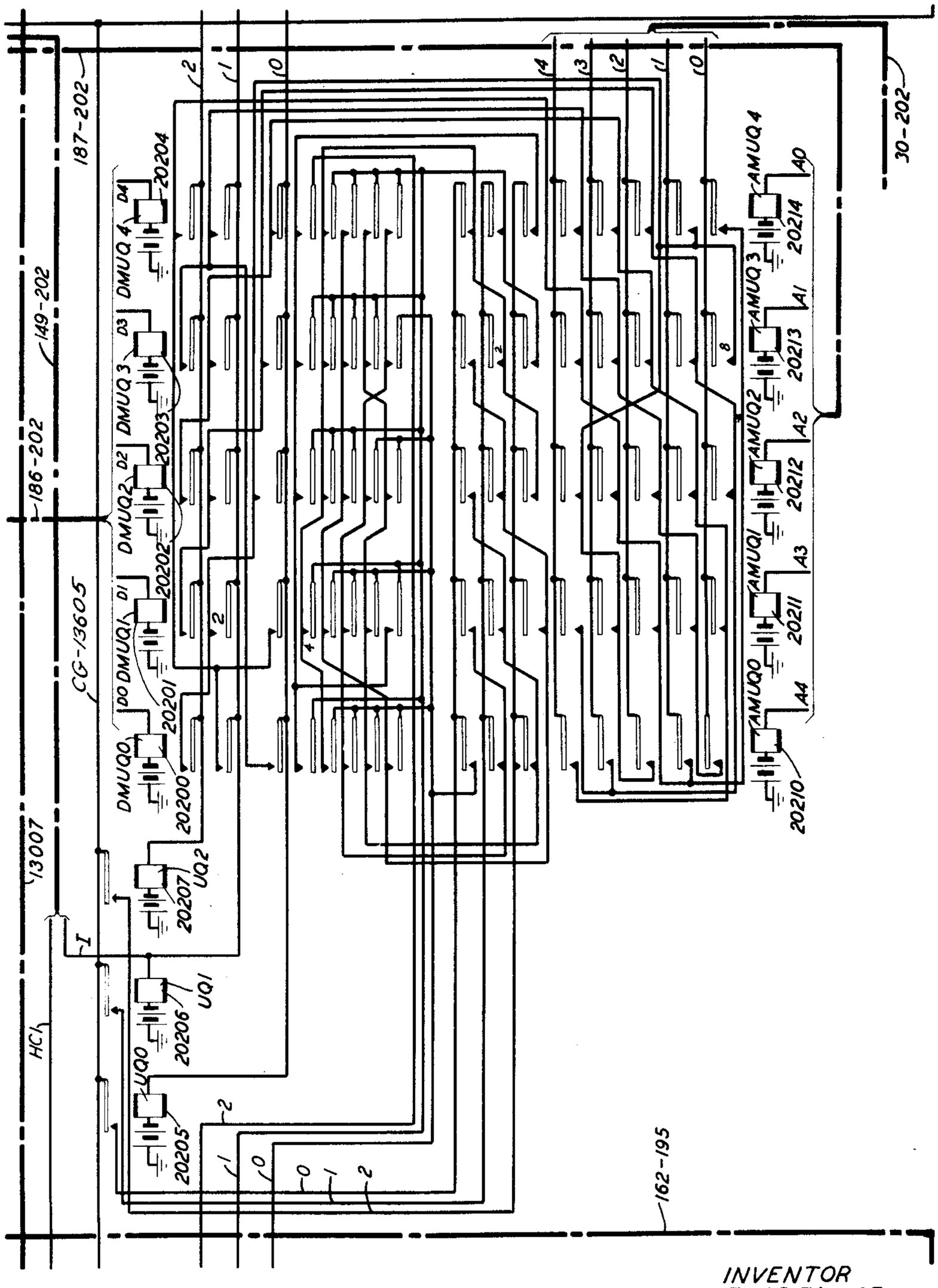


FIG. 202

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 202

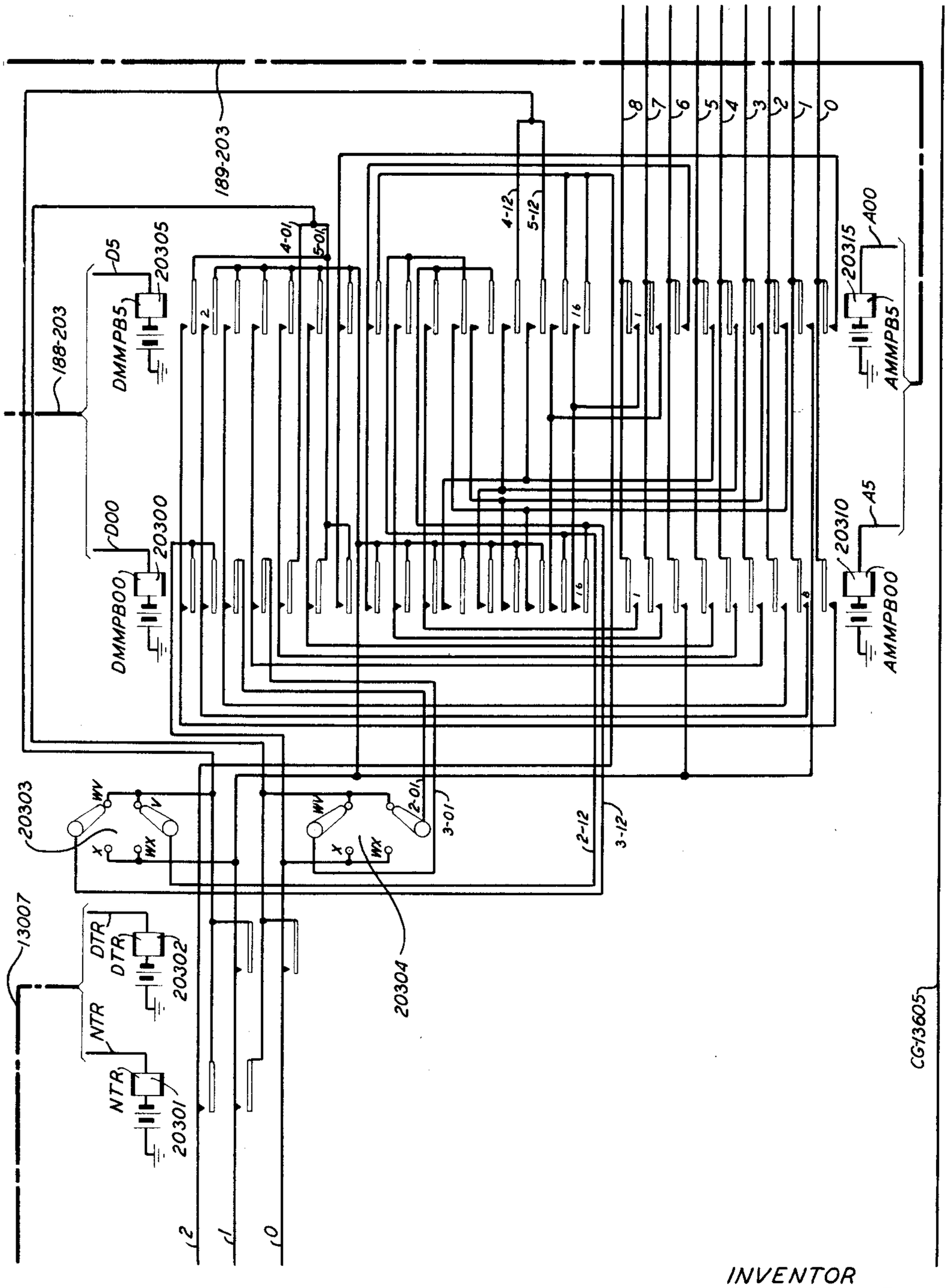


FIG.203

INVENTOR
A.E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 203

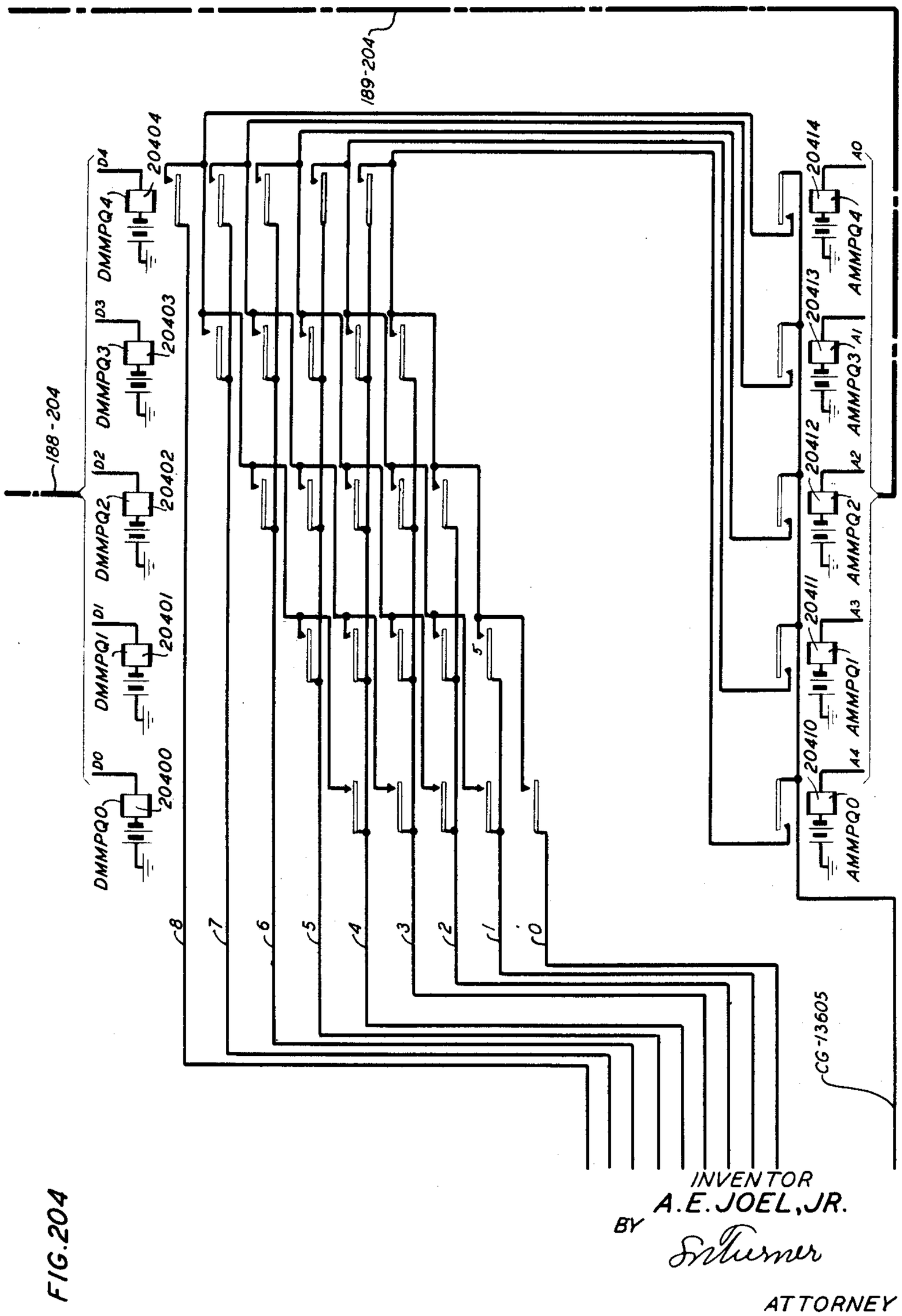


FIG. 204

INVENTOR
A. E. JOEL, JR.
BY S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 204

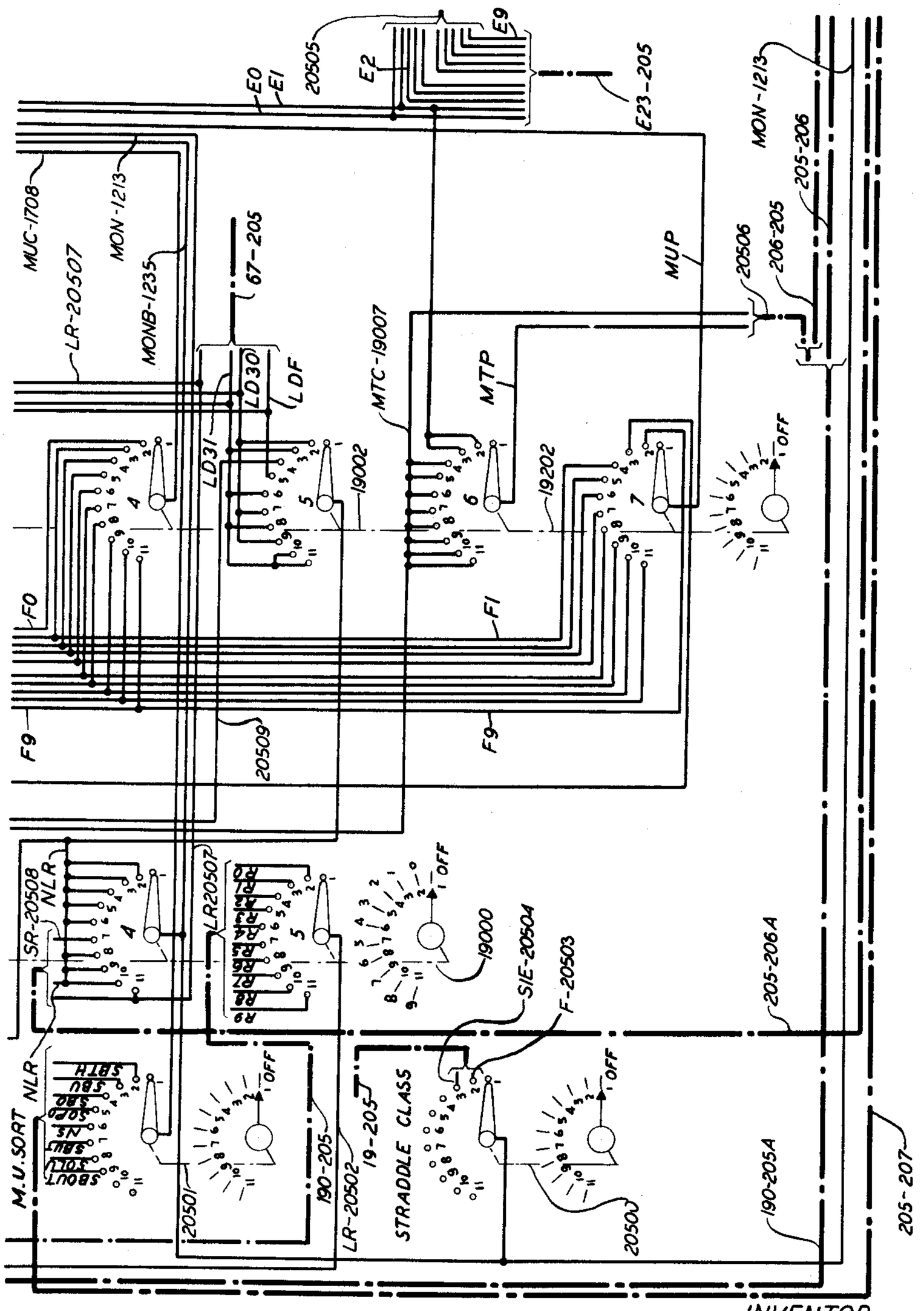


FIG. 205

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 205

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 206

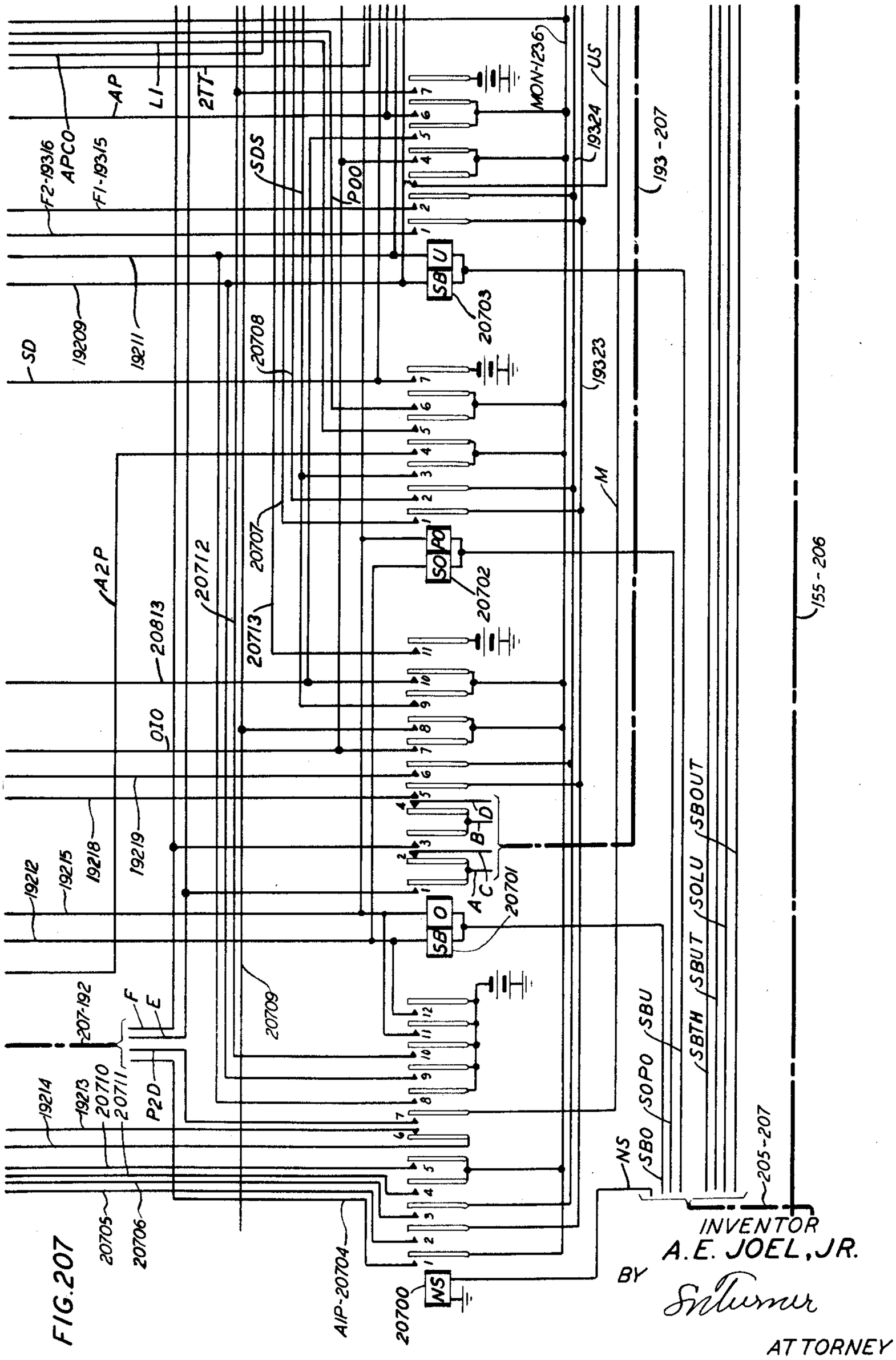


FIG. 207

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 207

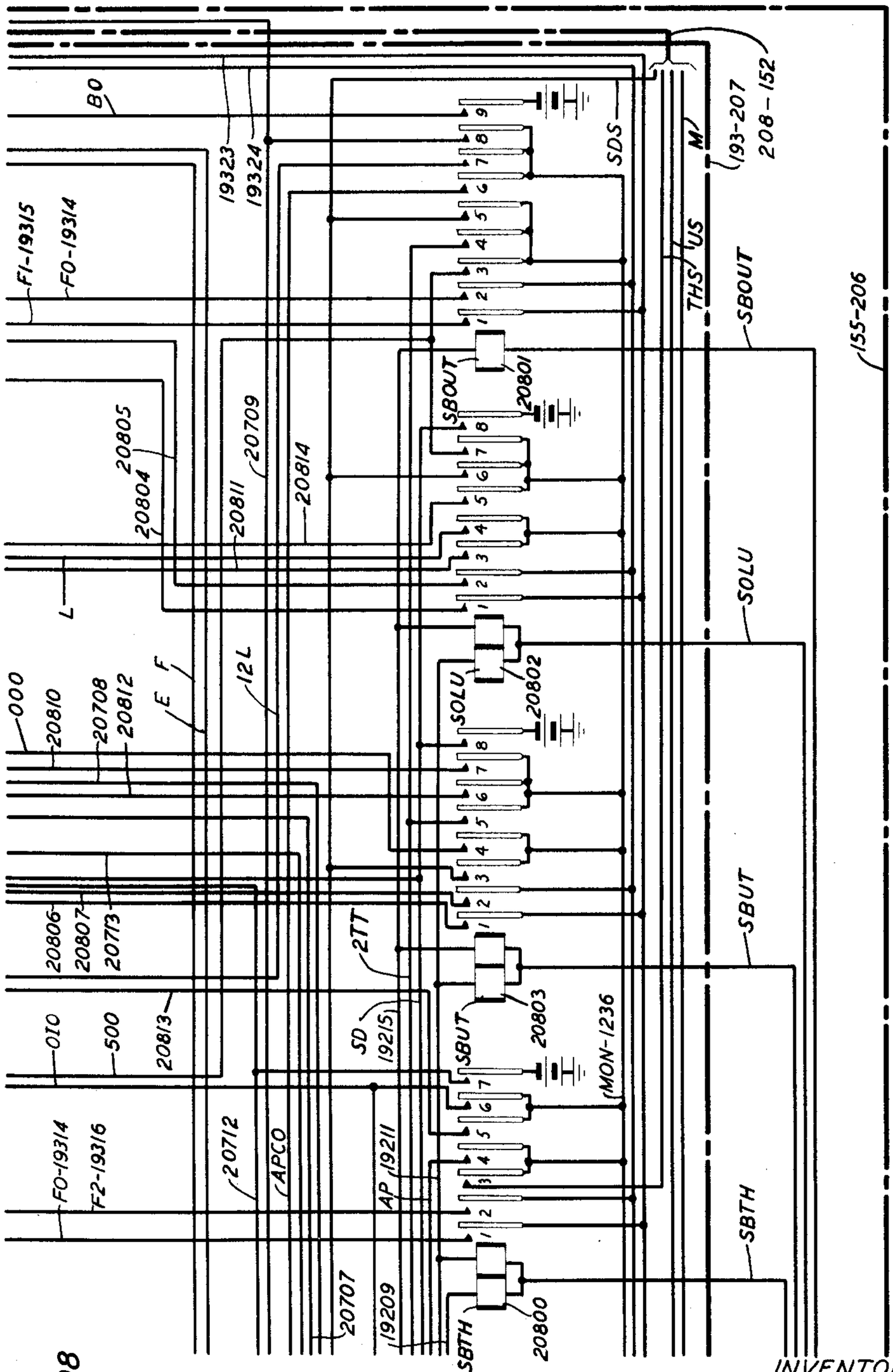


FIG. 208

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 208

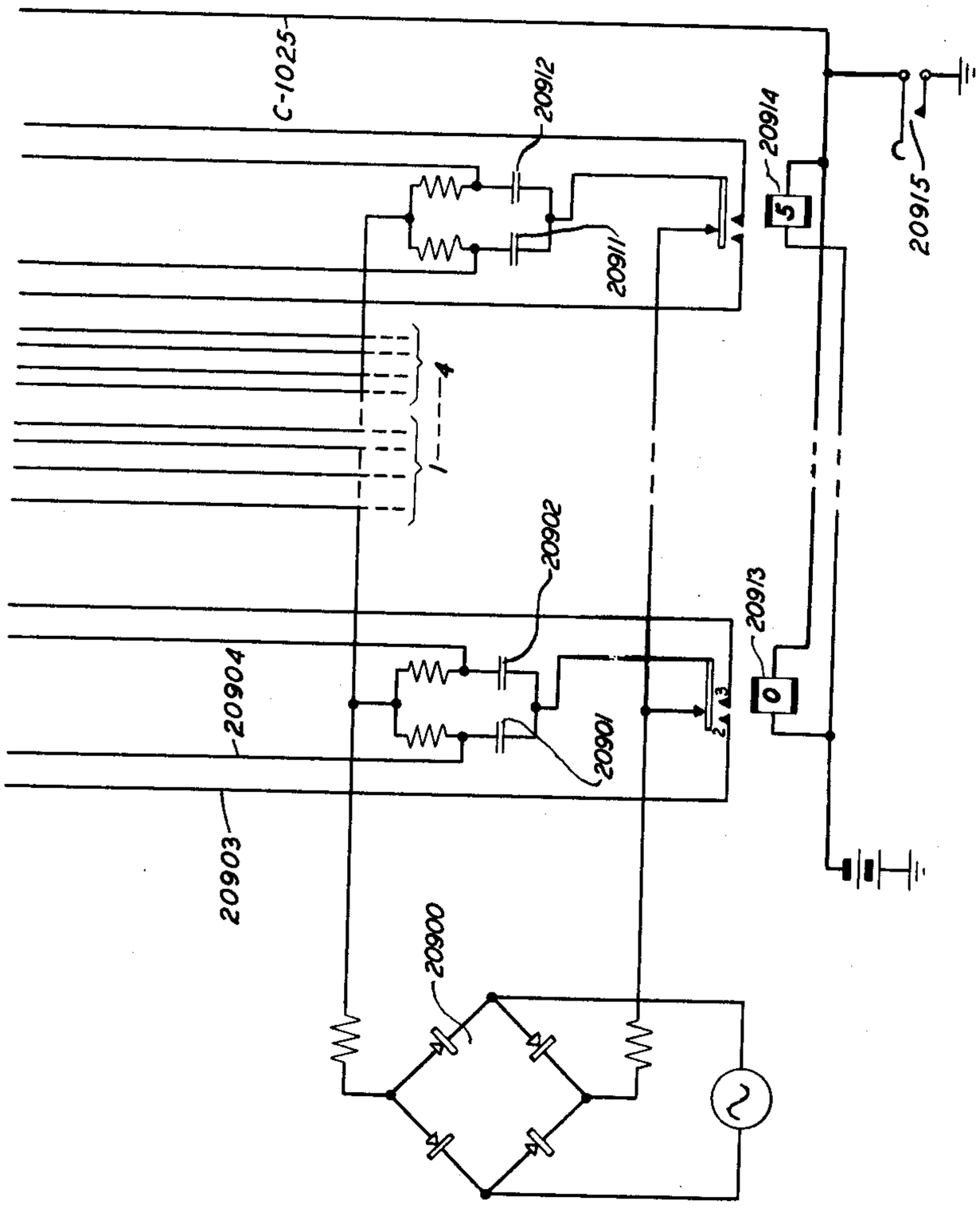


FIG. 209

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 209

FIG. 212

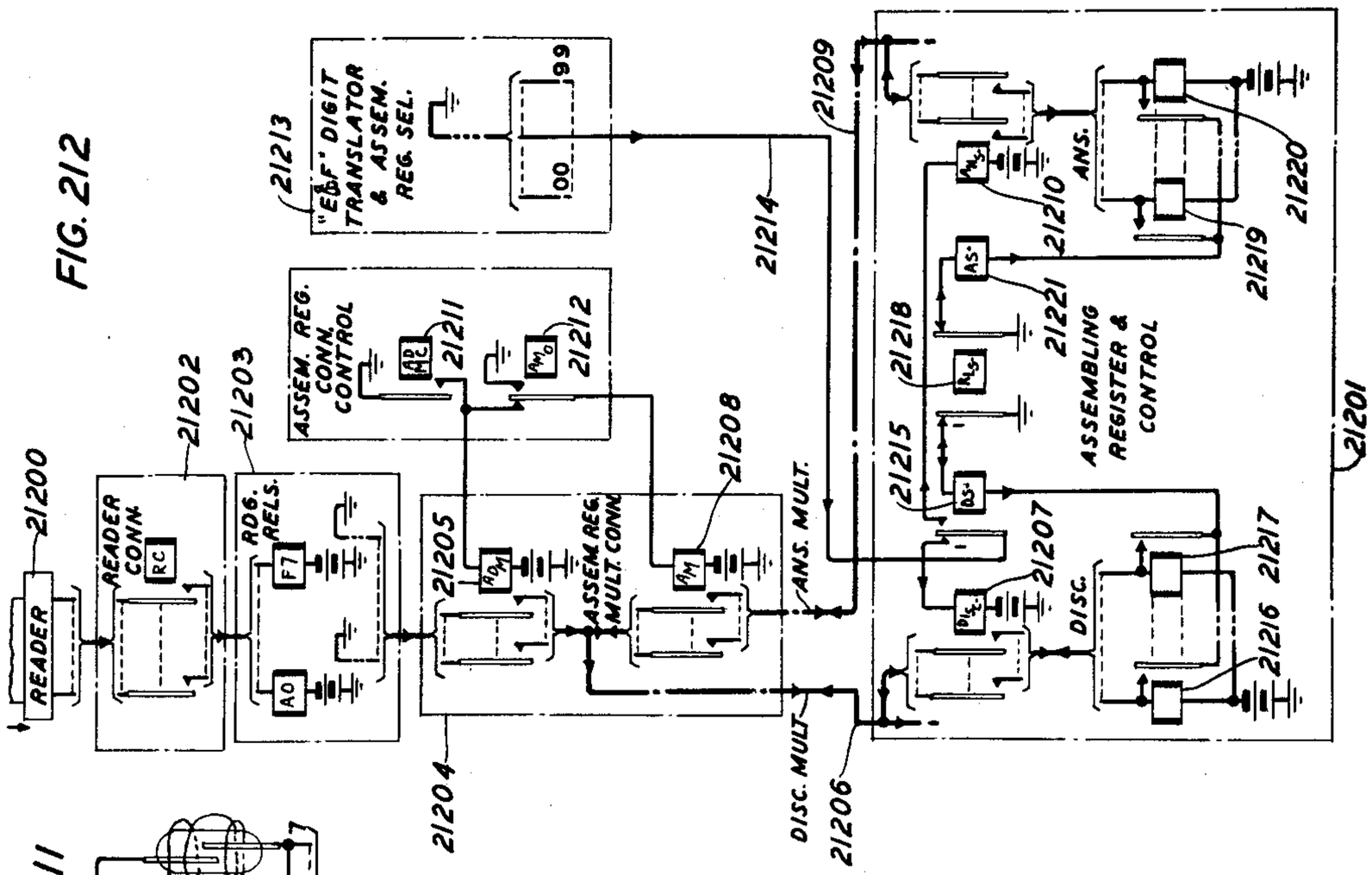


FIG. 211

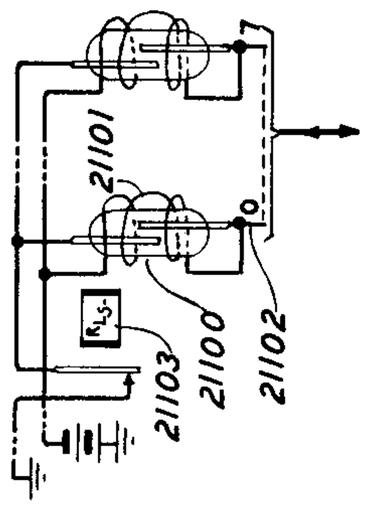
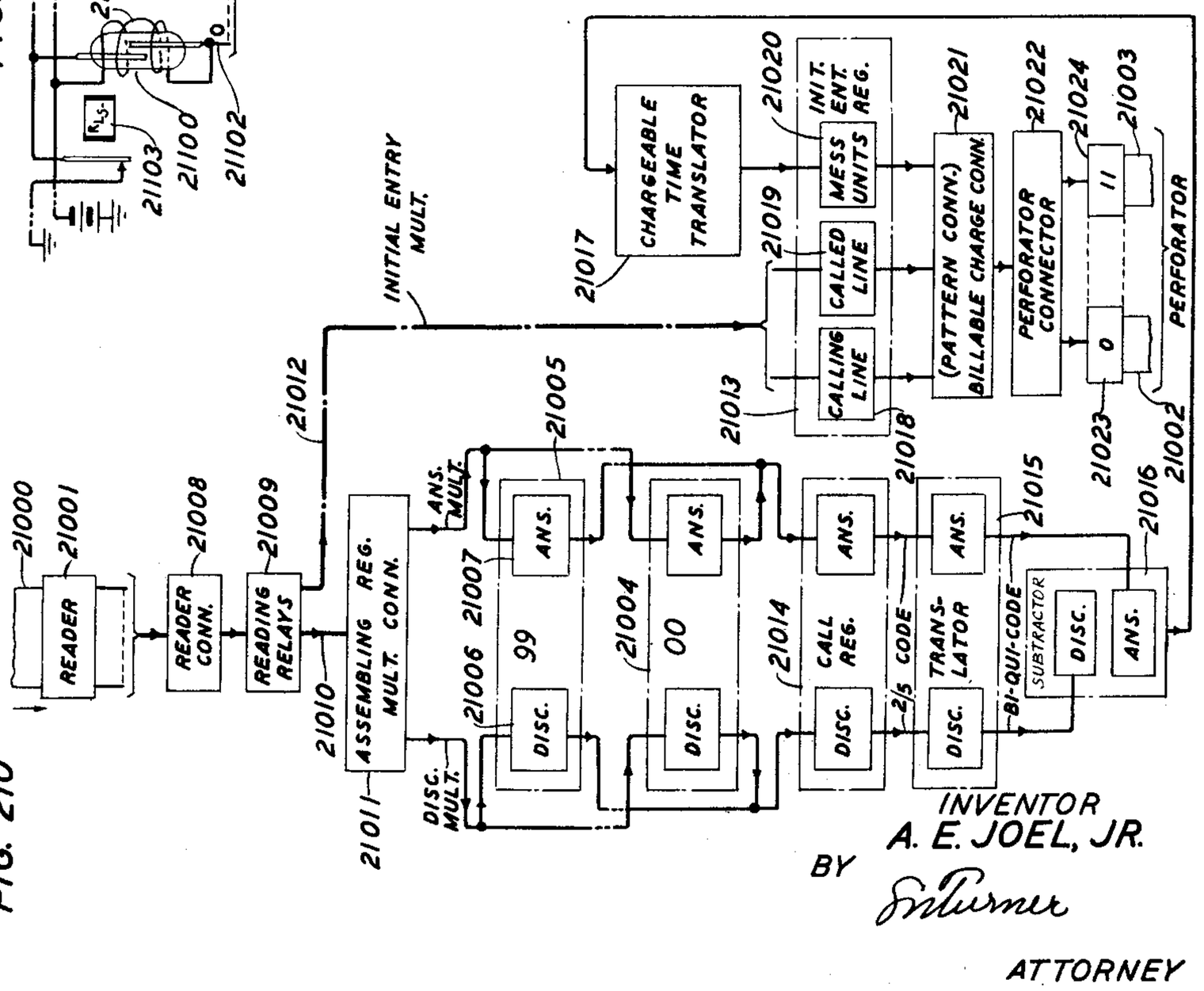


FIG. 210



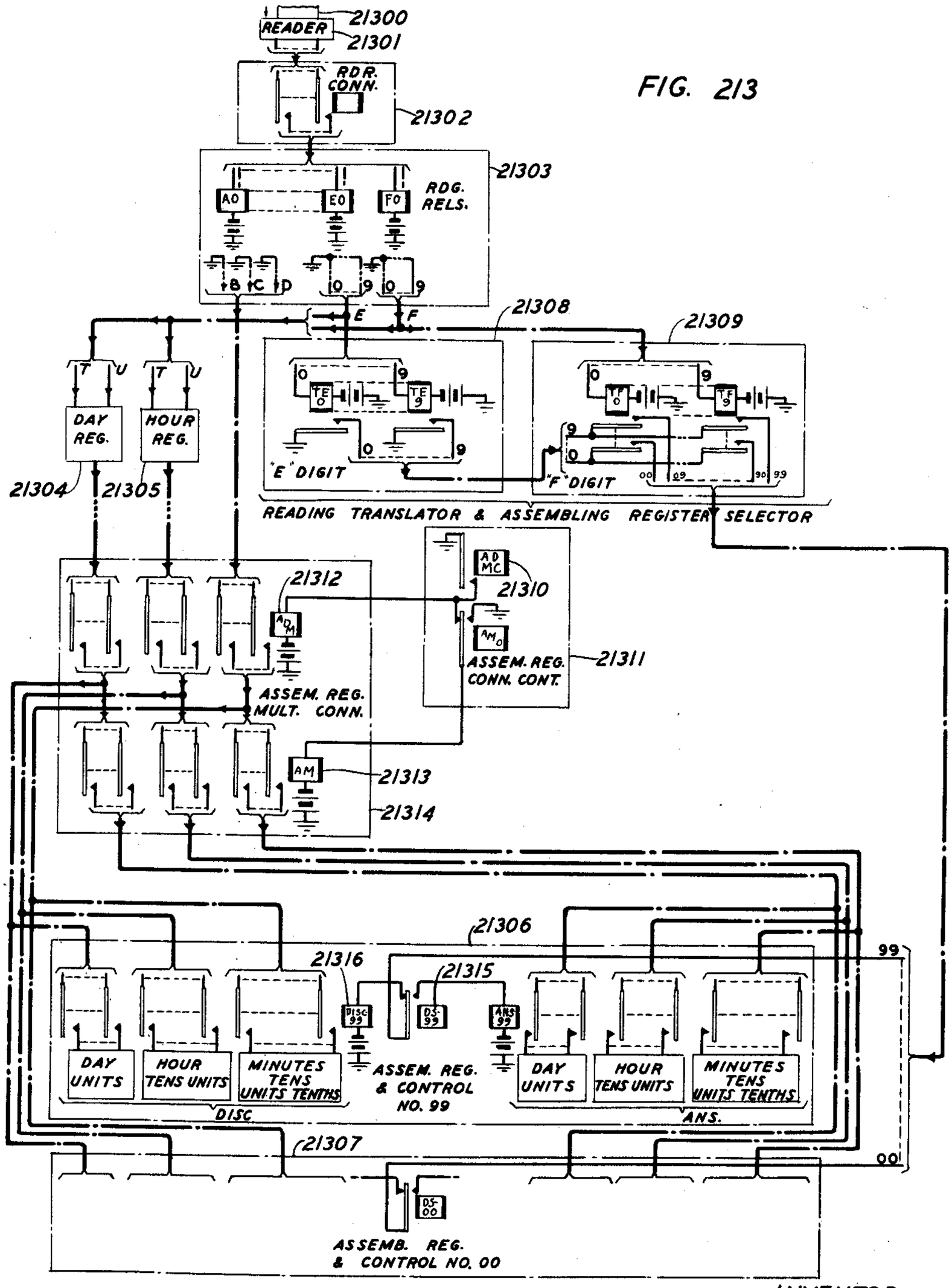
INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 210

FIG. 213



INVENTOR
A. E. JOEL, JR.

BY S. Turner

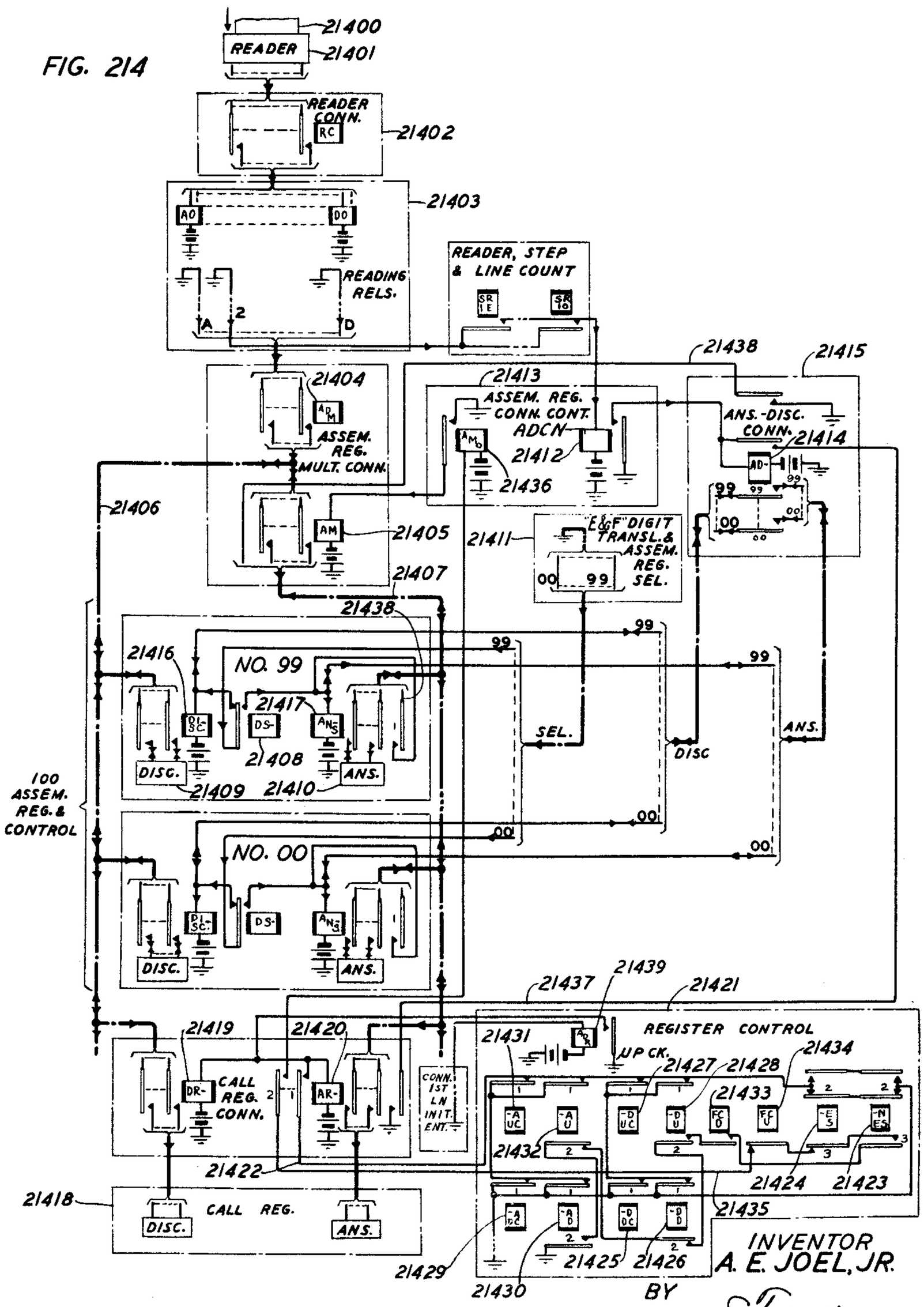
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 211

FIG. 214

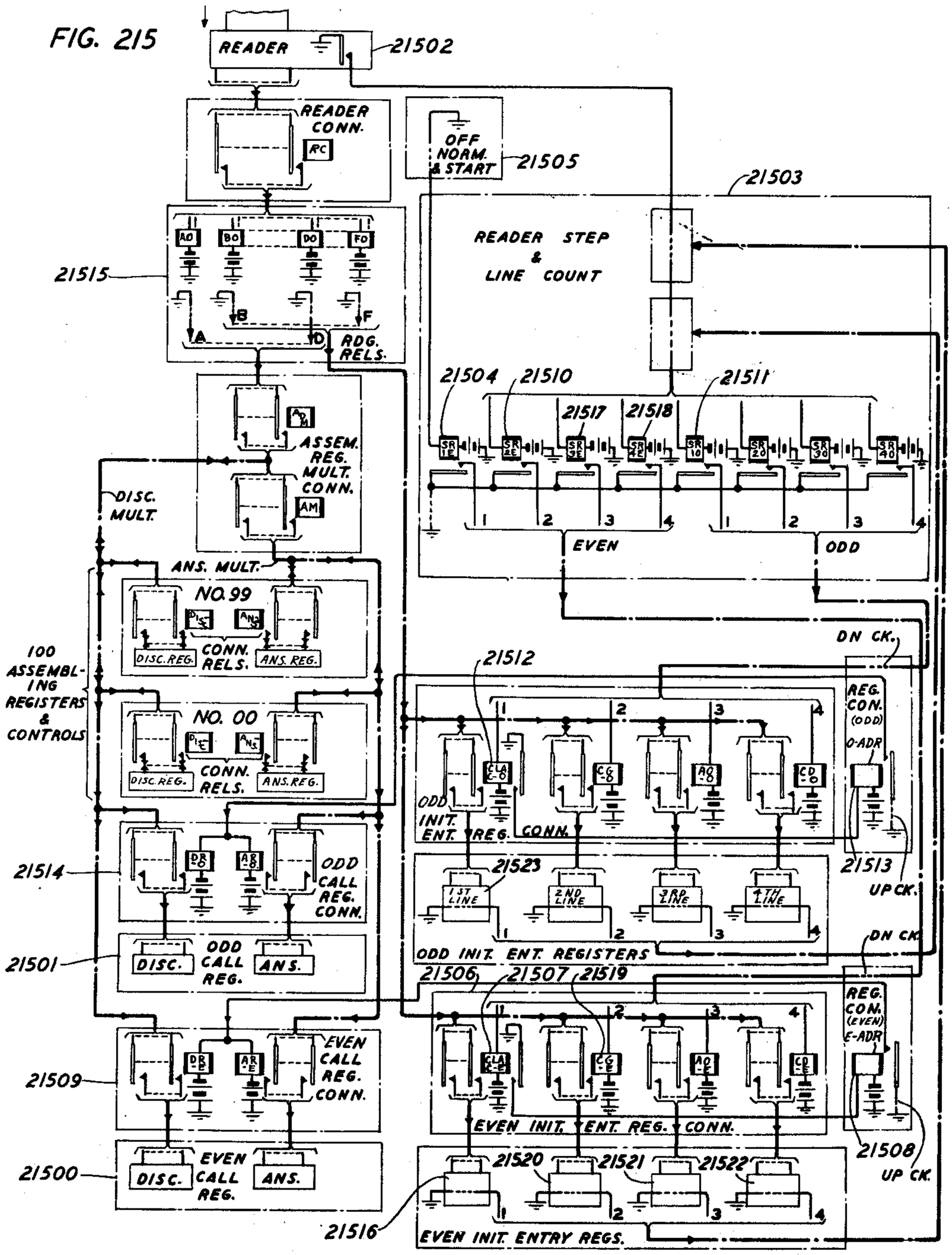


Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 212

FIG. 215



INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 213

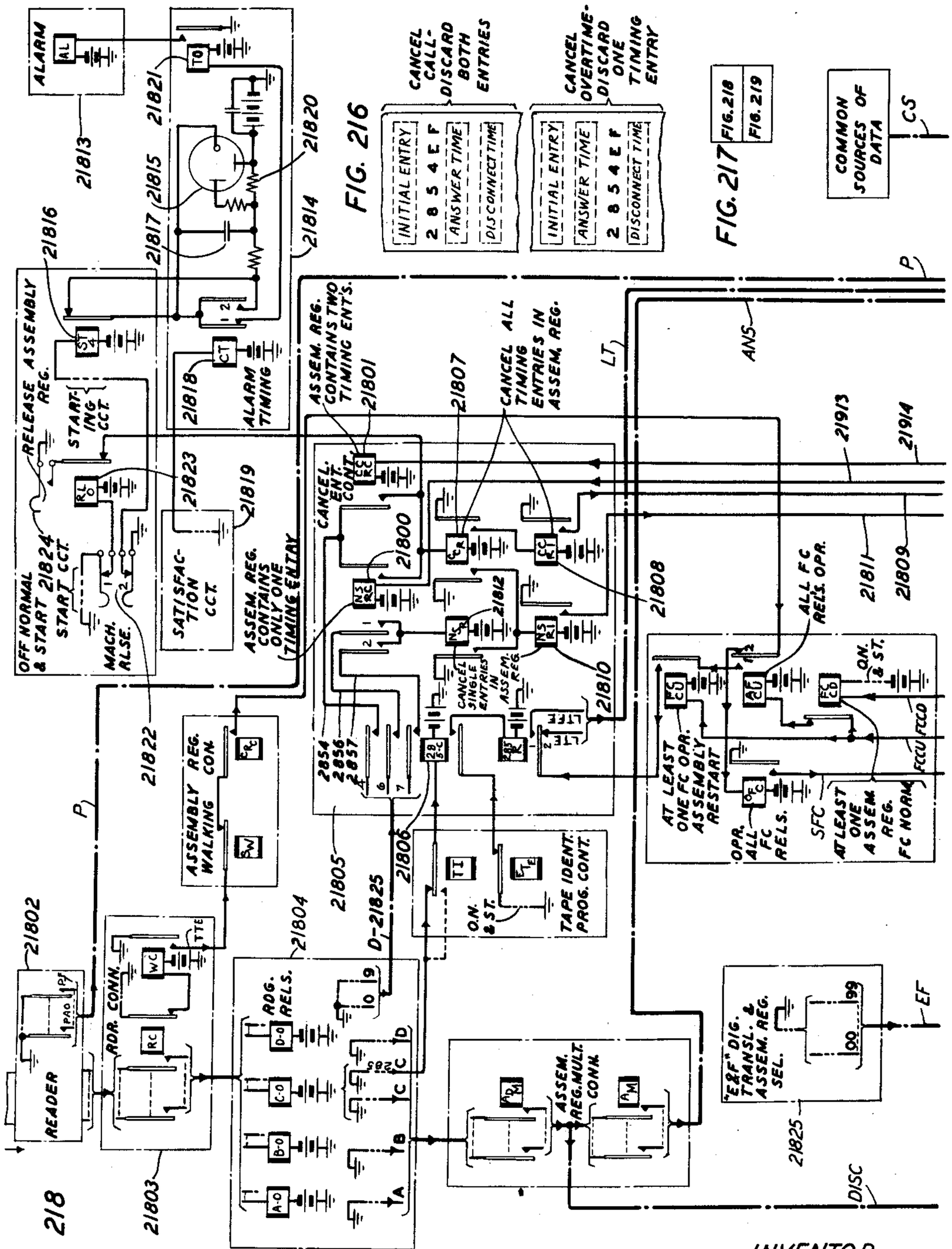


FIG. 218

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 214

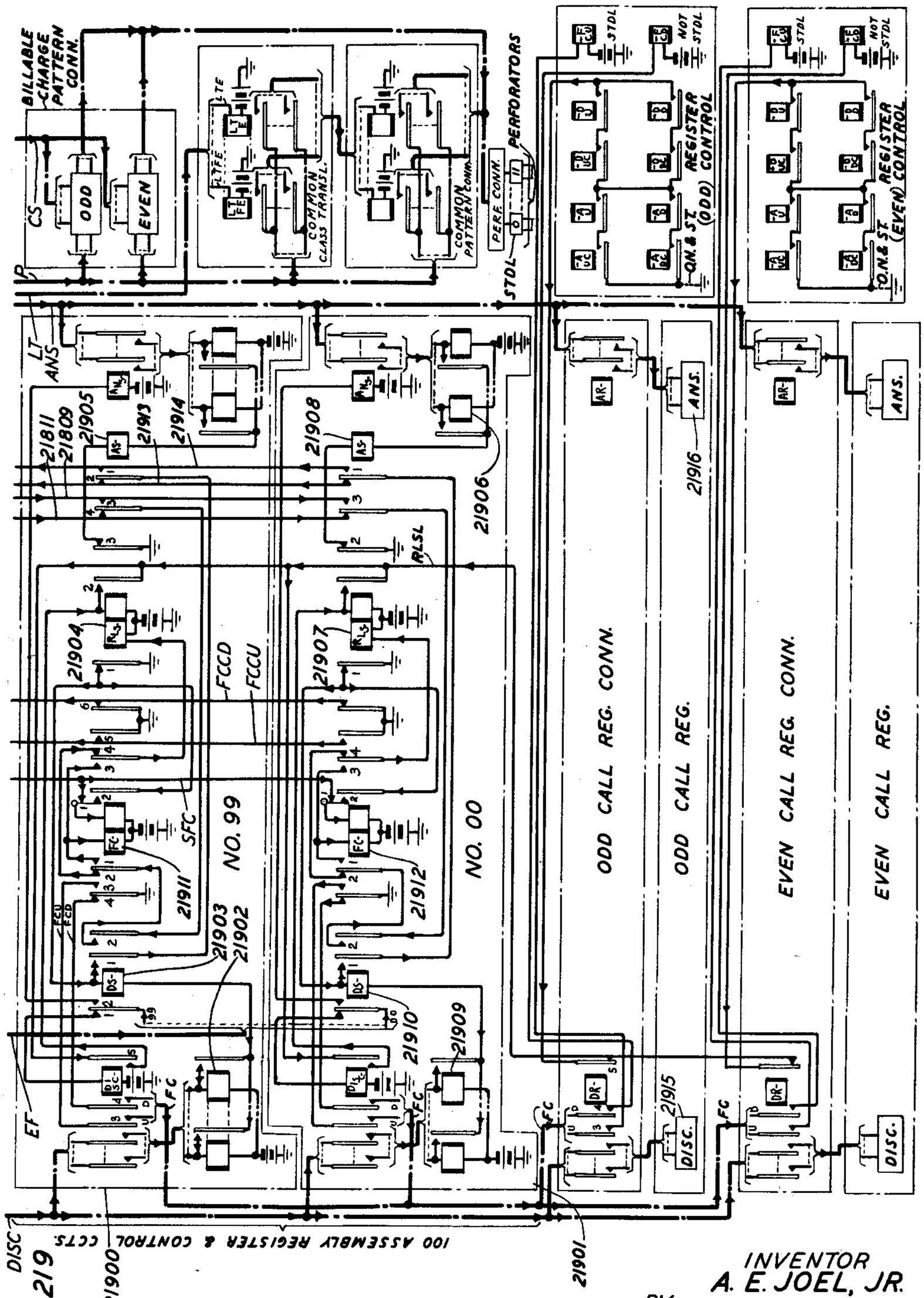


FIG. 219

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 215

FIG. 220

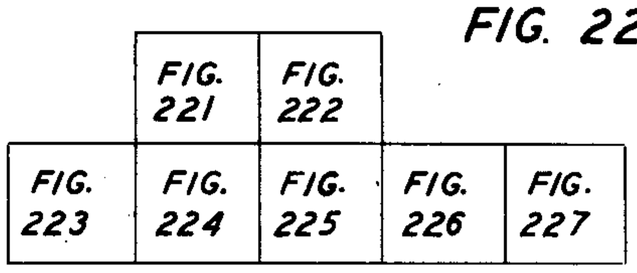


FIG. 221

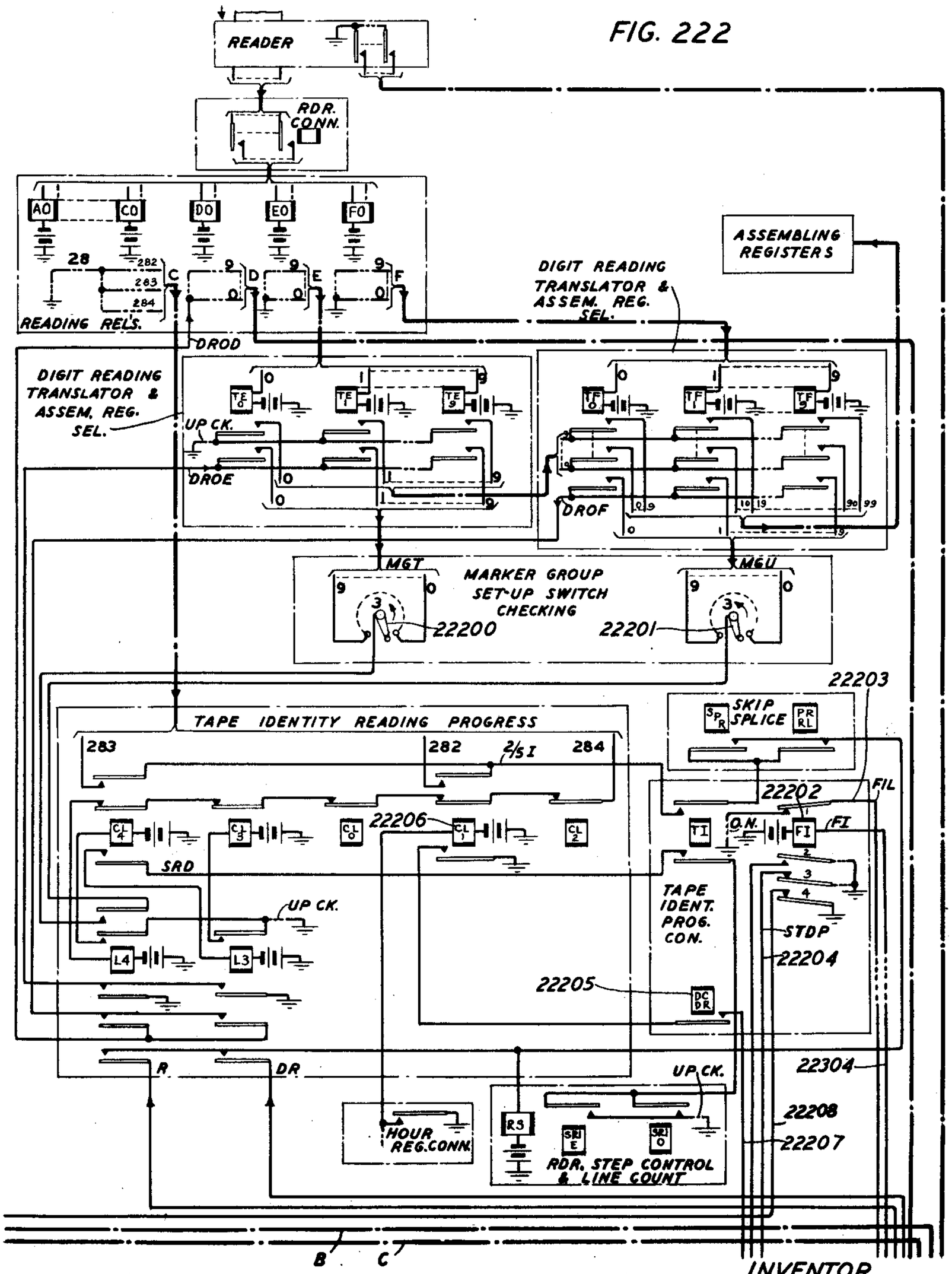
INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 216

FIG. 222



INVENTOR
A. E. JOEL, JR.
BY
Fitzpatrick Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 217

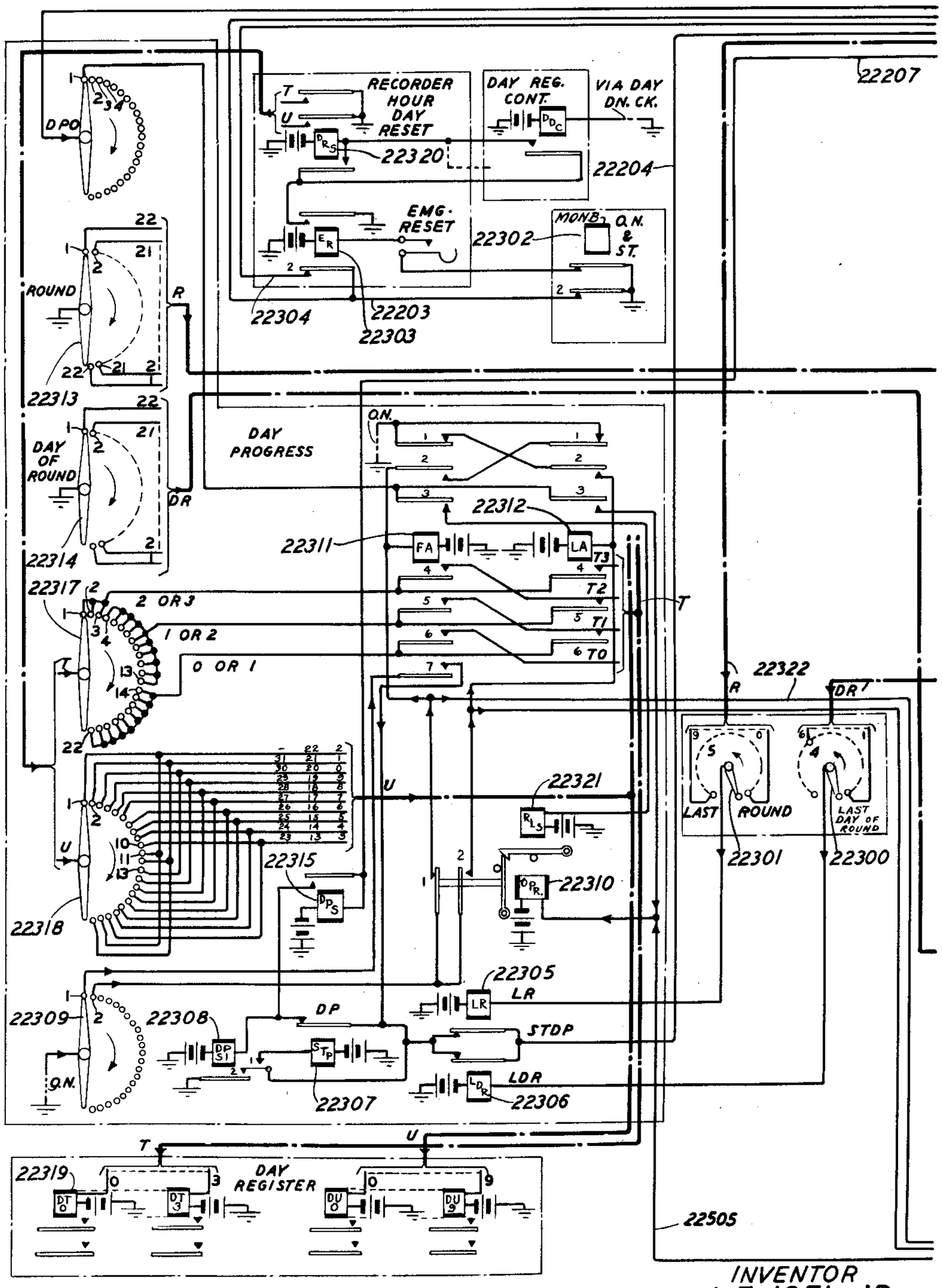


FIG. 223

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 218

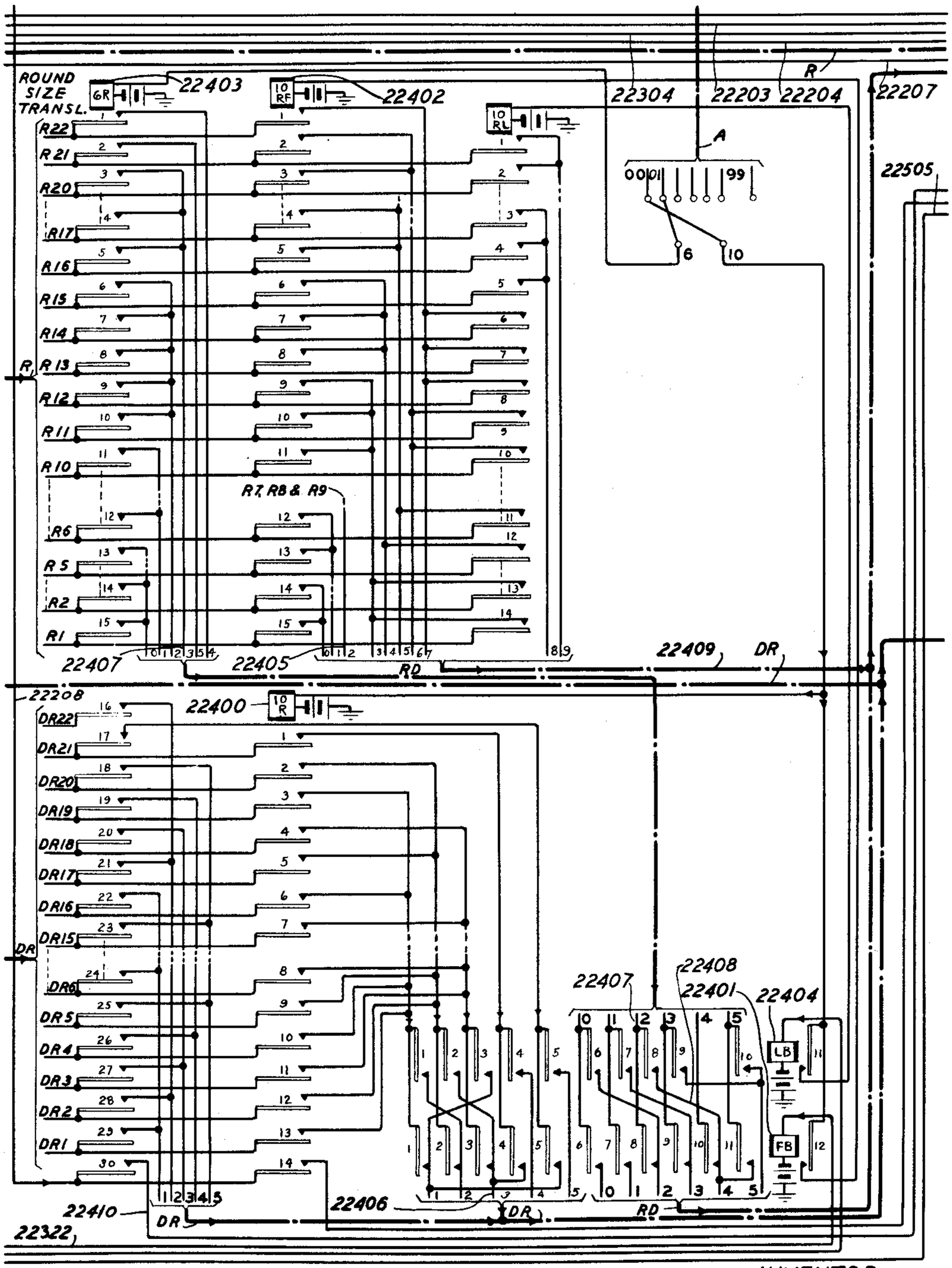


FIG. 224

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 219

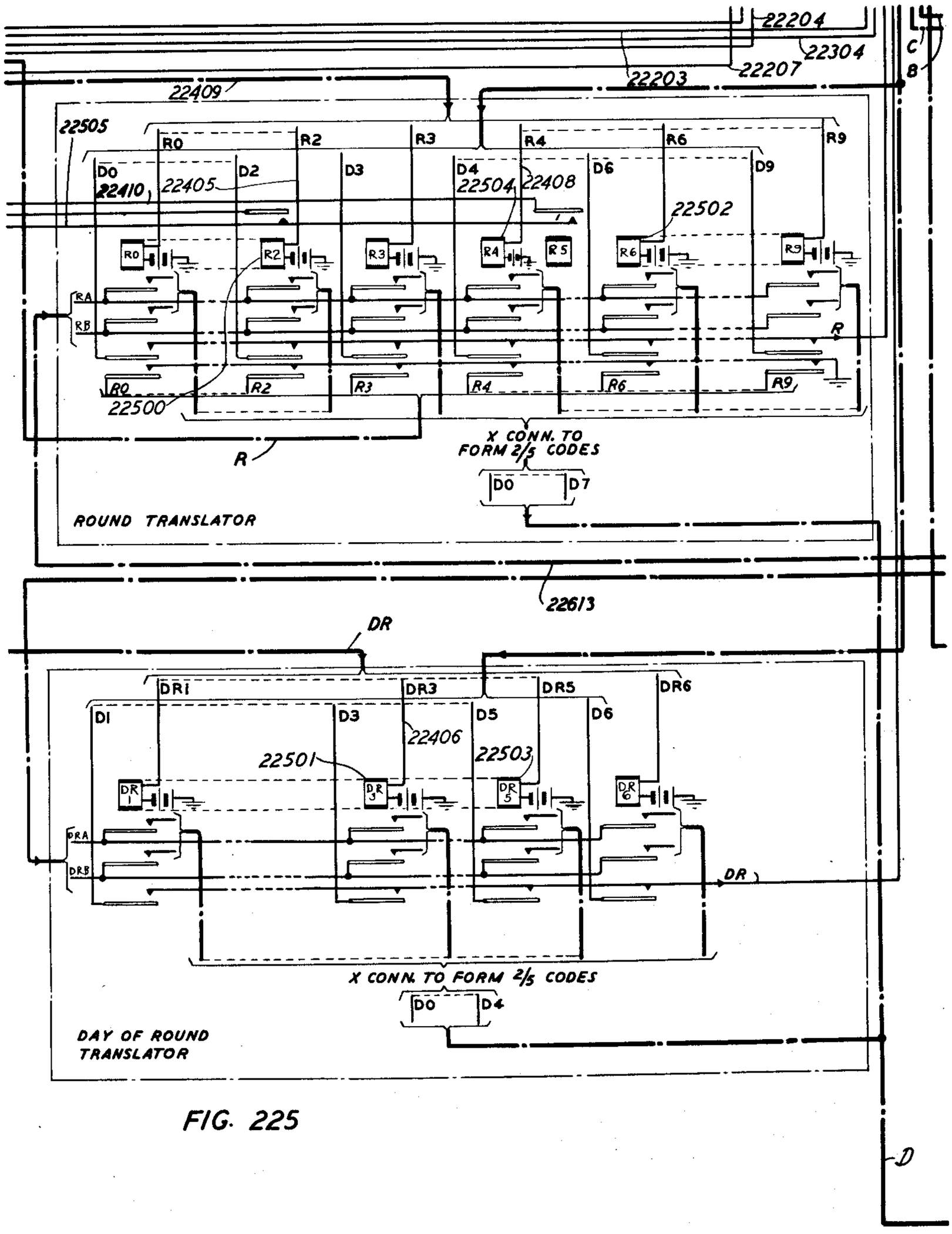


FIG. 225

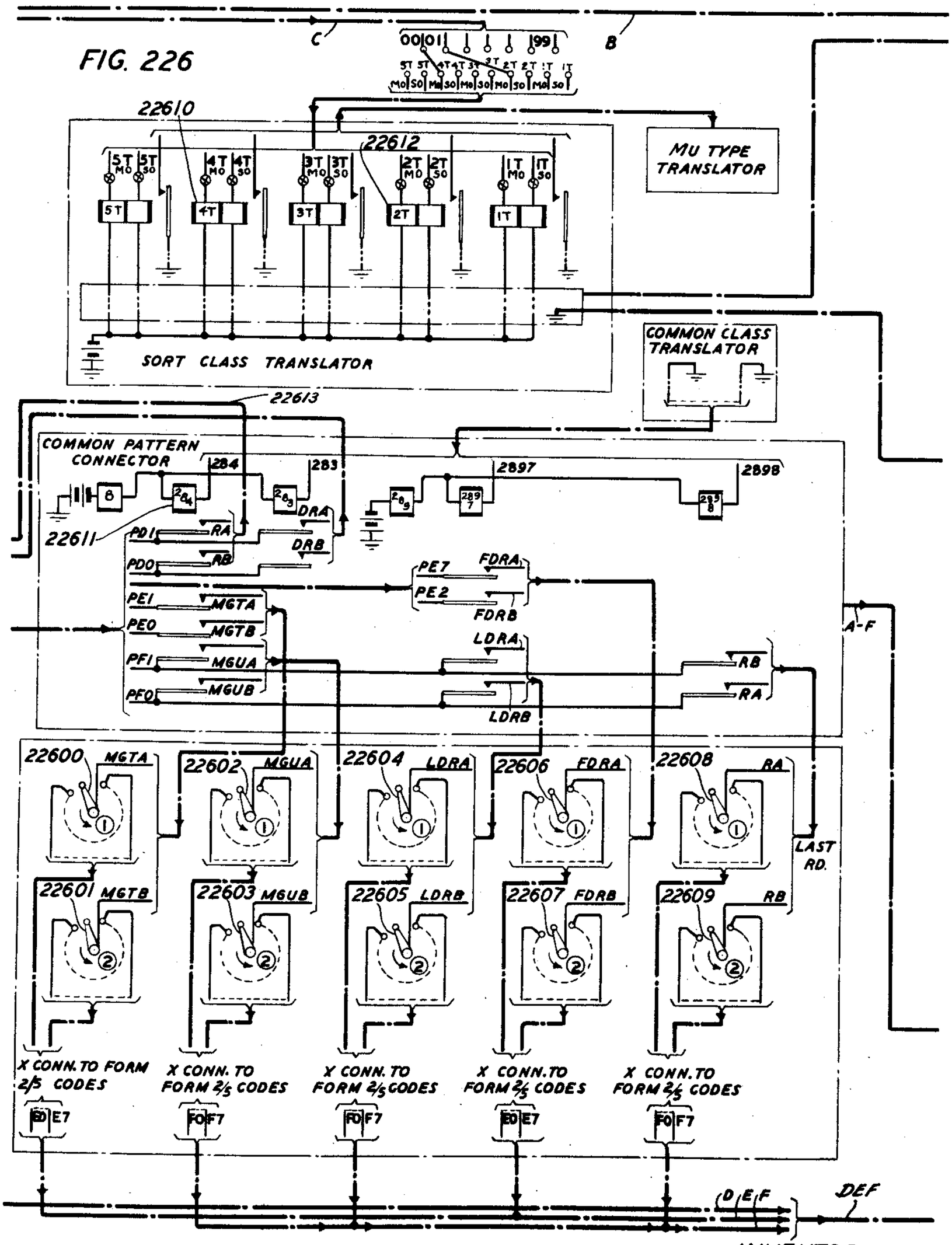
INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 220

FIG. 226



INVENTOR
A. E. JOEL, JR.

BY Silverner

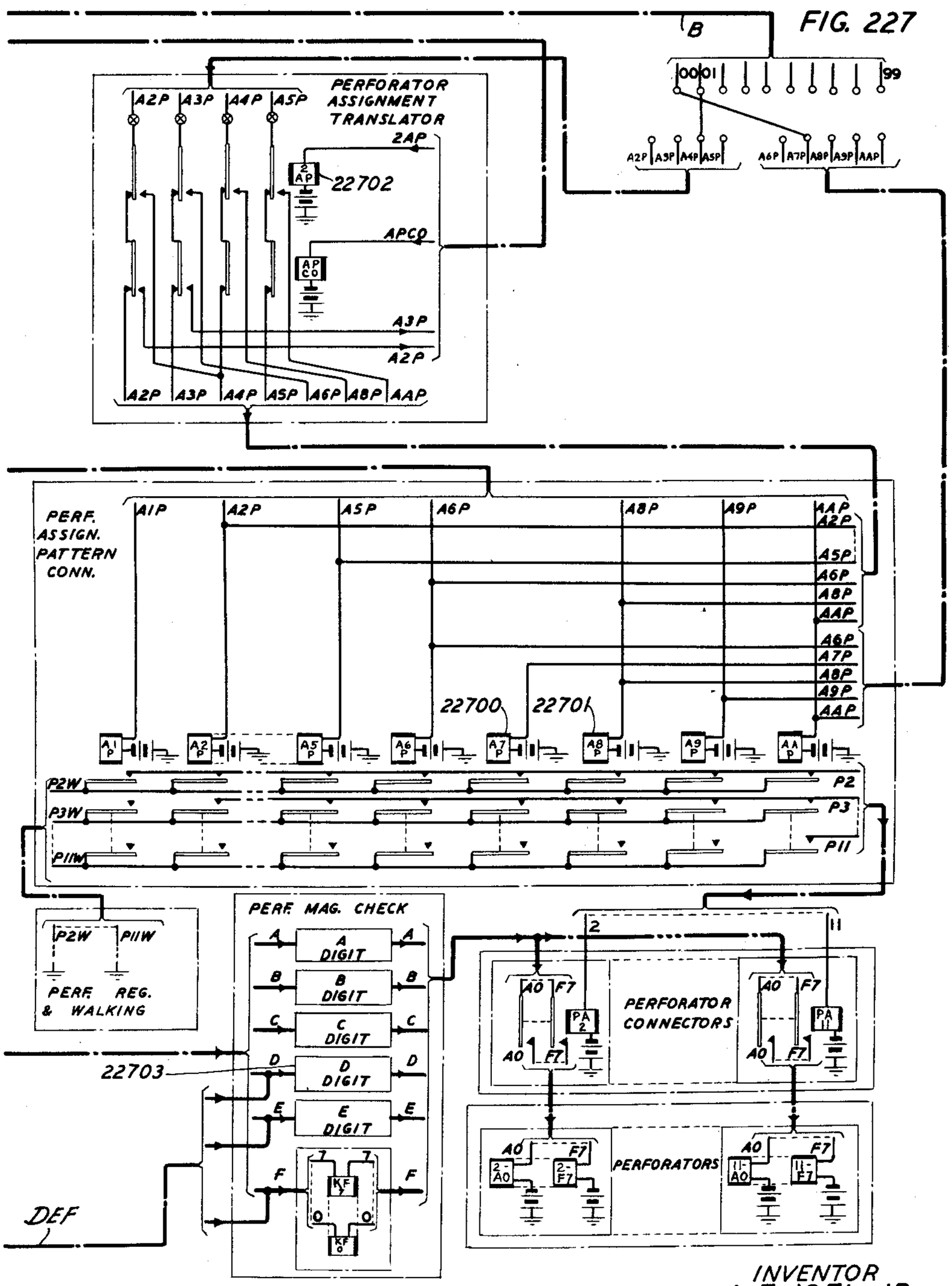
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 221

FIG. 227



INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

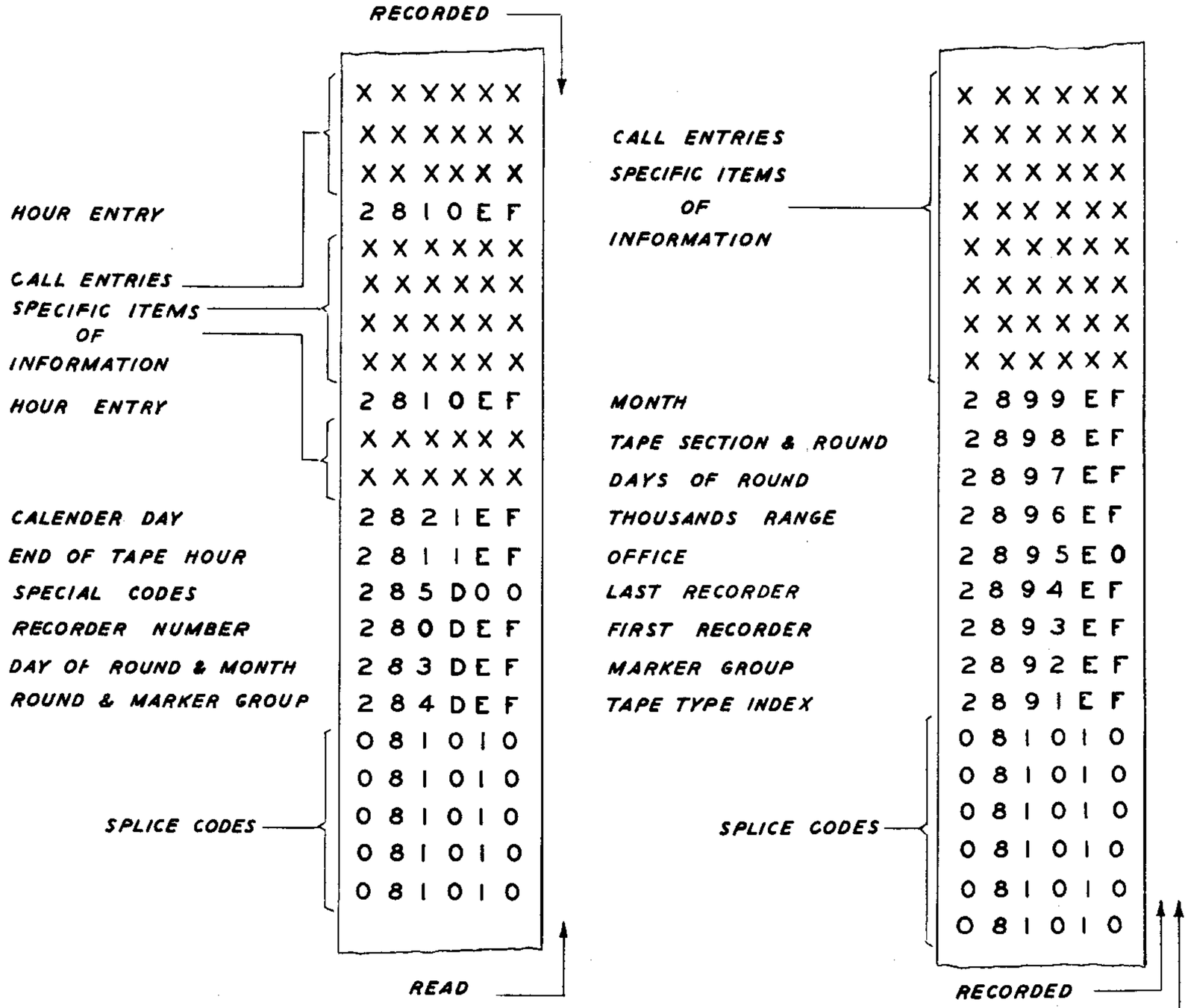
ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 222

FIG. 228

FIG. 229



INVENTOR
A. E. JOEL, JR.
BY Sturner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR.

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 223

FIG. 230

	FIG. 231	FIG. 232
FIG. 233	FIG. 234	FIG. 235

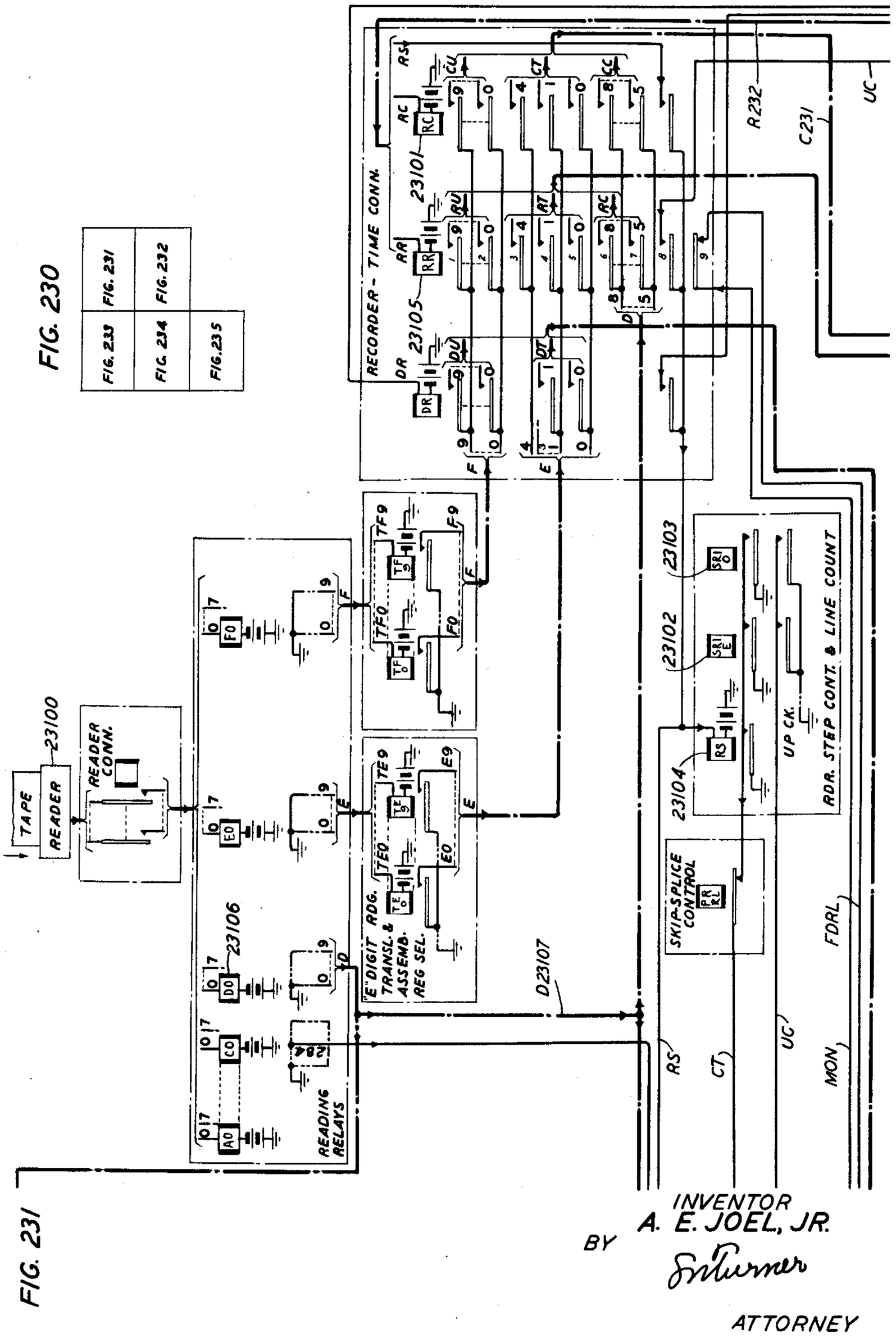


FIG. 231

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 224

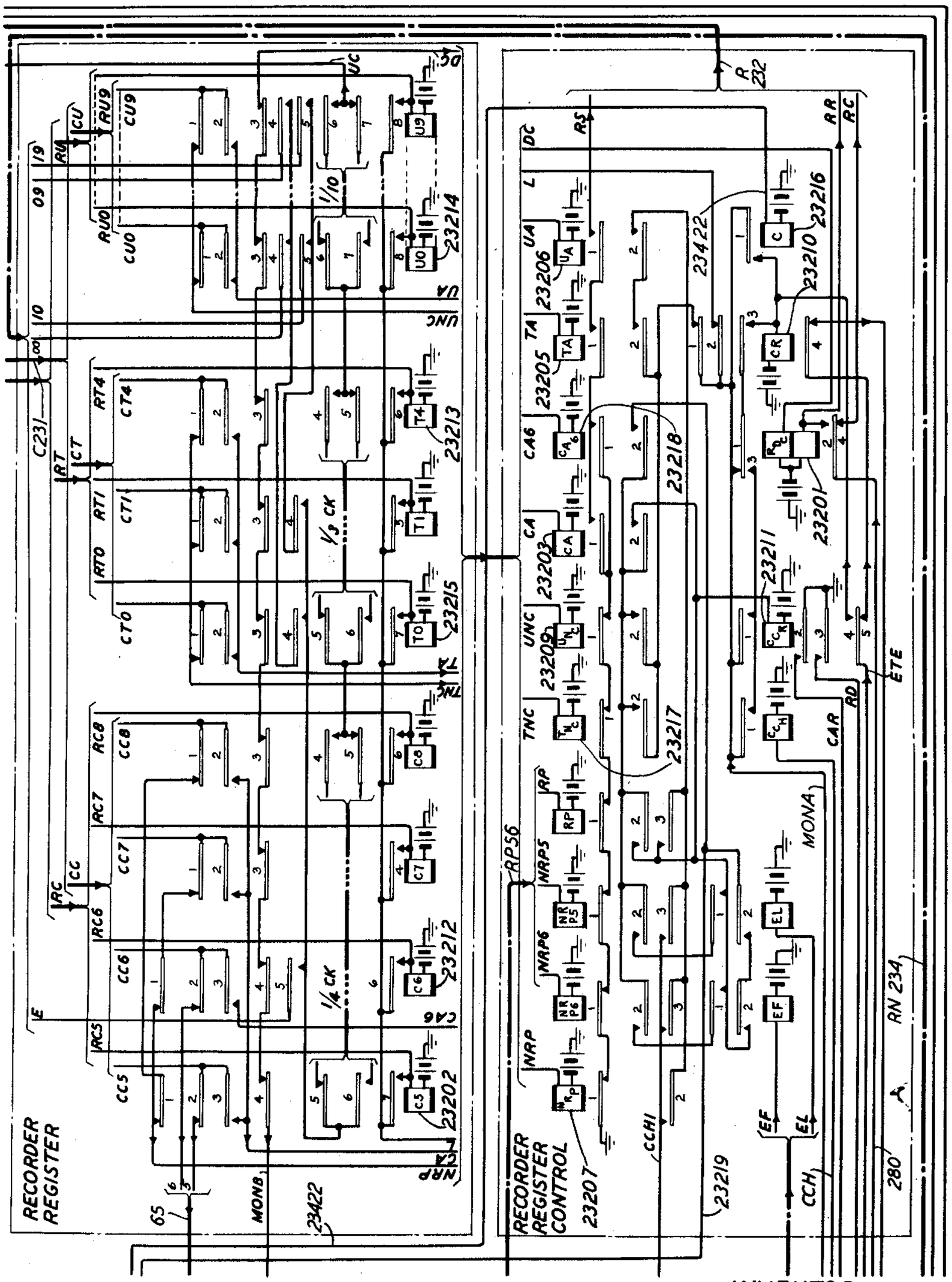


FIG. 232

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 225

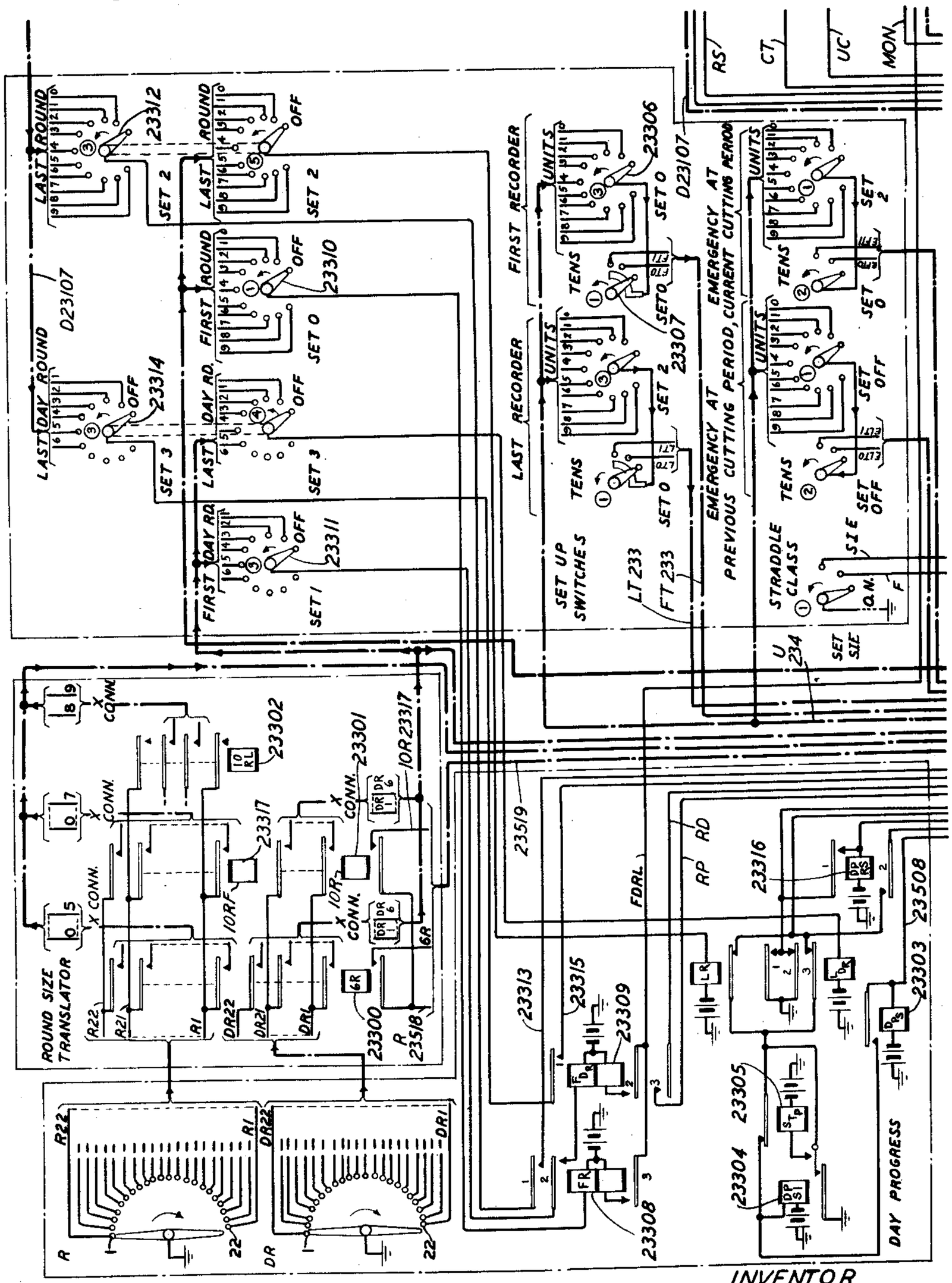


FIG. 233

INVENTOR
A. E. JOEL, JR.

BY

S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 226

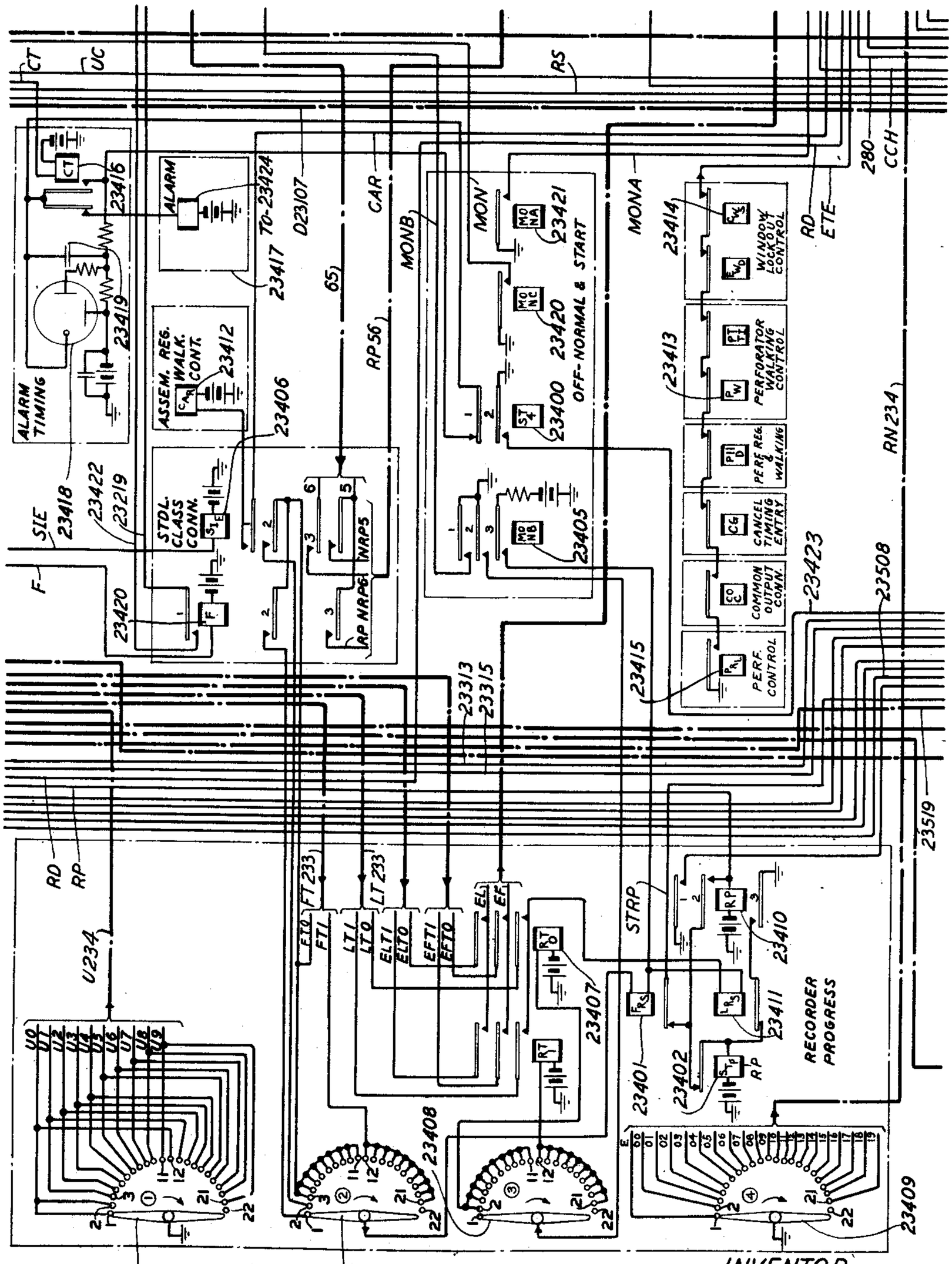


FIG. 234

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 227

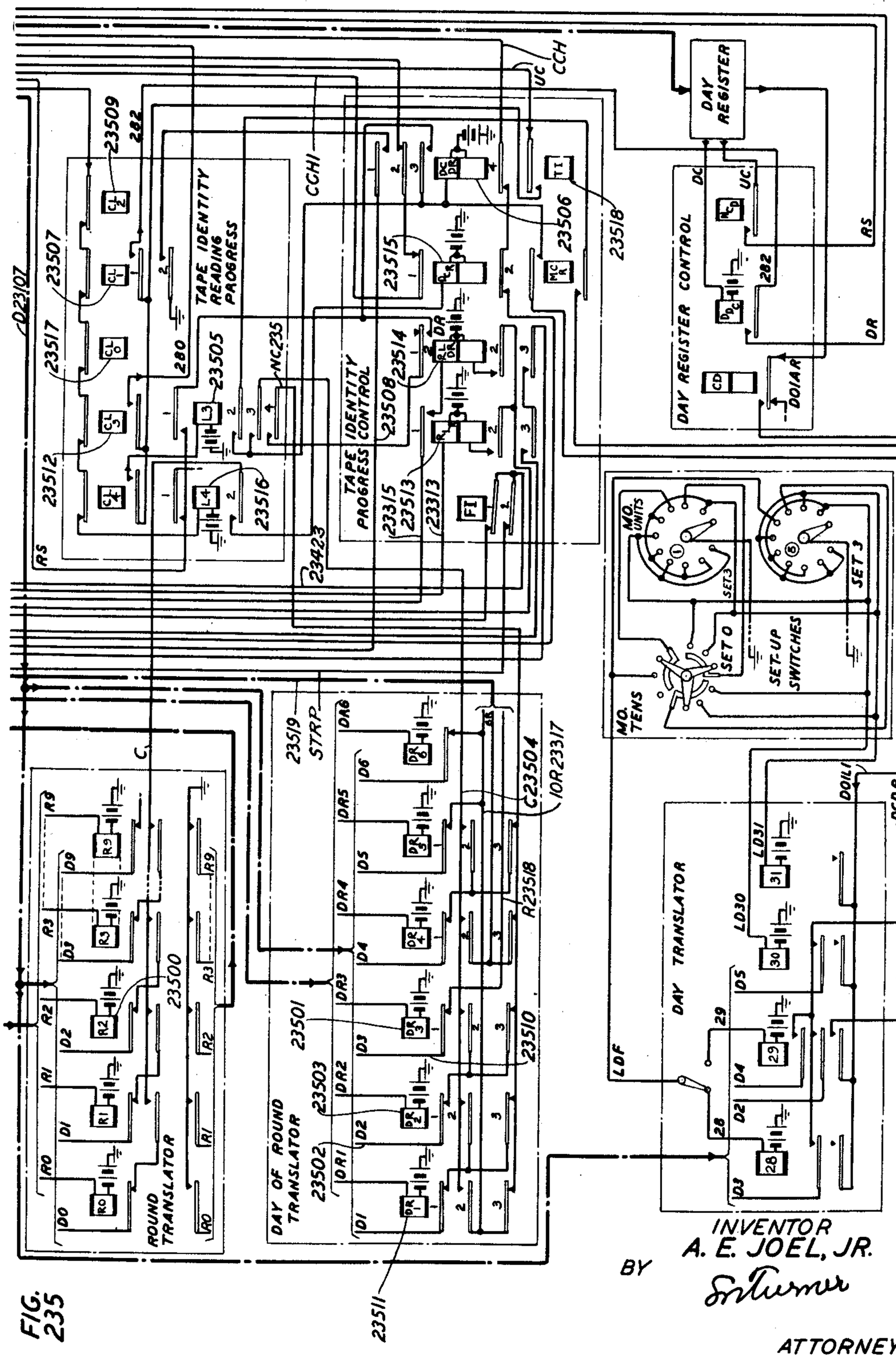


FIG. 235

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 228

FIG. 236

CENTRAL OFFICE TAPE
READ UPWARDLY

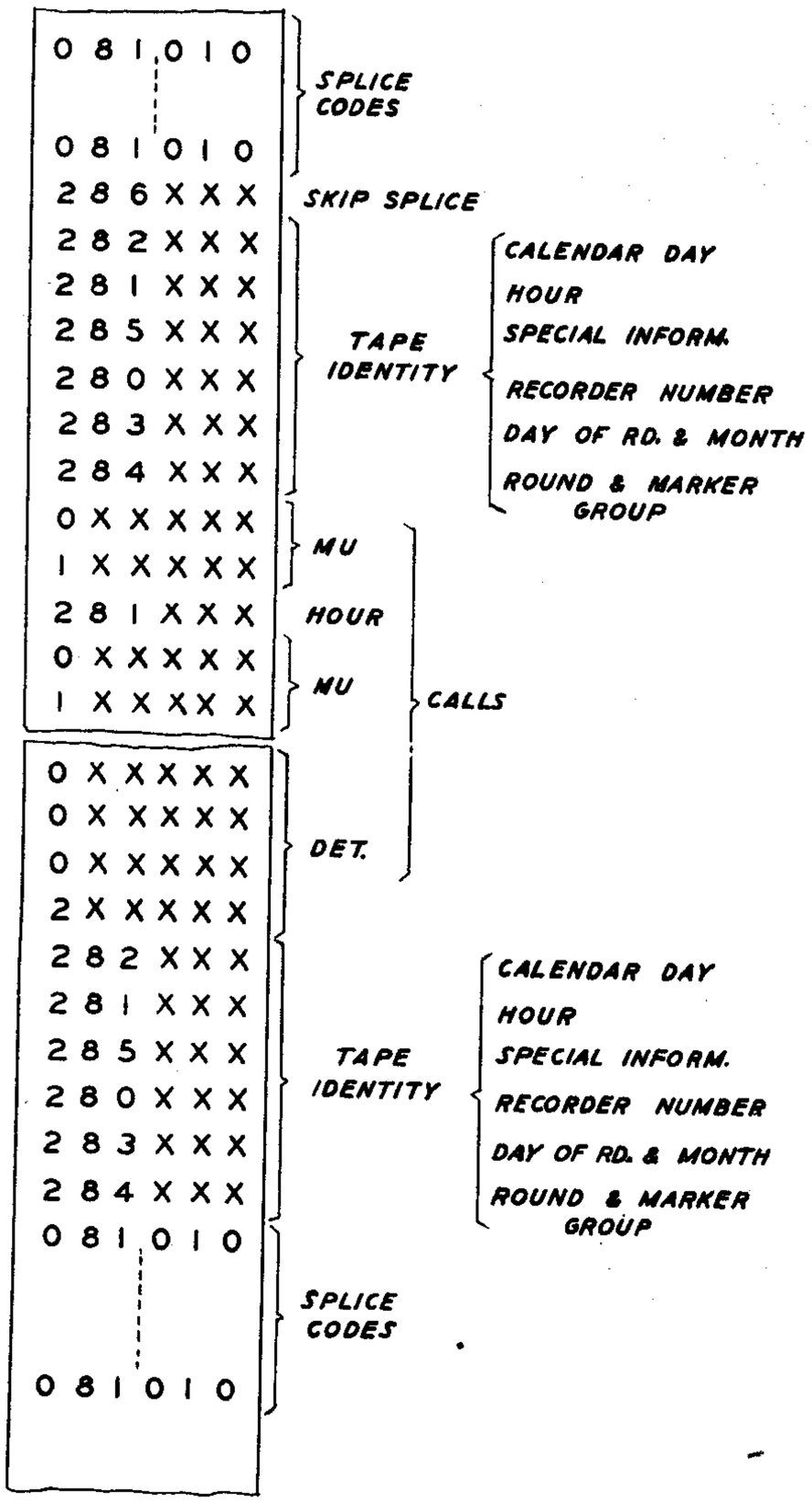


FIG. 237

081010

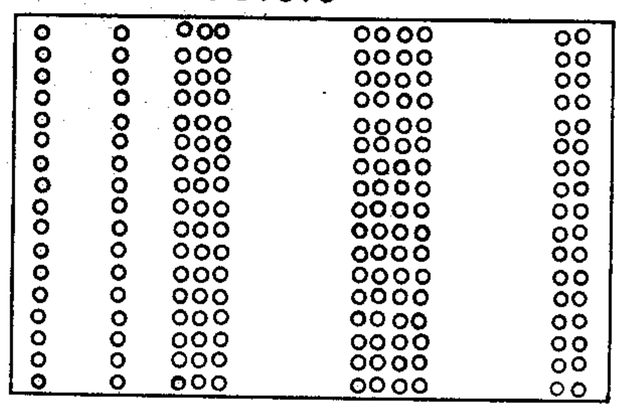


FIG. 238

080002

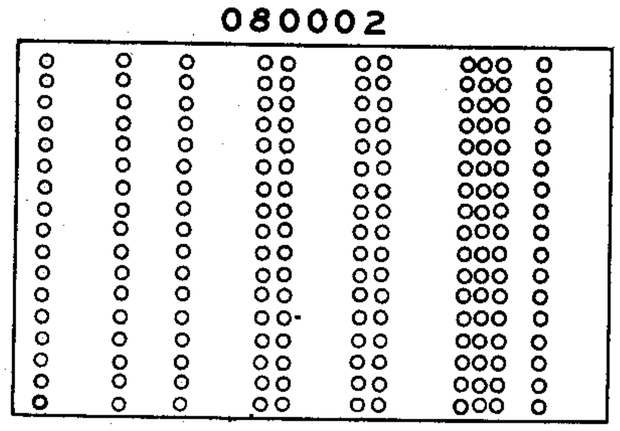
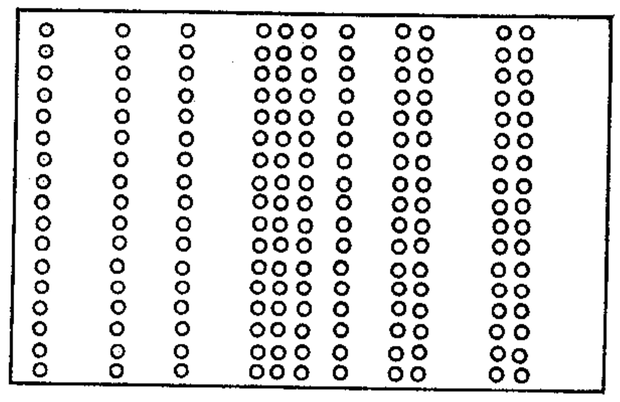


FIG. 239

080211



INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 229

FIG. 240

FIG. 241 FIG. 242	FIG. 243 FIG 244 FIG. 245
	FIG. 246 FIG. 247 FIG. 248

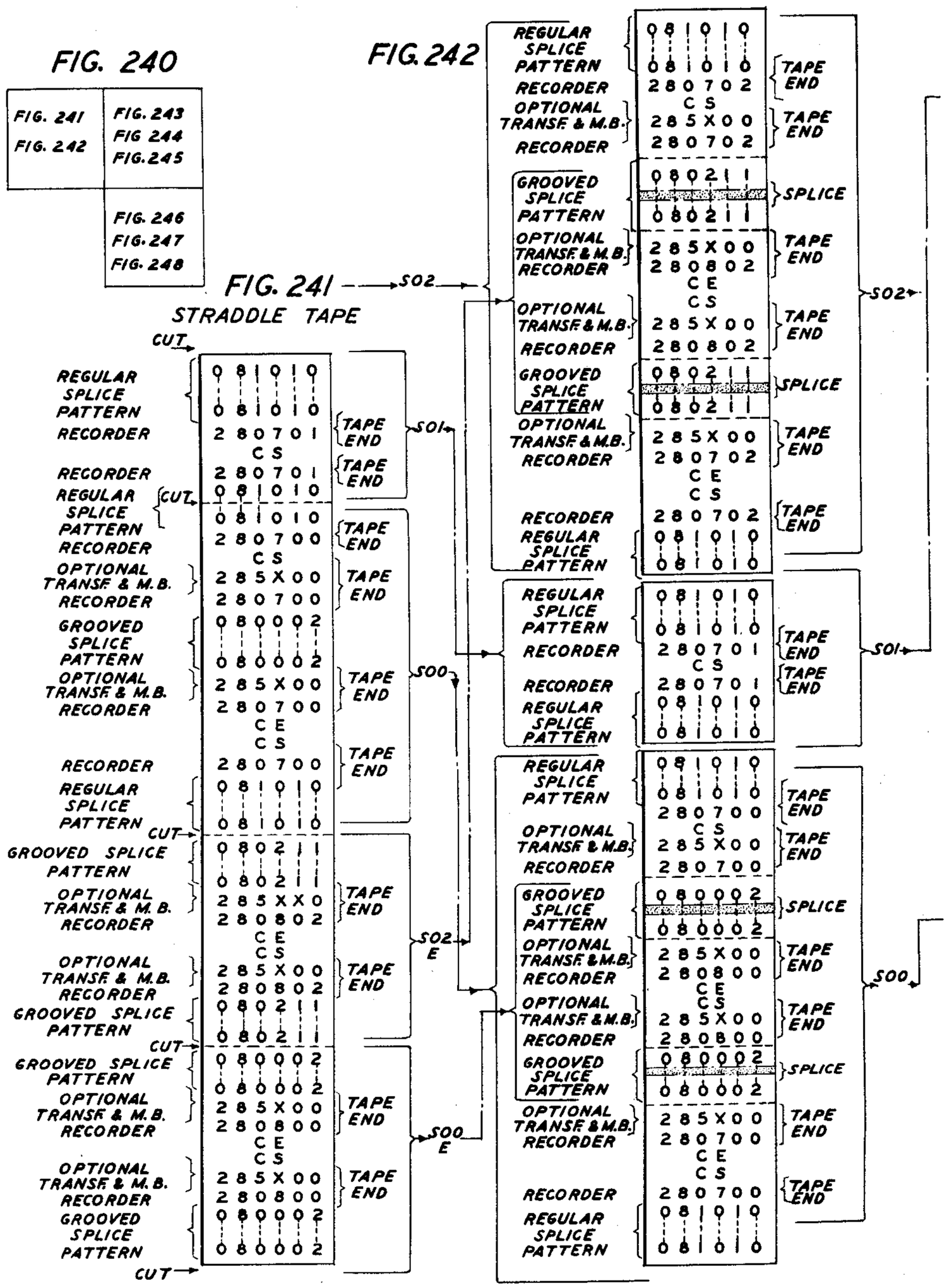


FIG. 242

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 230

FIG. 243

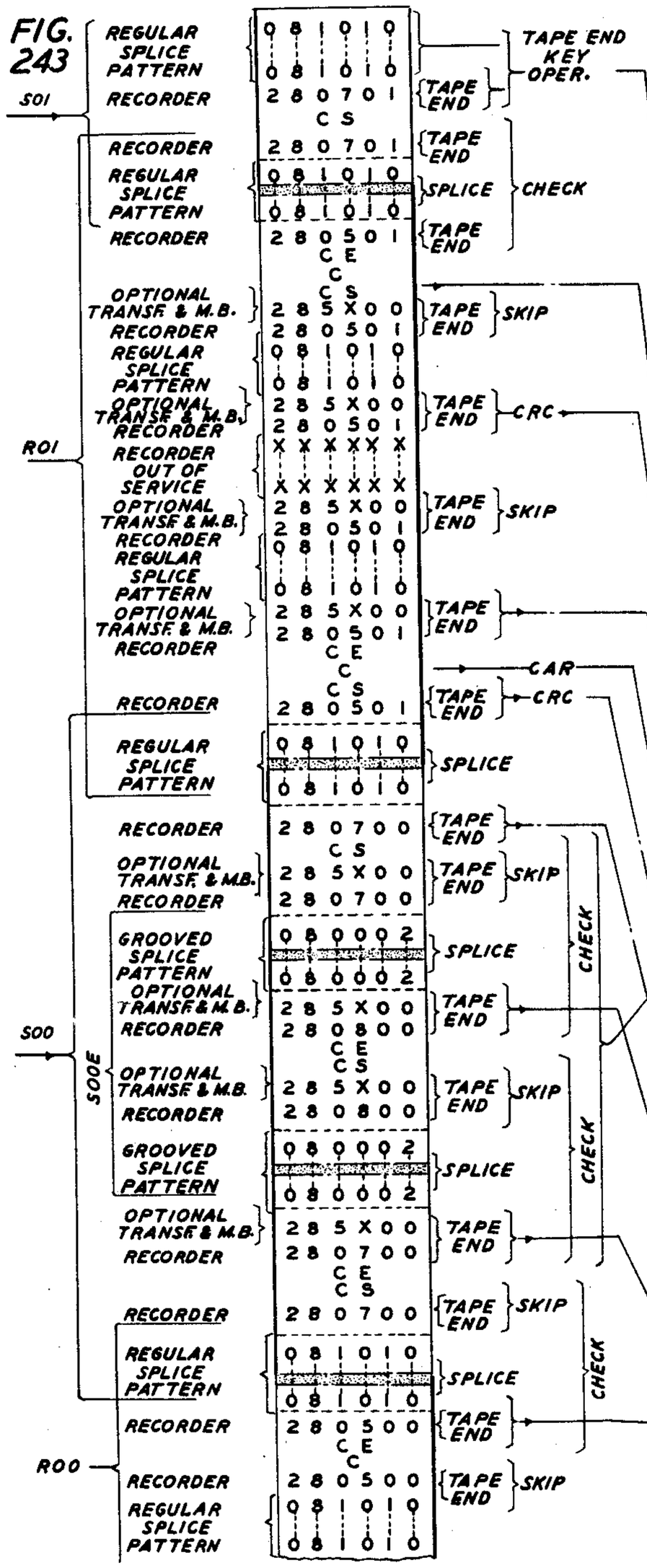


FIG. 244

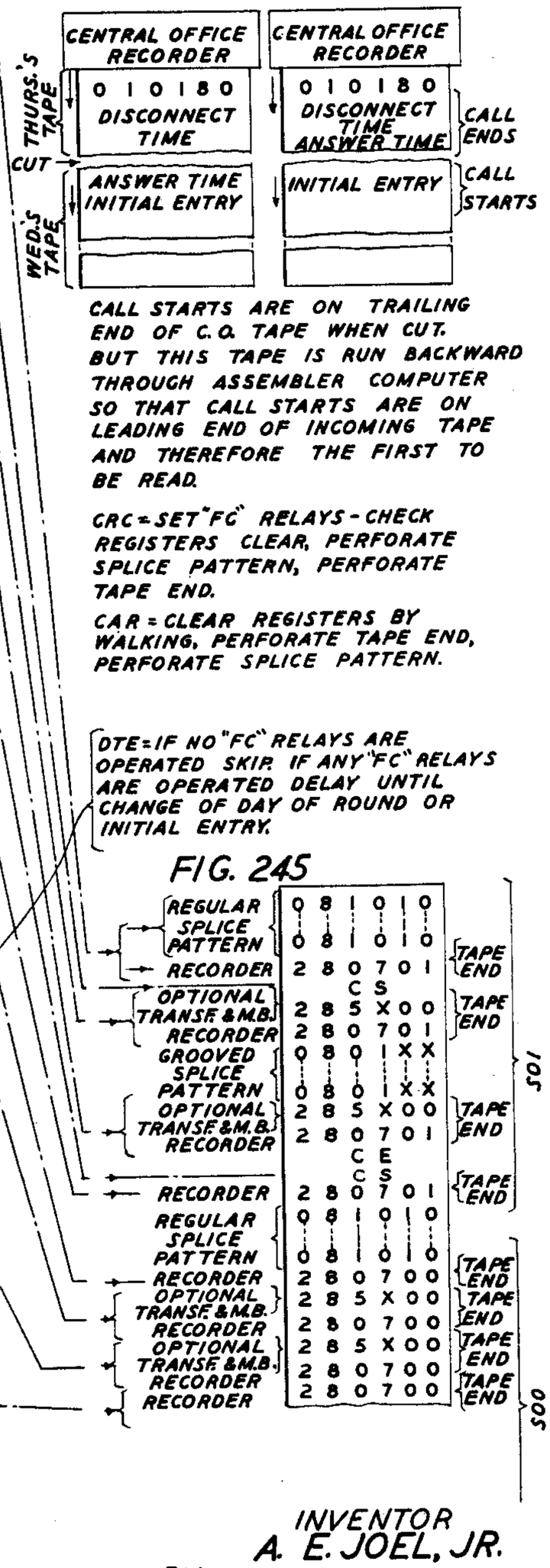


FIG. 245

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 231

FIG. 246

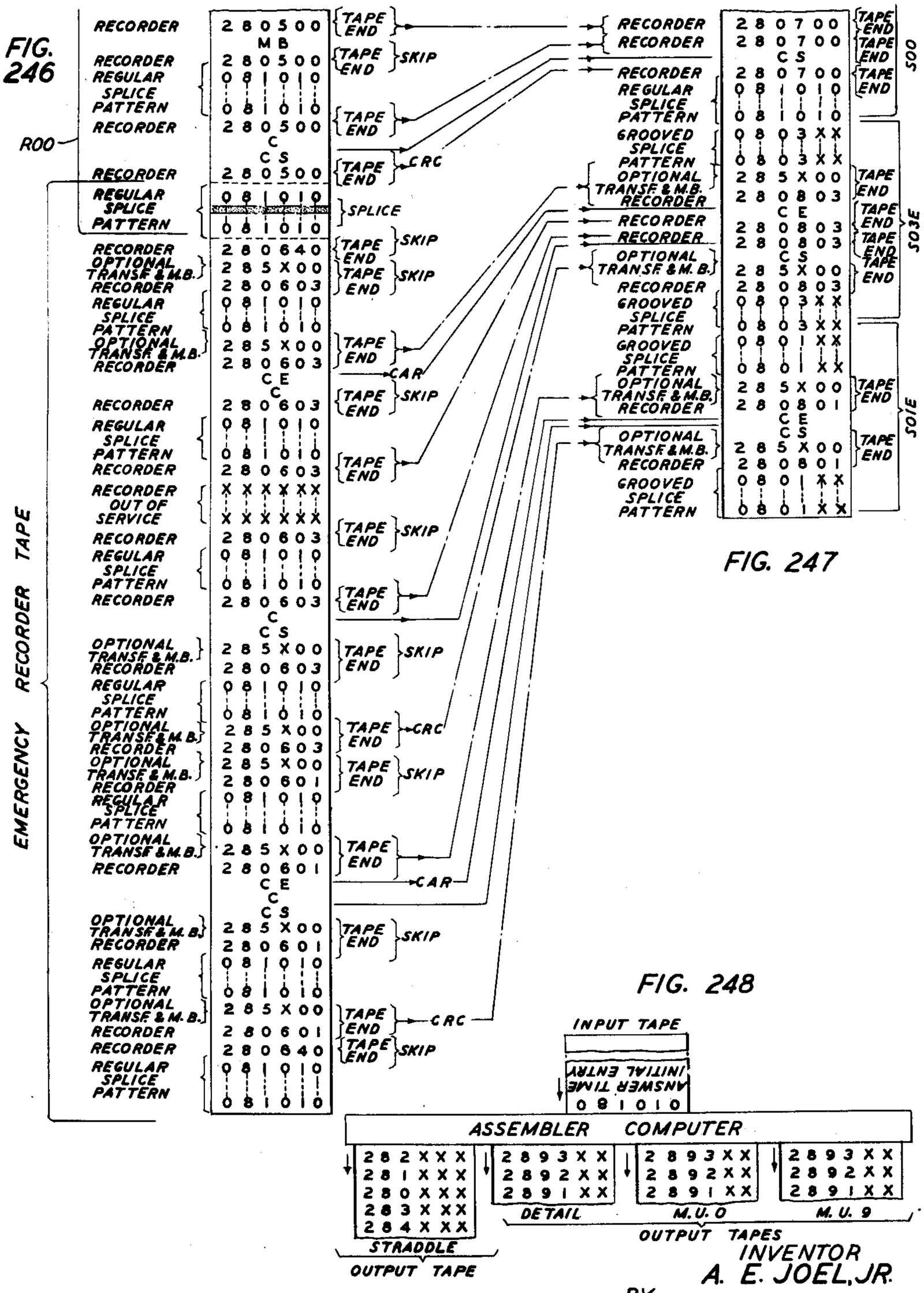


FIG. 247

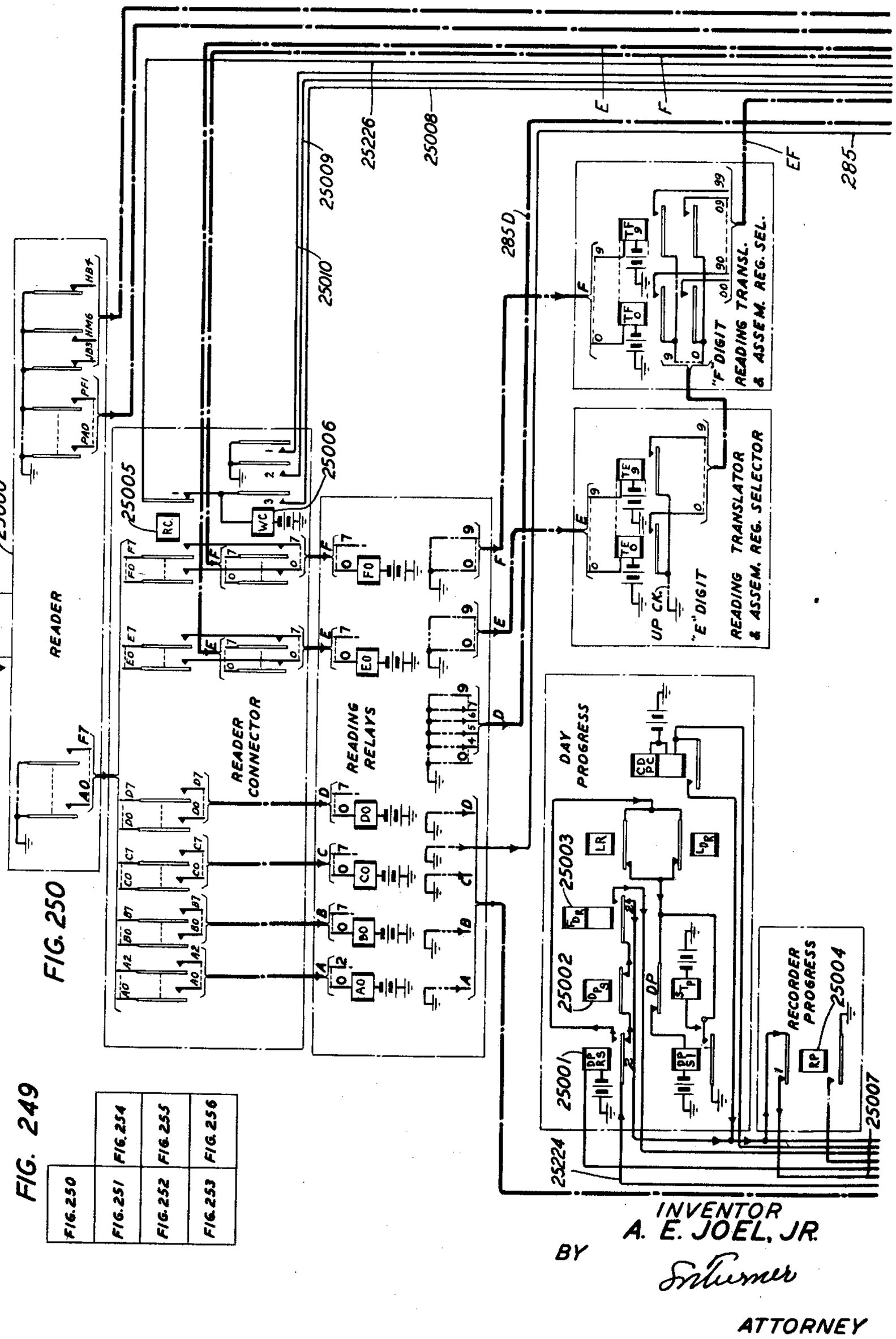
FIG. 248

INVENTOR
A. E. JOEL, JR.
BY
Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 232



INVENTOR
A. E. JOEL, JR.
BY
Schurmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 233

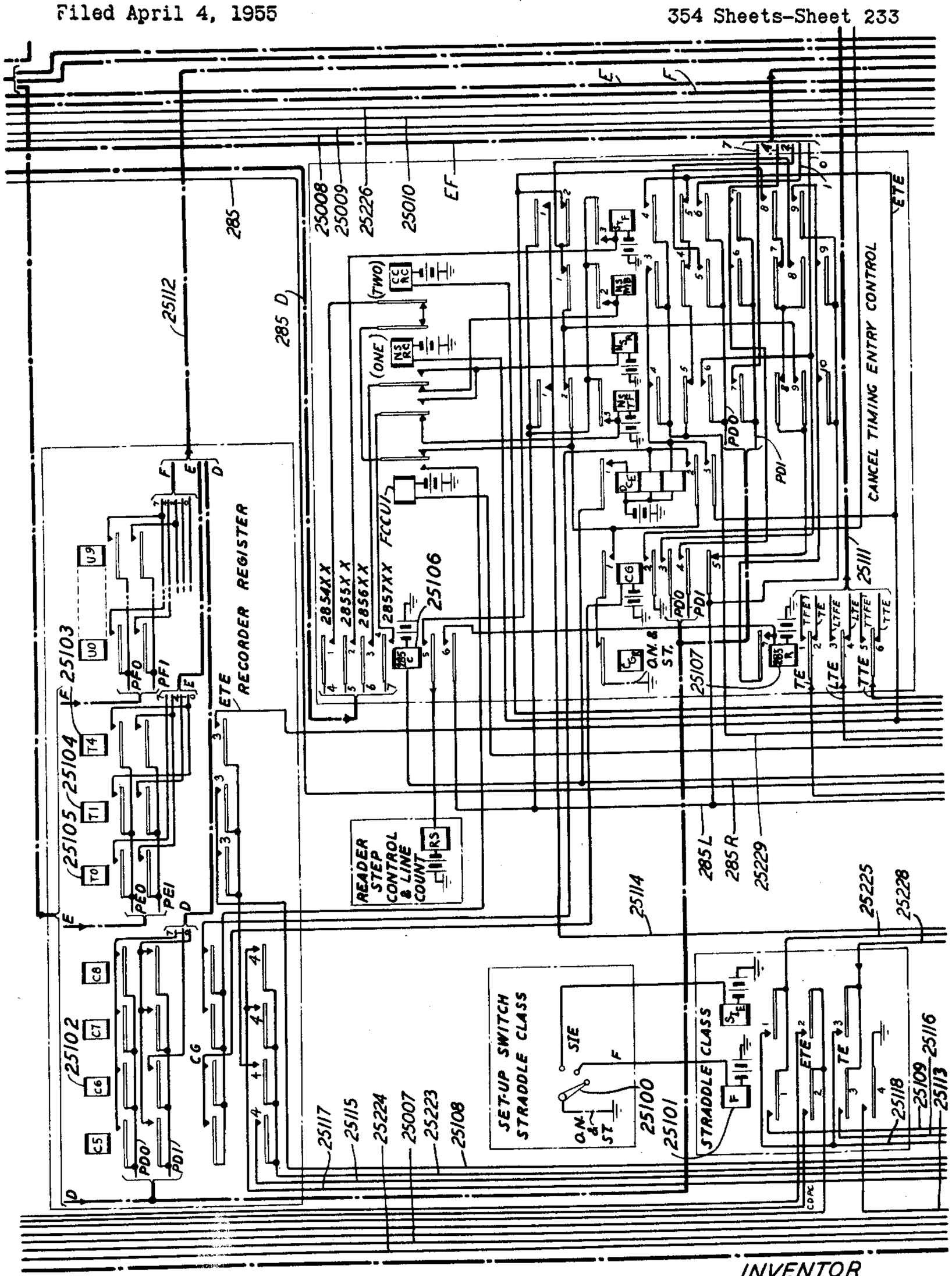


FIG. 251

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 234

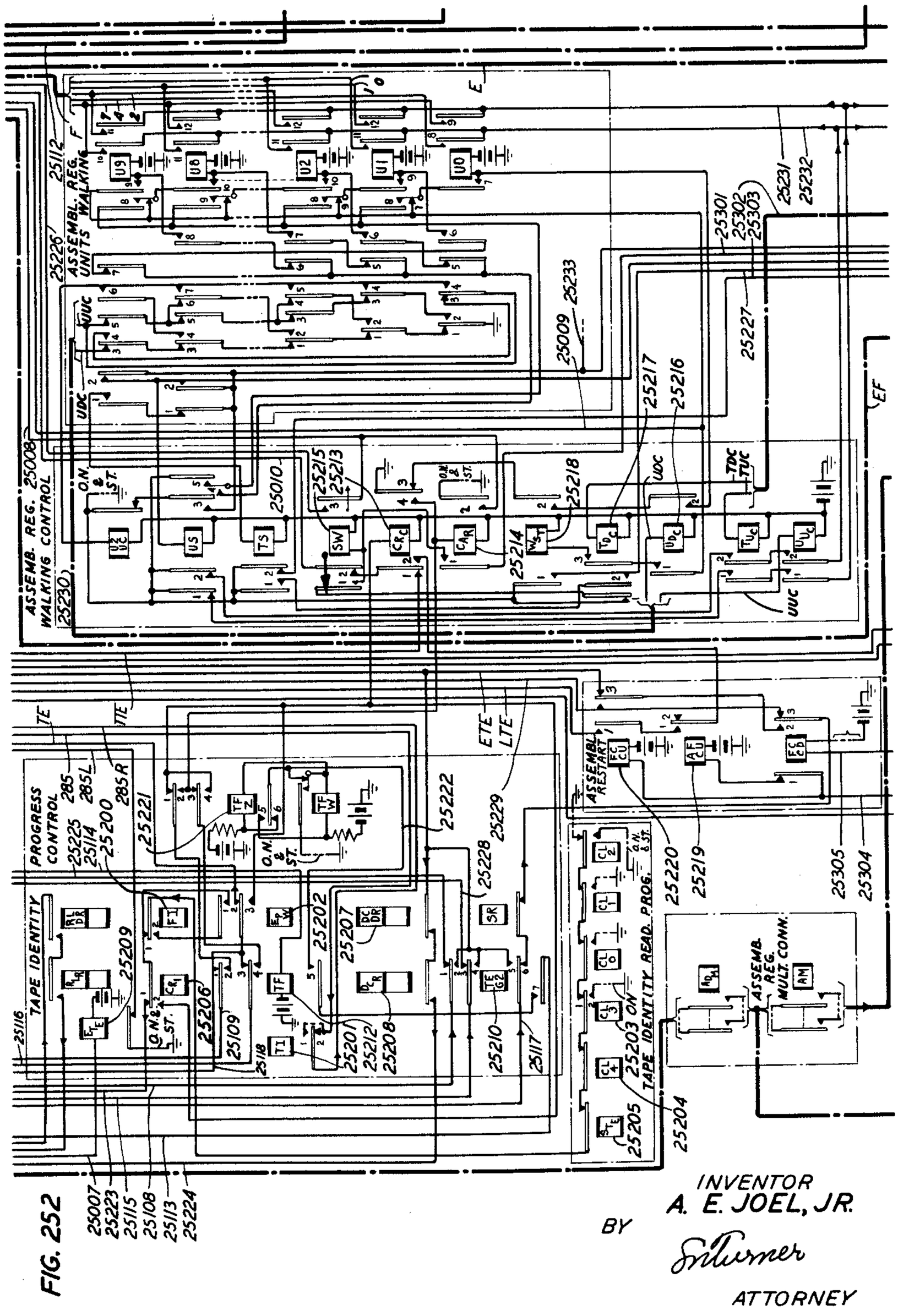


FIG. 252

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 235

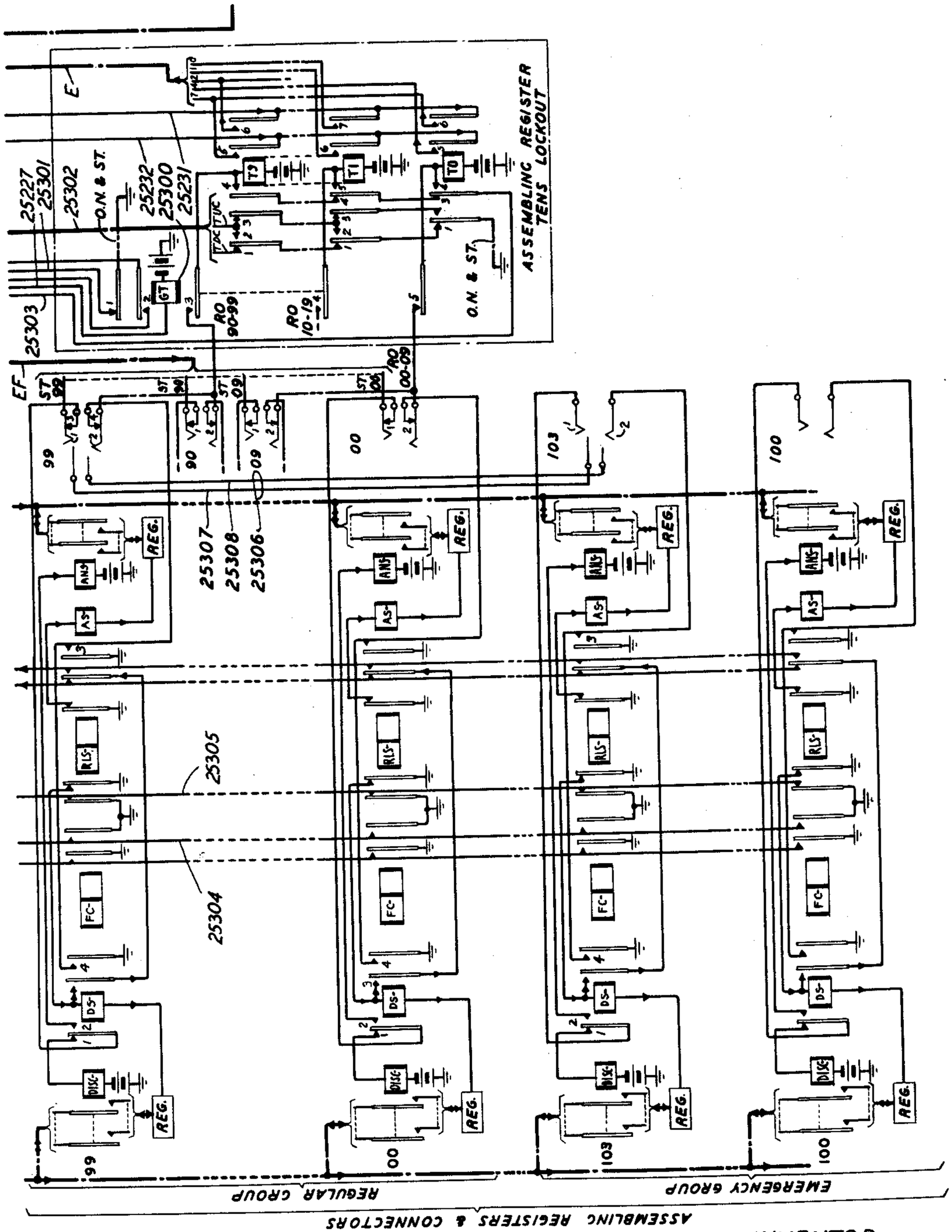


FIG. 253

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 236

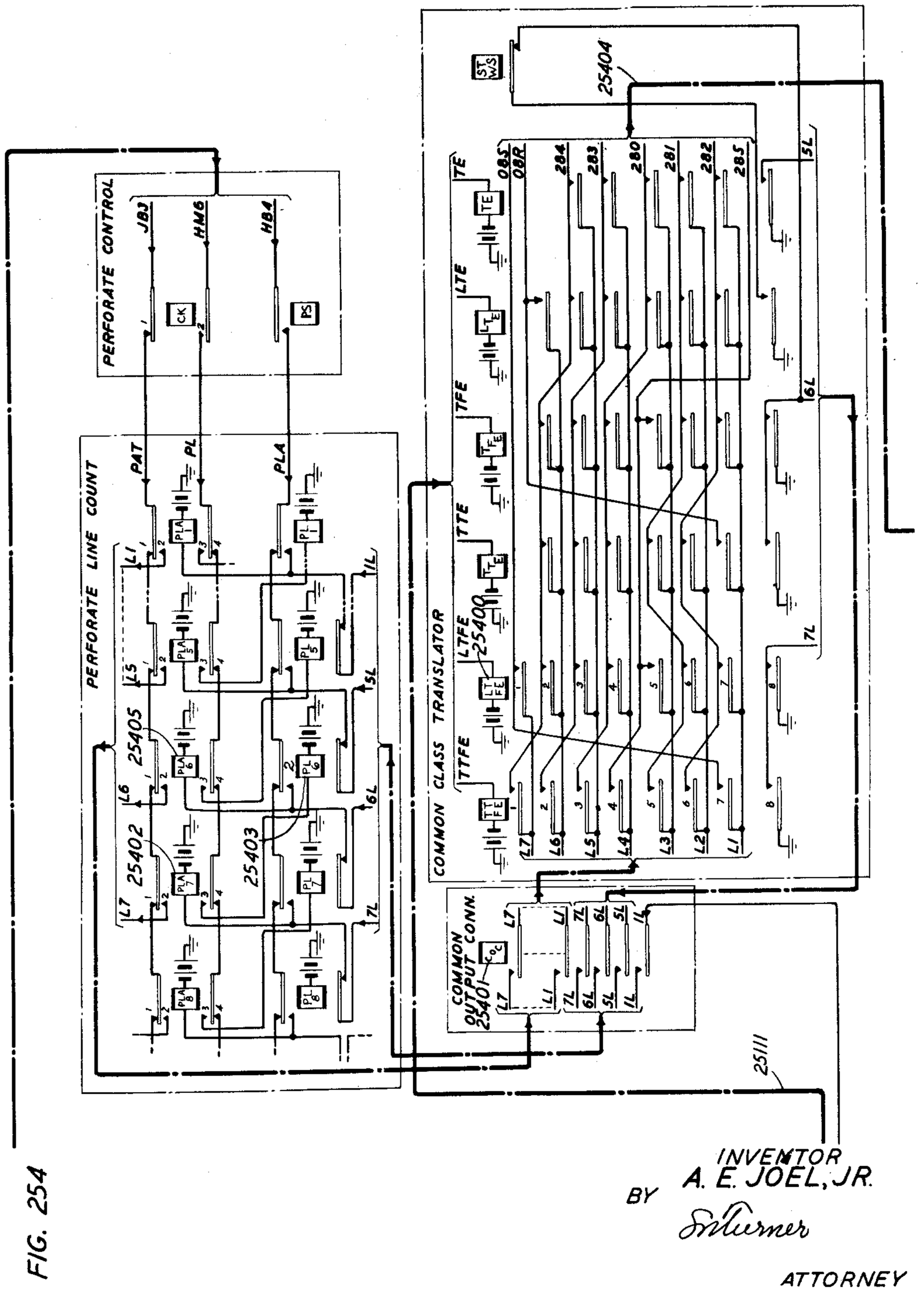


FIG. 254

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 237

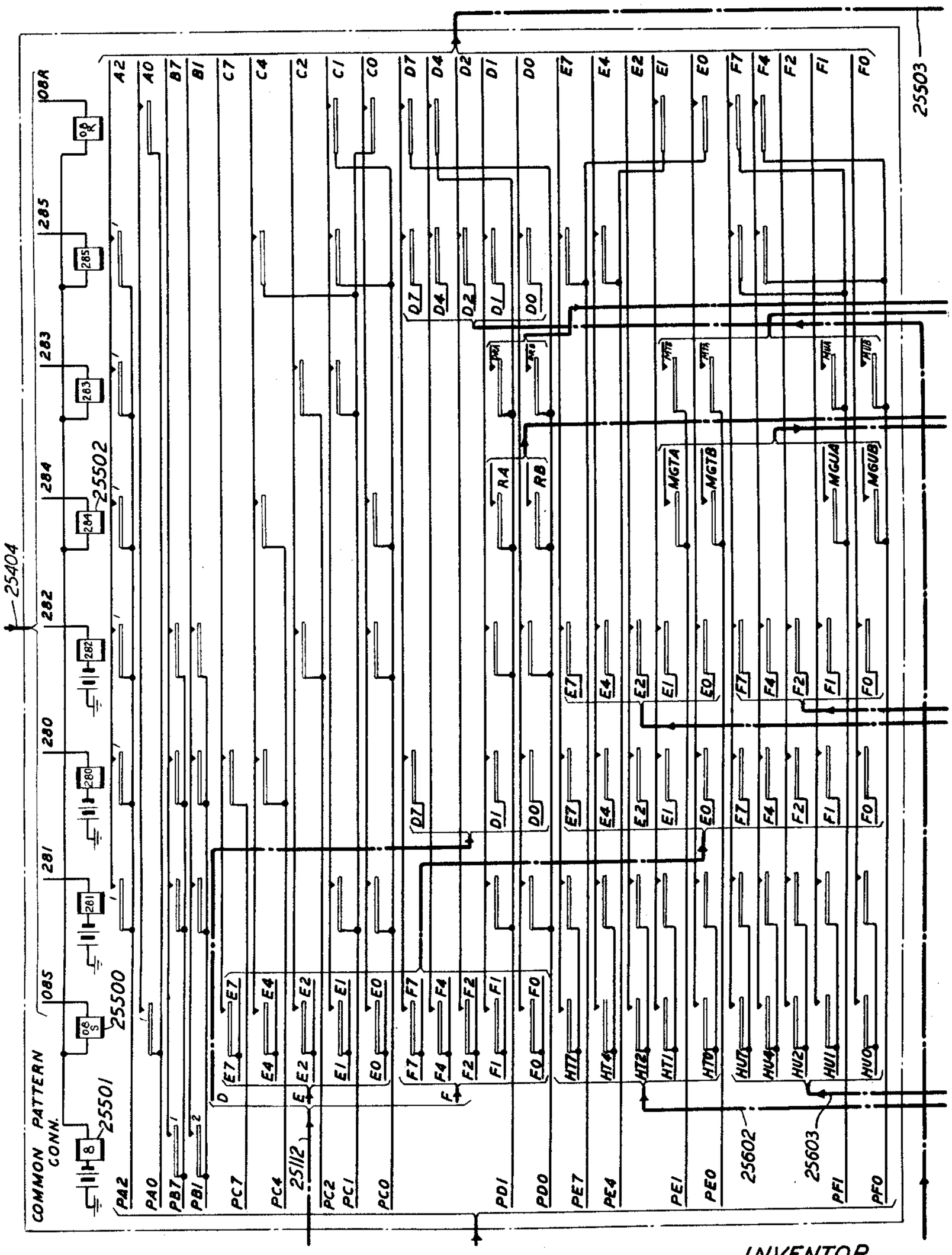


FIG. 255

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 238

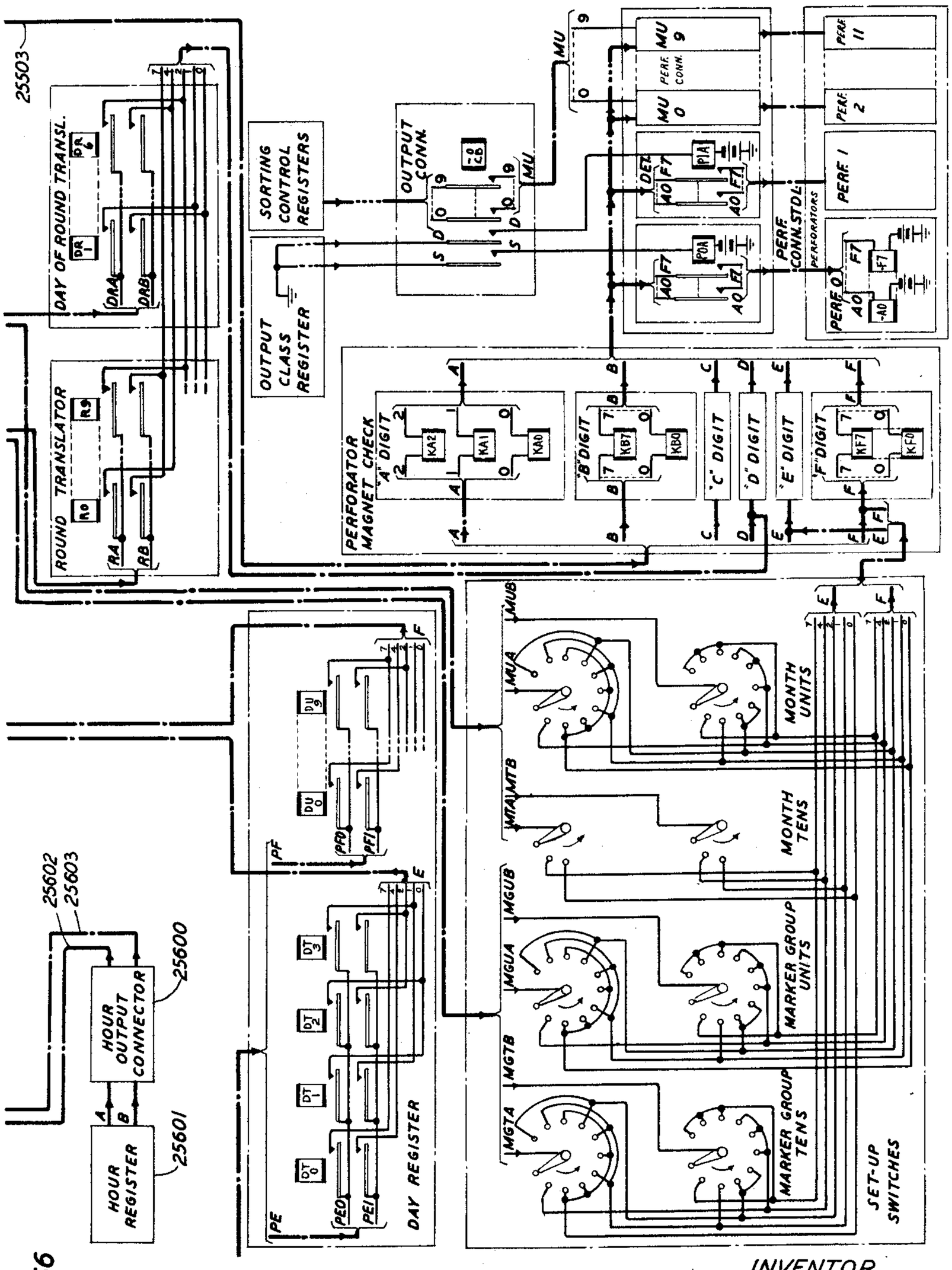


FIG. 256

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR.

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 239

FIG. 257

FIG. 258	FIG. 259

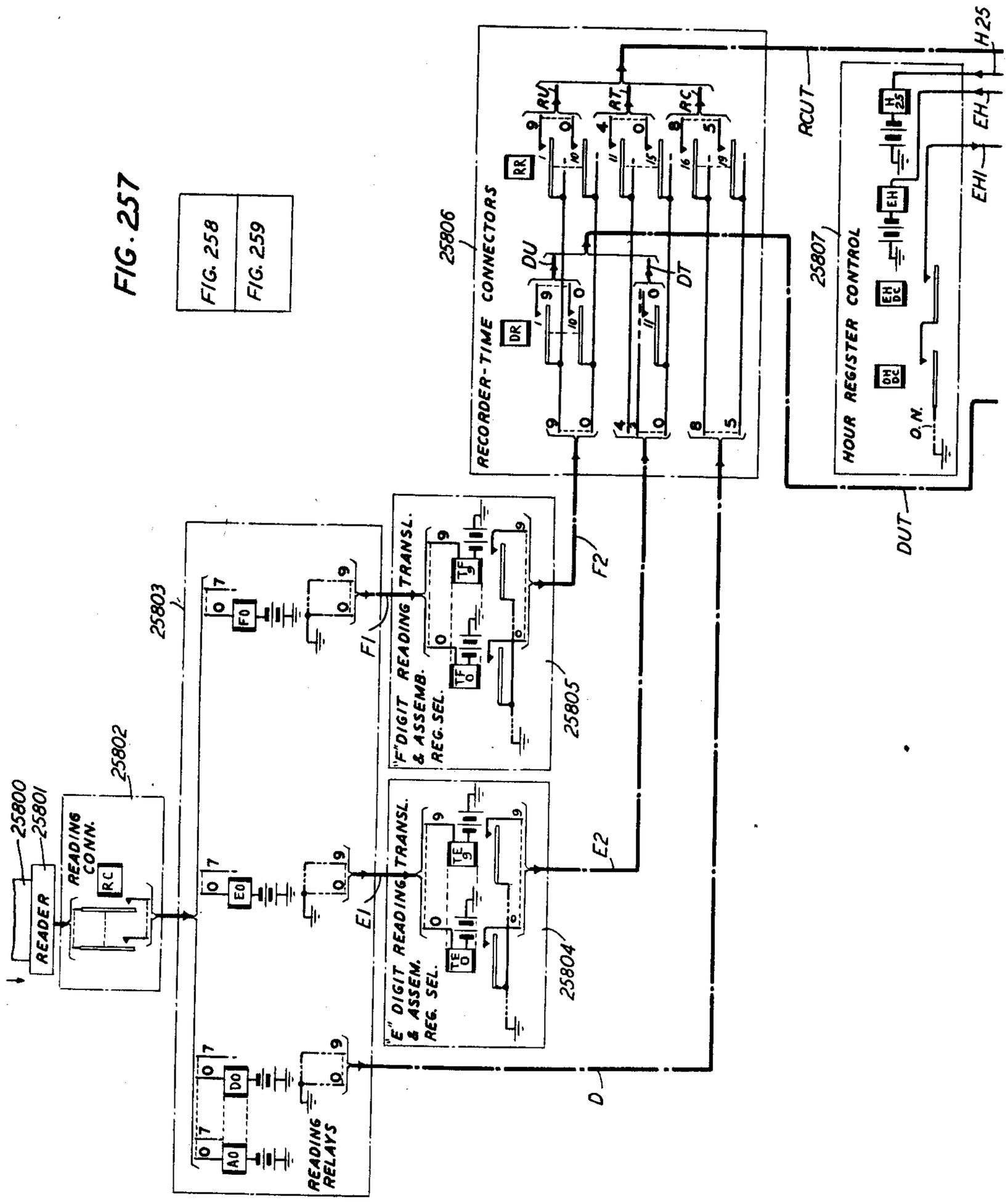


FIG. 258

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 240

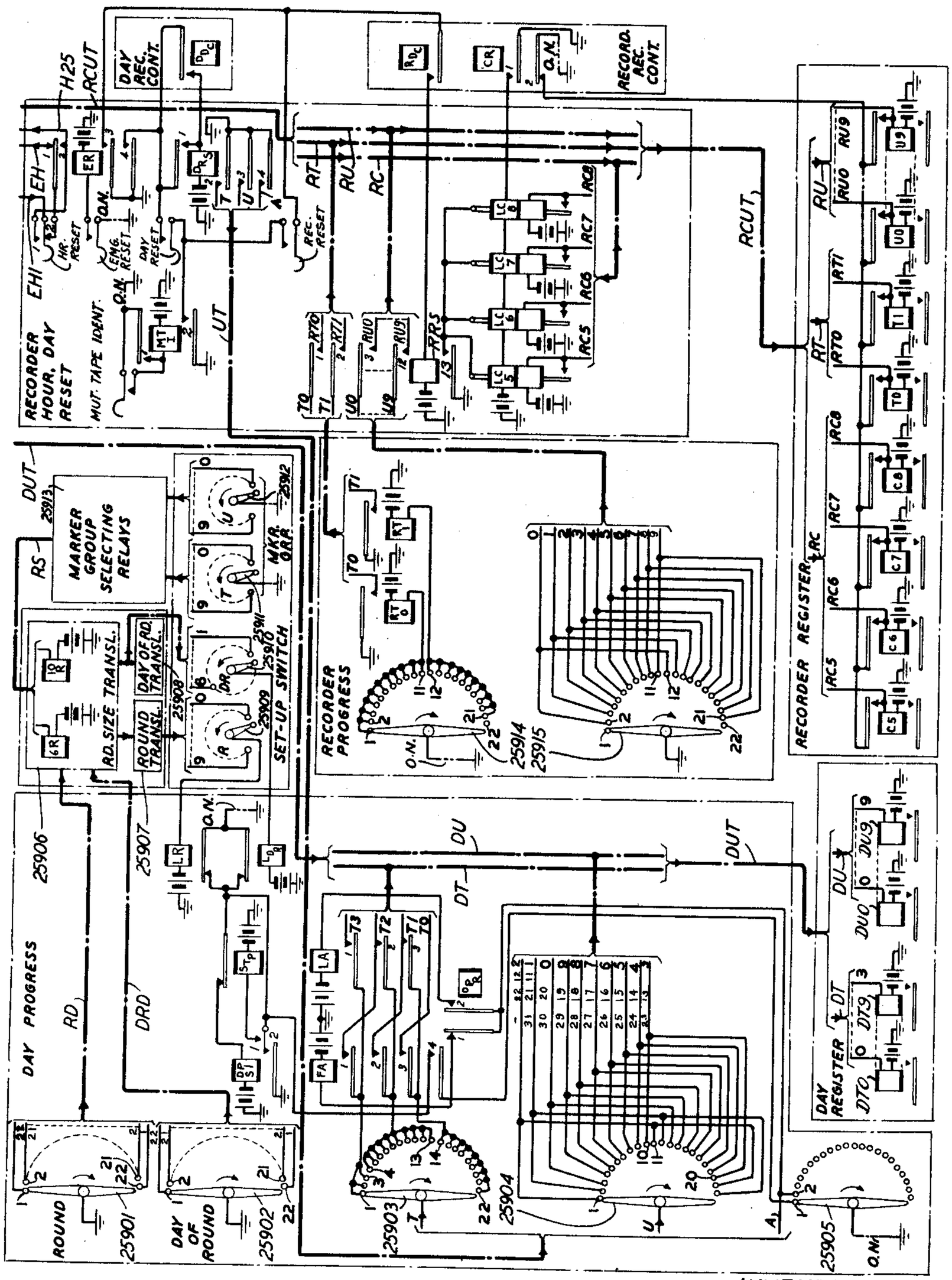


FIG. 259

INVENTOR
A. E. JOEL, JR.

BY Sturmer

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 241

FIG. 260

FIG. 261	FIG. 262	FIG. 263	FIG. 264
		FIG. 265	FIG. 266
		FIG 269	FIG. 270
			FIG. 271
			FIG. 268

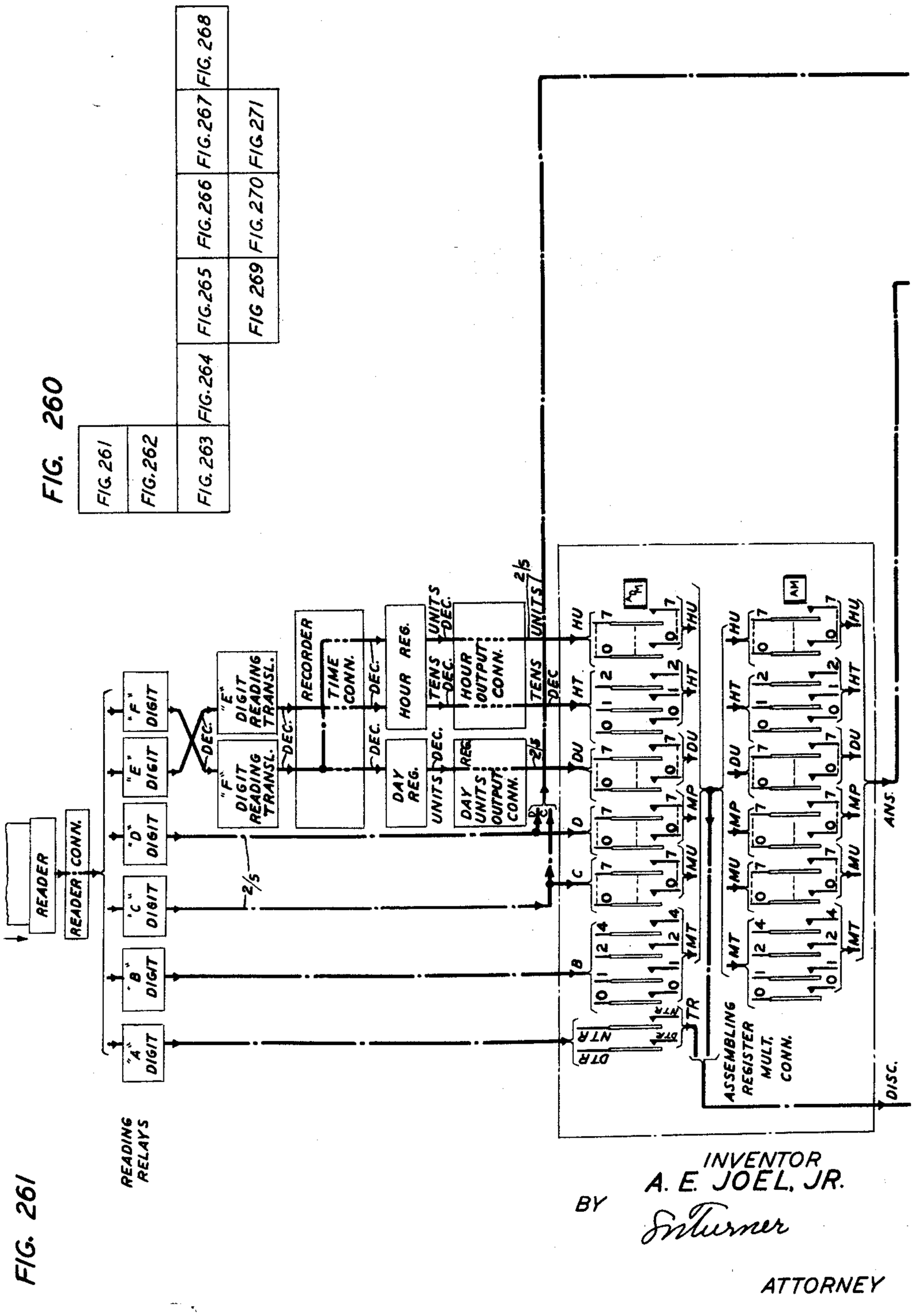


FIG. 261

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 242

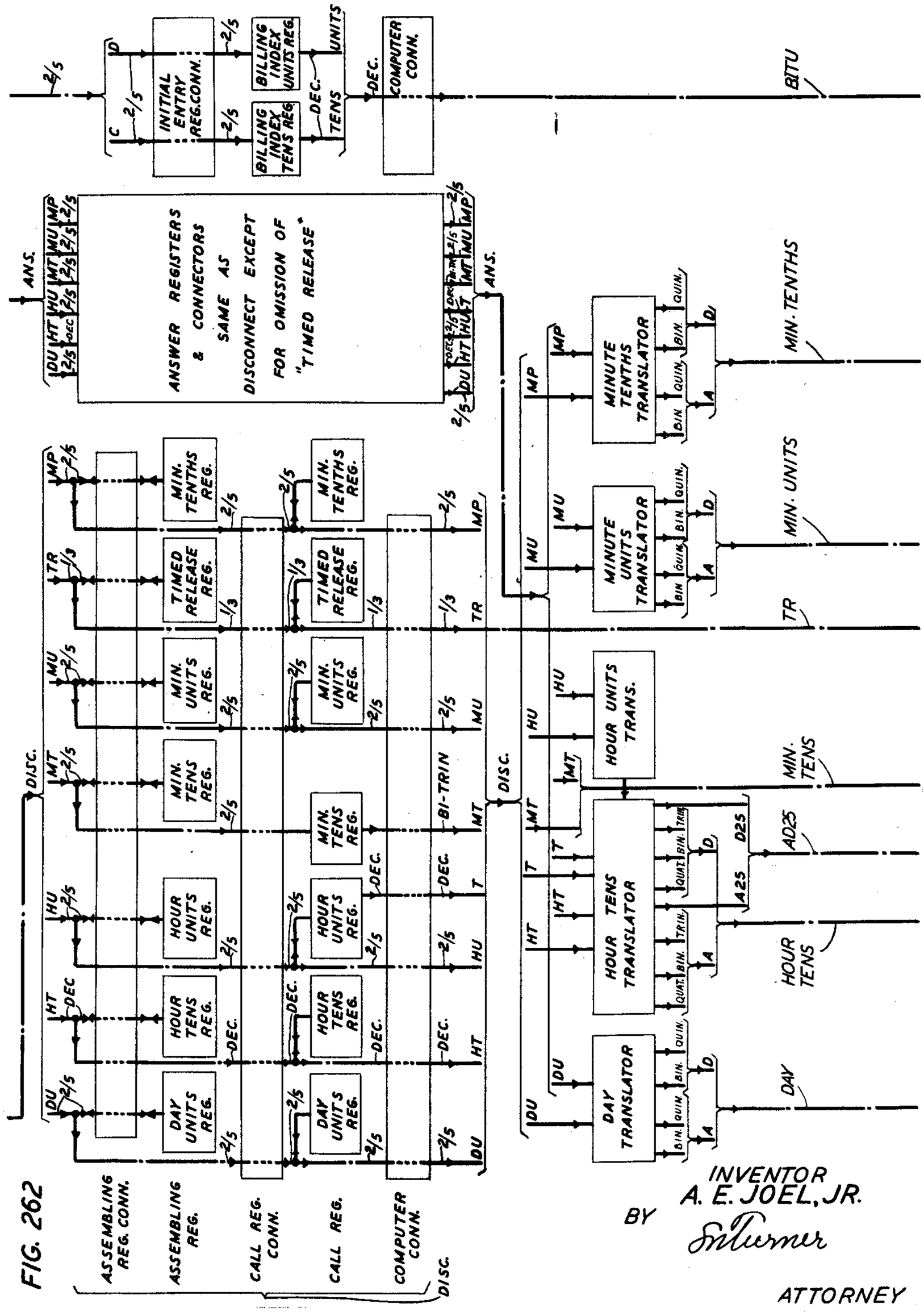


FIG. 262

INVENTOR
A. E. JOEL, JR.
BY
S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 243

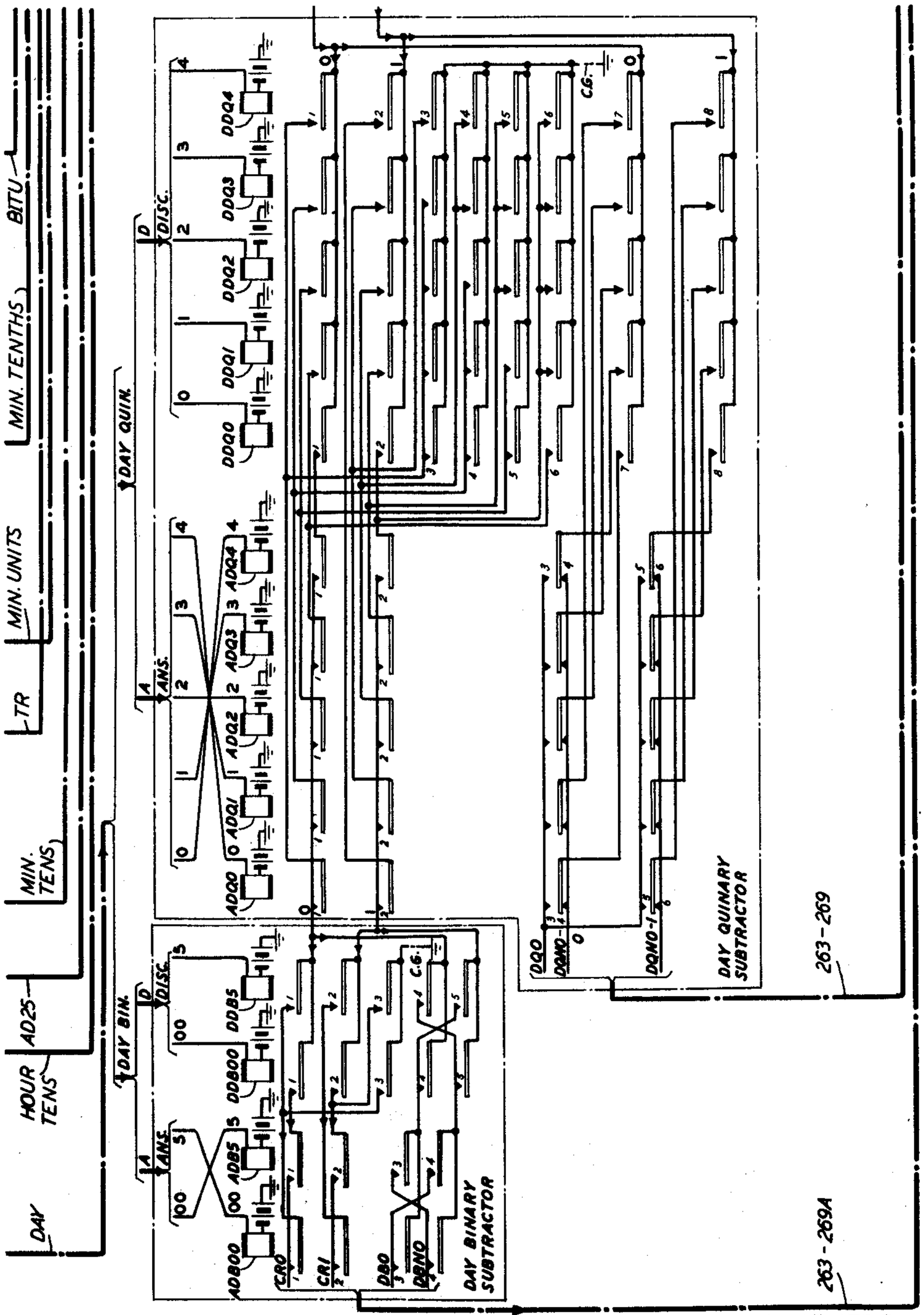


FIG. 263

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 244

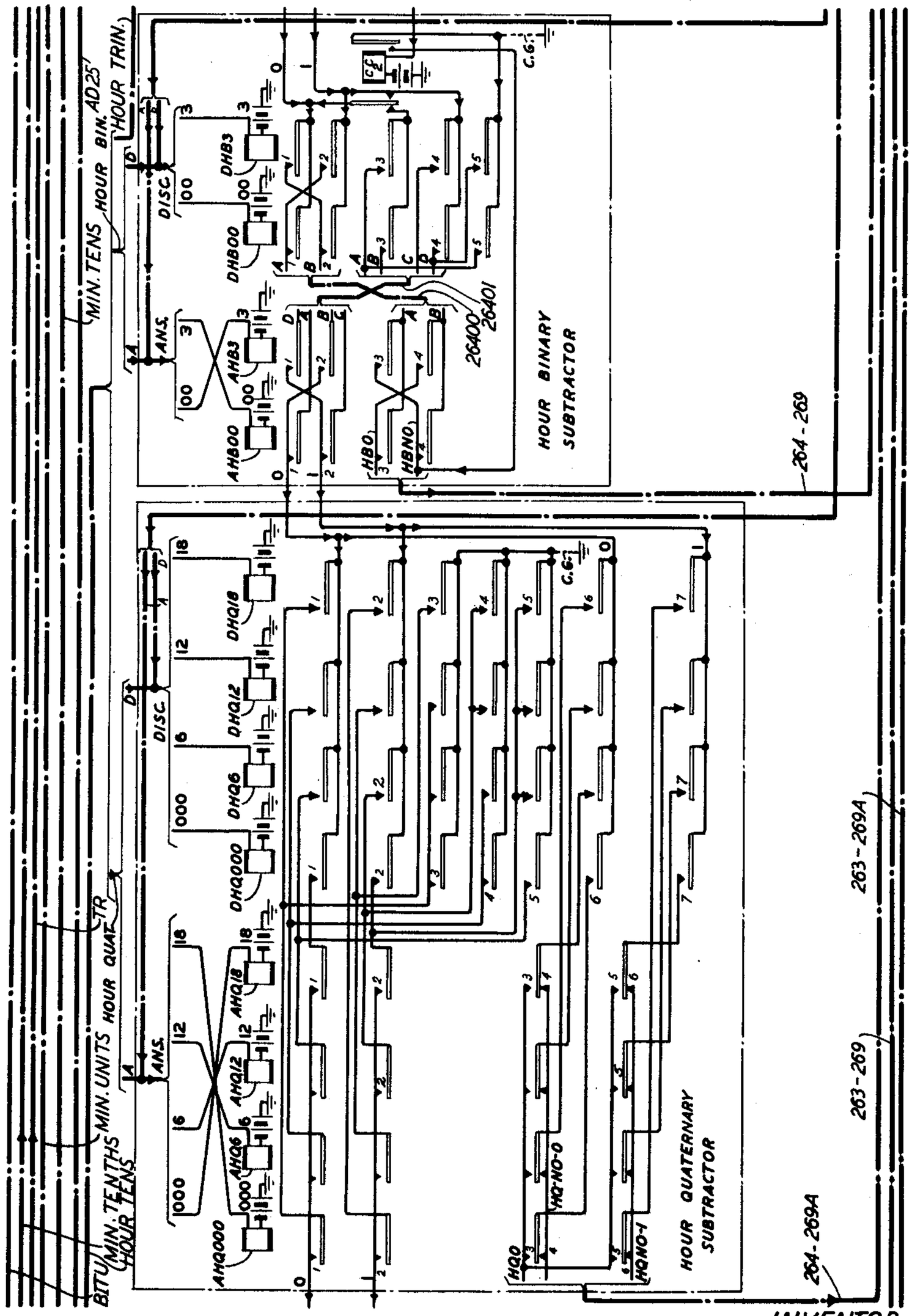


FIG. 264

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 245

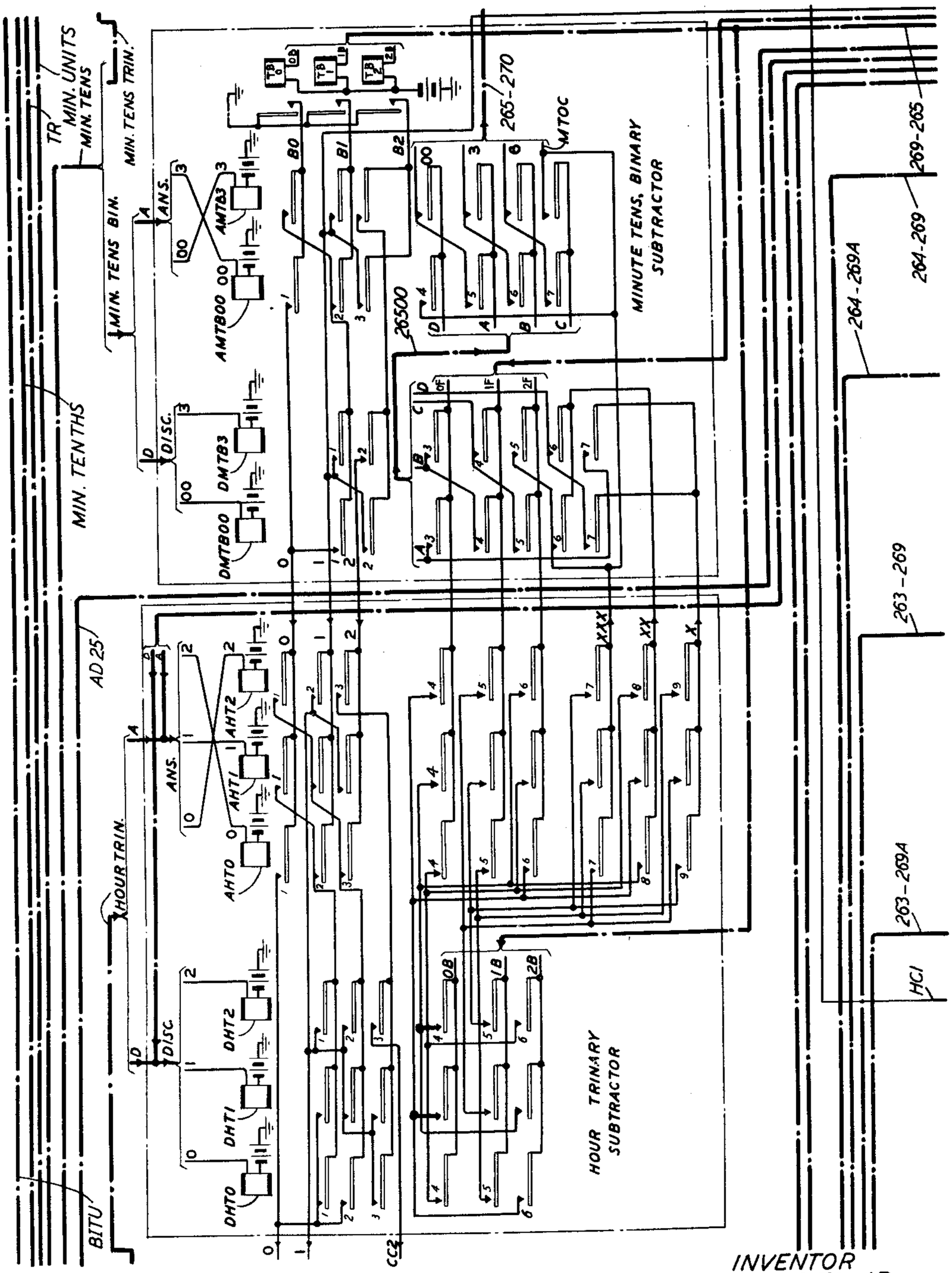


FIG. 265

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 246

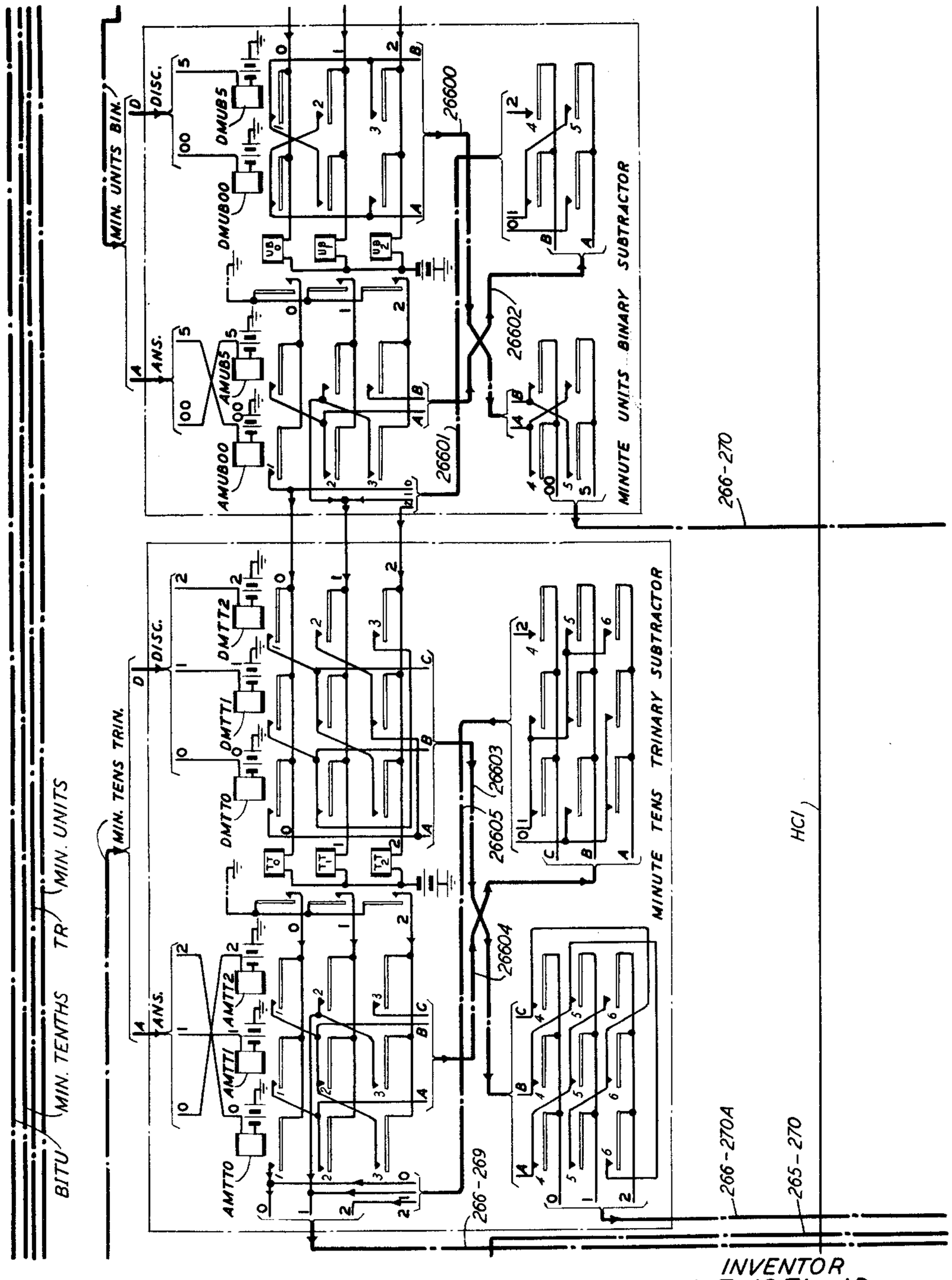


FIG. 266

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 247

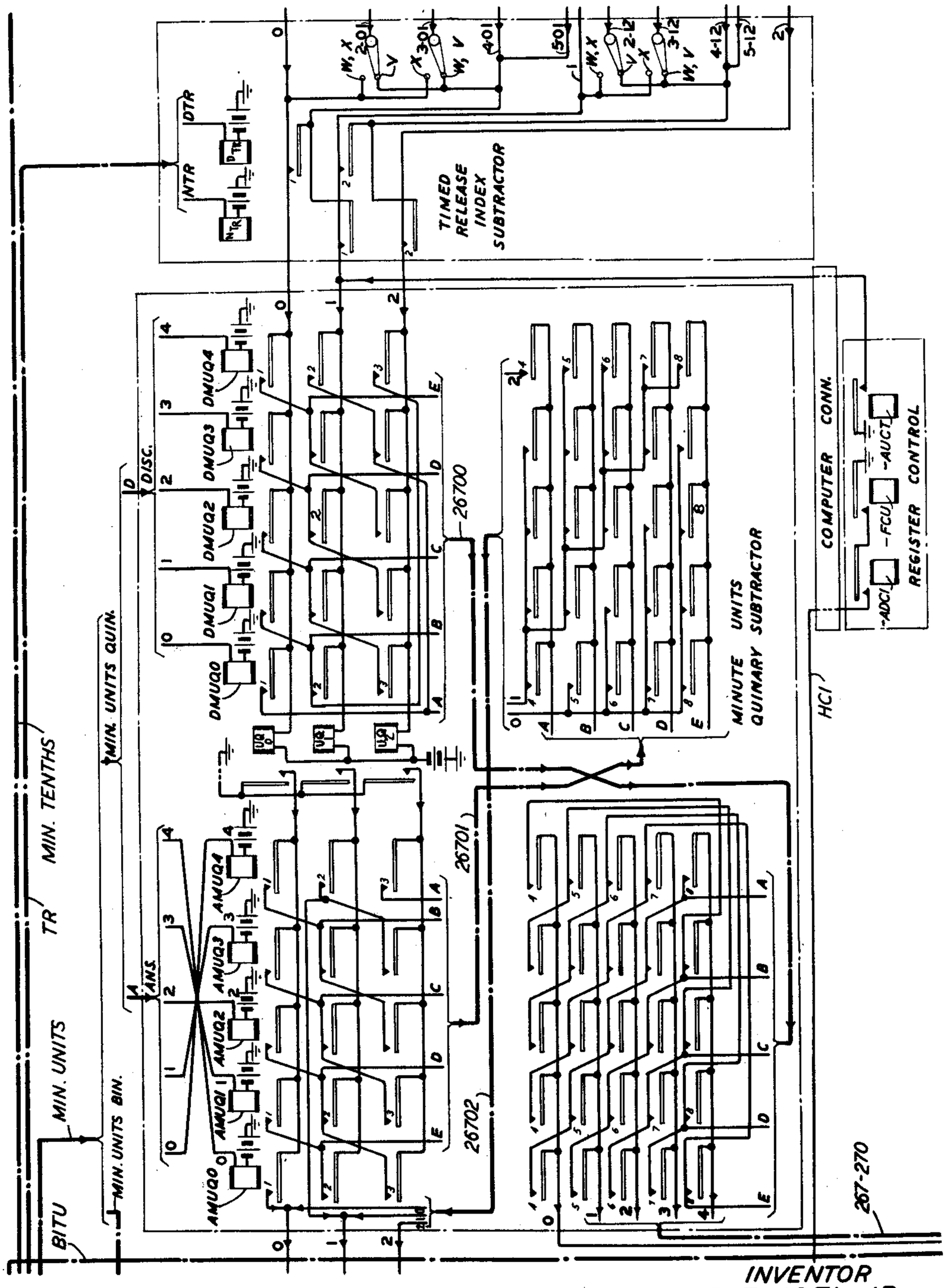


FIG. 267

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 248

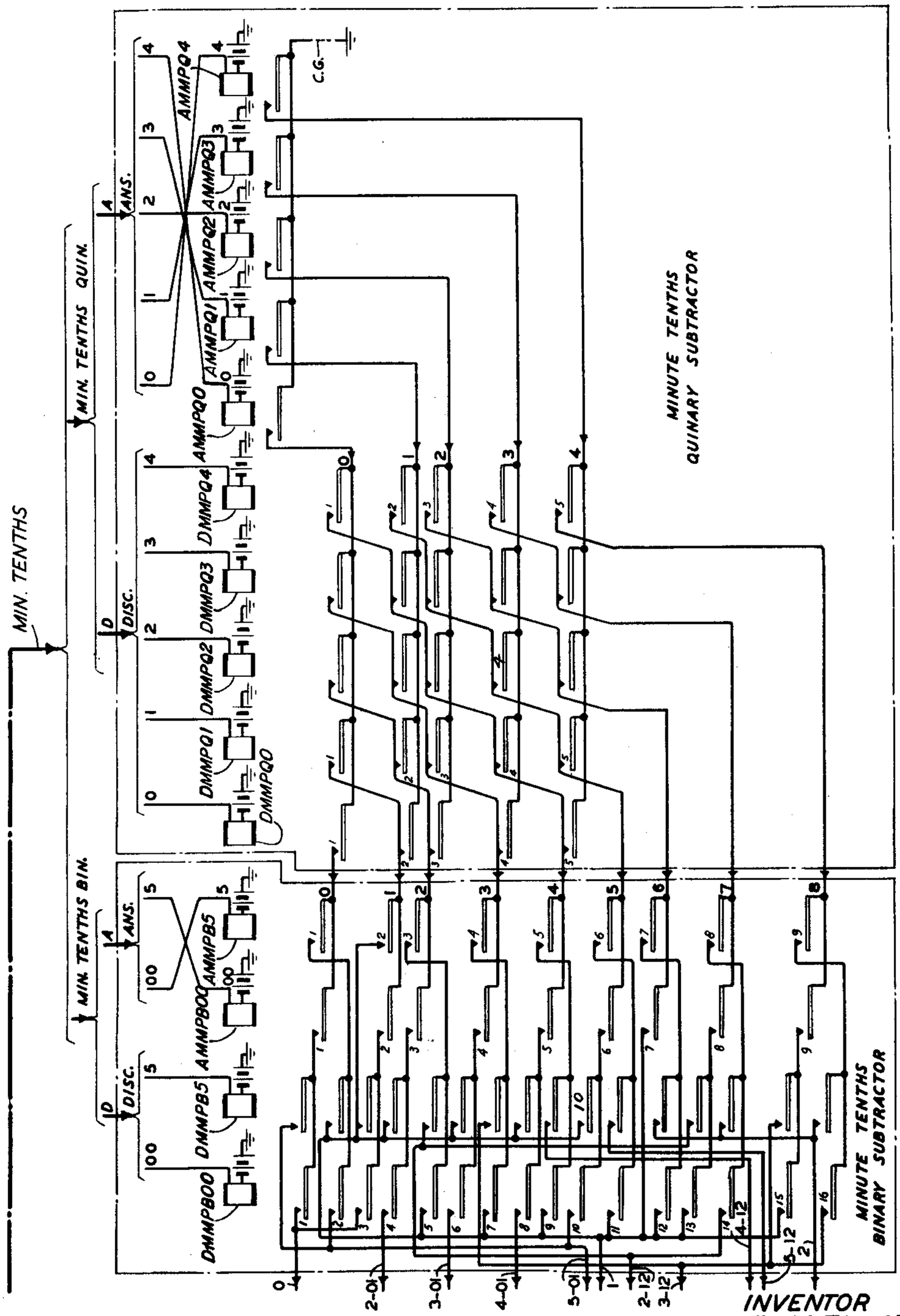


FIG. 268

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 249

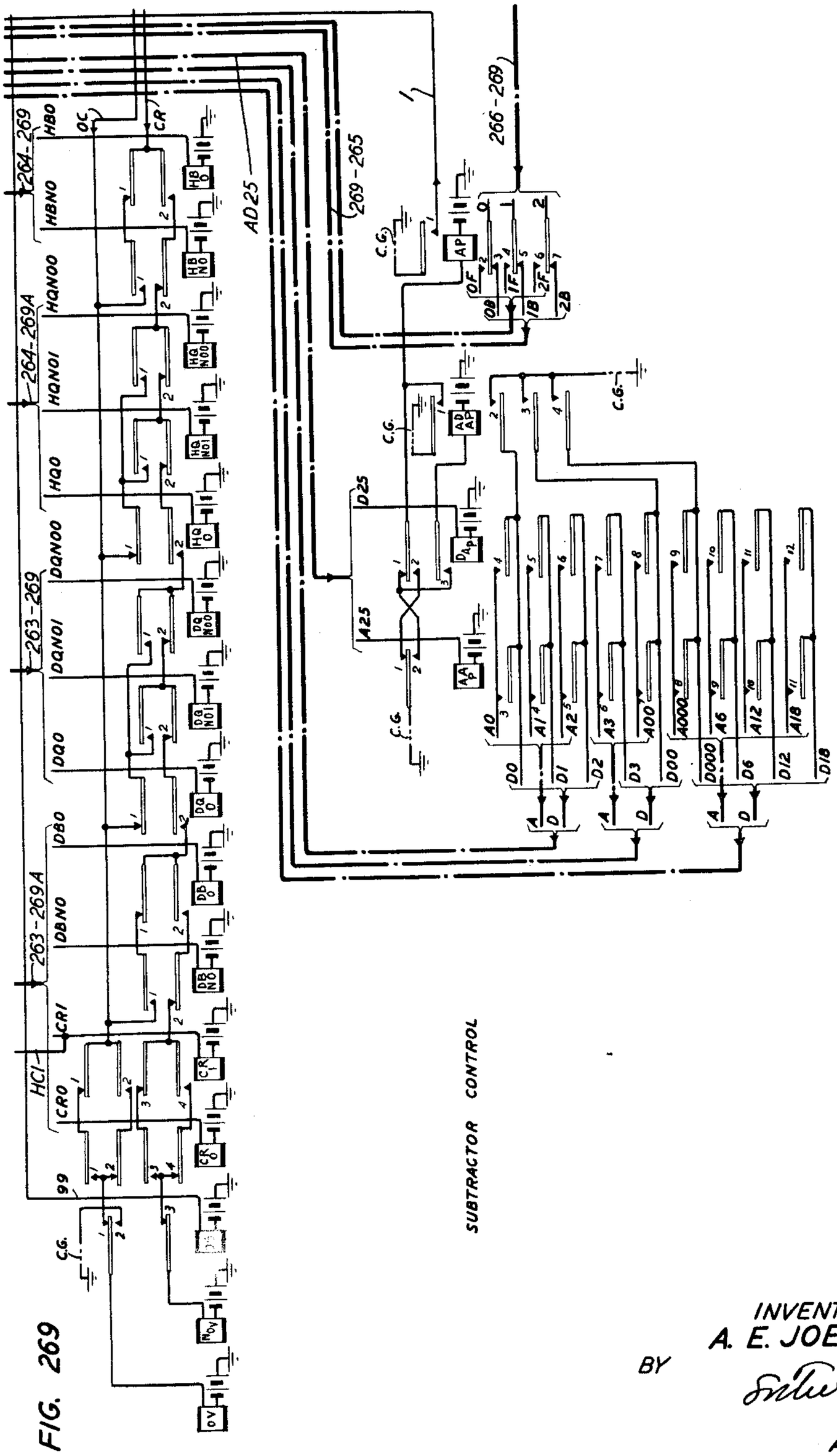


FIG. 269

SUBTRACTOR CONTROL

INVENTOR.
A. E. JOEL, JR.
BY
Fulliner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 250

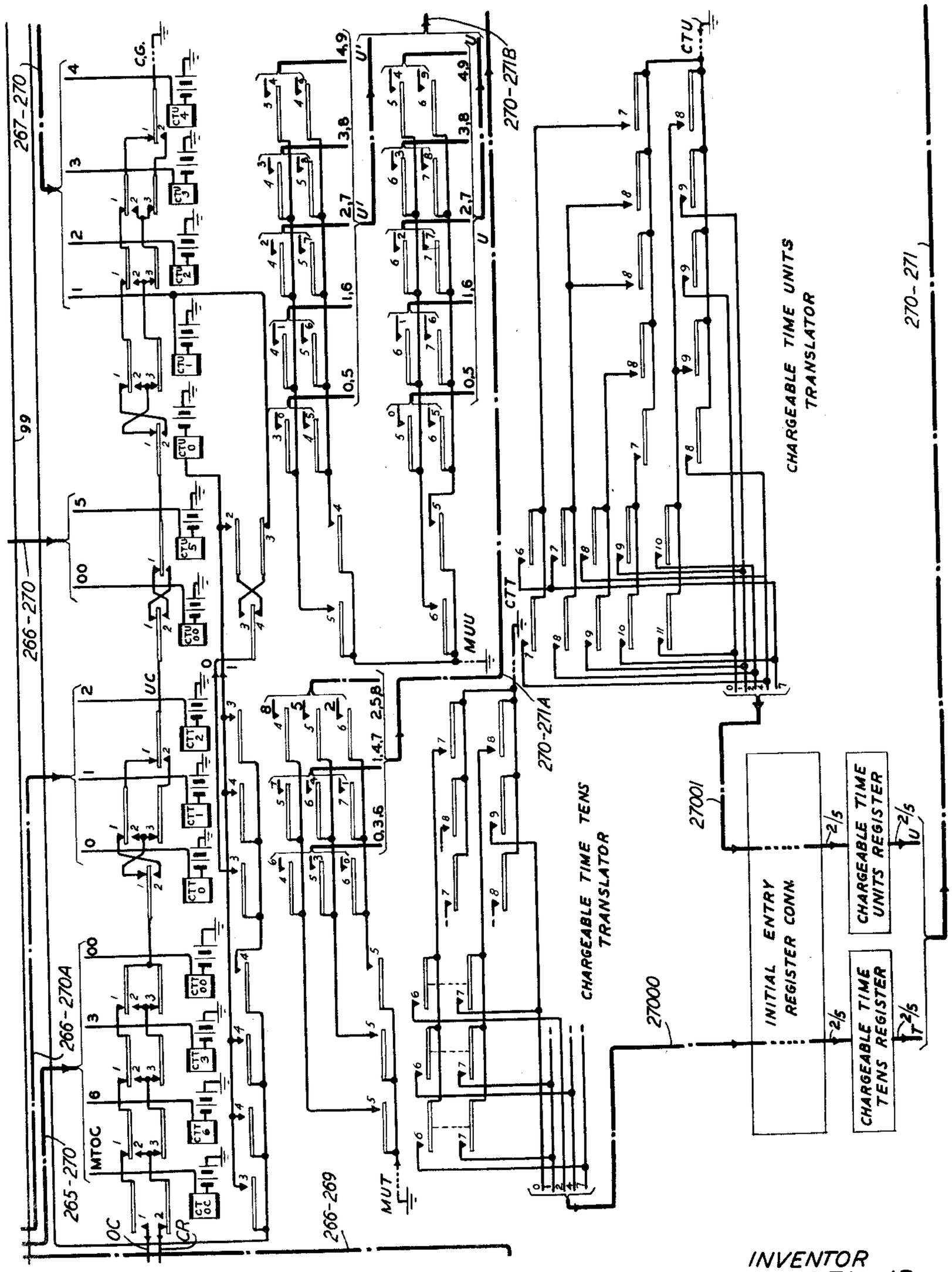


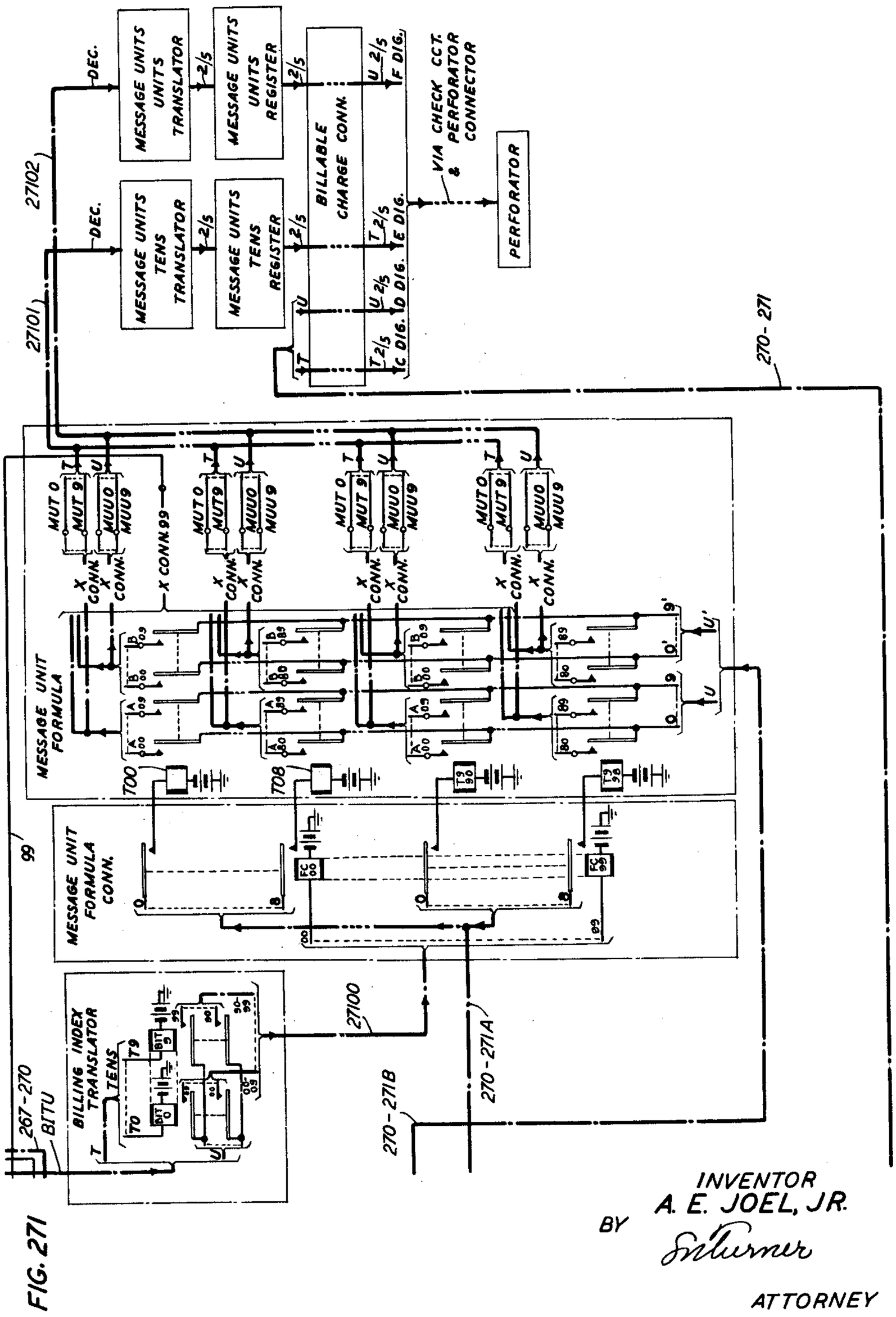
FIG. 270

INVENTOR
A. E. JOEL, JR.
BY
S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 251



INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

FIG. 271

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 252

FIG. 273

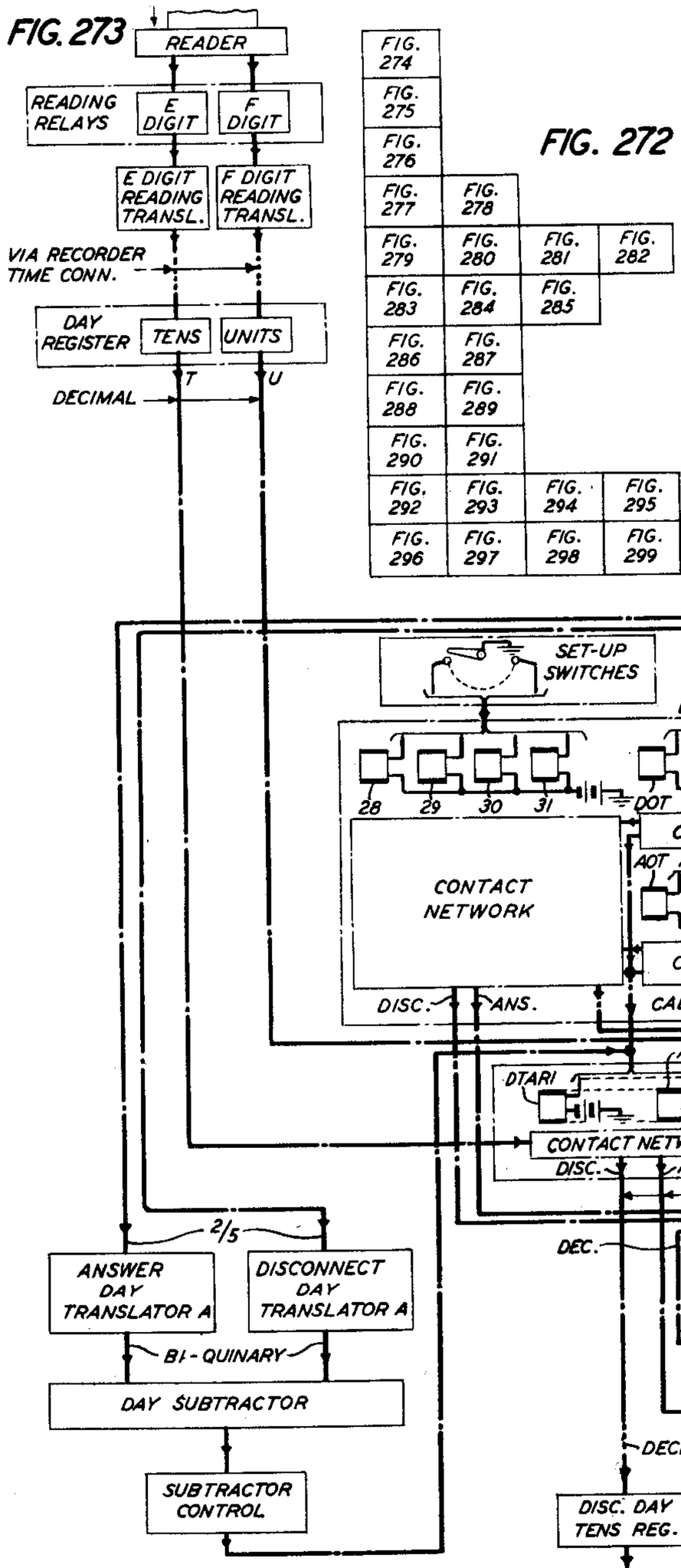


FIG. 272

FIG. 274				
FIG. 275				
FIG. 276				
FIG. 277	FIG. 278			
FIG. 279	FIG. 280	FIG. 281	FIG. 282	
FIG. 283	FIG. 284	FIG. 285		
FIG. 286	FIG. 287			
FIG. 288	FIG. 289			
FIG. 290	FIG. 291			
FIG. 292	FIG. 293	FIG. 294	FIG. 295	
FIG. 296	FIG. 297	FIG. 298	FIG. 299	FIG. 300

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 253

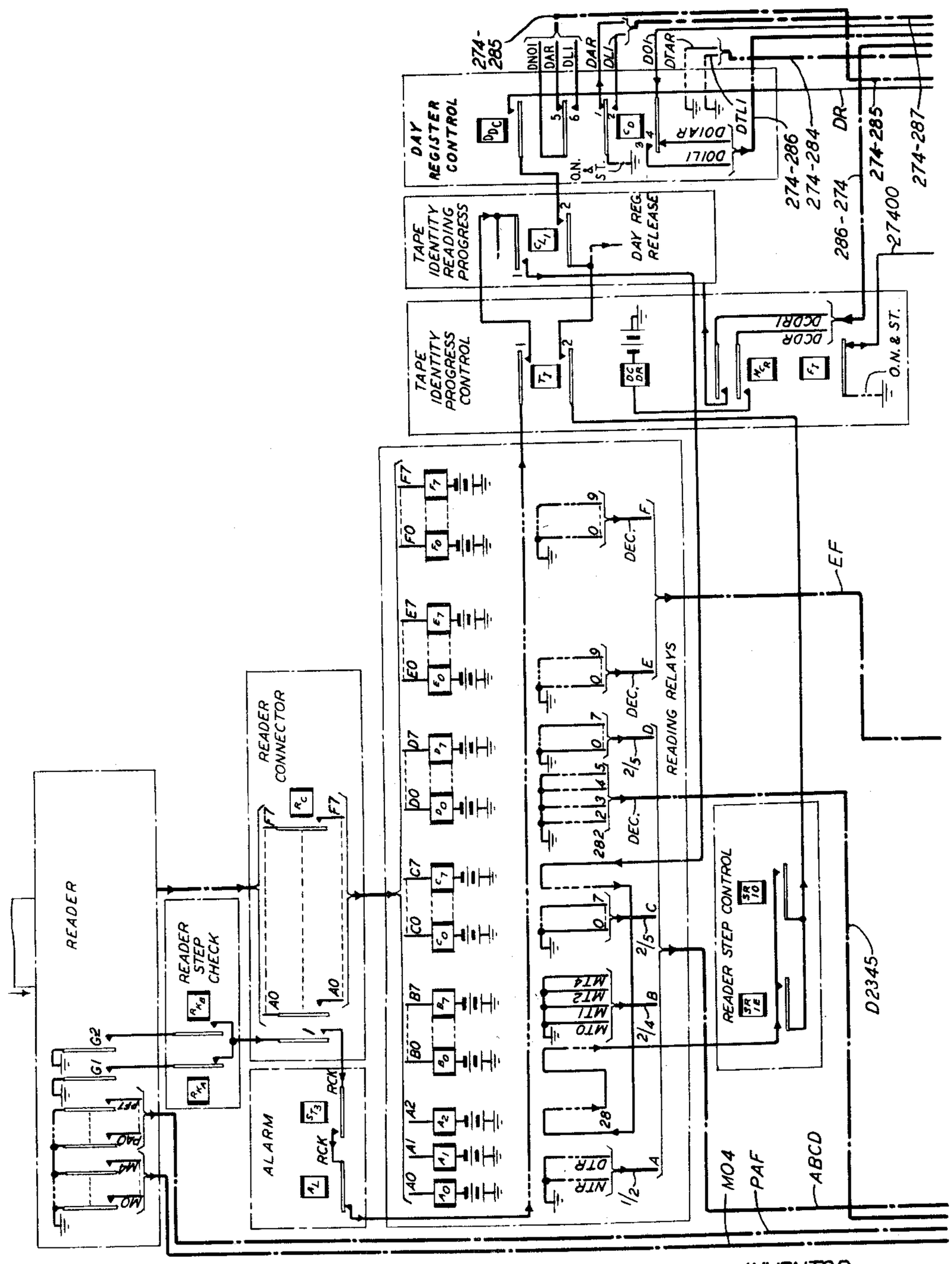


FIG. 274

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 254

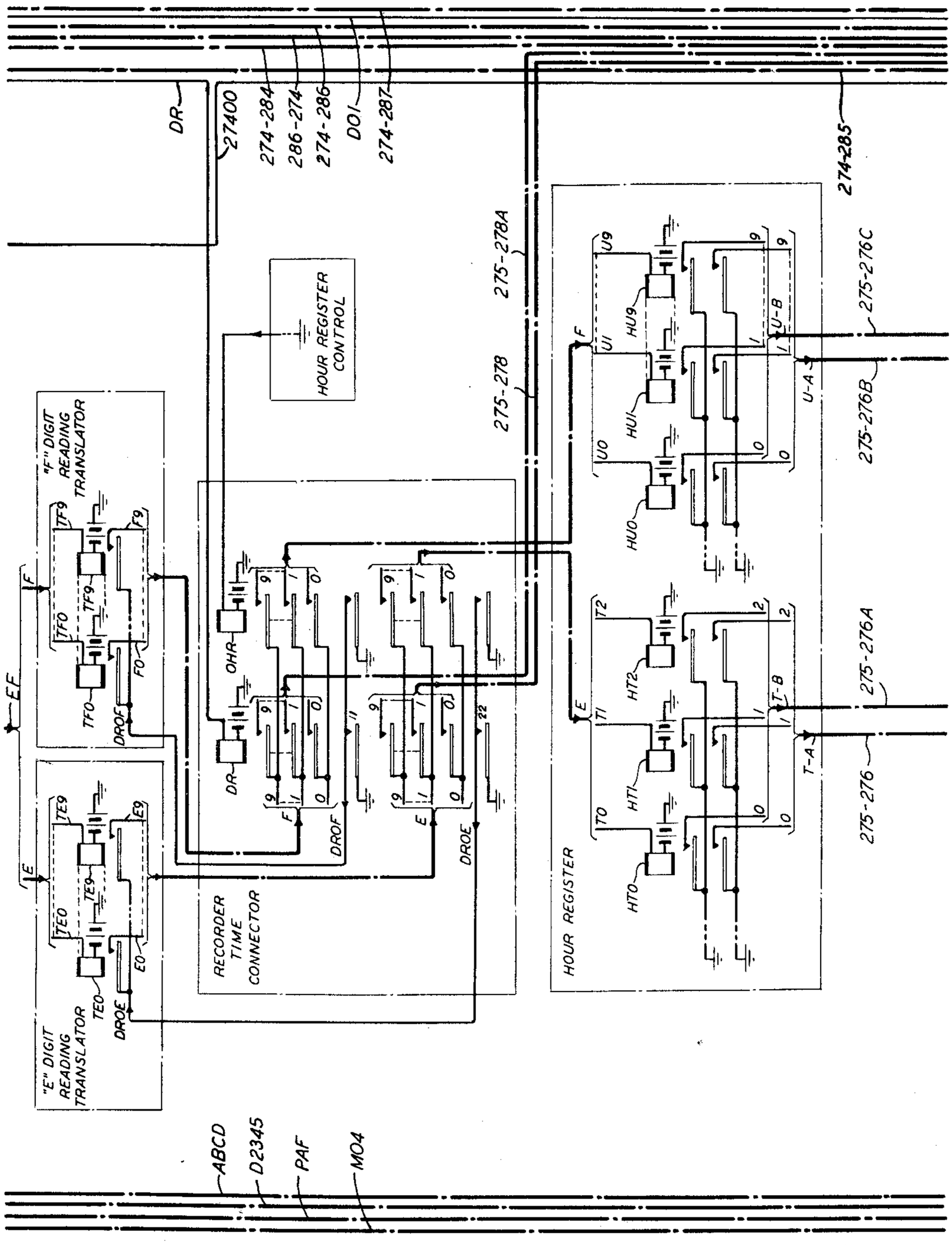


FIG. 275

INVENTOR
A. E. JOEL, JR.
BY Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 255

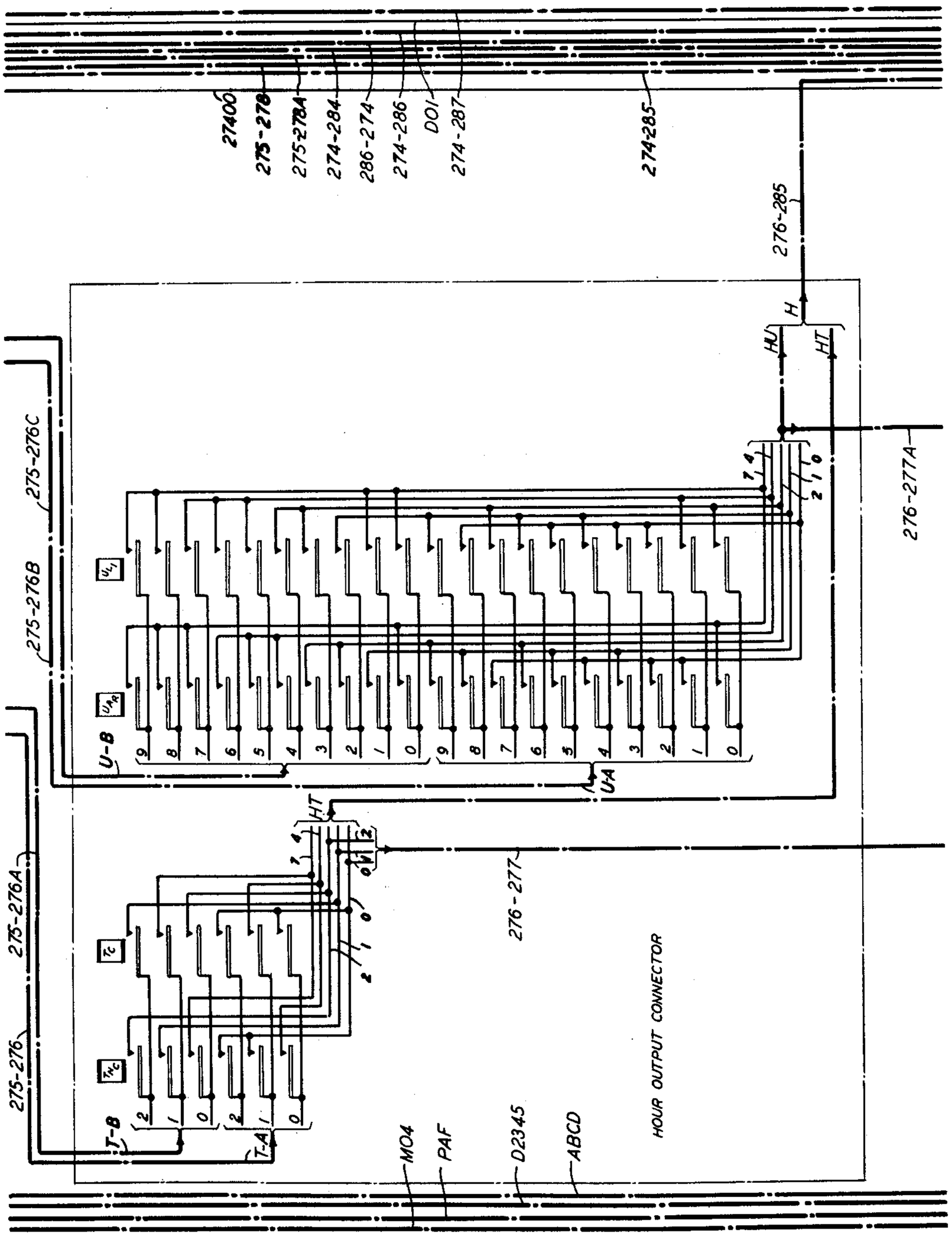


FIG. 276

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 256

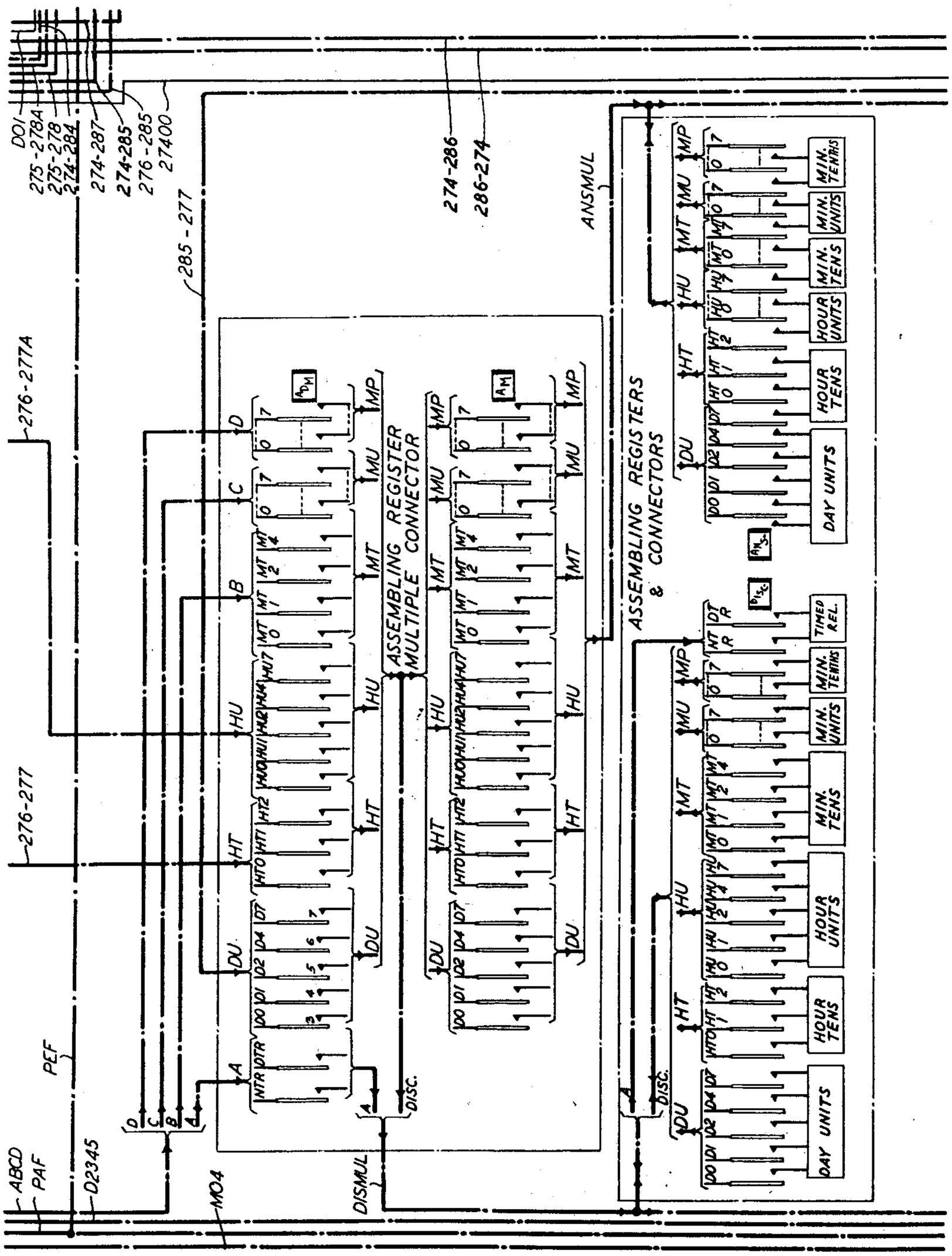


FIG. 277

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 257

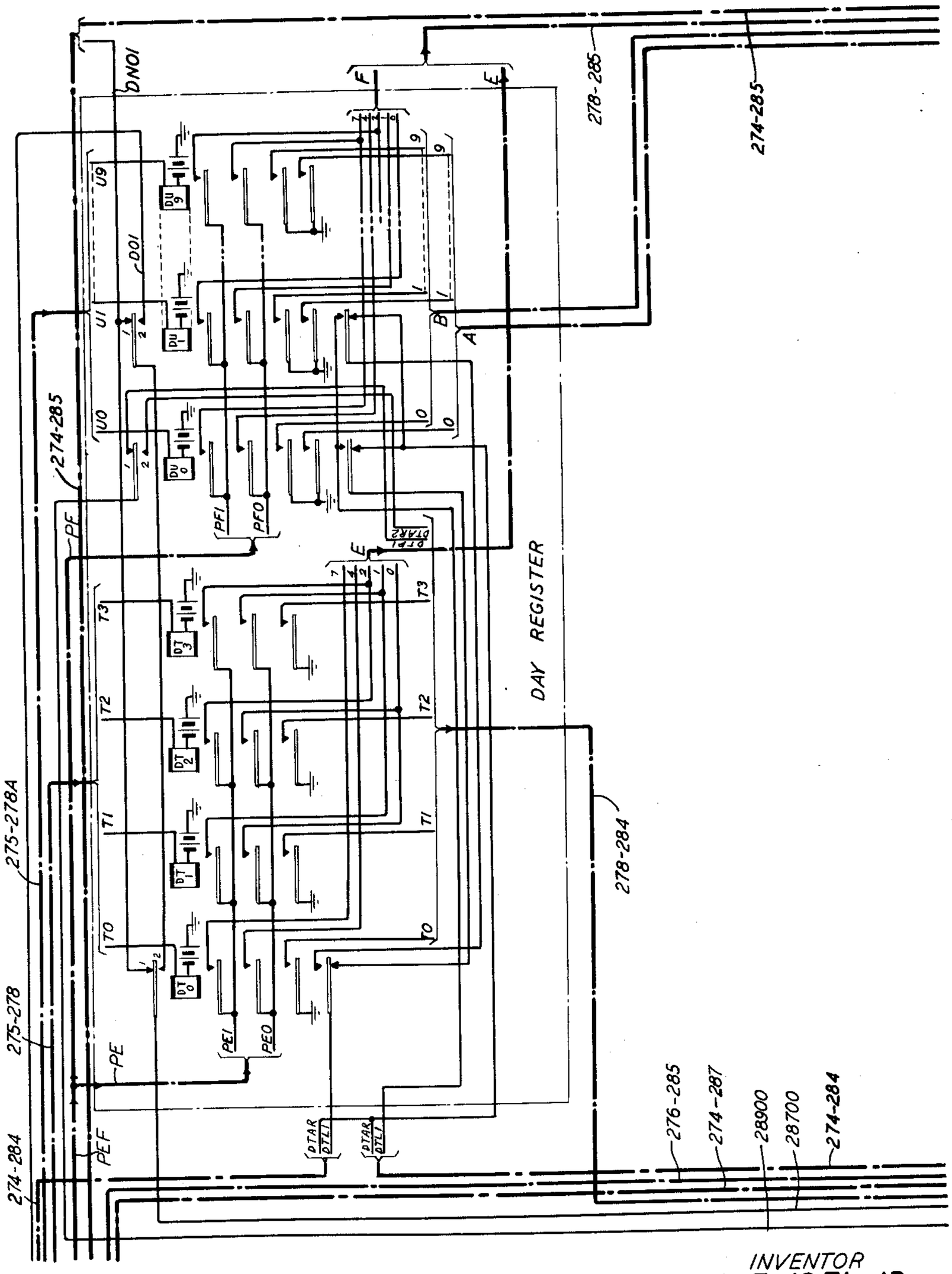


FIG. 278

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 258

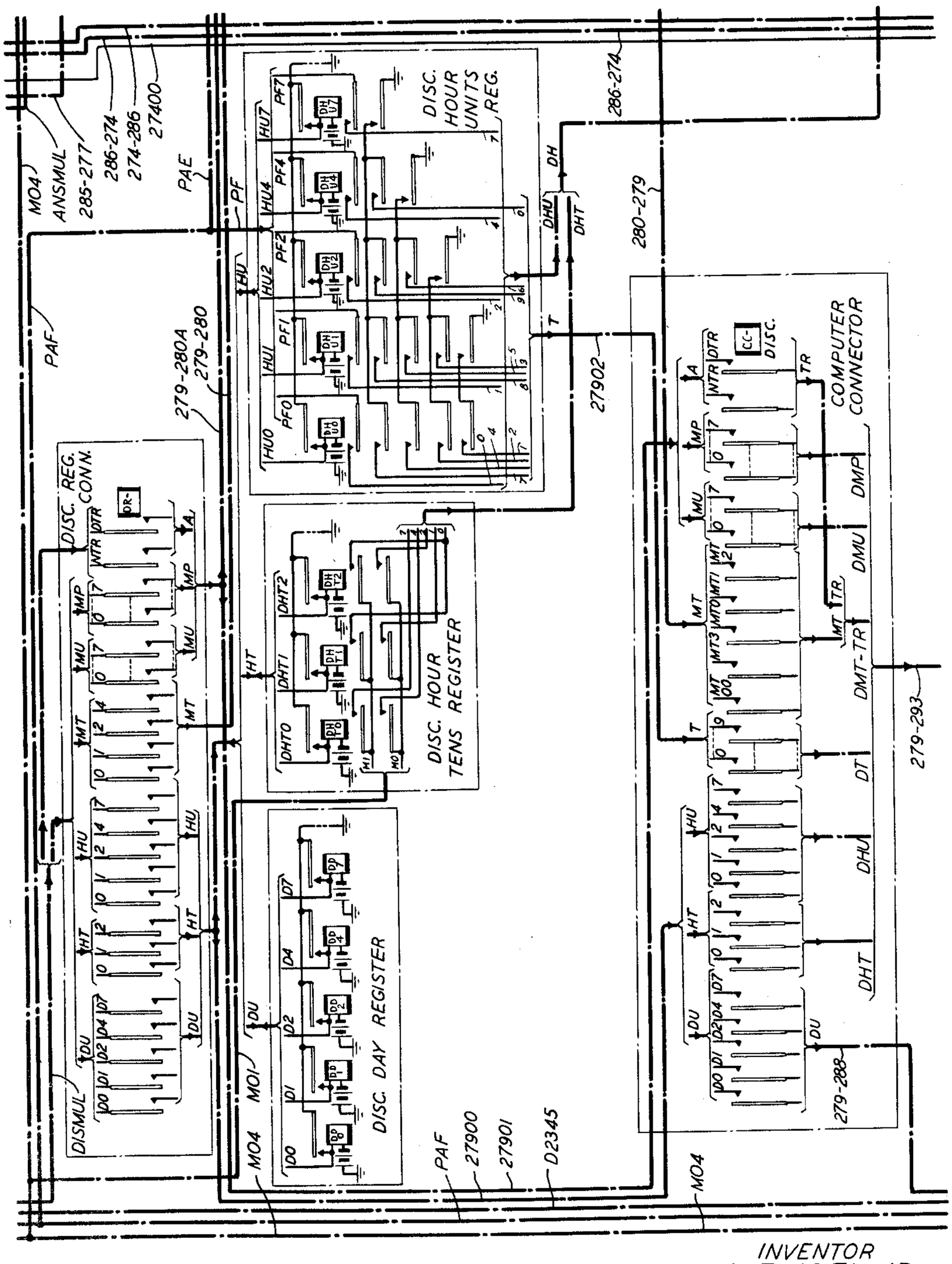


FIG. 279

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 259

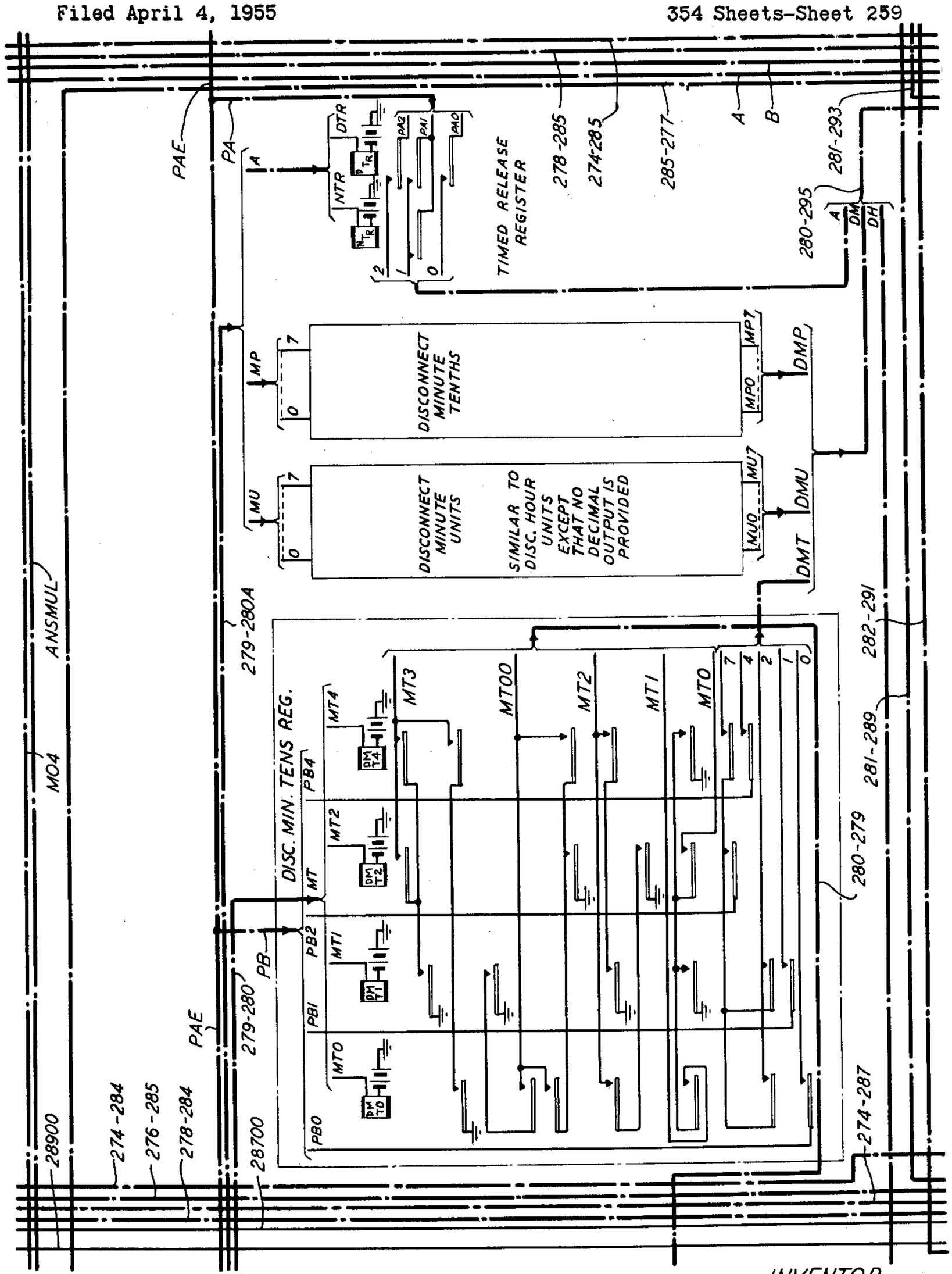


FIG. 280

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 260

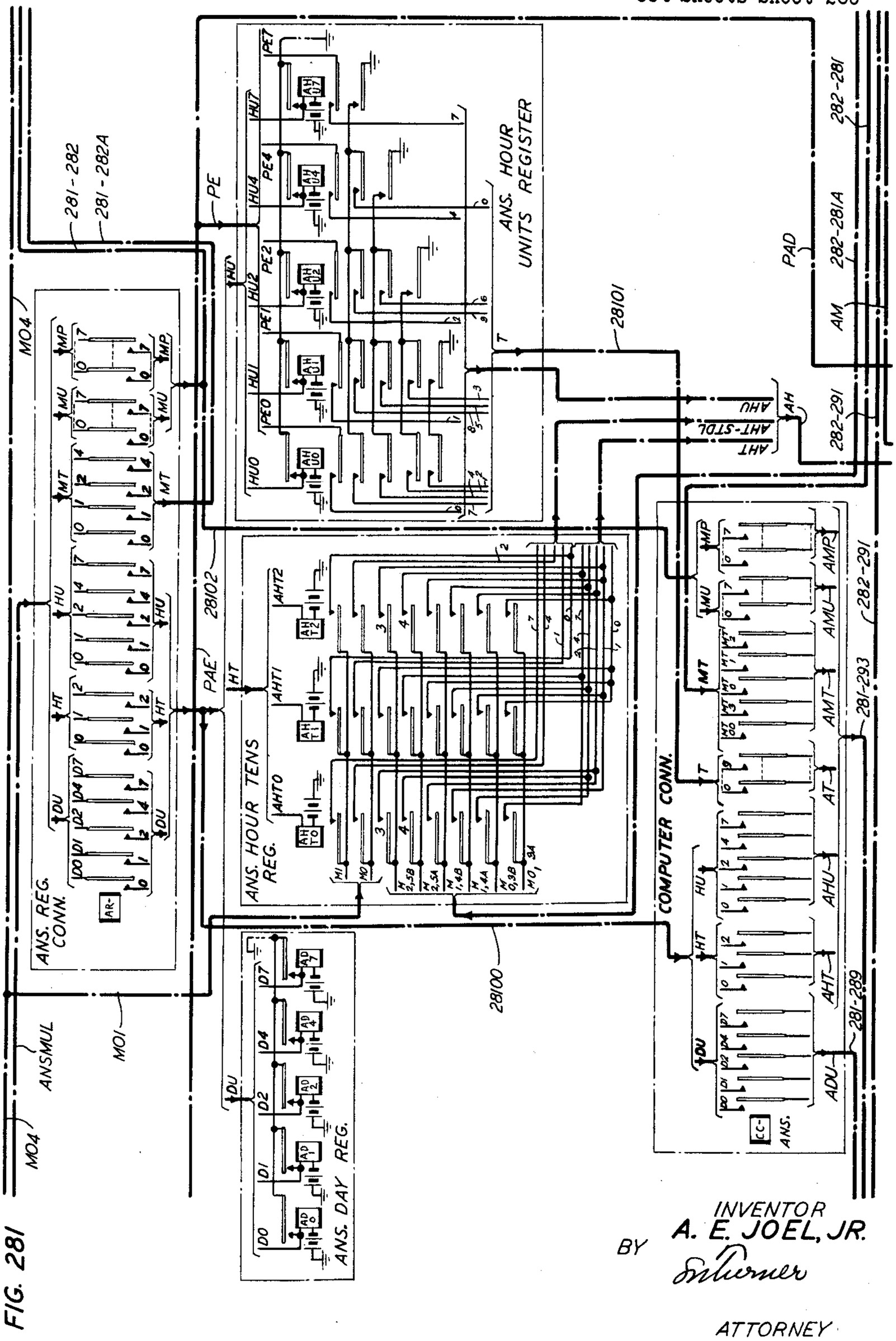


FIG. 281

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 261

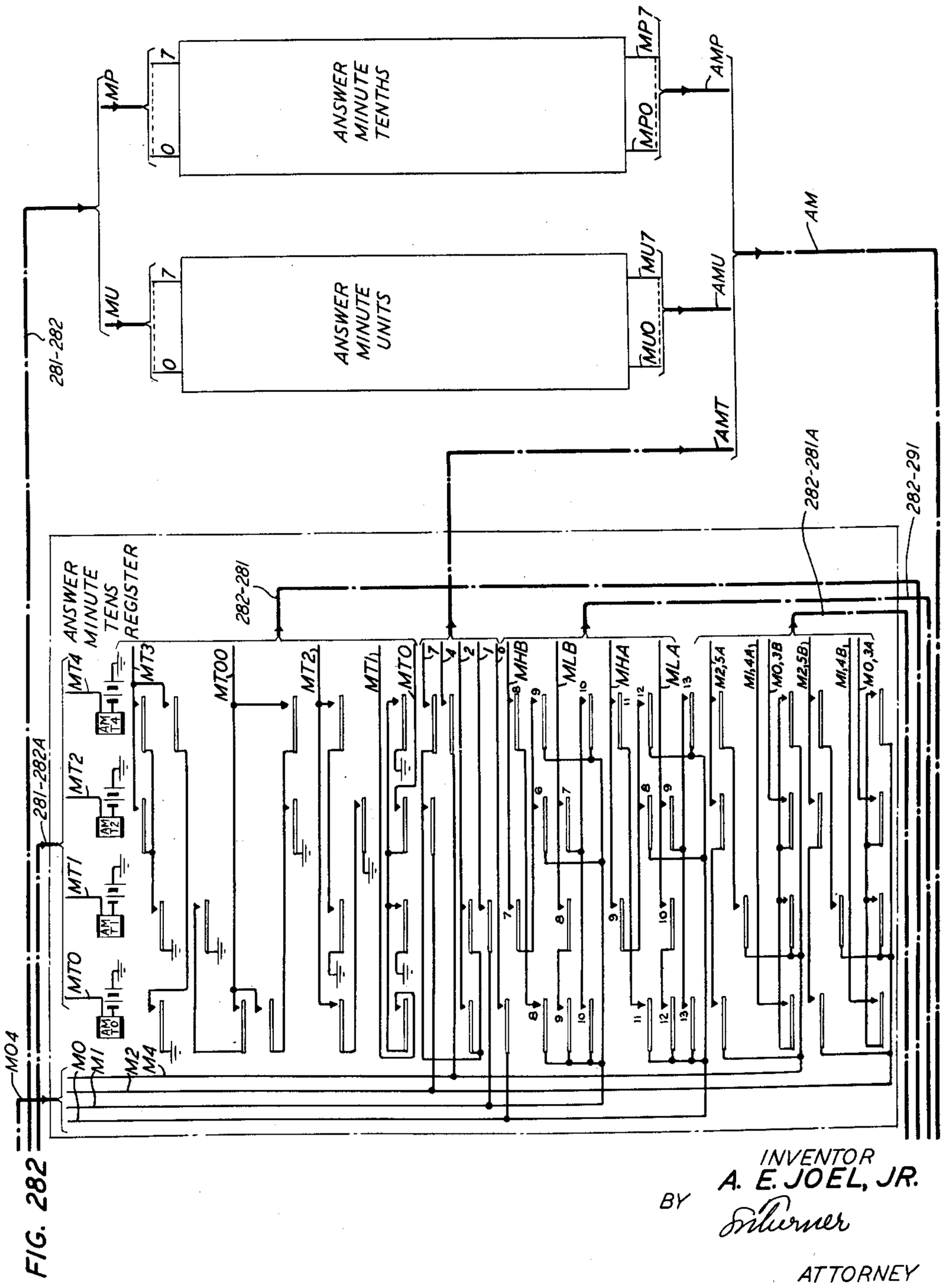


FIG. 282

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 262

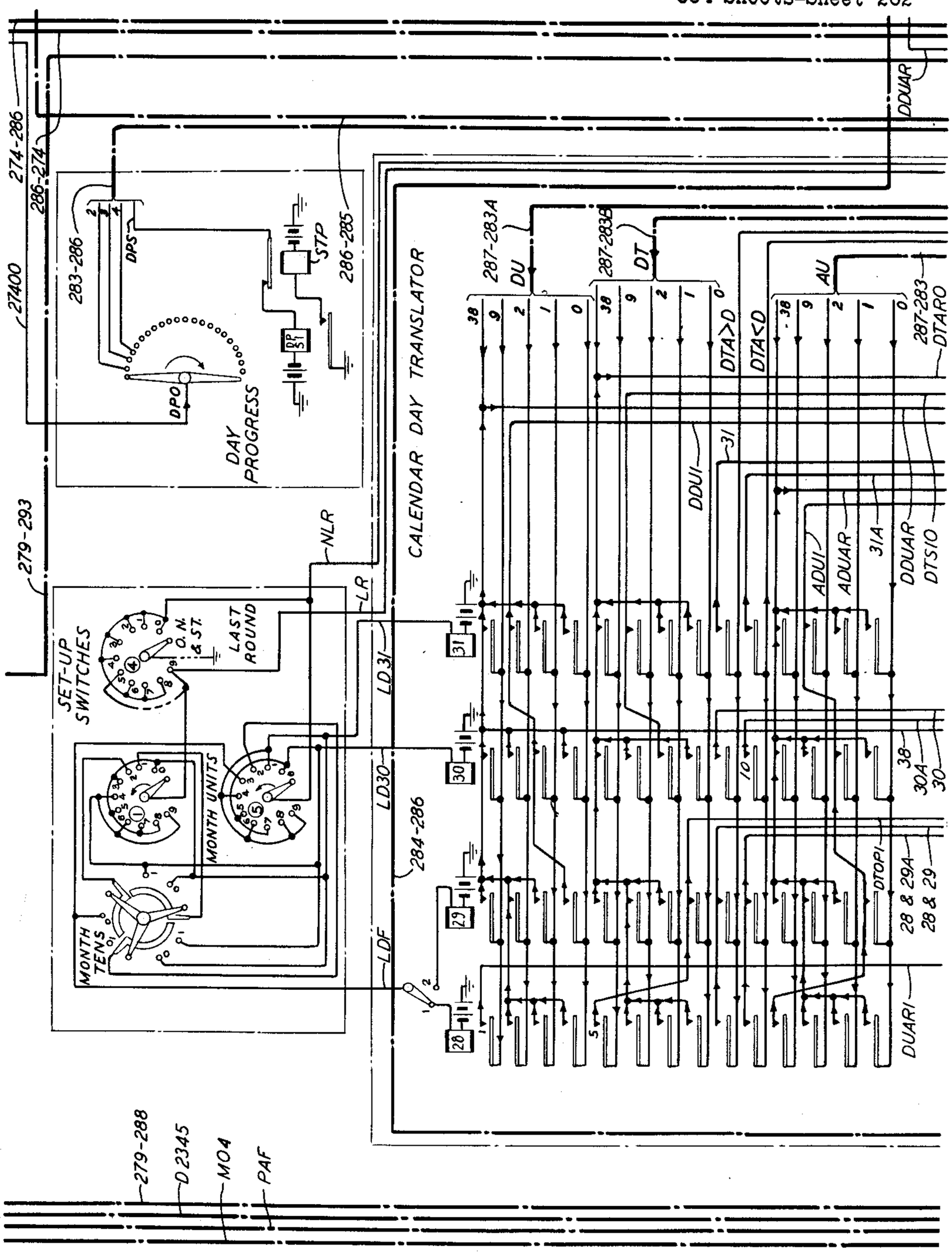


FIG. 283

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 263

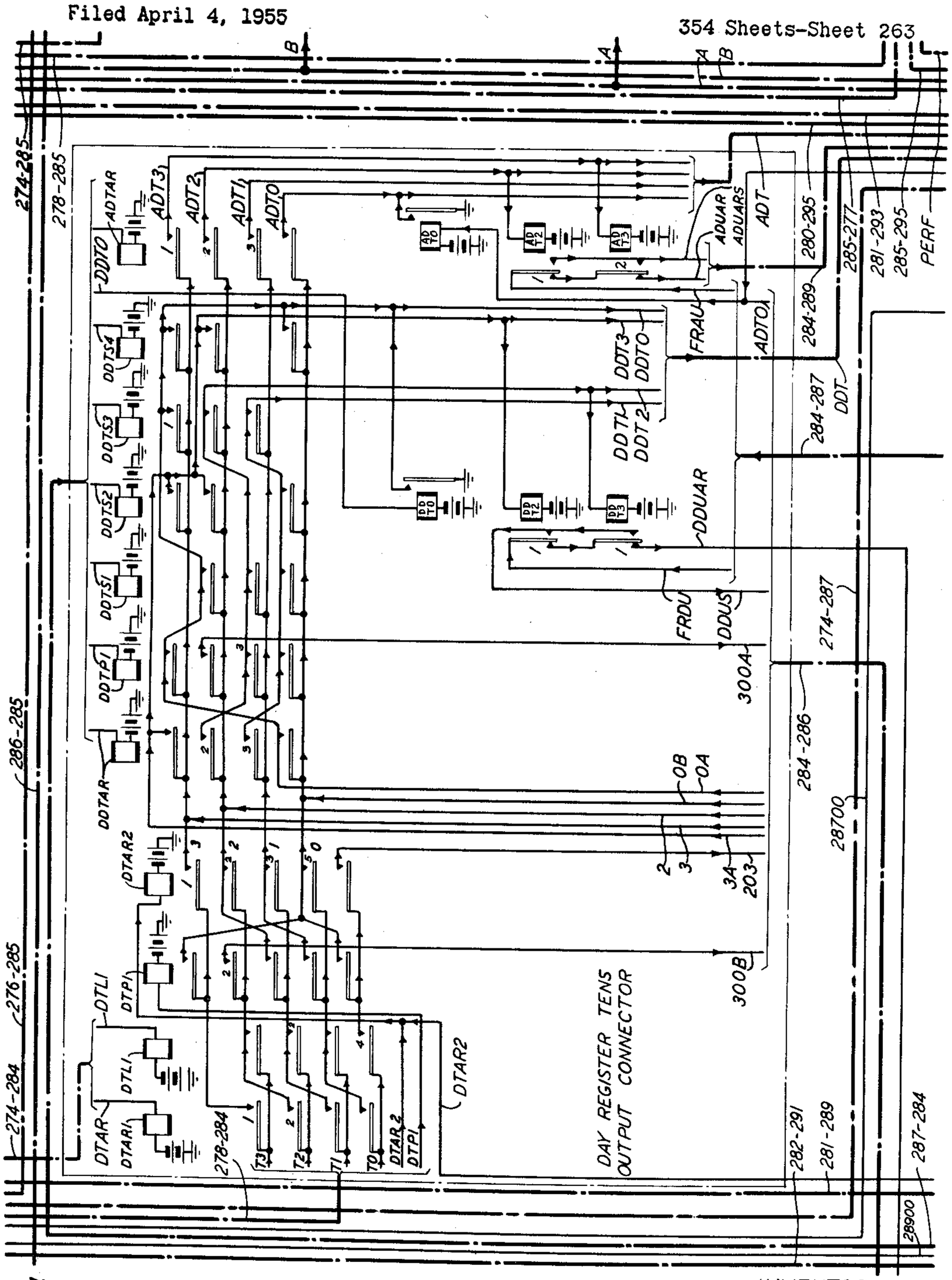


FIG. 284

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 264

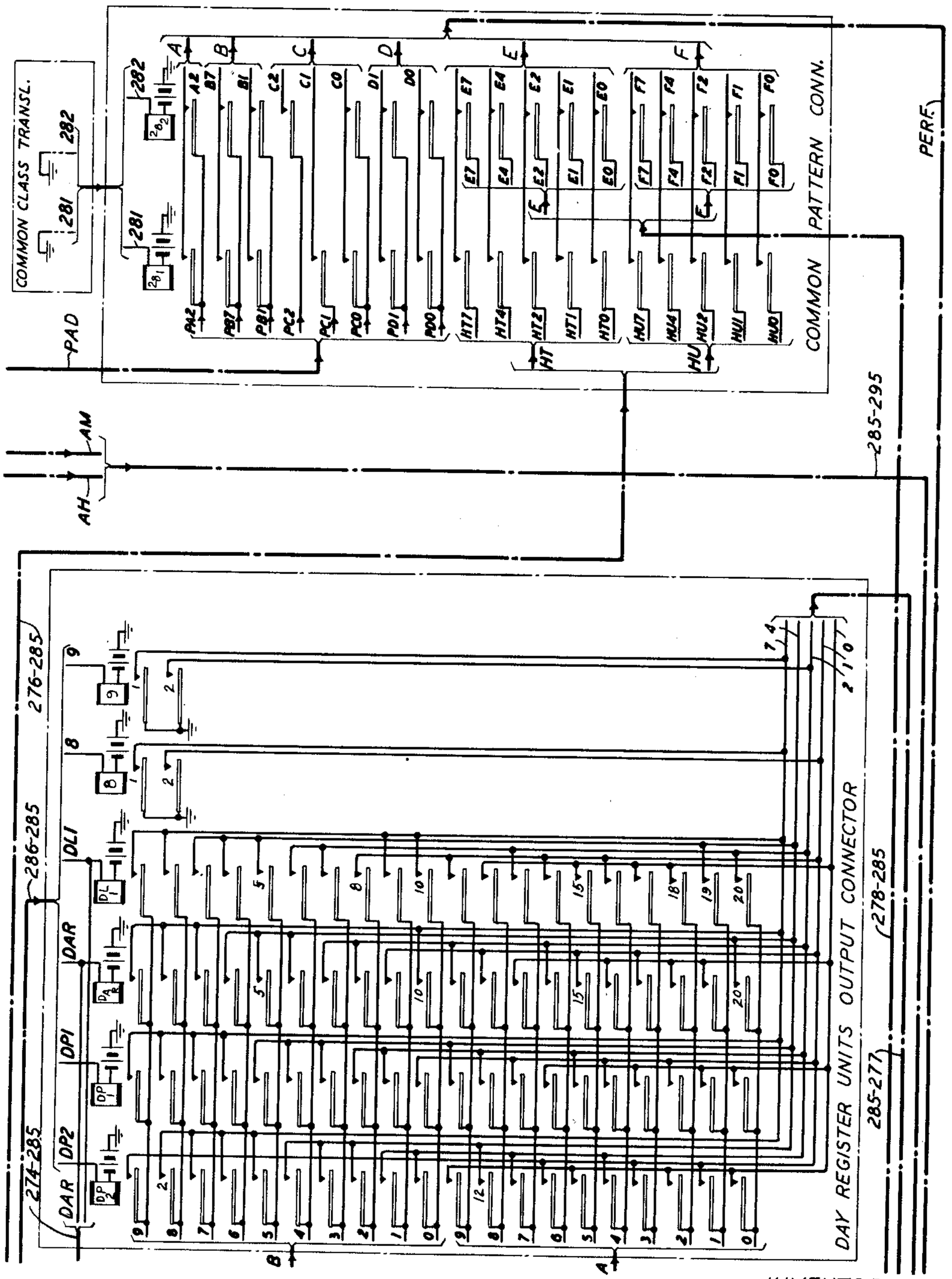


FIG. 285

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 265

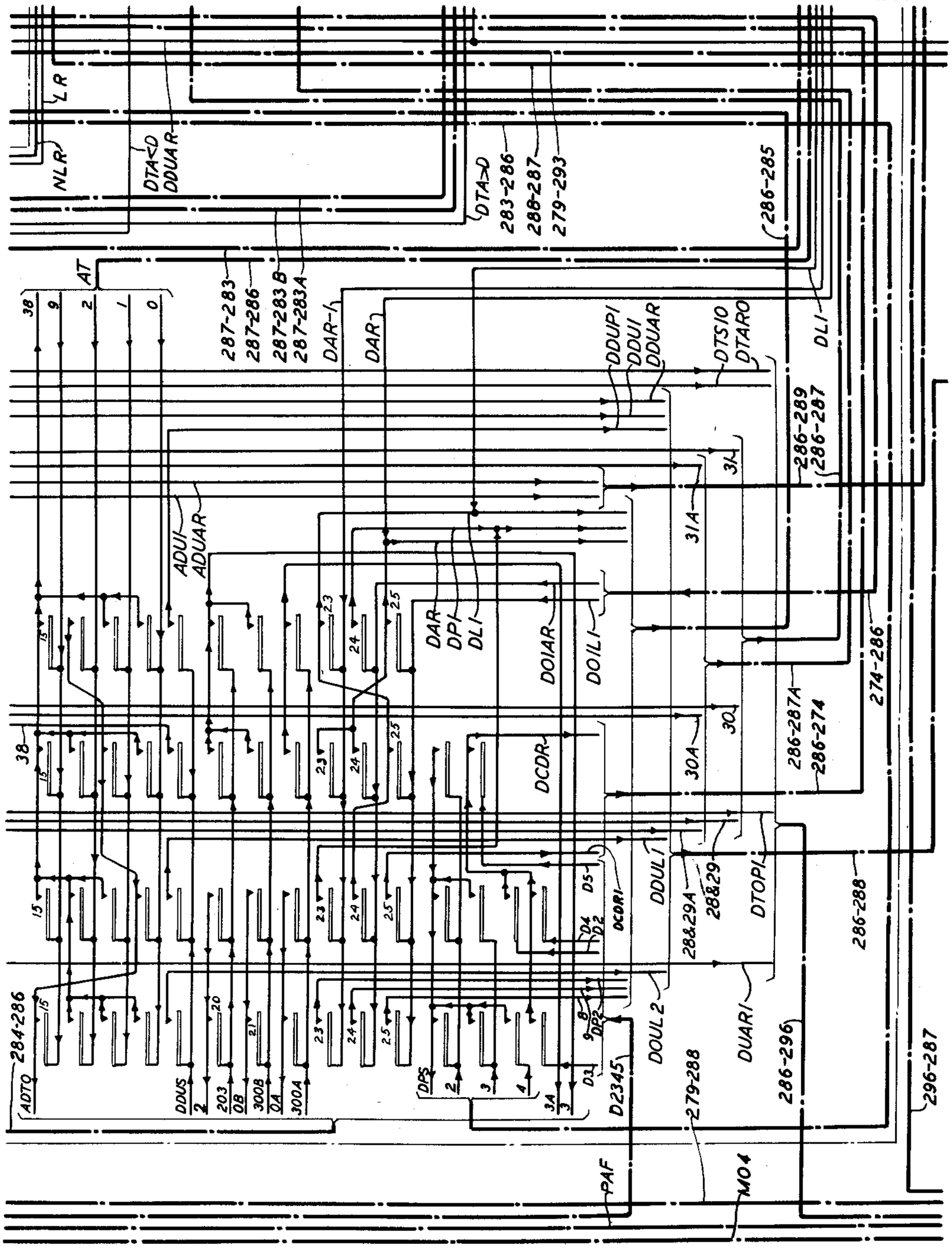


FIG. 286

INVENTOR
A. E. JOEL, JR.
BY
Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 266

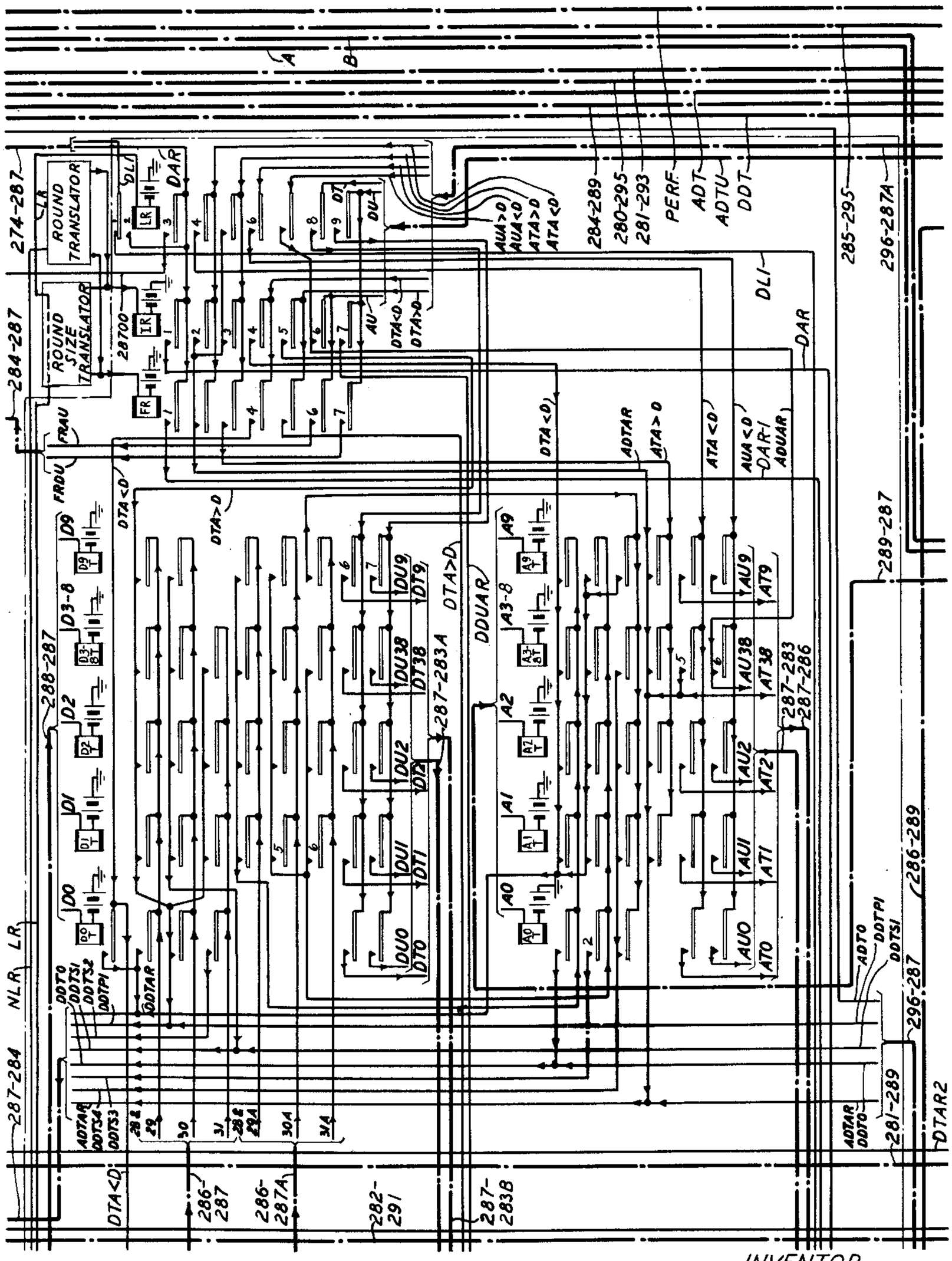


FIG. 287

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 267

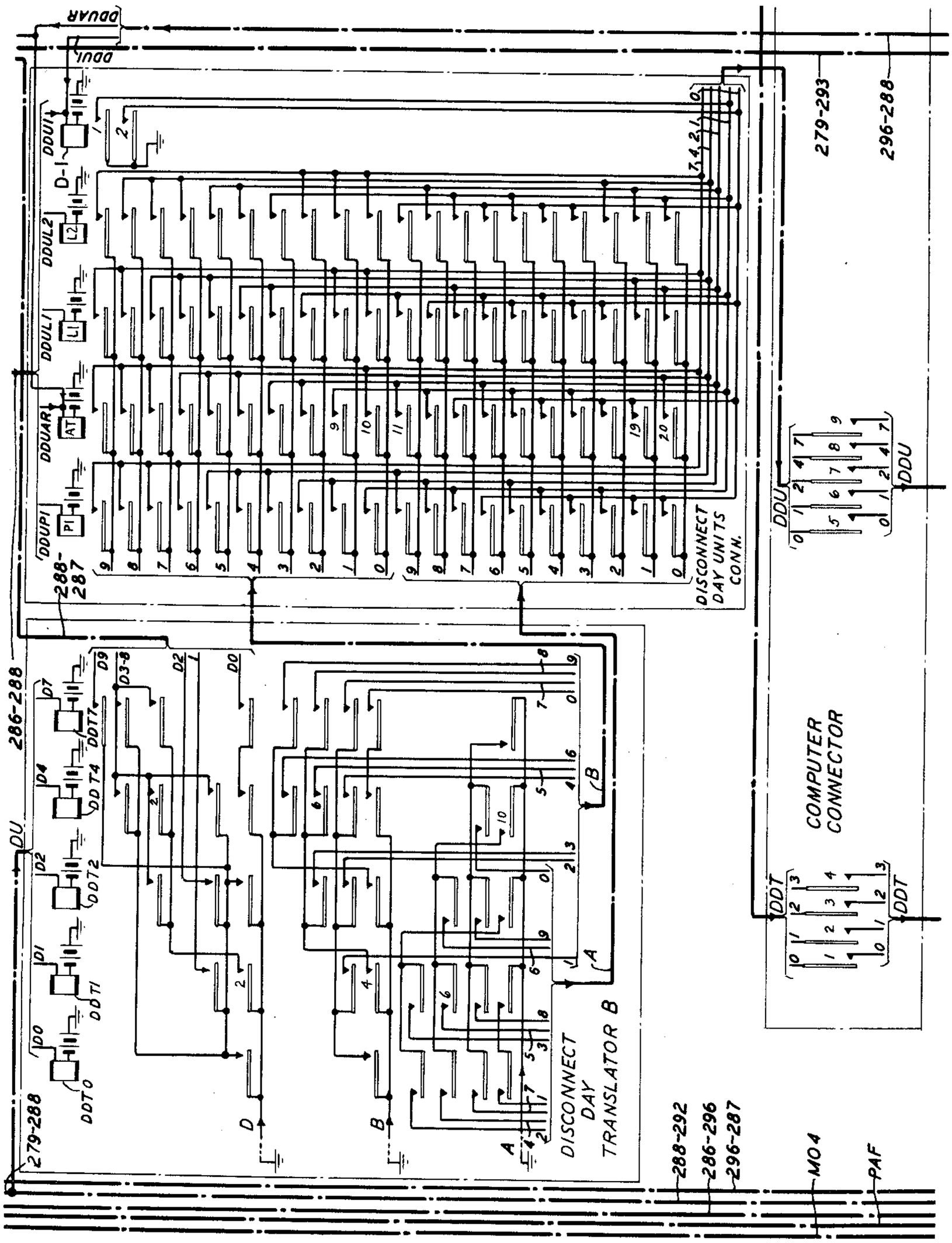


FIG. 288

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 268

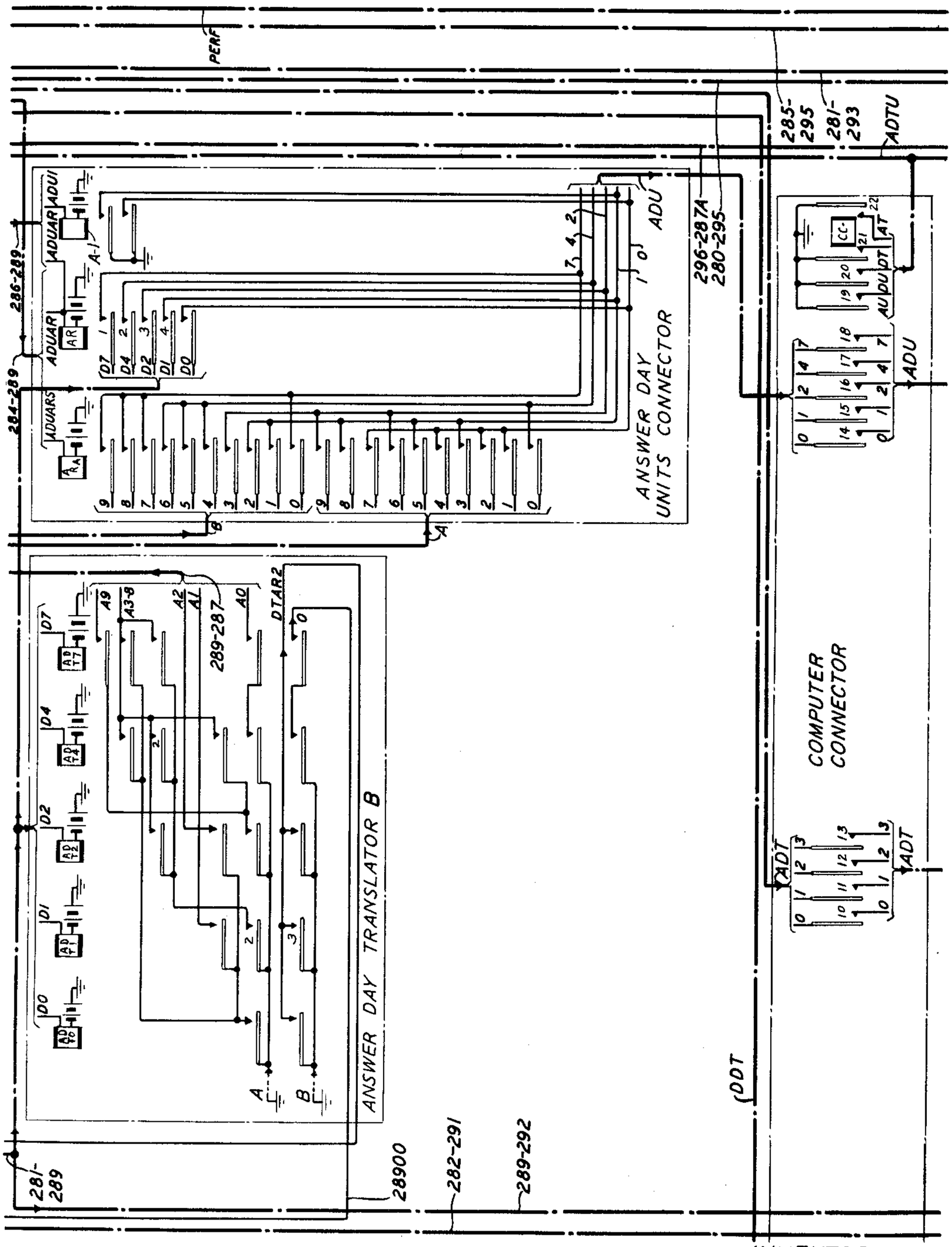


FIG. 289

INVENTOR
A. E. JOEL, JR.
BY Silturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 269

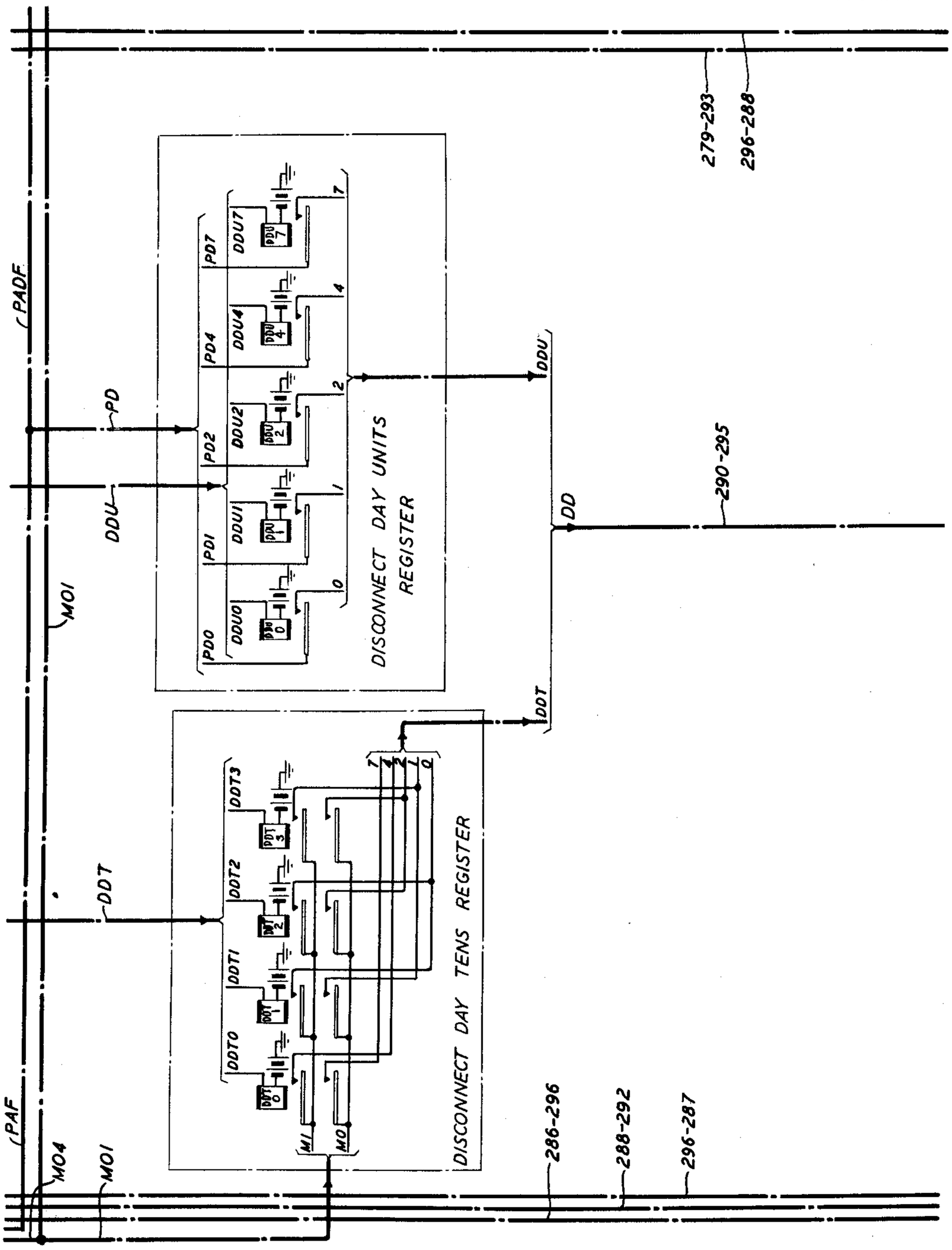


FIG. 290

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 270

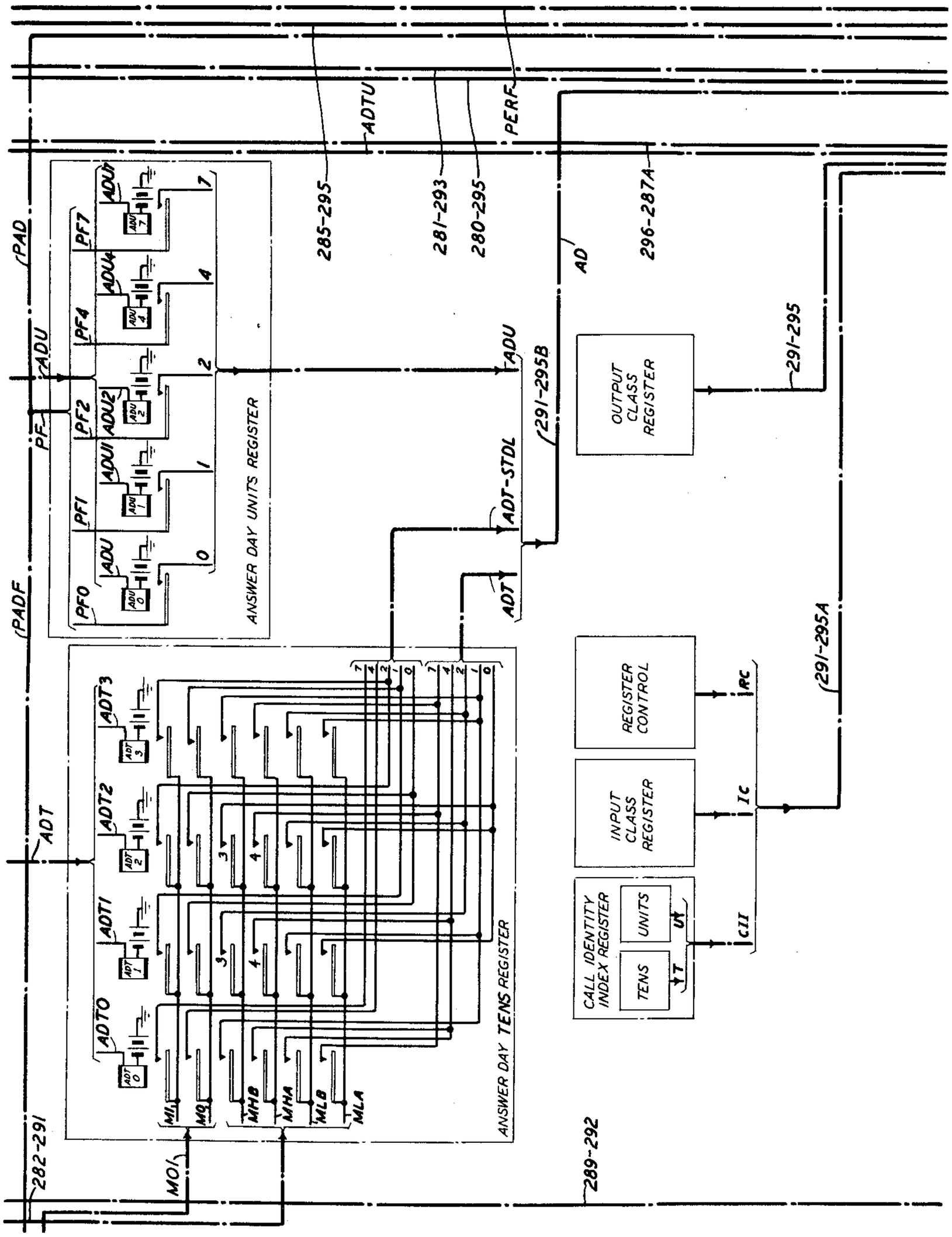


FIG. 291

INVENTOR
A. E. JOEL, JR.
BY Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 271

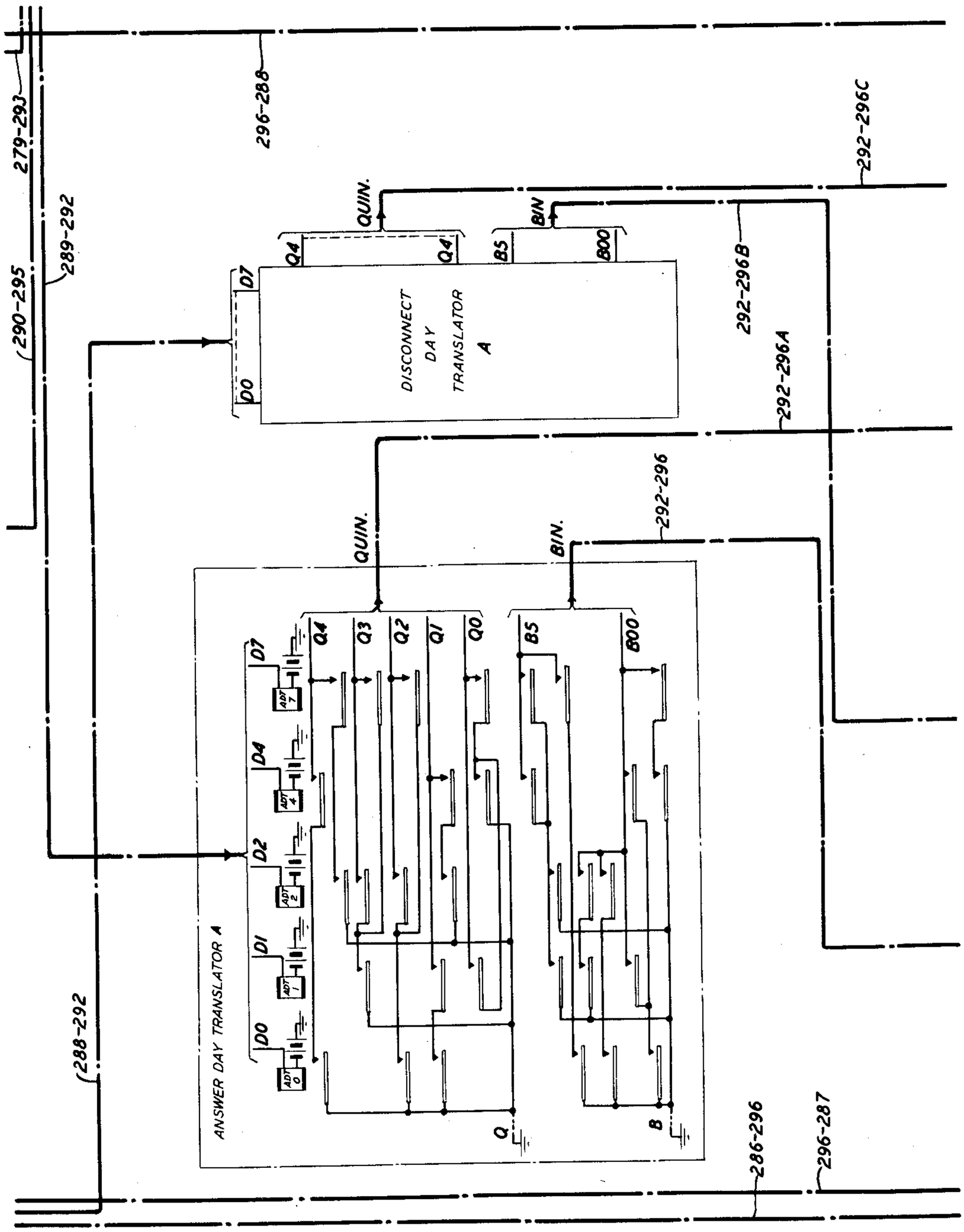


FIG. 292

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 272

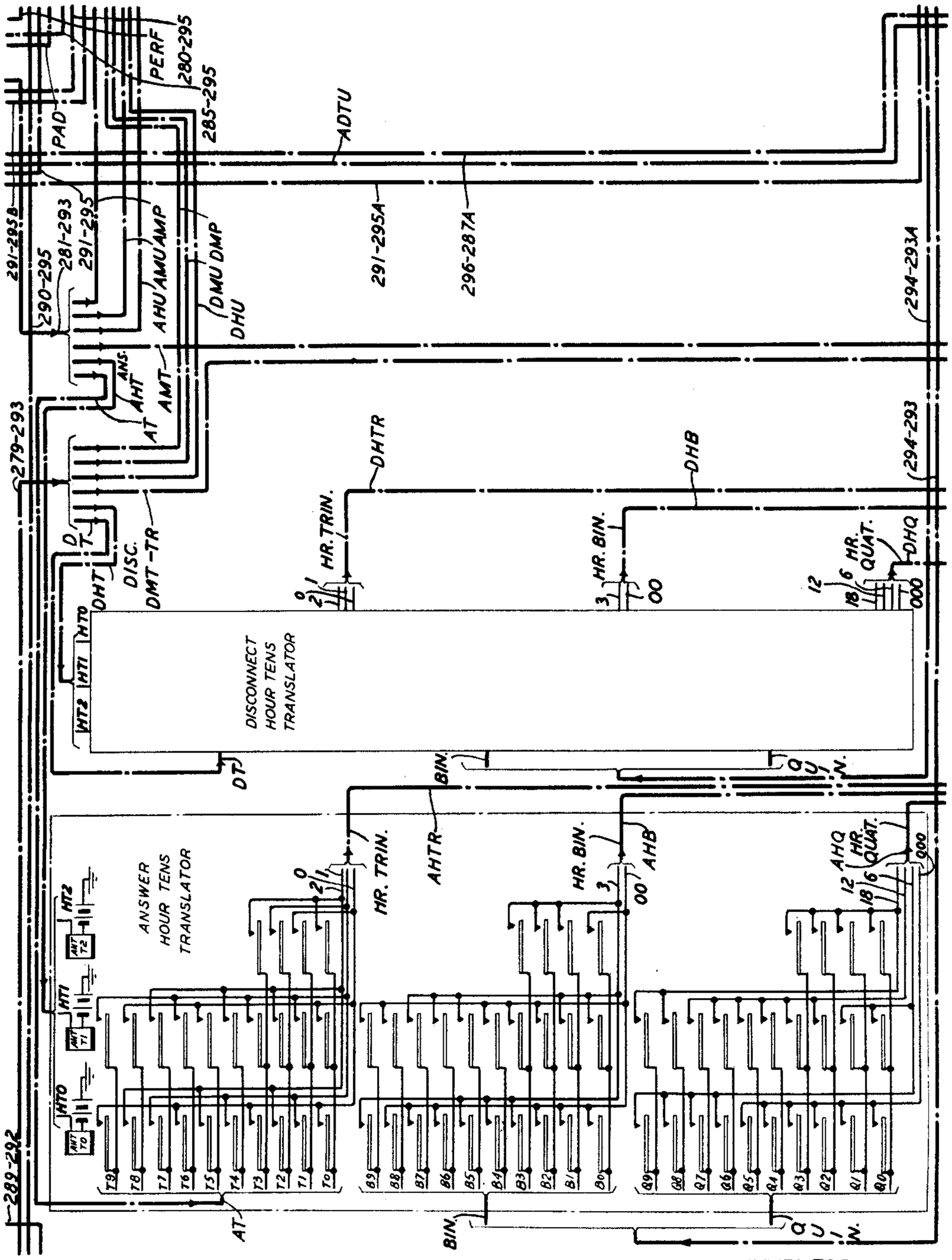


FIG. 293

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 273

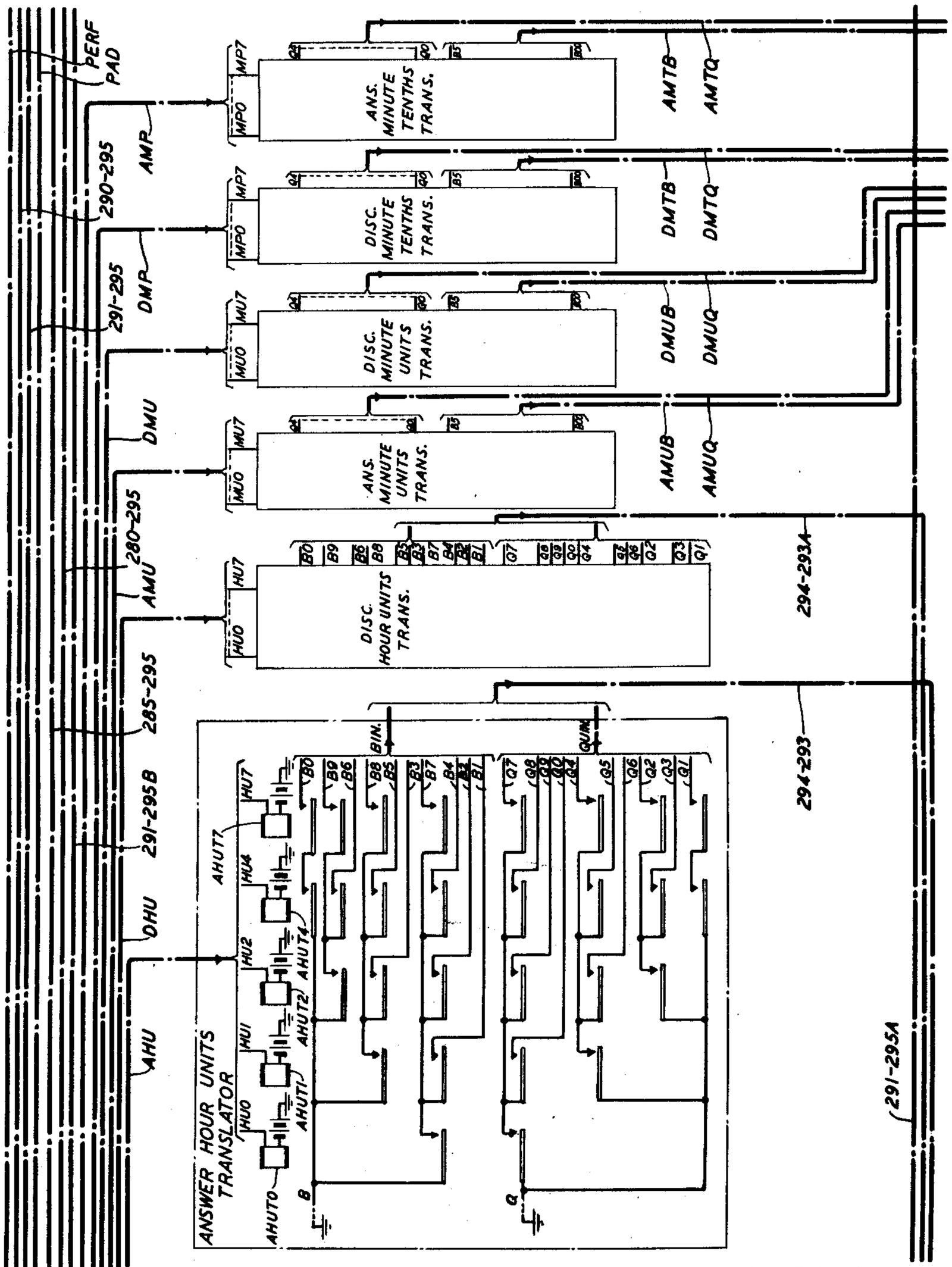


FIG. 294

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 274

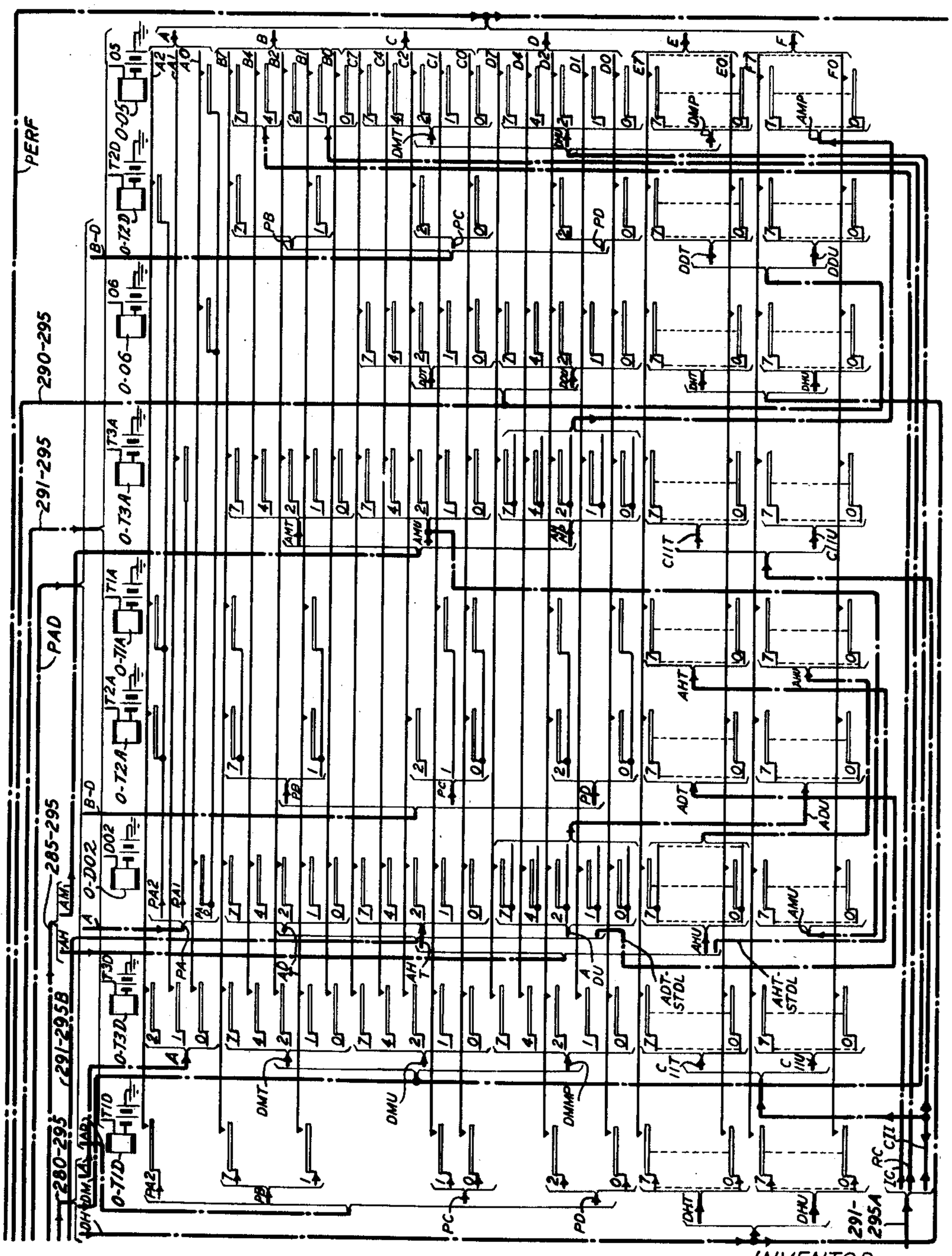


FIG. 295

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 275

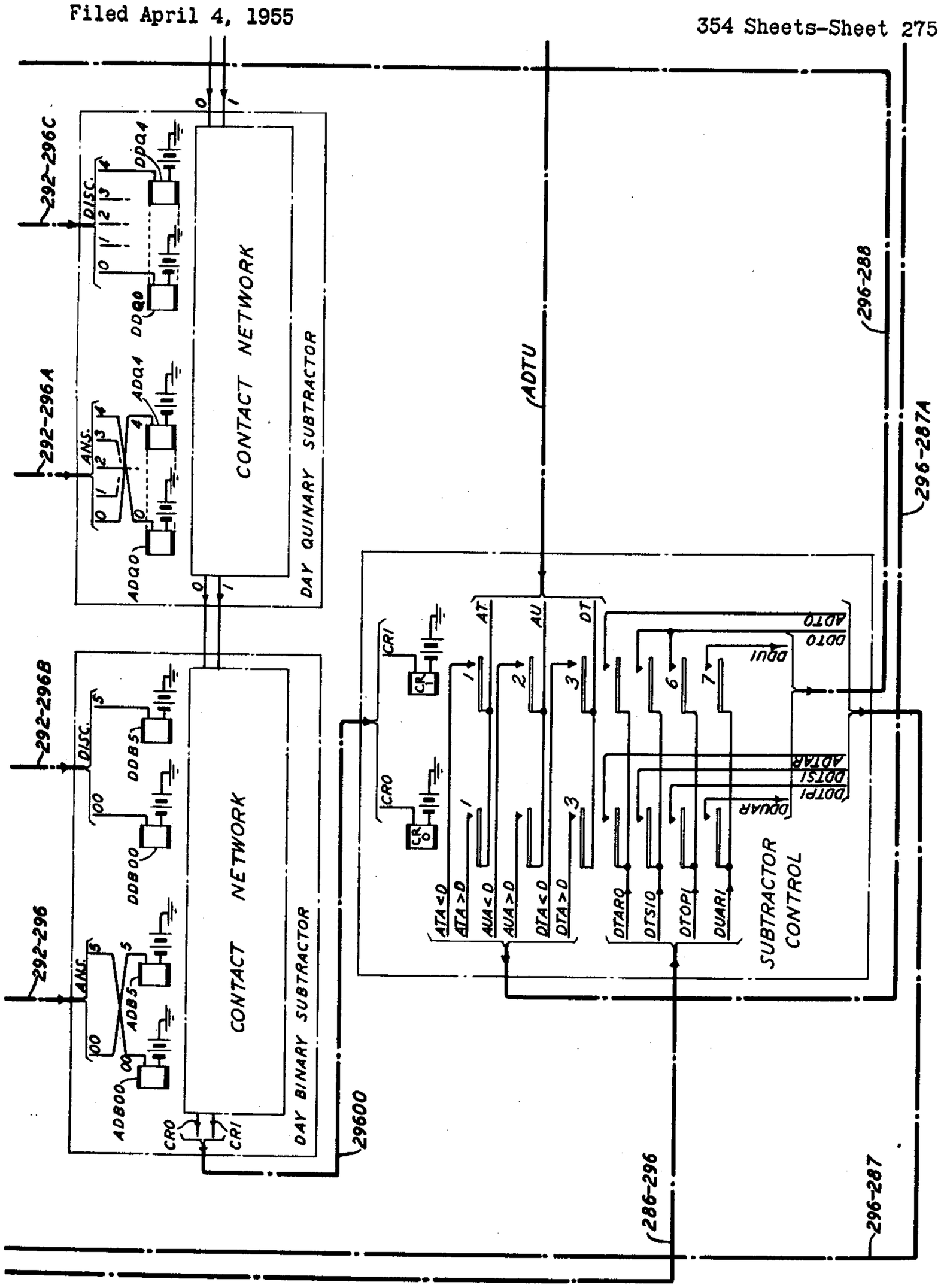


FIG. 296

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 276

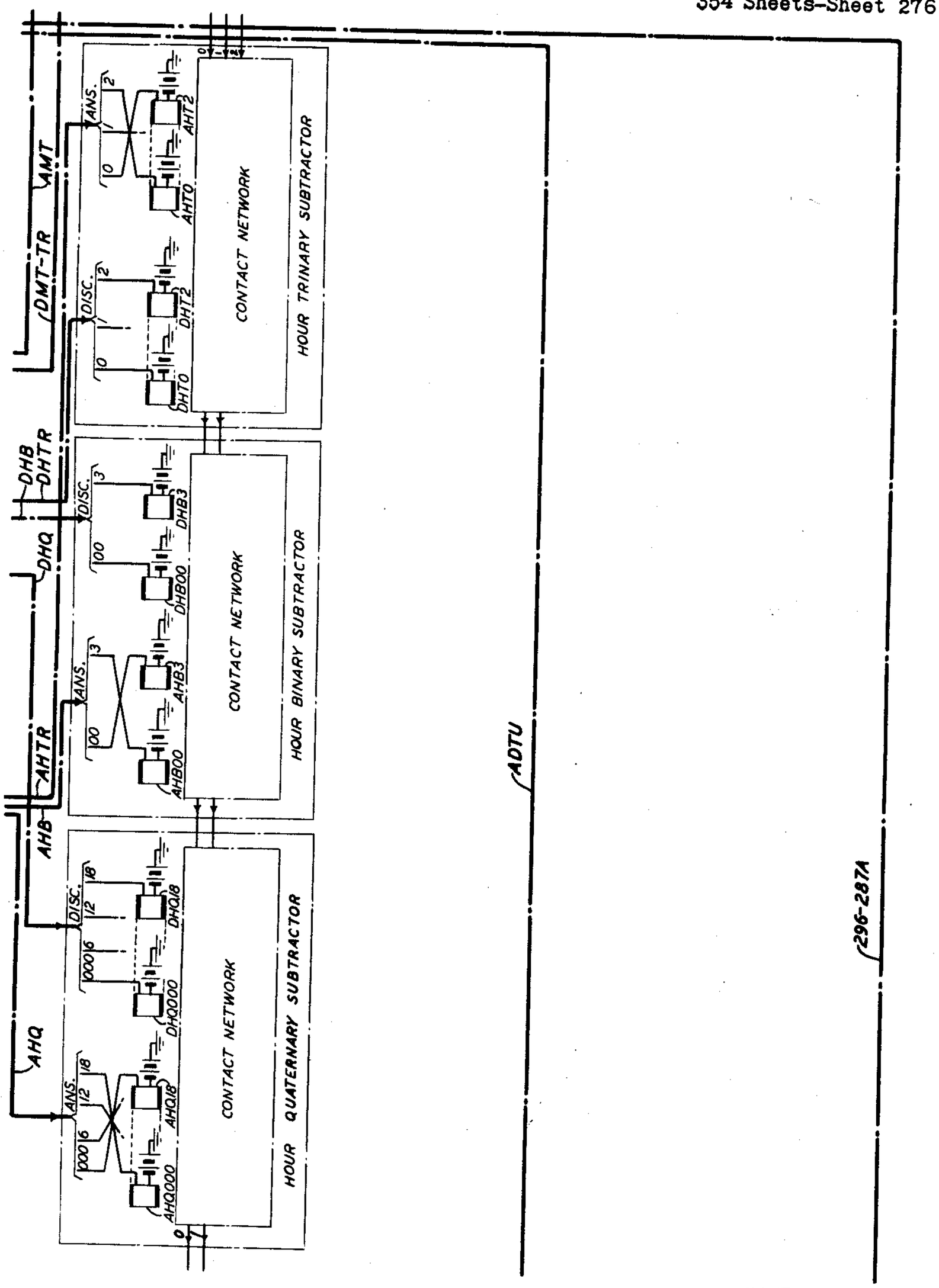


FIG. 297

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 277

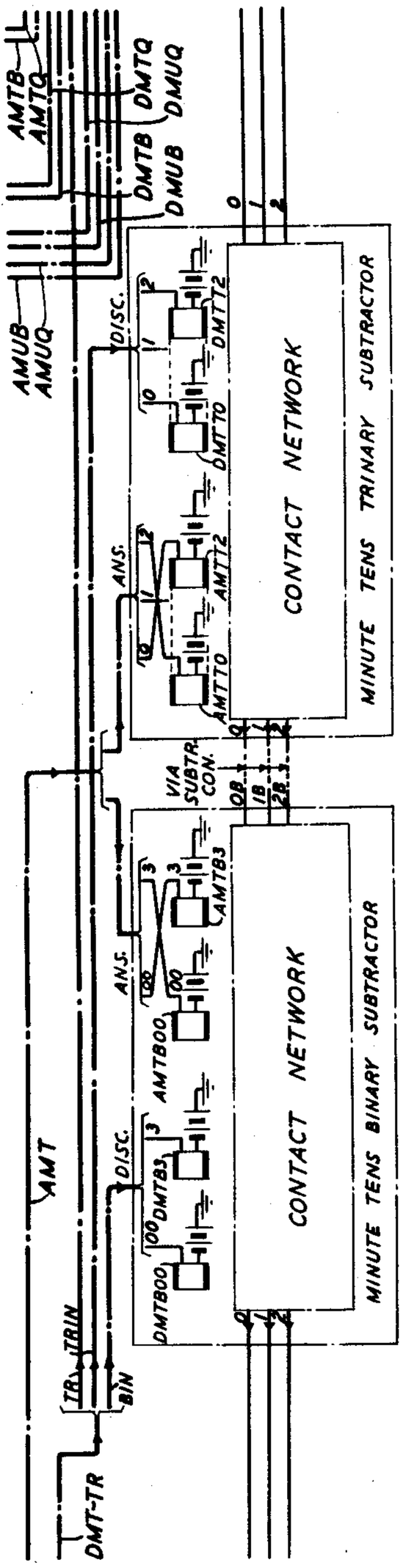


FIG. 298

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 278

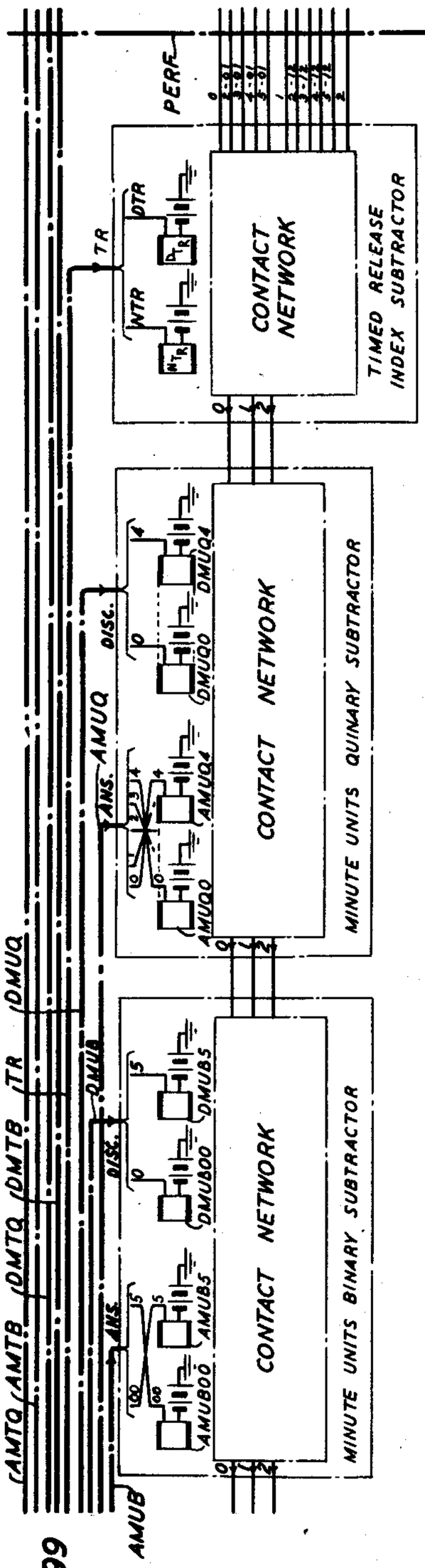


FIG. 299

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 279

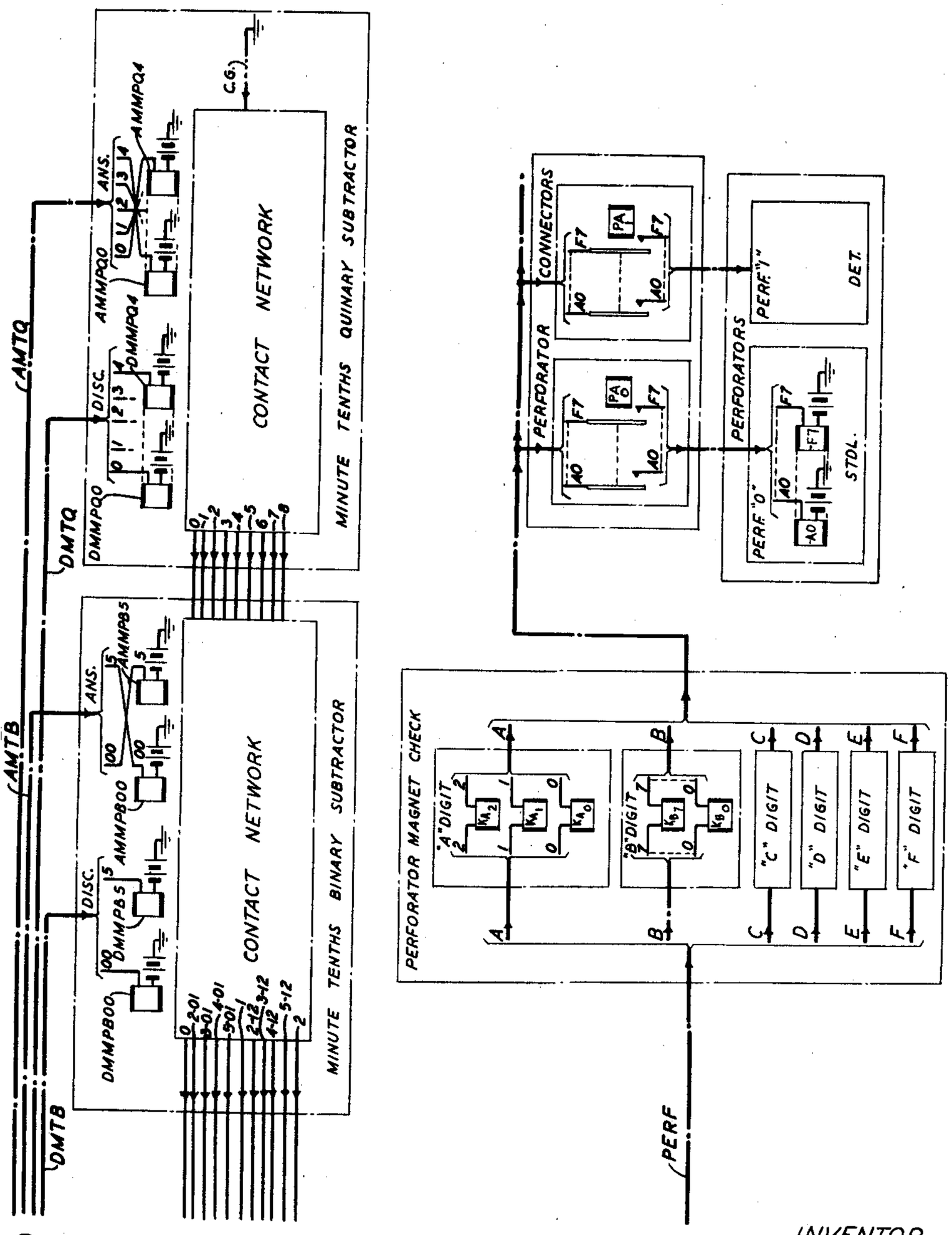


FIG. 300

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 280

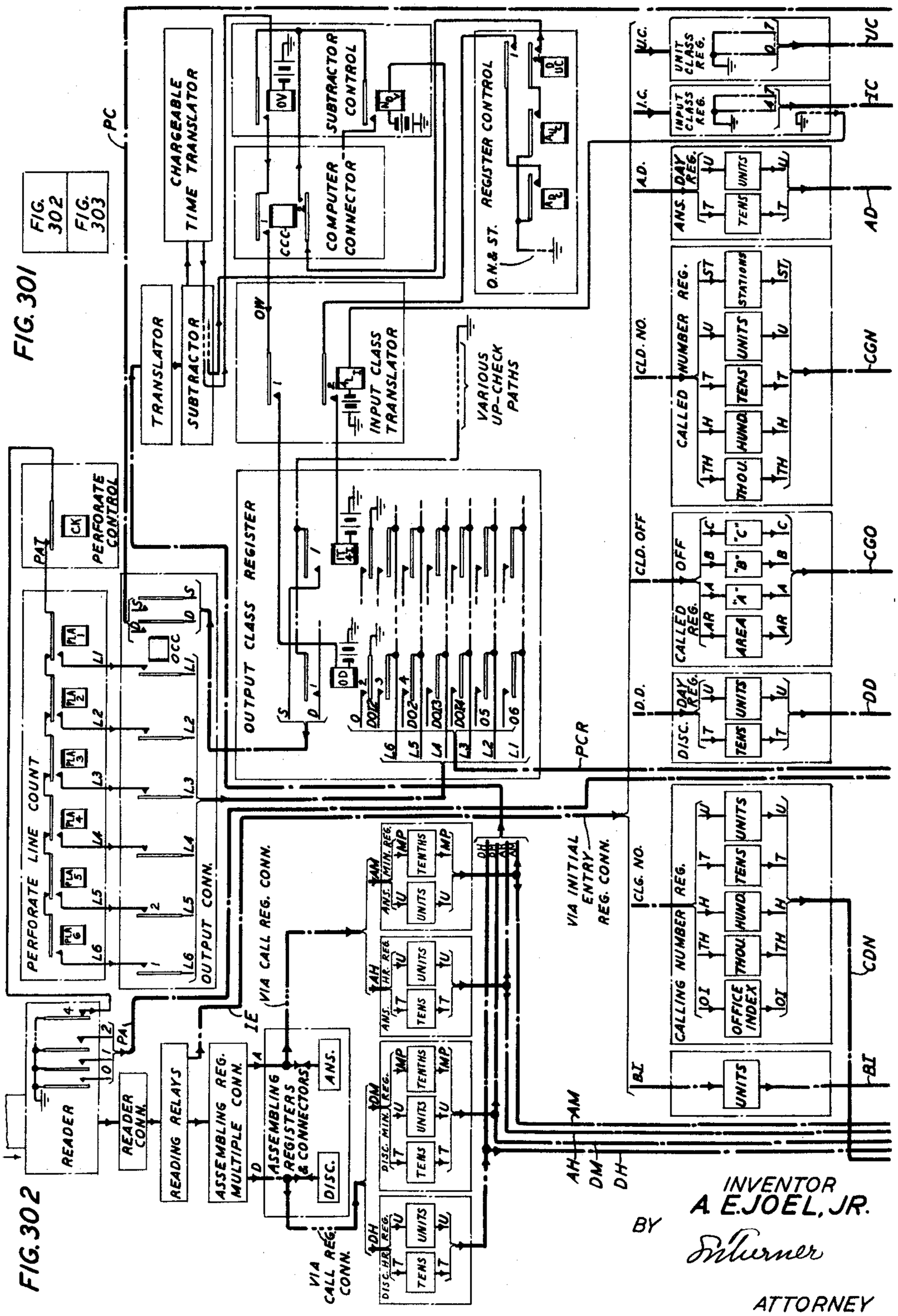


FIG. 302

INVENTOR
A. E. JOEL, JR.
BY
J. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 281

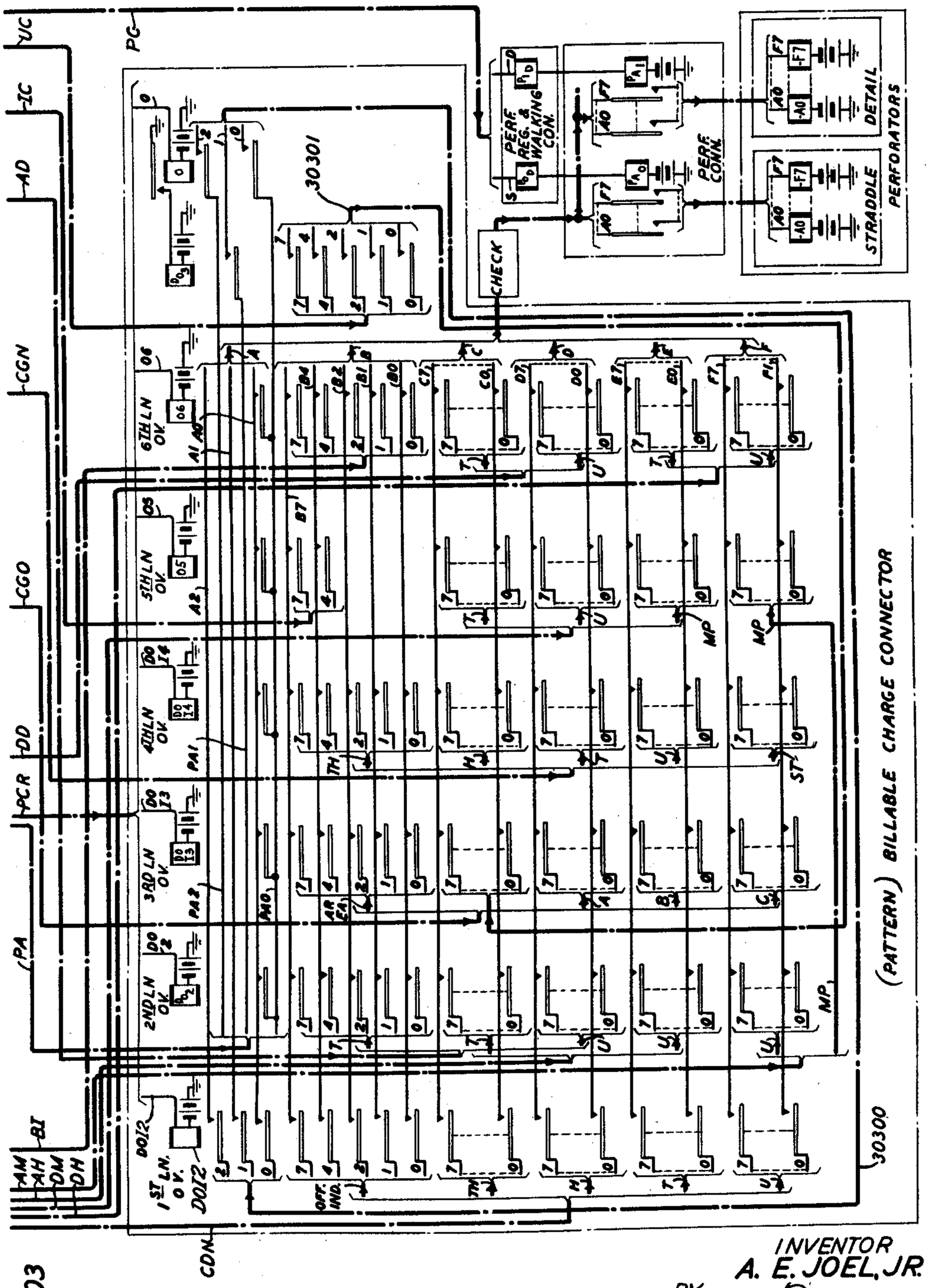


FIG. 303

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 282

FIG. 305

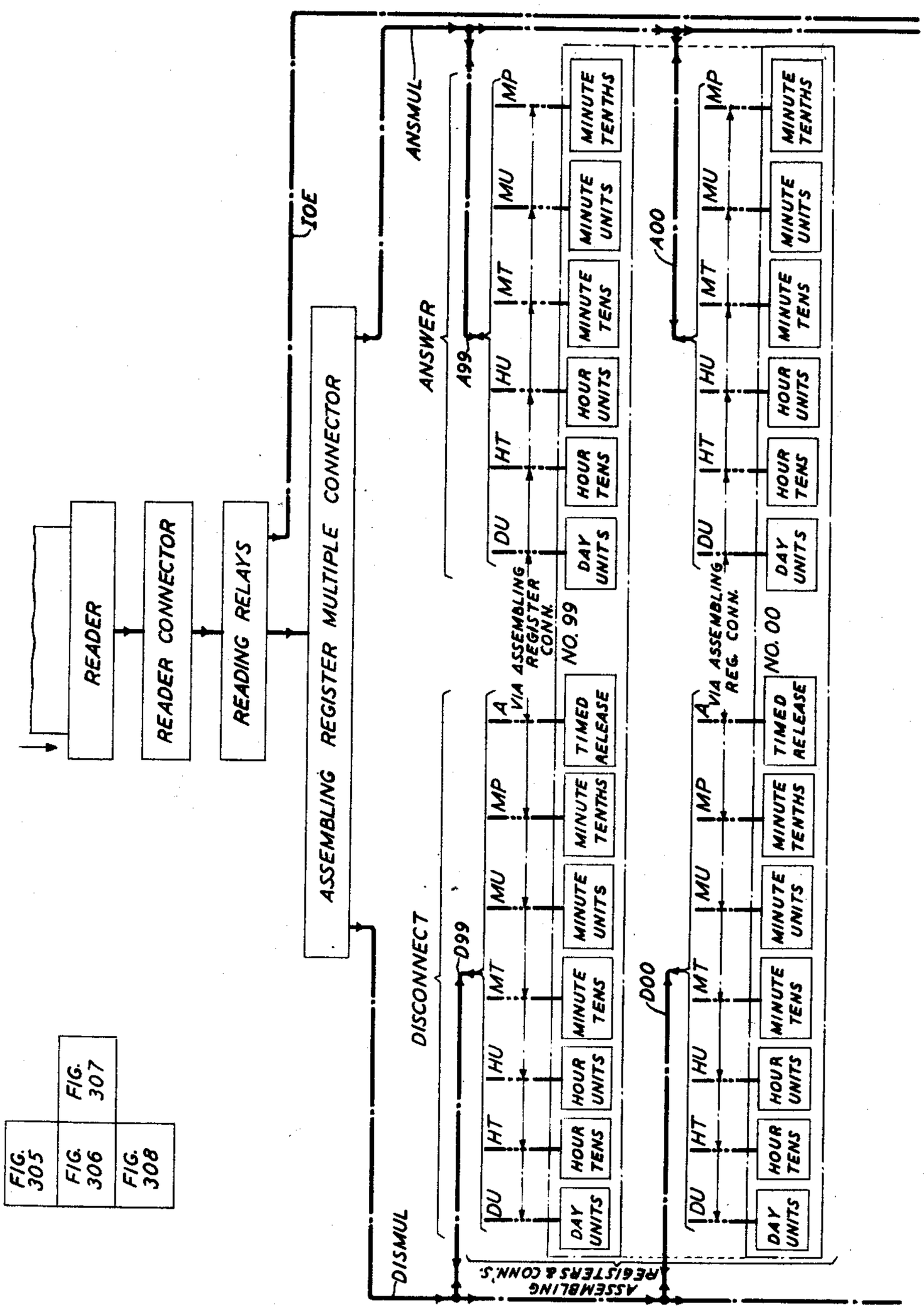


FIG. 304

	FIG. 307	
FIG. 305	FIG. 306	FIG. 308

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 283

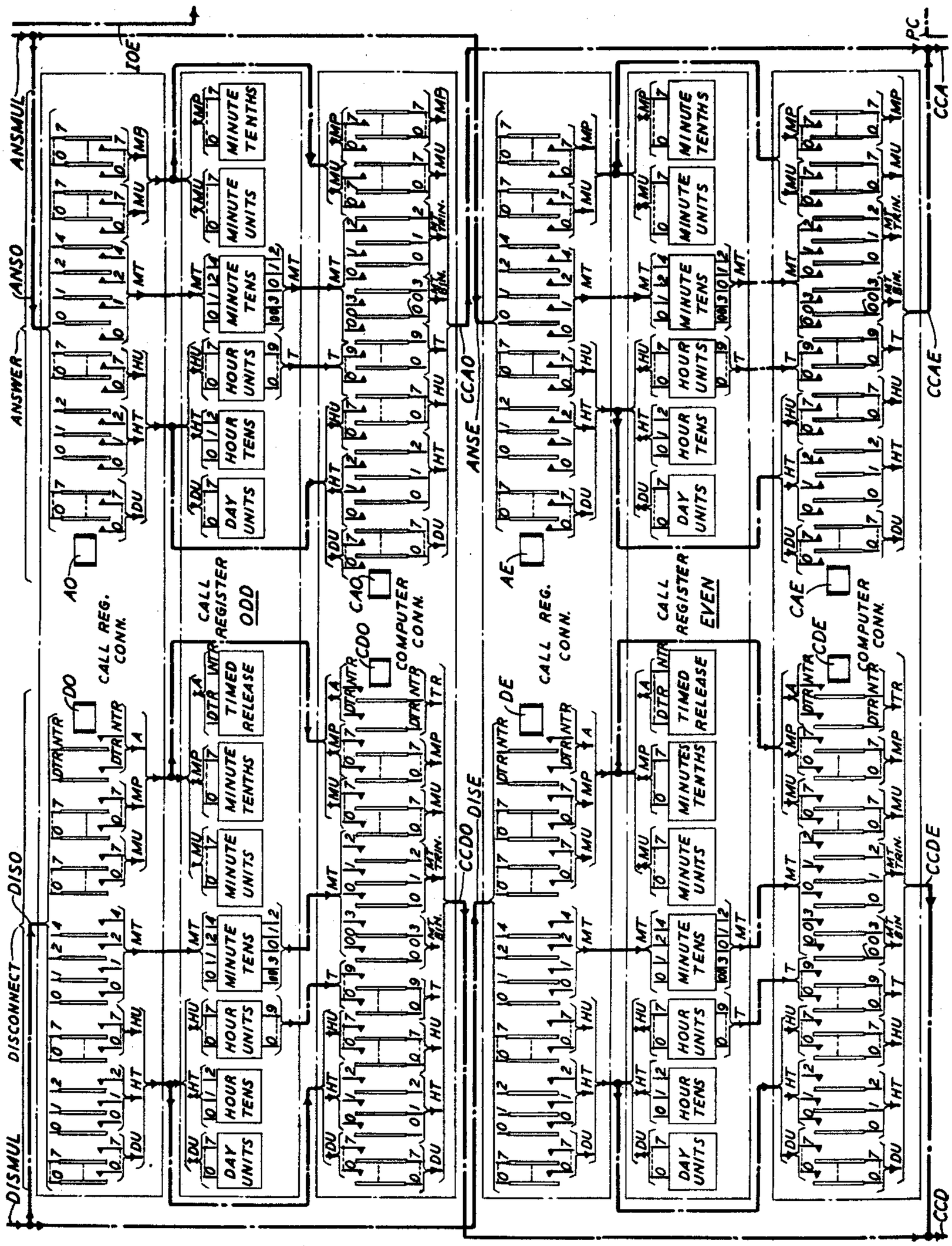


FIG. 306

INVENTOR
A. E. JOEL, JR
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 284

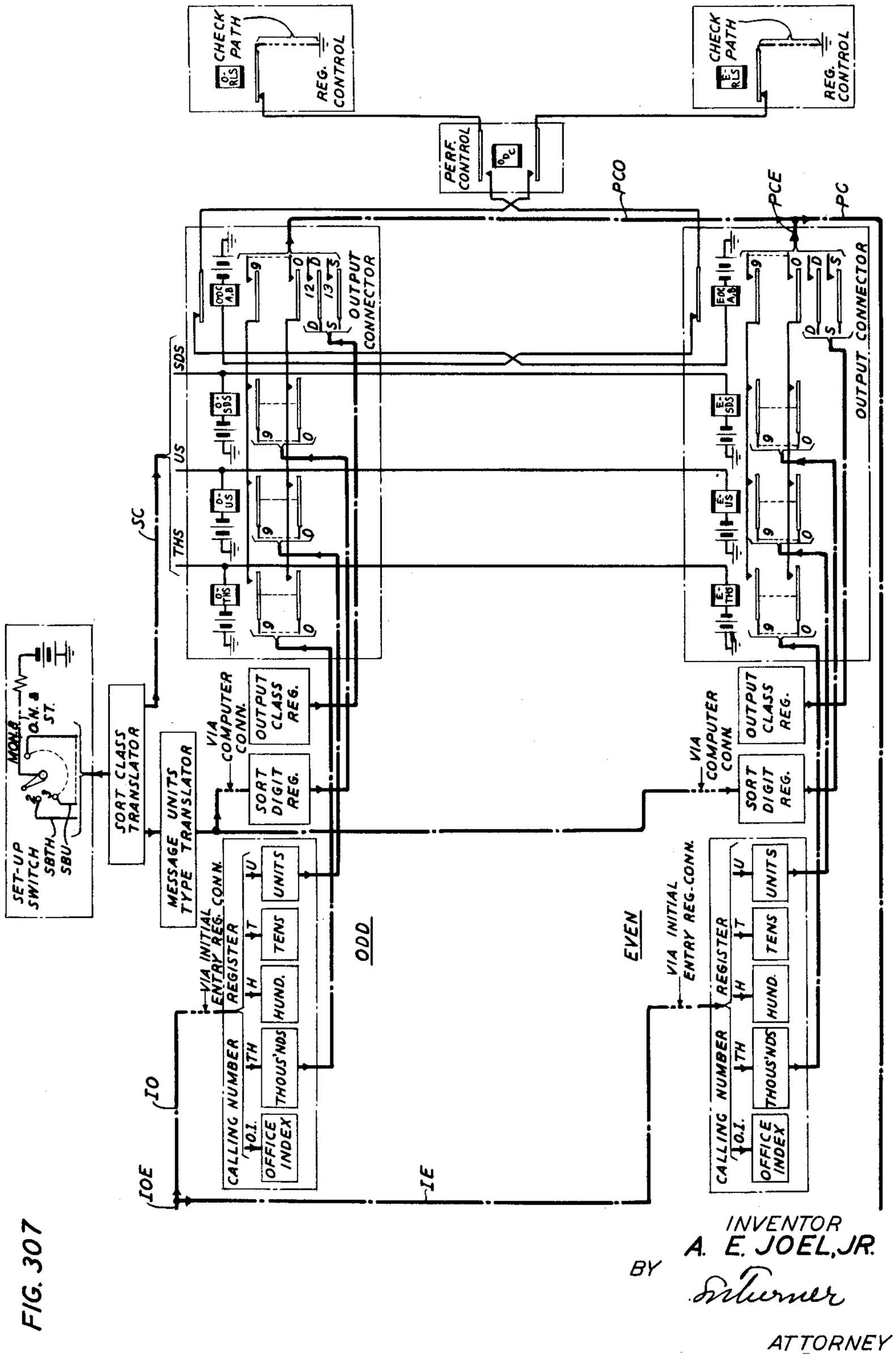


FIG. 307

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 285

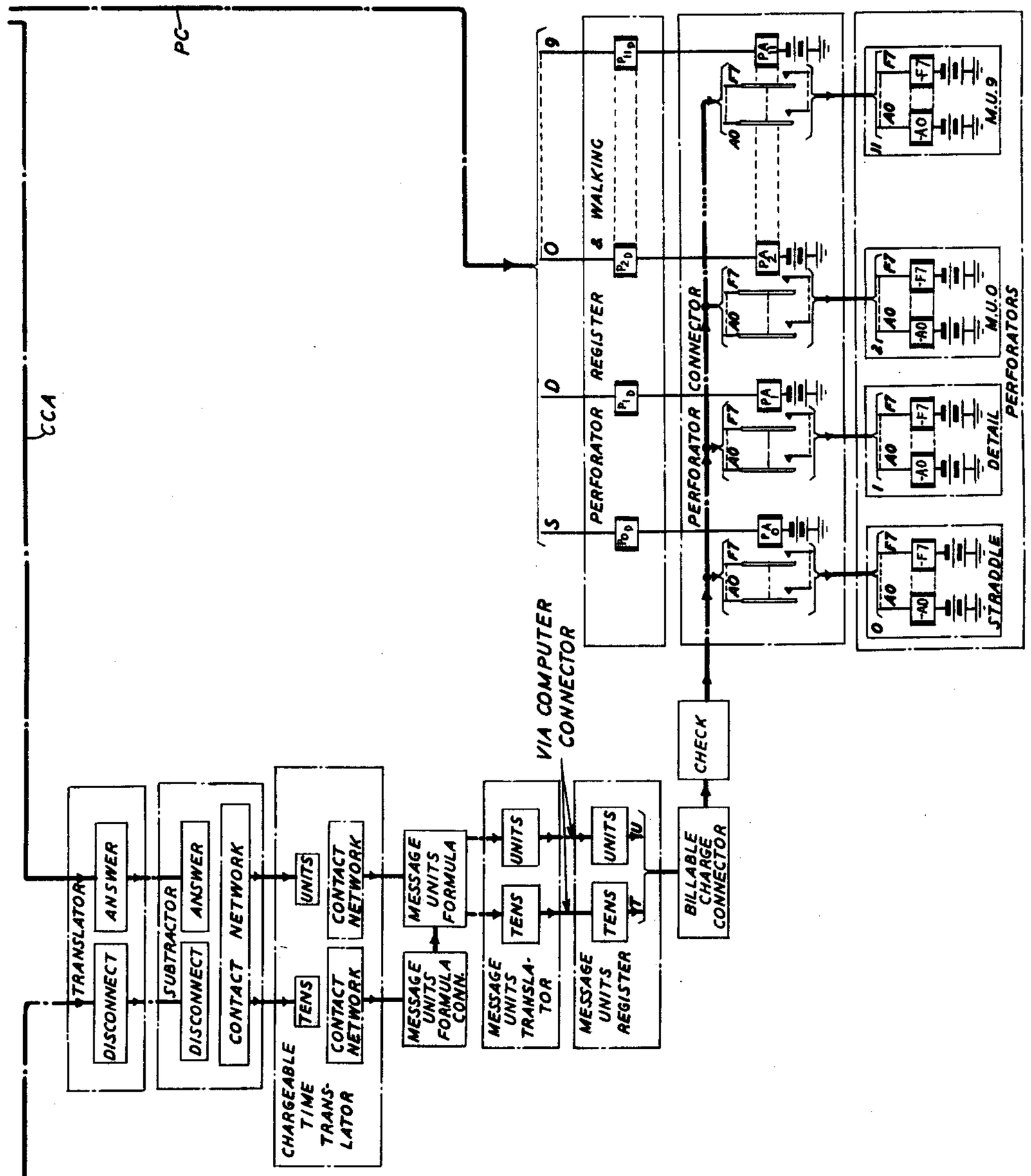


FIG. 308

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 286

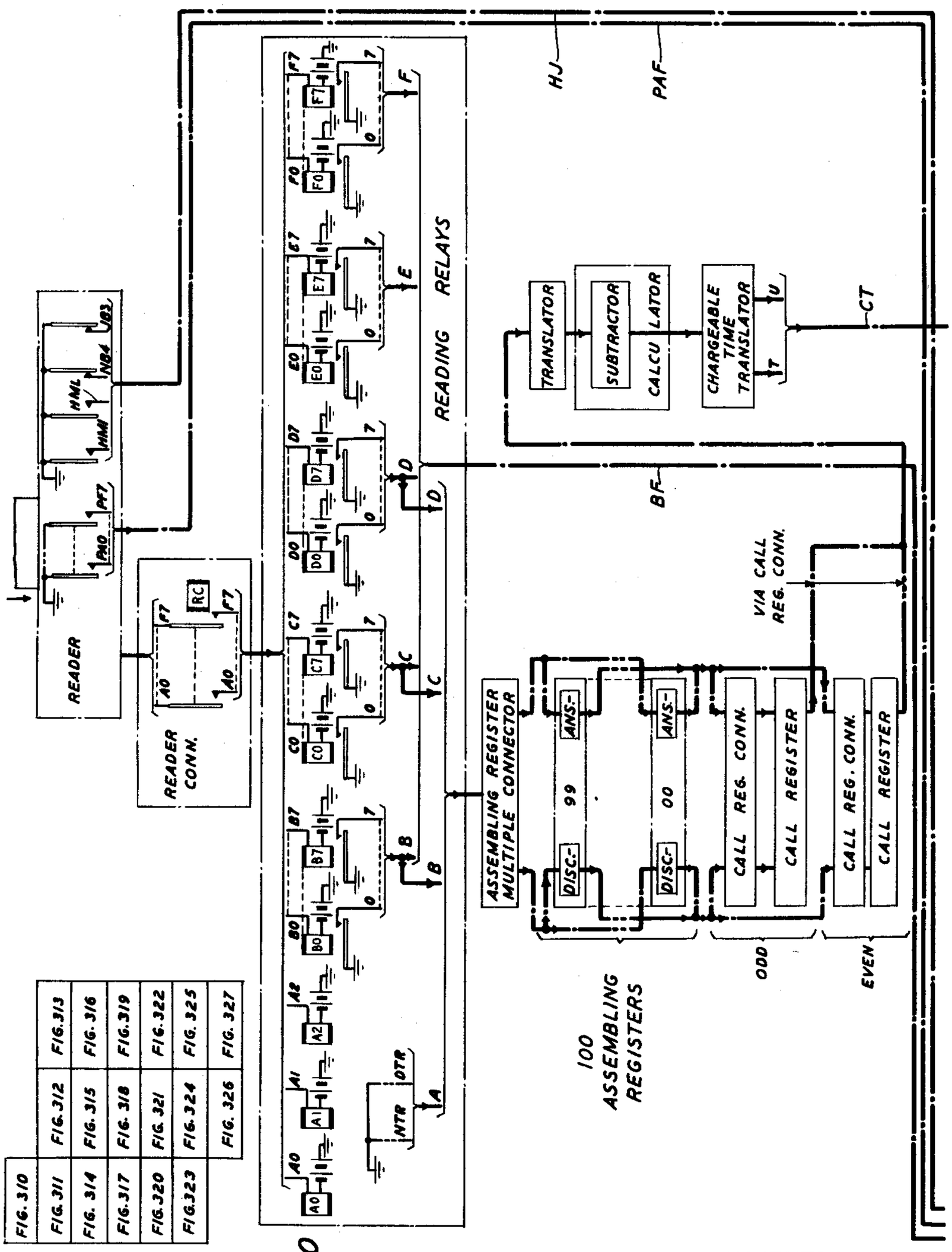


FIG. 309

FIG. 310	FIG. 312	FIG. 313
FIG. 311	FIG. 315	FIG. 316
FIG. 314	FIG. 318	FIG. 319
FIG. 317	FIG. 321	FIG. 322
FIG. 320	FIG. 324	FIG. 325
FIG. 323	FIG. 326	FIG. 327

FIG. 310

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 287

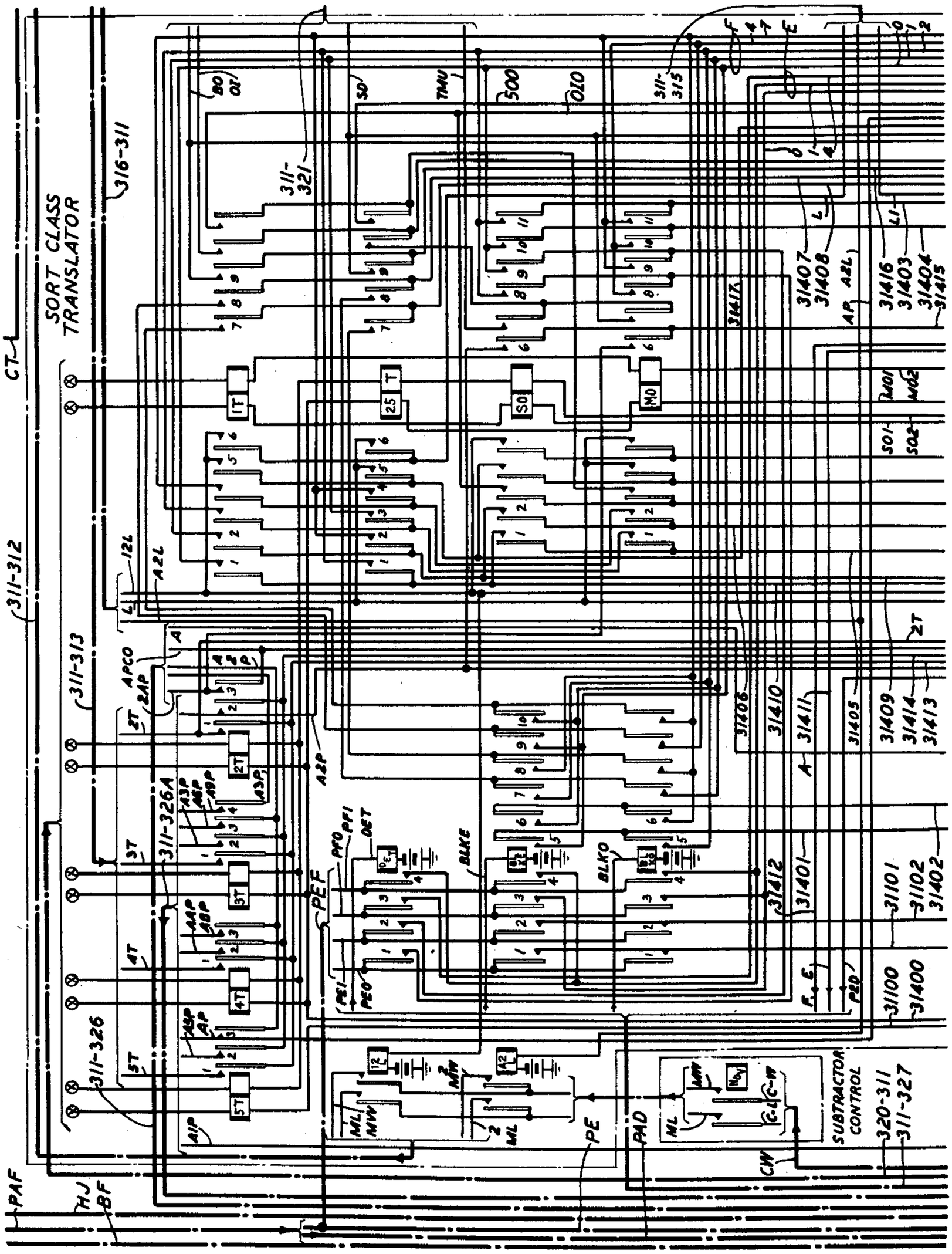


FIG. 311

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 288

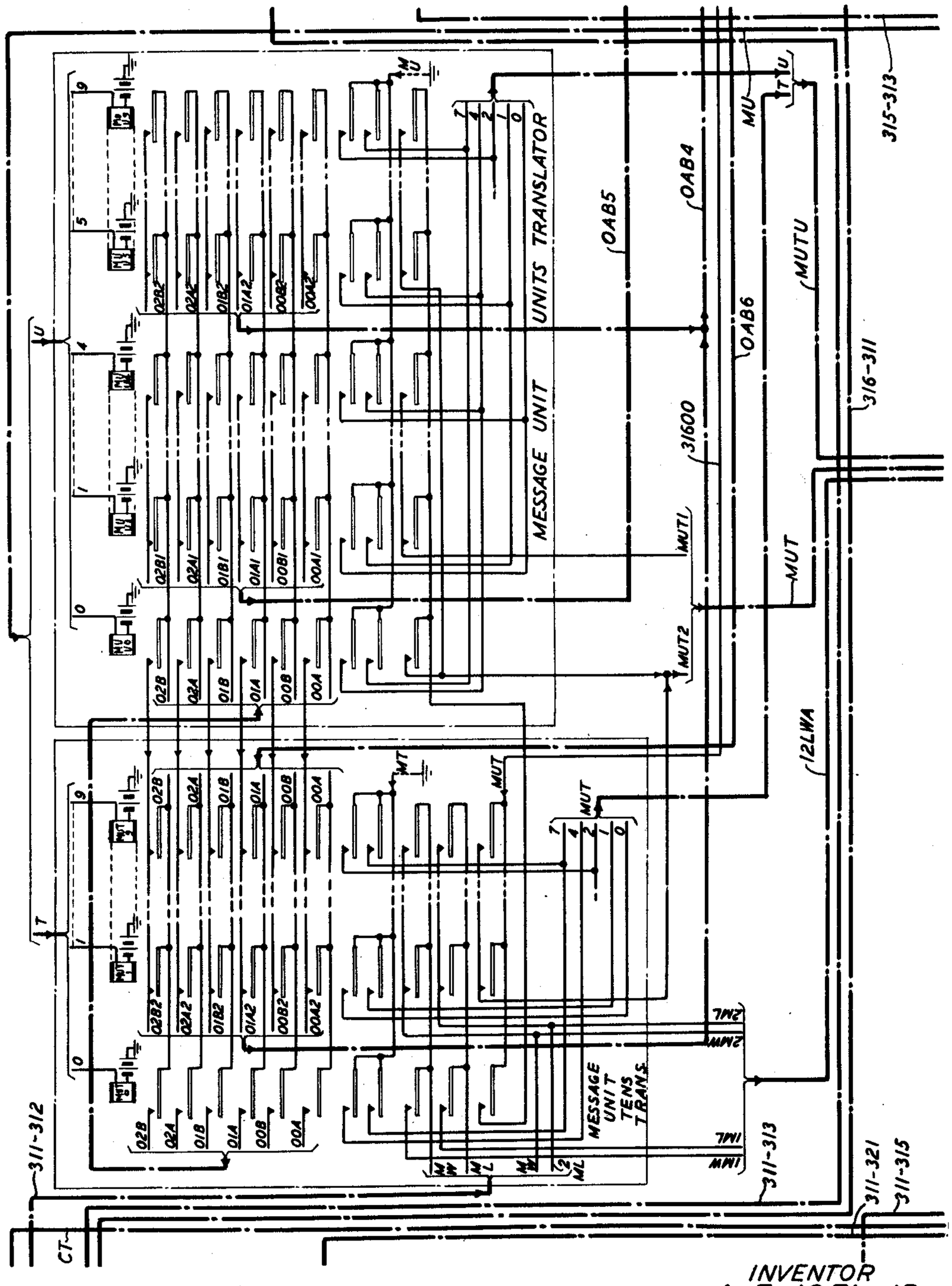


FIG. 312

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 289

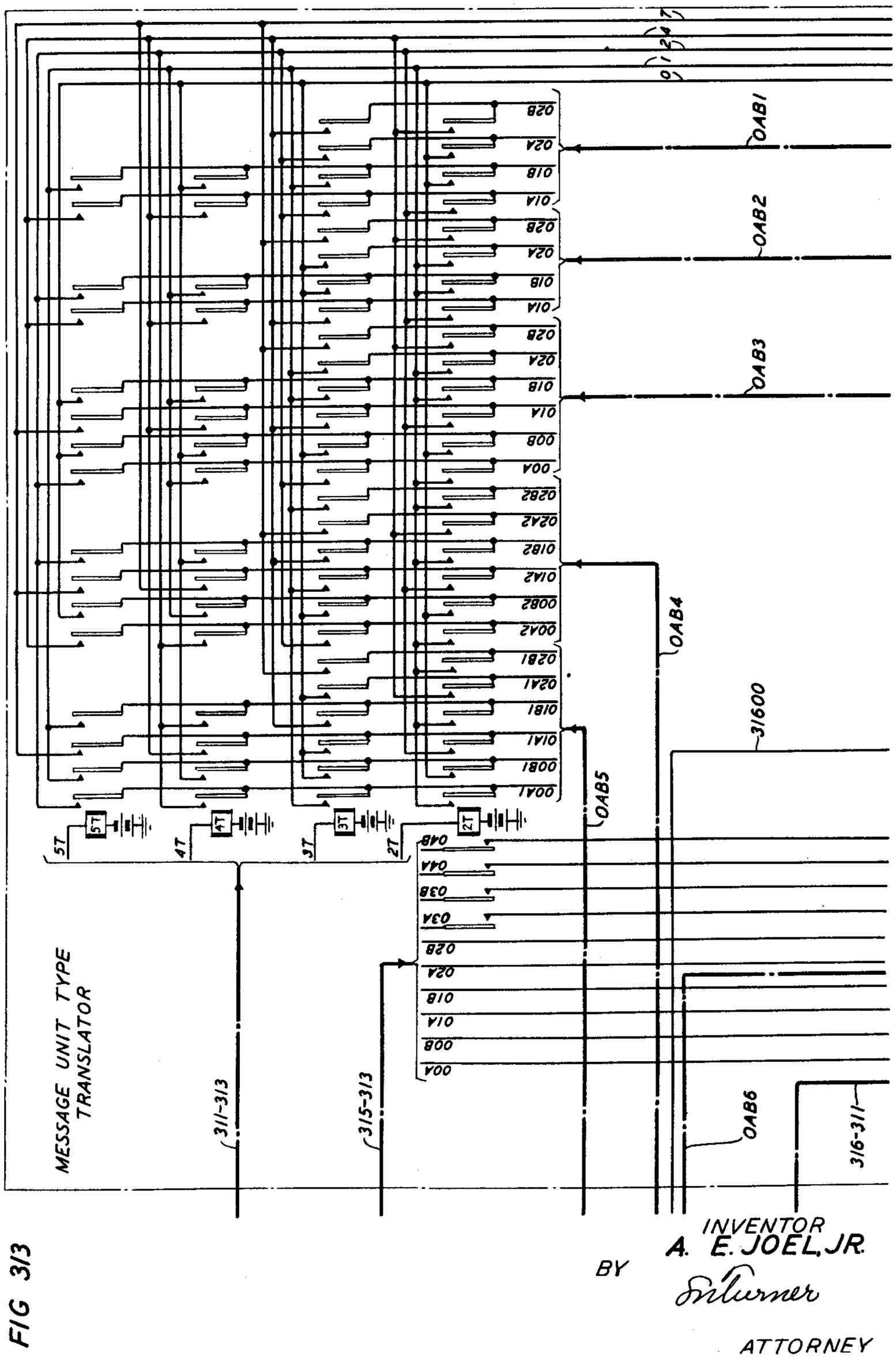


FIG 3/3

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 290

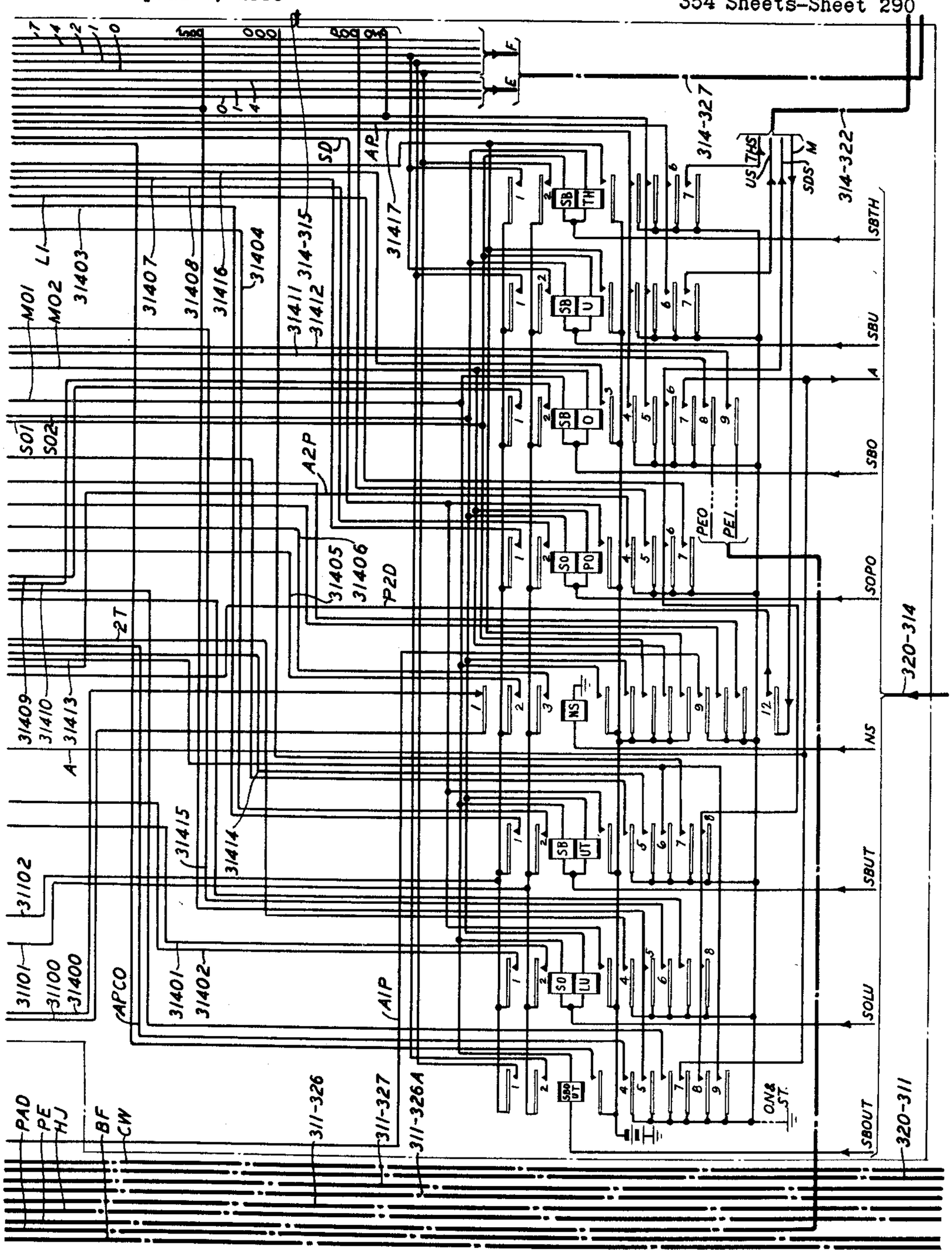


FIG. 3/4

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 291

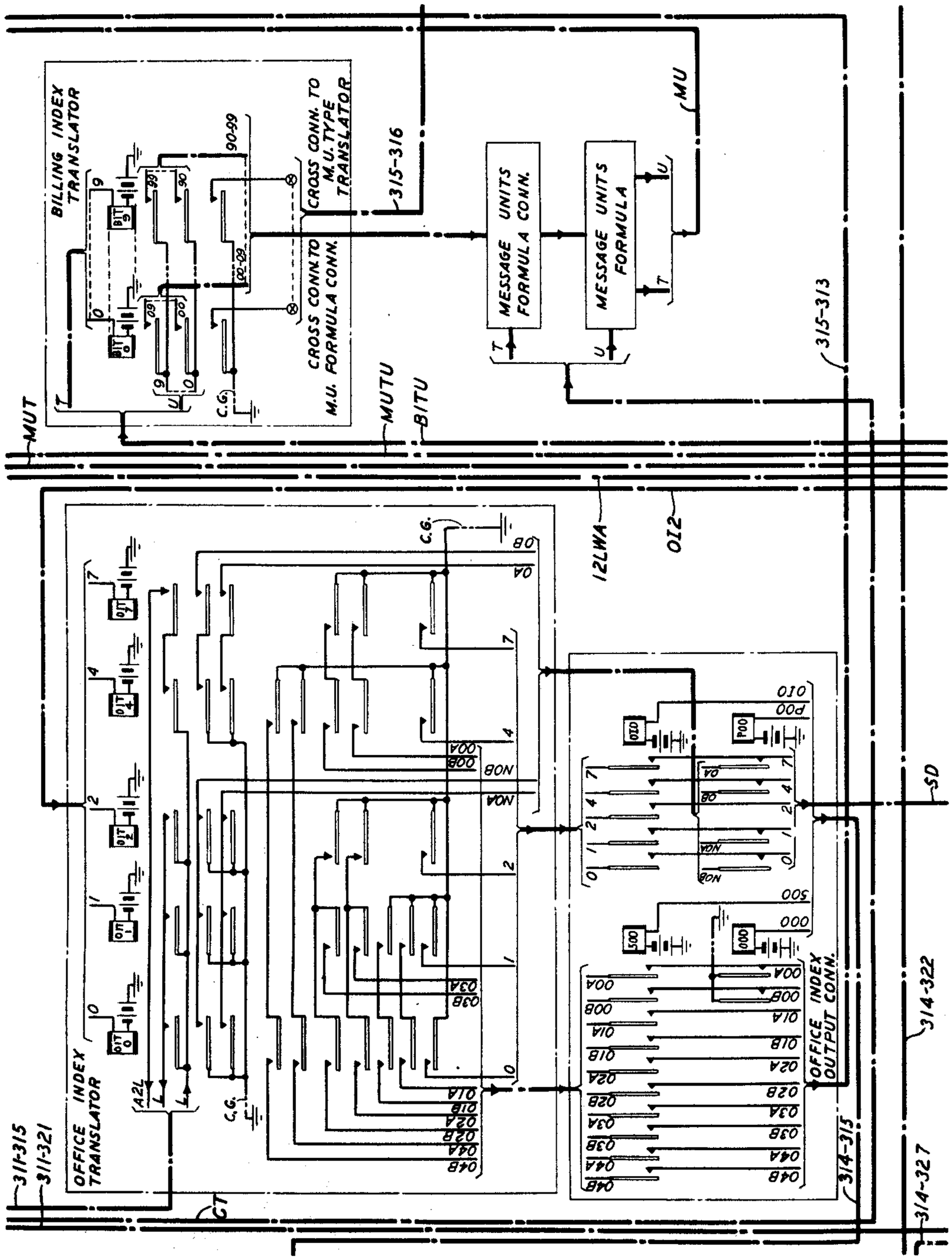


FIG. 315

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 292

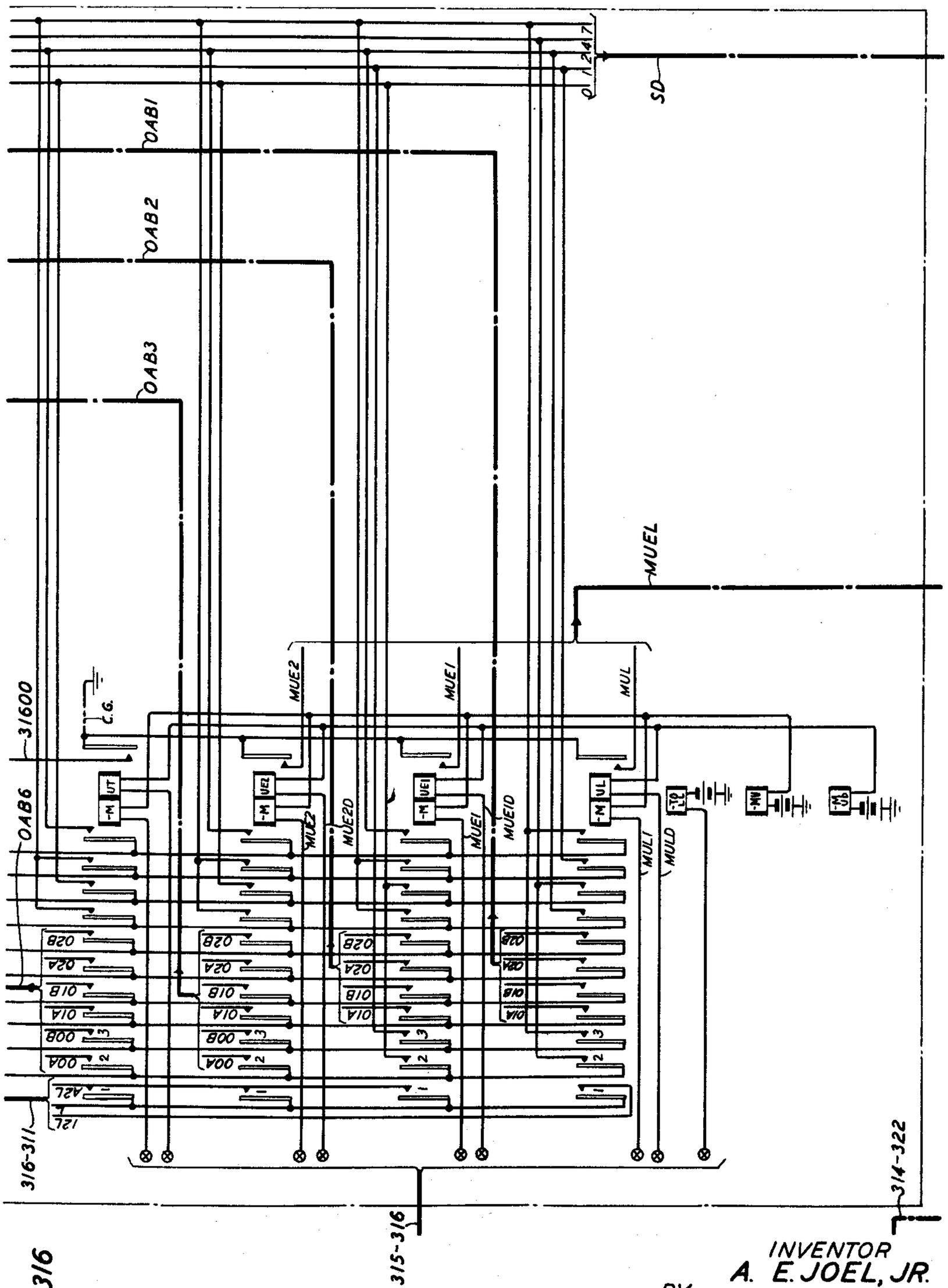


FIG. 316

INVENTOR
A. E. JOEL, JR.
BY
Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 293

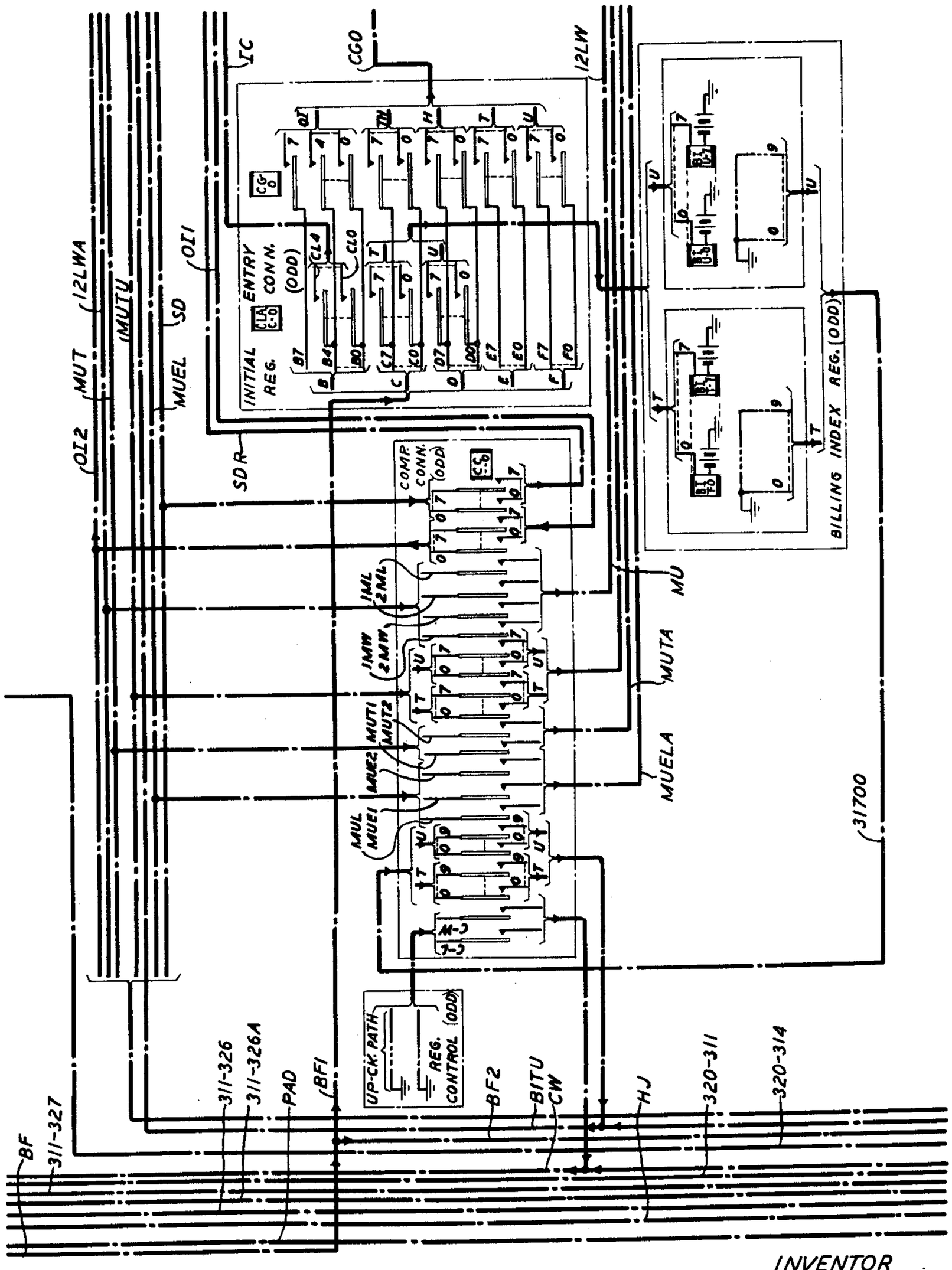


FIG. 317

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 294

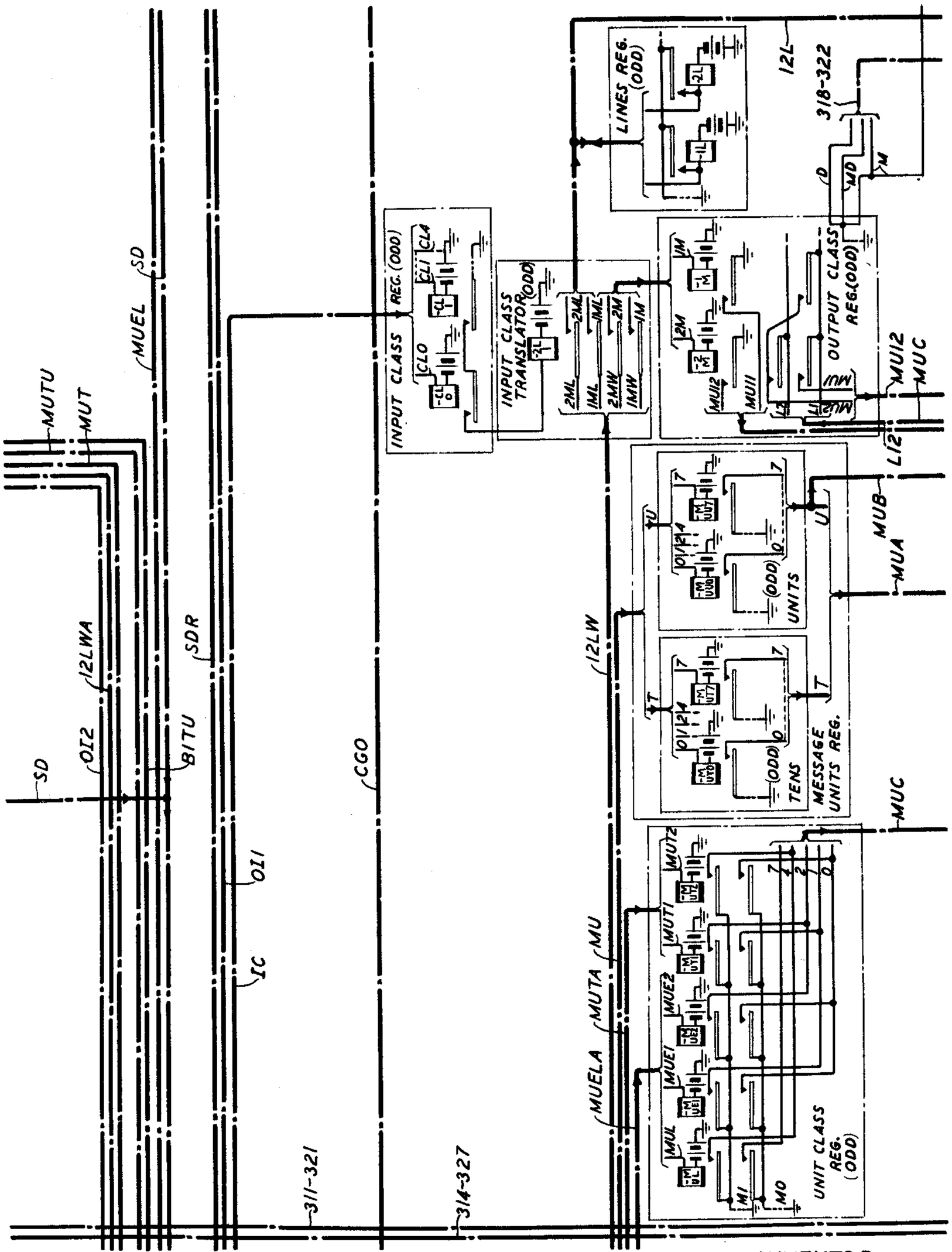


FIG. 3I8

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 295

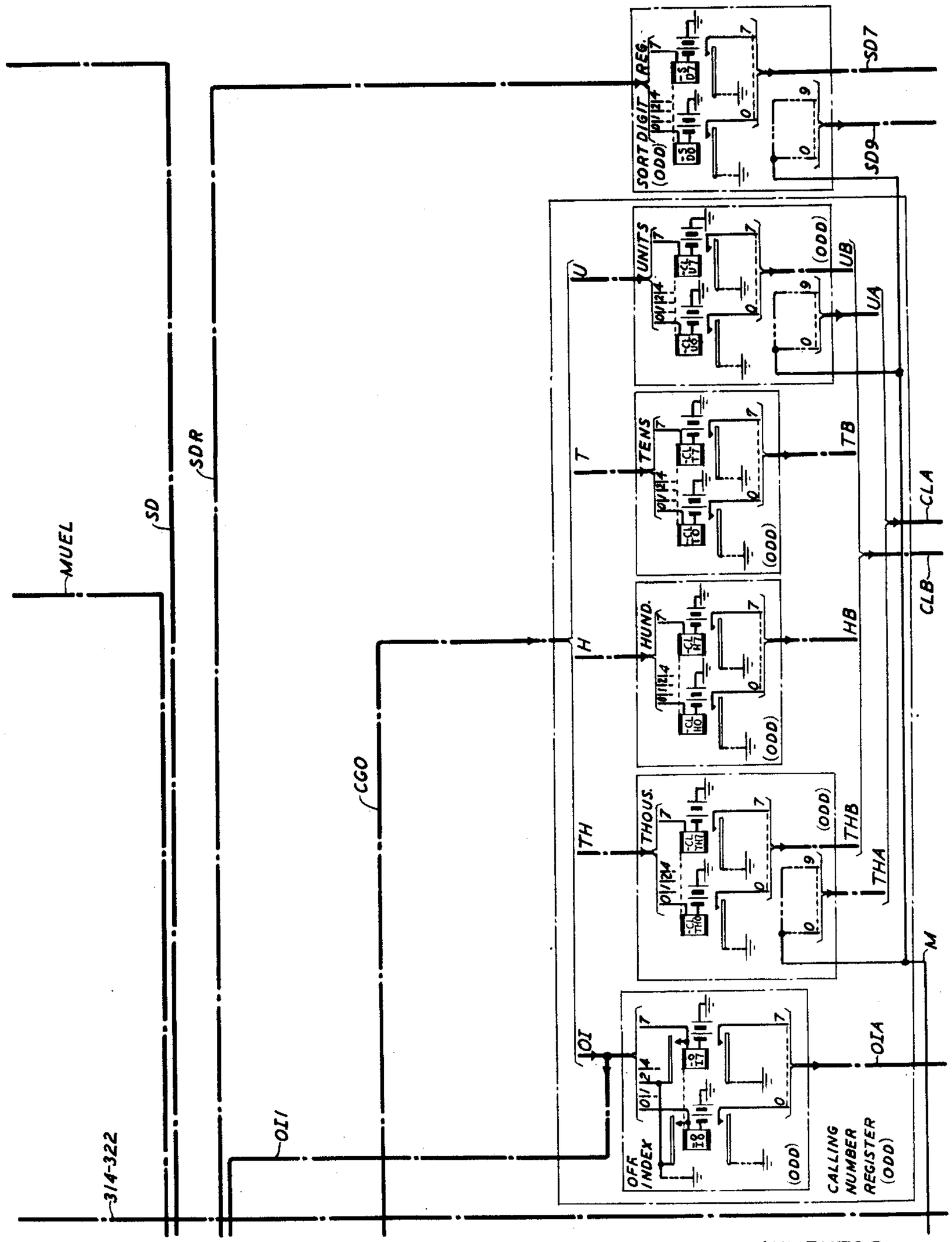


FIG. 319

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 296

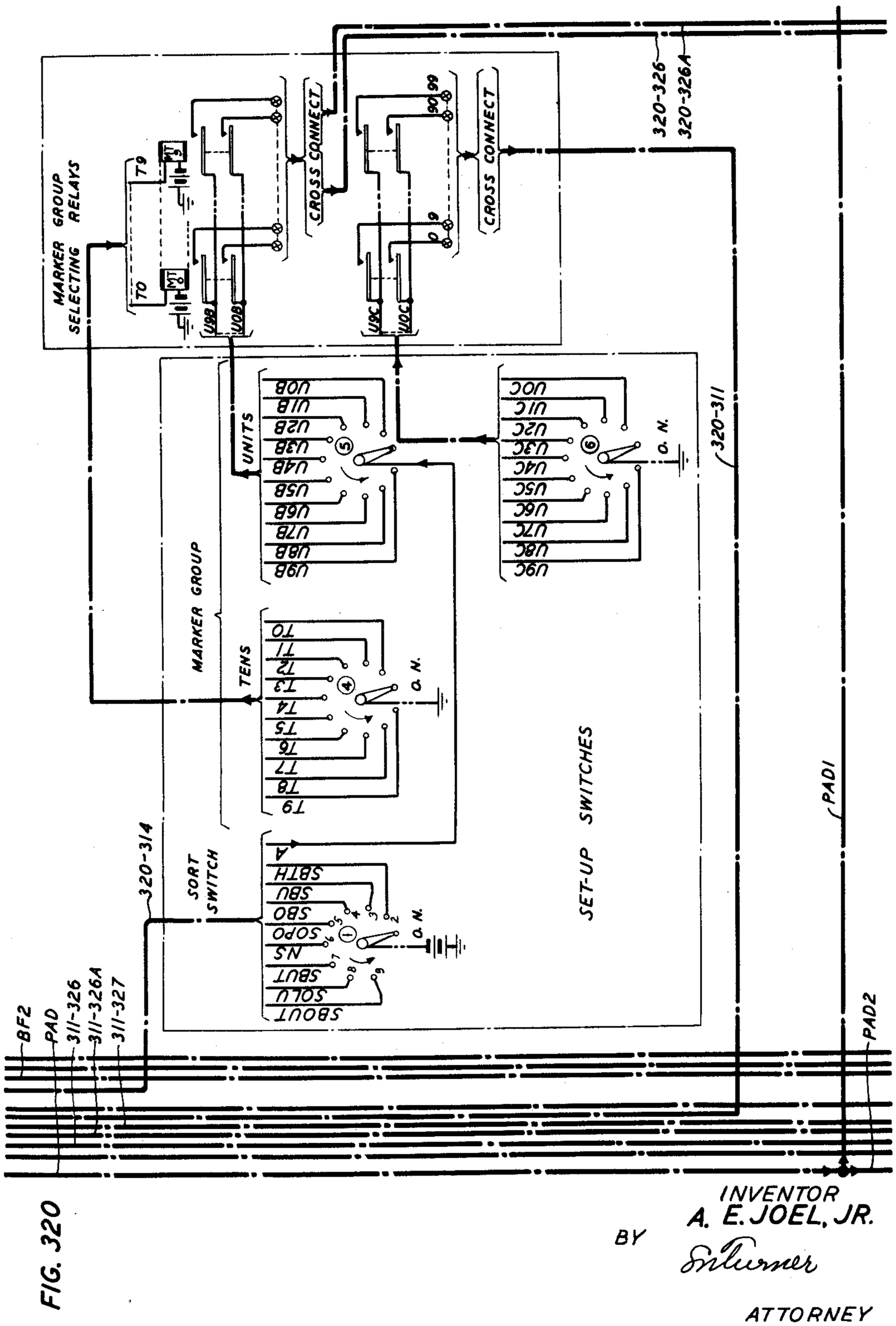


FIG. 320

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 297

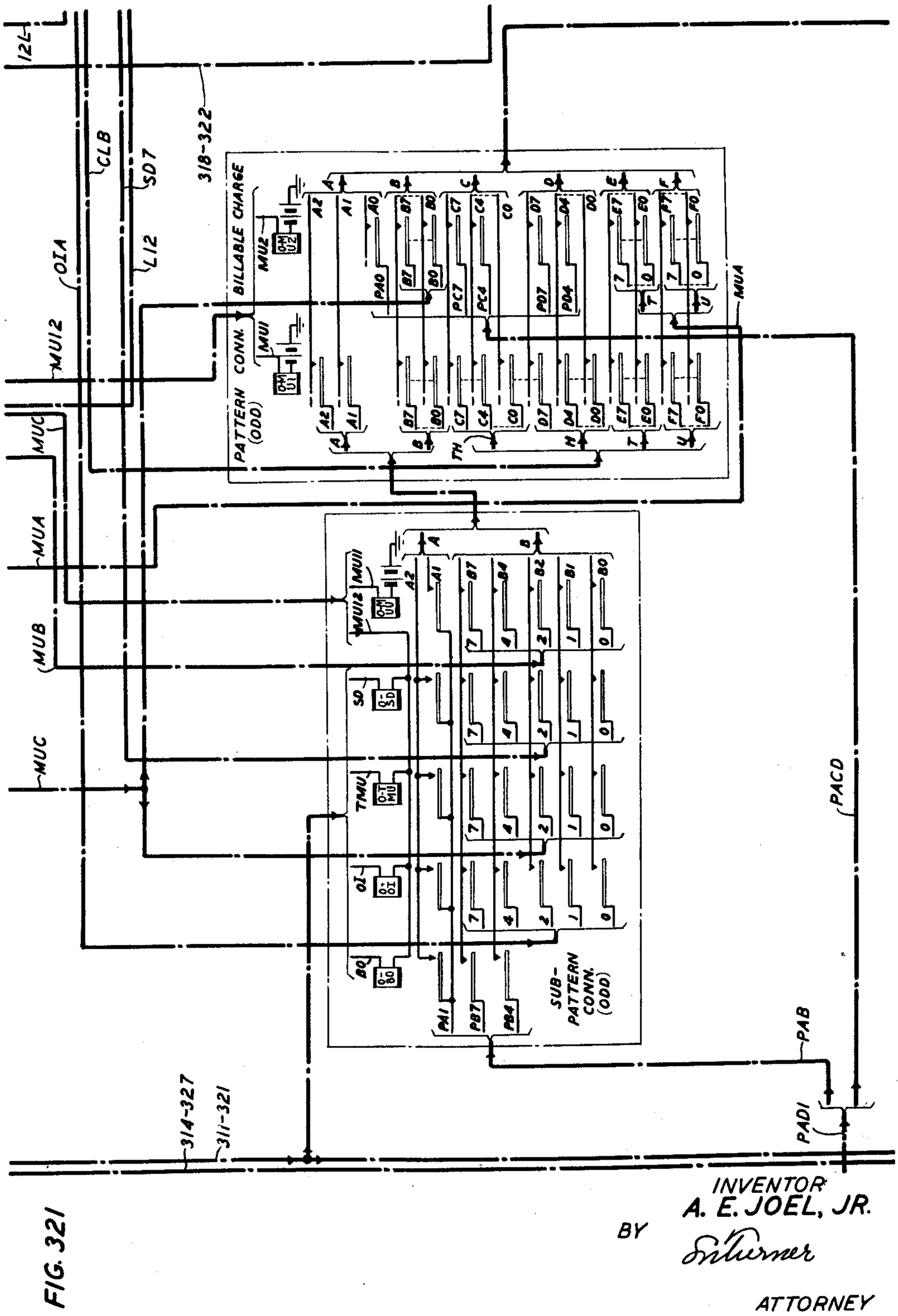


FIG. 321

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 298

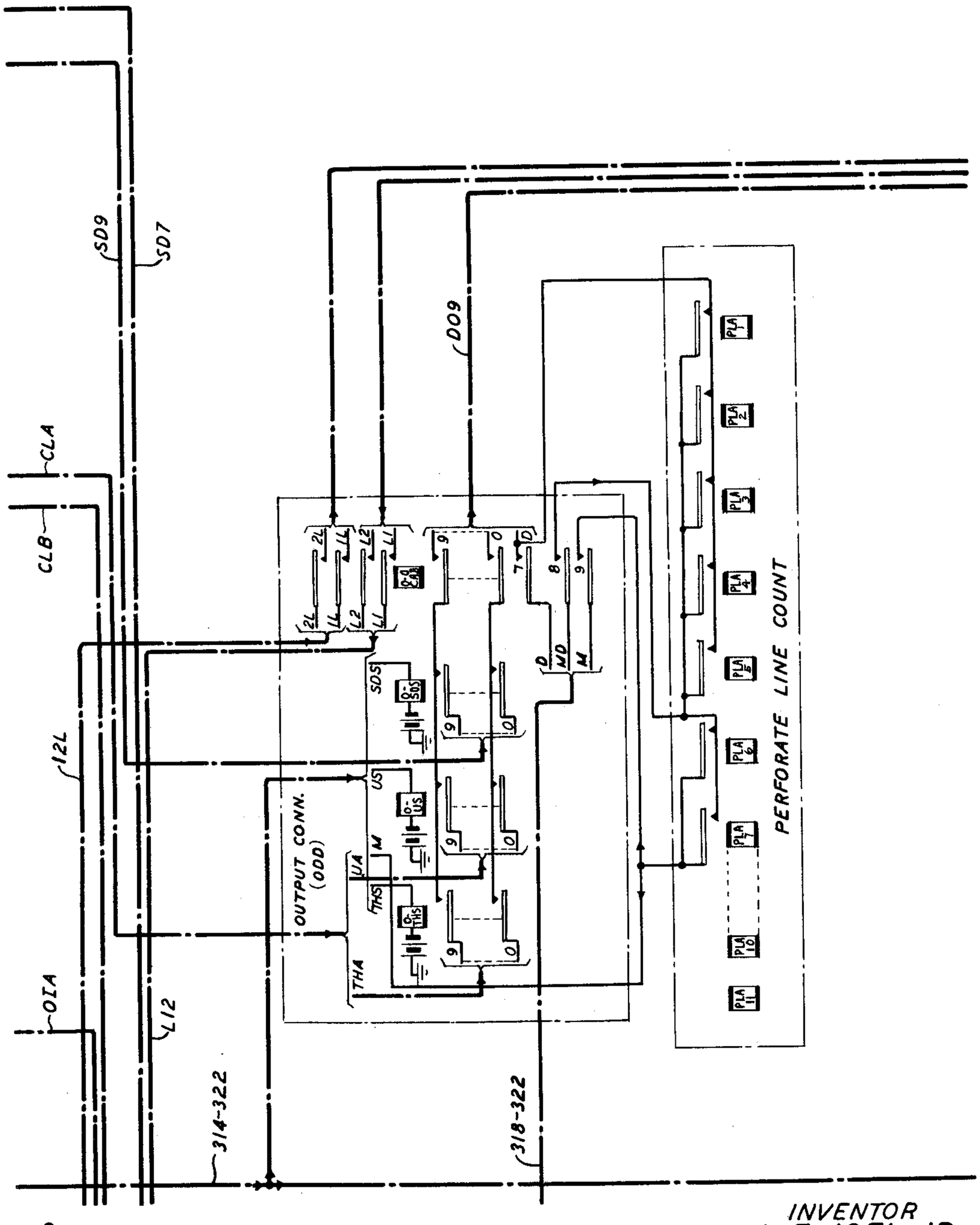


FIG. 322

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 299

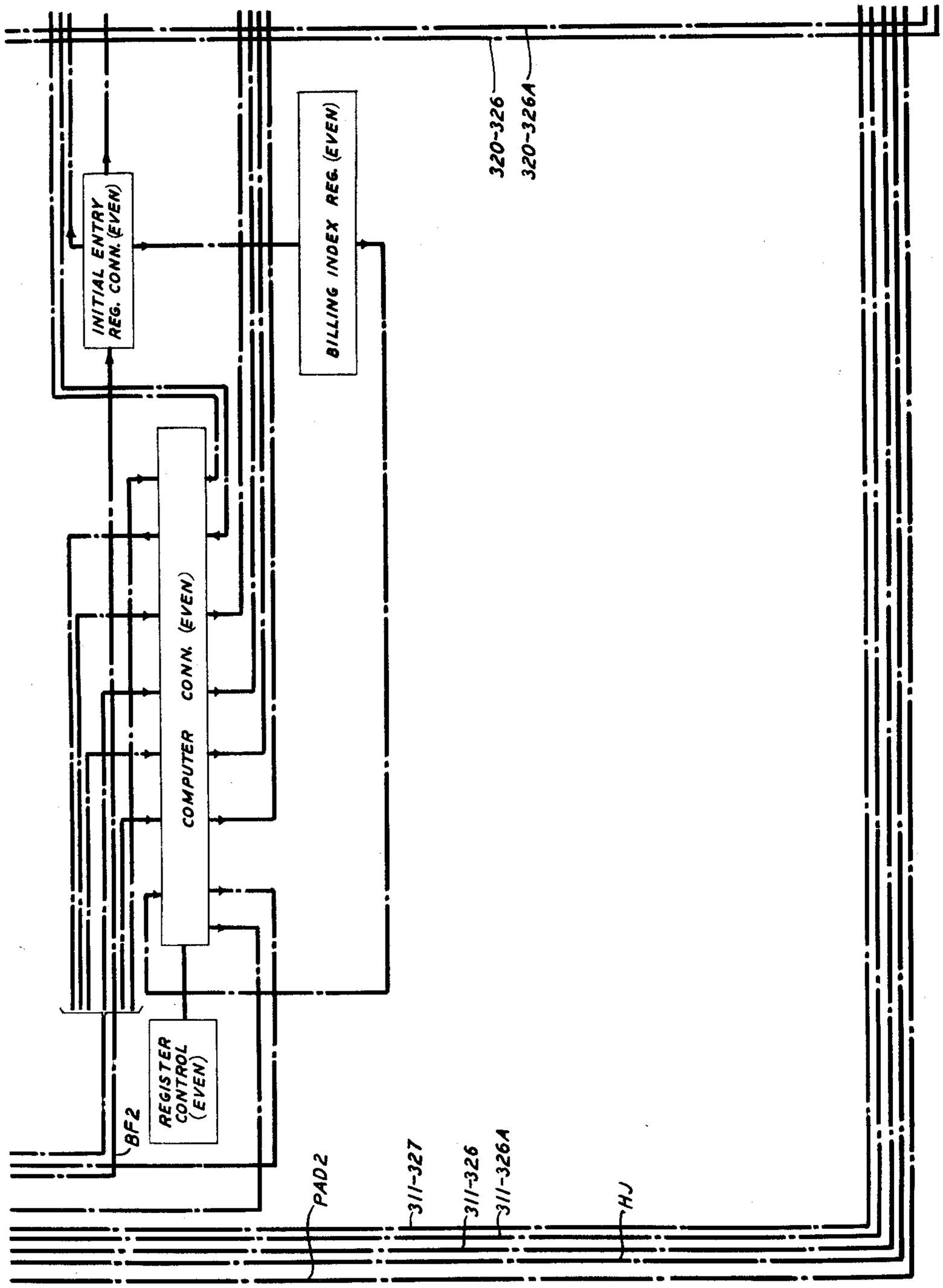


FIG. 323

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 300

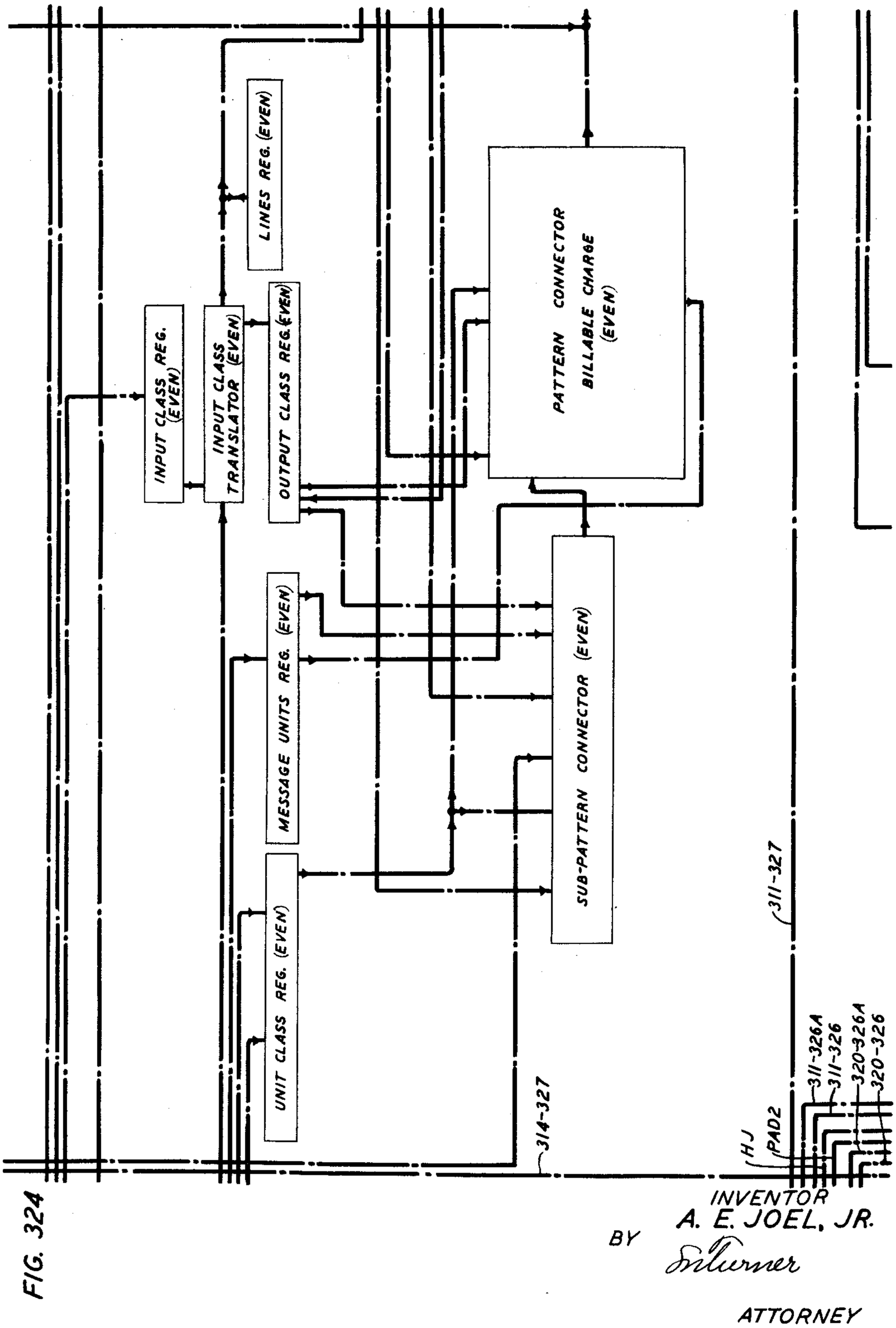


FIG. 324

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 301

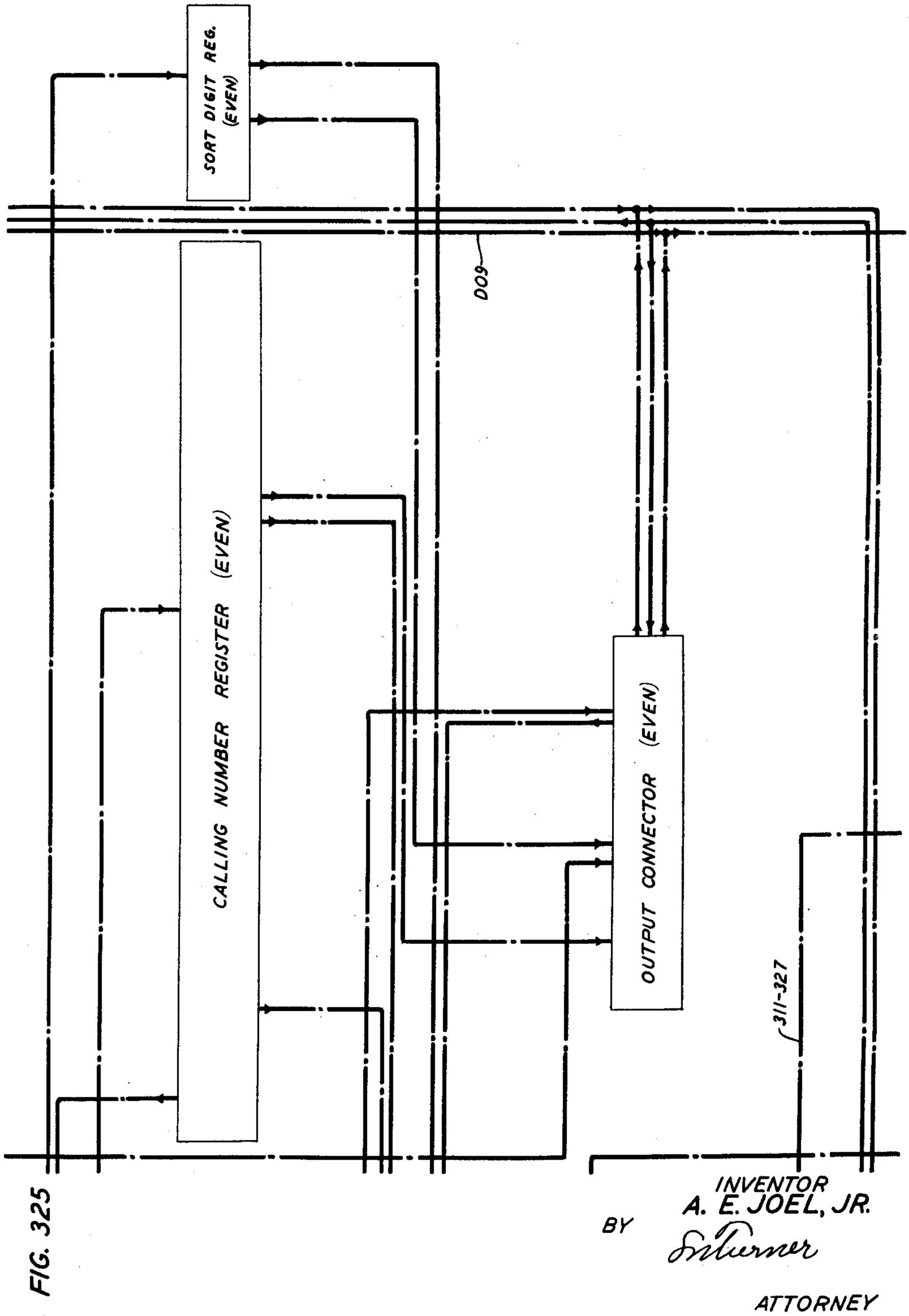


FIG. 325

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 302

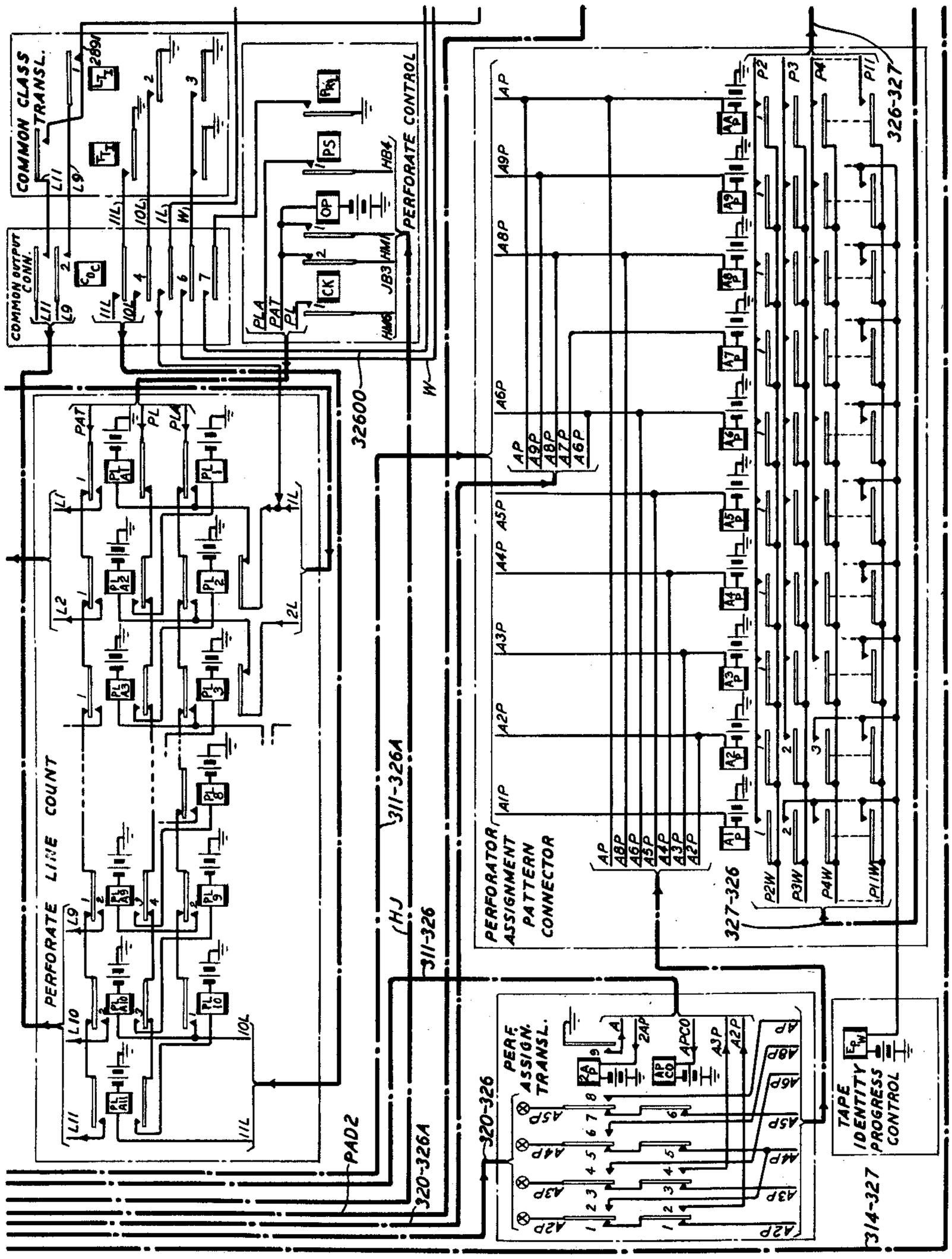


FIG. 326

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 303

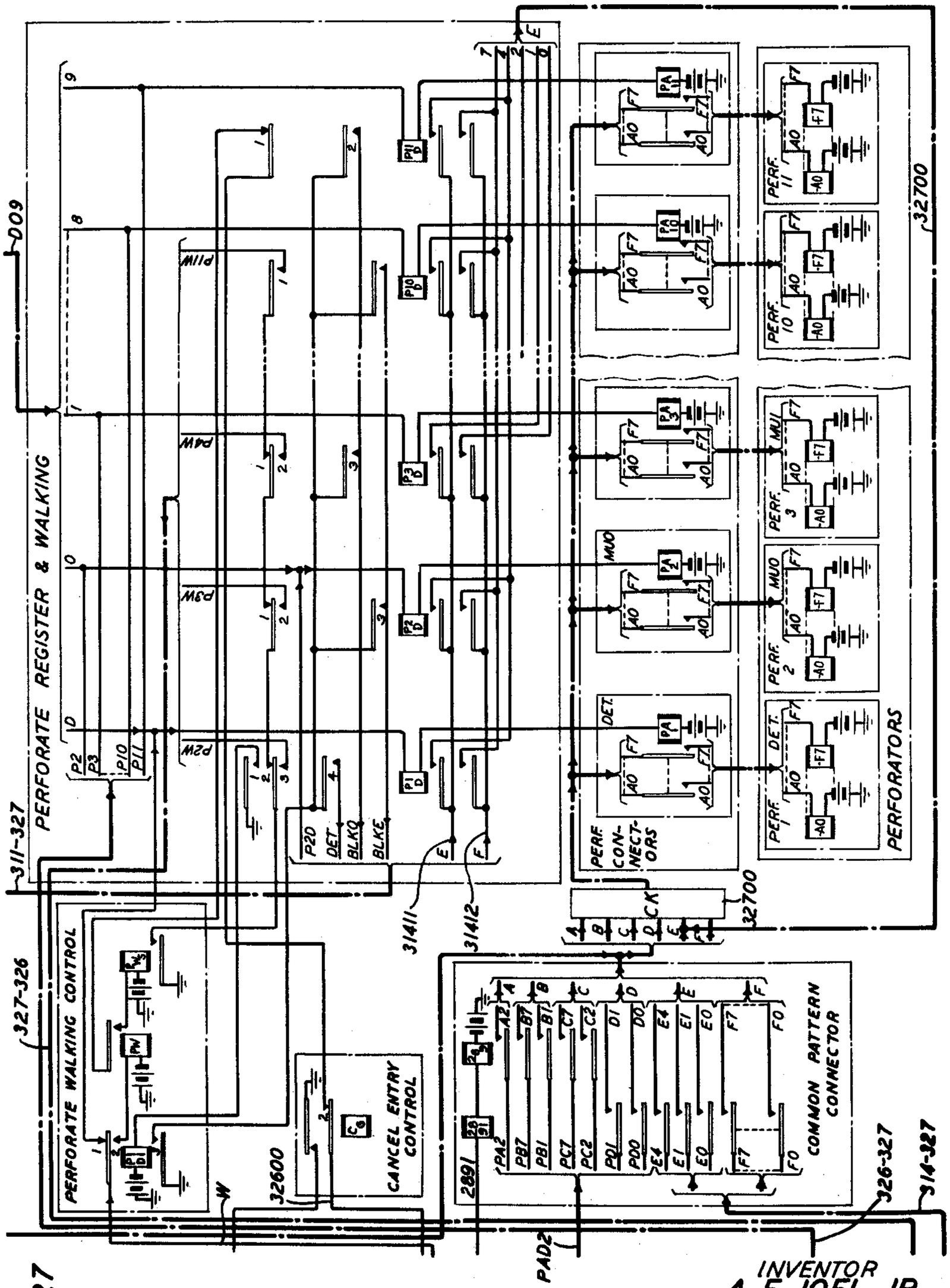


FIG. 327

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 304

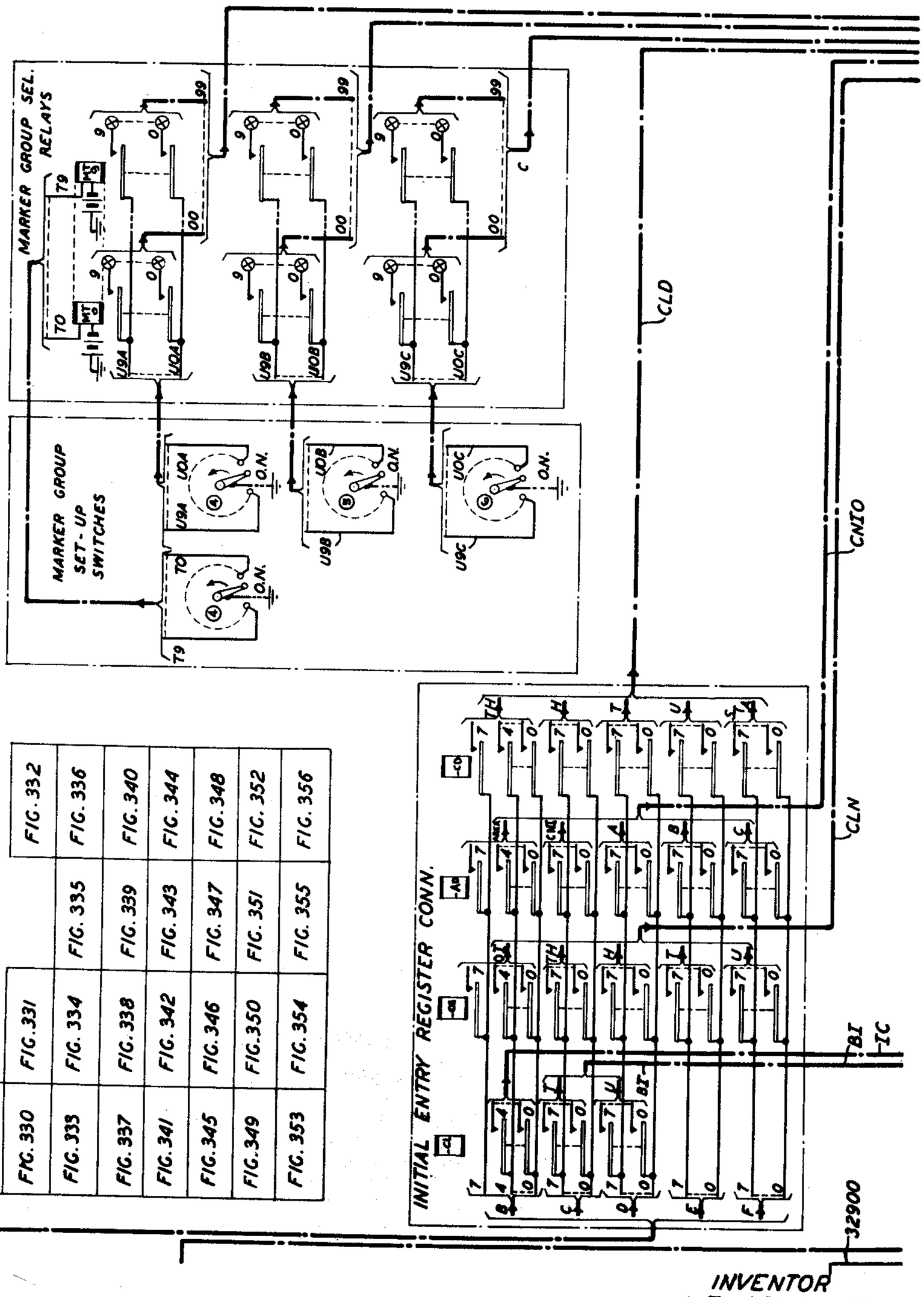


FIG. 331

FIG. 328

FIG. 329	FIG. 330	FIG. 331	FIG. 332	FIG. 333	FIG. 334	FIG. 335	FIG. 336
FIG. 337	FIG. 338	FIG. 339	FIG. 340	FIG. 341	FIG. 342	FIG. 343	FIG. 344
FIG. 345	FIG. 346	FIG. 347	FIG. 348	FIG. 349	FIG. 350	FIG. 351	FIG. 352
FIG. 353	FIG. 354	FIG. 355	FIG. 356				

INVENTOR
A.E. JOEL, JR.
BY
Scherner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 305

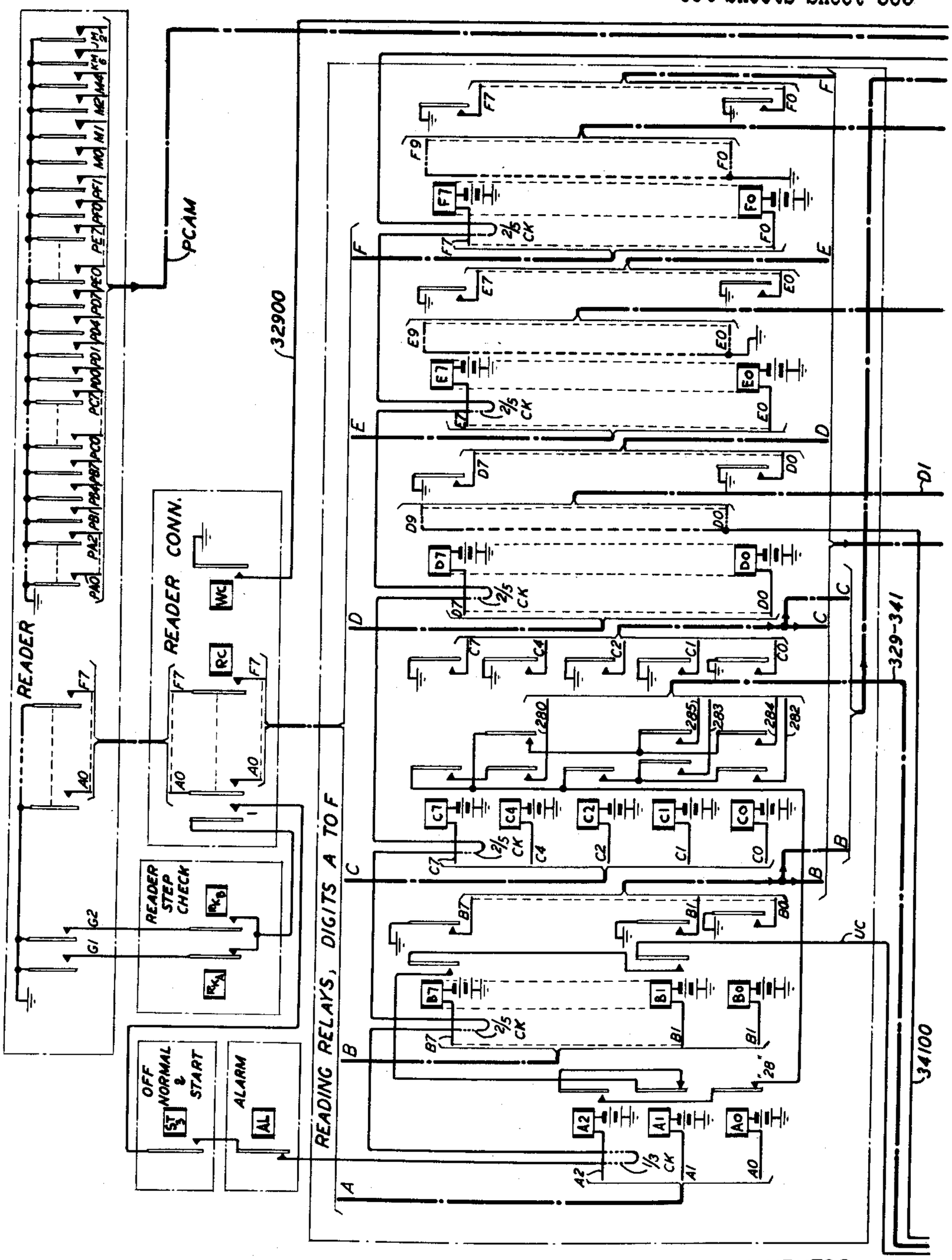


FIG. 329

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 306

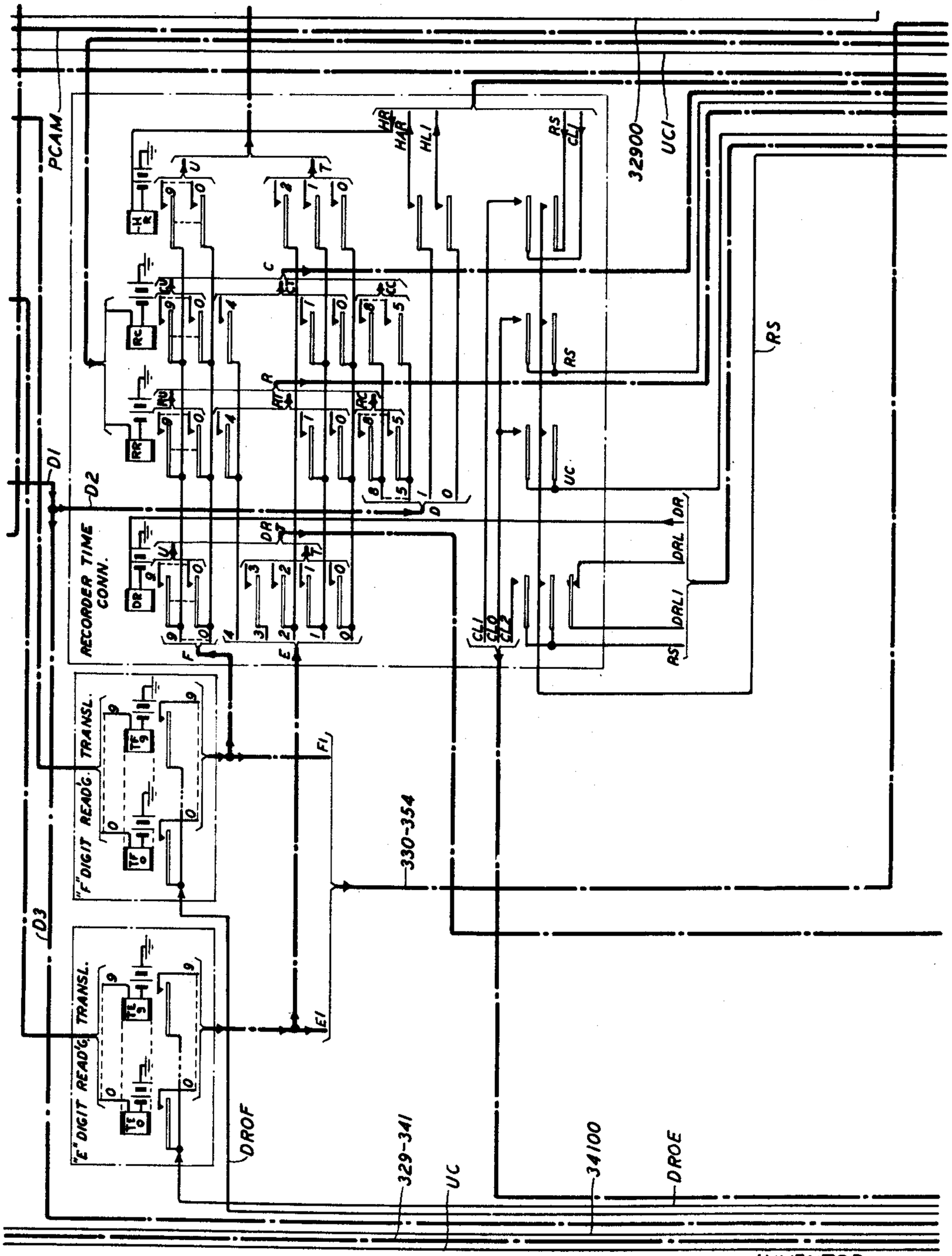


FIG. 330

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 307

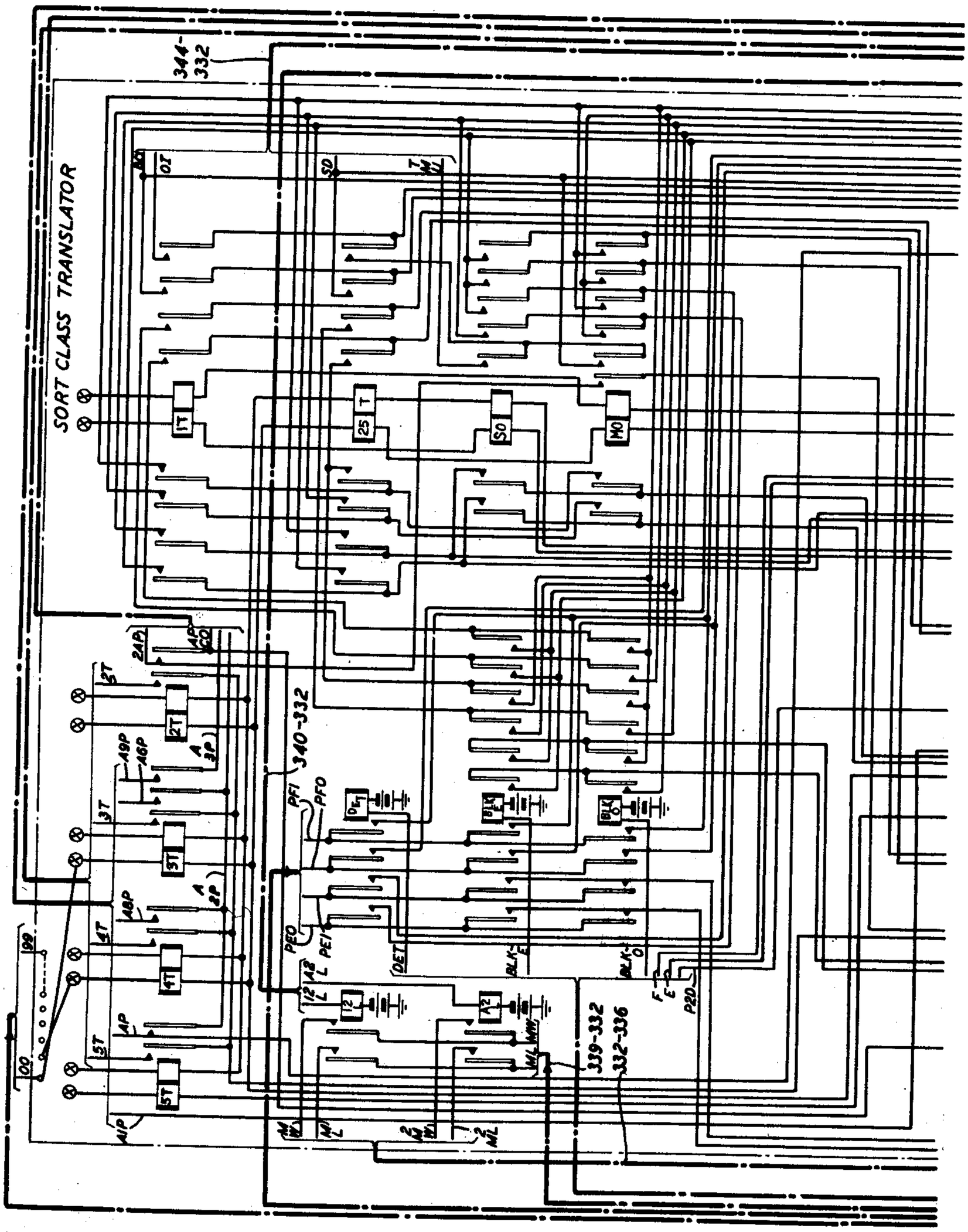


FIG. 332

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 308

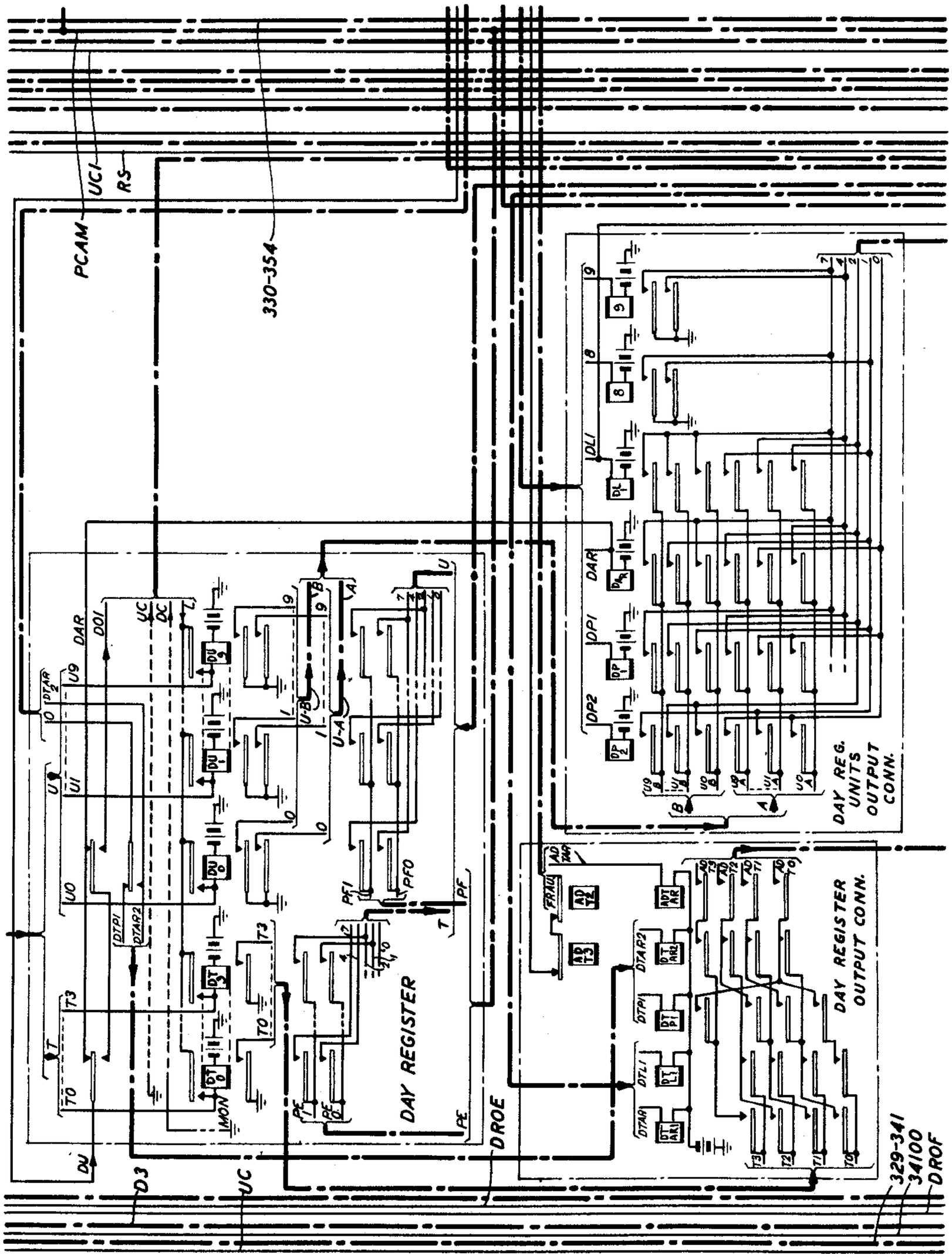


FIG. 333

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 309

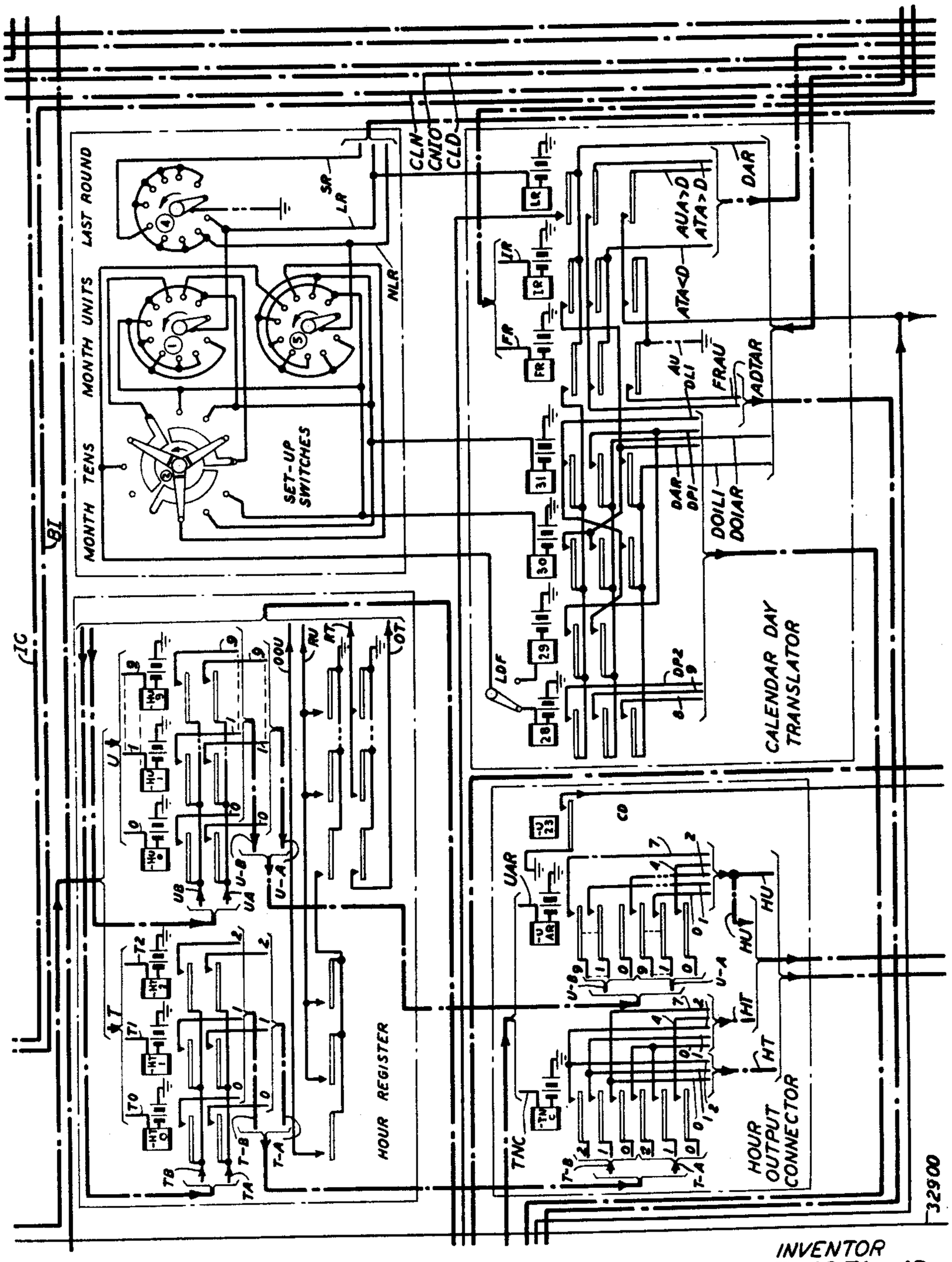


FIG. 334

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 310

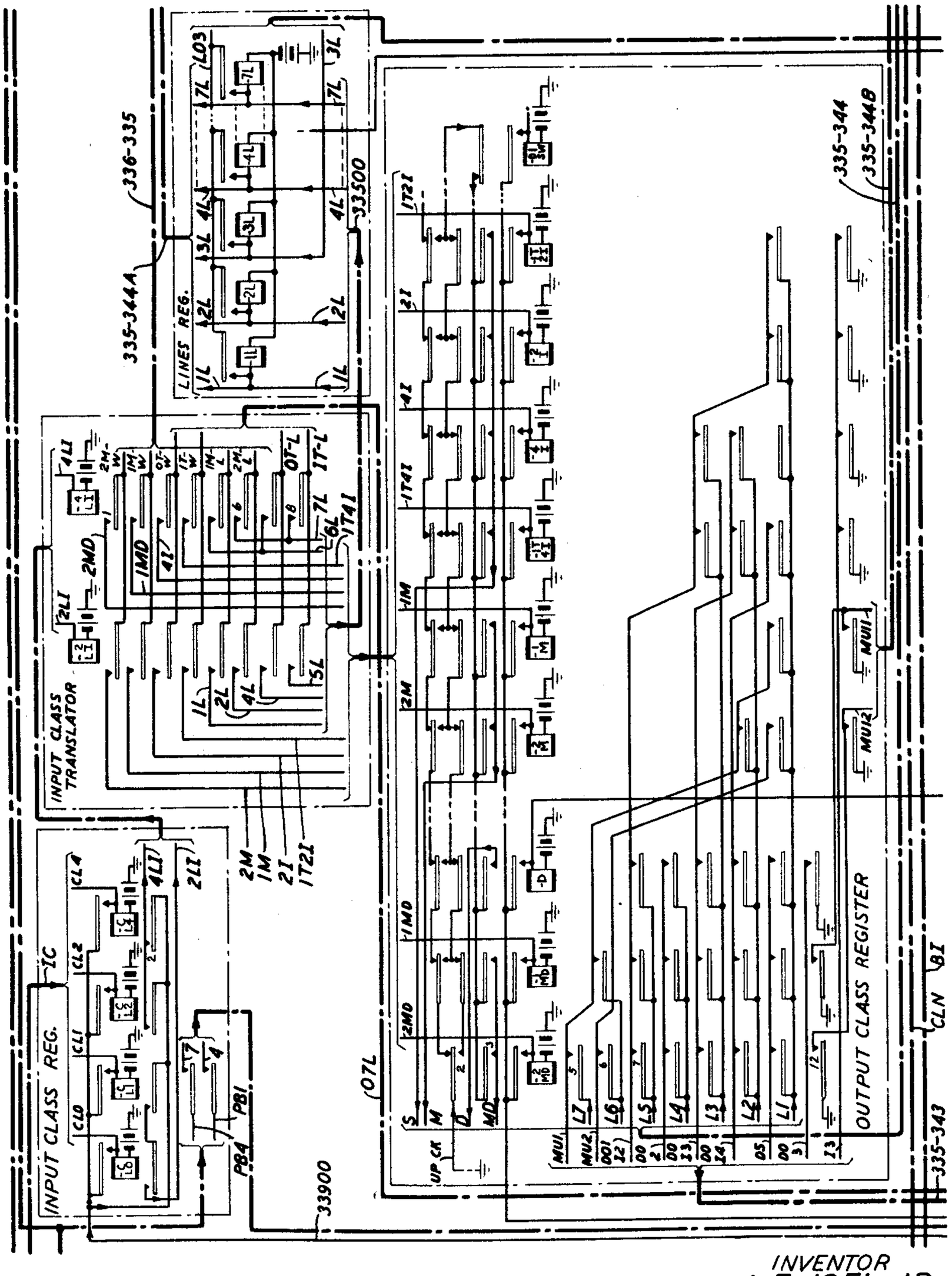


FIG. 335

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 311

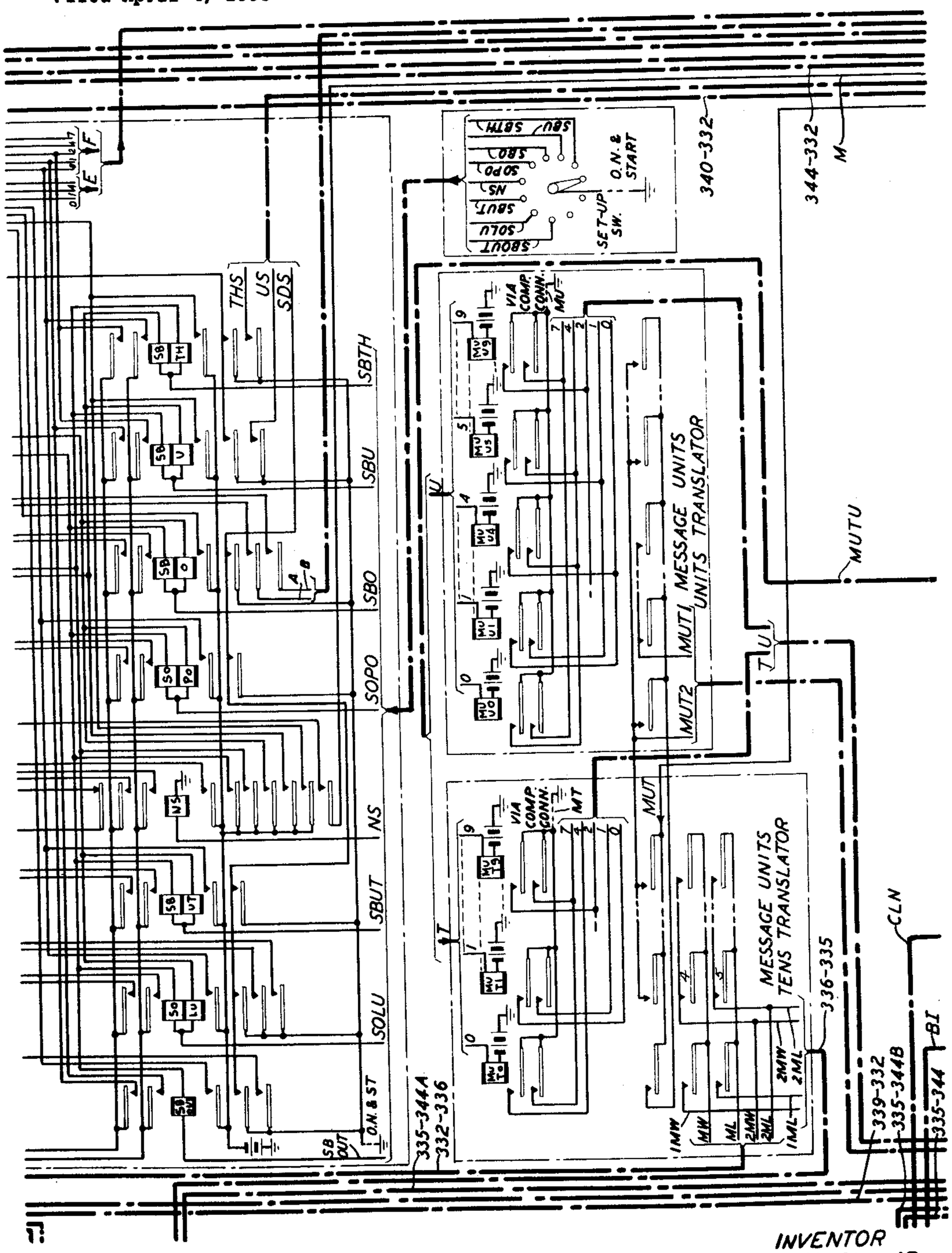


FIG. 336

INVENTOR
A. E. JOEL, JR.
BY Fuerner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 312

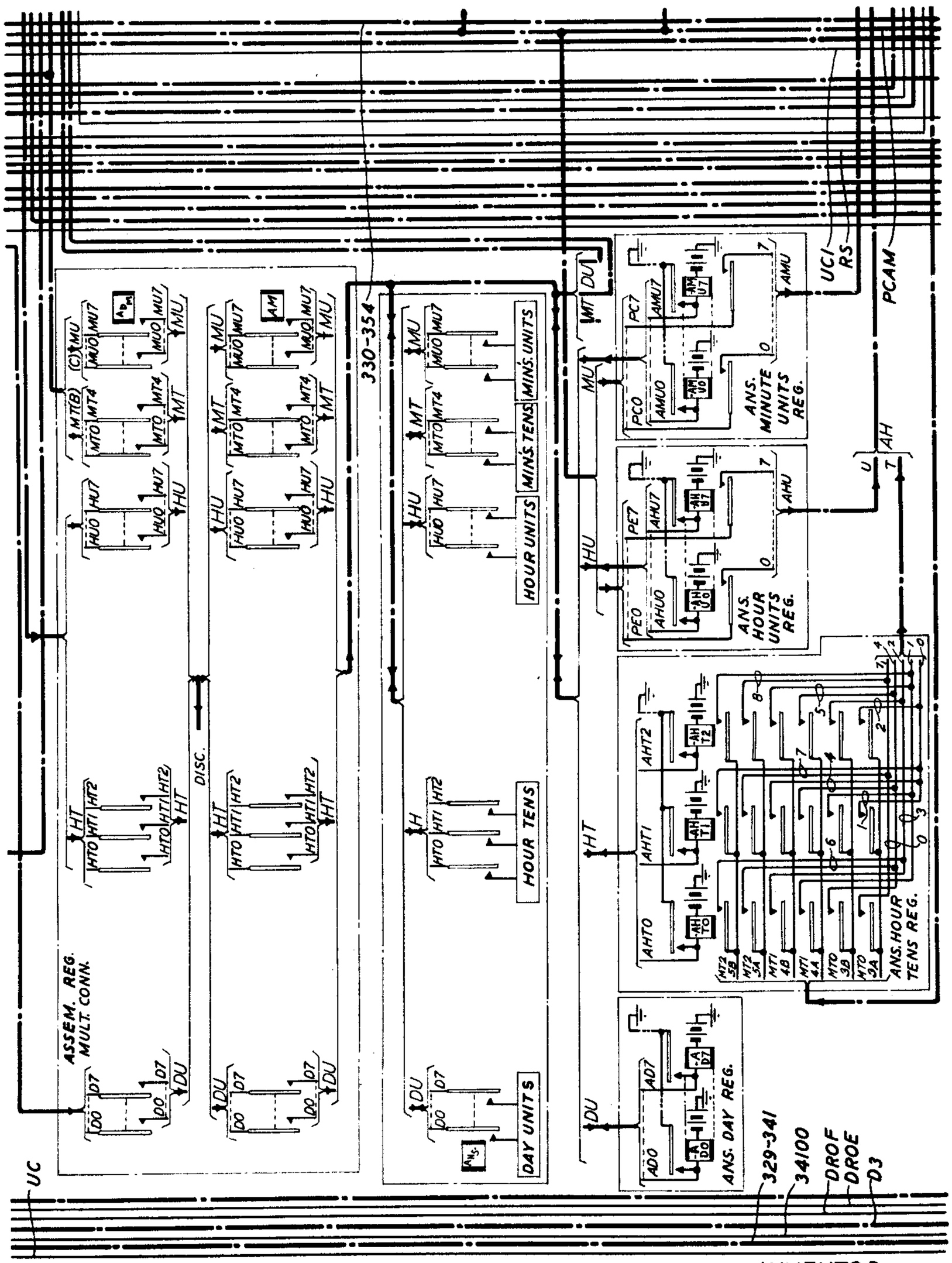


FIG. 337

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 313

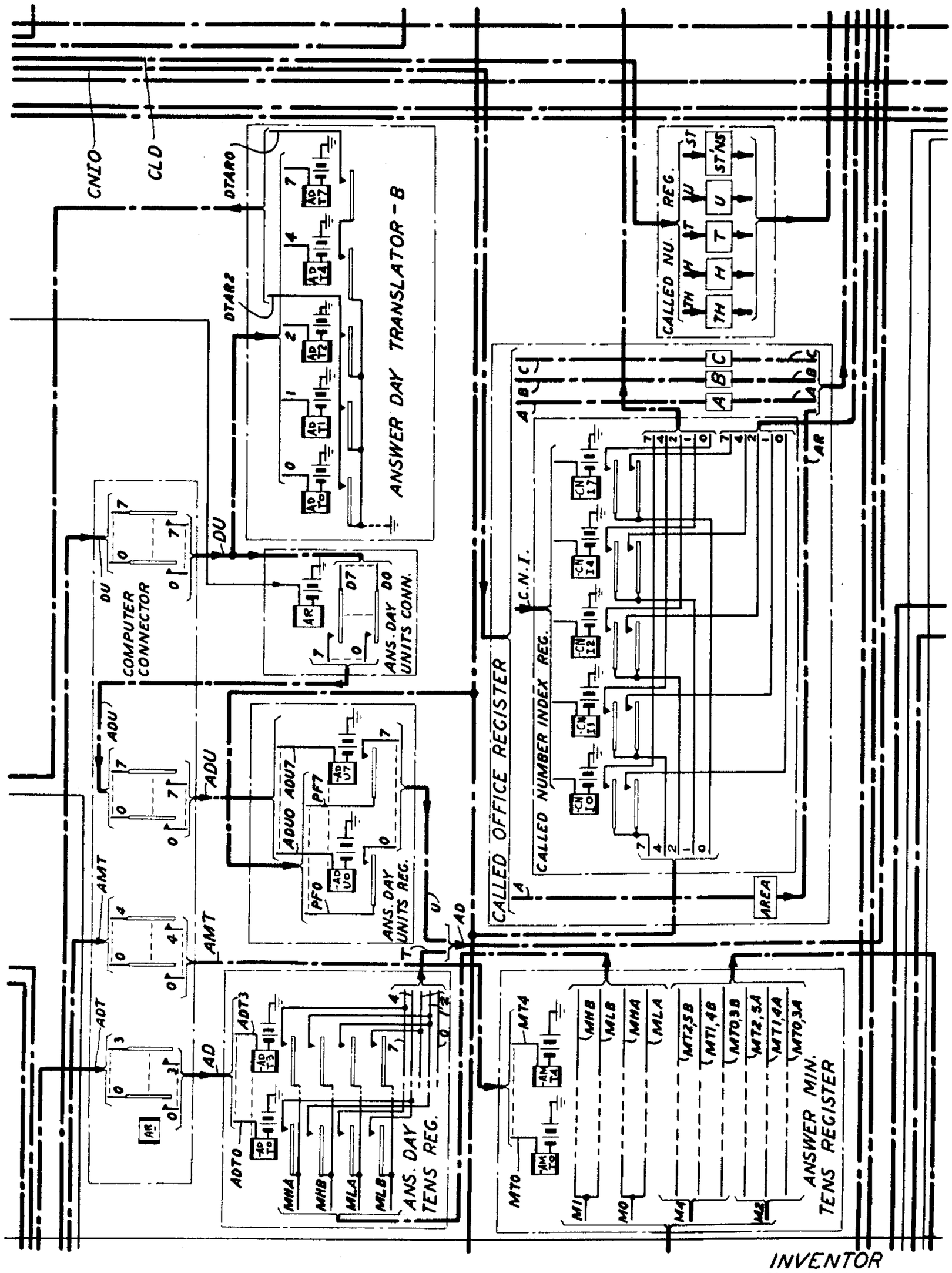


FIG. 338

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 314

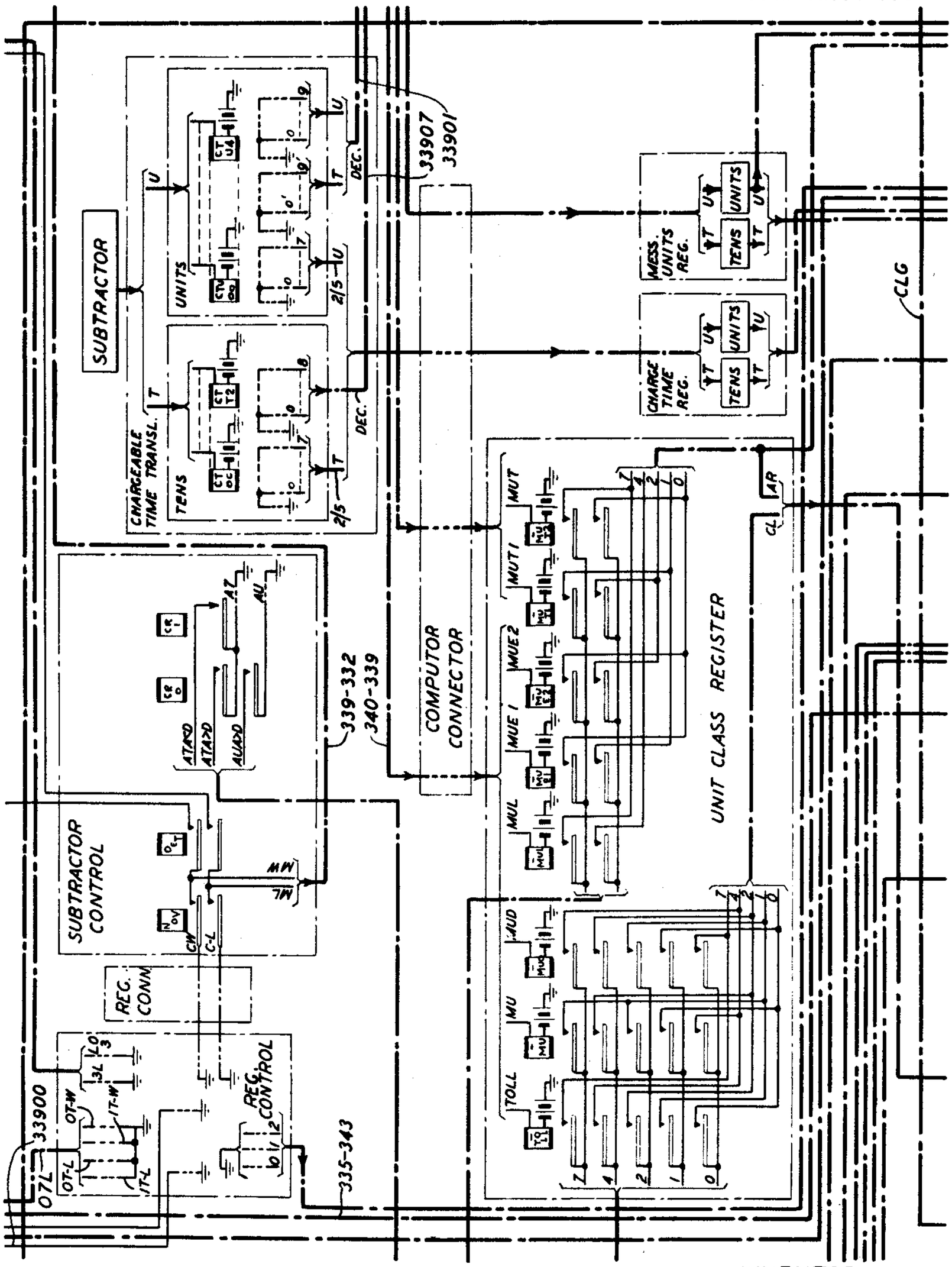


FIG. 339

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 315

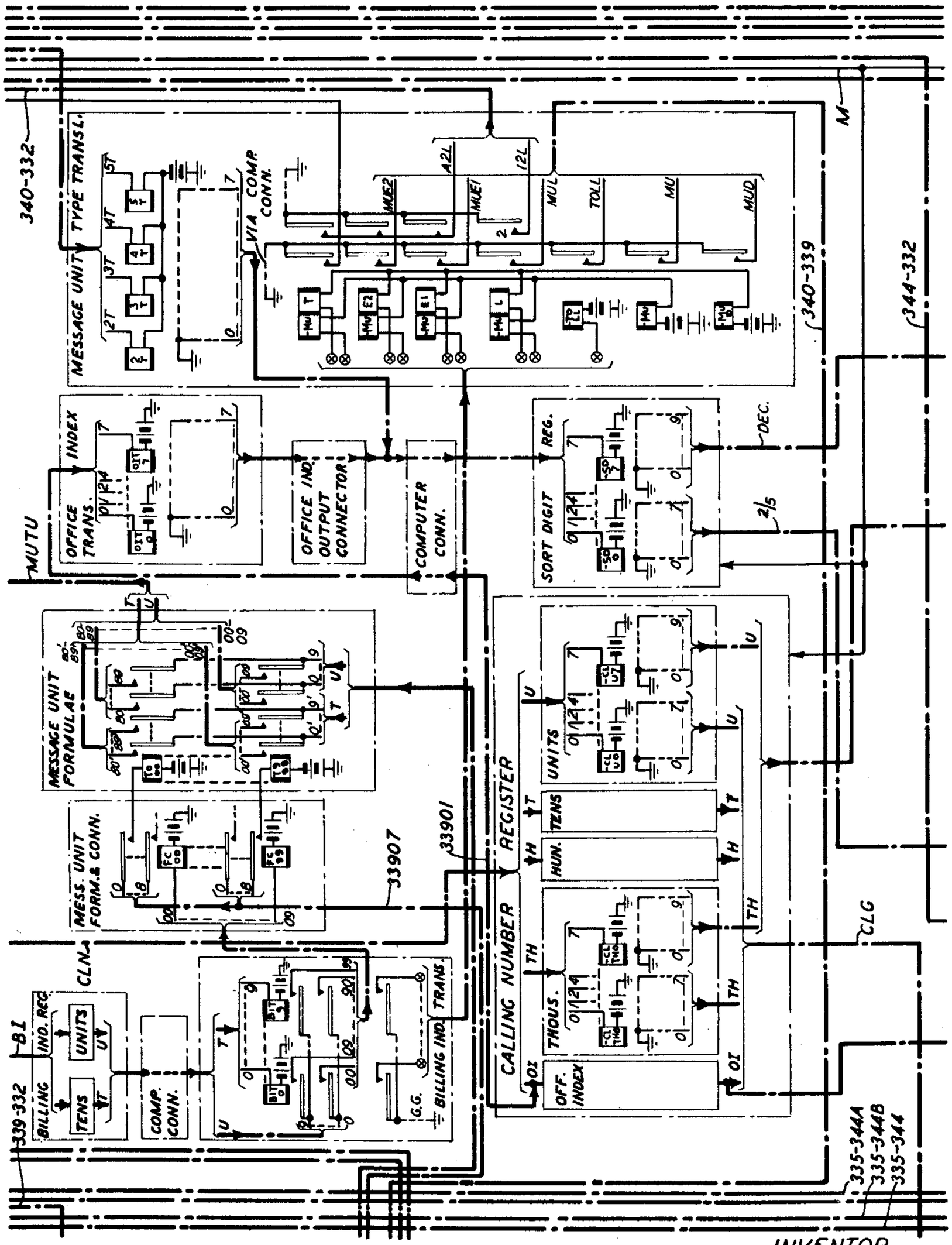


FIG. 340

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 316

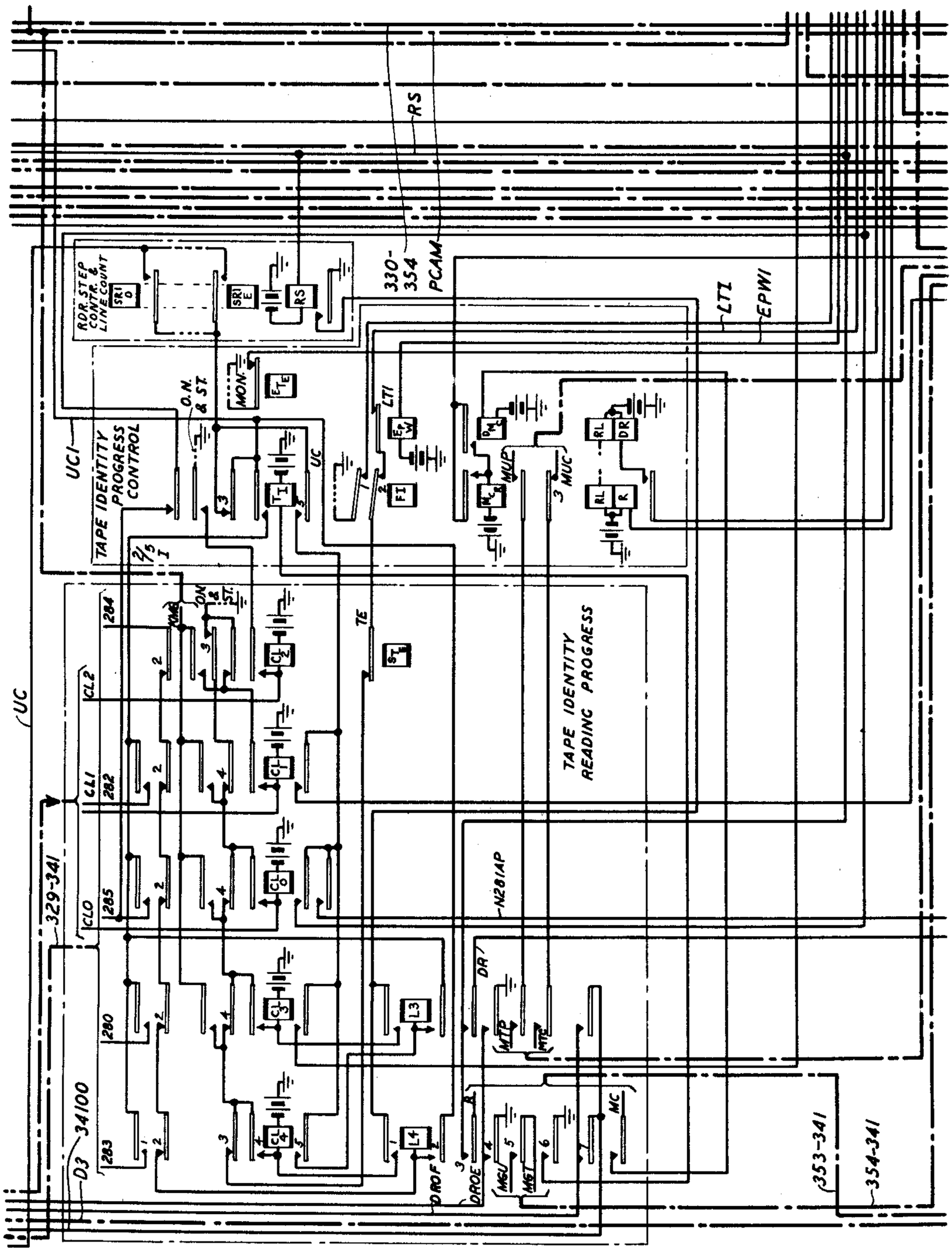


FIG. 341

INVENTOR
A. E. JOEL, JR.

BY Silverner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 317

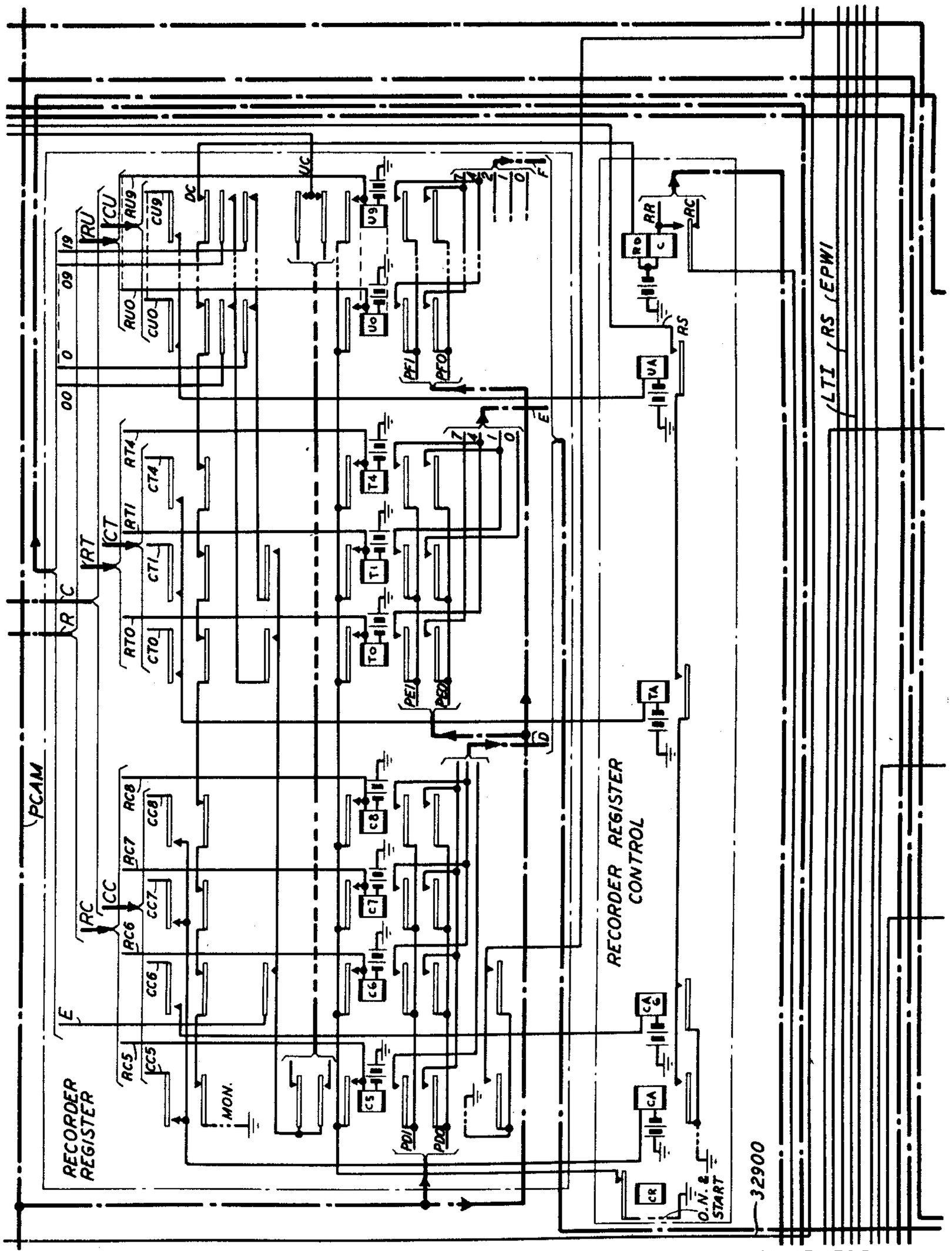


FIG. 342

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 318

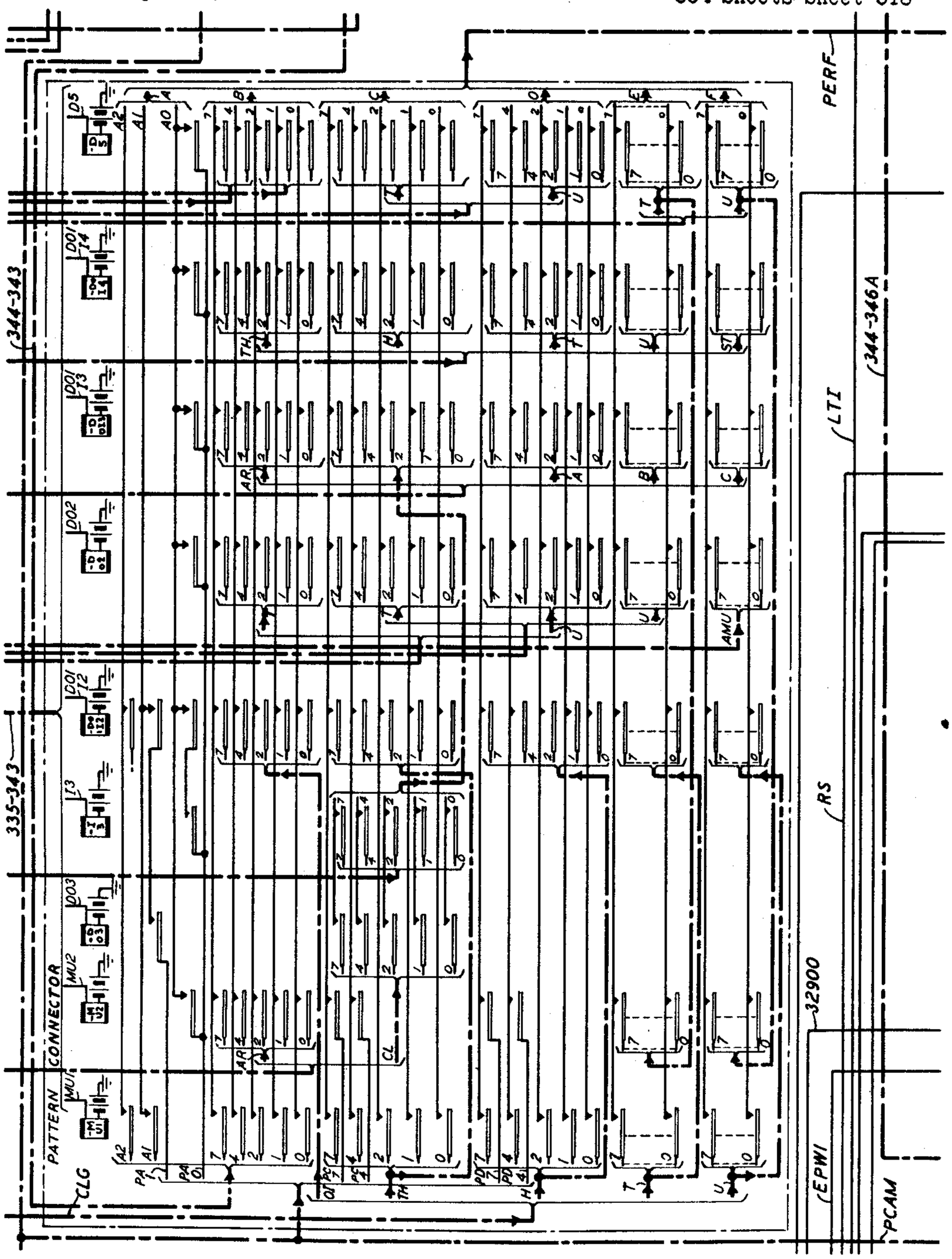


FIG. 343

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 319

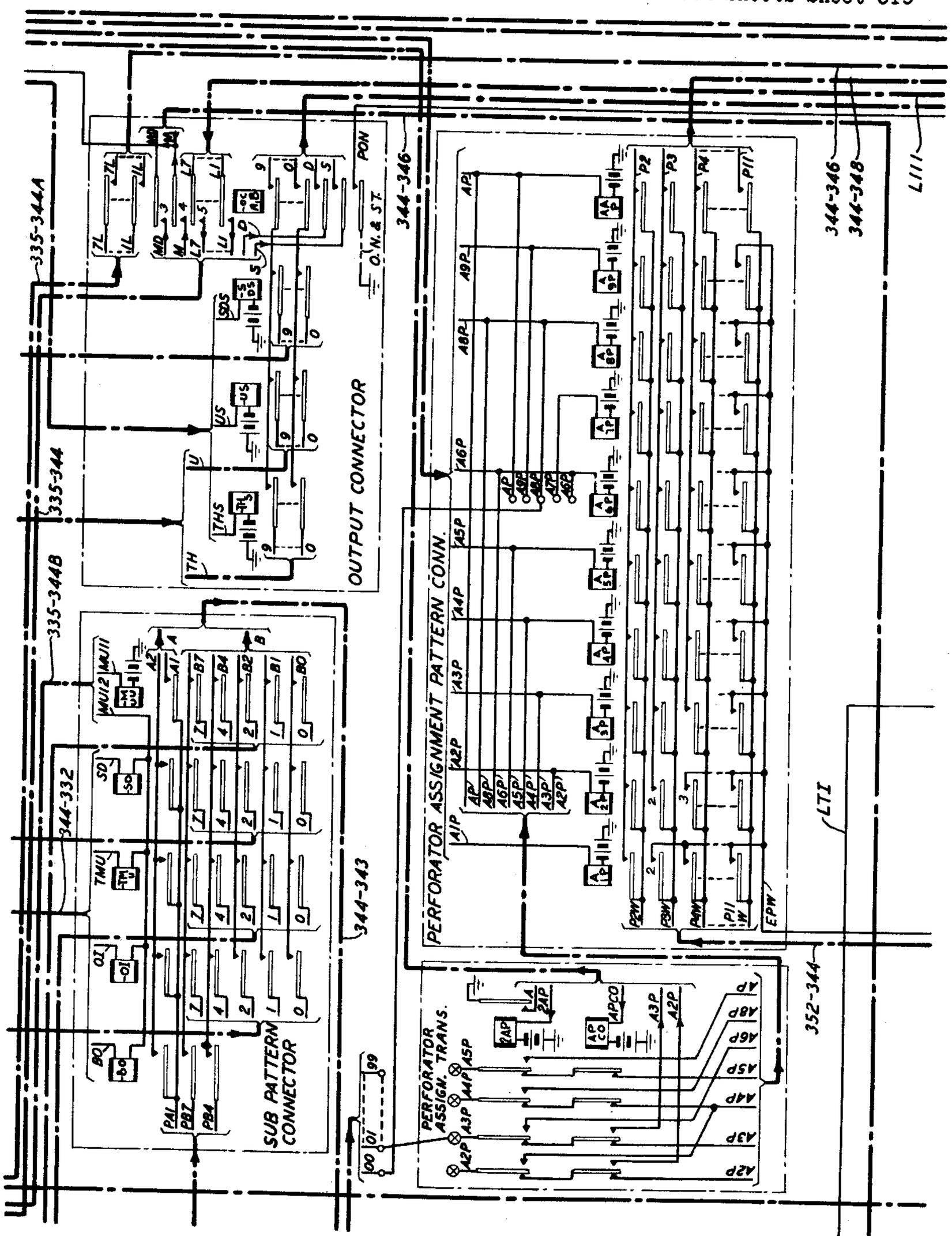


FIG. 344

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 320

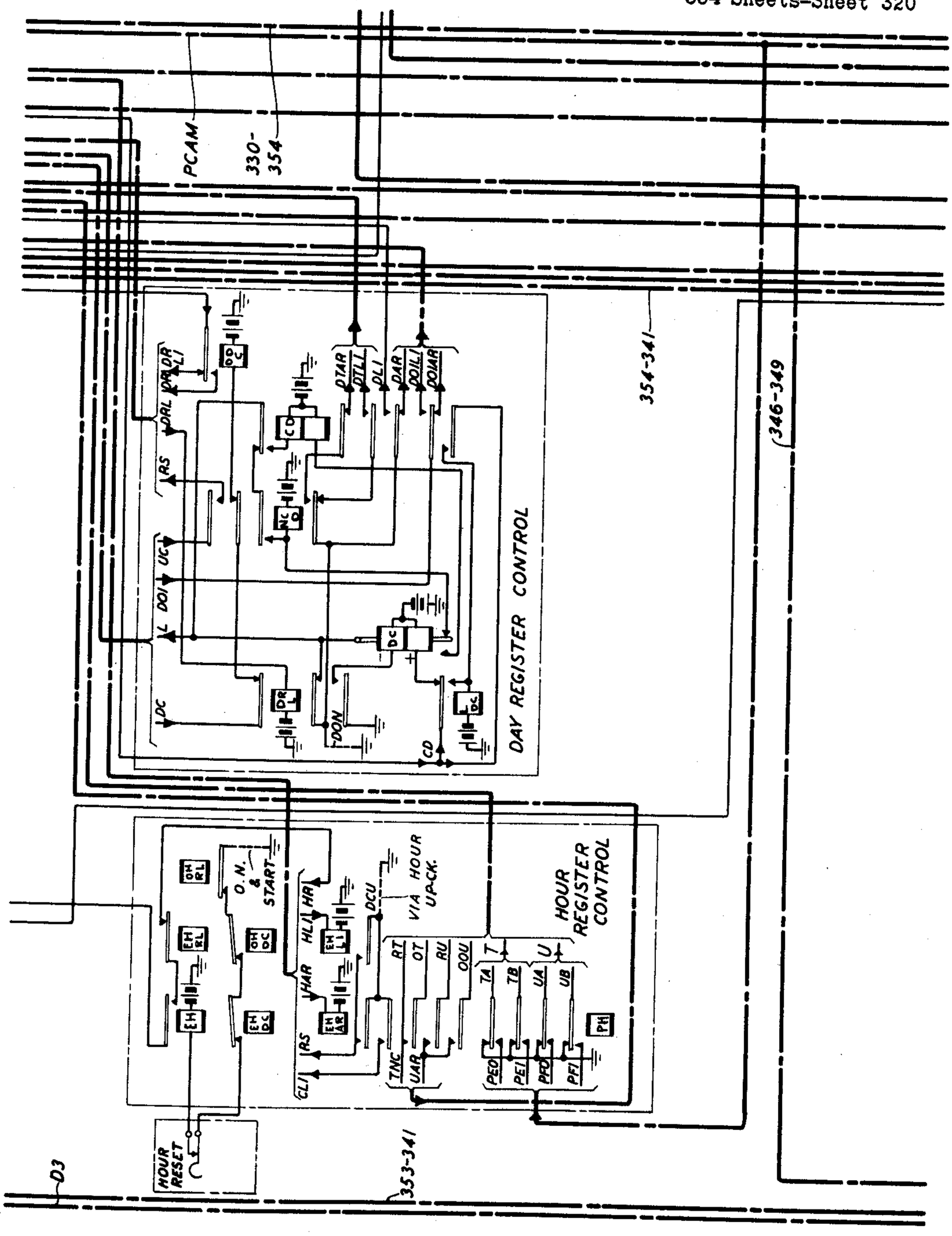


FIG. 345

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 321

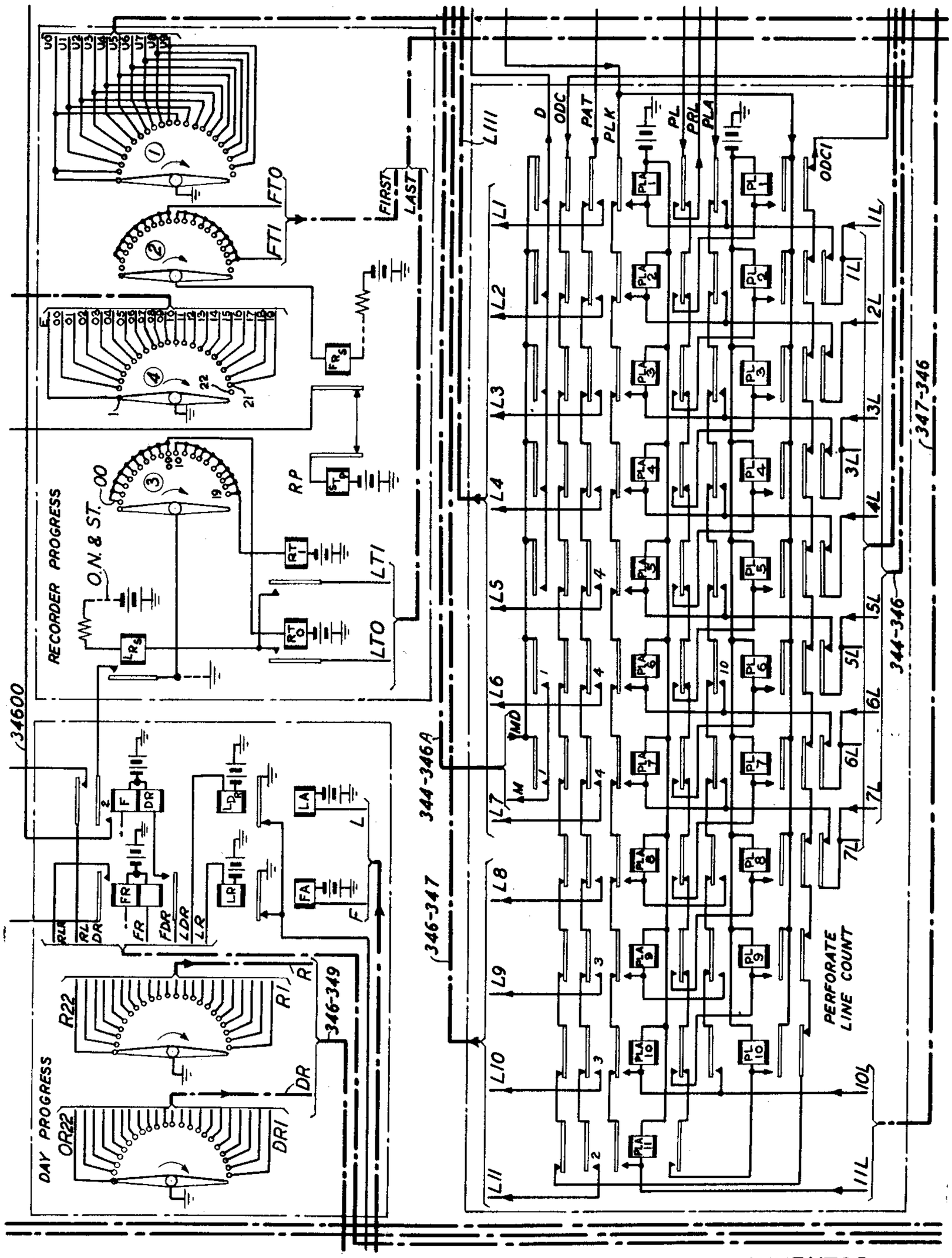


FIG. 346

INVENTOR,
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 322

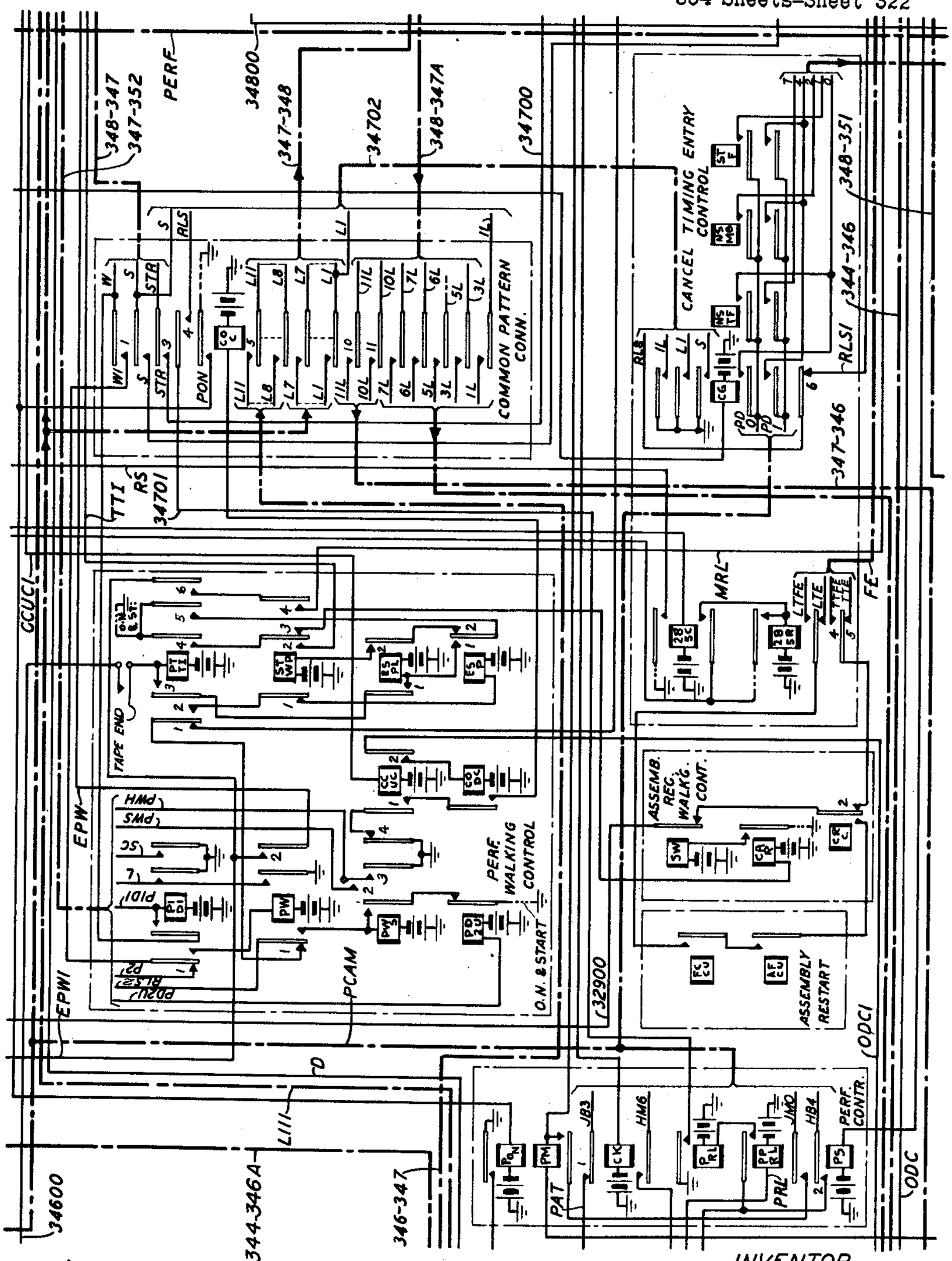


FIG. 347

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 323

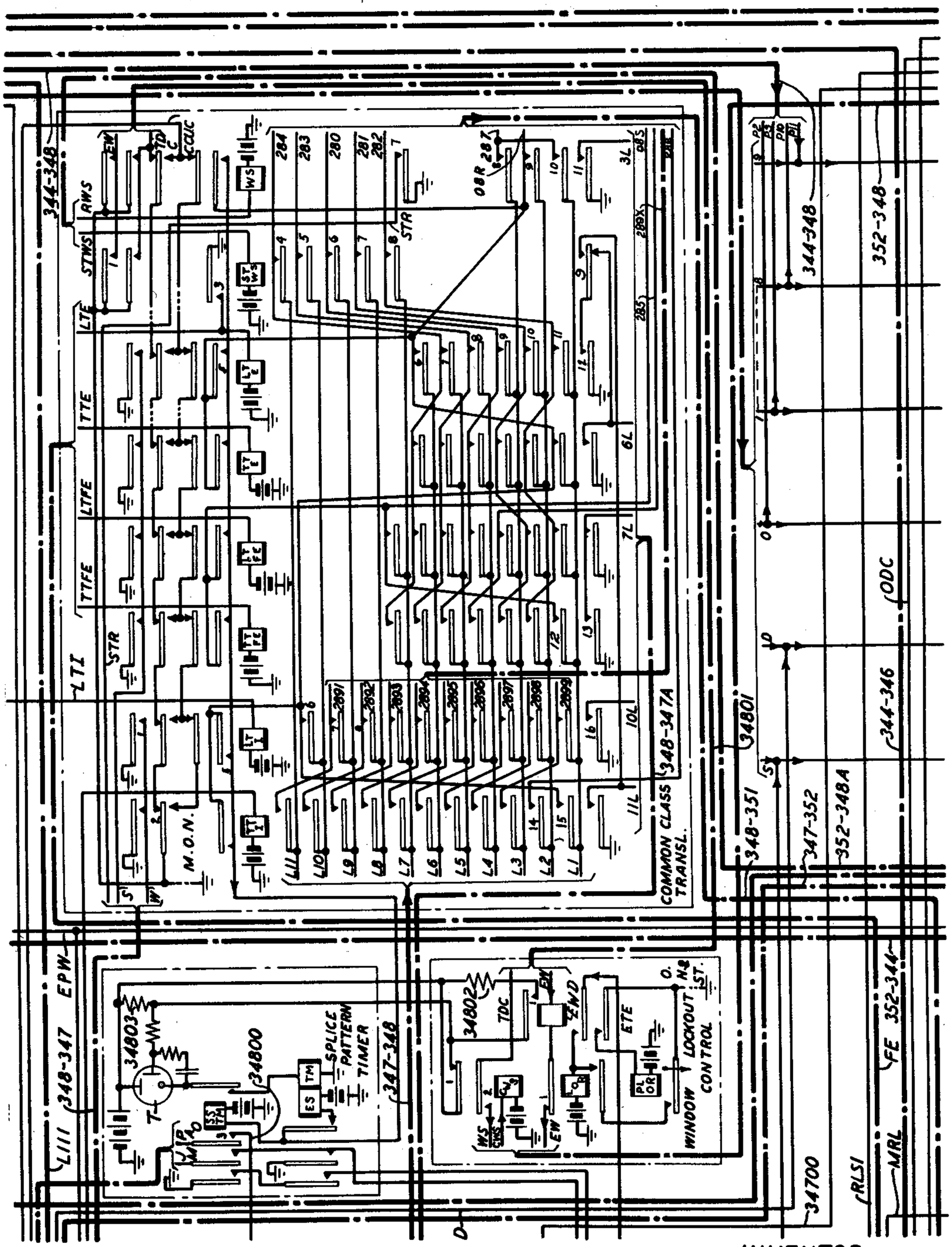


FIG. 348

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 324

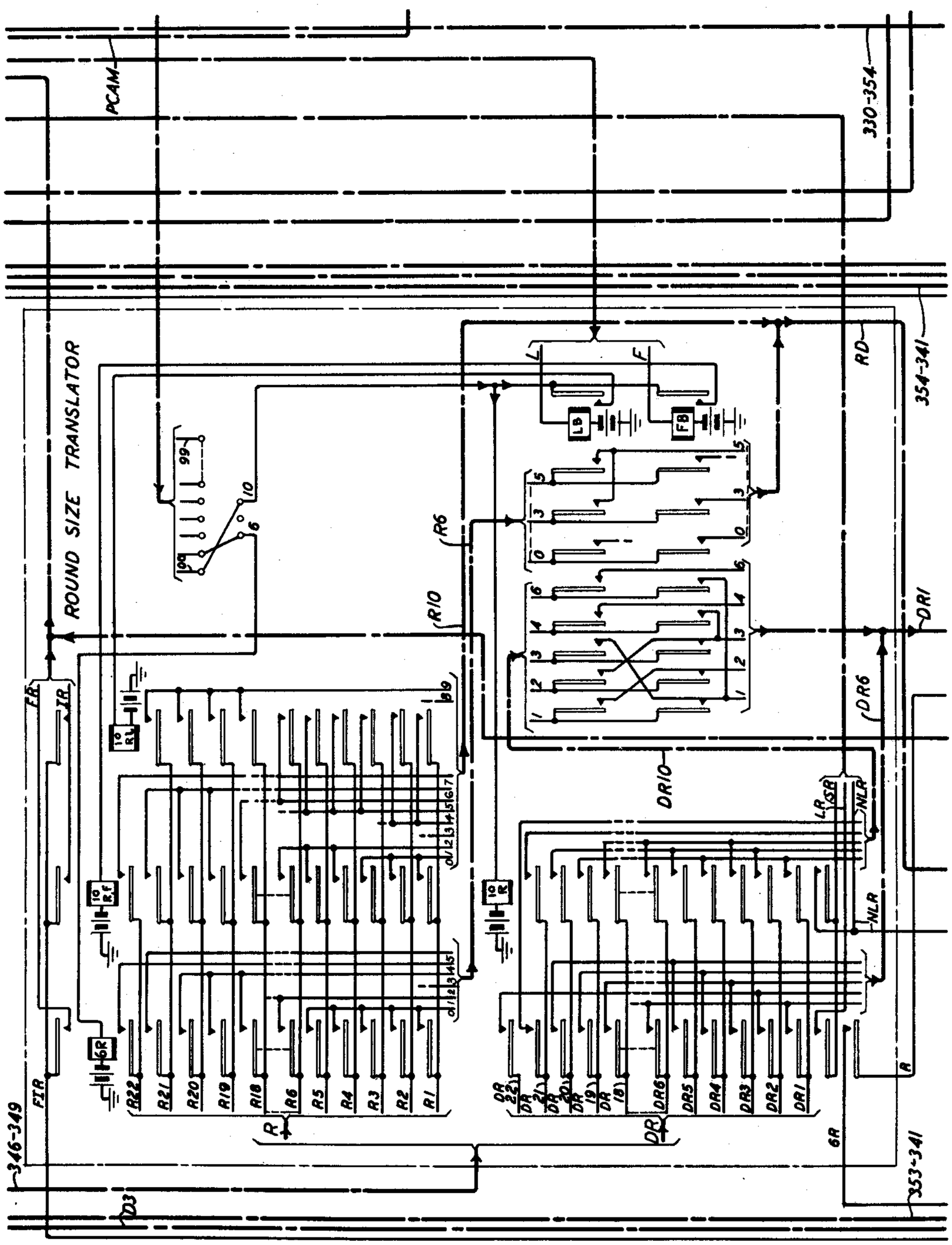


FIG. 349

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 325

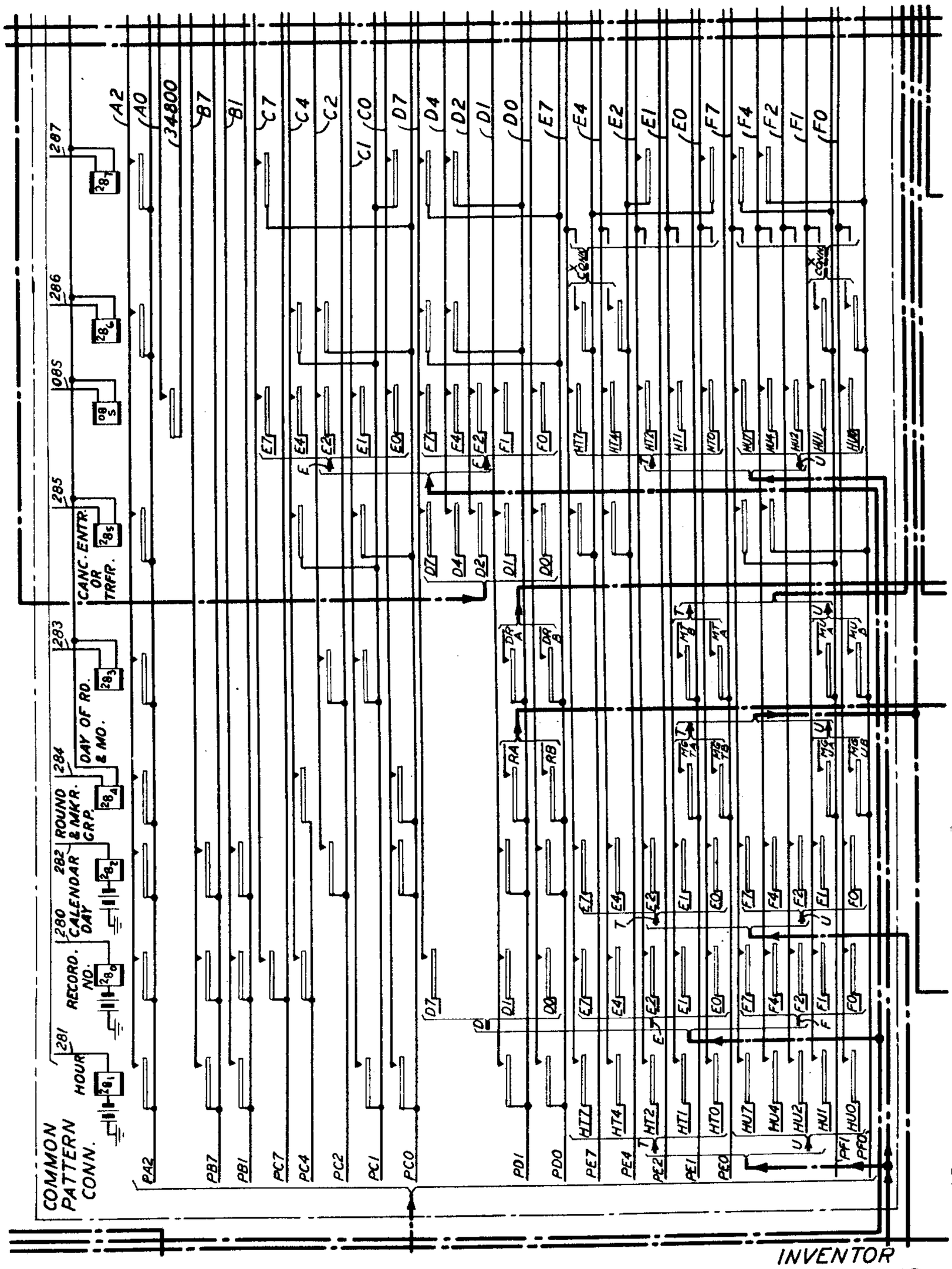


FIG. 350

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 326

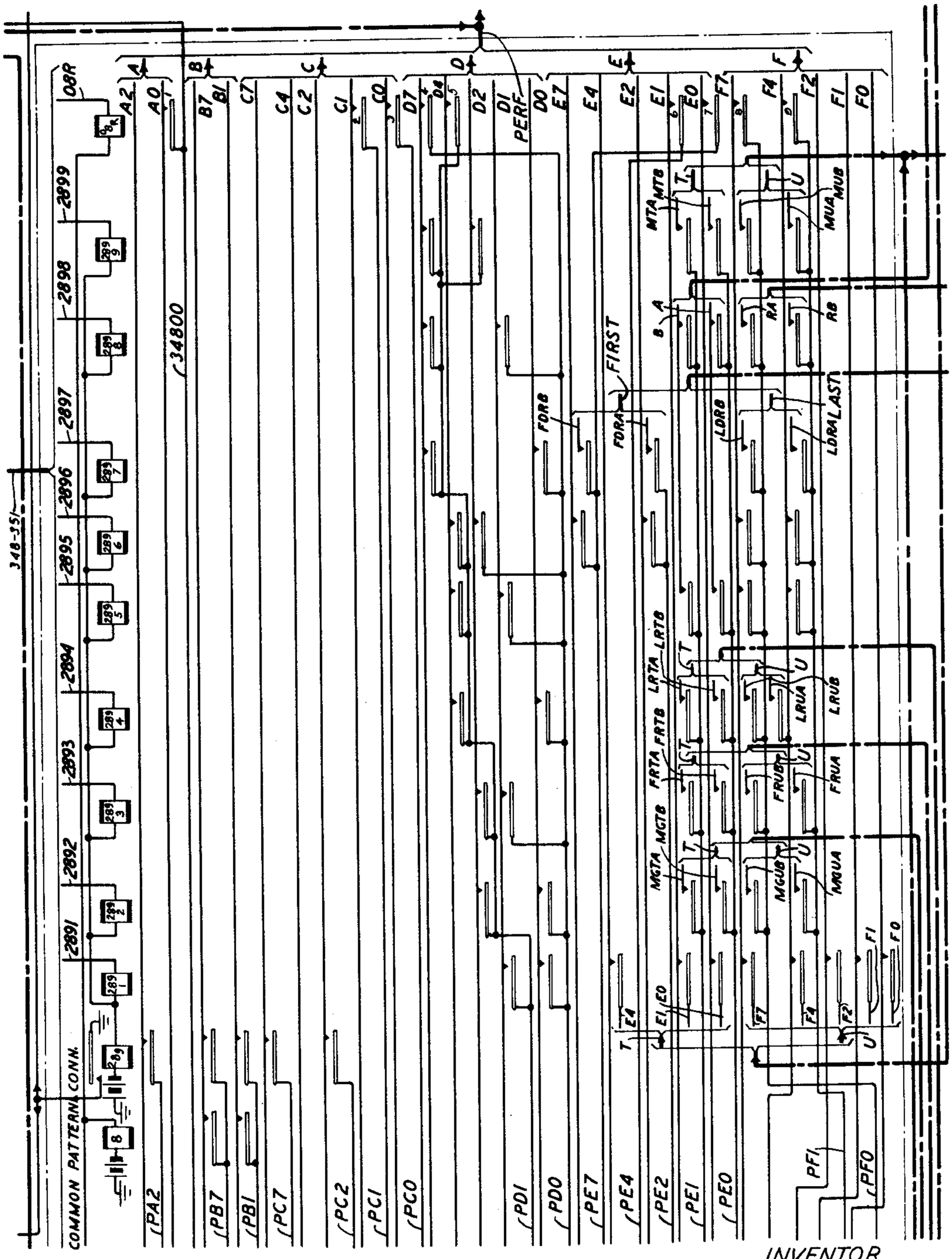


FIG. 351

INVENTOR
A. E. JOEL, JR.
BY S. Werner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 327

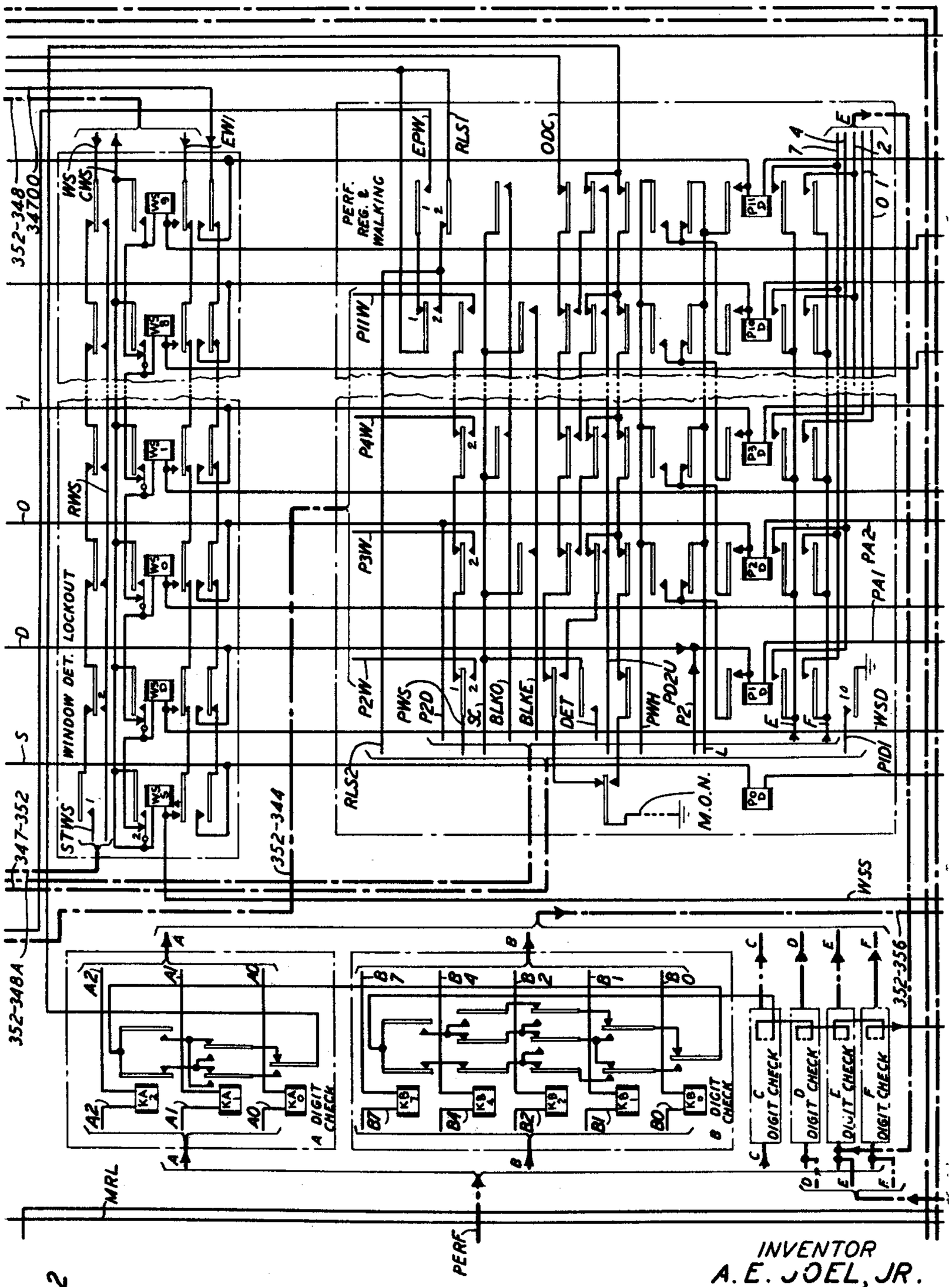


FIG. 352

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 328

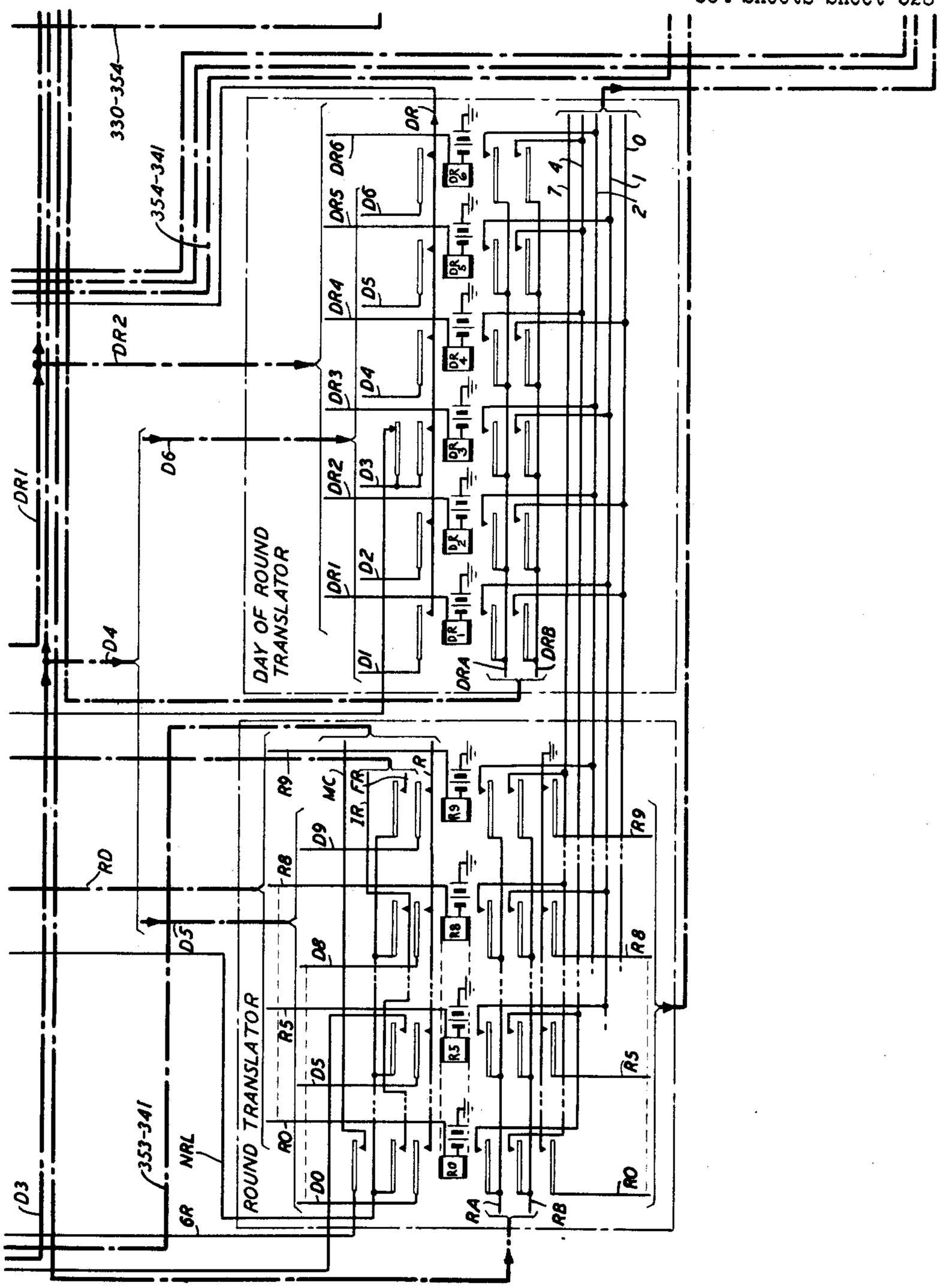


FIG. 353

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 329

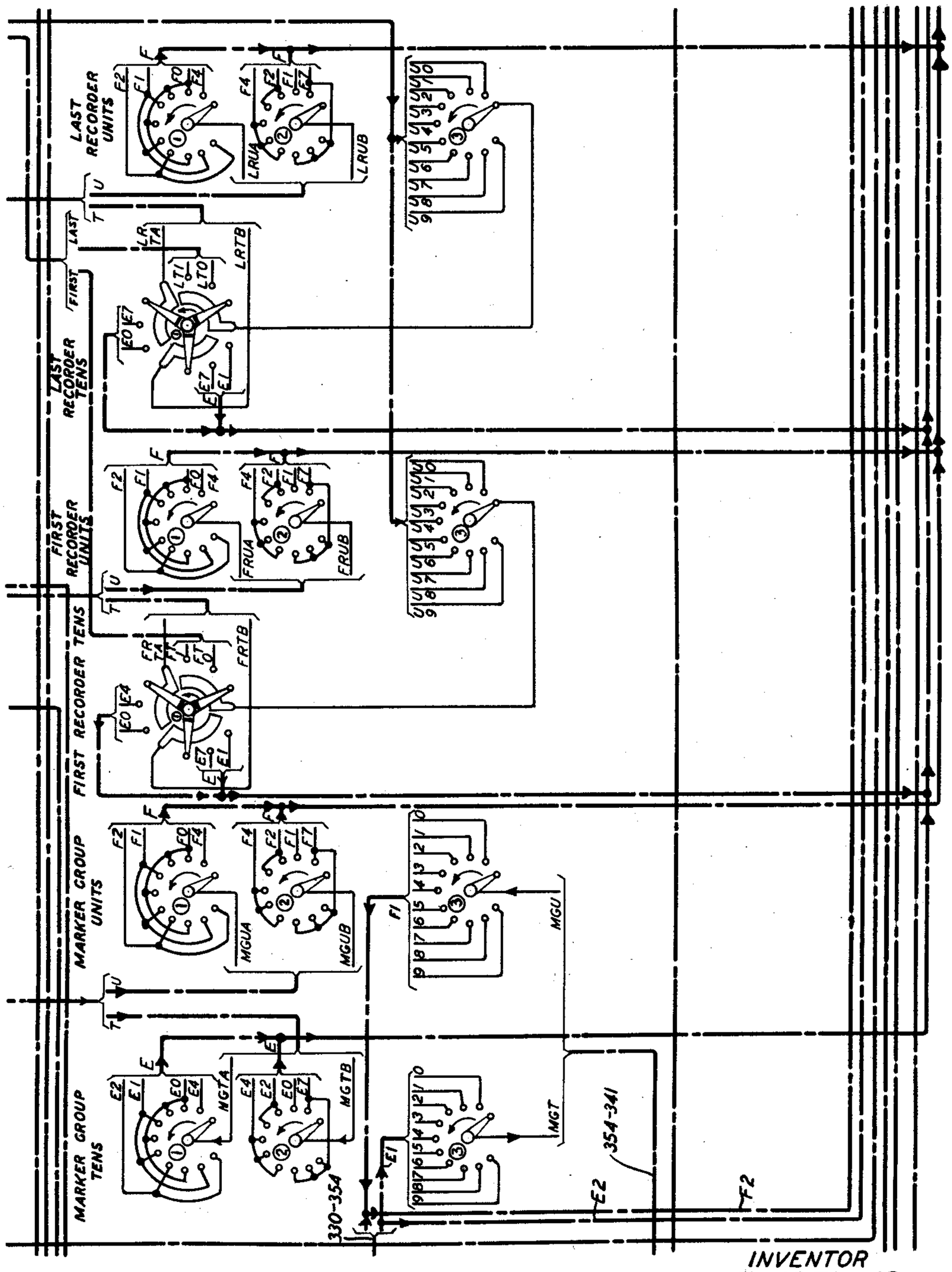


FIG. 354

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 330

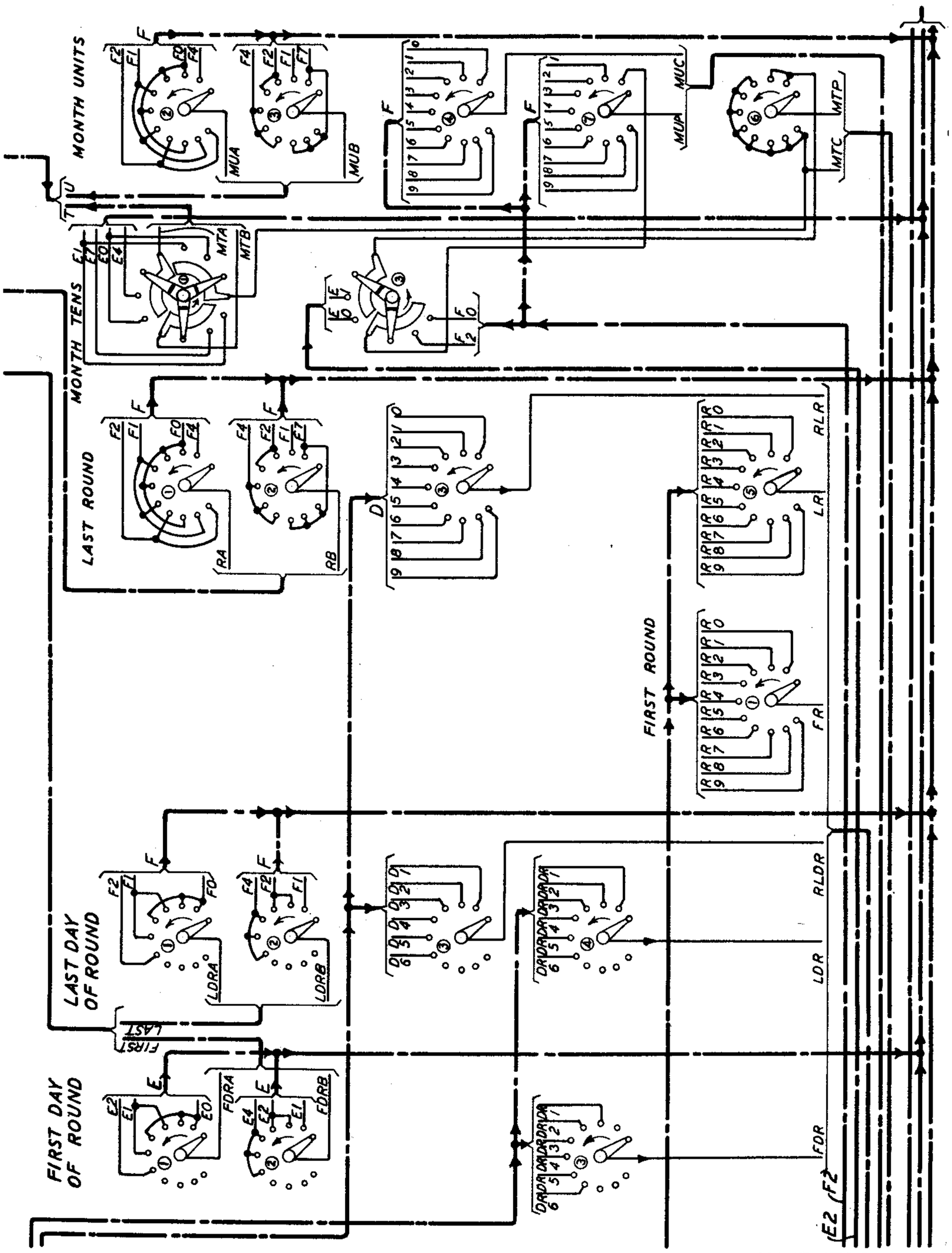


FIG. 355

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 331

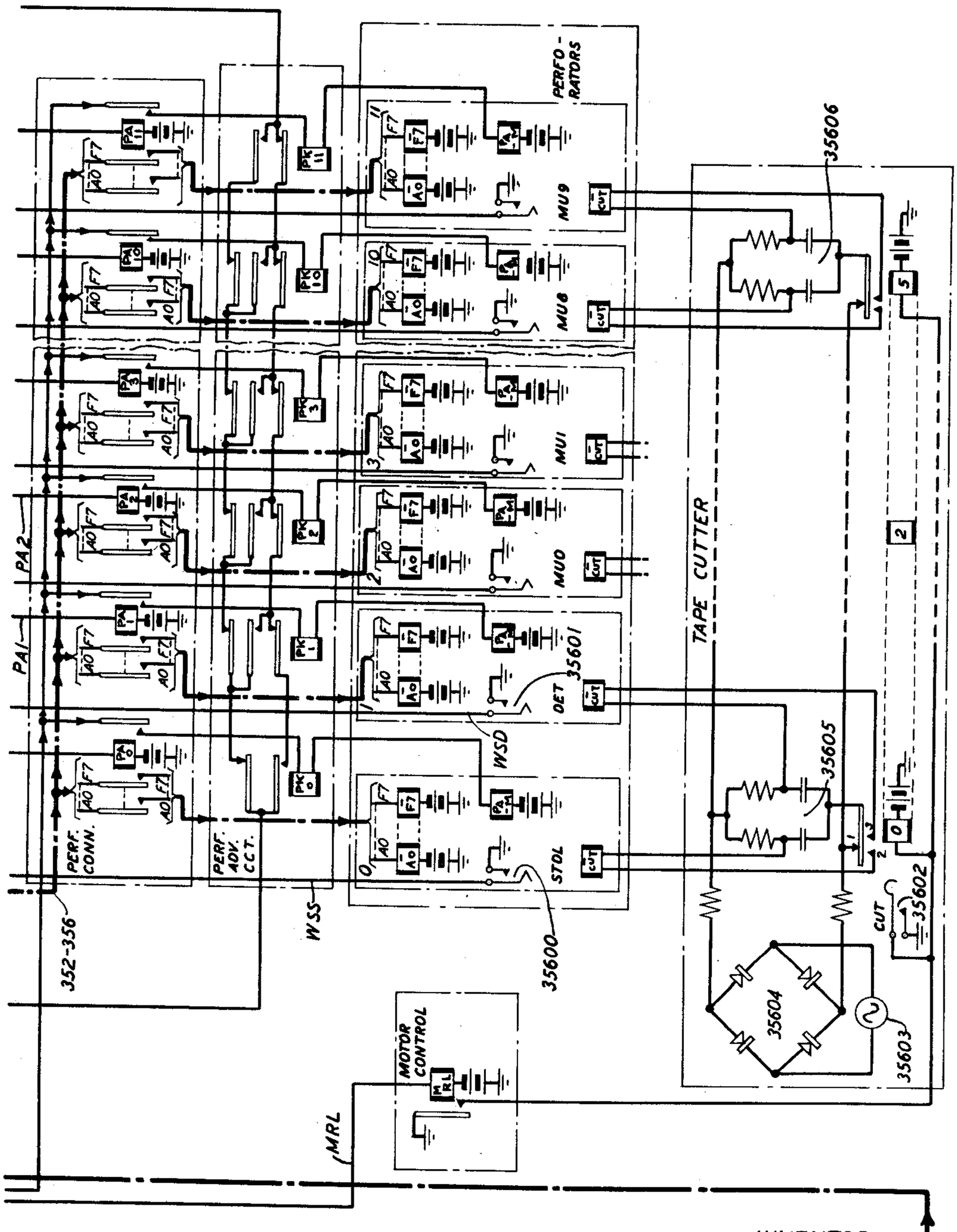


FIG. 356

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 332

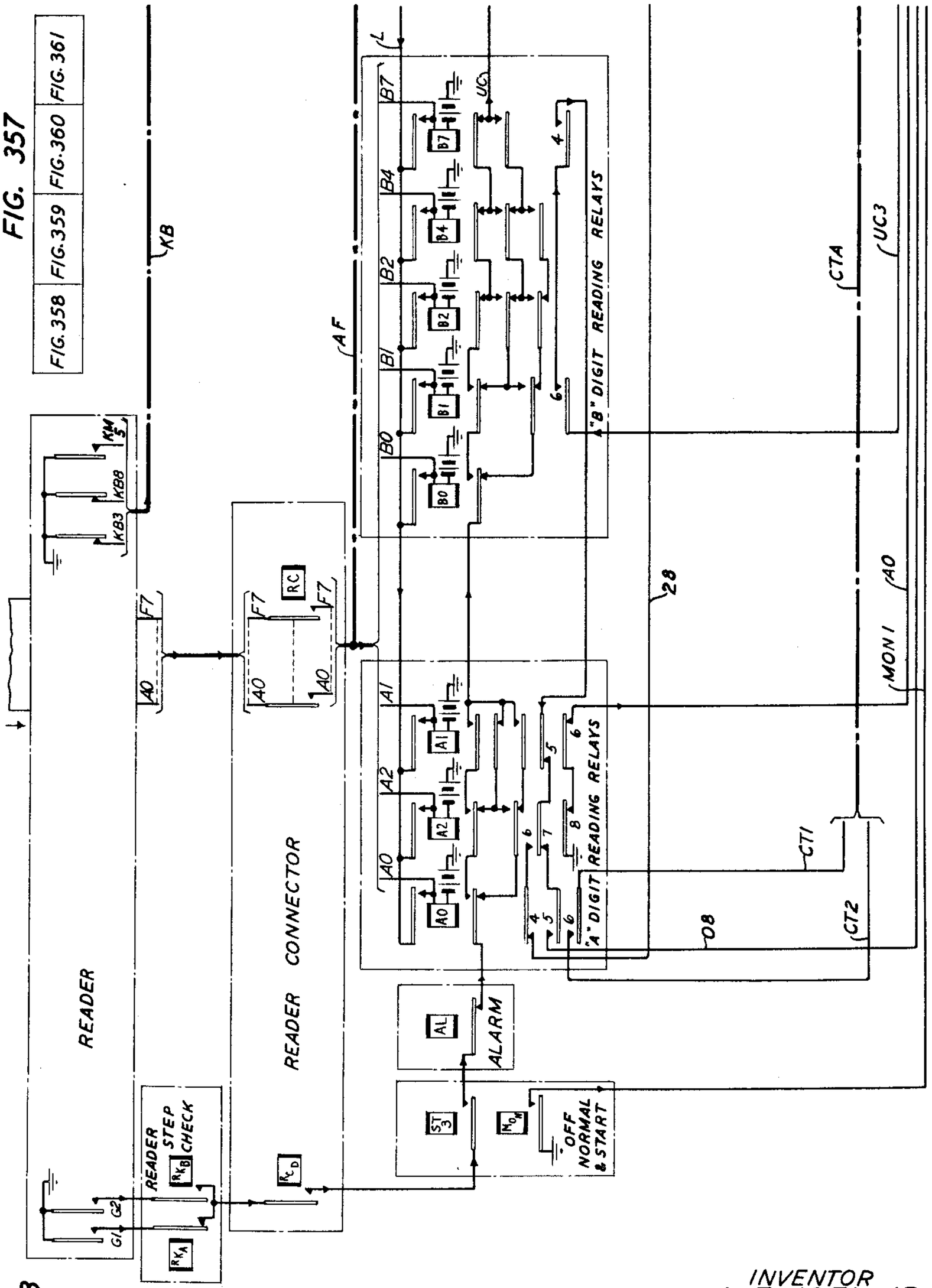


FIG. 358

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 333

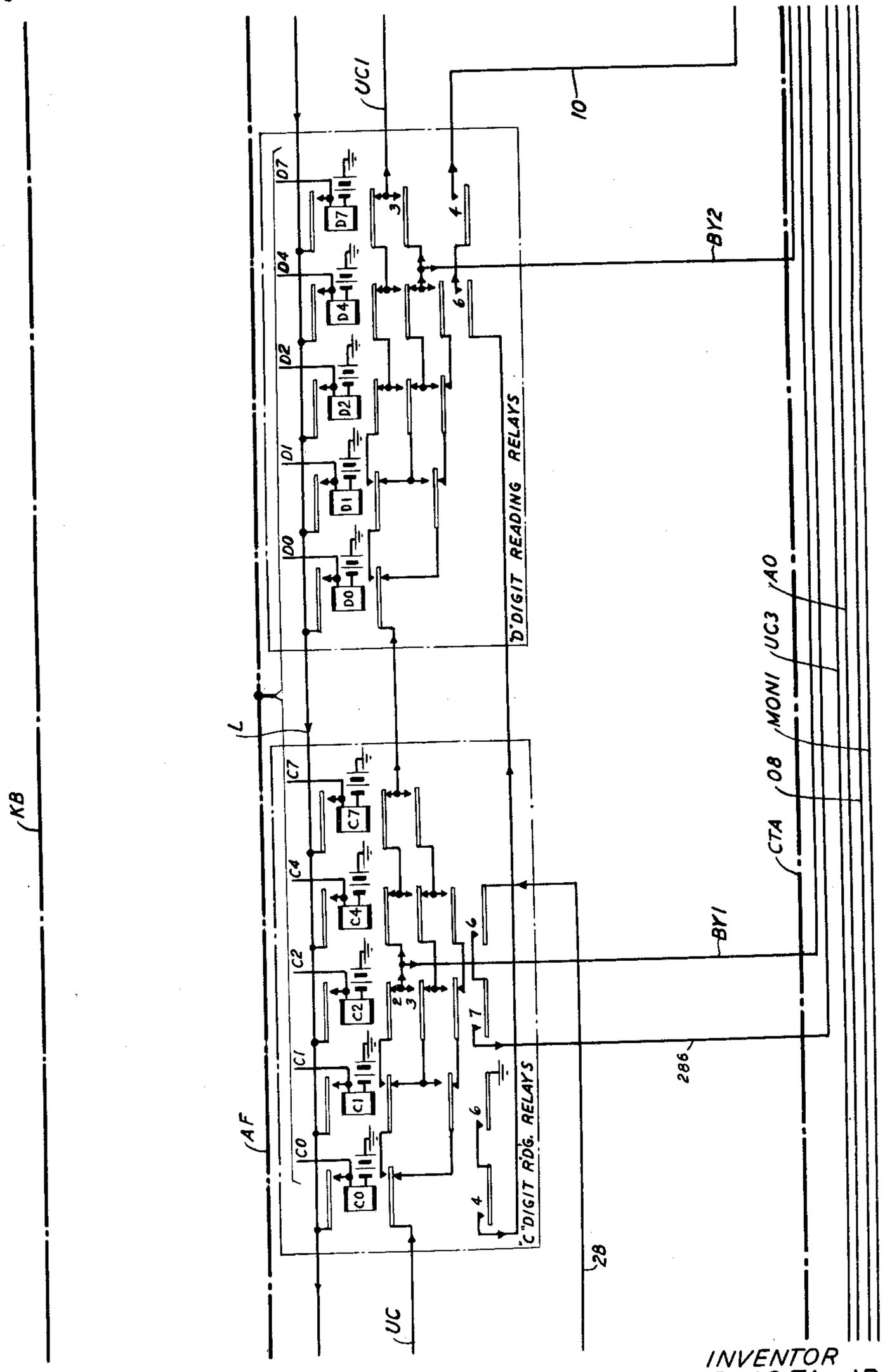


FIG. 359

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR. 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 334

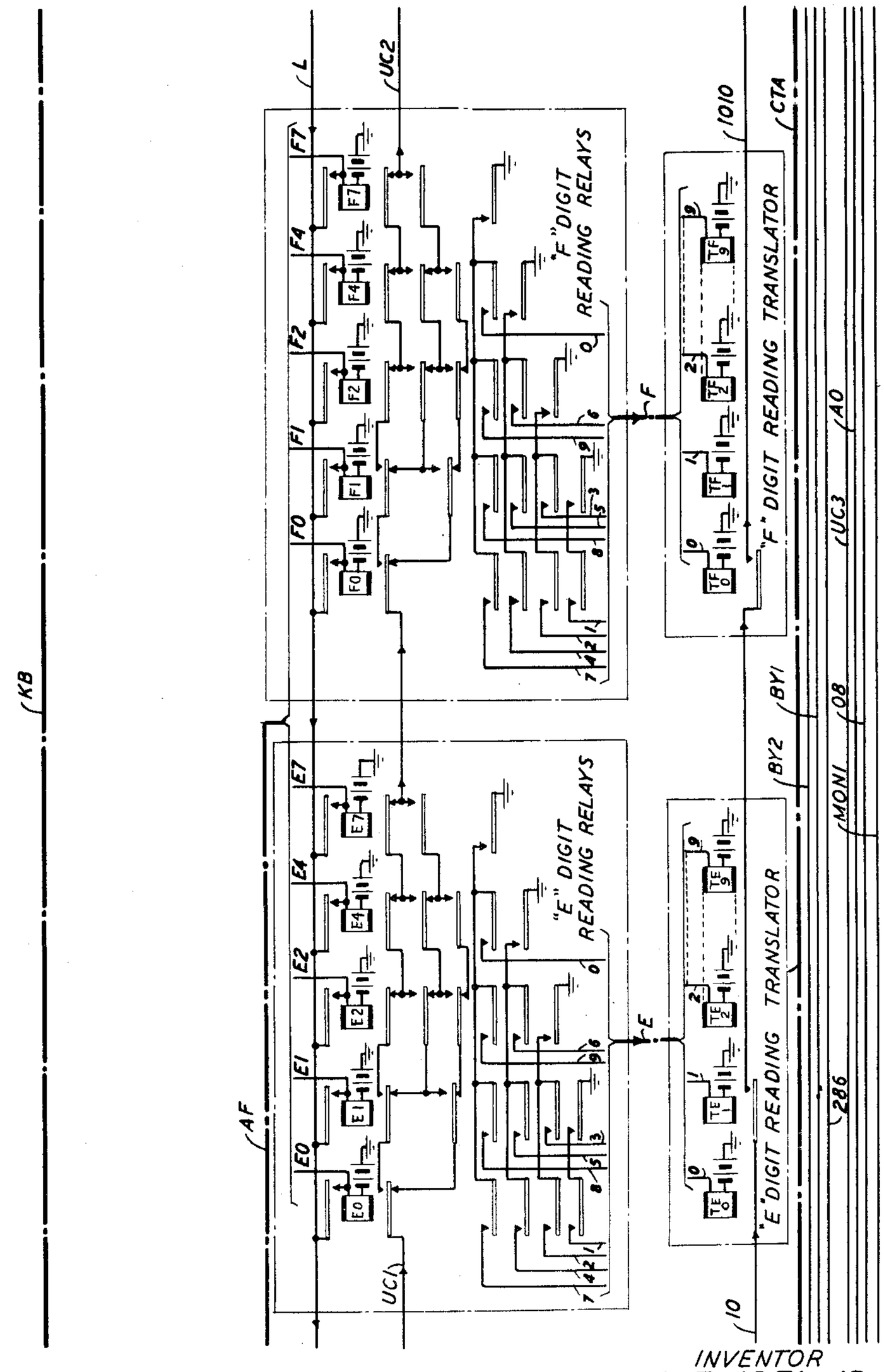


FIG. 360

INVENTOR
A. E. JOEL, JR.
BY Silverman
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 335

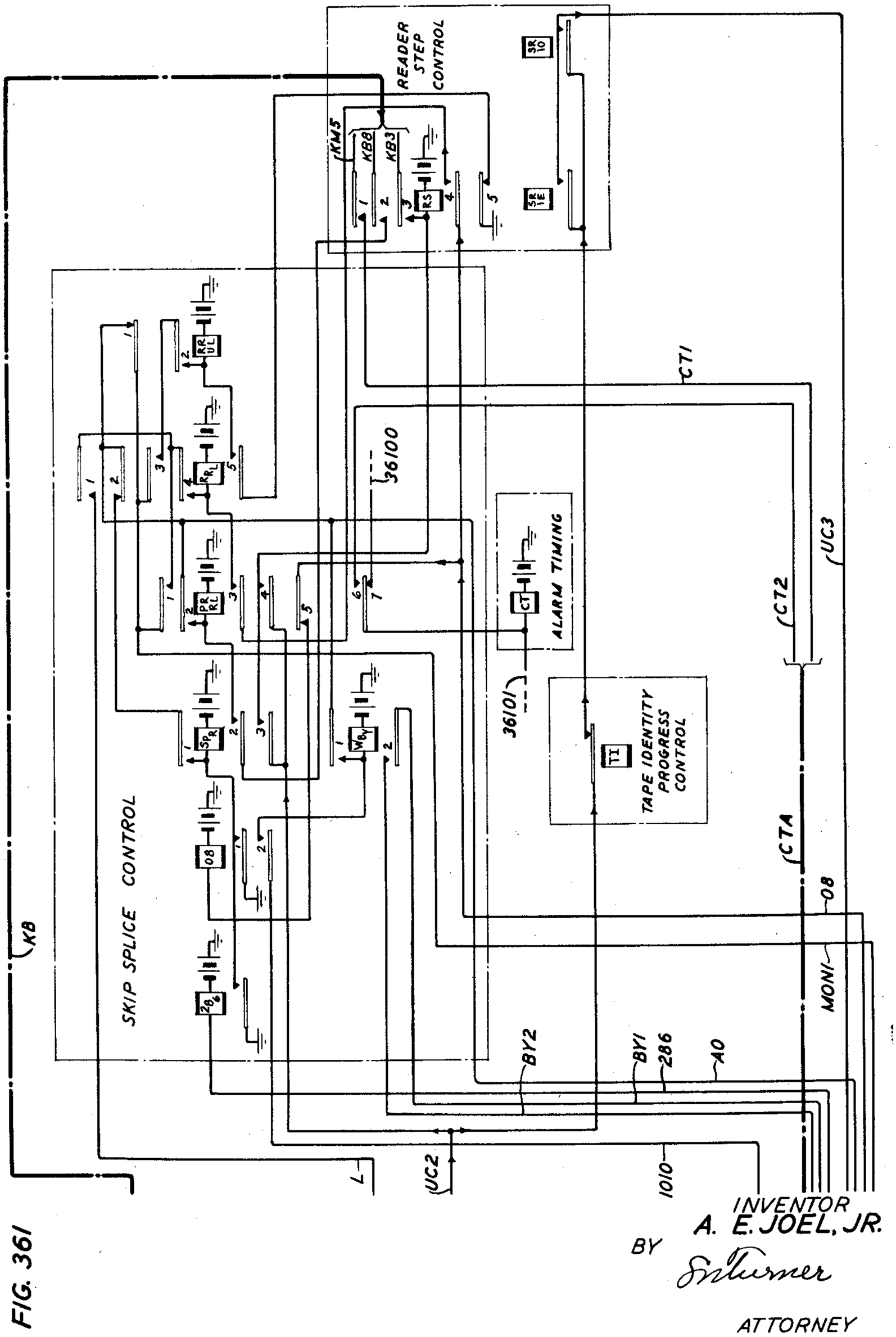


FIG. 361

INVENTOR
A. E. JOEL, JR.
BY
S. L. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 336

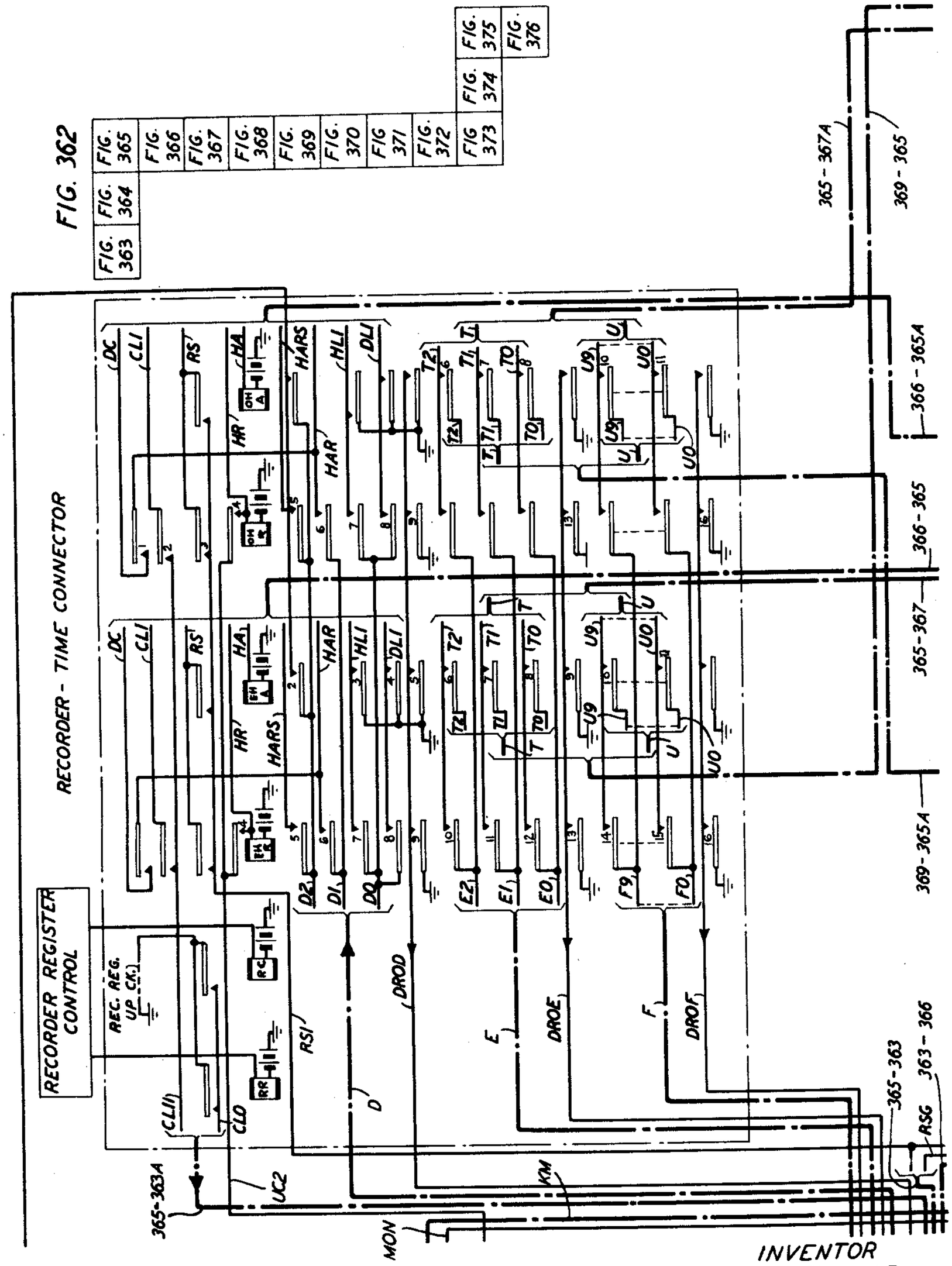


FIG. 365

INVENTOR
A. E. JOEL, JR.
BY Silverner
ATTORNEY

Feb. 23, 1960

A. E. JOEL, JR

2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955

354 Sheets-Sheet 337

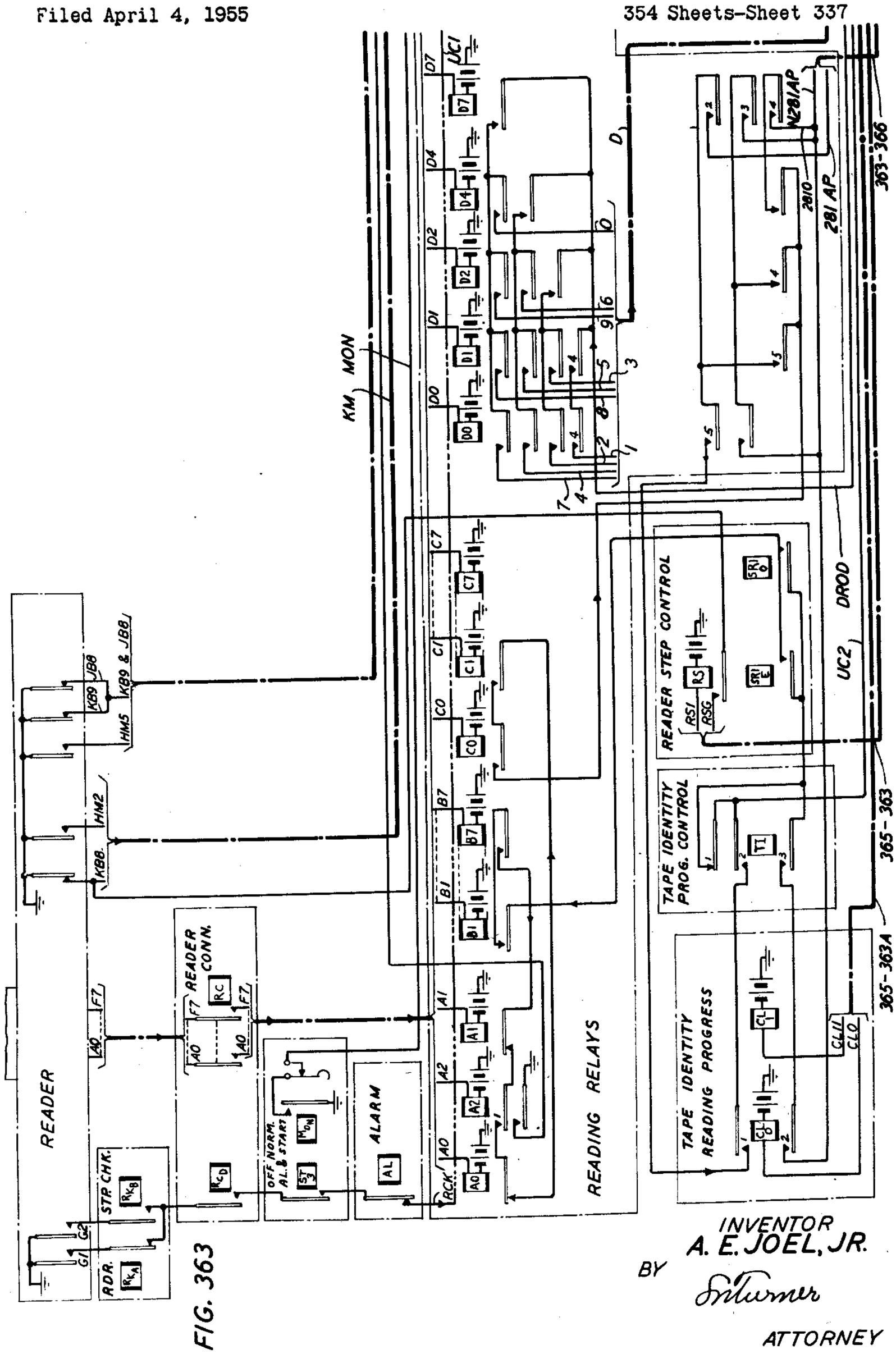


FIG. 363

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 338

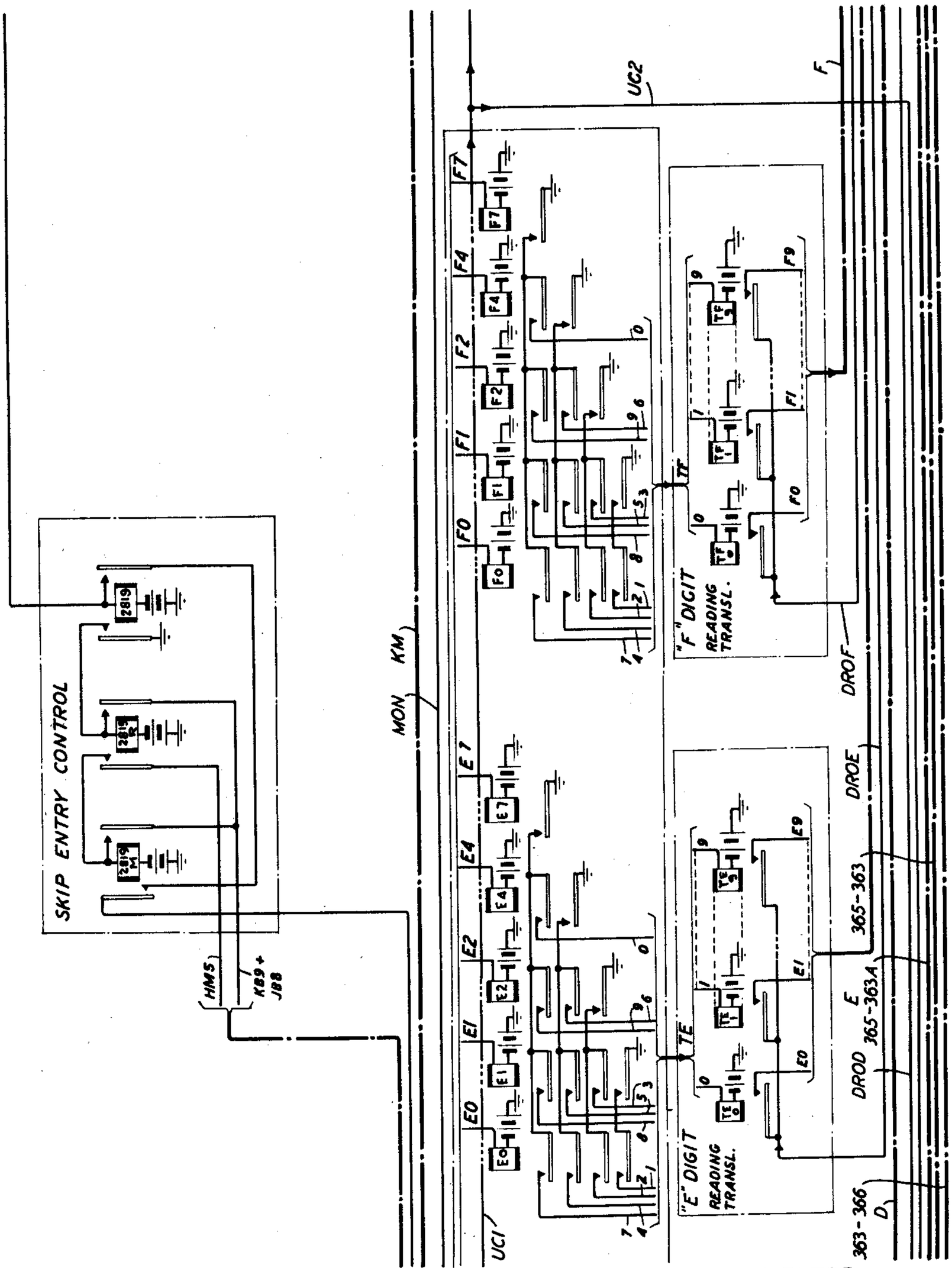


FIG. 364

INVENTOR
A. E. JOEL, JR.
BY Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 339

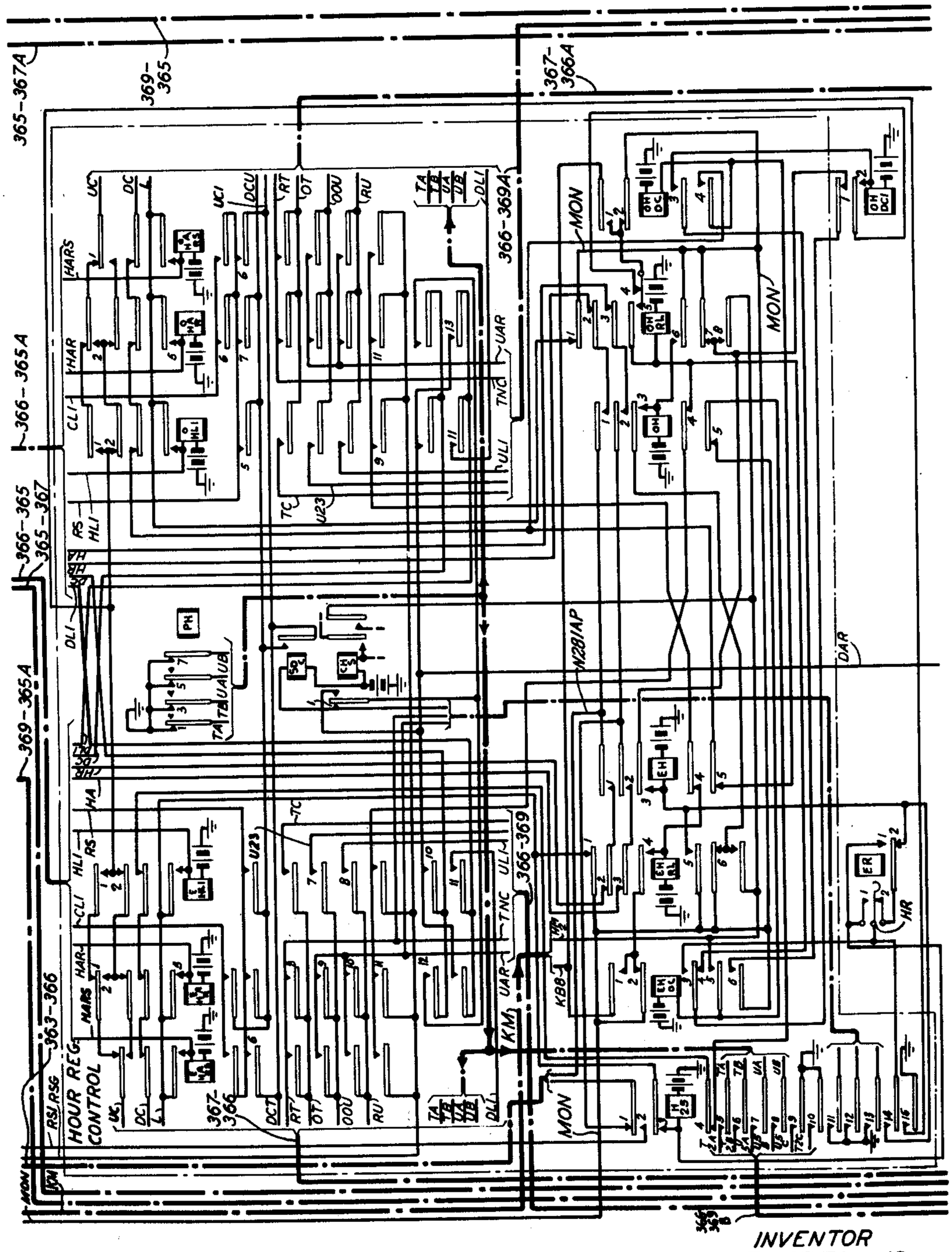


FIG. 366

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 340

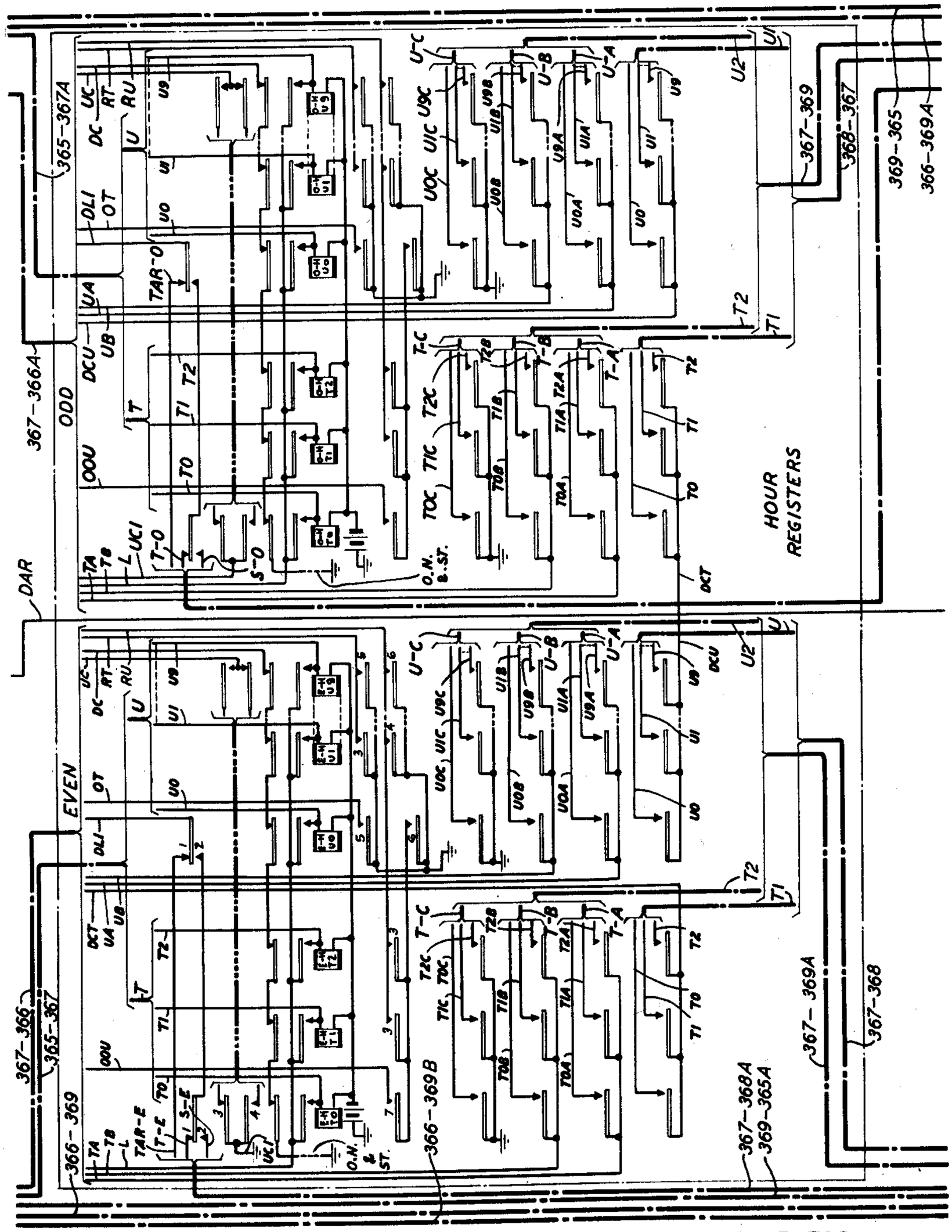


FIG. 367

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 341

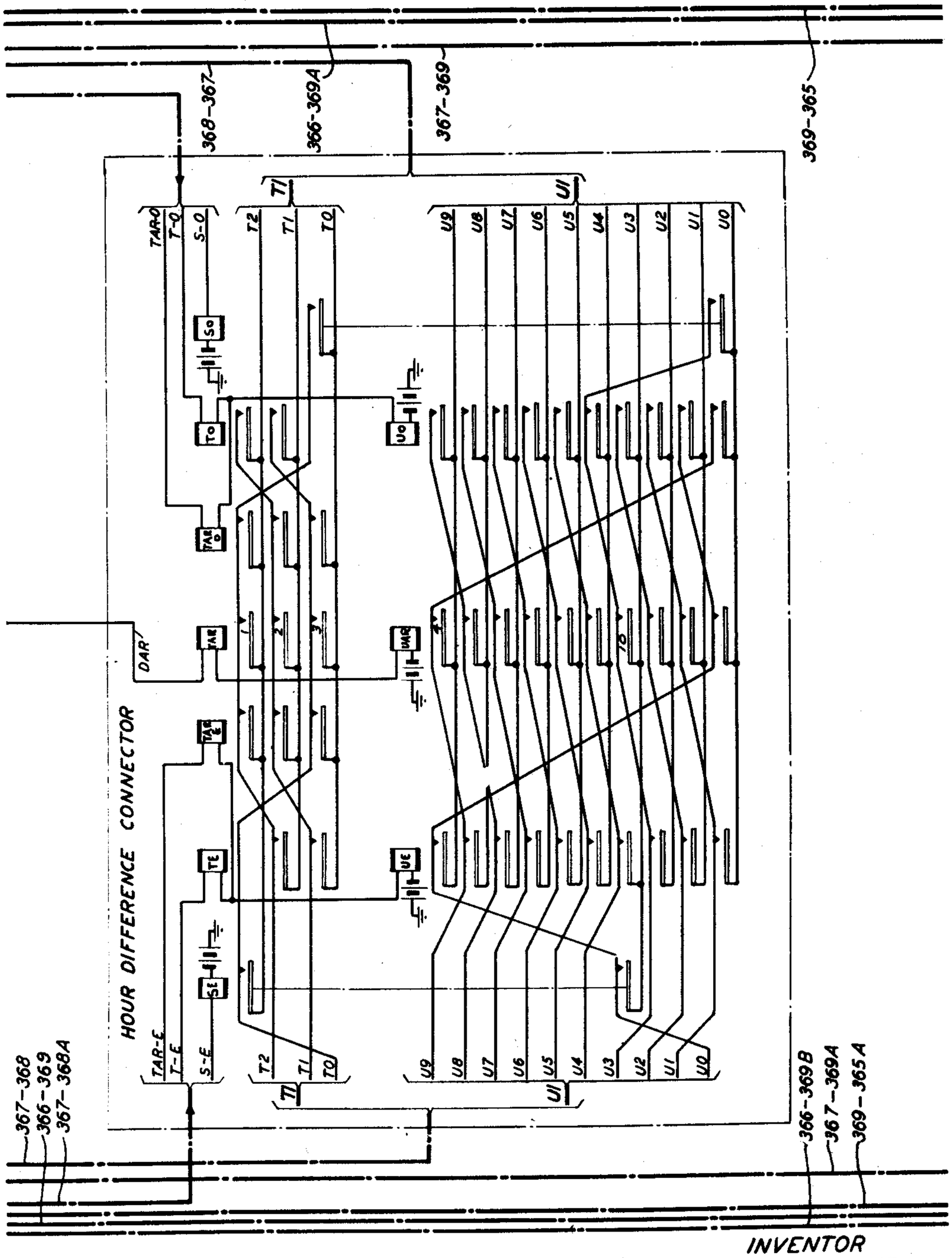


FIG. 368

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 342

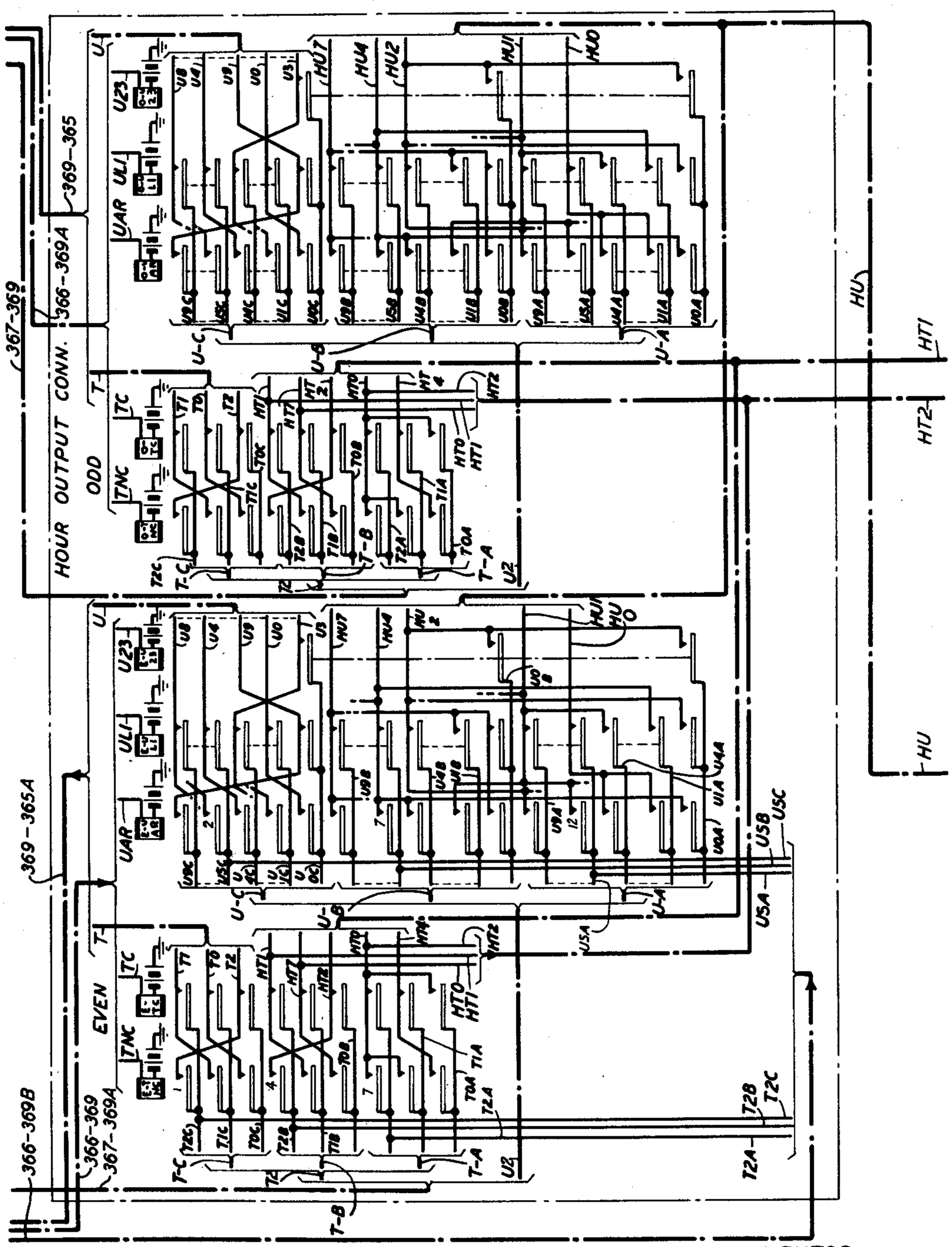


FIG. 369

INVENTOR
A. E. JOEL, JR.
BY Sitterner
ATTORNEY

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 343

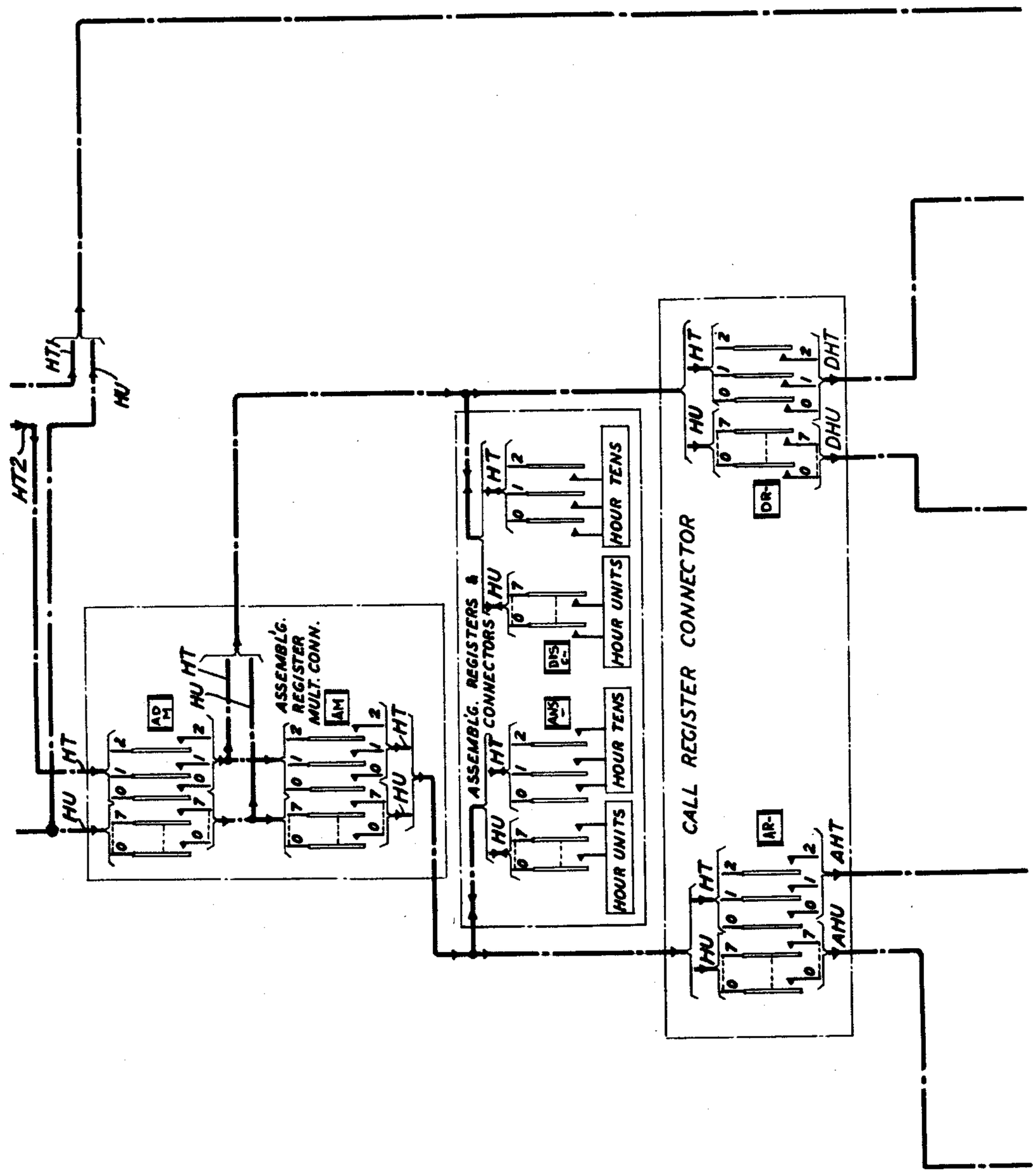


FIG. 370

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 344

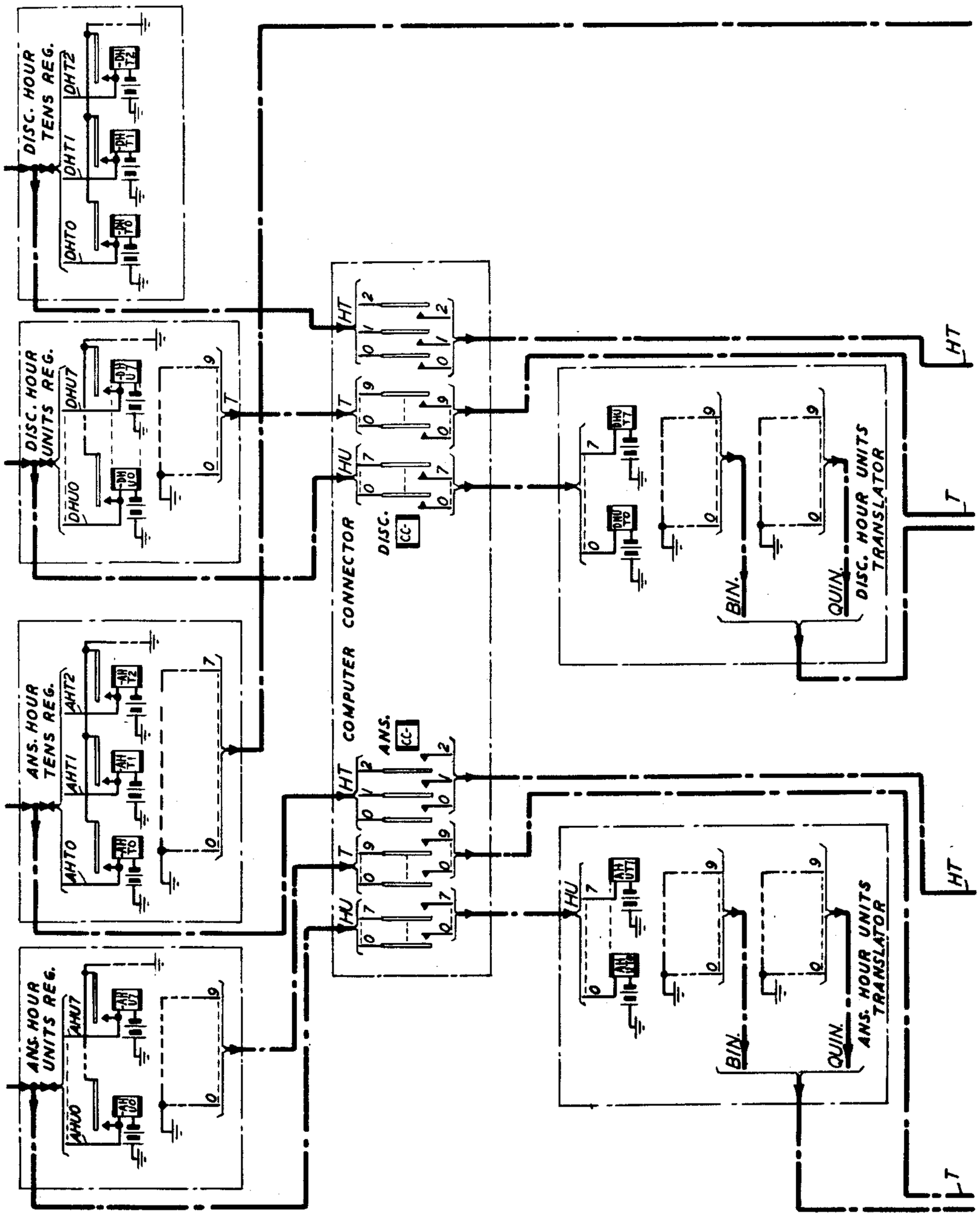


FIG. 371

INVENTOR
A. E. JOEL, JR.

BY Sitturner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 345

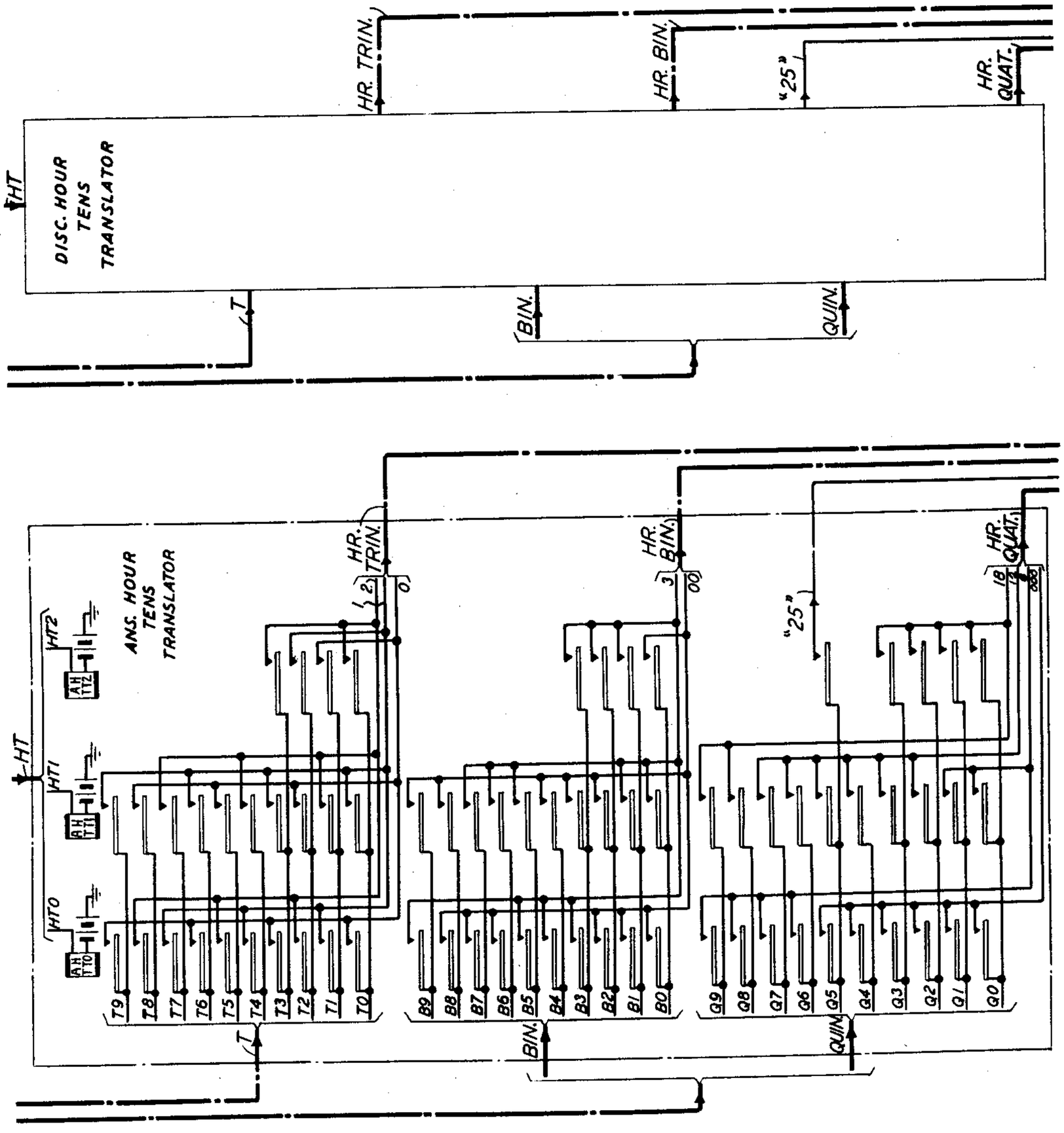


FIG. 372

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 346

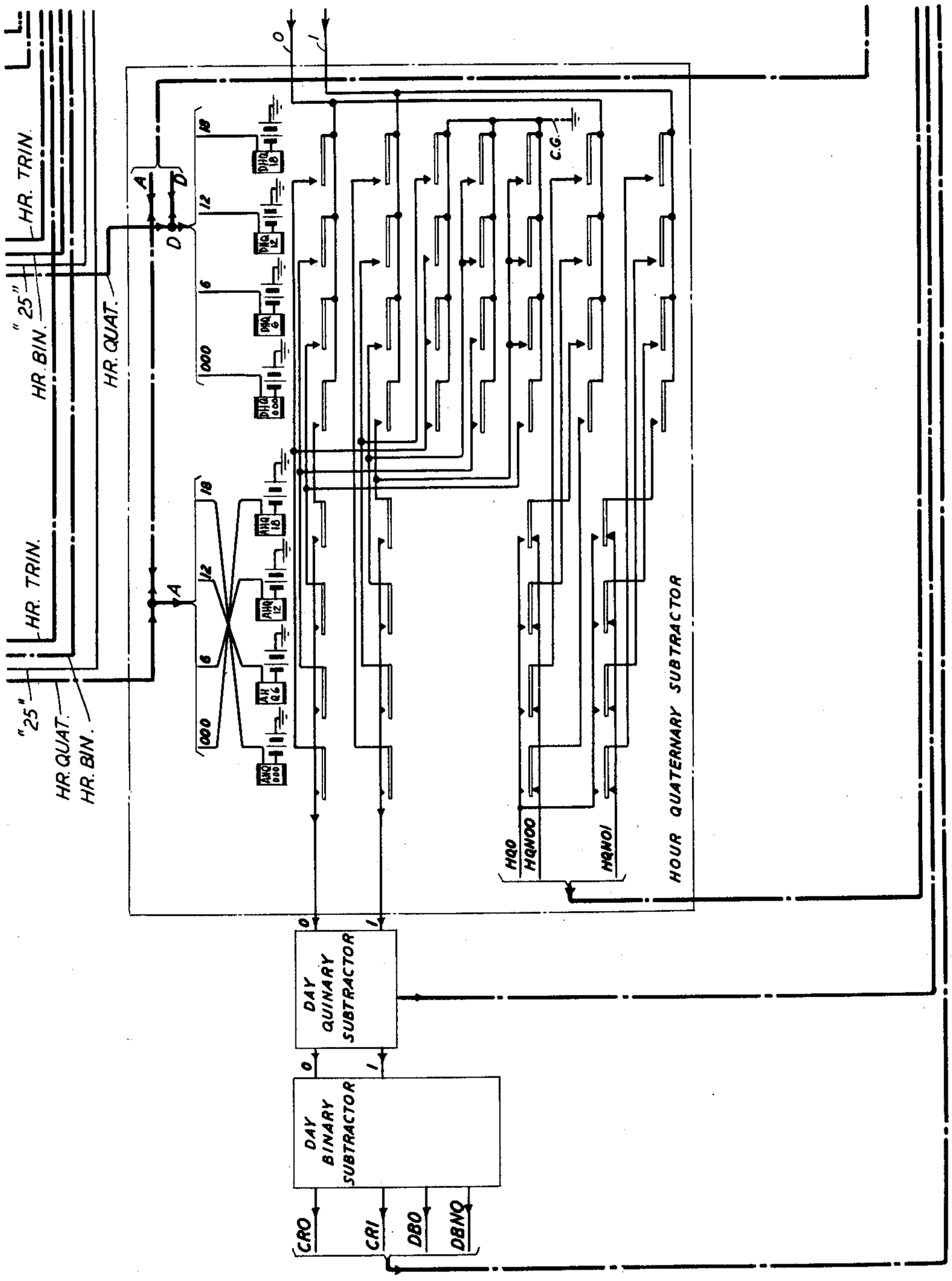


FIG. 373

INVENTOR
A. E. JOEL, JR.
BY
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 347

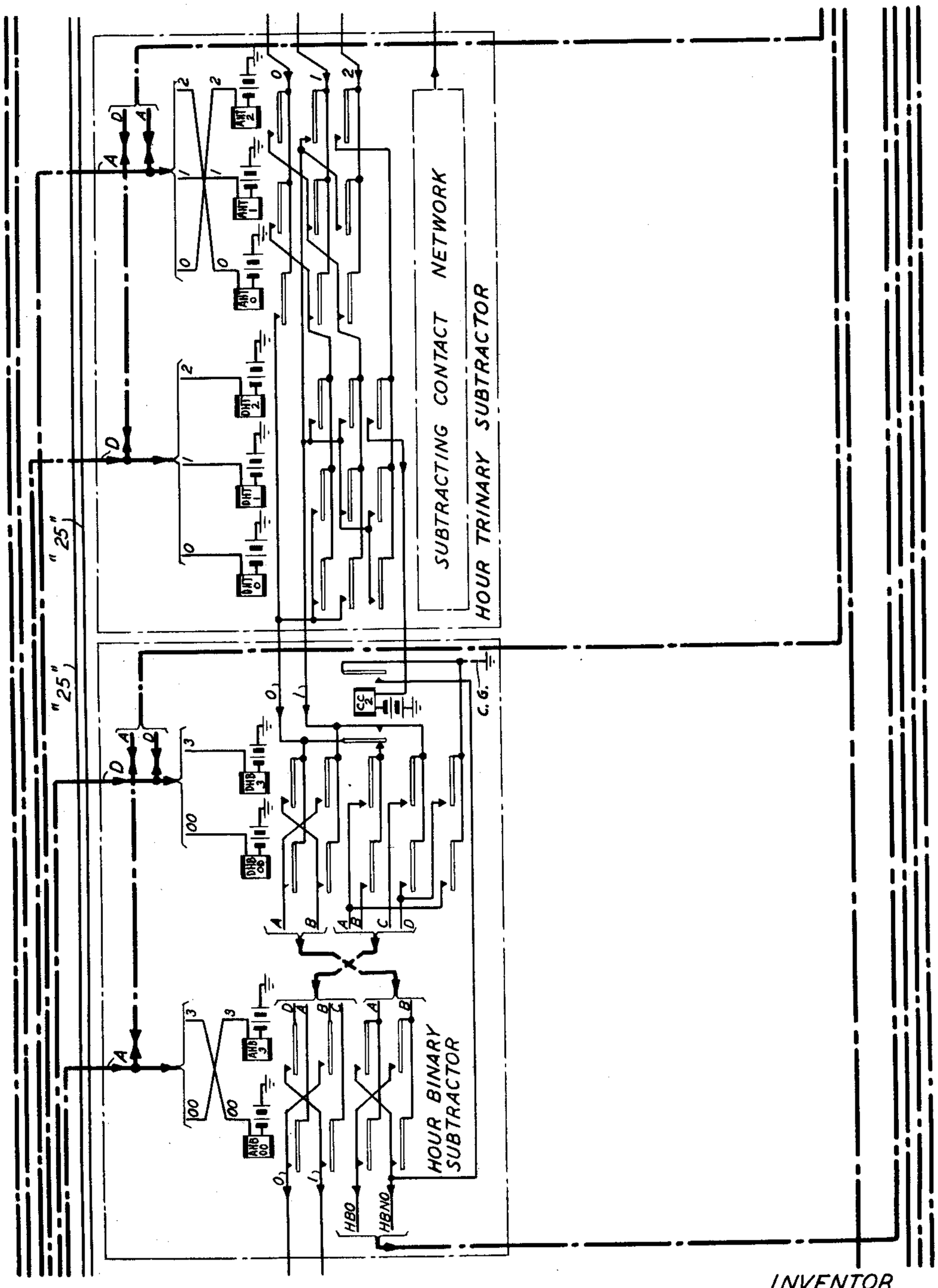


FIG. 374

INVENTOR
A. E. JOEL, JR.
BY
S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 348

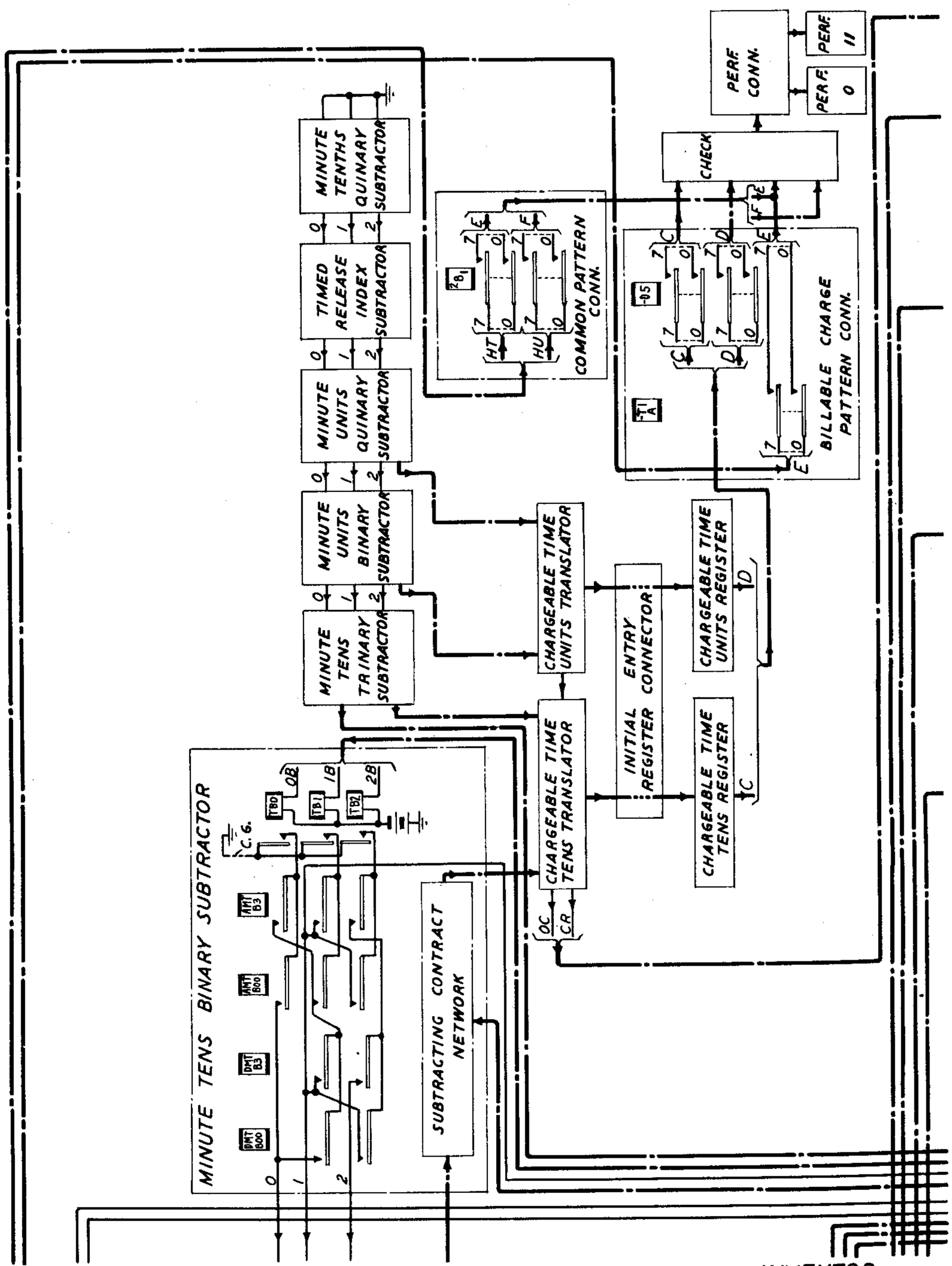


FIG. 375

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 349

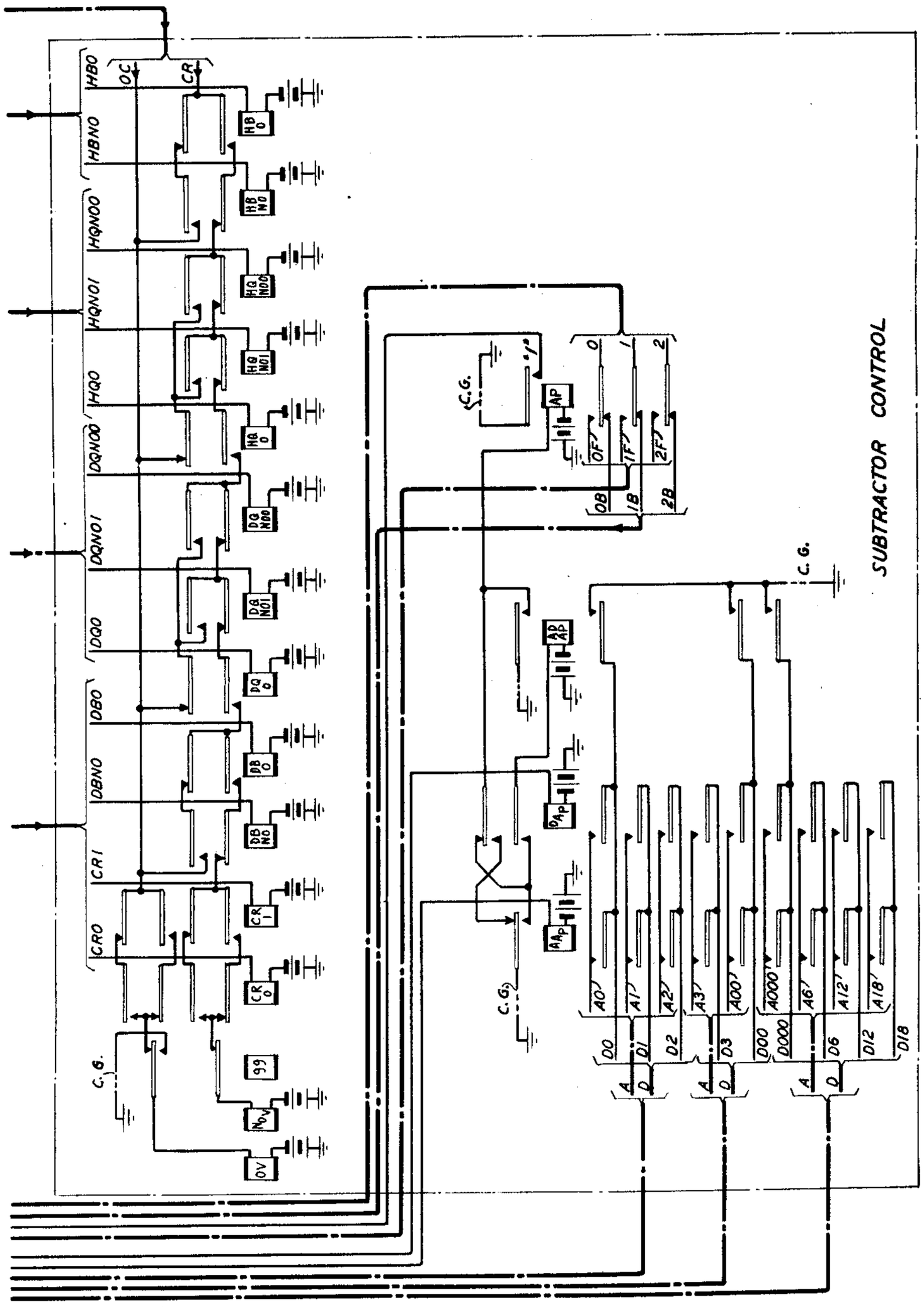


FIG. 376

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 350

FIG. 377

FIG. 378	FIG. 379	FIG. 381
FIG. 380	FIG. 382	

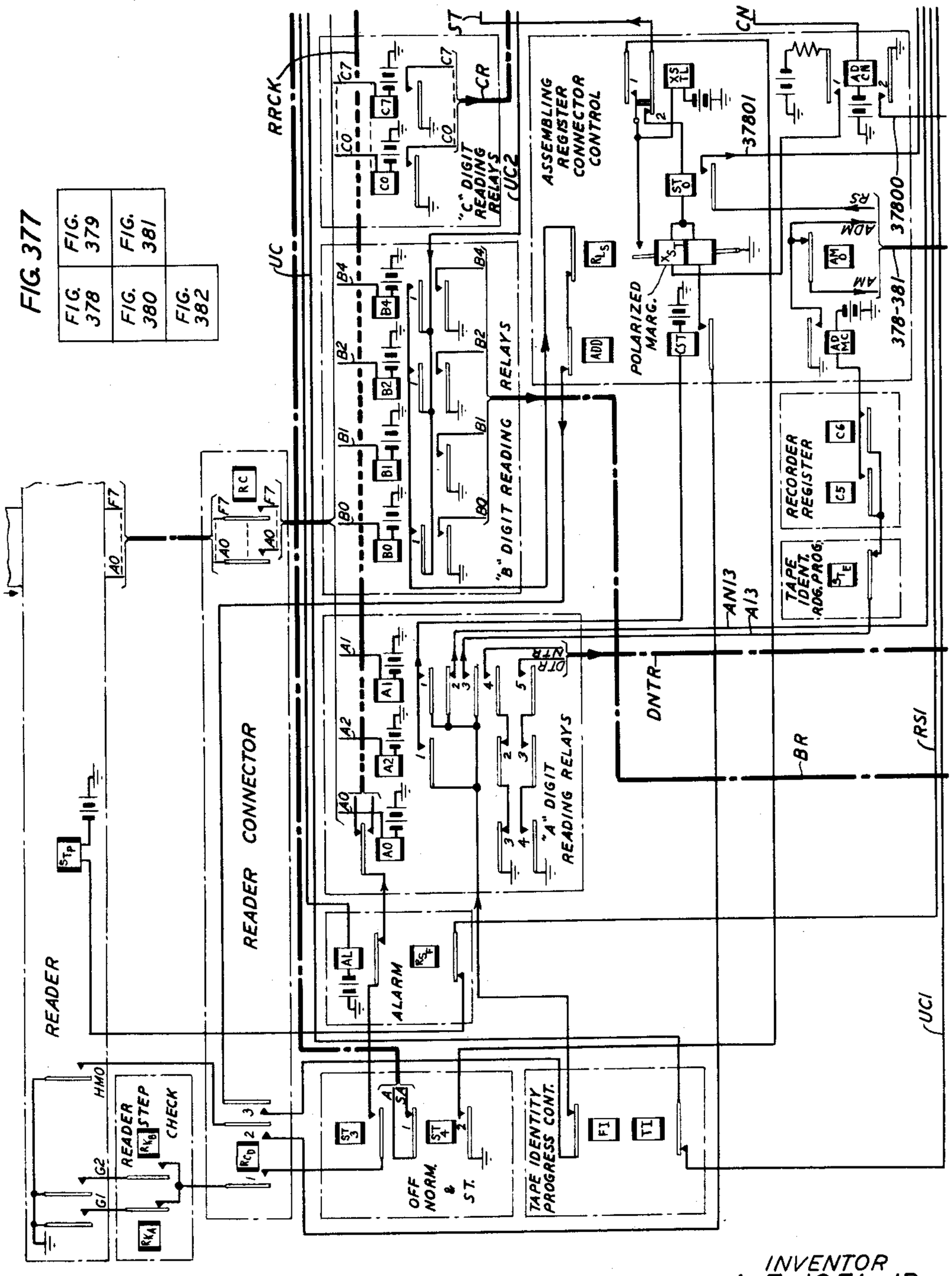


FIG. 378

INVENTOR
A. E. JOEL, JR.

BY

ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 351

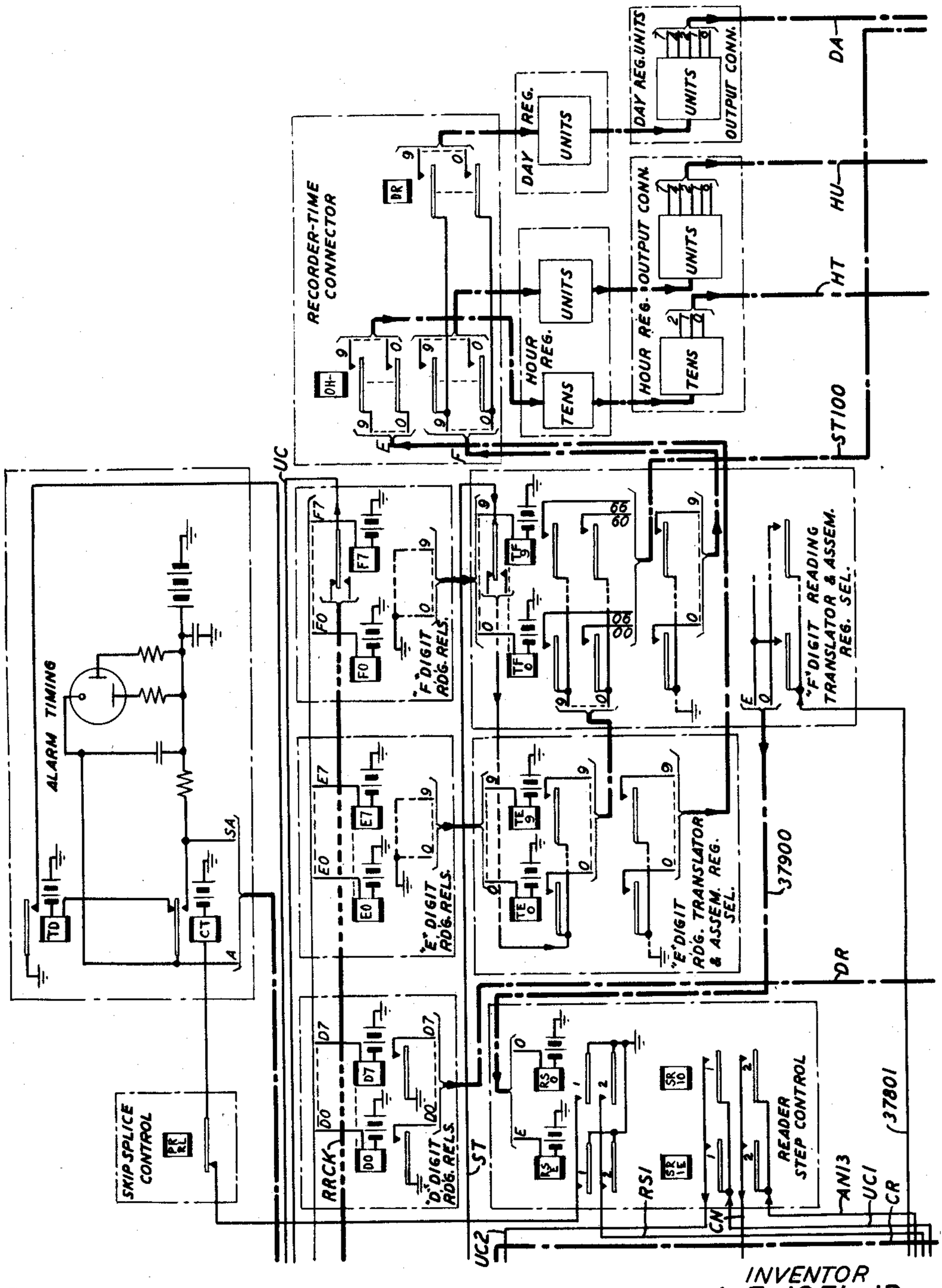


FIG. 379

INVENTOR
A. E. JOEL, JR.
BY
Sturner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

ACCOUNTING SYSTEM

Filed April 4, 1955 354 Sheets-Sheet 352

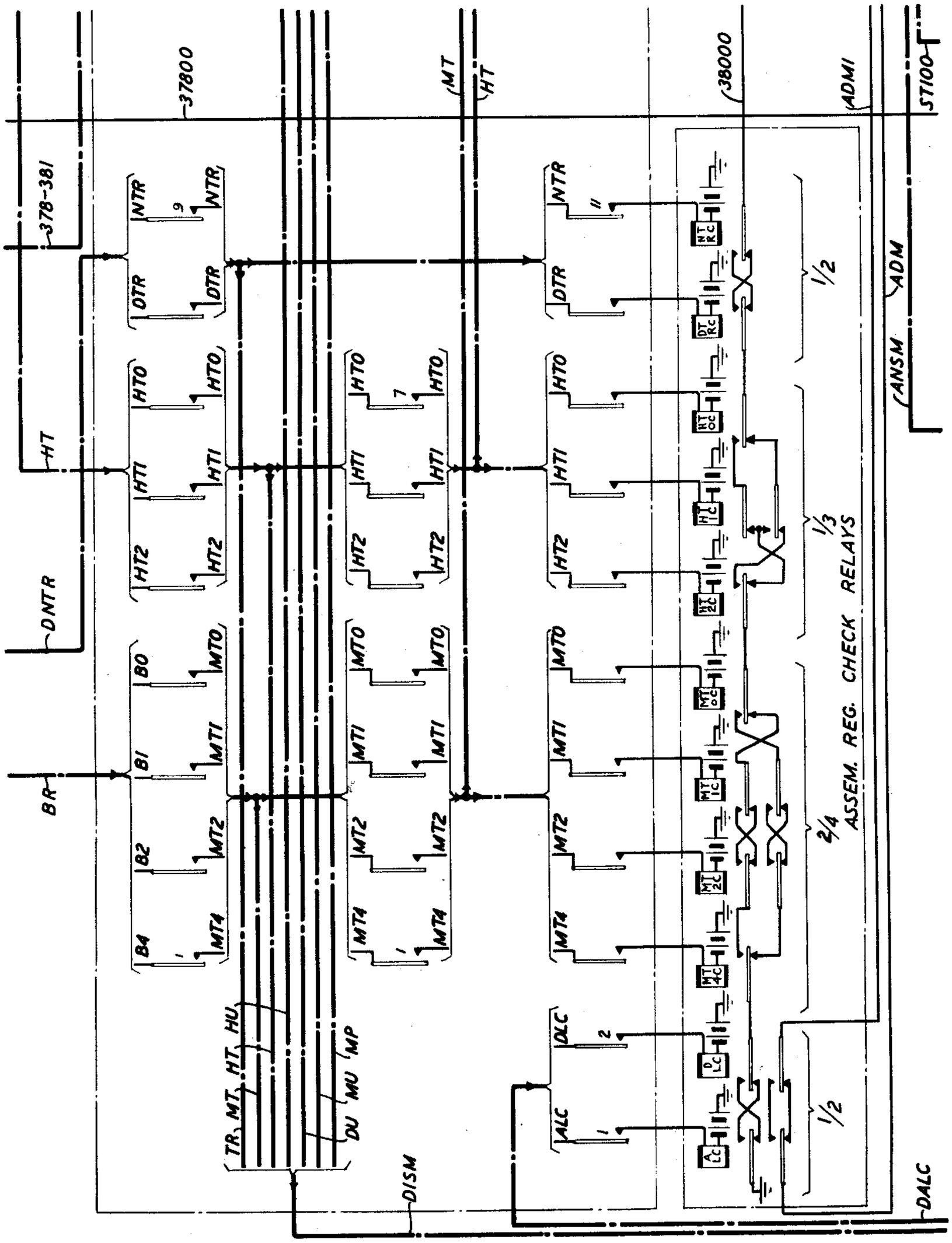


FIG. 380

INVENTOR
A. E. JOEL, JR.
BY
Fitzmer
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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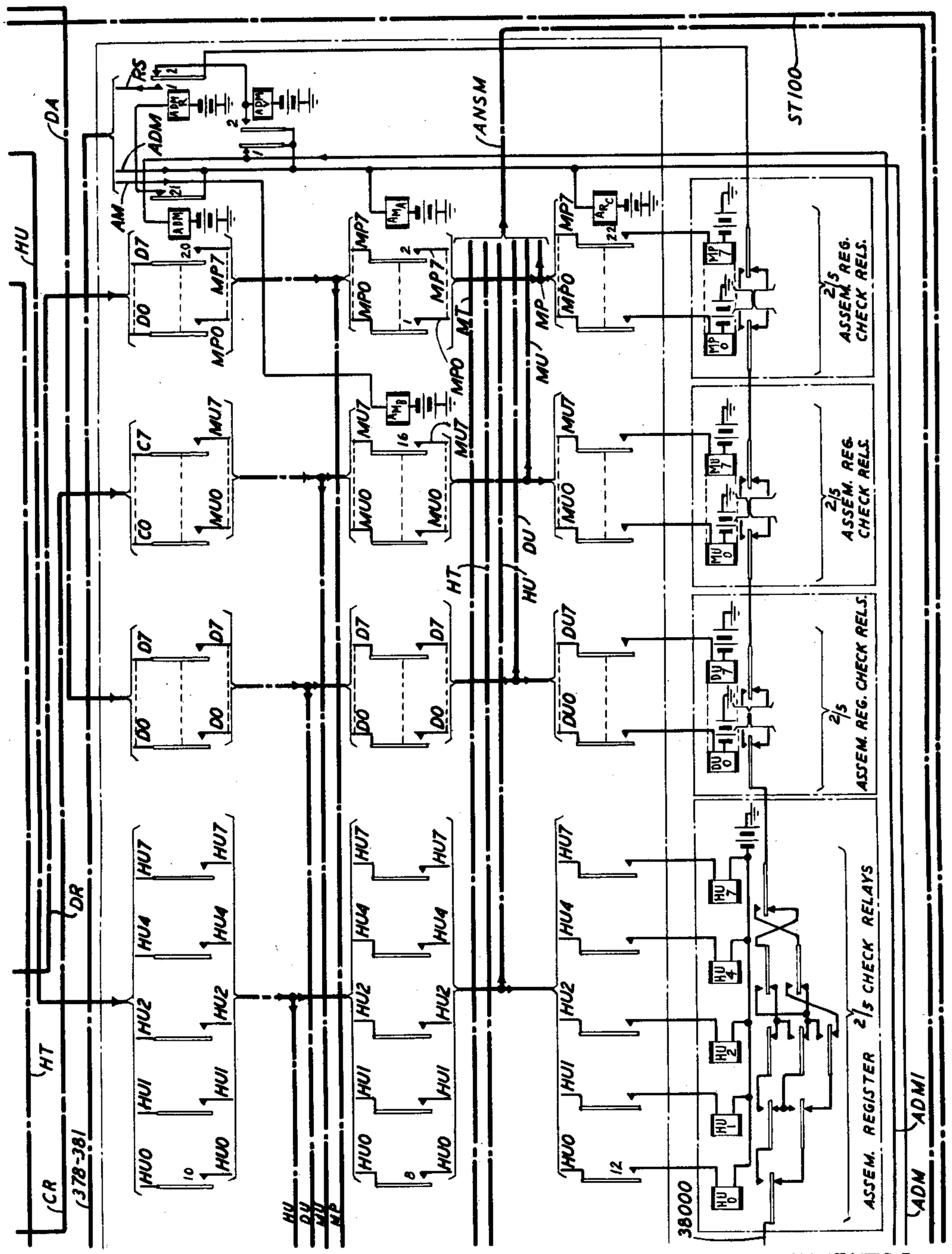

FIG. 381

INVENTOR
A. E. JOEL, JR.
BY S. Turner
ATTORNEY

Feb. 23, 1960 A. E. JOEL, JR 2,925,957

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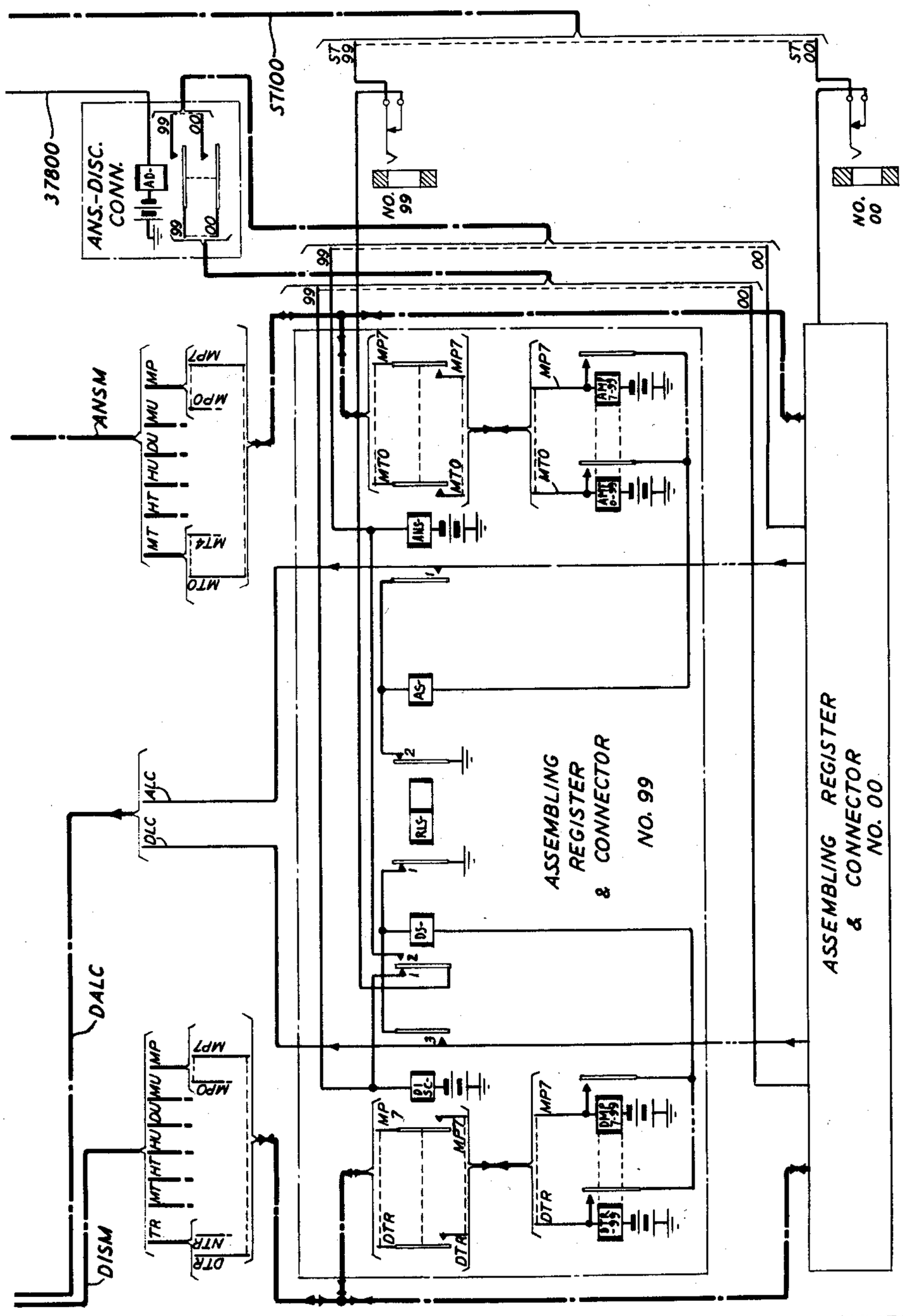

FIG. 382

INVENTOR
A. E. JOEL, JR.

BY S. Turner

ATTORNEY

United States Patent Office

2,925,957

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2,925,957

ACCOUNTING SYSTEM

Amos E. Joel, Jr., South Orange, N.J., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Application April 4, 1955, Serial No. 499,195

243 Claims. (Cl. 235—61.7)

This invention relates to automatic accounting systems and particularly to means for assembling, processing and computing customer charges from items of information recorded by and through facilities controlled and used by customers of a public service company.

The object of the invention is to promote economy, accuracy and speed in the preparation of customer bills for services.

The invention resides in details of a device which may be employed in an automatic accounting system. In such a system, which may be employed by way of example by a telephone company, items of information, including the data pertaining to telephone calls, are automatically recorded through the subscriber's use of the telephone station facilities. Such information for each complete call includes at least three items; first, that known as the initial entry giving details of the calling telephone number and at times also the called telephone number; second, the time at which the subscriber at the called number answered; and, third, the time at which the conversation terminated as signaled by the hanging up of the calling or the called subscriber or both. Under the prior plan in actual operation these three items are recorded on a perforated tape and are scattered indiscriminately among other similar items relating to other calls. In accordance with such a system the recorded items of information are then subjected to processing in at least three steps in two processing devices, two steps in an assembler device to assemble into groups the items of information pertaining to each call and a third step in a device known as a computer to evaluate the charges for each call from the informtaion embodied in these assembled groups of items of information. Further processing may be accomplished subsequently, such as sorting such computed calls by subscriber's numbers, etc.

The present invention may be called an assembler-computer since its overall function is to execute in one accounting step all of the steps heretofore carried out by the two devices above described for accomplishing the assembling and computing stages.

In each of the three steps of the process of the prior system, a single perforated tape is entered into a device and a plurality of outgoing tapes are produced therefrom with the same information rearranged or processed in accordance with the function of the device. In each case, the output tapes of one step in the process become the input tapes for the next step, after which they are discarded as being of no further use. It thus appears that in this process an immense amount of tape is used which has only a temporary use. An immense amount of tape is consumed and very shortly thereafter is discarded. The device of the present invention eliminates the tape ordinarily used between the first and second and between the second and third process steps and thus promotes economy by reducing the amount of tape consumed.

Another saving effected by means of the present invention is in the tape handling time. In each processing step of the automatic accounting system each tape produced must have both the leading end and the trailing end of the tape prepared with both a long series of codes known as the splice code and with the tape identity codes. Thus, in the system in use before the development of the present device, the input tape for the computer is in one hundred sections each joined to the other with two copies of the tape identity codes and a length of splice code. It is evident that the machine time in preparing the tape ends as well as the operator time entailed in the physical handling and splicing is a major fraction of the complete processing time. The device of the present invention eliminates a very substantial amount of this time.

Another factor in time, eliminated by the present invention, is found in the following characteristic operations of the present devices. The so-called central office tape, as before described, contains a great number of items of information pertaining to individual calls. It also contains certain items of general information, such, for instance, as an hour entry automatically perforated in the tape and interspersed between the individual items. Now if, for some reason, an hour entry is missing, the assembler of the prior system makes no adjustment for it other than to cause such missing entry to be noted one hundred items in the input tape for the computer. When this input tape is processed, each detection of a missing hour entry will cause the bringing in of an alarm and the stopping of the action of the computer. Of course, it is a matter of but a few minutes of time for the attendant to determine the cause of the alarm, to produce a fictitious hour entry and to start the device operating again. But this must occur one hundred times so that in the end the time consumed is of serious proportions.

This operation is entirely eliminated, as far as its reoccurrence one hundred times is concerned, and, by certain novel arrangements hereinafter set forth, is eliminated even for the single occurrence where such an entry is expected and fails to appear.

Again, the device of the present invention promotes accuracy by eliminating the chances for error through faulty perforation of the tape, or imperfections in the texture of the tape, which should be stated truly as a matter of economy, for error in this respect is translated into time since all these devices are characterized by the use of checking means to detect all possible errors. An error then is at once reported and the functioning of the device is stopped before the error can be introduced in and can affect the output. It then becomes only a matter of time to produce a correction. Hence, the device of the present invention is an improvement over the means heretofore employed.

In addition, many novel features which will be brought out shortly, contribute to smaller physical size, the use of less costly apparatus and increased speed of operation so that further substantial economies in floor space, apparatus cost and wiring are assured.

BRIEF DESCRIPTION OF FEATURES

Feature 1.—The device of the present invention essentially comprises a reader for scanning an incoming tape and a plurality of perforators for preparing a plurality of outgoing tapes. There are one hundred registers each identified by a two-digit number and into which two of the three items of information making up the data for a call, each identified in like manner by a two-digit number, are stored until the third item is read. Since the incoming tape has recorded on it a large number of items of information bearing different two-digit call identity index numbers and since the three items

going to make up the complete information for any one call are scattered at random among items for other calls, and since the tape is read backwards, then it appears that the disconnect time will be read first, the answer time second, and the initial entry third. The disconnect time and the answer time as read are stored in a register (bearing the same call identity index) until the initial entry is reached. Then, this initial entry and the temporarily stored timing information are routed through the calculating part of the device and the charge information is calculated, composed and recorded on one of the outgoing tapes. The register from which the timing information has been taken is cleared so that if the next item of information encountered by the reader bears the same call identity index it may be stored immediately.

Feature 2.—A feature of the invention is a register of such dependable and economical construction that the use of a bank of one hundred such registers is not only feasible but is highly practical and is a main factor in leading to the economies of the present device as a unit. The register consists of a plurality of decimal denominational orders each having a plurality of single make contact glass sealed contact devices which may carry current while they are operated but which will never carry current either when the contacts are moving together or when they are moving apart. The glass sealed contact device, being sealed in an atmosphere of inert gas and never having its contact surfaces injured by sparking, will last indefinitely, a requirement in a device of this nature where each element is expected to operate perfectly a fantastically large number of times.

The fact that each code contact of each decimal denominational order consists of but a single make contact is an economical improvement in registers where the trend seems to have been in the opposite direction, that is, to operate a large plurality of switches for each code place. The additional fact that the code contact device is freed from making or breaking a current flow, but is employed to provide only a selected path, is important since these sealed contacts are manufactured with microscopically conforming surfaces to provide a very low contact resistance and this can be maintained without injury over an extremely long life.

In accordance with the present invention, each denominational order of the said register consists of a plurality of code places and each said place consists of a simple electromagnetic coil having a sealed contact unit placed within the said coil and along its axis. An active terminal for each said coil is also connected to one terminal of said contact unit, the other terminal of which is connected through a common contact maker and breaker to the same pole of a battery which may be connected under controlled conditions to said active terminal of said coil for the energization thereof. Hence, when the coil is energized, no current will flow through the said contacts until the energizing battery is disconnected from said coil terminal and then the coil will be held energized through current now flowing through the said contacts. Thereafter when the information registered in the said register is wanted, the active coil terminals of the said register are examined and those which have been energized are discovered by the presence of holding current (that is, by the holding potential supplied thereto by the closed contacts). When the registration is to be released, the said common contact maker is released. Hence, the current flow through the said operated contacts is stopped before the said individual contacts are opened.

By this arrangement a register is provided having contacts capable of carrying a substantially heavy current but not adapted to make or to break such a current, so that the economy of such a device which must be provided in large numbers will be at once apparent.

A feature of the invention may thus be stated to be a register in which the same terminal serves both as a read-in and a read-out terminal.

Another feature of the invention may be stated as a register having a single make contact in each denominational order thereof serving in the double capacity of a holding means and as a means for indicating the operated condition of that particular denominational order.

Another feature of the invention may be stated as a register having a single make contact in each denominational order thereof and which is arranged to carry current only while the relay is operated but never during the operating or release movement thereof.

Feature 3.—Another feature of the invention is a register consisting of two parts, essentially two registers and having a simple and individual control circuit by means of which two items actually indistinguishable from each other except in the content of their information are routed to the two parts in sequence. In accordance with this invention, the two timing entries, which must be registered as they are read from the incoming tape, namely the disconnect time and the answer time, are exactly alike except for the actual time notation. It is assumed that the first such entry received is the disconnect time and hence it is routed to that part of the register provided to register the disconnect time. The next timing entry is routed to that part of the register provided to register the answer time. Should the actual disconnect time entry in some manner fail to be transmitted, then the first timing entry received will be the answer time; but the answer time, being the first, will be routed to that part of the register provided to register the disconnect time. The disposition of such fragmentary information will be brought out hereinafter.

Heretofore, means have been provided to function in a similar manner, but the circuits there provided were elaborate and placed on a common basis. The use herein of an individual control circuit rendering it possible to construct a two-part register which will automatically accept two items of information sequentially submitted and to cause them to be properly registered in the said two parts thereof is an important part or detail of the present invention, rendering the employment of a great plurality of such registers economically feasible and leading to the overall economy of the present device. This feature of the device may then be stated as a register for registering a plurality of items of information and having an individual steering means for routing each item of information to a different part thereof as it is submitted.

Feature 4.—Another feature of the invention is the use of an assembling register which may be seized through the use of part of the information contained in a line being read and which, upon seizure, will record other parts of this information as well as additional information gleaned from other registers in which certain common information has been previously deposited. In the specific form herein disclosed either the disconnect time line or the answer time line contains a three-digit minutes notation (tens, units and tenths minutes) and a two-digit call identity index. The register which is selected will be that one identified by a corresponding two-digit call identity index number. The time, either disconnect or answer, however, must contain other data, such as the hour, the day and an index which is for the purpose of weighing the computation which will later be made from the data so registered. Therefore, the data to be registered is composed not only from the data instantly being read from the incoming tape but also from items gleaned from other registers in which the information common to many calls has been previously deposited and, through certain novel circuit arrangements, has been constantly kept up to date. Thus, upon the reading of a given specific item of information, a combination of previously registered common information and this specific information is registered.

A feature of the invention may thus be stated as means

for selecting one of a plurality of registers under the control of some of the information contained in a line of tape being read and for submitting for registration therein the remainder of the line, together with certain common information previously read and registered elsewhere.

Feature 5.—Another feature of the invention is a novel circuit arrangement for making incoming and outgoing connections to the assembling registers. These registers, as above stated, are in two sections, each capable of registering considerable information and each, therefore, having a plurality of register terminals. A connector relay for each section of the register is used for connecting the register terminals to a set of common trunk conductors. For incoming service when the registers are to be set, the common conductors leading to the two sections are connected together and the registration connections are extended simultaneously toward both sections but are admitted to only one section through the selective operation of said connector relays so that these two sections may be set sequentially over the same connections. For outgoing service, however, the connections between the common conductors leading toward the two sections are broken and the two connector relays are concurrently operated so that transmission from the said two sections may take place simultaneously.

This feature may then be stated as means for simultaneously reading out of all the sections of a register over the same path employed for reading in to the said sections sequentially.

By means of this feature a great and economical improvement entailing the utmost simplicity and flexibility is obtained. The feature fundamentally comprises a switching system under the joint control of the reader (responsive to the item being read at the time) and the individual control circuit of the register.

Feature 6.—Another feature of the invention is the arrangement whereby upon the receipt of an initial entry by the reader, circuits are set up to simultaneously read out of the reader and out of the disconnect and answer parts of the assembling register identified in the first line of the said initial entry and into the calculating or processing part of the device the complete data for the customer charge. There are two complete sets of registers for the processing and these are used alternately on successive calls. This is a matter of economy in time, for by registering one call the processing may take place as soon as all information is transferred and the next call may be put into the alternate set of registers during the processing operations and thus be ready for processing as soon as the operations for the first call have been completed. This is an overlap operation similar in principle to such operations heretofore employed and which provides the utmost speed in operation. The manner of setting up the connections, however, is new and embodies specific improvements in the switching system and particularly in the control thereof.

It is to be remembered that each item of specific information contains a call identity index and in every case this will result in the selection of an assembling register. In the case of either of the two timing entries, the selected assembling register will be conditioned to have timing information read into the register; while, in the case of the initial entry, the pertinent assembling register will be conditioned to read out the timing information therein. Therefore, as the reader reads the first line of an initial entry, the corresponding assembling register will be selected and connections therefrom and from the reader will be simultaneously established to one set of the processing registers for the simultaneous registration therein of all the information for a call.

This feature may, therefore, be stated as means for reregistering the information read out of a timing register into either of two call entry registers simultaneously with the registering of another entry being read from the tape into the corresponding call entry register, the selection of a particular assembling register being determined by information contained in the first line of the entry.

Feature 7.—Another feature of the invention, which specifically concerns itself with the alternate use of the two call entry registers, is an arrangement whereby the reading of the first line of an initial entry, which may contain two or four lines of facility information, causes the seizure of one of the call entry registers for registration therein of the initial entry along with the associated timing information and whereby a control circuit identifies from the first line the number of lines expected and thereafter permits the other call entry register to handle a call only after the proper number of initial entry lines is registered in the seized call entry register.

This feature, therefore, may be stated as means for permitting the entire line content of an initial entry to be registered in one call entry register before the alternate use of the other call entry register is permitted for the next call.

Feature 8.—Another feature of the invention is a means for supplying data for a missing registration. In the automatic accounting system previously in use means are provided to cancel the overtime on any call where but a single timing entry is recorded, for in such a case there is no way of establishing definitely the value of the overtime (where the charges are, for instance, five cents for the first five minutes and five cents for each three minutes thereafter, any time after the initial period of five minutes being known as overtime). In accordance with the present invention, as set forth hereinbefore, the first timing entry will be recorded in the disconnect section of the assembling register. Thus, where but a single timing entry has been registered it cannot be known whether this is the actual disconnect time or the answer time which is recorded. Thereafter, when the reader encounters an initial entry and attempts to set up the connections just above described to the processing registers, the processing would be stalled due to the fact that there is no registration in the answer time section of the assembling register. However, means is provided responsive to this condition which will cause switching arrangements to be made so that the registration in the disconnect time section will now be transferred to and be reregistered in both the disconnect time and the answer time sections of the processing registers. Hence, when the calculator finds that the call extended over zero minutes, the calling subscriber will be charged for only the initial period. In other words, overtime will be effectively canceled.

This feature may then be stated as means for substituting the registration taken from one subregister of an assembling register for the absence of a registration in the second subregister.

Feature 9.—Another feature of this invention is a means for selectively and automatically releasing one or both of the subregistrations of all the assembling registers upon the receipt of a special entry on the tape being read. This action cancels all charges or only the overtime charges on calls recorded on the same central office tape and which calls were in progress at the time the special entry was placed on the tape. In accordance with the previous feature, the absence of one timing entry in the assembling register results in the calculation of zero time for the call and the consequent making of a charge for the initial period only. In a similar manner, if both timing entries are missing then the call appears to be the same as a "don't answer" call and no charge at all is made.

In accordance with the present feature, there are certain conditions which are met in service which will cast doubt upon the validity of charges for use of the facilities embracing this period and which must therefore be accorded special treatment. Such conditions result in

the recording of a special item of information and when the reader encounters such a special item the timing entries in various of the assembling registers are automatically erased. Specifically, if a 2856EF or a 2857EF item is read, then one timing entry is released from each register having one or more entries registered therein at the time, so as to cancel the overtime. If a 2854EF item is encountered, then all timing entries are released so as to cancel overtime if but a single entry has been registered and all charges if two entries have been registered for such calls. Thus, the charges for calls embracing the period in which the operation causing the recording of this special item of information occurred are effectively canceled in whole or in part.

Feature 10.—Another feature of the invention is one closely allied with the last feature above described. It may happen, in the course of selectively registering a large number of scattered items of information, that one or more timing entries will have been registered in different assembling registers. To be specific, let us say that there are at a given stage five assembling registers completely operated, all having two timing entries registered therein. At this time an initial entry item is read from the incoming tape and which initial entry should be associated with one of the five calls registered; however, it is assumed that the call identity index is mutilated and therefore that this item of information cannot be matched with any one of the five calls. At a result, due to the inability of the device to properly dispose of this initial entry item of information, the operation of the device is halted and an alarm is brought in. The attendant will ascertain the reason for the alarm and may thereupon, by a key operation, release the alarm condition. However, the key used for this purpose will also thereupon release all five of the assembling registers, thus effectively canceling all charges on five calls despite the fact that initial entries for four of them may be properly received unmutilated at a later stage of operation. In any event, since it cannot be known with certainty the identity of the mutilated item, all other information with which it might be matched is release.

Another aspect of this feature is illustrated in the case where one or more assembling registers have but a single timing item registered therein when such a mutilated initial entry is received. In this case, all such timing entries are released, but this does not necessarily result in the cancellation of all charges because under normal conditions, when the second timing entry for each of these calls is received, it will be registered in the proper assembling register. At some later stage, the initial entry associated with the first released timing entry and the later registered timing entry is received. Then the call will be processed normally, with the exception that since but a single timing entry is found registered therein, zero elapsed time will be calculated and the subscriber will be charged for the initial period only, all overtime being canceled.

Thus, manual means is provided to cancel overtime and to cancel all charges as a prerequisite to and as part of the operation of placing the device back into operation when it has been halted and when the alarm has been brought in due to a mutilated entry of a particular nature.

Feature 11.—In the previously described arrangements, the selection of the particular assembling register and the seizure of one of the sets of processing registers is responsive to the reading out by the reader of the first line of an initial entry. However, the time during which the two sections (answer and disconnect) of the assembling register and the two sections (answer and disconnect) of the processing or call register are interconnected over the disconnect and the answer multiples (so that the information heretofore registered in the assembling register may be reregistered in the processing or call register) is of very short duration, being but a part of a reader cycle. To insure that the interconnection of these registers will be maintained for a length of time sufficient for a successful reregistration of the information, a locking circuit is provided under the control of a considerable number of check relays so that the interconnection will be maintained until all required conditions are fulfilled. By way of example, this locking circuit is controlled at one point by a relay which indicates that the timing entries being taken from the assembling registers are in conjunction with and are identified by the same call entry index characterizing the initial entry being read from the tape at that time. In addition, another pair of relays control this locking circuit, the first of which indicates that a timing entry is registered in the answer portion of the assembling register and the second of which indicates that a valid registration of the answer time taken from the assembling register has been successfully reregistered. Further, a similar pair of relays performing the same function in connection with a disconnect timing entry must be operated.

This feature of the invention may be stated as a checking means to insure that the amount of information read out of an assembling register agrees with the amount of information reregistered in the processing registers before releasing the assembling register. Hereinabove it has been set forth that if but one section of the assembling register has been filled, or if one section has been released under certain conditions, when processing is to take place then the record in such one filled section is read out to two places in the processing register so that zero elapsed time may be calculated. If, however, both sections of the assembling register have been properly filled, it must be certain that both sections are properly read out and not merely one section read out to two places in the processing registers. Each of the processing registers is provided with both up and down-check circuits. A register control circuit associated with the processing registers tests the up and down-check circuits to insure that the information transferred is complete.

A feature of the invention may then be stated as a plurality of multisection registers each of which has up and down-checking circuits, a set of processing registers common thereto, means to selectively connect the said common processing registers to any one of said multisection registers to transfer information registered therein to said processing registers, a register control circuit for said processing registers, up and down-check circuits for said processing registers, and means in said register control circuit responsive to the up and down-check circuits of said multisection registers and to the up and down-check circuits of said processing registers for determining that the amount of information read out of the multisection register agrees with the amount of information read into and registered in the said processing registers.

Feature 12.—Another feature of the invention is a selective means whereby incoming tapes of different characters may be processed and whereby adjustments to care for the differences are made automatically. Heretofore, it has been proposed that tapes carrying data taken on the basis of six rounds to a month or on the basis of ten rounds to the month be processed by devices fixed and adjusted to such periods. However, no device fixed for one such period could process tape taken under other conditions. Arrangements are made herein responsive to the marker group number to automatically adjust the device to different round periods. Thus, marker group 00 data, for instance, might be taken on a ten-round basis, that is, a month divided into billing periods of ten rounds of three days each; whereas, marker group 01 data might be taken on a six-round basis, that is, a month divided into billing periods of six rounds of five days each. The set-up for one or another marker group number will automatically adjust the device to process the data in accordance with the proper periods.

This feature may be stated as the provision of means

to automatically adjust the processing device and to select a suitable circuit network for the processing of data taken under various conditions.

Feature 13.—Another feature of the invention is a means for processing and checking the day sequence of each central office recorder tape extending over more than one round. Heretofore, it was never attempted to process data for more than a single round for this meant not only the need of a counter for counting off the days of a round but also of a means to count off the number of rounds and heretofore there has been no provision for the latter. In the present device means have been provided to repeatedly use the counter for counting off the days of a round and, in addition, to count the number of rounds, so that now a long series of days from the last day of a later round to and through the first day of an earlier round may be accounted for. In addition, and for the purpose of accounting for so-called straddle calls, means are provided for extending the processing and day accounting beyond (in time) the first day of the first round and therefore into the business of a previous month (always reading the tape backwards).

Thus, great flexibility is provided so that the taking of data need not be so rigidly controlled and so that economy may be practiced when the traffic varies in accordance with calendar progression (the volume of traffic is extremely light in a business district on a holiday).

Feature 14.—Another feature of the invention is a check circuit employed to insure the proper operation of certain sequencing means. Certain items of general information recorded on each incoming tape set forth the month, the round, the day of the round and the number of the central office recorder which had been employed in making such records. Since these tapes are read backwards, the first occurrence of the round and the day of the round must be the last round and the last day of the round of the period over which the record was made. Thereafter, the progress is toward the first round and the first day of the round and may extend beyond that (actually into a period prior to that generally represented by the tape to register partial or straddle calls). Now, when a new tape is encountered (or a new section of the tape made by another recorder), it is necessary that the data after such a change in central office recorder number start from the last round and the last day of the round. Therefore, when a change in central office recorder number occurs, a check must be made to see that the items of general information pertaining thereto set forth the last round and the last day of the round as established by the set-up switches. If this check is satisfactory, then the device will continue to operate uninterruptedly, otherwise the operation is halted and an alarm is brought in.

From a specific standpoint, certain codes (only the first three significant digits of which are noted here) recorded on a central office tape and constituting items of general information are read off in the following order:

284	round and marker group
283	day of round and month
280	recorder number
281	hour
282	calendar day

The feature now being set forth concerns the means for insuring that when the 280 code is read an alarm is brought in under the condition where there is a change in this code over the last previously read 280 code and where the just previously read 284 and 283 codes have defined anything other than the starting limit (last round and last day of round) of the progression of the rounds and the days of the rounds as specified by the set-up switches.

This feature may, therefore, be stated as a means for defining a sequence of periods and a checking means responsive to the reading of general items of information defining a new sequence to be pursued to insure that the last period read just prior to the said reading of such general items of information was the first of such a defined sequence.

Closely associated with the circuits provided for this feature is a means for temporarily retaining unchanged an established record of common items of information when it appears that a recorder number is changed. In another feature (see Feature 16) to be described in detail hereinafter, and having to do with a new and novel method of handling the so-called straddle calls, it will appear that the incoming tape will have a plurality of sections each from a different recorder. Such tape is cut at each change in recorder number and the straddle tape sections from like numbered recorders are spliced therein. By way of example, let us assume that Thursday's tape is being processed and that there are two recorders, numbered 00 and 01 represented. Then in between the record from the regular recorder 00 and the regular recorder 01 the tape will be cut and the section of the straddle tape produced from regular recorder 00 by Wednesday's tape will be spliced in. When the splice between the new regular recorder 00 record and the straddle tape for regular recorder 00 is reached there is no change in recorder number, though there will be a change in a day of round and round. At the end of this straddle tape section, now spliced to the new tape from regular recorder 01, there will be a change in recorder number. However, before the processing of this new tape section can be undertaken, it is necessary to end up the section of straddle tape which has been formed in the meantime, which means particularly that the tape end information must be perforated thereon. Hence, the registration of the old information is temporarily retained because the registers, if any still contain any information (specifically if any FC relays are still operated), must be cleared and the tape end of this newly formed straddle tape section must be perforated before the new sections may be prepared and before the record from regular recorder 01 may be processed.

A feature of the invention may then be stated as a means responsive to a change in recorder number for performing certain routine duties before new information may be processed.

Implicit in this arrangement is a means for retaining the last information in the registers of common information when a tape in the reader has been completed and, as a result thereof, the device has automatically come to a stop and an alarm has been brought in. In such a case the device must be restarted manually so that the registers may be cleared and all trailing tape ends, particularly the straddle tape, may be prepared. When it appears that one or more of the assembling registers still has or have in formation registered therein, the preparation of the tape ends is deferred until such information can be transferred to the straddle tape.

In the making of the original record on the so-called central office tape, if there is a completely uninterrupted operation of the recorder then a tape is produced having a tape end group of items of common information at both the leading end and the trailing end of the tape and a large number of items of specific information in between. There are, however, a number of circumstances which may interrupt the operation of this device. If the maintenance man makes the device artificially busy, for one reason or another, then a tape end is prepared to signify the end of a section and this is followed by another tape end group of items to signify the start of a new section. If this "make busy" operation endures only for a very short time, this multiple recording of tape end information nevertheless is carried out so that when this tape is read as an incoming tape in the assembler-computer the unmodified operations therein, and particularly with respect to the straddle tape, might result in the reperforating of a large number of tape end groups

which are in fact unnecessary. The tape identity progress control therefore has means for preventing the reperforating of end of tape groups on the straddle tape when they duplicate others which have been placed thereon or when there is no doubt that no further straddle entries have been perforated since the perforating of the previous end-of-tape group.

A feature of the invention may then be stated as the provision of a supervisory circuit for controlling the preparation of one of the output tapes by recognizing certain given conditions which render it unnecessary to reperforate end-of-tape groups of common items of information.

Feature 15.—Another feature of this invention is a means for automatically disposing of certain registered items of information before proceeding with operations under changed information. In the regular progression the items of information extend from the last day of the last round to the first day of the first round and when this data has been completely used then data taken by another recorder is used. Consequently, when this data is introduced, the first items to be read (with which we are at present concerned) is the last day of the last round and immediately thereafter the new recorder number. However, the completion of the data before this for the first day of the first round may be followed by certain data for irregular or straddle calls, particularly where the first day of the first round is the first calendar day of a month, and hence the completion of the normal data for the first day of the first round cannot be taken as a signal that the recorder number is about to be changed.

Therefore, when the 284 and 283 codes are read and this shows the last day of the last round (as defined by the set-up switches), the fact is registered but the information is not as yet changed in the registers because it is first necessary to dispose of the old information still registered by perforating the old recorder number and the day and the round on the straddle tape. When the straddle tape circuit has thus been satisfied, the regular operation of the device is allowed to proceed, whereupon the 280 code is read, and if this proves to be a new recorder number, it is registered, the last day of the round and the last round are derived from the set-up switches and registered and the operations continue regularly. If this change from the first day of the round and the first round to the last day of the round and the last round is not followed by a change in recorder number—then an alarm is brought in so an attendant may ascertain the reason for such irregularity.

This feature then may be stated as a means responsive to the reading of certain items of general information indicating the normal ending of a series of items of information for temporarily holding up normal operations and for automatically interpolating special operations to dismiss the means provided to make records of irregular calls.

Feature 16.—Another feature of the present invention is a novel method of handling the so-called straddle calls. It will be remembered that every call essentially consists of three parts, the initial entry, the answer time and the disconnect time. Since a recorder tape must be cut somewhere, this may leave on the trailing end of the tape (just cut off) several call starts, each consisting of an initial entry or an initial entry and an answer time and on the leading end of the tape still in the recorder an equal number of call ends each consisting of an answer time and a disconnect time or a disconnect time alone. Heretofore such incomplete call data was recorded on a straddle tape which was forwarded to a clerical unit for analysis and the manual formulation of customer charges.

In accordance with the operation of the present device, after an incoming central office tape has been completely run through the device, there will be a number of call starts registered in the various assembling registers, which, of course, could be left there providing the next incoming tape to be read were the next tape cut from the same recorder. But such ideal condition cannot always be met because the device cannot be left idle for the length of time that would be required and particularly because there are many other tapes from other recorders to be processed. Therefore, at the end of the processing of the record produced by any given recorder, the CAR (clear all registers) signal is given and all information registered and pertaining to such record is copied onto a straddle tape.

The straddle tape used in the present instance differs in several respects, the more important of which are outlined below, from previously used tapes:

Firstly, it is intended to be used in a feedback method whereby portions of it are physically spliced into the next tape received from the same recorder so that the call starts carried by the former will match the call ends in such new recorder tape and so that customer charges may thereby be formulated and reported in the regular way without the help of any clerical personnel.

Secondly, since this straddle tape is to be spliced into the new central office tape, it will have to have its tape ends prepared in the manner of a central office tape rather than in the manner of an accounting center (output of assembler, computer, sorter, summarizer, etc.) tape. The tape ends, both leading and trailing, are characterized by the so-called tape identity which is in one form on the central office tapes and in a different form on all accounting center tapes. The first processing device, the assembler used in the prior accounting center, will accept the central office type of tape identity information and will automatically produce in its output tapes, the accounting center type. In the present case, however, the device of the present invention, a combined assembler-computer, will accept the central office type of tape identity information and will automatically produce the accounting center type on all of its output tapes except this particular so-called straddle tape and on that it will produce tape identity information corresponding in form to that of the incoming central office type of tape. This is because this straddle tape is to be cut in sections each of which is to be spliced into a central office tape to be used as an incoming tape.

Thirdly, the splice pattern codes used for the various sections of the straddle tape differ so that there can be no error in splicing in sections of this tape to form the incoming tape. Heretofore but a single type of splice pattern has been employed, which will be spoken of hereinafter as regular splice pattern. The new type, of which there may be a large number, will be spoken of as grooved or special splice pattern. The latter, then, form a mark of identification in addition to the items of tape identity, which follow immediately thereafter, and are used to facilitate the mechanical handling of the tapes but do not require any extensive circuit response.

And lastly, the information recorded on the straddle tape is only the call start information left registered in the various registers of the device after an incoming tape has been completely read and does not include the several different types of information heretofore recorded in the straddle tape, such as the overcapacity calls and the various cancel charge calls.

A feature of the invention may, therefore, be stated as a method of processing data left incomplete by the (necessarily periodic) severing of the original central office record tape and which method consists of producing an output tape having the distinguishing characteristics of an input tape and containing a record of all data registered in the device and left unprocessed at the termination of the processing of an incoming tape and thereafter splicing sections of this output tape into a new input tape.

A particular feature of the invention may be stated as a means for automatically producing a plurality of distinctive splice patterns to facilitate the formation of a new input tape and to prevent machine response to

a misplacing of sections of the tape used to carry over the data of incomplete calls.

Included in this feature, and herein set forth as a new and more economical arrangement, is the complete organization of the means for forming the output entries, those items of information which are perforated on the output tapes. In accordance with the present invention each and every output entry is formed through the use of an output class relay which controls the general form of the entry, that is, the number of lines it shall have and the general form of each of these lines. This relay then sets a line count circuit to count the lines of the output as they are formed and perforated and successively operates a selected number of pattern relays each of which gleans specific information from various sources to make up the line. There are three sets of output class relays and three sets of controlled pattern relays, one for the odd call register, one for the even call register (both for controlling the perforation of specific items of information) and one for controlling the perforation of common items. There is but a single line count and control means operating in conjunction with these three sets of relays.

By this arrangement a completely flexible and economical circuit is provided, capable of greater scope and simplicity in operation and maintenance than heretofore without the use of certain fixed and special circuits previously employed. By way of example, if the TE (tape end) common class translator relay is operated it will set the line count means to count 5 lines formed for certain tape end perforations. Specifically, it will successively operate relays to form the lines:

284DEF
283DEF
280DEF
281DEF
282DEF

This will be recognized as the central office type tape identity information. In the case of the STWS class (straddle tape window splice), an entry placed on the straddle tape when a window (indication of a blank tape splice point) is encountered, the line count circuit will operate 11 of the pattern relays and will count 11 as follows:

Count 11	284DEF
Count 10	283DEF
Count 9	280DEF
Count 8	281DEF
Count 7	282DEF
Count 6	081010 (regular splice pattern)
	*
	*
	*
	*
	*
	*
	*
	081010
Count 5	284DEF
Count 4	283DEF
Count 3	280DEF
Count 2	281DEF
Count 1	282DEF

In the above, count 6 covers the perforation if a plurality of splice pattern codes, enough to span the window and to continue for a given time interval thereafter. The point is that the perforation of the outgoing items of information of every nature, and now more diversified than heretofore, is organized in a more compact circuit arrangement leading to economy in first cost and maintenance.

Another feature of the invention is a means for automatically clearing out all of the registers of the device in which information is still registered when a proper change in recorder number is detected. It will be remembered that the record for a given period may be made at a central office on several recorders and that the input tape to the device of the present invention is made up by splicing the tapes from these several recorders into one continuous tape with the recorder numbers in ordered sequence. Therefore, it is evident that when one such section has been completely read, any registrations remaining in the registers of the device are call starts which must be reported on a straddle tape. Therefore, when the reading circuits detect a change in recorder number, a means (the CAR "clear all registers" relay) is operated with the result that before any further reading of the input tape may take place, the record of such remaining incomplete calls is transferred from the registers to the straddle tape.

A feature of the invention may then be stated as a means for automatically storing incompleted calls upon an indication that a tape from another recorder is about to be processed and that, therefore, there is no possibility that any one of such incomplete calls may be completed in the instant tape run.

Feature 17.—Another feature of the present invention is a means for checking and indicating that a section of emergency recorder tape is spliced into a regular recorder tape at the proper point, particularly when such emergency recorder tape section contains elements of calls which are in progress at a tape cutting period.

It has been set forth hereinbefore that a telephone central office may have a number of regular recorders and a single emergency recorder, which may be substituted for any one of the regular recorders. Each of the regular recorders is regularly numbered from 00 to 19. The emergency recorder reports itself (in its tape and identity items) while unassigned as numbered 40; but, as soon as it is placed in service as a substitute for one of the regular recorders, it assumes and will report itself as having the same number as the regular recorder.

Thus, if regular recorder 01 develops trouble and the emergency recorder is substituted therefor, it reports itself as emergency recorder 01. Now, when regular recorder 01 meets with a trouble condition, it will have its tape end prepared and the identity information will contain a 280501 code identifying it as a regular (D digit 5) recorder 01 (E and F digits) followed by a 285DEF trouble-transfer indication code. Since the emergency recorder tape must then be spliced into the regular recorder tape at that point, means are provided responsive to the reading of the above-noted codes to allow continued progress in the reading of the tape only if the next tape identity group immediately following contains first the code 280601, identifying it as an emergency (D digit 6) recorder acting for the regular recorder 01, and the 285DEF code to match that previously read.

And again at the end of such section of emergency recorder tape, the change from emergency recorder back to the regular recorder must be checked in a similar manner so as thus to insure the proper and sequential reporting of the call elements through a change from a regular recorder to an emergency recorder and finally back again to the regular recorder.

A feature of the invention may thus be stated to be a checking means for insuring the proper sequence of spliced sections of a tape, the checking means serving to halt the progress of the device in which such a tape is being processed in case this check fails.

Feature 18.—Another feature of the invention is a means for deriving and registering the correct calendar day from the correct setting of the day progress circuit when the calendar day register fails to hold or the entry is mutilated on the central office tape. This feature is one of the many specific circuit arrangements incorporated in the present device used to anticipate possible

sources of interruption in the continuous operation thereof and to automatically compensate for operations which might otherwise result in the halting of operations and the bringing in of an alarm. The information regarding the day is registered in several places and in several forms, and hence if there is a failure of some kind, means is provided to derive the correct information and to register it rather than to introduce a time delay. The limits of the days involved are registered on the set-up switches in the form of the last and first days of the round and the last and first rounds and, of course, the calendar day may always be derived from any given registered day of round and round. The set-up switches define the limits and a group of relays register the particular day within these limits. There is also a sequence switch for counting off the orderly progression of the days as this information is read off of the incoming tape. There is also a circuit for checking the calendar day when it is read as an item of specific information against the registration of the day of round and the round in the said progress circuit. Consequently, if the register for temporarily registering the calendar day for a specific call should fail to hold or if the item should be mutilated, this item is then automatically derived from the checking circuit so that the operation of the device may not be delayed.

This feature may, therefore, be stated as a means responsive to a failure, under certain specific conditions, to register an item of specific information, to derive such information from circuits employed to register and continuously keep a check on general information of the same nature.

Feature 19.—Another feature of the invention is one specifically different from the previous feature. The device is provided with a set-up switch means by which limits may be set in the numbers of the recorders employed in gathering the information. There is also a sequence means for checking off each recorder number as it is received in the form of an item of general information. In this case, if the recorder number register fails to hold or if the recorder number digits are mutilated on the central office tape, then the same information may be derived from the said sequence means, thus saving time which would otherwise be lost in bringing in an alarm.

Feature 20.—Another feature of the invention is a means for reconstructing a record after a power failure. In the device of the present invention, the information from which customer charges are derived is partly of a general nature and partly of a specific nature. The items of general information involved in the processing of each customer charge are in turn partly of a fixed nature and partly of a slowly changing nature. Those of a fixed nature may be registered on the so-called set-up switches and cannot be affected by a power failure. Other items of general information such, for example as the hour, are constantly changing and are, therefore, registered in the form of relay operations. Now, if a power failure occurs it is important, after the condition has been rectified, that the record of the items of general information be retained or at least be capable of reconstruction. Accordingly, where such important information is registered in the form of a relay operation, means is provided to reoperate this relay. The difficulty is that the relay has been operated and then locked in the operated position, but when released by a power failure there is nothing which will indicate thereafter the condition of such relay just prior to the loss of power.

Accordingly, each such relay is provided with a sensitive companion polar relay connected in parallel therewith and which must definitely be driven to either its front or its back contact. Under normal operation, when the register relay is energized, the polar relay will be driven to its front contact, and when the register relay is released and moves its armature to its back contact, the polar relay (being supplied by a lower potential battery than the

register relay) will have the current through its winding reversed and will, therefore, be definitely driven to its back contact. If there is a power failure, however, the register relay will be released but the polar relay will fail to move because of the lack of power. Therefore, when power is restored, the device will find the register relay released but with the companion polar relay resting on its front contact. This closes a circuit which will immediately operate the register relay.

This feature may then be stated as the combination of a normal relay and a polar relay having one terminal of each connected to an operating lead, the other terminal of each being connected to a source of current, the source of current for one being of greater potential than the source of current for the other, and a circuit controlled by said polar relay for operating said normal relay when said sources of current are simultaneously reconnected to said two relays after having been simultaneously disconnected therefrom while said normal relay was in an operated condition.

Feature 21.—Another feature of the invention is a means to signal a complete and successful use of a register during a use of the device as a whole. Due to the fact that even though data of customer uses is being continuously taken, it becomes necessary to cut the records at definite periods so as to process the data for accounting purposes, the commercial arrangement is to cut the record at 3:00 o'clock a.m., when it is supposed that traffic is at its lowest ebb. It is likely, therefore, that there may be one or more calls or customer uses in progress at this time and that, therefore, the record is cut in such a way that the initial entry or the initial entry and the answer time is on the trailing end of the tape now taken for processing, and the answer time and disconnect time or the disconnect time alone will be placed on the leading end of the tape used for the next day's record. Such incomplete calls are known as straddle calls since the complete data for such a call straddles the cut in the tape. Hence, when an incoming tape is placed in the device of the present invention for processing, the first items read will be the last items recorded, and, therefore, the "first use" made of each assembling register may be to process one of these straddle calls. In accordance with the present invention, each assembling register (of which there may be as many as one hundred, not including spares) is provided with a so-called "first call" relay (FC) and one of the first acts of the device is to operate all of these first call relays and then to make a test to determine that each and every one of them has properly operated. The operation of a first call relay is a signal that any information registered therein may be part of the data for a straddle call and may have to be given certain special treatment which has been mentioned previously and which will be more fully described hereinafter. If any data is registered in such an assembling register and is processed normally, then as the data is transferred to the processing registers and the assembling register is released, its first call relay is also released and will thereafter remain released until another tape is introduced into the device.

This first call relay, therefore, constitutes what might be termed a preliminary signal means, always operated during the first use of a register and always released or dismissed thereafter regardless of the number of times such register may be used.

This feature may, therefore, be stated as the provision of means in a register to establish a condition, prior to and lasting throughout the first use of such register, to render the register susceptible to special use and means responsive to a complete normal use of such register to dismiss and release the said conditioning means.

In the operation of the device it may happen that when an initial entry having a given index is read from the incoming tape and an attempt is then made to secure the disconnect and answer times from the assembling

register designated by this same index, it will be found that such assembling register will have no such information. Under ordinary circumstances such an occurrence will indicate a "don't answer" call and hence the data will be discarded. However, if this occurs during the first use of the assembling register, it is not at all certain that this is in fact such a "don't answer" call. It may equally well be a legitimate call for which the answer time and the disconnect time are recorded on the tape for the next day's business. In other words, this may be a straddle call. Hence, if the first call relay is operated at this time the call, instead of being discarded, is routed to the straddle tape and a record thereof is made. In this way then, the first call relay becomes operated and serves as a preliminary signal to divert data to the straddle tape if the information registered for this first call is incomplete. When the first call (complete or incomplete) has been processed, the first call relay is released and plays no further part in the ensuing operations until a new tape or a new section of a tape made by another recorder is entered into the device.

Feature 22.—Another feature of the invention is the use of factor base code register calculators. The bi-quinary code system set forth in Patent No. 2,486,809, issued November 1, 1949, to G. R. Stibitz is a specific type of factor base code register system. It will be noted that the bi-quinary register is always in two sections, one having two relays and the other having five relays for expressing any one of the digits of the decimal or base ten system, and it may further be noted that two and five are the factors of ten. In this system a carry 1 is produced and transmitted when the base value is reached (complementary addition being used to accomplish subtraction).

In like manner, when the tens digit of minutes is being registered and used in calculations, the numbering system is then said to be on a base six, for the tens digit of any figure to express minutes is one of the digits zero to five, inclusive. Therefore, a register and calculator arrangement may be used having two sections, one having two relays and the other having three relays, the figures two and three being the factors of the base six, and a carry 1 being produced and transmitted when the base value is reached.

Again, in like manner, when the numbers representing hours are being registered and used in calculations, the numbering system may be said to be on the base twenty-four, for the hours of a day are expressed by a series of two-digit numbers from zero zero to twenty-three. Therefore, a register and calculator arrangement may be used having three sections, one having four relays, another having three relays and the last having two relays, the figures four, three and two being the factors of the base twenty-four and a carry 1 being produced and transmitted when the base value is reached.

It may be noted that any other sectionalized arrangement may be used, such as eight and three, or six and four or twelve and two, but the four, three, two arrangement is one using the smallest number of relays.

A factor base code register may, therefore, be defined as one in which the numbers of the system of a given base are expressed in a plurality of register sections each having a number of relays equal to a factor of the base and the total number thereof being the sum of the factors of the base, a carry 1 being produced and transmitted when the base value is reached.

Another feature of the present invention, therefore, is a computer arranged to operate on mixed bases. The information entered therein is expressed in decimal notation but is coded in various factor base codes and arranged in a plurality of denominational orders with carry means between such orders arranged in a given special manner. The computer is provided to calculate elapsed time, the result being always in the form of elapsed minutes from 00.0 minutes to 89.9 minutes. The information entered in the computer is in the form of days 0 to 9, hours 0 to 23 and minutes 00.0 to 59.9 (tens, units and tenths). The carry arrangements are of some importance and are made to conform to the ordinary system of counting time periods. Thus, the carry between the units and tens minutes is on the base ten, the carry between the tens minutes and the hours is on the base six, and the carry between the hours and the days is on the base twenty-four. It is to be remembered that "carry" is being referred to because the subtraction employed in the exemplary calculator operates by complementary addition.

The calculator includes means to enter two time notations, one value being subtracted from the other (by complementary addition) to produce a simple two-digit result expressed as tens and units elapsed minutes. There is output from the minutes tens and minutes units orders only. The sum produced in the minutes tenths order is used in its entirety as a carry, is then passed through an allowance register and finally is entered into the minutes units order as a carry. In accordance with the charging plans so many charge units are made for so many minutes and any fraction thereof so that the sum of the minutes tenths minus the allowances becomes a carry.

By way of example, if a charge of two units is made for a customer use of each two minutes or any fraction thereof, the charges may be calculated as follows:

If the disconnect time is	23.3
And the answer time is	21.0
The elapsed time is	2.3
Which is rounded off to	3.0
And the charge is	4 units

Certain allowances are made by subtracting given amounts of time. First there is a fixed allowance given on all subscriber uses on the theory that there may be deviation in the time of operation of the facilities. This allowance is in the form of tenths of a minute and is specifically disclosed herein as being on an optional basis either two, three or four tenths of a minute. Another allowance made is based on the standard mode of operation of the facilities provided. It is specifically disclosed here as a telephone system in which the automatic data recording means is associated with the calling subscriber's line. If, at the end of a conversation the calling subscriber is the first to hang up, then the use of the calling subscriber's equipment is terminated immediately and no allowance is made. If, however, the calling subscriber is slow and the called subscriber is the first to hang up, the notation of the disconnect time would ordinarily await the delayed action of the calling subscriber and hence he might be charged for time which he did not actually use for conversation. Hence, a timing device comes into operation, and when this "times out" there is a so-called forced or timed disconnect of the calling subscriber's equipment and a consequent notation thereof with the disconnect time. In order to compensate for this, an allowance of six tenths of a minute is made; that is, this amount is subtracted from the calculated elapsed time.

These allowances are alternative. Each customer use is allowed one but not both. If the calling subscriber is the last to hang up and the forced disconnect circuits operate, then the elapsed time will be diminished by six tenths of a minute and the customer will not be given the fixed allowance. If the calling subscriber is the first to hang up, he will get the fixed allowance but not the forced disconnect allowance.

In the calculator the denominational order handling the tenths minutes of the reported disconnect and answer times is separated in its ordinary carry arrangements from the units minutes order by the interposition of the allowance subtracter so that the derived sum of the dis-

connect tenths minutes and the complement of the answer tenths minutes is weighed by the necessary fugitive one and is then translated by the allowance subtracter into a rounded-off carry-in to the units minutes order. Due to the range in values from zero to eighteen (actually minus 9 to zero to plus 9) it is necessary to use three carry-in values which under ordinary arithmetical arrangements should be termed borrow 1, carry 0 and carry 1, but which due to the prereckoned fugitive 1 are in fact a carry 0, a carry 1 and a carry 2.

The allowance subtracter is a selective device responding to an incoming code read from the incoming tape to select between giving the fixed allowance (here shown on an optional basis of either two, three or four tenths of a minute) or the forced disconnect allowance of six tenths of a minute.

Any value other than zero left after the allowance is made is rounded off to a carry-in to the units order and this explains why the range of nineteen combinations of results in the minutes tenths calculator order may be expressed by these three carry leads.

This feature of the invention may then be stated as a calculator having a plurality of denominational orders, means for deriving a value in the lowest of said orders, selective means for diminishing the said derived value by different fixed amounts, means for increasing said diminished value by a complemental allowance and means for rounding off the final result into one of a plurality of carries to the next higher denominational order.

Another feature of this invention is a means in the calculator above described for adding into the output of one of the denominational orders thereof an output of a higher order denominational output. It has been stated hereinabove that the complete output of the calculator is a two-digit number representing tens and units of minutes and that the capacity of the calculator is so limited to the computation of time periods from zero to eighty-nine minutes. However, in order to reach this capacity, at least a part of an hour has to be reckoned-in and, therefore, the minutes tens output may be modified by computation in the hour denominational order.

Although the capacity of the registers of the computer is ten days, it is not expected that more than an insignificant fraction of the charges computed will prove to exceed the capacity of the output. Should this capacity be exceeded, then means are provided to abandon the calculation and to report the full details of the disconnect time and the answer time registered in the computer registers for orderly clerical processing.

The hour denominational order consists of three base factor sections, the hour quaternary (on the base four), the hour binary (on the base two) and the hour trinary (on the base three). It will be recognized at once that if the hour binary section or the hour quaternary section or any part of the day denominational order derives a value greater than zero, then the capacity of the computer will be exceeded. Therefore, the output of these higher denominational order computer sections is arranged to be a mere indication that the computations therein have produced a result zero or not-zero. The characterization not-zero from any one of these sections halts the computation and reports the time entries in full as before.

Even though the report from each of these higher denominational orders is zero, the capacity of the computer may be exceeded. Hence means is provided to halt the computation and to report the information in full in like manner. In this case, an overcapacity indication is derived and transmitted in a translator interposed in the path of the output of the calculator and this overcapacity indication or signal will produce the same result as the not-zero signal from the higher denominational orders of the calculator.

It may also be noted at this point that the highest denominational order of the calculator has an outgoing carry 0 and carry 1 circuit. If the result of the computation produces an outgoing carry 1, this is an indication of a proper positive result, but if an outgoing carry 0 is produced, this is an indication of a negative result which in turn indicates trouble of some nature. Therefore, if an outgoing carry 0 appears, then the computation is halted and the full details are reported as before.

This feature may then be stated as a calculator provided with a plurality of denominational orders for calculating with compound numbers, the various digits of which are on different arithmetical bases, having output provided from certain of the intermediate orders thereof, means to reckon-in to the calculations of said intermediate orders values derived in adjacent lower and higher orders and means for signaling the derivation of any result exceeding the output capacity of said calculator.

It must be noted that since the value in the lowest denominational order of the calculator is to be rounded off and translated into a carry, this may be added to another carry already produced in normal manner and hence three carries, a carry 0, a carry 1 and a carry 2 must be provided and this must be extended through the higher denominational orders. In conventional calculators only two mutually exclusive carry circuits are needed, but where three or more carries are involved, means must be provided to prevent the establishment of unauthorized connections, sometimes known as back-up or sneak circuits. Isolation means is, therefore, introduced into the carry circuits between each factor section within a denominational order of this calculator to guard against the establishment of unauthorized connections.

A feature of the invention may, therefore, be stated as the use of isolation relays in each carry circuit between the different factor sections of a factor base code register calculator.

Feature 23.—Another feature of the invention is a translating arrangement by which time elements may be translated and stored and later restored to their original form. In the device of the present invention, there are one hundred assembling registers so it becomes an engineering necessity to make each as simple and inexpensive as possible. It has been found that an economic advantage may be gained by providing a translating device in a common piece of apparatus rather than to provide one hundred extra denominational orders sets of relays in the assemblying registers. Consequently, only the units digit of a date is registered and a translating means is provided to translate this units digit to something which will include some representation of the tens digit, both to prepare the time instant (calendar day, hour and minutes) for mechanical computation and later for reconstruction of the date when this has to be reported in detail.

By way of example, let us suppose a call was answered on February 28 at 11:54 and .5 minutes p.m. and that disconnect took place on March 1 at 1:15 and .3 minutes a.m. As a matter of economy, only the 8 of February 28 is registered in the answer register of the device and only the 1 of March 1 is registered in the disconnect register. When the initial entry is read, then the time elements are entered into the subtracter for calculation of elapsed time. The translator will translate the 1 in the disconnect part of the assembling register to an arbitrary 9 in accordance with certain translating tables controlled by the set-up switches and having due regard to the months involved. March 1 at 1:15.3 a.m. will then appear as 901153.

The answer time February 28 at 11:54.5 p.m. will be 823545 but will be entered in the subtracter in its complemental form as 100054 remembering that in twenty-four hours the complement of 23 must be 00 (take 1 for the next lower order) and that in a sixty-minute hour the (nine's) complement of 545 is 054. Therefore, the subtracter will have the following figures entered therein

and will derive (by complementary addition) the following sum:

901153
100054
1001207

This shows the elapsed time to be 1 hour 20 and .7 minutes or 80.7 minutes, and after the fractional part (.2 to .6 minutes) is rounded off, this will appear as an elapsed time of

81 minutes

This sum, by producing a 1 in an extra denominational order (at the left end of the sum), indicates that the disconnect day units digit translated value is greater than the answer day units digit translated value, which condition plays a part in the translation particularly for the reconstruction of the tens digit at some later time when this may be wanted, as, for instance, if the elapsed time proved to be greater than 89.9 minutes and details of the call had to be reported.

A feature of the invention, then, is a translator controlled by the tape identity set-up switches and by a partial registration of an instant of time for translating such instant of time to a number suitable for mechanical calculation.

Another feature may be stated as a translator controlled by the same means as above and by the said calculator for reconstructing the instant of time to its original form for mechanical recording.

Feature 24.—Another feature of the present invention is the means for handling the overcapacity calls, those extending over 89.9 minutes or which figure to charges of over 99 message units. Heretofore such calls were diverted to a straddle tape (even though the essential character of a straddle situation was missing) and the details were reported so that the charges could be calculated manually.

In accordance with the present invention, only true straddle call elements, that is, the call starts and the call ends, are put on the straddle tape and the others, such as overcapacity calls, test calls and so forth, are reported on a detail tape. A call may first appear as a true straddle and will then be treated as such; but, when all the elements of the call have been assembled, it is disposed of in the regular manner. If, after the calculation of elapsed time, the call appears to be overcapacity, then it is reported on a detail tape for disposal by the clerical force. In accordance with this method, certain indicators showing the probable location of other elements of the call are no longer necessary because the report is not made until the elements have been brought together, and then the report is made as a single (six-line) entry. None of the cancellation indications are necessary because the proper cancellation of charges will have been carried out as hereinbefore explained. This feature then appears as a considerable improvement in the art since it leads to the elimination of apparatus and circuits for these special indications and very greatly simplifies the clerical work entailed.

A feature of the invention may then be stated as a means to completely report every customer charge as a single entry, even though elements of the call previously may have been carried by a straddle tape.

Feature 25.—Another feature of the invention is the use of duplicate processing registers common to a large plurality of assembling registers in combination with a single calculator or translator common to the processing registers. The use of duplicate processing registers leads to economy in providing certain overlapping operations (hereinbefore set forth) and the use of a common calculating or translating section leads to further economy in apparatus because a single such calculator or translator may be employed without interfering with the said overlapping arrangements.

Feature 26.—Another feature of the invention is basically the same as the last foregoing feature, that is the use of a single circuit common to a plurality of other circuits which are in turn common to a larger plurality of circuits. In the present case there are provided duplicate or alternate processing registers common to a large number of assembling registers for processing the assembled items of information, each assembled group constituting the data for a customer charge. When the data has been processed, an outgoing tape recorder must be selected and a new (generally multiline) entry must be formed. The perforator control circuit for selecting the outgoing perforator or recorder and for gleaning the information for the lines of the outgoing entry from various sources including the registers of the processing registers, the common calculator or translator and the set-up switches of the device comprise a circuit common to the duplicate or alternate processing registers.

Feature 27.—Another feature of the invention is a means used in the selection of an outgoing tape perforator. As it will appear hereinafter, provision has been made, for reasons based on commercial considerations, for a great variety of sorting arrangements. It is economically desirable to shorten the time taken for processing an original record to the final end product, namely a list of customer charges in billable form, and hence means have been provided herein to make a variety of sorts in accordance with many different factors all contained in the items of information in the incoming tape. By way of example, the records coming from a certain marker group may contain calls from one principal office and a plurality of smaller offices. It may be that the number of calls from the principal office is far greater than the total from all the other offices combined and hence it becomes expedient to sort the processed calls into two groups, one for the principal office so that the billing may be carried out as quickly as possible, and one for all the other offices which may later be further sorted into separate offices. Since, in accordance with another feature (see Feature 31) to be more fully described, a means is provided to sort in accordance with a plurality of factors, the calls for this principal office may be further sorted into types of message unit charges, such as the bulk billed or the toll charges. And again, means are provided to make a sort of message unit charges in accordance with the relative values of the calls; that is, the longer and more expensive calls in one group and the smaller, less expensive and more numerous calls in another group.

Therefore, a means is now provided to calculate by the common calculator or to otherwise formulate a sorting index which is then registered in one of the processing registers and is later employed through the common perforator control to control the selection of the output perforator.

A feature of the invention may then be stated as a means for selecting, comprising means for gathering from various input registers information indicating the probable destination of an item and means in a common calculator for modifying the said gathered information and for translating this to a selection index and means for registering the said gathered, modified and translated information or selection index and for thereafter using said registered index as a direct control in the said selection.

Closely associated with this feature is the means for selecting for use one or more perforators. Heretofore, separate circuit means were used, one to select any single perforator and another for spreading common patterns; that is, for sequentially selecting one perforator after another. In accordance with the present arrangement, a so-called walking circuit is used, the relays of which may be operated in sequence for spreading either over all the perforators or over a selected group thereof or may be operated selectively for using but a single perforator. This is an improvement in that a single agency is now employed for several different operations.

Feature 28.—Another feature of the invention is the

use of a billing index which will carry information in addition to that carried heretofore and will exercise controls in accordance with such additional information. Means have been provided hereinbefore to use the billing index in the control of the formulation of message units from the calculated elapsed time. Now it is arranged that the billing index will also indicate the type of message units as well as the manner in which they shall be calculated from the elapsed time, and accordingly will control the sorting of customer charges into a plurality of outgoing tapes, each of which may be summarized. It will be noted that message units charged for local services are generally bulk billed; that is, the customer is allowed a given basic number of calls at a flat rate, but then has to pay for excess calls at another rate. On the other hand, this same customer has to pay for message units charged for toll calls at still another rate, say a straight five cents per message unit. Therefore, it was not possible heretofore to summarize the various charges for any one customer because the toll rate message units could not be mixed in with the local service message units. In accordance with this feature, the nature of the message units is indicated and the charges may be sorted so that the two or more lists produced may be immediately summarized in an accounting step and by an accounting device, so that the whole operation of accounting is accelerated and performed at less cost.

Feature 29.—Another feature of the invention is the provision of means to sort derived customer charges by the factor of the extent of the use of the given facility, the extent as measured in elapsed time or as measured in the value of the charge. It has been set out hereinbefore that the selection of the outgoing tape perforator is made by the formulation, partly by the calculator, of a selection index which is then registered in one of the registers of the processing register in use at the time. It will be seen that the calculator may then be set to differentiate between low and high values of derived results either in elapsed time or formulated message units and to modify accordingly the selection index, whereby one list may be made of "high cost" charges and another list may be made of "low cost" charges. Such an arrangement is used to provide a customer service which is at times demanded so that the customer may know the relative cost of the service in terms of long and short calls.

In the formulation of the output entries, it has heretofore been customary to use a single line output entry when the number of customer charge units can be expressed in one digit and to use a two-line entry when the number of units cannot be expressed in less than two digits. The reason for this is that in a single-line entry there is but a single digital place available for this purpose. The selection index may then be formulated differently in accordance with this factor, the formulation of a one or a two-line entry, and hence the output may be sorted in accordance with high value or low value charges.

Feature 30.—Another feature of the invention is a means to control sorting by controlling the formulation of the output entries. It has been set forth hereinbefore that in some cases an output entry may be in the form of a one-line entry and in other cases in the form of a two-line entry depending upon the size of the derived customer charge, and that the form of the entry may be used as a determining factor in sorting. Means are herein provided to control the sorting through controlling the formulation of the output entry, such as by making all entries two-line entries by converting those which would normally be formulated as one line into two-line entries and expressing the number of customer charge units in two digits, as by way of example 03. By this means, where it is desired, all customer charges of one class, whether they be large or small, may be sorted into one list. This becomes of advantage in some cases by producing longer tape runs and less splicing through the sorter stage in the accounting process. Another of the advantages of this arrangement will be seen in the following feature.

Feature 31.—Another feature of the invention is a further sorting control whereby a greater refinement in sorting may be achieved, means being provided to sort by a plurality of factors simultaneously. It has been stated under the heading of Feature 27 that customer charges may be sorted roughly into two categories, one a list from a principal office and the other a list from a plurality of smaller offices. It has also been stated under the heading of Feature 28 that customer charges may be sorted into different categories such as the type of customer charge units (that is, a list of customer charges for local calls and another list for toll calls), whereby such lists may be immediately summarized. The present feature is a combination of these two in that means are provided to sort into a plurality of outputs and by a plurality of factors simultaneously. By way of example, all calls for a principal office may be separated from the calls for all other offices and the two lists may be further subdivided into two or more lists in accordance with the type of customer charge units.

A feature of the invention may then be stated as a means for sorting controlled by a plurality of factors or, expressed otherwise, as a means for sorting and then resorting customer charges.

Feature 32.—Another feature of the invention is a means provided to prepare the tape ends of the outgoing tapes with appropriate items of tape identity information. In accordance with the foregoing Feature 31, it may be desirable to sort the output customer charges into a particular number of classes and to identify the output tapes accordingly. The number of perforators to be used and the duty of each is determined by the setting of the set-up marker group and sort switches and the tape ends of the required output tapes are automatically prepared, each identified by its own tape identity index. In accordance with complete tables of tape type index codes given hereinafter (Section 2.42), it will appear that both the tapes which have been sorted simultaneously by office and MU type will have a first line of tape identity as 289110, the last two digits characterizing these tapes as type 10 tape. The sorting by office consists of a sorting-out of the principal office so that if the other list contains but a single office then the tape end will bear the type 10 marking; but, if such other list contains more than one office, it becomes a list which has not been office sorted and will therefore appear as a type 19 tape.

In accordance with this feature, the preparation of the tape ends is automatic, that is, the incoming tape is placed in the reader, and as soon as this begins to function, that is, as soon as the tape identity is read and checked, then all the tape ends of the determined number of output tapes are automatically prepared. By way of example, when a relay LTI (leading tape identity) is operated, a splice code pattern is formulated and that is repeatedly perforated in all the output tapes for a given period under control of a timer which is adjusted so that a sufficient number of these splice codes will be perforated. Thereafter, each of the nine lines of tape identity is perforated in these output tapes, the first lines being formulated differently in accordance with the tape type as above set forth. A perforator register and walking circuit is provided to sequentially connect each of the determined perforators in circuit and the relays of this circuit control the formulation of the tape type index for each corresponding output tape.

This feature includes a substantial improvement over the prior art in that, broadly stated, it consists of the automatic tape end preparation. Heretofore, in order to start the operation of one of the accounting devices, it was necessary to first operate the (PTE) perforate tape

end key and maintain it in operation for an indefinite period (until a sufficient length of splice pattern code had been perforated), then to restore the key, and after the continued automatic operation of the perforators had terminated to then operate the machine start key. Thus, the attendance of an operator was required and the length of splice code pattern perforation was left up to the judgment of the operator, often leading to waste both of tape and time. In accordance with the present arrangement, all of this is made automatic. The operator places the incoming tape in the reader of the device and starts the operation thereof. The reader traverses the splice code patterns of the incoming tape and then checks the tape identity information against the setting of the set-up switches. If it is found that the set-up switches have been properly set, then a relay means is operated to cause the automatic preparation of the tape ends of the determined number of output tapes.

Feature 33.—Another feature of the invention is a new and more advantageous way of handling customer charges that must be doubly reported. The so-called message unit-detail calls (MUD) are of the type where the charges are made in message units which may be summarized but where the calls nevertheless must be reported in detail to the customer. The output for such customer charges are therefore made on two outgoing tapes, one of which will be converted into the actual bill presented to the customer and the other of which will be converted into information which can be presented to the customer for whatever use he may wish. Heretofore, such double entries were made separately and some time was consumed in this double operation. In accordance with the present feature, the two entries are formulated as one. The line count means is set for the total number of lines, and as this counts down to zero, a certain number of the lines is placed on one outgoing tape and then a switching operation takes place whereupon the remaining lines are placed on another outgoing tape.

By way of example, if an outgoing class relay (2MD) is operated as a means of disposing of the computed customer charge, the number of lines to be counted will be set at seven, two lines carrying the charge will be perforated on the message unit outgoing tape and then five lines carrying the detail information regarding the call will be perforated on the detail outgoing tape, the switching between the two tapes taking place automatically after the first two lines have been formulated and transmitted.

A feature of the invention may therefore be stated as a means for formulating a composite entry consisting of a plurality of entries each for recording on a different output tape and means for automatically steering the separate entries of such composite entries to different output channels.

Feature 34.—Another feature of the invention is a checking means consisting of the use of the reading relay validity circuit for insuring the proper match of splice patterns where two tape ends have been spliced together. It is usual to provide a long series check circuit operated by the twenty-eight reading relays to insure that these relays have been operated in a valid combination, that is, either one or all three of the A digit relays and two out of five of each of the B, C, D, E, and F digit relays. This validity circuit normally must be properly closed upon each operation of the reading relays to maintain the device in operation. Any deviation from this condition will bring in an alarm.

In accordance with the present feature, a means is provided when splice pattern code is encountered to lock those of the reading relays which have been operated on the first encounter with such a code and to maintain such relays in their operated condition until a code indicating a legitimate following code is encountered, whereupon the locking circuit is opened and normal functioning is resumed. During the time these reading relays are locked-in, the validity circuit is properly closed although the primary operating circuits of the locked relays may be repeatedly opened and closed. However, if any other code is encountered at this time, such as a code mutilated by an extra perforation in one or more digital place or a different splice pattern code, then some other reading relay beside those already operated and locked will be operated, with the result that the validity circuit will be opened and an alarm will be brought in.

This arrangement is of especial value as a checking means where the so-called grooved splice pattern is used to insure the proper splicing-in of special tapes, as brought out in a previous feature (see Feature 16) dealing with the spliced-in method of handling straddle calls. Where but a single type of splice pattern is used, a special circuit adapted to this may be used to promote the continuous operation of the reader in passing over the splice; but, where, as here, an indefinite number of different patterns are used, then the circuit must be of general application. Therefore, the reading relays are locked in upon the encounter with the first splice pattern code, regardless of what the code actually is, and thereafter so long as the pattern does not change, the continued operation of the device is insured. However, if two tape ends are wrongly spliced, the error will be detected as soon as the different pattern is read and in time to correct the error before any otherwise erroneous operation can take place.

In particular, every type of splice pattern will have a zero in the A digit place, such as the regular splice pattern code 081010, and invariably a following legitimate code will have a one or a two in this place, such as the skip splice code 284DEF. Therefore, a change in the A digit code is a signal to release the locking circuit to resume normal operation.

This checking method is applied to checking the splice pattern codes but is of general application. A feature of the invention may then be stated as a means for checking a code which is to be repeated a number of times consisting of means for locking in the reading relays when operated in response to the reading of a first of these codes and means responsive to the continued operation of the validity circuit to indicate a satisfactory check until the reading relays are unlocked by a following legitimate code or until the validity check is destroyed by the operation of additional relays.

Feature 35.—A feature of the invention is a so-called hour circuit whereby a twin pair of registers common ot the assembling registers of the device maintains an accurate account of time. It will be remembered that the items of information as they are originally recorded are scattered and that among the items of specific information there will regularly be found the hour entries or items of common information. Such entries are regularly recorded each hour. As they are read from the incoming tape, they must be checked to see that each is one less in value than the preceding one. The new item is registered before the preceding registered hour entry may be wiped out or released. In accordance with this feature, two registers are provided and are termed an odd and an even register, one of which is occupied and the other of which is empty. When an hour entry is read, it is registered in the empty register, and when it is proved that this newly registered entry is one less in value than the previously registered entry, the old one is wiped out and the register which it occupied is cleared, awaiting the reading of the next succeeding entry. The alternate use of these two registers is an improvement over prior art devices where an hour entry was first reduced by one, entered into one register, and then, after the hour difference check was made, reregistered or moved to another register. The circuits are simpler and the time taken for the operations is less, with a gain in

first cost of apparatus and in accuracy through less handling.

A feature of the invention may then be stated as the provision of alternative registers for items of common information necessary in the processing of specific items of information, means for registering a newly read item of common information, means for comparing a newly read item of common information with a previously registered item, and means responsive to a satisfactory comparison for clearing out said previously registeerd item from the other.

One of the elements of this feature is that the item being read is not reduced in value as it is being read but is registered without change, and it is thereafter reduced or not as circumstances dictate when it is being read out for use. Thus, if the original end-of-tape hour registration was 03 and the next regular hour entry was 03, these two values would be compared to see that they were equal. Before the second of these two items is registered, the first would be "interpreted" as 03, that is, without change, but after the second one is registered, the output (still 03) would be interpreted as 02; that is, it would be interpreted as one less in value.

The device, known as a recorder, which makes the original records, is arranged to devise the hour entries in different forms in accordance with different circumstances. The final hour entry which the recorder makes and which will be the first to be read by the device of the present invention will be in the form

2811EF

the last two digital places denoting the actual hour. Thus, if a recorder tape is cut at 3:20 a.m., this should note the hour as 03 because the last previous hour entry that should have been read and registered should have been 3:00 a.m. Therefore, this item of common information will be 281103. The 2811 form of entry is one that need not be compared but which is registered as read.

The next or any other following regular hour entry (as distinguished from end-of-tape hour entries) is in the form

281003

the 2810 form being one that must be compared wtih a previously registered entry but, although it is the same as the output of the first and will be so registered, it will be interpreted as one less, or 02.

There are other circumstances under which the form of the entry is changed. Thus, the recorder is arranged to enter what is known as an apology hour entry if within a given time (in the order of six seconds) the regular hour entry is not recorded. The apology hour entry is in the form

281899

the last two digits 99 being known as a fictitious hour. No comparison is made in this case between this actual entry and one previously registered; but, the previously entered hour is treated as being one less in value and is then compared, and in its new form is registered in the opposite register, thus satisfying the circuits. Thus, when an apology hour entry is read, it is not registered, but the output of the occupied hour register is effectively connected to the input of the unoccupied register and in the transmission the value is reduced by one.

If in recording an hour entry the record becomes mutilated, then the recorder circuit notes this fact (the validity circuit fails) and an apology hour entry in the form

281999

is made directly following the mutilated entry (the 281999 will be read first in the accounting center). The result of the reading of this particular form of apology is to entirely disregard the following (mutilated but real) hour entry but otherwise to cause the same operations as before; that is, the currently registered hour is transferred to the other register and is reduced by one in the process. There is one other circumstance under which the apology hour entry

281999

is used. It may happen that the validity circuit of the recorder will report a mutilated entry erroneously. In this case, the report of the mutilation will cause the apology hour entry to be recorded so that the assembler-computer in reading these two entries, both of which are actually genuine, would otherwise attempt to register two hour entries at nearly the same time and thus reduce the hour account by two. Hence, the apology hour entry

281999

is employed also in this case and the succeeding genuine hour entry is disregarded.

Lastly, there is the straddle hour entry

2812EF

When the last call is read for processing from an incoming tape, then the call ends left in the assembling registers must be copied onto the straddle tape for splicing into the succeeding central office tape and the hour and day data must be carried along with each call end. Hence, in the CAR (clear all registers) operation, an hour entry in the form

2812EF

is made as a part of the data for each call end and hence, when such data is again read as a part of the incoming tape, the hour entry must be received and registered exactly as it is. In other words, it is not compared to a previously registered hour and rejected if it is not one less in value but is received and registered at its face value. This is necessary because there may be a plurality of such calls all having the same hour value or alternatively there may be succeeding hour entries of this nature having a difference of more than one hour.

Now it will be noted that these various hour entries are disposed of in various manners. It will also be noted that the outstanding difference in such entries is in the fourth code place or D digit, and it may be stated therefore that in the hour entries the D digit is a control and by its value determines the disposition of the entry. These disposition control interpretations in the order above recited will be as follows:

1—register, compare with output of previous registered item if any, and interpret without change.
0—register, compare with previously registered item, and interpret as one less in value.
8—reduce existing registration by one, register in other register, and interpret as one less in value.
9—operate as in previous case and in addition disregard next following hour entry.
2—register without change and interpret as one less in value.

In accordance with this feature, and in more detail, there are a plurality of connector relays for establishing checking circuits between the odd and the even hour registers. The relays of each of these registers control a plurality of circuit networks. One of these connector relays will interconnect such networks so that a satisfaction circuit will be closed only when the value registered in the odd register minus the value registered in the even register is equal to zero, another when the remainder is equal to one, another when the minuend and the subtrahend come from the even and odd registers respectively, and the remainder is zero and a fourth like the third with the remainder equal to one. Expressed mathematically, there is a connector relay for each of the conditions:

Odd—Even=0
Odd—Even=1

Even—Odd=0
Even—Odd=1

Thus, there is provided a means for selecting the conditions under which the satisfaction circuit will be operated, and this selective means is under control of the fourth or D digit of the incoming hour entry.

A feature of the invention may then be stated as the provision of an hour circuit including a means controlled by a given element of the incoming hour entry code for controlling the disposition of the said hour entry.

Feature 36.—Another feature of the invention is the provision of extra or spare assembling registers which may be substituted for any of the regularly assigned registers when one or more of these develops trouble. Where, by way of example, there are four spare assembling registers, there will be one hundred and four such registers permanently wired in the circuit, each having large multicontact connector relays for interconnecting the relays of the registers with the answer and disconnect multiples in an invariable circuit. The only thing which differentiates one register from another is its identification consisting of two wires, one for identifying it and another by which it identifies the group in which its identification places it. These two wires enter the register through a cut-off jack so that a double plug-ended jumper placed in the jack, say, of assembling register No. 47 and in the jack of any one of the spares will extend the No. 47 identification wire to the said spare and the group identification wire of the space to the No. 4 (40 to 49) group. Thus, the substitution of a spare register for any given register consists only of the transfer of its very simple identification circuit, leaving all its may other circuit connections undisturbed.

Feature 37.—Another feature of the invention is a novel checking means. It is common in modern extensive circuit networks to employ checking networks, sometimes known as upcheck circuits and down-check circuits, whereby each circuit operation consists of three operations, first a check to determine that a circuit about to be operated is in condition and ready to be operated, second, the actual operation and third, a check to determine that the resulting operation has been reasonably carried out; that is, that a valid combination of relays have operated. This requires a number of extra contacts on all the relays of such a circuit and, although expensive, is nevertheless of great value in the assurance it gives of accuracy. In the present invention where one hundred or more registers, each having a large number of relays, are employed, this sort of checking circuit would be unduly costly and so a different method of checking is used. In this case, the input to the register is first checked in the circuit which transmits the information and is then checked again in the same circuit to see that exactly the same configuration is transmitted out of the register, thus assuring that the register has been correctly operated. It has been set forth hereinbefore that each of these registers has a plurality of code leads which act both as input and as output. Hence, the combination of those leads grounded may be checked for validity; that is, to see that the proper number in each subgroup is operated. Each such leads extends to a relay and each relay, upon operating, becomes locked and hence a ground is returned over this lead. Therefore, the validity check is maintained for a short time after the original actuating ground is removed so that the grounds returned from the register must also prove a valid combination of relays to have been operated.

Specifically, a set of checking relays is provided common to the large plurality of assembling registers. These checking relays are temporarily connected to the register leads and check the validity of the information transmitted to each register. If that check is satisfactory, then the source of such transmission is disconnected and a second check is made to see that the valid information

has been registered; that is, that a ground is returned on each register lead over which a ground was originally transmitted. If this second validity check is satisfactory, the sequence of operations is advanced.

A feature of the invention may then be stated as means to check the operation of a circuit first by checking the input to the circuit, second by removing the operating potential and then by checking that a locking potential is being returned from the circuit over the same paths used for the input. Stated otherwise, a feature of the invention is the provision of a checking circuit for sequentially making a check and a recheck of the valid selective application of operating and then locking potentials to a plurality of code conductors and means responsive to the sequential double-check response of said checking circuit for advancing the operation of the device.

Feature 38.—Another feature of the present invention is a circuit arrangement whereby a double use is made of the reading relays, These are the relays which correspond to and act for the reader contacts and which, because each is capable of moving a plurality of armatures, may exercise a far greater circuit control than could be had with the single contact of the reader. In the present instance, other circuits are also brought to control the operation of the reading relays since certain operations controlled over the reading relays' output circuit are timed to occur when the reading relays otherwise would be idle. Thus, the reading relays are employed to a greater extent than usual and other costly apparatus is eliminated.

There is an operaton heretofore spoken of as the CAR (clear all registers) operation in which it is necessary to sequentially operate each of the assembling registers which at a given point still have information registered therein. The "operation" of a register is a simple matter depending only on its identification, and since these registers are numbered and are usually otherwise identified by two digits (the E and F digits) of the specific items of information, they may be similarly identified, and by the same circuits, by simply operating the (E and F digits) reading relays.

This so-called CAR operation consists of the sequential identification of each of the registers in turn, a calling of the roll so to speak. A feature of this walking circuit operation is a skipping means.

The registers are grouped and if, in the sequential operation, a group is encountered in which not a single register is occupied, then the whole group is skipped. If, however, a single register in such a group is occupied, then every register in that group is identified in turn.

A feature of the invention may, therefore, be stated as a means for selecting indirectly groups and individual registers by using the ordinary means for identification of the registers but controlled by indications produced by the registers themselves rather than such indications transmitted from elsewhere, as from the incoming tape.

A feature of the invention may also be stated as a means for sequentially generating one digit (the units digit) of the two-digit number and for effectively generating the other (the tens digit), by repeating this operation, combined with means for reducing the number of these repeated operations when a group of completely released registers to which these numbers are applied is encountered.

In more specific detail, this feature includes means combining lockout and sequence operations for connecting with each of a plurality of circuits; that is, for connecting with or enabling each of the assembling registers in turn, primarily in accordance with the tens digit of their identification and secondarily with their units digits. The tens digit controls a lockout circuit; whereas, the units digit is strictly in a sequence circuit. In the CAR operation, therefore, only those (tens) groups will be served

wherein there is one or more occupied registers. In this case the various tens digits will, so to speak, compete for use of the lockout circuit and each will sequentially take its turn. In each such group the entire ten registers (different units digits) will be sequentially enabled. The novelty in this feature is believed to be of broad application. Whereas, in the usual and conventional lockout circuit means, the circuits seeking connection usually enter the contest at odd times and are served in order, here a number seeks connection strictly simultaneously and, therefore, has to be served in some particular order. Hence, a sequence circuit is used to admit such circuits in order.

A feature of the invention may then be stated as a means for indicating and making a service request on a digital basis by using a selecting circuit under control in part by a lockout circuit.

Feature 39.—Another feature of the invention is a means for automatically correcting an elapsed time computation when there has been a power failure, with a consequent loss of an hour registration and a substitution therefor of a fictitious hour registration. In such a case, after a power failure, the means provided for restarting the device will effectively establish the fictitious value 25 in the hour register. This, of course, will be corrected when the next regular hour entry appears. However, while the hour circuit is set to supply the value 25 as the hour, there may be one or more specific items of information in the form of answer or disconnect timing entries registered in the assembling registers, so that when an initial entry comes along this value 25 is transmitted into the subtractor and enters into the computation. Means are provided, therefore, to detect the entry of the fictitious value 25 into the subtractor under three conditions, (1) as the disconnect hour, (2) as the answer hour or (3) as both disconnect and answer hour, and these means will act to automatically correct what would otherwise be a wholly erroneous computation.

A feature may, therefore, be stated as means responsive to the detection of a single fictitious hour value, out of the two which must be used in a computation, to substitute for the fictitious value the other truly expressed value, and, in cases where this would produce a negative result, to automatically carry in a one to convert this to a positive result.

A feature may also be stated as means responsive to the detection of two fictitious values to substitute an arbitrary but acceptable value for both and again, in cases where this would produce a negative result, to automatically carry in a one to convert this to a positive result.

Feature 40.—Another feature of the invention is the completely automatic window splice operation. Heretofore, when a new section of blank tape feeding into a perforator was spliced onto a section just about to be entirely used, an oblong hole, known as a window was cut in the tape at the splice in order to provide a signal to the perforator that it was approaching a double thickness of tape. This led to a stoppage of the device and the bringing in of an alarm. In accordance with the present invention means are provided, responsive to the signal that a window has been detected, to cause the perforator to automatically perforate a series of splice pattern codes in the tape and to maintain this automatic operation for a given time interval after detecting a signal that the window has been passed. This automatic operation stops the operation of the reader so that as soon as a window is detected, all other operations which depend upon the use of the perforating function of the machine are suspended until the window has been passed through the perforator and until there is no longer any danger that an output item might be mutilated by the failure or inability of the perforator to pierce a double thickness of tape.

This feature also includes the means for straddling a window with a distinctively different type of splice pattern code, hereinbefore set forth as grooved splice pattern.

A feature of the invention may, therefore, be stated as means responsive to the detection of a comparatively great hole in the center of a blank tape for suspending further operation of the device as far as perforating is concerned, means for thereupon repeatedly perforating in the tape a series of splice pattern codes of either regular or special type depending on the type of tape being produced, means for maintaining this automatic operation for a predetermined interval of time after the said hole has passed through the perforator, and means for resuming normal operations thereafter.

Feature 41.—Another feature of the invention is the use of a novel checking means employing a marginal relay which may be adjusted to respond to a plurality of different conditions. Primarily, a marginal relay is used to bring in an alarm when, through error, more than a single circuit out of a large plurality is enabled. Specifically, when an assembling register is selected for read-out purposes, it is necessary to guard against the enabling of more than one at a time and this is done by inserting a marginal relay in series with the selecting means. If by chance two or more are simultaneously selected, this marginal relay will operate on this increased load current and bring in an alarm. However, there are occasions when two such registers must legitimately be enabled at once but more than two must not be enabled. In accordance with the present feature, means are provided to alter the circuit of the said marginal relay so that it will not respond to the simultaneous selection of two circuits but will respond when a greater number of circuits are enabled.

Feature 42.—Another feature of the present invention is a means provided for automatically severing the completed tape from the tape supply of each of the output tape perforators. Each of the perforators is provided with a tape cutter operated by a magnet and the magnets of all of the output tape perforators are included in a circuit controlled by the master release (MRL) relay. After all functions of the device have been properly performed, one of the last operations is to release the circuits and to shut down the operation of the device. At this time, the master release relay becomes operated, and through its operation completes a circuit for the tape cutter magnets. Thus, in coming to rest, one of the last acts of the machine is to sever the output tapes.

BRIEF DESCRIPTION OF DRAWINGS

The drawings consist of 354 sheets, having 382 figures which may be described briefly as follows:

Fig. 1 is a block diagram showing the general arrangement of five sheets of drawings, each containing a block diagram, Figs. 2 to 6, inclusive, giving the related placing of Figs. 7 to 209, inclusive, to form a complete circuit diagram. Generally, Figs. 7 to 209, inclusive, are placed in horizontal rows and are numbered from left to right, starting in the topmost row and ending in the lowermost row;

Figs. 7 to 209, inclusive, when placed in the order indicated in Figs. 2 to 6, comprise a complete circuit diagram of the arrangement of the present invention, each separate figure forming a component part briefly described and identified by the labels lettered in the blocks in Figs. 2 to 6;

Figs. 210 to 382 are a series of highly schematic circuit diagrams, showing portions of the whole circuit of Figs. 7 to 209 but condensed and somewhat rearranged in order to clearly illustrate certain of the outstanding features of the invention;

Fig. 210 is a flow chart illustrating Feature Number 1 and showing a broad and general outline of the present invention;

Fig. 211 is a schematic circuit diagram showing the

bare essentials of a register, set forth in Feature Number 2;

Fig. 212 is a schematic circuit diagram illustrating Feature Number 3 and showing the geenral manner in which an assembling register is filled;

Fig. 213 is a schematic circuit diagram illustrating Feature Number 4 and showing the general manner in which information to be registered in an assembling register is gleaned partly from registers containing common items of information and partly from the reading relays expressing specific items of information;

Fig. 214 is a schematic circuit diagram illustrating Features 5, 7, 8 and 11 and showing the general manner in which the information registered in an assembling register may be transferred to a call register upon the arrival of an initial entry;

Fig. 215 is a schematic circuit diagram illustrating Feature 6 and showing the use of alternative call registers and the manner in which one or the other is filled, upon the receipt of an initial entry, partly from the first line of such initial entry and partly from the assembling register bearing the same identification number as the call identity index of the initial entry;

Figs. 216 to 219 illustrate Features 9, 10 and 21;

Fig. 216 is a block diagram showing two arrangements in the sequence of certain codes on an incoming tape which will result in certain cancellation of charges;

Fig. 217 is a block diagram showing the placing of Figs. 218 and 219 to form a schematic circuit diagram for carrying out the cancellation operations under normal operation caused by the code sequences of Fig. 216 and for preventing such cancellation under first call conditions;

Fig. 220 is a block diagram showing the placing of Figs. 221 to 227, inclusive, to form a schematic circuit diagram illustrating Feature 12 and showing in general how the device may be automatically accommodated to different accounting procedures;

Fig. 228 is a representation of a tape produced by a central office recorder with number codes shown rather than the actual perforations and giving an indication of the order in which the codes are recorded and the order in which they are read when this tape is placed in the device of the present invention;

Fig. 229 is a representation of an output tape from the device of the present invention showing the order in which the codes are recorded and the order in which they will be read in some other processing device;

Fig. 230 is a block diagram showing how Figs. 231 to 235, inclusive, may be placed to form a complete schematic circuit diagram used in the explanation of certain features, including Features 13, 14 and 15, having to do particularly with the checking of the proper sequence of days, rounds and recorder numbers;

Fig. 236 is a representation of a normal form of central office tape in which the codes are shown in the form of numbers rather than perforations;

Fig. 237 is a view of a short piece of tape as perforated with the regular splice pattern code 081010;

Fig. 238 is a view of a short piece of tape as perforated with a grooved splice pattern code 080002 representing recorder No. 00 and hour 02;

Fig. 239 is a view of a short piece of tape as perforated with a grooved splice pattern code 080211 representing the recorder No. 02 and the hour 11;

Fig. 240 is a block diagram showing how Figs. 241 to 248, inclusive, may be arranged in order to explain the manner in which tape sections may be spliced together to carry out the feedback method of straddle calls;

Fig. 241 is a representation of a straddle tape produced in the device of the present invention with indications as to the points where this tape is to be cut;

Fig. 242 is a representation of the tape of Fig. 241 with the various sections rearranged and spliced together ready for insertion at the proper place in the central office tape for the next day's business;

Figs. 243 and 246 represent the central office tape for the said next day's business with the small sections of the tape represented in Fig. 242 spliced in to make a complete incoming tape for the said next day's business;

Figs. 245 and 247 represent the straddle tape produced during the processing of the tape represented in Figs. 243 and 246, this latter straddle tape, Figs. 245 and 247, being similar to the straddle tape, Fig. 241, except that Fig. 241 is for one day's business and the other Figs. 245 and 247 are for the succeeding day's business;

Fig. 244 is a representation of a central office tape as it issues from the central office recorder showing two places at which such central office tape might be cut in order to produce what are known as straddle entries. A certain amount of explanatory matter is included in this Fig. 244 for the purpose of definition;

Fig. 248 is a schematic representation of the assembler-computer showing an input tape which has been produced by a central office recorder and a number of output tapes produced by the device of the present invention, the figure being noted on the representation of the input tape that this tape is being read by the assembler-computer in the reverse order to which it has been recorded;

Fig. 249 is a block diagram showing how Figs. 250 to 256, inclusive, may be placed to form a complete schematic circuit diagram illustrating Features 16 and 17 concerned with handling the assembled input tape of Figs. 243 and 246 used in the straddle call feedback method of operation and illustrating Feature 36 dealing with the provision for substitution of spare assembling registers and illustrating Feature 38 concerned with the flexibility in the use of the reading relays for jobs other than merely the reading of the sensed tape;

Fig. 257 is a block diagram showing how Figs. 258 and 259 may be arranged to form a schematic circuit diagram illustrating Features 18, 19 and 20 dealing with the derivation from registered information of subsequent mutilated or lost information of a similar nature and the reconstruction of registered information after a power failure;

Fig. 260 is a block diagram showing how Figs. 261 to 271, inclusive, may be placed to form a schematic diagram illustrating Feature 22 which involves the use in a calculator of computing circuits set up for calculations involving mixed base factor codes;

Fig. 272 is a block diagram showing how Figs. 274 to 300, inclusive, may be arranged to show a schematic diagram illustrating Feature 23 dealing with the means whereby an element of time first may be recorded on a code base for simplicity and economy and later may be translated to its full meaning for calculation purposes;

Fig. 273 is a highly skeletonized showing of the basic circuitry disclosed in Figs. 274 to 300, inclusive;

Fig. 301 is a block diagram showing how Figs. 302 and 303 may be placed to show a schematic diagram illustrating Feature 24 dealing with the handling of over-capacity calls on detailed entry output tapes;

Fig. 304 is a block diagram showing how Figs. 305 to 308, inclusive, may be arranged to show a schematic layout illustrating Features 25 and 26 dealing with the provision of processing registers and a calculator common to the assembling registers and an output perforator control circuit common to the foregoing;

Fig. 309 is a block diagram showing how Figs. 310 to 327, inclusive, may be placed to disclose a schematic diagram illustrating Features 27, 28, 29, 30 and 31 dealing with means for sorting processed calls according to such factors as office of origin, type of call, length of use of the facility, etc., including sorting by combinations of such factors simultaneously;

Fig. 328 is a block diagram showing how Figs. 329

to 356, inclusive, may be arranged to show a schematic diagram illustrating Features 32, 33, 40 and 42 concerning respectively automatic preparation of end-of-tape identity patterns, preparation of doubly reported entries on more than one perforator, automatic window splice procedure and automatic severing of completed tapes from the blank tape supplies at the end of a processing run;

Fig. 357 is a block diagram showing how Figs. 358 to 361, inclusive, may be placed to show a schematic layout illustrating Feature 34 dealing with a novel validity checking circuit controlled by the tape reading relays for checking a series of splice pattern codes;

Fig. 362 is a block diagram showing how Figs. 363 to 376, inclusive, may be arranged to disclose a schematic drawing illustrating Features 35 and 39 concerning circuits for interpreting and handling various types of hourly timing information read from an incoming tape and circuit means for utilizing a fictitious hour entry for correcting elapsed time calculation where a regular hourly entry has been lost or mutilated; and,

Fig. 377 is a block diagram showing how Figs. 378 to 382, inclusive, may be placed to show a schematic layout illustrating Features 37 and 41 dealing with circuit means for checking validity of registrations transferred from one circuit to another and circuit means for enabling automatic validity checking on a variable marginal basis.

INTRODUCTORY MATTER

In the following description the various relays are designated by both letters and numerals which have come to have certain significance to persons familiar with the technical details of the disclosed arrangements. By way of example, the reading relays are known as the **A0**, **A1** and **A2** relays for the first group thereof used to register the A digit of the six-digit line used in the automatic accounting system tapes. In the present case, there are three relays in the first or A set and five relays, such as the **B0**, **B1**, **B2**, **B4** and **B7** relays, in each of the remaining five sets. In a great many cases a relay will have only such an alphabetic designation but in other cases it will have in addition a numerical designation which always consists of the figure number plus two other following digits, whereby the location of a piece of apparatus can be found at once by turning to the corresponding figure number. Where conductors are designated by numerals in addition to the usual alphabetic designation thereof the number used will in most cases be a combination including the figure number wherein the conductor is first mentioned in the tracing of a circuit and this number will be retained even though the conductor extends through a large number of other figures. For obvious purposes conductors will often bear the same alphabetic designation as other apparatus. This is not to be taken as a duplication of the designation but it will be readily understood that such a conductor bears an intimate relation to the said other piece of apparatus. Another combination used herein for the sake of clarity is a numbering scheme for the cables or bundles of conductors which must be carried over long distances. This is the use of a hyphenated number such as **29–118** indicating that this cable or bundle of conductors extends between Figs. 29 and 118.

Similar logical means for designating various elements of the circuits will be found in the drawings and are used as an aid to the clear understanding of the present arrangement.

The operative apparatus of the disclosed embodiment includes relays, tape readers, tape reperforators, otherwise designatable as recorders, and auxiliary equipment for supplying tape and for storing the used or reproduced tapes.

A suitable tape reader is disclosed in Patent 2,669,304 to W. W. Carpenter of February 16, 1954; obviously other devices of similar function may be employed.

The tape perforators may consist of devices such as disclosed in the Patent 2,583,086 to W. W. Carpenter of January 22, 1952.

Brief description of accounting system

The general overall plan of an automatic message accounting system in which the present invention may be used as an improvement is described briefly as follows.

Central office automatic telephone systems may be provided with recording equipment which can record on perforated tapes the statistics pertinent to customer uses of chargeable facilities. Such information includes such items as the calling subscriber's number, the time the call was answered, the disconnect time, the trunk or junctor or other transmission channel number (identifying the channel used for the call), the called party's number, etc. The three basic parts of each complete call are the initial entry (general data re calling party, office, etc.), the answer time and the disconnect time. These parts of a call will be interspersed at random in a tape or tapes among other such items for other calls and among general data such as hourly time entries, end-of-tape patterns, etc. Two disclosures of systems for producing such central office tapes may be found in the Carpenter-Collis Patent 2,688,658 of September 7, 1954, and in the Cahill-Carpenter-Dimond Patent 2,599,358 of June 3, 1952. Since all elements of any particular call must necessarily involve the use of the same transmission channel, the identification number of the latter is a good way of identifying or detecting parts of the same call. The channel, whether it be a trunk or a junctor, etc., may be identified by a two digit number which in the accounting center can be used to assemble and to process parts of calls.

The present disclosure is related to the disclosures of a group of patents and applications generally relating to equipment which may constitute an accounting office. The object of an accounting office from the over-all viewpoint is to process a tape of the kind produced in a central office having recorded thereon data relative to telephone calls specifically originating in or, more generally, set up through or by means of said central office and to process said tape with the ultimate result of producing through successive steps typed records giving the details of toll calls made by each subscriber during a given period of time, typed message unit records giving the number of units to be charged to each subscriber for a given period of time in cases where such subscribers are billed on a total message unit basis, and typed records of so-called straddle calls, i.e., those in which, for one reason or another, the answer time entry, the disconnect time entry and the initial entry relating to a call are present on more than one tape. Within the scope of the accounting system certain other information may be derived and produced as a typed record, for example, line observing information, verification of numbers of newly connected subscribers, etc.

A tape suitable for initial use in an accounting office of the class referred to may be one produced in accordance with the disclosure of the above-mentioned Patent 2,599,358 to Cahill-Carpenter-Dimond or the above-mentioned Carpenter-Collis, Patent 2,688,658 or the equivalent thereof.

Such a tape may contain entries resulting from the use of many transmission circuits (which may be known as district junctors or trunks or by other designations) of the central office. Such tapes contain the initial entries, including among other information, the calling subscriber line number, and contain answer entries, disconnect entries, and day and hour entries. Because a single recorder may be used in common to and ordinarily is used in common to a number of transmission circuits, the initial, the answer, and the disconnect entries of a

particular call are interspersed on the tape at random among entries relating to other calls. Initial entries of calls which are never answered may also be recorded. However, each such entry is identified by the transmission circuit used for the purpose of this call and the number of this circuit forms a part of the entry record.

The principal stages of processing are the assembling, the computing, the sorting, the summarizing and the printing stages.

The first step in the accounting center is to assemble all of the recorded data on each call, so that subsequent processing can deal with complete information per call. This is accomplished by a machine known as an assembler which perforates assembled messages on its output tapes. Such a machine is disclosed in Patent 2,558,476 to Carpenter and Gooderham of June 26, 1951. Assembling is the process whereby the fragments of information belonging to a particular call are identified by a two-digit call identity index number (which is generally the trunk or junctor number used as the transmission path) and by their time sequence on the central office tape and such fragments are sorted onto output tapes in accordance with these indices without disturbing the time sequence of the various calls.

After the calls have been assembled, the output tapes of the assembler may be fed into a computer for performing the next or computing step of the process. The computer computes and prepares output tapes providing data on each call as to the chargeable time for toll calls and the chargeable message units for bulk-billed calls. Uncompleted calls are discarded. Portions of calls which straddle accounting periods are preserved on straddle tapes. Other miscellaneous tape outputs are made for calls whose segregation is desired for various reasons. A suitable computer is disclosed in Patent 2,630,269 to A. E. Joel of March 3, 1953.

Since the objective of the accounting center processing is to determine the total charges applicable to each telephone customer, the computed messages are next arranged in a sorting step by a sorter according to the telephone numbers of the calling subscribers. The output tapes of such a machine contain all of the messages originated by a particular subscriber adjacent to each other and all such subscriber groupings are arranged in ascending order of calling subscribers' telephone numbers. Patent 2,590,625 to A. E. Joel of March 25, 1952, discloses a sorter whereby such sorting may be accomplished in a number of discrete steps, each step comprising a separate sort by a different telephone number digit.

After all of the bulk-billable messages for subscribers have been brought together by means of the assembling, computing, and sorting steps, these may now be summarized by a summarizer which produces an output tape containing the total number of message units chargeable to each subscriber. A suitable summarizer is disclosed in Patent 2,572,132 to Giroud-Irwin-Kille-Retallack-Riggs-Strickler of October 23, 1951.

The last process step is the printing process which translates the sorted and/or summarized tapes into information understandable in terms of the actual billing of a customer. The printer accordingly may accept these sorted and/or summarized tapes and produce from them typewritten lists of message units and typewritten toll slips which may then be used to bill the customer. Such a printer arrangement is disclosed in Patent 2,510,061 to Branson-Locke-Marshall of June 6, 1950.

The present invention is what may be termed an "assembler-computer" because it is one machine which may take the place of the assemblers and computers of the prior system thereby to accomplish the assembling and computing steps in one automatic step directly from the central office tapes.

The features of the invention

The device of the present invention has been sketched in by enumerating and explaining the significance of certain of its most outstanding features. The following descriptions will go into a more detailed explanation of each of these features by reference to a number of schematic circuit diagrams each designed to illustrate in the most simple manner one or more of these features which might otherwise be obscured in the great mass of complex circuit details forming the main body of the following description. These feature sketches are highly schematic and are intended to explain the method of operation or the manner in which the circuits operate and are hence somewhat in the nature of flow charts and guides to the more complete circuit diagrams found in Figs. 7 to 209.

DETAILED DESCRIPTION OF FEATURES

Feature 1.—This feature, illustrated in Fig. 210, has been stated to be a broad outline sketch of the organization of the device of the present invention. The device is one of the accounting units of an automatic accounting system, is known as the assembler-computer and takes the place of two devices heretofore employed, such as described hereinbefore and known as the assembler and the computer. Essentially, an incoming tape **21000** is fed into a reader **21001** and the information contained therein is assembled, computed, rearranged and sorted out onto a plurality of outgoing tapes such as the outgoing tapes **21002** and **21003**. The device is characterized by the use of one hundred assembling registers such as the **00** assembling register **21004** and the **99** assembling register **21005**. Each of these registers has a disconnect time register such as the register **21006** and an answer time register **21007** into which the first two specific items of information relating to a particular call are registered. The incoming tape **21000** is one which has been produced at a central office by the actual customer use of the facilities provided and the various items of specific information are scattered at random on this tape. Each item of information, however, is characterized by a call identity index number which is actually the number of a particular piece of apparatus (such as a trunk or junctor, etc.) employed for the connection and, since these call identity index numbers are in two digits each, such item of information will be automatically delivered to an assembling register bearing the same number as the call identity index. Thus, if a specific item of information bearing the disconnect time of a call and characterized by the call identity index **99** is read by the reader, it will be registered in the disconnect register **21006** in the No. **99** assembling unit **21005**.

In operation, the codes on the incoming tape are read by the reader **21001** and then are passed through the connections of the reader-connector **21008** to the reading relays **21009**. The reading relays then have access to a number of paths, including the path **21010** leading to the assembling register multiple connector **21011**, and including the initial entry multiple connector **21012** leading to the initial entry register **21013**. Since the reading relays will clearly differentiate the timing entries from the initial entry items of information as well as from the items of common information, the routing of the information as read will be certainly and selectively carried out.

It will be noted hereinafter that as the reader **21001** encounters the various items of information in making up the data for a customer charge, first the disconnect register **21006** will be employed, next the answer time register **21007** will be employed and finally the initial entry register **21013** will be employed. This last-named initial entry register is common to all of the so-called assembling registers; that is, it bears no number such as the **00** assembling register **21004** and the **99** assembling register **21005**, but the item directed to it will bear a call identity index and will immediately activate the correspondingly numbered assembling register. Thereupon the information held in this assembling register will be

transmitted through the call register **21014** and the translator **21015** to the subtractor **21016** wherein the elapsed time for the call will be calculated by subtracting the answer time minutes from the disconnect time minutes. The result of this calculation will then be transmitted to the chargeable time translator **21017** and this device will transmit the information concerning the number of message units to be charged therefor to the device herein known as the initial entry register **21013**. Since the initial entry is also transmitted to this device **21013**, all the information for the call is thus registered including the calling line number in the register **21018**, the called line number in the register **21019** and the message unit charge in the message unit register **21020**. Thereupon, the information contained in these various registers is passed through the pattern connector **21021** and in turn to the perforator-connector **21022** where the computed charge together with the accompanying information therefor is transmitted through a selected one of a number of perforators such as the perforators **21023** and **21024**.

In this manner it will be seen that when the reader reads from the incoming tape the various scattered items of information, the various assembling registers will be gradually and at odd times filled with disconnect and answer time data. At some later period, when the initial entry corresponding to a particular assembling register is read, then the three items, the disconnect time, the answer time and the initial entry will be combined for the processing and the formulating of the output to be perforated on one of the output tapes. This assembling register is then freed and made ready to receive the information for another call, which might conceivably start with the next item directly after the initial entry which caused the above action.

Feature 2.—Fig. 211 shows the bare essentials of a register. This is made up of a plurality of units known as the Ellwood switch unit consisting essentially of a glass envelope having two flexible magnetic reeds, each sealed into the opposite end thereof with their ends overlapping so that when this unit is energized by a coil external thereto the reeds will come into contact and close a circuit. The Ellwood Patent 2,289,830 discloses and claims such units. The contact unit **21100** is shown as being under the control of a coil **21101** wound about it. There is one of these units for each code place in each denominational order of the register and such a unit has a single terminal **21102** known as the active terminal thereof. The coil **21101** is connected to this active terminal and has its other terminal connected to a source of battery, so that if the active terminal is grounded the relay will operate and, through its contacts, will close a circuit to ground. When the ground applied to the active terminal **21102** is removed the relay remains operated through its own contacts and all operated relays of a register may then be maintained in operation until the common lead to ground is opened by a means provided therefor. It will thus also appear that when ground is applied to the active terminal **21102** both reeds of the relay are grounded so that when they come together there will be no current flow established by this action. Also it will appear that when the relay is to be released the circuit therefor is broken at an external point before the reeds are allowed to move apart. A release relay **21103** is shown as a means for releasing the register.

It will also appear hereinafter that when such a register is to be caused to give up or transmit its registration to some other point, its active conductors will be connected by a multiple contact relay to the trunk or multiple over which the information is to be transmitted so that each conductor of this trunk which is thus connected to an active terminal of a relay which is operated will thereby be grounded; whereas, each other terminal will have battery potential through the coil of its relay connected thereto. Since the point to which the information is to be transmitted will be of the same nature (battery connected), then only those conductors which become grounded will be effective to operate a device at the other end of such transmisison channel. In Fig. 211, the active terminals of a single denominational order are indicated and only the 0 and 7 code place conductors are actually shown. These are bracketed to an indicated channel which shows flow in both directions, indicating that information may be both read in and read out of such a register over the same conductors as above described.

Feature 3.—This feature has been set forth as a register having two parts, essentially each a register, and an individual control circuit whereby two items of information identical in make-up may be successively registered in the two portions thereof. This is shown in Fig. 212 where the reader **21200** will in time read off a disconnect and an answer time entry both characterized by the same call identity index and will register these in the assembling register **21201**. The disconnect time entry and the answer time entry are identical with the exception that they carry different time notations in the form of tens, units and tenths of a minute. The item of information read by the reader will be transmitted through the reader-connector relays **21202** to operate the reading relays **21203** and thence over a transmission channel to the contacts of the relays in the assembling register multiple connector **21204**. The ADM relay **21205** will transmit the code over the disconnect multiple **21206** which leads in parallel to the contacts of all of the disconnect relays, such as the relay **21207**, in all of the one hundred assembling registers. This code will also be passed through the contacts of the AM relay **21208** and transmitted out over the answer multiple **21209** to the contacts of all the answer relays, such as the relay **21210**. Through the operation of the assembler register connector control ADMC relay **21211**, both the relays **21205** and **21208** are energized. The energization of the AM relay **21208** alone, through the operation of the AMO relay **21212** under other circumstances, is for another purpose with which the description is not at present concerned.

At the same time that these disconnect and answer time entries are being read by the reading relays **21203**, a circuit (rectangle **21213**) will be set up by the E and F digit reading relays to ground the particular conductor leading to the assembling register having the same number as the call identity index entries of these items of information. Therefore, ground will be extended over the conductor **21214** and over contact **1** of the DS relay **21215** to operate the DISC relay **21207** so that, this being the first item of information received by the assembling register **21201**, it will be transmitted through the disconnect multiple into the disconnect section of this assembling register here represented by the relays **21216** and **21217**. Upon the operation of any one or more of these relays, such relays will establish a holding circuit over their contacts and thence through the winding of the DS relay **21215** and contact **1** of the RLS relay **21218**. It will be remembered that the code for the item of information just registered in the disconnect section of this assembling register was also transmitted simultaneously over the answer multiple **21209**, but, since the answer relay **21210** was not operated, this code did not reach the answer section of the register.

Upon the establishment of the locking circuit for the disconnect section of the register and the removal of the operating grounds therefor, the DS relay **21215** is operated so that the disconnect relay DISC **21207** is released. Thereafter, when another timing entry characterized by the same call identity entry is received the particular conductor **21214** will again be grounded and will this time result in the energization of the ANS relay **21210**, so that the code now being simultaneously transmitted over both the disconnect multiple **21206** and the answer multiple **21209** will reach the relays only of the

answer section of this assembling register, such as the relays **21219** and **21220**. These relays lock in a circuit similar to that hereinbefore described, causing the operation of the AS relay **21221** (when the operating grounds are removed) for purposes with which the present description is not at present concerned.

When, at some later period, the initial entry characterized by the same call identity index as the number of this particular assembling register **21201** is received, the call will be processed as before described and the register **21201** will be released through the operation of the RLS relay **21218**, which opens the holding circuits for the disconnect and answer sections of this assembling register.

It will thus be noted that the first timing entry bearing the call identity index identifying this particular assembling register will be routed into the disconnect section thereof regardless of the fact that it may be an answer time rather than a disconnect time. The use of this capability of the assembling register forms the basis of other features which will be described with more particularity hereinafter.

Feature 4.—This feature has been described hereinbefore as a means for simultaneously entering into a register items of information from a code line being currently read and from registers set previously by other code lines. This is shown in schematic form in Fig. 213, where the incoming tape **21300** is indicated as entering the reader **21301** where the codes read thereby are then passed through the reader-connector **21302** into the reading relays **21303**. It will be noted that when the tape identity information, comprising the end of tape groups of coded lines, is read, the day register **21304** will be set from the E and F digits of the reading relays and that shortly thereafter, from among the items of common information, the hour register **21305** will also be set from the E and F digits of the reading relays. Through hour entries occasionally encountered in the incoming tape **21300**, the hour register **21305** will be reset from time to time and this may even entail a resetting of the day register. The point is that the day and hour registers are two registers which are set and maintained in this condition throughout the reading of successive specific items of information.

Near the bottom of this figure two assembling registers **21306** and **21307** are indicated, the first, in some detail and the other, in a schematic manner. Each of these registers is approached or enabled over a conductor shown at the extreme right thereof and bracketed to a channel emerging from the F digit part of the reading translator and assembling register selector. The E digit part of this translator and selector is designated **21308** and the F digit part is designated **21309**. Both play a part in selecting a particular conductor leading to a particular assembling register, such as the register **21306**.

When a specific item of information is read and proves to be either an answer or a disconnect timing entry, the ADMC relay **21310** of the assembling register-connector circuit **21311** will be operated, whereupon both the ADM relay **21312** and the AM relay **21313** of the assembling register multiple connector circuit **21314** are operated. Thereupon the information comprised in the B, C and D digits of the code being read will be transmitted over both the disconnect multiple and the answer multiple. At the same time one of the conductors corresponding in number to the number expressed by the E and F digits of this code will be grounded. Assuming this to be conductor **99**, then this ground will be extended to the armature of the DS relay **21315** and, if this is the first timing entry to be transmitted to this particular assembling register, the ground will cause the operation of the DISC **99** relay **21316**, so that the disconnect multiple will be extended into the register relays of the disconnect part of this register.

The ADM relay **21312**, at the same time that it transmits the codes from the B, C and D reading relays, will transmit codes from the day register and the hour register into corresponding register relays of the disconnect section of the assembling register. It will thus be seen that the enabling of the disconnect section of an assembling register will gather information both from the reading relays, set by a currently read code, and from registrations maintained by other registers, previously set for holding common information.

Feature 5.—This feature has been stated as an arrangement whereby the two sections of an assembling register may be enabled separately for reading-in items of information sequentially or may be enabled simultaneously for reading-out all the information held therein. This is illustrated in Fig. 214. In this case the incoming tape **21400** enters the reader **21401** and the code read is transmitted through the reader-connector **21402** to the reading relays **21403**. When a timing entry is encountered both the ADM relay **21404** and the AM relay **21405** are operated together as hereinbefore described, so that the code being read is extended both over the disconnect multiple **21406** and the answer multiple **21407**. Through the non-operation or the operation of the DS relay **21408** the code being read is routed either to the disconnect section **21409** or the answer section **21410** of the selected register. It will be noted that the AM relay **21405**, of the assembler register multiple connector, connects the disconnect and the answer multiple together.

At some later time, when the initial entry having the same call identity index as this assembling register is encountered, the E and F digit translator and assembling register selector **21411** will ground the corresponding conductor leading to the armature of the DS relay **21408**. At the same time the ADCN relay **21412** of the assembling register connector control circuit **21413** will operate and will cause the operation of the AD relay **21414** of the answer and disconnect connector **21415**. This relay will interconnect the conductors leading to the windings of the disconnect and answer connector relays **21416** and **21417**, respectively, within each one of the assembling registers. By means of the ground supplied over the armature of the associated DS relay **21408** both of these relays **21416** and **21417** will become operated. Therefore, the disconnect section **21409** is connected into the disconnect multiple **21406** and the answer section **21410** is simultaneously connected to the answer multiple **21407**. Since these two multiples are disassociated from each other through the non-operation of the AM relay **21405**, the registrations in these two sections do not interfere with each other and may be transmitted into the call register **21418** through the simultaneous operation of the disconnect call register connector relay **21419** and the answer call register connector relay **21420**, which are operated together when the ADR relay **21439** is operated as an indication that the first line of the initial entry has been or is being transmitted to the call entry register concerned.

Thus it will be seen that the two sections of an assembling register may be separately and sequentially set and may be made to simultaneously give up their registration for transmission to some other point.

Figure 6.—This feature has been set forth hereinbefore as a means for reregistering the timing information read out of an assembling register into either of two call entry registers simultaneously with the registering of another entry (such as an initial entry) being read from the tape into the corresponding call entry register, the selection of a particular assembling register being determined by information contained in the first line of the initial entry. When the first line of an initial entry has been encountered by the reader, this first line containing the call identity index, the pertinent assembling register, which contains the timing information forming part of the data for the customer charge of which this initial entry forms another part, is identi-

fied by the call identity index in said initial entry. Therefore, during the first line of this initial entry the assembling register will be connected to the disconnect and answer multiples as explained in connection with Feature 5 and with the help of Fig. 214. Fig. 215 may be used to further explain the present Feature 6 for it shows two call registers, the even call register **21500** and the odd call register **21501**. The reader **21502** controls, in a manner which is more completely described in the body of the specification, a series of relays in the reader step and line count circuit **21503**. The first SR1E relay **21504** of these relays will have been operated by the off-normal and start circuit **21505** and thereafter the reader will cause the sequential operation of the remaining relays as shown during the reading of initial entry codes.

If the SR1E relay **21504**, which is operated during the reading of the first line of an initial entry, is operated, then the corresponding CLAC–E relay **21507** in the even initial entry register connector **21506** is operated. This CLAC–E relay **21507**, of all relays in this group, will cause the operation of the E–ADR relay **21508** so that a ground is extended to the disconnect DISC and answer ANS relays of the even call register connector **21509**, whereby the even call register is made to receive the registrations now being transmitted from one of the assembling registers over the disconnect and answer multiples. When the reader moves on to the second line of the initial entry, then the SR1E relay **21504** will be released and the next SR2E relay **21510** will be operated in its stead. This releases the E–ADR relay **21508** so that the answer and disconnect multiples may be used for other purposes while the second and subsequent lines of the initial entry are being read by the reader. After this initial entry has been completely registered, then upon the reading of the next initial entry the first SR1O relay **21511** for the odd call register circuit will be operated resulting in the operation of the CLAC–O relay **21512** and in turn the operation of the O–ADR relay **21513**, whereby the disconnect DISC and answer ANS relays of the odd call register-connector **21514** are operated.

Thus, through the operation of the CLAC–E relay **21507** during the reading of the first line of an initial entry, not only will this first line be transmitted from the reading relays **21515** through the contacts of this CLAC–E connector relay **21507** to the corresponding register circuit **21516** of the even initial entry register, but the answer and disconnect information will be simultaneously read from the answer and disconnect multiples into the answer and disconnect register sections of the even call register **21500**. Thereafter, the second and subsequent lines, if any, of the initial entry may be read into the other corresponding sections of the even initial entry register for processing purposes, which will be explained in more detail hereinafter.

Feature 7.—This feature has been stated as means for locking out of use one of the call entry registers until the other one has been able to register therein all of the lines of the initial entry which may relate to the instant call.

The salient aspects of this feature may be described with reference to Fig. 215, which necessarily does not show all circuit details but which, it is believed, is sufficiently descriptiive to outline the basis of this feature.

First of all, an initial entry, which comprises data relating primarily to the customer identification, the class of call, etc., that is, customer facility usage information, may contain two or four lines of data. The A digit of the first line of an initial entry will be a 2, which is used to steer the initial entry into registers of a call entry register. The B digit of the first line will be a 1 for a two line entry and a 3 or 4 for a four line entry. All supplemental lines of an initial entry are identified by an A digit of zero.

With reference to Fig. 215, the SR1E relay **21504** is operated at the start of the processing under control of the off-normal and start circuit **21505**, as previously explained. When the first line of an initial entry (information relating to the identification of the customer facility used) is read by the reader **21502**, the A digit of two in the first line identifies the information as being the first line of an initial entry. As has been explained previously, the E and F digits of this first line, comprising the call identity index, cause the operation of the disconnect and answer connectors of the assembling register identified by this call identity index, such that the disconnect and answer times relating to this call are placed on the disconnect and answer multiples and the disconnect and answer connectors of the appropriate call entry register, such as the even call register connector **21509**, are operated to enable the disconnect and answer timing information on the disconnect and answer multiples to be registed in the disconnect and answer register portions of the even call register **21500**.

The appearance of an A digit of two in the first line of the initial entry, coupled with the operation of the SR1E relay **21504**, causes a ground to be applied over the contact of the SR1E relay **21504** and through a down-check circuit (indicating that the facility information registers of the even initial entry register are empty and indicating that the output part of the even call entry register is normal), thereby to operate the line 1 connector relay **21507** in the even call entry register connector circuit **21506**. Thereupon, the first line of this initial entry is registered in the line 1 register **21516** of the even call entry register, the B digit of this line representing the input class of the call and indicating the number of lines of information which should be received.

As soon as all of the information relating to this first line is registered in the first line register **21516**, an up-check circuit is completed through this register, back into the reader step and line count circuit **21503** to cause the reader **21502** to step ahead onto the next line. This causes the operation of the SR2E relay **21510** and the release of the SR1E relay **21504** and provides the reader step and line count circuit **21503** with information derived from the B digit of the first line as to how many lines should be expected. The operation of the SR2E relay **21510** prevents any further lines of information to be read and processed by the reader **21502** except lines whose A digits are zero which, as above explained, indicates a supplemental line of an initial entry. The stepping of the reader **21502** releases the reading relays and the release of the SR1E relay **21504** releases the line 1 connector relay **21507** of the even call entry register connector **21506**.

The A digit of zero in the second line, in combination with the operation of the SR2E relay **21510**, causes the operation of the line 2 connector **21519** of the even call entry register connector **21506**, thereby registering the second line of information in the line 2 register **21520**. The satisfactory registration of this second line in the second line register **21520** causes the reader step and line count circuit **21503** to perform one of two operations: If the B digit of the first line was a 1 (indicating a two-line initial entry for a bulk-billed call) the line count circuit **21503** will operate the SR1O relay **21511** as an indication that the complete initial entry for the last call has been fully registered in the even call entry register and that the next initial entry should be processed by the odd call entry register; and if the B digit of the first line was a 3 or a 4 (indicating a four-line initial entry for a detailed billed or observed call) then the line count circuit **21503** will operate the SR3E relay **21517**, thereby to cause the next two lines of the last initial entry to be registered in the line 3 and line 4 registers **21521** and **21522** of the even call entry register. If the SR1O relay

21511 is operated, this permits the reader 21502 to read and to process any lines of information except those whose A digits are zero. If, on the other hand, the SR3E relay 21517 is operated, this permits the reader 21502 to read and to process only those lines of information containing an A digit of zero.

This feature, therefore, contemplates the means whereby the two call entry registers may be used alternately to handle alternate calls and whereby each is locked out from being used until the other has finished registering the initial entry information whether it be two lines or four lines as indicated by the B digit of the first line.

Feature 8.—Feature 8 has been set forth as a means for automatically supplying a timing entry where but a single such entry has been recorded in the disconnect section of the assembling register. It will be remembered that the first timing entry presented to a given assembling register will be registered in the disconnect section thereof. If such first timing entry is actually a disconnect timing entry then it is properly entered therein. The answer timing entry may be missing and, therefore, may not be recorded before the initial entry is encountered. Or it may be that the disconnect timing entry is missing, so that when the actual answer time entry is presented it will be recorded in the disconnect section of the assembling register. Thus, when the initial entry is later encountered it will appear as though the answer timing entry has not been registered. In this case (see Fig. 214) a circuit will be established from ground, contact 2 of the AD relay 21430, contact 2 of the AU relay 21432, contact 2 of the DD relay 21426, contact 2 of the DU relay 21428, contact of the FCD relay 21433, contact 3 of the NES relay 21423, contact 3 of the ES relay 21424, contact of the FCU relay 21434, to conductor 21435 leading over contact 2 of the AR– relay 21420 (which is the answer call register connector relay for connecting the answer multiple to the answer section of the processing or call register), and thence to the winding of the AM0 relay 21436 in the assembling register connector circuit 21413. The operation of this relay causes the operation of the AM relay 21405, so that the registration which is found in the disconnect section 21409 of the assembling register not only will be transmitted over the disconnect multiple 21406 to the disconnect section of the call register 21418, but also will be transmitted over the answer multiple 21407 to the answer section of the call register 21418. The chain circuit for grounding the conductor 21435 in the register control circuit 21421 is established to fulfill certain conditions defined by the function of these relays which are all set forth in Section 3.057 Register Control. By way of example, it must apepar that (1) the AD relay 21430 is operated (indicating that no timing entry is registered in the answer portion of the assembling register being read out) and (2) the AU relay 21432 must be released (thus failing to indicate that a timing entry is registered in the answer time portion of the assembling register) and (3) the DD relay 21426 must be released (thus by its non-operation failing to indicate that no timing entry is registered in the disconnect portion of the assembling register) and (4) the DU relay 21428 must be operated (indicating that a timing entry is recorded in the disconnect portion of the assembling register). The other four relays alter this situation only where possible straddle calls are involved.

Therefore, when an initial entry is encountered and the correspondingly numbered assembling register is connected to the processing or call register, if the answer time is not registered in the answer portion of this assembling register then the registration which is present in the disconnect section will be transmitted to both the disconnect and answer sections of the processing call register so that elapsed time 00 may be arrived at by the calculator.

Feature 9.—This feature has been stated as a means for selectively and automatically releasing one or both of the sections of all assembling registers occupied at a given time upon the receipt of an item of special information in the tape.

Fig. 216 illustrates a succession of certain entries on two pieces of tape. In both of these the tape is supposed to have its lower end inserted in the reader so that the lowermost entry is read first by the reader and then the other entries next above in succession. In the case of the lower piece of tape the reader will read first, a disconnect time entry, second, a special entry 2854EF, third, the answer time and fourth, the initial entry. In this case since the cancellation or "charge guard" entry 2854EF occurs between the disconnect and answer time entries it will be desired to cancel only the overtime on the call and hence only the disconnect time, which will have been heretofore registered, is released. In the case of the upper piece of tape the cancellation entry occurs between the answer time and the initial entry and, therefore, it is desired to cancel the call in its entirety, so that both the disconnect time and the answer time will be released.

The manner in which this is done is shown in the schematic drawing blocked out in Fig. 217, which represents the manner in which Figs. 218 and 219 are to be placed in order to form a complete skeletonized schematic circuit diagram. In Fig. 219, two assembling registers 21900 and 21901 are illustrated in part. Let us assume that both of these registers have received and now contain a registration of a disconnect timing entry and that the register 21901 has also received and now holds an answer timing entry. The relays of the disconnect section of the assembling register 21900, such as the relay 21902, have been operated and are now locked in a circuit from battery, the winding thereof, contact thereof, through the DS relay 21903 (which is operated) and left contact 1 of the RLS relay 21904 to ground. The AS relay 21905 is not operated in this assembler and, therefore, the ground on left contact 1 of the RLS relay is extended over right contact 1 of the DS relay 21903, contact 2 of the AS relay 21905, and over conductor 21913 to the winding of the NSRC relay 21800, resulting in the operation of this latter relay.

In the lower of these assembling registers, that designated 21901, it will be assumed that one of the relays of the answer time section thereof is also operated, such as the relay 21906, so that ground will be extended from right contact 2 of the RLS relay 21907, through the winding of the AS relay 21908 (which is operated) to hold the relay 21906 operated. One of the relays of the disconnect section, such as the relay 21909, will also be operated, so that the DS relay 21910 will be in operated position. Therefore, the ground at left contact 1 of the RLS relay 21907 will be extended over such contact thereof, through right contact 1 of the DS relay 21910, and over contact 1 of the AS relay 21908 and over conductor 21914 to the winding of the CCRC relay 21801.

There are certain charging entries which are recorded in the central office tape by the central office recorder under certain special conditions. One of these is known as the 2854EF charge guard entry. If this occurs, as indicated in Fig. 216, between the disconnect and the answer time entries of any call, it will have the effect of cancelling the overtime of a call by actually releasing the disconnect time entry in all registers wherein only a disconnect time entry has been registered. If, on the other hand, this entry occurs between the answer time and the initial entry then it will have the effect of cancelling the call in its entirety by actually releasing both the disconnect and answer timing entries where both have been registered in any one or more assembling registers.

Two other entries of this kind are known as the 2856EF and the 2857EF entries. If either of these entries appears between the disconnect time and the answer

time of any call then it will have the same effect as the 2854EF entry at this time. That is, it will cause the cancelling of overtime through the actual release of all disconnect time entries in all assembling registers holding only disconnect time entries. If, on the other hand, either of these entries appears between the answer time and the initial entry the call will be fully chargeable and no timing entry will be released.

Let us suppose, as above, that there is at least one assembling register having either a disconnect time entry or both a disconnect and an answer time entry registered therein at the present time. If, therefore, at this time the reader **21802** encounters a cancellation entry 2854EF, then such an entry will be transmitted through the reader connector **21803** to the reading relays **21804** and thence out over a special conductor D–21825 into the cancel entry control circuit **21805**. The 285 portion of the entry in the reading relays will cause the operation of the **285**–C relay **21806** and the 4 in the D digit thereof will transmit a ground to the **2854** conductor leading to the armatures of both the NSRC relay **21800** and the CCRC relay **21801**. Either or both of these relays will extend the ground to the winding of the CCR relay **21807**, which in turn, upon operating, will cause the operation of both the CCR1 relay **21808** and the NSR1 relay **21810**. The CCR1 relay **21808** now places a ground on the conductor **21809** and the NSR1 relay **21810** will place a ground on the conductor **21811**. In the assembling register **21900**, which it will be remembered contains only a disconnect time entry, the ground on conductor **21811** will be extended over contact **4** of the AS relay **21905**, through right contact **2** of the DS relay **21903**, through left contact **2** or **1** and thence through a similar right contact **4** or **3** of the FC relay **21911**, to the left-hand winding of the RLS relay **21904**. This relay, upon operating, now releases the register relay **21902** representing the disconnect portion of this assembling register, thus dropping the disconnect time entered in this register in accordance with the lower portion of tape shown in Fig. 216. The result will be that at some later time an answer time entry may be entered into this disconnect portion of the assembling register **21900** and later, when the initial entry appears, the registration in this disconnect time section will be transmitted to both the disconnect and answer sections of the call register so that an elapsed time 00 will be calculated, thus effectively cancelling overtime on this call.

In the assembling register **21901**, which is assumed to contain both a disconnect and an answer time entry, the ground on conductor **21809** will be transmitted through contact **3** of the AS relay **21908**, right contact **2** of the DS relay **21910**, through the path provided by the FC relay **21912** (whether operated or non-operated) to the winding of the release relay **21907**. This relay, upon operating, thereupon releases both the disconnect and answer time entries registered therein. Since both timing entries have now been released, the call will be canceled in its entirety when the initial entry appears.

Let us suppose again that either a 2856EF entry or a 2857EF entry is received. Either of these will extend a circuit through a left contact **1** or **2** of the NSRC relay **21800**, providing that this relay is operated, to cause the operation of the NSR relay **21812**, so that the NSR1 relay **21810** is operated and ground is placed only on conductor **21811**. Therefore, in the assembling register **21900**, which has been assumed to have only a disconnect time entry, such disconnect time entry will be released in the manner hereinbefore described. Since no ground has been placed on the conductor **21809**, the registration of both a disconnect timing entry and an answer timing entry in the two sections of the assembling register **21901** will be left unaffected.

In the case where there are no assembling registers having but a single disconnect time entry registered therein, the NSRC relay **21800** will not be operated and hence, upon the receipt of the special code 2856EF or the special code 2857EF, the NSR relay **21812** will not be operated and no ground will be placed on the conductor **21811**. It is immaterial at this time that the CCRC relay **21801** may be operated by one or more assembling registers having registered therein both a disconnect and an answer timing entry. This is strictly in accordance with the plan because such registers fulfill the conditions that the two timing entries have been entered and the special code 2856EF or 2857EF has occurred after these two timing entries but before the initial entry. In this case the call is to be fully chargeable and, therefore, no adjustment is to be made through the release of any timing entry.

Feature 10.—This feature has been stated as a means for canceling overtime or all charges on calls partially registered when the machine is restarted after an alarm due to a multilated initial entry call identity index.

In the upper part of Fig. 218 there is shown in highly schematic form an alarm circuit **21813**. This alarm is worked by an alarm timing circuit **21814** consisting essentially of an electronic tube **21815**. In operation, the ST4 relay **21816** of the off-normal and start circuit is normally operated, thereby removing a shunt from across the condenser **21817**. Also in operation, the CT relay **21818** is periodically operated from the satisfaction circuit **21819** so that the condenser **21817** is periodically shunted sufficiently often to prevent it from becoming fully charged. If, however, the satisfaction circuit fails to operate the CT relay **21818** within a given period, then the condenser **21817** will become charged in a circuit from positive battery, a resistance **21820**, condenser **21817**, contact **1** of the CT relay **21818** to negative battery through the winding of the **T0** relay **21821**. When the condenser **21817** becomes highly charged, then the charging current drops to a very low amount and the drop in potential due to this circumstance in the resistance **21820** becomes negligible so that the potential on the striking anode of the tube **21815** rises to such a point that the tube fires, first over the striking anode and secondly, and immediately following, over the main anode, which is connected directly to the positive battery. Therefore, the current in the **T0** relay **21821** increases to the point that this relay will operate and in turn will operate the alarm relay AL in the alarm circuit **21813**.

The satisfaction circuit may remain open for the required length of time due to the fact that an E or an F digit code in an initial entry is mutilated. Since this makes it uncertain with which assembling register this initial entry should be matched the alarm is brought in. The attendant may thereupon release the alarm by operating the machine release key **21822**, which in turn will release the normally operated RLO relay **21823**. The ST4 relay **21816** is shown as being operated through contact **2** of the machine release key **21822** and this circuit represents effectively the circuit as actually wired. Therefore, upon the operation of the machine release key **21822**, the ST4 relay **21816** is released and the shunt across the condenser **21817** is reestablished so that the tube **21815** is quenched and the T0 relay **21821** is released. At this time the operator, realizing that the initial entry, which cannot now be identified, may belong to any one of the various groups of data which are already registered, operates key **21824** to release the assembling registers which are now partially operated. This establishes a circuit from ground over key **21824**, and over a contact of the RLO relay **21823** to operate the CCR relay **21807**, which in turn operates both the CCR1 relay **21808** and the NSR1 relay **21810**. The operation of these two latter relays places grounds on both of the conductors **21809** and **21811** so that the assembling registers, which are partially or wholly occupied, will now be released in the manner hereinbefore described.

Feature 11.—This feature has been set forth as a means for insuring that the information in an assembling

register has been completely and successfully reregistered in a processing or call register before the interconnections between these registers may be released, when it appears that the normal time during which these interconnections are established is of very short duration. The establishment of the interconnection between the assembling register and the call register is shown in both Figs. 214 and 215. The checking or holding circuit for temporarily maintaining these connections is shown in Fig. 214 where a number of relays are shown in the register control circuit **21421**. Upon the operation of the disconnect call register connector DR– relay **21419** and the answer call register connector AR– relay **21420**, a locking circuit is established over conductor **21422** through a front contact **1** of the answer AR– relay **21420**. Ground is fed to this locking circuit over a plurality of paths, one of which may be traced through contact **2** of the NES relay **21423** and contact **2** of the ES relay **21424**. Another path may be traced from ground over a contact **1** of either the DDC relay **21425** or the DD relay **21426**, thence over a contact **1** of either the DUC relay **21427** or the DU relay **21428**. Another path of a similar nature may be traced from ground over a contact **1** of either the ADC relay **21429** or the AD relay **21430** and thence through a contact **1** of either the AUC relay **21431** or the AU relay **21432**. It will thus appear that in order to remove ground from the conductor **21422** it will be necessary (1) to have only either the ES relay **21424** or the NES relay **21423** operated and (2) to have either both relays DDC–**21425** and DD–**21426** or both relays DUC–**21427** and DU–**21428** operated and (3) to have either both relays ADC–**21429** and AD–**21430** or both relays AUC–**21431** and AU–**21432** operated.

The function of each of these relays is set forth in some detail in the following body of this specification in Section 3.057. It will appear, by way of example, that if (1) the NES relay **21423** (which, if operated, indicates that the timing entries being taken from the assembling register are in conjunction with calls being read from the tape) is operated and (2) if both the AUC relay **21431** (which, if operated, indicates that a valid registration of the answer time taken from the assembling register has been successfully recorded in the call register) and the AU relay **21432** (which, if operated, indicates that a timing entry is registered in the answer portion of the assembling register) are both operated and (3) if the corresponding DUC relay **21427** and the DU relay **21428** are operated, then the interconnection between the registers may be released.

It has been shown above how the disconnect and answer registers of the call register **21418** are maintained in communication with the answer multiple **21407** and the disconnect multiple **21406** until it is certain that the transfer of information from the assembling register is complete. By the same token it is necessary to hold the assembling register (in other words to maintain the disconnect connector relay such as the DISC relay **21416** and the answer connector relay such as the ANS relay **21417** operated) this same length of time. This is accomplished by a ground which is extended by the answer AR– relay **21420**, to a conductor **21437**, which locks the AD relay **21414** operated so as to maintain the operating connection between the disconnect DISC relay **21416** and the answer ANS relay **21417**. At the same time the AD relay **21414** places a ground on the conductor **21438**, which enters into and becomes a part of the answer multiple **21407**, so that through the operation of the answer ANS relay **21417** ground will be extended over a contact **1** of this relay and thence to the winding thereof and also through an appropriate contact **99** of the AD relay **21414** to the winding of the disconnect DISC relay **21416**.

When, therefore, the ground is removed from the conductor **21422**, as a signal that the information has been passed from the assembling register and successfully registered in the call register, both the call register and the assembling register will be released insofar as timing information is concerned.

This feature has been stated as a means for insuring that the amount of information read out of an assembling register agrees with the amount of information registered into the processing registers before releasing the assembling register. The means for carrying this out is shown schematically in Fig. 214, as above described, where the answer and disconnect register upcheck and downcheck relays control the interconnection of an assembling register and a processing register. It has been shown how, when such a connection for the reregistration of information is set up, the conductor **21422** will be held grounded until it is certain that all the information in the assembling register has been properly reregistered. It has also been shown how the conductor **21435** is grounded if the assembling register has only its disconnect section operated, so that in this case the registration in such disconnect section is transmitted over both the disconnect and the answer multiples to the call or processing register. The relays within the register control circuit **21421** are the means for insuring that the information reregistered has been successfully and completely passed to the call or processing register.

Feature 12.—This feature has been set forth as comprising automatic means for adjusting the processing device so that tapes taken on different billing bases may be processed. Heretofore there were alternatives provided for processing tapes taken on either a six-round per month basis or a ten-round per mouth basis. But, these alternatives were semi-permanently established through soldered connections so that if a tape recorded on the basis of ten rounds per month were received at the accounting center then it would have to be processed on devices wired for such an arrangement and could not be processed on a device wired on the basis of six rounds per mouth. In accordance with the present arrangement tapes taken on either a six-round per month basis or a ten-round per month basis may be introduced into the device of the present invention and the device will be automatically adjusted in accordance with the tape identity information recorded in the end of the tape. Also in accordance with this invention any other billing basis could be used, the six- and ten-round arrangements being those generally acceptable in commercial practice but not being exclusive of other arrangements.

This feature is illustrated in a schematic circuit arrangement shown in Figs. 221 to 227, inclusive, arranged as indicated in the block diagram, Fig. 220. Further, by way of explanation, Figs. 228 and 229 are presented to explain the sequence of coded items of information. Fig. 228 shows the end of a tape recorded in a central office and Fig. 229 shows the end of a tape issued from the device of the present invention. In Fig. 228 the tape end shown is known as the trailing end of the central office tape since it is that portion that has been recorded just before the tape has been cut. Arrows at the top and bottom of this figure indicate the sequence in which the various items have been recorded and in which they will be read and it will be noted that the tape, when used as the incoming tape in the device of the present invention, is read in the opposite direction to that in which it was recorded. In Fig. 229 the leading end of a tape issued from the device of the present invention is shown and by the arrows located at the bottom of this figure it will be noted that the various items of information are recorded and read in the same sequence.

In the central office tape shown in Fig. 228 the first code read into the device of the present invention (after the reading of the splice pattern 081010, of course) is known as the 284 code labeled in this figure as Round and Marker Group. The information concerning the round is contained in the fourth digit (D) of this code and the marker group in tens and units is contained in

the fifth (E) and sixth (F) places of this code. In the next code above, the 283 code marked Day of Round and Month, the day of round is a single digit in the fourth (D) place and the month in tens and units occupies the fifth (E) and sixth (F) places. In the next code, the 280 code labeled Recorder Number, the fourth digit (D) is used as an indicator to note whether the recorder is a regular or an emergency machine and the recorder number itself in tens and units occupies the fifth and sixth places (E and F) of this code. The next code 285D00, labeled Special Codes, is one which may or may not be recorded in this central office tape end. If it is recorded, it is one of three codes 285500, 285600 or 285700 and this carries the information that a transfer or some other special condition is to be noted. We are not concerned with this code at the present but merely note that if it is recorded it comes in between the recorder number code (280) and the next or end-of-tape hour code (281). This end-of-tape hour code 2811EF notes the hour in tens and units in the fifth and sixth places of the code. Following this there is the 2821EF code in which the calendar day in tens and units occupies the fifth and sixth places of the code. Thereafter, there will be a long succession of call entries each being a specific item of information and interspersed among these codes is an occasional hour entry as indicated by the 2810EF code.

Since there may be within one marker group a number of recorders and since each recorder makes its own tape, then a number of tapes may be gathered together to carry the information for one or more billing periods or rounds. Each tape will have its own tape ends, and therefore, the recorder number may be different on each one as well as the round, the day of the round and the calendar day.

The device includes a bank of manual switches which must be set before a tape may be processed. These switches are set in accordance with information transmitted to the accounting center with the tape. When the tape is read the information in this tape end must check exactly with the setting of these switches. By way of example, the marker group tens switch may be set in any one of ten positions to indicate one of the digits 0 to 9. This marker group tens switch is shown in several places in this schematic diagram for convenience in explanation of the circuit details. It will, however, be understood that these various switches are all set by the same dial. For instance, the switches **22600**, **22601**, **22200** and **22100** all form part of the same marker group tens switch. Each has a numeral **1**, **2**, **3** and **4**, respectively, which indicates that these are blades **1**, **2**, **3** and **4** of the switch. In a similar manner other tape identity switches are numbered and scattered throughout the drawings for the purpose set forth.

When all of these manual switches have been set in accordance with the information transmitted with the central office tape and when this tape is introduced into the device as an incoming tape, these items of common information read from the tape are checked against the setting of the switches and thereafter the specific items of information comprising the data of the customer charges are read off and processed.

The device of the present invention will produce a plurality of outgoing tapes each one of which will have a series of common items of information recorded on its tape end as shown in Fig. 229. The first item of information is the "tape type index" in tens and units occupying the fifth and sixth places of this code. In the next item the "marker group" in tens and units occupies the fifth and sixth places of the code and will correspond exactly with the marker group identified in the tape end of Fig. 228. In the third and fourth lines the "first" and "last recorder," each in tens and units and occupying the fifth and sixth places of their respective codes, will run through in regular sequence from the lowest to the highest numbered recorder identified on the various sections of the incoming tape and will correspond exactly to the recorder numbers identified in the 280DEF codes of Fig. 228. The next code marked "Office" is a single digit code occupying the fifth place. The "thousands range" code carries the information in its fifth place identifying the first thousands and in its sixth place identifying the last thousands. This code is used in some cases where particularly heavy traffic is encountered and the codes are divided into thousands groups to be further processed on a plurality of like devices. The next "days of round" code 2897EF shows the days, first and last, of the round in two digits in the fifth and sixth places thereof. The next "tape section and round" code 2898EF has in its fifth place the number of the tape section and in its sixth place the number of the round. The last code 2899EF gives the information identifying the "month" by tens and units in its last two places. Thereafter a large number of call entries in the form of specific items of information will be given.

For purposes of illustration let us assume that two tapes are used as incoming tapes, each from a different marker group so that the different cross-connections indicated in Figs. 224, 226 and 227 may be shown as typical examples. The following table of assumed information will be helpful in understanding the next following descriptions:

Marker Group	00	01
Number of Rounds per Month	10	6
Round	2	4
Day of Round	2	3
Calendar Day	08	23
Tape Type (MU Output)	11	11
Number of Offices	7	4
Sorting	SBO	SBOUT

11—MU type tape, office sorted.
SBO—sort by calling offices.
SBOUT—sort by calling offices and type of MU.
Rounds—first to tenth are represented by respective single digits 0 to 9; i.e., Round 2 is the third round, and round 4 is the fifth round, etc.

Cross-Connections	Marker Group	
	00	01
Fig. 224	10	6
Fig. 226	4T-MO	2T-MO
Fig. 227	A7P	A4P
Number of MU Perforators	7	8

(4T, 2T-MO—four MU types and two MU types, multioffice—assumed.)

The tape identity information perforated in the first of these tapes will be as follows (read downwardly):

284200 Round 2, marker group tens 0, units 0
283209 Day of round 2, month 09 (September)
280603 Emergency (6), recorder 03
281103 End-of-tape hour 03 (3 a.m.)
282108 Calendar day 08

When such a central office tape is placed in the reader of the present device, the set-up switches will be set as follows:

Marker group ---------- Tens 0, units 0.
Sort ---------- SBO (sort by office).
First recorder ---------- Tens 0, units 0 } assumed.
Last recorder ---------- Tens 0, units 5 }
Month ---------- Tens 0, units 9.
Day of round ---------- First 1, last 3.
Round ---------- First 0, last 2.

With these set-up switches so adjusted, the tape identity of the incoming tape will be read and properly checked

and the tape identity codes on the end of an outgoing tape will be perforated as follows:

289111 Tape type index 11 (MU tape office sorted)
289200 Marker group 00
289300 First recorder tens 0, units 0
289405 Last recorder tens 0, units 5
289550 Office 5 (one of seven)
289609 Thousands range (complete)
289713 Day of round, first 1, last 3
289812 Tape section 1, round 2
289909 Month 09

In like manner the data for the second example will be as follows. The tape identity of the incoming central office tape will be:

284401 Round 4, marker group tens 0, units 1
283309 Day of round 3, month 09
280504 Regular (5), recorder 04
281103 End-of-tape hour 03
282123 Calendar day 23

The set-up switches will be adjusted as follows:

Marker group ---------- Tens 0, units 1.
Sort ---------- SBOUT (sort by office and type of MU).
First recorder ---------- Tens 0, units 0.
Last recorder ---------- Tens 0, units 5.
Month ---------- Tens 0, units 9.
Day of round ---------- First 1, last 5.
Round ---------- First 4, last 5.

With these set-up switches so adjusted, the tape identity of the incoming tape will be read and properly checked and the tape identity codes on the end of an outgoing tape will be perforated as follows:

289111 Tape type index 11 (MU tape office sorted)
289201 Marker group 01
289300 First recorder tens 0, units 0
289405 Last recorder tens 0, units 5
289530 Office 3 (one of 4)
289609 Thousands range (complete)
289715 Day of round, first 1, last 5
289814 Tape section 1, round 4
289909 Month 09

In the first instance, the marker group tens switches **22100, 22200, 22600** and **22601** will be set to represent 0 and the marker group units switches **22101, 22102, 22103, 22201, 22602** and **22603** will be set to represent 0. The last day of round switches **22604, 22605** and **22300** will be set to represent 3 and the first day of round switches **22606** and **22607** will be set to represent 1. Lastly, the last round switches **22608, 22609** and **22301** will be set to represent 2.

The semipermanent cross-connections from the marker group 00 terminals in each of the cross-connecting frames will be as follows: in Fig. 224 to the 10 terminal leading to the winding of the **10**R relay **22400**; in Fig. 226 to the terminal 4T–MO leading to the left-hand winding of the 4T relay **22610**; and, in Fig. 227 to the A7P terminal leading to the winding of the A7P relay **22700**. Through marker group tens switch **22100**, the MT0 relay **22104** will be operated, whereby the marker group wires **00** will be grounded over cable A to Fig. 224 thus to operate the **10**R relay **22400**, over cable C to Fig. 226 to the **4**T relay **22610** and over cable B to Fig. 227 to the A7P relay **22700**. These connections, resulting in the operation of these relays, become effective when the device has been started and when the off-normal grounds have been established, such as the off-normal grounds indicated as connected to the switch arms **22100** to **22103**, inclusive.

The FI relay **22202** is normally operated from ground, over contact **2** of the MONB master off-normal relay **22302**, conductor **22203** thence through contact **2** of the ER relay **22303**, and over the FI conductor **22304** to cause the operation of this FI relay **22202**. Upon the operation of the start key (not shown), a ground is placed on the FIL lock conductor **22203**, shown here as connected to contact **1** of the FI relay **22202**. Upon the operation of the master off-normal relay (not shown), this ground is permanently connected to this FIL lock conductor **22203** so that upon the operation of MONB relay **22302**, when the original ground supplied thereby is removed from the conductor leading to contact **2** of the ER relay **22303**, a ground will be returned through contact **1** of the FI relay **22202**, over the FIL conductor **22203**, through contact **2** of the ER relay **22303** to the conductor **22304** leading to the winding of the FI relay **22202**. Thus, the FI relay **22202** remains locked under the control of the ER relay **22303**.

Through the operation of the FI relay **22202** an off-normal ground is extended over contact **3** thereof, STDP conductor **22204** and thence in a parallel circuit through the contact of the LR relay **22305** and the contact of the LDR relay **22306**, thence through the contact of the STP stepping magnet **22307** of the day progress switch (Fig. 223) to the winding of the DPS1 relay **22308**. The DPS1 relay **22308** operates, and through its contacts **1** and **2** operates the STP stepping magnet **22307**. This in turn opens the winding of the DPS1 relay **22308** so that the STP stepping magnet **22307** is first energized and then deenergized. Upon the deenergization of the STP stepping magnet **22307**, the six switch wipers shown in a vertical row at the left of this Fig. 223 are moved one step in a clockwise direction. Upon the movement of the switch arm **22309** to its second contacts, an off-normal ground will be extended over contact **1** of the OPR operate magnet **22310**, thence to the winding of the FA relay **22311** which operates and, through its contact **2**, now locks through contact **1** of the LA relay **22312** to an off-normal ground. The FB relay **22401** is connected in parallel with the FA relay **22311** over conductor **22322** and thereupon operates at this same time. The FB relay **22401**, through its right-hand contact, extends the ground, which operated the **10**R relay **22400** to the winding of the **10**RF relay **22402** to operate same.

When the STP stepping magnet **22307** has returned to normal, it will close the circuit for the DPS1 relay **22308** so that the operation of the stepping magnet as described will be repeated. In this manner, an automatic operation of the stepping magnet will take place so that the six wipers of this day progress switch will automatically step in a clockwise direction until both the LR relay **22305** and the LDR relay **22306** become operated to stop this movement. In general, it may be noted that this day progress switch will operate in some cases to come to a stop during a first revolution and in other cases will go through a complete sweep over all the contacts and then come to a stop some time in a second sweep. The FA relay **22311** will be operated during the first movement of the switch arms and the LA relay **22312** will be operated during the second movement thereof.

In the example now being described where the first round is 0 (first round) and the last round is 2 (third round), the last round switch **22301** will be set with its switch arm on its No. **2** terminal and thereby extending the winding of the LR relay **22305** over a conductor R2 over cable R into Fig. 225 to a contact of the R2 relay **22500** such that the LR relay **22305** will operate when the R2 relay **22500** operates. Likewise, since the days of round are 1 and 3, the last day of round switch **22300** will be set on its No. **3** terminal, thereby extending the winding of the LDR relay **22306** over a DR3 conductor **22406** over cable DR to Fig. 224 to contacts of the LB relay **22404** and the FB relay **22401** such that if contact **3** or **4** of the FB relay **22401** or contact **2** of the LB relay **22404** are grounded the LDR relay **22306** will operate.

Below is a table entitled "Setting day progress switch,"

which is a complete table of connections of the day progress switch shown in Fig. 223. The combination of the settings of the last day of round and last round set-up switches are used to determine the position of the day progress switch at the beginning of processing any central office tape. The day progress switch must, therefore, be set in the proper position at the start of processing. The table below shows the position of the day progress switch for each calendar day of the month for either a six or a ten round month.

SETTING DAY PROGRESS SWITCH

Day Progress Switch Position	Calendar Day (F)	Calendar Day (L)	10R Day of Round		10R Round		6R Day of Round		Round	
			(F)	(L)	(F)	(L)	(F)	(L)	(F)	(L)
1	22		1		7		2		4	
2	21	31	3	4	6	9	1	6	4	5
3	20	30	2	3	6	9	5	5	3	5
4	19	29	1	2	6	9	4	4	3	5
5	18	28	3	1	5	9	3	3	3	5
6	17	27	2	3	5	8	2	2	3	5
7	16	26	1	2	5	8	1	1	3	5
8	15	25	3	1	4	8	5	5	2	4
9	14	24	2	3	4	7	4	4	2	4
10	13	23	1	2	4	7	3	3	2	4
11	12	22	3	1	3	7	2	2	2	4
12	11	21	2	3	3	6	1	1	2	4
13	10	20	1	2	3	6	5	5	1	3
14	9	19	3	1	2	6	4	4	1	3
15	8	18	2	3	2	5	3	3	1	3
16	7	17	1	2	2	5	2	2	1	3
17	6	16	3	1	1	5	1	1	1	3
18	5	15	2	3	1	4	5	5	0	2
19	4	14	1	2	1	4	4	4	0	2
20	3	13	3	1	0	4	3	3	0	2
21	2	12	2	3	0	3	2	2	0	2
22	1	11	1	2	0	3	1	1	0	2

As these switch arms move in their clockwise direction and when they have reached their fourteenth terminals, the day of round switch arm **22314** will extend a ground over the DR9 conductor leading over cable DR into Fig. 224 to an armature (not shown, but indicated between armatures 7 and 8) of the 10R relay **22400**, the contact of which is connected to the conductor leading to armature 3 of the FB relay **22401**, thence through contact 3 thereof over the day of round conductor **22406** and over cable DR to Figs. 225 and 223 to operate the DR3 relay **22501** and to extend through the last day of round switch arm **22300** to operate the LDR relay **22306**. The round switch arm **22313** will likewise extend a ground over the R9 conductor leading over cable R to Fig. 224 to an armature (not shown, but indicated between armatures 11 and 12) of the 10RF relay **22402**, the contact of which is connected to the conductor **22405** which leads over cable **22409** to Fig. 225 to the winding of the R2 relay **22500**, which, in operating as above explained, operates the LR relay **22305** through the last round switch **22301**.

Thus, when the day progress switch of Fig. 223 reaches a position indicating 3 as the last day of round and 2 as the round in a ten-round month, the circuit for the stepping magnet **22307** is broken and the switch comes to a halt on its fourteenth terminal which then represents the last day of the last round as specified on the set-up switches.

It is assumed, however, hereinabove that the particular section of tape now incoming to the reader is one for the second day of this round and not the third or last day. In Fig. 222 there is a number of relays marked CL4, CL3, CL0, CL1 and CL2, each of which will respond when the 284, 283, 280, 281 and 282 codes, respectively, are being read. As the tape identity of this new tape is being read, the day of round 2 does not correspond to the day of round indicated by the day progress switch which is now set at 3 as the day of round. Therefore, a DCDR relay **22205**, whose function is to detect an expected change in the day of round, operates during the checking of the 283 code. Correction of this detected change, however, is delayed for purposes which will appear hereinafter until the last code is read. During the reading of the next to last code, that is, the 281103 code, the CL1 relay **22206** will operate and among its duties will be that of extending a ground through the contact of the DCDR relay **22205**, thence over conductor **22207** to operate the DPS day progress switch relay **22315**. This relay in turn extends the ground from conductor **22207**, over its contact, to the winding of the DPS1 relay **22308** to cause this relay to operate and in turn to operate the STP stepping magnet **22307**. Then, upon the checking of the last or calendar day code the CL1 relay of Fig. 222 is released, in turn releasing the DPS relay **22315** and the DPS1 relay **22308**, thus allowing the day progress switch of Fig. 223 to step one terminal further. Thus the switch has reached its fifteenth terminal wherein the R8 conductor and the DR8 conductor are grounded, thereby indicating the round as 2 and the day of round as 2.

It may also be noted that through the operation of the FA relay **22311** and the fact that the switch arm **22317** and the switch arm **22318** are set on their fifteenth terminals, the tens code through contact 6 of the FA relay **22311** is expressed over cable T and the T0 conductor to operate the DT0 relay **22319** in the day register of Fig. 223 and the No. 8 conductor in the units group is grounded over cable U to express the value 8 and to operate the DU8 relay (not shown) in the day register of Fig. 223. Grounds are extended to the tens and units switch arms **22317** and **22318** by the DRS relay **22320**, which is operated under conditions with which we are not at present concerned.

When the day progress switch of Fig. 223 moves forward one step as above described, the R2 relay **22500** will remain operated, but the DR3 relay **22501** will release and the DR2 relay (not shown in Fig. 225) will be operated. These relays in the round translator and the day of round translator of Fig. 225 will extend connections from the contacts thereof to the D digit connections over cables D and DEF of Figs. 225, 226 and 227 for the perforators indicated in Fig. 227 when some one of the common pattern connector relays indicated in Fig. 226 become operated. Thus, by way of example, when the output straddle tape is being formed, the **284** relay **22611** will be at one time operated to form the pattern for this line. At that time the PD0 and PD1 conductors, grounded by certain contacts in the reader of Fig. 222, will extend grounds over the RA and RB conductors leading over cable **22613** and through contacts of the R2 relay **22500**, thence over cables D and DEF to Fig. 227 and through the D digit perforator magnet check relays, indicated by the rectangle **22703**, thence

through the D digit contacts of one of the perforator-connector relays to the D digit magnets of the selected perforator.

It may be noted here, but will be more fully explained hereinafter, that with the marker group set-up switches set to indicate the marker group 00, the 4T relay **22610** will be operated and that the A7P relay **22700** will likewise be operated. It has been set forth hereinabove that the number of offices in the marker group 00 is seven and that since the sorting is to be by office, it is appropriate that seven perforators will be used. Thus, the operation of the A7P relay **22700** will determine that the first seven of the message unit perforators will be employed.

Thus, it will be seen that with the marker group switches set to express the value 00 the circuits are adjusted, particularly by the operation of the **10**R and **10**RF relays **22400** and **22402** in Fig. 224, to express proper values in accordance with the ten-round month.

In order to further illustrate the automatic adjustment of these circuits, it may now be assumed that the second of these tapes will be used as an incoming tape. In this case, the set-up switches will be adjusted to express the marker group 01, the sort SBOUT (that is, sort by office and type of message unit calls) the first recorder as 00, the last recorder as 05, the month as 09, the day of round first 1, last 5 and the round first 4, last 5.

In accordance with the cross-connections shown in Figs. 224, 226 and 227, the marker group switches, when set to the value 01, will cause the operation of the **6**R relay **22403**, the **2**T relay **22612** and the A8P relay **22701**. It will appear that the cross-connection in Fig. 227 leads over the A4P conductor, but since the **2**AP relay **22702** will be operated, this will ground the A8P lead to the winding of the A8P relay **22701** (the latter because of the operation of the **2**AP relay **22702** from the operated **2**T relay **22612**).

In this case, the day progress switch of Fig. 223 will be set in motion in the same manner as that heretofore described. However, and in accordance with the above table, it will appear that the last round switch **22301** should be set on its R5 terminal and that the last day of round switch **22300** should be set on its DR5 terminal. No combination of this kind is detected during the first complete movement of the switch arms of the day progress switch. However, during this revolution the R5 relay in the round translator will have operated and this will extend an off-normal ground from contact **4** of the F1 relay **22202** over conductor **22208** and the bottommost contact of the **6**R relay **22403**, over conductor **22410** and contact **1** of the R5 relay of Fig. 225 and over conductor **22505** to the winding of the OPR mechanical interlock relay **22310**. This relay operates its armatures which thereupon mechanically remain locked in that position under control of the RLS magnet **22321**. When the day progress switch arms reach the position shown, the ground through contacts of the LR and LDR relays **22305** and **22306** is augmented by an off-normal ground from the switch arm **22309**, through contact **7** of the FA relay **22311**. Thus, the day progress switch is impelled forward to its second contact, whereupon the ground on switch arm **22309** is now extended over contact **2** of the OPR relay **22310** to cause the operation of the LA relay **22312**. This relay breaks the locking circuit of the FA relay **22311**. When this FA relay **22311** is fully released, it establishes a similar locking circuit for the LA relay **22312**. In a manner like that hereinbefore noted, the LB relay **22404** will also be operated in parallel with the LA relay **22312**.

Now as the switch arms of the day progress switch in their second revolution reach their No. **3** terminals, ground will be extended by the round switch arm **22313** and the day of round switch arm **22314** over contacts **3** and **18** of the **6**R relay **22403**. The ground extended over contact **3** of the **6**R relay **22403** is now extended over conductor **22407**, thence over contact **8** of the LB

relay **22404**, to the RD4 conductor **22408** serving to operate the R4 relay **22504**, which extends ground through the last round switch **22301** to operate the LR relay **22305**. The ground extended over contact **18** of the **6**R relay **22403** will extend over the DR5 conductor to operate the DR5 relay **22503**, and will extend through the last day of round switch **22300** to operate the LDR relay **22306**. Thus, the day progress switch comes to rest in its No. 3 position in its second revolution to express the last round as 4 and the last day of round as 5.

However, the particular tape now being processed, by way of example, will express the round as 4 and the last day of round as 3. In a manner similar to that hereinbefore described, and during the reading of the tape information, the day progress switch will be impelled forwardly one step at a time until it finally comes to rest in its tenth position in which the round is expressed as 4 and the day of round as 3. The calendar day will then be expressed over the units and tens switch arms **22318** and **22317**, respectively, as 23, that is, the tens digit for the calendar day will be expressed by a ground extended over contact **5** of the LA relay **22312** to the T2 conductor to operate the DT2 relay (not shown in Fig. 223). In like manner, the units switch arm **22318**, resting in its tenth position, will ground the No. **3** conductor leading to the DU3 relay (not shown in Fig. 223) in the day register, so that the calendar day 23 is properly expressed.

The R4 relay **22504** and the DR3 relay **22501** in the round translator and the day of round translator, respectively, will be operated so that proper information may be expressed in the perforation of other output tapes.

It will thus be seen that when the marker group set-up switches are adjusted to express the marker group 01 that the circuits will be automatically adjusted to the connections necessary for a six-round month in which each round contains five days.

Feature 13.—This feature has been stated hereinbefore as the provision of means whereby a tape made of many sections and covering a plurality of rounds and each round of a plurality of days may be processed. This feature will be explained by the schematic circuit diagram of Figs. 231 to 235, inclusive, arranged as indicated in the block diagram of Fig. 230. By way of example, we will assume that a tape taken from a marker group (such as group 00) arranged for accounting on a ten-round-per-month basis (three-day rounds) is used and that this tape will cover a period for the first nine days of the month of March. This means that the tape will cover three rounds, namely, round 0, round 1 and round 2 with three days in each round and thus will cover the business for the first to the ninth of March, inclusive. In accordance with this assumption then, the set-up switches may be as follows:

Marker group	Tens 0, units 0.
Sort	SBO (sort by office).
First recorder	Tens 0, units 0.
Last recorder	Tens 0, units 2.
Month	Tens 0, units 3.
Day of round	First 1, last 3.
Round	First 0, last 2.
Straddle class	SIE (Spliced-in emergency).
Emergency—previous	Off.
Emergency—current	Tens 0, units 2.

It may be explained here briefly that there are two methods of handling straddle calls, one of which is known as the spliced-in-emergency method. If the device is to be operated under this method it means that wherever a regular recorder has been temporarily taken out of service and the emergency recorder is operated in its stead, the section of tape produced by the emergency recorder will be spliced into the tape produced by that regular recorder so that one section of tape may actually consist of several sections produced by the regu-

lar recorder and by the emergency recorder. If, by way of example, the emergency recorder is actually in use at one of the cutting periods, then the section of tape provided for the regular recorder will either end or begin with a part of the tape produced by the emergency recorder. We will assume that the emergency recorder is in operation in place of the regular recorder 02 at the current cutting period and, therefore, that the section of tape appearing in the following table and relating to recorder 02 will consist of at least a section of tape produced by the emergency recorder followed by the tape produced by the regular recorder 02. A set-up switch is provided to adjust the circuits to accept this situation without disturbing the sequence of operations of the day progress switch and the recorder progress switch.

Under the above assumptions, there will be twenty-seven sections of tape spliced together in accordance with the following table to form a single incoming tape for the device. Although, theoretically, there will be but three sections of tape, one from each of the three recorders, it will be considered that there are twenty-seven sections in all since the tape, even though remaining uncut, is prepared for cutting each day at 3 a.m. Therefore, since each recorder tape contains the records for nine days' business, there will be nine sections in such tape. This tape will be read in the following order:

Tape Section	Round 284	Day of Round 283	Recorder 280	Calendar Day 282
1	2	3	00	09
2	2	2	00	08
3	2	1	00	07
4	1	3	00	06
5	1	2	00	05
6	1	1	00	04
7	0	3	00	03
8	0	2	00	02
9	0	1	00	01
10	2	3	01	09
11	2	2	01	08
12	2	1	01	07
13	1	3	01	06
* * *	*	*	*	*
17	0	2	01	02
18	0	1	01	01
19	2	3	02	09
20	2	2	02	08
* * *	*	*	*	*
27	0	1	02	01

Certain of the set-up switches are shown in Figs. 233 and 235 and below each and to the left there is a caption "Set 1, Set 2," etc., to indicate the effective positions to which these switches are set in accordance with the above tape.

Fig. 233 also shows certain portions of the day progress switch described in somewhat more detail in accordance with the previous Feature 12. The previous description shows the manner in which such relays as the **6**R relay **23300**, the **10**R relay **23301**, the **10**RF relay **23317** and the **10**RL relay **23302** were operated in accordance with the setting of the marker group set-up switches. These details are omitted here and only the connections pertinent to the present description are included.

A similar stepping switch known as the recorder progress switch is shown in Fig. 234 so that the present following descriptions will be an account of how these two switches keep track of the progression of recorders from the last recorder 02 to the first recorder 00 and of days from the last day 3 of the last (third) round 2 to the first day 1 of the first round 0.

In accordance with the description of the previous Feature 12 and in accordance with the table of positions of the day progress switch set forth in connection with that previous description, this switch will assume a position on its No. 14 terminal upon the reading of the tape information of the first section of tape where it will denote the round 2 and day of round 3. Consequently, the R2 relay **23500** and the DR3 relay **23501** will be operated. After this first section of tape is processed, then the No. 2 section will be processed. There is no change in recorder number, but there is a change in the information regarding the day of round. The stepping of the recorder progress switch will be set forth in detail hereinafter in connection with other features.

When the second section of tape comes to the reader **23100**, the tape identity information is read off. Upon the reading of the first line 284200, the round and marker group are found not to have changed and so the reader is stepped to the second line. Upon the reading of the second line, which in this instance will be 283202, showing the round to still be 2 and the day of round to be 2, a circuit will be established from the D reading relays, herein represented by the D**0** relay **23106**, over cable D**23107** to Fig. 235 and over the D**2** conductor **23502** through contact **1** of the DR**2** relay **23503**, contact **2** of the operated DR**3** relay **23501**, the conductor C**23504**, through contact **3** of the L**3** relay **23505**, to the winding of the DCDR (detects change in day of round) relay **23506** to battery. The L**3** relay **23505** is operated when the 283DEF code is read by the reader **23100**. The DCDR relay **23506** operates and locks in a circuit with which we are not concerned at the present time. However, as the reader **23100** continues to read the tape information the CL**1** relay **23507** will become operated on the 281DEF code carrying the information of the end-of-tape hour. This will establish a circuit from ground, contact **2** of the CL**1** relay **23507**, contact **1** of the DCDR relay **23506**, conductor **23508**, to the winding of the DPS relay **23303**, which, in operating, extends its operating ground over its contact to cause the operation of the DPS**1** relay **23304**. This relay, in operating, extends a ground to the STP stepping magnet **23305** which operates but does not as yet move the wipers of the day progress switch forward. When the reading of the 281DEF code has been completed properly, the reader **23100** steps the tape forward and encounters the 282DEF code, in this case 282108. As the CL**2** relay **23509** operates in response to the reading of this last line, the CL**1** relay **23507** releases, which thereupon releases the DPS relay **23303**, in turn releasing the DPS**1** relay **23304**, so that the STP stepping magnet **23305** in turn becomes released. The STP magnet **23305**, in releasing, moves the wipers of the day progress switch of Fig. 233 forward from their fourteenth to their fifteenth position wherein the round is noted as 2 and the day of round is noted as 2.

Upon the reading of the tape information of the third section, where the day of round changes from 2 to 1, the day progress switch of Fig. 233 will be stepped forwardly again in a similar manner. After three sections of the tape have been read and the tape information for the fourth section is encountered in the reader, then the day of round changes from 1 to 3 and the round changes from 2 to 1. In this instance, the D digit of the 283DEF code will be 3 and, therefore, the D**3** conductor **23510** out of cable D**23107** in Fig. 235 will be grounded and this will extend a ground over contact **1** of the DR**3** relay **23501**, the conductor R**23518** over cable **23519** to Fig. 233, to the lower contact of the **10**R relay **23301**, the **10**R**23317** conductor and over cable **23519** to Fig. 235, the conductor **10**R**23317**, through contact **2** of the DR**1** relay **23511** (now operated because the day progress switch is still on its sixteenth position where the day of round is noted as 1), thence over the C**23504** conductor, contact **3** of the L**3** relay **23505**, to the winding of the DCDR relay **23506**. This relay operates with the same results heretofore noted.

It thus appears that in accordance with the setting of the various set-up switches, the relays of the day of round translator, indicated at the left of Fig. 235, will be operated in such a manner that the regular succession of days of round beginning with the last day of the last round through to the first day of the first round will

have the effect of stepping the day progress switch of Fig. 233 one step ahead at each change in the day of round so that a correct record of the day of round and of the calendar day will be kept in the device at all times.

In further explanation of this feature, let us assume that the set-up switches are set as follows:

Marker group	Tens 0, units 0.
Sort	SBO.
First recorder	Tens 0, units 0.
Last recorder	Tens 0, units 1.
Month	Tens 0, units 2.
Day of round	First 3, last 1.
Round	First 7, last 9.

This will produce ten sections of tape in the following order:

Tape Section	Round 284	Day of Round 283	Recorder 280	Calendar Day 282
1	9	1	00	28
2	8	3	00	27
3	8	2	00	26
4	8	1	00	25
5	7	3	00	24
6	9	1	01	28
7	8	3	01	27
8	8	2	01	26
9	8	1	01	25
10	7	3	01	24

It may be noted that as the leading end of the tape identity of the fifth section of this tape is read, the 284DEF code will now carry the information that the round is No. 7, that is, the first round. Since the **R8** relay (not shown) in the round translator (upper left-hand corner of Fig. 235) is operated at this time and the **D7** conductor is grounded, a circuit will be established to ground the C conductor leading through contact **2** of the **L4** relay **23516**, and thence to the winding of the DCR relay **23515**. (The **L4** relay **23516** is operated when the 284DEF code is read by the reader.) This registers the fact that a change in the round number has been detected.

On the reading next of the 283DEF code, a circuit will be established from the **D3–23510** conductor through contact **1** of the **DR3** relay **23501**, the **R23518** conductor, leading through the lower contact of the **10R** relay **23301**, the **10R23317** conductor, contact **2** of the **DR1** relay **23511** (operated because the previous day of round was 1), over the **C23504** conductor, now through contact **3** of the **L3** relay **23505** and the winding of the DCDR relay **23506** to battery to cause the operation of this relay to establish the fact that a change in day of round number has been detected. The ground extended to the winding of the DCDR relay **23506** is also extended through its contact **3**, contact **1** of the **L3** relay **23505**, to the RS conductor, which causes the reader to step and to attempt to read the next or 280DEF code. It is thus normal to have the day of round change from 1 to 3 where the marker group is such as to call for a ten-round month.

When the 283DEF code is thus read and the day of round is of such nature that the DCDR relay **23506** is operated, then the reader is advanced, the 280DEF code is read and the recorder number is compared to the previously registered recorder number. This comparison being proper, the RS lead coming from contact **1** of the UA relay **23206** is grounded and the reader will step forward to read the 281DEF code, which, in time, will cause the operation of the **CL1** relay **23507**. This, as explained hereinbefore, will close a circuit through contact **1** of the DCDR relay **23506** to advance the day progress switch of Fig. 233. When this has been done, then the FR relay **23308** will be operated through the first round switch arm **23310**, and in turn

the FDR relay **23309** will be operated through the first day of round switch arm **23311**.

Now, when section 6 of the tape is read upon the reading of the 284DEF code, the value **9** of the D digit will appear and, since this is the last round, the ground will be extended over the **9** conductor out of cable **D23107** in Fig. 233, the last round set-up switch **23312** through contact **1** of the FR relay **23308**, conductor **23313**, to the winding of the RLR relay **23513**. Immediately following thereafter, the 283DEF code is read, and in this case, the day of round (of the D digit) value is 1 and, since this is the last day of the last round, this value 1 will cause a ground to be extended over the **1** conductor out of cable **D23107** through the last day of round switch arm **23314**, contact **1** of the FDR relay **23309**, conductor **23315**, contact **1** of the RLR relay **23513**, to the winding of the RLDR relay **23514**. Upon the operation of this relay, a ground will also be extended over the **D1** conductor out of cable **D23107** in Fig. 235, through contact **1** of the **DR1** relay **23511**, contact **3** of the **DR2** relay **23503** (the **DR3** relay **23501** is the one which is operated at this time because the last day of round noted was 3), the **NC235** conductor, contact **4** of the **L3** relay **23505**, contact **2** of the RLDR relay **23514**, thence through contact **1** of the **L3** relay **23505**, to the RS reader step conductor. This is in the nature of a satisfaction signal and, by causing the reader to step, will be instrumental in maintaining the complete automatic operation of the device.

It thus appears that this feature provides for the complete and automatic check and count of the number of sections in a tape starting with any given round and day of round and extending to any other given round and day of round. Under ordinary circumstances in this operation, the transition from 1 to 3 in the day of round is normal and will be handled through the DCDR relay **23506**. The RLDR relay **23514**, however, which becomes operated when the first round and first day of round have been encountered, provides a path to the reader step conductor only under the condition encountered (i.e., transition from 3 to 1 in the day of round). As will be more fully explained in the following feature, the operation of the RLR relay **23513** and of the RLDR relay **23514** will permit the further stepping of the reader upon a proper change in recorder number.

Feature 14.—This feature has been set forth hereinbefore as a means for insuring, when a change in recorder number occurs, that the accompanying information regarding the round and day of round is at the beginning of the cycle or, in other words, that the round and day of round as read indicate the last day of the last round defined by the setting of the set-up switches. In the previous Feature 13, a table is given setting forth twenty-seven sections of a tape used as an input to the assembler-computer, in which tape it will be noted that the recorder No. 00 remains constant through the first nine sections and changes to the recorder No. 01 in the tenth section. It may also be noted here that in the tenth section the round changes back to 2 (the last round) and the day of round changes back to 3 (the last day of round) as set up on the set-up switches of Fig. 233.

The movement of the day progress switch of Fig. 233 to its first set position, in which the relays in the round translator and the day of round translator of Fig. 235 will indicate the last round and the last day of round, has been set forth hereinbefore. At the time that processing has been started, the recorder progress switch, shown in Fig. 234, will similarly be moved to its first position. Upon the operation of the off-normal and start circuit, the **ST4** relay **23400** will become operated and through its contact **2** will extend a ground over conductor **23423** into Fig. 235, thence through the contact **2** of the normally operated relay FI, conductor STRP back into Fig. 234, and thence through the contact

of the FRS relay **23401**, thence through the interrupter contact and the winding of the STP stepping magnet **23402**. As long as the FRS relay **23401** remains unoperated, this circuit will be effective and the stepping magnet **23402** will cause the wipers of the recorder progress switch to move forward step by step. Without going into too many details, it may be noted that when the wipers of this switch reach their second position, a circuit will be established from ground, the No. 1 wiper **23403**, the second contact thereof, the **U0** conductor and over cable **U234** to the first recorder units switch (which has its wiper **23306** set upon the contact to which the **U0** conductor is connected), thence to the wiper **23307** of the first recorder tens switch, the first contact thereof to the **FT0** conductor, over cable **FT233**, thence through contact **2** of the SIE relay **23406** (operated from ground on the wiper of the straddle class switch of Fig. 233 set on its first terminal), the second terminal on which the wiper **23404** is now resting, the winding of the FRS relay **23401**, contact **3** of the MONB master off-normal relay **23405**, to battery. Thus as the wipers of the recorder progress switch of Fig. 234 reach their second position, corresponding to recorder No.00, they will come to rest. The **RT0** relay **23407** will be operated through the wiper **23408** and a ground will be extended by wiper **23409**, over the **00** conductor and cable **RN234** into the recorder register in Fig. 232, where it appears at armature **4** of the **U0** relay **23214**.

Let us now assume that the first section of this tape has been completely processed and that the identity information of the second section is being read. As set forth hereinbefore, the succession of the codes read will be the 284, the 283, the 280, the 281, and lastly the 282 code. Thus, the round will be maintained at 2, the day of round will be changed from 3 to 2 and the day progress switch of Fig. 233 will be advanced. Code 280 will now be read and the recorder number 00 will appear. At this point, the RC recorder compare relay **23101** will be operated so that this recorder number now being read can be compared to the previously registered recorder number. When the 280 code is read, the **CL0** relay **23517** cannot operate until the reader step circuit is pulsed and, therefore, the **CL3** relay **23512** remains operated. Hence, a circuit will be established from ground, through the reader up-check circuit, and thence through the lower contact of either the **SR1E** relay **23102** or the **SR10** relay **23103** (the even and odd relays in the reader step and line count circuit), thence over the UC conductor to Fig. 235 and over the contact of the TI tape identity relay **23518**, to the armature and lower contact of the **CL3** relay **23512**, thence over the **280** conductor, contact **4** of the RDC (register down-check relay **23201**), the RC conductor over cable **R232** to Fig. 231 to the winding of the RC relay **23101**. The TI tape identity relay **23518** is operated during the reading of tape identity groups. The **CL3** relay **23512** is not effectively released until this comparing operation has been completed, as will appear from the complete circuit description hereinafter. Through the contacts of the RC relay **23101**, the D, E and F digits of this 280 line will be transmitted as follows: The D digit, which may be any one of the values 5, 6, 7 or 8, will, in this instance, be 5 denoting a regular recorder in a central office tape and hence the value 5 will be transmitted over the **CC5** conductor and cable **C231** to Fig. 232 to armature **2** and **3** of the **C5** relay **23202**. Since the recorder No. 00 noted in the first tape section was also a regular recorder, this **C5** relay **23202** will have been operated and hence the ground on the **CC5** conductor will now be extended over contact **3** thereof and the CA conductor to operate the CA relay **23203**.

The E and F digits will be 00 and hence the **CT0** lead will be extended over cable **C231** to armatures of the **T0** relay **23215** and the **CU0** lead will be extended over cable **C231** to armatures of the **U0** relay **23214**. Since both of these relays have been heretofore operated to record the recorder No. 00, the ground on the **CT0** lead may be traced over contact **2** of the **T0** relay **23215**, the TA conductor, to the TA relay **23205** and the ground on the **CU0** conductor will be traced through contact **2** of the **U0** relay **23214**, the UA conductor, to the UA relay **23206**. Thus, with the CA, the TA and the UA relays **23203**, **23205** and **23206** respectively operated, a circuit from ground on the armature of the NRP relay **23207** may be traced in series through armatures and contacts of all these relays starting with the NRP relay **23207** at the left and ending with the UA relay **23206** at the right, over the RS conductor, over cable **R232** to Fig. 231, through a contact of the RC relay **23101**, to the RS reader step relay **23104**. It will thus be seen that when the RC recorder compare relay **23101** operates and the number now being read compares exactly with the number previously registered, the RS reader step relay **23104** is operated to advance the operations of the reader **23100**.

It may now be noted that the day progress switch of Fig. 233 will step forward for each of the first nine sections of the tape so that the tenth section is approached in an orderly manner. On reading the leading tape identity of section 7, where the first round 0 appears, the **284** code will cause the operation of the DCR relay **23515** in the manner hereinbefore noted. Following this, the 283 code will cause the operation of the DCDR relay **23506**. Later, through the operation of the **CL1** relay **23507** and the **CL2** relay **23509**, the day progress switch of Fig. 233 will be stepped forward.

As soon as the day progress switch steps to its next position the FR (first round) relay **23308** will be operated from the upper day progress switch wiper, through the first round switch wiper **23310** and the winding of the FR relay **23308**. The FR relay **23308** locks through its contact **3** to the FDRL conductor, which may be traced through contact **9** of the RR recorder register connector relay **23105**, to a MON ground supplied over the contact of the MONC master off-normal relay **23420**.

Thereafter, the day progress switch moves forward step by step in the normal manner. When tape section 9 is reached, however, and the day progress switch is moved on to the position where it indicates the day of round as 1. Then a ground is supplied through the lower wiper of the day progress switch, and thence over the **DR1** lead, through a contact of the operated LOR relay, and through the first day of round switch **23311** and contact **2** of the FR relay **23308** to cause the operation of the FDR relay **23309**. This relay operates and locks also to the locking ground on conductor FDRL.

On reading the leading tape identity of section 10 the reading of the 284 code will cause the operation of the RLR relay **23513** through the last round switch **23312** and contact **1** of the first-round FR relay **23308**, as heretofore described, the next reading of the 283 code will similarly operate the RLDR relay **23514**. In this particular case the **D3** conductor is grounded and, hence a circuit is established over contact **1** of the **DR3** relay **23501**, the **R23518** conductor, cable **23519**, through the contact of the **10R** relay **23301**, the **10R23317** conductor, thence back over cable **23519** and through contact **2** of the **DR1** relay **23511** (now operated because the last reading of the day of round was 1), over the **C23504** conductor, contact **3** of the **L3** relay **23505** to the winding of the DCDR relay **23506**. When this relay has operated this ground is extended over its contact **3**, thence over contact **1** of the **L3** relay **23505**, to the RS reader step conductor, thus causing the reader **23100** to move forward to read the 280 recorder code. The **280** conductor to the lower armature of the RDC relay **23201** is grounded, as hereinbefore described, and hence this ground is extended over contact **4** of this relay and the RC conductor over cable **R232** to cause the operation of the R relay **23101**. The D, E and F digits of this 280

code will now lead into the recorder register over the CC5, the CT0 and the CU1 conductors over cable C231 from Fig. 231 to Fig. 232. The C5, the T0 and the U0 relays 23202, 23215 and 23214 respectively will be operated at this time to record the operation of the previous recorder number 00. Therefore, these three grounds will be extended through appropriate armatures to cause the operation of the CA relay 23203, the TA relay 23205 and, in this case, the UNC relay 23209 since the units digit fails to check as the CU1 grounded conductor grounds the UNC lead over contact 1 (not shown) of the non-operated relay U1 (not shown). With the UNC relay 23209 operated and the UA relay 23206 not operated, the RS conductor cannot be grounded and hence the reader 23101 remains repeatedly reading the 280 code until it can be given a satisfaction signal.

With these relays operated as described, a circuit is extended from ground, over the contact of the MONA master off-normal relay 23421, conductor MONA, contact 1 of the CR change recorder relay 23210, contact 2 of the UNC relay 23209, contact 2 of the CA relay 23203, to the winding of the CCR change recorder check relay 23211. The CCR relay 23211 operates and closes a circuit from ground, through its contact 3, the RD conductor to Fig. 233, contact 3 of the FDR relay 23309 and over the RP conductor to the winding of the RP recorder progress relay 23410. This relay operates and, through contact 3, steadily grounds the STP stepping magnet 23402. The wipers of this recorder progress switch, however, do not step forward until the STP stepping magnet 23402 is released and this will not happen until certain other operations have been completed.

The CCR relay 23211, through its contact 2, extends a ground over the CAR conductor and contact 1 of the SIE relay 23406 to the winding of the CAR (clear all registers) relay 23412. This CAR relay 23412 causes an automatic operation in the device in which all information now remaining in the assembling registers of the device is transferred to and is perforated on a straddle tape. The operation employs a perforator walking control circuit including the PW relay 23413. When this CAR operation has been completed and all of the assembling registers have been cleared, then, and not before, the PW relay 23413 will be released. Then the circuit here indicated as starting from a ground on the armature of the PRL relay 23415 will be extended through to the ETE conductor (fully explained in the complete description hereinafter), thence through contact 4 of the CCR relay 23211 to cause the operation of the CR relay 23210. This relay operates and locks through its contact 3 and contact 1 of the RDC relay 23201 to the master off-normal ground MONA. Also, at contact 2 of the CR relay 23210 the master off-normal ground is broken away from the L locking conductor so that all the relays in the recorder register of Fig. 232 and relays CA–23203 and TA–23205 and CCR–23211 return to normal. Thereupon a down-check circuit will be established from ground, contact 1 of the MONB relay 23405, conductor MONB, through back contacts of each of the relays in the recorder register (upper part of Fig. 232), to the DC conductor leading to the upper winding of the RDC relay 23201. The RDC relay 23201 operates at this time and, since the 280 ground is still being transmitted from the lower contact of the CL3 relay 23512, the RC recorder compare relay 23101 will be released, thereby releasing relay UNC–23209, and the RR recorder register relay 23105 will be operated in its stead. Thereupon the CR relay 23210 will be released and the locking circuit for the recorder register will be restored so that now as the D, E and F digits of the 280 code are read, the C5 relay 23202, the T0 relay 23215 and the U1 relay (not shown) will be operated.

The operation of the RR relay 23105 opens, at its contact 9, the ground on the FDRL lead so that the FR and FDR relays 23308 and 23309 will release. Thereupon the RP relay 23410 will be released so that the STP stepping magnet 23402 is deprived of its operating circuit. The wipers of the recorder progress switch of Fig. 234 thereupon move forward one step so that the value 01 as the recorder number is now established. With the recorder progress switch 23409 now grounding the 01 lead, and since the U1 relay (not shown) in the recorder register is operated, this ground will be extended over a circuit similar to the 00 lead, through contact 4 of the U1 relay, thence contact 4 of the T0 relay 23204, contact 6 of the C5 relay 23204, thence through a validity circuit indicated here as requiring the operation of one of the four relays C5, C6, C7 and C8, one of the three relays T0, T1 and T4 and one of the ten relays U0 to U9, inclusive, to the UC (up-check) conductor leading through contact 8 of the RRAB relay 23105 and over the RS conductor to the winding of the RS relay 23104. Thus, when the recorder number is changed it first produces a mismatch in the recorder register and then, provided the last day and last day of round have been properly read and recorded, it causes the clearing of this register and the recording of the new number and the stepping of the recorder progress switch and finally the pulsing of the reader step circuit.

Now let us assume that the recorder number in the eighth section instead of being 00 was 01 by mistake, as though section 17 had been spliced on to section 7. The round 0 and the day of round 2 would have been accepted properly and the day progress switch of Fig. 233 would have been properly forwarded. However, the reading of the recorder number will produce a mismatch in the recorder register with the consequent operation of the CCR relay 23211, as hereinbefore described. In this case the ground extended by the armature 3 of the CCR relay 23211 to contact 3 of the FDR relay 23309 over conductor RD cannot at this time be extended further to the winding of the RP relay 23410. This, as will be recalled, is because the FDR relay 23309 is unoperated to indicate that the previous reading was not of the first day of the first round. Thus it is not legitimate to accept a change of regular recorder number at this time. Hence, the recorder progress switch will not be advanced and, therefore, when the RR relay 23105 causes the value 01 to be entered into the recorder register, the recorder progress switch wiper 23409 will still be grounding the 00 conductor. Hence, with the U1 relay (not shown) up and the U0 relay 23214 unoperated, the ground on the 00 conductor cannot close through the up-check and validity circuit of this recorder register and hence the UC ground cannot be extended to cause the operation of the RS relay 23104.

Now the RS relay 23104 is one of a number of relays which may place ground over conductor CT to the winding of the CT cancel timing relay 23416. As long as this CT relay 23416 is operated the alarm 23417 is held from operating. The alarm circuit controlled by the CT relay 23416 is conventional in design and consists generally of a cold-cathode tube 23418 which is maintained unoperated as long as the CT relay 23416 is operated. When the CT relay 23416 becomes released tube 23418 will still remain unoperated until the condenser 23419 can be charged to the firing potential of tube 23418. This is a time function and hence, if the CT relay 23416 is released, the alarm cannot be brought in for a predetermined time. In normal operation of the device an occasional operation of the RS relay 23104 will cause the operation of the CT relay 23416 long enough and often enough to discharge the condenser 23419 and to prevent the operation of the alarm until this CT relay 23416 has been unoperated for a given interval.

In the instant case, therefore, since the recorder progress switch has not been forwarded to its next position, the up-check and validity circuit of the recorder register cannot be completed. The RS relay 23104 therefore cannot be operated and since there is nothing else

in the circuit to pulse the CT relay **23416**, an alarm will in time be brought in.

Thus, it will be seen that when a recorder number changes in the succession of reading the various sections of tape, it is necessary that the round and day of round just previously read (as part of the instant tape identity group reading) must have been the last round and the last day of round or, put in another manner, it must be that the FDR relay **23309** was operated by the reading of the tape identity of the immediately preceding section of tape.

Explained in another way, this feature resides in the provision of a plurality of sequencing devices for steering through the device an incoming tape made up of a plurality of sections when and only when these sections are arranged in proper order and when and only when every component of time and numbering of original recorders between stated limits has been accounted for. This means that any given number of days and any given number of recorders may be reported and, the facts having been established by the setting of the set-up switches, the device will then function automatically to progress the incoming tape from end to end when the data is presented in a rigidly controlled sequence.

It should be noted in the above description that when a change in recorder number occurs, as, for instance, when the tape identity information of section 10 is read, the 284 code, the 283 code and the 280 code will be read in sequence. The first and the second of these codes will be read but will not effect a change in the day progress switch of Fig. 232 and the 280 code, although read, will not cause any change in the recorder progress switch until certain other operations have been completed. Actually, the reader will hold the tape in the position to read the 280 code repeatedly until these other operations, such as the CAR operation, have been completed. One of these operations is the preparation of the trailing tape ends of all the tapes in the perforators of the device. Since the day progress and the recorder progress switches have not been progressed, the items of common information which are taken from these switches are still available for the preparation of the trailing tape ends associated with items taken from section 9 of the tape, that is, from the section with the previously noted round, day of round and recorder number. Thus, means is provided for temporarily maintaining a record of the last used items of common information before the record of these items has been changed responsive to the reading of the changed items in a new section of tape.

Feature 15.—This feature has been stated hereinbefore as the provision of means responsive to the reading of certain items of general information, indicating the normal ending of a series of items of information, for temporarily holding up normal operations and for automatically interpolating special operations to dismiss the means provided to make records of irregular calls.

It has been fully explained in connection with the schematic drawings of Figs. 231 to 235, inclusive, that when a change in recorder number occurs this change produces a mismatch of information in the recorder register of Fig. 232 so that in the recorder register control circuit the CCR relay **23211** becomes operated. Upon the operation of this relay, if the straddle class switch is set on its SIE spliced in emergency position, then the CAR relay **23412** will be operated. This relay as explained causes the "clear-all-registers" operation to take place, whereby any information left in any one of the assembling registers is transferred to and perforated on the straddle tape. Part of the CAR operation is the operation of the perforator register and walking circuit so that the PW relay **23413** in the perforator walking control circuit is operated and thereby maintains the ground disconnected from the ETE conductor. It is necessary, after a mismatch of recorder numbers in the recorder register, that the ETE conductor Figs. 234 and 232 be grounded in order to further the operation of the device by causing the operation of the CR relay **23210**. Until the CR relay **23210** can be operated, the 280 code will remain in the reader and the reader cannot be advanced.

This Feature 15 is, in truth, one aspect of Features 13 and 14, and the circuit arrangement thereof has been fully explained hereinbefore.

Feature 16.—General.—This feature has been stated hereinbefore to be the provision of means for handling straddle calls by what is known as a feedback method, that is, one providing for the maximum machine handling of these calls, leaving for report to clerical personnel only certain extraordinary calls mostly in the nature of over-capacity calls.

In order to give a clear understanding of this feature, Fig. 236 has been included to show or to display a section of a central office tape in normal form. Reading the codes of this tape from the bottom upwards (as read by the processing machine), it will be noted that first, a series of regular splice code patterns 081010 are encountered. Thereafter, the tape identity codes characteristic of the central office tape are encountered in the form of first, the 284 code identifying the round and the marker group, the 283 code identifying the day of round and the month, the 280 code identifying the recorder number, the 285 code used only if this section is of special nature and identifying thereby the nature of the tape section, the 281 code identifying the beginning of tape hour (end of tape hour in the central office) and lastly the 282 code identifying the calendar day. Thereafter, there will be the codes comprising parts of a large number of calls of various natures such as the detail calls, the message unit calls, etc., all having the various component parts thereof scattered among the parts of the others and interspersed with an occasional 281 or hour code. Following this will be another series of tape identity codes identical with those first encountered with the exception of the hour code and followed by the 286 code (known as the skip splice code) which is used to condition the processing device, into which this tape is inserted as an incoming tape, to skip the following splice codes. This section of tape ends in the regular splice pattern codes 081010.

The regular splice pattern code is the code 081010, chosen arbitrarily but nevertheless characteristic of all the tapes used in the automatic message accounting system. Fig. 237 is a representation of the appearance of a tape having perforated therein a long series of regular splice pattern codes.

For certain purposes, which will be explained in connection with the feedback method of handling straddle tapes, it has been deemed advisable for purposes of checking and surety to use what is known as a grooved or special splice pattern at certain points in the formation of the straddle tape. This grooved splice pattern will differ from the regular splice pattern in the make-up of the code. Figs. 238 and 239 represent two such grooved splice pattern codes, the first representing by its C and D digits the central office recorder 00 from which the original central office tape came and by its E and F digits the hour 02. In Fig. 239 recorder 02 and hour 11 are presented. It will be noted in Fig. 241, by way of example, that the section of straddle tape including incomplete calls originally coming from emergency recorder 00 is included within a tape, each end of which is characterized by the grooved splice pattern 080002. Somewhat further up on this tape there is a section of tape produced by the regular recorder 00 which begins and ends with the regular splice pattern 081010 but which has somewhere within its body first, a trailing tape and preparation followed by a leading tape end preparation between which this grooved splice pattern 080002 has been perforated. Thus, the regular recorder 00 tape may be cut near the center of this grooved splice pattern and the section of tape produced by the emergency recorder

00, having exactly this same special grooved splice pattern, may be spliced therein.

This reassembly of the straddle tape is indicated in Fig. 242 where the lowermost section of the tape made by recorder 00, both regular and emergency, is represented. The section of tape as a whole begins and ends with the regular splice pattern but inserted in it will be spliced the section produced by the emergency recorder beginning and ending with the special grooved splice code pattern 080002. In the representation of Fig. 242 the tape section coming from the recorder 01 is shown as a short piece beginning and ending with the regular splice pattern code 081010 and having therein no grooved splice pattern section. Again, the straddle tape section having to do with recorder No. 02 is shown near the top of Fig. 242 and this also has spliced within it a section produced by the emergency recorder 02. The tape section as a whole is characterized by the designation S02 but has spliced within it at some point a small section of tape characterized as S02E. Thus, as Fig. 243 shows, there will be a straddle tape section produced for each recorder number and ready to be spliced into the central office tape for the next day's business.

Throughout Figs. 241 and 242 as well as Figs. 243, 245, 246 and 247 each section of tape is shown as one beginning and ending with regular splice code pattern and tape end tape identity codes, of which only those codes of particular interest in each case are shown. Thus in the S00E (straddle tape carrying items from the emergency recorder 00) section (reading from the bottom upwardly) there is indicated a plurality of 080002 grooved splice code patterns (recorder 00, hour 02) followed by the tape identity codes of which only the code 285X00 is of particular interest here. This code, as indicated in Fig. 236 is one which, if used, is invariably placed between the 280 and 281 codes and carries the information that this particular tape section has been produced as the result of a transfer from regular recorder 00 to an emergency recorder (which will carry the number 00). Within the body of the tape there will be a number of codes here represented merely as C, CS and CE standing for calls, call starts and call ends.

Fig. 244 shows what is meant by call starts and call ends. When a tape being recorded by a central office recorder is cut, usually at about 3:00 a.m., unless the business at the office has come to a full stop, it is inevitable that some calls will be parted, leaving part of the information on the section which has been cut off and the remainder on the section left in the recorder. As shown in Fig. 244, call starts always contain the initial entry and call ends always contain the disconnect time entry. The answer time entry may be in either. Thus, if a call is parted between the answer time and the disconnect time, the call start contains the initial entry and the answer time and the corresponding call end contains only the disconnect time. On the other hand, if the call is parted between the initial entry and the answer time, then the call start contains only the initial entry and the corresponding call end contains both of the time entries.

Call ends and call starts can also be formed when a regular recorder is taken out of service and an emergency recorder is enabled to act for such disabled regular recorder or when any other transfer is made, as when the disabled regular recorder is placed back in service.

Since the central office tape is read backwardly and since the straddle tape for, let us say, Wednesday's business is spliced after the regular tape for Thursday's business, it then happens that the call end for a call in progress at the time Wednesday's tape was cut off is one of the last items to be read from Thursday's tape. This call end, consisting of one or more timing entries, is then registered in the appropriate assembling register awaiting the following timing and initial entries, or the initial entry only, of the corresponding interrupted call. Therefore, at the end of the reading of the regular recorder tape for Thursday's business the straddle tape prepared from Wednesday's business will next be read and in this will appear the call start of that call whose call end has just previously been registered in an assembling register. Therefore, it will appear that in the feedback method of handling interrupted calls the call ends will be registered in the assembling registers at the end of the reading of a section of tape from a regular recorder and will be followed immediately thereafter by the call starts recorded on the straddle tape prepared from the previous day's business, so that these calls will then be normally processed and the derived charges will be included in the list of charges for the following day's business.

Going back to Fig. 241, it will be noted that the S00E section of tape contains both call starts and call ends. Such fragmentary calls are formed when a transfer from a regular to an emergency recorder is made in exactly the same manner as when the tape is cut at the end of a day's business or when the tape is prepared with the 3:00 a.m. tape ends even though not actually cut. It will be noted that in some sections of tape, as in Fig. 243, calls (C) are indicated as well as call starts (CS) and call ends (CE). However, no one of the sections of tape in Fig. 241 contains calls (C) because these are straddle tape sections and all the complete calls on the original tape from which these straddle tape sections have been formed will have been processed. This section (Fig. 241) contains only call starts or call ends or both, since it is from an emergency recorder. The topmost section (S01) from regular recorder 01 contains only call starts because in this case it appears that the regular recorder 01 functioned throughout a day without interruption.

Before proceeding with the consideration of the make-up of a tape, Fig. 248 should be noted. It has been stated hereinbefore that of all the various tapes used in the automatic accounting system, the central office tape alone is read backwardly. This means that the codes in such tapes are also recorded backwardly, that is, to read from right to left instead of from left to right. If Fig. 248 is turned upside down, it will be noted that the splice pattern code 081010 is actually recorded by the central office recorder as 010180 so that when it is placed backwardly in the reader of the accounting machine its true nature will be revealed; that is, it will appear to the reader as a normal tape such as the lowermost tape section of the straddle tape of Fig. 242.

Now when the central office tape for Thursday's business is received by the processing machinery at the accounting center, it will have had the section of straddle tape of Fig. 242 spliced thereinto as shown in Figs. 246 and 243.

For purposes of graphical illustration the various tapes in this group of figures have been shown with the left-hand edge thereof as it issues from a recorder drawn with a heavy line. Thus, tapes shown in Fig. 244 have the heavy line at the left; whereas, the tape shown as the input tape in Fig. 248 has the heavy line to the right indicating that the tape is being fed in in the opposite direction to which it was produced. Thus, call ends are read from a central office tape before the corresponding call starts are read.

The tape which has been spliced together and prepared as an input tape for the device of the present invention, when using the feedback straddle method, is shown in Figs. 243 and 246 reading upwardly from the bottom of the tape shown in Fig. 246. It thus consists of first, the various sections of tape formed by the emergency central office recorder after which will be the tape produced by the regular central office recorder 00. Between the end of this tape and the beginning of the tape for regular recorder 01 will be spliced in the recorder

00 straddle tape from the previous day's business, here marked S00.

Again reading upwardly on this tape, from the bottom of Fig. 246, there will be a section of regular splice pattern and then the code 280640. This 280 code is the only significant tape identity code with which we are at present concerned and this shows the recorder number as 40. Actually, there is but a single emergency recorder in a central office and this emergency recorder assumes the number of the regular recorder for which it is substituting at any particular time. When the emergency recorder is idle, and is not being used in place of another, it assumes a number 40 so that this particular code 280640 is, in a manner of speaking, a signal that the emergency recorder has finished its work and has been returned to its idle condition.

Just above this, another tape end is indicated having the recorder number code 280601, showing that for the time being this emergency recorder (D digit of 6 means emergency recorder) is acting in place of the regular recorder 01. The following code 285X00 is the transfer signal showing that a transfer from a regular to the emergency recorder has been made. During the reading of this latter tape end information the so-called CRC operation takes place. This requires that the FC (first call) relays of the assembler-computer all be set to recognize incomplete calls as straddle calls rather than "don't answer" calls. It will be recognized that if an initial entry is received by the assembler-computer under ordinary circumstances and was not preceded by an answer and a disconnect time, or at least one timing entry, the call is recognized as a don't answer call and is abandoned. However, if the FC relay is operated, then this initial entry alone is recognized as a call start. There is a line drawn from the tape end portion of Fig. 246 to a corresponding portion in Fig. 247 indicating that as part of the CRC operation the same information is transferred to and is perforated in the corresponding section of the straddle tape of the device.

After this has been accomplished then there will be a section of regular splice pattern followed again by the tape end information which in this case is skipped and is not reproduced in the straddle tape. Thereafter follow the items of information constituting the call starts, the calls and the call ends in this section of the emergency central office recorder tape. The call starts and the call ends will be recorded in the straddle tape but the calls will be processed and therefore will not be reproduced in the straddle tape. At the end of these operations when the tape end of the emergency tape for recorder 01 is reached and it is certain that no more items of information are to be read, then the CAR operation takes place. This is known as the clear-all-registers operation by which all information on uncompleted calls left registered in the various registers of the device is transferred as call ends to the straddle tape. After the registers have all been cleared then the tape ends with the various appropriate identifying items of information are read and are reproduced in the straddle tape followed by a series of special or grooved splice code patterns. In the straddle tape shown as the section S01E at the bottom of Fig. 247 the section is started and ended with a grooved splice pattern instead of the regular splice pattern characteristic of the tape produced by the emergency recorder. In the example shown the grooved splice pattern is 0801EF, indicating that the recorder is number 01 and the hour is EF (indefinite in the example).

Reading upwardly in Fig. 246 it will appear that the next emergency recorder operation is in place of regular recorder 03, thus also indicating that the regular recorder 02 had operated without interruption.

Thus, the tape produced by the emergency recorder is first read and any complete calls recorded therein are processed whereas any and all call starts and call ends are transferred to the straddle tape which will then be in the form shown in Figs. 245 and 247 identical in form with the tape shown in Fig. 241 and which will be cut up and spliced together to be spliced into the tape for the next day's business.

After all of the items of information produced by the emergency tape are read then the items of information produced by the regular recorder 00 are read. This is shown near the top of Fig. 246 where first, the call starts are encountered and then the calls are encountered. There may be a period of make-busy (MB) and thereafter further calls are read. Finally, as at the bottom of Fig. 243, the call ends are read but these are not transferred to the straddle tape because immediately thereafter the straddle tape for the previous day's business is spliced in and these call ends will match up with the call starts recorded on this piece of straddle tape so that they will constitute in most cases complete calls which will be properly processed.

It is believed that with this explanation and the graphical illustration in this group of figures that the manner in which the feedback method is employed will be clearly apparent. No straddle tape to be given over to the clerical force for interpretation will be produced but all call starts left on the trailing end of a central office tape (last read by the assembler-computer) will be matched up with the corresponding call ends on the leading end of the next day's tape (first read by the assembler-computer). There are provided circuit means for skipping a good deal of tape identity information in the input tape where this constitutes repetition and there would be no point in reproducing it on the straddle tape.

It has been set forth hereinbefore that in the feedback method of handling straddle calls the straddle tape must be prepared with the type of tape identity information characteristic of the central office tape rather than the accounting center tapes. The two types of tape ends are shown in Figs. 228 and 229 and the characteristics of the two are fully explained in the accompanying description.

The circuits shown in Figs. 250 to 256, inclusive, show the means employed to carry out the operations depicted in the drawings, Figs. 241 to 247. Let it be assumed that the set-up switch **25100** has been set on its F (feedback operation) contact so that the F relay **25101** is operated. Then let it be assumed that the tape of Figs. 246 and 243 is placed in th reader **25000**, which is then started in operation. The regular splice pattern codes 081010 will be read and passed over in a conventional manner. Next the tape end of this tape will be encountered, the 284 and 283 codes will be read and checked against the settings of the set-up switches, the last round and last day of round being checked as hereinbefore described particularly in connection with Figs. 231 to 235, inclusive. It is to be noted here that the emergency recorder tape is prepared with 3 a.m. end-of-tape groups and regular splice pattern just as are the regular recorder tapes. Also the emergency tape is perforated with hour record entries only if the emergency recorder is in use at that time. However, whether busy or idle at the 3 a.m. point, it is prepared with end-of-tape groups. Thus the daily progression of emergency tape will satisfy the set of switches.

During the reading of these tape identity codes, and as fully explained in the detailed description hereinafter, certain of the type identity progress control relays will be operated. Thus, the FI relay **25200**, the TI relay **25201** and the EPW relay **25202** will be operated. Next the 280 code will be read, this code carrying the recorder number. The D digit, in this case (code 280640) being a 6, indicates that the recorder is the emergency recorder and the number 40 in the E and the F digits indicates that such emergency recorder is idle. In the tape identity reading progress circuit the CL3 relay **25203** will be

operated since the 280 code has not as yet been accepted. Therefore, a circuit will be established from an off-normal ground through contact 2 of the CL3 relay **25203**, thence through a back contact of the CL4 relay **25204**, a back contact of the STE relay **25205**, through contact 2 of the FI relay **25200**, contact 1 of the EPW relay **25202**, contact 1 of the CR1 relay **25206**, conductor **25223**, contact 4 of the C6 relay **25102** in the recorder register (which relay is operated responsive to the value 6 in the D digit), through contact 3 of the T4 relay **25103** also in the recorder register (which relay is responsive to the value 4 in the E digit), thence to the ETE conductor leading through the contact of the DCDR relay **25207**, the contact of the DCR relay **25208**, thence over conductor **25224** and in a chain circuit through back contacts of the DPRS relay **25001**, the DPS relay **25002**, the FDR relay **25003**, the RP relay **25004** to the winding of the ETE relay **25209** over conductor **25007**. The ETE relay **25209**, in responding to this circuit, initiates the release of the tape identity TI relay **25201** as well as the FI relay **25200** and the EPW relay **25202**, which allows the reader to read codes other than those found in a tape identity group.

Referring back now for a moment to the drawings, Figs. 231 to 235, inclusive, it will be noted that the recorder register in Fig. 232, being unoccupied when this code 280640 is first read, will have its down-check circuit closed through to cause the operation of the RDC relay **23201**, so that when the **280** conductor in Fig. 232 is grounded this ground will be extended through contact **2** of the RDC relay and over the RR conductor to cause the operation of the RR relay **23105**, whereby recorder number 40, characterized by the fact that it is an emergency recorder, will be recorded in the register of Fig. 232. Thus, the C6 relay **23212**, the T4 relay **23213** and the U0 relay **23214** will be operated and locked into continued operation. These relays being a legitimate combination, a ground will be extended from the recorder progress switch arm **23409**, in its first or normal position, over the E (for emergency) conductor and cable RN234, through contact **5** of the C6 relay **23212** and thence over the validity or up-check circuit of the recorder register, conductor UC, through contact **8** of the RR relay **23105**, to the winding of the reader step RS relay **23104**, whereby the reader is forwarded in its operation. This constitutes acceptance of the 280 code so that the CL0 relay **23517** will be operated and the CL3 relay **23512** released.

The remaining codes, that is, the 281 and 282 codes of this tape end will then be read, the hour and the calendar day being registered or checked in the conventional manner.

Following this reading of an end-of-tape group of tape identity codes, which is effectively skipped without any action being taken toward perforating an output tape, another tape end group is encountered, this being the trailing end of the emergency recorder tape after it has finished acting for the last time in place of some other one of the regular recorders or, if idle since the last 3 a.m. cutting point, this 3 a.m. end-of-tape group and splice pattern, etc. It may be noted that in the emergency tape constituting the larger portion of Fig. 246 two instances of the use of this emergency recorder have been shown, once when it was acting for regular recorder 01 and once when it was acting for regular recorder 03. There is no given sequence in which the emergency recorder numbers should appear since this tape is one produced by the emergency recorder over a period during which it may have acted for one or more regular recorders at odd times and in no given sequence. In the present case it is indicated by the next tape and group that it has been acting for regular recorder 01. Therefore, the tape end items of information are read, including the recorder code 280601.

Since the recorder register, Fig. 232, now contains the registration of the emergency recorder when idle (280640), the RDC relay **23201** will be unoperated and hence the **280** ground will be extended over contact **4** of the RDC relay **23201**, conductor RC and cable R232, to cause the operation of the compare RC relay **23101**. As indicated hereinbefore, this will cause a mismatch in the recorder register control circuit of Fig. 232, resulting in the operation in this case of the C relay **23216**. The code 280601 will extend ground through the armature of the RC relay **23101** over the CC6 lead, the CT0 lead and the CU1 lead over cable C231 causing, in the manner hereinbefore described, the operation of the TNC relay **23217**, the UNC relay **23209** and the CA6 relay **23218**. Thereupon, an off-normal ground over contact 1 of the CR relay **23210** will be extended through contact 2 of both the TNC and the UNC relays, thence through contact 2 of the CA6 relay **23218**, conductor **23219**, contact 1 of the F (feedback) relay **23420**, conductor **23422**, to the winding of the C relay **23216**, so that this relay now operates. This C relay **23216**, in operating, causes the operation of the CR relay **23210**, which opens the locking circuit for the relays of the recorder register of Fig. 232 and thus allows them to become released. When this register is entirely released, its downcheck circuit, starting from the master off-normal lead to contact **4** of the C5 relay **23202**, will be extended to the upper winding of the RDC relay **23201**, so that this relay now becomes operated, and, in so doing, extends the **280** ground through its contact 2 to the winding of the RR relay **23105** and allows the RC relay **23101** to release. Upon the operation of the RR relay **23105**, the new recorder number (01) in the code 280601 is now recorded, the C6 relay **23212**, the T0 relay **23215** and the U1 relay (not shown) becoming operated.

It should be noted at this point that as the emergency recorder tape of Fig. 246 is run through the reader there must be a means of holding the recorder progress switch of Fig. 234 in its normal unoperated position (resting upon its terminal "E") since the recorder numbers in this emergency tape do not follow any given pattern as explained hereinbefore. A circuit may, therefore, be traced from battery, contact 3 of the MONB relay **23405**, through the winding of the FRS relay **23401**, the recorder progress switch arm **23404**, contact 2 of the F relay **23420**, the FT0 lead and cable FT233 to the first recorder tens switch **23307** (set on its **0** lead), the first recorder units switch **23306** (set on its **0** lead) over the U0 conductor and cable U234 to the recorder progress switch arm **23403** which is grounded in its first position. Since the recorders in any office are invariably numbered from 00 upward, and since the emergency recorder tape is invariably processed before the number 00 recorder, this first recorder switch **23306** and **23307** will invariably be set to express the number 00, even though the processing load may be divided among other assembler-computers and the first recorder in others may be some other number than 00. In this case, the FRS relay **23401** is operated, which will open the start ground from contact 2 of the ST4 relay **23400** leading normally to the step magnet **23402**. Therefore, in this case the recorder progress switch of Fig. 234 does not move until the RP relay **23410** is operated on a change in recorder number after the first day of the first round has been encountered at the very end of the emergency recorder tape.

From the above, it will be noted that the recorder progress switch arm **23409** is set on its first or emergency lead "E" and, therefore, a ground is extended over the lead E and cable RN234 through the contact **5** of the C6 relay **23212** and thence over the up-check circuit of this recorder register so that the UC lead is grounded and this, through contact **8** of the R relay **23105**, causes the operation of the reader step RS relay **23104**. This causes the reader to advance the tape to its next code. This next code, as indicated in Fig. 246, could be a 285DEF code which indicates a transfer from a regular to an emergency recorder and this will result (see Figs.

250, 251 and 252) in the operation of the 285C relay **25106** and in turn the operation of the 285R relay **25107.**

(The registration of the 280601 code constituted a complete acceptance thereof and hence, as will appear in the complete detailed description, the CL0 relay **23517** will have been operated and the CL3 relay **23512** will have been released.)

Turning now again to the schematic circuit shown in Figs. 250 to 256 (not shown in detail), another circuit controlled by the operated CL0 relay and the released CL3 relay, similar to that hereinbefore described for the operation of the ETE relay **25209**, will now be established over contact **3** of the T1 relay **25104**, thence over the conductor **25108**, contact **1** of the TEG2 relay **25210**, conductor **25225**, contact **1** of the F relay **25101**, conductor **25109**, contact **2** of the TF relay **25212**, contact **1** of the TFZ relay **25221**, to the winding of the CRC relay **25213**. This relay as will be more fully explained hereinafter, in connection with Feature 21 particularly, causes all of the FC (first call) relays, one for each assembling register, to be operated. It checks the registers clear and causes splice pattern and end-of-tape information to be perforated in the end of the straddle tape.

The operation of the CRC relay **25213** starts a chain of operations which ends in the operation of the LTFE relay **25400** which relay, as explained in Section 3.112, will cause the straddle tape perforator to prepare the end of the S01E section shown at the bottom of Fig. 247, first with the grooved splice pattern 0801EF, and thence the various codes in the central office tape comprising the 284, the 283, the 280, the 285, the 281 and 282 codes. The LFTF relay **25400** causes the formation of what is known as a seven-line non-call entry.

In some detail, the operation of the CRC relay **25213** directly causes the operation of the CAR relay **25214** and this closes a circuit for the SW (slow releasing) relay **25215** so that the SW relay **25215** operates. Through contact **2** of the CAR relay **25214** and contact **3** of the SW relay **25215**, a ground is extended over conductor **25226** and through contact **1** of the RC relay **25005** to the winding of the WC relay **25006**. This relay operates and locks through its contact **3** to ground over conductor **25008** and contact **2** of the CAR relay **25214**.

The CAR relay **25214** normally causes an automatic operation for clearing all registers. In the present case (beginning of a run), however, all of the registers are already clear and hence the two down-check relays, the UDC units down-check relay **25216** and the TDC tens down-check relay **25217** are operated so that the ground supplied over contact **2** of the WC relay **25006** and conductor **25009** is now extended over contacts **1** of the UDC relay **25216** and **3** of the TDC relay **25217** to cause the operation of the WST relay **25218**. This relay, becoming operated, causes the operation of the GT relay **25300** in a circuit from off-normal ground in Fig. 252, over contact **1** of the WST relay **25218** and conductor **25227** to Fig. 253. This relay now opens the circuit for the SW relay **25215**. Upon the release of this slow-release SW relay **25215**, ground from contact **1** of the WC relay **25006** is extended over conductor **25010** and over contact **2** of the SW relay **25215**, contact **2** of the CRC relay **25213**, contact **1** of the AFCU relay **25219**, contact **1** of the FCCU relay **25220** (the AFCU and FCCU relays **25219** and **25220** will both be operated when all of the FC relays are operated or "up"), conductor LTE, contact **3** of the **285R** relay **25107**, the LTFE lead, cable **25111**, to the winding of the LTFE relay **25400**, thus causing the operation of this relay with the results hereinabove stated.

The relays of the common class translator of Fig. 254, such as the LTFE relay **25400**, cause the successive formation of various output codes in number counting down from the highest to the lowest. Thus, contact **8** of the LTFE relay **25400** extends a ground over the **7L** lead which is extended by the C0 common output connector relay **25401** to the perforator line count circuit of Fig. 254 to cause the operation of the PLA7 relay **25402**. With this relay operated, then the L7 lead is the first to be grounded (at contact **2** of the PLA7 relay **25402**) over a chain circuit and this in turn will extend over contact **1** of the LTFE relay **25400** to the **08S** lead and cable **25404** to operate the **08S** relay **25500**. This is a line-forming relay and will cause the code 0801EF to be transmitted to the perforators for the perforation of this grooved splice pattern code on the end of the straddle tape. Each of the relays of this common pattern connector of Fig. 255 will make connections over cable **25503** to certain of the twenty-eight code leads extending through the perforator magnet check circuit of Fig. 256 and into the perforator magnets of the selected perforator. The **08S** relay **25500** will extend a circuit from its contact **1** over the **A0** lead and its companion **8** relay **25501** will extend grounds from its contacts **1** and **2** over the **B7** and **B1** (code for 8) leads. The C and D digit leads are shown here as being derived over cable **25112** from the relays of the recorder register of Fig. 251 and, therefore, will reflect the number of the recorder now registered, in this case 01. The E and F digit leads to the perforator are shown here as being derived over cables **25602** to **25603** from the hour output connector **25600** coming directly over cables A and B from the hour register **25601**, so that the unstated number EF in the code 0801EF is the value of the hour at the particular time at which this emergency recorder went into service in place of the regular recorder 01.

It will be noted that this code 0801EF constitutes one count in the perforator line count circuit of Fig. 254 but actually this one count is controlled, as will be more fully explained hereinafter, by a timing circuit so that a plurality of these codes will be perforated in the end of the straddle tape under the control of this timing arrangement. When this time runs out then the perforate line count circuit will be advanced, the PL6 relay **25403** will be operated from the PL lead over contact **3** of the PLA7 relay **25402** and in turn the PLA6 relay **25405** will be operated to ground over contact **2** of the PL6 relay **25403** and over the PLA lead. The L6 lead, carrying ground from the PAT lead over contact **2** of the PLA6 relay **25405**, is now extended through contact **2** of the LTFE relay **25400** to the **284** lead, in turn extending over cable **25404** to the **284** relay **25502** to form the next or 284 code line. The first four digits of this line, namely, 2841 are derived from the armatures and contacts of the **284** relay **25502** and the **8** relay **25501** but the E and F digits therefore are derived from the marker group tens and marker group units set-up switches shown in the lower left-hand corner of Fig. 256. The digit 1 in the 0 digit position is translated to the proper round number by a translation accomplished in the round translator according to the registration therein, as shown in the upper part of Fig. 256. This same type of translation occurs in the 283DEF code by means of the day of round translator relays.

In similar manner, the other lines of this group are formed and perforated on the end of the straddle tape, so that this tape end is completely formed and ready to receive the call starts and call ends now on the emergency tape. As the tape of Fig. 246 now is fed through the reader, another series of regular splice pattern codes and another tape end identical to that just read is encountered, this being due to the operations of the transfer from the regular to the emergency recorder. It is, however, unnecessary to copy these into the straddle tape. Hence, the regular splice pattern is skipped in the conventional manner and the other codes are read until the recorder number 280601 is found. Since this compares with the recorder number now registered in the recorder register, the reader step control circuit shown in Fig. 232, starting from the armature of the NRP relay

23207, is closed and the reader is forwarded in its operation without operating either the CRC relay 25213 or the CAR relay 25214 (which would cause the straddle tape perforator to operate as before). Hence, this second group of tape identity information on the emergency tape is skipped as indicated on the drawing, Fig. 246.

Next, the call starts, the calls and the call ends which may be found on this emergency tape are processed. The call starts and the call ends are transferred to and perforated in the straddle tape but the calls which are complete are processed in the normal manner. Therefore, only the call starts and the call ends are put on the straddle tape for processing along with the next day's business. It will be noted that a guide line is drawn from the tape of Fig. 246 to the tape of Fig. 247 in which the symbol CAR is inscribed. This means that when all of the specific items of information have been read from this section of the emergency recorder tape and when a tape end is encountered, the items of common information constituting the tape identity information at the trailing end of this section will be read. It should be noted that the F relay 25101 extends a ground from its contact 4 which may be traced over conductor 25113, over contact 7 of the TEG2 relay 25210 and contact 5 of the TF relay 25212 to conductor 25222 to operate the TFW relay and the TFZ relay 25221, which, as implied by their designations, operate in the manner of the conventional W and Z relay combination. Each time a tape end group is read this conductor 25222 will be grounded and then released, whereupon relay TFW operates, followed by TFZ when the ground is removed. In the present instance, when a ground is extended after the reading of the 280601 code to the 6 conductor 25108, the TFZ relay 25221 will be held operated and relay TFW shunted down, and hence the CAR relay 25214 will be directly operated over contact 2 of the TFZ relay 25221 and the CRC relay 25213 will be left unoperated. It will thus appear that a means is provided for differentiating on a sequential basis between the leading tape end and the trailing tape end of a tape section so that the CRC relay 25213 will be operated on the leading end and only the CAR relay 25214 will be operated on the trailing end.

Thus, each time the trailing tape end of this section is encountered the CAR relay 25214 will be operated to perform the clear-all-registers operation.

It will be helpful again to define the call starts and call ends. A call start consists of an initial entry or an answer time and an initial entry and since, in either case, the full information for timing is not in the assembling register when the initial entry is encountered, then the information is transferred to the straddle tape. A call end consists of a disconnect time or an answer time plus a disconnect time and since, at the end of the processing of the specific items of information on this section of tape, there are some of the assembling registers in which timing entries are registered and since there is no hope that an initial entry will be encountered to convert these timing entries to call charges, then the CAR operation will "call the roll" of the assembling registers and transfer the information contained therein to the straddle tape. The manner in which the various assembling registers are approached in sequential order to give up any information registered therein for recording on the straddle tape forms the basis of another feature to be more fully described hereinafter. In the present instance it is sufficient to note that due to the operation of the TFW and the TFZ relays of Fig. 252, the CAR relay 25214 is operated when the trailing end of this section is encountered and all of the call ends are transferred as indicated by the guide line to the straddle tape.

This CAR operation also controls the perforation on the straddle tape of a trailing tape end group of items of common information. It may be noted at this point that after the tape identity codes have been perforated in this tape end, then another grooved splice pattern code is formed, which may or may not be the same as that at the reading end of the straddle tape depending on the elapsed time during which the emergency recorder was in service. If the emergency recorder was placed in service and taken out of service again before an hour entry had come along, then the grooved splice pattern would be the same (the recorder number does not change); but, if an hour entry had been received, then the two digits in the grooved splice pattern identifying the hour would change.

END-OF-TAPE PATTERNS

Under the feedback operation the entire emergency tape is processed first followed by the regular and straddle tapes. In the body of the tape the transfer points, where transfers were made to or from the emergency recorder and from or to the regular recorder, are arranged in pairs of end-of-tape groups separated by splice pattern. Recalling that the tape is read backwards in time, the first pair on an emergency tape will represent a transfer back to a regular recorder, the second pair a transfer from a regular recorder, etc. Thus, the first and each alternate pair are transfers back to a regular recorder and the second and each alternate pair are transfers to a regular recorder. The first end-of-tape group of a pair (ahead of splice pattern) is designated the odd group and the one across the splice is termed the even group. Likewise, the first, third, etc. pairs are the odd pairs, etc. Odd pairs on the emergency tape therefore represent places where emergency straddle entries (first call operation—CRC) should be produced and even pairs are places where emergency straddle entries (clear registers operation—CAR) should be produced. The reverse situation prevails when the regular recorder tape is processed after the emergency sections are processed. That is, odd pairs represent transfers from an emergency recorder and even pairs represent transfers to an emergency recorder. Thus, odd pairs on the regular tape are places where regular straddle entries (CAR operation) should be produced and even pairs are places where regular straddle entries (CRC operation) should be produced.

Referring to Fig. 252 and particularly to the TFZ and TFW relays therein, as explained in detail elsewhere, the TFZ relay 25221 is released on all odd pairs and is operated on even pairs under the feedback (F) type of operation.

On emergency and regular tapes a circuit is completed on all odd groups of all pairs extending from ground in the tape identity reading progress circuit in Fig. 252, over contact 1 of the FI relay 25200 (released except when reading the first identity group of a tape under process), contact 1 of the CR1 relay 25206 (released on odd groups), conductor 25223 to the recorder register of Fig. 251. Grounded conductor 25223 may extend over contact 4 of the C5 relay (if the tape is a regular tape) and over conductor 25115, contact 3 of the TEG2 relay 25210 (released when reading odd groups of a pair) conductor 25228 into Fig. 251, and over contact 3 of the F relay 25101 to conductor 25116 into Fig. 252 to the armature of the TF relay 25212 associated with contacts 3 and 4 thereof. The grounded conductor 25223 in Fig. 251 may extend over contact 4 of the C6 relay 25102 (if the tape is an emergency tape) and over contact 3 of either of the T0 or T1 relays 25105 or 25104 (indicating that the emergency recorder is or was acting for a regular recorder), thence over conductor 25108 into Fig. 252, and over contact 1 of the TEG2 relay 25210, and over conductor 25225 into Fig. 251, over contact 1 of the F relay 25101 to conductor 25109, extending into Fig. 252 to the armature of the TF relay 25212 associated with contacts 1 and 2 thereof.

If a transfer code (2855EF or 2857EF) were received

as part of an odd end-of-tape group, then the TF relay **25212** will be operated in a circuit extending from ground in Fig. 252 over the contact of the ETE relay **25209**, conductor **285L** into Fig. 251, over contact **1** of the NSTF relay (non-synchronous transfer 2857EF code) to conductor **25114** or over contact **1** of the STF relay (synchronous transfer 2855EF code) to conductor **25114** into Fig. 252 to operate the TF relay **25212**. Similarly, if no transfer code were received as part of the odd end-of-tape group, the TF relay **25212** will be released.

If a transfer code is read as part of the odd identity group of an odd pair of such groups, the emergency recorder tape will have grounded conductor **25109** in Fig. 252 and this ground will be extended over contact **2** of the TF relay **25212** and over contact **1** of the TFZ relay **25221** (released for odd pairs of identity transfer groups) to the winding of the CRC relay **25213**. The operation of the CRC relay **25213**, as will be explained below, causes all registers to be cleared of emergency tape straddle entries, followed by the setting of the first call relays in all of the assembling registers and by the preparation of a suitable straddle tape identity group. This operation may be referred to as the CRC operation.

If a transfer code is received as part of the odd identity group of an even pair of groups on the emergency tape, the grounded conductor **25109** in Fig. 252 will be extended over contact **2** of the TF relay **25212** and over contact **2** of the TFZ relay **25221** (operated on even pairs of transfer identity groups) to the winding of the CAR relay **25214**. The operation of the CAR relay **25214**, as will be explained hereinafter, causes the clearing of all emergency straddle entries from the assembling registers, followed by suitable straddle tape identity group perforation. This operation may be referred to as the CAR operation.

If a transfer code is received as part of an odd group of an odd pair on the regular tape, the conductor **25116** in Fig. 252 will have been grounded by the C5 relay of Fig. 251 and this grounded conductor **25116** will be extended over contact **4** of the TF relay **25212** and over contact **3** of the TFZ relay **25221** to the winding of the CAR relay **25214**, to cause the CAR operation to remove regular straddle entries from the assembling registers relating to regular tape calls. Similarly, if a transfer code were received as part of an odd identity group of an even pair of such groups while processing the regular tape, the conductor **25116** in Fig. 252 will be extended over contact **4** of the TF relay **25212** and over contact **4** of the TFZ relay **25221** to the winding of the CRC relay **25213**, to cause the CRC operation, which removes regular straddle entries from the assembling registers for the regular tape.

If in reading the emergency tape the emergency recorder should be found idle (the **T4** relay **25103** in Fig. 251 operated), the grounded conductor **25223** in Fig. 251 will be extended over contact **4** of the C6 relay **25102** and contact **3** of the **T4** relay **25103** to the ETE lead extending into Fig. 252, over the contacts of the DCDR and DCR relays **25207** and **25208**, conductor **25224** into Fig. 250, over contact **2** of the DPRS relay **25001**, the contact of the DPS relay **25002**, contact **2** of the FDR relay **25003**, and contact **1** of the RP relay **25004** to conductor **25007**, extending into Fig. 252 to operate the ETE relay **25209**. The operation of the ETE relay **25209** effectively skips any special tape preparation operations for this particular end-of-tape group reading.

If in reading the odd identity group of any pair of groups on either the emergency or regular tape sections, a 2856EF code (non-synchronous make busy) were received, the TF relay **25212** in Fig. 252 will not have been operated and the grounded conductor **25109** or **25116** (representing respectively the emergency and regular recorders) will be extended over contact **1** or contact **3** of the TF relay **25212** and contact **2** of the EPW relay **25202** to the TE conductor extending into Fig. 251 and over contact **1** of the **285R** relay **25107** (operated whenever a 285DEF code is received), to the TFE conductor extending by means of cable **25111** into Fig. 254 to operate the TFE common class translator relay.

The grounded conductor TE, extending from contact **2** of the EPW relay **25202** in Fig. 252, will extend over contact **2** of the **285R** relay **25107** (released if no 285DEF code were received) to conductor TE extending by means of cable **25111** into Fig. 254 to operate the TE common class translator relay.

While processing the regular recorder tape, if a straddle tape section is encountered which was produced as a result of previously reading a regular or an emergency central office recorder tape, either of the relays C7 and C8 of Fig. 251 will be operated. Under this condition, the grounded conductor **25223** in Fig. 251 will be extended over contact **4** of either one of the C7 and C8 relays of Fig. 251 to conductor **25117**, into Fig. 252 and over contact **6** of the TEG2 relay **25210** and the contact of the SR relay to the right-hand armature of the FCCD relay of Fig. 252. The FCCD relay will be operated if the first call relay (see Fig. 53) of one or more assembling registers is released, and will be released if all of the first call relays are operated. Therefore, if all of the first call relays are released, ground will extend over contact **2** of the FCCD relay and contact **3** of the FCCU relay **25220** (released when all first call relays are released, and operated if the first call relay is operated in any one or more assembling registers) to the ETE conductor. Such as described above, the grounded conductor ETE will eventually operate the ETE relay **25209** to effectively skip any tape preparation for this particular end-of-tape group. If all of the first call relays are operated, ground will extend over contact **3** of the FCCD relay to conductor **25229** extending into Fig. 251 and over contact **5** of the NSTF relay, contact **4** of the NSMB relay and contact **5** of the STF relay (if no 285DEF code has been received) to the ETE conductor extending into Fig. 252, etc., to operate the ETE relay **25209**. In the event that a synchronous transfer code (2855EF) had been received as part of this odd identity group, then relay STF in Fig. 251 will have been operated and the grounded conductor **25229** in Fig. 251 will be extended over contact **4** of the STF relay to the ETE lead. In the event that either a non-synchronous transfer code (2857-EF) or a non-synchronous make busy code (2856EF) had been received, then either relay NSTF or NSMB of Fig. 251 will have been operated, and the grounded conductor **25229** will be extended over contact **4** or **3** respectively of relay NSTF or relay NSMB to the lower winding of the DCE relay which, upon operating, will extend this ground over its contact **3** directly to the ETE lead.

While skipping the splice pattern between the odd and even identity groups, the TEG2 relay **25210** in Fig. 252 will be operated. If no recorder change is detected across the splice pattern, the CR1 relay **25206** will remain released. The ground on conductor **25223** in Fig. 252 from contact **1** of the CR1 relay **25206** will thereupon be extended into Fig. 251 and over either contact **4** of the C5 relay to conductor **25115** or contact **4** of the C6 relay and contact **3** of the **T0** or the T1 relay to conductor **25108** or over contact **4** of either of the C7 or C8 relays to conductor **25117**. These three conductors **25115**, **25117** and **25108** extend into Fig. 252 and over respective contacts **4**, **5** and **2** of the TEG2 relay **25210** directly to the ETE lead.

If a recorder change is detected across the splice pattern, then the CR1 relay **25206** will be operated whereupon ground on its armature will be extended over its contact **2** to the winding of the CRC relay **25213** to cause the CRC operation.

The so-called CAR operation is initiated by the oper-

ation of the CAR relay **25214** other than through the agency of the operation of the CRC relay **25213**. The operation of the CAR relay **25214**, as will be explained subsequently, initiates a series of operations whereby all of the timing entries then remaining in any of the assembling registers, such as Fig. 253, are removed and placed as straddle timing entries onto the straddle tape. At the conclusion of this operation which involves the operation of the WC relay **25006** in Fig. 250 and the release of the RC relay **25005**, ground is extended over contact **1** of the WC relay **25006**, over conductor **25010** into Fig. 252, over contact **2** of the SW relay **25215** and over contact **1** of the CRC relay **25213** to the TTE conductor extending into Fig. 251 to the lowermost armature of the **285**R relay **25107**. If no 285DEF code is recorded as having been read as a result of the end-of-tape group which causes the CAR operation, then this grounded lead TTE will extend over contact **6** of the **285**R relay **25107** and by means of cable **25111** into Fig. 254 to operate the TTE common class translator relay. On the other hand, if a 285DEF code had been received, then ground will extend over contact **5** of the **285**R relay **25107** and by means of cable **25111** into Fig. 254 will operate the TTFE relay of the common class translator circuit.

The so-called CRC operation is initiated by the operation of the CRC relay **25213** in Fig. 252. The CRC relay **25213**, in operating, causes the operation of the CAR relay **25214** in an obvious circuit over contact **4** of the CRC relay **25213**. As explained above, the operation of the CAR relay **25214** causes all timing entries in the assembling registers of Fig. 253 to be placed upon the straddle tape. The CRC operation, however, further causes the operation of all of the first call relays in the assembling registers, the final conclusion of which should be the operation of the FCCU relay **25220** and the AFCU relay **25219** and the release of the FCCD relay of Fig. 252, whereupon the grounded conductor **25010** in Fig. 252 would extend over contact **2** of the SW relay **25215**, contact **2** of the CRC relay **25213**, contact **1** of the AFCU relay **25219** and contact **1** of the FCCU relay **25220** to conductor LTE extending into Fig. 251 and over contact **3** or contact **4** of the **285**R relay **25107** depending upon whether or not a 285DEF code had been received as part of the tape identity group which causes the CRC operation. Either one of the contacts **3** or **4** of this relay being grounded will, by means of cable **25111**, cause the operation of either the LTFE relay **25400** or relay LTE of the common class translator of Fig. 254.

Previously, in the discussion of this Feature 16, some rather detailed description has been set forth with respect to the manner in which the operation of certain of the common class translator relays of Fig. 254 produce certain perforated tape identity groups on the straddle tape. The effect of the operation of the LTFE relay **25400** in the common class translator was particularly described earlier in the discussion of this Feature 16. It is believed that it will be apparent from an inspection of Figs. 254, 255 and 256 that the nature of the various codes produced by various of the common class translator relays of Fig. 254 and the manner in which these codes are put together in various tape identity groups for the purposes of causing the operation of the straddle perforator (perforator **0** in Fig. 256) will be understood, and that it is unnecessary to go into similar details for each of the six possible situations.

CLEARING-OUT OPERATION

The clearing of timing entries from assembling registers is initiated by the operation of the CAR relay **25214**. As indicated in the above discussion, the CAR relay **25214** may be operated either directly or as a result of the operation of the CRC relay **25213**. The discussion to follow will deal with the clearing-out operation as

initiated by the operation of the CAR relay **25214** regardless of how its operation may come about. The additional circuit operations invoked by the operation of the CRC relay **25213** will be dealt with later.

The CAR relay **25214**, in operating, releases the reader connector RC relay **25005** and causes the operation of the SW relay **25215** in a circuit extending from ground in Fig. 253 over contact **1** of the GT relay **25300**, conductor **25301**, contact **1** of the CAR relay **25214** to the winding of the SW relay **25215**. The reader walking WC connector **25006** in Fig. 250 is now operated in a circuit extending from ground over contact **2** of the CAR relay **25214**, contact **3** of the SW relay **25215** and over conductor **25226** into Fig. 250 and over contact **1** of the RC connector **25005** to the winding of the WC connector **25006**. The WC connector **25006** thereupon operates and locks over its contact **3**, conductor **25008** into Fig. 252 to ground over contact **2** of the CAR relay **25214**.

In the upper right-hand portion of Fig. 252 are indicated the ten assembling register units walking relays **U0** to **U9**, and in the upper right part of Fig. 253 are indicated the ten assembling register tens lock-out relays **T0** to **T9**. Both of these groups of relays should be released, whereupon the units down-check UDC relay **25216** in Fig. 252 will be operated in a circuit extending from ground in Fig. 252, over contacts **1** of the units walking relays **U0** to **U2** etc. and contacts **3** of the **U8** and **U9** relays, conductor UDC, cable **25230** and conductor UDC to the winding of the UDC relay **25216** and whereupon the tens down-check TDC relay **25217** is operated in a circuit extending from ground in Fig. 253 over contacts **1** of the tens lock-out relays, and conductor TDC over cable **25302** into Fig. 252, where conductor TDC emerges and extends to the winding of the TDC relay **25217**. A circuit is now completed for the operation of the WST relay **25218** extending from ground in Fig. 250 over contact **2** of the WC connector **25006** and conductor **25009** extending into Fig. 252 over contact **1** of the UDC relay **25216**, and contact **3** of the TDC relay **25217** to the winding of the WST relay **25218**.

With the WST relay **25218** and the UDC relay **25216** operated and the CRC relay **25213** released, a circuit is now completed for operating the **U0** units walking relay of Fig. 252. This circuit extends from ground over contact **3** of the CRC relay **25213**, contact **2** of the WST relay **25218**, contact **2** of the UDC relay **25216** to the winding of the **U0** walking relay which operates and locks over its contact **7** and contact **7** of the **U1** walking relay to ground on the conductor **25009**.

The operation of the WST relay **25218** also operates the GT relay **25300** in a circuit extending from off-normal ground in Fig. 252 over contact **1** of the WST relay **25218** and conductor **25227** into Fig. 253 to the winding of the GT relay **25300**. The operation of the GT relay **25300** causes the operation of one of the tens lock-out relays **T0** to **T9** if any one of the ten assembling registers indicated in Fig. 253 and pertaining to that particular tens lock-out relay contains any timing entries. For instance, the **T0** relay will operate over contact **5** of the GT relay and contact **2** of the **00** jack if either of the DS– or AS– disconnect or answer relays of the **00** assembling register is operated. It will be noticed that this operating circuit for the **T0** tens lock-out relay is multipled to all of the contacts **2** of all of the jacks **00** through **09** so that it will operate if a timing entry exists in any one of these ten assembling registers. Similarly, relay **T1** or **T9**, etc., will operate if a timing entry is presently registered in any one of the assembling register falling within their particular "tens groups." It will be noted that the only one of these tens lock-out relays can lock operated at any one time, such as the locking circuit for the relay **T0** which extends over its contact **4**, conductor **25303** into Fig. 252 and over contact **2** of the

TS relay to off-normal ground. As soon as one of the tens lock-out relays T0 through T9 of Fig. 253 operates, the TDC relay **25217** releases thereby providing a locking circuit for the SW relay **25215** extending from the winding of the SW relay **25215** over contact **1** thereof, contact **1** of the TDC relay **25217** to off-normal ground. In connection with the SW relay **25215**, it will be noted that this is a slow-releasing relay, and its operating circuit is opened whenever the GT relay **25300** is operated and its locking circuit is opened whenever the TDC relay **25217** is operated. The SW relay **25215**, therefore, will not release to conclude the assembling register walking control operation until such time as both the TDC relay **25217** and the GT relay **25300** are operated at the same time for a sufficiently long period of time to permit the slow release of the SW relay **25215**.

The release of the TDC relay **25217** causes the release of the WST relay **25218** which in turn causes the release of the GT relay **25300**. Furthermore, as soon as a tens lock-out relay of Fig. 253 is operated, a circuit is completed for operating the tens up-check TUC relay of Fig. 252 in a circuit extending from ground in Fig. 253 over a one-and-one-only check through contacts of all of the tens lock-out relays and over conductor TUC through cable **25302** into Fig. 252 where conductor TUC emerges to operate the TUC relay.

Likewise, as soon as one of the units walking relays of Fig. 252 operates, the UDC relay **25216** will be released and a circuit will be completed for operating the units up-check UUC relay of Fig. 252 in a circuit extending from ground in Fig. 252 over a one-and-one-only check of the contacts of the units walking relays to conductor UUC extending over cable **25230** to operate the UUC relay.

With the UUC and the TUC relays operated, a circuit is now completed for causing the sequential generation of call identity indices beginning with the index **00** and extending through the entire gamut of assembling register numbers **00** to **99** for the purposes of "calling the roll" to remove from all of these registers any timing entries that may be left therein. This circuit extends from off-normal ground in Fig. 252 over contacts **1** and **2** of the US relay, contacts **1** and **2** of the TUC relay, contacts **1** and **2** of the UUC relay to conductors **25231** and **25232** extending to contacts of the units walking relays of Fig. 252 and the tens lock-out relays of Fig. 253. Depending upon which ones of these two groups of relays are operated, these two grounded conductors **25231** and **25232** will be extended over the corresponding relay contacts to ground two of the five conductors of cables E and F extending into Fig. 250. In Fig. 250 these two cables E and F are extended over contacts of the WC connector **25006** to operate on a two-out-of-five basis the E and F digit reading relays indicated in Fig. 250. The operated E and F digit relays will in turn operate the E and F digit translator relays indicated in the lower right-hand portion of Fig. 250 to eventually extend into cable EF a single grounded conductor representing a selection of one out of a hundred possible call identity indices ranging from **00** to **99**. The cable EF extends into Fig. 253 where the grounded conductor, such as conductor **00**, emerges and extends over contact **1** of the jack **00** to the left-hand armature of the DS– disconnect relay of the **00** assembling register.

The complete circuits whereby the disconnect and answer connectors of an assembling register, such as connectors DISC– and ANS– of the **00** assembling register of Fig. 253, are operated to transmit the possible answer and disconnect times from this assembling register to one of the call entry registers and eventually to the straddle tape perforator are not shown, but are described in detail in the detailed description. However, the grounding of the left-hand armature of the DS– relay of the **00** assembling register, as above described, is part of the procedure whereby eventually this particular assembling register is emptied of its timing registrations and whereby these registrations are placed as straddle entries on the straddle tape perforated by the perforator **0** in Fig. 256.

As soon as the registrations have been successfully removed from the assembling register **00**, the release relay RLS– therein is operated to return this assembling register to its normal unoperated condition. Also the dotted conductor **25233** in Fig. 252 is grounded as an indication that the assembling register **00** has been properly cleared, and that the units walking relays may proceed to effect the same clearing operation with respect to the assembling register **01** (not shown in Fig. 253).

The grounding of lead **25233** extends this ground over contact **2** of the U9 walking relay to the winding of the US relay which thereupon operates. Relay US, in operating, extends ground over its contacts **5** and **4**, contact **7** of the U9 relay and contact **6** of the U0 relay to the winding of the U1 relay, which thereupon operates and locks over its contact **9**, contact **9** of the U2 relay to ground on the conductor **25009**. Relay U0 remains locked over its contact **7** and contact **8** of the U1 relay and contact **5** of the US relay to off-normal ground. A circuit is now completed for operating the U2UC relay extending from ground in Fig. 252 over contact **2** of the U0 relay and contact **4** of the U1 relay to the winding of the U2UC relay which, upon operating, causes the release of the US relay. With two units walking relays operated at the same time, the UUC relay of Fig. 252 releases, and with relay US released, the U0 walking relay releases. As soon as the U0 relay releases, the UUC relay again operates.

With the US relay released and the UUC relay reoperated, circuits are again completed for causing the sequential generation of the E and F digits of 01 for the purpose of clearing out the registrations in the assembling register **01** (not shown in Fig. 253).

This process continues until such time as the U8 walking relay of Fig. 252 is released and the U9 walking relay is operated, whereupon when the conductor **25233** in Fig. 252 is grounded as an indication that the **09** assembling register has been properly cleared, a circuit is completed from this grounded conductor **25233** over contact **1** of the U8 relay and contact **1** of the U9 relay to the winding of the TS relay which thereupon operates, thereby releasing the then operated tens lock-out relay of Fig. 253. Upon the release of the tens lock-out relay, the tens down-check TDC relay **25217** reoperates. With the TS relay and the TDC relay **25217** operated, a circuit is completed for operating the GT relay **25300** extending from ground in Fig. 252 over contact **1** of the TS relay and contact **2** of the TDC relay **25217** to conductor **25227** extending into Fig. 253 to operate the GT relay **25300**. The GT relay **25300**, in operating, reoperates the US relay and causes the release of the U9 walking relay. The release of the U9 walking relay causes the release of the UUC relay of Fig. 252 and the reoperation of the UDC relay **25216**.

Now that the UDC relay **25216** and the TDC relay **25217** are reoperated, the entire process may be repeated. It is to be noted, however, that during this step of the process the T0 tens lock-out relay of Fig. 253 cannot operate because the ten assembling registers associated therewith have been emptied. The next tens lock-out relay which can operate and lock will be the T1 relay which will cause the clearing out of the next group of ten registers.

As soon as all of the assembling registers have been cleared, none of the tens lock-out relays of Fig. 253 will operate when the GT relay **25300** is operated. This condition will cause the simultaneous operation of the TDC relay **25217** and the GT relay **25300** for a sufficiently long time to cause the release of the SW relay **25215**. The SW relay **25215**, in releasing, with the CRC relay **25213** released, will cause a ground to be extended

over contact 1 of the WC connector 25006 in Fig. 250 over conductor 25010 into Fig. 252 and over contact 2 of the SW relay 25215 and contact 1 of the CRC relay 25213 to the conductor TTE extending into Fig. 251 to the lowermost armature of the 285R relay 25107 to cause the eventual operation of either the TTFE or TTE common class translator relay of Fig. 254 to cause the appropriate end-of-tape pattern to be placed on the straddle tape.

The so-called CRC operation is initiated by the operation of the CRC relay 25213 of Fig. 252. The CAR relay 25214 is operated immediately in an obvious circuit over contact 4 of the CRC relay 25213 and the SW relay 25215 is operated, as above described, for the purpose of initiating the CAR clearing-out operation above described in detail. The conclusion of the CAR operation is indicated by the release of the SW relay 25215. Upon the release of the SW relay 25215, with the CRC relay 25213 operated, a circuit is completed from ground in Fig. 250 over contact 1 of the WC connector 25006 and over conductor 25010 into Fig. 252 and thence over contact 2 of the SW relay 25215 and contact 2 of the CRC relay 25213 to the armature of the AFCU relay 25219. The AFCU relay 25219 under normal circumstances will be released at this time because certainly some of the assembling registers of Fig. 253 will have processed their first calls. The ground on the armature of the AFCU relay 25219 will, therefore, be extended over its contact 2 to a circuit (not shown) for operating a relay (also not shown) which, when operated, will cause the operation of all of the first call FC– relays in the assembling registers of Fig. 253. Upon the operation of any one of the FC– relays of Fig. 253, a circuit is completed from ground over an armature of any one of these relays to conductor 25304 extending into Fig. 252 to operate the FCCU relay 25220 as an indication that a first call FC– relay is operated in at least one of the assembling registers of Fig. 253. Also, when all of the FC– relays of Fig. 253 are operated, ground will be removed from conductor 25305 in Fig. 253, thereby releasing the FCCD relay of Fig. 252, which relay, upon releasing, extends the ground on conductor 25304 over its contact 1 to operate the AFCU relay 25219 as an indication that all first call relays FC– of Fig. 253 are operated.

Upon the operation of the FCCU relay 25220 and the AFCU relay 25219, the ground on the armature of the CRC relay 25213 will be extended over its contact 2 and contacts 1 of the AFCU relay 25219 and the FCCU relay 25220 to conductor LTE extending into Fig. 251 to the middle armature of the 285R relay 25107 to cause the operation of either the LTFE relay 25400 or the LTE relay of the common class translator circuit of Fig. 254 to produce the appropriate tape identity group on the straddle tape representative of the circuit condition existing at that time.

Feature 17.—General.—This feature has been stated as means for checking that the various sections of input tape are properly spliced together when the "spliced-in emergency" method of straddle tape operation is used.

In the discussion of Feature 16 it was indicated that when the "feedback" method is employed, the output straddle tape, whether produced from a central office emergency or regular recorder tape, is spliced into the regular central office tape at proper points according to regular recorder numbers and the emergency recorder tape is processed in full, irrespective of recorder number sequence and ahead of the regular tape (with the feedback straddle tape spliced-in).

Under the "spliced-in emergency" method of operation all straddle tapes are processed manually. There is no feedback type of operation. The input tape is arranged according to recorder numbers right from the start, the emergency recorder sections being spliced into the corresponding regular recorder sections at the proper points. Thus the input tape will contain only tape sections having recorder number entries of the 280DEF variety where the D digit will be only either a 5 (regular recorder) or a 6 (emergency recorder). There will be no sections having a 280DEF entry where the digit 7 (straddle tape produced from a regular tape) or 8 (straddle tape produced from an emergency tape) appears, as was the case with the "feedback" method of Feature 16.

Wherever a transfer took place from or to an emergency or regular recorder the end-of-tape group of codes identifying such a transfer will, as previously explained, contain a transfer code 285DEF. The D digit will be a 5, 6 or 7 indicating respectively that the transfer condition was made synchronously with the time clock, non-synchronously therewith or that there was no actual transfer but that the regular recorder was made "busy" (for maintenance reasons presumably). This necessarily qualifies as a non-synchronous transfer as far as charge control is concerned. The E and F digits represent, as usual, the regular recorder number, either in fact or representative of the one for which the emergency recorder is about to be, is or was substituted.

For this "spliced-in emergency" type of operation, which may be referred to as the SIE operation, the straddle class setup switch, shown on Fig. 233 and as numeral 25100 on Fig. 251, will be set on its "SIE" terminal instead of its "F" terminal, as was the case for the "feedback" operation. This means at the outset that the SIE relay shown on Figs. 234 and 251 will be operated instead of the F relay.

It will be recalled that the recorder progress switch of Fig. 234 is initially set to represent the first recorder number 00 as set up on the first recorder set-up switches 23306 and 23307 of Fig. 233 and that if the feedback method is in use the progress switch will start on its No. 1 terminal, where relay FRS–23401 operates over contact 2 of the F relay 23420, until all of the emergency tape is processed. If the SIE relay 23406 is operated, as in the present case, instead of the F relay 23420, then the switch arm 23404 of the progress switch will not cause the operation of the FRS relay 23401 until the No. 2 terminal is contacted.

As described in some detail under Features 14, 15 and 16, under the feedback method, the entire emergency tape (D digit of 6 in the 280DEF code) will be processed irrespective of the values or sequence of recorder numbers. This is effected by means of the grounding, at contact arm 23409 of the recorder progress switch of Fig. 234, of the E lead into the recorder register of Fig. 232.

Under the spliced-in emergency method the proper sequence of recorder numbers must be satisfied right from the start. This is the reason why the recorder progress switch of Fig. 234 is started on its No. 2 terminal when the SIE relay 23406 is operated. The SIE relay 23406, in operating, causes the operation of the FRS relay 23401 when the switch arm 23404 of the recorder progress switch contacts its No. 2 contact instead of its No. 1 contact, as was the case of the F operation. As previously explained, this causes the recorder number sequence to be checked right at the start, since contact arm 23409 grounds its 00 lead instead of its E lead.

In the remote event that none of the regular recorders required emergency or busy services, there will be no transfer (285DEF) code end-of-tape groups and the reading progress proceeds without special action. That is, the recorder register, in cooperation with the recorder progress switch checks for the proper numerical progression of tape sections and at the end of each recorder section, where the recorder number changes, the CAR operation takes place to put all call starts onto the straddle tape and all assembling registers are set for "first call" operation.

The present feature is concerned primarily with the particularities of operation where an emergency recorder

section of tape is spliced into a regular recorder tape, thus representing some sort of busy or transfer condition. This condition is detected by noting a transfer end-of-tape group of codes as illustrated in the following table.

C
CS
282105
281110
285D00
280500
283211
284101
081010

081010
282105
281110
285D00
280600
283211
284101
CE
C
CS
282105
281109
285D00
280600
283211
284101
081010

081010
282105
281109
285D00
280500
283211
284101
CE
C

In the above table, read from the bottom up as presented to the accounting machine, the following assumptions and particularities are to be noted:

(1) C represents calls (answer and disconnect times and initial entry) and CE represents call ends (one or two timing entries only).
(2) The D digit of 1 in the 284 entry represents the second round (numbered 0 to 9 for a 10 round month) or round 1.
(3) The E and F digits 01 of the 284 entry represent the 01 marker or recorder group, assumed to specify a 10 round month.
(4) The D digit of 2 in the 283 entry represents the second day (numbered 1 to 3 for a 10 round month) of round.
(5) The E and F digits of 11 represent the eleventh month—November.
(6) The D digit of 5 in the 280 entry indicates a regular recorder of number 00 (E and F digits of the 280 entry).
(7) The 285 entry indicates that there was a transfer, etc. The D digit of 5 means that the transfer was made synchronously so no cancellation of charges is necessary. D digits of 6 and 7 indicate non-synchronous busy and transfer conditions.
(8) The E and F digits of 09 in the 2811 entry show that this end-of-tape code group was made at 9 a.m.
(9) The E and F digits of 05 in the 2821 entry indicates that the calendar day is day 05.
(10) 081010 is splice pattern where physical splices can be made (as indicated by the dashed line).

This end-of-tape group will be placed on the end of the

regular recorder 00 tape at 9 a.m. on November 5, at which time the emergency recorder was substituted for it. When the emergency recorder was called into operation it was at once prepared with a similar end-of-tape group, starting, however, with a section of splice pattern 081010 to facilitate the physical connection. This group will differ from the one previously described only in that the D digit of the 280 entry will be a 6 (indicating the emergency tape). Then will follow call starts (CS—initial entry with or without one timing entry), calls C and call ends CE, followed by an end-of-tape group at the point where the regular recorder 00 was placed back in service. This has been assumed to be after 10 a.m. (E and F digits of the 2811 entry). At this time the regular recorder 00 will place a suitable end-of-tape group on its tape which can be spliced into the emergency tape, as shown by the dotted line.

Thus, at each transfer point there are two end-of-tape groups differing primarily only in that one is on a regular tape (2805) and the other is on an emergency tape (2806). If the transfer is synchronous (285500) these end-of-tape groups can be disregarded and the straddling call entries (those straddling the transfer point) processed just as though there were no splice. If the transfer or make-busy is non-synchronous (285700 or 285600), a similar action can proceed but modified slightly. Where the switch is non-synchronous, certain charge cancellation operations must take place to compensate for what otherwise might be an overcharge.

The particularly significant control items of concern here are the 280 and 285 entries. When the machine reads the first 280500 and 285D00 entries (reading from the bottom up) it notes the facts that the recorder is regular recorder 00 and that a particular kind of transfer condition exists. It remembers this information, along with the matters of the time (9 a.m.) as remembered by the hour register, etc. and the day (05—day 2 of round 1) as remembered by the day register, etc. and awaits the reading of the next group to see if the information matches according to the situation. The next end-of-tape group should specify the same time (9 a.m.) of the same day (05), should indicate the same type of transfer, and should specify an emergency recorder acting for the regular recorder 00 (280600). If this check proceeds normally, processing can continue; otherwise, the machine will block.

Bearing previous discussion in mind, some detailed explanation of this particular action will be set forth with the assistance of the two groups of figures, 230 to 235 and 249 to 256. When the first (or odd) group of a pair of end-of-tape groups is read, the 284DEF and 283DEF codes are dispensed with in the usual manner, the round, day of round, marker group and month being checked. The 280DEF code will check as to recorder number (EF) and the D digit of 5 or 6 will check also, according to the recorder register check circuits of Figs. 231 and 232.

When the 285DEF code is read by the reader (see Fig. 250) the **285** lead will be grounded and this ground extends through Figs. 250 and 251 into Fig. 252, where it extends over circuits indicated by a dotted line and contact **1** of relay **TI–25201** (operated when reading tape identity) to conductor **285R** into Fig. 251 to operate the **285C** relay **25106**. The **285R** relay **25107** then operates from ground in Fig. 252, over the contact of the ETE relay **25209**, conductor **285L** to Fig. 251 and over contact **6** of the **285C** relay **25106**. The **285C** relay **25106**, in operating, extends a ground from the D reading relays of Fig. 250 (according to the D digit of 5, 6 or 7) over cable **285D** to Fig. 251 and over one of the contacts **2, 3** or **4** of the **285C** relay **25106**, to one of the leads **2855EF, 2856EF** or **2857EF** to eventually operate one of the relays **STF, NSMB** or NSTF of Fig. **251** (assum-

ing any timing entry cancellations to be taken care of first). The 285R relay 25107 thereupon locks over its contact 7 and a make contact of the relay STF, NSMB or NSTF to the 285L conductor. The grounded 285L conductor is also extended over contact 5 of the CG relay and a one-and-one-only chain of contacts on the relays NSTF, NSMB and STF, over contact 5 of the 285C relay 25106 to operate the reader step relay RS.

It will be recalled in the previous discussion of the timing circuit of Fig. 234 that proper and timely operation of the reader step relay (such as the RS relay 23104 of Fig. 231) will prevent the operation of the alarm relay T0–23424 of Fig. 234. The reader step relay RS of Fig. 251 similarly will operate the cancel time CT relay 23416 of Fig. 234, thereby to prevent the giving of an alarm.

Upon the stepping of the reader of Fig. 250, the 285C relay 25106 is released, leaving the operated 285R relay 25107 and the operated relay NSTF, NSMB or STF locked to conductor 285L. Furthermore, if relay NSTF or STF is operated (a transfer code), the TF relay 25212 of Fig. 252 will be operated from the grounded conductor 285L in Fig. 251, over contact 1 of relay NSTF or STF, to conductor 25114 into Fig. 252 to the TF relay 25212.

The 2811EF and 2821EF codes are checked as to end-of-tape hour and day as usual, whereupon the splice pattern is skipped (and the TEG2 relay 25210 is operated incident thereto) and the even or second group of tape identity codes is started to be read and checked, the 284DEF and 283DEF entries checking out properly for the normal type of transfer situation. When the 280DEF entry is read, the D digit will normally change from a 5 (regular recorder) to a 6 (emergency recorder) or vice versa, the recorder number (EF) being the same as that on the opposite side (odd) of the splice.

Under the SIE operation (SIE relay 23406 operated), a D digit of 6 with the C5 relay 23202 operated will extend ground from conductor CC6 in Fig. 232, over contact 2 of the C6 relay 23212, conductor 6, cable 65 into Fig. 234, conductor 6, contact 3 of the SIE relay 23406, conductor NRP6, cable RP56 to Fig. 232 to operate the NRP6 relay. Likewise, a D digit of 5 with the C6 relay 23212 operated will cause the relay NRP5 to operate. Under either circumstance, ground will extend from the MONA lead in Fig. 232, over contact 1 of the CR relay 23210, contacts 2 of the TA and UA relays 23205 and 23206 (tens and units digits of the recorder number check no change), contact 3 of the NPR5 or NRP6 relay to conductor CCH1, thence through Fig. 234 into Fig. 235, over contact 1 of the DCR relay 23515 (released when no change in round is detected), contact 2 of the DCDR relay 23506 (released when no change in day of round is detected), conductor CCH, through Fig. 234 into Fig. 232 to operate the CCH relay.

The operation of the CCH relay causes the hour register circuits of the machine to check that the end-of-tape hour entry (2811EF) is the same on both sides of the splice. Under normal circumstances, this check is canceled but here it is necessary in order to verify the correctness of the splice. Relay CCH, in operating, causes the operation of a relay CHS (not shown) which actually sets up the check for the subsequently read hour entry and this relay, in cooperation with the operated CCH relay, causes the operation of the CR relay 23210, which releases the old recorder registration in Fig. 232 and replaces it with the new one, the up-check lead UC in Fig. 232 thereupon being extended into Fig. 231 and over contact 8 of the RR recorder register connecter 23105 to the reader step RS relay 23104. This permits the reader to advance to the new 285DEF entry.

Referring to Fig. 251, it will be apparent that the 285DEF entry will reoperate the 285C relay 25106 and will attempt to operate one of the NSTF, NSMB and STF relays. If the 285DEF code is the same as the one on

the other (odd) side of the splice, as it should be, then the appropriate relay (NSTF, NSMB or STF) will already be operated and locked, in which case nothing happens except reader step as before. However, if the D digit of this 285DEF code differs from the one previously remembered from reading the odd side, then two of the three relays NSTF, NSMB and STF will now be operated and locked, whereupon the previously described one-and-one-only reader step circuit through contacts of these three relays will be open. Thus, when the RS reader step relay of Fig. 251 fails to operate soon enough (indicating a trouble here) the cancel time CT relay 23416 of Fig. 234 will not be operated soon enough and this permits the alarm T0–23424 relay of Fig. 234 to operate.

Assuming that the 285DEF transfer code checks all right and that the following 2811EF end-of-tape hour checks satisfactorily, and that the 2821EF calendar day is proper, the ETE relay 25209 is operated in a circuit extending from ground in the tape identity reading progress circuit of Fig. 252, over contact 1 of the FI relay 25200, contact 1 of the CR1 relay 25206, conductor 25223 to armatures of the relays C5, C6, C7 and C8 of Fig. 251, and either over contact 4 of the C6 relay 25102 and contact 3 of the T0 relay 25105 or the T1 relay 25104 to conductor 25108, or over contact 4 of the C5 relay to conductor 25115, conductors 25108 and 25115 extending into Fig. 252 and over contacts 2 and 4 of the TEG2 relay 25210 to the ETE conductor, thence over the contacts of the DCDR relay 25207 and the DCR relay 25208 to conductor 25224, thence into Fig. 250, over contact 2 of the DPRS relay 25001, the contact of the DPS relay 25002, contact 2 of the FDR relay 25003, contact 1 of the RP delay 25004 to conductor 25007, thence into Fig. 252 to operate the ETE relay 25209. The operation of the ETE relay 25209 opens up locking circuits to revert all tape identity reading, checking and progress circuits to normal and permits the reading and processing of call entries.

END-OF-TAPE-PATTERNS

Under the spliced-in emergency type of straddle operation (SIE operation), the TFZ relay 25221 remains released at all times.

While reading the odd tape identity group of a pair, if the emergency tape is being read and it is found that the emergency recorder is idle, the relays C6 and T4 in Fig. 251 will be operated, whereupon ground will extend from the grounded conductor 25223 in Fig. 251 over contact 4 of the C6 relay 25102 and contact 3 of the T4 relay 25103 to the ETE lead, thereby as previously described, operating the ETE relay 25209 to effectively skip tape preparation at this point.

If the emergency recorder or the regular recorder is in operation, the grounded conductor 25223 will extend over either contact 4 of the C5 relay of Fig. 251 to conductor 25115 or over contact 4 of the C6 relay 25102 and contact 3 of either of the T0 and T1 relays 25105 and 25104 to the conductor 25108. The grounded one of these conductors 25115 and 25108 will extend into Fig. 252 and over contact 3 or contact 1 of the TEG2 relay 25210 to conductor 25228 or 25225 into Fig. 251, and thence over contact 3 or 1 of the SIE relay to conductor 25118 into Fig. 252, and over contact 2 of the EPW relay 25202 to the TE conductor extending to the armature controlling contacts 1 and 2 in Fig. 251 of the 285R relay 25107. As previously explained in connection with the feedback type of straddle operation, when the TE conductor in Fig. 251 is grounded, this will cause the operation of the TE or the TFE common class translator relay of Fig. 254 depending upon whether or not a 285DEF code has not or has been received (the 285R relay 25107 released or operated).

During the reading of the splice pattern between the odd and even identity groups of a pair, the TEG2 relay 25210 will be operated.

If no change of recorder number is detected across

the splice pattern, the grounded conductor **25115** or **25108** in Fig. 252 will be extended over contact **4** or **2** of the TEG2 relay **25210** directly to the ETE lead.

If a recorder number change is detected on the other side (even side) of the splice pattern, the CR1 relay **25206** will be operated, whereupon ground will extend from the armature thereof, over contact **2** of the CR1 relay **25206** to the winding of the CRC relay **25213** to cause the CRC operation. This CRC operation will, as previously described, remove from the assembling registers of Fig. 253 call end emergency or regular straddle entries onto the straddle tape and will cause the setting of the first call relays in the assembling registers preparatory to processing possible call start straddle entries for either the regular or emergency tape section, whichever may appear first in connection with processing the next recorder tapes.

Features 18, 19 and 20.—These features have been stated as relating to means for reconstructing certain vital items of tape identity information in the event of a power failure or in the event of a mutilated entry causing a failure of such information to register.

Fig. 257 of the drawings shows how Figs. 258 and 259 may be arranged to show a skeletonized schematic arrangement of the salient apparatus elements involved in the performance of the functions relating to these features.

With reference to Fig. 259, certain of the set-up switches of the assembler-computer are shown, such as the last-round switch **25909**, the last-day-of-round switch **25910** and the marker group tens and units switches **25911** and **25912**. The tens and units digit settings of the marker group switches will cause the operation of certain of the marker group selecting relays **25913**, thereby to operate over cable RS one of the relays **6R** and **10R** of the round size translator **25906** as an indication of the type of round division relating to that particular marker. It will be recalled that the operation of the assembler-computer permits the processing of central office tape produced under either a six or a ten round month accounting period. The round translator **25907** and the day-of-round translator **25908** are similarly adjusted. In the left upper portion of Fig. 259 are shown two of the day progress step-by-step switch arcs represented by the round wiper **25901** and the day-of-round wiper **25902**. Due to the operation of the day progress switch, these wipers **25901** and **25902** will be stepped from contact to contact depending upon the day value currently involved in the processing. At each step of these wipers, grounds are transmitted from these wipers over the cables RD and DRD, through the round size translator **25906** and, by means of the round translator **25907** and the day-of-round translator **25908**, to the contacts of the round and day-of-round set-up switches **25909** and **25910**. At such time as the setting of the day progress switch wiper arms **25901** and **25902** correspond to the last-round and the last-day-of-round, as specified on the set-up switches **25909** and **25910**, the respective last-round and last-day-of-round relays LR and LDR will be operated to stop the automatic stepping of the day progress switch so that processing may start at the prescribed point.

When the machine is first started, off-normal ground is applied in parallel circuits over contacts of the LR and LDR relays and over the contact of the STP day progress switch stepping magnet to the winding of the DPS1 relay. Relay DPS1 operates and applies ground over its contact **1** to the winding of the stepping magnet STP, which thereupon operates to release the DPS1 relay. Relay DPS1, in releasing, releases the STP magnet which thereupon again completes the operating circuit for the DPS1 relay. Each time the STP magnet releases, the day progress switch advances one step. This automatic self-interrupting stepping circuit is effective to step all of the wipers **25901** through **25905** of the day progress switch until such time as both of the relays LR and LDR are operated, representing a setting of the day progress switch corresponding to the prescribed last-round and last-day-of-round on the set-up switches **25909** and **25910**. The wiper arms **25903** and **25904** of the day progress switch represent, at any particular step position thereof, the respective tens and units digits of the calendar day represented by the above-mentioned round and day-of-round specified by the settings of the wipers **25901** and **25902**.

From this starting position and throughout the processing of a central office tape, since the central office tape is processed in the reverse order of time, each change of calendar day in the end-of-tape identity group on the central office tape will cause the day progress switch to advance one step. At any time, therefore, the positions of the tens and units wipers **25903** and **25904** will represent the calendar day currently under process.

More than one passage of the wipers of the day progress switch over their respective contact banks is necessary in order to specify all of the possible calender days in any particular month. Therefore, the OPR relay is arranged to be released during the first passage of the wipers and is arranged to be operated during the last or second passage of the wipers. During the first passage of the wipers, ground on wiper **25905** is extended over its contact **2** and contact **1** of the OPR relay to operate the FA relay which, in operating, provides over its contacts **1**, **2** and **3** the necessary translations of the tens digit of the calendar day as represented by any particular setting of the wiper **25903**. During the second pass, the ground on wiper **25905** will be extended over its contact **2** and contact **2** of relay OPR to operate the LA relay to provide over its contacts **1**, **2** and **3** similar translations of the calendar day tens digit. As wiper **25905** completes its first pass and arrives back at its contact **1**, ground will be extended thereover and over contact **4** of the FA relay and over the contact of the STP stepping magnet to cause the day progress switch to advance one step to its contacts **2**.

Throughout the above-described operation of the day progress switch of Fig. 259, the reader **25801** will be reading the respective calendar day entries from the tape **25800**. These calendar day entries, comprising the E and F digits of the 2821EF entry, will be passed through the reading connector **25802** and into the E and F digit reading relays **25803**. The E and F digit reading relays will, over cables E1 and F1, cause the operation of one each of the E digit translators **25804** and F digit translators **25805**. Tens and units grounds are extended from these translator relays over cables E2 and F2 and over contacts of the DR part of the connector **25806** and over cables DU and DT into cable DUT, extending into Fig. 259 to operate one each of the tens and units day register relays.

The recorder progress step-by-step switch, represented by wipers **25914** and **25915** in Fig. 259, is advanced step by step according to the changing recorder number as an input tape is processed, so that the respective positions of the wipers **25914** and **25915** at any one time represent the tens and units digit of the recorder number presently under process. As was the case above mentioned in connection with the calendar day entries 2821EF, the various recorder number entries 280DEF will contain E and F digits representing the tens and units digits of the recorder number as read by the reader **25801** from the tape **25800**. The E and F digit translator relays **25804** and **25805** will transmit tens and units grounds over respective cables E2 and F2 and over contacts **1** through **10** and **11** through **15** of the RR part of the connector **25806**, and thence over cables RU and RT into cable RCUT, extending into Fig. 259 where the recorder number tens and units digits emerge by means of cables RT and RU to operate one each of the recorder number tens and units relays of Fig. 259.

The D digit of the 280DEF recorder number entry can be a 5, 6, 7 or 8, depending on what kind of a recorder produced the tape in question. This information is passed from the reading relays **25803** over cable D and over one of the contacts **16** through **19** of the R part of the connector **25806** and over cables RC and RCUT into Fig. 259, where cable RC emerges to cause the operation of one of the recorder register relays **C5, C6, C7** or **C8**, and at the same time to cause the operation of one of the polar relays LC5 through LC8.

With respect to the day progress and recorder progress step-by-step switches, it will be appreciated that these switches will remain in whichever position they find themselves should power be removed from the circuit, because these switches cannot move from any one position unless caused to so move by means of the operation and release of the STP stepping magnet for the day progress switch and another suitable stepping magnet (not shown) for the recorder progress switch.

The respective polar relays LC5 through LC8, whenever energized over one of the conductors RC5 through RC8 in Fig. 259, will move their respective armatures to make contact with the respective contacts shown, whereupon these relays are so arranged that they will remain in this condition regardless of the fact that power may be removed from the circuit. These relays are returned to their normal condition, as illustrated, only by means of the operation of the CR relay which operates whenever a recorder number changes.

If for any reason the source of power for operating an assembler-computer should be removed, all registers therein would become released except, of course, for the mechanical settings of the day and recorder progress switches and except for the settings of the polar relays LC5 through LC8.

As an incident to putting the machine back into operation after a power failure, the emergency reset key of Fig. 259 is operated, whereupon the ER relay operates in an obvious circuit. Ground will thereupon be applied over contact **3** of the ER relay and the contact of the RDC relay (operated because the recorder register is empty) to cause the operation of the RRS recorder reset connector. Off-normal ground will be extended over the wiper arm **25914** of the recorder progress switch to operate the appropriate recorder tens relays RT0 or RT1, which will thereupon extend a ground over the T0 or T1 conductor, over contact **1** or **2** of the RRS connector and over cable RT to operate one of the recorder tens register relays T0 or T1 in accordance with the previous setting of the recorder tens digit on the recorder progress switch. Similarly, the recorder units digit will be registered in a circuit extending from ground on the wiper **25915** of the recorder progress switch, over one of the ten units conductors, one of the contacts **3** through **12** of the recorder reset connector and over cable RU to operate one of the ten recorder units register relays U0 to U9. These tens and units recorder register relays thereupon lock over their own contacts to off-normal ground on contact **2** of the CR relay. The operation of the recorder reset connector RRS also extends ground over its contact **13** and over the armature of an operated one of the LC5 through LC8 polar relays and over the appropriate conductor RC5 through RC8 to operate one of the C5 through C8 recorder register relays, which thereupon locks over its contact to off-normal ground. This operation comprises a resetting of the recorder register in accordance with the recorder number remembered by the mechanical setting of the recorder progress switch.

The operation of the ER relay also causes a resetting of the day register by extending ground over its contact **4** and over the contact of the DDC relay (operated because the day register is empty) to cause the operation of the DRS day reset connector, which thereupon locks over its contact **1** to ground over contact **4** of the ER relay. Ground is extended over contact **4** of the DRS

connector and over conductor A and cable UT to the left-hand side of Fig. 259, where conductor A emerges and extends over contact **1** or contact **2**, as the case may be, of the OPR relay to operate the appropriate FA or LA relay. Additional grounds are extended over conductors T and U and contacts **2** and **3** of the DRS connector and over cable UT to the respective tens and units wipers **25903** and **25904** of the day progress switch. Ground on the units wiper arm **25904** will ground one of the conductors extending into cable DU, thereby to operate one of the calendar day units register relays DU0 to DU9. The grounded tens wiper arm **25903** will extend a ground over its appropriate contact and over the appropriate contact **1** or **2** or **3** of the FA or LA relay into cable DT, thereby to cause the operation of the appropriate calendar day tens register relays DT0 through DT3. This operation comprises a resetting of the calendar day register by virtue of the mechanical memory retained in the day progress switch.

As a result of both of these resetting operations, the relays RDC and DDC will become released, thereby opening up the operating circuits of the recorder and day reset connectors, both of which eventually will release.

The hour register (not shown) may be supplied with a fictitious hour entry for the purpose of satisfying the circuit temporarily, by means of a circuit extending from off-normal ground in the hour register control circuit **25807** in Fig. 258, over contacts of the operated relays OHDC and EHDC (both operated because both the odd and even hour registers will be empty as a result of the power failure), thence over conductor EH1 into Fig. 259, over contact **2** of the hour reset key and over contact **2** of the ER relay to conductor H25 extending into Fig. 258 to operate the H25 relay. The H25 relay, in operating, causes a fictitious hour entry "25" to be deposited in the even hour register for the purpose of temporarily satisfying the end-of-tape progress reading circuits.

In the event that a mutilated tape identity entry is discovered, the operation of the mutilated tape identity key of Fig. 259 will cause the operation of the MTI relay, which thereupon locks over its contacts **1** to off-normal ground. The operation of the MTI relay applies ground over its contact **2** to each of the day and recorder reset keys of Fig. 259. The operation of either one of the day or recorder reset keys will manually cause the same operation as was automatically caused by the operation of the ER relay, as above described. This will be apparent by inspection of the circuitry shown in the upper right-hand portion of Fig. 259.

It will be noted that the operation of the hour reset key of Fig. 259 whenever the odd and even hour registers are empty, as indicated by the operation of both of the OHDC and EHDC relays of the hour register control circuit **25807**, will extend the ground on conductor EH1 over contact **1** of the hour reset key to the H25 conductor extending into Fig. 258 to cause the operation of the H25 relay as above described.

Feature 21.—This feature has been stated as comprising means associated with each of the assembling registers of the assembler-computer for indicating to the odd or even processing call register whether or not the particular assembling register involved in the processing of a call has or has not handled its so-called "first call."

The central office recorder tapes are provided with splice pattern at 3 a.m. each day to indicate and to provide places for cutting such tapes for transmission to the accounting center for processing. When such tapes are processed in the assembler-computer of the accounting center, they are processed in the reverse order of time such that the leading end of a particular recorder tape into the assembler-computer represents the latest section of that tape with respect to the accounting time when it was processed by the central office recorder. It is probable that not many telephone calls

will be interrupted by virtue of these 3 a.m. cutting points. However, it is possible that a particular call may straddle this cutting point such that the initial entry (placed on a central office recorder tape when a subscriber initiates a call), or an initial entry and an answer time (placed on the central office recorder tape when the called subscriber answers) may appear on the leading end of such a tape when it is fed into the assembler-computer. This would mean that the trailing end of the next section of the same recorder tape subsequently to be sent to the accounting center for processing would contain, respectively, the answer time and the disconnect time (placed on the central office recorder tape when the call between the calling and the called subscribers is disconnected) or the disconnect time alone. This then would represent one way or the other a call, the complete entries for which straddle the 3 a.m. cutting point.

Each of the 100 assembling registers **00** to **99**, having index numbers corresponding to the call identity indices which will identify each entry for each call, are provided with so-called "first call" relays. At such time as a different or new central office recorder tape or tape section is about to be processed by the assembler-computer, circuits are brought into play whereby all of these first call relays are operated in all of the assembling registers. The operation of the first call relay in an assembling register provides a signal to one of the processing registers, designated the odd and even call entry registers, at such time as these processing registers may be brought into play, to process a call, indicating to the processing register that the particular assembling register currently involved in processing a call has not yet handled its first call. This signal informs the processing register that, in the event that it finds insufficient timing entries in this particular assembling register to process a complete call, it should take notice of the first call condition and cause the incomplete entries of which it is aware to be placed on the straddle tape for subsequent manual processing or for subsequent automatic processing in accordance with the feedback method of straddle operation.

At such time as an assembling register may have been relieved of whatever timing entries it may contain relating to any particular call, this first call relay will be released automatically as a result of this operation. The first call relay in an assembling register when first released, remains released throughout the entire processing of the central office tape for any particular recorder and will be operated, as above indicated, at such time as a new recorder tape is about to be processed. The released condition of a first call relay provides a signal to a processing register that this particular assembling register has handled its so-called "first call" and that thereafter the processing register, if it finds incomplete information upon the basis of which it cannot process the call, may discard the call, particularly when no timing entries appear at all—this being stated as a "don't answer" call.

If the first call relay of an assembling register is operated at such time as a time cancellation signal may be received into the control circuits of the assembler-computer, the first call relay will be held operated during the circuit action which causes the elimination of one or two timing entries in all assembling registers, depending upon the type of cancel entry read by the assembler-computer reader. This prevents the assembling register from indicating to the processing register that it has handled a first call when, in fact, it has not.

Figs. 218 and 219 illustrate in a schematic fashion this so-called "first call" relay operation.

When the assembler-computer is initially started into operation, a circuit will be completed for operating the OFC relay in Fig. 218. This circuit extends from ground over the contact of the WC reader connector, conductor TTE, contacts of the SW and CRC relays, and contact **2** of the AFCU relay to the winding of the OFC relay. Relay OFC, in operating, causes the operation of all of the "first call" relays (such as the FC relay **21911** of Fig. 219) in all of the assembling registers **00** to **99** of Fig. 219. This circuit extends from ground over the contact of the OFC relay to the conductor SFC, extending into Fig. 219, and over the right contact **1** of each of the FC– relays, such as right contact **1** of the FC relay **21911** of assembling register **99**, to operate that particular FC– relay, which thereupon locks over its right contact **2** to ground over contact **1** of the RLS release relay **21904** of that particular assembling register. If any FC– relay, such as FC relay **21911**, releases, ground will extend over its right contact **6** to the FCCD conductor, extending into Fig. 218 to operate the FCCD relay. However, when all of the FC– relays have been operated, the FCCD relay releases. Thereupon, ground will extend over an operated contact of any one of the FC– relays, such as right contact **5** of the FC relay **21911**, to conductor FCCU, extending into Fig. 218 to operate both of the relays FCCU and AFCU, thereby releasing the OFC relay. At this point, the ground on the armature of the AFCU relay will be extended over contact **1** of the AFCU relay and over the contact of the FCCU relay to the armature of the **285R** relay (operated or released depending upon whether or not a transfer entry 285DEF was received by the assembler-computer as part of the leading tape identity). The ground on the armature of the **285R** relay will be extended over its associated contact **1** or **2** to conductor LTFE or LTE, extending by means of cable LT into Fig. 219 to cause the operation of the LTFE or LTE common class translator relay.

The operated LTFE or LTE common class translator relay controls the common pattern connector of Fig. 219, whereby suitable grounds may be extended from the reader **21802**, over the **PA0** through **PF7** conductors, and over cable P into Fig. 219 and into and through the common pattern connector to control the straddle perforator to produce a suitable leading tape identity on the straddle tape in contemplation of possible straddle entries representing parts of "first calls."

None or one or two timing entries may be received in the assembling register No. **99** of Fig. 219 during the ensuing process of the particular recorder tape presently being read by the reader **21802**. The first timing entry identified by the call identity index **99** will be passed from the reader **21802** through the RC reader connector into the reading relays **21804**. The E and F digits of this timing entry represent the call identity index and will, through the agency of the E and F digit translators **21825**, cause the grounding of the conductor **99**, extending from the translators **21825**, over cable EF into Fig. 219, where conductor **99** emerges and extends over left contact **1** of the DS relay **21903** to the winding of the disconnect connector DISC of register **99**. The operation of the DISC connector causes the timing information comprising the A, B, C and D digits of this entry to be passed from the reading relays **21804** through the assembling register multiple connector ADM and over the DISC disconnect multiple cable into Fig. 219 and over contacts of the connector DISC of register **99** into the register relays **21902**, which thereupon lock over their contacts through the winding of the DS relay **21903** to ground over contact **1** of the RLS relay **21904**. The DS relay **21903**, in operating, transfers the conductor **99** through its left contact **1** to its left contact **2** such that the next timing entry, if any, which may be received bearing the call identity index **99**, will cause the operation of the answer connector ANS for this assembling register, thereby to transfer the next timing entry, if any, from the reading relays **21804** through the assembling register multiple connectors ADM and AM to the ANS answer multiple cable extending into Fig. 219 and over contacts of

the ANS connector to operate the answer time register relays, which thereupon lock over their own contacts through the winding of the AS relay **21905** to ground, over right contact **3** of the RLS relay **21904**.

The operation of any AS relay, such as AS relay **21905**, is an indication that there is at least one assembling register which contains two timing entries. This will cause the operation of the CCRC relay **21801** in a typical circuit extending from ground over contact **1** of the RLS relay **21904**, contact **1** of the DS relay **21903** and contact **1** of the AS relay **21905** to conductor **21914**, extending into Fig. 218 to operate the CCRC relay **21801**.

Similarly, the operation of any DS– relay, such as the DS relay **21903** with the corresponding AS– relay, such as AS relay **21905** released, is an indication that there is at least one assembling register containing only a single timing entry. This will cause the operation of the NSRC relay **21800** in a circuit extending from ground on the inner left armature of the AS relay **21905** and over contact **2** of this relay to conductor **21913**, extending into Fig. 218 to the winding of the NSRC relay **21800**.

At such time as an initial entry identified by a call identity index **99** may be received in the assembler-computer, the E and F digit translators **21825** will be brought into operation to cause the concurrent operation of both the disconnect and answer connectors DISC and ANS of the associated assembling register **99** for transferring the registered disconnect and answer timing information contained therein to the respective DISC and ANS multiple cables. As an incident to this operation, the disconnect and answer connectors and AR of the odd or even call register connectors of Fig. 219 will be operated, whereupon the disconnect and answer timing entries appearing on the disconnect and answer multiples will be transferred over contacts of these connectors DR and AR into the associated registers **21915** and **21916** of the associated call entry register. At the same time, the operated or released condition of the FC relay **21911** will be transferred as a signal to the odd call entry register by means of an alternate circuit from ground over the left outer armature of the FC relay **21911**, and over its contact **4** or **3**, conductor FCD or FCU, contact **4** or **3** of the No. **99** connector DISC, cable FC, and over contact **3** or **4** of the odd call entry register connector DR to operate either the FCD or FCU relay in the odd call entry register control circuit in the lower right-hand portion of Fig. 219.

As an incident to the interconnection between the assembling register **99** and the odd call entry register, certain relays in the odd call entry register control circuit will be operated to indicate whether or not an answer time and a disconnect time were detected as available in the assembling register **99** and whether or not such answer and disconnect registrations, if any, were received and registered in the odd call entry register. The odd call entry register which is used for processing a particular call, therefore, will have information in its comprising knowledge as to how many timing entries it received, if any, or whether or not the assembling register from which it received this information had or had not previously handled its so-called "first call."

If the odd call entry register control circuit ascertains that it has received each of the timing entries that it is supposed to receiver, ground will be extended from this control circuit over contact **5** of the DR connector associated with the odd call entry register to conductor RLSL, which thereupon will extend over contact **5** of the DISC connector of register **99** to the right-hand winding of the RLS relay **21904**, which thereupon operates and locks over its contact **2** to ground on the RLSL conductor. The operation of the RLS relay **21904** will effect the release of all relays operated in the assembling register **99** including the FC first call relay **21911**. In the meantime, the odd call entry register control circuit has ascertained sufficient information to deal with these timing entries as the situation may dictate; that is, if the FCD relay of the odd call entry register control circuit is operated, indicating that these timing entries are taken from an assembling register which already has handled its first call, there may be one of three types of processing action as follows: If only an initial entry exists; this call is discarded as a don't answer call; if a single timing entry has been received, this call is processed as a normal call, charges for which will be computed only for the minimum time period associated with the use of this facility; and if two timing entries have been received, this obviously is processed as a complete call. On the other hand, if the FCU relay of the odd call entry register control circuit is operated, indicating that the assembling register from which these timing entries have been taken has not handled its first call, then one of two types of circuit actions can take place: If two timing entries are received, this obviously is processed as a complete call; but if only a single or no timing entry is received, the odd call entry register control circuit under these circumstances will assume that this is an answer time (or an initial entry alone) associated with a call which straddles the 3 a.m. cutting point, the disconnect time (and answer time perhaps) for which call will appear on a central office tape which has not yet been received in the accounting center and the answer time and initial entry for this call will be caused to be placed on the straddle tape to be processed manually or automatically, depending upon what type of staddle operation the machine happens to be following at the time. In any event, the RLS release relay **21904** of assembling register **99** is operated to return the register **99** to its normal condition in preparation for handling the next call having an identity index **99**.

If at such time as the FC relay **21911** of assembling register **99** may be operated, a cancellation signal comprising an entry 285DEF may be received in the assembler-computer, thereby to ground conductor **21811** or **21809** in Fig. 218 (to respectively signal the assembling registers that a single timing entry or both timing entries should be eliminated), this ground will extend to the outer left armature of the AS relay **21905** and over right contact **2** of the DS relay **21903** and left contact **1** of the FC relay **21911** (to the left-hand winding thereof to hold it operated), and over right contact **3** of the FC relay **21911** to the left-hand winding of the RLS relay **21904**. The operation of the RLS relay **21904** under these circumstances will release all of the operated relays in the register **99** with the exception of the FC relay **21904**, which, as above indicated, remains operated as it should to preserve the indication that it has not as yet handled its so-called "first call."

Feature 22.—This feature has been stated as comprising various features of a mixed base factor code calculator wherein such items as days, hours and minutes may be so arranged in a subtractor such that an elapsed time of a telephone conversation may be computed. It will be noted in such a calculation ranging from tenths of a minute to day values, that carry circuits must be provided between denominational order sections of such a computer and that, in most cases, the computer will not be composed of sections having the same computing basis. For instance, tenths of a minute are conveniently handled on a bi-quinary basis as are minute unit values. Tens of a minute are most conveniently handled on a bi-trinary basis because there are only six values of minute tens to work with, namely digits 0 to 5. Days are divided into 24-hour periods; therefore, the hour computation is conveniently handled on a quaternary-binary-trinary basis, splitting the 24-hour day into its factors of 4, 2 and 3.

In the calculator of the present invention, the ultimate purpose is to subtract a disconnect time from an

answer time to arrive at a value of chargeable time in tens and units of minutes and, where desirable, to convert this chargeable time into an equivalent number of so-called "message units." The calculator, which is in effect a subtractor, is actually an adder because, as is well known in some situations, it is easier to subtract by complementary addition.

The units value of the disconnect and answer day digits are deposited in answer and disconnect calculator register sections on a bi-quinary basis; the disconnect and answer hour values are registered in the calculator in separate sections on the above-mentioned quaternary-binary-trinary basis; the minute tens values for the answer and disconnect times are registered on a bi-trinary basis; the minute units values are registered on a bi-quinary basis; and, the minute tenths or minute "parts" are registered in the calculator on a bi-quinary basis. Each of the answer values is registered in the calculator as the respective complement of its actual value in order that the calculator may add to find the difference.

It is necessary during the calculation to provide for carries from one denominational order to the next, and in the calculator of the present invention separate carry relays are provided between denominational sections of the calculator in order to prevent possible harmful circuit conditions which might exist if separate carry relays were not provided.

Fig. 260 shows how Figs. 261 through 271 may be arranged to disclose a skeletonized circuit arrangement of the calculator in the present invention. Figs. 261 and 262 show various pieces of equipment involved in the assembler-computer for deriving the correctly coded values of the answer and disconnect times for registering in the calculator which comprises Figs. 263 through 268. Fig. 269 shows a number of subtractor control relays. Fig. 270 shows registers for recording the result of the computation in chargeable time tens and units values. Fig. 271 shows part of the translating mechanism whereby the computed chargeable time may be translated to so-called "message units."

Fig. 263 shows the binary and quinary sections of the day subtractor; Fig. 264 shows the quaternary and binary sections of the hour subtractor; Fig. 265 shows the trinary section of the hour subtractor and the binary section of the minute tens subtractor; Fig. 266 shows the trinary section of the minute tens subtractor and the binary section of the minute units subtractor; Fig. 267 shows the quinary section of the minute units subtractor and the timed release index subtractor (which is used to make certain allowances in favor of the subscriber with respect to chargeable time); and, Fig. 268 shows the binary and quinary sections of the minute tenths subtractor.

For the purpose of illustrating some of the novel features of the calculator, two examples will be followed in detail. The first example will assume that the answer and disconnect days are the same, such as day 04; that the answer time is 10:59.6 hours (59 and 6/10 minutes past the hour of 10 a.m.); that the disconnect time is 11:02.7 (2 and 7/10 minutes past the hour of 11 a.m.); and that the disconnect condition on this call was a normal disconnect condition which means "no timed release." The second example will assume that the answer day is day 02; that the disconnect day is day 03; that the answer time is 22:47.9 hours (47 and 9/10 minutes past the hour of 10 p.m.); that the disconnect time is 00:21.3 hours (21 and 3/10 minutes past midnight); and that the disconnect condition for this call was a so-called "timed release" condition, requiring a special time allowance in favor of the calling party as far as chargeable time is concerned.

Example 1

The answer minute tenths value of 6 is registered in Fig. 268 by the operation of the binary relay AMMPB00 and the quinary relay AMMPQ3. The disconnect minute tenths value of 7 is registered in Fig. 268 by the operation of the binary relay DMMPB5 and the quinary relay DMMPQ2. The normal disconect condition associated with this call is registered by the operation of relay NTR in Fig. 267. The answer minute units value 9 is registered in Figs. 266 and 267 by the operation of the binary relay AMUB00 in Fig. 266 and the quinary relay AMUQ0 in Fig. 267. Likewise, the disconnect minute units value 2 is registered in Figs. 266 and 267 by the operation of the binary relay DMUB00 and the quinary relay DMUQ2. The answer minute tens value of 5 is registered in the calculator by the operation of the binary relay AMTB00 in Fig. 265 and the trinary relay AMTT0 in Fig. 266. Likewise, the disconnect minute tens value 0 is registered by the operation of the binary relay DMTB00 in Fig. 265 and the trinary relay DMTT0 in Fig. 266. The answer hour value of 10 is registered in the calculator by the operation of the quaternary relay AHQ12 in Fig. 264 and the binary relay AHB00 in Fig. 264 and the trinary relay AHT1 in Fig. 265. Likewise, the disconnect hour value of 11 is registered in the calculator by the operation of the quaternary relay DHQ6 in Fig. 264, the binary relay DHB3 in Fig. 264 and the trinary relay DHT2 in Fig. 265. The answer and disconnect day values 04 are registered by the operation of the binary relays ADB5 and DDB00 in Fig. 263 and the quinary relays ADQ0 and DDQ4 in Fig. 263.

It will be noted, with respect to registrations of the answer time, that the actual relays which are operated represent the complements, in the various codes used, of the actual value of the answer time. This, as above explained, is to permit the calculator to perform as an adder in order to arrive at a difference.

It will be noted in this Example 1 that the actual value of the elapsed time difference is 3 and 1/10 minutes. Since the disconnect condition is a normal one, no allowance will be made for a timed release. However, in the righthand part of Fig. 267 are shown a number of switches which may be adjusted, as indicated, to either a V or a W or an X condition which, respectively, will allow the subscriber 2/10, 3/10 and 4/10 of a minute with respect to the actual elapsed time in order to arrive at chargeable time. This means that for this particular example the chargeable time will result, respectively, in a chargeable time of either 2.9 minutes or 2.8 minutes or 2.7 minutes, any one of which will be treated as 3 minutes of chargeable time since any fraction of a minute, for charging purposes, is considered as a whole minute after allowances.

A circuit is completed for operating the chargeable time units quinary translator relay CTU3 in Fig. 270 and for operating the units quinary carry relay UQ1 in Fig. 267 from ground in Fig. 268, over the contact of relay AMMPQ3, contact 4 of relay DMMPQ2, contact 6 of relay AMMPB00 and contact 10 of relay DMMPB5 to conductor 1, which extends into Fig. 267 to operate the relay UQ1 and which conductor 1 in Fig. 267 extends over contact 2 of the relay DMUQ2 to conductor D, cable 26700, conductor D, contact 7 of relay AMUQ0, conductor 3, cable 267—270 into Fig. 270 where conductor 3 emerges to operate the relay CTU3.

Upon the operation of the relay UQ1 in Fig. 267, a circuit is completed for operating the units binary carry relay UB0 in Fig. 266, and the chargeable time units binary relay CTU00 in Fig. 270 from ground in Fig. 267, over the contact of relay UQ1, contact 2 of the relay AMUQ0, conductor E, cable 26701, conductor E, contact 8 of relay DMUQ2, conductor 0, cable 26702, conductor 0, extending into Fig. 266, to operate relay UB0, and extending over contact 1 of relay DMUB00, conductor A, cable 26600, conductor A, contact 4 of relay AMUB00, conductor 00, cable 266—270, extending into Fig. 270, where conductor 00 emerges to operate relay CTU00.

Upon the operation of the units binary carry relay UB0 in Fig. 266, a circuit is completed for operating the tens trinary carry relay TT0 in Fig. 266 and the chargeable time tens trinary relay CTT0 in Fig. 270, extending from ground in Fig. 266, over the contact of relay UB0, contact 1 of relay AMUB00, conductor 0, to operate relay TT0, and extending over contact 1 of relay DMTT0, conductor A, cable 26603, conductor A, contact 4 of relay AMTT0, conductor 0, cable 266—270A, extending into Fig. 270, where conductor 0 emerges to operate the relay CTT0.

Upon the operation of the tens trinary carry relay TT0 in Fig. 266, a circuit is completed for operating the tens binary carry relay TB0 in Fig. 265 and the chargeable time tens quaternary relay CTT00 in Fig. 270, extending from ground in Fig. 266, over the contact of relay TT0, contact 1 of relay AMTT0, conductor 0, cable 266—269 extending into Fig. 269, conductor 0, contact 3 of relay AP, conductor OB, cable 269—265 into Fig. 265, conductor OB, to operate the relay TB0, and extending over contact 4 of relay DHT2, contact 4 of relay AHT1, conductor OF, contact 3 of relay DMTB00, conductor A, cable 26500, conductor A, contact 5 of relay AMTB00 to conductor 00, cable 265—270 into Fig. 270, to operate relay CTT00.

Upon the operation of the tens binary carry relay TB0 in Fig. 265, circuits are completed for operating the relays HB0, HQ0, DQ0, DB0 and CR1 in the subtracter control circuit of Fig. 269. The circuit for relay HB0 of Fig. 269 extends from ground in Fig. 265, over the contact of relay TB0, contact 1 of relay AMTB00, conductor 0, contact 1 of relay AHT1, contact 1 of relay DHT2 to conductor 1, extending into Fig. 264, over contact 2 of relay DHB3, conductor A, cable 26400, conductor A, contact 3 of relay AHB00, conductor HB0, cable 264—269, extending into Fig. 269, to operate the relay HB0. The circuit for operating relay HQ0 in Fig. 269 extends from ground on the conductor 1 in the extreme right-hand portion of Fig. 264, over contact 4 of relay DHB3, conductor C, cable 26401, conductor C, contact 2 of relay AHB00 to conductor 1, thence over contact 7 of relay DHQ6, contact 5 of relay AHQ12 to conductor HQ0, cable 264—269A, extending into Fig. 269, to operate relay HQ0. The circuit for operating relay DQ0 in Fig. 269 extends from ground on the conductor 1 from contact 2 of relay AHB00 in Fig. 264, over contact 2 of relay DHQ6, contact 2 of relay AHQ12 to conductor 1, extending into Fig. 263, thence over contact 8 of relay DDQ4, contact 5 of relay ADQ0, to conductor DQ0, extending over cable 263—269, into Fig. 269, to operate relay DQ0. The circuit for operating relays DB0 and CR1 in Fig. 269 extends from ground on conductor 1 at the extreme right portion of Fig. 263, over contact 2 of relay DDQ4, contact 2 of relay ADQ0 to conductor 1, thence over contact 5 of relay DDB00 and contact 4 of relay ADB5 to conductor DB0, entering cable 263—269A, and also thence from conductor 1 over contact 2 of relay DDB00 and contact 2 of relay ADB5 to conductor CR1, entering cable 263—269A, conductors DB0 and CR1, extending by means of this cable into Fig. 269, to operate the relays DB0 and CR1.

A circuit is now completed for operating the relay NOV in the subtracter control circuit of Fig. 269, indicating that this particular call does not exceed the capacity of the computer. This circuit extends from ground in Fig. 270, over contact 1 of relay CTU4, contact 2 of relay CTU3, contact 3 of relay CTU2, contact 3 of relay CTU1, contact 1 of relay CTU0, contact 1 of relay CTU5, contact 2 of relay CTU00, conductor UC, contact 1 of relay CTT2, contact 1 of relay CTT1, contact 2 of relay CTT0, contact 2 of relay CTT00, contact 3 of relay CTT3, contact 3 of relay CTT6, contact 2 of relay CTOC, conductor CR into Fig. 269, contacts 2 of relays HB0, HBN0, HQN00, HQN01, HQ0, DQN00, DQN01, DQ0, DB0 and DBN0, contact 4 of relay CR1, contact 4 of relay CR0, contact 3 of relay 99, to the winding of relay NOV.

It will be noted that with the operation of the chargeable time tens quaternary relay CTT00 and trinary relay CTT0 in Fig. 270, the chargeable time tens digit will be 0. This information is recorded on a two-out-of-five basis in the chargeable time tens register of Fig. 270 by the CTT ground in Fig. 270 being extended over contacts 7 and 8 of relay CTT0 and other suitable contacts (not shown) of relay CTT00 to ground conductors 0 and 7 into cable 27000, extending through the initial entry register connector into the chargeable time tens register. It is also noted that with the chargeable time units quinary relay CTU3 and binary relay CTU00 operated, the chargeable time units digit will be 3. This information is recorded in the chargeable time units register of Fig. 270 by the extension of the CTU ground in Fig. 270 over contacts 8 and 9 of the relay CTU3 and contact 8 of the relay CTU00 to ground leads 1 and 2 into cable 27001, extending through the initial entry register connector into the chargeable time units register. The chargeable time tens and units information may be transmitted by means of cable 270—271 through the billable charge connector of Fig. 271, for perforating purposes, in the event that it is necessary to perforate the actual chargeable time on an output tape.

The billing index applicable to this particular call will have been ascertained by the reader of Fig. 261, and will have been transferred on a two-out-of-five basis through the initial entry register connector of Fig. 262, into the billing index tens and units registers of Fig. 262. These tens and units registers provide decimal outputs of the tens and units digits of the billing index and transfer this information through the computer connector of Fig. 262, over cable BITU into Fig. 271, where the tens digit will operate one of the billing index translator relays BIT0 to BIT9 and where the units digit will be transferred over a contact of the operated tens translator relay and over cable 27100 to operate one of a hundred possible message unit formula connector relays FC00 to FC99. The chargeable time tens translator relays of Fig. 270 complete a circuit from the MUT ground in Fig. 270, over contact 5 of the relay CTT00 and contact 6 of relay CTT0 to conductor 0, extending by means of cable 270—271A into Fig. 271, and over a contact of the operated message unit formula connector to operate a tens relay in the message unit formula circuit, such as relays T00 to T990. The chargeable time units translator of Fig. 270 provides a circuit extending from the MUU ground in Fig. 270, over contact 6 of relay CTU00 and contact 6 of relay CTU3, to conductor 3 into cable U, and another circuit extending over contact 5 of relay CTU00 and contact 4 of relay CTU3, conductor 3, extending into cable U'. Cables U and U' extend over cable 270—271B into Fig. 271 where conductors 3, out of cables U and U', will extend over separate contacts of the operated relay in the message unit formula circuit and via cross-connections to energize a message unit tens and units conductor, such as MUT0 to MUT9 and MUU0 to MUU9, which in turn will extend over cables 27101 and 27102 as decimal translations through the message unit tens and units translators in Fig. 271, to register the tens and units values of the computed message units in the message units tens and units registers. This information may be transferred through the billable charge connector to the perforators for perforating on an output tape the tens and units digits of the computed message units where desired.

The maximum capacity of the chargeable time tens and units translators of Fig. 270 is 89.9 minutes. However, it is possible, under some circumstances, that a chargeable time up to this maximum value, when translated into computed message units, may exceed the message unit capacity to the calculator, which is 99 message units. In such a case, suitable cross-connection will be made

in Fig. 271 to the cross-connection marked "X CONN 99," which thereupon will ground conductor 99, extending from Fig. 271 into Fig. 269, to operate relay 99. The operation of relay 99 in turn will extend a ground over its contact 2 to operate the over-capacity relay OV. This over-capacity relay OV may also be operated, as will be shown in Example 2, whenever the computed chargeable time exceeds 89.9 minutes.

The relays OV and NOV are instrumental, when operated, in controlling the operation of certain so-called "output class" relays which, in turn, determine the action, if any, which will be taken on this call with respect to perforating certain entries on output tapes.

Example 2

The answer minute tenths value of 9 is registered in Fig. 268 by the operation of the binary relay AMMPB00 and the quinary relay AMMPQ00. The disconnect minute tenths value of 3 is registered in Fig. 268 by the operation of the binary relay DMMPB00 and the quinary relay DMMPQ3. The timed release disconnect condition associated with this call is registered by the operation of relay DTR in Fig. 267. The answer minute units value 7 is registered in Figs. 266 and 267 by the operation of the binary relay AMUB00 in Fig. 266 and the quinary relay AMUQ2 in Fig. 267. Likewise, the disconnect minute units value 1 is registered in Figs. 266 and 267 by the operation of the binary relay DMUB00 and the quinary relay DMUQ1. The answer minute tens value of 4 is registered in the calculator by the operation of the binary relay AMTB00 in Fig. 265 and the trinary relay AMTT1 in Fig. 266. Likewise, the disconnect minute tens value 2 is registered by the operation of the binary relay DMTB00 in Fig. 265 and the trinary relay DMTT2 in Fig. 266. The answer hour value 22 is registered in the calculator by the operation of the quaternary relay AHQ000 in Fig. 264, the binary relay AHB00 in Fig. 264 and the trinary relay AHT1 in Fig. 265. Likewise, the disconnect hour value of 00 is registered in the calculator by the operation of the quaternary relay DHQ000 in Fig. 264, the binary relay DHB00 in Fig. 264 and the quinary relay DHT0 in Fig. 265. The answer day value 02 is registered by the operation of the binary relay ADB5 in Fig. 263 and the quinary relay ADQ2 in Fig. 263. The disconnect day value 03 is registered by the operation of the binary relay DDB00 in Fig. 263 and the quinary relay DDQ3 in Fig. 263.

It will be noted in this Example 2, that the actual value of the elapsed time difference is 93.4 minutes. Since the disconnect condition is a timed release condition, a fixed allowance of $\frac{6}{10}$ of a minute will be made, and this is the only allowance which will be accounted for. This means, for this particular example, that the actual chargeable time will result in 92.8 minutes, which will be treated as 93 minutes. It is further noted that this elapsed time of 93.8 minutes exceeds the chargeable time capacity of the calculator, which is 89.9 minutes. Therefore the subtracter control circuits of Fig. 269 should indicate that this call is over-capacity by operating relay OV in Fig. 269.

As a result of the operations of the various relays of the subtracter, as above described, a number of circuits will be completed for operating certain of the carry relays in the subtracter, and certain of the relays in the chargeable time translator of Fig. 270, and certain of the subtracter control relays of Fig. 269. It is not considered necessary to describe each one of these circuits in detail, as was done above with respect to Example 1, since the circuits are very similar.

A first circuit is completed for operating the units quinary carry relay UQ0 of Fig. 267 and the chargeable time units quinary relay CTU3 of Fig. 270. A second circuit is completed under the control of the operated units quinary carry relay UQ0 of Fig. 267 for causing the operation of the units binary carry relay UB0 of Fig. 266 and the chargeable time units binary relay CTU00 of Fig. 270. A third circuit is completed under the control of the units binary carry relay UB0 of Fig. 266 for causing the operation of the tens trinary carry relay TT0 of Fig. 266 and the chargeable time tens trinary relay CTT2 of Fig. 270. A fourth circuit is completed under the control of the tens trinary carry relay TT0 of Fig. 266 for causing the operation of the tens binary carry relay TB1 of Fig. 265 and the chargeable time tens quaternary relay CTOC of Fig. 270. An additional circuit is completed under the control of the tens binary carry relay TB1 of Fig. 265 for causing the operation of the relay HB0 in Fig. 269. Additional circuits are completed for causing the operation of the relays HQ0, DQ0, CR1 and DB0 in Fig. 269.

A circuit is now completed for operating the relay OV in the subtracter control circuit of Fig. 269, indicating that this particular call exceeds the capacity of the chargeable time translator section of the calculator. This circuit extends from ground in Fig. 270, over contact 1 of relay CTU4, contact 2 of relay CTU3, contacts 3 of relays CTU2 and CTU1, contacts 1 of relays CTU0 and CTU5, contact 2 of relay CTU00, conductor UC, contact 2 of relay CTT2, contact 3 of relay CTT1, contacts 1 of relays CTT0, CTT00, CTT3, CTT6 and CTOC to conductor OC, extending into Fig. 269, over contacts 2 of relays CR1 and CR0, and over contact 1 of relay 99, to the winding of the relay OV.

It will be noted that there are no contacts provided for the relay CTOC in Fig. 270 whereby a two-out-of-five translation of the chargeable time tens value may be transmitted through the initial entry register connector to the chargeable time tens register in Fig. 270. This is because the operation of the relay CTOC indicates that this chargeable time value is over-capacity.

Under these circumstances, no value of message units can be computed, and the machine, under the control of the operated relay OV, will cause entries to be placed on suitable output tapes whereby the charges for this call may be computed manually.

The four relays AAP, DAP, ADAP and AP in Fig. 269 are used to permit the calculator to perform its operation even though one or both of the answer and disconnect hour values, as detected by the hour tens translator of Fig. 262, may be a fictitious hour 25. The presence of this hour value 25 indicates that at the time when the answer or disconnect timing entries were received in the registers of the appropriate call entry register in Fig. 262, the hour values thereof were missing or were mutilated or, for some other reason, were not reliable. If the answer hour is detected as fictitious, ground will be applied to the conductor A25 in Fig. 262, and will be extended over cable AD25, extending into Fig. 269, where conductor A25 emerges to operate the relay AAP. This will complete a circuit from ground in Fig. 269, over contact 2 of relay AAP and contact 1 of relay DAP, to operate relay AP. The operation of relay AP applies a ground over its contact 1 to conductor 1, extending into Fig. 265, to substitute for a non-operated minute tens binary carry relay. Contacts 2, 4 and 6 of relay AP transfer certain of the circuits of the carry-out from the minute tens trinary subtracter into the minute tens binary subtracter to permit the calculator to function. Additionally, the operation of the relay AAP, over its contacts 3 through 11, connects together the operating leads of the disconnect and answer hour trinary subtracter relays, and connects together the operating leads for the disconnect and answer sections, respectively, of the hour quaternary and hour binary subtracters of Fig. 264, whereby the disconnect hour values are transferred to the answer subtracter sections to effect a computation, as far as these subtracter sections are concerned, of 0.

If the disconnect hour is fictitious, then the relay DAP in Fig. 269 will be operated instead of relay AAP, pro-

ducing effectively the same results, except that in this instance the answer hour is used to fill the disconnect hour subtracter sections.

In the event that both of the hour values are fictitious, both of the relays AAP and DAP of Fig. 269 will be operated, whereupon relay ADAP is operated in a circuit extending over contact 2 of relay AAP and contact 3 of relay DAP. The operation of relay ADAP operates relay AP over its contact 1, and over its contacts 2, 3 and 4 applies grounds in multiple over operated contacts of both of the relays AAP and DAP to inject into the hour quaternary, binary and trinary subtracter sections hour values of 00 for both cases.

Feature 23.—This feature has been stated as a translating arrangement by means of which time elements may be translated and stored, and later restored to their original form. More particularly, this feature comprises a translator controlled by the tape identity set-up switches and by a partial registration of an instant of time for translating such instant of time to a number suitable for mechanical calculation, and comprising a translator controlled by the same means as above and by the said calculator for reconstructing the instant of time to its original form for mechanical recording.

Fig. 272 of the drawings illustrates how Figs. 274 through 300 may be arranged to illustrate, in a skeletonized fashion, the particulars of the assembler-computer illustrating the present feature. Fig. 273 is a form of flow chart or functional diagram illustrating in a highly schematic fashion, the general flow of information describable in more detail with reference to Figs. 274 through 300.

This feature relates particularly to the treatment of calendar day values as recorded in the machine associated with timing entries and as used for perforating certain output entries on output tapes of the assembler-computer. In view of the fact that there are one hundred operational assembling registers in the machine, each containing a disconnect and an answer time registration section, if the calendar day associated with each timing entry were registered therein as a tens and units digit, 400 separate registers would be required (four in each assembling register) to record this information. The machine is provided with circuits whereby the calendar day associated with a particular timing entry is registered as the units digit thereof only, thereby reducing the number of register sections required to 200. Translators are provided whereby this units digit is made to represent the entire calendar day for registration in the assembling registers and for reconstructing from this single digit the full tens and units digits of the particular calendar day for other purposes.

Referring to Fig. 273, each time a calender day entry is read from a tape identity group on the incoming tape by the reader, the tens and units digits thereof are registered in the day register. Certain set-up switches are provided for operating one of the four relays **28**, **29**, **30** and **31** in the calendar day translator for indicating the number of days in the current or previous month (as the circuits require) for purposes to be described in more detail hereinafter. The tens and units sections of the day register provide indications to contact networks in the day register tens output connector and the day register units output connector.

At such time as a timing entry is received for registration in one of the assembling registers shown in the upper right-hand portion of Fig. 273, circuits associated with the calendar day translator cause the operation of one of the day register units output connector relays, whereby a day units value is derived from the contact network associated therewith, and extended over cable DU through the assembling register multiple connector to register a day units digit in one or the other of the disconnect or answer sections of the associated assembling register.

When an initial entry is read by the reader associated with two timing entries for a complete call, certain connectors are operated whereby the disconnect and answer times are transferred from the assembling register to a call register. Included in this reregistration is the disconnect and answer day units registrations.

At such time as the computer portion of the machine is brought into operation for completing the charges associated with this call, certain computer connector relays are operated whereby the disconnect day units digit is caused to operate the disconnect day translators A and B, and the answer day units digit is caused to operate answer day translators A and B. Furthermore, the disconnect day translator B provides a decimal translation of the disconnect day units digit for operating one of the relays D0T to D9T in the calendar day translator, and in the answer day translator B similarly causes the operation of one of the relays A0T to A9T in the calendar day translator. The answer day units digit, as received from the call entry register, also provides an input to a contact network in the answer day units connector in the lower right-hand portion of Fig. 273. Similarly, the disconnect day translator B provides a decimal output to the contact network in the disconnect day units connector in the lower right-hand portion of Fig. 273. The calendar day translator provides circuits for operating one of the answer day units connector relays ARA through D–1 and the disconnect day units connector relays P1 through A–1.

In the meantime, the answer day and disconnect day translators A provide bi-quinary translators of the answer and disconnect day values which are used as part of the computation in the subtracter to provide an indication to the subtracter control circuit which in turn is used in controlling one of the day register tens output connector relays DTAR1 through ADTAR.

As an end result of all of these translators and contact network operations, the disconnect and answer day tens and units digits may be reconstructed for controlling the pattern connector relays in the lower right-hand portion of Fig. 273 whereby the perforators may perforate output entries involving the whole calendar day information.

DAY REGISTRATION

Whenever a calendar day entry (2821EF) is read by the reader in Fig. 274 from a tape identity group, a circuit is completed for operating the DR recorder time connector in Fig. 275 in a circuit extending from ground in the reader, over the G1 or G2 contact thereof, over the contact of the RKA or RKB reader step check relay, contact 1 of the R reader connector, the contacts of the ST3 and AL relays, contact 1 of relay TI, contact 1 of relay CL1, through a check circuit extending over contacts of the reading relays to detect ABC digits of 282, thence over a contact of one of the reader step control relays, contact 2 of relay TI to a dotted circuit indicated as "Day Reg Release," which releases all of the relays in the day register circuit of Fig. 278. When the day register circuit of Fig. 278 is fully released, relay DDC of the day register control in Fig. 274 operates to extend ground over contact 2 of relay CL1 and the contact of the DDC relay over conductor DR into Fig. 275 to operate the connector DR. At this time, the E and F digits in the reading relays of Fig. 274 (representing the tens and units digits of the calendar day) are transferred over cable EF, into Fig. 275 to operate one relay in each of the E and F digit reading translators. Grounds over contacts 11 and 22 of the DR connector cause decimal outputs from the reading translators to be extended over contacts of the DR connector, and over cables 275–278 and 275–278A, extending into Fig. 278, to operate a tens and a units relay in the day register circuit.

HOUR REGISTRATION

Whenever an hour entry is read by the reader of Fig. 274 (2811EF for end-of-tape hours and 2810EF for

other hours), the hour register control circuit of Fig. 275 causes the operation of an hour time connector OHR whereby the E and F digits of the hour entry then registered in the reading relays of Fig. 274 are transferred to the hour register circuit of Fig. 275.

REGISTERING TIMING ENTRY AND COMPUTING

Whenever a disconnect timing entry is received, the A digit thereof will be a 3 or a 1, depending upon whether the disconnect time was a normal one or one involving a "timed" release, the B digit will represent the minute tens of the disconnect time, and the C and D digits will represent, respectively, the minute units and minute parts (tenths) of disconnect time. The detecting of the timing entry will cause the operation of the assembling register multiple connectors ADM and AM in Fig. 277, and the E and F digits of the timing entry will cause the operation of the disconnect connector DISC of the pertinent assembling register, such as the lower part of Fig. 277. This will cause the registration of the A, B and C digits in the respective timed release, minute tens, minute units and minute tenths register sections of the assembling register identified by the E and F digits of the timing entry.

The day units, hour tens and hour units registrations in the assembling register are derived from the day and hour registers of Figs. 278 and 275. The hour register of Fig. 275 feeds its tens registration over cables **275–276** and **275–276**A into the hour tens output connector relays TNC and TC in Fig. 276. Similarly, the hour register of Fig. 275 feeds its units information over cables **275–276**B and **275–276**C, into the hour units output connector relays UAR and UL1 of Fig. 276. In view of the fact that the central office tape is processed backward in time sense, the hour value to be associated with any timing entry will necessarily be one less than the hour value currently registered in the hour register of Fig. 275. Suitable ones of the hour tens and units output connector relays of Fig. 276 are operated at the time that a timing entry is received to provide, over cables **276–277** and **276–277**A into Fig. 277, the hour tens and units digits to be associated with that timing entry, and these digits are thereupon deposited in the hour tens and units sections of the assembling register.

The day units value associated with the timing entry is derived from the day register units output connector relays of Fig. 285 and is supplied therefrom over cable **285–277** into Fig. 277, and thence into the day units section of the assembling register.

A number of factors enter into the operation of the day register units output connector of Fig. 285, and three examples will be given to illustrate the operation of this connector circuit. One factor is whether or not the accounting round being processed is a last round (relay LR in Fig. 287 operated), an intermediate round (relay IR in Fig. 287 operated), or a first round (relay FR in Fig. 287 operated). Another factor is the number of days in the current or previous month, as the case may be (one of the relays **28**, **29**, **30** and **31** in Fig. 283 operated), and another factor is whether or not the hour register of Fig. 275 has detected a change of day due to passing of midnight, such that the day registered in the day register of Fig. 278 represents a day later than the proper current day (relay CD of the day register control circuit of Fig. 274 operated).

Example 1

Assume a disconnect time of February 20 at 0005.3 a.m. and an answer time of February 19 at 1150.6 p.m. and the receipt of an initial entry on February 19 at 1150 p.m. This represents a situation where the day register of Fig. 278 contains the registration 20 and where we are concerned with a change in the day caused by the detection of the passing of midnight by the operation of the CD relay of Fig. 274. This is assumed to be an intermediate round condition whereby the IR relay of Fig. 287 is operated, and since the month tens and units set-up switches of Fig. 283 will have been set on the values 02 (February), the calendar day translator relay **31** of Fig. 283 will be operated because it will be assumed that we are concerned with ten round months and that the last round set-up switch of Fig. 283 will be set on a position which does not represent the last round of a month. In connection with the latter situation, ground will extend over the wiper of the last round set-up switch to conductor NLR, over contact **2** of the No. **5** wiper arm of the month units set-up switch, and contact **0** of the month tens switch to conductor LD**31**, to cause the operation of the relay **31** in Fig. 283.

Under these circumstances, the disconnect day 20 will be registered as a zero. The day register units output connector DAR of Fig. 285 will be operated in a circuit extending from ground over contact **1** of relay CD of Fig. 274, conductor DAR, cable **274–287** into Fig. 287, conductor DAR, contact **1** of relay IR, conductor DAR extending into Fig. 286, thence over cable **286–285** into Fig. 285, to operate the DAR relay. Upon the operation of the DAR relay of Fig. 285, the units section of the day register of Fig. 278 will ground the No. **0** conductors extending over cables B and A into Fig. 285, and over contacts **10** and **20** of connector DAR, thereby grounding conductors **4** and **7** into cable **285–277** extending into Fig. 277, to cause the registration in the assembling register of the disconnect day units digit 0 for the disconnect timing entry.

The answer day 19 will be registered as a 9. The CD relay of Fig. 274 will be operated when the hour register circuit of Fig. 275 detects the passage of midnight. Since the day register of Fig. 278 contains day 20, it will be necessary to register the answer day as "one less" than that which is registered. This is accomplished by operating the day register units output connector DL**1** of Fig. 285 in a circuit extending from ground, over contact **2** of relay CD in Fig. 274, conductor DL**1**, cable **274–287** into Fig. 287, conductor DL**1**, contact **1** of relay LR into Fig. 286, conductor DL**1**, cable **286–285** into Fig. 285 to operate relay DL**1**. The units section of the day register of Fig. 278 will ground conductors **0** into cables B and A extending into Fig. 285 and over contacts **10** and **20** of relay DL**1** to ground conductors **7** and **2** into cable **285–277** extending into Fig. 277 to provide, on a two-out-of-five basis, an answer day units digit of 9.

When the initial entry is received, the disconnect register connector DR of Fig. 279 and the answer register connector AR of Fig. 281 are operated to transfer the disconnect and answer timing registrations from the assembling register of Fig. 277 into the corresponding register sections of the call entry register indicated in Figs. 279 through 282. The disconnect information is transmitted from the assembling register in Fig. 277, over the disconnect multiple DISMUL extending into Fig. 279, where the day units, hour tens, hour units, minute tens, minute units, minute parts and timed release indications are transmitted over contacts of the DR connector into the disconnect registrations of Figs. 279 and 280, and the answer information is transmitted over the answer multiple ANSMUL from Fig. 277 into Fig. 281, and over contacts of the AR connector into the answer time registers of Figs. 281 and 282.

At such time as the calculator or computer section of the machine is to be brought into operation to calculate the charges associated with this call, the disconnect computer connector DISC of Fig. 279 and the answer computer connector ANS of Fig. 281 are operated. Upon the operation of the disconnect computer connector DISC of Fig. 279, the disconnect timing information is transferred from the call entry registers of Figs. 279 and 280 into the subtractor disconnect relays of Figs.

296 through 300 with suitable translations to facilitate the subtraction. Upon the operation of the answer computer connector ANS of Fig. 281, the answer time in the call entry registers of Figs. 281 and 282 is transferred to the subtractor answer relays of Figs. 296 through 300 with suitable translations to facilitate subtraction, but modified to represent the complement in order that the subtractor may arrive at a difference by taking a sum.

The disconnect day units digit is transferred from Fig. 279, over cable **279–288** into Fig. 288, to operate two out of five of the disconnect day translator B relays (for a purpose to be described hereinafter), and extends over cable **288–292** into Fig. 292, to operate two out of five of the disconnect day translator A relays (not shown in detail), which provide a bi-quinary translation of the disconnect day units digit extending over cables **292–296**B and **292–296**C into Fig. 296, to operate a disconnect day binary relay and a disconnect day quinary relay. The disconnect hour tens and units and the minute tens, units and parts and the timed release indications are transferred from Fig. 279 over cable **279–293** into Fig. 293 where these various indications extend over suitable cables to operate one of the relays in the disconnect hour tens translator in Fig. 293, and two out of five of each of the disconnect hour units, disconnect minute units and disconnect minute tenths translators of Fig. 294, the disconnect minute tens and time release indications extending from Fig. 293, over cable DMT–TR into Fig. 298, to operate the disconnect minute tens binary and trinary subtractor relays and the timed release index subtractor relays of Fig. 299. These various disconnect translator relays in Figs 293 and 294 cause suitable translations for operating the disconnect hour quaternary, binary and trinary subtractor relays of Fig. 297 and the disconnect minute units binary and quinary subtractor relays of Fig. 299 and the disconnect minute tenths binary and quinary subtractor relays of Fig. 300.

The answer day units digit is transferred from Fig. 281 over cable **281–289** into Fig. 289, to cause the operation of two out of five of the answer day translator B relays (for a purpose to be described hereinafter) and extends over cable **289–292** into Fig. 292, to operate two out of five of the answer day translator A relays, which thereupon provide a bi-quinary output over cables **292–296** and **292–296**A into Fig. 296, to cause the operation of the answer day binary and quinary subtractor relays, which, however, are the complements of the actual indication. The answer hour tens and units and minute tens and units and parts indications are transferred from Fig. 281, over cable **281–293** into Fig. 293, where, as was the case with the disconnect information, the answer translators of Figs. 293 and 294 are operated and whereby the subtractor relays of Figs. 297 through 300, associated with the answer information, are operated to indicate the complements of the actual information.

Referring to Fig. 300, a ground designated C.G. extends into the contact network associated with the minute tenths quinary subtractor to initiate a computation process which extends from Fig. 300 through Figs. 299, 298, 297 and 296, eventually to operate one of the two relays CR**0** and CR**1** in Fig. 296 to indicate, respectively, whether or not a negative or a positive result has occurred, meaning respectively, that the answer day is greater or less than the disconnect day. The operation of the relay CR**0** or CR**1** enters into subsequent description concerned with the reconstruction of calendar day information for perforating purposes.

To summarize what has taken place up to this point, in connection with this Example 1, it will be noted that the actual disconnect day units value is 0, the hour value

00, the minute tens value 0, the minute units value 5, and the minute tenths value 3. This may be indicated as

D (actual) 0–00–0–5–3

This disconnection information is registered in the assembling register and in the calculator as shown. The actual answer information corresponding to this is

A (actual) 9–23–5–0–6

This answer information is registered in the assembling register as shown. However, this answer information is registered in the calculator by its complement, which is in this case

A (C) 0–00–0–9–3

A tabular summary of this information may be shown as

D (actual)	0–00–0–5–3
D (AR and C)	0–00–0–5–3
A (actual)	9–23–5–0–6
A (AR)	9–23–5–0–6
A (C)	0–00–0–9–3

In the calculator, the elapsed time is computed by adding the disconnect time to the complement of the answer time as follows:

D—0–00–0–5–3
A—0–00–0–9–3
Fugitive 1—0–00–0–0–1
0–00–1–4–7

This represents an answer of 14.7 minutes of chargeable time which, after certain allowances, will result in a rounded-off chargeable time of 15 minutes for the call. Since a 0 appears at the extreme left-hand part of the answer, this represents a condition where the CR**0** relay of Fig. 296 will be operated (relay CR**1** will be operated in those cases where a 1 appears at the left-hand edge of the answer).

Example 2

Assume a disconnect time of March 1 at 0005.3 a.m. and an answer time of February 28 at 1150.6 p.m. and the receipt of an initial entry on February 28 at 1149.2 p.m. This represents a situation where the day register of Fig. 278 contains the registration 01 and where we are concerned with a change in the day caused by the detection of the passing of midnight by the operation of the CD relay of Fig. 274. This is a last round condition whereby the LR relay of Fig. 287 is operated, and since the month tens and units set-up switches of Fig. 283 will have been set on the values 02 (February), the calendar day translator relay **28** of Fig. 283 will be operated because it will be assumed that we are concerned with ten round months and that the last round set-up switch of Fig. 283 will necessarily be set on a position which represents the last round of a month. In connection with the latter situation, ground will extend over the wiper of the last round set-up switch to conductor LR which extends into Fig. 287 to operate the LR relay in Fig. 287, and which conductor LR extends over contact **2** of the wiper arm **1** of the month units set-up switch in Fig. 283, and over contact **0** of the month tens set-up switch and through the switch LDF of Fig. 283 to operate the relay **28** (assuming that this is not a leap year).

Under these circumstances, the disconnect day 01 will be registered as a 9 in order that it will represent one day greater than the answer day which will be registered as an 8. Ground will extend over contact **2** of the CD relay of Fig. 274, over conductor DL**1**, cable **274–287**, conductor DL**1**, contacts **2** and **3** of relay LR, conductor **28700**, extending into Fig. 278, and over contacts **2** of

relays DT0 and DU1 in Fig. 278 (indicating that the day registered in the day register is 01), out over conductor D01 into Fig. 274, over contact 3 of relay CD, conductor D01L1, cable 274–286, conductor D01L1, contact 25 of the 28 relay, conductor 8, cable 286–285 into Fig. 285 to operate relay 8 in the day register units output connector. Upon the operation of relay 8, grounds are extended over its contacts 1 and 2 to ground conductors 7 and 1 into cable 285–277 extending into Fig. 277 to provide an answer day units digit of 8.

Prior to midnight when the disconnect timing entry was received, ground will have extended over contact 1 of relay CD in Fig. 274, conductor DAR, cable 274–287, contact 3 of relay LR in Fig. 287, conductor 28700 extending into Fig. 278, over contacts 2 of relays DT0 and DU1, conductor D01 into Fig. 274, over contact 4 of relay CD, conductor D01AR, cable 274–286, contact 24 of relay 28, conductor 9, cable 286–285 extending into Fig. 285 to operate relay 9. Upon the operation of relay 9, grounds are extended over its contacts 1 and 2 to ground conductors 7 and 2, extending over cable 285–277 into Fig. 277 to provide a disconnect day units digit of 9.

When the initial entry is received, the disconnect register connector DR of Fig. 279 and the answer register connector AR of Fig. 281 are operated to transfer the disconnect and answer timing registrations from the assembling register of Fig. 277 into the corresponding register sections of the call entry register indicated in Figs. 279 through 282. The transfer of this information is handled in the same way as previously described in Example 1.

At such time as the calculator or computer section of the machine is brought into operation to compute the charges associated with this call, the disconnect computer connector DISC of Fig. 279 and the answer computer connector ANS of Fig. 281 are operated, whereby disconnect and answer timing information is transferred from the call entry registers of Figs. 279 through 282 into the answer and disconnect relays of the subtractor of Figs. 296 through 300 with suitable translations to facilitate the subtraction processes.

As was the case of Example 1, the disconnect day units digit is caused to operate certain of the relays in the disconnect day translator B relays of Fig. 288 and translator A relays in Fig. 292.

Similarly, the answer day unit digit is transferred to the answer day translator A and B relays.

The net result of the computation of calculated time in this example causes the operation of the CR1 relay in Fig. 296, indicating a positive result.

To summarize what has taken place up to this point in connection with this Example 2, the following table is provided corresponding to that set forth in Example 1:

D (actual)	1–00–0–5–3
D (AR and C)	9–00–0–5–3
A (actual)	8–23–5–0–6
A (AR)	8–23–5–0–6
A (C)	1–00–0–9–3

In the calculator, the elapsed time is computed by adding the disconnect time to the complement of the answer time as follows:

D—	9–00–0–5–3
A—	1–00–0–9–3
Fugitive 1—	0–00–0–0–1
	10–00–1–4–7

This represents an answer of 14.7 minutes of chargeable time which, after certain allowances, will result in a rounded-off chargeable time of 15 minutes for the call. Since a 1 appears at the extreme left-hand part of the answer, this represents a condition where the CR1 relay of Fig. 296 will be operated.

Example 3

Assume a disconnect time of May 1 at 0305.3 a.m. and an answer time of April 30 at 1150.6 p.m. and receipt of an initial entry on April 30 at 1149 p.m.

In view of the facts that the May tape will have been cut at the 3 a.m. end-of-tape group splice point and that we are processing an answer which occurred prior to that cutting point indicates that this answer time appears on the straddle tape which was produced at the time that we processed the April tape. Under these circumstances, the answer time will be an answer straddle timing entry composed of three lines, 2812EF (hour), 2822EF (day) and ABCDEF (time). The day value recorded in the second line of the answer straddle timing entry will be 30, because when the last round of the April tape was processed, this straddle timing entry was discovered relating to day 30 of April and, therefore, had to be recorded as day 30. It is also to be noted that, in this example, day 01 will be recorded in the day register of Fig. 278 when the disconnect entry is received and day 30 when the answer entry is received. Under this condition, the last round set-up switch of Fig. 283 will be set on one of its contacts which grounds the NLR conductor which extends into Fig. 287 to the round translator. The round translator detects the indication that the last round set-up switch is not set on the last round of a month and combines this with an indication from the straddle tape from the April processing that the answer time actually belongs to a last round condition and thereby operates the FR relay of Fig. 287 by the time the answer is read. When the disconnect is read the IR relay will be operated as previously described. Also, the grounded NLR conductor in Fig. 283 extends over the No. 5 contact of wiper 5 of the month units set-up switch in Fig. 283 to operate the relay 30 in the calendar day translator of Fig. 283.

Under these circumstances, the disconnect day 01 will be registered as a 1 by the operation of the day register units output connector DAR of Fig. 285, as previously described.

In this type of feedback straddle operation, each time a day entry (2822EF) is read from the straddle timing entry, the day value indicated thereby is registered in the day register of Fig. 278 in place of whatever was there before. Therefore, when the answer time is read, the day register will contain the day 30. It is necessary that this day value 30 be registered as 0 in order that a proper answer day units value 0 will be used for computation purposes. The grounded conductor DAR, out of cable 274–287 in Fig. 287, will extend over contact 1 of relay FR in Fig. 287, over conductor DAR–1 into Fig. 286, over contact 23 of relay 30, conductor DAR, cable 286–285 into Fig. 285 to operate relay DAR. The value of 0, extending out of cables B and A in Fig. 285 from the day register of Fig. 278, will be extended over contacts 10 and 20 of the connector relay DAR to ground conductors 7 and 4 extending over cable 285–277 into Fig. 277 to provide an answer day units value of 0 (this effects a one day difference between the disconnect day 01 and the answer day 30).

The transfer of the answer and disconnect timing entries from the assembling register of Fig. 277 into the call entry register and into the subtractor of the computer are the same as previously described. The following indicates in tabular form the end result of these operations:

D (actual)	1–03–0–5–3
D (AR and C)	1–03–0–5–3
A (actual)	1–23–5–0–6
A (AR)	
A (C)	0–23–5–0–6
	9–00–0–9–3

In the calculator, the elapsed time is computed by

adding the disconnect time to the complement of the answer time as follows:

D—	1–03–0–5–3
A—	9–00–0–9–3
Fugitive 1—	0–00–0–0–1
	10–03–1–4–7

This represents an answer time of 3 hours and 14.7 minutes as before, and results in the operation of the CR1 relay of Fig. 296 since a 1 appears at the left-hand edge of the answer.

RECONSTRUCTING CALENDAR DAYS

Example 1

It will be recalled that in this example the day register of Fig. 278 contains the registration 20, and that the following relays are operated: CR0 of Fig. 296; IR of Fig. 287; 31 of Fig. 283; ADT2 and ADT7 of Fig. 289; and DDT4 and DDT7 of Fig. 288.

Because the answer units digit 9 is registered in the answer day translator B of Fig. 289, conductor A9 therefrom will be grounded and will extend over cable **289–287** into Fig. 287 to operate the A9T relay in the calendar day translator. Silimarly, since the disconnect day units digit of 0 is registered in the disconnect day translator B of Fig. 288, the conductor D0 therefrom will be grounded and will extend over cable **288–287** into Fig. 287 to operate the D0T relay therein. Since the computer connector CC in Fig. 289 is operated, contacts **19**, **20**, **21** and **22** thereof will ground conductors AU, DU, DT and AT extending by means of cable ADTU into Figs. 287 and 296 where these grounded conductors appear before contacts of the subtractor control relays CR0 and CR1 of Fig. 296 and the FR, IR and LR relays of the calendar day translator of Fig. 287. The grounded conductor AU in Fig. 287 extends over contact **6** of relay IR and conductor ADUAR to conductor AU38, cable **287–283** into Fig. 283, conductor AU38 to conductor ADUAR extending into Fig. 286 and over cable **286–289** into Fig. 289 to operate the answer day units connector relay AR. The grounded conductor DU, out of cable ADTU in Fig. 287, extends over contact **7** of relay IR, conductor DDUAR into Fig. 286 and into Fig. 288 to operate the relay AT of the disconnect day units connector of Fig. 288. In Fig. 289, conductor DTAR2 from the answer day translator B will be grounded and will extend into Fig. 284 to operate the day register tens output connector relay DTAR2. In Fig. 296, the grounded conductor AT, out of cable ADTU, is extended over contact **1** of relay CR0 to conductor ATA>D, cable **296–287**A extending into Fig. 287 over contact **3** of relay IR to conductor ADTAR, extending by means of cable **287–284** into Fig. 284 to operate the relay ADTAR. The grounded conductor DT, out of cable ADTU in Fig. 296, extends over contact **3** of relay CR0 to conductor DTA>D, cable **296–287**A into Fig. 287, over contact **5** of relay IR to conductor DDTP1 extending by means of cable **287–284** into Fig. 284 to operate relay DDTP1. In Fig. 274, ground extends from the day register control circuit to conductor DTL1 (indicating a change of day due to the passage of midnight) extending over cable **274–284** to operate relay DTL1.

In Fig. 288, the disconnect day translator B provides a grounded conductor **0** into each of the cables A and B which are extended over contacts **10** and **20** of the connector relay AT to ground the conductors **7** and **4** extending by means of cable DDU via contacts **9** and **8** of the computer connector CC into Fig. 290 to operate relays DDU4 and DDU7 of the disconnect day units register, thereby indicating that the units digit of the true calendar day is 0.

The tens digit of 2 in the day register of Fig. 278 grounds conductor T2 into cable **278–284** into Fig. 284 and over contact **2** of relay DTL1, contact **3** of relay DTAR2 and contact **3** of relay DDTP1 to operate relay DDT3 in Fig. 284 and extending over cable DDT into Fig. 288 and over contact **3** of the computer connector into Fig. 290 to operate the relay DDT2, indicating a disconnect day tens digit of 2.

In Fig. 284, the grounded conductor T2, out of cable **278–284** from the day register of Fig. 278, extends over contact **2** of relay DTL1, contact **3** of relay DTAR2, contact **3** of relay ADTAR to conductor ADT1 extending by means of cable ADT into Fig. 289, and over contact **11** of the computer connector CC into Fig. 291 to operate relay ADT1, indicating that the answer day tens digit is 1.

The operation of the AR relay of the answer day units connector of Fig. 289 extends over its contacts **1** and **3** to grounds representing the answer day translator B registration of 9 to ground conductors **7** and **2** into cable ADU and over contacts **18** and **16** of the computer connector CC to operate the ADU7 and ADU2 relays of the answer day units register in Fig. 291 to indicate that the answer day calendar units digit is 9.

The operation of the appropriate tens and units registrations of Figs. 290 and 291 is the result of the reconstruction of the disconnect and answer calendar day tens and units digits corresponding with the original information as read from the respective timing entries.

The disconnect day tens and units information is transferable from the registers of Fig. 290, over cable **290–295** into Fig. 295 where this information appears before contacts of certain of the pattern connector relays of Fig. 295 which, when operated for the purposes of producing output entries, will transmit this information in the proper digital position over cable PERF into Fig. 300 where it is used to operate certain of the perforating magnets in the perforator circuit.

The answer day units registration in Fig. 291 is transferable over cable **291–295**B into Fig. 295 where this information is used in a fashion similar to that above described for the disconnect day digits. The answer day tens digit in the register of Fig. 291, when used for straddle timing entry purposes, is provided over cable ADT–STDL in Fig. 291 and extends over cable **291–295**B into Fig. 295 where this information appears before the E digit contacts of the T2A pattern relay, whereby the tens digit of the answer day may be reproduced by a perforator as such.

Whenever the answer day tens digit in the register of Fig. 291 is to be used for perforating purposes in connection with operations other than straddle, a translation takes place such that the answer day tens digit and the answer hour tens digit are perforated in two digital positions on the output tape in such a manner as to represent also a third bit of information, namely the answer minute tens information. In this example, it will be noted that the answer minute tens information is 5, and this will have been recorded as such in Fig. 282 by the operation of the AMT1 and AMT4 answer minute tens register relays, thereby grounding the two conductors MHA and MHB into cable **282–291**, extending into Fig. 291 and over contacts **4** and **3** of the ADT1 relay to ground conductors **4** and **2** into cable ADT, representing a combined digit 6 extending over cable **291–295**B into Fig. 295, and appearing before the B digit contacts of the D02 pattern connector relay. In Fig. 282, the operated relays AMT1 and AMT4 will also ground the conductors M2, 5A and M2, 5B extending over cables **282–281**A into Fig. 281, and over contacts **3** and **4** of the AHT2 relay (operated because the tens digit of the answer hour is 2) to ground conductors **7** and **1** into cable AHT representing a combined answer hour tens and answer minute tens digit of 8, further extending, by means of cables AH and **285–295**, into Fig. 295, where this information appears before the C digit contacts of the D02 pattern connector

relay. The B and C digits of an output entry line produced by the D02 pattern connector relay of Fig. 295 are coded as shown in the following table:

		AMT						
		L			H			
		0	1	2	3	4	5	
AHT	0	0	3	6	0	3	6	C
	1	1	4	7	1	4	7	
	2	2	5	8	2	5	8	
ADT	0	0			5			B
	1	1			6			
	2	2			7			
	3	3			8			

Example 2

It will be recalled that relays ADT1 and ADT7 in Fig. 289 were operated as an incident to the recording of the answer day units digit 8 for this call, and that similarly the relays DDT2 and DDT7 were operated in Fig. 288 as an incident to the recording of the disconnect day units value 9. In Fig. 287, the D9T relay is operated to indicate the disconnect day value 9 and the A3–8T relay is operated to indicate that the answer day digit is not A, 0, 1, 2 or 9. Also, relay CR1 in Fig. 296, relay LR in Fig. 287 and relay 28 in Fig. 283 are operated. Also, the day register circuit of Fig. 278 contains the registration 01.

Ground extends from the conductor DU in Fig. 287, over contact 9 of the LR relay, contact 7 of the D9T relay, conductor DU9, cable 287–283A into Fig. 283, over contact 1 of relay 28, conductor DUAR1, cable 286–296 into Fig. 296, over contact 7 of relay CR1, conductor DDU1, cable 296–288 into Fig. 288 to operate relay 1.

Ground extends from the conductor DT in Fig. 287, over contact 8 of relay LR, contact 6 of relay D9T, conductor DT9, cable 287–283B into Fig. 283, contact 5 of relay 28, conductor DT0P1, cable 286–296 into Fig. 296, over contact 6 of relay CR1, conductor DDT0, cable 296–287 into Fig. 287, conductor DDT0, cable 287–284, conductor DDT0 to operate relay DDT0 in Fig. 284.

Ground extends from conductor AT, out of cable ADTU in Fig. 296, over contact 1 of relay CR1, conductor ATA<D, cable 296–287A into Fig. 287, contact 4 of relay LR, contact 5 of relay A3–8T to conductor ADTAR extending by means of cable 287–284 into Fig. 284 to operate relay ADTAR. Ground extends from conductor AU in Fig. 296, over contact 2 of relay CR1 to conductor AUA<D, cable 296–287A into Fig. 287, over contact 6 of relay LR, contact 6 of relay A38T, conductor AU38, cable 287–283 into Fig. 283 to conductor ADUAR extending by means of cable 286–289 into Fig. 289 to operate relay AR.

Relays DTL1 and DTAR2 in Fig. 284 will be operated as before. The tens digit of 0 from the day register of Fig. 278 grounds the T0 conductor out of cable 278–284 in Fig. 284 which thereupon extends over contact 4 of relay DTL1, contact 5 of relay DTAR2, conductor 203, cable 284–286 into Fig. 286, contact 20 of relay 28 of Fig. 283, conductor 2, cable 284–286 into Fig. 284, conductor 2, contact 2 of relay ADTAR to operate relay ADT2 in Fig. 284.

The grounded conductor DDT0 in Fig. 284 extends over cable DDT to Fig. 288, over contact 1 of the computer connector CC and into Fig. 290 to operate the disconnect day tens register relay DDT0, indicating a disconnect day tens digit of 0. The grounded conductor ADT2 in Fig. 284 extends over cable ADT into Fig. 289, over contact 12 of the connector CC into Fig. 291 to operate relay ADT2, indicating an answer day tens digit of 2.

The operation of relay 1 in Fig. 288 extends grounds over its contacts 1 and 2 to ground conductors 1 and 0 into cable DDU, extending over contacts 5 and 6 of the connector CC into Fig. 299 to operate relays DDU0 and DDU1, indicating a disconnect day units value of 1.

The operation of the relay AR in Fig. 289 extends grounds from the windings of the operated answer day translator B relays ADT1 and ADT7, over its contacts 4 and 1 to ground conductors 1 and 7 into cable ADU extending over contacts 15 and 18 of the connector CC into Fig. 291 to operate the relays ADU1 and ADU7, indicating an answer 1 units value of 8.

The various indications provided by the registers of Figs. 290 and 291 are utilized for output perforation purposes in the same manner as described above in connection with Example 1.

Example 3

It will be recalled that in Figs. 288 and 289 the relays DDT0, DDT1, ADT4 and ADT7 were operated to indicate that the disconnect and answer day units digits used for the timing entries into the assembler-computer were 1 and 0 respectively. These disconnect and answer day translator B operations cause the operation of the two relays D1T and A0T in Fig. 287.

This situation involves the operation of the relay CR1 in Fig. 296, relay FR in Fig. 287, and relay 30 in Fig. 283. Circuits similar to those described above are present for accomplishing similar purposes and result in this instance to the operation of the following relays in Fig. 284: ADTAR, DDTS3, DTAR1, DTAR2 and ADT3. Also are operated the relays ARA in Fig. 289 and AT in Fig. 288.

Relay DDTS3 operates from ground on conductor DT out of cable ADTU in Fig. 296, over contact 3 of relay CR1, conductor DTA<D, cable 296–287A to Fig. 287, contact 4 of relay FR, conductor DTA<D into Fig. 283, over contact 10 of relay 30, conductor 30A, cable 286–287A into Fig. 287, contact 5 of relay D1T, contact 2 of relay A0T, conductor DDTS3, cable 287–284 into Fig. 284 to relay DDTS3. The tens digit in the day register of Fig. 278 is 3. Relay DT3 grounds conductor T3 into cable 278–284 to Fig. 284, over contacts 1 of relays DTAR1 and DTAR2 and over contact 1 of relay DDTS3 to conductor DDT0 into cable DDT, whereby relay DDT0 in Fig. 290 is operated. Ground also extends over contact 1 of relay ADTAR to operate relay ADT3 in Fig. 284 and to ground conductor ADT3 into cable ADT whereby relay ADT3 in Fig. 291 is operated. Grounds extend over contacts 6 and 7 of the FR relay in Fig. 287, conductors FRAU and FRDU into Fig. 284, where conductor FRDU extends over contacts 1 of relays DDT2 and DDT3 to conductor DDUAR into Fig. 288 to operate relay AT, and where conductor FRAU extends over contact 1 of relay ADT2 and contact 2 of relay ADT3 to conductor ADUARS, over cable 284–289 into Fig. 289 to operate relay ARA. The operation of relays AT in Fig. 288 and ARA in Fig. 289 operates the DDU0, DDU1 relays in Fig. 290 and ADU4, ADU7 in Fig. 291.

The net result of the above relay operations is the operation in Fig. 291 of the ADT3 tens relay and the ADU4 and ADU7 units relays whereby the answer day is reconstructed as 30. Also, in Fig. 290, are operated the relays DDT0, DDU0 and DDU1, indicating a reconstructed disconnect day as 01. Again, as was the case with Examples 1 and 2, these registers of Figs. 290 and 291 provide outputs which are used for output perforating purposes.

Feature 24.—This feature has been indicated as com-

prising means in the assembler-computer for placing the elements of over-capacity calls on the detail tape.

Fig. 301 shows how Figs. 302 and 303 may be arranged to illustrate, in a highly schematic form, the assembler-computer parts primarily concerned with this feature.

During the processing of call entries, the reader of Fig. 302 causes the registration of a disconnect and answer time in the disconnect and answer portions of the assembling register. Subsequently, when the initial entry is received, the associated disconnect and answer times are removed from the assembling register and are placed in the call entry register along with other information concerning the call, as indicated in the lower portion of Fig. 302.

Fig. 303 shows for the cost part a group of pattern relays which, when operated, select certain information concerning the call and cause it to be perforated on output tapes by the perforators shown in the lower right-hand part of Fig. 303. The particular pattern connector relays shown in Fig. 303 are those involved in producing a six-line over-capacity call.

Assuming that the initial entry concerned with this call is a four-line initial entry (a detail billed call), the input class register in the lower right portion of Fig. 302 will provide a ground for operating the 4LI input class translator relay. As a result of computing the chargeable time from the answer and disconnect times, the subtractor in Fig. 302 will operate either of the OV and NOV relays (over-capacity and not over-capacity). At such time as the register control circuit in Fig. 302 ascertains whether or not it is in possession of one or two timing entries, it will be energize one of two circuits as follows: If only one timing entry is present, ground will extend over the contact of the ADC relay (operated if there was a timing entry in the answer section of the assembling register) and over contact 1 of relay DUC (indicating that there was a time registered in the disconnect part of the assembling register) and over contact 2 of relay 4LI to operate the 1T4I output class register relay to cause a straddle output entry because there are insufficient timing entries associated with this call for it to be considered as complete under these circumstances. In this respect, ground will extend over contact 1 of relay 1T4I to conductor S, over a contact of the output connector OCC via cable PC to Fig. 303, where it operates the PA0 perforator connector associated with the straddle perforator. Pattern relays not shown but similar to those shown in Fig. 303 will thereupon be operated to cause the perforation of the necessary lines of output for a straddle entry.

If the register control circuit of Fig. 302 detects the presence of two timing entries, ground will extend over the contact of relay AUC, contact 2 of relay DUC and contact 2 of the computer connector CCC to armatures of the OV and NOV relays. If the NOV relay is operated, this ground will extend over its contact and through the computer connector to cause circuit operations for producing a perforated output entry associated with a detail call which is not over-capacity.

If the relay OV is operated, ground will extend over its contact and contact 1 of the computer connector CC, contact 1 of relay 4LI to operate the OD output class register relay to indicate that this is an over-capacity detail call. Ground extends over contact 2 of the OD relay to conductor 0, extending by means of cable PCR into Fig. 303 to operate the 0 relay which, upon operating, causes the operation of the D03 pattern connector and which supplies an A digit for perforating purposes to the contacts of the D0I2 pattern relay. Ground also extends over contact 1 of the OD relay to conductor D extending over a contact of the output connector OCC and through cable PC into Fig. 303 to operate the perforator connector PA1 to connect the detail perforator to the output circuits of the pattern connectors.

In Fig. 302, a perforate line count circuit is shown in the upper portion of the figure for counting six lines of output. Ground is supplied from the reader over contact 4 thereof and over the contact of the CK relay in the perforate control circuit and over contacts 1 of all of the line count relays to conductor L6, extending over contact 1 of the connector OCC and contact 3 of the OD relay into cable PCR to operate the D012 pattern connector to reproduce for perforating purposes the information to be placed in the first line of the six-line over-capacity detail output entry, which information is gleaned from the various registers of Fig. 302 and transmitted over contacts of the pattern relay D0I2. As soon as this first line is perforated properly, the perforate line count circuit of Fig. 302 is advanced, whereby the PLA5 relay is operated thereby grounding the conductor L5 over contact 2 of the connector OCC and contact 4 of relay OD, cable PCR into Fig. 303 to operate the pattern connector D02 to cause the perforation of the second line of the six-line over-capacity entry, etc.

Features 25 and 26.—These features have been indicated as comprising certain aspects of the general overall assembler-computer arrangement whereby the following equipments function in cooperation with each other: A large number (100) assembling registers; a pair (odd and even) of call entry registers; a common calculator circuit; and, a common output perforator control circuit.

Fig. 304 shows how Figs. 305 through 308 may be arranged to illustrate schematically the above indicated cooperative relationship of the various main parts of the assembler-computer.

In Fig. 305, when the answer and disconnect timing entries for a particular call (identified by a call identity index of 00 to 99) are read by the reader, they are transmitted over the respective disconnect and answer multiples DISMUL and ANSMUL into the disconnect and answer sections of the assembling register identified by that call identity index, such as register No. 00 or No. 99 in Fig. 305.

In Fig. 306 are shown an odd and an even call register, each having a disconnect and an answer section. These odd and even call registers are the main processing registers of the assembler-computer and function alternately to handle the processing of alternate calls, and in this respect, cooperate with the 100 assembling registers indicated in Fig. 305. In Fig. 307 are shown portions of the odd and even call entry registers, whereby when the initial entry for a call (identified by the call identity index) is read by the reader of Fig. 305, it is transferred from Fig. 305 over cable IOE into Fig. 307 into whichever of the odd or even call entry registers is allotted to handle this particular call. At this time the odd and even call entry register causes the assembling register associated with this call to transfer the timing entries contained therein over the disconnect and answer multiples into Fig. 306 and into the disconnect and answer sections of the odd or even call entry register over contacts of the connectors DO, AO, DE or AE.

In the left portion of Fig. 308 are shown a number of boxes comprising parts of the calculator and associated odd or even call entry register of the assembler-computer. Whenever the chargeable time or chargeable message units for a particular call are to be ascertained, the call entry register which is processing the call will cause the operation of one of the computer connector sections of Fig. 306 (CDO, CAO or CDE, CAE) whereby the timing information registered in the disconnect and answer sections of the call entry register are transferred over cables CCD and CCA into Fig. 308 and through a translator into the subtractor. The subtractor ascertains the tens and units values of the chargeable time and causes this information to be registered in the chargeable time translator. Various other circuits associated with the calculator come into play, such as the message unit formula circuit and the message unit translator, whereby

the chargeable time is translated, where desired, into a tens and units digit of chargeable message units. This information is transmitted back over a portion of the computer connector into message unit tens and message unit units registers in the appropriate call entry register.

In Fig. 307 is indicated a set-up switch which is used to designate the type of sorting operation which the assembler-computer will follow for a particular processing interval. For instance, calls may be sorted by the thousands digit of the calling subscriber's number, in which case the set-up switch will be set on its terminal 2. Similarly, the calls may be processed and produced on output tapes as sorted according to the units digit of the calling subscriber's number, in which case the set-up switch of Fig. 307 will be set on its terminal 3. The assembler-computer is arranged whereby any one of some eight modes of sorting operation may be chosen. The actual number of perforators to be used and the type of information which they are to contain is dependent upon the setting of this sort set-up switch, together with certain information obtained from other set-up switches, such as the number of offices which may be involved in the marker group presently being processed and a number of types of message units which are handled by any one office. Features 27 through 31 describe this sorting feature more particularly.

As a result of the setting of the set-up switch in Fig. 307 and certain other factors not particularly indicated in detail, one of the output connector relays for the odd or even call entry register will be operated. The OTHS connector will be operated if the calls are to be sorted by the thousands digit of the calling subscriber's number; the OUS connector causes a sort by units digit; the OSDS connector causes a sort according to a sort digit which is derived at by combining a number of factors, such as calling office index, message unit tape; etc.

When the perforator control circuit, indicated at the right part of Fig. 307, operates its ODC relay, this is an indication that the output circuits are normal and may be seized by one or the other of the call entry registers. Ground will extend over the contact of the ORLS or ERLS relay in the register control circuit for one of the call entry registers and over a contact of the ODC relay and over contact 1 of the ODC or EDC released output connector of the opposite register to operate the instant connector. The output class register in the odd or even call entry register of Fig. 307 thereupon causes a ground to extend over contact 12 or 13 of the associated output connector ODC or EDC if the particular call involved at the moment is to be perforated by the respective detail or straddle perforator of Fig. 308. This ground will extend over cables PC0 and PC into Fig. 308 to operate the perforator register relay P1D and perforator connector PA1 in series for the detail perforator or perforator register relay P0D and perforator connector PA0 in series for the straddle perforator.

Unless the output associated with the particular call of interest at the moment is to to be reproduced on the detail or straddle perforator, one of the remaining ten perforators MU0 to MU9 will be operated under the control of the sort switch or sort digit as the case may be, depending upon which one of the output sort connectors in Fig. 307 is operated.

In connection with the operation of various of the perforator connectors for producing output entries associated with a particular call, it is, of course, possible that some sort classes may involve the use of one or more perforators. For instance, the so-called MUD class will cause the perforation of an output entry on one of the message unit perforators MU0 to MU9 according to a specified sort pattern and, in addition, the perforation on the detail perforator of related information for the same call. This latter situation is particularly used in those circumstances where, even though a call may be handled on a message unit basis, there may be some reason why all of the details of the call may also be desired.

The above general outline of the apparatus shown in Figs. 305 through 308 will illustrate this feature of the invention, whereby a large number (100) of assembling registers function in cooperation with a plurality (two) of call entry registers and with a common calculator and a common perforator control circuit.

Features 27 through 31.—These features have been stated as comprising means in the assembler-computer whereby calls may be sorted according to a variety of conditions. Some of these conditions are sorting by a selecting index, sorting by office index, sorting by principal office, sorting by the type of call, sorting by the length (time or chargeable value) of use, sorting by the type of output information, sorting by a plurality of factors, etc.

Fig. 309 shows how Figs. 310 through 327 may be arranged to disclose, in highly skeletonized fashion, the basic circuit components involved in the performance of the functions of the assembler-computer which are attributable to these features.

The sort set-up switch of Fig. 320 provides for eight different mode of circuit operation in connection with message unit calls on the ten message unit output tapes. These eight different modes of operation may be employed only with certain types of offices. Marker groups which contain but a single office and which employ message unit charging of but one type may be sorted by the units (SBU) or thousands (SBTH) digit of the calling line number. Provision is made so that the message unit tape need not be sorted (NS) at all. Marker groups which contain but a single office but which office provides more than one type of message unit may be handled in any of five different ways. Three of these have been described above, namely sorting by thousands, units or not sorted at all. In addition, the calls may be sorted by the type of message unit (SBUT) or a mode of operation employed where only calls to local areas are placed on one tape, whereas calls using the other types of message units to contiguous areas are placed on a second tape (SOLU). For marker groups containing more than one office, three modes of operation are available if only one type of message unit is employed. The calls may be sorted by office (SBO) or by principal office (SOPO) only. That is, the main office in the marker group which is usually called a physical office may be separated from the theoretical office, but all theoretical office calls are placed on one tape. In addition, it is possible with only one type of message unit, but a number of offices, to leave the messages unsorted. Where the marker group contains more than one office and each office has several types of message units, the calls may be sorted, by principal office only, by the types of message unit, by sorting out local message units or by sorting by both message unit and office (SBOUT).

The following tables indicate the nature of the eight modes of sorting as related to the eight positions of the sort set-up switch and the number of output tapes produced under varying sort conditions as related to the number of offices in the marker group and the number of message unit types involved in such office or offices.

Class Abbreviation	Types of Message Unit Message Sorts	Sort Switch Position
NS	No Sort	6
SBTH	Sort by Thousands Digit of Calling Line Number.	2
SBU	Sort by Units Digit of Calling Line Number.	3
SBO	Sort by Calling Offices	4
SOPO	Sort Out Principal Calling Office of Marker Group.	5
SBOUT	Sort by Calling Offices and Type of Message Units.	9
SOLU	Sort Out Local Message Unit Calls	8
SBUT	Sort by Type of Message Units	7

Sort Class	Marker Group	Types of Message Units	Number of Message Unit Tapes
SBTH	Single Office	One	10.
SBU	do	do	10.
NS	do	do	1.
SBTH	do	Plurality	10.
SBU	do	do	10.
NS	do	do	1.
SBUT	do	do	One per M.U. Type (5 maximum).
SOLU	do	do	2.
SBO	Multioffice	One	One per Office (5 maximum).
SOPO	do	do	2.
NS	do	do	1.
SBO	do	Plurality	One per Office (5 maximum).
SOPO	do	do	2.
NS	do	do	1.
SBUT	do	do	One per M.U. Type (5 maximum).
SOLU	do	do	2 Times No. of Offices (2 tapes per office).
SBOUT	do	do	One per M.U. Type per Office.

OUTPUT TAPE PREPARATION

When the assembler-computer is initially started for processing input tapes, it is necessary that leading tape identity (LTI) be placed on the number of output tapes which will be required in order to process the incoming tape in the fashion specified by the set-up switches. To effect this operation, relays LTI and COC in Fig. 326 are operated. When the output circuit is available for handling this end-of-tape preparation, a circuit is completed from ground over contact **2** of relay LTI in Fig. 326, over coductor **10**L, contact **4** of relay COC, conductor **10**L extending by means of a cable to operate relay PLA**10** in the perforate line count circuit. A circuit is also completed from ground over contact **3** of relay LTI and contact **6** of relay COC, conductor W extending into Fig. 327, over contact **1** of relay P1D1, and in series through the windings of the P1D relay and the PA1 connector of Fig. 327, whereby the detail perforator **1** is connected to the circuits which feed it information. Relays P1D and PA1 lock to circuits not shown. Relay P1D1 in Fig. 327 thereupon operates in a circuit over contact **1** of relay P1D and this causes the operation of relay PW in Fig. 327, which also locks. Ground extends over contact **3** of the P1D1 relay and over contact **4** of relay P1D to conductor DET extending over cable **311–327** into Fig. 311 to operate the DET relay.

The operation of the PLA**10** relay in the perforate line count circuit of Fig. 326 specifies ten lines of tape identity output information which must be perforated on the detail tape. Line 10 is caused to be perforated by ground extending from the JB3 contact of the reader in Fig. 310, over cable HJ into Fig. 326, conductor JB3, contact **2** of the CK relay, conductor PAT, over contacts **1** of relays PLA**1** through PLA**9** and contact **2** of relay PLA**10** to conductor L**10** extending over a contact (not shown) of the COC connector, etc., whereby a specified number of lines of splice pattern are placed on the detail output tape as line 10 of this tape identity. Relay OP in the perforate control circuit of Fig. 326 operates from the ground on this conductor PAT and relay OP locks over a circuit not shown. As a result of a check by the check circuit **32700** in Fig. 327 that the lines of splice pattern perforated by the perforator **1** are proper, relay PS in Fig. 326 is operated, indicating that the line or lines which have been perforated are proper lines. Relay CK in Fig. 326 is also operated to advance the perforate line count circuit by extending ground from the HM**6** conductor, over its contact **1**, conductor PL, over back contacts of relays PLA **1** through PLA**9**, contact **3** of relay PLA**10** to operate relay PL**9**. Ground will thereupon extend from the HB**4** conductor over contact **1** of relay PS, conductor PLA, back contacts of relays PL**1** through PL**8**, contact **2** of relay PL**9** to operate relay PLA**9**. Relay PLA**10** is released and the operation of relay PLA**9** grounds conductor L**9** extending by means of a cable and over contact **2** of relay COC and contact **1** of relay LTI, conductor **2891** into Fig. 327 to operate relays **2891** and **289** in the common pattern connector circuit, whereby the code 2891EF is perforated on the detail perforator **1**. The E and F digits of this entry represent the tens and units digits of the tape index, the tens digit of which is a 5 for the detail tape and a 1 for all message unit tapes (perforators **2** through **11**) and the units digit of which is a 0 for the detail tape in a multioffice marker group and a 1 for the detail tape in a single office marker group, and a 0, 1, 2, 3, 8 or 9 for a message unit tape depending upon the type of sort.

As soon as this line 2891EF is properly perforated, the CK relay in Fig. 326 will reoperate to again advance the perforate line count circuit for perforating line 8. Line 8 represents a code 2892EF, the successive lines 7, 6, 5 and so forth down to 1 representing successive codes 2893EF, 2894EF, etc., down to 2899EF completing the 9 lines of tape identity codes.

At the completion of the last line of perforating the tape identity group on the detail perforator **1**, relay PRL in the perforate control circuit of Fig. 326 is operated to extend ground over its contact and over contact **7** of relay COC, conductor **32600** into Fig. 327, contact **2** of relay CG, contact **1** of relay P11D and the contact of relay PW to operate the PWS relay. The operation of relay PWS extends ground over its contact and over contact **3** of the P1D relay to conductor P2W, extending over cable **327–326** into Fig. 326 to contacts of the perforator assignment pattern connector relays for selecting the next specified perforator for having tape identity placed thereon. In this instance, conductor P2W will extend over contact **1** of whichever one of the pattern connectors A1P through AAP is operated, to conductor P**2**, extending over cable **326–327** into Fig. 327 to operate the relays P2D and PA**2** in series for selecting the perforator **2** for the next tape identity operation, the relays P1D and PA**1** in Fig. 327 being released in the ensuing process.

One of the perforator assignment pattern connector relays A1P through AAP of Fig. 326 will be operated under the control of various means including the month tens and month units set-up switches of Fig. 320, the marker group selecting relays of Fig. 320, the sort class translator relays of Figs. 311 and 314 and the perforator assignment translator relays of Fig. 326. The particular manner in which only one at a time of these assignment pattern connector relays is operated will be described below, it being significant to note at this point that no matter which one is operated, the perforator **2** relays P2D and PA**2** of Fig. 327 will be operated.

Upon the operation of the PWS relay in Fig. 327, the common output connector COC in Fig. 326 is released to return the perforator line count circuit to Fig. 326 to normal and to return to normal all other relays used for the leading tape identity perforating job previously described with reference to the detail perforator **1**. Relay PWS releases due to some incidental operations effective at the instant when the circuits detect two perforate register relays (P1D and P2D) operated simultaneously. As soon as relay PWS releases, the relays P1D and PA**1**, associated with the detail perforator **1**, release, permitting the reoperation of the connector COC of Fig. 326.

The above-described process of applying leading tape identity to an output tape is repeated with respect to the perforator **2**, as above described in connection with the detail perforator **1**. Eventually the PWS relay of Fig. 327 reoperates to again cause the process to be repeated with respect to the next perforator **3**—if assigned by the assignment connector of Fig. 326.

A few details differ with respect to the output identity perforation on the detail perforator **1** and the other perforators, designated as message unit perforators **0** to **9**. For instance, with perforator **2** in operation, ground will

extend over contact 3 of relay P1D1 in Fig. 327, over contact 3 of relay P2D to conductor BLKE extending by means of cable 311–327 into Fig. 311 to operate the relay BLKE, indicating an even numbered bulk billed call. This same circuit will be completed for all even numbered perforators. With an odd perforator involved, such as perforator 3, this same circuit will extend over contact 3 of relay P3D to conductor BLK0, cable 311–327 into Fig. 311 to operate the relay BLK0, indicating a bulk billed call on an odd numbered perforator.

The number of message unit tapes (tapes produced by the message unit perforators 2 through 11) to be prepared by end-of-tape identity depends essentially upon the setting of the marker group units and tens switches of Fig. 320 as they control the operation of one of the perforator assignment pattern connectors of Fig. 326. The operation of one of these assignment connectors A1P through AAP of Fig. 326 designates the last perforator which will be prepared with tape identity group which, of course, means that only these numbers of perforator output tapes are required for processing calls involved at the moment in the assembler-computer. With relay A2P operated, only two of the message unit perforators, perforators 2 and 3, will be prepared with end-of-tape group because, upon the operation of relay PWS in Fig. 327, ground will extend over contact 2 of relay P1D, contact 1 of relay P2D and contact 2 of relay P3D to conductor P4W, cable 327–326 into Fig. 326 and over contact 3 of relay A2P to operate the EPW relay in the tape identity progress control circuit in Fig. 326. The operation of relay EPW designates the end-of-perforator walking control for tape identity purposes. It will be noted that the detail perforator 1 and the message unit perforator 2 are always prepared with tape identity under any circumstances. The operation of relay EPW releases the LTI relay of Fig. 326 which returns to normal all circuits used for the leading tape identity perforating job, thereby preparing the circuits to handle calls. These calls will be processed and the results thereof will be perforated on one or more of the assigned perforators.

NUMBER OF PERFORATORS PREPARED

As indicated above, many factors enter the consideration as to how many message unit tapes are to be prepared, including the type of sort specified by the sort set-up switch of Fig. 320, the number of offices in the marker group, the number of types of message unit calls involved in the marker group and the marker group number itself, as specified by the marker group set-up switches of Fig. 320.

There are some seventeen situations to be considered in discussing the matter of tape preparation. The above table sets forth these seventeen situations with pertinent data indicated therein.

If the sort switch of Fig. 320 is set on its contact 6, this specifies a no-sort condition (NS) by extending battery over conductor NS and cable 320–314 into Fig. 314 to operate the sort class translator relay NS of Fig. 314. Ground thereupon extends over contact 9 of relay NS to conductor A1P, extending into Fig. 311 and over cable 311–326A into Fig. 326 to operate the A1P assignment connector. This specifies that only one message unit tape (perforator 2) will be prepared in addition to the detail perforator 1.

If the sort switch of Fig. 320 is set on its position 7, designating a sort by message unit type, battery will extend over conductor SBUT and cable 320–314 into Fig. 314 to the left-hand windings of relays SBUT. The circuit may continue from the lower winding of relay SBUT over conductor S02 into Fig. 311, through the right-hand winding of relay SO (single office marker group) through the right-hand winding of relay 25T to the right-hand windings of relays 2T, 3T, 4T and 5T. The circuit through relay SBUT in Fig. 314 may also extend over its upper winding, conductor M01 into Fig. 311 through the left-hand winding of relay MO (a multioffice marker group) and left-hand winding of relay 25T to the left windings of relays 2T, 3T, 4T and 5T. The circuit is completed by extending one of the windings of relays 2T through 5T in Fig. 311, over cable 320–311 into Fig. 320 to the cross-connection punchings marked 0, 9, etc., through 99, associated with the marker group selecting relays MT0 through MT9, one of which will be operated from the marker group tens set-up switch in Fig. 320 in accordance with the marker group tens digit. Ground will extend over the No. 6 wiper of the marker group units set-up switch in Fig. 320 to ground one of the ten conductors U0C through U9C extending over contacts of the marker group selecting relays, thereby to ground one of the 100 punchings above referred to. This cross-connecting scheme will permit certain marker group numbers to be associated particularly with certain of the sort class translator relays of Figs. 311 and 314. Upon the operation of relay SBUT of Fig. 314, ground will extend over its contact 5, conductor 31414 into Fig. 311 and over contact 2 of one of the relays 2T through 5T, thereby to ground one of the conductors A2P, A3P, A4P and A5P extending over cable 311–326A into Fig. 326 to operate one of the assignment connectors A2P, A3P, A4P and A5P. This will cause from two to five message unit perforators to be prepared with leading tape identity.

If the sort switch of Fig. 320 specifies a sort by sorting out local message units, it will be set on its contact 8. This will cause the operation of relay SOLU in Fig. 314 and one of the relays MO and SO in Fig. 311 depending upon whether or not the marker group involves a single office or a plurality of offices. Relay 25T in Fig. 311 will be operated to indicate more than one type of message unit charging involved in this processing. Ground will extend over contact 6 of relay SOLU, conductor 31415 into Fig. 311, whereupon for the single office condition ground will extend over contact 6 of relay SO to conductor A2P into cable 311—326A extending into Fig. 326 to operate relay A2P. This prepares two message unit tapes for this processing. For the multioffice condition, ground will extend over contact 6 of relay MO in Fig. 311 to conductor 2AP, extending by means of cable 311–326 into Fig. 326 to operate relay 2AP in the perforator assignment translator circuit. With relay 2AP operated, ground will extend over its contact 9, conductor A, cable 311–326 into Fig. 311, conductor A extending into Fig. 314, cable 320–314 into Fig. 320, conductor A, wiper 5 of the marker group units set-up switch to one of the ten conductors U0B through U9B, over a contact of one of the marker group selecting relays MT0 through MT9, by means of a cross-connection through cable 320–326 into Fig. 326, over contact 2 or 4 or 6 or 8 of relay 2AP (depending upon whether the marker group involves two offices or three offices or four offices or five offices) to respective conductors A4P, A6P, A8P or AP to cause the operation of one of the perforator assignment connectors A4P, A6P, A8P or AAP in Fig. 326 to cause the preparation of output tapes on four or six or eight or ten perforators depending upon the number of offices in the marker group. It should be noted that in this instance two tapes per office are prepared, one containing all of the local message unit calls for that office and the other containing the rest of the calls for that office.

If the sort switch of Fig. 320 specifies that the assembler-computer should sort out the principal office (presumably under conditions where the marker group represents at least two offices, the calls from a particular one of which are desired to be segregated) battery will extend over contact 5 of the sort switch to cause the operation of relay SOPO in Fig. 314. Ground will thereupon extend over contact 4 of relay SOPO to conductor A2P, extending into Fig. 311 and over cable 311–326A into

Fig. 326 to operate the assignment connector A2P, which causes the preparation of two message unit tapes.

If the sort switch of Fig. 320 is set on its position 2 or 3, designating respectively sorting by the thousands and units digits of the calling line number, battery will extend over this contact of the sort switch into Fig. 314 to operate relay SBTH or SBU. Ground will extend over contact 6 of either of these relays to conductor AP, extending into Fig. 311 and over cable 311–326A into Fig. 326 to operate the assignment connector AAP which causes the preparation of ten message unit tapes.

If the sort switch of Fig. 320 specifies a sort by office, ground will extend over contact 4 of the sort switch to cause the operation of relay SBO in Fig. 314. Ground will extend over contact 7 of relay SBO to conductor A, extending by means of cable 320–314 into Fig. 320 and over the No. 5 wiper of the marker group units set-up switch and over a contact of one of the marker group selecting relays MT0 through MT9, over cable 320–326 into Fig. 326 and over contact 1 or 3 or 5 or 7 of relay 2AP (depending upon whether there are 2, 3, 4 or 5 offices) thence over contact 1 or 3 or 5 or 6 of relay APCO to conductor A2P or A3P or A4P or A5P to cause the operation of the assignment connector A2P, A3P, A4P or A5P, which will cause the preparation of from two to five output tapes depending upon the number of offices in the marker group.

If the sort switch of Fig. 320 specifies that the sorting will be by office and message unit type, battery will extend over its contact 9 to cause the operation of relay SBOUT of Fig. 314. The relay MO in Fig. 311 will be operated. Two different situations will develop depending upon whether the number of message unit types involved in this marker group is two (relay 2T of Fig. 311 operated) or is more than two (one of the relays 3T, 4T and 5T of Fig. 311 operated). Under either situation, a circuit is completed from ground over contact 4 of relay SBOUT, conductor APCO into Fig. 311 over cable 311–326 into Fig. 326 to operate relay APCO in the perforator assignment translator. Also in either case, ground will extend over contact 7 of relay SBOUT to conductor A, extending over cable 320–314 into Fig. 320 and, as above described, over the No. 5 wiper of the marker group units switch and a contact of one of the marker group selecting relays out of cable 320–326 into Fig. 326 to ground one of the conductors A2P through A5P emerging from cable 320–326 in the perforator assignment translator.

If only two types of message unit calls are involved in this marker group, relay 2T in Fig. 311 will be operated, whereupon the ground on conductor APCO in Fig. 311 will extend over contact 3 of relay 2T to conductor 2AP, extending by means of cable 311–326 into Fig. 326 to operate relay 2AP. The grounded conductors A2P through A5P will extend over contact 2 or 4 or 6 or 8 of relay 2AP to cause the operation of the assignment connector A4P or A6P or A8P or AAP to cause the preparation or 4 or 6 or 8 or 10 tapes depending upon whether there are 2 or 3 or 4 or 5 offices in the marker group.

In the event that there are more than two message unit types involved in this marker group, relay 2AP in Fig. 326 will not be operated, but relay APCO will be operated, as above described, whereupon the grounded conductor A2P or A3P will extend over contact 1 or 3 of relay 2AP (there can never be more than three offices in a marker group which has more than two message unit types involved) and contact 2 or 4 of relay APCO to conductor A2P or A3P, extending over cable 311–326 into Fig. 311 where these conductors emerge and appear before contacts of the relays 3T through 5T of Fig. 311. If conductor A3P is grounded, it will extend over contact 4 of relay 3T in Fig. 311 to conductor A9P. Conductor A2P, if grounded, will extend over contact 3 of one of the relays 3T, 4T and 5T to respective conductors

A6P, A8P and AP. One of these four conductors A9P, A6P, A8P and AP will extend over cable 311–326A in Fig. 326 to cause the operation of the respective assignment connectors A9P, A6P, A8P or AAP to prepare 9 or 6 or 8 or 10 tapes depending upon the product of the number of offices by the number of message unit types.

PROCESSING CALLS

When the disconnect and answer timing entries for a particular call are read by the reader of Fig. 310, the information is passed through the reader connector into the reading relays and thence by means of the assembling register multiple connector into the disconnect and answer register sections of one of the 100 assembling registers 00 to 99 in Fig. 310.

When the initial entry associated with timing entries in an assembly register is read by the reader in Fig. 310, these timing entries are removed from the assembling register and are registered in the odd or the even call register of Fig. 310 depending upon which one is available to handle this call, and the information in the initial entry is transmitted from the reading relays over cables BF and BF1 from Fig. 310 into Fig. 317 to the initial entry register connector for the odd call entry register. Information in the B digit is transmitted over the connector CLA and cable IC into Fig. 318 to operate one of the input class register relays. The C and D digit information is transmitted over the connector CLA to operate on a two-out-of-five basis the billing index tens and units registers of Fig. 317. Other information is transmitted over contacts of the connector CG and cable CGO into Fig. 319 to record in the appropriate registers of the odd call entry register such information as the calling office index and the calling office thousands, hundreds, tens and units digits.

At the time that the initial entry is received, the disconnect and answer timing information is transferred from the call entry register of Fig. 310 through a translator into the subtractor section of the calculator, which produces an answer of chargeable time in tens and units digits thereof. This chargeable time is transmitted from the calculator over cable CT from Fig. 309 into Fig. 315 where the tens and units digits of the chargeable time are used to adjust contact networks in the message unit formula circuits of Fig. 315. The billing index tens and units digits are transferred from the odd call entry register billing index section of Fig. 317 over cable 31700, contacts of the computer connector CC, cable BITU into Fig. 315 to operate one of the billing index translator relays B1T0 through B1T9 and to ground one of the ten conductors 0 to 9 connected to contacts of these relays. Ground will extend over one of the contacts of one of these relays to one of a hundred conductors 00 to 99, extending into a formula connector in Fig. 315, whereby the chargeable time is translated into a tens and units digit of message units. The message units tens and units digits are transferred over cable MU in Fig. 315 into Fig. 312 to operate a tens and a units relay in the message unit translator of Fig. 312. Also, the office index registered in Fig. 319 will be transferred over cable OI1 into Fig. 317 over contacts of the computer connector CC into cable OI2, extending into Fig. 315 to operate on a two-out-of-five basis the office index translator relays.

In Fig. 317 grounds will extend from the register control circuit of the odd call entry register to conductors C–L and C–W, extending over contacts of the computer connector CC, cable CW into Fig. 311 and over contacts of the relay NOV (indicating that this call is not an overcapacity call) to armatures of the relays 12L and A2L (one of which will be operated to respectively indicate that the output information for this message unit call will involve one or two lines of information), thence over contacts of one of these relays to the appropriate pair of conductors, out over cable 311–312 into Fig. 312 and over contacts of one of the message unit tens trans-

lator relays to ground the two conductors 1MW and 1ML or 2MW and 2ML into cable 12LWA extending into Fig. 317, over contacts of the computer connector CC, cable 12LW into Fig. 318 and over contacts of the operated input class translator relay –2L1 to cause the operation of one of the output class relays –1M and –2M (respectively less-than-ten-units and more-than-nine-units) and to operate one of the line register relays –1L and –2L (one-line or two-lines of output).

CALL OUTPUT PERFORATOR SELECTION

The output class register of Fig. 318 will ground one of three conductors D, M or MD depending upon whether the output class of this call is a detail class or a message unit class or a combined message unit and detail class. Whenever the conductor D (detail) is grounded, this ground will extend over cable 318–322 into Fig. 322, over contact 7 of the output connector CAB to conductor D extending by means of cable D09 into Fig. 327 to select the detail perforator for perforating the output information relating to this detail call. Whenever the output class of the call is a message unit class, conductor M will be grounded and will thereupon extend into Fig. 319 to produce decimal outputs from the thousands, units and sort digit registers of the odd call entry register.

No sort

This conductor M will also extend from Fig. 318 over cable 318–322 into Fig. 322, over contact 9 of the output connector CAB, conductor M, cable 314–322 into Fig. 314 and over contact 12 of relay NS (for a no-sort condition), conductor P2D into Fig. 311 over cable 311–327 into Fig. 327 to select the perforator No. 2 for handling the output information on all message unit calls under a no-sort condition.

If the output class of the call as indicated by the output class register of Fig. 318 is a message unit detail class (outputs must be provided both in the message unit form on a message unit perforator and in detail form on the detail perforator), conductor MD in Fig. 318 will be grounded and will extend over cable 318–322 into Fig. 322 and over contact 8 of the output connector CAB into the perforate line count circuit. The message unit detail class (MUD) involves a possible total of seven lines of output, the first five of which comprise the detail output and the additional one or two lines comprises the message unit output. If the perforate line count circuit is involved in perforating any one of the first five lines of this prescribed seven-line output, one of the relays PLA1 through PLA5 will be operated, whereupon ground will extend over a contact thereof to the previously-described conductor D, extending over cable D09 to select the detail perforator 1. If, on the other hand, the perforate line count circuit is involved in perforating line 6 or line 7 of this MUD class, ground will extend over the contact of relay PLA6 or PLA7 to conductor M, extending over cable 314–322 into Fig. 314 and over contact 12 of the NS relay, as previously described, to select perforator 2 in connection with the message unit part of this output.

Sort by units

With relay SBU in Fig. 314 operated, ground will extend over its contact 7 to conductor US, cable 314–322 into Fig. 322 to operate the output connector US, whereupon one out of ten conductors, grounded in the calling line units register of Fig. 319, will be extended over cables UA and CLA into Fig. 322 and over a contact of the output connector US and a contact of the output connector CAB into cable D09, extending into Fig. 327 to cause the selection of one of the perforators 2 through 11 depending upon the units digit of the calling line number.

Sort by thousands digit

With relay SBTH in Fig. 314 operated, ground will extend over its contact 7 and conductor THS, over cable 314–322 into Fig. 322 to operate the output connector THS, whereupon the thousands digit of the calling line number, as registered in Fig. 319, will be extended over cables THA and CLA into Fig. 322 and over contacts of the connectors THS and CAB into cable D09 to select a perforator in accordance with the thousands digit of the calling line number.

SBOUT—SOLU—SBUT—SOPO—SBO

With any one of these relays in Fig. 314 operated, ground will extend over contact 6 or 8 thereof to conductor SDS and cable 314–322 into Fig. 322 to cause the operation of the output connector SDS, whereupon the sort digit register of Fig. 319 will cause one out of ten conductors to be grounded into cable SD9 extending into Fig. 322 and over contacts of the connectors SDS and CAB into cable D09 to select a perforator in accordance with this specified one-out-of-ten sort digits.

Sort by office

With relay SBO in Fig. 314 operated, ground will extend over its contact 5 to conductor OIO, cable 314–315 into Fig. 315 to operate relay OIO in the office index output connector circuit. In Fig. 315, depending upon what the office index is (could be any one of five offices), this index will be transmitted on a two-out-of-five basis, over contacts of the relay OIO, into cable SD, extending into Fig. 317 and over contacts of the computer connector CC, cable SDR into Fig. 319 to operate the sort digit register in accordance therewith.

Sort out principal office

The operation of relay SOPO in Fig. 314 will extend a ground over contact 5 thereof to conductor P00, extending over cable 314–315 into Fig. 315 to operate relay P00. Ground will extend over contacts of the operated ones of the office index translator relays of Fig. 315 to ground the pair of conductors OA and OB, if the office index is 0, and to ground the pair of conductors NOA and NOB, if the office index is anything else but 0. This pair of grounded conductors will extend over contacts of the relay P00 and the previously-described path involving cable SD, whereby this index digit is transferred as a 1 or a 0 into the sort digit register of Fig. 319.

Sort by unit type

With relay SBUT in Fig. 314 operated, ground will extend over contact 7 thereof to conductor 000 and over cable 314–315 to operate relay 000 in Fig. 315.

To digress a moment, it should be pointed out that a cross-connection will extend from the billing index translator circuit of Fig. 315 over cable 315–316 to the winding of one of the message unit type translator relays of Fig. 316 depending upon what type of message unit call the billing index represents. Also, ground will extend over contact 6 of relay SBUT in Fig. 314, conductor 31413 into Fig. 311 and over contact 1 of one of the relays 2T through 5T of Fig. 311, out over cable 311–313 into Fig. 313 to operate one of the four message unit type translator relays 2T through 5T depending upon the number of types of message units involved in the marker group of interest.

Under these circumstances, ground will extend from Fig. 315 over contacts 2 and 1 of relay 000 to conductors OOA and OOB, extending by means of cable 315–313 into Figs. 313 and 316 where these two conductors appear before and are translated over contacts of the relays of Figs. 313 and 316, and in some cases, over contacts of the message unit translator relays of Fig. 312, to provide a sort digit into cable SD, extending from Fig. 316 to the computer connector of Fig. 317, whereby this sort digit will be used through the agency of the sort digit register of Fig. 319 to select the perforator in accordance therewith.

In this connection, there are five possible types of mes-

sage units which could be involved, namely local area (MUL relay of Fig. 316), contiguous area 1 (MUE1 relay of Fig. 316), contiguous area 2 (MUE2 relay of Fig. 316), toll area-less than five message units (relay MUT of Fig. 316 and translator of Fig. 312) and toll area-5 or more message units (MUT relay of Fig. 316 and translator of Fig. 312). In this connection, the table immediately below shows the type number for various ones of these message unit types when they are used in combination in marker groups having two or three or four or five such types.

TYPE NO. (FOR MORE THAN ONE TYPE OF MU)

No. of Types	2	3	4	5
Types:				
MUL	1 1	1 1	1 1	1
MUE1	2	2	2	2
MUE2	2	3	2	3
MUT{MUT1		2	3 3	4
MUT{MUT2		3	4 4	5

The table immediately below shows the sort digit value obtained from the message unit type translator circuit of Figs. 313 and 316 depending upon the number of types of message units involved in the marker group and the type number within the groupings of 2, 3, 4 and 5 types, and the office index anywhere from 1 to 5 offices (0 to 4).

SORT DIGIT VALUE

No. of Types of MU	2	3	4	5
Type No	1 2	1 2 3	1 2 3 4	1 2 3 4 5
Office Index:				
0	0 1	0 1 2	0 1 2 3	0 1 2 3 4
1	2 3	3 4 5	4 5 6 7	5 6 7 8 9
2	4 5	6 7 8		
3	6 7			
4	8 9			

In connection with the above sorting by types of units, it must be mentioned that there can be no toll class (MUT relay of Fig. 316) involved in marker groups which have only two types of message units therein.

Sort out local units

With relay SOLU in Fig. 314 operated, ground will extend over its contact **5** to conductor **500** and over cable **314–315** into Fig. 315 to operate relay **500**. Five pairs of conductors extend from the office-index translator of Fig. 315, over contacts of relay **500**, a pair for each of five office 0 to 4, which pairs of conductors extend by means of cable **315–313** into Figs. 313 and 316 to produce two different sort digits for each office in the marker group, whereby a different pair of perforators are selected for perforating the output calls for each office.

Sort by office and unit type

With relay SBOUT in Fig. 314 operated, ground will extend over its contact **5** to conductor **500** to operate relay **500** in Fig. 315, whereupon the office index (0 to 5) will be used to initiate control in the message unit type translator of Figs. 313 and 316 for developing a group of sort digits which will in effect select a number of perforators for outputs where the number of perforators to be selected represents the product between the number of offices in the marker group and the number of message unit types involved in the marker group. Again, it must be pointed out here that there can be no toll type message unit class in a marker group which involves two message unit types.

Feature 32.—This feature has been stated as comprising means in the assembler-computer for causing the automatic preparation of end-of-tape identity information. Fig. 328 of the drawings shows how Figs. 329 through 356 may be arranged to disclose the parts of the

assembler-computer useful in illustrating on a skeletonized basis this feature of automatic end-of-tape preparation.

READING TAPE IDENTITY

At the start of processing an incoming central office tape, the day progress and recorder progress switches of Fig. 346 are set to positions representing the last round and last day of round and the last recorder number as specified by certain of the setup switches in Figs. 354 and 355. Others of the set-up switches are set to specify the marker group tens and units digits, the first recorder number, the first day of round number, the first round, and the month of processing.

At the start of reading an input tape, the first codes read are a series of splice patterns 081010. Following this splice pattern, a central office tape identity group will be read comprising at least the five codes in the order specified 284DEF (round and marker group), 283DEF (day of round and month), 280DEF (recorder number), 2811EF (end of tape hour) and 2821EF (end of tape calendar day).

The 284DEF code represents in the D digit the round number and in the E and F digits the marker group number. Upon reading this code, relay L4 in Fig. 341 is operated in a circuit extending from ground in the reader of Fig. 329, over the G1 or G2 contact thereof, over a contact of the RKA or RKB relay in the reader step check circuit of Fig. 329, contact **1** of the reader connector RC, contact of the ST3 relay, contact of the AL relay, through an up-check circuit of the reading relays of Fig. 329, conductor UC1 into Fig. 341, contact **3** of relay TI, contact of the SR1E reader step control relay, conductor UC into Fig. 329, contacts **1** of reading relays B1 and B7 (B digit 8), contacts of the reading relays A1, A2 and A0 (A digit 2), contacts **2** of the reading relays C4 and C0 (C digit 4), conductor **284**, cable **329–341** into Fig. 341, conductor **284**, contacts **2** of relays CL2 through CL4, to the winding of relay L4, which locks over its contact **2** to the up-check conductor UC1. Relay TI in Fig. 341 operates in an obvious circuit over contact **6** of relay L4. Ground extends over contact **4** of relay L4 in Fig. 341, conductor DROE into Fig. 330 and over a contact of one of the operated E digit reading translator relays (operated from the E digit reading relays of Fig. 329), over cable E1 and cable **330–354** into Fig. 354, cable E1 over the marker group tens set-up switch **3**, conductor MGT, cable **354–341**, conductor MGT, contact **5** of the relay L4, conductor MGU, cable **354–341** into Fig. 354, conductor MGU over the marker group units set-up switch **3**, cable F1, cable **330–354** into Fig. 330, cable F1 over a contact of the operated F digit reading translator relay (operated by the F digit reading relays of Fig. 329), conductor DROF into Fig. 341, over contact **7** of relay L4, conductor **34100** into Fig. 329, over a contact of the operated D digit reading relay, cable D1, cable D3 into Fig. 353 and cables D4 and D5 into the round translator of Fig. 353, and over the upper inner contact of the operated round translator relay (operated over cable RD from the round size translator of Fig. 349 in accordance with the setting of the day progress switch of Fig. 346 and the operation of the round size translator relays as specified by the marker group number under process) to conductor R in Fig. 353 extending into and over cable **353–341** into Fig. 341 to contact **3** of the L4 relay. The grounding of this conductor R is an indication that the round and marker group numbers in the 284DEF code check with the settings of the set-up switches and with the day progress switch. This grounded conductor R will extend over contact **3** of relay L4 in Fig. 341 to the RS lead to operate the RS reader step relay of Fig. 341 as an indication that the reader may step to the next code 283DEF. Ground will thereupon extend over the contact of the RS relay and contact **1** of the L4 relay

to the winding of relay CL4, which thereupon operates and locks over its contact 4 and back contacts of the other CL– relays to off-normal ground. The operation of the CL4 relay is an indication that the 284DEF code has checked out properly and that the 283DEF may now be checked.

Upon reading the 283DEF code, the grounded conductor UC in Fig. 341 will extend over the contact of the SR1E relay and contact 5 of the TI relay and contact 5 of the CL4 relay to operate the L3 relay. The L3 relay in Fig. 341, in operating, checks the last day of round and month against the set-up switches and against the day progress switch settings of Fig. 346 and causes the operation of the reader step relay RS in Fig. 341 and the CL3 relay in Fig. 341 when the check is completed.

Upon reading the next code 280DEF, the recorder register circuit of Fig. 342 is operated in accordance with the type of recorder (C5 relay represents a regular recorder) and in accordance with the tens and units digits of the recorder number, which should agree with the last recorder specified by the set-up switches of Fig. 354. Relay CL0 of Fig. 341 operates at the conclusion of this operation to indicate that the recorder number entry is proper and permits the reading and checking and registering of the end-of-tape hour entry comprising the E and F digits of the 2811EF entry which follows. Upon reading the 2811EF entry, the hour register circuit of Fig. 334 is operated in accordance with the tens and units digits of the end-of-tape hour, whereupon relay CL1 of Fig. 341 will be operated to advance the tape end identity reading progress.

Upon the reading of the 2821EF entry, comprising the calendar day associated with this end-of-tape group, the day register circuit of Fig. 333 will be operated in accordance with the tens and units digits of the calendar day represented by this entry.

At the conclusion of the reading of this end-of-tape group on the incoming central office tape, relay LTI in the common class translator circuit of Fig. 348 will be operated to initiate the automatic end-of-tape preparation on the output tapes required for the processing at hand. This operating circuit for relay LTI of Fig. 348 extends from ground in Fig. 341, over contact 3 of relay CL2, contacts 4 of relays CL1, CL0 and CL3 and contact 3 of relay CL4, the contact of relay STE, contact 2 of relay FI (operated during the reading of the first tape identity group), contact of relay EPW, conductor LTI extending into Fig. 348 to operate the LTI relay therein.

LEADING TAPE IDENTITY OUTPUT

Ground will extend over contact 1 of relay LTI, the conductor W extending over cable 348–347 in Fig. 347 over contact 1 of the common pattern connector COC, conductor W1, contact 1 of relay P1D1, conductor P2, cable 347–352 into Fig. 352 to operate, in series, the perforator register relay P1D of Fig. 352 and the perforator connector PA1 of Fig. 356, the operation of which connects the DET detail perforator of Fig. 356 to the circuits whereby the first end-of-tape group on an output tape will be placed upon the detail perforator tape.

Ground will extend over contact 16 of relay LTI in Fig. 348, over conductor 10L, cable 348–347 into Fig. 347, over contact 11 of the common pattern connector COC, conductor 10L, cable 347–346 into the perforate line count circuit of Fig. 346 to operate the relay PLA10 which, upon operating, specifies ten lines of output information. Ground will thereupon extend from conductor JB3 out of cable PCAM in Fig. 347 from the reader of Fig. 349, over contact 1 of the CK relay, conductor PAT into Fig. 346, over back contacts of the relays PLA1 through PLA9, contact 3 of relay PLA10 to conductor L10 extending over cable 346–347 into Fig. 347, over a contact (not shown) of the COC connector, conductor L10 (not shown), cable 347–348 into Fig.348 and over contacts 6 and 5 of the LTI relay to the winding of the SSTM relay in the splice pattern timer circuit of Fig. 348. The operation of relay SSTM initiates the timing operation, whereby a specified amount of time will be permitted for a number of splice pattern lines 081010 to be perforated on the detail perforator of Fig. 356. In the connection, the grounded conductor extending from contact 6 of the relay LTI in Fig. 348 extends to and over conductor 08R in Fig. 348, over cable 348–351 into Fig. 351 to operate the common pattern connector relays 08R and 8, whereby grounds from the reader of Fig. 329 are extended over contacts of the common pattern connectors 8 and 08R, and over cable PERF from Fig. 351 into Fig. 352, through the digit check relays and over cable 352–356 into Fig. 356, over contacts of the PA1 perforator connector to the perforate magnets A0 through F7 of the detail perforator to perforate the line 081010. This splice pattern line is repeated until the relay ESTM in the splice pattern timer of Fig. 348 operates to stop it, at which time line 10 of this entry will have been completed.

When line 10 has been completed, the perforate line count circuit of Fig. 346 advances by causing the optration of the PL9 relay which, in turn, causes the operation of the PLA9 relay, grounding over its contact 3 the conductor L9 extending by means of cable 346–347 into Fig. 347, over a contact of the common pattern connector COC and by means of cable 347–348 into Fig. 348 and over contact 7 of the LTI relay to conductor 2891. This grounded conductor 2891 in Fig. 348 extends over cable 289X and cable 348–351 into Fig. 351 to operate the common pattern connectors 2891 and 289 therein. The operation of these two connectors causes the output entry 2891EF to be perforated on the detail perforator of Fig. 356 as line 9 of this entry.

At the conclusion of the perforating of the entry 2891EF on the detail perforator of Fig. 356, the perforate line count circuit of Fig. 346 again advances to call for the perforation of line 8 which, as will be seen by referring to Fig. 348, comprises the grounding of the conductor 2892 over contact 8 of the LTI relay. This causes the operation of the common pattern connector relays 2892 and 289 in Fig. 351 to specify an output line of 2892EF.

This procedure repeats itself automatically until all of the output lines 2891EF through 2899EF have been completed, at which time ground will extend over contacts 2 and 3 of relay PWS in Fig. 347, over conductor PWS, cable 347–352 into Fig. 352, conductor PWS, over contact 2 of the perforator register P1D to conductor P2W, cable 352–344 into Fig. 344, to contacts of all of the perforator assignment pattern connector relays A1P through AAP. One of these ten assignment relays will have been operated under the control of various ones of the set-up switches in accordance with the number of output tapes which will be required during the processing specified by the type of sort (see sort set-up switch of Fig. 336) and by the type of marker group involved (see set-up switches of Fig. 331). In the instant case, it will be observed that no matter which one of these pattern assignment connectors is operated, the grounded conductor P2W will extend over the contact thereof to conductor P2 extending by means of cable 344–348 into Fig. 348 and over conductor 0 into Fig. 352 to operate the perforator register relay P2D in series with the perforator connector PA2 of Fig. 356. This connects the MU0 message unit perforator to the circuits whereby the above-described end-of-tape preparation may be perforated thereon. In each instance, therefore, at least the DET detail and the first message unit perforator (MU0 in Fig. 356) will be prepared with end-of-tape group.

The switch-over from the detail perforator to the MU0 perforator in Fig. 356 causes a return to normal of the

perforate line count circuit of Fig. 346 and the associated control circuits, whereby the common class translator relay LTI of Fig. 348 may cause the repetition of the above-described process, whereby a measured group of splice pattern codes 081010 may be perforated on the MU0 perforator followed by the nine end-of-tape codes 2891EF through 2899EF.

At the conclusion of perforating the end-of-tape items on the MU0 perforator of Fig. 356, the grounded conductor PWS out of cable 347–352 in Fig. 352 will be extended over contact 1 of the perforator register relay P1D and contact 2 of relay P2D to conductor P3W extending over cable 352–344 into the perforator assignment pattern connector of Fig. 344. If the pattern assignment relay A1P in Fig. 344 has been operated (indicating that only two perforators—DET and MU0 of Fig. 356—are to be prepared) ground will extend over contact 2 of relay A1P to the EPW conductor which extends into Fig. 347 and over contact 2 of relay PW to the conductor EPW1 extending into Fig. 341 to operate the EPW relay as an indication that all of the necessary tapes have been properly perforated with end-of-tape entries by the perforators in Fig. 356 as specified by the perforator assignment connector of Fig. 344. It will be noted, in Fig. 344, that if the A2P assignment relay were operated, the grounded P3W conductor would extend over contact 2 thereof to the conductor P3 which extends over cable 344–348 into Fig. 348 and over conductor 1 into Fig. 352 to operate the perforator register relay P3D in series with the perforator connector PA3 of Fig. 356, whereby the second message unit perforator MU1 would be brought into operation for automatic end-of-tape perforation thereon. At the conclusion of this latter job, the grounded conductor P4W, extending from contact 2 of the relay P3D in Fig. 352, would extend over contact 3 of the A2P relay in Fig. 344 to the end of perforator walking conductor EPW to cause the operation of relay EPW in Fig. 341, etc.

The operation of the EPW relay in Fig. 341 causes the release of the common class translator relay LTI of Fig. 348, which releases all of the circuits involved in the automatic end-of-tape perforation and places the assembler-computer circuit in condition for receiving and processing ordinary call entries.

Feature 33.—This feature has been indicated as comprising means for handling customer charges in a new and more advantageous way by permitting them to be doubly reported on an automatic basis. That is, some calls which ordinarily would be reported as a one or a two-line message unit output class on one of the message unit perforators may also be reported on the detail perforator for some accounting or administration or reporting reason. The present feature concerns itself with those parts of the assembler-computer which permit this double reporting to be handled on an automatic basis.

Fig. 328 shows how Figs. 329 through 358 may be arranged to disclose the essentials of this feature along with those of Features 32, 40 and 42.

As mentioned in connection with the previous description of Feature 32, the operation of the relay EPW in Fig. 341 is an indication that the necessary number of output tapes have been prepared with tape identity groups in Fig. 356, and that the processing of individual calls may proceed.

When the reader of Fig. 329 reads a timing entry (answer and disconnect timing entries for each call), this timing entry is transferred into one of the assembling registers, such as is shown in Fig. 337, along with the hour and day information associated with this particular timing entry. When the initial entry for this call is read by the reader of Fig. 329, the timing entries associated therewith are transferred from the assembling register of Fig. 337 into the answer and disconnect timing sections of a call entry register (such as the registers indicated in Figs. 337 and 338 for the timing information pertaining to the answer entry) and the information in the initial entry is transferred from the reading relays of Fig. 329 over the initial entry register connectors of Fig. 329 into other registers of the call entry register in Figs. 338 and 340. The latter information comprises such items as the called office number index registration in Fig. 338, the called number register in Fig. 338, the billing index information into Fig. 340, the calling line number information into Fig. 340 and the input class information into Fig. 335.

The answer and disconnect timing information is transferred from the appropriate registers of the call entry register (Figs. 337 and 338) into the subtractor (Fig. 339) which computes the chargeable time for this call and registers this on a tens and units basis in the chargeable time translator of Fig. 339.

Ground will extend from the register control circuit of Fig. 339 over conductor 33900 into Fig. 335 and over a contact of the input class register, such as contact 2 of relay –CL4, to conductor 4LI to operate the relay –4LI of the input class translator of Fig. 335 indicating that the initial entry for this call comprised four lines.

The billing index translator of Fig. 340 will ground one of its lower punchings, thereby to operate one of the message unit type translator relays of Fig. 340, MUT through MUL, in series with the relay MUD therein as an indication that this call is a message unit detail call involving either a toll or a local message unit call which should be reported as a double entry on a message unit and the detail tape. Ground will extend over a contact of the operated MU– relay in Fig. 340, such as contact 2 of relay –MUL, to conductor 12L over cable 340–332 into Fig. 332 to operate the relay 12L. The output of the chargeable time translator of Fig. 339 will extend over cables 33901 and 33907 into Fig. 340 to the message unit formula and formula connector circuits of Fig. 340 to produce into cable MUTU a tens and units digit of the chargeable message units for this call. Cable MUTU extends into Fig. 336 to cause the operation of a tens and units relay in the message unit tens and units translators of Fig. 336. Grounds will extend from Fig. 339 over contacts 1 and 2 of the relay NOV in the subtractor control circuit (indicating that this call is not overcapacity), conductors MW and ML, cable 339–332 into Fig. 332, contacts 2 and 1 of relay 12L, conductors MW and ML into cable 332–336, contacts 4 and 5 of relay MUT1, conductors 2MW and 2ML into cable 336–335 into Fig. 335 and over contacts 1 and 6 of relay –4LI to conductor 2MD to operate the relay –2MD in the output class register of Fig. 335 and to conductor 7L extending over cable 33500 to operate the lines register –7L in Fig. 335. The operation of the lines register 7L in Fig. 335 specifies a seven-line output and causes ground to extend from conductor 7L therein over cable 335–344A into Fig. 344, over contact 1 of the output connector OCAB, conductor 7L into cable 344–346 into Fig. 346 to operate the perforate line count relay PLA7. Ground will extend over contact 4 of the PLA7 relay and conductor L7, over cable L111 into Fig. 344, over contact 5 of the output connector OCAB, conductor L7 into cable 335–344 into Fig. 335 to contact 5 of the relay 2MD in the output class register. Ground will extend over this contact 5 to conductor MU1, cable 335–343 into Fig. 343 to operate the pattern connector MU1 therein for forming the first line of a two-line message unit output into cable PERF extending from Fig. 343 into Fig. 352 to cause the perforation of this first line on the perforator selected for operation.

Ground will extend over contact 2 of relay 2MD in Fig. 335 and over back contacts of the other output class register relays, contact 1 of relay D1SW in Fig. 335 and contact 3 of relay 2MD to conductor MD, cable 335–344 into Fig. 344, over contact 3 of the output connector OCAB, conductor MD, cable 344–346A into Fig. 346,

contact 1 of relay PLA7 therein to conductor M extending over cable 344–346A into Fig. 344, where conductor M emerges and extends into Fig. 340 to the calling number register and the sort digit register. This grounded M lead in Fig. 340 causes the calling number thousands digit or the units digit or the sort digit to produce a decimal digit for selecting, over the contacts of one of the operated output connectors of Fig. 344, a thousands or a units or a sort digit number for operating the perforator register relay and perforator connector relay of Figs. 352 and 356 in accordance with the selected digit required for sorting calls. This digit will be one of the digits 0 to 9, thereby causing the selection of one of the perforators in Fig. 356, MU0 through MU9, for the perforation of the seventh line of this seven-line output which, as above indicated, is formed by the operation of the MU1 pattern connector relay of Fig. 343.

When this line has been properly perforated, the perforate line count circuit of Fig. 346 will advance, whereby relay PLA6 will be operated and relay PLA7 will be released. It will be noted that the contacts 1 of these two relays in Fig. 346 are in parallel with the M conductor entering cable 344–346A, which specifies that the message unit perforator MU0 through MU9 will again be used for the sixth line of this entry (second line of the message unit part thereof) in accordance with the above-mentioned sorting digit as specified by the output connector relays of Fig. 344. In Fig. 346 ground will extend over contact 4 of relay PLA6 to the L6 conductor which extends in the same manner as above described for the L7 conductor to and over contact 6 of relay –2MD in Fig. 335 to conductor MU2 extending over cable 335–343 into Fig. 343 to operate the pattern connector –MU2 which forms the second line of the message unit entry (sixth line of the MUD seven-line entry) onto the perforator selected in accordance with the sort digit.

As soon as the sixth line is properly perforated, the perforate line count circuit of Fig. 346 will advance, whereby relay PLA5 is operated and relay PLA6 is released. The grounded MD conductor in Fig. 349 will now extend over contact 1 of relay PLA5 to the conductor D, extending into Figs. 352 and 356 to operate the perforator register relay P1D and the perforator connector relay PA1 for causing the fifth line of this seven-line entry to be perforated on the detail perforator of Fig. 356. In this connection, ground will extend over contact 4 of relay PLA5 in Fig. 346 to the L5 conductor which, as previously described in connection with conductors L7 and L6, extends into Fig. 335 and over contact 7 of relay –2MD to the conductor D01I2 and over cable 335–343 into Fig. 343 to operate the pattern connector D01I2, which, when operated, gathers the necessary information from various registers throughout the circuit and passes this information over cable PERF from Fig. 343 into Fig. 352 to cause the fifth line of this seven-line entry to be placed on a detail perforator.

The situation with respect to lines 4, 3, 2 and 1 of this seven-line entry is substantially the same as above-described in connection with line 5. That is, these lines will be perforated on the detail perforator of Fig. 356 and the information in each of these lines is determined by the pattern connector relay of Fig. 343, the operated one of which is determined by the particular line count involved in Fig. 346 as extended over the contacts of the output class register relay –2MD in Fig. 335.

At the conclusion of the perforation of line 1 of this seven-line entry, the output circuits, which have been seized and kept in operation for this job, are released for use by other functions of the machine.

It will be noted that this composite output entry is placed on two output tapes on an automatic basis.

Feature 34.—This feature has been indicated as comprising circuits including the reading relays for insuring the proper match of splice patterns where two tape ends have been spliced together. When reading splice patterns on incoming tapes, means are provided in accordance with this feature, whereby upon the reading of the first two lines of a splice pattern, the reading relays become locked and the reader is permitted to step continuously until such time as the splice pattern changes, whereupon the usual reading relay validity check is put back into operation.

Fig. 357 shows how Figs. 358 through 361 may be arranged to show circuits embodying this feature.

During the normal operation of the reader of Fig. 358, the reader connector relays RCD and RC will be operated as will the off-normal and start relays ST3 and MON. The KM5 contact of the reader will be closed during the reader closure period (when the sensing pins are reading the code entries on the tape) and the KB3 and KB8 contacts will be closed during the reader open cycle. Ground will be supplied from the reader over the G1 or G2 contact and a contact of the RKA or RKB reader step check relay and over the contact of the RCD reader connector and the contact of the ST3 relay and the AL relay into the A digit reading relays. Ground is supplied over the contact of the MON relay to the MON1 conductor extending into Fig. 361 for purposes to be described hereinafter. In Fig. 361 the tape identity progress control relay TI will be released when reading splice patterns. Either of relays SR1E or SR1O in Fig. 361 will be operated.

In Fig. 361 is shown a CT relay indicated as contained in the alarm timing circuit. Without going into unnecessary details, it may be indicated that the CT relay must be operated periodically in order to cancel the build up of charge on a condenser in the alarm timing circuit in order to prevent the bringing in of an alarm. If the CT relay is not operated sufficiently frequently, this condenser will acquire sufficient charge to fire a gas tube thereby bringing in an alarm.

There are two kinds of splice patterns which may be involved in this splice pattern skipping process. The usual regular type of splice pattern is the line 081010. There is a special splice pattern 08CDEF ("grooved splice pattern") which is used on certain tapes in connection with the feedback type of straddle operation.

When the reader of Fig. 358 enters a regular splice pattern area, the reading relays of Figs. 358, 359 and 360 will be operated in accordance with the ABCDEF digits 081010. Each of the B, C, D, E and F digit reading relays will be operated on a two-out-of-five basis and the A reading relays will be operated on a basis of one relay operated or all three relays operated. The ground from the contact of the AL relay in Fig. 358 extends over an up-check circuit through the A relays and the B relays, conductor UC into Fig. 359, an up-check circuit through the C and D relays, conductor UC1 into Fig. 360, an up-check circuit through the E and F digit reading relays, conductor UC2 into Fig. 361 over the contact of the TI relay and a contact of the SR1E or SR1O relay, conductor UC3 into Fig. 358 over contact 6 of relay B1 and contact 4 of relay B7 (B digit of 8) contact 5 of relay A1, contact 7 of relay A2 and contact 5 of relay A0 (A digit of 0), conductor 08 extending into Fig. 361 over contacts 5 of relay PRRL to operate the 08 relay. The 08 relay, in operating, completes a circuit over its contact 1 to operate relay SPR which locks over its contact 1, contact 2 of relay RRL and contact 1 of relay RRUL to ground on conductor MON1.

Relay SPR, in operating, extends the ground on conductor UC2 over its contact 3 to operate the reader step relay RS. Relay RS, in operating, causes the reader of Fig. 358 to step ahead one line, which releases the reading relays in the process. During the open reader period, the ground from the KB3 contact of the reader in Fig. 358 extends over conductor KB3 and cable KB

into Fig. 361 over contact 3 of relay RS to hold the RS relay operated during the open period of the reader cycle. When the reading relays release, the ground on conductor 08 in Fig. 361 disappears permitting the 08 relay to release. The KB8 conductor out of cable KB in Fig. 361 extends over contact 2 of relay RS and contact 2 of the SPR relay to operate relay PRRL which locks over its contact 2 and contact 1 of relay RRUL to the ground on conductor MON1. Just prior to the next reader closed period, the grounds on conductors KB8 and KB3 out of cable KB in Fig. 361 are removed permitting the RS relay to release to stop the stepping of the reader in Fig. 358 after the advance of one line.

When the splice pattern 081010 is read again by the reader, the reading relays will reoperate as above described, again causing the operation of the RS relay of Fig. 361 from ground on the up-check conductor UC2 over contact 3 of relay SPR or contact 4 of relay PRRL. The ground on the 08 conductor in Fig. 361 will this time be extended over contact 4 of the RS relay and contact 3 of the PRRL relay to the winding of relay RRL which operates and locks over its contact 4 and contact 1 of the PRRL relay to the MON1 ground. The operation of relay RRL releases relay SPR. Relay RRL, in operating, extends its locking ground over its contacts 4 and 1 to the lock conductor contact which extends to Figs. 360, 359 and 358 to lock operated all of the reading relays in accordance with the pattern 081010.

With the reading relays locked operated, the RS relay of Fig. 361 remains operated until the reading relay operated pattern changes, breaking the up-check ground on conductor UC2, the KB3 ground holding the RS relay operated over reader open cycle and the grounded up-check conductor UC2 holding the RS relay operated during reader closed periods.

In the event that the 081010 pattern changes, this will cause the operation of more of the reading relays than are already locked operated. This breaks the ground from the up-check conductor UC2 in Fig. 361 thereby permitting the RS relay to release during that reader closed period. Upon this release of the RS relay, ground will extend over its contact 5 and contact 5 of the RRL relay to operate the RRUL relay, which thereupon locks over its contact 2 and contact 3 of the RRL relay to the MON1 ground. Upon the operation of the RRUL relay, the relay PRRL releases providing that the A digit is not 0. If the A digit is 0, ground will extend from the A digit reading relays in Fig. 358 over contact 8 of relay A2, contact 6 of relay A1, conductor A0 extending into Fig. 361 to the locking contact 2 of relay PRRL. In this connection, during the operation of the reading relays responsive to the 081010 code, ground will extend from the C reading relays of Fig. 359 over contact 6 of relay C1 and contact 4 of relay C0 (C digit 1), contact 6 of relay D4, contact 4 of relay D7 (D digit 0), conductor 10 into Fig. 360 over the contact of the E digit translator relay TE1 (E digit 1) over the contact of the F digit translator relay TF0 (F digit 0) to conductor 1010 extending into Fig. 361 over contact 2 of the relay 08 to the winding of the WBY relay which operates and locks over its contact 1 to ground on the A0 conductor. Relay WBY, in operating, eliminates the C digit reading relays C4 and C7 of Fig. 359 and the D digit relays D0, D1, D2 and D4 of Fig. 359 from the previously-described up-check circuit. This is necessary when reading splice pattern because these six digital positions are in the center of the tape which may have been cut out to form a "window." Such a window may be present when reading tapes produced by the output straddle tape which may contain a splice. The UC conductor in Fig. 359 will be extended over contact 2 or 3 of the C2 relay to conductor BY1 into Fig. 361 over contact 2 of the WBY relay, conductor BY2 into Fig. 359 and over contact 3 of the D7 relay to the UC1 conductor, thereby eliminating the six relays C4, C7, D0, D1, D2 and D4 from the previously-described up-check path.

The normal situation following a splice pattern will be an A digit of 1 or 2 or 3, that is, something other than 0. In this case, relay PRRL will be released because there will be no ground on the A0 conductor of Fig. 361. Upon the release of the relay PRRL, relay RRL releases thereby unlocking the reading relays which in turn release. The release of relay RRL causes relay RRUL to release.

During the time when the reading relays are locked operated and relay RS remains operated as above described, the KM5 ground from the reader of Fig. 358 extends over conductor KM5 and cable KB into Fig. 361, conductor KM5 over contact 1 of relay RS, conductor CT1, cable CTA into Fig. 358 over contact 6 of relay A0, conductor CT2 back to Fig. 361 over cable CTA and over contact 6 of the PRRL relay to repeatedly cause the operation of the CT relay, as previously mentioned, to cancel the alarm timing. The repeated frequent operation of the CT relay prevents an alarm from being sounded. If for any reason the PRRL relay should remain locked (because of an A digit of 0) when it should release, no circuit will be available for operating the CT relay in sufficient time to cancel the alarm timing. This will cause an alarm to be sounded indicating trouble during the splice skipping operation.

If a so-called "grooved" splice pattern (08CDEF) code is read by the reading relays, the same process, as above described, will be repeated except that the conductor 1010 in Fig. 361 will not be grounded. Therefore, the relay WSY in Fig. 361 will not be operated to short-circuit the complete up-check path through the reading relays. All other details remain the same because as long as the reading relays are once operated in accordance with the grooved splice pattern (regardless of what the C, D, E and F digits may be) the splice skipping operation described herein will continue as long as the same pattern is presented to the reading relays.

Feature 35.—This feature has been mentioned as comprising a pair of hour registers and various control circuits whereby these hour circuits receive alternately from the input tape certain timed codes representative of the hour and check that successive hour entries are in the proper order, etc.

There are several types of hour codes which may be encountered, such as 2811EF (end-of-tape hour), 2810EF (regular hour entry), 281899 (in lieu of a missing regular hourly entry), 281999 (a code indicating that the next code on the tape is a mutilated hour entry) and 2812EF (hour code in a straddle timing entry).

The hour circuits and their controls accomplish the following action with respect to the D digit in these hourly codes, which is the distinguishing feature of each code.

D digit 1—The D digit 1 indicates an end-of-tape hour entry and causes the E and F digits thereof to be registered in one of the hour registers, to be compared with the previous entry in the other hour register and to be interpreted without change.

D digit 0—The D digit 0 represents a regular hour entry and causes the E and F digits to be registered in one of the hour registers, to be compared with the previous entry in the other register and to be interpreted less one.

D digit 8—The D digit 8 indicates a missing hour entry and causes the previously registered hour to be reduced by one and registered in the other register and to be interpreted less one.

D digit 9—The D digit 9 indicates a mutilated hour entry causing the same circuit operations as the D digit 8 and, in addition, causes the circuits to disregard the next entry on the tape, since it is a mutilated entry,

D digit 2—The D digit 2 represents a straddle hour entry and causes the E and F digits thereof to be registered without change and to be interpreted as less one.

Fig. 362 shows how Figs. 363 through 376 may be arranged to disclose those parts of the assembler-computer pertinent to an understanding of the present feature involving the hour control.

At the beginning of processing an input tape through the reader of Fig. 363, the odd and even hour registers of Fig. 367 should be released. This fact is indicated by the operation of the odd and even hour down-check relays OHDC and EHDC of Fig. 366. Relay EHDC operates in a circuit from ground in Fig. 367, over back contacts of all of the even hour register relays, conductor DC, cable **367–366**, conductor DC, back contacts of the even hour register control relays of Fig. 366, contact **4** of relay **H25** in Fig. 366, contact **5** of relay OH to the winding of relay EHDC. Relay OHDC of Fig. 366 operates in a similar circuit under the control of the released condition of all of the odd hour register relays of Fig. 367. With relays EHDC and OHDC operated, a circuit is completed for operating relay **OHDC1** in Fig. 366, extending from ground in Fig. 363 over the contact of the MON relay to conductor MON, extending into Fig. 366, over contact **6** of relay EHDC and contact **3** of relay OHDC to the winding of relay **OHDC1**. Relay OHDC, in operating, locks over its contact **4** to ground on the odd hour down-check conductor DC emerging from cable **367–366A** in Fig. 366 and, therefore, remains locked as long as the odd hour register of Fig. 367 remains released.

With the relays EHDC and **OHDC1** operated, a circuit is completed for operating the EH relay from ground on the conductor MON in Fig. 366, over contact **7** of relay OHRL, contact **1** of relay **OHDC1**, contact **3** of relay EHDC, contact **2** of the reset key of Fig. 366, the contact of the ER relay to the winding of relay EH which operates and locks over its contact **3** and contact **7** of relay OHRL to the MON ground. The operation of the EH relay permits the receipt of the first end-of-tape hourly entry into the even hour register of Fig. 367.

When the 2811EF end-of-tape hour entry is read, a path is closed from ground in Fig. 363, over the **G1** or **G2** contact of the reader over a contact of the RKA or RKB relays, over a contact of the RCD connector and the **ST3** relay and the AL relay, over an up-check circuit through the A, B, C and D reading relays of Fig. 363, conductor **UC1** into Fig. 364, over an up-check circuit through the E and F digit reading relays to the up-check conductor **UC2**, extending into Figs. 363 and 365. In Fig. 363, the grounded **UC2** conductor extends over contact **2** of the TI relay (operated when reading tape identities), over contact **1** of the operated CLO relay (operated as a prerequisite to the reading and checking of an end-of-tape hour entry), over contacts **5** of relays **D0** and **D1** (D digit of 1), over contacts of the **C0** and **C1** relays (C digit of 1), over the contact of the **A0** relay, contact **1** of the **A2** relay and the contact of the **A1** relay (A digit of 2) and over contacts of the **B7** and **B1** relays (B digit of 8), over a contact of the **SR1E** or **SR1O** relay and over contact **3** of relay TI and contact **2** of relay **CL0** to conductor **N281AP** extending by means of cable **363–366** into Fig. 366, over contact **1** of relay EH and contact **2** of relay EHRL, conductor HR, cable **366–365** into Fig. 365 to cause the operation of the EHR even hour time connector, which locks over its contact **4** to the ground on the up-check conductor **UC2**.

The tens and units digits of this end-of-tape hour entry **2811EF** are read from the E and F digit reading translators of Fig. 364 into the even hour register of Fig. 367. Upon the operation of the EHR connector of Fig. 365, grounds are extended over its contacts **13** and **16** to conductors **DROE** and **DROF** into Fig. 364 and over a contact of the operated E and F digit translators to ground one out of ten conductors into each of the cables E and F extending back into Fig. 365 where the E digit extends over contact **10**, **11** or **12** of the EHR connector and the F digit extends over contact **14**, **15**, etc. thereof into cable **365–367** extending into Fig. 367 to cause the operation of a tens and units digit even hour register relay in Fig. 367, each of which locks to conductor L extending over cable **367–366** into Fig. 366 to conductor L, extending over contact **1** of the EHRL relay to the MON ground.

Ground extends over contact **9** of the EHR connector of Fig. 367 to conductor DROD extending into Fig. 363 and over contacts **4** of relays **D1** and **D0** to conductor **1**, extending over cable D into Fig. 365, where the conductor **D1** emerges and extends over contact **6** of the EHR connector to conductor HAR extending over cable **366–365** into Fig. 366 to cause the operation of the EHAR relay, which locks over its contact **5** to the ground on the lock conductor L.

In Fig. 369, one of the tens and one of the units hour output connectors for the even hour register will be operated. In Fig. 367, if the units digit of the hour as registered in the even hour register is a 0, ground will extend over contact **5** of the **EHU0** relay to conductor OT into cable **367–366**. If both the units and tens digits are 0, ground will extend over contact **6** of relay **EHU0** and contact **7** of relay **EHT0** to ground the conductor **00U**. If the units digit is a 0 and the tens digits is not 0, ground will extend over contact **6** of the **EHU0** relay and contact **3** of the **EHT1** or **EHT2** relays to conductor RU. If the units digit is not 0, irrespective of what the tens digit may be, ground will extend over contact **4** or **6**, etc. of relays **EHU1** through **EHU9** to conductor RU and contacts **3** and **5**, etc. thereof to conductor RT. These latter conductors extend over cable **367–366** into Fig. 366 and appear before contacts of the even hour register control relays. With relay EHAR therein operated, conductor OT will extend over its contact **8** to join up with conductor RT and will extend over conductor TNC into cable **366–369**. Conductors **00U** and RU will extend over contacts **9** and **10** of the EHAR connector to conductor UAR into cable **366–369**. These conductors UAR and TNC emerge from cable **366–369** in Fig. 369 to cause the operation of the ETNC and EUAR even hour output connectors. These two connector relays arrange that any hour output taken from the even hour register will be the tens digit with "no change" and the units digit "as registered."

Relay EHDC in Fig. 366 will release during the first reader open period when an hour registration has been made in the even hour register of Fig. 367. Upon the release of relay EHDC during the next reader open period, relay OHRL in Fig. 366 operates in a circuit from ground on the MON conductor over contact **7** of relay OHRL, contact **1** of relay OHDC1, contact **4** of relay EHDC to the winding of relay OHRL which operates and locks over its contact **5** and contact **1** of relay OHDC to the **KB8** conductor extending into cable KM to reader contacts in Fig. 363, relay OHRL releasing at the end of the next reader open period. The operation of the OHRL relay releases the EH relay and the OHDC1 relay and completes a circuit for operating relay OH from ground on the MON conductor over contact **6** of relay OHRL. Relay OH locks over its contact **3** and over contact **6** of relay EHRL to the MON ground.

The reader of Fig. 363 is not permitted to step to the next code whereupon the same code 2811EF will be read a second time during the next reader closed period. This second reading of the 2811EF code will cause the E and F digits therein (the same as before) to be registered in the odd register of Fig. 367. In Fig. 366 the grounded conductor **N281AP** out of cable **363–366** will extend over contact **1** of the OH relay, contact **2** of relay OHRL,

conductor HR, cable 366–365A into Fig. 365 to operate the OHR connector which locks over its contact 4 to the up-check ground on conductor UC2.

The tens and units digits of this end-of-tape hour entry will, as before, be extended out of cables E and F in Fig. 365, over contacts of the OHR connector and over cable 365–367A into Fig. 367 to cause the operation of a tens and a units register relay in the odd hour register which lock to conductor L extending over cable 367–366A into Fig. 366, over contact 1 of the OHRL relay to the MON ground.

Simultaneously, with the above registering operation, relay OHAR in Fig. 366 is operated in a circuit extending from ground on the conductor D1, extending out of cable D in Fig. 365 (D digit of 1), over contact 6 of the OHR connector to conductor HAR extending over cable 366–365A into Fig. 366 to operate the OHAR connector which locks over its contact 5 to ground the lock conductor L. Relay OHAR, in operating, causes the operation of the odd hour output connector relays OTNC and OUAR of Fig. 369 in a manner similar to that above described with respect to the even hour output connectors in Fig. 369.

Relay SDC in Fig. 366 operates simultaneously with the operation of relay OHR of Fig. 365, provided that relay EHAR in Fig. 366 is operated. This circuit extends from ground on contact 6 of the OHR connector of Fig. 365, over its contact 1, conductor DC, cable 366–365 into Fig. 366, conductor DC, contact 12 of the EHAR relay and over contact 1 of relay CHS to the winding of the SDC relay. The operation of the SDC relay completes a path for permitting the reader of Fig. 363 to step off of the 2811EF entry. This path extends from ground in Fig. 367, over contact 3 or 4 of the EHT0 relay and through an up-check circuit through the even hour register, conductor UC, cable 367–366 into Fig. 366, conductor UC, contact 1 of relay EHARS, contacts 2 of relays EHAR, EHL1, OHL1 and OHAR, contact 1 of relay OHARS, conductor UC, cable 367–366A, conductor UC through an up-check circuit of the odd hour register of Fig. 367, conductor UC1, cable 367–366A into Fig. 366, conductor UC1, the contact of the SDC relay, contact 7 of relay OHAR, conductor RS, cable 366–365A, conductor RS, contact 3 of relay OHR in Fig. 365, conductor RS1 extending into Fig. 363 by means of cable 365–363 to the winding of the RS reader step control relay.

When the reader step relay RS of Fig. 363 operates, relay CL1 in Fig. 363 is operated in a circuit from ground on contact 7 of the OHAR relay of Fig. 366, over its contact 6 to conductor CL1, cable 366–365A, conductor CL1, contact 2 of relay OHR in Fig. 365, conductor CL11, cable 365–363A into Fig. 363 to the winding of relay CL1. The operation of relay CL1 indicates that the end-of-tape group presently being checked may now accept a 2811EF calendar day entry.

Upon the operation of the reader step relay RS of Fig. 363 and during the reader open period when the reading relays are released, ground will extend over the KB8 conductor from the reader of Fig. 363, over the contact of the RS relay to conductor RSG extending by means of cable 365–363 into Fig. 365, where conductor RSG emerges and extends into Fig. 366 over contact 11 of relay OHAR and contact 4 of the EH relay to the winding of relay EHRL which operates and locks over its contact 4 and contact 2 of relay EHDC to the MON ground. Relay EHRL, in operating, opens at its contact 1 the locking circuit for the even hour register, thereby releasing relay EHAR of Fig. 366 and the even hour register relays of Fig. 367 and the even hour output connector relays of Fig. 369.

Relay EHRL, in operating, opens the locking circuit for the OH relay, thereby permitting it to release during the next reader open period and completes a circuit for operating relay EH over its contact 5 in an obvious circuit. This prepares the even hour circuit for receiving the next hourly entry. As soon as the even hour register of Fig. 367 is returned to normal, the EHDC relay of Fig. 366 will reoperate, thereby releasing the EHRL relay.

The operation in Fig. 369 of the OTNC and OUAR odd hour output connectors supplies the current hour to armatures of the ADM assembling register connector of Fig. 370 such that, when timing entries are read by the reader of Fig. 363, these may be entered in the assembling register of Fig. 370 along with the current hour pertinent thereto. Grounds will extend from Fig. 366 over contacts 1, 3, 5 and 7 of the PH relay to conductors TA, TB, UA and UB extending over cable 367–366A into Fig. 367 and over contacts of the operated tens and units digit odd hour register to ground two conductors into each of cables T2 and U2 extending over cable 367–369 into Fig. 369 and over contacts of the operated OTNC and OUAR odd hour output connectors, whereby the tens and units digits of the current hour are supplied over cables HT2 and HU into Fig. 370. With the relays OTNC and OUAR operated in Fig. 369, the tens and units digits of the hour will be supplied to Fig. 370 exactly as registered in the hour register of Fig. 367. In the event that relay OTC in Fig. 369 is operated, the tens digit will be supplied to Fig. 370 less one. With relay OUL1 operated, the units digit will be supplied to Fig. 370 less one. With relay OU23 operated, the units digit will be transferred to Fig. 370 as a 3.

If the next hourly entry received on the tape is a regular hourly entry 2810EF, this will be registered in the even register of Fig. 367 and the circuit will be permitted to advance provided that this regular hourly entry agrees precisely with the previously registered end-of-tape hour 2811EF currently in the odd register of Fig. 367. Under these circumstances, the D0 conductor out of cable D in Fig. 365 will extend over contacts 7 and 8 of the EHR connector to conductors HL1 and DL1 over cable 366–365 into Fig. 366 to operate the relay EHL1 and to extend conductor DL1 over contact 13 of relay OHAR to conductor DAR extending into Fig. 368 to cause the operation of the TAR and UAR hour difference connectors, the operation of which requires that the new hour register in the even side of Fig. 367 must compare exactly as registered in tens and units values with the hour previously registered in the odd side of Fig. 367. Ground will extend from Fig. 367 through an up-check circuit of the even side, conductor UC, cable 367–366 into Fig. 366, conductor UC, contacts 1 of relays EHARS, EHAR and EHL1, contacts 2 of relays OHL1 and OHAR, contact 1 of relay OHARS, conductor UC, cable 367–366A into Fig. 367, conductor UC through an up-check circuit of the odd side, conductor UC1, cable 367–366A into Fig. 366, conductor UC1, conductor DCT, cable 367–366, conductor DCT over a contact of the operated even side tens relay, cables T1 and 367–368 over contact 1, 2 and 3 of relay TAR in Fig. 368, cables T1 and 368–367 into Fig. 367, over the operated contact of the odd tens register and over a contact of the operated even units register, cables U and 367–368, over a contact 4 through 10 of relay UAR of Fig. 368, cables U1 and 368–367 into Fig. 367, over the contact of the operated odd units relay, conductor DCU, cable 367–366A, conductor DCU, over contact 7 of the OHAR relay in Fig. 366 to conductor RS which, as previously described, causes the reader of Fig. 363 to step ahead, etc.

As a result of this 2810EF entry being properly checked and registered in the even side of Fig. 367, the odd hour register of Fig. 367 with its associated control relays will be returned to normal and the even hour output connector relays of Fig. 369 will be operated in such a manner as to present to the assembling register multiple connector of Fig. 370 the current hour which is in effect the hour presently registered in the even side reduced by one.

Whenever a regular hour entry 2810EF is received by the hour circuit, when the previously registered hour en-

try is also a regular hour 2810EF, the new entry will be received and registered provided that it differs from the previously registered entry by being less one. For instance, such a 2810EF entry might be received by the odd register of Fig. 367 if the even register contained the old 2810EF entry. In this case, relay OHL1 of Fig. 366 will be operated as will relay OHR of Fig. 365. The grounded D0 conductor out of cable D in Fig. 365 will extend over contact 8 of relay OHR, conductor DL1, cable 366–365A, conductor DL1, contact 11 of relay EHL1, conductor DL1 into cable 367–366 into the even hour register of Fig. 367. If the units digit in the even register is not 0, the grounded DL1 conductor will extend over contact 1 of relay EHU0 to conductor TARE extending by means of cable 367–368A into Fig. 368 to operate the TARE connector. If the units digit in the even hour register of Fig. 367 is 0, ground will extend over contact 2 of relay EHU0 to the armature of the EHT0 tens relay, whereupon if the tens digit is also 0, ground will extend over contact 2 of this relay to the SE conductor which extends into Fig. 368 over cable 367–368A to operate the SE relay. If the tens digit is anything other than 0, ground will extend over contact 1 of the EHT0 relay in Fig. 367 to conductor TE to operate the TE relay of Fig. 368. If either of the TE and TARE relays of Fig. 368 operate, relay UE operates in series therewith. The previously-described checking circuit will extend over contacts of the operated ones of these relays of Fig. 368, whereby if the old hour value in the even side of Fig. 367 is one greater than the new hour value in the odd side of Fig. 367, the circuit may proceed; otherwise, the circuit will block.

If an apology hour entry 281899 or 281999 is received by the reader of Fig. 363, the ground from the contact of the C0 relay in Fig. 363 will extend, respectively, over contact 5 of the D1 relay and contact 2 of the D7 relay (D digit of 8) to conductor 281AP or over contact 4 of the D2 relay and contact 3 of the D7 relay (D digit of 9) to conductor 281AP. Conductor 281AP will extend over cable 363–366 into Fig. 366, over contact 1 of the H25 relay therein and over contact 2 of the EH relay (assuming that the even side is prepared to receive the next hour entry), over contact 3 of relay EHRL to conductor HA extending over cable 366–365 into Fig. 365 to operate the EHA even time connector.

Relay EHA of Fig. 365, in operating, connects the current hour output from the odd hour register of Fig. 367 and transfers it into the even hour register and indicates that this new hour is to be treated as one less by operating the associated EHLI relay of Fig. 366. If the old hour in the odd side were a regular hour (2810EF), it will be transferred to the even register reduced by one. If on the other hand, the old hour (odd side) were an end-of-tape hour (2811EF), then it will be transferred to the even side without change. This is controlled by the operation in Fig. 366 of one of the relays OHAR (odd side contains end-of-tape hour) or OHL1 (odd side contains regular hour). Grounds will extend from Fig. 367 over contacts of the operated tens and units register relays in the odd side over cables TC and UC into cable 367–369 into Fig. 369, over contacts of the odd hour output connectors, cable 369–365 into Fig. 365, over contacts of the EHA connector, cable 365–367 into Fig. 367 to operate the tens and units even side hour register relays in accordance with the old hour contained in the odd side and in accordance with the operation of the odd hour output connectors of Fig. 369 depending upon whether or not the transfer takes place as is or less one.

In the event that the apology hour entry is a 281999 entry instead of 281899, this merely means that an hourly entry will follow the apology entry on the input tape of Fig. 363 and that the reader should disregard it. Under these circumstances, the relay 2819 in Fig. 364 will be operated in the skip entry control circuit, which thereupon causes the reader of Fig. 363 to skip the next line without action.

When reading the feedback straddle tape, straddle timing entries will contain an hourly entry 2812EF. Under these circumstances, the D digit of 2, extending out of cable D in Fig. 365, will extend over contact 5 of either relay EHR or OHR to an HARS conductor to cause the operation of either connector EHARS or OHARS of Fig. 366. Contacts 6 of these relays by-pass the hour difference check network directly, without necessitating the operation of the relay SDC. This hour difference check is by-passed or canceled under these circumstances because the timing entries read from a straddle tape will not necessarily contain hour entries which occur in regular succession. Therefore, each time a straddle hour entry is read, it is deposited in the then idle hour register of Fig. 367 regardless of what is in the opposite register.

Feature 36.—This feature has been stated as comprising means in the assembler-computer whereby a spare assembling register may be substituted for a regular operational assembling register in such a way that the spare assembling register assumes the identity number of the regular register for which it is substituting.

Fig. 249 illustrates how Figs. 250 through 256 may be arranged to illustrate this feature as well as Features 16, 17 and 38.

In Fig. 253 are shown one hundred assembling registers numbered 00 through 99. Also in Fig. 253 are shown four spare assembling registers indicated as numbers 100 through 103.

The regular assembling registers of Fig. 253 are used to register the answer and disconnect timing entries for a particular call when these entries are read by the reader of Fig. 250. A timing entry for a call is a line ABCDEF where the E and F digits are the tens and units digits of a transmission channel number, such as a trunk, over which that particular call was handled. This number is termed a "call identity index" and this index is used to select one of the one hundred assembling registers in accordance with the number thereof for registering therein the associated timing entry.

In Fig. 250 the E and F digit reading translator relays are operated in accordance with the E and F digits of the timing entry when read by the reader 25000. A decimal lead is grounded out of the E digit translator and is fed over one of the contacts of the F digit translator to ground into cable EF one of a hundred leads 00 through 99. Cable EF extends into Fig. 253 where the one hundred "start" leads ST00 through ST99 emerge and terminate on the jacks of the regular assembling registers bearing the same number. For instance, if the call identity index were 99, then the ST99 lead out of cable EF in Fig. 253 would be grounded. This grounded lead would extend over contacts 1 and 3 of the jack 99 and over contact 1 or 2 of the DS– relay of the register 99 to operate either the disconnect or answer connector relay therein for registering the disconnect or answer time. Each of the regular assembling registers has a separate start lead similarly situated.

The jack associated with each register includes a conductor which is in multiple with each of nine other conductors grouped in accordance with the tens digit of the register number. For instance, the conductor R0 90–99 in Fig. 253 is multipled to contact 2 of each of the assembling registers 90 through 99. Similarly, the conductor R0 00–09 in Fig. 253 is multipled to contact 2 of each of the jacks associated with assembling registers 00 through 09. Therefore, there will be ten of these R0 conductors representing the ten groups of assembling registers represented by the ten tens digits 0 through 9. Whenever an assembling register contains one or two timing entries, the R0 conductor associated therewith will be grounded. For instance, if a disconnect time is registered in the register 99 of Fig. 253, relay DS– therein will be operated, and if an answer time is registered therein, the AS– relay will be operated. The operation of either or both of the DS– and AS– relays will apply

ground over the respective contacts 4 and 3 thereof, and over contacts 4 and 2 of the associated jack to ground the R0 conductor assigned thereto. If no assembling register in a tens group thereof contains any timing entries, the associated R0 conductor will not be grounded. When the GT relay 25300 is operated in connection with certain operations whereby the assembling registers are cleared on a sequential basis of their timing entries, the ten R0 conductors are extended over contacts of this GT relay 25300 to operate assembling register tens lock-out relays T0 through T9 to indicate to the assembling register walking control circuit of Fig. 252 which "tens groups" of assembling registers contain timing entries.

A double-ended cord 25306 is indicated in Fig. 253 and may be plugged into the jacks associated with a regular and an emergency assembling register for the purpose of substituting the spare for the regular register. For instance, if the cord 25306 were plugged into the jacks associated with the spare register 103 and the regular register 99, it will be apparent that the start lead ST99 will be extended over contact 1 of the jack 103 to cause circuit operations in the spare assembling register 103 identical with those previously described for the regular register 99. Similarly, the grounds which may be extended over contact 4 of relay DS– and/or contact 3 of the relay AS– in the spare register 103 will be extended over contact 2 of the jack 103 and conductor 25308 and contact 2 of the jack 99 to ground the R0 90–99 conductor into the assembling register tens lock-out circuit in exactly the same fashion as above described for the register 99.

It will be seen, therefore, that the use of the double-ended cord 25308 is for the purpose of substituting a spare register for a regular register, whereby the spare register assumes the call identity index designation of the regular register for which it is substituting. In this connection it will be apparent that the rest of the assembler-computer does not concern itself with which register is in operation because it need not know.

Feature 37.—This feature has been described as comprising circuit means whereby the timing entries when transferred from the reading relays to the assembling registers are checked by checking relays to insure that the information transferred is correct, before the reading mechanism is permitted to advance to the next information to be read from the incoming tape.

Fig. 377 shows how Figs. 378 through 382 may be arranged to disclose circuitry embodying this feature.

The timing entry is an ABCDEF code whereby an A digit will be a 1 or a 3. When the reader of Fig. 378 reads a timing entry, the information is passed over contacts of the RC reader connector into the A through F digit reading relays of Figs. 378 and 379. The A digit is registered on the A relays of Fig. 378 on the basis of the operation of one or all three of the relays. The B through F digits are registered on a two-out-of-five basis. Ground will extend from the reader of Fig. 378 over the G1 or G2 contact thereof over a contact of the RKA or RKB reader step check relay, contact 1 of the RCD connector, the contacts of the ST3 and AL relays and over an up-check circuit through all of the reading relays of Figs. 378 and 379 by means of cable RRCK out over a conductor UC in Fig. 379, back into Fig. 378 over the contact of the TI relay, conductor UC1 into Fig. 379, contact 1 of relay SR1E or SR1O, conductor UC2 into Fig. 378, contact 1 of the B digit relays, the contacts of the RLS and ADD relays, contact 3 of the RCD connector, the contact of the FI relay into the A digit reading relay circuit of Fig. 378. If the A digit is a 1 or a 3, the ground on this conductor will extend over contact 1 of relay A1 to battery through the winding of the CST relay, which operates to start the selection of an assembling register (of Fig. 382) wherein this timing entry is to be registered.

During the reader closed period (when the reading relays are operated by the reader), ground will extend from Fig. 378 over the HM0 contact of the reader, contact 2 of connector RCD, the contact of the CST relay through the lower winding of the XST relay and through the winding of relay STO, contact 2 of relay XSTL, conductor ST into Fig. 379, over an up-check circuit through the E and F digit reading translator relays, over a contact of the operated E digit reading translator relays and over a contact of the operated F digit translator relays to ground one of a hundred conductors 00 through 99 extending over a cable into Fig. 382 to ground one of a hundred start leads, such as conductor ST99 which extends over the contact of the No. 99 jack to the armature of the DS– relay in the No. 99 assembling register. If there is no timing entry registered in the No. 99 register, the relay DS– therein will be released, whereupon the ground on its armature will extend over its contact 1 to operate the DISC– connector. If a disconnect time is registered in the disconnect portion of register 99, then relay DS– will be operated, whereupon ground will extend over its contact 2 to operate the ANS– connector.

The relay XST in Fig. 378 is a polarized marginal relay whose lower winding is in the operating circuit of relay STO adjacent thereto and in series with the disconnect or answer connector in the assembling register 99. The upper winding of the XST relay is not energized as long as the relay ADCN in Fig. 378 is released. The relay XST is arranged such that if its lower winding is in series with the energizing circuit for only one of the disconnect or answer connectors in an assembling register, then the relay XST will not operate. However, if more than one of these connectors in an assembling register is operated in the series circuit including the lower winding of the XST relay, it will operate. The purpose of the XST relay is to operate in the event that more than one connector is operated in series therewith for the purpose of operating the XSTL relay, the operation of which will bring in an alarm indicating an erroneous circuit condition. It will be assumed for present purposes that there is no erroneous condition and, therefore, that the XSTL relay does not operate when one of the disconnect or answer connectors in an assembling register of Fig. 382 is operated as above described. The STO relay of Fig. 368 operates in any instance as an indication that at least one such connector has operated.

The grounded conductor from the contact of the FI relay in Fig. 378 will extend over contact 3 of relay A1 (A digit of 1 or 3) to conductor A13 over the contact of the STE relay, over the contact of the C5 or C6 relay to operate the ADMC relay in Fig. 378. Ground will thereupon extend over the contact of the ADMC relay in Fig. 378 to conductors ADM and AM, cable 378–381 into Fig. 381 where conductor AM emerges to operate the AMB connector extending throughout Figs. 380 and 381, and where the conductor ADM emerges to operate the AMA and ARC connectors and extends over contact 1 of the relay ADMV in Fig. 381 to operate the ADM connector in Figs. 380 and 381. The operation of the ADM connector of Figs. 380 and 381 gathers information from the B, C, E and F digit reading relays of Figs. 378 and 379 and transfers the information therefrom over respective cables BR, CR and DR, over contacts of the ADM connector into the disconnect multiple DISM of Fig. 380. Also, the hour tens and units information is transferred from the hour register of Fig. 379, over cables HT and HU, extending into Figs. 380 and 381, over contacts of the ADM connector of Fig. 381 into the disconnect multiple DISM of Fig. 380. Also, the day units value is transferred from the day register of Fig. 379 by means of cable DA into Fig. 381 and over contacts of the ADM connector into the disconnect multiple DISM. The A digit of 1 or 3 in the A digit register of Fig. 378 will be indicated by the grounding of conductor NTR or DTR, respectively, into cable DNTR in Fig. 378, which cable extends into Fig. 380 and over contacts

of the ADM connector into the disconnect multiple DISM.

The operation in Fig. 381 of the AMA and AMB connectors extends all of the above-described conductors of the disconnect multiple DISM of Fig. 380 over its contacts into the answer multiple ANSM of Fig. 381, except for the information in cable DNTR of Fig. 380 which, of course, relates only to disconnect times. The disconnect and answer multiples DISM of Fig. 380 and ANSM of Fig. 381 extend into Fig. 382 where they appear before contacts of the respective disconnect and answer connectors of all of the one hundred assembling registers such that whichever connector is operated in an assembling register will determine into which register the timing entry goes and whether it goes into the disconnect or answer section thereof.

Upon the registering of a disconnect time in Fig. 382, the disconnect registers lock in series with the relay DS– to ground over contact **1** of the RLS– relay. Upon the registration of an answer time, the answer relays lock in a circuit including the winding of the AS– relay to ground, over contact **2** of the RLS– relay. One or the other of these two locking grounds will extend over respective conductors DLC and ALC into Fig. 380 by means of cable DLAC and over contacts **2** and **1** of the check connector ARC of Figs. 380 and 381 to operate one or the other of the relays DLC or ALC of Fig. 380 as an indication that one of but not both of the disconnect and answer sections of an assembling register have been operated as an incident to this timing entry registration.

Upon the operation of the check connector ARC in Figs. 380 and 381, the minute tens (MT) cable and the hour tens (HT) cable and the timed release (TR) cable of Fig. 380 will be extended over contacts of the ARC connector to operate the minute tens check relays of Fig. 380 on a two-out-of-four basis, the hour tens relays on a one-out-of-three basis and the timed release relays on a one-out-of-two basis. In Fig. 381 the hour units (HU) cable, the day units (DU) cable, the minute units (MU) cable and the minute parts (MP) cable will be extended over contacts of the ARC check connector to operate the check relays of Fig. 381. All of the check relays of Fig. 381 are operated on a two-out-of-five basis.

If all of the check relays of Figs. 380 and 381 are operated properly, ground will extend from Fig. 380 over a one-out-of-two check circuit over contacts of the ALC and DLC relays, a two-out-of-four check circuit through the minute tens check relays, a one-out-of-three check circuit through the hour tens check relays, a one-out-of-two check circuit through the timed release check relays, conductor **38000** into Fig. 381 and over a two-out-of-five check circuit through the hour units, day units, minute units and minute parts check relays to the right-hand armature of relay ADMR in Fig. 381. Relay ADMR will be released because its operating circuit is opened at contact **2** of the connector ADM. Ground on the right-hand armature of relay ADMR will extend over its contact **2** to operate the ADMV relay, which locks over its contact **2** to the ground on conductor ADM. Upon the operation of the ADMV relay of Fig. 381, the connector ADM will release because its operating circuit will be opened at contact **1** of the ADMV relay. At this point, it will be noted that the ground on the ADM conductor of Fig. 381 extends into Fig. 380 to the lower armature of the ALC relay of Fig. 380. If both the ALC and DLC relays are operated or released, the ground on conductor ADM will extend over back or front contacts thereof to conductor ADM1 extending back into Fig. 381 to the winding of the ADM conductor to hold it operated. As indicated previously, only one of the answer or disconnect connectors of an assembling register of Fig. 382 should be operated when registering a timing entry therein. Therefore, the ALC and DLC relays of Fig. 380 should be operated on a one-out-of-two basis, thereby opening the connection between the conductors ADM and ADM1 in Fig. 380. The connector ADM of Fig. 381 therefore will release.

Upon the release of the ADM connector, ground will extend from conductor ADM in Fig. 381, over contact **2** of the ADM connector to operate the ADMR relay. Relay ADMR, in operating, extends the ground on its right-hand conductor over its contact **1** to conductor RS which extends into Fig. 378 by means of cable **378–381** and extends over the contact of the STO relay to conductor **37801**. Conductor **37801** extends into Fig. 379 and over a contact of the operated F digit reading translator relay, depending upon whether the F digit of the call identity index which selected the assembling register is an even or an odd number. The even or odd conductor grounded by this operation will extend over cable **37900** to operate either of the even or odd reader step control relays RSE or RSO in Fig. 379. Upon the operation of one of these reader step control relays, ground will extend over contact **1** thereof and over the contact of the PRRL relay in Fig. 379 to cause the operation of the CT relay, which, in operating causes the alarm timing circuit of Fig. 379 to recycle (that is, not to bring in an alarm). Ground will also extend over contact **2** of the operated RSE or RSO relay of Fig. 379 to conductor **RS1** extending into Fig. 378 over the contact of the RSF relay therein to the winding of the reader step magnet STP.

The operation of the step magnet STP causes the reader of Fig. 378 to step to the next entry on the input tape. This reader step operation causes the release of the reading relays of Figs. 378 and 379 which, in turn, causes the return to normal of all of the circuit operations heretofore described, leaving the timing registration locked in the assembling register of Fig. 382.

It will be noted throughout the above discussion that it is necessary for the check relays of Figs. 380 and 381 to be properly operated in accordance with the information on the answer or disconnect multiple DISM or ANSM of Fig. 380 or 381 in order that the reader may be permitted to advance. The advance of the reader under these circumstances represents a proper check by these relays that the information presented on these answer and disconnect multiples is proper information.

Feature 38.—This feature has been indicated as comprising means whereby the reading relays are useful for other purposes than their main function of reading and registering the indications provided by the sensing pins on the perforated tape reader in accordance with the coded entry lines being sensed.

One of the numerous functions of the reading relays is associated with the operation of the assembler-computer which is referred to in a number of places as the "clearing-out operation." This so-called CAR operation is useful at the end of processing the input central office tape pertaining to a particular recorder numbering.

At the end of processing a particular central office incoming recorder tape, there may be a number of timing entries still registered in the assembling registers and for which no associated initial entry was read from that recorder tape. This represents incomplete calls for which the timing entries must be removed from the assembling registers onto the straddle tape because the initial entries relating to these calls probably appear on a central office tape for a subsequent accounting period.

Fig. 249 shows how Figs. 250 through 256 may be arranged to illustrate circuits representing the subject-matter of this feature as well as Features 16, 17 and 36.

Fig. 253 illustrates one hundred assembling registers **00** through **99**, an assembling register tens lock-out circuit and circuitry interconnecting these two groups of apparatus. Fig. 252 shows portions of the assem-

bling register walking control circuit and the assembling register units walking circuit which are used in conjunction with the apparatus shown in Fig. 253 for the purpose of "walking over" the one hundred assembling registers in a predetermined numbering sequence order for removing timing entries therefrom.

In view of the fact that these timing entries must be removed from the assembling registers, some means must be provided for energizing the various start leads, such as ST99 in Fig. 253 for register 99, in order to operate the disconnect and answer connectors in each register. Ordinarily, during the processing of normal call data from incoming tapes, the E and F digit reading relays of Fig. 250 are operated directly from the reader 25000 in accordance with the tens and units digits of the tape identity index, which index is used, as discussed in a number of other places, for selecting the assembling register into which the timing entry shall be registered. When an intial entry is received having the same call identity index in the E and F digits of the first line thereof, the processing part of the assembler-computer will cause the E and F digit reading relays to be effective to make the selection, whereby the timing entries are removed from the assembling register into the processing part of the machine. During the CAR operation, however, there will be no E and F digit reading relay operation due to reader action which can be responsible for making this selection. Under these circumstances, the assembling register units and tens walking and lock-out circuits of Figs. 252 and 253 under the control of the assembling register walking control circuit of Fig. 252 cause a synthetic E and F digit reading relay operation to synthesize the call identity index selection of asesmbling registers on a "call the roll" basis of 00 through 99 as required.

The so-called CAR operation is initiated by the operation of the CAR relay 25214 in Fig. 252. The operation of the CAR relay causes the RC reader connector 25005 to be released and completes a circuit from ground in Fig. 253, over contact 1 of relay GT, conductor 25301 into Fig. 252, over contact 1 of relay CAR to the winding of relay SW. Relay SW, in operating, completes a circuit for operating the reader walking connector WC of Fig. 250 in a circuit extending from ground over contact 2 of relay CAR, contact 3 of relay SW, conductor 25226 extending into Fig. 250, over contact 1 of the RC connector to the winding of the WC connector, which thereupon operates and locks in a circuit extending over its contact 3, conductor 25008 extending into Fig. 252 directly to ground over contact 2 of relay CAR.

The assembling register tens lock-out relays of Fig. 253 will all be released because relay GT is not operated. This causes the operation of the TDC relay in Fig. 252 in a circuit extending from ground in Fig. 253 over contacts 1 of the tens lock-out relays T0 through T9, conductor TDC, cable 25302 into Fig. 252, conductor TDC to the winding of the TDC relay.

Similarly, the assembling register units walking relays of Fig. 252 will all be released, causing the operation of the UDC relay in Fig. 252 in a circuit extending from ground in Fig. 252 over contacts 1 of the units walking relays U0 through U8, contact 3 of relay U9, conductor UDC, cable 25230, conductor UDC to the winding of relay UDC.

Relay WST in Fig. 252 is operated in a circuit extending from ground in Fig. 250, over contact 2 of the WC connector, conductor 25009 extending into Fig. 252, contact 1 of relay UDC and contact 3 of relay TDC to the winding of the WST relay. The units walking relay U0 will now operate in a circuit extending from ground over contact 3 of relay CRC, contact 2 relay WST, contact 2 of relay UDC to the winding of the U0 relay, which thereupon operates and locks over its contact 7 and contact 7 of the U1 relay to ground on the conductor 25009. The relay GT in Fig. 253 may now operate in a circuit extending from ground in Fig. 252, over contact 1 of the WST relay to conductor 25227 extending into Fig. 253 to the winding of the GT relay. Upon the operation of the GT relay, any of the tens lock-out relays T0 through T9 will operate depending upon whether or not the associated R0 conductor is grounded (indicating that that particular tens group of assembling registers contains at least one register having therein at least one timing registration). The tens lock-out relays of Fig. 253 are provided with locking circuits which are arranged in a preferential order. For instance, if relay T0 is operated, it will lock over its contact 4, conductor 25303 into Fig. 252 to ground over contact 2 of the TS relay in Fig. 252. However, if relay T1 also operates, it cannot lock over this locking circuit because its locking circuit will be broken at contact 3 of the T0 relay, etc. In other words, the lowest numbered tens lock-out relay which can operate will do so and will lock in the above-described circuit. Upon the operation of one or more of the tens lock-out relays, the tens down-check relay TDC of Fig. 252 will release, thereby providing over its contact 1 and the contact 1 of the relay SW a locking circuit for the SW relay.

Upon the release of the TDC relay, relays WST in Fig. 252 and GT in Fig. 253 release in that order, only one of the tens lock-out relays of Fig. 253 remaining locked as previously described. Upon the operation and locking of only one of the ten tens lock-out relays of Fig. 253, the tens up-check relay TUC of Fig. 252 operates in a circuit extending from ground in Fig. 253, over a one-and-one-only up-check circuit of the tens lock-out relays and over conductor TUC extending into Fig. 252 by means of cable 25302 to operate the TUC relay.

Upon operation of the units walking relay U0 of Fig. 252, as previously described, the units down-check relay UDC of Fig. 252 will release and the operation and locking of only one of these units walking relays completes a circuit for operating the units up-check relay UUC in a circuit extending from ground in Fig. 250 over a one-and-one-only up-check of the units walking relays to conductor UUC extending by means of cable 25230 to the winding of the UUC relay.

Upon the operation of both of the tens and units up-checks relays TUC and UUC of Fig. 252, ground will extend over contacts 1 and 2 of the relays US, TUC and UUC to conductors 25231 and 25232 extending into the tens lock-out circuit of Fig. 253 and into the units walking circuit of Fig. 252. These two conductors will extend over contacts of the operated tens lock-out relay of Fig. 253 to ground two-out-of-five conductors into cable E to provide on a two-out-of-five basis and E digit of 0 to 9 in accordance with the specified group of ten assembling registers which caused the operation of the associated tens lock-out relay. These two conductors also will extend over the contacts of the operated U0 units walking relay of Fig. 252 to ground two out of five of the conductors into cable F, thereby providing on a two-out-of-five basis an F digit of 0. These cables E and F extend into Fig. 250 and over contacts of the WC reader connector to operate on a two-out-of-five basis the E and F digit reading relays in accordance with the E and F digits generated by the tens lock-out and units walking circuits of Figs. 253 and 252. These operated E and F digit reading relays will cause the operation of corresponding relays in the E and F digit reading translators of Fig. 250, which in turn cause the grounding of one out of the hundred conductors 00 through 99 extending by means of cable EF into Fig. 253 where this grounded conductor emerges as a start lead. This start lead, such as conductor ST00, will extend over contacts of its associated jack to operate the connector relays therein for

removing from this assembling register timing entries which may be registered therein.

When the timing information has been removed from the selected assembling register, the processing part of the assembler-computer will cause ground to be applied to conductor **25233** in Fig. 250 as an indication that the units walking circuit of Fig. 252 may advance to remove timing entries from the next numbered assembling register. Ground on conductor **25233** will extend over contact **2** of the **U9** relay in Fig. 252 to the winding of the US relay which operates and locks over contact **2** of relay **U9** and contact **3** of relay **US** to ground over the contact of the relay **U2UC**. The operation of the relay US removes, at its contacts **1** and **2**, the above-described grounds, whereby the E and F digits were generated.

Upon the operation of the US relay, the ground will extend over its contacts **5** and **4** and contact **7** of the **U9** relay and contact **6** of the **U0** relay to the winding of relay **U1** which opertaes and locks over its contact **9**, contact **8** of relay **U2** to ground on the conductor **25009**. Relay **U0** remains locked over contact **8** of relay **U1** to ground over contact **5** of relay **US**. Relay UUC releases because more than one units walking relay is operated. With two of the units walking relays operated in succession, a circuit is completed for operating relay U2UC extending from ground in Fig. 252 over contact **2** of relay **U0** and contact **4** of relay **U1** to the winding of relay U2UC. Relay **U2UC**, in operating, releases relay US, which in turn causes the release of the **U0** relay and the reoperation of the units up-check relay UUC to again apply grounds to the two conductors **25231** and **25232**.

These two grounded conductors **25231** and **25232** will again cause the generation of an E digit from the tens lock-out circiut of Fig. 253 and an F digit from the units walking circuit of Fig. 252 for selecting the next numbered assembling register. Since the **U1** relay is operated in this instance, the F digit will be a 1, which will advance the assembling register start lead one units digit higher in the tens group represented by the tens lock-out relay which is still operated.

The above-described process is repeated throughout the units walking relays **U0** through **U9**, thereby covering all ten units registers in the tens group represented by the tens lock-out relay which is operated in Fig. 253. With the **U9** relay operated when ground is applied to conductor **25233** in Fig. 252 (indicating that the timing information has been removed from an assembling register in response to the operation of the **U9** relay), a circuit is completed for operating relay TS in Fig. 252 extending from ground on the conductor **25233**, over contacts **1** of relays **U8** and **U9** to the winding of the TS relay. Relay TS, in operating, opens the locking circuit for the operated tens lock-out relay of Fig. 253, which releases and causes the reoperation of the tens down-check relay TDC of Fig. 252. Relay TDC, upon reoperating, completes the previously-described circuit for operating the GT relay of Fig. 253. The GT relay, upon reoperating, again permits any of the tens lock-out relays to operate, indicative of the fact that any one of the assembling registers in the tens group represented contains at least one timing entry. Again, only one of these tens lock-out relays can lock operated under control of the TDC relay of Fig. 252 (which releases as soon as one of the tens lock-out relays operates). It, of course, will be appreciated that the previously operated (and now released) tens lock-out relay will not reoperate and, therefore, the next numbered tens lock-out relay may lock operated.

As soon as a new tens lock-out relay is operated and locked, the entire above-described process is repeated, whereby the **U0** relay in the units walking circuit operates to initiate the "walking over" of this new tens group.

This use of the reading relays to synthesize the selection of assembling registers on a rigidly controlled sequential numbering basis is a fairly important job that these reading relays do, in addition to their more general task of registering the information detected by the reader of Fig. 250.

Feature 39.—This feature has been mentioned as comprising means in the assembler-computer whereby it is necessary to deposit in one of the hour registers a fictitious hour value 25 for purposes of continuing machine operation under circumstances, such as a power failure, when registrations normally controlling the machine may be lost.

Fig. 362 shows how Figs. 363 through 376 may be arranged to illustrate the basic circuit operations to disclose an embodiment of this feature.

During the normal operation of the assembler-computer, the two hour registers of Fig. 367 handle successive hour entries 2811EF (end-of-tape hour) and 2810EF (regular hour) on an alternate basis throughout the processing of an input tape. Generally, as described in more detail in Feature 35, each successive hour entry is received in the released register, is checked against the old registration in the other register and causes the release of the old registration provided that the check indicates the proper sequence of hour values. Therefore, during the normal operation of the machine, at least one of the odd or even hour registers of Fig. 367 will contain an hour registration and will control the associated hour output connector relays of Fig. 369 for supplying to an assembling register of Fig. 370 the appropriate tens and units digits of the current hour associated with a timing entry (ABCDEF—A digit of 1 or 3) which may be read by the reader of Fig. 363.

If at any time the main power should fail, the entire machine would go to normal, releasing all except a few registrations in the machine. The operated hour register of Fig. 367 will be released under this condition. When the machine is restarted, it is necessary that some of the released registrations be reestablished in order that the machine may continue with its processing. One of these reestablished registrations must be a proper operation of one of the two hour registers. A fictitious hour value 25 is used to simulate the operation of one of the hour registers of Fig. 367 for the purpose of satisfying certain progress and check circuits, whereby the machine may continue to process input tape.

As an incident to restarting the machine, the hour reset key of Fig. 366 is operated and the even and odd down-check relays EHDC and OHDC (and OHDC1) of Fig. 366 will be operated as an indication that the even and odd registers of Fig. 367 are released. Relay EHDC of Fig. 366 is operated in a circuit extending from ground in Fig. 367, over back contacts of all of the even hour register relays, conductor DC, cable **367–366** into Fig. 366, conductor DC, back contacts of the even hour register control relays, contact **4** of relay **H25**, contact **5** of relay OH to the winding of relay EHDC, which locks over its contact **5** to the **HM2** conductor, extending back to the reader of Fig. 363 to provide a locking circuit for relay EHDC during the reader closed period (when the reader reading contacts are closed). Relay OHDC of Fig. 366 operates in a circuit from ground in Fig. 367, over back contacts of the odd hour register relays, conductor DC, cable **367–366**A into Fig. 366, conductor DC, back contacts of the odd hour control relays, contact **5** of relay EH to the winding of relay OHDC, which locks over its contact **4** to the down-check conductor DC of the odd hour register of Fig. 367. Relay OHDC1 of Fig. 366 operates in a circuit extending from ground on the master off-normal MON conductor in Fig. 366, over contact **6** of relay EHDC and contact **3** of relay OHDC to the winding of relay OHDC1, which locks over its contact **2** and contact **4** of relay OHRL and contact **1** of relay OHDC to the KB8 conductor extending to the reader of Fig. 363 to provide a locking circuit

for relay OHDC1 during the reader open period (when the reader reading contacts are open).

After a power failure, the ER relay of Fig. 366 may be operated by circuits, not shown, to take care of an emergency reset condition, or the HR key of Fig. 366 may be operated. If the hour reset key HR is operated, ground will extend from the MON conductor of Fig. 366, over contact 7 of the OHRL relay, contact 1 of the OHDC1 relay and contact 3 of relay EHDC and over contact 1 of the HR key to cause the operation of relay H25 which locks over its contact 3 to MON ground, over contact 1 of relay EHRL. The ground from contact 3 of the EHDC relay will extend over contact 14 of the H25 relay to the winding of relay EH, which operates and locks over its contact 3 and contact 7 of relay OHRL to MON ground.

Relay H25, in operating, simulates the registration of an hour value 25 in the even side of the hour register of Fig. 367. Grounds extend over contacts 12 and 13 of the H25 relay to conductor TNC and UAR, extending over cable 366–369 into Fig. 369 to cause the operation of the ETNC and EUAR even hour output connectors. Grounds will extend over contacts 1, 3, 5 and 7 of the PH relay in Fig. 366 to conductors TA, TB, UA and UB, extending over contacts 5, 6, 7 and 8 of the H25 relay to conductors T2A, T2B, U5A and U5B extending by means of cable 366–369B into Fig. 369 to armatures 7 and 4 of relay ETNC and armatures 12 and 7 of relay EUAR to provide an output 25 into the hour tens and units cables HTU and HU extending into Fig. 370 for use by the assembling registers. Grounds will extend over contacts 9 and 10 of the H25 relay in Fig. 366 over conductors U5C and T2C, cable 366–369B into Fig. 369 to armature 2 of relay EUAR and armature 1 of relay ETNC to provide into cable 369–365A the hour 25 into Fig. 365A to armatures of the OHA time connector. Ground will extend over contact 11 of relay H25 to operate the SDC relay of Fig. 366 to cancel any check of the time difference between this fictitious 25 entry simulated for the even hour register and the next legitimate hour entry which will be read by the reader of Fig. 363 into the odd hour register of Fig. 367.

Relay OHDC1 of Fig. 366 remains operated over contact 6 of relay EHDC as long as this latter relay is operated or to ground on the KB8 conductor from the reader during reader open periods. Eventually, relay EHDC (which is locked over its contact 5 to the HM2 conductor) will release during an ensuing reader closed period, whereupon relay OHRL of Fig. 366 operates in a circuit extending from MON ground over contact 7 of relay OHRL, contact 1 of relay OHDC1, contact 4 of relay EHDC to the winding of relay OHRL which locks over its contact 5 and contact 1 of the OHDC relay to ground on the KB8 conductor.

During the next ensuing reader closed period, when ground is removed from the KB8 conductor in Fig. 366, relay OHDC1 releases, relays EH and H25 remaining locked to the master off-normal ground on conductor MON.

When the hour reset key HR is released, relay EH releases leaving relay H25 locked to off-normal ground under control of the released EHRL relay. Upon the above-described operation of relay OHRL, a circuit is completed for operating relay OH from MON ground in Fig. 366, over contact 6 of relay OHRL. Relay OH locks over its contact 3 and contact 6 of relay EHRL to MON ground. During the next reader closed period, relay OHRL releases.

Since the operation of relay H25 creates a condition which is equivalent to the even hour register of Fig. 367 having a legitimate hour entry therein, the assembler-computer may be allowed to proceed to process incoming tape. The next action which will take place in the hour register control circuits will be when an hour entry (2811EF, 2810EF or 2821EF) occurs on the tape or when an apology hour entry (281899 or 281999) occurs as detected by the reader of Fig. 363.

If an apology hour entry is detected by the reader of Fig. 363, the 281AP conductor in Fig. 363 will be grounded and will extend over cable 363–366 into Fig. 366 and over contact 2 of the H25 relay to conductor RS1 extending into Fig. 365 and over cable 365–363 into Fig. 363 to cause the operation of the reader step control relay RS. The operation of relay RS causes the reader of Fig. 363 to step ahead of the apology entry without any action being taken in the hour circuits of Figs. 365 through 369.

If an hour entry other than an apology entry is received by the reader of Fig. 363, the conductor N281AP in Fig. 363 will be grounded and will extend over cable 363–366 into Fig. 366, over contact 1 of relay OH, contact 2 of relay OHRL to conductor HR extending over cable 366–365A into Fig. 365 to operate the OHR relay which locks over its contact 4 to ground on the up-check conductor UC2 (grounded when all of the reading relays of Figs. 363 and 364 are properly operated). Depending upon what the D digit in the reading relays of Fig. 363 is, one of the conductors D0, D1 and D2 out of cable D in Fig. 365 will be grounded and will extend over contact 7 or 6 or 5 of relay OHR to one of the three conductors HL1, HAR or HARS which will extend by means of cable 366–365A into Fig. 366 to operate one of the three odd hour register control relays. Upon the operation of the OHR relay of Fig. 365, the E and F digits detected by the reading relays of Fig. 364 will be transmitted over cables E and F into Fig. 365 and over contacts of the OHR relay and over cable 365–367A into Fig. 367 to operate one of the tens and one of the units relays in the odd hour register. Upon the operation of the odd hour register of Fig. 367, the odd hour down-check relay OHDC of Fig. 366 releases.

Ground will now extend over contact 15 of relay H25 and over contact 1 or 2 of the OHL1 relay in Fig. 366 through a one-and-one-only check of these odd hour register control relays, conductor UC, cable 367–366A into Fig. 367, conductor UC through an up-check circuit of the odd hour register, conductor UC1 extending back into Fig. 366, over the contact of the SDC relay therein and over contact 5 of relay OHL1 or contact 7 of relay OHAR to conductor RS, cable 366–365A, conductor RS, contact 3 of relay OHR in Fig. 365 to the RS1 conductor which, as above described, will cause the operation of the reader step control relay RS in Fig. 365 to permit the reader to advance to the next code. The operation of relay RS extends ground over its contact to conductor RSG which extends over cable 365–363 into Fig. 365, conductor RSG into Fig. 366, over contact 9 or 11 of the operated odd hour register control relay of Fig. 366 and over contact 4 of relay EH to the winding of relay EHRL which operates and locks over its contact 4 and contact 2 of relay EHDC to the MON ground. Relay EHDC, in operating, releases relay H25 which, in turn, releases the operated even hour output connector relays of Fig. 369, the counterpart in Fig. 369 for the odd register having been operated over contacts of the odd hour register control relays of Fig. 366 in accordance with the type of hour entry involved.

Relay EHRL, in operating, in Fig. 366 releases relay OH, permitting relay EHDC to reoperate as an indication that the even hour register of Fig. 367 is available to handle the next hour entry. The reoperation of relay EHDC eventually permits relay EHRL to release, thereby reverting the odd and even hour control circuits to a condition whereunder a legitimate hourly code is registered in the odd side of Fig. 367 and the control circuits are ready to receive the next hour entry in the even side under proper check conditions, relay SDC of Fig. 366 having released when relay H25 released.

Feature 40.—This feature has been described as comprising means for detecting in the output tape a lack of blank tape or detecting a splice of blank tape sections

and for straddling this so-called "window" with a so-called "window splice end-of-tape pattern." In some cases, this window pattern may comprise merely a 287DEF skip splice code followed by a number of splice codes 081010 and ending up with another 287DEF skip splice code. This latter type of window pattern is used in connection with any one of the perforators except the straddle perforator. Another type of window pattern comprises eleven lines of output consisting of a five-line end-of-tape group 284DEF, 283DEF, 280DEF, 2811EF and 2821EF followed by a section of splice pattern 081010 and followed by another five lines of 28CDEF codes. This window pattern is used particularly in connection with the straddle perforator.

Fig. 328 shows how Figs. 329 and 356 may be arranged to disclose circuits illustrating this feature as well as previously described Features 32 and 33 and Feature 42 to be described subsequently.

In Fig. 356 are shown representations of eleven perforators consisting of the STDL straddle perforator, the DET detail perforator and nine message unit perforators MU0 through MU9, associated with each of which is a window detecting contact, such as contact **35600** for the straddle perforator and contact **35601** for the detail perforator. These contacts are arranged mechanically to ride on the central parts of the blank tapes which are fed to these perforators for perforation. Whenever a new section of blank tape is spliced into that section of tape which is feeding a perforator, a square hole is cut out of the center of the splice. This hole is designated a "window." Whenever a window is detected on an input tape the contact associated with that particular perforator will close.

If the contact **35600** closes, thereby detecting a window in the input tape of the straddle perforator of Fig. 356, a circuit is completed from ground in Fig. 356, over contact **35600**, conductor WSS into Fig. 352 through the winding of the WSS window detecting lock-out relay for the straddle perforator, over conductor CWS, cable **352–348** into Fig. 348 to battery, through the CWS relay in the window lock-out control circuit, whereby relays WSS and CWS operate. The operating ground in Fig. 352 on conductor WSS will be extended over contact **4** of relay WSS and back contacts of the other window detecting lock-out relays, conductor **EW1**, cable **352–348** into Fig. 348, over contact **1** of the LOR relay through the winding of the EWD relay, conductor EW, cable **340–348**, out of which emerges the conductor EW and appears before contacts of one of the common class translator relays STWS and WS.

When one of the other of these common class translator relays is operated, the EW lead is connected to ground over contact **1** thereof, whereby the relay EWD in Fig. 348 has ground on both of its winding leads, whereby it remains released. It will remain released until the contact **35600** in Fig. 356 opens as an indication that the window has passed, at which time the EWD relay of Fig. 348 will be operated in series with the relays WSS of Fig. 352 and CWS of Fig. 348. The operation of the EWD relay of Fig. 348, therefore, is an indication that the end of the window has been detected.

Ground will extend from the common class translator circuit of Fig. 348, over contact **2** of the TTI relay in Fig. 348 and over back contacts of the other common class relays to conductor TDC over cable **34801**, conductor TDC, contact **2** of relay CWS, conductor WS, cable **352–348**, conductor WS, back contacts of the window lock-out relays WS9 through WSD of Fig. 352, contact **1** of relay WSS, conductor STWS, cable **352–348A** and conductor STWS in Fig. 348 to the winding of the STWS relay. Relay STWS in Fig. 348, in operating, operates the adjacent relay LTE in an obvious circuit over contact **3** of relay STWS.

The operation in Fig. 348 of relays LTE and STWS completes a circuit from ground over contact **12** of relay LTE and contact **9** of relay STWS to conductor **11L** extending by means of cable **348–347A** into Fig. 347, over contact **10** of the common pattern connector COC, conductor **11L**, and over cable **347–346** into Fig. 346 to cause the operation of the perforate line count relay PLA11. Ground will thereupon extend over contact **2** of relay PLA11 and conductor **L11**, over cable **346–347** into Fig. 347, over contact **5** of the connector COC, conductor **L11**, cable **347–348**, into Fig. 348, conductor L11 and over contact **4** of relay STWS to the **284** conductor which extends over cable **348–351** into Fig. 350 to cause the operation of the common pattern connector relays **284** of Fig. 350 and **8** of Fig. 351. The operation of these two pattern connector relays causes the extension of grounds from the contacts of the reader of Fig. 329 over contacts of these connectors for presenting into cable PERF in Fig. 351 the 284DEF coded digits for perforation by the straddle perforator of Fig. 356.

At the conclusion of this eleventh line of this window-pattern, the perforate line count circuit of Fig. 346 advances by the operation of relay PLA10 and the release of relay PLA11 for specifying the line 10 of this window pattern. This comprises the extension of ground in Fig. 348 on conductor **L10** over contact **5** of relay STWS to conductor **283**, extending by means of cable **348–351** into Figs. 350 and 351 to operate the common pattern connectors **283** in Fig. 350 and **8** in Fig. 351 to cause the perforation of the 283DEF line by the straddle perforator of Fig. 356.

The perforate line count circuit of Fig. 346 again advances, and this process repeats itself over contacts **6**, **7** and **8** of the common class translator relay STWS of Fig. 348 to perforate the successive lines 280DEF, 2811EF and 2821EF on the straddle output tape.

When the perforate line count circuit of Fig. 346 specifies the perforation of line **6**, the conductor **L6** out of cable **347–348** in Fig. 348 will be grounded and will extend over contact **6** of the LTE relay and contact **5** thereof to the winding of the SSTM relay in the splice pattern timer circuit of Fig. 348 to start a timing interval during which a plurality of lines of splice pattern may be applied to the straddle output tape. The ground from contact **6** of the LTE relay grounds conductor **08R** extending over cable **348–351** into Fig. 351 to operate the pattern connectors **8** and **08R**, whereby a line of splice pattern 081010 will be perforated by the straddle perforator. As long as the SSTM relay of Fig. 348 is operated and until the relay ESTM in the splice pattern timer circuit of Fig. 348 operates (after a time interval determined by the condenser charging circuit associated with tube T causes this tube to fire and operate relay ESTM), the straddle perforator will continue to perforate successive splice pattern lines 081010. At the conclusion of the timing period, the perforator line count circuit of Fig. 346 will be advanced to call for line 5.

The grounding of the conductor L5 in Fig. 348, out of cable **347–348**, extends ground over contact **7** of relay LTE to the **284** conductor into cable **348–355**. This, as above described, causes the perforation of a 284DEF line by the straddle perforator.

At the conclusion of the 284DEF line, contacts **8**, **9**, **10** and **11** of the LTE relay of Fig. 348 cause the successive lines 283DEF, 280DEF, 2811EF and 2821EF to be perforated by the straddle perforator as lines 4, 3, 2 and 1.

In Fig. 348 it will be noted that when the relay CWS operated at the beginning of this window pattern process, a circuit was opened at its contact **1** removing a short circuit across resistance **34803** in the splice pattern timer condenser-resistance charging circuit for tube T, thereby making the charging time almost indefinite. On the other hand, when the relay EWD in the window lock-

out control circuit of Fig. 348 operates as an indication that the window has passed, a circuit is completed over contact **1** of the relay EWD to insert a resistance **34802** in parallel with the resistance **34803**, thereby enabling the tube T to fire very quickly thereafter.

In the event that the window contact **35601** for the detail perforator of Fig. 356 operates, ground will be extended thereover and over conductor WSD into Fig. 352, through the winding of the WSD relay in the window detecting lock-out circuit, over contact **2** of relay WSS (if released or when released) and over conductor CWS, etc. to cause the operation of relay WSD of Fig. 352 in series with relay CWS of Fig. 348. In this case, the grounded WS conductor in Fig. 352 emerging from cable **352–348** will be extended over contact **2** of relay WSD to the RWS conductor and over cable **352–348** into Fig. 348 to cause the operation of the common class translator relay WS.

Ground will extend over contact **11** of relay WS to a **3L** conductor which sets the perforate line count circuit of Fig. 346 to specify three lines of output. The third line is called for when the **L3** conductor out of cable **347–348** in Fig. 348 is grounded from the perforate line count circuit of Fig. 346. This grounded conductor **L3** extends over contact **8** of the WS translator relay to conductor **287** extending over cable **348–351** into Figs. 350 and 351 to cause the operation of the common pattern connector relays **287** of Fig. 350 and **8** of Fig. 351. This will cause the perforation by the detail perforator of Fig. 356 of a skip splice entry 287020. At the completion of perforating this line, the perforate line count circuit of Fig. 346 advances to call for line 2, which comprises the grounding of conductor **L2** out of cable **347–348** in Fig. 348. Conductor **L2** extends over contact **9** of relay WS to the **08R** conductor which, as previously described, causes the operation of the common pattern connectors of Fig. 350 and 351 required for developing the splice code 081010. This same ground on conductor **08R** in Fig. 348 extends over contact **6** of the relay WS to the winding of the SSTM relay in the splice pattern timer of Fig. 348, as above described, to measure a length of time during which a plurality of splice code lines can be perforated. When the timing interval is finished, the perforate line count circuit will advance to call for line 1. The grounded conductor **L1** in Fig. 348 will extend over contact **10** of the WS translator relay to conductor **287** to again operate the common pattern connector relays of Figs. 350 and 351 for perforating as line 1 of this window pattern a 287020 skip splice code.

This feature is illustrated, therefore, by those circuits which cause the automatic preparation of a special window pattern across the splice point in an input tape to one of the perforators of Fig. 356.

Feature 41.—This feature has been indicated as comprising checking means involved in the circuits for selecting an assembling register, whereby under certain circumstances (registration of a timing entry in an assembling register) only one of the disconnect and answer connectors in an assembling register is permitted to be operated or an alarm will be sounded, and under other circumstances (operation of both timing connectors in an assembling register when an initial entry is received) whereunder the alarm circuit must not operate when two connectors are operated.

Fig. 377 shows how Figs. 378 through 382 may be arranged to illustrate this feature of the invention.

In Fig. 378, when a timing entry is read by the reader for registration in an assembling register of Fig. 382, the relay ADCN of Fig. 378 will be released, thereby opening at its contact **1** a circuit including the upper winding of the XST marginal relay of Fig. 378. In selecting an assembling register of Fig. 382 for registering therein a timing entry (ABCDEF, where the A digit is a 1 or a 3), ground will extend over the contact of the CST relay of Fig. 378, through the lower winding of the XST relay through the winding of the STO relay, contact **2** of relay XSTL, conductor ST into Fig. 379, over an upcheck circuit through the F and E digit reading translator relays of Fig. 379, over a contact of the operated E digit translator relay and a contact of the F digit reading translator relay to ground one of a hundred conductors **00** through **99** extending into cable **ST100**. The grounding of this conductor represents a selection of one-out-of-one hundred conductors depending upon the tens and units digits (E and F digits) of the call identity index in the timing entry. This grounded conductor will extend over cable **ST100** from Fig. 379 into Fig. 382 and over a contact of the jack associated with the same numbered assembling register to the armature of the DS– relay, over which it is extended to one of two circuits to operate either the disconnect or answer connector DISC or ANS– in the appropriate assembling register. It will be noted that the circuit over the contact **1** or **2** of the DS– relay in the assembling register of Fig. 382 will cause the operation of only one of these two connectors which, of course, is the proper situation because the timing entry which appears on the disconnect and answer multiples DISM and ANSM must be registered in only one of the disconnect and answer sections of the particular assembling register selected by a grounding of the one conductor out of the hundred above described.

Relay STO of Fig. 378 operates in this selecting circuit as an indication that at least one assembling register connector has been operated. The relay XST in Fig. 378, being energized only by means of its lower winding, is arranged not to operate when only one of the assembling register connectors is operated in series with its lower winding. If more than one of the assembling register connectors is operated (in parallel) in the series circuit including the lower winding of the XST relay, the latter is arranged to operate, indicating an erronous condition. Ground will thereupon extend over the contact of the XST relay to the winding of relay XSTL which locks over its contact **1** to ground over contact **2** of the ST4 relay in Fig. 378, opening at its contact **2** the above-described start circuit which causes the XST relay to operate, thereby releasing the STO relay.

During the proper operation of a single assembling register connector, and after the timing entry which is registered therein is properly checked by the check relays of Figs. 380 and 381, relay ADMR in Fig. 381 will be operated, thereby extending a ground from Fig. 380, over a check circuit through the check relays of Fig. 380, conductor **38000** into Fig. 381, over a check circuit through the check relays of Fig. 381, over contact **1** of the ADMR relay, conductor RS, cable **378–381** into Fig. 378, conductor RS, over the contact of the STO relay (operated under proper conditions), conductor **37801** into Fig. 379, over a contact of the operated F digit reading translator relay to an even (E) or odd (O) conductor, over cable **37900** to operate the even or odd reader step control relay RSE or RSO, the operation of which indicates a proper registration of a timing entry and extends a ground over its contact **1** to cause the operation of the CT relay of the alarm timing circuit. Relay CT, in operating under these proper circumstances, cancels the alarm timing operation of Fig. 379 to prevent the bringing in of an alarm.

Under the previously-described conditions, whereunder it may be assumed that the XST relay of Fig. 378 operates because more than one assembling register connector is operated in series with its lower winding, the XSTL relay is operated to cause the release of relay STO. With relay STO released, it will be apparent that the circuit over its contact will be opened, thereby preventing the operation of a reader step control relay RSE or RSO of Fig. 379. This in turn prevents the timely operation of the CT relay of the alarm timing circuit, thereby permit-

ting the alarm timing circuit to function to bring in an alarm.

When an initial entry is received by the reader of Fig. 378, one of the first operations necessary is the removal from the associated assembling register of Fig. 382 of whatever timing entries may be registered therein and pertaining to this call. The first line of the initial entry will contain an A digit which is not 1 or 3 and will contain E and F digits which represent the tens and units digits of the call identity index. If the A digit is not 1 or 3, ground will extend from the reading relay upcheck conductor UC in Fig. 379 into Fig. 378, over the contact of the TI relay, conductor UC1 into Fig. 379, over contact 1 of the reader step control relay SR1E or SR1O, conductor UC2 into Fig. 378, over a contact 1 of the operated B digit reading relays and over the contacts of the RLS and ADD relays in Fig. 378, over contact 3 of the RCD reader connector, the contact of the FI relay to the A reading relays of Fig. 378, where it will extend over contact 2 of the A1 relay (operated whenever the A digit is not a 1 or a 3), conductor AN13 into Fig. 379, over contact 2 of the operated reader step control relay SR1E or SR1O to conductor CN extending into Fig. 378 to operate the relay ADCN.

Relay ADCN, in operating, extends ground over its contact 2 and over conductor 37800 into Fig. 382 to cause the operation of the answer disconnect connector AD–. The operation of this connector AD– connects over its contacts the operating circuits of the answer and disconnect connectors of the same assembling register in multiple such that when the start lead for that assembling register (such as lead ST99 out of cable ST100 in Fig. 382) is grounded, both of the answer and disconnect connectors in that assembling register will be operated. Unless something is done to the operating circuit of the XST relay of Fig. 378, it will operate when two assembling register connectors are operated in series with its lower winding. Under this circumstance, the operation of two of these connectors is a proper operation. Therefore, a circuit is completed over contact 1 of the ADCN relay of Fig. 378 to ground on the right-hand side of the lower winding of the XST relay to change the marginal condition of this XST relay to permit it to remain released even though more than one connector is operated in a circuit in series with its lower winding.

Feature 42.—This feature has been stated as means provided for automatically severing the completed tape from the blank tape supplied to each of the output tape perforators at the conclusion of processing.

Fig. 328 shows how Figs. 329 through 356 may be arranged to illustrate circuits responsible for this feature.

When the assembler-computer has finished processing all of the input tape fed thereto, a signal will be provided to the operator and the machine will stop. At this point, the operator will close the tape end key, shown in Fig. 347. Providing certain conditions are satisfied, the operation of this tape end key will cause the operation of the PTTI relay in Fig. 347 in a circuit extending from ground in the recorder progress circuit of Fig. 346 over the contact of the LRS relay (providing it is operated indicating that the last recorder has been processed) over contact 2 of the FDR relay in the day progress circuit of Fig. 346 (operated to indicate that the first round and the first day of round have been processed) over conductor 34600 into Fig. 347 and over the contacts of the tape end key to the winding of the PTTI relay.

Upon restarting the machine, ground will extend in Fig. 347 over contact 4 of the PTTI relay, contact 3 of the STWP relay to the winding of the CAR relay in the assembling register walking control circuit of Fig. 347. The operation of the CAR relay clears all timing registrations from all of the assembling registers, such as in Fig. 337, and initiates a process whereby the trailing tape end group is placed on the straddle tape.

When the output circuits have finished with tape identity on the straddle tape, relay PRL in Fig. 347 will be operated as an indication that this process is finished. Ground will extend over the contact of the PRL relay, conductor 34701, contact 4 of the connector COC in Fig. 347, conductor RLS, cable 34702, conductor RLS, contact 6 of the CG relay in Fig. 347, conductor RLS1 extending into Fig. 352 over contact 2 of the perforator register relay P11D to conductor RLS2 extending over cable 347–352 into Fig. 347, conductor RLS2, contact 1 of relay PW, contact 2 of relay PTTI, contact 1 of relay STWP to the winding of the ESP relay, which thereupon operates. Ground thereupon extends over contact 5 of the PTTI relay in Fig. 347 and contact 1 of the ESP relay to the winding of relay ESPL which operates and locks over its contact 1 and contact 3 of the PTTI relay to the ground supplied by the tape end key in Fig. 347.

Relay CCUC in the perforator walking control circuit in Fig. 347 will have been operated by ground over the CCUC1 conductor from the common class translator circuit of Fig. 348. When the common class translator of Fig. 348 is released as an incident to having completed the trailing tape identity job on the straddle tape, relay CCUC in Fig. 347 will release. This in turn will release the common pattern connector COC in Fig. 347 which in turn releases the ESP relay of Fig. 347. Upon the release of the ESP relay, with relays PTTI and ESPL operated in Fig. 347, ground extends over contact 4 of the PTTI relay, contact 2 of relay ESP and contact 2 of relay ESPL to operate the STWP relay, thereby releasing the CAR relay in the assembling register walking control circuit of Fig. 347.

During the operation of clearing out the timing entries from the assembling registers, pursuant to the operation of the CAR relay of Fig. 347, ground will be extended from Fig. 329 over the contact of the WC reader connector, conductor 32900 extending into Fig. 347 over the contact of the SW relay and contact 2 of the CRC relay and contact 4 or 5 of the 285R relay (operated or released depending upon certain machine conditions not of immediate concern) to one of the conductors TTFE or TTE extending by means of cable FE into Fig. 348 to cause the operation of the TTFE or TTE common class translator relay. Relay TTFE will cause seven lines of output information to be perforated on the straddle perforator comprising the codes 284DEF, 283DEF, 280DEF, 285DEF (representing a transfer condition), 2811EF, 2821EF and a plurality of special splice pattern codes caused by the grounding of the conductor 08S over contact 12 of the relay TTFE. This conductor 08S extends by means of cable 348–351 into Figs. 350 and 351 to cause the operation of the common pattern connector relays 08S of Fig. 350 and 8 of Fig. 351. This produces a so-called "grooved" splice pattern 08CDEF where the C and D digits represent the recorder number and where the E and F digits represent the hour of transfer. The operation in Fig. 348 of the TTE common class translator will cause the perforation of six lines of output comprising the codes 284DEF, 283DEF, 280DEF, 2811EF, 2821EF and regular splice pattern 081010.

As above described, in connection with the operation of the STWP relay in the perforator walking control circuit of Fig. 347, when the trailing tape identity has been placed on the straddle tape and when the perforator control circuit is ready to cause the perforation of trailing tape identity on others of the tapes, ground will extend over contact 4 of relay PTTI in Fig. 347, over contact 2 of relay STWP to conductor TTI extending into Fig. 348 to operate the TTI common class translator relay. The TTI relay, in operating, will cause eleven lines of trailing tape identity information to be perforated on

each of the detail and message unit perforators of Fig. 356 upon which it is required. This group comprises the nine lines of output tape identity 2891EF through 2899EF followed by line 2 of this eleven line entry, which is produced by ground extending over contact **14** of the relay TTI in Fig. 348 to ground the conductor **286** extending by means of cable **348–351** into Figs. 350 and 351 to cause the operation of the common pattern connector relays **286** in Fig. 350 and **8** in Fig. 351. These pattern relays produce an output entry 286000 which is a form of skip splice entry. The first line (that is, line 1) of this eleven line entry comprises regular splice pattern 081010 as determined by ground extending over contact **15** of the TTI relay of Fig. 348 to conductor **08**R to cause the operation of the common pattern connector relays **08**R and **8** in Fig. 351.

When ground is extended over contact **2** of the PW relay in Fig. 347 to ground the conductor EPW**1** extending into Fig. 341 to operate the EPW relay therein as an indication that the process of walking over the various perforators with end-of-tape group is completed, this same ground in Fig. 347 will extend over contact **2** of the PW relay therein and over contact **6** of relay PTTI, contact **4** of relay STWP to conductor MRL extending into Fig. 356 to cause the operation of the MRL relay in the motor control circuit. Relay MRL, in operating, completes an obvious circuit for operating the six cut relays **0, 1, 2, 3, 4** and **5** in the tape cutter circuit of Fig. 356.

In the tape cutter circuit of Fig. 356, prior to the operation of any one of the cut relays **0** through **5**, a source **35603** of alternating current, through the agency of the rectifier **35604**, will have charged the various condensers **35605** through **35606** to a fairly high potential. Upon the operation of one of the cut relays **0** through **5**, two of these condensers will be discharged in circuits including contacts **2** and **3** of the associated cut relay and including a cut magnet for each of a pair of perforators, whereby the blank input tape of these perforators is severed. It will be noted that a manual cut key is provided in Fig. 356 whereby this cutting operation may be manually controlled at any time.

GENERAL DESCRIPTION OF APPARATUS SECTIONS

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1. *Purpose of circuit*

This circuit may be used to replace the separate assembler and computer circuits heretofore required in the automatic message accounting center for processing central office tape. It performs the following general class of functions.

1.1 Reads, identifies and checks input central office tapes.

1.2 Reads timing entries (answer and disconnect) from central office tapes and individually stores them, together with day and hour which appear as common information on the central office tape, in assembling registers for use when the initial entry of the call is read from the same tape as identified by the same call identity index.

1.3 Reads initial entries and stores them in either of two call registers, simultaneously registering with it whatever timing entries have been stored in the associated assembling register identified by the call identity index in the initial entry.

1.4 Computes in a portion of the circuit common to either call register, the elapsed time, chargeable time and/or equivalent representation of this time in accordance with the billing index furnished by the central office equipment in the initial entry.

1.5 Discards unanswered calls and calls to free or busy lines that are not required for service observation.

1.6 Perforates appropriate identification on each of the twelve output tapes: a maximum of ten for message unit calls and toll calls charged for on a message unit basis; one for detail billed calls or calls recorded on a detailed basis for record purposes and one for recording calls on which only partial information is available at the time of processing (straddle calls).

1.7 Perforates appropriate call entries on the aforementioned tapes after registering the output of the computer portion of the machine which is common to both call registers.

2. *General description*

2.1 *Input*

The principal inputs to this machine are central office recorder tapes. However, the machine is capable of two types of straddle call operations, that is, the handling of calls which are recived only in part on different tape sections.

For the feedback method of straddle operation, the machine will also handle as an input the output straddle tape of an assembler-computer of this type containing the starts of calls from the previous day associated with the same central office recorder tape as now being processed.

The following subsections list the entries which are found on both the regular and emergency central office recorder tapes and to some extent the entries that are placed by the assembler-computer on the straddle tape which is fed back.

2.11 *End-of-tape entries on central office tape*

At each 3 a.m. cutting point the central office recorder perforates two end-of-tape groups separated by

approximately 600 lines of splice pattern. An end-of-tape group is shown in the table below:

END-OF-TAPE GROUP

Digit	A	B	C	D	E	F
Entry:						
Round and Marker Group.	2	8	4	Round	Marker Group	
Day of Round and Month.	2	8	3	Day of Round	Month	
Recorder	2	8	0	(*)	Recorder	
(**)	2	8	5	X	0	0
End-of-Tape Hour	2	8	1	1	Hour	
Calendar Day	2	8	2	1	Calendar Day	

*5 Regular recorder—Central office tape.
6 Emergency recorder—Central office tape.
7 Regular recorder—Straddle tape.
8 Emergency recorder—Straddle tape.
**Optional line of end-of-tape group:
285500 Transfer in synchronism.
285600 Make-busy out of synchronism.
285700 Transfer out of Synchronism.

LEADING END-OF-TAPE GROUP

0 8 1 0 1 0—Plurality of lines of splice pattern E of T group

TRAILING END-OF-TAPE GROUP

E of T group
2 8 6 0 0 0
0 8 1 0 1 0—Plurality of lines of splice pattern

When the tape is cut the effect is to make a leading end-of-tape group on the end of the tape, which is processed first. During other central office operations, such as recorder made-busy or recorder transferred-to-emergency, end-of-tape groups are placed on the tape in two pairs. The two end-of-tape groups in each pair are identical and separated by splice patterns.

Each of the above transfer and make busy out-of-synchronism end-of-tape groups are identified by an additional line which appears in the group between the recorder number and the end-of-tape hour entry. On straddle tapes the recorder number is given a distinctive mark in the D digit so that regular and emergency parts of the straddle tape may be properly identified and checked as described later.

As may be seen in the above table, the end-of-tape group supplies the assembler-computer with the necessary common information that applies to individual call entries.

2.12 *Timing entries*

Each central office recorder tape contains the records of all calls handled by one hundred transmission circuits. The call elements from the circuits are mixed or interlaced but are perforated in the proper time sequence. The number of the transmission circuit which handles the call is recorded in the E and F digits of the first line of each entry and is known as the "call identity index."

The central office records each message on the tape in three separate elements: (1) initial entry, (2) answer time and (3) disconnect time. It is the call identity index which provides the means by which these call elements can be assembled in the accounting center. As described in paragraph 2.22 this is done by placing the timing elements of a call in one of a hundred registers from which they may be withdrawn when all elements are available in the assembler-computer at the same time. No distinction is made on central office or straddle tapes as to whether a timing entry represents the answer or the disconnect time. The table below shows the form of the timing entries on each of these types of tapes.

TIMING ENTRY ON CENTRAL OFFICE TAPE

A	B	C	D	E	F
(*)	Minutes			Call Identity Index	

TIMING ENTRY ON STRADDLE TAPE

A	B	C	D	E	F
2 2 (*)	8 8	1 2 Minutes	2 2	Hour Day Call Identity Index	

*1—Not timed release; 3—Timed release.

In addition to the timing entries, there appears on the central office tape at precise hourly intervals an entry which gives the value of the preceding hour which has been processed. The timing entries on the straddle tape show the associated hour and day because these consecutive hour entries are not copied onto this tape.

The central office tapes are inserted in the reader of the assembler-computer in a reverse manner from that recorded in the central office; that is, the last entries recorded on the central office tape will be the first entries to be read in the assembler-computer. With this arrangement the first entry of a call read on a central office tape will be the disconnect timing entry followed later by the answer timing entry and the initial entry in that order. This arrangement is rather essential to an assembler-computer operation since it would be more difficult to register in the one hundred assembling registers the initial entries of calls and then wait for the appearance of the associated answer and disconnect timing entries of the call before computation could take place. With the arrangement as designed the timing entries are stored to wait for the associated initial entry which, when it appears, is stored and acted upon by a common portion of the machine.

2.13 *Initial entries*

The initial entries are of either of two varieties, namely, four-line entries for detail record calls and two-line entries for calls which are bulk-billed.

INITIAL ENTRY ON CENTRAL OFFICE OR STRADDLE TAPE

A	B	C	D	E	F	
2	(*)	Billing Index		Call Identity Index		
0	Office Index Calling Line No.					
0	Area	Called Number Index		Called Office		Omit these lines on bulk-billed calls
0				Called Line Number		

*1. Bulk-billed call; 3. Detail billed call; 4. Observed call.

2.2 *Disposition of input information*

2.21 *Set-up and progress switches (Figs. 190, 191, 205, 206)*

The assembler-computer is provided with eighteen set-up switches (Figs. 190, 191, 205 and 206) which are set manually before the tape processing operation is started. These switches, together with two electromechanical rotary step-by-step switches (day progress switch **3112** of Fig. 31 and recorder progress switch **3205** of Fig. 32), are used to check the information in the end-of-tape groups on central office and straddle tapes read by this machine. They also provide the information for use on the output tapes as described in paragraph 2.4. The following is a list of the switches and their principal uses:

The day progress switch **2112** of Fig. 31 is of the electromechanical type and is initially set to indicate the round and day of round at which the processing of a central office tape is to start. The switch is of the 22-point variety but by the use of an electromechanical relay it is possible to represent each of the thirty-one days of a month in terms of day of round and round by a position of the switch. Each step of this switch in the forward direction, in effect, indicates the preceding day of round which is the order in which they appear on the central office tape. This switch is set at the beginning of processing of each central office recorder tape as indicated by the last day of round set-up switch **19100** and the last round set-up switch **19000**. Arcs on the day progress switch **3112** are used to check the sequence of the round and the day of round portions of the end-of-tape groups of entries. These arcs also indicate, through associated translator relays, whether the round and day of round read from the tape represent the round and day of round preceding those which are manually set on the switch. If so, the associated control circuit remembers this fact until such time as the switch **3112** may be stepped after processing all calls that were in progress during the round and day of round indicated.

The marker group tens and units set-up switches, **20600** and **19101**, respectively, are used to check the marker group in the end-of-tape group of entries. Marker group is constant for all central office tapes processed at the same time. The marker group set-up switches **20600** and **19101** give the circuit information in connection with the number of offices that are represented in this marker group and the type of sorting permissible for the message unit bulk-billed call entries that are perforated on the ten output tapes. These switches **20600** and **19101** also indicate the number of output tapes that are to be required for the message unit bulk-billed calls and the number of rounds into which the month for each particular marker group is divided.

The month-tens and units set-up switches, **19001** and **19002**, respectively, are used to check the corresponding information as it appears in the end-of-tape group of entries. These switches **19001** and **19002** indicate the month of the last part of the central office tape being processed. When the processing extends back into the preceding month these switches **19001** and **19002** provide the necessary translation to indicate the number of days in the month in process as well as the preceding month, so that the calendar day values and translations of day of round may be kept straight.

The recorder progress switch **3205** of Fig. 32 is used to indicate the number of the central office recorder tape that is being processed at a particular time. Set-up switches **19102, 19103** and **19104, 19105** indicate the respective tens and units digits of each of the first and last recorder tapes which are to be processed. These switches **19102** to **19105** give the range of recorders while the recorder progress switch **3205** indicates the particular recorder which is being processed. The recorder progress switch **3205** is set on the first recorder number at the beginning of processing. Thereafter, each recorder entry of the end-of-tape group is checked to make sure that it agrees with the recorder number set up on the recorder progress switch **3205**. The recorder numbers must progress one number at a time from the first recorder number to the last recorder number. Interlocks between the day progress (Fig. 31) and recorder progress (Fig. 32) insure that for each recorder the tape sections progress from the last day of round and last round, as indicated on the switches **19100** and **19000**, the first day of the first round, as indicated on the first day of round and first round set-up switches **19003** and **19004**.

In the case of straddle tapes, which are fed back, the processing may continue beyond the first day of the first

round. No check is made as to how far this straddle tape processing may continue. However, when the recorder number changes all call information in the machine must have been cleared out. This indicates that all call information for a given recorder has been completely processed. When a change in recorder number is detected, the machine takes certain actions with regard to disposing of any call information which may be retained in it and then the day and recorder progress may be changed to suit the conditions of the end-of-tape information which is thereafter to be read.

The straddle class set-up switch **20500** is used to indicate either of two modes of operation which this machine may perform with regard to the eventual disposition of straddle calls. In one position ("F") this switch **20500** provides for a feedback of the straddle call information such that a tape made therefrom may be read after the central office tape of the same recorder on the following cutting period. The other class of straddle operation (position "SIE" on switch **20500**) is arranged to provide for the splicing-in of the emergency central office tape at the proper point in the regular recorder tapes of the central office. In this way the larger percentage of the total straddle calls are assembled by this machine automatically. However, 3 a.m. straddle calls will still require manual processing and these appear on the output straddle tape for verbatim printing by a regular printer of the AMA accounting center. With the feedback method of straddle operation the straddle tape being received from the preceding day's operation is prepared so that the emergency transfer straddle call information is assembled in the proper order on the straddle tape. This operation is described in more detail later.

Two sets of switches entitled "Emergency at previous cutting period" and "Emergency at current cutting period," are provided and used when the spliced-in-emergency type of straddle operation is employed. These sets **20601**, **20602** and **20603**, **20604** are set up for respective tens and units digits of recorders for which the emergency recorder was acting at the time in question. The purpose of these switches **20601** to **20604** is to enable the completion of the recorder progress when the emergency recorder tape is in use at the 3 a.m. cutting point for either the previous or the current cutting period. In either of these cases no regular recorder tape will appear before or after the processing of the emergency recorder tape and these switches provide this information.

The sort set-up switch **20501** is used to indicate which of eight possible modes of operation are to be taken in the handling of message unit (bulk-billed) calls. The actual number of perforators to be used and the type of information which they are to contain is dependent upon the setting of this switch **20501** together with the information obtained from the marker group set-up switches **20600** and **19101** as regard to the number of offices which are handled and the number of types of message units which are handled by the central office equipment.

2.22 *Assembling registers*

After the end-of-tape group has been checked against the set-up switches and the progress switches have been set in the position indicating the tape and period which are being handled, the call element entries are read from the tape. Each timing entry is stored in an assembling register which is numbered to correspond with a call identity index. When a timing entry is received it is placed in its associated assembling register together with the hour and day which are taken from the set-up information and from information stored in the machine from the end-of-tape group. Each assembling register has a capacity of storing two timing entries (including the day, hour and minute) which represent the answer or commence and the disconnect or terminate times of a call.

At the beginning of the processing of a central office recorder tape, a relay in each assembling register is operated to indicate that the first call handled by that assembling register may be a straddle call. Once any stored information from this register has been taken out and used to form tape entries as a result of the reading of an initial entry, this first call indication is dropped. Thereafter, the call entries that are received for that assembling register may be considered to represent a complete call, that is, one which is not straddled from one tape to the next.

The assembling register also stores the indication as to whether or not a timing entry occurs on the central office tape as a result of a timed release operation in the transmission circuit. This indication may occur and is registered only on disconnect timing entries.

2.23 *Initial entry (call) registers*

The two or four lines of an initial entry are registered in call register portions of the assembler-computer machine. Two such portions are provided, one being known as the odd and the other as the even call register. The first line of each initial entry includes as a part thereof the call identity index with which the entry is associated. These digits (tens and units digits of the call identity index) also indicate in which assembling register any timing entries associated with this call are located, if any. The call registers therefore receive from the assembling registers this timing entry information concurrently with the registering of the successive lines of the initial entry. By the time the second line of the initial entry has been registered all of the timing information taken from the assembling registers is reregistered in the same call register portion of the machine and the actions as described in section 2.3 may begin.

On some calls the central office recorder places only one timing entry (the answer time) on the tape. In such cases and when no straddle call is indicated, the call register control places the same time in both the answer and disconnect time call registers to cause a zero elapsed time calculation due to the uncertainty of the disconnect time. Such a call will be charged only for the initial period for that type of call.

Once timing entry information for a given call is transferred from its assembling register to a call register the assembling register may be released and thereby prepared to receive information on the next call which the corresponding transmission circuit in the central office handled.

The odd and even call registers are used alternately. This enables the circuit to completely register one call while computing and perforating a second call. During either of these operations the circuit may continue to record time entries in the various assembling registers.

2.24 *Hour entries*

In addition to the end-of-tape hour entries which occur as part of the end-of-tape group, there appear on central office tapes hour entries which mark every hour as it occurred in the central office. These entries, as they occur, are registered and checked in an hour circuit which then provides the proper hour information for the timing entries as they are registered in the assembling registers as described in section 2.22.

The hour circuit consists of two identical parts which are labelled odd and even hour registers. The end-of-tape hour is initially registered in the even hour register. The first regular hour entry occurring thereafter is registered in the odd hour register. A check is made to insure that the value of the hour read from the regular hour entry is one less than that read on the previous hour entry, if it was a regular hour entry. If it was an end-of-tape hour entry and was followed by a regu-

lar hour entry, the circuit checks that these two entries agree as to hour value. Once a regular hour entry is registered and checked the other hour register is released and the output from the register containing the last hour read is used to provide the latest hour information to the assembling registers and to certain of the output perforating patterns. By means of hour output connectors the hour value is decreased by one in these operations over what is actually registered from the hour entry.

The central office tape may also contain irregular (apology) hour entries. These entries indicate that the regular hour entry was either mutilated or missing. The circuit in that case automatically receives its hour value in the alternate register from the output connector of the other hour register instead of from the tape reading relays. Since the output connector provides the hour registration with one hour subtracted, the hour as registered in the other hour register is one less and consequently agrees with what would have been received had a regular hour entry not been missing or mutilated.

2.25 *Day entries*

As part of the end-of-tape group, the calendar day entry gives the correct calendar day for each end-of-tape group. This day is registered in a relay register and is used for providing the day associated with timing entries which are registered in the assembling register. The actual units value of the calendar day is the day registered in the assembling registers on each timing entry. Care is taken to insure that as the days progress these day units digits also progress uniformly in a decreasing manner. Hence, when a month change is reached the units digit of the day placed in the assembling registers does not necessarily agree with the units of the day as registered from the calendar day entry on the tape. This translation is described more in the detailed portion of this description. (See sections 3.035, 3.036, 4.112, etc.) Means are provided so that should the power fail and the day entry registered be lost, the calendar day may be reconstructed from the position of the day progress switch and hence the proper day may be placed on all timing entries occurring thereafter.

2.3 *Action taken on calls*

2.31 *Computation of chargeable time*

The common computer portion of the circuit is automatically connected with the call register which is to receive the next call. Usually, therefore, the computer portion of the machine is connected with the call register prior to its receiving a call. However, in some instances the call register may have to wait for association of the computer portion of the circuit with it before proceeding. The day, hour and minutes of the answer and disconnect time are placed in the subtractor portion of the computer which automatically determines the elapsed time and rounds this time off to indicate the nearest minute, within all allowance, which has elapsed and for which a charge may be made. This is known as "chargeable time." In this computer the subtractor is arranged to automatically make the allowance and round off at the same time that it determines the elapsed time. This is described in more detail later. The billing index taken from the initial entry indicates what method of charging is to apply to this call and to its chargeable time.

2.32 *Translation of billing index*

It is assumed that one hundred billing indices are available in the central office for recording the type of billing treatment. In this case no provision need be made, as in the previous machines, for indicating a different treatment of the same billing index number for each marker group. Therefore, a billing index number has the same significance regardless of which marker group is being processed. The tens digit of the billing index indicates whether the message being computed is a toll call, message-unit-detail or message unit type of call. In either of the latter two cases, the type of messages which are represented is also determined from this billing index tens digit.

The billing index units digit indicates which of a number of formulas is to be used in computing the number of units which are represented by the computed chargeable time. In addition to these formulas, which take into account an initial period, an initial charge, each overtime period and an overtime charge for each period, there is provided a single message unit for each call regardless of length of elapsed time. Bulk-billed messages are computed in terms of local or toll message units depending upon the significance of the billing index tens digit. Toll messages, detailed billed, may use the unit formulas to determine the number of five-cent toll units to be charged. For calls on which no message or toll units are computed provision is made for indicating this fact from the billing index units digit.

2.33 *Computation of message units*

The billing index units digit selects the formula to be used in computing the number of message or toll units required to be charged on a call for which a given chargeable time has been previously computed. The desired formula is connected to the chargeable time subtractor and the output of the formula is translated and registered in a call register for perforation on the output tapes. Where no message units are computed the zeros are placed in the corresponding message units registers in the call register portion of the machine.

2.34 *Determining output class of call*

Associated with each call register portion of the assembler-computer is a register control circuit which controls not only the reading into the registers, but also controls the release of these registers in preparing them for use on later calls. The call register control contains information as to whether two, one or no timing entries were taken from the associated assembling register for a particular call. The call entry register control also receives from the assembling register at the time that the information contained therein is reregistered in the call register, information as to whether this call may possibly be a straddle call. This information together with information received from the computer as a result of the billing index translation and the computation of chargeable time and message or toll units determines the class of output to be used in perforating this call on output tapes or in completely discarding the information on this call. The types of output classes together with their abbreviations are listed below:

TYPES OF OUTPUT CLASSES

Straddle—bulk initial	2I
Straddle—detail initial	4I
Straddle—one timing and bulk initial	1T2I
Straddle—one timing and detail initial	1T4I
Straddle—two timing	2T
Straddle—one timing	1T
Detail	D
Overcapacity—detail	OD
Overcapacity—message unit	OM
Message unit—less than 10 units—one line	1M
Message unit—more than 10 units—two lines	2M
Message unit detail—less than 10 units	1MD
Message unit detail—more than 10 units	2MD
Observing—non-answered	LODA

Six of these output classes are straddle output and thus require the use of only the output straddle tape. The first four of the straddle output classes are what may be called "call starts," that is, the initial portions of

calls consisting of either the initial entry alone or the initial entry and one timing entry which would, of course, be the answer time. The latter two straddle output classes are those which are "call ends," that is, a single timing entry or two timing entries, both without the initial entry. In certain extreme cases it is possible for a straddle call to be divided among three tapes in which case a single timing entry may be an answer time on a call for which another single timing entry representing the disconnect time appears on a different tape.

There are two classes of message unit outputs. Calls which have been computed on a message unit basis may have ten or more message units or may have less than ten message units. Each of these requires different treatment since the number of lines perforated on the message unit tapes in each of these cases differs. The message unit detail class of call requires that, aside from the regular message unit tape entries, an entry be placed on the detail tape to indicate the details of the records of these calls. The detail output class is used for all regular toll calls.

The computation formulas may also be used in connection with detail calls to compute toll units which may be converted into charges in dollars and cents. On this class of call the message unit formulas are used to determine toll units but there are no corresponding message unit entries placed on message unit tapes.

Two of the classes deal with the messages which are known as overcapacity. In these cases the chargeable time as computed exceeds that which can be handled by an entry which indicates the chargeable time or the particular number of message units. In this case the time of origination (answer or commence time) and the disconnect time (or terminate time) are given in terms of day, hour and minute and from these times the operator manually computes the chargeable time and the charges.

Overcapacity messages are two types—detail or message unit since in the latter case, the called line number and office are not known. Calls of the overcapacity class are placed on the detail tape. In addition, observed calls, including those not answered, are placed on the detail tape. This is a final class of call. In determining the call class a duplicate network of contacts running through the call register control and computer control determines the number of lines of tape which are to be perforated for each class. The output class and the number of lines to be perforated are registered in the call entry portion of the machine. This is passed along to the perforate control portion of the machine when it is available for perforating these output classes.

2.35 *Discarding calls*

The same networks which determine the number of lines and the output class of the call described in the preceding subsection (2.34) are also used to determine when a call is to be discarded. This occurs when it is found that a call is not the first call in an assembling register but that there are no time lines associated with the call in the selected assembling register. In this case all of the information recorded in the call register, which consists principally of the initial entry, is discarded and the call register is made available for the next alternate initial entry which occurs on the tape.

2.36 *Sorting output message unit calls*

The sort set-up switch provides for eight different modes of circuit operation in connection with message unit calls on the ten message unit output tapes. These eight different modes of operation may be employed only with certain types of offices. Marker groups which contain but a single office and which employ message unit charging of but one type may be sorted by the units or thousands digit of the calling line number. Provision is made so that the message unit tape need not be sorted at all. Marker groups which contain but a single office but which office provides more than one type of message unit may be handled in any of five different ways. Three of these have been described above, namely, sorting by thousands, units or not sorted at all. In addition the calls may be sorted by the type of message unit—a mode of operation employed where only calls to local areas are placed on one tape whereas calls using the other types of message units to contiguous areas are placed on a second tape. For marker groups containing more than one office three modes of operation are available if only one type of message unit is employed. The calls may be sorted by office or by principal office only. That is, the main office in the marker group which is usually called a physical office may be separated from the theoretical offices but all theoretical office calls are placed on one tape. In addition it is possible with only one type of message unit but a number of offices to leave the messages unsorted. Where the marker group contains more than one office and each office has several types of message units the calls must be sorted by principal office only, by the types of message unit, by sorting out local message units or by sorting by both message unit and office. These modes of operation are described in more detail later in this description.

Class Abbreviation	Types of Message Unit Message Sorts	Sort Switch Position
NS	No sort	6
SBTH	Sort by Thousands Digit of Calling Line Number.	2
SBU	Sort by Units Digit of Calling Line Number	3
SBO	Sort by Calling Offices	4
SOPO	Sort out Principal Calling Office of Marker Group.	5
SBOUT	Sort by Calling Offices and Type of Message Units.	9
SOLU	Sort out Local Message Unit Calls	8
SBUT	Sort by Type of Message Units	7

Sort Class	Marker Group	Types of Message Units	No. of Mess. Unit Tapes
SBTH	Single Office	One	10.
SBU	do	do	10.
NS	do	do	1.
SBTH	do	Plurality	10.
SBU	do	do	10.
NS	do	do	1.
SBUT	do	do	One per M.U. Type (5 maximum).
SOLU	do	do	2.
SBO	Multi-Office	One	One per Office.
SOPO	do	do	2.
NS	do	do	1.
SBO	do	Plurality	One per Office.
SOPO	do	do	2.
NS	do	do	1.
SBUT	do	do	One per M.U. Type (5 maximum).
SOLU	do	do	2 Times No. of Offices (2 tapes per office).
SBOUT	do	do	One per M.U. Type per Office.

2.4 *Perforating output information*

The perforating portion of the machine is common to both call register portions. Hence means is provided so that only one call may be perforating an output entry at any one time. However, one call register may be using the computer portion of the machine while the other call register is using the perforate portion. Associated with each call register portion of the machine are a number of pattern connector relays. Each pattern connector represents a line of an entry which may be perforated.

The output class determines in which line of an entry a given pattern is to be used. Each perforator is associated with a perforator connector which connects it with

the pattern connectors of both groups. In addition there are a number of common pattern connectors which perforate information on tapes from the common portions of the machine, particularly those which deal with the end-of-tape entries. A set of check relays is provided to insure that every entry as perforated on the tape meets the requirement of two and only two holes perforated in each five-element digit.

The control portion of the output of this machine has a counting circuit which counts the lines of tape as they are perforated and steers the output class to the next pattern connector to be used. This perforate line count also determines when the last line of an entry is perforated and thereby enables the call register controller to release the call register and the output control so that the next call may be handled.

2.41 *End-of-tape entries on straddle tape*

With the feedback method of straddle operation, it is essential that the straddle tape be provided with end-of-tape groups of entries which are similar to those that would have been received on a regular central office tape. Hence as the end-of-tape groups are read from the central office tape, they may be copied onto the straddle tape.

Since the end-of-tape groups appear on the central office tape in pairs it is not necessary that these pairs be entirely copied onto the straddle tape. The circuit is arranged to delete the second of the pairs of end-of-tape group entries. In some cases it completely skips end-of-tape groups which are superfluous and in other cases it performs certain functions in the circuit before allowing an end-of-tape group to change the setting of the recorder or day progress switches so that the previous recorder or day of round may be copied onto the straddle tape to close a portion of that tape with the proper end-of-tape group.

2.42 *Tape identity entries on detail and message unit tapes*

After the first end-of-tape group has been identified on the first central office recorder tape being read, the reading of call entries from the tape is halted until tape identity group is placed on the detail tape and on each of the message unit tapes which is to be used. The number of message unit tapes to be used is determined as described in Subsection 2.36 and is the result of the sort class switch settings together with certain cross-connections resulting from the selected marker group. The following table indicates the formation of a tape identity group.

TAPE IDENTITY GROUP

A	B	C	D	E	F
2	8	9	1	Tape Index	
2	8	9	2	Marker Group	
2	8	9	3	First Recorder	
2	8	9	4	Last Recorder	
2	8	9	5	Office Index	0
2	8	9	6	9	0
2	8	9	7	Day of Round	
2	8	9	8	First Tape Section	Last Round
2	8	9	9	Month	

LEADING TAPE IDENTITY

0 8 1 0 1 0—plurality of lines of splice pattern T.I. group

TRAILING TAPE IDENTITY

T.I. group
2 8 6 0 X X (XX=machine number)
0 8 1 0 1 0—plurality of lines of splice pattern

The digits for the tape index are as given in the following tables with the meaning of each such index:

TAPE INDEX UNITS DIGIT

Value	Meaning
0	M.U. Type Sorted (More than one office).
1	Office Sorted.
2	Thousands Sorted.
3	Units Sorted.
8	Unsorted (more than one M.U. Type and Office).
9	Unsorted by M.U. Type.

TAPE INDEX TENS DIGIT

1	M.U. Tape.
5	Detail Tape.

The marker group, first and last recorder, office index and first and last day of round and round are taken from the set-up switches described in Section 2.21. The tape section number identifies the number of the tape from 0 to 9 for the ten message unit tapes. In the case of office sorted tapes the office index indicates the actual office index as it appears in the initial entries. For tapes that are not office sorted this index value together with the marker group indicates what type of information is contained on the tape. Knowing the units digit of the tape index and the number of types of message units associated with any given office in the marker group it is possible to construct a digit for this index which will indicate the particular type of sort treatment which was received by this tape in the assembler-computer processing.

2.43 *Message unit entries*

There are two types of entries which may appear on the message unit tapes. One entry is a single line entry used when the number of message units is less than ten. This entry is known as a one-line message unit entry.

ONE-LINE MU ENTRY

Pattern	A	B	C	D	E	F
MU1	1	MU	Calling Line No.			

This entry may not always be used when the number of message units is less than ten. If there are several types of message unit calls on the same tape, or if the number of message units exceeds 9, the more general message unit entry is the two-line message unit entry.

TWO-LINE MU ENTRY

Pattern	A	B	C	D	E	F
MU2	0	Type of MU	0	0	Mess. Units	
MU1	2	Office Index or Type of MU or 0.	Calling Line No.			

The B digit of the first line of this entry is capable of indicating either the office index or the type of message unit, depending upon whether the tape upon which it is located represents a plurality of offices or a plurality of types of message unit calls. In any event the B digit of the second line of this entry always indicates the type of message units which are involved and the number of message units involved may be as great as 99. When more than 99 message units are required to form a message unit entry the call is considered as overcapacity and is placed on the detail tape for manual accounting.

Two-line message unit entries are used in some cases in order to get longer tape runs and less splicing through the sorter stage in the accounting process.

2.44 *Detail entry*

There are two entries which appear on the detail tape.

One is known as the detail entry and is used for all toll calls and message unit detail calls. This entry is five lines as shown below:

DETAIL ENTRY

Pattern	A	B	C	D	E	F
D5	0	Observing Index	Chargeable Time		Message or Toll Units	
DOI4	0		Called Line No.			
DOI3	0	Area	Class and Called No. Index		Called Office Code	
DO2	0		Start Time Line			
DOI2	1	Office Index	Calling Line No.			

It contains all the information that appeared in the initial entry of the call together with the start time taken from the answer time and with the chargeable time and message or toll units computed on this call.

The observing index represents one of four conditions depending upon whether or not the call was observed and if so what the charges, if any, represent.

0 Not observed
1 Observed—answered
3 Observed—cancel call charge or not answered
4 Observed—cancel overtime charges

The called number and class index is a combination of the called number index as received from the initial entry and the class as interpreted from the tens digit of the billing index of the initial entry.

CALLED NO. AND CLASS INDEX

Class	Called Number		
	3 Numerals	4 Numerals With or Without Party Letter	5 Numerals
Toll	0	1	2
Mess. Unit	3	4	5
Mess. Unit Detail	6	7	8

The message unit class of detail entry occurs only on observed calls. The observing index and called number index in combination may indicate a message unit detail observed call.

2.45 *Overcapacity entry*

The overcapacity entry is placed on the detail tape when the computed chargeable time or the number of message or toll units exceeds the capacity of the computer portion of this machine. The overcapacity entry shown below is a six-line entry and contains in addition to the information given in the detail entry (except chargeable time and message or toll units) the disconnect time in day, hour and minutes and the answer minute tenths.

OVERCAPACITY ENTRY

Pattern	A	B	C	D	E	F
06	0	Mess. Billing Index Units	Disconnect Day		Disconnect Hour	
05	0	Observing Index	Disconnect Minutes		Answer Min. Tenths	
DOI1 *	0		Called Line No.			
DOI3 *	0	Area	Class and Called No. Index		Called Off. Code	
DO2	0		Start Time			
DOI12	3	Office Index	Calling Line No.			

* If overcapacity message unit—fill in with common pattern 000000.

2.46 *Straddle entries*

The entries which appear on the straddle tape have been covered in the input entries described in paragraphs 2.12 and 2.13 since these entries are similar to the entries which appear on central office tapes and must be received on the input of an assembler computer under the feedback mode of straddle operation. The only variation in this pattern is that the timing entries now consist of three lines instead of one. The timing line containing the minutes is preceded by a line which gives the hour and another line which gives the calendar day on which the timing entry was received. The circuit on receiving these entries checks to make sure that a complete group of three entries is recorded since the hour entries and calendar day entries are not received in numerical succession from the straddle tape.

2.47 *Forming call entries*

The output class and number of lines registered by the call registers indicate to the output perforator control the exact line patterns which are to be perforated. The table below shows the line count order and the patterns which make up each output class.

FORMING CALL ENTRIES

Output Class		No. of Lines	Line No.—Count Down							
			8	7	6	5	4	3	2	1
2I	Tape Pattern	2							S I1	S DOI2
4I	do	4					S I1	S DOI2	S DOI3	S DOI4
1T2I	do	5				S T1D	S T2D	S T3D	S I1	S DOI2
1T4I	do	7		S T1D	S T2D	S T3D	S I1	S DOI2	S DOI3	S DOI4
2T	do	6			S T1D	S T2D	S TsD	S T1A	S T2A	S T3D
1T	do	3						S T1D	S T2D	S T3D
D	do	5				D DOI2	D D02	D DOI3	D DOI4	D D5
OD	do	6			D DOI2	D D02	D DOI3	D DOI4	D 05	D 06
OM	do	6			D DOI2	D D02	D 0	D 0	D 05	D 06
1M	do	1								MU MU1
2M	do	2							MU MU1	MU MU2
1MD	do	6			MU MU1	D DOI2	D D02	D DOI3	D DOI4	D D5
2MD	do	6		MU MU1	MU MU2	D DOI2	D D02	D DOI3	D DOI4	D D5
LODA	do	5				D DOI2	D D02	D DOI3	D DOI4	D D5

The line count is arranged so that it always starts at a point in the line count circuit indicated by the number of lines determined in the call entry register control. In the case of the message unit detail classes 1MD and 2MD the line count circuit also determines when a different perforator is to be called in so that a message unit entry is placed on a message unit tape and a detail entry placed on the detail tape. The line count is so arranged that when counting down to one, the last line always appears at line one.

2.48 *Window pattern*

The circuit is arranged so that when a window is detected in the blank paper supply of one of the twelve output perforators the machine stops processing the regular calls and automatically places over this splice a special window splice pattern. The window splice pattern for the detail and message unit tapes consists of a line 287020, a block of splice pattern lines 081010 and finally a 287020 as shown below:

WINDOW PATTERN ON DETAIL AND MESSAGE UNIT TAPES

2 8 7 0 2 0
0 8 1 0 1 0—plurality of lines of splice pattern
2 8 7 0 2 0

On the straddle tape the window pattern must appear as it does on central office tapes. Hence, when a window is detected in this tape, a window pattern consisting of an end-of-tape group, taken from the latest end-of-tape information available in the tape identity portion of the machine, followed by a plurality of lines 081010 and again followed by an end-of-tape group that is placed on the straddle tape as shown below:

WINDOW PATTERN ON STRADDLE TAPE

End-of-tape group
0 8 1 0 1 0—plurality of lines of splice pattern
End-of-tape group

2.5 *Miscellaneous actions*

In addition to the regular actions described above in handling call entries the circuit takes a number of special actions particularly in connection with the handling of straddle calls. These actions are described in the following two subsections.

2.51 *Setting assembling registers*

Once the end-of-tape of the central office tape has been read the output tape identity and end-of-tape is perforated on the output tapes as described in Sections 2.41 and 2.42. Before perforating the end-of-tape pattern on the straddle tape all the assembling registers are set to indicate that the first call which they receive may be a straddle call as described in Section 2.22.

When an assembling register is released after the first call is handled for it, this first call indication is restored to normal. Thereafter, calls processed are of one of three varieties: not answered when the initial entry appears alone, cancel overtime when one timing entry alone appears in assembling register at the time the initial entry is received and full charge call when the two timing entries appear in the assembling register at the time the initial entry is received.

2.52 *Cancel entries*

Several types of cancel entries are received from the central office tape. These entries indicate that due to timing difficulties in the central office all of the charges on all the calls in progress served by this recorder are in doubt. Hence, to avoid false charging one or both of the timing entries on all calls in progress at that time may be cancelled.

The receipt of an out of synchronism signal, such as a 2856 or 2857, as part of an end-of-tape group is used to wipe out of the assembling registers all single time entry calls. Any assembling register which contains two timing entries is unaffected by this cancellation signal. Should the second timing entry of a call occur after this cancellation the call will then be interpreted as a single time entry call and consequently charges will be made only for the initial period.

Another cancel entry which may occur at any point on a central office tape is 285400. This cancel entry, known as a "charge guard entry," cancels the charges on all calls in progress irrespective of whether one or two timing entries have been received. Under certain types of trouble conditions which stop the machine, it is also desirable to cancel all of the charges or merely the overtime on all calls in progress. In this case a special key is provided which is operated by the attendant in combination with the machine release key, under a circuit release and alarm restoral condition, to cancel these charges and to release the timing records from all assembling registers.

2.53 *Clearing call ends from assembling registers*

With the feedback type of straddle operation it is expected that no call ends will be left in assembling registers at the end of processing each recorder tape and its associated straddle tape for a given cutting period. However, for the spliced-in-emergency method of straddle operation the call ends of calls which were originated during the previous cutting period will appear in the assembling registers when a change in recorder number is detected on the central office input tape.

The circuit is arranged so that under this class of straddle operation the timing entries in the assembling registers are taken out of one assembling register at a time and are formed into straddle output entries of the class 2T or 1T. The call entry registers are used for this type of operation alternately as if regular calls were being read from the central office tape. A combination of a walking circuit and a lockout circuit is used to detect the assembling registers in which timing entries have been left and to indicate the sequence in which these registers will be cleared out.

2.54 *Resetting recorder, hour or day registers*

In the event of a power failure or trouble with any of the recorder, hour or day entries of the central office tape, it is desirable to provide means by which the proper recorder or day may be inserted in their associated registers from the recorder or day progress switches. Should trouble develop with an hour register, means are provided for inserting a fictitious hour 25 for this purpose until the next regular hour appears to permit normal recorder, hour or day registers to be filled by their appropriate counterparts.

3. *Functional description of figures and relays*

3.001 *Fig. 10—motor control*

This apparatus controls the starting and stopping of the reader motor.

Relay RR–**1000** supplies alternating-current power from the source **1012** thereof to the reader motor **702** of Fig. 7.

Relay MST–**1001** controls the motor power relay RR–**100**, prepares the operate path for the reader step magnet **700**, prepares to allow the start of alarm timing and locks under control of the emergency motor stop key **1004** and the alarm relay AL–**1005**.

Relay RLM–**1002** operates from the motor start key **1006** and locks to the machine release key **1200** to remember when the latter key is operated, thereby enabling the machine to stop at a convenient stopping point.

Relay MRL–**1003** releases the entire machine and restores it to normal at the end of all tape processing. It also controls the cutting of the input tapes at that time.

The master release key **1007**, in combination with the machine release key **1200**, is used to restore the entire machine to normal under unusual circumstances.

3.002 *Figs. 11 and 12—off-normal and start*

This apparatus controls the operation of the reading relay connector RC–**900** and provides all circuits for holding other parts of the circuit off-normal either during the entire machine's operation or during the operation until a convenient or alarm stopping point is reached.

Relay ST**1**–**1100** operates from a reader back contact (**K3** in Fig. 8) to start the process of getting the circuit in phase with the reader (Figs. 7, 8 and 9) at the time that the latter is connected to the reading relays (Figs. 13, 14 and 15). Relay ST**1**–**1100** also operates the reading relay connector RC–**900** and controls the reader step check relays (Fig. 16) so that they may get into phase with the reader drum in its present position.

Relay ST**2**–**1101** detects the start of the first closed period after relay ST**1**–**1100** has operated and prepares for the operation of relay ST**3**–**1102** on the next open period of the reader cycle.

Relays ST**3**–**1102** and ST**4**–**1103** provide off-normal grounds and control conditions for the circuit when operating normally. These grounds and conditions are removed when the machine stops due to an alarm or a release condition.

Relay MON–**1201** provides master off-normal grounds and other circuit conditions for all other parts of the circuit. These grounds and circuit and circuit conditions remain while the machine is processing or until a power failure occurs.

Relay RL**0**–**1202** repeats the inverse of the operations of the machine release key **1200** to provide more contacts therefor. The machine start key **1200** controls the operation of relays ST**1**–**1100** and ST**2**–**1101** in starting the connecting and synchronizing of the reader with the reading relays. The machine release key **1200** is used to stop the machine at a convenient stopping point or to restore the machine to normal after an alarm condition. The simultaneous operation of the machine release key **1200** with the hour release, day release or recorder release keys **1203**, **1204** and **1205** restores the corresponding registers to normal. The simultaneous operation of the machine release and master release keys **1200** and **1007** restores the entire machine to normal. The simultaneous operation of the machine release and release assembling register keys **1200** and **1206** controls the restore-to-normal of all information registered in the assembling registers.

3.003 *Figs. 7, 8 and 9—reading relay connector*

This apparatus connects either the reader reading pin contacts or the assembling register walking and lockout circuits to the reading relays for interpretation of digits read from the tape or of digits representing the assembling register numbers when being read out under certain types of straddle conditions.

Relay RC–**900** connects the rear reading pins of Fig. 7 to the reading relays of Figs. 13, 14 and 15. It also connects certain control leads of the reader to the reading relays and to other parts of the circuit for controlling the circuit action when reading from the reader.

Relay WC–**901** connects the assembling register walking and lockout circuits to the E and F digit reading relays of Fig. 15. It also connects certain control leads of the reader to the reading relays and to other parts of the circuit for controlling the circuit action when reading from the reader.

3.004 *Figs. 7, 8, 9—reader*

These figures cover the wiring associated with the reader used in the machine. This reader is arranged to advance the tape whenever the step magnet **700** is energized. This action is controlled by the reader step control circuit (Figs. 26 and 27). A tape feed key **701** is provided on the reader to enable the attendant to feed tape into the reader provided the circuit is normal as indicated by a back contact on relay ST**3**–**1102**, or while

the circuit is prepared to perforate trailing tape identity and end-of-tape groups. The reader perforate contacts of Fig. 8 connect with various register circuits for purposes of perforating the information contained therein, as will be discussed hereinafter. The connections are as shown in the following table:

CONNECTIONS OF CALL REGISTERS TO READER-PERFORATE CONTACTS

B digit:
- Called area (Figs. 87 and 140)
- Called No. thousands (Figs. 89 and 142)
- Office index (Figs. 85 and 138)
- Sort digit (Figs. 93 and 146)
- Disconnect minute tens (Figs. 78 and 131)
- Input class (Figs. 83 and 136)

C digit:
- Called number index (Figs. 87 and 140)
- Called No. hundreds (Figs. 89 and 142)
- Calling No. thousands (Figs. 85 and 138)
- Disconnect minute units (Figs. 78 and 131)
- Billing index tens (Figs. 83 and 136)
- Answer minute units (Figs. 82 and 135)
- Message units tens (Figs. 94 and 147)

D digit:
- Called office code A digit (Figs. 87 and 140)
- Called No. tens (Figs. 89 and 142)
- Calling No. hundreds (Figs. 86 and 139)
- Chargeable time units (Figs. 94 and 147)
- Disconnect minute tenths (Figs. 79 and 132)
- Billing index units (Figs. 84 and 137)
- Disconnect day units (Figs. 91 and 144)
- Message units tens (Figs. 94 and 147)

E digit:
- Called office code—B digit (Figs. 88 and 141)
- Called No. units (Figs. 90 and 143)
- Calling No. tens (Figs. 86 and 139)
- Call identity index tens (Figs. 84 and 137)
- Answer hour units (Figs. 80 and 133)
- Answer minute tenths (Figs. 82 and 134)
- Chargeable time tens (Figs. 93 and 146)

F digit:
- Called office code—C digit (Figs. 88 and 141)
- Called No. station (Figs. 90 and 143)
- Calling No. units (Figs. 86 and 139)
- Call identity index units (Figs. 84 and 137)
- Answer day units (Figs. 92 and 145)
- Disconnect hour units (Figs. 77 and 130)

Miscellaneous digit:
- Answer hour tens (Figs. 80 and 133)
- Message unit type (Figs. 95 and 148)
- Disconnect day tens (Figs. 91 and 144)
- Disconnect hour tens (Figs. 77 and 130)
- Answer minute tens (Figs. 81 and 134)
- Answer day tens (Figs. 92 and 145)

3.005 *Fig. 13—A digit reading relays*

The A**0**–**1300**, A**1**–**1301** and A**2**–**1302** relays are used to read the three holes in the A digit of the tape in the reader when connected thereto. These relays are provided with a check path which insures that one and only one is operated or that all three are operated. These relays are provided with locking contacts to enable the reading indication to be maintained across a splice in the tape. These relays distinguish a line with a 0 in the A digit from one with a 2 in the A digit to separate end-of-tape patterns (28CDEF) from splice pattern entries (081010). These relays give an indication to the assembling registers as to whether the A digit on a timing entry being read was a 1 or a 3. These relays distinguish between timing and initial entries once it is known that the B digit is not an 8.

Relay A**0**–**1300** cancels the timing when skipping splice pattern. Relay A**0**–**1300** also controls the restore-to-nor-

mal of the circuit after a release key operation until after the supplementary entry lines are skipped.

3.006 *Fig. 13—B digit reading relays*

These relays **B0–1303, B1–1304, B2–1305, B4–1306** and **B7–1307** operate in the additive or two-out-of-five code to indicate one of ten possible digit values in the B digit position of a tape entry line being read when connected. A check path is provided to insure that two and only two of the five relays are operated. Locking circuits are provided for these relays to enable the reading pattern to remain when skipping splices. These relays distinguish a B digit of 8, used for special control and end-of-tape entries, from a B digit not 8, usually employed for call entries. Contacts are provided to enable the digit as read to be transferred to the call entry registers or to be read into the assembling registers as minute tens in the following code:

B Digit	Minute Tens
4, 7	2, 4
0, 1	0, 1
0, 2	0, 2
1, 2	1, 2
0, 4	0, 4
1, 4	1, 4

3.007 *Fig. 14—C digit reading relays*

These relays **C0–1400, C1–1401, C2–1402, C4–1403** and **C7–1404** also operate on a two-out-of-five basis and are provided with a check path for this purpose. They are also provided with locking contacts to enable the passing of a tape splice point. In addition, these relays contain a decimal translation network for use on entries which have an A and B digit of 28. These relays also have contacts for controlling the registration of the digit contained therein into the assembling registers or into the call entry registers.

3.008 *Fig. 14—D digit reading relays*

These relays **D0–1405, D1–1406, D2–1407, D4–1408** and **D7–1409**, like the B and C digit relays of Figs. 13 and 14, contain a two-out-of-five check path, locking contacts for skipping splice pattern and contacts for copying this digit as read into the assembling registers or into the call entry registers. In addition, these relays have a decimal translation for use in connection with interpreting this digit for end-of-tape and other miscellaneous purposes. These relays also contain contacts for interpreting this digit in connection with 281DEF (hour) entries to distinguish those hours which are of 2819 and 2818 variety (apology entries) from those which are of the 2811 and 2810 variety (regular or end-of-tape hour). That is, they distinguish 281DEF entries as to which of the four it is and whether it is an apology entry or not.

3.009 *Fig. 15—E digit reading relays*

Like the other reading relays, the E digit reading relays **E0–1500, E1–1501, E2–1502, E4–1503** and **E7–1504** contain a two-out-of-five check path, locking contacts for skipping splice and contacts for copying this digit as read into the call entry registers. These relays also contain a decimal translating network for operating the E digit reading translator relays of Fig. 23 which are used in conjunction with the relays of Fig. 24 for selection of an assembling register according to the E and F digits representing the call identity index.

3.010 *Fig. 15—F digit reading relays*

Like the other reading relays, the F digit reading relays **F0–1505, F1–1506, F2–1507, F4–1508** and **F7–1509** are provided with the two-out-of-five up-check, locking contacts for skipping splice pattern and contacts for copying the entry as read into call entry registers. Like the E digit reading relays of Fig. 15 these relays provide decimal translating networks for controlling the F digit reading translator relays of Fig. 24 which are used for assembling register selection. The two-out-of-five check path through the A to F digit reading relays ends after it goes through the contacts of the F digit reading relays. From here it is distributed to various points in the circuit as will be referred to hereinafter.

3.011 *Fig. 18—skip splice control*

This circuit enables the skipping of lines of tape being read which represent splice pattern (081010) whether or not it is preceded by a skip splice entry 286000. The skipping of splice pattern is the first circuit action which occurs after the operations of the motor start key **1006** and the machine start key **1200** have caused the connection of the reading relays with the reader reading pins.

Relay **286–1800** detects the reading of a 286 line by the reading relays.

Relay **08–1801** detects the reading of a line beginning with 08.

Relay WBY–**1802** detects the reading of an 081010 line and by-passes part of the check for two-out-of-five on the C and D digit reading relays (Fig. 14) so that the circuit may automatically by-pass the window splice on a central office tape, this cut-out portion coming within the tape area normally containing legitimate C and D digit perforated codes.

Relay SPR–**1803**, when operated, registers the fact that splice pattern is being skipped. It also permits the reader to step off of the first line of a splice pattern.

Relay PRRL–**1804** prepares to arrange for the locking of the reading relays while skipping splice pattern after the first line of splice pattern has been skipped. This relay also indicates to the alarm timing and machine release portions of the circuit that the machine is skipping splice pattern.

Relay RRL–**1805** provides the locking ground for holding the reading relays operated while skipping splice pattern. This action checks that the splice pattern used on both halves of a splice are identical and also enables the reading relays to hold the line being read even when passing over the splice. This relay prepares a path to detect the end of the splice pattern as indicated by the failure of a reader step relay (Figs. 26 and 27) to continue to operate, and prevents the alarm from coming in due to the reader step relay being continuously energized while skipping splice pattern. This relay also provides an indication to the tape identity progress control circuit to indicate that a second end-of-tape group on a central office tape is about to be approached.

Relay RRUL–**1806**, when operated, unlocks the reading relays and restores the skip splice control to normal.

3.012 *Fig. 16—reader step check*

This circuit provides for the check of the reader to detect over-stepping or under-stepping in conjunction with the **G1** and **G2** alternately closed contacts on the reader drum (see Fig. 7).

Relay RW–**1600** operates upon skipping lines where the **G1** cam was closed and relays RZ**1**–**1601**, RZ**2**–**1602** and RZ**3**–**1603** operate on lines where the reader steps off of lines where the **G2** cam was closed.

Relays RKA–**1604** and RKB–**1605** connect the check circuit through the reading relays to either the G1 or G2 cam, provided such cam is closed as expected. If these cams are out of step and the circuit fails; then these relays extend a circuit through to the alarm circuit (Fig. 10) for indicating a reader step failure.

3.013 *Figs. 26 and 27—reader step control*

This circuit contains the reader step relays which operate when the circuit has determined that the reader

should step and which control the operation of the reader step magnet **700** through one cycle.

Relay RS–**2600** is a general reader step relay used for stepping off of lines which are used in the end-of-tape groups or off of special lines which might occur in a tape and off of splice pattern lines.

Relays RSE–**2700** and RSO–**2709** are used for stepping off of timing entries having respective odd and even units digits of call identity indices.

Relay RS1E–**2601** and RS1O–**2701** are used for stepping off of the first lines of respective even or odd initial entries.

Relays RS2E–**2602** and RS2O–**2702** are used for stepping off of the second lines of even and odd initial entries.

Relays RS3E–**2603** and RS3O–**2703** are used for stepping off of the third lines of even and odd initial entries.

Relays RS4E–**2604** and RS4O–**2704** are used for stepping off of the fourth lines of even and odd initial entries.

3.014 *Figs. 26 and 27—reader line count*

These relays control the progress for successively operating the initial entry register connectors on initial entries.

Relay SR1E–**2605** operates on the start of reading operations when the machine start key **1200** is operated. Its operation permits the reading of any line which is not a supplementary line (A digit of zero) of an initial entry. This relay SR1E–**2605** steers the first initial entry into the even call register. The relay is released after the first line of an initial entry has been registered in the even call registers.

Relay SR2E–**2606** permits the second line of an initial entry to be registered in the even call register after a first line has been registered therein.

Relay SR3E–**2607** permits a third line to be registered in the even call register if a third line is indicated by the even input class register.

Relay SR4E–**2608** permits a fourth line of an initial entry to be registered in the even call register provided a third line was successfully registered therein.

Relay SR1O–**2705** operates to prepare to steer the next initial entry into the odd call register. This occurs once an initial entry has been successfully registered in the even call register. The operation of relay SR1O–**2705** also permits entries other than supplementary lines (A digit of zero) of initial entries to be read and to be handled.

Relays SR2O–**2706**, SR3O–**2707** and SR4O–**2708** permit the successive lines of initial entries to be sequentially registered in the odd call register.

3.015 *Figs. 21 and 22—tape identity reading progress*

This circuit checks for the presence of each proper line of an end-of-tape group in the proper order and steers that line to the proper point after the previous line has been checked.

Relay L4–**2100** detects the reading of the first line of the end-of-tape group (284DEF). This relay, in operating, closes paths for enabling the check of the marker group and round as it appears on the tape against the setting of the marker group set-up switches (Figs. 190, 191, 205 and 206) and the round as read from the day progress circuit switch (Fig. 31). This relay also indicates to the tape identity progress control circuit (Fig. 17) that an end-of-tape is started. The relay is provided with a locking path to permit it to remain operated even after the operation of its associated check relay CL4–**2101**.

Relay CL4–**2101** operates to indicate that the first line of an end-of-tape group (284DEF) has been successfully read and has been checked. This relay, in operating, prepares for the reading of the second line of the end-of-tape group.

Relay L3–**2102** operates upon the receipt of the next line of tape identity (283DEF). This is the only line which may be accepted by the circuit once relay CL4–**2101** has been operated. The operation of relay L3–**2102** controls the checking of the month and day of round as read from the 283 entry on the tape against the setting of the month set-up switches (Figs. 190, 191, 205 and 206) and the day of round as read and interpreted from the day progress switch (Fig. 31). Relay L3–**2102** locks independently of relay CL3–**2103**.

Relay CL3–**2103** operates as a result of checking the 283DEF line of tape against correspondingly registered and set information in the machine. The operation of relay CL3–**2103** prepares for the receipt of the next line of the end-of-tape group. With relay CL3–**2103** operated only a 280DEF line may be successfully read from the tape.

Relay CL0–**2200** operates after the successful reading and registering of the recorder number entry 280DEF. The operation of relay CL0–**2200** prepares the circuit to receive the next line of the end-of-tape group, which may be either a 2810 or a 285 entry.

Relay CL1–**2201** operates after the successful registration of a 2811 hour entry. Relay CL1–**2201** also operates as a result of receiving an hour entry 2812 associated with a straddle timing entry. Under this latter condition the operation of relay CL1–**2201** informs the tape identity progress control (Fig. 17) for the first time that a group of entries is being received. Relay CL1–**2201**, in operating, prepares the circuit to receive a 282DEF calendar day entry.

Relay CL2–**2202** operates after the successful registration of the 282 calendar day entry. Relay CL2–**2202**, in operating, indicates to the tape identity progress control (Fig. 17) that a complete end-of-tape group has been read.

Relay STE–**2203** indicates that a straddle timing entry is to be received when the calendar day entry which was read is of the 2822EF variety instead of the usual 2821EF type. The operation of this relay indicates that the next line read from the tape will be a timing entry which goes with the hour and day entries (respectively 2812EF and 2822EF) immediately preceding it and all of which comprise a straddle timing entry.

3.016 *Figs. 17 and 25—tape identity progress control*

This apparatus determines the action to be taken during and after reading each end-of-tape group and particularly in connection with the placing of end-of-tape groups on the output straddle tape. It also controls the placing of tape identity groups on the detail and message unit tapes.

Relay FI–**2500** is normally operated and releases after the reading and checking of the first end-of-tape group. Relay FI–**2500** cannot operate once it is released, even under certain power failure conditions.

Relay TI–**2501** indicates that a tape identity group is being or has been read from the tape and that the necessary tape identity or end-of-tape action is to be taken on an output tape. Relay TI–**2501**, in operating, prevents the reading relays from reading any other than the entries allowed by the tape identity reading progress control (Figs. 21 and 22).

Relay ETE–**2502** indicates that the necessary end-of-tape group action has been taken in both reading and perforating and that the TI–**2501** relay may therefore be released. This relay ETE–**2502** also controls the release of relay FI–**2500** after action is taken upon reading the first end-of-tape group.

Relay TEG2–**2503** operates and locks to indicate that the tape identity progress is to expect an end-of-tape group of a pair of same as read from a central office tape. The operation of this relay in effect permits the skipping of duplicate end-of-tape groups without action being taken in perforating end-of-tape groups on the output straddle tape.

Relay EPW–**2504** operates to indicate that the per-

forating of a leading tape identity group on the detail and necessary message unit tapes has been completed and controls the placing of leading end-of-tape group, if any, on the output straddle tape.

Relay CR1–2505 operates to indicate a change in recorder number and thereby prepares to set the first call relay in each of the assembling registers under the feedback method of straddle operation.

Relay TF–2506 operates to indicate that a transfer indication has been received in the form of a 285 entry read as part of the end-of-tape group. The operation of this relay changes the mode of operation with regard to placing end-of-tape groups on the output straddle tape and to the clearing of assembling registers which may have timing entries recorded therein under the feedback method of straddle operation.

Relays TFW–1700 and TFZ–1701 operate on alternate groups at the leading and trailing ends of a transfer indication so that the necessary actions for setting the first call relays in the assembling registers and for clearing the assembling registers at the beginning and at the end of a transfer may take place under the feedback method of straddle operation.

Relay SR–2507 operates to register when entries are placed on the straddle tape while reading the call section of a central office tape, so that the necessary end-of-tape group may be perforated on the output straddle tape to close that tape section. This is necessary when reading the straddle tape on feedback method of straddle operation because straddle calls may exist even in the straddle tape section being read.

Relay DMC–1702 detects from a round change that a change is expected in the month that appears on an end-of-tape group.

Relay MCR–1703 registers the expected month change as detected by the operation of relay DMC–1702, and prepares to switch the month check path when reading the 283DEF line to different arcs on the month set-up switches (Figs. 190, 191, 205 and 206). The registration of an expected month change prepares two paths for indicating the expected value of the last day of round for the last round of the preceding month used in detecting a day of round change.

Relay DCR–1704 detects an expected change in round when reading the 284DEF line of the end-to-tape group.

Relay RLR–1705 registers that a last round has been detected while reading this line of tape when the round value expected does not check against that which is read from the tape.

Relay DCDR–1706 detects an expected change in the day of round while reading the 283DEF line of the tape. Detecting the change in the day of round is preliminary to arranging for the advance of the tape progress switch when the end-of-tape group has been satisfactorily handled by the tape identity progress control.

Relay RLDR–1707 detects and registers the last day of round when a non-consecutive day of round is read from the tape.

3.017 *Figs. 190, 191, 205 and 206—set-up switches*

These switches are set manually before the tape processing operation is started as described in Section 2.21. Wafers on these switches are used to control register relays, to generate two-out-of-five code output digits for perforating the information on end-of-tape and tape identity groups and also to provide contacts for checking the settings of the switch against digits read from the tape.

3.018 *Fig. 31—day progress*

This apparatus controls and follows the progress of the days which are represented by the input central office and straddle tapes for each recorder from the last day of the last round to the first day of the first round and beyond where necessary when reading straddle tapes under the feedback method of straddle operation. The principal element of this figure is a day progress switch indicated generally as 3112 and of which six arcs are used as shown to the right of Fig. 31. Although each arc has 22 points, normally only 20 of these points are used. Switch positions 1 to 22 represent the calendar days either from day 22 down to 1 or in positions 2 to 22 represent the calendar day from 31 down to 11 (see table in Section 4.05). A mechanical interlock between the armatures of the operate magnet OPR–3102 and the release magnet RLS–3103 indicates whether the first or the last usage is made of the day progress switch. On alternate cycles of the wipers across the arcs of the switch this mechanical interlock is operated and released so that in effect each 22-point switch gives day progress from day 22 of one month to day 11 of the preceding month. As will be explained later, particularly in Section 4.29, within any given month processing can proceed from day 22 down to day 1 (or any part thereof) or from any day higher than 22 down to day 11 (or any part thereof) but cannot proceed from a day higher than 22 down below day 11.

The magnet STP–3113, when operated, causes the switch to advance a step.

Relays FA–3100 and LA–3101 follow the mechanical interlock (comprising the OPR magnet 3102 and the RLS magnet 3103) to translate the tens digit of the day according to the representation of switch position and calendar day. Relay FA–3100 operates during the first half of the month and relay LA–3101 during the second half of the month.

Relay FR–3104 operates when the first round of the processing is detected while reading the 284DEF line of the tape.

Relay FDR–3105 operates when the first day of the first round is detected while reading the 283DEF entry of an end-of-tape group. Detecting the first day of the first round permits the circuit to prepare for stepping the day progress switch after the next recorder tape appears.

Relay DPRS–3106 is used to reset the day progress switch to the last day of the last round when beginning the processing of a new recorder's central office tape.

Relay LDR–3107 operates when the last day of round matches the day indicated by the then setting of the day progress switch.

Relay LR–3108 operates when the last round matches the positions of the day progress switch which indicate that that round is the one as set on the set-up switches (Figs. 190, 191, 205 and 206).

Relay DPS–3109 operates to start one step of the day progress switch.

Relay DPS1–3110 is a pulse-help relay used in stepping the day progress switch.

Relay CDPC–3111 permits the change of day progress after the first day of the first round has been detected when used with the feedback method of straddle operation. The operation of this relay cancels the check of the day of round and round during the reading of an end-of-tape group but does allow the day progress switch to continue to step when possible.

3.019 *Figs. 129 and 155—round size translator*

This translator controls the action of the day progress switch in connection with the number of days in a round and with the round numbers. This round size is indicated by the marker group which is being processed. A month may be divided into ten three-day rounds or six five-day rounds (the last round of a 31-day month contains one extra day while the last round of a 28 or 29-day month of February contains one or two less days).

Relay 6R–12900 indicates a six-round month and translates indications of the day progress switch settings for day of round and round independently of

whether the day progress switch is in the first of last half of its cycle.

Relays FB–15500 and LB–15501 indicate whether the day progress switch is in its first or last half cycle.

Relay 10R–15502 translates the day of round from the day progress switch for a ten-round month independently of the switch half cycle.

Relay 10RF–12901 translates the round for a ten-round month for the first half cycle of the day progress switch.

Relay 10RL–12902 translates the round from the day progress switch for its last half cycle.

3.020 *Fig. 180—round trranslator*

These relays, R0–18000 to R9–18009, translate, for the round indicated by the day progress switch through the round size translator, the round values for use in end-of-tape groups to be perforated. In addition, they provide the necessary contacts for checking the round against the round as read in a 284DEF entry and for indicating whether the round as read is equal to or one less than or does not agree with the round as set on the day progress switch.

3.021 *Fig. 102—marker group selecting*

The relays MT0–10200 to MT9–10209 are provided for each ten marker groups which the accounting center is arranged to process. Three groups of units leads corresponding to the marker group in this units digit thereof pass through contacts of the marker group tens relays to select for each particular marker group three items of information. The "A" cross-connections (Fig. 102) indicate number of rounds in the month for the particular marker group. The "B" cross-connections (Fig. 102) indicate for the particular marker group the number of message unit tapes that are to be prepared. The "C" cross-connection (Fig. 102) for each marker group indicates the number of offices in that marker group and the number of types of message units used by that marker group.

3.022 *Fig. 180—day of round translator*

These relays, DR1–18011 to DR6–18016, translate the day of round as set on the day progress switch into the necessary code for perforation on the output end-of-tape group. In addition, these relays indicate whether the day of round as read from the tape in a 283DEF entry is equal to, one less than or does not agree with the day of round as indicated by the day progress switch (Figs. 190, 191, 205 and 206).

3.023 *Figs. 33 and 34—recorder time connector*

This connector is divided into four parts. The first part (in Fig. 33) consists of the DR–3300 relay which connects the reading relays to the day register (Figs. 40 and 41) for registering the calendar day from a 282DEF entry. The second major division of this connector (in Fig. 33) consists of the recorder register connector RR–3301 and the recorder compare connector RC–3302.

Relay RR–3301 connects the reading relays to the recorder register (Figs. 42 and 43) for registering the recorder number read from a 280DEF entry.

Relay RC–3302 connects the reading relays to contacts on the recorder register to compare the 280DEF entry being read with the number of the recorder already registered.

The remaining two connector divisions are identical and are on Fig. 34. One is the odd hour connector and the other is the even hour connector. Each of these connectors is subdivided into a regular hour register connector and an irregular (apology) hour connector. The odd regular hour register connector OHR–3400 connects the reading relays with the odd hour register (Fig. 44) when reading an hour entry from the tape. The even regular hour register connector EHR–3401 connects the reading relays with the even hour register (Fig. 45) when reading an alternate 281DEF hour entry from the tape. The odd irregular (apology) hour connector OHA–3402 connects the even hour register output with the odd hour register to record in the odd hour register an irregular hour value. The even irregular (apology) hour connector EHA–3403 is used to connect the output of the odd hour register to the even hour register for registering irregular hour values.

3.024 *Fig. 32—recorder progress*

This circuit consists principally of a rotary step-by-step switch which is designated generally as 3205 and which records the progress of the recorder tapes processed from the first recorder to the last recorder and checks that each one appears in its proper turn. Four arcs on this switch are used in twenty-one positions giving the recorder numbers starting from the emergency recorder when used with the feedback type of straddle operation through recorders 00 to 19 in that order.

The magnet STP–3206, when actuated, controls the stepping of the switch 3205.

Relays RT0–3200 and RT1–3201 are used to give further translations of the recorder tens zero and the recorder tens one indications as taken from arc 3 of the recorder progress switch.

Relay RP–3202 is used to advance the recorder progress switch once the need for such action is detected while comparing the recorder number as part of an end-of-tape group.

Relay FRS–3203 operates when the recorder progress switch is in the first recorder number position as indicated by the first recorder set of switches (Figs. 190, 191, 205 and 206).

Relay LRS–3204 operates when the recorder progress swicth is in the last recorder position as indicated by the last recorder set-up switches.

3.025 *Figs. 42 and 43—recorder register*

These relays register the recorder number as taken from the tape when reading a 280DEF entry.

Relays T0–4200, T1–4201 and T4–4202 record the recorder tens digit of zero, one or four.

Relays U0–4300 to U9–4309 record the recorder units digit of zero to nine.

Relays C5–4203, C6–4204, C7–4205 and C8–4206 record the special recorder D digit which indicates respectively whether the recorder number is made on the regular central office tape (D=5), the emergency central office tape (D=6), the straddle tape as a result of reading a regular central office tape (D=7) or the straddle tape as a result of reading an emergency central office tape (D=8).

All of these relays provide the necessary two-out-of-five translations for perforating the recorder number on output end-of-tape groups, locking contacts for registering the information, contacts for comparing the number registered against a number being read, and a check chain for indicating that a number is registered properly. The recorder progress switch (Fig. 32) passes a signal through these relays to indicate that the recorder number registered agrees with the recorder number expected. Contacts on the C5–4203 to C8–4206 relays indicate the type of end-of-tape group which may be read as a result of changes in this D digit alone.

3.026 *Fig. 19—recorder register control*

This circuit controls and indicates the result of registering and comparing recorder numbers and controls the recorder registers (Fig. 42 and 43).

Relays TA–1900 and UA–1901 indicate that when the recorder number on the tape as being compared with

the recorder number registered, the tens and units digits respectively agree.

Relay CA–1902 indicates when the D digit of the recorder number being read from the tape and operated C relay (Fig. 42) agree as to the source of the tape beign read (see Section 3.025).

Relay CA6–1903 indicates when the recorder number being read has a D digit 6 and the number registered has operated relay C6–4204.

Relays TNC–1904 and UNC–1905 indicate when either the tens or units digits respectively of a recorder number being read disagree with a recorder number registration.

Relay NRP5–1906 operates on the spliced-in emergency method of straddle operation to indicate that the recorder number being read is from a regular central office recorder while the number registered is not.

Relay NRP6–1907 indicates on the spliced-in emergency method of straddle operation that the recorder number being read is from an emergency section of central office tape while the number registered is not.

Relay RP–1908 operates on the feedback method of straddle operation to indicate when the recorder number read is from the regular central office tape while the registered recorder number is not.

Relay NRP–1909 operates when a feedback straddle tape section is read for the first time after a regular central office recorder tape with the proper identification.

Relay EF–1910 operates to indicate for the spliced-in emergency method of straddle operation that the central office recorder tape being processed was not in service at the present cutting period.

Relay EL–1911 operates to indicate for spliced-in emergency method of straddle operation that the central office recorder tape being processed was not in service at the previous cutting period.

Relay CCH–1912 indicates that the type of change in recorder number which has been detected necessitates that the next end-of-tape group read must agree in entirety with the information which is registered.

Relay CCR–1913 indicates that the type of change in recorder number which has been detected requires that the recorder progress switch should be advanced, that the day process switch reset, that the assembling registers be set to expect a first call if and when the reading of the end-of-tape group is completed, and that in the spliced-in emergency method of straddle operation assembling registers be cleared immediately of timing entries as straddle call ends and the end-of-tape group perforated.

Relay C–1914 indicates that on the type of change in recorder number which has been detected the day progress switch should be reset.

Relay CR–1915 controls the release of the recorder register when a change in recorder number is indicated.

Relay RDC–1916 indicates when the recorder number register is normal to control the comparing or registering of the recorder number from the reading relays.

3.027 *Fig. 19—straddle class connector*

This circuit provides the necessary connections and progress checks required for each class of straddle operation.

Relay SIE–1917 provides the necessary circuit conditions for the spliced-in emergency class of straddle operation.

Relay F–1918 provides the necessary circuit conditions for the feedback class of straddle operation.

3.028 *Fig. 73—cancel entry control*

This figure provides for registering and controlling circuit actions in conjunction with reading entries from the tape and which require the cancellation of timing registrations in the assembling registers.

Relay STF–7300 registers the indication that a 285500 (transfer-in-synchronism) entry has been read from the tape.

Relay NSTF–7302 registers the indication that a 285700 (transfer out-of-synchronism) entry has been read from the tape and that the necessary cancellation in assembling registers containing but a single timing entry has been completed.

Relay NSMB–7301 registers the indication that a 285600 (make-busy out-of-synchronism) entry has been read from the tape and that the necessary cancellation in assembling registers containing but a single timing entry has been completed.

Relay 285R–7303 registers the indication that a transfer or make-busy entry has been received as part of an end-of-tape group and provides for the perforation of the corresponding line in any new end-of-tape group perforated on the straddle tape by preparing for the selection of a different output class.

Relay 285C–7304 serves to connect the reading relays to the cancel entry control relays to permit the necessary cancelling and registering operations to proceed when reading these entries from the tape.

Relay CCRC–7305 indicates when there are assembling registers containing two timing entries so that the necessary cancellation action may proceed.

Relay NSRC–7306 indicates when there are assembling registers containing only one timing entry so that the necessary cancellation action may proceed.

Relay CCR–7307 permits the circuit to proceed to effect the cancellation of all timing entries in all assembling registers.

Relay CCR1–7308 repeats the indication of relay CCR–7307 in order that mercury contacts may be used to actuate the necessary relays in the plurality of assembling registers.

Relay NSR–7309 permits the circuit to proceed to effect the cancellation of single timing entries in assembling registers.

Relay NSR1–7310 repeats the indication of relay NSR–7309 in order that mercury contacts may be used to actuate the necessary relays in the plurality of assembling registers.

Relay FCCU1–7311 indicates that at least one assembling register is prepared to handle a straddle call and hence that charge guard entries (285400) may be required on the output straddle tape.

Relay CG–7312 registers the indication that a 285400 charge guard entry has been read from the tape, that the necessary cancellation of all timing entries in all assembling registers has been completed, and that the perforation of a charge guard entry on the output straddle tape should proceed.

Relay CGR–7313 indicates that the perforation of a charge guard entry on the output straddle tape has been completed and that the registration of the reading of this entry may be released.

Relay DCE–7314 indicates that a 285400 cancel entry, which may effect timing entries on straddle calls, has been read but that its perforation is to be deferred until it has been determined whether or not any further call entries are to be perforated on the output straddle tape. This relay is also used to defer the perforation of a charge guard entry in place of a non-synchronous entry read as part of an end-of-tape group on an input straddle tape under the feedback method of straddle operation.

3.029 *Figs. 44 and 45—hour register (odd or even)*

These circuits provide for registering the tens and units digits of hour entries read from the tape or from the other hour register.

Relays OHT0–4400 to OHT2–4402 and relays OHU0–4403 to OHU9–4509 register the hour tens and units digits on a decimal basis, with suitable up-check paths and contacts for indicating the value of the hour regis-

tered for the purposes if translation as required by the hour register output connector.

3.030 *Figs. 35 and 36—hour register control*

This circuit provides for controlling and steering the registration of hour entries into the two hour registers (odd and even).

Relays EH–**3600** and OH–**3500** indicate that the next hour entry is to effect registration in the even or odd hour register respectively. Relay EH–**3600** is operated when no registration is present in either hour register. Otherwise, the OH–**3500** or EH–**3600** relay operates when the associate hour register is available for registration and the other hour register is occupied with the current hour entry.

Relays EHDC–**3601** and OHDC–**3501** indicate that the relays of the even and odd hour registers and their associated control relays respectively are normal.

Relays EHRL–**3602** and OHRL–**3502** release the even and odd hour register and associated control relays respectively.

Relay CHS–**3506** makes necessary the check for agreement between consecutively registered 2811EF hour entries when reading end-of-tape groups across certain types of splices.

Relays EHAR–**3603** and OHAR–**3503** register the indication that the hour registered in the even or odd hour register respectively is taken from a 2811EF end-of-tape hour entry and that it therefore should be read out of the register without change and that the hour difference check should be for a decrease in hour value of one. The operation of both of these –HAR relays cancels the hour difference check except when relay CHS–**3506** is operated to enforce the check that the hour values agree. The hour difference check is for a difference of one when the previously registered hour was 2810EF.

Relays EHARS–**3604** and OHARS–**3504** register the indication that the hour registered in the even or odd hour register is taken from a 2812EF hour entry, which is part of a straddle timing entry group, and hence that the hour difference check should be canceled.

Relays EHL**1**–**3605** and OHL**1**–**3505** register the indication that the hour registered in the even or odd hour register respectively is taken from a 2810EF regular hour entry or from the other hour register when an irregular hour entry 281899 or 281999 has been registered therein and indicates that therefore the hour difference check should be for a decrease in hour value of one and that the hour read out from the register should be less one.

Relay PH–**3507** transfers the hour register outputs to reader perforating contacts for perforating current hour information on the output straddle tape.

Relay H**25**–**3508** simulates the registration of the fictitious hour value 25 in the even hour register, by supplying 25 as the current hour value from the even hour register, when the hour registers are reset due to mutilation of an hour entry or due to the loss of registration due to power failure.

Relay SDC–**3509** provides for by-passing the hour difference check under certain circumstances when no check is required.

3.031 *Fig. 51—hour difference connector*

This circuit sets up connections between the two hour registers to permit a check of the difference between the hour value previously registered and the hour value being registered, before advancing the reader when reading an hour entry from the tape.

Relay UE–**5100** connects an output of the even hour register with an output of the odd hour register to check that the units digit of the hour value registered in the odd hour register is one less than the units digit value registered in the even hour register.

Relay U**0**–**5101** connects an output of the odd hour register with an output of the even hour register to check

that the units digit of the hour value registered in the even hour register is one less than the units digit value registered in the odd hour register.

Relay UAR–**5102** connects together the outputs of the odd and even hour registers to check that the units digit values agree.

Relay TE–**5103** connects an output of the even hour register with an output of the odd hour register to check that the tens digit of the hour value registered in the odd hour register is one less than the tens digit value registered in the even hour register.

Relay T**0**–**5104** connects an output of the odd hour register with an output of the even hour register to check that the tens digit of the hour value registered in the even hour register is one less than the tens digit value registered in the odd hour register.

Relays TAR–**5105**, TARE–**5106** and TARO–**5107** connect together an output of the odd and even hour registers to check that the tens digits values agree. Relay TAR–**5105** is used in conjunction with relay UAR–**5102**, while relays TARE–**5106** and TARO–**5107** are used in conjunction with relays UE–**5100** and U**0**–**5105** respectively.

Relay SE–**5108** connects an output of the odd hour register with an output of the even hour register when hour 23 registered in the latter is to be checked against the 00 hour registered in the former.

Relay S**0**–**5109** connects an output of the even hour register with an output of the odd hour register when hour 23 registered in the latter is to be checked against the hour 00 registered in the former.

3.032 *Figs. 52 and 53—hour register output connector (odd or even)*

These circuits connect outputs from the odd and even hour registers (Figs. 44 and 45) to provide the current hour value to the assembling registers as part of timing entries and for use in perforating hour information on the straddle tape.

Relay OUAR–**5200** connects the outputs from the units digit hour registers to the assembling register multiple connector and provides perforate patterns to give two-out-of-five coding of the digit values as registered. It also connects the outputs from the units digit hour register to the recorder time connector for use in registering irregular hour entries on a decimal basis in the other hour register when the units digit is required as previously registered.

Relay OUL**1**–**5300** connects the outputs from the units digit hour registers to the assembling registers multiple connector and provides perforate patterns to give two-out-of-five coding of the digit values registered less one. It also connects the outputs from the units digit hour register to the recorder-time connector for use in registering irregular hour entries on a decimal basis in the other hour register when the units digit is required as one less than previously registered.

Relay OU**23**–**5201** connects the outputs from the units digit hour register to the various hour output points when the hour value 00 previously registered is to be reduced by one. It also indicates to the day register control that a change in calendar day is required.

Relay OTNC–**5202** connects the outputs from the tens digit hour register to produce the digit values as previously registered on a two-out-of-five basis and on a decimal basis.

Relay OTC–**5203** connects the outputs from the tens digit hour register to produce the digit values as one less than the value previously registered on a two-out-of-five and on a decimal basis. The tens digit value 0 is changed to 2 in this process.

3.033 *Figs. 40 and 41—day register*

This circuit registers the calendar day on a decimal basis from readings of the tape of a 2821EF or 2822EF

day entry or from settings of the day progress switch when one of these entries is mutilated or when a previous registration has been lost during a power failure.

Relays DT0–4000 to DT3–4003 register the day tens digit on a decimal basis, check the registration and provide outputs for translation on a decimal basis and for perforating on end-of-tape and tape identity series on a two-out-of-five basis.

Relays DU0–4010 to DU9–4119 register the day units digit on a decimal basis, check the registration and provide outputs for translation on a decimal basis and for perforating on end-of-tape and tape identity entries on a two-out-of-five basis.

3.034 *Fig. 58—day register control*

This circuit controls the registration of calendar day entries 2821EF and 2822EF read from the tape. Relay DDC–5805 indicates that all day register and associated control relays are normal.

Relay DRL–5800 releases the day register and associated control relays.

Relay NCD–5801 indicates that the calendar day as registered is the correct current day.

Relay CD–5802 indicates that a calendar day one less than the value as registered is the correct current day.

Relay LDC–5803 indicates that a day change indication has been received from the hour registers and has been acted upon.

Relay DC–5804 detects the day change received for the hour registers and remembers this indication in the event of power failure.

3.035 *Fig. 49—day register units output connector*

This circuit translates from decimal to two-out-of-five code the output for the day register units digit and connects same to the assembling register multiple connector for producing the required day registration which accompanies each timing entry as registered in the assembling registers.

Relay DAR–4900 translates the decimal output of the day units register to the two-out-of-five code without any change in value as registered.

Relay DL1–4901 translates the decimal output of the day units register to the two-out-of-five code with a value of one less than as registered.

Relay DP1–4902 translates the decimal output of the day units register to the two-out-of-five code with a value of one greater than as registered.

Relay DP2–4903 translates the decimal output of the day units register to the two-out-of-five code with a value of two greater than as registered.

Relay 9–4904 substitutes the day units output value 9 for the value contained in the day register.

Relay 8–4905 substitutes the day units output value 8 for the value contained in the day register.

3.036 *Fig. 48—day register tens output connector*

This circuit translates the output for the day register tens digit for use in reconstructing the day tens digit as indicated in part by the day registered with the answer and disconnect time when taken from assembling registers.

Relays DTAR1–4800 and DTL1–4801 allow the day tens digit to be used as registered (DTARL–4800) or less one (DTL1–4801), according to whether or not there is any appropriate day change indication in effect in the day register control, to indicate the correct current day tens digit.

Relays DTAR2–4802 and DTP1–4803 are operated to reconstruct the day tens as it was at the answer time of a call. A day change affecting the tens digit may have occurred between the answer time and the initial entry of a call, in which case relay DTP1–4803 is operated to increase the current day tens digit by one. Relay DTAR2–4802 operates in all other cases.

Relay ADTAR–4804 provides the value of the answer day tens digit reconstructed from the current day for registering in the odd or even answer day tens register.

Relay ADT0–4805 provides the odd or even answer day tens register with the day tens value of 0 independently of the current day tens value.

Relays ADT2–4806 and ADT3–4807 detect answer day tens values of 2 and 3 respectively for use in controlling the reconstruction of the answer day units digit from that taken from the assembling registers for calls which are answered in one month and which are disconnected in the next month.

Relays DDTAR–4808, DDTP1–4809, DDTS1–4810, DDTS2–4811, DDTS3–4812 and DDTS4–4813 are operated to provide the value of the disconnect day tens digit reconstructed from the current day and from the answer and disconnect day values taken from the assembling registers, for registering in the odd or even disconnect day tens register. (See Section 3.087—Table legend for significance of S1, S2, S3, S4 and P2 portions of the above designations.)

Relay DDT0–4815 provides the odd or even disconnect day tens register with the day tens value of 0 independently of the current day or day's digits as registered on the call in the assembling register.

Relays DDT2–4816 and DDT3–4817 detect disconnect day values of 2 and 3 respectively for use in controlling the reconstruction of the disconnect day units digit from that taken from the assembling registers for calls which are answered and disconnected in the month preceding the one being processed, as a result of assembling calls on the straddle tape in the feedback method of straddle operation.

3.037 *Fig. 61—assembling register connector control*

This circuit controls the operation of the connector relays of the assembling register which is selected by the call identity index digits read from the tape on timing and initial entries and by the corresponding digits derived from and by the assembling register walking circuit.

Relay CST–6100 operates to close the operating path (ST lead) for the connector relays of an assembling register.

Relay XST–6101 operates if more than the expected number of assembling register connectors operate as a result of a short circuit or cross of ST leads.

Relay XSTL–6102 locks-in the indication of a cross of assembling register ST leads.

Relay STO–6103 operates to indicate that the assembling register connector has operated, thereby indicating that the timing entry will be accepted in or will be read out.

Relay ADMC–6104 operates to control the connection of the answer and disconnect multiples of the assembling registers to the reading relays, to the day and hour register outputs and to the multiple check relays.

Relay AMO–6105 operates to connect the answer multiple with the disconnect multiple when only one timing entry is taken from an assembling register on a non-straddle call. This, in effect, makes the answer time equal to the disconnect time and produces a charge for the initial timing period only.

Relay ADCN–6106 operates to control the connection of all answer and disconnect connectors of the assembling registers to their respective start leads.

Relay ADD–6107 guards or gates the circuit to prevent it from taking action on a new call entry if the answer-disconnect connector is still operated.

Relay RLS–6108 gates or guards the circuit to prevent it from taking action on a new call entry if the release lead for the assembling registers is still energized.

3.038 *Fig. 23—E digit reading translator and assembling register selector*

These relays (TE0–2300 to TE9–2309) respond to the decimal translation of the operated E digit reading relays to select the tens group of the assembling register to be read-into or read-out-of. A check path insures that one and only one of these relays operates. Other contacts on these relays provide a decimal translation of the E digit for registering or checking end-of-tape entries.

3.039 *Fig. 24—F digit reading translator and assembling register selector*

These relays (TF0–2400 to TF9–2409) respond to the decimal translation of the operated F digit reading relays to select the particular assembling register within a group of ten to be read-into or read-out-of. A check path insures that one and only one of these relays operates. Other contacts on these relays provide a decimal translation of the F digit, for registering or checking end-of-tape entries. These relays determine which of the even or odd reader step control relays (RSE–2700 or RSO–2709) is to be used when stepping off of timing entry lines of tape. The assembling register switching panel (shown in part on Figs. 57 and 63) enables one of four spare assembling registers (shown on Fig. 70) to be substituted for any regular assembling register in the event of trouble. The emergency or spare plug of Figs. 70 and 53 need merely be inserted into the appropriate jack of Figs. 57 and 63.

3.040 *Figs. 56, 57, 62, 63, 69 and 70—assembling register*

One hundred (100) of these registers are regularly provided to store the two timing entries for each call handled with the same call identity index. Call entries for various identity indices occur interspersed along the central office tape. Each assembling register comprises two almost identical portions, one for registering answer time and one for registering disconnect time. Each portion has a connector which may be operated independently of the other to connect the register with a multiple. First, the disconnect multiple connector operates to register the first timing entry, which is presumed to be a disconnect entry. Later, the answer multiple connector operates to register the second (answer) timing entry. The registered information is the minute tens, units and tenths; hour tens and units; and day of the answer time and the same information for the disconnect time. Also, an indication of timed release or no timed release is registered, but on disconnect time only. On registering operations both the answer and disconnect multiples carry the same data, the assembling register connector relay which is operated making the necessary discrimination.

Connectors DISC99–5603 and DISC00–6203 are the disconnect multiple connectors for the disconnect parts of the respective No. 99 and No. 00 assembling registers of respective Figs. 56 and 62.

Connectors ANS99–5701 and ANS00–6301 are the answer multiple connectors for the answer parts of the respective No. 99 and No. 00 assembling registers of respective Figs. 57 and 63.

The disconnect part of register No. 99, shown in Fig. 56, contains the following register sections: relays DDU99–0 to DDU99–7 for registering the disconnect day units value on a two-out-of-five basis; relays DHT99–0 to DHT99–2 for registering the disconnect hour tens digit on a decimal basis; relays DHU99–0 to DHU99–7 for registering the disconnect hour units digit on a two-out-of-five basis; relays DMT99–0 to DMT99–4 for registering the disconnect minute tens digit in two-out-of-four code; relays DMU99–0 to DMU99–7 for registering the disconnect minute units digit on a two-out-of-five basis; and, relays DMP99–0 to DMP99–7 for registering the disconnect minute parts (tenths) digit in two-out-of-five code. The disconnect parts of the other registers, such as register No. 00 of Fig. 62 and spare registers, such as register No. 00 of Fig. 62 and spare registers 100 to 103 of Fig. 69, are similarly constituted, as are the answer parts of all such registers, as shown in Figs. 57, 63 and 70.

The disconnect parts, as shown in Figs. 56 and 62 for registers No. 99 and 00, also contain two relays, such as relays DTR99 and NDTR99 of Fig. 56 and relays DTR00 and NDTR00 of Fig. 62, which register respectively a timed-release disconnect and a no-timed release disconnect.

Relays DS99–5600 to DS00–6200 detect the completion of the registration of the first timing entry to be stored (presumably the disconnect time) and steer the circuit to register the next timing entry in the answer register portion of the assembling register. They also indicate that an entry has been registered.

Relays AS99–5700 to AS00–6300 detect the completion of the registration of the second timing entry to be stored. They also indicate that both timing entries have been registered and prepare for operating both connectors when the expected read-out occurs.

Relays FC99–5601 to FC00–6201 are preoperated at the beginning of the processing of a new tape section to indicate that the first call handled by an assembling register may be a straddle call element (call start). This relay may be released only when the register is read-out. It is not released when registrations are cancelled.

Relays RLS99–5602 to RLS00–6202 are operated to release the answer and disconnect registrations after detecting the first call or when timing entries are cancelled and to release the FC– relays after detecting the first call. The integrity of the contacts of the RLS– relay, which hold the register relays, is checked on each registration made in an assembling register.

Four spare or reserve registers (see Figs. 69 and 70) are also supplied which may be substituted through the assembling register switching panel for regular assembling registers as mentioned in paragraph 3.039. On Fig. 69 are shown the disconnect multiple connectors DISC100 and DISC103 for the spare registers No. 100 and No. 103. Also, on Fig. 70 are shown the respective answer multiple connectors ANS100 and ANS103 for these same spare registers.

3.04 *Fig. 50—assembling register multiple and check connector*

This circuit provides the path for connecting together the answer and disconnect multiples to the answer and disconnect portions of the assembling registers, for connecting the multiples to the reading relays and to the day and hour registers and for connecting the multiples to check relays when registering. This circuit also provides for dissociating the answer from the disconnect multiple when reading timing information out of an assembling register. When reading out on non-straddle calls, where only one timing entry is registered, this circuit connects the answer and disconnect multiples together to permit the registration of the same values for both the answer and disconnect times.

Relay ADM–5000 connects the reading relays and the day and hour register outputs to the disconnect multiple when registering in the assembling registers.

Relays AMA–5001 and AMB–5002 connect the answer and disconnect multiples together when registering in assembling registers or when reading out of registers with single timing entries on non-straddle calls.

Relay ARC–5003 connects the answer multiple with the check relays when registering in assembling registers.

Relays ADMR–5004 and ADMV–5005 control the sequence of operation and release of the connectors ADM–5000, AMA–5001, AMB–5002 and ARC–5003 so that the check relays of Figs. 54 and 55 may verify the validity of the timing information present on the

answer and disconnect multiples before the reader is stepped ahead. Relay ADMV–**5005** operates as a check that the information is valid, whereupon relay connector ADM–**5000** releases to permit relay ADMR–**5004** to operate to effect a reader step operation. These relays ADMR–**5004** and ADMV–**5005** are effective only when reading-in timing entries into the assembling registers.

3.042 *Figs. 54 and 55—assembling register check relays*

These relays check the integrity of leads and contacts to the assembling register answer and disconnect multiples before permitting the tape to advance off a timing entry line being read and registered.

Relays ALC–**5400** and DLC–**5401** check the integrity of locking grounds for the assembling register into which a registration is being made.

The respective group of relays MT0C–**5402** to MT4C–**5403**, HT0C–**5404** to HT2C–**5405**, NTRC–**5406** to DTRC–**5407**, HU0–**5500** to HU7–**5501**, DU0–**5502** to DU7–**5503**, MU0–**5504** to MU7–**5505** and MP0–**5506** to MP7–**5507** are operated from the information present on the answer and disconnect multiples upon the operation of the check connector ARC–**5003** and thereby complete a validity check path, which effects a reader step in the event of a valid condition.

3.043 *Fig. 61—answer-disconnect connector*

These relays AD0–**6110** to AD9–**6109** operate to connect together individually the answer and disconnect connector operate paths for the one hundred regular and four reserve assembling registers. By connecting together these paths on the reading of initial entries, both portions of any assembling register content will be read-out simultaneously, whether or not both these portions contain timing entries.

3.044 *Figs. 83 to 90 and 136 to 143—initial entry register connector (odd and even)*

These connectors each consist of four subdivisions. Each subdivision connects the output of the reading relays to the register relays for a different line of the four possible lines of an initial entry. Two connectors are provided so that alternate initial entries are steered by the reader line count to use a particular initial entry register connector. Thus two successive initial entries may be read from the tape and registered without halting the advance of the tape through the reader. Interspersed timing entries may also be handled with interruption.

Relays CLAO–**8400**, CLAE–**13700**, CLCO–**8401** and CLCE–**13701** connect the reading relay output with the respective odd (O) and even (E) registers for recording the first line of an initial entry comprising input class (B digit), billing index tens and units (C and D digits) and call identity index (E and F digits). Under certain types of straddle call-end conditions only relay CLCO–**8401** or CLCE–**13701** will operate to register the call identity index with the timing entries.

Relays CGO–**8600** and CGE–**13900** connect the reading relay output with the respective odd (O) and even (E) registers for recording the second line of an initial entry comprising office index (B digit) and thousands, hundreds, tens and units digits of the calling line number (C, D, E and F digits).

Relays A0O–**8800** and A0E–**14100** connect the reading relay output with the respective registers for recording the third line of four-line initial entries comprising area index (B digit), called number index (C digit) and called office code (D, E and F digits).

Relays CDO–**9000** and CDE–**14300** connect the reading relay output with the respective registers for recording the fourth line initial entries comprising thousands, hundreds, tens, unit and station digits of the called line number (C to F digits).

3.045 *Figs. 77 to 82 and 130 to 135—answer-disconnect register connector (odd and even)*

These connectors connect the answer and disconnect multiples from the assembling registers to the odd or even answer and disconnect registers. One of these connectors, together with one of the initial entry connectors, places a call in one of the two call handling register portions of the assembler-computer preparatory to computing the chargeable time and message unit charges and preparatory to the perforating of one or more call entries on an output tape. The answer-disconnect register connector operates just after the operation of the connector for the first line of the initial entry and remains operated until the information in the selected assembling register has been read out and until the assembling register has been restored to normal. During this interval, which is usually completed before the end of the registering of the second line of the initial entry, no new timing entry may be placed in any assembling register.

Relays ARO–**8200**, ARE–**13500**, DRO–**7900** and DRE–**13200** connect the answer and disconnect day, hour tens and units and minute tens, units and tenths digits of assembling register content to corresponding digit registers in the call portion of the circuit which is presently registering the accompanying initial entry. Under certain straddle call conditions these digits are taken from the assembling register in the absence of an initial entry. The control leads for checking the read-out and for restoring the assembling registers to normal also pass through these connectors.

3.046 *Figs 91 to 96, 130, 133, 136 and 144 to 149—computer connector (odd and even)*

These relays CCAO–**9200**, CCAE–**14500**, CCBO–**9400**, CCBE–**14700**, CCCO–**9600**, CCCE–**14900**, CCDO–**13600**, CCDE–**16200**, CCEO–**13300**, CCEE–**15900**, CCFO–**13000** and CCFE–**15600** connect the day, hour tens and units, minute units and tenths digits of the answer and disconnect time and the calling office index as registered in an odd or even call register to the computer portion of the circuit. In addition, the translated output of the billing index tens and units digits and the answer and disconnect minute tens digits are passed along to the computer portion of the circuit. Indications and digits which result from the computer operation are passed back over these connectors. In addition, these connectors provide off-normal holding grounds for all computer portions of the circuit so that they will restore to normal simultaneous with the operation of a connector on the next call to be computed. The connectors are operated simultaneously with the corresponding answer-disconnect register connector or as soon thereafter as the computer portion of the circuit is ready to accept a new call. Translator relays in the computer portion of the circuit operate in parallel with many of the registers in the call register portion of the circuit, thus permitting the computing to start as early as possible.

3.047 *Figs. 83 and 136—input class register (odd and even)*

These relays OCL0–**8300**, OCL1–**8301**, OCL2–**8302** and OCL4–**8303** register on a two-out-of-five code basis the B digit of the first line of initial entries in the odd register. Similar relays are provided in Fig. 136 for the even register. Contacts on these relays check that a valid combination of these relays has operated, check the relays normal when registration is released, indicate to the recorder line count the number of expected lines in the initial entry (2 for digit value 1 and 4 for digit values 3 or 4), control the input class translator (Figs. 98 and 151), provide two-out-of-five output for perforating this digit on straddle initial entries, indicate for both the number of lines and output class whether or not the call was under observation in the central office (digit value 4) and

provide in part for the formation of a two-out-of-five digit for the observing index used on detail and over-capacity entries.

3.048 *Figs. 87 and 140—called number index register (odd and even)*

These relays OCNI0–8700, OCNI1–8701, OCNI2–8702, OCNI4–8703 and OCNI7–8704 register on a two-out-of-five code basis the C digit of the third line of initial entries in the odd register. The even register is shown in Fig. 140. Contacts on these relays check that a valid combination of these relays has operated, check the relays normal when registration is released, provide two-out-of-five output for perforating this digit as registered on straddle initial entries and provide in part for the combining of this digit with the call class to form a two-out-of-five digit for the combined class and called number index used on detail and overcapacity entries.

3.049 *Figs. 77 and 130—disconnect hour tens registers (odd and even)*

These relays ODHT0–7700, ODHT1–7701 and ODHT2–7702 register on a trinary basis (one-out-of-three) the tens digit of the hour as taken from the disconnect portion of the selected assembling register into the odd register. Fig. 130 indicates the corresponding even register. Contacts on these relays check that a valid one and only one of these relays has operated, check the relays normal when registration is released and provide a two-out-of-five output for perforating this digit on straddle timing and overcapacity entries.

3.050 *Figs. 80 and 133—answer hour tens register (odd and even)*

These relays OAHT0–8000, OAHT1–8001 and OAHT2–8002 register on a trinary basis (one-out-of-three) the tens digit of the hour taken as from the answer portion of the selected assembling register into the odd register. Fig. 133 shows the similar even register. Contacts on these relays check that one and only one of these relays has operated, check the relays normal when registration is released, provide a two-out-of-five output for perforating this digit on straddle timing entries and provide in part for the combining of this digit with the answer minute tens digit (Figs. 81 and 134) to form a two-out-of-five digit for use as part of the start time line on detail and overcapacity entries.

3.051 *Figs. 78 and 131—disconnect minute tens register (odd and even)*

These relays ODMT0–7800, ODMT1–7801, ODMT2–7802 and ODMT4–7803 register on a two-out-of-four basis (see below) the minute tens digit as taken from the disconnect portion of the selected assembling register into the odd register. The corresponding even register is shown in Fig. 131. Contacts on these relays check that a valid combination of these relays has operated, check the relays normal when registration is released, provide a two-out-of-five output for perforating this digit on traddle timing and overcapacity entries and provide a translation from the two-out-of-four code to the bi-trinary base (see below) for use in the computing of chargeable time.

Minute Tens	2-Out-of-4	B-Trinary
0	2, 4	00, 0
1	0, 1	00, 1
2	0, 2	00, 2
3	1, 2	3, 0
4	0, 4	3, 1
5	1, 4	3, 2

3.052 *Figs. 81 and 134—answer minute tens register (odd and even)*

These relays OAMT0–8100, OAMT1–8101, OAMT2–8102, OAMT4–8103 register on a two-out-of-four basis (see table Section 3.051) the tens digit of the minute tens taken from the answer portion of the selected assembling register into the odd register. Fig. 134 is the corresponding even register. Contacts on these relays check that a valid combination of these relays has operated, check the relays normal when registration is released, provide a two-out-of-five output for perforating this digit on straddle timing entries, provide a translation from the two-out-of-four code to the bi-trinary base (see table of Section 3.051) for use in the computing of chargeable time, provide in part for the combination of this digit with the answer hour tens digit (Figs. 80 and 133) to form a two-out-of-five digit for use as part of the start time line on detail and overcapacity entries and provide in part for the combining of this digit with the answer day tens digit (Figs. 80 and 133) to form another two-out-of-five digit for use as part of the start time line.

3.053 *Figs. 79 and 132—timed release index register (odd and even)*

These relays ONTR–7901 and ODTR–7902 register in the odd register on a binary basis an indication taken from the disconnect portion of the selected assembling register as to whether or not the disconnect timing entry was placed on the central office type as a result of a time release condition. Fig. 132 includes similar relays for the even register. Contacts on these relays check that one of these relays is operated, check the relays normal when registration is released and provide a one or a three-out-of-three output for perforating the A digit of straddle timing entries.

3.054 *Figs. 77, 80, 83 to 86, 93, 130, 133, 136 to 139 and 146—registers with decimal translators (odd and even)*

Each of these groups of relays (such as ODHU0–7703, ODHU1–7704, ODHU2–7705, ODHU4–7706 and ODHU7–7707 for registering the disconnect hour units in the odd register) registers on a two-out-of-five basis a digit as part of an initial entry line, as part of a computer result or as part of a digit taken from a selected assembling register. Figs. 77, 80, 83 to 86 and 93 relate to the odd register and Figs. 130, 133, 136 to 139 and 146 relate to the even register. Contacts on each group of these relays check that a valid combination of these relays has operated, check the relays normal when registration is released, provide a two-out-of-five output for perforating the digit registered on one or more entries and provide a translation from two-out-of-five to one-out-of-ten for computing purposes or prepare for sorting message unit calls. Particularly, registers of this class are the relays OAHU– (Fig. 80), OBIT– (Fig. 83), OBIU– (Fig. 84), OCLTH– (Fig. 85), OCLU– (Fig. 86) and OSD– (Fig. 93) of the odd register.

3.055 *Figs. 78, 79, 82, 84 to 94, 131, 132, 135 and 137 to 147—registers with two-out-of-five output (odd and even)*

Each of these groups of relays (such as ODMU0–7804, ODMU1–7805, ODMU2–7806, ODMU4–7807 and ODMU7–7808 for registering disconnect minute units in the odd register) registers on a two-out-of-five basis a digit as part of an initial entry line, as part of a computer result or as part of a digit taken from a selected assembling register. Contacts on each group of these relays check that a valid combination of these relays has operated, check the relays normal when registration is released and provide a two-out-of-five output for perforating the digit registered. Figs. 78, 79, 82 and 84 to 94 relate to the odd register and Figs. 131, 132, 135 and 137 to 147 relate to the even register.

3.056 *Figs. 77, 80, 130 and 133—registers without output (odd and even)*

These relays (such as ODD0–7708, ODD1–7709, ODD2–7710, ODD4–7711 and ODD7–7712 for registering disconnect day) register on a two-out-of-five basis the day digits as taken from the answer and disconnect portions of assembling registers into the odd register. Fig. 80 shows the answer day relays for the odd register. Figs. 130 and 133 indicate corresponding relays in the even register. Contacts on these relays check that a valid combination of these relays has operated and check the relays normal when registration is released. These relays merely hold the registration for use by the computing portion of the circuit.

3.057 *Figs. 123 to 126 and 175 to 178—register control (odd and even)*

This circuit controls the registration in and the restoration to normal of a complete call register portion of the machine, including the associated input (initial entry, answer and disconnect) connector, computer connector and output connector apparatus. The odd register control is shown in detail as follows:

Relay OCLDC–**12300** indicates that the registers used to record the first line of an initial entry are normal.

Relay OCGDC–**12301** indicates that the registers used to record the second line of an initial entry are normal.

Relay OAODC–**12302** indicates that the registers used to record the third line of an initial entry are normal.

Relay OCDDC–**12303** indicates that the registers used to record the fourth line of an initial entry are normal.

Relay OCLUC–**12304** indicates that the registers used to record the first line of an initial entry have made a successful check of this registration. This relay is also used to indicate that an initial entry has been received on a call and for determining the output class of the call and the number of lines to be used in perforating the output.

Relay OCGUC–**12305** indicates that a valid registration has been received in the registers which record the second line of an initial entry.

Relay OAOUC–**12306** indicates that a valid registration has been received by the registers used to record the third line of an initial entry.

Relay OCDUC–**12307** indicates that a valid registration has been received by the registers which record the fourth line of an initial entry.

Relay ODDC–**12506** indicates that the registers used to record the disconnect time and the indication of the first call taken from an assembling register are normal.

Relay OADC–**12401** indicates that the registers used to record the answer time taken from the assembling registers are normal.

Relay ODUC–**12507** indicates that a valid registration of the disconnect time and the first call indication taken from the assembling register has been recorded.

Relay OAUC–**12403** indicates that a valid registration of the answer time taken from the assembling register has been successfully recorded.

Relay OFCD–**12600** indicates that the call entries taken from an assembling register do not represent a possible first call.

Relay OFCU–**12601** indicates that the call entries taken from an assembling register are or may be part of a first call.

Relay ONES–**12602** indicates that the time entries being taken from the assembling registers are in conjunction with calls being read from the tape.

Relay OES–**12603** indicates that the call entries being taken from the assembling registers are not part of calls taken directly from the tape but are the call ends remaining in assembling registers which are being cleared out preparatory to accepting a new tape section.

Relay ODD–**12500** indicates that no timing entry is registered in the disconnect portion of the assembling register being read-out.

Relay ODU–**12501** indicates that a timing entry is recorded in the disconnect portion of the assembling register being read-out.

Relay OAD–**12502** indicates that no timing entry is registered in the answer portion of the assembling register being read-out.

Relay OAU–**12503** indicates a timing entry is registered in the answer time portion of the assembling register being read-out.

Relay ORONG–**12604** supplies off-normal ground to all call register entries in this odd register portion of the circuit of the machine.

Relay OAUCT–**12504** indicates that only one timing entry is to be taken from the assembling register on read-out and, therefore, that the answer time register is to be filled with the same quantities as the disconnect time registers.

Relay OADR–**12404** indicates that an initial entry is being registered and that the answer-disconnect register connector may be operated.

Relay OCCR–**12405** indicates that a call is being registered in this odd call register portion of the machine and that the operation of the computer connector is desired if the computer portion of the machine is available.

Relay ORLS–**12605** releases all registrations in this odd call register portion of the machine upon a suitable signal from the perforate portion or upon the discard of a call.

Relay OADC1–**12505** indicates that only one timing entry was received on the call and therefore sets the proper observing index value on observing calls.

Relay OODC–**12400** indicates that the registers used to record the output class, number of lines in the output and other output information from the computer are normal.

Relay OOUC–**12402** indicates that a valid registration has been received in the registers used to record the output class, number of lines to be perforated and other output computer information and that the connection to the perforate portion of the machine may be started by operating the associated output connector. At the same time the associated computer portion of the machine may be released.

Relay OODUC–**12406** indicates that the call is to be discarded and that no output is required.

3.058 *Fig. 181—day translator—A (answer and disconnect)*

These two groups of five relays DDT0–**18100** to DDT7–**18104** and ADT0–**18105** to ADT7–**18109**, located in the computer portion of the machine, translates the respective disconnect and answer day digits (registered in a call register portion) from the two-out-of-five code as registered to the bi-quinary code (as shown in the table below) for use in subtracting the answer time from the disconnect time.

Decimal	2/5	Bi	Quinary
0	4,7	00	0
1	0,1	00	1
2	0,2	00	2
3	1,2	00	3
4	0,4	00	4
5	1,4	5	0
6	2,4	5	1
7	0,7	5	2
8	1,7	5	3
9	2,7	5	4

3.059 *Figs. 184 and 185—hour units translator (answer and disconnect)*

These two groups of five relays DHUT0–**18400** to DHUT7–**18404** and AHUT0–**18500** to AHUT7–**18504**, located in the computer portion of the machine, provide two translations of the answer and disconnect hour units

digits registered in a call register portion from the two-out-of-five code to the out-out-of-ten code for use in converting the hour value for use in subtracting the answer from the disconnect time.

3.060 *Figs. 182 and 183—hour tens translator (answer and disconnect)*

These two groups of relays DHTT0–18200, DHTT1–18201, DHTT2–18202 and AHTT0–18300, AHTT1–18301, AHTT2–19302 located in the computer portion of the machine operate in parallel with the answer and disconnect hour tens digits register relays (Figs. 77, 80, 130 and 133) in a call register portion to translate in combination with two decimal outputs of the hour units translator (Figs. 184 and 185) and one decimal output from the hour units register (Figs. 77, 80, 130 and 133) from decimal to a base 24 code (as shown below) for use in subtracting the answer time from the disconnect time.

Hour		Hour Translation		
Tens	Units	Quaternary	Binary	Trinary
0	0	000	00	0
0	1	000	00	1
0	2	000	00	2
0	3	000	3	0
0	4	000	3	1
0	5	000	3	2
0	6	6	00	0
0	7	6	00	1
0	8	6	00	2
0	9	6	3	0
1	0	6	3	1
1	1	6	3	2
1	2	12	00	0
1	3	12	00	1
1	4	12	00	2
1	5	12	3	0
1	6	12	3	1
1	7	12	3	2
1	8	18	00	0
1	9	18	00	1
2	0	18	00	2
2	1	18	3	0
2	2	18	3	1
2	3	18	3	2

3.061 *Figs. 186 and 187—minute units translator (answer and disconnect)*

These two groups of five relays DMUT0–18600 to DMUT7–18604 and AMUT0–18700 to AMUT7–18704, located in the computer portion of the machine, translate the answer and disconnect minute units digits (Figs. 78, 82, 131 and 135) registered in a call register portion from the two-out-of-five to the bi-quinary code as shown in the table of Section 3.058) for use in subtracting the answer time from the disconnect time.

3.062 *Figs. 188 and 189—minute tenths translator (answer and disconnect)*

These two groups of five relays DMMPT0–18800 to DMMPT7–18804 and AMMPT0–18900 to AMMPT7–18904, located in the computer portion of the machine, translate the answer and disconnect minute tenths digits (Figs. 79, 82, 132 and 135) registered in a call register portion from the two-out-of-five code to the bi-quinary code (as shown in the table of Section 3.058) for use in subtracting the answer time from the disconnect time.

3.063 *Fig. 204—minute tenths quinary subtractor*

These relays DMMPQ0–20400 to DMMPQ–20404 and AMMPQ0–20410 to AMMPQ4–20414 add the complement of the quinary portion of the answer minute tenths (obtained from the minute tenths translator—Figs. 188 and 189) to the corresponding portion of the disconnect minute tenths.

3.064 *Fig. 203—minute tenths binary subtractor*

These relays DMMPB00–20300, DMMPB5–20305 and AMMPB00–20310, AMMPB5–20315 add the complement of the binary portion of the answer minute tenths (obtained from the minute tenths translator—Figs. 188 and 189) to the corresponding portion of the disconnect minute tenths with the carry-in of the result of the minute tenths quinary (see paragraph 3.063) to determine the carry-in to the timed release index subtractor (Fig. 203). Three options are provided, in the form of various settings of the switches 20303 and 20304, to determine the number of tenths of a minute to be allowed in computing chargeable time in whole minutes.

3.065 *Fig. 203—timed release index subtractor*

These relays NTR–20301 and DTR–20302 modify the carry from the minute tenths to minute units subtractor to account for a further allowance of .6 second on calls where the disconnect timing entry was placed on the central office tape as a result of a timed release. These relays, located in the computer portion of the machine, operate in parallel with the timed release index register relays (Figs. 79 and 132) in a call portion of the circuit.

3.066 *Fig. 202—minute units quinary subtractor*

These relays DMUQ0–20200 to DMUQ4–20204 and AMUQ0–20210 to AMUQ2–20214 add the complement of the quinary portion of the answer minute units, obtained from the answer minute units translator, to the corresponding portion of the disconnect units with a carry-in of 0, 1 or 2 from the minute tenths subtraction to determine the quinary part of the chargeable time units digit. A carry-in of 1 is also possible on non-straddle calls on which only one timing entry is taken from the assembling register.

Relays UQ0–20205, UQ1–20206 and UQ2–20207 repeat the carry-in from the minute tenths subtractor. Another contact network on the minute units quinary subtractor relays provides a carry-out of 0, 1 or 2 to the minute units binary subtractor.

3.067 *Fig. 201—minute units binary subtractor*

These relays DMUB00–20100, DMUB5–20105 and AMUB00–20110, AMUB5–20115 add the complement of the binary portion of the answer minute units, obtained from the answer minute units translator, to the corresponding portion of the disconnect minute units with a carry-in of 0, 1 or 2 from the minute units quinary subtractor to determine the binary part of the chargeable time units digit.

Relays UB0–20101, UB1–20102 and UB2–20103 repeat the carry-in from the minute units quinary subtractor. Another contact network on the minute units binary subtractor relays provides a carry-out of 0, 1 or 2 to the minute tens trinary subtractor.

3.068 *Fig. 200—minute tens trinary subtractor*

These relays DMTT0–20000, DMTT1–20001 DMTT2–20002 and AMTT0–20010, AMTT1–20011, AMTT2–20012 add the complement of the trinary portion of the answer minute tens, obtained from a call register portion of the machine (Figs. 81 and 134), to the corresponding portion of the disconnect minute tens with a carry-in of 0, 1 or 2 from the minute units binary subtractor to determine the trinary part of the chargeable time tens digit.

Relays TT0–20003, TT1–20004 and TT2–20005 repeat the carry-in from the minute units binary subtractor. Another contact network on the minute tens trinary subtractor relays provides a carry-out of 0, 1 or 2 to the hour trinary subtractor and minute tens binary subtractor.

3.069 *Fig. 199—minute tens binary subtractor*

These relays DMTB00–19900, DMTB3–19903 and AMTB00–19910, AMTB3–19913 add the complement of

the binary portion of the answer minute tens, obtained from a call register portion of the machine (Figs. 81 and 134), to the corresponding portion of the disconnect minute tens with a carry-in of 0, 1, 2, 3, 4 or 5 from the hour trinary subtractor to determine part of the chargeable time tens digit.

Relays TB0–19904, TB1–19901 and TB2–19902 repeat the carry-in from the minute tens trinary subtractor relays. Another contact network on the minute tens binary subtractor relays provides a carry-out of 0, 1 or 2 to the hour trinary subtractor.

3.070 *Fig. 198—hour trinary subtractor*

These relays DHT0–19802, DHT1–19803, DHT2–19804 and AHT0–19807, AHT1–19808, AHT2–19809 add the complement of the trinary portion of the hour, obtained from the answer hour tens translator, to the corresponding portion of the disconnect hour with a carry-in of 0, 1 or 2 from the minute tens trinary subtractor to determine the carry-out of 0, 1, 2, 3, 4 or 5 to the minute tens binary subtractor. Another contact network on these relays provides a carry-out of 0, 1 or 2 to the hour binary subtractor.

3.071 *Fig. 198—hour binary subtractor*

These relays DHB00 – 19800, DHB3 – 19801 and AHB00–19805, AHB3–19806, together with relay CC2–19810, add the complement of the binary portion of the hour, obtained from the answer hour tens translator, to the corresponding portion of the disconnect hour with a carry-in of 0, 1 or 2 from the hour binary subtractor to determine whether the result is zero or not zero. Another contact network on these relays provides a carry-out of 0 or 1 to the hour quaternary subtractor.

3.072 *Fig. 197—hour quaternary subtractor*

These relays DHQ000–19700, DHQ6–19701, DHQ12–19702, DHQ18–19703 and AHQ000–19704, AHQ6–19705, AHQ12–19706, AHQ18–19707 add the complement of the quaternary portion of the hour, obtained from the answer hour tens translator, to the corresponding portion of the disconnect hour with a carry-in of 0 or 1 from the hour binary subtractor to determine whether the result is zero, is not zero when the carry-in is 0 or is not zero when the carry-in is 1. Another contact network on these relays provides a carry-out of 0 or 1 to the day quinary subtractor.

3.073 *Fig.196—day quinary subtractor*

These relays DDQ0–19600 to DDQ4–19604 and ADQ0–19610 to ADQ4–19614 add the complement of the quinary portion of the answer day, obtained from the answer day translator A, to the corresponding portion of the disconnect day with a carry-in of 0 or 1 from the hour quaternary subtraction to determine whether the result is zero, is not zero when the carry-in is 0 or is not zero when the carry-in is 1. Another contact network on these relays provides a carry-out of 0 or 1 to the day binary subtractor. A carry-in of 1 is also possible on straddle calls involving one timing entry to enable the production of a day difference to permit the reconstruction of the answer day.

3.074 *Fig. 196—day binary subtractor*

These relays DDB00–19606, DDB5–19605 and ADB00–19616, ADB5–19615 add the complement of the binary portion of the answer day, obtained from the answer day translator A, to the corresponding portion of the disconnect day with a carry-in of 0 or 1 from the day quinary subtractor to determine whether the result is zero or is not zero. Another contact network on these relays provides a final carry-out of 0 or 1 from the complete subtraction to the subtractor control for distinguishing positive and negative results.

3.075 *Fig. 29—chargeable time tens translator*

These relays CTT00–2900, CTT3–2901, CTT6–2902, CTT0–2903, CTT1–2904 and CTT2–2905 translate the result of subtracting part of the answer hour and minute tens digits from the disconnect hour and minute tens digits, giving the chargeable time tens digit. The result, if within the capacity of the subtractor circuit, is translated in this circuit the tri-trinary code to the decimal and two-out-of-five codes as follows:

Tri-Trinary	Decimal	2-Out-of-5
00, 0	0	4, 7
00, 1	1	0, 1
00, 2	2	0, 2
3, 0	3	1, 2
3, 1	4	0, 4
3, 2	5	1, 4
6, 0	6	2, 4
6, 1	7	0, 7
6, 2	8	1, 7

Relay CTOC–2906 operates in lieu of one of the relays CTT00–2900, CTT3–2901 and CTT6–2902 to indicate when the subtraction result exceeds an 8 in the chargeable time tens digit. Other contacts on these relays check that a valid combination thereof has operated and indicates whether or not the chargeable time tens digit is zero, thereby to aid in determining the chargeable time units digit.

3.076 *Fig. 30—chargeable time units translator*

These relays CTU00–3010, CTU5–3005, CTU–0–3000, CTU1–3001, CTU2–3002, CTU3–3003 and CTU4–3004 translate the result of subtracting the answer minute units digit (rounded off by the answer minute tenths digit) from the corresponding disconnect digits, giving the chargeable time units digits in tri-quinary code. Contacts on these relays check that a valid combination thereof has operated and translate from the bi-quinary to the decimal (2 sets) and two-out-of-five codes. In the event that the true subtraction result is 00, then the circuit is arranged to operate the relay CTU1–3001 to translate this condition as 01, thereby to produce the minimum charges on calls of such short duration.

3.077 *Fig. 195—subtractor control*

This circuit receives indications from part of the subtractor and is further controlled by the resulting chargeable time output to indicate the nature of the subtraction result.

Relays HB0–19500 and HBN0–19501 indicate whether or not the result of the hour binary subtraction is zero.

Relays HQ0–19502, HQN01–19503 and HQN00–19504 indicate whether or not the result of the hour quaternary subtraction is zero (2 not-zero relays, HQN01–19503 and HQN00–19504, are used to simplify the design of the subtractor contact network).

Relays DQ0–19505, DQN01–19506 and DQN00–19507 indicate whether or not the result of the day quinary subtraction is zero (2 not-zero relays DQN01–19506 and DQN00–19507, are used to simplify the design of the subtractor contact network).

Relays DB0–19508 and DBN0–19509 indicate whether or not the result of the day binary subtraction is zero.

Relay CR0–19510 indicates that the carry-out from the subtractor is 0 and hence that the result is negative. This indication is used to control the reconstruction of the calendar day associated with timing entries.

Relay CR1–19511 indicates that the carry-out from the subtractor is 1 and hence that the result is positive. This indication is used to control the reconstruction of the calendar day associated with timing entries.

Relay NOV–19512 indicates that all digit portions (hour binary and quaternary and day binary and quinary) beyond that used to indicate the chargeable time are zero. This indication in part determines the output class and the number of lines required in controlling the output perforation.

Relay OV–19513 indicates that some digit portions or the chargeable time tens digit, exceeds the limit of 8 which may be conveniently handled by the computer. This indication in part determines the output class and the number of lines required in controlling the output perforation.

Relay 99–19514 indicates that although the chargeable time is not overcapacity (less than 90) the number of message units calculated therefrom does exceed the allowable limit of 99.

Relay AAP–19515 indicates that the answer hour tens translator has detected that the answer hour as taken from the assembling register is the fictitious value 25. Contacts of this relay substitute the disconnect hour for the answer hour, if that hour is not also fictitious.

Relay DAP–19516 indicates that the disconnect hour tens translator has detected that the disconnect hour as taken from the assembling register is the fictitious value 25. Contacts on this relay substitute the answer hour for the disconnect hour if that hour is not also fictitious.

Relay ADAP–19517 detects when both the answer and disconnect hours are fictitious and substiutes the quaternary-binary-trinary representation of hour 00 for these two hours in the subtractor.

Relay AP–19518 operates on all fictitious hour conditions to by-pass the hour trinary portion of the circuit in computing chargeable time. A carry-in of one is automatically substituted for the normal carry-in from the minute tens binary subtractor. Thus, the result provided is that which is secured without adding in elapsed hours.

Relay DET–19519 indicates that no message unit formula is required for the billing index as translated. Hence, 00 is substituted for the output of the message unit tens and units translator. In addition, this relay in part controls the output class and number of lines required in controlling the output perforating.

3.078 *Fig. 20—billing index translator*

The relays BIT0–2000 to BIT9–2009 connect the group of ten billing index units leads to cross-connection punchings to provide a flexible interpretation of these digits according to the corresponding billing under the tens digit. The billing index tens digit, in operating one of these relays, indicates by a single cross-connection whether the call is toll, message unit or message unit-detail. Several subclasses of message unit and message unit detail are provided as follows according to the significance attached to the message units.

TYPES OF MESSAGE UNITS

MUL —Local area
MUE1—Contiguous area 1—intrastate
MUE2—Contiguous area 2—intrastate
MUT{MUT1—Contiguous area—interstate—less than 5 mess. units
MUT{MUT2—Contiguous area—interstate—5 or more mess. units

The units digit of the billing index either selects the message unit formula to be used in interpreting the chargeable time or indicates that no message units are to be computed (DET).

3.079 *Figs. 39, 46 and 47—message unit type translator*

This circuit indicates the type of message units (which are used for each call as interpreted by the billing index translator), the class of the call and the number of types of message units which may appear on calls in the marker group being processed.

Relays MUL–4700, MUE1–4600, MUE2–4601 and MUT–4602 indicate the type of message units which are involved on a particular call. Contacts on these relays indicate, for a particular combination of office index (taken from the office index translator through the office index translator output connector) and message unit type for a marker group with a particular number of types of message units, the value of the digit registered in the call register as the sort digit. These values are shown in the table below.

SORT DIGIT VALUE*

No. of Types of MU	2		3			4				5				
Type No.	1	2	1	2	3	1	2	3	4	1	2	3	4	5
Office Index:														
0	0	1	0	1	2	0	1	2	3	0	1	2	3	4
1	2	3	3	4	5	4	5	6	7	5	6	7	8	9
2	4	5	6	7	8	----				----				
3	6	7	----			----				----				
4	8	9	----			----				----				

* When obtained from message unit type translator.

The type numbers are assigned according to the number of types of message units for the marker group being processed and according to the particular significance of these types (see table below). Toll message units must be treated as two different types in order to obtain separate summaries of calls above and below the five message unit tax change point.

TYPE NO. (FOR MORE THAN ONE TYPE OF MU)

No. of Types	2		3			4				5				
Types:														
MUL	1	1	1	1		1	1			1				
MUE1	2		2			2				2				
MUE2		2	3				2			3				
MUT (MUT1	----			2		3	3			4				
MUT (MUT2	----			3		4	4			5				

Other contacts on these relays pass on for registration, in the call register portion of the machine, the type of message unit class.

Relays TOLL–4701, MU–4702 and MUD–4703 indicate, to the call register portion of the machine for registration therein, the class of the call being handled as obtained from the translation of the billing index tens digit.

Relay 2T–3900 indicates, and provides in part, the translation shown in the table above for sort digit values when the marker group being processed may produce calls requiring either of two types of message units.

Relay 3T–3901 indicates, and provides in part, the translation shown in the table above for sort digit values when the marker group being processed may produce calls requiring any of three types of message units (considering two types for the class MUT).

Relay 4T–3902 indicates, and provides in part, the translation shown in the table above for sort digit values when the marker group being processed may produce calls requiring any of four types of message units (considering two types for the class MUT).

Relay 5T–3903 indicates, and provides in part, the translation shown in the table above for sort digit values when the marker group being processed may produce calls requiring any of five types of message units (considering two types for the class MUT).

3.080 *Fig. 28—message unit formulae connector*

One of these one-hundred FC– – relays, such as FC00–2800, is provided for each message unit formula to connect the output of the tens digit of the chargeable time translator (Fig. 29) in decimal form to the formula selected on the call by the billing index units digit.

3.081 *Fig. 28—message unit formulae*

Each of these formulae translator relays T000–2801 to

T998–2802 translates the chargeable time into message unit charges. The tens and units digits of the number of message units is given for each number of minutes of chargeable time. The tens digit of the chargeable time selects two groups of connections (one for tens and the other for units digit of number of message units) for the two sets of decimal leads giving the units digit of the chargeable time and which are multipled to all formulae.

3.082 *Fig. 20—single message unit formula*

This relay, SMU–2010, is used when but one message unit is to be charged for each call regardless of its duration.

3.083 *Fig. 37—message unit tens translator*

These relays MUT0–3700 to MUT9–3709 translate the tens digit of the number of message units from the decimal code into the two-out-of-five code for storage in the connected call register portion of the machine. Other contacts on these relays determine in part the output class, the number of lines to be perforated and the sort digit on the tool message unit class of call.

3.084 *Fig. 38—message unit units translator*

These relays MUU0–3800 to MUU9–3809 translate the units digit of the number of message units from the decimal code into the two-out-of-five code for storage in the connected call register portion of the machine. Other contacts on these relays determine in part the output class, the number of lines to be perforated, the sort digit and the subclass on the toll message unit class of call.

3.085 *Fig. 127—office index translator*

This group of relays OIT0–12700, OIT1–12701, OIT2–12702, OIT4-12704 and OIT7–12707 translates the office index received in the computer portion from a call register portion of the machine (Figs. 85 and 138) to form, alone or in combination, the sort digit. These relays indicate to the office index translator output connector (Fig. 127), the office number for offices 0 to 4 with two leads on a decimal basis, whether or not the office index is zero (when sorting by principal office, the principal office is given office index 0) with two leads, and the office index on a two-out-of-five code when the sort digit is to be the office index.

3.086 *Fig. 127—office index translator output connector*

These relays connect the output from the office index translator (Fig. 127) to the sort digit register directly through the computer connector or indirectly through the message unit type translator.

Relay OIO–12703 permits the office index, as read, to be registered as the sort digit.

Relay P00–12705 permits the translation of the office index, whether or not it is zero, to be registered as the sort digit.

Relay 500–12708 permits the translation of office indices 0 to 4 to pass to the message unit type translator for securing a sort digit which combines the office index and the message unit type.

Relay 000–12706 passes an office index value of 0 (independently of the office index which is registered) to the message unit type translator to permit the production of a sort digit independent of the office index.

3.087 *Figs. 67 and 68—day translator*

These relays 28–6700, 29–6701, 30–6702, 31–6703, A0T–6800, A1T–6801, A2T–6802, A3–8T–6803, A9T–6804, D0T–6805, D1T–6806, D2T–6807, D3–8T–6808, D9T–6809, LR–6810, IR–6811 and FR–6812 take indications from:

(1) The round size translators (Figs. 129, 155) and round translators (Fig. 180) and round set-up switches (Figs. 190, 191, 205 and 206) to indicate whether the round being processed is the first, last or intermediate round.

(2) The set-up switches to indicate whether the month being processed is February or has 30 or 31 days.

(3) The subtractor control (Fig. 195) to indicate if the answer time is equal to, greater than or less than the disconnect time.

(4) The answer day translator (Fig. 181) to indicate whether the answer day as read from the assembling register on this call is a 0, 1, 2 or a 9 or is any value from 3 to 8.

(5) The disconnect day translator B (Fig. 181) to indicate whether the disconnect day as read from the assembling register on this call is a 0, 1, 2 or a 9 or is any value from 3 to 8.

From this information this circuit determines which value, or from what sources, the disconnect and answer day tens and units digits applicable on this call are to be obtained. The following tables and description indicate how the day is obtained for registering in the assembly registers and what translations are required for its complete reconstruction.

Last round.—Registering.—When processing the last round of the month, the period between 12 midnight and the 3 a.m. cutting point will register as a day units value of one greater than the number of days in the month. Thus

Day 01	Days in Current Month			
	28	29	30	31
Registered in Assembling Registers as	9	0	1	2

This enables the units value which is registered for call entries before (in actual time) midnight of the last day of the month to have the true day units value and also permits the arithmetical subtraction of day units to give the proper result.

Translating.—(The order of digits is 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 1, 2, etc. so that such a designation of 0–8 means all digits in the order inclusive of the two stated and such a designation as 3–1 means the same, etc.)

		Day Units Output							
Days in Month		28		29		30		31	
Units Value from Register		0–8	9	1–9	0	2–0	1	3–1	2
For—	where—								
Answer	A>D	AR	AR	AR	AR	AR	AR	AR	AR
	A≤D	AR	1	AR	1	AR	1	AR	1
Disconnect	A>D	AR	AR	AR	1	AR	1	AR	1
	A≤D	AR	1	AR	1	AR	1	AR	1

Days in Month		Day Tens Output							
		28		29		30		31	
Units Value from Register		0-8	9	1-9	0	2-0	1	3-1	2
For—	where—								
Answer	A>D	AR	AR	AR	AR	AR	AR	AR	AR
	A≤D	AR	0	AR	0	AR	0	AR	0
Disconnect	A>D	P1	------	P1	P1	P1	S1	P1	S1
	A≤D	AR	0	AR	0	AR	0	AR	0

First round.—Registering.—When processing the first round of the month the day units value of calls which straddle the change in month are registered as given in the following table. This permits complete arithmetical subtraction of day units on these calls.

Days in Previous Month	Register in Assembling Registers			
	28	29	30	31
Day:				
20	2	------	------	------
21	3	2	------	------
22	4	3	2	------
23	5	4	3	2
24	6	5	4	3
25	7	6	5	4
26	8	7	6	5
27	9	8	7	6
28	0	9	8	7
29	------	0	9	8
30	------	------	0	9
31	------	------	------	0

Translating.—For the disconnect day units output if the day tens output digit as obtained below is 2 or 3 then use the inverse of the shift shown for registering. On answer day units the units of the day as registered are used. Otherwise day units output are the same as day registered in assembling registers.

AR	P1		Other Day Tens Translations				
	28 or 29 Day Month	30 or 31 Day Month	P2	S1	S2	S3	S4
0	1	1	2	1	1	------	0
1	2	2	------	2	------	1	------
2	0	3	------	0	3	2	3
3	0	------	------	------	3	0	0

The day translator also performs some miscellaneous functions in connection with interpreting the number of days in the month being processed for controlling day progress. The relays of the day translator indicate all information outlined at the beginning of this section except Item 3 which is taken directly from the CR0–19510 relay and from the CR1–19511 relay of the subtractor control (Section 3.077).

3.088 *Fig. 60—answer day translator—B*

These relays ADT0–6000, ADT1–6001, ADT2–6002, ADT4–6004 and ADT7–6007, in the computer portion of the machine, determine from the answer day received from a call register portion of the machine whether the answer day digit as registered in the assembling register

Days in Previous Month	Day Tens Output										
	28		29		30		31				
Units Value from Register	1-9	0	1-9	0	1-9	0	1-8		9		0
For—	where—										
Answer	A>D	AR	------	AR	------	AR	------	AR		AR	------
	A≤D	AR	AR	AR	AR	AR	AR	AR		AR	AR
Disconnect	A>D	P1	AR	P1	AR	S1	P1	P1		------	S2
	A≤D	AR 0	AR	AR 0	AR	AR S3	AR	AR	S3 S4	AR S4	AR
Answer Units from	------	1-9 0	0-9	1-9 0	0-9	1-9 0	0-9	1-9	0 1-8	9 0	0-9

Intermediate rounds.—Registering.—Use day units as registered or changed, less one, as a result of the hour passing midnight.

Translating.—Use day units from register as day units output. Also applies a priori to above tables for day tens output.

For—	Where—	Day Tens Output		
Answer	A>D	AR	P1	AR
	A≤D	AR	P1	AR
Disconnect	A>D	P1	P2	P1
	A≤D	AR	P1	AR
Answer Units from Register	------	0	0	1-9
Current Units from Day Register	------	0	1-9	0.9

LEGEND

For units output.—AR means "as registered" in assembling register.

For tens output.—AR means "as registered" in day register, corrected by hour at midnight.

was a 0, 1, 2, or a 9 or was any of the values 3 to 8. This determination is for use in controlling the day translator (Section 3.087) in reconstructing the answer and disconnect day tens and units digits. Other contacts on these relays control directly the day register tens output connector in connection with a difference between the answer day registered on a call and the current day (see Section 3.036). These contacts indicate whether or not the answer day was zero.

3.089 *Fig. 66—answer day units connector*

These relays connect to the answer day translator or to the calendar day register for storing in the call register associated with the computer portion of the machine, through the computer connector, the correct answer day units digit under the principal control of the day translator.

Relay ARA–6600 connects the decimal outputs from

the day register to the computer connectors to form therefrom the answer day units digit on a two-out-of-five basis.

Relay AR–6601 connects the answer day, as read from the assembly register, to the computer connectors for use as the answer day units digit.

Relay A–1–6602 forms the answer day units value 1 on a two-out-of-five basis for storage as the answer day units digit independently of the current calendar day or the answer day taken from the assembling registers.

3.090 *Fig. 60.—disconnect day translator—B*

These relays DDT0–6010, DDT1–6011, DDT2–6012, DDT4–6014 and DDT7–6017, in the computer portion of the circuit, determine from the disconnect day received from a call register portion of the machine whether the disconnect day as registered in the assembling register was a 0, 1, 2 or a 9 or was any of the values 3 to 8. This determination is for use in controlling the day translator (Section 3.087) in reconstructing the answer and disconnect day tens and units digits. Other contacts on these relays translate from two-out-of-five to two decimal sets of leads to provide the disconnect day to the disconnect day units connector for reconstructing the disconnect day units digit.

3.091 *Fig. 66—disconnect day units connector*

These relays connect the disconnect day translator, in the computer portion of the machine, through a computer connector to the disconnect day units register in the connected call register.

Relay AT–6603 reforms, on a two-out-of-five basis, the disconnect day units digit with the same value as the disconnect day.

Relay P1–6604 reforms, on a two-out-of-five basis, the disconnect day units digit one greater than the disconnect day.

Relay L1–6605 reforms, on a two-out-of-five basis, the disconnect day units digit one less than the disconnect day.

Relay L2–6606 reforms, on a two-out-of-five basis, the disconnect day units digit two less than the disconnect day.

Relay D–1–6607 forms, on a two-out-of-five basis, the disconnect day units digit of one with a value independent of the value of the disconnect day.

3.092 *Figs. 91 and 144—disconnect day tens register (odd and even)*

These relays, exemplified by the relays ODDT0–9100, ODDT1–9101, ODDT2–9102 and ODDT3–9103 of the odd register, register on a one-out-of-four basis the disconnect day tens digit in a call register portion of the machine as received from the computer portion after the latter has interpreted the disconnect day as taken from the assembly register on the call. Contacts on these relays check that one and only one of these relays has operated, check that all relays are normal when the registration is released and provide a set of two-out-of-five output leads for perforating this digit on straddle timing and overcapacity entries.

3.093 *Figs. 92 and 145—answer day tens register (odd and even)*

These relays, exemplified by the relays OADT0–9201, OADT1–9202, OADT2–9203 and OADT3–9204 of the odd register, register on a one-out-of-four basis the answer day tens digit in a call register portion of the machine as received from the computer portion after the latter has interpreted the answer day as taken from the assembling register on the call. Contacts on these relays check that one and only one of these relays has operated, check that all relays are normal when the registration is released, provide a set of two-out-of-five output leads for perforating this digit on straddle timing entries and, together with the answer minute tens register, form a two-out-of-five coded digit of the start time line for perforating on detail and overcapacity entries.

3.094 *Figs. 95 and 148—units class register (odd and even)*

This circuit, illustrated in detail as to the odd register, registers the class of the call in the call register portion of the machine as indicated by the billing index tens digit translation in the computer portion of the machine.

Relays OTOLL–9500, OMU–9501 and OMUD–9502 operate on a one-out-of-three basis to indicate whether the call is toll, message unit or message unit-detail respectively. These relays contain contacts for checking that one and only one has operated, for checking that the relays are normal when the registration is released and for providing, in combination with the called number index register, a combined class and called number index digit on a two-out-of-five basis for perforating on detail and overcapacity entries.

Relays OMUL–9503, OMUE1–9504, OMUE2 (not shown), OMUT1 (not shown) and OMUT2–9505 operate on a one-out-of-five basis to indicate, on a message unit or message unit-detail class of call, the type of message units involved. These relays contain contacts for checking that one and only one has operated, for checking that the relays are normal when the registration is released or the call is of the toll class, for providing an indication to the traffic registers control circuit the type of message unit call and for providing for the perforating, on a two-out-of-five basis, the type of message unit, according to the following table, on message unit entries.

Type of MU	Digit Value	2-out-of-5 Code
MUL	0	4,7
MUE1	1	0,1
MUE2	2	0,2
MUT1	3	1,2
MUT2	4	0,4

3.095 *Figs. 98 and 151—input class translator (odd and even)*

These relays, illustrated in detail by the relays O2LI–9800 and O4LI–9801 of the odd register, indicate whether the initial entry registered in a call register is a bulk (2LI) or detail (4LI) initial entry. Paths through these relays determine in part the number of lines and the output class to be used in perforating a call.

3.096 *Figs. 95 and 148—lines register (odd and even)*

These relays, illustrated in detail by the ones in the odd register, register an indication of the number of lines to be perforated for a call being handled in a call register.

Relays O1L–9506, O2L–9507, O3L (not shown), O4L (not shown), O5L–9508, O6L–9509 and O7L–9510 indicate that 1, 2, 3, 4, 5, 6 and 7 lines respectively are to be perforated.

Relay ODISL–9511 indicates in effect that no lines are to be perforated. In other words, it indicates that the call is to be discarded.

Contacts on these relays check that one and only one of them has operated and check that they are normal when the registration is released. Relays in the perforate line count circuit (Fig. 64—see paragraph 3.111) operate in parallel with these register relays to prepare for perforating more rapidly.

3.097 *Figs. 96, 97, 149 and 150—output class register (odd and even)*

These relays, illustrated in detail by the relays O2MD–9601, O1MD–9602, OD–9603, OLODA–9604, OOD–9605, OOM–9606, O2M–9607, O1M–9608, O1T4I–9700,

O41–9701, O21–9702, O1T2I–9703, O2T–9704 and O1T–9705 in the odd register, indicate the entry or entries to be formed from the information stored in a call register. Specifically, the relays are designated to correspond to the output class covered in Section 2.47. Contacts on these relays indicate the tape on which the entry is to be placed and indicate for each perforate line count position which line pattern connector will be operated. Other contacts of these relays check that one and only one of them has operated, while others check that the relays are normal upon the release of registration. Relay ODISW–9706 indicates that no output entry is to be perforated. For classes 2MD and 1MD (relays O2MD–9601 and O1MD–9602), where the two entries are perforated on different tapes, the selection of the proper perforator is controlled by the perforate line count. Relay OLODA–9604 fills in 00 for the answer minute tens and units digits in perforating start time on observing non-answered calls.

3.098 *Figs. 99 and 152—output connector (odd and even)*

These relays, illustrated in detail for the odd register, connect a call register portion of the machine to the perforate control position thereof after the registered call has been processed through the computer portion of the machine.

Relay OUS–9900 is operated by the sort class translator (Figs. 192, 193, 207 and 208) at the beginning of the processing of a particular marker group to connect the message unit perforator connectors (Figs. 128, 154 and 179) to the units digit register of the calling line (Figs. 86 and 139) for the case where this digit controls the sorting of message unit calls.

Relay OTHS–9901 is operated by the sort class translator at the beginning of the processing of a particular marker group to connect the message unit perforator connectors to the thousands digit register of the calling line (Figs. 85 and 138) for the case where this digit controls the sorting of message unit calls.

Relay OSDS–9902 is operated by the sort class translator at the beginning of the processing of a particular marker group to connect the message unit perforator connectors to the sort digit produced by the computer portion of the machine for the classes where the sorting of message unit calls is controlled by office index or by message unit type or by a combination thereof.

Relay OOCA–9903 (and relay EOCA–15200 in its similar way) connects the output of the OUS–9900, OTHS–9901 or OSDS–9902 relays on each call when ready for perforating from a particular call register portion of the machine.

Relay OOCB–9904 (and relay EOCB–15201 in its similar way) connects the leads which select the number of lines to be counted by the perforate line count from the output class register of a particular call register portion of the machine. In addition, it connects through certain leads which control the output connector and which indicate when the perforate control portion of the machine is ready for and finished with a complete perforate operation. This relay also connects the leads which indicate the line being perforated to the output class register of a particular call register portion of the machine to control the operation of a particular line pattern connector. In addition, it connects through leads which control the particular perforator selected by the output class register.

3.099 *Figs. 104 to 122 and 156 to 174—pattern connectors (odd and even)*

These relays, illustrated in detail for the odd register, connect the outputs of the digit of each call register portion of the machine to the perforator check and perforator connectors for controlling the perforation of call entry

lines on output tapes. The following is a list of the line pattern connectors, the entries in which they are used and the general contents of each line.

Pattern Designation	Where Used (entries)	Contains
OI1-11000	1st line of straddle initial	Class, billing and call identity indices.
ODOI2-11200	2nd line of straddle initial 1st line of detail and overcapacity.	Office index and calling line number.
ODOI3-11400	3rd line of straddle initial detail and overcapacity.	Area and called number (class) indices and called office.
ODOI4-11600	4th line of straddle initial detail and overcapacity.	Called line number.
ODO2-10701	2nd line of detail and overcapacity.	Start (ans.) time.
OD5-12000	5th line of detail	Observing index chargeable time and message or toll units.
OO5-10600	5th line of overcapacity	Observing index, disconnect minutes and tenths of minutes and tenths of answer minutes.
OO6-11100	6th line of overcapacity	Billing index and disconnect hour and day.
OMU1-11201	1st line of message unit	Calling line number and sorting digit or message units (see Section 3.100).
OMU2-12200	2nd line of message unit	Message unit index and message units.
OT1D-10400 or OT1A-10700.	1st line of straddle timing.	Hour.
OT2D-11800 or OT2A-11900.	2nd line of straddle timing.	Day.
OT3D-10500 or OT3A-10800.	3rd line of straddle timing.	Minute and call identity index.

(Use OT1D, OT2D and OT3D for disconnect time and OT1A, OT2A and OT3A for answer time.)

3.100 *Figs. 100 and 153—MU1 sub-pattern connector (odd and even)*

These relays, illustrated in detail for the odd register, determine the information to be placed in the A and B digits of the MU1 line pattern (first line of message unit) in perforating message unit entries from a call register.

Relay OOI–10000 connects the output of the office index register (Figs. 85 and 138) to the B digit and a 2 to the A digit for perforating the first line of a two-line message unit entry where office sorting may be required at a later accounting stage.

Relay OTMU–10001 connects the output of the units class register (Figs. 95 and 148) to the B digit and a 2 to the A digit for perforating the first line of a two-line message unit entry where sorting by message unit type may be required at a later accounting stage.

Relay OSD–10002 connects the output of the sort digit register (Figs. 93 and 146) to the B digit and a 2 to the A digit for perforating the first line of a two-line message unit entry where sorting by a digit determined by the computer portion of the machine may be required at a later accounting stage.

Relay OMUU–10003 connects the output of the message unit units digit register (Figs. 94 and 147) to the B digit and a 1 to the A digit for perforating a one-line message unit entry where no sorting by this digit is to be required at a later stage and where the total message unit charge does not exceed 9.

Relay OB0–10004 connects a 0 to the B digit and a 2 to the A digit for perforating the first line of a two-line message unit entry where no sorting is to be required at a later stage and where the office of the calling line is fully identified by the tape identity information.

3.101 *Figs. 192, 193, 207 and 208—sort class translator*

These relays determine, from the setting of the sort class set-up switch (Figs. 190, 191, 205 and 206) and from the "C" cross-connecting of the marker group selecting circuit (Fig. 102), the sorting treatment to be afforded to message unit calls and to the related tape

identity information for both message unit and detail tapes.

Relays **1T–19300**, **2T–19200**, **3T–19201**, **4T–19202** and **5T–19203** indicate the number of types of message units (1, 2, 3, 4 or 5 respectively) which may be expected on calls from the marker group being processed.

Relays SO–**19204** and MO–**19205** indicate respectively whether the marker group contains one (SO) office or more than one (MO) office.

Relay **25T–19301** indicates that more than one type of message units may be expected on calls from the marker group being processed.

Relays NS–**20700**, SBTH–**20800**, SBO–**20701**, SOPO–**20702**, SBOUT–**20801**, SOLU–**20802**, SBUT–**20803** and SBU–**20703** indicate the type of message unit sorting indicated by the sort class set-up switch (Figs. 190, 191, 205 and 206) as described in Section 2.36.

Relays BLKO–**19302** and BLKE–**19303** indicate whether the message unit tape being perforated with a tape identity group is being perforated by an odd or an even (respectively) perforator.

Relay DET–**19304** indicates when the detail tape is being perforated with a tape identity group.

Relay **A2L–19206** indicates that all message unit calls should be formed into two-line message entries.

Relay **12L–19207** permits the number of message units computed on a message unit call to determine in part the number of lines to be perforated on message unit entries.

The following table shows the various translations made by these relays to determine the digit by which the sorting is to be done, to determine how the sort digit register is to be filled from the computer (control of office index translator output connector), to determine what is to be filled into the B digit of the first line of two-line message unit entries (control of MU1 sub-pattern connector), to determine with what sort classes all message unit entries must be two lines and to determine the units digit of the tape index to be perforated on message unit tapes as a result of sort class selection as part of the tape identity group. These relays also participate in the control which determines the number of message unit tapes on which tape identity is to be perforated. (See table in Section 2.36.)

tors the perforation of tape identity groups will be stopped. Tape identity is placed first on the detail tape and then on the message unit tape section 0 and then on others in numerical order as determined by this circuit. The tape identity is concluded with the message unit section indicated by these relays as follows:

Relay	M.V. Perforators Prepared
A1P–10201	0 only
A2P–10202	0 to 1
A3P–10203	0 to 2
A4P–10204	0 to 3
A5P–10205	0 to 4
A6P–10206	0 to 5
A7P–10207	0 to 6
A8P–10208	0 to 7
A9P–10210	0 to 8
AAP–10211	0 to 9

These relays are controlled by the marker group selecting relay "B" cross-connection (see Fig. 102 and Section 3.021) directly or indirectly through the perforator assignment translator (see Fig. 102 and Section 3.103).

3.103 *Fig. 102—perforator assignment translator*

These relays modify the marker group selecting relays "B" cross-connection indications of the number of offices in each marker group (see Fig. 102 and Sections 3.021 and 3.102).

Relay **2AP–10212** permits the number of message unit perforators prepared with tape identity groups to equal two times the number of offices in the marker group.

Relay APCO–**10213** permits the number of message unit perforators prepared with tape identity groups to be acted upon by the sort class translator to in effect equal the number of offices in the marker group multiplied by the number of message unit types used in the marker group when the latter is greater than 2.

The table in Section 2.36 indicates the number of message unit tapes prepared under each class of sorting.

SORT CLASS TRANSLATIONS

Sort Class	Single or Multi-Office	One or More Types of MU	Fill in Sort Digit with Office Index Trans. Output Conn.	Fill in B Digit of MU1 Pattern on 2 Line MU Entries From—	Sort MU Calls by—	All Two Line Entries	Tape Index Units
SBTH	SO	IT	OIO	OI	THS		2.
SBU	SO	IT	OIO	OI	US		3.
NS	SO	IT	OIO	OI	NS		1.
SBTH	SO	25T	OIO	TMU	THS	A2L	2.
SBU	SO	25T	OIO	TMU	US	A2L	3.
NS	SO	25T	OIO	TMU	NS	A2L	9.
SBUT	SO	25T	500	OI	SD		1.
SOLU	SO	25T	500	TMU	SD	Other than MUL–2L.	BLKE 1. BLKO 9.
SBO	MO	IT	OIO	BO	SD		1.
SOPO	MO	IT	P00	OI	SD	Other than OF–0–2L.	BLKE 1. BLKO 0.
NS	MO	IT	OIO	OI	NS	A2L	0.
SBO	MO	25T	OIO	TMU	SD	A2L	9.
SOPO	MO	25T	P00	TMU	SD	Other than OF–0–2L.	BLKE 9. BLKO 8.
NS	MO	25T	500	SD	NS	A2L	8 No. of offices X, No. of Types of MU 8.
SBUT	MO	25T	000	OI	SD	A2L	0.
SOLU	MO	25T	500	TMU	SD	Other than MUL–2L.	BLKE 1 BLKO 9 } Maximum 5 offices.
SBOUT	MO	25T	500	BO	SD		1 No. of offices X, No of Types of MU 10.
			(Relay Designations).	(Relay Designations).			

3.102 *Fig. 102—perforator assignment pattern connector*

These relays **A1P–10201** to **A9P–10210** and **AAP–10211** determine at which of the message unit perfora-

3.104 *Fig. 101—perforator register and walking*

This circuit indicates and controls the connection of a selected perforator to the perforate magnet check

relays (Figs. 128, 154 and 179) and to the advance check relays (Fig. 194). The relays are associated with the perforator as follows: P0D–10100 straddle tape; P1D–10101 detail tape; P2D–10102 message unit tape; P3D–10103 message unit tape; P4D–10104 message unit tape; P5D–10105 message unit tape; P6D–10106 message unit tape; P7D–10107 message unit tape; P8D–10108 message unit tape; P9D–10109 message unit tape; P10D–10110 message unit tape; P11D–10111 message unit tape.

These relays have contacts for checking that one and only one connector is operated at any one time during perforating, for permitting the circuit to walk in ascending order over these tapes starting with the detail tape, for forming a two-out-of-five digit for the tape section digit of the tape identity group, for indicating odd and even numbered message unit tapes or detail tape, for controlling the perforating of the tape index number and, on the P0D–10100 relay, for indicating when an entry is placed on the straddle tape.

3.105 *Figs. 128, 154 and 179—perforator connector*

These relays PA0–17900, PA1–17901, PA2–17902 to PA10–17910 and PA11–17911 connect the 28 leads (for perforating the six digits of a line of tape) from the perforate magnet check relays (Figs. 128, 154 and 179) to the perforate magnets (Fig. 194) of the selected perforator. In addition, these relays connect the perforator advance magnet (Fig. 194) of the selected perforator and the perforator advance check relays (Fig. 194) to the perforate control circuit of Fig. 59.

3.106 *Figs. 194 and 209—perforator and tape cutter*

Twelve perforators are provided, one for making the output straddle tape, one for making the detail tape and ten for making the ten message unit tapes. Each perforator, such as perforator 0, has a perforator advance magnet 0PAM–19412, 28 punch magnets 0A2–19413 to OFO–19414 and a tape cut magnet 0CUT–19415 controlled by the tape cutter circuit of Fig. 209.

The tape cutter circuit of Fig. 209 includes a rectifier 20900 for supplying direct current to change the 12 condensers 20901 to 20912. The tape cut relays 0–20913 to 5–20914, when operated, cause the operation of an associated pair of perforator cut magnets (Fig. 194). These tape cut relays may be operated by closure of the tape cut key 20915 or by the operation of the relay MRL–1003 (see paragraph 3.001), which operates at the end of all tape processing to release the entire machine and to restore it to normal.

3.107 *Fig. 128—perforator magnet check—A digit*

These relays KA0–12800, KA1–12801 and KA2–12802 are connected in series between the perforator magnets for the A digit of the connected perforator and the reader perforating contacts through an operated pattern relay (odd, even or common group) and through a register or other group of digit forming relays. A check path through these relays insures that only a valid combination for this digit is perforated.

3.108 *Figs. 128, 154 and 179—perforator magnet check B to F digits*

These relays KB0–12810, KB1–12811, KB2–12812, KB4–12814, KB7–12817, KC0–15400 to KC7–15407, KD0–15410 to KD7–15417, KE0–17920 to KE7–17927 and KF0–17930 to KF7–17937 are connected in series between the perforate magnets for the B to F digits, respectively, of the connected perforator and the reader perforating contacts through an operated pattern relay (odd, even or common group) and through a register or other group of digit forming relays. A check path through these relays insures that only the valid two-out-of-five combination for each of these digits is perforated.

3.109 *Fig. 194—Perforator advance check*

These relays PK0–19400, PK1–19401, PK2–19402 to PK10–19410 and PK11–19411 are provided one for each perforator to check that the perforator advance magnet (such as 0PAM–19412) for one and only one perforator is energized when perforating a line of tape.

3.110 *Fig. 59—perforate control*

These relays control the perforate portion of the machine.

Relay PS–5900 operates during the perforating of each line of tape to indicate that a complete line has been perforated by one and only one perforator and that this perforator is the only one prepared to step when the open period of the reader cycle is completed.

Relay PM–5901 operates on lines being perforated and which have been validity checked to delay the advance of the tape of the perforator until the perforating pins have been withdrawn therefrom.

Relay PON–5902 operates to indicate that the perforate control portion of the machine has been seized for perforating a call from a call register portion (through odd or even pattern connectors) or for perforating an end of tape or a tape identity group or a window pattern (through common pattern connectors). This relay PON–5902 supplies off-normal ground for all perforate portions of the machine.

Relay ODC–5903 indicates that the perforate portion of the circuit is normal so that an odd or even call register portion of the machine may seize the perforate portion.

Relay PPRL–5904 indicates that the last line of an entry or entry group has been reached and prepares for indicating that the line has been perforated successfully and that the release of a call register or a common class relay may proceed.

Relay PRL–5905 detects the successful perforating of the last line of an entry or entry group and originates the transmission of a release signal to the connected register portion of the machine.

Relay CK–5906 indicates that a line pattern connector has operated and therefore that the perforate line count may be advanced.

Relay OP–5907 controls the operation of a line pattern connector (odd, even or common) through the perforate line count and output connector (odd, even or common) and insures its operation for only one reader perforate cycle.

3.111 *Fig. 64—perforate line count*

These relays PL1–6401, PL2–6402 to PL7–6407, PL8–6408 and PL10–6410 (representing ten such relays) and PLA1–6421, PLA2–6422 to PLA7–6427, PLA8–6428, PLA10–6430 and PLA11–6431 (representing eleven such relays) count in descending order the number of lines to be perforated in an entry or entry group. The relays PL– operate to prepare for the perforation and selection of a pattern connector while the relays PLA– operate between perforating cycles to steer to the next line pattern connector. A check path is provided to indicate to the perforate control when these relays are all normal.

3.112 *Fig. 65—common class translator*

These relays determine the number of lines required and the order in which common line pattern connectors

are required in perforating non-call entry groups on output tapes as shown in the table below:

Output Class	No. of Lines	Forming Non-Call Entries—Patterns Line No.—Count Down										
		11	10	9	8	7	6	5	4	3	2	1
TTI	11	2891	2892	2893	2894	2895	2896	2897	2898	2899	286	08
LTI	10	-----	08	2891	2892	2893	2894	2895	2896	2897	2898	2899
TTE	6	-----	-----	-----	-----	-----	284	283	280	281	282	08
LTE	6	-----	-----	-----	-----	-----	08	284	283	280	281	282
TTFE	7	-----	-----	-----	-----	284	283	280	285	281	282	08S
LTFE	7	-----	-----	-----	-----	08S	284	283	280	285	281	282
TE	5	-----	-----	-----	-----	-----	-----	284	283	280	281	282
TFE	6	-----	-----	-----	-----	-----	284	283	280	285	281	282
WS	3	-----	-----	-----	-----	-----	-----	-----	-----	287	08	287
STWS	11	284	283	280	281	282	08	284	283	280	281	282

The relays of this figure are designated to corresponds to the output class.

Relay TTI–**6500** is used to place trailing tape identity on the detail and message unit tapes.

Relay LTI–**6501** is used to place leading tape identity on the detail and message unit tapes.

Relay WS–**6502** is used to place window pattern over a window detected on the detail or a message unit tape.

Relay TTE–**6503** is used to place a trailing end-of-tape group with regular splice pattern on the straddle tape.

Relay LTE–**6504** is used to place a leading end-of-tape group with regular splice pattern on the straddle tape.

Relay TTFE–**6505** is used to place a trailing end-of-tape group, containing a 285 cancellation or transfer entry line and special splice pattern, on the straddle tape.

Relay LTFE–**6506** is used to place a leading end-of-tape group, containing a 285 cancellation or transfer entry line and special splice pattern, on the straddle tape.

Relay TE–**6507** is used to place an end-of-tape group without splice pattern on the straddle tape.

Relay TFE–**6508** is used to place an end-of-tape group, containing a 285 cancellation or transfer entry line without splice pattern, on the straddle tape.

Relay STWS–**6509**, in cooperation with relay LTE–**6504**, is used to place a central office tape type of window pattern (two end-of-tape groups) over a window detected on the straddle tape.

3.113 *Figs. 71 and 72—common pattern connector*

These relays connect a selected perforator to various common sources of information within the machine for perforating lines of non-call entry information. The following lists each pattern, tells where it is needed and shows the information contained in the entry line.

Pattern Relay	Where Used	Contains
2891–7101	Tape Identity Group	Tape Index.
2892–7102	do	Marker Group.
2893–7103	do	First Recorder Number.
2894–7200	do	Last Recorder Number.
2895–7201	do	Office Index if office sorted otherwise 0.
2896–7202	do	90-Thousands Range.
2897–7203	do	First and last day of round.
2898–7204	do	Tape section number and last round.
2899–7205	do	Month.
286–7207	do	Skip Splice.
285–7206	End-of-Tape Group	Cancellation and/or transfer signal.
287–7208	Window Pattern	Skip window.
08R–7209	Splice Pattern	Regular (splice pattern).
08S–7109	do	Special (splice pattern).
281–7105	End-of-Tape Group	Hour.
282–7106	do	Calendar Day.
280–7104	do	Recorder Number.
283–7107	do	Round and month.
284–7108	do	Day of round and marker group.

Relay **289–7110** operates with all 289-patterns.

Relay **8–7119** operates with all end-of-tape group patterns and with splice patterns.

Relay OB–**7210** operates to give a blank line (000000) for use on overcapacity message unit entries (lines 3 and 4) for either call register group.

3.114 *Fig. 64—common output connector*

This relay COC–**6400** connects the control indication of the number of lines required to be perforated on a non-call output entry to the perforate line count and connects the perforate line count indications through the common class translator to operate the proper common pattern connectors. Other contacts provide for selecting the straddle perforator connector, for progressing over the detail and assigned message unit perforators and connectors, for informing the perforate portion of the machine when it is seized for perforation of a non-call output class and for receiving the indication that the required perforation has been completed.

3.115 *Fig. 103—perforate walking control*

This circuit controls in general the operation of the perforate portion of the machine and in particular the advancing from the detail to successively assigned message unit perforator registers for placing tape identity groups on the associated tapes.

Relay CCUC–**10300** detects when it is desired to perforate a non-call entry on an output tape as indicated by a one and only check of the common output class translator. This relay prevents the further use of the perforate portion of the machine until the non-call output is completed.

Relay CODC–**10301** detects when the perforate portion of the machine is normal and therefore is available for use under control of the common class translator and to the exclusion of the call register portions of the machine.

Relay P1D1–**10302** operates to indicate that the perforator register for the detail tape has operated.

Relay PW–**10303** indicates that a tape identity group is to be perforated on the detail and assigned message unit tapes and prepares to control the walking of the perforator registers.

Relay PWS–**10304** indicates that the perforating of a tape identity group on a tape has been completed and that the next perforator register should be operated or the end of walking indicated.

Relay PD2U–**10305** indicates that the next perforator register has operated.

Relay PTTI–**10306** prepares the circuit to perforate trailing tape identity groups when the tape end key is operated after the last expected tape has been processed

and all call ends and end-of-tape groups have been placed on the straddle tape.

Relay ESP–**10307** indicates when the trailing end-of-tape group has been perforated on the straddle tape after the operation of the tape end key.

Relay ESPL–**10308** locks-in the indication afforded by relay ESP–**10307**.

Relay STWP–**10309** indicates that the placing of trailing splice pattern on the detail and assigned message unit tapes should be performed. It also prepares for returning the entire machine to normal when this action is concluded.

3.116 *Fig. 101—window detecting lockout*

These relays WSS–**10112**, WSD–**10113** and WS0–**10120** to WS9–**10129** are provided, one for each perforator (straddle, detail and ten message unit, respectively) for detecting a splice window in the unperforated tape being fed into each perforator. The machine then prevents call entries from being perforated over the splice by placing a spice pattern on the indicated tape or tapes, permitting, however, the output being perforated to be finished. These relays are arranged in a double-chain lockout so that when more than one window is detected simultaneously on different tapes, only one tape at a time will have window pattern perforated thereon. These relays select the order in which a plurality of such requests are to be served. They also distinguish a window on the straddle tape from one on any of the remaining tapes so that the central office tape form of window pattern may be used on the straddle tape if required.

3.117 *Fig. 59—window lockout control*

These relays act, in response to the detection of a window by any perforator, to control the perforating of the required common output class.

Relay CWS–**5908** indicates that some window has been detected, prepares the path for selecting the proper perforator register and lengthens the timing interval of the splice pattern timer.

Relay EWD–**5910** detects when the window contact of the perforator in which splice pattern is being perforated has reclosed, thereby indicating that the splice has passed.

Relay PLOR–**5911** prepares to introduce a delay in the restoring of the common output portion of the machine to normal to enable the window detecting lockout relays to restore to normal, thereby to give the circuit a chance to detect further windows before proceeding.

Relay LOR–**5912** attempts to release the window detecting lockout to normal when a window pattern is completed.

3.118 *Fig. 59—splice pattern timer*

This is a gas tube condenser-resistance controlled timer T–**5913** which, on **08** (regular) and **08S** (special) splice pattern lines permits the circuits to reperforate this line for the timed interval without advancing the line count.

Relay SSTM–**5914** starts the splice pattern timing.

Relay ESTM–**5915** indicates the end of a timed interval and permit the advance of the perforate line count to the next line pattern.

3.119 *Fig. 74—assembling register tens lockout*

The assembling registers are grouped according to their assigned tens digit of the call identity index and these relays detect the condition when any register in the group holds a registration. Contacts on these relays T**0**–**7400**, T**1**–**7401**, T**2**–**7402**, T**3**–**7403**, T**4**–**7404**, T**5**–**7405**, T**6**–**7406**, T**7**–**7407**, T**8**–**7408** and T**9**–**7409** provide a translation from a decimal code to a two-out-of-five code to form the tens digit of the call identity index, which is set up on the reading relay through the reading relay connector, thus enabling regular read-out control of the assembling registers. Relay GT–**7410** connects the decimal code leads to the detecting relays.

3.120 *Fig. 75—assembling register units walking*

These relays provide means for generating the successive two-out-of-five code digits (0 to 9), representing the units digit of the assembling registers in a group of ten, by progressing a step at a time with a group of ten relays U**0**–**7500**, U**1**–**7501**, U**2**–**7502**, U**3**–**7503**, U**4**–**7504**, U**5**–**7505**, U**6**–**7506**, U**7**–**7507**, U**8**–**7508** and U**9**–**7509**. Contacts on these relays control the walking from one step to the next. In addition, they contain contacts for alternating the selection of one or the other of the two call register portions (answer and disconnect) of the machine for handling the discard of the call or the perforating of a straddle entry or entry group.

3.121 *Fig. 76—assembling register walking control*

This circuit controls the actions of clearing the assembling registers of timing entries when a discontinuity in the possessing of central office tape occurs. The clearing is done by detecting all groups of ten assembling registers in which timing entries are registered and then by walking within the group to read these entries out into the call register portions of the machine.

Relay TUC–**7600** indicates when one and only one assembling register tens lockout relay is operated.

Relay UUC–**7601** indicates when one and only one assembling register unit walking relay is operated.

Relay TDC–**7602** indicates when all assembling register tens lockout relays are normal.

Relay UDC–**7603** indicates when all assembling register unit walking relays are normal.

Relay TS–**7604** operates to permit the assembling register tens lockout circuit to select a group which contains timing entries to be read-out.

Relay US–**7605** operates to permit the assembling register units walking circuit to take one step.

Relay U2UC–**7606** indicates when two successive assembling register units walking relays are operated.

Relay WST–**7607** indicates that the walking process may start after the reading relays have been connected to the lockout and walking circuits.

Relay CAR–**7608** detects that the tape identity progress requires that the assembling registers be cleared of call-ends. It also starts the transfer of the reading relays to the lockout and walking circuit through the reading relay connector.

Relay SW–**7609** completes the switching of the reading relays to the lockout and walking circuit through the reading relay connector.

Relay CRC–**7610** detects from the tape identity progress that the processing of a new tape section is to begin and indicates that a check is to be made that the assembling registers contain no timing entries.

Relay WSRE–**7611** and WSRO–**7612** are operated alternately under control of the assembling register units walking circuit to enable the even and odd call register portions of the machine to be used alternately.

3.122 *Fig. 61—assembly restart*

These relays control the setting of the first call indication in all assembling registers at the start of processing a tape section.

Relay OFC–**6111** operates the first call relays in all assembling registers when required.

Relay FCCU–**6112** indicates when at least one assembling register has its first call relay operated.

Relay FCCD–**6113** indicates when at least one assembling register has its first call relay normal.

Relay AFCU–**6114** uses the indications provided by

relays FCCD–**6113** and FCCU–**6112** to indicate when all first call relays are operated.

3.123 *Fig. 16—skip entry control.*

This circuit enables multilated entries which may appear on the central office tape and which are preceded by apology entries, to be passed over by an advance of the tape without the taking of action or checking.

Relay **287–1606** detects a 287DEF cancel-entry code preceding a mutilated call entry.

Relay **287R–1607** registers the cancel-entry 287DEF and provides for skipping the next line of tape and every line containing an A digit of zero thereafter, thereby skipping all lines of multiline entries.

Relay **2819–1608** detects a 281999 irregular hour entry preceding a mutilated hour entry.

Relays **2819R–1609** and **2819M–1613** register the irregular hour or cancel entries and provide for skipping the next line of tape provided the A2 hole is perforated in either case or A1 is perforated in the case of the cancel-entry.

3.124 *Fig. 10—alarm timing*

This gas tube condenser-resistance timing circuit T–**1014** detects when the machine is in trouble as a result of failure of any one or more of the following actions: (1) reader stepping; (2) lines perforated circuit not started; (3) walking over assembling registers when clearing out call ends and (4) skipping splice pattern.

Relay CT–**1013** acts to cancel the timing when any of the above conditions are detected.

Relay **T0–1008** indicates when the time out interval has occurred after the release of relay **CT–1013.**

3.125 *Fig. 10—alarm*

These relays detect an alarm condition and halt further tape reading by the machine.

Relay AL–**1005** indicates the alarm condition.

Relay ALS–**1009** indicates that a fuse has blown and that the alarm condition should not be brought in if possible until the call entry being read is completed.

Relay RSF–**1010** detects a condition where the reader fails to advance the tape when requested to do so.

Relay RSR–**1011** detects a condition where the reader is being continuously stepped without appropriate control at each step (RS relays of Figs. 26 and 27 fail to release).

3.126 *Fig. 58—recorder, hour, day reset*

These relays provide for resetting the recorder, hour and day registers in the event of a power failure or in the event of mutilation of these entry lines on the tape.

Relay RRS–**5806** connects to the recorder register for registration, under the control of the recorder reset key, the recorder number indicated by the setting of the recorder progress switch, provided the recorder register is normal.

Relays LC5–**5807**, LC6–**5808**, LC7–**5809** and LC8–**5810** are magnetically locking relays which indicate the previous setting of the corresponding RC relays (Fig. 42) of the recorder register and enable their resetting under control of the recorder reset key **1221.**

Relay DRS–**5811** connects for registration in the day register, under the control of the day reset key, the calendar day indicated by the setting of the day progress switch provided the day register is normal.

Relay ER–**5812** responds to the operation of the emergency reset key to reset the recorder, hour and day registers as performed by the associated reset keys and to reset other off-normal portions of the machine control when the indications are that the power has failed releasing all operated relays.

Relay MTI–**5813** responds to the operation of the mutilated tape identity, indicating that subsequent operation of the recorder or hour or day reset keys will set the tape identity reading progress to the proper point.

3.127 *Fig. 16—traffic register control*

These relays DA–**1610**, TC–TOLL–**1611** and TC–MUT2–**1612**, and associated traffic register counters, provide for counting the number of each class of call perforated on tapes and the number of discarded calls.

DETAILED DESCRIPTION OF CIRCUITS

4. *Detailed description*

4.01 *Setting of set-up switches*

The set-up switches (Figs. 190, 191, 205 and 206) on the control panel are set manually, before the actual tape processing is begun, in accordance with information accompanying a tape to be processed.

After the machine has been started by the several other preliminary operations described below, the positions of the set-up switches are compared with the information perforated in the end-of-tape group of the central office tape to be processed. The set-up switches and their indications are used in the circuit as described in Sections 4.05 to 4.10. Section 2.21 describes the set-up switches which are used in this machine and their purpose.

4.02 *Motor start and master off-normal operation*

Prior to the insertion into the reader (Figs. 7, 8 and 9) of a tape **703** to be processed, the motor start key **1006** is operated to start the reader motor **702** and to operate several off-normal relays which provide master off-normal grounds for various parts of the machine.

Relay MST–**1001** is operated through the emergency motor stop key **1004** normal and relay AL–**1005** normal. This operating circuit extends from ground, over contact **2** of key **1006**, over the contacts of key **1004**, over contact **1** of relay AL–**1005**, to the winding of relay MST–**1001.** Relay RLM–**1002** is operated directly from ground over contact **1** of the operated key **1006** when the motor start key **1006** is operated. Relay RR–**1000** is operated in an obvious circuit over contact **2** of the operated relay MST–**1001.**

Upon the operation of relay RR–**1000**, the reader motor **702** is energized and made to run by the extension of the alternating current source of power **1012** over contacts **1** and **2** of the operated relay RR–**1000**, over conductors **1015** and **1016** to motor **702**, assuming the motor switch **704** to be closed. The starting of motor **702** causes the cam shaft **705** to turn through the agency of gear box **718**, thus causing the cam surfaces **706**, **800** and **902** to turn continuously (1) to permit the reading pins of Fig. 7 to sense the tape **703** once per revolution, (2) to close the reader-perforator contacts at the left in Fig. 8 once per revolution, (3) to open and close the break and make contacts at the right of Fig. 8 and at the left of Fig. 9 once per revolution and (4) to open and close the control contacts at the right of Fig. 9 once per revolution. These various contacts, etc. will be referred to by their indicated designation.

Motor **702**, through the agency of gear box **718** and gearing **707** and **708**, turns cam shaft **709** with cam **710** attached thereto. Cam **710**, in rotating, imparts a square motion to the box-like cam follower **711** such that with the step magnet **700** operated (thereby withdrawing the solenoid plunger **712** thereof up into the magnet **700** and out of the way of the cam follower **711**—see Fig. 7A) the step pawl **713** will be successively raised from engagement with the teeth on the step gear **714** against the action of spring **717**, moved to the right against the action of spring **716**, lowered into engagement with step gear **714** by the action of spring **717**,

and allowed to move to the left under the action of the spring **716** to step the drum **715**, carrying tape **703** therewith one step. If the step magnet (solenoid) **700** is not operated, then the plunger pin **712** will prevent the cam follower from moving to the left under the action of spring **716**, thereby preventing the stepping of the tape drum **715**. The soledoind **700** is thus properly referred to as a step magnet, for when it is energized the tape drum **715** will be stepped one step for each revolution of the cam **710**. This reader stepping mechanism is of the type disclosed and claimed in the aforementioned application of F. M. Thomas.

At the start of processing when motor **702** is running adn when the step magnet **700** is unoperated all of the contacts of the reader as shown in Figs. 8 and 9 are repeatedly opened and closed once for each revolution of cam shaft **705**. The reader pins of Fig. 7, on the other hand, will be allowed to sense the tape **703** (or the holes in the drum **715** if there is no tape **703**) once per revolution of cam shaft **705**, thus opening and closing those contacts associated with tape or drum holes. For each new step of the drum **715** the contacts of Figs. 8 and 9 merely repeat their same operations but the reader pins of Fig. 7 will sense different holes in the tape **703**.

For purposes of having a yardstick at hand for intelligently discussing the circuit operation it is necessary to have some idea of the timing of various cam contact operations, etc. The cam shaft **705** turns 360 degrees for each cycle of reader operation. The stepping cam **710** is so phased mechanically that, for purposes of reference, the midpoint of the step stroke of the cam follower **711** is considered as zero degrees. With this reference point in mind the following tables indicate the timing of various reader contact operations related to 360 degrees of rotation of the cam shaft **705** and measured from the arbitrary reference zero degree rotation position. All contacts, reader pins, etc. are self-spring-biased to normally make contact with cooperating contacts. Cam surfaces, drum holes, or tape holes either prevent contacts from closing or permit them to close.

CONTACT GROUPS

Contact Group	Content of Group
Group I	Reader contacts A0 to F7 of Fig. 7. Step control contacts G1 and G2 of Fig. 7. Reader perforate contacts PA0 to PF7 of Fig. 8. Reader perforate contacts P1 and P2 of Fig. 9. Control contacts H0, H1, H2, H5, H6, H7, K0, K5, K6 and K7 of Fig. 8.
Group II	Control contacts H3, H4, H8, H9, K3, K8 and K9 of Fig. 8.
Group III	Control contacts J0, J1, J2, J5, J6 and J7 of Figs. 8 and 9.
Group IV	Control contacts J3 and J8 of Figs. 8 and 9.

READER CONTACT TIMING

Contact Group	Contact Closure	Contact Opening
Group I	63° to 298°	298° to 0° to 63°.
Group II	298° to 0° to 63°	63° to 298°.
Group III	115° to 350°	350° to 0° to 115°.
Group IV	350° to 0° to 115°	115° to 350°.

The MST–**1001** relay operates the master off-normal relay MON–**1201** from ground at the master release key **1007** normal, over contact **5** of relay MST-**1001**, over contact **2** of relay MRL–**1003**, over conductor **1017**, to the winding of relay MON–**1201**. This master off-normal relay MON–**1201** remains operated until the machine is master released by the simultaneous operation of the machine release key **1200** and the master release key **1007** or until the tape processing is completed at the end of placing trailing tape identity groups and splice pattern on the output tapes.

A locking path is provided for relay MST–**1001** extending over contact **1** of relay AL–**1005**, over the contacts of the emergency motor stop key **1004**, contact **4** of relay MST–**1001**, contact **2** of relay RLM–**1002**, over conductor **1018**, to ground over contact **29** of relay MON–**1201**. Relay RLM–**1002** is locked through its own contact **1**, over conductor **1019**, contact **2** of the release key **1200** to the off-normal ground on conductor **1018**. The operation of relay MON–**1201** causes relay RL0–**1202** to be operated from off-normal ground on conductor **1018**, over contact **3** of the release key **1200** to the winding of relay RL**0**–**1202**. Relay RL0–**1202** locks over its contact **5** and conductor MONLL–**1220** to ground over the master release key **1007** normal.

When the reader motor **702** has been started, the tape **703** to be processed is fed into the reader by operating the tape feed key **701**. With the motor **702** running, the operation of the tape feed key **701** operates the step magnet **700** in a circuit extending from ground, over contact **11** of relay ST**3**–**1102**, over conductor **1105**, through the contacts of the tape feed key **701**, through the winding of magnet **700**, over conductor **719**, to battery over contact **3** of relay MST–**1001**, thus permitting the reader drum **715** to rotate. The tape feed key **701** is released after it is ascertained that the tape **703** is tracking properly in the reader but before the section of splice pattern on the leading end of the tape **703** has completely passed the reader pins of Fig. 7.

4.03 *Starting reading operation*

Once the tape **703** has been inserted into the reader, the machine start key **1200** may be operated to enable the start of processing the tape. During the open period of the reader cycle (as shown on Figs. 7, 8 and 9) the KB**3** contact of Fig. 8 (break contact K**3**) closes causing ground to be extended from the reader contact ground **720**, over contact K**3**, conductor KB**3**, cable **8**–**9**, cable **9**–**18**, cable **18**–**26**, conductor KB**3**, contact **1** of relay ST**4**–**1103**, conductor **1106**, contacts of the start key **1200**, conductor **1207**, contact **2** of relay ST**2**–**1101**, conductor **1107**, contact **2** of relay ALS–**1009**, contact **5** of relay RLM–**1002**, conductor **1020**, to relay ST**1**–**1100** to operate same.

The reader connector RC–**900** operates from relays ST**1**–**1100** and MON–**1201** operated and relays CAR–**7608** and WC–**901** normal. This circuit may be traced from ground, over contact **7** of relay MON–**1201**, conductor **1208**, contact **3** of relay ST**1**–**1100**, conductor RC–**1108**, cable **11**–**25**, cable **25**–**36**, cable **36**–**59**, cable **59**–**72**, cable **72**–**73**, cable **7315**, conductor RC–**1108**, contact **2** of relay CAR–**7608**, conductor RC–**7613**, cable **76**–**75**, cable **9**–**75**, cable **903**, conductor RC–**7613**, contact **12** of relay WC–**901**, to the winding of relay connector RC–**900**. The operation of this connector relay RC–**900** connects the reader pins of Fig. 7 to the reading relays of the A to F digits (Figs. 13 to 15).

When the KB3 contact (Fig. 8) opens, the ground shunt on the right side of the winding of relay ST**2**–**1101** is removed permitting it to operate in series with relay ST**1**–**1100** through the following path: Ground over contact **6** of relay MON–**1201**, conductor **1209**, contact **1** of relay ST**1**–**1100**, winding of relay ST**2**–**1101**, conductor **1107**, contact **2** of relay ALS–**1009**, contact **5** of relay RLM–**1002**, conductor **1020**, through the winding of relay ST**1**–**1100** to battery.

The operation of relay ST**1**–**1100** closes a circuit for priming the reader line count circuit of Figs. 26 and 27 by operating relay SR1E–**2605**. This circuit extends from ground, over contact **7** of relay ST–**1100**, contact **7** of relay ST**3**–**1102**, conductor **2L**–**1109**, to the winding of relay SR1E–**2605**.

During this same reader closure, contact G**2** (Fig. 7) may close priming the reader step check. (See Section 4.04).

On the next reader open interval the closure of contact KB3 operates relay ST3–1102 through relay ST2–1101 operated. This circuit extends, as above described for the operation of relays ST1–1100 and ST2–1101, from the KB3 contact of the reader (Fig. 7), over the KB3 conductor, contact 1 of relay ST4–1103, conductor 1106, in parallel over the contacts of the start key 1200 if still operated or over contact 2 of relay ST1–1100, to conductor 1207, over contact 1 of relay ST2–1101, to the relay ST3–1102.

Relay ST3–1102, in operating, locks to ground through relays AL–1005 and RLS–1104 normal or through the machine release key 1200 and relay RLS–1104 normal. This circuit extends from the winding of relay ST3–1102, over its contact 1, through resistance 1110, in parallel over conductor 1111 and contact 1 of the release key 1200 to conductor 1210 or over conductor 1111 and contact 4 of relay AL–1005 to conductor 1210, to ground over contact 2 of relay RLS–1104. Relay ST3–1102 operated supplements the operate path for relay RC–900 by adding a ground over its contact 3 to the conductor RC–1108 and the hold path for relays RW–1600 and RZ1–1601 through RW–1600 operated and RZ3–1603 normal as described in Section 4.04. Relay ST3–1102 operated opens the priming circuit for the reader step check relays of Fig. 16 (Section 4.04) and reader line count relay SR1E–2605 but maintains locking circuits for these relays.

Relay ST4–1103 operates directly from contact 2 of relay ST3–1102.

Relays ST3–1102 and ST4–1103 operated provide grounds for holding the various relays in the circuit which pertain to the processing of calls and for preparing for regular tape reading operations. Relay ST4–1103 operated also supplements the locking path of relay MST–1001, making it independent of relay RLM–1002. This ground extends over contact 5 of relay MON–1201, conductor 1211, contact 2 of relay ST4–1103, conductor 1112, contact 4 of relay MST–1001, contacts of the motor stop key 1004, contact 1 of relay AL–1005, to relay MST–1001.

4.04 *Reader step check*

This feature provides that the reader of Fig. 7 steps once each time it is allowed to step by the operation of one of the reader step relays RS– of Figs. 26 and 27. The G1 and G2 contacts (Fig. 7) are closed in alternate positions of the reader drum. The reader step check circuit in the upper left of Fig. 16 predetermines the one of these two contacts it expects will be closed.

If the reader is initially stopped in a position where the G1 contact is closed at the closed portion of the reader cycle, a path is closed through relay RKA–1604 normal to permit the reading and checking of a line of tape by grounding lead RCK–1021 which extends from contact 3 of relay AL–1005 to Fig. 13 where it begins its validity route through the reading relays of Figs. 13, 14 and 15. This circuit for grounding lead RCK–1021 extends, under these circumstances from ground, over the G1 contact, conductor G1–721, contact 2 of relay RKA–1604, conductor 1614, contact 34 of connector RC–900, conductor 904, contact 9 of relay ST3–1102, conductor 1113, and over contact 3 of relay AL–1005 to conductor RCK–1021.

If the reader is initially stopped in a position where the G2 contact (Fig. 7) is closed at the closed portion of the reader cycle, the reader step check relays (Fig. 16) are primed during the starting of the circuit as follows: Relay RW–1600 is operated from contact G2 through relay ST3–1102 normal, relay ST1–1100 operated and relay RZ2–1602 normal. This circuit extends from ground, over the G2 contact, conductor G2–722, contact 6 of relay ST3–1102, contact 6 of relay ST1–1100,

reader step check conductor RSC–1114, contact 1 of relay RZ2–1602, to relay RW–1600. Upon the operation of relay RW–1600, ground is extended over contact 5 of relay ST1–1100 (later augmented by ground over contact 5 of relay ST3–1102 when the latter operates), conductor RSH–1115, contact 1 of relay RZ3–1603, contact 2 of relay RW–1600 to the relays RKA–1604 and RKB–1605, which thereupon are operated. The operation of relay RKB–1605 extends the grounded G2–722 conductor over its contact 2 to conductor 1614, contact 34 of connector RC–900, conductor 904, contact 9 of relay ST3–1102 when it operates, conductor 1113, and over contact 3 of relay AL–1005 to the check conductor RCK–1021, previously described. Relay RZ1–1601 is prevented from operating in series with relay RW–1600 until the ground on its right-hand terminal is removed at the end of the reader closure by the operation of rela ST3–1102. At this time, relay RZ1–1601 operates in series with relay RW–1600 from the ground on conductor RSH–1115 over contact 1 of relay RW–1600. Relay RZ1–1601, in operating, operates relay RZ2–1602 in an obvious circuit.

When a reader step relay RS– of Figs. 26 and 27 operates to advance the reader, the HB8 break contact (Fig. 8), during the open period of the reader, grounds lead RSC–1114 to the reader step check relays of Fig. 16. This circuit extends from ground, over contact H8 of the reader, conductor HB8, cable 8–9, cable 9–18, cable 18–26, conductor HB8, over contact 9 of relay RS–2600 or over contact 6 of any one of relays RS1E–2601 to RSO–2709, conductor RSC–1114 to Fig. 16. If relay RZ2–1602 is normal, relay RW–1600 is operated from the grounded conductor RSC–1114 over contact 1 of relay RZ2–1602, in turn operating relays RKA–1604 and RKB–1605 as before. At the end of the open interval relay RZ1–1601 operates in series with relay RW–1600, as previously described, in turn operating RZ2–1602 as before. If, however, relay RZ2–1602 is operated when lead RSC–1114 is grounded, relay RZ3–1603 will be operated from conductor RSC–1114 over contact 2 of relay RZ2–1602 to release relays RZ1–1601 and RW–1600. Relays RKA–1604 and RKB–1605 release in turn. Relay RZ2–1602 is held operated over contact 2 of relay RZ3–1603 until relay RZ3–1603 releases at the end of the open interval, whereupon relay RZ2–1602 also releases.

Thus, the check relays RKA–1604 and RKB–1605 operate in a cycle of two reader steps. These relays are set during the reader open period. If the wrong G contact (G1 or G2 of Fig. 7) closes during the reader close period, lead RSF–1615 is grounded instead of lead 1614 and relay RSF–1010 operates to indicate a reader step failure. That is, if the check relays RKA–1604 and RKB–1605 get out of step with the reader (i.e., the G1 and G2 cam contacts of Fig. 7), the respective conductors G1–721 and G2–722, instead of being routed over respective contacts 2 of relays RKA–1604 and RKB–1605, to the check conductor 1614, will be routed over respective contacts 1 of these relays to ground the reader step failure conductor RSF–1615, which extends over contact 10 of relay ST3–1102 and conductor 1116 to operate the reader step failure relay RSF–1010.

4.05 *Setting day progress switch*

The combination of the settings of the last day of round and last round set-up switches 19100 and 19000 are used to determine the position of the day progress switch 3112 at the beginning of processing any central office tape. The day progress switch 3112 must therefore be set into the proper position at the start of processing. The following table shows the position of the day progress switch 3112 for each calendar day of the month for either a six or a ten round month (F and L refer to the respective first and last transits of the switch arcs by the brushes).

Day Progress Switch Position	Calendar Day (F)	Calendar Day (L)	10R Day of Round		10R Round		6R Day of Round		6R Round	
			(F)	(L)	(F)	(L)	(F)	(L)	(F)	(L)
1	22		1		7		2		4	
2	21	31	3	4	6	9	1	6	4	5
3	20	30	2	3	6	9	5	5	3	5
4	19	29	1	2	6	9	4	4	3	5
5	18	28	3	1	5	9	3	3	3	5
6	17	27	2	3	5	8	2	2	3	5
7	16	26	1	2	5	8	1	1	3	5
8	15	25	3	1	4	8	5	5	2	4
9	14	24	2	3	4	7	4	4	2	4
10	13	23	1	2	4	7	3	3	2	4
11	12	22	3	1	3	7	2	2	2	4
12	11	21	2	3	3	6	1	1	2	4
13	10	20	1	2	3	6	5	5	1	3
14	9	19	3	1	2	6	4	4	1	3
15	8	18	2	3	2	5	3	3	1	3
16	7	17	1	2	2	5	2	2	1	3
17	6	16	3	1	1	5	1	1	1	3
18	5	15	2	3	1	4	5	5	0	2
19	4	14	1	2	1	4	4	4	0	2
20	3	13	3	1	0	4	3	3	0	2
21	2	12	2	3	0	3	2	2	0	2
22	1	11	1	2	0	3	1	1	0	2

The operation of relay ST4–1103 closes ground on conductor ON–1117 through relay FI–2500 operated, relay LRD–3107 or LR–3108 normal and the interrupter contact on the switch step magnet STP–3113 to operate relay DPS1–3110. Relay F1–2500 was operated from off-normal-normal ground, over contact 9 of relay MON–1201, conductor FIL–1212, cable 12–17, cable 17–58, conductor FIL–1212, contact 7 of the emergency reset relay ER–5812, conductor FI–5814, cable 5815, cable 58–59, cable 36–59, cable 3605, conductor FI–5814, to relay FI–2500. Relay FI–2500 locks over conductor FI–5814, cables 3605, 36–59, 58–59 and 5815, conductor FI–5814, contact 7 of relay ER–5812, conductor FIL–1212, contact 4 of relay FI–2500, conductor IL–2511, contact 3 of relay ETE–2502 to off-normal ground on conductor MON–2205. The circuit for operating relay DPS1–3110 extends from ground, over contact 6 of relay ST4–1103, conductor ON–1117, contact 8 of relay FI–2500, conductor STDP–2507, cable 25–31, cable 3114, conductor STDP–2507, contact 2 of relay LR–3108 or contact 2 of relay LDR–3107, contact of step magnet STP–3113, to relay DPS1–3110. Relay DSP1–3110, in operating, operates the day progress step magnet STP–3113 in an obvious circuit. Each energization of step magnet STP–3113 releases relay DPS1–3110. Thus, the day progress switch runs until the path through the interrupter contact of step magnet STP–3113 is opened at some other point. This will be when relays LR–3108 and LDR–3107 both are operated at the same time as an indication that the day progress switch 3112 has moved to the position representing the last round and last day of round which are set on set-up switches 19000 and 19100.

Arcs on the day progress switch 3112 operate relays DR1–18011 to DR6–18016 in the day of round translator of Fig. 180 and relays R0–18000 to R9–18009 in the round translator of Fig. 180 which correspond to the day of round and round for each position of the switch in accordance with the table for the round size indicated by the relays operated in the round size translator of Figs. 129 and 155. An off-normal ground is extended over contact 23 of relay MON–1201, conductor MON–1213, cable 12–175, conductor MON–1213, over wiper 4 of the marker group tens switch 20600 and over one of the ten conductors T0 to T9 into cable 20605. The same ground on conductor MON–1213 extends over wiper 4 of the marker group units switch 19101 and over one of the ten conductors U0A to U9A into cable 20606. Cables 20605 and 20606 extend over cable 206–192, over cable 192–193, cable 193–102 and cable 10214. Thence the leads T0 to T9 extend over cable 20605 to operate one of the ten relays MT0–10200 to MT9–10209 according to the tens digit of the marker group. Also the leads U0A to U9A extend over cables 10215 and 20606, and over the contacts of the operated marker group selecting tens relay MT0–10200 to MT9–10209, to energize one of the conductors 90A to 99A according to the tens and units digits of the marker group. This conductor may be cross-connected ("A") to conductor 6R–10216 or 10R–10217 depending upon whether this marker group is a six-round or a ten-round group (i.e. a month of six, five day rounds or of ten, three day rounds). If conductor 6R–10216 is grounded, relay 6R–12900 operates thereover. If conductor 10R–10217 is grounded, relay 10R–15502 operates thereover. These two relays are the main parts of the round size translator relays.

When the day progress switch 3112 first passes position 2 a path is closed from master off-normal ground over contact 21 of relay MON–1201, conductor MON–1214, cable 1215, cable 12–35, cable 35–33, cable 33–42, conductor MON–1201, over the lowermost wiper of switch 3112, over contact 2 thereof, and over contact 1 of the mechanical interlock relay OPR–3102, to operate relay FA–3100 and to operate relay FB–15500 in parallel therewith over conductor FB–3116, cable 3115, cable 31–129, cable 3115, conductor FB–3116, to relay FB–15500. These relays FA–3100 and FB–15500 lock over contact 1 of relay FA–3100 and contact 2 of relay LA–3101 to the master off-normal ground on conductor MON–1201 independently of switch 3112. With relay FB–15500 operated, if the marker group being processed is a ten round group (relay 10R–15502 operated from ground on conductor 10R–10217), then ground is extended from conductor 10R–10217, over contact 12 of relay FB–15500 and conductor 15503 to operate relay 10RF–12901.

Grounds are supplied from the "Round" and "Day of Round" wipers on the day progress switch 3112 for each step of these switch arms from steps 1 to steps 22 (corresponding to conductors R22 to R1 of cable R–3117 and to conductors DR22 to DR1 of cable DR–3118). These two cables R–3117 and DR–3118 extend over cable 31–129 over cables R–3117 and DR–3118 and branch out into conductor groups R22 to R1 of Fig. 129 and DR22 to DR1 of Fig. 155.

The round conductors R1 to R22 are extended over contacts of either relay 6R–12900 or relay 10RF–12901, into either cable 129–155A and over contacts of relay FB–15500 and cable 15504 or cable 129–155B, into cable 155–180A, to operate a different one of the round translator relays R0–18000 to R9–18009 for each step of switch 3112 as translated by the relays of Figs. 129 and 155. Likewise, the day of round conductors DR1 to

DR22 are extended over contacts of either relay 6R–12900 or relay 10R–15502 and relay FB–15500, into cable 155–180B to operate a different one of the day of round translator relays DR1–18011 to DR6–18016 for each step of switch 3112 as translated by the relays of Figs. 129 and 155. These latter day of round conductors of cable 155–180B are extended in parallel over cable 15505, cable 155–206, cable 15505, to the contacts on wiper arc 4 of the last day of round switch 19100. Likewise grounds are extended from the operated round translator relay R0–18000 to R9–18009, from the contacts 8 and 9 thereof (9 for relays R3 and R6—8 for the others), over cable 180–190, cable 190–205, to the contacts on wiper arc 5 of the last round switch 19000. Conductor LR–20502 runs into cable 32–190 from the wiper of arc 5 of switch 19000. Conductor LDR–19106 runs from the wiper of arc 4 of switch 19100 into cable 19005 and then into cable 32–190. These conductors LR–20502 and LDR–19106 emerge from cable 32–190 (in Fig. 32) into cable 32–31, and terminate at relays LR–3108 and LDR–3107 respectively. As mentioned previously, when the day progress switch 3112 has stepped to the position where the translated round and day of round correspond to the settings of last round and last day of round on the set-up switches 19000 and 19100, respectively, then both relays LR–3108 and LDR–3107 will operate to open up the switch 3112 stepping circuit. Then, switch 3112 will be set at the proper position for the start of tape processing.

Relay FB–15500, in the round size translator, sets the translation for the calendar days running from 1 to 22. Should the last day of round and last round switches 19100 and 19000 indicate a day which is beyond day 22 of the calendar month, the wipers of the day progress switch 3112 will make one sweep of the contact arcs without relays LDR–3107 and LD–3108 operating. The circuit is arranged so that when a six round month is being processed the day progress switch 3112 is set with relays FA–3100 and FB–15500 normal for rounds 0 to 3. When ten 3 day rounds are being processed the day progress switch 3112 is set with relays FA–3100 and FB–15500 operated for rounds 0 to 6. All other rounds are processed starting with the LA–3101 and LB–15500 relays operated. The mechanically interlocked relay OPR–3102 is operated when the day progress switch 3112 is detected as having passed round 3 or round 6 for 6 and 10 round months, respectively. This path may be traced from ground, over contact 5 of relay FI–2500, conductor STDP–2508, cable 25–103, cable 103–101, conductor STDP–2508, contact 26 of relay 6R–12900 or contact 3 of relay 10R–15502, conductor ST6R–15506 or conductor ST10R–15507, cable 155–180C, conductor ST6R–15506 or conductor ST10R–15507, contact 3 of relay R3 (Fig. 180) or contact 3 of relay R6 (Fig. 180), to conductor FI–18017, cable 18018, cable 21–180, conductor FI–18017 to relay OPR–3102. If relay OPR–302 is operated, then when the day progress switch 3112 returns to position 2, relays LA–3101 and LB–15501 will be operated from ground on the lowermost wiper arm of switch 3112, over contact 2 thereof, and over contact 2 of relay OPR–3102, thereby releasing relays FA–3100 and FB–15500. The operation of relay LB–15501 permits the round size translator of Fig. 180 to start searching for the last day of round and the last round which may represent calendar days 22 to 31. The operation of relay LB–15501 and the release of relay FB–15500 releases relay 10RF–12901 (if a ten round month is being processed) and operates relay 10RL–12902 in its stead in a circuit extending from ground on conductor 10R–10217, contact 11 of relay LB–15501, and over conductor 15508 to relay 10RL–12902.

4.06 *Setting recorder progress switch*

The recorder progress switch 3205 is set in a similar way at the beginning of processing to agree with the number set on the first recorder tens and units set-up switches 19102 and 19103. A path for the self-interrupted running of the recorder progress switch 3205 is established through relays ST4–1103 and FI–2500 operated and relay FRS–3203 normal. This circuit extends from ground, over contact 6 of relay ST4–1103, off-normal ground conductor ON–1117, contact 9 of relay FI–2500, conductor STRP–2509, cable 25–22, cable 22–32, conductor STRP–2509, contact of relay FRS–3203, contact of step magnet STP–3206, to the magnet STP–3206. When magnet STP–3206 operates, the switch 3205 steps one position ahead (clockwise). This opens the step magnet circuit and releases magnet STP–3206. When it releases, the circuit is again closed, etc. Thus, the switch 3205 is stepped ahead until relay FRS–3203 operates. Relay FRS–3203 operates when the recorder progress switch 3205 moves into a position which corresponds to the number set on the first recorder tens and units set-up switches 19102 and 19103. This circuit extends from battery, through resistance 1216, over contact 12 of relay MON–1201, conductor MONB–1217, cable 1215, cable 12–35, cable 35–33, conductor MONB–1217, winding of relay FRS–3203, to wiper arm 2 of switch 3205. Thence the circuit extends over any one of the contacts 3 through 11 of arc 2 to the lead FT0–3207 or over any one of the contacts 12 through 21 of arc 2 to the lead FT1–3208 (disregarding temporarily the contacts 1 and 2 of arc 2), cable 3209, cable 32–190, cable 190–205A, cable 205–206, cable 20607, cable 206–191, conductor FT0–3207 or conductor FT1–3208, and depending upon the setting of the first recorder tens switch 19102 (there being a maximum of twenty recorders 00 to 19) over the wiper arm 19107, conductor 19108, wiper arm 3 of the first recorder units switch 19103, out over one of the ten leads U0 to U9, over cable 191–206, cable 205–206, cable 190–205A, cable 32–190, cable 191–206, to the contacts of arc 1 of switch 3205, and over the wiper arm thereof to ground. Wherever the switch 3205 stops a circuit is completed for operating either relay RT0–3200 or RT1–3201 to record the tens digit (0 or 1) of the recorder number. This circuit extends from ground, over contact 14 of relay MON–1201, conductor MON–1218, cable 1215, cable 12–35, cable 35–33, conductor MON–1218, wiper of arc 3 of switch 3205 and over contacts 2 through 11 to relay RT0–3200 or over contacts 12 through 21 to relay RT1–3201. Ground is supplied from the wiper of arc 4 of switch 3205 to the recorder register circuit of Figs. 42 and 43 (for checking purposes) over one of the leads 00 to 19, through cable 32–43 and over conductors 00 to 19 of Fig. 43 to contacts of the recorder number units digit relays U0–4300 to U9–4309.

An exception to the above action of switch 3205 occurs with the feedback method of straddle operation and is employed when the emergency recorder tape from the central office may be expected to precede, in the processing, a tape from the first recorder 00. Hence, although the first recorder as set up on the set-up switches is 00 (and for this type of operation the first recorder must be specified as No. 00), the recorder progress switch 3205 stops one position ahead to indicate that an emergency recorder tape is expected first. This action is controlled by the straddle class connector relays F–1918 and SIE–1917. The straddle class set-up switch 20500 may be set in one of three positions—"Off" where the recorder progress switch 3205 will follow the previously described initial action—"F" where each straddle feedback tape (produced from processing previous accounting period tapes) will be spliced into the tape for its recorder—"SIE" where the emergency tape for the current processing period for all recorders will be spliced into the input tape ahead of each respective regular recorder tape. The "F" operation requires no check of recorder numbers until the regular recorder tape 00 is reached because the complete emergency tape will be processed first and then

the regular tapes with the feedback straddle parts spliced in will be processed, requiring a recorder check. The "SIE" operation requires a recorder check right from the start.

For the "F" situation, relay F–**1918** is operated from ground on conductor MON–**1213** in Fig. 205, over the wiper of the straddle class switch **20500**, over conductor F–**20503**, cable **19–205**, and conductor F–**20503** to operate relay F–**1918**. In this case (full emergency tape preceding regular tapes), relay FRS–**3203** will be operated over contact **1** of arc **2** of switch **3205** to stop the switch **3205** from hunting as above described. This circuit extends from relay FRS–**3203**, over wiper arm of arc **2**, contact **1** thereof, conductor F–**3210**, cable **3211**, cable **32–33**, cable **33–34**, cable **34–35**, cable **35–19**, cable **1919**, cable **1920**, conductor F–**3210**, contact **5** of relay F–**1918**, conductor FT**0**–**1921**, cables **1920**, **1919**, **3519**, **34–35**, **33–34**, **32–33**, **3211**, conductor FT**0**–**1921**, conductor FT**0**–**3207**, over the previously traced path through the first recorder tens and units set-up switches **19102** and **19103**, back over the U**0** conductor from cable **191206** to the contacts **1** and **2** of arc **1** of switch **3205** and thence to ground over the wiper thereof. In this case, arc **3** does not operate relay RT**0**–**3200** or relay RT**1**–**3201** and the check ground from the wiper of arc **4** extends over contact **1** thereof, conductor E–**3212**, cable **32–43**, conductor E–**3212**, to Fig. 42, where, as will be explained, a check is made regardless of recorder number under the control of relay C**6**–**4204** for the duration of the emergency tape processing. Thereafter, the normal recorder check is brought into play beginning with contacts **3** on the arcs of switch **3205** (contact **2** of arc **2** is not needed to operate relay FRS–**3203** for recorder 00 because the relay F–**1918** takes care of this on contact **1** as soon as the emergency tape is finished; i.e. contact **1** acts as the stop point for the emergency as well as recorder 00).

In the case of the "SIE" condition, relay SIE–**1917** is operated from ground on conductor MON–**1213** of Fig. 205, over the wiper of the straddle class switch **20500**, conductor SIE–**20504**, cable **19–205**, and conductor SIE–**20504** to operate relay SIE–**1917**. In this case (emergency tapes spliced into regular tapes), relay FRS–**3203** will be operated over contact **2** of arc **2** of switch **3205** to stop the switch **3205** from hunting provided the first recorder is 00. Otherwise the switch will hunt for the first recorder number and stop there. In the case of a first recorder 00, relay FRS–**3203** operates in a circuit extending from the relay, over wiper arm of arc **2**, contact **2** thereof, conductor I–**3213**, cables **3211**, **32–33**, **33–34**, **34–35**, **35–19**, **1919** and **1920**, conductor I–**3213**, contact **4** of relay SIE–**1917**, conductor FT**0**–**1921**, cables **1920**, **1919**, **35–19**, **34–35**, **33–34**, **32–33**, **3211**, conductor FT**0**–**1921**, conductor FT**0**–**3207**, over the set-up switches **19102** and **19103** for recorder 00, back over the U**0** conductor from cable **191–206** to the contact **2** of arc **1** of switch **3205** and thence to ground over the wiper thereof. In this case, arc **3** causes the appropriate relay RT**0**–**3200** or RT**1**–**3201** to operate from contact **2** to contact **21**. The check ground from the wiper of arc **4** extends through conductors **00** to **19** of cable **32–43** to Fig. 42 where a check is made for the proper recorder number, as will be explained.

4.061 *Recorder, day and hour emergency reset*

If at any time the main power should fail, the entire machine would go to normal, releasing all registrations except the operation of one of the magnetically locking relays LC**5**–**5807**, LC**6**–**5808**, LC**7**–**5809** and LC**8**–**5810** (see Section 4.081), except the mechanical setting of the recorder progress switch **3205** (see Sections 4.06 and 4.081) and except the mechanical setting of the day progress switch **3112** (see Sections 4.05 and 4.081). When the machine is restarted it is necessary that the recorder number register of Figs. 42 and 43 be reset, that the calendar day register of Figs. 40 and 41 be reset and that the even hour register of Fig. 45 be reset, all in order that the machine may continue with its processing.

Before the usual start procedure, comprising the operation of the motor start key **1006** and the machine start key **1200**, the emergency reset key **1222** is operated. This extends a ground for operating the emergency reset relay ER–**5812**, over contact **9** of relay MON–**1201**, conductor FIL–**1212**, contact of key **1222**, conductor ER–**1223**, cable **12–17**, cable **17–58**, conductor ER–**1223**, to relay ER–**5812**. With the relay ER–**5812** operated (emergency reset key **1222** operated), the operations of the recorder reset key **1221**, the day reset key **1224** and the hour reset key **1225** are not required to reset the appropriate registers.

At the end of this section the operation of the mutilated tape identity key **1246** is described. This will require the operation of the individual reset keys to reset the registers.

Relay ER–**5812**, in operating, causes the operation of the motor start relay MST–**1001** thereby providing all of the off-normal relay operations incident to a normal starting procedure under the control of the motor start key **1006**, as previously described. This series of events, as above described, will provide all necessary master off-normal grounds, etc. The circuit for operating relay MST–**1001** extends from ground, over contact **4** of relay ER–**5812**, conductor MST, cable **17–58**, conductor MST, into Fig. 10, lower contact of the emergency stop key **1004**, contact **1** of relay AL–**1005**, to relay MST–**1001**.

Upon the operation of the off-normal and motor start circuits, incident to the operation of relay MST–**1001**, relay RDC–**1916** is operated in a circuit from ground on the recorder register down-check conductor DC–**4310** of Fig. 43, cable **43–34**, cable **34–35**, cable **35–19**, cables **1919** and **1922**, conductor DC–**4310** to relay RDC–**1916**. With relay RDC–**1916** operated, relay RRS–**5806** operates in a circuit from ground, over contact **5** of relay ER–**5812**, conductor RRS**1**–**5816**, cable **58–59**, cable **36–59**, cable **19–36**, conductor RRS**1**–**5816**, contact **5** of relay RDC–**1916**, conductor RRS–**1926**, cables **19–36** and **58–59**, conductor RRS–**1926**, to relay RRS–**5806**, which locks over its contact **14** to conductor RRS**1**–**5816** independently of relay RDC–**1919** and until relay ER–**5812** releases. With relay RRS–**5806** operated, ground is applied over contact **1** thereof and over the armature and contact of the operated relay LC**5**–**5807** to LC**8**–**5810** to one of the conductors RC**5**–**3303** to RC**8**–**3306**. Also a ground is supplied over contact **1** of relay RT**0**–**3200** or RT**1**–**3201** to conductor T**0**–**3219** or T**1**–**3220** and a ground is supplied over the wiper of arc **1** of the switch **3205** to one of the ten conductors U**0** to U**9** into cable **3221**. Cable **3221** and conductors T**0**–**3219** and T**1**–**3220** extend over cable **3222**, cable **32–49**, cable **49–58**, and cable **5817** to armatures of relay RRS–**5806**. Here the tens conductor T**0**–**3219** or T**1**–**3220** and the units conductor U**0** to U**9** extend over contacts of relay RRS–**5806** to a tens conductor RT**0**–**3308** or RT**1**–**3309** and to a units conductor RU**0**–**3312** to RU**9**–**3313**, thence along with the conductors RC**5**–**3303** to RC**8**–**3306** into cable **33–58**, into cable **33–42**A of Fig. 33, to Fig. 42, thence over cables **4208** and **42–43** to operate one of the relays C**5**–**4203** to C**8**–**5206**, one of the relays T**0**–**4200** to T**4**–**4202** and one of the relays U**0**–**4300** to U**9**–**4309**, which relays then lock to the lock conductor L–**4209** as before. As soon as one of these relays operates, relay RDC–**1916** releases.

Upon the operation of relay ER–**5812** (and the off-normal circuits, as above) certain preliminary relay operations are effected to enable a day reset. The day register down-check relay DDC–**5805** is operated from ground, over contact **18** of relay MON–**1201**, conductor MON–**1230**, cables **1215**, **12–35**, **35–33** and **33–42**, conductor MON–**1230**, contact **3** of relay DT**0**–**4000**, contacts **1** of relays DT**1**–**4001** to DT**3**–**4003**, contact **1** of relay DU**0**–**4010**, contact **3** of relay DU**1**–**4011**, contact

1 of relay DU2–4012, conductor 4004, contacts 1 of relays DU3–4113 to DU9–4119, conductor DC–4100, cables 41–49 and 49–58, conductor DC–4100, contact 3 of relay DRL–5800, and contact 7 of relay CD–5802 to relay DDC–5805. Relay DRS–5811 thereupon operates from ground, over contact 3 of relay ER–5812, conductor DRS1–5818, contact 1 of relay DDC–5805, to relay DRS–5811, which locks independently of relay DDC–5805 over the contact 1 of relay DRS–5811 to ground on lead DRS1–5818. The relay FA–3100 or LA–3101 is reoperated in a circuit extending from ground in Fig. 58, over contact 4 of relay DRS–5811, conductor 5824, cables 49–58, 32–49 and 3222 into Fig. 32, conductor 5824 into Fig. 31 and over contact 1 or 2 of the relay OPR–3102 to the winding of relay FA–3100 or LA–3101. The actual day reset is effected by the two grounds, over contacts 3 and 2 of relay DRS–5811, conductor T–5821 and U–5820, cables 49–58, 32–49 and 3222, conductors T–5821 and U–5820, the tens day reset arc and the units day reset arc of switch 3112, over contacts of relays FA–3100 and LA–3100 for the tens digit and out over one of the leads T0, T1, T2 or T3, and from the units arc out over one of the ten leads U0 to U9, and into cable 33–40, thence to the windings of one of the day tens relays DT0–4000 to DT3–4003 and one of the day units relays DU0–4010 to DU2–4012 and DU3–4113 to DU9–4119. The operated relays lock as previously described to ground on the lock lead L–5819.

Upon the operation of relay ER–5812, etc. as above, the even hour register of Fig. 45 is supplied with a 25 hour quantity independently of the condition of the hour reset key 1225. The odd hour register of Fig. 45 is not actually filled with the 25 entry but relay H25–3508 is operated to simulate this condition. The odd hour down-check relay OHDC–3501 and the even hour down-check relay EHDC–3601 will be operated to indicate the loss of an hour registration due to the power failure or as a start condition at the beginning of tape processing. The odd down-check circuit extends from off-normal ground, over contact 19 of relay MON–1201, conductor MON–1226, cables 1215 and 12–35, conductor MON–1226, contacts 2 of relays OHT0–4400 to OHT2–4402, contact 5 of relay OHU0–4403, contacts 2 of relay OHU1–4404 and OHU2–4405, conductor 4406, contacts 2 of relays OHU3–4503 to UHU9–4509, conductor DC–4510 (indicating a released condition of the odd hour register of Figs. 44 and 45), cables 45–44 and 44–35, conductor DC–4510, contacts 1 of the odd hour register control relays OHARS–3504, OHAR–3503 and OHL1–3505, conductor 3510, contact 5 of relay EH–3600, conductor 3606, to relay OHDC–3501. The even down-check relay operates in a similar path from off-normal ground on conductor MON–1226 of Fig. 45, through the even hour register at the right of Fig. 45, out on the down-check lead DC–4511, cables 4512 and 45–36, conductor DC–4511, contacts 1 of the even hour register control relays EHARS–3604, EHAR–3603 and EHL1–3605, conductor 3607, contact 9 of relay H25–3508, contact 5 of relay OH–3500, conductor 3511, to relay EHDC–3601. Relay EHDC–3601 locks over its contact 3 to conductor HM2 (grounded during the reader closed period) and relay OHDC–3501 locks over its contact 3 to the odd hour register down-check lead 3510. Relay OHDC1–3532 now operates in a circuit from ground on conductor HON–1227 in Fig. 36, contact 6 of relay EHDC–3601, conductor 3615, contact 4 of relay OHDC–3501, to relay OHDC1–3532, which locks over its contact 1, contact 6 of relay OHRL–3502 and contact 1 of relay OHDC–3501 to conductor KB8 (grounded during reader break period). Ground is now extended over contact 25 of relay MON–1201, over the hour release key 1203 normal or contact 1 of relay RL0–1202, to conductor HON–1227, contact 2 of relay OHRL–3502, contact 2 of relay OHDC1–3532, conductor 3512, contact 4 of relay EHDC–3601, conductor EH1–3608, cables 3605, 36–59, 58–59 and 5815, conductor EH1–3608, thence over cables 17–58 and 12–17, conductor EH1–3608, over contact 3 of key 1225, to conductor HR–1228, cables 1217 and 17–58, over conductor HR–1228 and contact 2 of relay ER–5812 to conductor H25–1229, cables 5815, 58–59, 36–59 and 3605, conductor H25–1229, to relay H25–3508, which locks over its contact 8, conductor L–3513, contact 4 of relay EHRL–3602, to off-normal ground on conductor HON–1227. (If relay ER–5812 were not operated, as is the normal case at the start of tape processing, the ground on conductor HR–1228 extends over contact 1 of relay ER–5812, conductor EH–3514, cables 5815, 58–59, 36–59 and 3605, conductor EH–3514, to relay EH–3600, which operates and locks over its contact 1, conductor 3609 and contact 2 of relay OHRL–3502 to off-normal ground on conductor HON–1227.) Upon the operation of relay H25–3508, circuit conditions are simulated to be the equivalent of the even hour register having received a legitimate hour entry and having caused the release of the odd hour register and having caused the control relays of Figs. 35 and 36 to be set to accept the next hour entry into the odd hour register. Contact 9 of relay H25–3508 opens the down-check lead for the even register, thereby releasing relay EHDC–3601 (during the reader open period) to simulate an operated even hour register. Relay EH–3600 is operated to simulate the registration. This circuit extends from ground on the lock conductor L–3513 of Fig. 36, contact 8 of relay H25–3508, conductor H25–1229, over the previously traced path through the relay ER–5812 and the key 1225 to conductor EH1–3608, contact 12 of relay H25–3508, conductor EH–3514, to relay EH–3600. Eventually, as will be described in connection with the receipt of hourly entries (see Sections 4.083 and 4.114) relays OHDC–3501 and OHDC1–3532 release, relay OHRL–3502 operates and releases, relay OH–3500 operates and locks operated (to steer the next hour entry to the odd register), relay EH–3600 releases, and relay OHDC–3501 reoperates. Meanwhile, grounds over contacts 10 and 11 of relay H25–3508 extend over conductors UAR–3515 and TNC–3516, cable 36–53, conductors UAR–3515 and TNC–3516 to connectors EUAR (not shown) and ETNC (not shown) equivalent to connectors OUAR–5200 and OTNC–5202 for the odd hour register. The connectors EUAR and ETNC operate but perform no function at this time. Grounds are extended over contacts 7 and 6 of relay H25–3508, conductors T2C–3517 and U5C–3518, cable 35–53 and conductors T2C–3517 and U5C–3518 to the even hour output connector of Fig. 53, where such ground leads simulate an hour 25 registered in the even hour register of Fig. 45.

Under circumstances where the machine might block because of a mutilated tape identity code either of the recorder, day or hour registers may be reset by first operating the mutilated tape identity key 1246 and then operating the appropriate reset key 1221, 1225 or 1224. This will accomplish the same function as the emergency reset relay ER–5812 did except that in the present instance the start and off-normal circuits would not be lost and thus would not be required to be restarted. Also, in the present instance, the operation of the reset key will operate the appropriate one of the relays CL0–2200, CL1–2201 and CL2–2202 in the tape identity reading progress circuit of Figs. 21 and 22 to enable the machine to continue to read and to check the tape identity group.

Upon the operation of the mutilated tape identity key 1246, relay MTI–5813 is operated in a circuit extending from ground in Fig. 11, over contact 3 of relay ST4–1103, conductor ONN into Fig. 12, over the contact of the key 1246 to conductor MTI extending over cables 12–17 and 17–58 into Fig. 58 to the winding of the relay MTI–5813. Relay MTI–5813 locks over its contact 1 to the ground on conductor ONN until such time as relay ST4–1103 is operated upon a restart of the machine.

Relay MTI–5813, in operating, extends ground over its

contact 4 to conductor ON–1117 to ground this off-normal conductor until such time as relay ST4–1103 is operated upon a restart of the machine. At such time, as previously described, relay ST4–1103 will apply a ground to this off-normal conductor ON–1117 over its contact 6.

With relay MTI–5813 operated, any one of the hour reset key 1225, day reset key 1224 and recorder reset key 1221 may be operated in order to reset the respective register and to operate the associated tape identity reading progress relay CL1–2201, CL2–2202 or CL0–2200.

If the day reset key 1224 is operated, relay CL2–2202 is operated in a circuit extending from ground in Fig. 58, over contact 3 of relay MTI–5813, conductor DR–1232, cables 17–58 and 12–17, conductor DR–1232, contact 1 of the day reset key 1224 to conductor CL2–1231, extending over cable 12–22 into Fig. 22 to operate the relay CL2–2202. Also, ground will extend from the grounded conductor DR–1232 in Fig. 12, over contact 2 of the day reset key 1224 to conductor DRS1–5818 extending over cables 12–17 and 17–58 into Fig. 58 where conductor DRS1–5818 joins with the same conductor previously described in connection with the operation of relay ER–5812 and which, in that instance, was grounded over contact 3 of relay ER–5812. As previously described, the grounding of the conductor DRS1–5818 will effect a reset of the day register.

If the recorder reset key 1221 is operated, ground will extend over contact 2 of relay MTI–5813 to conductor RR, extending over cables 17–58 and 12–17, conductor RR, over contact 1 of the recorder reset key 1221 to conductor CL0–3314, which extends over cable 12–22 into Fig. 22 to operate the tape identity reading progress relay CL0–2200. Also, the grounded conductor RR in Fig. 12 will be extended over contact 2 of the recorder reset key 1221 to conductor RRS1–5816, which extends over cables 12–17 and 17–58 into Fig. 58 where conductor RRS1–5816 joins up with the same conductor previously described in connection with the operation of relay ER–5812 as grounded over contact 5 of that relay. As previously described, the grounding of conductor RRS1–5816 will effect the reset of the recorder register.

If the hour reset key 1225 is operated, ground will extend from the grounded conductor DR–1232 out of cable 12–17 in Fig. 12, over contact 1 of the hour reset key 1225, to conductor CL1–3411, which extends over cable 12–22 into Fig. 22, to operate the tape identity reading progress relay CL1–2201.

As previously described, the reset of the hour register was caused by the grounding of the conductor H25–1229 into cable 5815 in Fig. 58. This was accomplished by extending a ground on conductor EH1–3608 in Fig. 58, over cables 17–58 and 12–17 into Fig. 12 and thence over contact 3 of the hour reset key 1225 to conductor HR–1228, over cables 12–17 and 17–58 into Fig. 58 and thence over contact 2 of the relay ER–5812 to conductor H25–1229 into cable 5815. Under the present circumstances, the relay ER–5812 will be released and the hour reset key 1225 will be operated. A similar circuit may be traced from ground on the conductor EH1–3608 in Fig. 12, over contact 2 of the hour reset key 1225 to conductor H25–1229 extending over cables 12–17 and 17–58 directly to conductor H25–1229 entering cable 5815 in Fig. 58.

4.07 *Skipping initial splice pattern*

When the machine start key 1200 has been operated at the beginning of processing, the first lines to be read from the input tape is a group of splice pattern (081010) lines. On a closure cycle of the reading pins of Fig. 7 the reading pins A0, B1 and B7, C0 and C1, D4 and D7, E0 and E1, F4 and F7 find holes in tape 703 and thus ground the associated contacts. With the reader connector RC–900 operated, as previously described, the grounded reader contacts A0 to F7 of Fig. 7 operate reading relays A0–1300, B1–1304 and B7–1307, C0–1400 and C1–1401, D4–1408 and D7–1409, E0–1500 and E1–1501, and F4–1508 and F7–1509. Relay A0–1300 is operated in a circuit from ground, over contact A0 of the reader Fig. 7, conductor A0–723, contact 1 of connector RC–900, conductor A0–724, to relay A0–1300. Relays B1–1304 and B7–1307 operate from ground, over contacts B1 and B7 of the reader, conductors B1–725 and B7–726, cable 729, conductors B1–725, and B7–726, contacts 5 and 8 of connector RC–900, conductors B1–727 and B7–728, to relays B1–1304 and B7–1307. Relays C0–1400 and C1–1401 operate from ground, over contacts C0 and C1 of the reader, conductors C0–730 and C1–731, cable 7–8A, conductors C0–730 and C1–731, contacts 9 and 10 of connector RC–900, conductors C0–801 and C1–802, to relay C0–1400 and C1–1401. Relays D4–1408 and D7–1409 operate from ground, over contacts D4 and D7 of the reader, conductors D4–732 and D7–733, cable 7–8B, conductors D4–732 and D4–733, contacts 17 and 18 of connector RC–900, conductors D4–803 and D7–804 to relays D4–1408 and D7–1409. Relays E0–1500 and E1–1501 operate from ground, over reader contacts E0 and E1, conductors E0–734 and E1–735, cable 7–9A, conductors E0–734 and E1–735, contacts 19 and 20 of connector RC–900, conductors E0–905 and E1–906, to relays E0–1500 and E1–1501. Relays F4–1508 and F7–1509 operate from ground, over reader contacts F4 and F7, conductors F4–736 and F7–737, cable 7–9B, conductors F4–736 and F7–737, contacts 27 and 28 of connector RC–900, conductors F4–907 and F7–908, to relays F4–1508 and F7–1509.

A path is closed for operating relay 08–1801 extending from ground, over the G1 reader contact (Fig. 7) and conductor G1–721 and contact 2 of relay RKA–1604 (unoperated) or over the G2 reader contact and conductors G2–722 and contact 2 of relay RKB–1605 (operated), conductor 1614, contact 34 of connector RC–900, conductor 904, contact 9 of relay ST3–1102, conductor 1113, contact 3 of relay AL–1005, to the reading relay check conductor RCK–1021, contact 2 of relay A0–1300, contact 3 of relay A2–1302, contact 2 of relay A1–1301, contact 1 of relay B0–1303, contact 2 of relay B1–1304, contact 3 of relay B2–1305, contact 2 of relayB4–1306, contact 1 of relay B7–1307, conductor 1308, contact 2 of relay C0–1400, contact 4 of relay C1–1401, contact 5 of relay C2–1402, contact 4 of relay C4–1403, contact 2 of relay C7–1404, contacts 1 of relay D0–1405, D1–1406, D2–1407, D4–1408 and D7–1409, conductor 1410, contact 2 of relay E0–1500, contact 4 of relay E1–1501, contact 5 of relay E2–1502, contact 4 of relay E4–1503, contact 2 of relay E7–1504, contacts 1 of relays F0–1505, F1–1506, F2–1507, F4–1508 and F7–1509, to the up-check conductor UC–1510 (the latter circuit through the reading relays of Figs. 13, 14 and 15 being a one-only check of the A digit relays of Fig. 13 and a two-out-of-five check of the B, C, D, E and F digit relays of Figs. 13, 14 and 15—such check as validity path may hereinafter be described briefly as the reading relay up-check path, or some such terminology), cable 23–25, conductor UC–1510, contact 8 of relay TI–2501, conductor UC–2510, contact 4 of relay SR1E–2605, conductor UC–2610, cable 26–15, conductor UC–2610, cable 15–13, conductor UC–2610, contact 6 of relay B1–1304 and contact 4 of relay B7–1307 (to check the B digit of 8), contact 4 of relay A1–1301 and contact 5 of relay A2–1302 and contact 3 of relay A0–1300 (to check the A digit of zero), conductor 08–1309, cable 13–14, cable 14–18, conductor 08–1309, contact 6 of relay PRRL–1804, to relay 08–1801.

The operation of relay 08–1801 operates relay SPR–1803 over contact 2 of relay 08–1801. Relay SPR–1803 locks over its contact 1, contact 1 of relay RRL–1805, contact 1 of relay RRUL–1806, conductor MON–1807, to ground over contact 24 of off-normal relay

MON–1201. Relay SPR–1803, in operating, causes the operation of the reader step relay RS–2600 by extending the reading relay up-check ground on conductor UC–1510 (at the contact 8 of relay TI–2501) over contact 3 of relay SPR–1803 and over the reader step conductor RS–1808 to relay RS–2600. This extends ground over contact 5 of relay RS–2600, conductor RS–2611, contact 2 of relay RSF–1010, conductor 1022, winding of reader step magnet STEP–700, conductor 719, to battery over contact 3 of relay MST–1001. This permits the drum 715 to be advanced one step after the reader pins have been extracted from the tape holes 081010.

All of the reading relays release during this open reader cycle and ground is supplied from the reader contact KB3 of Fig. 8, over conductor KB3, cables 8–9 and 9–18 and 18–26, conductor KB3, and contact 7 of relay RS–2600 to hold same operated. Relay 08–1801 releases when the reading relays release. Reader contact KB8 supplies ground over conductor KB8, cables 8–9 and 9–18 and 18–26, conductor KB8, contact 8 of relay RS–2600, conductor RSG–2612, contact 2 of relay SPR–1803, to operate relay PRRL–1804, which locks first over its contact 2 and contact 1 of relay RRUL–1806 to off-normal ground on conductors MON–1807 and second over conductor RRLL and cables 14–18 and 13–14 to ground over contact 9 of relay A1–1301 and contact 10 of relay A2–1302. Just before the next reader closed period the contacts KB3 and KB8 open to release relay RS–2600 and the step magnet STEP–700 to stop the stepping of the drum 715 after an advance of one line.

During the next reading of a 081010 line, relay RS–2600 will be reoperated (as before or over contacts 3 of relays SPR–1803 and PRRL–1804) and relay RRL–1805 will operate over a path from ground on the lead 08–1309 from the reading relays through contact 1 of relay RS–2600, conductor 2613, and contact 4 of relay PRRL–1804 to relay RRL–1805.

Relay RRL–1805, in operating, releases relay SPR–1803 and locks over its own contact 2 and contact 5 of relay PRRL–1804 to ground on lead MON–1807. Relay RRL–1805 supplies locking ground to all of the reading relays in a circuit from ground on conductor MON–1807, over contact 5 of relay PRRL–1804, contact 3 of relay RRL–1805 and conductor 1809 to the locking armatures of the reading relays of Figs. 13, 14 and 15. With all the reading relays locked up, relay RS–2600 will remain operated constantly until a different set of reading relays operates (on top of those which are locked operated) to open the reading relay up-check path long enough to release relay RS–2600. As above described, relay RS–2600 is held operated during the open reader cycle by the grounded reader contact KB3 and during the closed reader cycle by the reading relay up-check path and over conductor UC–1510 and contact 3 of relay PRRL–1804.

Relay RS–2600 releases as a result of a new reading appearing on the reading relays on top of the lock-in data. Under these circumstances, relay RRUL–1806 will be operated in a circuit from ground, over contact 2 of relay RS–2600, conductor 2614, and contact 4 of relay RRL–1805 to relay RRUL–1806. This releases relay PRRL–1804 (provided the A digit of the new reading is a 1 or a 2), which releases relay RRL–1805, which in turn releases the reading relays and relay RRUL–1806. Other contacts on these relays control alarm conditions as described in later sections.

4.08 *Reading and checking end-of-tape group*

The first line read after initial splice pattern should be 284DEF where the D digit indicates the round represented by the tape and the E and F digits indicate the tens and units digits of the marker group. As will be recalled relay FI–2500 was operated prior to the operation of relay MON–1201; in other words, it is normally operated when the machine is not in use. However, it locks in a circuit previously described and extending from its winding, conductor FI–5814, cable 3605, cable 36–59, cable 58–59, cable 5815, contact 7 of relay ER–5812, conductor FIL–1212, cables 5815, 58–59, 36–59 and 3605, conductor FIL–1212, contact 4 of relay FI–2500, lock conductor IL–2511, and over contact 3 of relay ETE–2502 and conductor MON–2205 to ground over contact 8 of relay MON–1201 or over cable 25–22 and cable 2204 and conductor IL–2511 and contact 1 of relay CL2–2202 and over conductor MON–2205 to ground over contact 8 of relay MON–1201. The operation of relay FI–2500 indicates that this is the beginning of the tape being processed. As described previously, the day of progress and recorder progress switches 3112 and 3205 must be set initially. Furthermore an end-of-tape group must be received before the processing of call entries can begin.

The reading of the 284DEF line, after the release of the reading relays under the skip splice lock condition, operates relay L4–2100 over the previously traced reading relay up-check path from the G1 or G2 reader contact and eventually over conductor UC–1510 of Fig. 25 and over contact 8 of relay TI–2501 to conductor UC–2610 in Fig. 13, thence over contact 6 of relay B1–1304 and contact 4 of relay B7–1307 (to check the B digit of 8), contact 4 of relay A1–1301 and contact 6 of relay A2–1302 and contact 4 of relay A0–1300 (to check the A digit of 2), conductor 1310, thence over contact 7 of relay C4–1403 and contact 5 of relay C0–1400 (to check the C digit of 4), conductor 284–1411, contact 7 of relay CL2–2202, contacts 6 of relays CL1–2201 and CL0–2200, conductor 2206, contact 5 of relay CL3–2103 and contact 4 of relay CL4–2101 to relay L4–2100.

Relay L4–2100 in operating locks directly to the reading relay up-check conductor UC–1510 over contact 5 of relay L4–2100. If the round as indicated by the day progress switch 3112 and the round translator (Fig. 180) and the marker group as indicated by the marker group set-up switches (Figs. 191 and 206) agree with the round (C digit) and marker group digits (E and F digits) of the 284DEF entry, the RS–2600 relay will operae in a circuit which is set up as follows. When two of the E digit reading relays of Fig. 15 are operated according to the E digit of the 284DEF entry, a decimal translation is made on the right-hand contacts thereof to ground one of the ten leads 0 to 9 entering cable EI5–23, which thereupon operates one of the ten E digit translator relays TE0–2300 to TE9–2309. The F digit reading relays of Fig. 15 likewise ground one of the ten leads 0 to 9 entering cable F15–24, which thereupon operates one of the ten F digit translator relays TF0–2400 to TF9–2409. Then ground extends over contact 3 of relay L4–2100, conductor 2104, over one of the contacts of the operated E digit translator relay group of Fig. 23 such as contact 4 of relay TE0–2300 of contact 5 of relay TE1–2301, etc. or contact 4 of relay TE9–2309, to one of the ten conductors E0 to E9 of cable E23–205 depending upon the E digit registered in the E reading relays of Fig. 15, thence to Fig. 205 over cable E23–205, one of the conductors E0 to E9, cable 20505, over the wiper arm of arc 3 of the marker group tens switch 20600 provided the setting thereof agrees with the registered E digit, conductor MGT–20608, cable 206–205, cable 190–205A, cable 32–190, cable 32–21, conductor MGT–20608, contact 10 of relay L4–2100, conductor MGU–2105, cables 32–21, 32–190, 190–205A and 206–205, conductor MGU–2105, wiper arm of arc 3 of the marker group units switch 19101, over one of the conductors F0 to F9 of cable 191–190 (it being assumed that the setting of this switch agrees with the registered F digit), cable F24–190, over the contact of the operated F digit translator relay of Fig. 24 such as contact 6 of relay TF9–2409, etc. or contact 7 of relay TF1–2401 or contact 6 of relay TE0–2400, conductor 2410, contact 2 of relay L4–2100, conductor 2106 to Fig. 14, thence over right-

hand contacts of the D digit reading relays and out over one of the ten leads 0 to 9 of cable D14–32, cable D14–32 of Fig. 32, cables 32–190 and D14–32, one of the conductors D0 to D9, over contact 3 of one of the relays R0–18000 to R2 and R4 and R5 and R7 to R9–18009 or over contact 4 of relay R3 or R6, to conductor R18019, cable 18020, cable 18018, cable 21–180, cable 18020, conductor R18019, contact 1 of relay L4–2100, conductor RS–1808, cable 21–22, cable 22–24, cable 24–26, and conductor RS–1808 to the reader step relay RS–2600, which thereupon operates to step the reader drum 715 as previously described. The stepping of the drum 715, as before, releases the reading relays and other relays controlled thereby except those which are held operated as will be mentioned.

Relay L4–2100, in operating, operates relay TI–2501 in a circuit extending from ground, over contact 9 of relay L4–2100, conductor TI–2107, cable 21–25, cable 25–22, cable 2512, conductor TI–2107, to relay TI–2501. Relay TI–2501 locks over its contact 5 to ground on the lock conductor IL–2511, previously traced over contact 1 of relay CL2–2202 to off-normal ground on conductor MON–2205. Relay TI–2501, in operating, opens the circuit from conductor UC–1510 over its contact 8 to conductor UC–2510 and in lieu thereof transfer conductors UC–1510 over its contact 7 to conductor UCI–2513, which extends through cable 2512, cable 25–22, cable 2204, to conductor UCI–2513 which extends through the tape identity reading progress circuit of Figs. 21 and 22. In other words the previously described reading relay up-check path now includes the progress relays of Figs. 21 and 22 as well as the other apparatus previously described, so that once the 284DEF entry has been detected no further entries may be received unless they are a part of the end-of-tape group and in the proper order.

When relay RS–2600 operates, relay CL4–2101 is operated in a circuit extending from ground, over contact 3 of relay RS–2600, conductor RSG–2615, cable 24–26, cable 22–24, cable 21–22 conductor RSG–2615, contact 4 of relay L4–2100, to relay CL4–2101. Relay CL4–2101, in operating, releases relay L4–2100 and locks in a circuit over contact 3 of relay CL4–2101, contact 3 of relay CL3–2103, conductor 2108, contacts 4 of relays CL0–2200, CL1–2201 and CL2–2202, to off-normal ground on conductor ON–1117.

Relay CL4–2101, in operating, prepares a path to receive the 283DEF entry as read by the reading relays as the next line of the end-of-tape group.

When the next line of the end-of-tape group 283DEF is read, relay L3–2102 operates over a path from ground over the G1 or G2 reader contact and over the previously described reading relay validity up-check path and out over conductor UC–1510 from the validity check contacts of the F digit reading relays of Fig. 15, over cable 23–25, contact 7 of relay TI–2501, conductor UCI–2513, cable 2512, cable 25–22, cable 2204, conductor UCI–2513, to Fig. 21, where the ground is extended over contact 1 of relay CL4–2101, conductor 283–2109, contacts 8 of relays C1–1401 and C2–1402 (to check the C digit of 3), conductor 1310, contacts 4 of relay A0–1300 and 6 of relay A2–1302 and 4 of relay A1–1301 (to check the A digit of 2), contacts 4 of relay B7–1307 and 6 of relay B1–1304 (to check the B digit of 8), conductor UC–2610, cable 15–13, cable 26–15, conductor UC–2610, contact 4 of relay SR1E–2605, conductor UC–2510, contact 9 of relay TI–2501, conductor SRD–2514, cable 2512, cable 25–22, cable 2204, conductor SRD–2514, contact 5 of relay CL4–2101, to relay L3–2102. Relay L3–2102, in operating, locks over its contact 5 directly to the identity up-check conductor UCI–2513 which is under the control of the reading relay validity up-check and relay TI–2501 only.

Assuming that the digits of the 283DEF line, which represent the last day of round (D digit) and the month (E and F digits), agree with the settings of the day progress switch 3112 and the month set-up switches 19001 and 19002, relay RS–2600 will operate over a path similar to that traced for its operation when relay L4–2100 was operated, except that it will be through a day of round translator relay (Fig. 180) and the month set-up switches 19001 and 19002. The path will also pass through the MCR–1703 relay normal when passing between the tens and units month set-up switches. This circuit extends from ground, over contact 3 of relay L3–2102, conductor 2104, over one of the operated E digit translator relays TE0–2300 or TE1–2301 (since the E digit is month tens and this can be only a zero or a one for months 01 to 12), out over conductor E0 or E1 into cable E23–205, over conductor E0 or E1 to Fig. 190 to contacts 2 or 3 of arc 1 of the month tens switch 19001, over wiper arm 19006 thereof (assuming that the registered E digit corresponds, as it should, to the switch setting), conductor MTC–19007, cable 20506, cable 190–205A, cable 32–190, cable 32–21, conductor MTC–19007, contact 10 of relay L3–2102, conductor MUC–2110, cable 2111, cable 21–25, cable 25–22, cable 2517, conductor MUC–2110, contact 4 of relay MCR–1703 (which is not operated unless a month change is expected when reading tape which may straddle a month change at a midnight to 3 a.m. cutting point), conductor MUC–1708, cable 17–12, cable 12–175, conductor MUC–1708, wiper arm of arc 4 of the month units switch 19002, out over one of the contacts 2 to 11 representing units digits of 0 to 9, over one of the ten conductors F0 to F9 into Fig. 190 and out over cable F24–190, over a contact of one of the F digit relay translators TF0–2400 to TF9–2400 (assuming that the registered F digit corresponds, as it should, to the month units digit as set upon switch 19002), out over conductor 2410, contact 2 of relay L3–2102, conductor 2106 to Fig. 14, thence through the translator contacts of the D digit reading relays, out over one of the six conductors D1 to D6 of cable D14–32 (depending upon the D digit registered which can never be more than 6 for a 6 round month—usually only 5 days per round but is needed for the last day of a 31 day month), over cable D14–32, cable 32–190, cable D14–32, cable 18021, one of the conductors D1 to D6, over contact 3 of the appropriate relay DR1–18011 to DR6–18016 (assuming that the day progress switch 3112 has operated the one of these day of round translator relays to which the registered D digit corresponds), out over conductor DR–18022, cable 18023, cable 21–180, cable 18023, conductor DR–18022, contact 1 of relay L3–2102, conductor RS–1808, cable 21–22, cable 22–24, cable 24–26, conductor RS–1808, to relay RS–2600.

Relay RS–2600, in operating, operates relay CL3–2103 in a circuit extending from ground, over contact 3 of relay RS–2600, conductor RSG–2615, cables 24–26, 22–24 and 21–22, conductor RSG–2615, contact 4 of relay L3–2102, to relay CL3–2103. Relay CL3–2103 locks over its contact 4 to conductor 2108, the previous locking ground for relay CL4–2101. Relay CL4–2101 is maintained operated over its contact 3 and contact 2 of relay CL3–2103 and conductor KM7 to ground over the K7 reader contact (Fig. 8) until the end of the closed reader cycle, whereupon relay CL4–2101 releases, releasing relay L3–2102 in turn.

The operation of relay CL3–2103 prepares the tape identity reading progress circuit of Figs. 21 and 22 to accept the next line of the end-of-tape group provided it is a 280DEF entry.

The 280DEF line represents the recorder number. The E and F digits represent the tens (0, 1 or 4) and units (0 to 9) digits of the recorder number while the D digit represents the type of recorder tape—see Section 3.025 re regular central office tape (D=5), emergency central office tape (D=6), straddle tape from regular tape (D=7) or straddle tape from emergency tape

(D=8). When the 280DEF entry appears on the reading relays, a path may be traced through the reading relay check path, relay TI–2501 operated, the C, A and B digit reading relays, relays TI–2501 and CL3–2103 operated to the recorder register control circuit of Fig. 19 where, since this is the first recorder number to be received in the machine, action is taken to satisfy the prerequisite that this number must be registered before it may be checked against the recorder progress switch 3205.

4.081 *Registering first recorder number*

Relay RDC–1916 was operated when the MON–1201 relay was operated at the start, provided all of the recorder register relays of Figs. 42 and 43 are normal. This circuit extends from ground, over contact 20 of relay MON–1201, conductor MON–1219, cable 1215, cable 12–35, cable 35–33, cable 33–42, conductor MON–1219, contacts 4 of relays C5–4203 to T4–4202, conductor 4207, contacts 1 of relays U0–4300 to U9–4309, conductor DC–4310, cable 43–34, cable 34–35, cable 35–19, cable 1919, cable 1922, conductor DC–4310, to the bottom winding of relay RDC–1916. With ground on the 280–1412 lead of the reading relay check path, relay RDC–1916 is held operated and relay RR–3301 is operated to register the recorder number as detected on the reading relays for the D, E and F digits. This circuit extends from ground over the G1 or G2 reader contact (Fig. 7) to reader check conductor RCK–1021 of Fig. 13 and through the validity check contacts of the reading relays to conductor UC–1510 of Fig. 15 as previously described, thence over cable 23–25, conductor UC–1510, contact 7 of relay TI–2501, conductor UCI–2513, cable 2512, cable 25–22, cable 2204, conductor UCI–2513, contact 1 of relay CL3–2103, conductor 280–1412, contact 6 of relay C4–1403 and contact 4 of relay C7–1404 (to check the C digit of zero), conductor 1310, contacts 4 of relay A0–1300 and 6 of relay A2–1302 and 4 of relay A1–1301 (to check the A digit of 2), contacts 4 of relay B7–1307 and 6 of B1–1304 (to check the B digit of 8), conductor UC–2610, cables 15–13 and 26–15, conductor UC–2610, contact 4 of relay SR1E–2605, conductor UC–2510, contact 9 of relay TI–2501, conductor SRD–2514, cables 2512, 25–22 and 2204, conductor SRD–2514, contact 6 of relay CL3–2103, conductor 280–2112, cables 21–22, 22–24, 24–26, 26–27 and 27–19, conductor 280–2112, to contact 2 of relay RDC–1916. This holds relay RDC–1916 operated and extends the ground on the lead 280–2112 to conductor RR–1923, thence over cables 1922, 1919, 35–19, 34–35 and 34–33, conductor RR–1923 to relay RR–3301, which thereupon operates and locks over its contact 21 to the up-check ground on conductor UC–1510, previously described. The E and F digit reading relays of Fig. 15 contain a decimal translation which energizes the corresponding relays of the E and F digit reading relay translators (Figs. 23 and 24) on a decimal base. Thus, one of the C5–4203 to C8–4206 relays, one of the T0–4200, T1–4201 or T4–4202 relays and one of the relays U0–4300 to U9–4309 are operated and locked to the master off-normal ground through relay CR–1915 normal.

The circuits for recording the recorder type (D digit) and number (E and F digits) may be described as follows. Upon the operation of relay RR–3301, ground is extended over contact 24 thereof, conductor 2106, over the right-hand translator contacts of the D digit reading relays (Fig. 14), out over one of the leads 5, 6, 7 or 8 and over cable D14–32, one of the conductors D5–3215, D6–3216, D7–3217 or D8–3218 of Fig. 32, cable 32–33A, one of the conductors D5–3215, D6–3216, D7–3217 or D8–3218, contact 20, 19, 18 or 17 of relay RR–3301, one of the conductors RC5–3303, RC6–3304, RC7–3305 or RC8–3306, cable 33–42A, cable 4208, to one of the relays C5–4203 to C8–4206. The operated relay locks over its locking contact 7 or 8, conductor L–4209, cable 43–34, cable 34–35, cable 35–19, cable 1919, cable 1922, conductor L–4209, contact 4 of relay CR–1915, conductor RON–1924, to ground over contact 2 of relay RL0–1202 and contact 26 of relay MON–1201 or over the recorder release key 1205 and contact 26 of relay MON–1201. Another ground is extended over contact 23 of relay RR–3301, conductor DROE–3307, cable 33–23, conductor DROE–3307, over the contact of the operated E digit translator relay TE0–2300, TE1–2301 or TE4 (not shown), out over one of the conductors 0, 1 or 4 into cable 33–23, one of the conductors 0, 1 or 4, over contact 15, 14 or 13 of relay RR–3301, one of the conductors RT0–3308, RT1–3309 or RT4–3310, cable 33–42A, cable 4208, to one of the relays T0–4200, T1–4201 and T4–4202 to register the recorder tens digit (which recorders run from 00 to 19 and 40 for the emergency). This operated tens digit relay locks to the lock conductor L–4209 over its contact 7 or 8. A third ground is extended over contact 22 of relay RR–3301, conductor DROF–3311, to Fig. 24 where it extends over a contact of the operated F digit translator relays TF0–2400 to TF9–2409, out over one of the ten conductors F0 to F9 into cable 24–34, over one of the conductors F0 to F9 into Fig. 33, over one of the contacts 2 to 11 (or vice versa), over one of the ten conductors RU0–3312 to RU9–3313, cable 33–42A, cable 42–43, to one of the ten units registers U0–4300 to U9–4309. The operated one locks over its contact 4 or 5 to the lock conductor L–4209.

The grounded lead RC5–3303, RC6–3304, RC7–3305 or RC8–3306 of Fig. 33, in addition to operating the associated relay C5–4203 to C8–4206 of Fig. 42, operates one of the magnetically locking polarized relays LC5–5807 to LC8–5810 of Fig. 58. This circuit extends from the RC5–3303 to RC8–3306 conductor in Fig. 33, over cable 33–58, over one of the conductors RC5–3303 to RC8–3306, to the lower winding of one of the relays LC5–5807 to LC8–5810. This moves the armature thereof to the right where it will remain until the upper winding is energized to return the armature to normal. Thus, even in the event of a power failure these relays remember the recorder type last processed so that the corresponding register of Fig. 42 can be reoperated under an emergency reset condition. The recorder progress switch 3205 mechanically remembers the recorder tens and units digits and the day progress switch 3112 remembers the day values. The hour register (even one) of Fig. 53, would, under these conditions be filled with a fictitious hour entry 25 under the control of the emergency reset relay ER–5812 and the relay H25–3508 of Fig. 35 (see Section 4.43).

A path is closed to permit the operation of the reader step relay RS–2600 and relay CL0–2200 through relay RR–3301 operated, through a one and one only check path through each of the register digits of the recorder number and over arc 4 of the recorder progress switch 3205. This circuit extends from ground, over the wiper arm of arc 4 of the recorder progress switch 3205, either contact 1 over conductor E–3212 or one of the contacts 2 through 21 over conductors 00 to 19, cable 32–43, to Fig. 43. Thence, as previously explained, if the feedback type of straddle operation is being used where the emergency central recorder tape (D digit of 280DEF line is a 6) is processed ahead of the regular tapes, relay C6–4204 will have been operated and the grounded lead E–3212 extends over contact 14 of relay C6–4204 to conductor 4211 without vertification of the recorder number registered in Figs. 42 and 43. At other times the recorder number must be checked (contacts 2 through 21 of arc 4 of the switch 3205) and so one of the leads 00 to 19 of Fig. 43 will be extended over one of the contacts 9 and 10, or 10 and 11 of the proper units relay U0–4300 to U9–4309 (assuming that the units digit

checks) thence over conductor **4312** or **4313** depending upon the tens digit according to arc **4** of switch **3205**, thence over contact **10** of relay **T0–4200** or contact **11** of relay **T1–4201** (assuming the tens digit to check properly) and to conductor **4211**.

The thus grounded conductor **4211** extends in an obvious one and one only check circuit through contacts of the relays **C5–4203** to **C8–4206**, a one only check circuit through contacts of relays **T0–4200** to **T4–4202**, conductor **4210**, a one only circuit through contacts of relays **U0–4300** to **U9–4309**, up-check conductor **UC–4311**, and in parallel over contacts **16** and **12** of relay RR–**3301** to the conductor **CL0–3314** and to the reader step conductor RS–**1808**. The grounded conductor **CL0–3314** extends over cable **33–22** to Fig. 22 where conductor **CL0–3314** branches off to operate relay **CL0–2200**. Relay **CL0–2200** locks over its contact **5** to the previously described locking circuit and permits relay **CL3–2103** to remain operated over the reader cam contact ground KM7 until the reader drum steps. Then relays **CL3–2103** releases. In the meantime, the grounded reader step conductor **RS–1808** operates the reader step relay RS–**2600** to step the reader one line.

At the end of the closed portion of the reading cycle, as the reader step occurs, relays **RR–3301** and **RDC–1916** release when the reading relays release. Hence the registered recorder number must agree with the first recorder number set on the recorder progress switch at the beginning of processing.

The next line of the end-of-tape group is usually the end-of-tape hour entry 2811EF. However, when processing the emergency section of tape a 285DEF entry may be interposed between the recorder entry 280DEF and the end-of-tape hour entry 2811EF. The operated **CL0–2200** relay permits either a 2811EF or a 285DEF entry to be received in this next position of the end-of-tape group. The receipt of a 285DEF entry does not change the tape identity reading progress but causes other action to take place as will be described presently.

4.082 *Registering cancel entries*

Any 285DEF entry, which may be received at this point, is registered in the cancel entry control portion (Fig. 73) of the machine without affecting the status of the tape identity progress circuit. Briefly, what may occur in this event is as follows. Relay **285C–7304** operates over a path through the reading relay check path, relay **TI–2501** operated, relay **CL0–2200** operated, the C, A and B digit reading relays (Figs. 14 and 13), relay **TI–2501** operated, the C4 reading relay operated and relay **CL0–2200** operated. This circuit extends from the usual ground on the reading relay up-check lead **UC–1510** of Fig. 15, cable **23–25**, conductor **UC–1510**, contact **7** of relay **TI–2501**, conductor **UCI–2513**, cables **2512**, **25–22** and **2204**, conductor **UCI–2513**, contact **2** of relay **CL0–2200**, conducting **285–2207**, contacts **7** of relays **C1–1401** and **C4–1403** (to check the C digit of 5), conductor **1310**, through the A and B reading relays of Fig. 13 to check the A and B digits of 28, conductor **UC–2610**, cables **15–13** and **26–15**, conductor **UC–2610**, contact **4** of relay **SR1E–2605**, conductor **UC–2510**, contact **9** of relay **TI–2501**, conductor **SRD–2514**, cables **2512**, **25–22** and **2204**, conductor **SRD–2514**, contact **8** of relay **CL0–2200**, conductor **2210**, contact **8** of reading relay **C4–1403** to conductor **285–2208**, over cables **25–36**, **36–59**, **59–72**, and **72–73**, conductor **285–2208**, to relay **285C–7304**. Relay **285R–7303** operates over contact **1** of relay **285C–7304** to the **285** lock conductor **285L–7316** which extends over cables **72–73**, **59–72**, **36–59** and **25–36**, conductor **285L–7316**, contact **4** of relay **ETE–2502**, to off-normal ground on conductor **MON–2205**. When and if one of the relays **STF–7300**, **NSMB–7301** and **NSTF–7302** operates, as will be explained, relay **285R–7303** locks over its contact **1** and contact **1** of one of these relays to the lock

conductor **285L–7316** independently of relay **285C–7304** thereby to remain operated until relay **ETE–2502** operates at the end of the end-of-tape group. Otherwise it remains under the control of relay **285C–7304** and releases with it when the reader steps off of the 285DEF line.

The operation of relay **285C–7304** extends decimal output leads **D4**, **D5**, **D6** and **D7** from the D digit reading relays of Fig. 14 (cable **D14–32**) to operate the **STF–7300**, **NSMB–7301** or **NSTF–7302** relays if the D digit of the 285DEF entry is a 5, 6 or 7, respectively. Ground is extended over contact **7** of relay **285C–7304**, conductor **2106**, cables **72–73**, **59–72**, **36–59** and **3605**, conductor **2106**, to the input of the D digit reading relay decimal contact translator of Fig. 14 where, as will be explained, one of the leads **4**, **5**, **6** or **7** into cable **D14–31** will be grounded depending upon the value of the D digit. Ground one of the conductors **4**, **5**, **6** and **7** entering cable **D14–31** (of Fig. 14) extend over cables **D14–31**, **31–67** and cable **6704**, conductor D4, D5, D6 or D7, cable **67–73**, conductor D4, D5, D6 or D7 to contacts of relay **285C–7304**. At the start of processing relay **FCCU1–7311** will be normal (see Section 4.29) and the rest of the relays in the cancel timing entry control circuit of Fig. 73 will be normal because there have been no timing entries registered as yet. If the **D5** lead is the one grounded (a 2855EF entry—a synchronous transfer), ground is extended over contact **2** of relay **285C–7304** to relay **STF–7300**. Relay **STF–7300** operates to register a synchronous transfer signal, locks over its contact **4** to the locking ground on conductor **285L–7316**, and extends the locking ground over its contact **5** to conductor TF–**7317**, which extends over cables **72–73**, **59–72**, **36–59** and **25–36**, conductor **TF–7317**, to relay TF–**2506** which thereupon operates to register the receipt of a 285DEF transfer entry received as part of an end-of-tape group. If the **D6** lead is grounded (a 2856EF entry—a non-synchronous make-busy), ground is extended over contact **4** of relay **285C–7304** and contact **4** of relay NSRC–**7306** to operate relay **NSMB–7301**. Relay **NSMB–7301** operates to register a non-synchronous make-busy signal and locks over its contact **5** to the lock conductor **285L–7316**. If the **D7** lead is grounded (a 2857EF entry—a non-synchronous transfer), ground is extended over contact **5** of relay **285C–7304** and contact **2** of relay NSRC–**7306** to relay NSTF–**7302**, which thereupon operates, locks over its contact **5** to the lock conductor **285L–7316** and extends the lock ground over its contact **6** and conductor **TF–7317** to operate relay TF–**2506** as above described. If the D4 lead is grounded (a 285400 entry—charge guard), ground is extended over contact **3** of relay **285C–7304**, contact **1** of relay CCRC–**7305**, contact **5** of relay NSRC–**7306**, contact **2** of relay FCCU1–**7311**, contacts **4** of relays NSTF–**7302** and NSMB–**7301**, contact **3** of relay STF–**7300**, contact **6** of relay **285C–7304**, reader step conductor RS–**1808**, cables **72–73**, **59–72**, **36–59** and **25–36** and conductor RS–**1808** to Fig. 26 to operate reader step relay RS–**2600** to step the reader one line.

If one of the relays **STF–7300**, **NSMB–7301** and **NSTF–7302** is operated, the locking ground on conductor **285L–7316** is extended over contact **3** of relay CG–**7312**, through a one only chain over contacts **2** and **3** of relays **NSTF–7302**, **NSMB–7301** and **STF–7300**, and over contact **6** of relay **285C–7304** to the reader step conductor **RS–1808**.

The next line of the end-of-tape group must now qualify as a 2811EF end-of-tape hour entry.

4.083 *Registering initial end-of-tape hour*

At the beginning of processing the odd and even hour registers (Figs. 44 and 45) should be normal as indicated by the operation of the relays **EHDC–3601**,

OHDC–3501 and OHDC1–3532 as fully described in Section 4.061 on the emergency reset situation. With these relays operated a path is closed from ground on conductor HON–1227 (master off-normal ground for hour registers), through relay OHRL–3502 released, relay OHDC1–3532 operated, relay EHDC–3601 operated, the hour reset key 1225 normal and relay ER–5812 normal to operate relay EH–3600 as previously described in Section 4.061.

The operation of relay EH–3600 permits the receipt of the first hour entry by the even hour register of Fig. 45.

When the 2811EF hour entry is read, a path is closed through the reading relay check path, relay TI–2501 operated, relay CL0–2200 operated, the D, C, A and B digit reading relays (Figs. 14 and 13), relays TI–2501 and CL0–2200 operated, over the C0–1400 reading relay operated, over lead N281AP, through relay EH–3600 operated and relay EHRL–3602 normal, to operate the EHR–3401 relay of the even hour register connector of Fig. 34. This circuit may be traced from ground on conductor RCK–1021 of Fig. 13 (as previously described), through the usual reading relay validity up-check path through Figs. 13, 14 and 15, out on conductor UC–1510, cable 23–25, conductor UC–1510, contact 7 of relay TI–2501, conductor UCI–2513, cables 2512, 25–22 and 2204, conductor UCI–2513, contact 1 of relay CL0–2200, conductor 2811–2209, contact 8 of relay D0–1405 and contact 9 of relay D1–1406 (to check the D digit of one), conductor 281–1413, contact 7 of relay C0–1400 and contact 9 of relay C1–1401 (to check the C digit of one), conductor 1310, contacts 4 of relay A0–1300 and 6 of relay A2–1302 and 4 of A1–1301 (to check the A digit of 2), contacts 4 of relay B7–1307 and 6 of relay B1–1304 (to check the B digit of 8), conductor UC–2610, cables 15–13 and 26–15, conductor UC–2610, contact 4 of relay SR1E–2605, conductor UC–2510, contact 9 of relay TI–2501, conductor SRD–2514, cables 2512, 25–22 and 2204, conductor SRD–2514, contact 7 of relay CL0–2200, conductor 2211, contact 0 of relays C0–1400, conductor N281AP, cable 23–35, conductor N281AP, contact 3 of relay EH–3600, contact 6 of relay EHRL–3602, conductor HR–3611, cables 3612 and 36–34, conductor HR–3611, to relay EHR–3401, which operates and locks over its contact 21 to ground on the reading relay up-check lead UC–1510.

The tens and units digits of the hour are read from the E and F digit reading relay translators (Figs. 23 and 24) into the even hour register of Fig. 45. Upon the operation of connector relay EHR–3401, ground is extended over its contacts 23 and 22 and 24 to the conductors DROE–3307, DROF–3311 and 2106. Ground on conductor DROE–3307 extends over cable 33–23 to conductor DROE–3307 of Fig. 23 where it extends over a contact of one of the E digit translator relays TE0–2300 to TE2 (not shown) (depending upon the value of the E digit), out over one of the leads 0, 1 or 2, cable 33–23, conductor 0, 1 or 2 into Fig. 34, over contact 14, 13 or 12 of relay EHR–3401, conductor T0, T1 or T2, cables 3404 and 34–45, conductor T0, T1 or T2 to operate one of the tens relays EHT0 (not shown), EHT1 (not shown) or EHT2 (not shown) in the even hour register of Fig. 45. This relay locks over its own contact to ground on the lock conductor L–3513, over cables 4512 and 45–36, conductor L–3513 and contact 4 of relay EHRL–3602 to off-normal ground on conductor HON–1227. Ground on conductor DROF–3311 in Fig. 34 extends to Fig. 24 where it continues over a contact of one of the F digit translator relays TF0–2400 to TF9–2409 (depending upon the value of the F digit), out over one of the leads F0 to F9 into cable 24–34, conductor F0 to F9, over one of the contacts 10 to 1 of relay EHR–3401, out over a conductor U0 to U9 into cables 3405 and 34–45, to one of the conductors U0 to U9 to operate one of the units relays EHU0 (not shown) to EHU9 (not shown) of the even hour register of Fig. 45. This relay also locks to the lock conductor L–3513.

Simultaneously, relay EHAR–3603 is operated from the 1 in the D digit of the 2811EF entry. This circuit extends from ground on the 1 lead from the D digit reading relay decimal translating contacts (Fig. 14), into cable D14–32, conductor D1 into cable 32–33A, conductor D1, contact 19 of relay EHAR–3401, conductor HAR–3406, cables 36–34 and 3610, conductor HAR–3406, to relay EHAR–3603. Relay EHAR–3603 locks over its contact 5 to locking ground on lead L–3513. Relay EHAR–3603, in operating, causes the operation of the even hour output connectors EUAR (not shown—Fig. 53) and ETNC (not shown—Fig. 53), similar to the odd connectors OUAR–5200 and OTNC–5202 for the odd hour register. These circuits extend from grounds in the even hour register. These sources of grounds may be explained with reference to the detailed showing of the odd hour register of Figs. 44 and 45. If the units digit is zero, ground is extended over contact 1 of relay OHU0–4403 to conductor OT–4407. If both the units and tens digits are zero, ground is extended over contact 9 of relay OHU0–4403 and contact 6 of relay OHT0–4400 to conductor OOU–4408. If the units digit is a zero and the tens digit is not zero, then ground extends over contact 9 of relay OHU0–4403 and either contact 6 of relay OHT2–4402 or contact 7 of relay OHT1–4401 to conductor RU–4409. If the units digit is not zero, irrespective of what the tens digit is, ground is extended over contacts 7 and 8 of one of the relays OHU1–4404 to OHU8–4508 or contacts 6 and 7 of relay OHU9–4509, to conductors RT–4410 and RU–4409. The corresponding conductors for the even hour register of Fig. 45 are conductors OT–4513, OOU–4514, RU–4515 and RT–4516. These latter conductors extend over cables 4517, 4512 and 45–36, to conductors OT–4513, OOU–4514, RU–4515 and RT–4516 of Fig. 36. With relay EHAR–3603 operated, conductor OT–4513 extends over contact 6 of relay EHAR–3603 to join up with conductor RT–4516 to energize conductor TNC–3516 and conductors OOU–4514 and RU–4515 extend over contacts 7 and 8 of relay EHAR–3603 to energize conductor UAR–3515. Both of these leads (UAR–3515 and TNC–3516) will be grounded at this time under even hour register operation as a result of the end-of-tape hour 2811EF having been read and registered. These leads extend over cable 36–53 to conductors UAR–3515 and TNC–3516 where the relays EUAR (not shown—see OUAR–5200 for odd register) and ETNC (not shown—see OTNC–5202 for odd register) operate. These two relays arrange that any hour output taken from the even hour register will be the tens digit with "no change" (ETNC–) and the units digit "as registered" (EUAR–).

Relay EHDC–3601 will release during the first reader open period when an hour registration has been made in the even hour register of Fig. 45, assuming relay EHAR–3603 to have operated.

Relay OHDC–3501, when operated, locks over its contact 3 to conductor 3510 independently of relay EH–3600 and thus stays operated until the odd side down-check conductor 3510 is ungrounded.

Upon the release of relay EHDC–3601 during the next reader open period, relay OHRL–3502 operates in a circuit from off-normal ground on conductor HON–1227 in Fig. 35, contact 2 of relay OHRL–3502, contact 2 of relay OHDC1–3532, conductor 3512, contact 5 of relay EHDC–3601, conductor 3525, to relay OHRL–3502, which operates and locks over its contact 5 and contact 1 of relay OHDC–3501 to the KB8 lead grounded during the reader open period and releases at the end thereof. The operation of relay OHRL–3502 releases relay EH–3600, opens at its contact 6 the locking circuit for relay OHDC1–3532, which releases, and operates relay

OH–3500 from ground on conductor HON–1227 in Fig. 35 over contact 3 of relay OHRL–3502 to relay OH–3500, which operates and locks over its contact 1, conductor 3526, and contact 2 of relay EHRL–3602 to conductor HON–1227.

On the next cycle of reading the 2811EF entry, registration of this entry may be accepted in the odd hour register of Figs. 44 and 45 by means of the operation of the odd hour connector relay OHR–3400 in a circuit which may be traced from ground on conductor N281AP in Fig. 35, over contact 3 of relay OH–3500, contact 7 of relay OHRL–3502, conductor HR–3520, cables 3521 and 35–34 into Fig. 34, conductor HR–3520 to connector OHR–3400, which thereupon operates and locks over its contact 21 to ground on the reading relay up-check conductor UC–1510.

The tens and units digits of the hour register are read from the E and F digit reading relay translators of Figs. 23 and 24 into the odd hour register of Figs. 44 and 45. Upon the operation of connector relay OHR–3400, ground is extended over its contacts 22, 21 and 23 to the conductors DROE–3307, DROF–3311 and 2106. Ground on the conductor DROE–3307 extends over cable 3323 to conductor DROE–3307 of Fig. 23 and there it extends over a contact of one of the E digit translator relays TE0–2300 to TE2 (not shown) (depending upon the value of the E digit), out over one of the leads 0, 1 or 2 over cable 3323, conductor 0, 1 or 2 into Fig. 34, over contact 14, 13 or 12 of connector relay OHR–3400, conductor T0, T1 or T2, cables 3412 and 34–44 into Fig. 44, cable 4419, conductor T0, T1 or T2 to operate one of the tens relays OHT0–4400, OHT1–4401 or OHT2–4402 in the odd hour register of Fig. 44. The operated one of these relays locks over its contact 5 or 6, as the case may be, to conductor L–4420 which extends into Fig. 45 and over cables 45–44 and 44–35 into Fig. 35, conductor L–4420, contact 4 of relay OHRL–3502 to off-normal ground on the conductor HON–1227. Ground on conductor DROF–3311 in Fig. 34 extends to Fig. 24 where it continues over the contact of one of the F digit translator relays TF0–2400 to TF9–2409 (depending upon the value of the F digit), out over one of the leads F0 to F9 into cable 24–34 into Fig. 34, conductor F0 to F9, over one of the contacts 10 to 1 of relay OHR–3400 out over a conductor U0 to U9 into cables 34–13 and 34–44 into Fig. 44, thence over cable 4417 and either cable 4418 or 44–45 to one of the conductors U0 to U2 of Fig. 44 or U3 to U9 of Fig. 45 to operate one of the units relays OHU0–4403 to OHU2–4405 or OHU3–4503 to OHU9–4509 of the odd hour register of Figs. 44 and 45. The operated one of these relays locks over its contact 8 or 6 or 5, as the case may be, to ground on the lock conductor L–4420.

Simultaneously, with the above operation, relay OHAR–3503 is operated from the 1 in the D digit of the 2811EF entry. This circuit extends from ground on the 1 lead from the D digit reading relay decimal translating contacts of Fig. 14 into cable D14–32, conductor D1 into cable 32–33A, conductor D1 into Fig. 34, contact 19 of relay OHR–3400, conductor HAR–3414, cables 35–34 and 35–22, conductor HAR–3414 to relay OHAR–3503, which thereupon operates and locks over its contact 5 to ground on the lock conductor L–4420. Relay OHAR–3503, in operating, causes the operation of the odd hour output connectors OUAR–5200 and OTNC–5202. These circuits extend from grounds in the odd hour register as have been explained in the detailed description of a previous part of this Section 4.083.

Relay SDC–3509 operates simultaneously with the operation of relay OHR–3400 provided relay EHAR–3603 is operated. This circuit extends from ground on the D1 lead of Fig. 34 over contacts 19 and 20 of relay OHR–3400, conductor DC–3415, cables 35–34 and 3521, conductor DC–3415, contact 9 of relay EHAR–3603, conductor 35–31, contact 5 of relay CHS–3506 to relay SDC–3509. The operation of relay SDC–3509 completes a path for stepping the reader off of the 2811EF entry, which path extends from ground in Fig. 45 through an up-check circuit of the even hour register out over the up-check conductor UC–4518, cables 4512 and 45–36, conductor UC–4518 through a one-and-one-only check of the relays EHARS–3604, EHAR–3603 and EHL1–3605, conductor 3613 into Fig. 35 through a one-and-one-only check of the relays OHL1–3505, OHAR–3503 and OHARS–3504, conductor UC–3523, cables 44–35 and 45–44 into Fig. 45, conductor UC–3523 through a one-and-one-only check of the odd hour units relays OHU9–4509 to OHU3–4503, conductor 4524 or 4520 into Fig. 44, thence over a one-and-one-only check of the odd hour units relays OHU2–4405 to OHU0–4403 and over a one-and-one-only check of the odd hour tens relays OHT2–4402 to OHT0–4400 to conductor UC1–4416, thence into Fig. 35, over the contact of relay SDC–3509, contact 10 of relay OHAR–3503 to conductor RS over cables 3522 and 35–34 into Fig. 34, conductor RS over contact 11 of relay OHR–3400 to the reader step conductor RS–1808 which, as previously described, operates the reader step relay RS–2600 thereby to step the reader off of the 2811EF entry.

When the reader step relay RS–2600 operates, relay CL1–2201 operates in a circuit extending from the ground on conductor RS of Fig. 35 (previously described as derived over contact 10 of relay OHAR–3503) extending over contact 13 of relay OHAR–3503 to conductor CL1–3529 over cables 3522 and 35–34 into Fig. 34, conductor CL1–3529 over contact 15 of relay OHR–3400 to conductor CL1–3411 into Fig. 33 and thence over cable 33–22 into Fig. 22, conductor CL1–3411 to relay CL1–2201, which operates and locks over its contact 5 and contact 3 of relay CL2–2202 to the ground on off-normal conductor ON–1117. The operation of relay CL1–2201 indicates that the end-of-tape group presently being checked may now accept a 2821EF calendar day entry.

Upon the operation of the reader step relay RS–2600, and during the reader open period, ground extends from the conductor KB8 in Fig. 26 over contact 8 of relay RS–2600, conductor RSG–2612 into Fig. 35 over contact 11 of relay OHAR–3503, conductor 3533 into Fig. 36 over contact 2 of relay EH–3600 to relay EHRL–3602, which operates and locks over its contact 5 and contact 2 of relay EHDC–3601 to ground on the off-normal conductor HON–1227. The operation of relay EHRL–3602 opens at its contact 4 the locking circuit over conductor L–3513 for the even hour register relays, thereby releasing relay EHAR–3603 and all of the even hour register relays of Fig. 45 in preparation for receiving the next tape hour entry in the even hour register of Fig. 45. The operation of relay EHRL–3602 also releases relay OH–3500 during the next reader open period and completes a circuit over its contact 3 for operating relay EH–3600 in an obvious manner.

When all of the even hour register relays of Fig. 45 and relay EHAR–3603 have returned to normal, the even hour down-check relay EHDC–3601 reoperates in a circuit previously described, thereby releasing relay EHRL–3602 and placing the hour register control circuit of Figs. 35 and 36 in condition such that the next tape hour entry will be received in the even hour register of Fig. 45, as will be described subsequently and particularly in Section 4.114 in connection with the description of circuits which check successively received hour entries to insure that the various tape sections are processed in the proper order.

4.084 *Registering initial calendar day entry*

The next entry of the end-of-tape group to be read is the 2821EF entry representing the first end-of-tape calendar day. The tens and units digits of the calendar day (E and F digits respectively) are registered in the day register circuit of Figs. 40 and 41. As was explained

under the description of the emergency day reset condition (Section 4.061), the day down-check relay DDC–5805 (in the day register control circuit of Fig. 58) is operated when the day register of Figs. 40 and 41 is normal and when the day release relay DRL–5800 and the change-day relay CD–5802 are normal. Also the no-change-day relay NCD–5801 is operated from off-normal ground on conductor DON–1233, over contact 2 of relay DRL–5800, armature and left contact of relay DC–5804 (which is normal in this condition), to relay NCD–5801, which locks over its contact 3 and contact 5 of relay CD–5802 to the lock conductor L–5819 (which is grounded over contact 2 of relay DRL–5800). The reading of this 2821EF entry closes a path through the reading relay check circuit, relays TI–2501 and CL1–2201 operated, through the C, A and B digit reading relays of Figs. 14 and 13, relay SR1E–2605 operated, relay TI–2501 and CL1–2201 operated, and over the lead 282–2212 to the day register control of Fig. 58. This path may be traced from ground on the reading relay up-check lead UC–1510 of Fig. 15, cable 23–25, conductor UC–1510, contact 7 of relay TI–2501, conductor UCI–2513, cables 2512, 25–22 and 2204, conductor UCI–2513, contact 2 of relay CL1–2201, conductor 282–2213, contacts 6 of relay C0–1400 and 8 of relay C2–1402 (to check the C digit of 8), conductor 1310, contacts 4 of relay A0–1300 and 6 of relay A2–1302 and 4 of relay A1–1301 (to check the A digit of 2), contacts 4 of relay B7–1307 and 6 of relay B1–1304 (to check the B digit of 8), conductor UC–2610, cables 15–13 and 26–15, conductor UC–2610, contact 4 of relay SR1E–2605, conductor UC–2510, contact 9 of relay TI–2501, conductor SRD–2514, cables 2512, 25–22 and 2204, conductor SRD–2514, contact 7 of relay CL1–2201, conductor 282–2212, cables 3222, 32–49 and 49–58, conductor 282–2212, contact 2 of relay DDC–5805, conductor DR–5822, cables 49–58, 32–49 and 32–33B, conductor DR–5822, to operate relay DR–3300, which locks to the reading relay up-check lead UC–1510 over its contact 19.

Now, when the day register connector relay DR–3300 is operated this permits the E and F digit reading (translated to a decimal base) to be read into the day register relays. The operation of relay DR–3300 applies ground over its contacts 21 and 20 to the leads DROE–3307 and DROF–3311, which as previously explained, cause one of the leads E0 to E3 from the E digit translator of Fig. 23 and one of the leads F0 to F9 from the F digit translator of Fig. 24 to be grounded depending upon the E and F digits of the 2821EF entry (the tens and units digits of the end-of-tape calendar day). The F0 to F9 lead of Fig. 24 extends over cable 24–34 to the F0 to F9 leads of Fig. 34 extending into Fig. 33 where it is extended over one of the contacts 1 to 10 of relay DR–3300 into cable 33–40. The E0, E1, E2 or E3 lead of Fig. 23 extends over cable 33–23 to the 0, 1, 2 or 3 lead of Fig. 33, where it extends over contact 15, 14, 13 or 12 of relay DR–3300 into cable 33–40. Thence these two grounded conductors extend over cable 33–40 into the day register of Figs. 40 and 41, where one of the day tens register relays DT0–4000 to DT3–4003 and one of the day units register relays DU0–4010 to DU2–4012 and DU3–4113 to DU9–4119 are operated. These operated relays lock over their locking contact (4, 5, 6 or 7) to ground on the lock conductor L–5819. This opens the down-check circuit, thereby releasing the down-check relay DDC–5805, which thereupon opens the operating circuit for the connector relay DR–3300 (which remains operated however until the reading relay up-check conductor UC–1510 is opened). The one-and-one-only up-check path through the tens and units digits of the day register, relay NCD–5801 operated and relay DR–3300 operated causes relay CL2–2202 and the reader step relay RS–2600 to operate, enabling the tape to advance from the 2821EF end-of-tape group calendar day entry and completing tape identity progress. This circuit extends from ground, over contact 4 or 5 of relay DT0–4000, contacts 2, 3 or 4 of relays DT1–4001 and DT2–4002, contacts 2 or 3 of relays DT3–4003 and DU0–4010, contact 4, 5 or 6 of relay DU1–4011, contact 2, 3 or 4 of relay DU2–4012, conductor 4005 or 4006, contact 2, 3 or 4 of relays DU3–4113 to DU8–4118, contact 2 or 3 of relay DU9–4119 to the up-check conductor UC–4101, cables 41–49 and 49–58, conductor UC–4101, contact 4 of relay NCD–5801, conductor RS–5823, cables 49–58, 32–49 and 32–33B and over conductor RS–5823 to the armatures of relay DR–3300 associated with contacts 11 and 16 thereof.

Ground on conductor RS–5823 of Fig. 33 extends over contact 16 of relay DR–3300, conductor CL2–1231, cable 33–22, conductor CL2–1231, to operate relay CL2–2202, which locks over its contact 6, conductor CL2L–2214, cables 2204, 25–22 and 2512, conductor CL2L–2214, contact 4 of relay TI–2501, to off-normal ground on conductor MON–2205. Eventually, when the reader is stepped, relay CL1–2201 will be released when the K7 make cam on the reader (Fig. 8) opens to remove ground from conductor KM7 (Fig. 22).

Ground on conductor RS–5823 of Fig. 33, meanwhile, is also extended over contact 11 of relay DR–3300 to conductor RS–1808, which operates the reader step relay RS–2600 thereby to cause the reader to step ahead one line off from the 2821EF calendar day end-of-tape entry. This releases relays CL1–2201 and DR–3300.

4.09 *Perforating leading tape identity group*

The circuit having read, checked and registered an end-of-tape group is now prepared to place the required tape identity on the output tapes to be used in further processing.

The first step in this process is to place leading tape identity on the detail and message unit tapes.

With relay CL2–2202 operated and the other CL–relays of Figs. 21 and 22 released, a path is closed from off-normal ground through relay STE–2203 normal, relay FI–2500 operated and relay EPW–2504 normal, to operate relay LTI–6501 in the common class translator.

This circuit may be traced from ground on master off-normal conductor MON–2205 of Fig. 22, contact 5 of relay CL2–2202, contacts 4 of relays CL1–2201 and CL0–2202, conductor 2108, contact 3 of relay CL3–2103, contact 2 of relay CL4–2101, conductor 2113, contact 4 of relay STE–2203, conductor TE–2215, cables 2204, 25–22 and 2512, conductor TE–2215, contact 6 of relay FI–2500, contact 4 of relay EPW–2504, conductor LTI–2515, cables 25–36 and 36–59, conductor LTI–2515, to operate relay LTI–6501.

The operation of the LTI–6501 relay prepares for the perforation of the leading tape identity group on these tapes. Relay LTI–6501, in operating, closes a one-and-one-only check path through the common class translator to operate relay CCUC–10300 in the perforator walking control circuit of Fig. 103. This circuit extends from ground, over contact 17 of master off-normal relay MON–1201, conductor MON–1234, cables 12–15, 12–35 and 35–58, conductor MON–1201, contact 1 of relay TTI–6500, contact 2 of relay LTI–6501, contacts 3 of relays TTFE–6505 to TE–6507, contact 5 of relay WS–6502, conductor CCUC–6510, cables 65–64 and 64–103 to Fig. 103, conductor CCUC–6510 to relay CCUC–10300.

Prior to the operation of relay CCUC–10300, a circuit was completed for operating the output down-check relay ODC–5903 extending from ground, over contact 14 of relay MON–1201, conductor MON–1218, cables 11–25A, 25–103 (to Fig. 103) and 103–101, conductor MON–1218, contact 1 of relay P0D–10100, contacts 4 of relays P1D–10101 to P9D–10109, contact 5 of relay P10D–10110, contact 4 of relay P11D–10111, conductor ODC–10114, cables 64–99 (to Fig. 64) and 6404, conductor ODC–10114, contacts 4 of relays PLA1–6421

to PLA7–6427, contacts 3 of relays PLA8–6428 to PLA10–6430, contact 2 of relay PLA11–6431, contact 3 of relay PL10–6410, contacts 5 of relays PL8–6408 to PL2–6402, contact 4 of relay PL1–6401, conductor ODC–6403, cable 64–103 (to Fig. 103), conductor ODC–6403, contact 3 of relay CCUC–10300, conductor ODC–10310, cables 64–103 (to Fig. 64) and 64–59, conductor ODC–10310, to operate relay ODC–5903, which thus indicates that the perforator output circuit is normal and may be seized by either of the odd and even call entry registers. The operation of relay CCUC–10300 transfers this down-check ground on conductor ODC–6403 from its contact 3 (thereby releasing relay ODC–5903 to prevent a call entry register from seizing the output circuits) to its contact 2 which thereupon operates relay CODC–10301 to indicate that the output circuit is normal and that the common class translator circuit of Fig. 65 may use it to the exclusion of the call entry registers.

With relays CCUC–10300 and CODC–10301 operated, the common output connector relay COC–6400 operates and locks independently of relay CODC–10301. This circuit extends from ground, over contact 4 of relay PWS–10304, contact 1 of relay CCUC–10300, contact 2 of relay CODC–10301, conductor COC–10311, cable 64–103 (to Fig. 64), conductor COC–10311, to relay COC–6400. Relay COC–6400 operates and locks over its contact 1, conductor COCL–6405, cable 64–103 (to Fig. 103), conductor COCL–6405, contact 1 of relay CCUC–10300, to ground over contact 4 of relay PWS–10304. Relay PON–5902 (perforator off-normal) is thereupon operated in a circuit from ground, over contact 8 of relay ST4–1103, conductor ON–1118, cables 11–17, 17–58 and 58–64, conductor ON–1118, contact 24 of relay COC–6400, conductor PON–6406, cables 6409 and 64–59A, conductor PON–6406 to relay PON–5902.

With relays LTI–6501, COC–6400 and PON–5902 operated, relay PLA10–6430 operates in a circuit extending from ground, over contact 16 of relay LTI–6501, conductor 10L–6511, cable 65–64, conductor 10L–6511, contact 15 of relay COC–6400, conductor 10L–6411, cable 6412, conductor 10L–6411, to relay PLA10–6430, which thereupon operates and locks over its contact 4, contact 5 of relay PLA9 (not shown), contact 5 of relay PLA8–6428, contact 6 of relays PLA7–6427 to PLA1–2421, conductor PLK–6413, cable 64–59A, conductor PLK–6413, to ground over the contact of relay PON–5902.

The operated LTI–6501 relay now operates the perforator register relay P1D–10101 to select the detail tape as the first one upon which the tape identity group is to be perforated. Perforator connector relay PA1–17901 operates in series with relay P1D–10101. This circuit extends from ground, over contact 4 of relay LTI–6501, conductor W–6512, cable 65–64A, conductor W–6512, contact 2 of relay COC–6400, conductor W–6414, cable 64–103 (to Fig. 103), conductor W–6414, contact 1 of relay P1D1–10302, conductor P2–10312, cables 10313, 103–101A and 10115, conductor P2–10312, winding of relay P1D–10101, conductor P1A–10116, cable 101–179, conductor P1A–10116, to battery through relay PA1–17901.

Relay P1D–10101, in operating, operates relay P1D1–10302 in a circuit from ground, over contact 10 of relay P1D–10101, conductor P1D1–10117, cables 10115, 103–101A and 10313, conductor P1D1–10117, to relay P1D1–10302, which locks over its contact 3, conductor W–6512, cable 64–103 (to Fig. 64), conductor W–6512, cable 65–64A, conductor W–6512, to ground over contact 4 of relay LTI–6501. Relays P1D–10101 and PA1–17901 lock over contact 9 of relay P1D–10101, contact 12 of relay P2D–10102, conductor L–10118, cables 10115, 103–101A and 10313, conductor L–10118, to ground over contact 4 of relay P1D1–10302. Relay P1D1–1302 transfers the ground on lead W–6414 out

of cable 64–103 (in Fig. 103) from its contact 1 (opening the operating circuit for relays P1D–10101 and PA1–17901) to its contact 2 to operate relay PW–10303, which, at its contact 4, augments the ground on the locking conductor L–10118. Relay P1D–10101, in operating, releases relay CODC–10301.

Relay P1D1–10302, in operating, provides a path for operating the DET–19304 relay of the sort class translator (Figs. 192 and 193) through relay P1D–10101 operated. This circuit extends from ground, over contact 5 of relay P1D1–10302, conductor SC–10314, cables 10313, 103–101A, 10131, conductor SC–10314, contact 3 of relay P1D–10101, conductor DET–10118, cables 10130, 102-193 and 19305, conductor DET–10119, to relay DET–19304, which thereupon operates to indicate that end-of-tape identity is being perforated on the detail output tape—herein assigned as perforator No. 1 (the straddle perforator being No. 0 and the ten bulk-billed message unit perforator 0 to 9 being perforators Nos. 2 to 11).

Relay PW–10303, in operating, prepares at its contact 2 a path for operating relay PWS–10304 after the leading tape identity entries have been placed on the detail tape.

With relay PLA10–6430 operated, the circuit is ready to begin perforation of the ten line tape identity group on the detail tape. Although these 289DEF entries comprise only 9 lines in this group, the group is introduced by a plurality of 081010 splice pattern lines which are treated by the circuit in their entirety as a single line of the leading tape identity.

During an open period in the reader cycle the J3 reader cam contact (Fig. 9) closes extending ground through the relay CK–5906 and relays PLA1–6421 to PLA9 (not shown), normal relays PLA10–6430 and LTI–6501 operated to operate the common pattern connector relays 08R–7209 and 8–7119. This circuit extends from ground, over the J3 reader break contact (Fig. 9), conductor JB3–909, cables 8–17, 17–58 and 58–59, conductor JB3–909, contact 2 of relay CK–5906, conductor PAT–5909, cable 64–69A, conductor PAT–5909, contacts 2 of relays PLA1–6421 to PLA8–6428, etc., contact 1 of relay PLA10–6430, conductor L10–6415, cable 6416, conductor L10–6415, contact 4 of connector relay COC–6400, conductor L10–6417, cable 65–64A, conductor L10–6417, contact 5 of relay LTI–6501, conductor 08–6513, cables 6515 and 65–72, conductor 08–6513, winding of relay 08R–7209, conductor 7211, to battery through the winding of relay 8–7119 (which operates on perforate codes having a B digit of 8, except 289DEF codes), which relays 08R–7209 and 8–7119 thereupon operate in series with each other.

Relay SSTM–5914 also operates at this time to start the timing which determines the number of repeated lines of splice pattern perforated on the tapehead of the tape identity group. This circuit extends from the ground on conductor 08–6513 in Fig. 65 (which operated relays 08R–7209 and 8–7119 as described above), over contact 15 of relay LTI–6501, conductor SSTM–6514, to relay SSTM–5914, which operates to start the timing of an interval during which splice pattern 081010 will be perforated and at the end of which interval the second line of the output pattern may be perforated. The action of the timing circuit will be described below at the appropriate time. The ground on the conductor PAT–5909 in Fig. 59, in addition to causing the operation of relays 08R–7209 and 8–7119 as above described, operates relay OP–5907. Relay OP–5907 operates from this reader break ground during the reader open cycle and locks over its contact 1, conductor HM1–5916, cables 58–59, 17–58 and 8–17, conductor HM1–5916, to ground over the make contact H1 (Fig. 8) during the reader closed cycle. This relay OP–5907, therefore, remains operated until relay CK–5906 is operated at the end of the timing interval to open the operating

circuit of relay OP–5907. The reader make ground on conductor HM1–5916 is then extended over contact 1 of relay OP–5907 to conductor PAT–5909 to assist the JB3–909 break ground to maintain ground on conductor PAT–5909 until the end of the splice pattern timing interval.

During the next make cycle of the reader, the perforate magnets (Fig. 194) and the perforate magnet check relays (Figs. 128, 154, and 179) of the detail tape (No. 1) are operated through the detail tape perforator connector relay P1D–10101. During the reader make or closure cycle (when the reading contacts of Fig. 7 are closed) the reader perforate contacts PA0 to PF–7 are closed. These twenty-eight make contacts are used to apply grounds to twenty-eight leads comprising the 0, 1 and 2 leads for the A digit in cable PA–805, the 0, 1, 2, 4 and 7 leads for the B digit in cable PB–806, etc., for the C, D, E and F digits, and the make cam contacts of Fig. 9 apply grounds to the miscellaneous group of leads M0 to M7 in cable M–910. All of these grounds enter cable 8–40 and eventually spread out to many places in the circuit, where, depending upon selective relay operations, these grounds are effective to cause perforation of specified information. In lieu of tracing each of these grounds back to the reader in each instance it will be understood that conductors designated PA0, PA1 and PA2 are grounded by the 0, 1 and 2 contacts of the A reader perforate contacts, conductors designated PB0 to PB7, PC0 to PC7, PD0 to PD7, PE0 to PE7 respectively, are grounded by the respective B, C, D, E and F reader perforate contacts and conductors M0 to M7 are grounded by the miscellaneous J and P reader perforate contacts. This will facilitate the description and thereby relieve it of unnecessary detailed repetition. With relays 8–7119 and 08R–7209 of the common pattern connector circuit of Figs. 71 and 72 operated the following circuits are completed; the grounded PA0 lead of Fig. 59 extends over contact 4 of relay SSTM–5914, conductor 5917, cable 59–71, conductor 5917, contact 1 of relay 08R–7209 to ground conductor A0 into cable 72–104; grounded leads PB1 and PB7 out of cable 69–72 in Fig. 72 extend over contacts 2 and 1 of relay 8–7119, to ground conductors B1 and B7 into cable 72–104; grounded leads PC1 and PC0 out of cable 69–72 in Fig. 72 extend over contacts 3 and 2 of relay 08R–7209 to ground conductors C0 and C1 into cable 72–104; grounded leads PD1 and PD0 from cable 69–72 extend over contacts 5 and 4 of relay 08R–7209 to ground leads D4 and D7 into cable 72–104; grounded leads PE7 and PE4 from cable 69–72 extend over contacts 7 and 6 of relay 08R–7209 to ground conductors E0 and E1 into cable 72–104; and, grounded PF0 and PF1 out of cable 69–72 extend over contacts 9 and 8 of relay 08R–7209 to ground conductors F4 and F7 into cable 72–104.

These grounded conductors A0, B1 and B7, C0 and C1, D4 and D7, E0 and E1, and F4 and F7 extend over cable 72–104 to Fig. 104, thence over cables 104–156 and 156–128 to Fig. 128. Here the A0 lead branches out over cable A12803, through the winding of the perforating magnet check relay KA0–12800, over lead A0, cable 12806, lead A0 contact 3 of connector PA1–17901, to conductor A0 into cable 12808, 15413 and 19403. The B, C, D, E and F leads continue through cable 12804 where, in Fig. 128, the leads B1 and B7 branch out over cable B12805, through the windings of relays KB1–12811 and KB7–12817, conductors B1 and B7, cable 12807, conductors B1 and B7, contacts 7 and 4 of connector PA1–17901, into cables 12808, 15413 and 19403. The C, D, E and F leads continue through cable 128–154 into Fig. 154 where the C0 and C1 leads branch out into cable C15403, conductors C0 and C1, relays KC0–15400 and KC1–15401, conductors C0 and C1, cable 15408, conductors C0 and C1, contacts 13 and 12 of connector PA1–17901 to conductors C0 and C1 into cables 15415, 15413 and 19403. The D, E, and F leads continue through cable 15405 whence leads D4 and D7 branch out through cable D15406, through relays KD4–15414 and KD7–15417, leads D4 and D7, cable 15409, conductors D4 and D7, contacts 15 and 14 of connector PA1–17901 to conductors D4 and D7 into cables 15415, 15413 and 19403. The E and F leads continue through cable 154–179 to Fig. 179 where the E0 and E1 leads branch out through cable E17903, through relays KE0–17920 and KE1–17921, conductors E0 and E1, cable 17905, conductors E0 and E1, contacts 23 and 22 of connector PA1–17901, to leads E0 and E1 into cable 19403. The F4 and F7 leads extend through cable 17904, relays KF4–17934 and KF7–17937, leads F4 and F7, cable 17906, leads F4 and F7, contacts 25 and 24 of connector PA1–17901, to leads F4 and F7 into cable 19403.

These leads A0, B1 and B7, C0 and C1, D4 and D7, E0 and E1, F4 and F7 of cable 19403 continue through the respective perforator magnets 1A0, 1B1 and 1B7, etc. and 1F4 and 1F7 for the perforator No. 1 of Fig. 194, to battery, whereupon the designated perforate magnets of the No. 1 perforator operate (to perforate splice pattern 081010 in the No. 1 output tape) in series with their corresponding magnet check relays (KA0–12800 to KF7–17937 of Figs. 128, 154 and 179).

The JM2 cam of the reader (Fig. 8), through relay SSTM–5914 operated, operates the perforate advance magnet check relay PM–5901 through the operated perforator connector relay PA1–17901 of the detail tape (No. 1) and through the windings of the perforate advance magnet relay PK1–19401 and the advance magnet 1PAM (Fig. 194) of the perforator to battery. This circuit extends from ground on the lead JM2–811 out of cable 58–59 of Fig. 59, over contact 3 of relay SSTM–5914, conductor PM–5919, winding of relay PM–5901, conductor PM–5918, cable 59–179 (to Fig. 179), conductor PM–5918, contact 29 of connector PA1–17901, conductor PA1–17907, winding of relay PK1–19401, winding of magnet 1PAM to resistance battery. The advance of the perforator tape will take place upon the release of the advance magnet 1PAM (Fig. 194).

The MON–1218 ground through the one-and-one-only path of the perforator register relays of Fig. 101, the one-and-one-only path through the KA0–12800 relay of the perforate magnet check A digit and the two-out-of-five check path of each of the digits B to F of the perforate magnet check relays KB7–12817 to KF7–17937 for these digits operates the PS–5900 relay of the perforate control (Fig. 59), thereby indicating that a satisfactory line of tape has been perforated. This circuit extends from ground on conductor MON–1218 of Fig. 101, contact 1 of relay P0D–10100, contact 5 of relay P1D–10101, contact 7 of relay P2D–10102, contacts 6 of relays P3D–10103 to P9D–10109, contact 7 of relay P10D–10110, contact 6 of relay P11D–10111, conductor PCK–10032, contact 2 of relay KA0–12800, contact 4 of relay KA1–12801, contact 2 of relay KA2–12802, contacts 1 of relay KB0–12810 and 2 of KB1–12811 and 3 of KB2–12812 and 2 of KB4–12814 and 1 of KB7–12817, conductor 12809, contacts 2 of relay KC0–15400 and 4 of KC1–15401 and 5 of KC2–15402 and 4 of KC4–15404 and 2 of KC7–15407, contacts 1 of relays KD0–15410 to KD7–15417, conductor 15416, contacts 2 of relay KE0–17920 and 4 of KE1–17921 and 5 of KE2–17922 and 4 of KE4–17924 and 2 of KE7–17927, contacts 1 of relays KF0–17930 to KF7–17937, conductor PCK–17908, contacts 2 of relays PK0–19400 and PK1–19401, contacts 1 of relays PK2–19402 to PK11–19411, conductor PS–19404, cable 59–179 to Fig. 59, conductor PS–19404, to relay PS–5900, which, as above mentioned, indicates the satisfactory perforation of a line of information on an output tape.

The perforate line count circuit (Fig. 64) advances only after the CK–**5906** relay has checked the operation of the pattern relay. However, when perforating splice pattern the operation of relay CK–**5906** is delayed until the ESTM–**5915** relay indicates the end of the splice pattern timing interval, because this entire interval is considered as one line count.

Hence, the splice pattern is completely perforated line by line, as indicated by the repeated operation and release of relay PS–**5900** on each reader closed and open cycle, as long as the relay SSTM–**5914** and the **08**R-**7209** and **8–7119** common pattern connectors are operated. Relay PS–**5900** releases at the end of each open reader cycle. At the end of each reader closure period (beginning of reader open period) the reader perforate cams (Fig. 8) open to release all operated perforator magnets (Fig. 194) and all operated perforator magnet check relays K– (Figs. 128, 154 and 179). This opens the perforator check circuit thereby opening the operating circuit of relay PS–**5900**. However, the break cam contact H3 (Fig. 8) grounds conductor HB3–**812** during the reader open cycle and this ground extends over cables **8–17**, **17–58** and **58–59**, conductor HB3–**812**, to the locking contact **2** of relay PS–**5900**, which holds relay PS–**5900** operated until the end of the reader open cycle when the H3 contact (Fig. 8) opens. Near the end of the reader closure cycle, the ground from the J0 make contact (Fig. 9) closes and remains closed for a short while after the reader perforate contacts (Fig. 8) open. This ground on conductor JM**0–911** extends over cables **8–17**, **17–58** and **58–59**, conductor JM**0–911**, contact **1** of relay PS–**5900** (held operated during the reader open cycle by ground on the lead HB3–**812**), and the contact of relay PM–**5901** to conductor PM–**5919**, which holds relays PM–**5901**, PK**1–19401** and **1**PAM operated until shortly after the reader perforate contacts (Fig. 8) open. This allows the perforate advance magnet **1**PAM (Fig. 194) to remain operated a little longer than the perforate magnets (Fig. 194), thereby allowing the latter to withdraw from drum before the perforator drum advances, which takes place upon the release of the advance magnet **1**PAM (Fig. 194).

When the late opening of cam J**0** (Fig. 9) takes place, relays PM–**5901**, PK**1–19401** and **1**PAM (Fig. 194) release, thus permitting the perforator drum to advance but only after the perforator magnets (Fig. 194) have released, thereby withdrawing the perforator pins from the output tape. Relay PS–**5900** releases at the end of the reader open cycle and the above process is repeated over and over again until the relay ESTM–**5915** operates to indicate the end of the splice timing interval.

The operation of relay SSTM–**5914** at the start of the timing (see above) closed ground through the left winding of relay ESTM–**5915** to the condenser **5920** and resistor **5921** between the start anodes and main anode M of the splice pattern timing gas tube T–**5913**. This ground extends through the left winding of relay ESTM–**5915**, over contact **1** of relay SSTM–**5914**, through condenser **5920** and resistance **5921**, resistance **5922**, over contact **1** of relay CWS–**5908** (which shunts out resistance **5923**, to positive battery). As the condenser **5920** charges the potential on the start anodes is raised toward the full potential on the main anode M. When the potential between the cathode and start anodes is high enough the gas in the tube T–**5913** will break down and will maintain a transferred conduction between main anode M and cathode to operate relay ESTM–**5915**.

The time provided by the splice pattern timer is long enough to perforate some 40 or 50 lines of splice pattern on end of the tape. As will be explained elsewhere, whenever relay CWS–**5908** is operated as an incident of applying splice pattern across a window in an output tape (a physical hole in the center part of an unperforated tape indicating a physical splice), the resistance **5923** is

added into the charging circuit for condenser **5920**, thereby lengthening the time interval for an almost indefinite period to cause a longer length of splice pattern to be perforated in this instance (see Section 4.38).

Relay ESTM–**5915** operated, grounds the lead PM–**5919** to hold the perforate advance magnet **1**PAM (Fig. 194) from stepping any further and also permits the CK–**5906** relay of the perforate control to operate. Relay ESTM–**5915** locks over its contact **1** to ground on the conductor SSTM–**6514**. Ground over contact **3** of relay ESTM–**5915** grounds conductor PM–**5919** which holds operated relays PM–**5901**, PK**1–19401** and magnet **1**PAM (Fig. 194) to prevent tape advance. Ground extends over contacts **2** of relays SSTM–**5914** and ESTM–**5915**, conductor CKP–**5924**, to operate relay CK–**5906**. With relay CK–**5906** operated if during the reader closed cycle, the relay OP–**5907** will remain operated until the end of the reader closure cycle when the HM**1–5916** ground disappears. This holds relays **08**R–**7209** and **8–7119** operated for the same time. With relay CK–**5906** operated if during the reader open cycle, relays OP–**5907**, **08**R–**7209** and **8–7119** release at once.

Eventually the operation of relay CK–**5906** closes ground from the **H6** cam (Fig. 8) during the closed reader cycle to operate the PL**9** relay (Fig. 64—not shown). This ground extends from the **H6** cam (Fig. 8), conductor HM**6–813**, cables **8–17**, **17–58** and **58–59**, conductor HM**6–813**, contact **3** of relay CK–**5906**, conductor PL–**5925**, cable **64–59**A, conductor PL–**5925**, contacts **8** of relays PLA**1–6421** to PLA**9** (not shown), contact **6** of relay PLA**10–6430**, to the relay PL**9** (not shown), which operates and locks to the ground on conductor PLK–**6413** like the relays PL**10–6410**, PL**8–6408**, etc.

With relay PS–**5900** operated as a result of the check of the perforating of the previous line of splice pattern, ground from the reader during an open reader cycle from the **H4** cam (Fig. 8) and extending through relay PS–**5900** operated and the PL**9** relay (Fig. 64) operated, operates relay PLA**9** (not shown—Fig. 64), thus preparing to perforate the next line of the leading tape identity group. The circuit extends from ground, over the **H4** reader contact (Fig. 8), conductor HB**4–814**, cables **8–17**, **17–58** and **58–59**, conductor HB**4–814**, contact **4** of relay PS–**5900**, conductor PLA–**5926**, cable **64–59**A, conductor PLA–**5926**, contacts **2** of relays PL**1–6401**, PL**2–6402** to PL**7–6407** and PL**8–6408**, contact **1** of relay PL**9** operated (not shown), just like contact **1** of relay PL**8–6408**, to operate relay PLA**9** (not shown), which locks like relay PLA**8–6428** over its own locking contact, contact **5** of relay PL**8–6428**, contacts **6** of relays PLA**7–6427** to PLA**1–6421**, and to ground on conductor PLK–**6413**.

If such has not happened prior to this instant, the operation of relay PLA**9** (Fig. 64) permits the release of relays SSTM–**5914** and ESTM–**5915** of the splice pattern timer and the release of the common pattern relays **08**R–**7209** and **8–7119**. This causes relay CK–**5906** to release at the end of the next reader closed cycle, if not sooner. The ground on the JB**3–909** lead during the reader open cycle, through relay CK–**5906** normal and relays PLA**9** (Fig. 64), COC–**6400** and LTI–**6501** operated, operates common pattern relays **2891–7101** and **289–7110** and relay OP–**5907** as before. This circuit extends from ground on conductor JB**3–909**, over contact **2** of relay CK–**5906** (to operate relay OP–**5907** as before), to conductor PAT–**5909**, cable **64–59**A, conductor PAT–**5909**, contacts **2** of relays PLA**1–6421** to PLA**8–6428**, contact **1** of operated relay PLA**9** (not shown), conductor L**9–6418**, cable **6416**, conductor L**9–6418**, contact **5** of connector relay COC–**6400**, conductor L**9–6419**, cable **65–64**A, conductor L**9–6419**, contact **6** of relay LTI–**6501**, conductor **2891–6516**, cables **6515**, **65–72** and **72–71**, conductor **2891–6516**, winding of relays

2891–7101 and 289–7110 (which operates on all 289DEF codes) to battery.

The operation of the common pattern relays 2891–7101 and 289–7110 prepares for the perforation of the tape index of the tape identity group on the detail tape as the E and F digits of a 2891EF entry, where the E and F digits represent the respective tens and units digits of the tape index (see Section 2.42).

The E and F digits of the tape index are obtained from the DET–19304 relay in the sort class translator and the 2891 code is obtained from the common pattern connector relays 2891–7101 and 289–7110. The PA2 lead from cable 69–72 in Fig. 72 extends over contact 3 of relay 289–7110 to conductor A2 into cables 72–104, 104–156 and 156–128 to operate the 1A2 perforator magnet. The PB1 and PB7 leads extend over contacts 5 and 4 of relay 289–7110 to conductors B1 and B7 into cables 72–104 etc. to operate the 1B1 and 1B7 perforator magnets. The PC2 and PC7 leads extend over contacts 7 and 6 of relay 289–7110 to conductors C2 and C7 into cables 72–104, etc. to operate perforator magnets 1C2 and 1C7. Leads PD0 and PD1 extend over contacts 2 and 1 of relay 2891–7101 to conductors D0 and D1 into cables 72–104, etc. to operate the 1D0 and 1D1 perforator magnets.

This takes care of the 2891 part of the 2891EF code, the E digit being effected as follows. Since this is the detail tape, as evidenced by the operation of the relay DET–19304 as previously described, the tens digit (the E digit) of the 2891EF must be perforated as a 5 (see Section 2.42). The leads PF1 and PF0 in Fig. 193 extend over contacts 4 and 3 of relay DET–19304, conductors E1–19307 and E4–19306, cables 19308, 72–193 (to Fig. 72), 7213 and 72–71A, conductors E1–19307 and E4–19306, contacts 4 and 3 of relay 2891–7101, to conductors E1 and E4 into cables 72–104, etc. to operate perforator magnets 1E1 and 1E4 of Fig. 194.

The F digit, the units digit of the tape index, will be either a 1 or a 0 on the detail tape depending upon whether the marker group being processed contains a single central office or more than one central office. A slight digression appears helpful here in order to understand how this units digit is generated. At the start of processing resistance battery is applied over contact 11 of relay MON–1201, conductor MONB–1235, cable 12–175 (to Fig. 175), and over conductor MONB–1235 to the wiper arm of the sort switch 20501. Depending upon where this switch is set according to the type of call sorting desired, the battery on conductor MONB–1235 will be extended over a contact of switch 20501 to one of the conductors SBTH to SBOUT in cable 205–207 (to Fig. 207) and to one of the sort class translator relays NS–20700 (no sort), SBO–20701 (sort by office), SOPO–20702 (sort out principal office), SBU–20703 (sort by units), SBTH–20800 (sort by thousands), SBUT–20803 (sort by message unit type), SOLU–20802 (sort out local message units) and SBOUT–20801 (sort by office and message unit type). Relay NS–20700 will operate from the sort switch 20501 alone if no sorting is to be done. The other relays, however, must be operated from another source as well. Off-normal ground is applied from conductor MON–1213 in Fig. 206, over the wiper of arc 6 of the marker group units set-up switch 19101, out over one of tens leads U0C to U9C, cables 20609, 206–192, 192–193, 193–102, 10214, and 10215, over a contact of one of the operated marker group tens translator relays MT0–10200 to MT9–10209, to one of a hundred C punchings. Thence, the C punching is cross-connected to one of ten conductors 1TSO to 5TSO and 1TMO to 5TMO depending upon how many message unit types (one—1T to five—5T) and how many offices (single office—SO or more than one office—MO) are involved in this particular marker group. One of these ten leads 1TSO to 5TMO is thus grounded and extends over cables 10219, 193–102, 19309, 192–193

and 19208 to the right or left winding of one of the relays 1T–19300, 2T–19200, 3T–19201, 4T–19202 and 5T–19203.

The lead 1TSO extends through the right winding of relay 1T–19300, over conductor 19310 to the left winding of relay SO–19204 (single office), over conductor 19209, to the left windings of relays SBU–20703 and SBTH–20800. Thus, for a marker group involving a single office and one type of message unit, relays 1T–19300 and SO–19204 will have been operated in series with either relay SBU–20703 or relay SBTH–20800.

The lead 1TMO extends through the left winding of relay 1T–19300, over conductor 19311, left winding of relay MO–19205, conductor 19212, and to the left windings of relays SBO–20701 and SOPO–20702. Thus, for a marker group involving one message unit type and a multiplicity of offices, relays 1T–19300 and MO–19205 will have been operated in series with either relay SBO–20701 or relay SOPO–20702.

The lead 2TSO, 3TSO, 4TSO or 5TSO extends through the right winding of the respective relay 2T–19200, 3T–19201, 4T–19202 or 5T–19203, conductor 19210, right winding of relay 25T–19301 (indicating, when operated, a plurality of message unit types), conductor 19312, right winding of relay SO–19204, conductor 19211, in parallel to the right windings of relays SBU–20703 and SBTH–20800 and to the left windings of relays SBUT–20803 and SOLU–20802. Thus, a marker group involving 2, 3, 4 or 5 message unit types and a single office will have operated one of the relays 2T–19200 to 5T–19203 in series with relays 25T–19301 and SO–19204 in series with one of the relays SBU–20703, SBTH–20800, SBUT–20803 and SOLU–20802.

The lead 2TMO, 3TMO, 4TMO or 5TMO extends through the left winding of the respective relay 2T–19200 to 5T–19203, conductor 19213 (in the case of relay 5T–19203 the left winding extends first over conductor 19214 and over contact 6 of relay NS–20700 to conductor 19213), left winding of relay 25T–19301, conductor 19313, right winding of relay MO–19205, conductor 19215, in parallel to the right windings of relays SBO–20701, SOPO–20702, SBUT–20803 and SOLU–20802 and to the winding of relay SBOUT–20801. Thus, if a marker group being processed involves more than one office and more than one type of message unit, one of the relays 2T–19200 to 5T–19203 will have been operated in series with relays 25T–19301 and MO–19205 in series with one of the relays SBO–20701, SOPO–20702, SBUT–20803 and SOLU–20802.

The significance of the above digression is, as explained in Sections 2.42 and 3.101, that the E and F digits of the perforated output entry 2891EF indicate the output tape index whose tens digit (E) is a function of the tape type (1 for MU tapes and 5, as in this case, for the DET tape) and whose units digit (F) is a function of the type of sort specified (0, 1, 2, 3, 8 or 9).

In the event that the no-sort relay NS–20700 is operated, all windings of relays SBO–20701, SOPO–20702, SBU–20703, SBTH–20800, SBUT–20803, SOLU–20802 and SBOUT–20801 are short-circuited to battery over one or more of contacts 8, 9, 10, 11 and 12 of relay NS–20700. They, therefore, cannot operate. These same short-circuiting battery sources, however, permit relay MO–19205 or SO–19204 to operate in series with relays 5T–19203 to 2T–19200 and 1T–19300 and 25T–19301 except under the condition where the left winding of relay 5T–19203 is energized, this circuit being opened at contact 6 of relay NS–20700. The latter condition however cannot occur because the relay NS–20700 will not be operated when the marker group involves as many as 5 types of message units in a plurality of offices.

Returning now to the generation of the units digit (F) of the 2891EF entry, the grounds on the reader perforate conductors PE0 and PE1 of Fig. 193 extend over contacts

1 and 2 of relay DET–19304 and conductors 19320 and 19321 to respective armatures 8 and 9 of relay MO–19205 and SO–19204. One or the other of these relays will always be operated. Therefore, conductors 19320 and 19321 extend over contacts 8 and 9 of relay SO–19204 to conductors F1–19315 and F0–19314 or over contacts 8 and 9 of relay MO–19205 to conductors F4–19317 and F7–19318. That is, two of the five leads F0–19314, F1–19315, F2–19316, F4–19317 and F7–19318 are grounded on a two-out-of-five basis to indicate the F digit of 1 (SO–19204) or 0 (MO–19205). These two-out-of-five conductors extend over cables 19319, 72–193 (to Fig. 72), 7213 and 72–71A, two-out-of-five conductors (F0–19314 and F1–19315 or F4–19317 and F7–19318), contacts 10 and 9 or 7 and 6 of relay 2891–7101 to conductors F0 and F1 or F4 and F7 over cables 72–104, etc. to operate perforator magnets 1F0 and 1F1 or 1F4 and 1F7 of Fig. 194. Thus the 2891EF entry is perforated as 289151 or 289150 depending upon whether relay SO–19204 or relay MO–19205 is operated.

During the reader closure cycle, ground is applied from cam J1 (Fig. 8), over conductor JM1–815, cables 9–15, 15–50, 50–69 and 69–70, conductor JM1–815, contact 1 of relay 289–7110, conductor PM–5919, cable 59–71, conductor PM–5919, through relay PM–5901 and through the perforator advance check relay PK1–19401 and perforator advance magnet 1PAM (Fig. 194) as before, except that the JM1–815 ground through relay 289–7110 grounds conductor PM–5919 of Fig. 59 to operate the perforator advance check relay PK1–19401 and the advance magnet 1PAM (Fig. 194) instead of this conductor being grounded by the JM2–811 ground over the operated splice patern timer relay SSTM–5914.

The other relays of the perforator control circuit of Fig. 59, namely, relays PS–5900, OP–5907 and CK–5906 operate as before, except that relay CK–5906 is operated under the control of relay 289–7110 instead of relay ESTM–5915, as will be described presently.

The closure of cam K6 (Fig. 8) at the beginning of the make reader cycle operates the CK–5906 relay in the perforate control circuit of Fig. 59. Cam K6 (Fig. 8) extends ground over conductor KM6–816, cables 9–15, 15–50, 50–69 and 69–70, conductor KM6–816, contact 2 of relay 289–7110, conductor CKP–5924, cable 59–71, conductor CKP–5924, to relay CK–5906. Relay OP–5907 stays operated through the lock ground on conductor HM1–5916, thus holding the pattern relays 289–7110 and 2891–7101 operated through its contact 1. The operation of relay CK–5906 operates the PL8–6408 relay, thus preparing for the operation of relay PLA8–6428 when the perforation of this line of tape has been successfully completed. Relay PS–5900 operates when the indications are that this line is successfully being perforated, as before. The conduit for operating relay PL8–6408 extends from the grounded conductor HM6–813 (Fig. 59), contact 3 of relay CK–5906, conductor PL–5925, cable 64–59A, conductor PL–5925, contacts 8 of relays PLA1–6421 to PLA8–6428, contact 7 of relay PLA9 operated (not shown), to relay PL8–6408.

Ground on conductor HB4–814 (Fig. 59) from the reader through relay PS–5900 operates the PLA8–6428 relay of the perforate line count circuit (Fig. 64) to advance the count to operate the next pattern relay for perforating the next line of the tape identity group. This circuit extends from ground on conductor HB4–814, over contact 4 of relay PS–5900, conductor PLA–5926, cable 64–59A, conductor PLA–5926, contacts 2 of relays PL1–6401 to PL7–6407, contact 1 of relay PL8–6408, to relay PLA8–6428, which locks over its contact 4 and contacts 6 of relays PLA7–6427 to PLA1–6421, to ground on conductor PLK–6413, as before. Relay PL8–6408 also locks to this conductor over its contact 3. This releases relay PLA9 (not shown) and leaves relays PL10–6410, PL9 (not shown), PL8–6408 and PLA8–6428 operated. Also the common pattern connectors 289–7110 and 2891–7101 are released.

This process continues until all of the 9 lines of the tape identity group 2891EF to 2899EF have been perforated on the detail tape of perforator No. 1 in Fig. 194 as follows:

(1) With relay PLA8–6428 operated, conductor 2892–6517 of Fig. 71 is grounded, thereby operating relays 2892–7102 and 289–7110. The A, B and C digits 289 are perforated as before under the control of the relay 289–7110. The last three digits of the 2892EF are perforated in a different way, the D digit of 2 being under the control of relay 2892–7102 and the E and F digits being derived under the control of relay 2892–7102 from the marker group tens and units set-up switches 20600 and 19101. The grounds on reader perforate leads PD0 and PD1 in Fig. 71 extend over contacts 2 and 1 of relay 2892–7102, to conductors D0 and D2, through cables 72–104, etc. to perforate a D digit of 2 by operating the 1D0 and 1D2 perforator magnets of Fig. 194. The two leads PE0 and PE1 extend over contacts 4 and 3 of relay 2892–7102 to conductors MGTB and MGTA. The two leads PF0 and PF1 extend over contacts 5 and 6 of relay 2892–7102 to conductors MGUB and MGUA. These four conductors extend over cables 7100, 71–72, 7214, 7215, 7216, 72–190 (to Fig. 190), 19008, 190–191, 19109, 19110 and 19111, over conductors MGTA and MGTB to the wipers of arcs 1 and 2 of the marker group tens switch 20600, the conductors MGUA and MGUB continuing from cables 19111 and 19112 to the wipers of arcs 1 and 2 of the marker group units switch 19101. The grounds on the wiper of arcs 1 and 2 of the tens switch 20600 extend to two of the conductors E0 to E7 (marker tens digit on a two-out-of-five basis) into cables E20610, E17909 and 191–179. The grounds on the wipers of arcs 1 and 2 of the units switch 19101 extend to two of the conductors F0 to F7 (marker units digit on a two-out-of-five basis) into cables F17912 and 191–179. These conductors emerge from cable 191–179 in Fig. 179 and extend over the cables E17909 and F17912 to the E and F digit perforate magnet circuits.

(2) With relay PLA7–6427 operated, conductor 2893–6518 of Fig. 71 is grounded, thereby operating relays 2893–7103 and 289–7110. The A, B and C digits of 289 are perforated as before under the control of relay 289–7110. The D digit of 3 in the 2893EF code is perforated under the control of relay 2893–7103. The E and F digits are perforated under the joint control of relay 2893–7103 and the first recorder tens switch 19102 (E digit) and the first recorder units switch 19103 (F digit). The two grounded reader perforate leads PD0 and PD1 in Fig. 71 extend over contacts 2 and 1 of relay 2893–7103 to conductors D1 and D2 and through cables 72–104, etc. to perforate a D digit of 2 by operating perforator magnets 1D1 and 1D2 of Fig. 194. The two leads PE0 and PE1 extend over contacts 4 and 3 of relay 2893–7103 to conductors FRTB and FRTA. The leads PF0 and PF1 extend over contacts 5 and 6 of relay 2893–7103 to conductors FRUB and FRUA. These four conductors extend over cables 71–72, 7214, 7215, 7216, 72–190 (to Fig. 190), 19008, 190–191 and 19109. The leads FRTA and FRTB come out of cable 19109 to the wipers 19113 and 19114 of the first recorder tens switch 19102 and ground either leads E4 and E7 (tens digit 0) or leads E0 and E1 (tens digit 1), because recorders are numbered from 0 to 19, into cables E17909 and 191–179. The leads FRUA and FRUB continue through cables 19110 and 19111 and terminate at the wipers of arcs 1 and 2 of the first recorder units switch 19103 where they ground two of the five leads F0 to F7 into cables F17912 and 191–179. These E and F digit values are carried over cable 191–179 and cables E17909 and F17912 in Fig. 179 to cause perforation of the E and F digits of the 2893EF entry.

(3) With relay PLA6 (not shown—Fig. 64) operated, conductor **2894–6519** in Fig. 72 is grounded, thereby operating relays **2894–7200** and **289–7110**. Relay **289–7110**, as before, causes the perforation of the A, B and C digits as 289. The D digit of 4 is perforated under the control of relay **2894–7200**. The E and F digits of the 2894EF entry are the last recorder tens and units digits and are perforated under the joint control of relay **2894–7200** and the last recorder tens and units set-up switches **19104** and **19105**. Ground on the reader perforate conductors PD0 and PD1 of Fig. 72 extends over contacts **2** and **1** of relay **2894–7200** to conductors D0 to D4 and over cables **72–104**, etc. to cause the perforation of the D digit of 4 by operating magnets 1D0 and 1D4 of Fig. 194. The leads PE0, PE1, PF0 and PF1 extend over contacts **4**, **3**, **5** and **6** of relay **2894–7200** to conductors LRTB, LRTA, LRUA and LRUB, cables **7217**, **7214**, **7215**, **7216**, **72–190** (to Fig. 190), **19008**, **190–191**, **19109** and **19110**. The leads LRTA and LRTB come out of cable **19110** to the wipers **19115** and **19116** of the last recorder tens switch **19104** and ground either leads E4 and E7 or E0 and E1 into cables E17909 and **191–179**. The leads LRUA and LRUB continue over cables **19111** and **19112** to the wipers of arcs **1** and **2** of the last recorder units switch **19105** and ground two of the leads F0 to F7 into cables F17912 and **191–179**. Cables E17909 and F17912 come out of cable **191–179** in Fig. 179 and cause the perforation of the appropriate E and F digits of the 2894EF entry.

(4) With the relay PLA5 (not shown—Fig. 64) operated, conductor **2895–6520** in Fig. 72 is grounded, thereby operating relays **2895–7201** and **289–7110**. Relay **289–7110**, as before, causes the perforation of the A, B and C digits 289 of the 2895ED code. The D digit of 5 and the F digit of 0 are perforated under the control of relay **295–7201**. The E digit is the office index, a digit identifying the calling office within the marker group. This digit is perforated under the joint control of relay **2895–7201**, relay SBO–**20701** (sort-by office relay in the sort class translator) and relay P1D–**10101** (perforator register walking circuit relay for the detail perforator No. **1** of Fig. 194). In any case, this E digit for the detail tape will be a zero. The grounded reader perforate leads PD0 and PD1 in Fig. 72 extend over contacts **2** and **1** of relay **2895–7201** to leads D1 and D4 over cables **72–104**, etc. to cause the perforation of the D digit 5 by operating perforating magnets **1D1** and **1D4** of Fig. 194. The leads PF0 and PF1 extend over contacts **7** and **8** of relay **2895–7201** to conductors F7 and F4 and over cables **72–104**, etc. to cause the perforation of the F digit zero. The leads PE0 and PE1 extend over contacts **6** and **5** of relay **2895–7201** to conductors A and B into cables **7219**, **7213**, **72–193** (to Fig. 193) and **193–207**, conductors A and B to armatures associated with contacts **1—2** and **3—4** of relay SBO–**20701**. If relay SBO–**20701** is released (not sorting by calling offices), leads A and B extend over contacts **2** and **4** of relay SBO–**20701**, conductors C and D, cables **193–207**, **72–193** (to Fig. 72), **7213** and **7219**, conductors C and D, contacts **3** and **4** of relay **2895–7201**, to conductors E7 and E4 and over cables **72–104**, etc. to cause the perforation of the E digit zero. If relay SBO–**20701** is operated (sorting by calling offices), conductors A and B extend over contacts **1** and **3** of relay SBO–**20701** to conductors E and F into cables **207–192**, **192–193A**, **102–193** and **10130**, conductors E and F, contacts **7** and **8** of relay P1D–**10101** to conductors E4 and E7 and over cable E17903 to the check relays of Fig. 179 to cause perforation of the E digit zero.

(5) With the relay PLA4 (not shown—Fig. 64) operated, conductor **2896–6521** in Fig. 72 is grounded, thereby operating relays **2896–7202** and **289–7110**. This will cause the perforation of the fixed pattern 289690, which is inserted merely to keep proper increasing progress of the

D digit. Relay **289–7110**, as usual, causes the perforation of the A, B and C digits as 289. Relay **2896–7202** causes the perforation of the D, E and F digits as 690. Grounded reader perforate conductors PD0 and PD1 extend over contacts **2** and **1** of relay **2896–7202** to conductors D2 and D4 and over cables **72–104**, etc. to cause perforation of the D digit 6 by operating the 1D2 and 1D4 perforator magnets of Fig. 194. Leads PE2 and PE7 extend over contacts **3** and **4** of relay **2896–7202** to leads E2 and E7 and over cables **72–104**, etc. to cause perforation of the E digit of 9. Leads PF0 and PF1 extend over contacts **5** and **6** of relay **2896–7202** to leads F7 and F4 and over cables **72–104**, etc. to cause perforation of the F digit of zero by operating the 1F7 and 1F4 perforator magnets of Fig. 194.

(6) With relay PLA3 (not shown—Fig. 64) operated, conductor **2897–6522** in Fig. 72 is grounded, thereby operating relays **2897–7203** and **289–7110**. This will cause the perforation of the 2897EF entry, where the E and F digits respectively represent the first and last days of round as indicated by the respective first day of round and last day of round set-up switches **19003** and **19100** under the control of relay **2897–7203**. As usual, relay **289–7110** causes the perforation of the A, B and C digits of 289 and relay **2897–7203** causes the perforation of the D digit of 7. The grounded reader perforate conductors PD0 and PD1 extend over contacts **2** and **1** of relay **2897–7203** to conductors D0 and D7 and over cables **72–104**, etc. to cause perforation of the D digit of 7 by operating perforator magnets **1D0** and **1D7** of Fig. 194. Leads PE2 and PE7 extend over contacts **4** and **3** of relay **2897–7203** to conductors FDRB and FDRA into cables **7220**, **7215**, **7216** and **72–190**. Leads PF0 and PF1 extend over contacts **5** and **6** of relay **2897–7203** to conductors LDRB and LDRA into cables **7220**, **7215**, **7216** and **72–190**. These four conductors extend over cables **72–190** (to Fig. 190) and **19008** where conductors FDRA and FDRB come out and terminate on the wipers of arcs **1** and **2** of the first day of round switch **19003**, and thence ground two of the four leads E0 to E4 (this digit cannot exceed 6), which extend through Figs. 190 and 191 into cables E17909 and **191–179**. Conductors LDRA and LDRB continue from cable **19008** into cable **190–191** to the wipers of arcs **1** and **2** of the last day of round switch **19100**, and thence ground two of the four leads F0 to F4 (this digit cannot exceed 6), which extend into cables F17912 and **191–179**. These four conductors then extend over cables **191–179**, etc. to cause the perforation of the E and F digits of the 2897EF entry according to the first and last day of round switches **19003** and **19100**.

(7) With relay PLA2–**6422** operated, conductor **2898–6523** in Fig. 72 is grounded, thereby operating relays **2898–7204** and **289–7110**. This will cause the perforation of the 2898EF entry where the E digit represents the Tape Section (see Section 2.42) and the F digit is the last round digit as determined by the set-up switch **19000**. As usual, relay **289–7110** causes the perforation of the A, B and C digits of 289. Relay **2898–7204** causes the perforation of the D digit of 8 when the grounded reader perforate leads PD0 and PD1 extend over contacts **2** and **1** of relay **2898–7204** to conductors D1 and D7 over cables **72–104**, etc. to operate perforator magnets **1D1** and 1D7 of Fig. 194. Leads PE0 and PE1 extend over contacts **4** and **3** of relay **2898–7204**, conductors A and B, cables **7219**, **7213**, **72–193** (to Fig. 193), and **193–207**, conductors A and B to armatures of relay SBO–**20701**. If relay SBO–**20701** is released (not sorting by office), leads A and B extend over contacts **2** and **4** of relay SBO–**20701**, conductors C and D, cables **193–207**, **72–193** (to Fig. 72), **7213** and **7219**, conductors C and D, contacts **5** and **6** of relay **2898–7204**, conductors E and F, cable **72–193** (to Fig. 193) and **19308**, conductors E and F, cables **207–192**, **192–193A**, **102–193** and **10130**,

conductors E and F, contacts 7 and 8 of relay P1D–10101, to conductors E4 and E7 into cable E17903, to perforate the E digit of zero. If relay SBO–20701 is operated, the conductors A and B extend over contacts 1 and 3 of relay SBO–20701 directly to the E and F leads into cables 207–192, etc. to produce the same result. Leads PF0 and PF1 extend over contacts 7 and 8 of relay 2898–7204, conductors RA and RB, cables 7216 and 72–190 (to Fig. 190), conductors RA and RB, to the wipers of arcs 1 and 2 of the last round set-up switch 19000, thence grounding two of the five conductors F0 to F7 (the last round could be anything from 0 to 9 or 0 to 5 representing first to tenth rounds for a ten-round month or first to sixth rounds for a six-round month), into Fig. 191 and over cables F17912 and 191–179, etc. to cause the perforation of the F digit in Fig. 194.

(8) With relay PLA1–6421 operated, conductor 2899–6524 in Fig. 72 is grounded, thereby operating relays 2899–7205 and 289–7110. This causes the perforation of the 2899EF entry where the E and F digits represent the tens and units digits of the month as determined by the setting of the month tens and month units set-up switches 19001 and 19002. As usual, relay 289–7110 causes the perforation of the A, B and C digits of 289. Relay 2899–7205 causes the perforation of the D digit of 9 by extending the grounded reader perforate leads PD0 and PD1 over its contacts 2 and 1 to conductors D2 and D7, over cables 72–104, etc., to operate perforator magnets 1D2 and 1D7 in Fig. 194. Leads PE0 and PE1 extend over contacts 4 and 3 of relay 2899–7205, conductors MTA and MTB into cables 7221 and 72–190 (to Fig. 190). Leads PF0 and PF1 extend over contacts 5 and 6 of relay 2899–7205, conductors MUB and MUA into cables 7221 and 72–190 (to Fig. 190). Conductors MTA and MTB come out of cable 72–190 in Fig. 190 and terminate on the wipers 19009 and 19010 of arc 1 of the tens switch 19001, where conductors E0 and E1 or E4 and E7 (month tens can be only a 0 or a 1) across Fig. 191 into cable E17909. Conductors MUA and MUB extend over cables 72–190 and 19008 and terminate on the wipers of arcs 2 and 3 of the units switch 19002, where two of the five conductors F0 to F7 (month units can be anything from 0 to 9) across Fig. 191 into cable F17912. Cables E17909 and F17912 extend over cables 191–179, etc. to perforate the E and F digits by operating the appropriate perforator magnets in Fig. 194.

During the perforating of the 2899EF line relay PPRL–5904 operates. This circuit extends from ground on the lead HM6–813 (Fig. 59) during the reader closure cycle, over contact 3 of relay CK–5906, conductor PL–5925, cable 64–59A, conductor PL–5925, contact 7 of relay PLA1–6421, conductor PRL–6420, cable 64–59A, conductor PRL–6420, to relay PPRL–5904, which locks to ground on conductor PLK–6413 over its contact 2. At the end of perforating the last line relay PRL–5905 operates through relay PS–5900. This circuit extends from ground on the lead HB4–814 (Fig. 59) during the reader open cycle, over contact 4 of relay PS–5900 and contact 1 of relay PPRL–5904, to relay PRL–5905, which locks over its contact 1 to ground on lead PLK–6413. Relay PRL–5905, in operating, grounds the RLS–5927 lead through the common output connector COC–6400 to operate the PWS–10304 relay over relays CG–7312 and P11D–10111 normal and relay PW–10303 operated. This circuit extends from ground, over contact 2 of relay PRL–5905, conductor RLS–5927, cables 64–59A and 6409, conductor RLS–5927, contact 23 of connector COC–6400, conductor RLS–6423, cable 64–73, conductor RLS–6423, contact 1 of relay CG–7312, conductor RLS–7321, cable 73–128 (to Fig. 128), conductor RLS–7321, contact 2 of relay P11D–10111, conductor RLS–10133, cables 10131, 103–101A and 10313, conductor RLS–10133, contact 2 of relay PW–10303, to operate relay PWS–10304, which locks over its contact 3, contact of relay PD2U–10305, conductor ON–1119, cables 10315, 25–103 (to Fig. 25) and 11–25A, conductor ON–1119, to ground over contact 7 of relay ST4–1103.

At this point in the description it is considered advisable to indicate that one of the perforator assignment pattern connector relays A1P–10201 to A9P–10210 and AAP–10211 of Fig. 102 will have been operated under the control of the marker group tens and units set-up switches 20600 and 19101 and the sort class translator relays of Figs. 192, 193, 207 and 208 and the perforator assignment translator relays 2AP–10212 and APCO–10213 and the marker group selecting relays MT0–10200 to MT9–10209. The details of the how and the why and the when of the operation of one of these assignment relays A1P–10201 to AAP–10211 will be dealt with shortly. It is significant at this point to note only that at least one of them is operated (which one, is not important at the moment).

Relay PWS–10304, in operating, operates the P2D–10102 relay in series with its associated perforator connector relay PA2–17902 through make contacts on the P1D–10101 relay and one of the assignment relays A1P–10201 to AAP–10211. This circuit extends from ground, over contacts 1 and 2 of relay PWS–10304, conductor PWS–10316, cables 10317, 103–101A and 10131, conductor PWS–10316, contact 2 of relay P1D–10101, conductor P2W into cable 101–102, conductor P2W, contact 1 of any one of the relays A1P–10201 to AAP–10211, conductor 0 into cable 10221, conductor 0 to relay P2D–10102, thence over conductor P2A, into cable 101–179, conductor P2A, through perforator connector PA2–17902 to resistance battery. Connector relay PA2–17902 and relay P2D–10102 lock over contact 11 of relay P2D–10102, contact 12 of relay P3D–10103, to ground on the conductor L–10118. Relay P1D–10101 and connector PA1–17901 remain operated over contact 9 of relay P1D–10101, contact 13 of relay P2D–10102, conductor PWH–10134, cables 10115, 103–101A and 10317, conductor PWH–10134, to ground over contact 1 of relay PWS–10304.

The operation of relay PWS–10304 releases the COC–6400 common output connector relay which, in turn, releases relay PON–5902 to release all of the output perforator line count circuit of Fig. 64 and associated relays used in perforating the tape identity group on the detail tape of perforator No. 1 of Fig. 194.

When two perforator register relays of Fig. 101 (such as relays P1D–10101 and P2D–10102) are detected as having been operated in succession, relay PD2U–10305 operates, releasing the PWS–10304 relay. Relay PD2U–10305 is operated in a circuit extending from ground on the off-normal conductor MON–1218 in Fig. 101, over contact 1 of relay P0D–10100, contact 5 of relay P1D–10101, contact 8 of relay P2D–10102, conductor PD2U–10135, cables 10131, 103–101A and 10317, conductor PD2U–10135, to relay PD2U–10305. This opens the locking circuit for relay PWS–10304, the operating circuit for which was opened when connector COC–6400 released.

Relay PWS–10304 in releasing, releases the P1D–10101 relay and its associated perforator connector PA1–17901. Withe relay PWS–10304 released, the common output connector relay COC–6400 may again operate as previously described as soon as or provided that the CODC–10301 relay operates or has operated to indicate that the output circuit is normal.

The operation of the common output connector COC–6400 enables the start of another 10 line leading tape identity group entry to be perforated on the first message unit tape by the No. 2 perforator in Fig. 194 (actually the "0" message unit perforator—No. 11, being the "9" perforator).

The steps previously described for perforating tape identity entries on the detail tape (No. 1 perforator Fig. 194) are repeated for this first message unit tape (No. 2 perforator, Fig. 194) and eventually relay PWS–10304

again operates to step the perforator register of Fig. 101 to the next message unit tape.

A few of the details of perforation differ as the perforator register advances to cause tape identity to be placed on successive tapes. Whereas, with relay P1D–10101 operated for causing the detail tape to be perforated, ground over contact 5 of relay P1D1–10302 was extended over conductor SC–10314, cables 10313, 103–101A and 10131, conductor SC–10314, and contact 3 of relay P1D–10101 and conductor DET–10119 to operate the detail tape relay DET–19304; this conductor SC–10314 is extended over contact 3 of relay P2D–10102 or P4D–10104 or P6D–10106 or P8D–10108 or contact 4 of relay P10D–10110, to conductor BLKE–10137 (even numbered message unit tapes—remembering that perforators 2, 4, 6, 8 and 10 correspond to message unit tapes 0, 2, 4, 6 and 8) or this conductor SC–10314 is extended over contact 3 of relay P3D–10103 or P5D–10105 or P7D–10107 or P9D–10109 or P11D–10111, to conductor BLKO–10136 (odd numbered message unit tape—remembering that perforators 3, 5, 7, 9 and 11 corresponds to message unit tapes 1, 3, 5, 7 and 9). These conductors BLKE–10137 and BLKO–10136 extend over cables 10130, 102–193 and 19305 to respective relays BLKE–19303 and BLKO–19302. Thus, relays BLKE–19303 and BLKO–19302 operate on alternate steps of the perforate register circuit of Fig. 101.

Of the previously described tape identity codes 2891EF (tape index), 2892EF (marker group), 2893EF (first recorder), 2894EF (last recorder), 2895E0 (office index), 289690, 2897EF (first and last day of round), 2898EF (tape section and round) and 2899EF (month), the only ones which will be controlled differently are the following codes with a description of their differences:

1. *2891EF (tape index)*

The tens digit (E) is a 1 for all message unit tapes (MU tapes). With relays 2891–7101 and 289–7110 operated, the grounded reader perforate conductors PF0 and PF1 in Fig. 193 extend over contacts 9 and 10 of relay BLKE–19303 or relay BLKO–19302, conductors E0–19322 and E1–19307, cables 19308, 72–193 (to Fig. 72), 7213, 72–71A, conductors E0–19322 and E1–19307, contacts 5 and 4 of relay 2891–7101, to conductors E0 and E1, over cables 72–104, etc., to cause the perforation of the E digit of 1 by operating the 2E1 to 11E1 and 2E0 to 11E0 perforator magnets of Fig. 194.

The units digit (F) depends upon the setting of the sort class translator of Figs. 192, 193, 207 and 208 (see Section 2.42 re possible units digit of 0, 1, 2, 3, 8 or 9 depending upon the sort procedure). In order to shorten the description at this point, it is to be remembered that the five conductors F0–19314 to F7–19318 of Figs. 192 and 193 into cables 19319 and 72–193, extend to Fig. 72 and over cables 7213 and 72–71A and over conductors F0–19314 to F7–19318, contacts 10 to 6 of relay 2891–7101, to conductors F0 to F7 to cause the perforation of the appropriate digit on a two-out-of-five basis.

The PE0 and PE1 leads in Fig. 193 extend over contacts 7 and 8 of relay BLKE–19303 or relay BLKO–19302 to conductors 19323 and 19324 into Figs. 208 and 207. According to the tables in Sections 2.36, 2.42 and 3.101 the various sort conditions will effect the following results on the message unit tapes 0 to 9 (tapes 2 to 11) within the limitations set forth in Section 3.101.

Situation	Sort Class	Single or Multi-office	One or More MU Types	Tape Index Units	No. of Output Tapes	Comments
1	SBTH	SO	1T	2	10	Thousands sorted—tapes 2 to 11.
2	SBU	SO	1T	3	10	Units sorted—tapes 2 to 11.
3	NS	SO	1T	1	1	Office sorted—tape 2.
4	SBTH	SO	25T	2	10	Thousands sorted—tapes 2 to 11.
5	SBU	SO	25T	3	10	Units sorted—tapes 2 to 11.
6	NS	SO	25T	9	1	Unsorted by MU type—tape 2.
7	SBUT	SO	25T	1	2 to 5	One tape for each MU type—offiec sorted—tapes 2 and 3 to 6.
8	SOLU	SO	25T	1	1	Office sorted—tape 2.
				9	1	Unsorted by MU type—tape 3.
9	SBO	MO	1T	1	2 to 10	One tape per office—office sorted—tapes 2 and 3 to 11.
10	SOPO	MO	1T	1	1	Office sorted—tape 2.
				0	1	MU sorted for many offices—tape 3
11	NS	MO	1T	0	1	MU sorted for many offices—tape 2.
12	SBO	MO	25T	9	2 to 10	One tape per office—unsorted by MU type—tapes 2 to 11.
13	SOPO	MO	25T	9	1	Unsorted by MU type—tape 2.
				8	1	Unsorted for many offices and many MU types—tape 3.
14	NS	MO	25T	8	1	Unsorted for many offices and many MU types—tape 2.
15	SBUT	MO	25T	0	2 to 5	One tape for each MU type—MU type sorted for many offices—tapes 2 and 3 to 6.
16	SOLU	MO	25T	1	2 to 5	One tape per office—office sorted—tapes 2, 4, 6, 8, 10.
				9	2 to 5	One tape per office—unsorted by MU type—tapes 3, 5, 7, 9, 11.
17	SBOUT	MO	25T	1	4 to 10	One tape per MU type per office—office sorted—tapes 2 and 3 and 4 and 5 to 11.

It is to be remembered that whenever a single tape is prepared it will be tape 2 under the control of the even relay BLKE–19303 and whenever more than one tape is prepared they will alternately be controlled by the even relay BLKE–19303 for tapes 2, 4, 6, 8 and 10 and by the odd relay BLKO–19302 for the tapes 3, 5, 7, 9 and 11.

For situation 17 in the above table the units digit (F) of the 2891EF entry is always a 1. This is produced by conductors 19323 and 19324 being extended over contacts 1 and 2 of the relay SBOUT–20801 to conductors F1–19315 and F0–19314.

For situations 16 and 8, the F digit is a 1 for even tapes and a 9 for odd tapes. This is effected by conductors 19323 and 19324 being extended over contacts 1 and 2 of relay SOLU–20802, conductors 20804 and 20805, contacts 3 and 4 of relay BLKE–19303 or relay BLKO–19302, to conductors F0–19314 and F1–19315 for even tapes or to conductors F2–19316 and F7–19318 for odd tapes.

For situations 15 and 7, the F digit is 0 for the multi-office condition and 1 for the single office condition. Conductors 19323 and 19324 extend over contacts 1 and 2 of relay SBUT–20803, conductors 20806 and 20807, contacts 10 and 11 of relay MO–19205 or relay SO–19204, to conductors F4–19317 and F7–19318 for the

multi-office condition or to conductors F0–19314 and F1–19315 for the single office condition.

For situations 14 and 11, the F digit is 8 for the many-type MU condition and 0 for the single MU type. Conductors 19323 and 19324 extend over contacts 2 and 3 of relay NS–20700, conductors 20705 and 20706, contacts 1 and 2 of relay MO–19205, conductors 19216 and 19217, contacts 1 and 2 of relay 25T–19301 or relay IT–19300, to conductors F4–19317 and F7–19318 for the single MU type or to conductors F1–19315 and F7–19318 for the many-type MU condition.

For situations 6 and 3, the F digit is 9 for the many-type MU condition and is 1 for the single MU condition. Conductors 19323 and 19324 extend over contacts 2 and 3 of relays NS–20700, conductors 20705 and 20706, contacts 1 and 2 of relay SO–19204, conductors 19218 and 19219, contacts 4 and 7 of relay 25T–19301 or relay 1T–19300, to conductors F2–19316 and F7–19318 for the many-type MU or to conductors F0–19314 and F1–19315 for the single MU.

For situations 12 and 9, the F digit is 9 for the many-type MU condition and is 1 for the single MU condition. Conductors 19323 and 19324 extend over contacts 5 and 6 of relay SB0–20701, conductors 19218 and 19219 and contacts 4 and 7 of relay 25T–19301 to conductors F2–19316 and F7–19318 or contacts 4 and 7 of relay 1T–19300 to conductors F0–19314 and F1–19315.

For situations 5 and 2 the F digit is 3. Conductors 19323 and 19324 extend over contacts 1 and 2 of relay SBU–20703 to conductors F2–19316 and F1–19315.

For situations 4 and 1, the F digit is 2. Conductors 19323 and 19324 extend over contacts 1 and 2 of relay SBTH–20800 to conductors F0–19314 and F2–19316.

For situation 13, the F digit is 9 for the tape 2 controlled by relay BLKE–19303 and is 8 for the tape 3 controlled by relay BLKO–19302. Conductors 19323 and 19324 extend over contacts 1 and 2 of relay SOPO–20702, conductors 20707 and 20708, contacts 10 and 11 of relay 25T–19301 and over contacts 2 and 1 of relay BLKE–19303 to conductors F7–19318 and F2–19316 or over contacts 2 and 1 of relay BLKO–19302 to conductors F7–19318 and F1–19315.

For situation 10, the F digit is 1 for tape 2 controlled by relay BLKE–19303 and is 0 for tape 3 controlled by relay BLKO–19302. Conductors 20707 and 20708 from relay SOPO–20702 extend over contacts 10 and 11 of relay 1T–19300 and over contacts 6 and 5 of relay BLKE–19303 to conductors F1–19315 and F0–19314 or over contacts 6 and 5 of relay BLKO–19302 to conductors F7–19318 and F4–19317.

2. *2895E0 (office index)*

The office index (E digit), as previously described, is 0 for situations where relay SBO–20701 is released (not sorting by calling office).

Also, as previously described, when relay SBO–20701 is operated the office index depends upon which relay of the group in Fig. 101 is operated. That is, with relays 2895–7201 and 289–7110 operated, the grounded reader perforate conductors PE0 and PE1 of Fig. 72 are extended over contacts 6 and 5 of relay 2895–7201, conductors A and B into cables 7219, 7213, 72–193 (to Fig. 193), 193–207, conductors A and B, contacts 1 and 3 of relay SBO–20701, conductors E and F into cables 207–192, 192–193A, 102–193, 10130, conductors E and F and over contacts 9 and 10 of one of the relays P2D–10102 to P9D–10109 or contacts 10 and 11 of relay P10D–10110 or over contacts 9 and 10 of relay P11D–10111, to respective pairs of conductors E4 and E7 or E0 and E1 or E0 and E2 or E1 and E2 or E0 and E4 or E1 and E4 or E2 and E4 or E7 and E0 or E7 and E1 or E7 and E2 into cables E17903, etc. to the perforator magnets of Fig. 194 to perforate respective E digits of 0 to 9.

3. *2898EF (tape section and round)*

The E digit (tape section) is, as above described, 0 to 9 for the ten message unit tapes and is 0 for the straddle and detail tapes.

The number of message unit tapes to be prepared is determined essentially from the marker group tens and units set-up switches 20600 and 19101.

A cross-connection "B" from the marker group tens selecting relays (Fig. 102) to the perforator assignment connectors (Fig. 102) indicates the number of perforators to be prepared with the tape identity information. Thus, only the number of tapes on which entries are to be placed will have the leading splice pattern and tape identity groups perforated thereon. An explanation of the means whereby the perforator assignment patern connectors A1P–10201 to AAP–10211 of Fig. 102 are controlled to determine or fix the number of perforator tapes to be prepared with splice pattern and leading tape identity groups will be provided shortly after a description of how the perforation of leading tape identity is concluded on the message unit tapes.

The repeated operation of relay PWS–10304 operates succeeding perforator register relays P3D–10103 to P11D–10111 and perforator connector relays PA3 (not shown—Fig. 179) to PA11–17911 through contacts on the relays A2P–10202 to AAP–10211 of the perforator assignment pattern connector depending upon which one is operated. When the last assigned perforator register relay (Fig. 101) is operated, the operation of relay PWS–10304 grounds lead EPW–10222 (Fig. 102) through the perforator assignment pattern connector (Fig. 102) to operate relay EPW–2504 of the tape identity progress control circuit of Fig. 25, through relay PW–10303 operated. As previously described, when relay PWS–10304 operates to advance the perforation of tape identity to the next assigned tape, ground is applied over contacts 1 and 2 of relay PWS–10304 to conductor PWS–10316 and over cables 10317, 103–101A and 10131 to conductor PWS–10316 in Fig. 101. It will be recalled that after the detail tape (corresponding to perforator register relay P1D–10101 operated) had been prepared with the proper leading end-of-tape groups of codes, register relay P2D–10102 was operated by ground on conductor PWS–10316 being extended over contact 2 of relay P1D–10101 and conductor P2W over cable 101–102 to the upper armatures of all of the relays A1P–10201 to AAP–10211, over contact 1 of any one of them, conductor 0 into cable 10221 and over conductor 0 in Fig. 101 to relay P2D–10102, etc. This meant that at least the first message unit tape (tape 2) will be prepared under all circumstances. If, when the end-of-tape job is completed on the tape 2, perforator assignment connector A1P–10201 is operated, then the ground on conductor PWS–10316 in Fig. 101 will be extended over contact 1 of relay P1D–10101 and contact 2 of relay P2D–10102 to conductor P3W into cable 101–102, and over conductor P3W and contact 2 of relay A1P–10201 to ground conductor EPW–10222. If, however, any other assignment connector A2P–10202 to AAP–10211 is operated, then the ground on conductor P3W in Fig. 102 will be extended over contact 2 of that operated connector to conductor 1 into cable 10221 to operate relay P3D–10103 of Fig. 101, etc., thereby to cause tape 3 to be prepared. Likewise, at the end of such procedure, the ground on lead PWS–10316 will be extended over contacts 1 of relays P1D–10101 and P2D–10102 and contact 2 of relay PED–10103, conductor P4W, cable 101–102 to conductor P4W in Fig. 102 and to armatures 3 of all of the assignment connectors. If relay A2P–10202 were operated, the grounded conductor P4W would extend over contact 3 thereof to place ground on lead EPW–10222. Otherwise, register relay P4D–10104 would be operated, etc.

In other words, the grounding of the conductor

EPW–10222 in Fig. 102 under the control of the perforator assignment connectors A1P–10201 to AAP–10211 determines which tape will be the last one prepared. This can vary from a single tape (No. 2) for an operated relay A1P–10201 to 10 tapes (Nos. 2 to 11) for an operated relay AAP–10211.

When conductor EPW–10222 is grounded, it extends over cables 10131, 103–101A and 10317, conductor EPW–10222, contact 1 of relay PW–10303, conductor EPW–10318, cables 10315 and 25–103 (to Fig. 25), conductor EPW–10318, to operate relay EPW–2504 to indicate that all assigned tapes (except the straddle tape—No. 0—where necessary) have been prepared with leading tape end splice pattern and tape identity groups. Relay EPW–2504 locks over its contact 2 and contact 3 of relay ETE–2502 to off-normal ground on conductor MON–2205.

The operation of relay EPW–2504 at the end of perforating tape identity on the detail (No. 1) and the message unit tapes (Nos. 2 to 11) releases relay LTI–6501, which returns to normal all of the circuits used for the tape identity job on the tapes Nos. 1 to 11. When relay EPW–2504 opens the circuit for relay LTI–6501 at contact 4 of relay EPW–2504, the circuit which previously operated relay LTI–6500 is extended over contact 3 of relay EPW–2504 to a circuit which determines the action to be taken, if any, with respect to the placing of end-of-tape groups of codes on the straddle tape (No. 0). This subject matter is discussed in the next numbered section.

As has been mentioned there may be many factors which enter a determination of how many message unit tapes are to be prepared. Such factors may be (1) the type of sort specified by the setting of the sort switch 20501, (2) the number of offices in the marker group indicated by relays MO–19205 and SO–19204, (3) the number of message unit types in the marker group indicated by relays 5T–19203, 4T–19202, 3T–19201, 2T–19200, 1T–19300 and 25T–19301 and (4) the marker group number itself.

In accordance with the last above set forth table there are certain fixed conditions not involving the "B" cross-connection of Fig. 102:

(1) Situations 3, 6, 11 and 14 are no sort conditions and always cause the operation of assignment connector A1P–10201 to specify only tape 2 for perforation. This circuit extends from ground on off-normal conductor MON–1236 in Fig. 207, contact 1 of relay NS–20700, conductor A1P–20704, cables 207–192, 192–193A, 102–193 and 10220, conductor A1P–20704 to relay A1P–10201.

(2) Situations 7 and 15 are conditions where sorting is to be done by types of message units (not to exceed five types) to produce from two to five tapes (tapes 2 and 3 to 6) depending upon the number of MU types involved. These circuits extend from ground on conductor MON–1236 in Fig. 208, over contact 7 of relay SBUT–20803, conductor 20810, and over either contact 2 of relay 2T–19200 (for two types) to conductor A2P or contact 3 of relay 3T–19201 (for three types) to conductor A3P or contact 3 of relay 4T–19202 (for four types) to conductor A4P or contact 3 of relay 5T–19203 (for five types) to conductor A5P, thence over cables 192–193A, 102–193 and 10220 to one of relay A2P–10202 or A3P–10203 or A4P–10204 or A5P–10205.

(3) Situation 8 is a condition where the sorting is to sort out local message unit calls in a single office marker group involving more than one type of MU. This will cause but two tapes (tapes 2 and 3) to be perforated. The circuit for relay A2P–10202 extends from ground on conductor MON–1236 in Fig. 208, contact 3 of relay SOLU–20802, conductor 20811, contact 6 of relay SO–19204, conductor A2P, over cables 192–193A, 102–193 and 102220, to operate relay A2P–10202.

(4) Situations 10 and 13 involving the sorting out of the principal office of a multi-office marker group to produce but two tapes (tapes 2 and 3). The operating circuit for relay A2P–10202 extends from ground on conductor MON–1236 in Fig. 207, over contact 4 of relay SOPO–20702, conductor A2P, over cables 192–193A, 102–193 and 10220, to operate relay A2P–10202.

(5) Situations 1 and 4 or 2 and 5 involve respectively a sorting out of the calling line number thousands or units digits. These conditions call for ten tapes, thus requiring the operation of relay AAP–10211, the operating circuit for which extends from ground on conductor MON–1236 in Fig. 208 or 207, contact 4 of relay SBTH–20800 or contact 6 of relay SBU–20703, conductor AP, over cables 192–193A, 102–193 and 10220, to operate relay AAP–10211.

Situations 9 and 12 involve conditions where the sorting is to be done by calling offices in a multi-office marker group. This calls for the preparation of from two to ten tapes (tapes 2 to 11) depending upon the number of offices in the marker group being processed. These conditions, therefore, will involve the "B" cross-connection of Fig. 102 as follows. With relay SBO–20701 operated, ground on conductor MON–1236 in Fig. 207 is extended over contact 8 of relay SBO–20701, conductor 20709, wiper of arc 5 of the marker group units switch 19101, out on one of the ten conductors U0B to U9B cables 20611, 206–192, 192–193, 193–102, 10214 and 10215, one of the ten conductors U0B to U9B, over a contact of one of the ten marker group tens translator relays MT0–10200 to MT9–10209, to one of a hundred No. 1 "B" cross-connecting points in Fig. 102. The No. 1 "B" point for any particular marker group will be cross-connected to a No. 3 "B" point corresponding with a lead A2P, A3P, A4P, A5P, for a respective 2, 3, 4, or 5 office marker group or to a No. 2 "B" point corresponding with a lead A6P, A7P, A8P, A9P, AP for a respective 6, 7, 8, 9 or 10 office marker group. The latter five connections will extend the No. 1 "B" ground directly over cable 10223 to relays A6P to AP respectively to prepare 6 to 10 tapes respectively. The No. 3 "B" points extend the No. 1 "B" ground over cable 102224, lead A2P, A3P, A4P or A5P, contact 2 or 4 or 6 or 8 of relay 2AP–10212, contact 1 or 3 or 5 or 6 of relay APCO–10213, cable 10225, to relay A2P, A3P, A4P or A5P to prepare 2 to 5 tapes respectively.

For situation 16, the sorting will be arranged to sort out local message unit calls for a marker group involving a plurality of offices and a plurality of MU types. This calls for the production of two tapes for each office or a number of tapes which equals the number of offices times 2. With relays SOLU–20802 and MO–19205 operated, ground is extended from off-normal conductor MON–1236 in Fig. 208, contact 3 of relay SOLU–20802, conductor 20811, contact 6 of relay MO–19205, conductor 2AP into cable 192–102, conductor 2AP, to operate relay 2AP–10212. (Relay APCO–10213 will also be operated if relay 2T–19200 is operated by conductor 2AP in Fig. 192 being extended over contact 3 of relay 2T–19200 and conductor APCO over cable 192–102 to relay APCO–10213; however, whether relay APCO–10213 is operated or not at this time does not effect the circuit operation for situation 16.) With relay 2AP–10212 operated, ground is extended over contact 1 thereof to conductor 20709, which, as previously described, grounds the appropriate No. 1 "B" marker group point in Fig. 102. With the No. 1 "B" point cross-connected to a No. 3 "B" point corresponding to the number of offices in the marker group, one of the conductors A2P, A3P, A4P and A5P out of cable 10224 is grounded for respective 2, 3, 4 and 5 office marker groups. One of these leads is extended over contact 3, 5, 7 or 9 of relay 2AP–10212 to a lead A4P, A6P, A8P or AP (thus multiplying the number of offices by two) over cable 10225 to

operate one of the relays A4P–10204, A6P–10206, A8P–10208 and AAP–10211 to prepare 4, 6, 8 or 10 tapes for the 2, 3, 4 or 5 office marker group.

Situation 17 involves sorting simultaneously by office and MU type where the product of the two cannot exceed 10. If there are no more than two types of MU involved (relay 2T–19200 operated) there will be two tapes produced per office. If there are 3, 4 or 5 types of MU's involved (relay 3T–10201 or 4T–19202 or 5T–19203 operated) there can be 6 tapes (for 2 offices and 3 MU types) or 8 tapes (for 2 offices and 4 MU types) or 10 tapes (for 5 MU types and 2 offices) or 9 tapes (for 3 offices and 3 MU types) produced. With relay SBOUT–20801 operated, ground on conductor MON–1236 in Fig. 208 is extended over contact 8 of relay SBOUT–20801 to conductor 20709, which, as previously discussed, grounds the appropriate No. 1 "B" marker group point in Fig. 102. Also, with relay SBOUT–20801 operated, ground on conductor MON–1236 in Fig. 208 is extended over contact 6 of relay SBOUT–20801 to conductor APCO which extends over cable 192–102 to operate relay APCO–10213. If relay 2T–19200 is operated, the grounded conductor APCO in Fig. 192 is extended also over contact 3 of relay 2T–19200 to conductor 2AP into cable 192–102 to operate relay 2AP–10212. This latter condition (both relays APCO–10213 and 2AP–10212 operated) the grounded No. 3 "B" point in Fig. 102 (representing 2, 3, 4 or 5 office marker groups) merely preselects a relay A4P–10204, A6P–10206, A8P–10208 or AAP–10211 which represents a number of tapes to be prepared which is twice the number of offices, as previously described. In the former case (relay APCO–10213 operated and relay 2AP–10212 released), the No. 3 "B" point for a 2 or a 3 office marker group grounds lead A2P or A3P into cable 10224, contacts 2 of relays 2AP–10212 and APCO–10213 to lead A2P into cable 192–102 for a 2 office marker group or contacts 4 of relays 2AP–10212 and APCO–10213 to lead A3P into cable 192–102 for a 3 office marker group. In Fig. 192 the lead A2P comes out of cable 193–102 and extends over contact 2 of relay 3T–19201 (for 3 MU types) or relay 4T–19202 (for 4 MU types) or relay 5T–19203 (for 5 MU types) to respective conductors A6P, A8P or AP into cable 192–193A. Conductor A3P comes out of cable 192–102 and extends over contact 4 of relay 3T–19201, if operated, to lead A9P into cable 192–193A. One of these four conductors A6P, A8P, AP or A9P extends over cables 192–193A, 102–193 and 10220 to operate one of relays A6P–10206, A8P–10208, AAP–10211 or A9P–10210.

4.10 *Perforating leading end-of-tape group on straddle tape*

With the feedback method of straddle operation, the first tape encountered will have been the emergency recorder tape. This tape always contains a recorder number entry 280640 when the emergency recorder is not in use at the 3 a.m. cutting point. The E and F digits of 40 in the 280640 recorder number entry indicate an idle emergency recorder and the D digit of 6 indicates a regular tape. Under these circumstances, no end-of-tape group is perforated on the straddle feeder tape immediately. The path for skipping this end-of-tape perforating is as follows: Off-normal ground through relays CL2–2202, CL1–2201, CL0–2220, CL3–2103, CL4–2101 and STE–2203 normal, relays FI–2500 and EPW–2504 operated, relay CR1–2505 normal, relays C6–4204 and T4–4202 operated, relays DCDR–1706, DCR–1704, DPRS–3106, DPS–3109, FDR–3105 and RP–3202 normal to operate relay ETE–2502. This circuit may be traced from off-normal ground on conductor ON–1117 in Fig. 22, contacts 4 of relays CL2–2202, CL1–2201 and CL0–2200, conductor 2108, contact 3 of relay CL3–2103, contact 2 of relay CL4–2101, conductor 2113, contact 4 of relay STE–2203, conductor TE–2215, cables 2204, 25–22 and 2512, conductor TE–2215, contact 6 of relay FI–2500, contact 3 of relay EPW–2504, contact 4 of relay CR1–2505, conductor TE–2516, cables 42–25 and 4214, conductor TE–2516, contact 3 of relay C6–4204, contact 3 of relay T4–4202, conductor ETE–4213, cable 42–25, conductor ETE–4213 to Fig. 17, contact 3 of relay DCDR–1706, contact 2 of relay DCR–1704, conductor ETE–1709, cables 25–17A, 25–31 and 3114, conductor ETE–1709, contact 3 of relay DPRS–3106, contact 3 of relay DPS–3109, contact 7 of relay FDR–3105, conductor ETE–3119, cable 32–31A, conductor ETE–3119, contact 4 of relay RP–3202, conductor ETE–3223, cables 2204 and 25–22, conductor ETE–3223, to operate relay ETE–2502.

Relay ETE–2502, in operating, locks to off-normal group supplied through the operated tape identity progress relays FI–2500, TI–2501 and EPW–2504. This locking circuit extends from the winding of relay ETE–2502, over contact 2 thereof and in parallel over contact 1 of relay EPW–2504 or contact 3 of relay TI–2501 or over contact 2 of relay FI–2500 to ground on off-normal conductor MON–2205. At the same time, the operation of relay ETE–2502 starts the release of these relays by opening at its contact 3 the supply of ground from conductor MON–2205 to the locking conductor IL–2511. The release of relays TI–2501 and FI–2500 permits call entries to be read and registered as described later. However, with the feedback method of straddle operation, the next entries to appear on the tape after an end-of-tape group containing a 280640 entry will be another end-of-tape group.

Should the emergency recorder have been in use at the 3 a.m. cutting period, the recorder number on the end-of-tape group or the end-of-tape group after the 3 a.m. group will be 2806EF (where EF is not 40). In this case relay LTE–6504 or LTFE–6506 will operate to control the perforating of a leading end-of-tape group on the output straddle tape. As mentioned in Section 3.112, relay LTE–6504 will cause the placing of leading end-of-tape pattern on the straddle tape (tape 0) comprising six lines of codes, the first "line" being a measured length of regular splice pattern 081010 followed by five lines of end-of-tape identity like that found on central office tapes—284DEF, 283DEF, 280DEF, 281DEF and 282DEF. Likewise, relay LTFE–6506 will cause the placing of leading end-of-tape pattern on the straddle tape (tape 0) comprising a measured amount of special (or "grooved") splice pattern 08CDEF (C and D digits—recorder number and E and F digits—the hour) followed by the six lines 284DEF, 283DEF, 280DEF, 285DEF, 281DEF and 282DEF. This action occurs after checking that all assembling registers are normal and after the setting of the first call relays of all assembling registers.

The operation of relay EPW–2504, upon the conclusion of perforating tape identity on the detail and message unit tapes, transfers the previously described operate path for relay LTI–6501 to operate relay CRC–7610 as follows: Relay CR1–2505 normal, relays C6–4204 and T0–4200 or T1–4201 operated, relay TEG2–2503 normal, relay F–1918 operated, relay TF–2506 normal and relay EPW–2504 operated. The previously described circuit for operating relay ETE–2502 for the condition where the 280640 entry appeared, indicating an idle emergency recorder, is shifted in Fig. 42 to a different circuit because relay T0–4200 or relay T1–4201 will be operated instead of relay T4–4202 (because the recorder number will not be 40). The ground on conductor TE–2516 coming out of cable 4214 extends over contact 3 of relay C6–4204 (indicating an emergency recorder tape), contact 3 of relay T0–4200 or relay T1–4201 (indicating the tens digit of the regular recorder for which the emergency recorder was acting), conductor 6–4215, cables 4214 and 42–25, conductor 6–4215, contact 3 of relay TEG2–2503, conductor 61–2517,

cable 25–19, conductor 61–2517, contact 7 of relay F–1918, conductor 6–1924, cable 25–19, conductor 6–1924, contact 4 of relay TF–2506, contact 5 of relay EPW–2504, conductor CRC–2518, cables 25–36, 36–59, 59–72, 72–73, 7315 and 7322, conductor CRC–2518, cable 73–76, conductor CRC–2518, to operate relay CRC–7610.

Relay CRC–7610, in operating, operates relay CAR–7608 to start a series of events described in detail in Section 4.33. At the end of this process, relay WC–901 is operated and relay SW–7609 is released, thereby operating relay OFC–6111 and the FC– (first call) relays in all assembling registers, all as described in Section 4.33. Later, relays AFCU–6114 and FCCU–6112 are operated and a path is completed through relay 285R–7303 to operate relay LTE–6504 or relay LTFE–6506, depending upon whether or not a 285DEF entry was previously received as part of the initial end-of-tape identity on the central office emergency recorder tape which started the processing. This circuit extends from ground on conductor SFC–7616 (Fig. 61), previously used to operate relay OFC–6111, over contact 2 of relay AFCU–6114, contact 1 of relay FCCU–6112, conductor LTE–6119, cables 72–61, 72–73, 7315 and 7323, conductor LTE–6119, to the armature of relay 285R–7303 which is associated with contacts 4 and 5 thereof. Depending upon whether relay 285R–7303 is operated (a 285DEF entry was remembered from reading the first tape identity) or released (there was no 285DEF entry in the first end-of-tape group), ground on conductor LTE–6119 is extended over contact 4 or 5 of relay 285R–7303, conductor LTFE–7324 or LTE–7325 and over cable 73–65, to operate relay LTFE–6506 or relay LTE–6504.

Relay LTFE–6506 is operated if a 285DEF entry was received as part of the initial end-of-tape group on the emergency recorder tape. Relay LTFE–6506, when operated, will cause seven lines of end-of-tape pattern to be perforated on the straddle tape (tape 0). The first line is a measured amount of special or "grooved" splice pattern 08CDEF where the C and D digits are the tens and units digits of the recorder number for which the emergency recorder was acting and where the E and F digits are the tens and units digits of the hour at the time of the transfer. The next six lines are the central office entries 284DEF (round and marker group), 283DEF (day of round and month), 280DEF (recorder type and recorder number), 285D00 (type of transfer), 281DEF (hour) and 282DEF (day), as described in Section 2.11.

Relay LTFE–6506, in operating, causes the operation of connector COC–6400 in the same manner as previously described. Also, perforator register relay P0D–10100 is operated in series with perforator magnet connector PA0–17900 (both for the straddle perforator—tape 0) in a circuit extending from ground, over contact 13 of relay LTFE–6505, conductor S–6526, cable 65–64, conductor S–6526, contact 22 of connector relay COC–6400, conductor S–6425, cables 6426, 64–103 (to Fig. 103) and 103–101A, conductor S–6425, relay P0D–10100, conductor P0A into cable 101–179, conductor P0A, to battery through connector PA0–17900. This permits the perforator line count relays of Fig. 64 to cause the seven successive lines 08CDEF, 284DEF, 283DEF, 280DEF, 285D00, 281DEF and 282DEF to be perforated on the straddle tape (tape 0) under the control of relay LTFE–6505. Relay PLA7–6427 is operated (to indicate a seven line pattern) from ground, over contact 12 of relay LTFE–6506, conductor 7L–6525, cable 65–64, conductor 7L–6525, contact 16 of relay COC–6400, conductor 7L–6424, cable 6412, conductor 7L–6424, contact 4 of relay PL8–6408, to relay PLA7–6427, which locks over its contact 5.

This line count circuit of Fig. 64 functions similarly to the previously described operation for the 10 line output regarding relay LTI–6501, and thus steps along from relay PLA7–6427 to relay PLA1–6421 as each line is perforated, thus successively grounding the leads L7 to L1 over their contacts 1 into cable 6429, over contacts 7, 8, 9, 10, 11, 12 and 13 of relay COC–6400, leads L7 to L1 into cable 65–64A, to armatures of relay LTFE–6506 associated with its contacts 4, 5, 6, 7, 8, 9 and 10. These respective contacts extend the ground successively as follows: contact 4 to conductor 08S into cables 6515 and 65–72 and contact 4 over contact 11 of relay LTFE–6506 to conductor SSTM–6514 to start the splice timer of Fig. 59; contact 5 to conductor 284 into cables 6527 and 65–72; contact 6 to conductor 283 into cables 6527 and 65–72; contact 7 to conductor 280 into cables 6527 and 65–72; contact 8 to conductor 285 into cables 6527 and 65–72; contact 9 to conductor 281 into cables 6527 and 65–72; and, contact 10 to conductor 282 into cables 6527 and 65–72. These conductors 08S, 284, 283, 280, 285, 281 and 282 extend over cable 65–72 to Fig. 72 where conductors 08S, 284, 283, 280, 281 and 282 extend over cable 72–71 to the windings of relays 08S–7109, 284–7108, 283–7107, 280–7104, 281–7105 and 282–7106, conductor 285 extending from cable 65–72 in Fig. 72, over cable 7212 to relay 285–7206.

Thus, under the control of the perforator line count circuit of Fig. 64 and the common class translator relay LTFE–6506, the relays 08S–7109, 284–7108, 283–7107, 280–7104, 285–7206, 281–7105 and 282–7106 of the common pattern connector circuit of Figs. 71 and 72 are successively operated one at a time to place the seven line pattern on the straddle tape (tape 0) as follows:

(1) *08CDEF—special splice pattern.*—With relays 08S–7109 and 8–7119 operated, the grounded reader-perforate conductor PA0 in Fig. 71 extends over cable 59–71, conductor PA0, contact 4 of relay SSTM–5914 (operated as before to time the splice pattern perforating), conductor 5917, cable 59–71, conductor 5917 and over contact 2 of relay 08S–7109 to conductor A0 into cables 72–104, etc. to cause the perforation of the A digit 0 in tape 0 by operating magnet OA0 in Fig. 194.

The leads PB1 and PB7 in Fig. 71 extend over contacts 2 and 1 of relay 8–7119 to conductors B1 and B7 into cables 72–104, etc. to perforate the B digit of 8 by causing the operation of magnets OB1 and OB7 in Fig. 194.

The C and D digits are the tens and units digits of the recorder number. Grounded leads PE0 and PE1 out of cable 40–42 in Fig. 42 extend over contacts 1 and 2 of either relay T0–4200 or T1–4201 (for tens digit of 0 or 1) to conductors E7 and E4 or E0 and E1, into cables E–4216 and 43–71. Leads PF0 and PF1 out of cable 40–43 in Fig. 43 extend over contacts 7 and 8 of relay U0–4300 or contacts 8 and 9 of one of relays U1 to U8 or contacts 7 and 8 of relay U9–4309 (depending on the units digit of the recorder number), to conductors F7 and F4, F0 and F1, F0 and F2, etc. to F7 and F2, into cables F–4314 and 43–71. These E and F pairs of conductors extend over cable 43–71 to Fig. 71, cables E–4216 and F–4314, and conductors E0 to E7 and F0 to F7. The two grounded E leads extend over two of the contacts 7, 6, 4 and 3 of relay 08S–7109 to two of the conductors C0, C1, C4 and C7 into cables 72–104, etc. to perforate a C digit of 0 or 1 according to the recorder tens digit registered in relay T0–4200 or relay T1–4201 of Fig. 42. The two grounded F leads extend over two of the contacts 12, 11, 10, 9 and 8 of relay 08S–7109 to two conductors D0 to D7 into cables 72–104, etc. to perforate a D digit of 0 to 9 according to the recorder units digit registered in Fig. 43.

The E and F digits are the tens and units digits of the hour of transfer as registered in the odd or even hour register of Figs. 44 and 45. It will be recalled that during the reading and checking of the tape identity of the first input tape, the end-of-tape hour was registered in the odd hour register of Figs. 44 and 45 and that relay OHAR–3503 remained operated, thereby keeping op-

erated the odd hour output connectors OTNC–5202 and OUAR–5200. With relay 08S–7109 operated, ground is applied over contact 1 of relay 08S–7109, conductor HP–7111, cable 59–71, conductor HP–7111, cables 36–59 and 3605, conductor HP–7111, to operate relay PH–3507. Grounded reader-perforate leads PE0, PE1, PF0 and PF1 coming out of cable 40–35 in Fig. 35 are then extended over contacts 2, 4, 6 and 8 of relay PH–3507, over leads TA, TB, UA and UB into cable 35–45 to Fig. 45. Thence, conductor UA extends over contact 8 of relay OHU9–4509 or contact 9 of one of the relays OHU8–4508 to OHU3–4503, to one of the conductors U9A to U3A into cables 4518 and 4411. Conductor UA in Fig. 44 may extend instead over contact 9 of relay OHU2–4405 or relay OHU1–4404 or over contact 10 of relay OHU0–4403, to one of the conductors U2A to U0A into cables 4413 and 4411. Likewise conductor UB in Fig. 45 will extend over an operated relay OHU9–4509 to OHU3–4503 or OHU2–4405 to OHU0–4403 to one of the conductors U9B to U3B into cables 4519 and 4412 or one of the conductors U2B to U0B into cables 4414 and 4412. Thus, in Fig. 52 the hour units value is represented by one grounded conductor of the group U0A to U9A out of cable 4411 and one grounded conductor of the group U0B to U9B out of cable 4412. The TA lead in Fig. 44 extends over contact 9 of relay OHT0–4400 or contact 8 of relay OHT1–4401 or contact 7 of relay OHT2–4402 to a conductor T0A, T1A or T2A to armatures of connector OTNC–5202. The TB lead extends over contact 10 of relay OHT0–4400 or contact 9 of relay OHT1–4401 or contact 8 of relay OHT2–4402 to a conductor T0B, T1B or T2B to armatures of relay OTNC–5202. With one of the conductors T0A, T1A and T2A and one of the conductors T0B, T1B and T2B grounded and extended over one of the contacts 9, 8 and 7 and one of the contacts 6, 5 and 4 of relay OTNC–5202, two of the five hour tens leads HT0 to HT7 are grounded and extend over cables 52–53 and HT–5302 into cable 53–71. With one of the conductors U0A to U9A and one of the conductors U0B to U9B grounded and extended over one of the contacts 30 to 21 and one of the contacts 20 to 11 of relay OUAR–5200, two of the five conductors HU0 to HU7 are grounded and extend over cable HU–5301 into cable 53–71.

These two sets of two-out-of-five grounded conductors HU0 to HU7 and HT0 to HT7 come out of cable 53–71 in Fig. 71 and extend over two of contacts 22 to 18 and 17 to 13 of relay 08S–7109 to ground two of the leads E0 to E7 and two of the leads F0 to F7 into cables 72–104 to perforate the E and F digits according to the current hour tens and units digits.

(2) *284DEF—round and marker group.*—With relays 284–7108 and 8–7119 operated, the grounded reader-perforate lead PA2 is extended over contact 1 of relay 284–7108 to lead A2 into cables 72–104, etc. to perforate the A digit of 2, the operated relay 8–7119 perforates a B digit of 8 as before, and the grounded leads PC0 and PC4 are extended over contacts 3 and 2 of relay 284–7108 to leads C0 and C4 into cables 72–104, etc. to perforate the C digit 4.

The grounded leads PD0 and PD1 extend over contacts 5 and 4 of relay 284–7108, conductors RB and RA, over cables 71–180 (to Fig. 180) and 18024, conductors RB and RA, and over contacts 2 and 1 of one of the operated round translator relays R0–18000 to R9–18009, to two of the five leads 0 to 7 into cable D15406 into Fig. 154, etc. to perforate a D digit of 0 to 9 depending upon the registered round.

Leads PE0 and PE1 extend over contacts 7 and 6 of relay 284–7108 to conductors MGTB and MGTA and leads PF0 and PF1 extend over contacts 8 and 9 of relay 284–7108 to conductors MGUB and MGUA. These four conductors extend over cables 7100, 71–72, 7214, 7215, 7216, 72–190 (to Fig. 190), 19008, 190–191, 19109, 19110 and 19111. where leads MGTA and MGTB come out and terminate on the wipers of respective arcs 1 and 2 of the marker group tens switch 20600, leads MGUA and MGUB continuing on over cable 19112 to the wipers of respective arcs 1 and 2 of the marker group units switch 19101. Depending upon what position these two switches are in two of the five conductors E0 to E7 into cable E20610 in Fig. 206 will be grounded and two of the five conductors F0 to F7 into cable F17912 in Fig. 191 will be grounded. These four conductors extend over cables 191–179, etc. to operate the E and F digit perforating magnets according to the marker group being processed.

(3) *283DEF—day of round and month.*—With relays 283–7107 and 8–7119 operated, the grounded reader-perforate lead PA2 is extended over contact 1 of relay 283–7107 to lead A2 into cables 72–104, etc. to perforate the A digit of 2, the operated relay 8–7119 causes the B digit of 8 to be perforated as before, and the leads PC1 and PC2 are extended over contacts 3 and 2 of relay 283–7107 to leads C1 and C2 into cables 72–104, etc. to perforate the C digit of 3.

Lead PD0 and PD1 extend over contacts 5 and 4 of relay 283–7107, conductors DRB and DRA, cables 71–180 (to Fig. 180) and 18025, conductors DRB and DRA and contacts 1 and 2 of one of the relays DR1–18011 to DR6–18016, to two of the four conductors D0 to D4 into cable D15406 to operate the D digit perforator magnets according to the registered day of round.

The pairs of leads PE0, PE1 and PF0, PF1 extend over pairs of contacts 7, 6 and 8, 9 of relay 283–7107 to pairs of leads MTB, MTA and MUB, MUA into cables 71–72A, 7221 and 72–190 (to Fig. 190), etc. to perforate the tens and units digits of the month as previously described in connection with the operation of relay 2899–7205.

(4) *280DEF—recorder type and number.*—With relay 280–7104 operated (relay 8–7119 is released) the grounded reader-perforate lead PA2 is extended over contact 3 of relay 280–7104 to lead A2 into cables 72–104, etc. to perforate the A digit of 2, leads PB1 and PB7 are extended over contacts 5 and 4 of relay 280–7104 to leads B1 and B7 into cables 72–104, etc. to perforate the B digit of 8, and leads PC4 and PC7 are extended over contacts 7 and 6 of relay 280–7104 to leads C4 and C7 into cables 72–104, etc. to perforate the C digit zero.

Since this is the straddle tape the D digit of the 280DEF entry will be a 7 or an 8 (see Section 2.11) depending upon whether the tape being read is a regular or an emergency central office tape. Leads PD0 and PD1 out of cable 40–42A in Fig. 42 extend over contacts 2 and 1 of relay C5–4203 or relay C6–4204 (regular or emergency central office recorder type) to leads D7 and D0 or D7 and D1 into cables D–4217, 43–71 and D–4217, leads D7 and D0 or D7 and D1, contacts 8 and 10 or 8 and 9 of relay 280–7104 to leads D7 and D0 or D7 and D1 into cables 72–104, etc. to perforate the D digit of 7 or 8.

The E and F digits, representing the recorder tens and units digits are perforated from grounds on two-out-of-five of the two groups of leads coming out of cables E–4216 and F4314 in Fig. 71 and over two of contacts 11 to 15 and 16 to 20 of relay 280–7104 to two-out-of-five of each of the perforating leads E0 to E7 and F0 to F7 into cables 72–104.

(5) *285D00—type of transfer.*—With relays 285–7206 and 8–7119 operated, the grounded reader-perforate lead PA2 is extended over contact 1 of relay 285–7206 to lead A2 into cables 72–104, etc. to perforate the A digit 2, relay 8–7119 causes the perforating of the B digit 8 as before, and leads PC0 and PC1 extend over contacts 3 and 2 of relay 285–7206 to leads C1 and C4 to perforate the C digit 5.

The D digit represents the type of transfer involved (see Section 2.11)—a 5 for a synchronous transfer, a 6 for a non-synchronous make-busy and a 7 for a non-syn-

chronous transfer. These respective transfer conditions will be recorded on one of the three relays STF–7300, NSMB–7301 and NSTF–7302 in Fig. 73. The grounded leads PD0 and PD1 in Fig. 73 are extended over contacts 6 and 7 of relay STF–7300 to conductors D1 and D4 into cable D–7326 or contacts 6 and 7 of relay NSMB–7301 to conductors D2 and D4 into cable D–7326 or contacts 7 and 8 of relay NSTF–7302 to leads D0 and D7 into cable D–7326. These two leads extend over cable D–7326 and over two of contacts 4 to 8 of relay 285–7206 to two of the leads D0 to D7 into cables 72–104, etc. to perforate the D digit of 5, 6 or 7.

The E and F digits are each zero. Leads PE4 and PE7 extend over contacts 10 and 9 of relay 285–7206 to leads E4 and E7 and leads PF0 and PF1 extend over contacts 12 and 11 to leads F4 and F7, all into cables 72–104, etc. to perforate the E and F digits of 00.

(6) *281DEF—type of hour and hour value.*—Since this is an end-of-tape hour the D digit is 1 (see Section 2.11). With relay 281–7105 operated, the perforate-hour relay PH–3507 is operated from ground, over contact 1 of relay 281–7105 and over conductor HP–7111, as was the case previously described for relay 08S–7109.

Lead PA2 extends over contact 4 of relay 281–7105 to lead A2 to perforate the A digit 2, leads PB1 and PB7 extend over contacts 6 and 5 of relay 281–7105 to leads B1 and B7 to perforate the B digit of 8, leads PC0 and PC1 extend over contacts 8 and 7 of relay 281–7105 to leads C0 and C1 to perforate the C digit of 1, and leads PD0 and PD1 extend over contacts 10 and 9 of relay 281–7105 to leads D0 and D1 to perforate the D digit of 1.

The E and F digits are the tens and units digits of the recorded hour. These digits are perforated from grounds on two-out-of-five of each of the two sets of leads HT0 to HT7 and HU0 to HU7 coming out of cable 53–71 (as was the case when relay 08S–7109 was operated as previously described) and over two of contacts 11 to 15 and 16 to 20 of relay 281–7105 to two each of the groups of perforating leads E0 to E7 and F0 to F7.

(7) *282DEF—type of day and day.*—Since this is an end-of-tape day the D digit will be 1 (see Section 2.11).

With relay 282–7106 operated, lead PA2 extends over contact 3 of relay 282–7106 to lead A2 to perforate the A digit of 2, leads PB1 and PB7 extend over contacts 5 and 4 of relay 282–7106 to leads B1 and B7 to perforate the B digit of 8, leads PC0 and PC2 extend over contacts 7 and 6 of relay 282–7106 to leads C0 and C2 to perforate the C digit of 2, and leads PD0 and PD1 extend over contacts 9 and 8 of relay 282–7106 to leads D0 and D1 to perforate the D digit of 1.

Leads PE0 and PE1 out of cable 8–40 in Fig. 40 extend over contacts 7 and 8 of relay DT0–4000 or contacts 6 and 7 of relay DT1–4001 or relay DT2–4002 or contacts 5 and 6 of relay DT3–4003 to ground two-out-of-five of the conductors E0 to E7 into cables E–4007 and 40–43A according to the tens digit of the calendar day as registered in the day register of Figs. 40 and 41. Leads PF0 and PF1 out of cable 8–40 extend over contacts 5 and 6 of relay DU0–4010 or contacts 8 and 9 of relay DU1–4011 or contacts 6 and 7 of one of relays DU2–4012 to DU8–4118 or contacts 5 and 6 of relay DU9–4119 to two-out-of-five of leads F0 to F7 extending into cables F–4008 and 40–43A according to the units digit of the calendar day as registered in the day register of Figs. 40 and 41. These two pairs of leads E0 to E7 and F0 to F7 extend over cables 40–43A, 43–71 and 7112 and over two each of contacts 10 to 14 and 15 to 19 of relay 282–7106 to two each of the perforating leads E0 to E7 and F0 to F7 to perforate the tens and units digits of the calendar day.

The perforating of the LTE–6504 leading end-of-tape group consists of timed regular splice pattern 081010 and the regular central office end-of-tape entries 284DEF, 283DEF, 280DEF, 281DEF and 282DEF. Relay LTE–6504 in operating indicates that a six-line entry is to be perforated, and the output of the perforate line count relays (Fig. 64) steer through the operated LTE–6504 relay in the corresponding common pattern connector relays. Relay LTE–6504 also grounds lead S–6526 through the common output connector COC–6400 to indicate that the straddle tape perforator register connector is to be operated.

Relay LTE–6504, in operating, causes the operation of the connector COC–6400 in the same manner as previously described. Also, perforator register relay P0D–10100 is operated in series with perforator magnet connector PAO–17900 in the same manner as for the above-described operated relay LTFE–6506 except that the energizing ground extends to conductor S–6526 from contact 12 of relay LTE–6504 instead of contact 13 of relay LTFE–6506. This permits the perforator line count relays of Fig. 64 to cause the six successive lines 081010, 284DEF, 283DEF, 280DEF, 281DEF and 282DEF to be perforated on the straddle tape (tape 0) under the control of relay LTE–6504. Relay PLA6 (not shown in Fig. 64) is operated (to indicate a six-line pattern) from ground, over contact 11 of relay LTE–6504, contact 10 of relay STWS–6509, conductor 6L–6528, cable 65–64, conductor 6L–6528, contact 17 of relay COC–6400, conductor 6L–6432, cable 6412, conductor 6L–6432, contact 4 of relay PL7–6407, to operate relay PLA6 (not shown).

The line count circuit of Fig. 64 functions in a manner similar to that above-described for the condition under which relay LTE–6506 is operated, and thus steps along from relay PLA6 (not shown) to relay PLA1–6421 as each line is perforated, thus successively grounding the leads L6 to L1 over their contacts 1 into cable 6429, over contacts 8 to 13 of relay COC–6400, leads L6 to L1 into cable 65–64A, to armatures of relay LTE–6504 associated with its contacts 4 to 9. These respective contacts extend the ground successively as follows: contact 4 to conductor 08–6513 into cables 6515 and 65–72 and contact 4 over contact 10 of relay LTE–6504 to conductor SSTM–6514 to start the splice timer of Fig. 59; contact 5 to conductor 284 into cables 6527 and 65–72; contact 6 to conductor 283 into cables 6527 and 65–72; contact 7 to conductor 280 into cables 6527 and 65–72; contact 8 to conductor 281 into cables 6527 and 65–72; and, contact 9 to conductor 282 into cables 6527 and 65–72. These conductors 08–6513, 284, 283, 280, 281 and 282 extend over cable 65–72 to Fig. 72, where conductors 284, 283, 280, 281 and 282 extend over cable 72–71 to the windings of relays 284–7108, 283–7107, 280–7104, 281–7105 and 282–7106, conductor 08–6513 extending from cable 65–72 in Fig. 72, over cable 7212 to relay 08R–7209.

Thus, under the control of the perforator line count circuit of Fig. 64 and the common class translator relay LTE–6504, the relays 08R–7209, 284–7108, 283–7107, 280–7104, 281–7105 and 282–7106 of the common pattern connector circuit of Figs. 71 and 72 are successively operated one at a time to place the six-line pattern on the straddle tape (tape 0) as follows:

(1) *081010—regular splice pattern.*—The lines of 081010 pattern are applied in the same manner as previously described for the operation of relays 08R–7209 and 8–7119.

(2) The successive lines 284DEF, 283DEF, 280DEF, 281DEF and 282DEF are applied in the same manner as above described for the operation of relay LTFE–6506.

When the RLS–5927 lead is grounded at contact 2 of relay PRL–5905 at the end of the perforation of the last line of the end-of-tape group, relay ETE–2502 is operated over a path through the back contacts of relay P11D–10111 and PW–10303. This circuit extends from ground, over contact 2 of relay PRL–5905, conductor RLS–5927, cables 64–59A and 6409, conductor RLS–5927, contact 23 of connector COC–6400, conductor

RLS–6423, cable 64–73, conductor RLS–6423, contact 1 of relay CG–7312, conductor RLS–7321, cable 73–128 (to Fig. 128), conductor RLS–7321, contact 2 of relay P11D–10111, conductor RLS–10133, cables 10131, 103–101A and 10313, conductor RLS–10133, contact 3 of relay PW–10303, contact 7 of relay PTTI–10306, conductor ETE–10319, cables 64–103 (to Fig. 64) and 64–59, conductor ETE–10319, contact 3 of relay EWD–5910, contact 2 of relay CWS–5908, conductor ETE–1930, cables 36–59 and 19–36, conductor ETE–1930, contact 2 of relay CCR–1913, contact 1 of relay CR–1915, conductor ETE–4213, cable 19–17, conductor ETE–4213, contact 3 of relay DCDR–1706, contact 2 of relay DCR–1704, conductor ETE–1709, cables 25–17A, 25–31 and 3114, conductor ETE–1709, contact 3 of relay DPRS–3106, contact 3 of relay DPS–3109, contact 6 of relay FDR–3105, conductor ETE–3119, cable 32–31A, conductor ETE–3119, contact 4 of relay RP–3202, conductor ETE–3223, cables 2204 and 25–22, conductor ETE–3223, to relay ETE–2502. The operation of relay ETE–2502 performs the same functions in restoring the tape identity progress control to normal as described previously.

On the spliced-in-emergency mode of straddle operation, the first recorder tape should be the first tape received from the central office, except as indicated by the two special set-up switches "Emergency at previous cutting period" 20601 and "Emergency at current cutting period" 20603. In either case the circuit for operating the LTE–6504 or LTFE–6506 relay is similar to that described above, except that the circuit for relay CRC–7610 passes through the SIE–1917 straddle class connector relay operated instead of relay F–1918 operated and relay TF–2506 released. The previously traced ground for operating relay LTE–6504 or relay LTFE–6506 extended from conductor 61–2517 (Fig. 25), into cable 25–19, conductor 61–2517, contact 7 of relay F–1918, conductor 6–1924, cable 25–19, conductor 6–1924, contact 4 of relay TF–2506, contact 5 of relay EPW–2504 to conductor CRC–2518 (to eventually operate relay CRC–7610). The spliced-in-emergency condition, as indicated previously, causes the operation of relay SIE–1917 under the control of the straddle class switch 20500. The circuit for relay LTE–6504 or relay LTFE–6506 thereupon will extend from conductor 61–2517 (Fig. 25), into cable 25–19, conductor 61–2517, contact 6 of relay SIE–1917 (instead of contact 7 of relay F–1918), conductor TE–1925 (instead of conductor 6–1924), cable 25–19, conductor TE–1925 (instead of conductor 6–1924 and contact 4 of relay TF–2506), contact 5 of relay EPW–2504 to conductor CRC–2518 (to operate relay CRC–7610 as described).

As has been described at the beginning of Section 4.10, the operation of relay ETE–2502 releases relays FI–2500, TI–2501 and EPW–2502, thereby returning to normal the various relays of the assembling register walking control circuit of Fig. 76, such as relays CRC–7610, CAR–7608, SW–7609, etc. This releases the connector WC–901 and reoperates the reader connector RC–900 to permit the reading and handling of call entries.

4.11 *Registering timing entries in assembling registers*

The entries which appear on the central office tape immediately following the end-of-tape group are regular timing and initial call entries. The timing entries, together with certain common information taken from an hour register (Figs. 44 and 45) and the day register (Figs. 40 and 41) through appropriate connectors are placed in one of the 100 assembling registers (Figs. 56, 57 and 62, 63) according to the call identity index digits (E and F digits) of the timing entry. The registration in the assembling registers is on dry-reed relays and no check is made at this point for the validity of the registration. However, the information to be registered is checked in the common part of the circuit by means of mercury contact check relays that are connected to the answer and disconnect multiples which serve the assembling registers. This check insures that all contacts in the common part of the circuit which supply information to the assembling registers are in working order when required.

As mentioned in Section 2.12 a timing entry on a central office tape will appear as a single line entry ABCDEF where:

(1) The A digit is a 1 except where a disconnect timing entry was produced as the result of a timed release of the circuits and there the A digit is a 3;

(2) The B, C and D digits are respectively the minute tens, minute units and minute tenths (or parts) digits; and,

(3) The E and F digits are the respective tens and units digits of the call identity index—from 00 to 99 depending upon what transmission channel (trunk, etc.) was used for the call.

The reading of a timing entry into the reading relays of Figs. 13, 14 and 15, as indicated by an A digit value of 1 (for a regular timing entry) or 3 (for a timed disconnect) closes a path for operating relay CST–6100 as follows: Reader contact G1 or G2 (Fig. 7) throughout the reading relay check path, relay TI–2501 normal, relay SR1E–2605 operated, relay B0–1303, B2–1305 or B4–1306 operated, relays RLS–6108 and ADD–6107 normal, relay RC–900 operated, relay FI–2500 normal and relay A1–1301 operated. This circuit may be traced from ground on the reading relay up-check lead UC–1510 (indicating the operation of one or three of the A digit reading relays in Fig. 13 and two out of five of each of the B, C, D, E and F digit reading relays of Figs. 13, 14 and 15), cable 23–25, conductor UC–1510, contact 8 of relay TI–2501, conductor UC–2510, contact 4 of relay SR1E–2605, conductor UC–2610, cable 26–15, conductor UC–2610, cable 15–13, conductor UC–2610, contact 4 of relay B0–1303 or contact 7 of relay B2–1305 or contact 6 of relay B4–1306 (showing that the B digit is not 8), conductor BN8–1311, cable 14–61, conductor BN8–1311, contacts 1 of relays RLS–6108 and ADD–6107, conductor BN8–6120, cable 14–61, conductor BN8–6120, contact 30 of connector RC–900, conductor BN8–916, cables 9–18 and 18–26, conductor BN8–916, contact 10 of relay FI–2500, conductor BN8–2519, cable 23–25, conductor BN8–2519, contact 7 of relay A1–1301 or contact 8 of relay A2–1302 in parallel, conductor CST–1312, cable 14–61, conductor CST–1312, to relay CST–6100.

Simultaneous with the operation of relay CST–6100, relay ADMC–6104 operates over a continuation of the CST–6100 relay operating path starting from the grounded conductor BN8–2519 in Fig. 13, through relay A1–1301 operated, STE–2203 released and one of the relays C5–4203 or C6–4204 operated. This circuit extends from grounded conductor BN8–2519 in Fig. 13, over contact 6 of relay A1–1301, conductor 1313, contact 1 of relay STE–2203, conductor 2216, contact 12 of relay C5–4203 or contact 13 of relay C6–4204, conductor ADM–4218, to Fig. 61 to operate relay ADMC–6104.

Relay CST–6100, in operating, closes the circuit which selects the assembling register into which the timing entry is to be registered. This path is as follows: Reader cam H0 (Fig. 8), relays RC–900 and CST–6100 operated, windings of relays XST–6101 and STO–6103, relay XSTL–6102 normal, a one and only check through the F digit and E digit reading relay translators and assembling register selectors (Figs. 24 and 23), through the operated TE– (E digit) reading translator relay (Fig. 23) and an operated TF– (F digit) reading translator relay (Fig. 24), through a normal jack contact on the assembling register switching panel (Figs. 57 and 63). This circuit extends from ground, over contact H0 of the reader of Fig. 8, conductor HM0–817, contact 31 of connector RC–900, conductor ST–917, cable 14–61, conductor ST–917, contact of relay CST–6100, lower wind-

ing of relay XST–6101, winding of relay STO–6103, contact 1 of relay XSTL–6102, conductor ST–6121, to Fig. 24 where it extends over contact 4 or 5 of relay TF9–2409, etc., contact 4 or 5 or 6 of relay TF1–2401 and contact 4 or 5 of relay TF0–2400 (a one and one only check of these ten F digit translator relays), conductor 2411 to Fig. 23 where it extends over contact 2 or 3 of relay TE9–2309, etc., and contact 2 or 3 or 4 of relay TE1–2301 and contact 2 or 3 of relay TE0–2300 (a one and one only check of these ten relays), thence over contact 1 of the operated one of relays TE0–2300 to TE9–2309, over one of the ten leads 2302 to 2304 (depending upon the value of the E digit), thence over contact 1 or 2 or 3 of one of the ten relays TF0–2400 to TF9–2409, to one of a hundred leads ST00 to ST99 into cable 24–57 to Fig. 57, where each of the hundred start leads ST00 to ST99 branches out to its like-numbered assembling register jack. For instance, lead ST99 extends over contact 2 of the 99 jack in Fig. 57 to lead ST–5702 into the assembling register No. 99 of Figs. 56 and 57; lead ST90 extends over contact 2 of the 90 jack in Fig. 57 to lead ST–5703 into register No. 90 (not shown); lead ST09 extends over contact 2 of the 09 jack in Fig. 57 to lead ST–5704 into register No. 09 (not shown); and lead ST00 continues into Fig. 63 where it extends over contact 2 of the 00 jack to lead ST–6302 into assembling register No. 00 of Figs. 62 and 63.

At this point 100 start leads branch out to the individual assembling registers as above described. Each assembling register contains a number of control relays of its own which are used in setting up and releasing the registrations. For instance, register No. 99 has, in Fig. 56, relays DS99–5600 and RLS99–5602 and FC99–5601 and, in Fig. 57, relay AS99–5700. Register No. 00 of Figs. 62 and 63 has similar local control relays. Assuming that no timing entry has as yet been registered in the selected assembling register such as No. 99, relay DS99–5600 will be normal and the dry-reed connector relay DISC99–5603 for the disconnect portion of that assembling register will be operated from the start lead. The grounded lead ST–5702 in Fig. 57 extends over contact 1 of relay DS99–5600 to operate connector DISC99–5603.

The operation of the dry-reed connector DISC99–5603 of the disconnect portion of the assembling register connects the dry-reed register relays of that portion with the corresponding multiple from the common part of the machine.

The operation of relay ADMC–6104 in the meantime proceeds to connect the minutes, hour and day digit outputs of the reading relays or appropriate registers to the assembling register multiples.

Relay ADMC–6104 operates relays ADM–5000, AMA–5001, AMB–5002, ARC–5003 and ADMR–5004. Relay ADMC–6104, in operating, applies ground over its contact directly to conductor ADM–6122 and over contact 3 of relay AMO–6105 to conductor AM–6123. These conductors extend over cable 61–50 into Fig. 50 where the ground on conductor AM–6123 operates the answer multiple connector AMB–5002. The grounded conductor ADM–6122 operates directly the answer multiple connector AMA–5001 and the check connector ARC–5003. Relay ADMR–5004 is operated from the grounded conductor ADM–6122 over contact 30 of the disconnect multiple connector ADM–5000 but releases immediately (if it had a chance to operate) when the connector ADM–5000 is operated from the grounded conductor ADM–6122 over contact 1 of relay ADMV–5005 and in parallel over conductor ADM–6122, cable 50–55, conductor ADM–6122, contacts 1 of relays DLC–5401 and ALC–5400, conductor A–5408, cable 50–55 and conductor A–5408, to connector ADM–5000.

Relay ADM–5000 connects the output of the B, C and D digit reading relays (minute tens, units and tenths), the hour register output and day register output to the disconnect multiple. The A digit will be a 1 or a 3. If a 1 is registered in the A digit relays of Fig. 13, ground extends over contact 10 of relay A0–1300, contact 11 of relay A2–1302 and contact 10 of relay A1–1301 to conductor NTR–1314 into cable A–1316; if the A digit is a 3, ground extends over contact 11 of relay A0–1300, contact 12 of relay A2–1302 and contact 11 of relay A1–1301 to conductor DTR–1315 into cable A–1316. The B digit (minute tens of 0 to 5) is represented by two grounded ones (where leads B2 and B4 represent zero) of the four conductors B0 to B4 entering cable B–1317 in Fig. 13 and joining up with cable A–1316 into cable 13–14A into Fig. 14. The C digit (minute units of 0 to 9) is represented by two grounded ones of the five conductors C0 to C7 entering cable C–1414 in Fig. 14 and joining up with cable 13–14A into cable 1415. The D digit (minute tenths of 0 to 9) is represented by two grounded ones of the five conductors D0 to D7 entering cable D–1416 in Fig. 14 and joining up with cable 1415 into cable 14–15 into Fig. 15 where it enters cable 15–50. Cable 15–50 extends to Fig. 50 where the cables A–1316, B–1317, C–1414 and D–1416 emerge and terminate their respective groups of leads on armatures of connector ADM–5000. The manners in which the hour and day outputs are fed into the armatures of connector ADM–5000 are treated in detail in the respective immediately following Sections 4.111 and 4.112, to which reference is now suggested before continuing with the present discussion. The end result is to place on armatures of connector ADM–5000 a two-out-of-five indication out of cable 49–50 representing the current calendar day, a one-out-of-three indication out of cable HT–5303 representing the hour tens value of 0, 1 or 2, and a two-out-of-five indication out of cable HU–5301 representing the hour units value of 0 to 9. All of this information is extended over contacts 1 to 29 of connector ADM–5000 and over the cables MT, MU, MP, DU, HT and HU into the disconnect multiple DISMUL which extends over cable 50–56 to the armatures of all of the assembling register disconnect connectors, such as connector DISC99–5603 for register No. 99 and connector DISC00–6203 for register No. 00.

Relays AMA–5001 and AMB–5002 pass this information on to the answer multiple. Connector AMA–5001 extends the D digit information, the minute parts (or tenths) over its contacts 1 to 5 into the answer multiple ANSMUL into cable 50–57. Connector AMB–5002 extends over its contacts 1 to 9 the minute tens and units and over its contacts 10 and 22 the day units and the hour tens and units into the answer multiple ANSMUL into cable 50–57. This answer multiple ANSMUL extends by means of cable 50–57 to armatures of all answer connectors of all assembling registers, such as connector ANS99–5701 for register No. 99 and connector ANS00–6301 for register No. 00.

Relay ARC–5003 connects the answer multiple to the assembling register check relays of Figs. 54 and 55. Connector ARC–5003, over its contacts 4 to 30, connects the answer multiple ANSMUL to cables MT, MU, MP, DU, HT and HU into cable 50–55A into Fig. 55, where cables HU (hour units), DU (day units), MU (minute units) and MP (minute parts) emerge to operate the associated assembling register check relays of Figs. 55, and where cable 55–54 continues into Fig. 54, where cables DNTR (timed disconnect or no timed disconnect), HT (hour tens), MT (minute tens) and 5409 (answer and disconnect lock lead checks) emerge to operate the associated check relays of Fig. 54.

Relay ARC–5003 connects the multiple leads ALC–5014 and DLC–5013 from the selected assembling register to the correspondingly designated check relays of Fig. 54 to indicate that the ground which will lock the operated dry-reed registers in the assembling register is available (locking circuit check).

Although the same information appears on the answer

and disconnect multiples ANSMUL and DISMUL before the armatures of the answer and disconnect connectors (such as ANS99–5701 and DISC99–5603 for register No. 99 of all assembling registers, the only connector operated is DISC99–5603, thus only the disconnect part (Fig. 56) of only register No. 99 can be operated. Thus, over contacts 1 to 29 of connector DISC99–5603 two of the disconnect day units relays DDU99–0 to DDU99–7 are operated, one of the disconnect hour tens relays DHT99–0 to DHT99–2 is operated, two of the disconnect hour units relays DHU99–0 to DHU99–7 are operated, two of the disconnect minute tens relays DMT99–0 to DMT99–4 are operated, two of the disconnect minute units relays DMU99–0 to DMU99–7 are operated, two of the disconnect minute parts relay DMP99–0 to DMP99–7 are operated, and one of the relays DTR99 and NDTR99 is operated. All of the locking contacts of these relays extend over conductor 5606, through the relay DS99–5600 to ground over contact 2 of relay RLS99–5602, which will operate in the register relay locking path when the operating grounds from the disconnect multiple DISMUL are removed where connector ADM–5000 releases. This action is treated in more detail here and in Section 4.113.

Relay DLC–5401 operates in a circuit extending from ground, over contact 2 of relay RLS99–5602, contact 30 of connector DISC99–5603, conductor DLC–5007, cable 50–56 to Fig. 50, conductor DLC–5007, contact 1 of connector ARC–5003, conductor DLC–5013, cables 50–55A, 55–54 and 5409, conductor DLC–5013 to relay DLC–5401. Relay DLC–5401, in operating with relay ALC–5400 released, opens at its contact 1 one of the circuits for operating connector ADM–5000, which, however, remains operated over contact 1 of relay ADMV–5005.

In the previously described path for the operation of the connector relay DISC99–5603 of the selected assembling register No. 99, relay STO–6103 operates in series with the connector relay DISC99–5603 to check that it is in the circuit. Relay XST–6101 operates (and in turn operates relay XSTL–6102 to open the start lead ST–6121) only if more than one assembling register connector is in the circuit, thus guarding against crosses on the start lead which may permit multiple registration of a single time entry.

A path may be traced for stepping the reader off of the timing entry just registered as follows: Ground from assembling register check relay DLC–5401 operated through the mercury contact check relays of the minute tens, hour tens, timed release index, hour units, day units, minute units and minute tenths (Figs. 54 and 55), through relay STO–6103 operated, and over a contact on the operated F digit reading translator relay of Fig. 24 to operate reader step relay RSO–2709 or RSE–2700, depending upon whether the units digit (F digit) of the call identity index is odd or even. This circuit is effective as follows. Ground extends over contact 3 of relay ALC–5400, contact 4 of relay DLC–5401, over a two-out-of-four contact check of the minute tens check relays MT0C–5402 to MT4C–5403, a one-out-of-three contact check of the hour tens check relays HT0C–5404 to HT2C–5405, a one-out-of-two check of the relays NTRC–5406 and DTRC–5407, conductor 5410, a two-out-of-five check of the four groups of check relays HU0–5500 to HU7–5501, DU0–5502 to DU7–5503, MU0–5504 to MU7–5505 and MP0–5506 to MP7–5507, conductor RS1–5508, cable 50–55, conductor RS1–5508, over contact 2 of relay ADMR–5004, to operate relay ADMV–5005. Relay ADMV–5005 operates and locks over its contact 2 to ground on the lead ADM–6122 and, in operating, releases connector ADM–5000. Connector ADM–5000, in releasing, permits relay DS99–5600 to operate (thereby releasing connector DISC99–5603) in the locking paths of the assembling register disconnect register relays of Fig. 56, as previously mentioned, and permits relay ADMR–5004 to operate from ground on conductor ADM–6122 in Fig. 50 over contact 30 of the connector ADM–5000. Relay ADMR–5004, in operating, switches the grounded lead RS1–5508 over its contact 1 to conductor RS–5008, which extends over cable 50–55 to Fig. 55 where conductor RS–5008 emerges and extends over the contact of relay STO–6103, conductor RS–6124, over contact 7 or 8, etc., of the operated F digit reading translator relay TF0–2400 to TF9–2409, to a lead RSO–2413 (for odd F digits) or a lead RSE–2412 (for even F digits), cables 24–26, 26–27, 2710, conductors RSO–2413 and RSE–2412, to reader step relay RSO–2709 or RSE–2700, the operation of one of these relays applies ground over its contact 2 to conductor RS–2611, which, as previously described, causes the reader step magnet 700 to operate to advance the tape. This releases the reading relays of Figs. 13, 14 and 15, the E and F digit translator relays of Figs. 23 and 24, the check relays of Figs. 54 and 55 and relay ADMC–6104, which releases the entire assembling register multiple and check relay connectors of Fig. 50.

4.111 *Preparing hour output*

The hour tens and units used in registering timing entries in the assembling register come from the hour register (odd or even) Figs. 44 and 45 which last received a registration. Assuming that the last hour registered in the odd hour register of Figs. 44 and 45 was the 2811EF entry from the initial end-of-tape group, relay OHAR–3503 will be operated as described in Section 4.083. The tens and units digit of the hour in the odd hour register (Figs. 44 and 45) is the correct hour at this itme and should be used without any change.

Under these conditions, the odd hour output connector OUAR–5200 is operated over a path from ground at the odd hour register of Fig. 44 to the hour register control of Fig. 35 through relay OHAR–3503 operated. This circuit extends from ground over contact 8 of any one of the hour units relays OHU1–4404, OHU2–4405 or OHU3–4503 to OHU8–4508 or contact 7 of relay OHU9–4509 to conductor RU–4409 or ground over contact 9 of relay OHU0–4403 and contact 7 of relay OHT1–4401 or contact 6 of relay OHT2–4402 to conductor RU–4409 or ground over contact 9 of relay OHU0–4403 and contact 6 of relay OHT0–4400 to conductor OOU–4408. Conductor RU–4409 in Fig. 45 extends into cable 45–44 into Fig. 44 and conductor OOU–4408 enters therewith into cable 44–35 to Fig. 35 where conductors RU–4409 and OOU–4408 extend over respective contacts 8 and 7 of relay OHAR–3503, to conductor UAR–3519, cable 35–52, conductor UAR–3519 to operate connector OUAR–5200. This connector takes the hour as registered on a decimal basis and converts the units digit into a two-out-of-five digit and passes the hour units indication out over cable HU–5301 into cable 53–50 in Fig. 53 as previously explained. Relay OTNC–5202 of the odd hour output connector circuit of Fig. 52 is operated over a similar path previously described. The resulting output is passed along to the cable HT–5303 into cable 53–50 in Fig. 53 and thence to armatures 22 to 29 of the assembling register disconnect connector ADM–5000.

In the other cases where different types of hour entries are registered other OH– – or EH– – relays of the hour register control circuits of Figs. 35 and 36 are operated to control the operation of the hour output connectors of Figs. 52 and 53 to produce the current hour values for use in the assembling register as described later.

4.112 *Preparing day output*

Only one digit is used as a registration in the assem-

bling registers to record the day on which the timing entry was made on the central office tape. This digit normally is equal to the units digit of the calendar day. However, when processing the last round of the current month the day digit to be registered for the first day of the succeeding month (3 a.m. to midnight) is not necessarily to be a one but is to be a value which is one higher than the units digit of the last day of the current month.

When processing the input straddle tape, when employing the feedback method of straddle operation, it is possible while processing the first round of a month to encounter timing entries which originated during the previous month. In this case the day digit to be registered in the assembling registers may differ from that of the calendar day on which the call is made. The day digit value which is assigned in this circumstance is determined by the number of days in the preceding month, the numbers decreasing from zero for the last day of the last round of the previous month to 9 to 8 to to 7, etc.

As was mentioned in Section 3.087, three different conditions may prevail which require different day units treatment:

(1) *Last round.*—When processing the last round of a month, the period between 12 midnight and the 3 a.m. tape cutting point is actually the first day of the next month, that is, day 01. In order that subtraction of day values be straightforward, this calendar day 01 of the succeeding month is registered as a digit value one greater than the units digit of the number of days in the current month. This permits a one day difference irrespective of the number of days in the current month. For instance, the following table shows the day digit which is registered for calendar day as part of timing entries which occur between 12 midnight and 3 a.m. on the first day of the succeeding month (that is, as part of the tape for the last day of the last round of the current month).

Days in Current Month	Digit Registered for Day 01 of Succeeding Month
28	9
29	0
30	1
31	2

(2) *First round.*—When processing the first round of a month, when employing the feedback method of straddle operation, the day units values of straddle timing entries which may be left over from the previous month's processing and which may comprise parts of calls which straddle the month change will not, if used as they stand, provide the proper day subtraction when compared to days 01, 02, 03, etc. on the first round of the current month. For instance, if there had been 31 days in the previous month and the 31st day had caused an answer straddle timing entry, which, during the processing of the first round of the current month, was to be compared to an answer time occurring on day 01 of the current month, this should give a subtraction of 1 day—but it will do so only if day 31 of the previous month were registered as a 0: similarly, if the answer day were the 30th day, the subtraction should give a 2—but only if the 30th day of the previous month is recorded as a 9, etc. The table below shows what day digit is to be registered for such straddle timing entries corresponding to the calendar day of the previous month

and the number of days in that month (X indicates an impossible situation):

Calendar Day of Previous Month	28 Day Month (Plus 2)	29 Day Month (Plus 1)	30 Day Month (As Reg.)	31 Day Month (Less 1)
20	2	X	X	X
21	3	2	X	X
22	4	3	2	X
23	5	4	3	2
24	6	5	4	3
25	7	6	5	4
26	8	7	6	5
27	9	8	7	6
28	0	9	8	7
29	X	0	9	8
30	X	X	0	9
31	X	X	X	0

(3) *Intermediate round.*—When processing intermediate rounds of a month, the day value will be the actual day units as registered, or less-one as a result of the passing of midnight in processing toward earlier days.

The day register units output connector (Fig. 49) is capable of making these necessary transformations of the day units digit as registered. The output connector is controlled through the day translator of Figs. 67 and 68, which indicates the nature of the round being processed and the number of days in the month.

The day units digit which is registered in assembling registers over contacts **17** through **21** of connector ADM–**5000** comes in over cable **49–50** from the output of the day register units output connector circuit of Fig. 49. In Fig. 49 cables A**4104** and B**4105** bring in, from the day register of Figs. 40 and 41, grounded leads from the operated day units relay, such as grounds over contacts **10** and **11** of relay DU**1–4011**, conductors U1B and U1A, cables A**4009** and B**4011** to cables A**4104** and B**4105**. This input to the connectors of Fig. 49 is transferred to the five conductors entering cable **49–50** over contacts of one of the four connectors DP**2–4903**, DP**1–4902**, DAR–**4900** and DL**1–4901** depending upon whether the units digit of the calendar day registration is respectively to be increased by two, increased by one, passed on as registered, or decreased by one, according to the above table. Under certain circumstances none of these four connectors is operated because the units digit used as part of each timing registration might be either an 8 or a 9. In this event and under these circumstances, either relay **8–4905** or **9–4904** will be operated instead of one of the other four connectors.

These relays and connectors of Fig. 49 are controlled primarily by the day translator relays of Figs. 67 and 68.

If the last round to be processed, as indicated by the setting of the last round set-up switch **19000**, is in fact the last round of the month, the relay LR–**6810** will be operated in a circuit extending from master off-normal ground on conductor MON–**1213** in Fig. 205, over the wiper of arc No. **4** of switch **19000** and over contact **11** thereof (for a 10 round month) to the LR–**20507** lead or over contact **7** thereof (for a 6 round month) to the SR–**20508** lead extending through cables **205–206A**, **155–206** and **15509**, conductor SR–**20508** and over contact **25** of relay **6R–12900** and lead LR–**20507** over cables **15509**, **155–206** and **205–206A** to the same LR–**20507** lead connected to contact **11** of arc No. **4** of switch **19000**. This LR–**20507** lead then extends over cable **67–205** to Fig. 67 to operate the relay LR–**6810**. Under these circumstances, one of the four relays **28–6700**, **29–6701**, **30–6702** and **31–6703** will be operated in a circuit as follows. The grounded LR–**20507** lead extends to the wiper of arc No. **1** of the month units switch **19002**. It may extend over any one of the contacts **2**, **5**, **7**, **9** or **10** thereof (representing months 10, 3, 5, 7 and 8—October, March, May, July and August) to conductor LD**31** extending over cable **67–205** to Fig. 67 to operate relay **31–6703**, indicating a current month of 31 days. The grounded lead LR–**20507** may extend over wiper of arc

No. 1 of switch 19002 to any one of the contacts thereof Nos. 6, 8 and 11 (representing months 4, 6 and 9—April, June and September) to conductor LD30 extending over cable 67–205 to Fig. 67 to operate relay 30–6702, representing a current month of 30 days. From contact 3 of arc No. 1 of switch 19002 (representing months 1 and 11—January or November) ground extends to the wiper 19011 of arc No. 2 of the month tens switch 19001, and over contact 2 thereof (representing a tens digit of 0—for January) to conductor LD31, etc., to operate relay 31–6703. The wiper 19011 of arc No. 2 of switch 19001 may extend over contact 3 thereof (representing a tens digit of 1—for November) and to conductor LD30 etc., to operate relay 30–6702. The wiper of arc No. 1 of switch 19002 may extend over contact 4 thereof (representing months 2 and 12—February or December), thence to the wiper 19012 of arc No. 2 of the month tens switch 19001, where it may extend over contact 6 or 7 thereof depending upon whether the month tens digit is a 0 (for February) or a 1 (for December). If contact 6 is grounded, lead LDF is grounded and extends over cable 67–205 to Fig. 67 to the leap year switch 6705 which will cause the operation of either relay 28–6700 (for a non-leap year) or relay 29–6701 (for leap year). If contact 7 is grounded, lead LD31 is grounded, etc., to operate relay 31–6703.

If the last round to be processed is some round other than the last round of the month, the wiper of arc No. 4 of switch 19000 will be set on any one of its contacts 2 through 10 and the NLR lead connected thereto will be grounded thereby—directly from any one of contacts 2 through 6 and 8 through 10 or indirectly from contact 7 over the SR–20508 lead, cables 205–206A, 155–206 and 15509, the SR–20508 lead, contact 2 of the relay 10R–15502, lead NLR, cables 15509, 155–206 and 205–206A to the previously-mentioned NLR lead which, when grounded, indicates that the last round set-up switch 19000 is not set in a position which indicates the last round of a month.

With the NLR lead grounded, one or the other of relays IR–6811 and FR–6812 will be operated as follows. The grounded NLR lead extends over cable 180–190 to Fig. 180 where it extends in parallel over a make contact (such as contact 7 or 8 as the case may be) of any operated one of the relays R0–18000 to R4–18004 and R6–18006 to R8–18008 to conductor IR, extending over cable 68–180 to Fig. 68 to operate relay IR–6811. This is the normal circumstance of an intermediate round where neither of the relays R5–18005 and R9–18009 of Fig. 180 is operated.

In the event that relay R5–18005 of Fig. 180 is operated, this will also indicate an intermediate round provided that we are dealing with a ten round month. Under these circumstances, the grounded NLR lead out of cable 180–190 in Fig. 180 will extend over contact 7 of the R5–18005 relay to conductor FIR, into cable 155–180A, conductor FIR, cable 129–155B, conductor FIR, in parallel over respective contact 23 or 22 of either relay 10RF–12901 or relay 10RL–12902, to conductor IR extending over cable 68–129 to Fig. 68 to operate relay IR–6811.

Under the feedback method of straddle tape processing it is possible that some timing entries may straddle a month change. In which event, although the last round switch 19000 may not be set in a position which indicates the last round of a month (i.e., the NLR lead will be grounded), nevertheless a last round registration may be received and thus cause the operation of either relay R5–18005 or R9–18009 of Fig. 180 due to processing the straddle tape left over from processing the previous month. In this event, the grounded NLR lead in Fig. 180 may extend over contact 7 of relay R9–18009 to the FR lead extending over cable 68–180 to Fig. 68 to operate relay FR–6812 or the grounded lead NLR in Fig. 180 may extend over contact 7 of relay R5–18005, conductor FIR, cable 155–180A, conductor FIR, cable 129–155B, conductor FIR, contact 23 of relay 6R–12900, conductor FR, extending over cable 68–129 to Fig. 68 to operate the relay FR–6812.

Under the circumstances where the lead NLR is grounded, and particularly circumstances whereunder relay FR–6812 is operated, it will be necessary to readjust the units value of the calendar day registration according to the number of days in the previous month to facilitate subtraction of day units values. Since this is the case, it will be necessary under these conditions to operate one of the relays 28–6700, 29–6701, 30–6702 and 31–6703 not according to the current month as set up on the set-up switches, but according to the month previous thereto in time. This is effected as follows. The grounded NLR lead in Fig. 205 extends to the wiper of arc No. 5 of the months units switch 19002 which, when making contact with its respective contacts 2 through 11, represents the units digits of 0 to 9 of the current month. Contact 5, for instance, represents the units digit of 3, which represents the current month of March. This contact will ground lead LDF which, as previously described, operates one of the relays 28–6700 or 29–6701 for February. Similarly, contact 4 represents the units digit of 2 for the current month of February or December. Lead 20509 extends from this contact to the wiper 19013 of arc No. 2 of the month tens switch 19001 and over contact 10 thereof for February or contact 11 thereof for December. If contact 10 is grounded (for the current month of February), this will ground lead LD31 which, as previously explained, will operate relay 31–6703 representing the 31 days in January. If contact 11 is grounded (for the current month of December), this will ground lead LD30 which, as previously explained, will operate relay 30–6702 representing the 30 days in November. Similarly, the other contacts associated with arc No. 5 of the month units switch 19002 will ground various leads and will operate one of the relays 28–6700, 29–6701, 30–6702 and 31–6703 in accordance with the month immediately previous in time to the current month.

INTERMEDIATE ROUND

Ground extends from conductor DON–1233 in Fig. 58 over contact 3 of relay CD–5802, conductor DAR–5818, cable 58–68, conductor DAR–5818, contact 4 of relay IR–6811, conductor DAR–6813, cable 67–49, conductor DAR–6813, to operate connector DAR–4900, to deposit in the assembling register as part of a timing entry the units digit of a calendar day as it exists as registered in the register of Figs. 40 and 41.

In the event that the hour register of Figs. 44 and 45 detects the passage of time past midnight (going backwards in time), relay OU23–5201 will operate (as described in Section 4.114) to extend ground over its contact 2, over conductor 5204 into Fig. 58, over contact 1 of relay LDC–5803 and through the lower winding of the polar relay DC–5804 to operate the armature thereof to its right-hand position. This completes a circuit from off-normal ground on conductor DON–1233, contact 2 of relay DRL–5800, armature of relay DC–5804, contact 2 thereof, through the lower winding of relay CD–5802, which thereupon operates to indicate a change in day as detected by the hour circuit in passing through midnight. Relay CD–5802, in operating, transfers the previously described off-normal ground circuit from contact 3 thereof to contact 4, over conductor DL1A and cable 49–58, to conductor DL1A, cable 67–49 to Fig. 67, conductor DL1A into Fig. 68, contact 9 of relay LR–6810, conductor DL1 to Fig. 67, over cable 67–49 into Fig. 49 and to conductor DL1 to operate connector DL1–4901 in Fig. 49, to cause the units digit of the calendar day registration of Figs. 40 and 41 to be trans-

ferred as the calendar day units digit of a timing entry to the assembling registers one unit less than as registered.

FIRST ROUND

Under the conditions where relay FR–6812 is operated (the reading of timing entries relating to a last round where the last round set-up switch 19000 is not adjusted to permit the reading of a last round), the timing entries are thus being read from the straddle tape produced during the previous month's accounting period. It is, therefore, necessary to adjust the calendar day portion of these straddle timing entries such that the units digit will have the proper subtraction relation to the units digit of current months timing entries in order to provide proper subtraction of day values. Under these circumstances, the grounded conductor DON–1233 in Fig. 58 extends over contact 3 of relay CD–5802 (which remains released during the reading of hour values as parts of straddle timing entries because the proper succession of hours as checked by the hour difference check—see Sections 4.114 and 4.115—is canceled for these operations) to conductor DAR–5818, cable 58–68, conductor DAR–5818, contact 3 of relay FR–6812, conductor 6814 to Fig. 67. Depending upon which of the relays 28–6700, 29–6701, 30–6702 and 31–6703 is operated, the grounded conductor 6814 will cause the straddle timing entry calendar day units digit to be registered respectively as plus two, plus one, as registered or less one according to the table previously set forth above. For instance, if relay 31–6703 is operated, the straddle timing entry calendar day must be less by one than the registration in Figs. 40 and 41. Conductor 6814, under these circumstances, extends over contact 24 of relay 31–6703 to conductor DL1, extending over cable 67–49 into Fig. 49 to operate connector DL1–4901. If relay 30–6702 is operated, conductor 6814 extends over contact 26 thereof to conductor DAR–6813, etc. to operate connector DAR–4900. If relay 29–6701 is operated, conductor 6814 extends over contact 28 thereof to conductor DP1 into cable 67–49, etc. to operate connector DP1–4902. Similarly, if relay 28–6700 is operated, conductor 6814 will extend over contact 28 thereof to conductor DP2 and over cable 67–49 to operate connector DP2–4903.

LAST ROUND

When relay LR–6810 is operated, indicating that the last round set-up switch 19000 is set at a position representing the last round of the current month, the day units digit for calendar days occurring between 12 midnight and 3 a.m. of the last day of the last round must be increased (according to the table set forth above) by one over the number of days in the current month in order that day subtraction may properly be cared for. Under these circumstances, ground extends from conductor DON–123 in Fig. 58, over contact 3 of relay CD–5802, conductor DAR–5818, cable 58–68, conductor DAR–5818, contact 2 of relay LR–6810, conductor DU–6815 into Fig. 40, over contact 2 of relay DT0–4000 (indicating a day tens digit of 0) and over contact 2 of relay DU1–4011 (indicating a day units digit of 1) over conductor DO1–4013, over cables 41–49 and 49–58, conductor DO1–4013, contact 1 of relay CD–5802, conductor DO1AR, cable 58–68, conductor DO1AR into Fig. 67. If relay 31–6703 is operated the units digit should be a 2. This is effected by using the units digit of 1 already registered and adding 1 to it by extending ground from conductor DO1AR, over contact 23 of relay 31–6703 to conductor DP1 into cable 67–49 to operate connector DP1–4902. If relay 30–6702 is operated the units digit should be a 1. This is effected by taking the units digit of 1 and using it as registered. This is accomplished by extending ground on conductor DO1AR, over contact 25 of relay 30–6702 to conductor DAR–6813 over cable 67–49 to operate connector DAR–4900. If relay 29–6701 is operated the units digit should be a zero. This is accomplished by taking the units digit of 1 as it is registered and subtracting 1 from it by extending ground on conductor DO1AR over contact 27 of relay 29–6701 and conductor DL1 over cable 67–49 to operate connector DL1–4901. Similarly, if relay 28–6700 is operated the units digit should be a 9. This is accomplished by extending ground on conductor DO1AR over contact 27 of relay 28–6700 to conductor 9, extending over cable 67–49 to operate relay 9–4904 which, upon operating, extends ground over its contacts 1 and 2 to the conductors 7 and 2, extending into cable 49–50 as a calendar day digit 9 on a two-out-of-five basis.

In the event that the day register of Figs. 40 and 41 does not show a day registration of 01, the grounded conductor DU–6815 will extend over contact 2 of relay DT0–4000 and contact 1 of relay DU1–4011 to conductor DAR–6813 or over contact 1 of relay DT0–4000 directly to conductor DAR–6813, thence to Fig. 49 to operate connector DAR–4900 to use the day units as registered.

In the event that the calendar day is registered as 01 in the registers of Figs. 40 and 41 but the hour circuit of Figs. 44 and 45 has detected the passing of midnight, relay CD–5802 will be operated as indicated above. Under this condition, ground will extend from the off-normal conductor DON–1233 in Fig. 58, over contact 4 of relay CD–5802, conductor DL1A, cable 49–58, conductor DL1A, cable 67–49, conductor DL1A into Fig. 68, contact 8 of relay LR–6810, conductor DAR–5818, contact 2 of relay LR–6810, conductor DU–6815 into Fig. 40, contact 2 of the zero tens day register relay DT0–4000, contact 2 of the one units day register relay DU1–4011, conductor DO1–4013, cables 41–49 and 49–58 into Fig. 58, conductor DO1–4013, contact 2 of relay CD–5802, conductor DO1L1, cable 58–68, to conductor DO1L1 into Fig. 67.

This condition means that day 01 is registered in the day register of Figs. 40 and 41 on a last round processing for the current month, where the day 01 was derived from the 3 a.m. splice point and where the hour circuit has detected that the tape has progressed backwards past the midnight point into the last day of the current month. The particular day register units output connector of Fig. 49 must therefore be operated which represents the proper last day units value for the current month.

If the current month has 31 days, then relay 31–6703 of Fig. 67 will be operated and the grounded conductor DO1L1 in Fig. 67 will extend over contact 25 of relay 31–6703 to conductor DAR–6813 which, as previously described, operates the connector DAR–4900 of Fig. 49 to deliver a day units value "as registered," or a day units digit of one, as is proper for a 31 day month.

If the current month has 30 days, the units digit of 1 must be reduced by one. This is accomplished by the grounded conductor DO1L1 of Fig. 67 being extended over contact 27 of relay 30–6702 to conductor DL1 which operates the "less one" connector DL1–4901 of Fig. 49 to reproduce from the registered units day digit of one an output of zero according to the current month of 30 days.

For months of 29 and 28 days, relays 29–6701 and 28–6700 will be operated and they will respectively extend the ground on conductor DO1L1 in Fig. 67 over contact 30 of relay 29–6701 to conductor 9 and over contact 29 of relay 28–6700 to conductor 8 to operate respective connectors 9–4904 and 8–4905 of Fig. 49 to provide respective units digits of 9 and 8.

4.113 *Steering registrations in assembling registers*

The dry-reed register relays of the disconnect portion of an assembling register (Fig. 56) lock in series with relay DS99–5600 to ground at the back contact of relay RLS99–5602 (Section 4.11). This back contact ground was checked by the operation of relay DLC–5401 when

the timing entry was registered. When the operating grounds for these register relays are removed from the multiple, relay DS99–5602 operates in series with the operated register relays (see Section 4.11). A transfer contact 2 on relay DS99–5600 steers the start lead path ST–5702 of the assembling register No. 99 to the winding of the dry-reed connector ANS99–5701 for the answer portion (Fig. 57) of the register No. 99 over lead ANS–5604. Thus, when this assembling register No. 99 is again selected for registration, the next timing entry will be stored in the answer portion (Fig. 57) from the answer multiple. This same action, of course, occurs also in all other assembling registers under appropriate conditions.

During the registration of timing entries in the assembling registers the connector relays AMA–5001 and AMB–5002 place the registration information on both the answer and disconnect multiples ANSMUL and DISMUL, as described, since it is not known in the common part of the register circuit whether the disconnect or answer connector relay DISC99–5603 or ANS99–5701 of the selected assembling register No. 99 will operate.

The winding of relay AS99–5700 is connected in series with the locking contacts of the register relays (Fig. 57) in the answer portion of the assembling register No. 99 and operates when the grounds making a registration are removed. This is similar to the above description of the operation of relay DS99–5600.

The functions of the various contacts on relays DS99–5600 and AS99–5700 of the assembling register No. 99 will be described in detail in succeeding sections. It is to be understood that the description of the controls associated with register No. 99 of Figs. 56 and 57 applies equally well to all other assembling registers, the specific circuit operation depending upon the call identity index (E and F digits) of the timing entry, which digits, as has been described, are effective to select for operation one of the hundred registers represented by registers No. 00 of Figs. 62 and 63 and No. 99 of Figs. 56 and 57, as well as any spare register, such as registers Nos. 100 to 103 of Figs. 69 and 70 in the event that one or more of these spare registers is or are substituting for a regular register.

4.114 *Registering and checking hour entries*

As described in Section 4.083 the machine comprises two identical registers (Figs. 44 and 45) which receive from the tape or from one another an hour value which may be read out from one of these registers through its respective hour output connector (Figs. 52 and 53) to continually provide the machine with the current hour value.

Assuming a normal succession of 2810EF regular hour entries, the hour difference check relays of Fig. 51 check to insure that each succeeding regular hour entry is one less than the previously registered one. With an hour registered in the odd hour register of Figs. 44 and 45, relay EH–3600 is operated in the hour register control of Figs. 35 and 36 to indicate that the next hour entry is to be registered in the even hour register of Fig. 45.

Assuming that the next hour entry is not an irregular hour entry (281899 or 281999), a path is closed from the G1 or G2 reading cam of Fig. 7, to the reading relay up-check conductor RCK–1021 into Fig. 13, over the up-check path through the reading relays of Figs. 13, 14 and 15, conductor UC–1510, cable 23–25, conductor UC–1510, contact 8 of relay TI–2501, conductor UC–2510, contact 4 of relay SR1E–2605 or relay SR1O–2705 (one or the other of which will have been operated preparatory to reading and stepping off of the first line of an initial entry), conductor UC–2610, cable 26–15, conductor UC–2610, cable 15–13, conductor UC–2610, contact 6 of relay B1–1304 and contact 4 of relay B7–1307 (to check the B digit of 8), contact 4 of relay A1–1301 and contact 6 of relay A2–1302 and contact 4 of relay A0–1300 (to check the A digit of 2), conductor 1310, contact 9 of relay C1–1401 and contact 7 of relay C0–1400 (to check the C digit of 1), conductor 281–1413, contact 9 of relay D4–1408 and contact 7 of relay D7–1409 (to check the D digit of 0), to conductor N281AP, cable 23–35, conductor N281AP, contact 3 of relay EH–3600 (operated to steer the next, that is, the present regular hour entry into the empty even hour register of Fig. 45), contact 6 of relay EHRL–3602, conductor HR–3611, cables 3612 and 36–34, conductor HR–3611, to operate the even hour connector EHR–3401.

The operation of the connector EHR–3401, as has been explained earlier, connects the decimal output of the E and F digit reading relays of Fig. 15 to the even hour tens and units register relays respectively of Fig. 45. Also ground over contact 24 of relay EHR–3401 extends over conductor 2106 into Fig. 14 where it extends over contact 5 of relay D7–1409 and contact 8 of relay D4–1408 (for the D digit of 0), over conductor 0 into cable D14–32 to Fig. 32, where conductor 0, indicated as D0, extends into and over cable 32–33A to Fig. 33.

The grounded lead D0 in Fig. 33 extends into Fig. 34 and over contact 17 of relay EHR–3401 to conductor HL1–3407 (indicating that the hour difference check is to be for an hour or less than the one currently registered in the odd hour register of Figs. 44 and 45), cables 36–34 and 3610, conductor HL1–3407, to operate relay EHL1–3605.

Assuming that the previously registered hour entry was a regular hour entry 2810EF, relay OHL1–3505 is operated (as above for relay EHL1–3605) and closes a path through the OHU0–4403 relay to operate relays TARE–5106 and UE–5100 to check the expected decrease of hour value by 1 provided the previously registered (in even register) hour value in the units digit was not zero. The grounded lead D0 in Fig. 34 also extends over contact 16 of relay EHR–3401, conductor DL1–3409, cables 36–34 and 3612, conductor DL1–3409, contact 11 of relay OHL1–3505 (operated by the previous regular hour entry 2810EF which is now the old regular hour registered in the odd register of Figs. 44 and 45), conductor DL1 into cable 44–35, conductor DL1, contact 2 of relay OHU0–4403 (to check that the units value of the old hour is not zero), conductor TAR–O, cables 4415, 44–51 and 4415, conductor TAR–O, relay TARO–5107 and relay U0–5101, both of which thereupon operate.

A circuit is thereupon completed to step the reader provided that the new hour value as registered in the even register of Fig. 45 is one less than the old one registered in the odd register of Figs. 44 and 45. Ground extends from Fig. 45, through the up-check path (UC1) of the even register, conductor UC–4518, cables 4512 and 45–36, conductor UC–4518, contacts 2 of relays EHARS–3604 and EHAR–3603 and EHL1–3605, conductor 3613, contacts 2 of relays OHL1–3505 and OHAR–3503 and OHARS–3504, conductor UC–3523, cables 44–35 and 45–44, conductor UC–3523, over a one-and-one-only operated check of the units relays OHU9–4509 to OHU0–4403 comprising contact 3 or 4 of relay OHU9–4509, contact 3 or 4 or 5 of relays OHU8–4508 to OHU3–4503, conductor 4524 or 4520, contact 3 or 4 or 5 of relays OHU2–4405 and OHU1–4404 and contact 6 or 7 of relay OHU0–4403, thence over an obvious one-and-one-only operated check of the tens relays OHT2–4402 to OHT0–4400, conductor UC1–4416 to Fig. 45, over a one-and-one-only check of the even tens relays (only EHT2 shown), out over one of the leads T0 or T1 or T2 into cables 4521, 45–51 and 4520, conductor T0 or T1 or T2, contact 1 or 2 or 3 of relay TARO–5107 to conductors T0 or T1 or T2 (the tens digit must be the same) into cables 5110, 44–51 and 5110, the corresponding lead T0 or T1 or T2 of the odd tens relays, conductor DCT–4417 into Fig. 45,

thence over a contact of the operated units relay (not shown) of the even register and out on one of ten leads U0 to U9 into cable 4522, thence over cables 45–51 and 45–22, to one of the conductors U0 to U9 representing the units value of the even register. There ten leads U0 to U9 out of cable 4522 pass over contacts 9 to 1 to 10 of relay U0–5101 to a units value one greater than the input. If this checks with the units registration in the odd register then it is assured that the new registration (even register) is one less than the old one (odd register). The leads U0 to U9 into cable 5111 extends over cables 44–51 and 5111, to conductors U0 to U9 and over a contact of the operated odd units relay of Figs. 44 and 45 (if it agrees), to conductor DCU–4523, cables 45–44 and 44–35, contact 9 of relay OHL1–3505, lead RS into cables 3522 and 35–34, lead RS, contact 11 of connector OHR–3400 to the reader step lead RS–1808, which, as previously explained, extends to and operates the reader step relay RS–2600 to step the reader.

Other operations take place whenever the units digit in the old hour (odd register) is zero, such as hours 00, 10 and 20. In the event that the units digit is 0 and the tens digit is 0, then the check relay SO–5109 is operated. If the units digit is 0 and the tens digit is not 0 (that is, a 1 or a 2), then the check relays T0–5104 and U0–5101 will operate in series.

If the units digit is zero and the tens digit is also zero, the ground on conductor DL1 in Fig. 44 extends over contact 3 of relay OHU0–4403, contact 7 of relay OHT0–4400, conductor S–0, cables 4415, 44–51 and 4415, conductor S–0, to relay SO–5109. The new hour (even side) 23 must check against the old hour (odd side) 00. The even tens conductor T2 out of cable 4521 in Fig. 51 extends over contact 2 of relay SO–5109 to the odd tens conductor T0 into cable 5110. The even units conductor U3 out of cable 4522 in Fig. 51 extends over contact 1 of relay S0–5109 to the odd units conductor U0 into cable 5111.

If the units digit of the old hour (odd side) is zero and the tens digit is not zero (that is, a 1 or a 2), then the grounded conductor DL1 in Fig. 44 extends over contact 3 of relay OHU0–4403, contact 8 of relay OHT0–4400, conductor T–0, cables 4415, 44–51, 4415, conductor T–0, relay T0–5104 and relay U0–5101. The new hour (even side) must check one less than the old hour (odd side) of 10 or 20. That is, the new hour must check to be 09 or 19 as against the old hour of 10 or 20. The new hour (even) tens lead T0 or T1 out of cable 4521 in Fig. 51 extends over contact 1 or 2 of relay T0–5104 to the old hour (odd) tens lead T1 or T2 into cable 5110. The new hour (even) units lead U9 out of cable 4522 extends over contact 10 of relay U0–5101 to the old hour (odd) units lead U0 into cable 5111.

It will be noted here that whenever the new regular hour 00 is received and is to be checked as one less than the old regular hour, the relay OU23–5201 or EU23 (not shown) in Fig. 53) will be operated to provide the hour output of 23 (since the receipt of a regular hour 00 indicates a passage past midnight—backwards in time) and to control the day register control circuit of Fig. 58 to indicate a day change as mentioned in Section 4.112. Under these circumstances, assuming the new registration to be placed into the odd register of Figs. 44 and 45, ground extends over contact 9 of relay OHU0–4403, contact 6 of relay OHT0–4400, conductor OOU–4408, cable 44–35, conductor OOU–4408, contact 6 of relay OHL1–3505 (operated to indicate a regular hour entry), conductor U23, cable 35–52, conductor U23, to relay OU23–5201. This relay alters the units zero registered in the odd register of Figs. 44 and 45 into a 3 at the output connectors of Figs. 52 and 53 and, by grounding conductor 5204, affects the day register control circuit of Fig. 58 to reflect a day change, as has been described. At the same time, ground extends over contact 1 of relay OHU0–4403, conductor OT–4407, cable 44–35, conductor OT–4407, contact 5 of relay OHL1–3505, conductor TC, cable 35–52, conductor TC, to operate the tens change relay OTC–5203. This alters the tens digit of 0 to a 2 at the output.

If the units digit is 0 and the tens digit is not zero, ground extends over contact 9 of relay OHU0–4403, contact 7 of relay OHT1–4401 or contact 6 of relay OHT2–4402, conductor RU–4409, cables 45–44 and 44–35, conductor RU–4409, contact 7 of relay OHL1–3505, conductor UL1, cable 35–52, conductor UL1, to operate relay OUL1–5300, which reduces the units output by one. As above, relay OTC–5203 will reduce the tens digit output by one.

If the units digit is other than zero, ground is applied over contacts 7 and 8 of one of the relays OHU1–4404 to OHU8–4508 or contacts 6 and 7 of relay OHU9–4509, to conductors RT–4410 and RU–4409, which extend over cables 45–44 and 44–35 to Fig. 35 where conductor RT–4410 extends directly to conductor TNC and conductor RU–4409 extends over contact 7 of relay OHL1–3505 to conductor UL1. Conductors TNC and UL1 extend over cable 35–52, conductors TNC and UL1 to operate relays OTNC–5202 and OUL1–5300, which operate to pass the tens output without change and the units output less one.

These same operations apply equally well to the even hour output connectors (not shown) in Fig. 53.

If the old hour (odd side) had been an end-of-tape hour entry 2811EF with a D digit of 1 (as distinguished from a regular hour 2810EF with a D digit of 0), then relay OHAR–3503 would have been operated instead of relay OHL1–3505. Any regular hour entry 2810EF read after such a registration will be placed with the even hour register and must necessarily check the same as the one in the odd side. Here the grounded digit lead D1 in Fig. 34 extends over contact 19 of relay EHR–3401, conductor HAR–3406, cables 36–34 and 3610, conductor HAR–3406 to operate relay EHAR–3603 instead of relay EHL1–3605. It will be apparent under these conditions that the tens-no-change and units-as-registered output connectors OTNC–5202 or ETNC (not shown) and QUAR–5200 or EUAR (not shown) will be operated to provide output as registered. Furthermore, the check connectors UAR–5102 and TAR–5105 will be operated to permit reader step upon a check that the new hour (even) is the same as the old hour (odd). This circuit extends from ground on the D0 lead in Fig. 34 (D digit of 0 in the new regular 2810EF hour), contact 16 of relay EHR–3401, conductor DL1–3409, cables 36–34 and 3612, conductor DL1–3409, contact 12 of relay OHAR–3503, conductor 3524, to relays TAR–5105 and UAR–5102. Inspection will show that these operated relays check for a coincidence of hour registrations.

If the old hour (odd side) had been a regular hour entry 2810EF and the new hour (even side) is an end-of-tape hour 2811EF, relay EHAR–3603 will be operated as before. And, with relay OHL1–3505 operated, relays of the check connector of Fig. 51 will be operated to check for a decrease in one for the new hour and the output connectors will operate to supply the hour output as registered.

When 2811EF end-of-tape hour entries occur in succession the second or succeeding 2811EF entries are not checked for value since they may represent a start of a new series of hour entries for a new tape section. Relay SDC–3509 of the hour register control operates under this condition to shunt out the hour difference check path.

With an old end-of-tape hour 2811EF in the odd side, relay OHAR–3503 will be operated. Relay EHR–3401 will operate and will cause relay EHAR–3603 to be operated from the D digit of 1 in the new end-of-tape hour 2811EF to be registered in the even register. The grounded lead D1 in Fig. 34 extends over contacts 19 and 20 of relay EHR–3401, conductor DC, cables 36–34

and 3612, conductor DC, contact 9 of relay OHAR–3503, contact 5 of relay CHS–3506, to relay SDC–3509. With relay SDC–3509 operated, the hour check is cancelled as follows: the ground from contact 3 or 4 of relay OHT0–4400, which originated in up-check paths of both registers and their control relays of Figs. 35 and 36, normally would extend over conductor UC1–4416 over to Fig. 45 to start the hour difference check circuit (previously described), which, if properly completed, would cause reader step; however, since relay SDC–3509 is operated, conductor UC1–4416 extends over the contact thereof, and over contact 10 of relay OHAR–3503 to the reader step lead RS without accomplishing an hour check.

There is an exception to this latter-described condition when relay CHS–3506 has been operated from the recorder register control as described in Section 4.31. Under this condition relay SDC–3509 is prevented from operating and the hour is checked to insure that it agrees with the previously registered hour value.

The operation of the reader step relay RS–2600 as a result of one of the above operations closes a path through relay EHAR–3603 or EHL1–3605 operated and relay OH–3500 normal to operate relay OHRL–3502. Ground on lead KB8 in Fig. 26 is extended over contact 8 of relay RS–2600 to conductor RSG–2612, thence over contact 10 of relay EHL1–3605 or contact 11 of relay EHAR–3603, conductor 3614, contact 2 of relay OH–3500, conductor 3525, to relay OHRL–3502; which operates and locks over its contact 5 and contact 2 of relay OHDC–3501 to off-normal ground on conductor HON–1227.

Relay OHRL–3502, in operating, releases the odd hour register relays of Figs. 44 and 45 and the operated OHL1–3505 or OHAR–3503 relay.

Relay OHRL–3502, in operating, operates relay OH–3500, which locks to relay EHRL–3602 normal. Ground on conductor HON–1227 extends over contact 3 of relay OHRL–3502 to operate relay OH–3500, which locks over its contact 1, conductor 3526, and contact 2 of relay EHRL–3602 to ground on conductor HON–1227 independently of relay OHRL–3502.

Relay OHRL–3502, in operating, also releases relay EH–3600.

Relay OHDC–3501 operates when the odd hour register of Figs. 44 and 45 and its control relays OHARS–3504 and OHAR–3503 and OHL1–3505 and when relay EH–3600 are normal. This circuit was previously described at the start of the description of initial end-of-tape checking (see Section 4.061). Should relay OHDC–3501 operate in the open interval of a reader cycle relay OHRL–3502 is held operated over contact 1 of relay OHDC–3501 to ground on the KB8 lead from the K8 reader cam contact of Fig. 7.

Relay OHRL–3502 releases at the beginning of the open reading interval and the hour circuit is then ready to receive immediately the next hour entry from the tape without delay. This entry is, of course, registered in the opposite (in this case odd) hour register and the process is repeated.

When an irregular hour entry (281899 or 281999) is read, a path is established through the operated reading relays and relay OH–3500 or EH–3600 to operate the irregular hour register connector relay OHA–3402 or EHA–3403. For instance, with the odd side released and the even side operated, relay OH–3500 will be operated as above described. Ground on lead 281–1413 of Fig. 14 (evidencing a check of the A, B and C digits of 281) will be extended over contact 9 of relay D1–1406 and contact 6 of relay D7–1409 (for a D digit of 8) or over contact 10 of relay D2–1407 and contact 8 of relay D7–1409 (for a D digit of 9) to conductor 281AP and over cable 23–35, conductor 281AP, contact 14 of relay H25–3508, conductor 3527, contact 4 of relay OH–3500, contact 8 of relay OHRL–3502, conductor HA–3528, cables 3521 and 35–34, conductor HA–3528, to relay OHA–3402.

This relay, OHA–3402 or EHA–3403, in operating, connects the current hour output from the opposite hour register into the other hour register and indicates that the hour is to be treated as one less by operating the associated OHL1–3505 or EHL1–3605 in the hour register control of Figs. 35 and 36. For instance, with the odd irregular hour connector relay OHA–3402 operated, the hour registered in the even side (Fig. 45) will be transferred to the odd register (Figs. 44 and 45) reduced by one hour if the old hour (even side) was a regular hour or not changed if the old hour was an end-of-tape hour. If the old hour (even side) was a regular hour then the relay EHAR–3603 and the even hour output connectors (of Fig. 53) ETNC (not shown) and EUAR (not shown), which are arranged similarly to the corresponding ones of the odd hour output connector circuit (of Figs. 52 and 53) such as OTNC–5202 and OUAR–5200, will be operated. The registered hour in the even register of Fig. 45 will be passed through the even output connectors of Fig. 53 unchanged, where the tens and units conductors extend over cables 5304 and 5305, over cable 53–34 to Fig. 34, where the units leads extend over contacts 1 to 10 of connector OHA–3402 into cable 3413 and to cable 34–44 and where the tens leads extend over contacts 12, 13 and 14 of connector OHA–3402 into cable 3412 and to cable 34–44. Cable 34–44 extends to Fig. 44 where the tens leads (over cable 4419) operate one of the odd hour tens relays OHT0–4400 to OHT2–4402 and where the units conductors extend over cables 4417, 4418 and 44–45 to operate one of the odd hour units relays OHU0–4403 to OHU2–4405 or OHU3–4503 to OHU9–4509. This registration is thus the same as the old one in the even side. Relay OHL1–3505 operates from ground, over contact 16 of connector OHA–3402, conductor HL1–3408, cables 35–34 and 3522, conductor HL1–3408, to relay OHL1–3505, as is the usual case as previously described for registration of a regular hour entry. Also ground extends over contact 15 of connector OHA–3402, conductor DL1, cables 35–34 and 3521, conductor DL1, contact 12 of relay EHAR–3603 to conductor 3524, which, as previously described, extends to Fig. 51 to operate the check connectors TAR–5105 and UAR–5102 to check the two hour registrations as the same as a prerequisite to releasing the even hour registration and stepping the reader. If the old registration (even side) had been a regular hour entry, then relay EHL1–3605 and even hour output connectors of Fig. 53 would have been operated to provide an output one less than the registration. This would then be passed into the odd hour register as before. The grounded DL1 lead in Fig. 36 would then extend over contact 11 of relay EHL1–3605 (instead of contact 12 of relay EHAR–3603) to conductor DL1 into cables 45–36 and 4517 into the even hour register of Fig. 45. Depending upon the type of hour registered therein, as previously described for the odd side, one of the leads TAR–E or S–E or T–E into cable 45–51 from the even hour register would be grounded, thereby operating the two check connectors TARE–5106 and UE–5100 or the connector SE–5108 or the pair of connectors TE–5103 and UE–5100 to check that the hour in the odd side is one less than the hour in the even side. This is prerequisite to releasing the even side and stepping the reader.

If the mutilation entry is a 281899 entry no special action in addition to the above is taken because this entry takes the place of a missing hour entry. However, if the entry is a 281899, this indicates that the next line is a mutilated hour entry. It is, therefore, necessary to skip the next line. This is accomplished as described in more detail in Section 4.36 under the control of the skip entry control relay circuit in the lower left portion of Fig. 16. It may be mentioned here that if the D digit

is a 9 the D2 lead in Fig. 34 will be grounded from the D reading relays of Fig. 14 and the ground will be extended over contact **17** of relay OHA–**3402** and conductor **3410**, to operate relay **2819–1608**, which, as described in Section 4.36, controls the line skipping operation.

When reading the straddle tape with the feedback method of straddle operation, 2812EF hour entries comprise part of the straddle timing entries as described in more detail in Section 4.115, relays EHARS–**3604** and OHARS–**3504** are operated when registering these hour entries to indicate that no check is made of the hour sequence. Contacts **8** on these relays by-pass the hour difference check network directly without operating relay SDC–**3509**. Also, relay OU**23–5201** cannot operate upon a passage through midnight and thus relay CD–**5802** is not operated, as mentioned under the discussion of "First round" control of the day output digit in Section 4.112.

4.115 *Reading straddle timing entries*

The straddle timing entries consist of three lines which appear in the order 2812EF, 2822EF and ABCDEF, where the 2 in the D digit of the hour (2812EF) and day (2822EF) entries characterizes them as parts of straddle timing entries and where the A digit of the time line (ABCDEF) is a 3 for timed-disconnect times or a 1 for regular answer or disconnect times, just as in the case of usual regular or emergency tape timing entries previously discussed. The first two entries appear and are treated in a manner similar to regular hour and calendar day entries. The third line is identical with the timing entries read while processing the regular central office recorder tapes.

Since the second line of the straddle timing is a calendar day entry, which normally occurs only during the reading and checking of an end-of-tape group, and since it is necessary to make a check when reading a straddle timing entry that all three lines thereof have been received, part of the tape identity reading progress circuit of Figs. 21 and 22 is used to insure this sequence.

The reading of the 2812EF hour line of the straddle timing entry operates one of the hour register connectors OHR–**3400** and EHR–**3401** in the usual manner. However, the D digit of 2 grounds lead **D2** in Fig. 34 and, assuming connector OHR–**3400** to be operated to register this hour entry into the odd hour register of Figs. 44 and 45, this ground is extended over contact **18** of relay OHR–**3400**, conductor HARS, cables **35–34** and **3522**, conductor HARS, to operate relay OHARS–**3504**. This relay, in operating, extends the grounded conductor **UC1–4416** (grounded, as described in previous sections relating to the registration of hourly entries, to indicate that the register has been operated) over contact **8** thereof directly to the reader step lead RS into cables **3522** and **35–34** and conductor RS, over contact **11** of connector OHR–**3400** to step the reader by grounding conductor RS–**1808** which, as previously described, operates the reader step relay RS–**2600**. When the registration of the line has been checked, relay CL**1–2201** of the tape identity reading progress is operated in parallel with the reader step relay RS–**2600** over a path through relays OHARS–**3504** and OHR–**3400** operated. This circuit extends from ground on the up-check conductor UC**1–4416** in Fig. 35, over contacts **8** and **9** of relay OHARS–**3504**, conductor CL**1–3529**, cables **3522** and **35–34**, conductor CL**1–3529**, over contact **15** of relay OHR–**3400** to conductor CL**1–3411** extending over cable **33–22** to Fig. 22 where it operates relay CL**1–2201**.

(NOTE.—A similar path for operating relays RS–**2600** and CL**1–2201** is closed—whenever an end-of-tape hour entry 2811EF is registered in an hour register—from ground on conductor DCU–**4523** in Fig. 35 over contacts **10** and **13** on relay OHAR–**3503**.)

Relay CL**1–2201**, in operating, operates relay TI–**2501** of the tape identity progress control to prevent any call entries from being read at this time and permitting only the entries to be read which are indicated by operated CL– relays of Figs. 21 and 22, as described in Section 4.08, etc. This circuit extends from ground, over contact **8** of relay CL**1–2201**, conductor TI–**2107**, cables **21–25**, **25–22** and **2512**, conductor TI–**2107** to relay TI–**2501**, which operates to bring the tape identity reading progress control circuits of Figs. 21 and 22 into play as described in Section 4.08, etc.

With relay CL**1–2201** operated, the circuit may accept a 282DEF day entry. Should a day be registered at this time, the first reading of the 2822EF entry will release that registration. This circuit is effective from ground on the up-check lead UC–**1510** in Fig. 15 (indicating a proper operation of all reading relays), cable **23–25**, conductor UC–**1510**, contact **7** of relay TI–**2501**, conductor UCI–**2513**, cables **2512**, **25–22** and **2204**, conductor UCI–**2513**, contact **2** of relay CL**1–2201**, conductor **282–2213**, contact **6** of relay C**0–1400** and contact **8** of relay C**2–1402** (to check the C digit of 2), conductor **1310**, contact **4** of relay A**0–1300** and contact **6** of relay A**2–1302** and contact **4** of relay A**1–1301** (to check the A digit of 2), contact **4** of relay B**7–1307** and contact **6** of relay B**1–1304** (to check the B digit of 8), conductor UC–**2610**, cables **15–13** and **26–15**, conductor UC–**2610**, contact **4** of either of relays SR1E–**2605** or SR1O–**2705**, conductor UC–**2510**, contact **9** of relay TI–**2501**, conductor SRD–**2514**, cables **2512**, **25–22** and **22–04**, conductor SRD–**2514**, contact **7** of relay CL**1–2201**, conductor **282–2212**, cables **3222**, **32–49** and **49–58**, conductor **282–2212**, contact **3** of relay DDC–**5805** (released to indicate an operated day register), conductor DRL**1**, cables **49–58**, **32–49** and **32–33B**, conductor DRL**1**, contact **18** of the released day register connector DR–**3300**, conductor DRL, cables **32–33B**, **32–49** and **49–58**, conductor DRL, to relay DRL–**5800**. The day release relay DRL–**5800**, in operating, removes at its contact **2** the off-normal ground previously supplied by conductor DON–**1233** to conductor L–**5819**, which, as shown in Figs. 40 and 41, is the locking lead for the day register relays. When the day register of Figs. 40 and 41 is normal, the day register connector DR–**3300** will operate and will thereby permit the day value to be registered on a decimal basis from the E and F digit reading relays of Fig. 15, as described in Section 4.084.

Relay CL**2–2202** operates upon the successful registration of and the advance of the tape from the 2822EF day entry, as previously described, and relay CL**1–2201** eventually releases.

During the registration of the day entry the value 2 in the D digit of this entry will have operated relay STE–**2203** of the tape identity reading progress circuit to indicate that the third line of the straddle timing entry must follow. This circuit will have been completed from ground on the lead D2 out of cable **32–33A** in Fig. 33 (supplied from the D reading relays of Fig. 14), over contact **17** of the operated connector DR–**3300**, conductor STE, to relay STE–**2203**, which operates and locks over its contact **5** to the locking ground on conductor IL–**2511** supplied over contact **5** of relay TI–**2501** from the operating ground thereon.

With relay STE–**2203** operated, the release of relay CL**1–2201** upon the operation of relay CL**2–2202** prevents an attempt of the tape identity progress control to deal with these entry lines as a complete end-of-tape group.

With relay STE–**2203** operated, the reading of the third line of the straddle timing entry, with relay TI–**2501** of the tape identity progress control still operated, closes a path to operate the relays necessary for the registering of the timing entry in an assembling register. Relays ADMC–**6104** and CST–**6100** of the assembling register connector control circuit will be operated to control the timing connectors of Fig. 50 as described in Section

4.11. Since these straddle timing entries are "call starts" (disconnect times or disconnect and answer times) left over from the previous month's processing, necessarily the first one will be registered as a disconnect time entry, etc.

In this process relays ADMC–**6104** and CST–**6100** of the assembling register connector control must be operated. Relay CST–**6100** operates over a path starting with the check path of the reading relays through relays TI–**2501**, STE–**2203** and A1–**1301** operated. This circuit extends from ground on conductor UC–**1510** in Fig. 15 (indicating a complete up-check of all reading relays), cable **23–25**, conductor UC–**1510**, contact **7** of relay TI–**2501**, conductor UCI–**2513**, cables **2512**, **25–22** and **2204**, conductor UCI–**2513**, contact **2** of relay STE–**2203**, conductor **1313**, contacts **6** and **7** of relay A1–**1301** (operated for both A digits of 1 and 3), conductor CST–**1312**, cable **14–61**, conductor CST–**1312**, to relay CST–**6100**. The path for operating relay ADMC–**6104** is through relays A1–**1301** operated, FI–**2500** normal, RC–**900** operated, ADD–**6107** and RLS–**6108** normal, one of the relays B0–**1303**, B2–**1305** and B4–**1306** operated, one of the relays SR1O–**2705** or SR1E–**2605** operated, and relay TI–**2501** and STE–**2203** operated. This circuit extends from the ground on lead **1313** in Fig. 13, over contact **6** of relay A1–**1301**, conductor BN8–**2519**, cable **23–25**, conductor BN8–**2519**, contact **10** of relay FI–**2500**, conductor BN8–**916**, cables **18–26** and **9–18**, conductor BN8–**916**, contact **30** of connector relay RC–**900**, conductor BN8–**6120**, cable **14–61**, conductor BN8–**6120**, contacts **1** of relays ADD–**6107** and RLS–**6108**, conductor BN8–**1311**, cable **14–61**, conductor BN8–**1311**, contact **6** of relay B4–**1306** or **7** of relay B2–**1305** or **4** of relay B0–**1303** (to check that the B digit is not an 8), conductor UC–**2610**, cables **15–13** and **26–15**, conductor UC–**2610**, contact **4** of relay SR1E–**2605** or relay SR1O–**2705**, conductor UC–**2510**, contact **9** of relay TI–**2501**, conductor SRD–**2514**, cables **2512**, **25–22** and **2204**, conductor SRD–**2514**, contact **6** of relay STE–**2203**, conductor ADM–**4218**, to relay ADMC–**6104**. The operation of relays CST–**6100** and ADMC–**6104**, as described in Section 4.11, causes the registration of the timing entry in the assembling register (Figs. 56, 57, 62 and 63) corresponding to the call identity index (E and F digits) of the timing entry.

When the entry has been successfully registered in the assembling register selected by the translation of the E and F digits read from the tape, one of the reader step relays RS0–**2709** and RSE–**2700** operates. This circuit has been described previously as extending from ground on conductor RS1–**5508** of Fig. 55 (as an indication that the timing entry was passed through the assembling register connector circuit of Fig. 50), cables **50–55**, conductor RS1–**5508**, contact **1** of relay ADMR–**5004**, conductor RS–**5008**, cable **50–55**, conductor RS–**5008**, the contact of relay STO–**6103** (operated as a check that only one assembling register answer or disconnect connector is operated), conductor RS–**6124**, over a contact **7** or **8** of one of the F digit translator relays of Fig. 24, to conductor RSO–**2413** (if an odd relay such as TF1–**2401** or TF9–**2409** is operated) or to conductor RSE–**2412** (if an even relay such as relay TF0–**2400** is operated), over cables **24–26**, **26–27** and **2710**, conductor RSO–**2413** or RSE–**2412** to operate reader step relay RSO–**2709** or RSE–**2700**. During the open interval of the reader cycle a path is closed through a make contact on relay RSO–**2709** or RSE–**2700** and relay STE–**2203** operated to operate relay ETE–**2502**. This circuit extends from ground, over contact K8 of the reader in Fig. 8, conductor KB8, cables **8–9**, **9–18** and **18–26**, conductor KB8, contact **5** of relay RSE–**2700** or RSO–**2709**, conductor ETE–**2711**, cables **2710**, **26–27**, **24–26** and **22–24**, conductor ETE–**2711**, contact **7** of relay STE–**2203**, conductor ETE–**3223**, cables **2204** and **25–22**, conductor ETE–**3223**, to relay ETE–**2502**.

The operation of relay ETE–**2502**, as previously described, restores the tape identity reading progress and tape identity progress control relays to normal so that the further processing of call entries (initial entries) or the restart of the progress for new straddle timing entries may occur.

4.12 *Registering initial entries*

The central office tape is read backwards in time so that the machine records the disconnect and answer timing entries of a call prior to reading the associated initial entry from the tape. Hence, when the initial entry is read from the tape the complete call, except in the case of possible straddle calls, is available in the machine and its disposition may proceed.

As indicated in Section 2.13, an initial entry may consist of either two or four lines. Two-line entries are for bulk-billed calls and take the form of a first line 2BCDEF followed by a second line 0BCDEF as read by the tape reader. The A digit of 2 characterizes the line as the first line of an initial entry; the B digit of 1 in the first line indicates a bulk-billed call; the C and D digits of the first line comprise the billing index and indicate the basic changing rate for this call (usually only the C digit is necessary, the D digit not being used); and, the E and F digits are the tens and units digits of the call identity index. The A digit of zero in the second line indicates a supplemental line of an initial entry; the B digit represents the calling office within the marker group by an index number; and, the C, D, E and F digits are the thousands, hundreds, tens and units digits, respectively, of the calling line numericals. Four-line entries are for detail billed and observed calls and take the form of four lines successfully 2BCDEF, 0BCDEF, 0BCDEF and 0BCDEF. In this case, the B digit of line 1 is a 3 (for message unit detail or toll calls) or a 4 (for observed calls); the B digit of line 3 is a calling area index; the C digit of line 3 is a 3 or a 4 or a 5 indicating a called number numerical part consisting of 3 or 4 or 5 digits; the D, E and F digits of line 3 represent the A, B and C called office code digits; and, the B, C, D, E and F digits of line 4 represent the thousands, hundreds, tens, units and station (party) digits of the called line numericals.

The first line of an initial entry is indicated by the operation of the reading relay A2–**1302**. A path may be traced for operating the register connector relays for the first line of the initial entry in either the odd or even call register portion of the machine as follows: Ground on the reading relay up-check lead UC–**1510** in Fig. 15 extends over cable **23–25**, conductor UC–**1510**, contact **8** of relay TI–**2501**, conductor UC–**2510**, contact **4** of relay SR1E–**2605** (operated if this initial entry is to be registered in the even side of the call entry register) or contact **4** of relay SR1O–**2705** (operated if the entry is to be registered in the odd side of the call entry register), conductor UC–**2610**, cable **26–15**, conductor UC–**2610**, cable **15–13**, conductor UC–**2610**, contact **4** of relay B0–**1303** or contact **7** of relay B2–**1305** or contact **6** of relay B4–**1306**, conductor BN8–**1311** (indicating that the B digit is not an 8), cable **14–61**, conductor BN8–**1311**, contacts **1** of relays RLS–**6108** and ADD–**6107**, conductor BN8–**6120**, cable **14–61**, conductor BN8–**6120**, contact **30** of connector RC–**900**, conductor BN8–**916**, cables **9–18** and **18–26**, conductor BN8–**916**, contact **10** of relay FI–**2500**, conductor BN8–**2519**, cable **23–25**, conductor BN8–**2519**, contact **8** of relay A1–**1301** (the A digit is not a 1 or a 3), conductor **2–1318**, cable **15–13**, conductor **2–1318**, contact **32** of connector RC–**900**, conductor **2–918**, conductors **2–1318** and **2–918** continuing from Fig. 15 over cable **26–15** to Fig. 26 where they go different ways for different reasons.

Conductor **2–1318** in Fig. 26 extends over contact **3** of relay SR1E–**2605** or relay SR1O–**2705**, to conductor AD–**2617**, cables **42–25**, **4219** and **42–61**, conductor AD **2617**, to operate relay ADCN–**6106** to start the process of transferring the timing entries to the call entry register, as described in detail in Section 4.121.

Conductor **2–918** in Fig. 26 extends over contact **2** of relay SR1E–**2605** to conductor CL–**2616** into cables **26–27A** and **27–149** to Fig. 149 or over contact **2** of relay SR1O–**2705** to conductor CL–**2713** into cables **2712** and **27–149** to Fig. 149.

In Fig. 149, cable **2712** comes out of cable **27–149** and extends into the odd register control circuit of Figs. 123 and 124; whereas, cable **26–27A** extends into the even register control circuit of Figs. 175 and 176. Since the details have been shown only for the odd call entry register (the even side being the same) it will be best to describe things as though the present initial entry were going into the odd side. It will be recalled, however, that upon initially starting the machine, the even side was conditioned, by the operation of steering relay SR1E–**2605**, to receive the first initial entry and that the odd side would take the next one, and so on. It will be seen presently, from a study of Sections 4.121, 4.122, 4.123 and 4.124 how the odd and even sides handle alternate calls.

Assuming the odd register line one steering relay SR1O–**2705** to be operated, the grounded conductor CL–**2713** in Fig. 27 will extend over cables **2712**, **27–149** to Fig. 149 and **2712**, conductor CL–**2713**, contact **7** of relay OCLUC–**12304** (released to indicate no first line registration in the odd register), conductor **12308**, contact **1** of relay OODC–**12400** (operated, as indicated shortly, to show that the output side of the odd register is normal), conductor **12407**, contact **1** of relay OCLDC–**12300** (operated, as described shortly, to indicate that the line 1 registers of the odd side are normal), contact **1** of relay OCGDC–**12301** (operated when second line registers are normal), contact **1** of relay OAODC–**12302** (operated for a normal third line register), contact **1** of relay OCDDC–**12303** (fourth line registers normal), conductor CL–**12309**, cables **12310**, **123–96**, **96–94**, **94–92**, **9205**, **92–91**, **9104**, **91–90**, **9001**, **90–88**, **8801**, **88–86**, to Fig. 86 and to conductor CL–**12309**. Conductor CL–**12309** branches out to Fig. 76 where it extends over contact **2** of relay WSRO–**7612** (released because the walking control of Fig. 76 is not being used), conductor CLAB–**7617** to Fig. 86. These two conductors extend over cables **8601**, **8602**, **8603** and **86–84**, into Fig. 84, where conductor CL–**12309** emerges to operate connector CLCO–**8401**, conductor CLAB–**7617** continuing through cable **8402** to operate connector CLAO–**8400**. These connectors CLAO–**8400** and CLCO–**8401** are the ones which allow registration into the first line registers (Figs. 83 and 84) of the odd call entry register. These connectors lock over contact **16** of connector CLAO–**8400** to the reading relay up-check ground on conductor UC–**1510**, which extends to Fig. 15 over cables **8300**, **83–82**, **82–79** and **79–50**, to conductor UC–**1510** to Fig. 15.

The operated relays OODC–**12400**, OCLDC–**12300**, OCGDC–**12301**, OAODC–**12302** and OCDDC–**12303** involved in the above-described call entry register connector operating circuit are operated in circuits as follows. Ground extends over contact **3** of relay MON–**1201** and conductor MON–**1239**, over cable **12–175** to Fig. 175, thence over cable **175–123** to Fig. 123, where conductor MON–**1239** emerges to the right sides of the windings of all five of these relays.

(1) The left side of relay OODC–**12400** extends over conductor DC–**12408**, cables **97–96**, **96–94**, **94–92**, **9205**, **92–91** and **9104** to Fig. 91 where conductor DC–**12408** emerges and traverses a down-check path through Figs. 91 through 97 (comprising the output section of the odd call entry register) over back contacts of relays

ODDT**0**–**9100** to ODDT**3**–**9103**, back contacts of relays ODDU**0** to ODDU**7**, conductor **9105** to Fig. 92, back contacts of relays OADT**0**–**9201** to OADT**3**–**9204**, back contacts of relays OADU**0** to OADU**7**, conductor **9206** to Fig. 93, back contacts of relays OSD**0** to OSD**7**, back contacts of relays OCHTT**0** to OCHTT**7**, conductor **9300** to Fig. 94, back contacts of relays OCHTU**0** to OCHTU**7**, back contacts of relays OMUT**0** to OMUT**7**, back contacts of relays OMUU**0** to OMUU**7**, conductor **9401** to Fig. 95, back contacts of relays OIL–**9506** to ODISL–**9511**, back contacts of relays OTOLL–**9500** to OMUT**2**–**9505**, conductor **9512** to Fig. 96, back contacts of relays O2MD to O1M, conductor **9601** to Fig. 97, back contacts of relays O1T4I–**9700** to OD1SW–**9706**, to resistance battery.

(2) The down-check circuit for the first line registers (Figs. 83 and 84) of the odd side extends from resistance battery in Fig. 183, over back contacts of relays OCL**0**–**8300** to OCL**4**–**8303**, back contacts of relays OBIT**0** to OBIT**7**, conductor **8304** to Fig. 84, back contacts of relays OBIU**0** to OBIU**7**, back contacts of relays OCIIT**0** to OCIIT**7**, back contacts of relays OCIIU**0** to OCIIU**7**, conductor DC**1**–**8403**, over cables **86–84**, **8603**, **8602**, **8604**, **88–86**, **8801**, **90–88**, **9001**, **91–90**, **9104**, **92–91**, **9205**, **94–92**, **96–94**, **123–96** and **12310**, conductor DC**1**–**8403**, to the left side of relay OCLDC–**12300**.

(3) The down-check circuit for the second line registers (Figs. 85 and 86) of the odd side extends from resistance battery in Fig. 85, over back contacts of relays OOI**0** to OOI**7**, back contacts of relays OCLTH**0** to OCLTH**7**, conductor **8500** to Fig. 86, back contacts of relays OCLH**0** to OCLH**7**, back contacts of relays OCLT**0** to OCLT**7**, back contacts of relays OCLU**0** to OCLU**7**, conductor DC**2**–**8604**, into cables **8602**, etc. and out of cable **12310** in Fig. 123, conductor DC**2**–**8604**, to the left side of relay OCGDC–**12301**.

(4) The down-check circuit for the third line registers (Figs. 87 and 88) of the odd side extends from resistance battery in Fig. 87, over back contacts of relays OCA**0** to OCA**7**, back contacts of relays OCNI**0**–**8700** to OCNI**7**–**8704**, back contacts of relays OCOFFA**0** to OCOFFA**7**, conductor **8705** to Fig. 88, back contacts of relays OCOFFB**0** to OCOFFB**7**, back contacts of relays OCOFFC**0** to OCOFFC**7**, conductor DC**3**–**8802**, through cables **8801**, etc., and out of cable **12310** in Fig. 123, conductor DC**3**–**8802**, to the left side of relay OAODC–**12302**.

(5) The down-check circuit for the fourth line registers (Figs. 89 and 90) of the odd side extends from resistance battery in Fig. 89, over back contacts of relays OCTH**0** to OCTH**7**, back contacts of relays OCH**0** to OCH**7**, back contacts of relays OCT**0** to OCT**7**, conductor **8900** to Fig. 90, back contacts of relays OCU**0** to OCU**7**, back contacts of relays OCST**0** to OCST**7**, conductor DC**4**–**9002**, over cables **9001**, etc., and out of cable **12310** in Fig. 123, conductor DC**4**–**9002**, to the left side of relay OCDDC–**12303**.

The B digit registration is passed from Fig. 13, over cable B–**1319** to Fig. 50 where it enters cable **79–50**. The C digit is passed from Fig. 14, over cable C–**1414** into cable **1415**, which joins the D digit information out of cable D–**1416** into cable **14–15**, thence over cable **15–50** into Fig. 50 where cables C–**1414** and D–**1416** emerge and reenter cable **79–50**. The F digit information passes from Fig. 15, over cable F–**1512** and joins the E digit information over cable E–**1511** into cables **1513** and **15–50** to Fig. 50, where cables E–**1511** and F–**1512** emerge and reenter cable **79–50**. These five cables B–**1319**, C–**1414**, D–**1416**, E–**1511** and F–**1512** pass over cable **79–50** to Fig. 79, thence over cables **82–79** and **83–82** into Fig. 83, where the five cables reemerge.

In Fig. 83, the B digit, comprising two out of four grounded conductors B**0** to B**4** in Fig. 83, extends over

two of the contacts 1 to 4 of connector CLAO–8400 to operate two of the odd side input class register relays OCL0–8300 to OCL4–8303 on a two-out-of-five basis.

In Fig. 83, the C digit, comprising two out of five grounded conductors C0 to C7 in Fig. 83, extends over two of the contacts 5 to 9 of connector CLAO–8400 to operate two of the odd side billing index tens register relays OBIT0 to OBIT7 on a two-out-of-five basis.

In Fig. 84, the D digit, comprising two grounded ones of the five conductors D0 to D7 in Fig. 84, extends over two of the contacts 11 to 15 of connector CLAO–8400 to operate two of the five odd side billing index units register relays OBIU0 to OBIU7 on a two-out-of-five basis.

In Fig. 84, the E digit, comprising two grounded ones of the five conductors E0 to E7 in Fig. 84, extends over two of the five contacts 1 to 5 of connector CLCO–8401 to operate two of the odd side call identity index tens register relays OCIIT0 to OCIIT7 on a two-out-of-five basis.

In Fig. 84, the F digit, comprising two grounded ones of the five conductors F0 to F7 in Fig. 84, extends over two of the contacts 6 to 10 of connector CLCO–8401 to operate two of the odd side call identity index units register relays OCIIU0 to OCIIU7 on a two-out-of-five basis.

The operation of the relay registers of Figs. 83 and 84 comprises the registration of the first line of the initial entry in the odd call entry register. All of these relays lock over their locking contacts to conductor L1L–8305, which extends to ground in a circuit from conductor L1L–8305 in Fig. 84, over cables 86–84, 8603, 8602, 8604, 88–86, 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96 and 123–126, conductor L1L–8305, contact 7 of the odd side release relay ORLS–12605, to ground over the contact of the odd side register off-normal relay ORONG–12604, which is operated in a circuit extending from ground, over contact 5 of relay ST4–1103, conductor ON–1120, cable 12–175 to Fig. 175, cable 175–123, conductor ON–1120, to the relay ORONG–12604.

(As described in Section 4.123 the even call register portion of the machine will be used for the registration of initial entries on alternate calls hereafter.)

The aforementioned digits comprising line 1 of the initial entry are registered, thereby releasing relay OCLDC–12300 and operating relay OCLUC–12304 if a valid registration occurs.

Relay OCLDC–12300 releases when the previously described down-check path through all of the relays of Figs. 83 and 84 is opened by the operation of any one of such relays. The operating circuit for the corresponding line 1 up-check relay OCLUC–12304 extends from ground in Fig. 84, through a two-out-of-five up-check of the relays OCIIT0 to OCIIT7, through a two-out-of-five up-check of the relays OCIIU0 to OCIIU7, up-check conductor UC–8405, to Fig. 83, through a two-out-of-five up-check of the two groups of relays OCL0–8300 to OCL4–8303 and OBIT0 to OBIT7, conductor 8306 to Fig. 84, through a two-out-of-five up-check of the relays OBIU0 to OBIU7, conductor UC1–8404, cables 8402, 86–84, 8603, 8602, 8604, 88–86, 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96 and 12310, conductor UC1–8404, to relay OCLUC–12304. Connectors CLCO–8401 and CLAO–8400 remain locked to the reading relay up-check conductor UC–1510.

4.121 *Answer-disconnect connector*

Registration of the first line of an initial entry (see Section 4.12) indicates that the timing information in the assembling register which bears the same number as the call identity index (E and F digits) of the initial entry should be connected with for purposes of removing any timing entries which are registered therein for use on this call. The selection of the assembling register proceeds as described in Section 4.11 operating the relay CST–6100 through relay A2–1302 operated on the first line of the initial entry (A digit of 2).

Relay ADCN–6106 operates connector relays CLCO–8401 and CLAO–8400 on this first line to connect together the operate paths of the answer and disconnect connector relays of each assembling register.

The operating path for relay ADCN–6106 was traced in Section 4.12 as a parallel extension of the circuit which operated connector CLCO–8401 and CLAO–8400.

The actual connection of these leads requires 104 sets of contacts, one set for each of the regular (100) and spare (4) assembling registers, and hence the relays AD0–6110 to AD9–6109 are operated from relay ADCN–6106.

This circuit is obviously controlled by contact 2 of relay ADCN–6106. The assembling register No. 99 of Figs. 56 and 57 has its answer and disconnect connector leads ANS–5604 and DIS–5605 connected together at contact 3 of relay AD9–6109. The assembling register No. 00 of Figs. 62 and 63 has its corresponding leads ANS–6204 and DIS–6205 connected together at contact 4 of relay AD0–6110. The other registers are similarly treated. The relays AD0–6110 to AD9–6109 lock over contact 2 of relay AD9–6109 to conductor ADL–6125 which extends into Fig. 80 where it is grounded over contact 1 thereof when the answer connector ARO–8200 is operated, as will be described, conductor ADL–6125 also in Fig. 79 extending into and over cables 7903, 82–79, 8201, 82–124 to Fig. 124, 124–125 and 12508, conductor ADL–6125 and to one or more grounds, such as over contact 3 of relay OAD–12502 or contact 2 of relay OAU–12503 or contact 5 of relay ODD–12500 or contact 1 of relay ODU–12501, depending upon the status of these relays (see Section 3.057).

Of the relays in Figs. 124, 125 and 126, the operating circuits for relays ODUC–12507, OAUC–12403, OFCD–12600, OFCU–12601, ONES–12602, OES–12603, ODD–12500, ODU–12501, OAD–12502, OAU–12503, OADC–12401, OADC1–12505 and OAUCT–12504 are described in the following Section 4.122. The circuit for relay OOUC–12402 is described in Section 4.19, the circuit for operating relay OCCR–12405 is described in Section 4.13 and the circuit for relay OODUC–12406 is described in Section 4.21. The circuits for relays OADR–12404 and ODDC–12506 are described presently in this section. The circuit for relay OODC–12400 has been described previously.

Relay ODDC–12506, indicating when operated that the registers of the odd side (Figs. 77 to 79) which are used for recording the disconnect time and first call indication from an assembling register are normal, is operated in a path extending from resistance battery in Fig. 77, through a down-check path (starting at contact 3 of relay ODD0–7708) through relays ODD0–7708 to ODD7–7712, a down-check through relays ODHT0–7700 to ODHT2–7702, a down-check through relays ODHU0–7703 to ODHU7–7707, conductor 7713 to Fig. 78, a down-check through relays ODMT0–7800 to ODMT4–7803, a down-check through relays ODMU0–7804 to ODMU7–7808, conductor 7809 to Fig. 79, a down-check through relays ODMP0 to ODMP7, a down-check through through relays ONTR–7901 and ODTR–7902, conductor DC–7904, over cables 7905, 79–82, 82–84, 8402, 86–84, 8603, 8602, 8604, 88–86, 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 97–96, 9707 and 97–98, conductor DC–7904, to relay ODDC–12506.

The operation of even register connector relay CLCO–8401 operates relay OADR–12404 of the even register control (Fig. 124), which in turn operates the relays ARO–8200 and DRO–7900 of the even answer-disconnect register connector. Connector relay CLCO–8401, in being operated, extends ground over its contact 11, conductor AD–8406, cables 86–84, etc., cable 123–96

in Fig. 96, cable 12310, cable 12311, conductor AD–8406, to relay OADR–12404. Ground thereupon extends from the off-normal conductor ON–1120 in Fig. 124, over contacts 1 of relays OODUC–12406 and OOUC–12402 and relay OADR–12404 to conductor ADR–12409 into cable 12410 and over cable 82–124 to Fig. 82, cable 8203, conductor ADR–12409 to operate connector relay ARO–8200 (answer time connector for the odd call entry register), conductor ADR–12409 extending over cable 82–79 into Fig. 79 where conductor ADR–12409 emerges to operate relay connector DRO–7900 (disconnect time connector relay for the odd call entry register). These connector relays DRO–7900 and ARO–8200 lock over contact 29 of connector ARO–8200, conductor ADRL–8204, cables 8203, 82–124 to Fig. 124 and 12410, conductor ADRL–8204 to off-normal ground on conductor ON–1120 over back contacts of various of the control relays of Figs. 124, 125 and 126. At the same time, the ground which extended over contact 1 of relay OADR–12404 to operate the timing connectors ARO–8200 and DRO–7900 also extends over contact 2 of relay OADR–12404 to operate relay OCCR–12405. The operation of this relay OCCR–12405 indicates that the odd call entry register desires connection with the computer part of the machine. The operations incident to this parallel action are described in detail in Section 4.13 hereinafter.

These relays ARO–8200 and DRO–7900 connect the answer and disconnect multiples of the assembling registers to the odd call register portion of the machine for registering the answer and disconnect times to be read out of the pertinent assembling register as described in Section 4.122.

These relays ARO–8200 and DRO–7900 lock operated through the odd register control relays of Figs. 124, 125 and 126 as mentioned, independently of the CLCO–8401 relay, which will release at the end of registering the first line of initial entry. Relays AD0–6110 to AD9–6109 lock operated to the answer-disconnect register connectors as previously described.

Relay AD0–6110, in operating, provides a ground over its contact 1 for locking operated the answer and disconnect connector relays of the selected assembling register so that these relays may remain operated after the reading relays release and after the start lead ground is removed at the end of reading the first line of the initial entry. For instance, ground extends over contact 1 of relay AD0–6110 and over conductor 6126 into Fig. 63 to the locking contact 3 of the answer connector ANS00–6301 of register No. 00 (which is also a locking contact for the corresponding disconnect connector DISC00–6203 of register No. 00 because the respective operating leads ANS–6204 and DIS–6205 are joined over contact 4 of relay AD0–6110) and into Fig. 57 to the locking contact 3 of the answer connector ANS99–5701 of register No. 99, etc. (These locking paths come into play when these connectors are operated as described in Section 4.11 by the grounding of the start lead ST–917 in Fig. 61, which extends over the contact of relay CST–6100, through the lower winding of relay XST–6101, through the winding of relay STO–6103, over contact 1 of relay XSTL–6102, conductor ST–6121, through a one-and-one-only operated check of the F digit translator relays of Fig. 24, conductor 2411, through a one-and-one-only operated check of the E digits translator relays of Fig. 23 over the operated E relay of Fig. 23 to one of the ten conductors 2302 to 2304, over the operated F relay of Fig. 24 to one of the hundred conductors ST00 to ST99, cable 24–57 into Fig. 57, where the grounded conductor, such as ST99 passes over contact 2 of its jack 99 to conductor ST–5702 to operate the connectors DISC99–5603 and ANS99–5701.)

Relay ADCN–6106, in operating, applies resistance battery over its contact 1 to the upper winding of relay XST–6101 to prevent this relay from operating (as is its normal reaction) due to the lower impedance of having more than one connector (DISC99–5603 and ANS–5701) in parallel in the path through its lower winding. This is a legitimate double-connector situation and relay ADCN–6106, in operating under these circumstances, indicates that the cross test relay XST–6101 should not operate to indicate trouble.

Relay ADD–6107 operates from ground over contact 1 of relay AD0–6110 and either of contact 2 of relay AD0–6110 or contact 1 of relay AD9–6109 to prevent the reading of any further entry lines which may require the selection of an assembling register until the multiple is cleared on the read out and reregistering operations by the odd register control.

4.122 *Checking answer-disconnect registration*

With the operation of the answer and disconnect register connector relays ARO–8200 and DRO–7900 of the odd side and the answer and disconnect connectors ANS99–5701 and DISC99–5603 of the selected assembling register (assumed to be No. 99 shown in Figs. 56 and 57) the registration of the answer and disconnect time from the assembling register No. 99 may proceed. These registrations are read out over the same read-in leads; that is, in reading out these registrations into the timing section of the odd call entry register the locking grounds supply the transfer signals.

If a disconnect time entry is registered in the disconnect section (Fig. 56) of the assembling register No. 99, the registration is transferred to the odd call entry disconnect time registers of Figs. 77, 78 and 79 as follows: the locking grounds from two of the five disconnect day units relays DDU99–0 to DDU99–7 of Fig. 56 extend over two of the contacts 1 to 5 of connector DISC99–5603, two of conductors DU0 to DU7 into the disconnect multiple DISMUL extending into Figs. 77, 78 and 79, over two of the contacts 1 to 5 in Fig. 77 of connector DRO–7900, to operate two of the five relays ODD0–7708 to ODD7–7712; the locking ground from one of the three hour tens relays DHT99–0 to DHT99–2 of Fig. 56 extends over one of the contacts 6 to 8 of connector DISC99–5603, one of the conductors HT0 to HT2, over the multiple DISMUL to Fig. 77, over one of the contacts 6 to 8 of connector DRO–7900, to operate one of the relays ODHT0–7700 to ODHT2–7702; similarly, the hour units, minute tens, minute units, minute parts and timed-release or no-timed-release registrations of Fig. 56 are transferred over similarly numbered contacts of the two connectors DISC99–5603 and DRO–7900 by means of the disconnect multiple DISMUL thereby to operate two of relays ODHU0–7703 to ODHU7–7707 of Fig. 77, two of relays ODMT0–7800 to ODMT4–7803 of Fig. 78, two of relays ODMU0–7804 to ODMU7–7808 of Fig. 78, two of relays ODMP0 to ODMP7 of Fig. 79 and one of relays ONTR–7901 and ODTR–7902 of Fig. 79. These relays lock over their locking contacts to the lock conductor L–7714, which extends to ground over cables 7905, 79–82, 82–84, 8402, 86–84, 8603, 8602, 8604, 88–86, 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96, 123–126, conductor L–7714, over contact 13 of relay ORLS–12605 and the contact of relay ORONG–12604. One of the relays ODU–12501 and ODD–12500 operates from the selected assembling register (No. 99) to indicate whether or not a disconnect time is stored therein. Referring to Fig. 56, it will be recalled that if a disconnect entry is stored in assembling register No. 99, relay DS99–5600 will have been operated, otherwise not. Correspondingly, ground is applied over contact 3 of relay DS99–5600 and contact 34 of connector DISC99–5603 to conductor DU into cable 5607, otherwise ground is applied over contact 2 of relay RLS99–5602 and contact 4 of relay DS99–5600 and contact 33 of connector DISC99–5603 to conductor DD into cable 5607. These two conductors DU and DD

extend over cable 5607 to Fig. 79 where they extend over contacts 33 and 32 of connector DRO–7900 to conductors DU0 and DD0 and over cables 7906, 7903, 82–79, 8201, 82–124 to Fig. 124, 124–125, 12509 and 12510, conductors DU0 and DD0 to relays ODU–12501 and ODD–12500, one of which will operate to indicate respectively that the assembling register to which the odd call entry register is connected contains or does not contain a disconnect time entry. The operated relay can lock over its locking contact, conductor DU or DD, over cables 12510, 12509, 124–125, 82–124 to Fig. 82, 8201, 82–79 and 7903, conductor DU or DD, cable 5607 to Fig. 56, to the operating grounds independently of connector DRO–7900.

If an answer time entry is registered in the answer section (Fig. 57) of the assembling register No. 99, this registration is transferred to the odd call entry answer time registers of Figs. 80, 81 and 82 as follows: the locking grounds of two of relays ADU99–0 to ADU99–7 extend over two of contacts 5 to 9 of connector ANS99–5701, two of conductors DU0 to DU7, over the answer multiple ANSMUL into Fig. 80, two of conductors DU0 to DU7, over two of contacts 2 to 6 of connector ARO–8200, to operate two of relays OAD0 to OAD7 of Fig. 80; the locking ground of one of relays AHT99–0 to AHT99–2 of Fig. 57 extends over one of contacts 10 to 12 of connector ANS99–5701, one of conductors HT0 to HT2, multiple ANSMUL to Fig. 80, one of conductors HT0 to HT2, one of contacts 7 to 9 of connector ARO–8200, to operate one of relays OAHT0–8000 to OAHT2–8002; likewise, over contacts 13 to 31 of connector ANS99–5701 and the multiple ANSMUL and contacts 10 to 28 of connector ARO–8200, two of relays OAHU0 to OAHU7 of Fig. 80 and two of relays OAMT0–8100 to OAMT4–8103 of Fig. 81 and two of relays OAMU0 to OAMU7 and OAMP0 to OAMP7 of Fig. 82 are operated. These relays lock over their locking contacts to the lock conductor L–8004, which extends to ground over cables 82–84, 8402, 86–84, 8603, 8602, 8604, 88–86, 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 97–96, 9707, 97–98, 9802, conductor L–8004 and over contact 3 of relay ORLS–12605 and the contact of relay ORONG–12604. One of the relays OAU–12503 and OAD–12502 operates from the selected assembling register (No. 99) to indicate whether or not an answer time is stored therein. Referring to Fig. 57, it will be recalled that if an answer time is stored in assembling register No. 99, relay AS99–5700 will have been operated, otherwise not. Consequently, ground is applied over contact 7 of relay AS99–5700 and contact 1 of connector ANS99–5701 to conductor AU into cable 5706, otherwise ground is applied over contact 1 of relay RLS99–5602 and conductor 5705 and contact 6 of relay AS99–5700 and contact 2 of connector ANS99–5701 to conductor AD into cable 5706. These two conductors AU and AD extend over cable 5706 to Fig. 82 where they extend over contacts 33 and 32 of connector ARO–8200 to conductors AU0 and AD0 and over cables 8203, 82–124 to Fig. 124, 124–125 and 12508, conductors AU0 and AD0 to operate one of relays OAU–12503 and OAD–12502 to indicate respectively that the assembling register to which the odd call entry register is connected does or does not contain an answer time entry. The operated one of these relays can lock over its locking contact, conductor AU or AD into cables 12508, 124–125, 82–124 to Fig. 82, cable 5706, etc. to conductor AU or AD independently of connector ARO–8200.

The successful registration of the answer time in the call register portion of the machine operates relay OAUC–12403. This circuit extends from ground in Fig. 80, through a two-out-of-five up-check through relays OAD0 to OAD7, a one-out-of-three up-check of relays OAHT0–8000 to OAHT2–8002, a two-out-of-five check of relays OAHU0 to OAHU7, conductor 8005 into Fig. 81, a two-out-of-five check of relays OAMT0–8100 to OAMT4–8103, conductor 8105 into Fig. 82, a two-out-of-five check of relays OAMU0 to OAMU7, up-check conductor UC–8205, a two-out-of-five check of relays OAMP0 to OAMP7, up-check conductor UC–8206, over cables 82–84, etc., cable 97–96 into Fig. 97, cable 9707, conductor UC–8206, to relay OAUC–12403.

One of the relays OFCU–12601 and OFCD–12600 operates from the selected assembling register through the answer-disconnect register connector DRO–7900 depending upon whether the first call relay of that assembling register is operated or released. Referring to Fig. 56, if the first call relay FC99–5601 is operated then ground extends over contact 2 thereof and over contact 31 of connector DISC99–5603 to conductor FCU into cable 5607, otherwise ground extends over contact 1 of relay FC99–5601 and contact 32 of connector DISC99–5603 to conductor FCD into cable 5607. These two conductors FCU and FCD extend over cable 5607 to Fig. 79, where conductors FCU and FCD extend over contacts 30 and 31 of connector DRO–7900, conductors FCU and FCD into cables 7906, 7903, 82–79, 8201, 82–124 to Fig. 124, 124–125, 12509 and 125–126, conductors FCU and FCD to one of relays OFCU–12601 and OFCD–12600. The operated one of these relays can lock over its locking contact to ground on the locking conductor L–8004.

The successful registration of the disconnect time and the first call indication in the call entry register portion of the machine operates relay ODUC–12507 in a circuit extending from ground in Fig. 77, through a two-out-of-five up-check through relays ODD0–7708 to ODD7–7712, a one-out-of-three check of relays ODHT0–7700 to ODHT2–7702, an up-check of relays ODHU0–7703 to ODHU7–7707, conductor 7715 into Fig. 78, an up-check of relays ODMT0–7800 to ODMT4–7803, an up-check of relays ODMU0–7804 to ODMU7–7808, conductor 7810 into Fig. 79, an up-check of relays ODMP0 to ODMP7, an up-check of one of relays ONTR–7901 and ODTR–7902, up-check conductor UC–7907, over cables 7905, 79–82, etc., cable 97–98 in Fig. 98, cable 9802, conductor UC–7907, contact 5 or 6 of relay OFCD–12600, contact 6 or 7 of relay OFCU–12601, conductor 12606, to relay ODUC–12507.

One of the relays OES–12603 or ONES–12602 operates from the reading relay connector RC–900 or WC–901 through the answer-disconnect register connector ARO–8200 to indicate whether or not the entries being taken from the assembling register are the result of walking over the assembling registers to clear out straddle call ends. Relay ONES–12602 operates when the reading relay connector RC–900 is operated under normal reading conditions and relay OES–12603 operates when the reading relay connector WC–901 is operated when clearing out straddle call ends. Referring to Fig. 9, if connector RC–900 is operated, ground extends over contact 33 thereof to conductor NES into cable 9–17; whereas, if connector WC–901 is operated, ground extends over contact 20 thereof to conductor ES into cable 9–17. These conductors ES and NES extend over cables 9–17, 17–58 and 5824 into Fig. 82 where conductors ES and NES extend over contacts 34 and 35 of connector ARO–8200, conductors ES and NES into cables 8203, 82–124 to Fig. 124, 124–125, 12509 and 125–126, conductors ES and NES, to relays OES–12603 and ONES–12602, the operated one locking over its locking contact to ground on the locking conductor L–8004.

If the odd register control (Figs. 123 to 126) determines that only one timing entry is to be read out of the selected assembling register on a non-straddle call, then relay AMO–6105 is operated in a circuit extending from ground, over contact 5 of relay OAD–12502 (nothing appears in answer portion of the assembling register), contact 1 of relay OAU–12503 (no answer time is stored in the assembling register), contact 4 of relay ODD–

12500 (a disconnect time is stored in the assembling register), contact 2 of relay ODU–12501 (something is stored in the disconnect portion of the assembling register), conductor 12515, contact 1 of relay OFCD–12600 (not part of a first call), contact 1 of relay ONES–12602 (normal reading condition), contact 2 of relay OES–12603 (not a reading operation to clear out straddle call ends), contact 3 of relay OFCU–12601 (not part of a first call), conductor AMO into cables 125–126, 12509, 124–125, 82–124 to Fig. 82, 8203, conductor AMO, contact 30 of connector ARO–8200, conductor AMO into cables 8207, 82–79 and 79–61, conductor AMO, to operate relay AMO–6105.

The operation of relay AMO–6105 connects together the answer and disconnect multiples (such as DISMUL of Fig. 56 and ANSMUL of Fig. 57) with the exception of the minute tenths (minute parts) digit by operating relay AMB–5002 in a circuit extending from ground, over contacts 1 and 2 of relay AMO–6105, conductor AM–6123, cable 61–50, conductor AM–6123 to relay connector AMB–5002. An inspection of Fig. 50 will show that the disconnect multiple DISMUL is connected over contacts 1 to 22 of connector relay AMB–5002 to the answer multiple ANSMUL except for the minute tenths (or parts as it may be called). As a result, the disconnect time (the only one stored in the assembling register) is registered (except for minute parts) also as the answer time of calls for which only one timing entry has been registered.

Relay AMO–6105, in operating, operates relay OAUCT–12504 of the odd register control in a circuit extending from ground, over contacts 1 and 2 of relay AMO–6105, conductor AUCT into cables 79–61, 82–79 and 8207 in Fig. 82, conductor AUCT out of cable 8207, contact 31 of connector ARO–8200, conductor AUCT into cables 8203, 82–124 to Fig. 124, 124–125, 12509 and 12510, conductor AUCT, to relay OAUCT–12504, which locks over its locking contact to the ground on conductor UC–8205 which is grounded (see Figs. 80, 81 and 82) so long as there is a valid up-check of all the answer time registers (Figs. 80, 81 and 82) except for the minute parts relays OAMP0 to OAMP7 of Fig. 82.

The operation of relay OAUCT–12504 forces the operation of relays OADC–12401 and OADC1–12505 regardless of the fact that some relays in the answer register portion of the circuit have operated. This circuit extends from resistance battery in Fig. 125, over contact 5 of relay OAUCT–12504 and contact 9 of relay ODUC–12507 to conductor 12511 which operates relays OADC1–12505 and OADC–12401 in parallel. Relays OADC–12401 and OADC1–12505 are normally operated only when relay ODD–12500 is operated to indicate that no disconnect entry is expected from the selected assembling register. This condition would extend the down-check ground on conductor DC–8202 in Fig. 125 (see Figs. 80, 81 and 82) over contact 1 of relay ODD–12500 to conductor 12511 to operate relays OADC1–12505 and OADC–12401 in parallel. Also, relay OAUCT–12504, in operating, applies ground over its contact 1 to conductor I into cable 125–96, conductor I, contact 17 of connector CCCO–9600, conductor I, cable 149–96, conductor I, cable 149–202, conductor I to operate the relay UQ1–20206 to synthesize a carry-in of 1 from the minute parts subtracter of Figs. 203 and 204. This is because no answer minute parts information is provided for the answer time where the disconnect time is used for both timing entries on a single timing entry non-straddle call (relay OAUCT–12504 operated).

As has been indicated hereinbefore, the odd register control relays OCCR–12405, OOUC–12402 and OODUC–12406 are operated as described in respective Sections 4.13, 4.19 and 4.21.

4.123 *Reader line count*

Relay RS1O–2701 operates in parallel with relay OCLUC–12304 over a path through the odd first line initial entry connector relay CLA0–8400 and through the odd answer-disconnect register connector ARO–8200 (see Section 4.121). This circuit extends from ground on the up-check lead UC1–8404 in Fig. 84, over contact 10 of connector CLA0–8400, conductor 8407, contact 36 of connector ARO–8200, conductor RS1–8208, cables 8307, 27–83 to Fig. 27, conductor RS1–8208, to operate reader step relay RS1O–2701.

The operation of relay RS1O–2701 indicates the successful registration of the first line of the initial entry in the odd call register portion of the machine. The tape in the reader is now advanced to the next line of the initial entry. During the open interval of the reader cycle after relay RS1O–2701 is operated, relay SR2O–2706 operates to prepare to steer the second line of the initial entry to the odd second line call entry register. The KB8 lead in Fig. 27 is grounded by the reader cam K8 in Fig. 8 during the open interval of the reader cycle. This grounded lead KB8 extends over contact 5 of relay RS1O–2701 to operate relay SR2O–2706, which locks over its contact 1 and contact 7 of relay RS2O–2702 to the locking ground on conductor 2609 supplied over contact 8 of relay ST3–1102, relay SR1O–2705 releasing when its locking circuit is opened at contact 7 of relay RS1O–2701. The release of relay SR1O–2705 prevents the receipt of any entry line other than a supplementary line of an initial entry (A digit of zero). The connector relays CLCO–8401 and CLAO–8400 lock to the reading relay check path (conductor UC–1510 in Fig. 84) independently of relays SR1O–2705, OCLUC–12304 and OCLDC–12300 as previously described.

The connectors CLCO–8401 and CLAO–8400 thus release when the reader steps off of line one, releasing the reading relays, etc., the line one registration in Figs. 83 and 84 remaining locked as described. The release of connector CLCO–8401 releases relay OADR–12404. Upon the operation of both of relays OAUC–12403 and OAU–12503 or both of relays OADC–12401 and OAD–12502, both of relays ODDC–12506 and ODD–12500 or both of relays ODUC–12507 and ODU–12501, and the operation of one of relays OES–12603 and ONES–12602, the connectors ARO–8200 and DRO–7900 release, thereby releasing relay AMO–6105 and the operated assembling register connectors such as DISC99–5603 and ANS99–5701.

The initial entry may consist of either two or four lines, depending upon the input class registered on the first line (B digit in registers OCL0–8300 to OCL4–8303 of Fig. 83). The second line of this entry is registered in the odd call register portion of the circuit by operating relay CG0–8600 over a path from ground on the reading relay up-check lead UC1510 in Fig. 15, cable 23–25, conductor UC–1510, contact 8 of relay TI–2501, conductor UC–2510, cable 23–25, conductor UC–2510 into Fig. 13, contact 8 of relay A0–1300 (A digit of zero), conductor 0–1320, cable 15–13, conductor 0–1320, cable 26–15 into Fig. 26, conductor 0–1320, contact 2 of relay SR2O–2706, conductor CG–2714, cables 2712, 27–149 to Fig. 149 and 2712, conductor CG–2714, contact 2 of relay OCGUC–12305, conductor CG–12312, cables 12311, 12310, 123–96, 96–94, 94–92, 9205, 92–91, 9104, 91–90, 9001, 90–88, 8801 and 88–86 into Fig. 86, conductor CG–12312, to operate connector CG0–8600, which thereupon locks over its contact 27 to the reading relay up-check ground on conductor UC–1510.

The B, C, D, E and F digits are transferred from the reading relays of Figs. 13, 14 and 15, as previously described, into cable 83–82 of Fig. 83, thence over cable 8408 across Figs. 84, 85 and 86. In Figs. 85, the B digit comes out of cable 8408 over cable B–1319 and over contacts 1 to 5 of connector CG0–8600 to operate two of relays OOI0 to OOI7 of Fig. 85 and the C digit in cable C1414 extends over contacts 6 to 10 of connector CG0–8600 to operate two of relays OCLTH0 to

OCLTH7 of Fig. 85. In Fig. 86, the D, E and F digits come out of cables D–1416, E–1511 and F–1512 and extend over respective groups of contacts 11 to 15, 16 to 20 and 22 to 26 of connector CG0–8600 to operate two relays of each respective group OCLH0 to OCLH7, OCLT0 to OCLT7 and OCLU0 to OCLU7 of Fig. 86. These relays lock over their locking contacts to the lock conductor L2L–8501, which extends over cables 8602, 8604, 88–86, etc. into Fig. 95 over cable 96–94, cables 96–94, 123–96 and 123–126, and over contact 8 of relay ORLS–12605 to ground over the contact of relay ORONG–12604.

When any one of these register relays is operated, the second line down-check relay OCGDC–12301 releases. When a valid registration is completed relay OCGUC–12305 operates in a circuit from ground in Fig. 85, through a two-out-of-five up-check of relays OOI0 to OOI7 of Fig. 85, an up-check through relay OCLTH0 to OCLTH7 of Fig. 85, conductor 8502 into Fig. 86, an up-check of the groups of relay OCLH0 to OCLH7 and OCLT0 to OCLT7 and OCLU0 to OCLU7 of Fig. 86, conductor UC2–8604, cables 8603, 8602, 8604, 88–86, etc., to cable 96–94 in Fig. 96, cables 123–96 and 12310, conductor UC2–8604, to relay OCGUC–12305, which operates and locks over its contact 1 to the connector CG0–8600 operating ground on conductor CG–2714.

Relay RS2O–2702 operates in parallel with relay OCGUC–12305 when a valid registration has been made in the odd second line initial entry registers. An extension of the grounded up-check conductor UC2–8604 in Fig. 86 extends over contact 21 of connector CG0–8600, conductor RS2–8605, cable 86–83, conductor RS2–8605, cables 8307 and 27–83 to Fig. 27, conductor RS2–8605, to relay RS2O–2702, which, like the other RS– relays of Figs. 26 and 27, locks over its locking contact to the KB3 reader open cycle cam ground.

Relay RS2O–2702, in operating releases relay SR2O–2706 and prepares a path for operating either relay SR3O–2707 or relay SR1E–2605 during the open portion of the next reader cycle. When the reader steps the reading relays release and connector CG0–8600 releases. The KB8 ground from the reader open cycle is then effective over contact 5 of relay RS2O–2702 to operate either relay SR3O–2707 (to permit the third line of a four-line entry to be registered in the odd side) of relay SR1E–2605 (to permit the first line of a new initial entry to be registered in the even side).

Relay SR3O–2707 operates if the initial entry being registered contains four lines as indicated by translating contacts on the odd input class register (input class digit values 3 and 4 represent four-line entries, while input class digit value 1 represents a two-line initial entry) and relay SR1E–2605 operates if it is a two-line entry. Ground on lead KB8 in Fig. 27 extends over contact 5 of relay RS2O–2702 to conductor L–2715, cables 27–83 to Fig. 83, 8308 and 8309, conductor L–2715 and over contact 7 of relay OCL2–8302 (for a B digit of 3) or contact 5 of relay OCL4–8303 (for a B digit of 4) to conductor 4L–8309 or over contact 7 of relay OCL1–8301 and contact 5 of relay OCL0–8300 (for a B digit of 1) to conductor 2L–1109, over cables 8309, 8308, 27–83 to Fig. 27, conductor 4L–8309 to relay SR3O–2707 or conductor 2L–1109 to relay SR1E–2605.

Relay SR1E–2605, in operating, permits the receipt of timing entries, end-of-tape entries or initial entries but prevents the receipt of supplementary lines of initial entries, since these may be registered only after the first line of an initial entry.

Relay SR3O–2707, in operating, forces the odd register to accept third and fourth lines before operating relay SR1E–2605 to return conditions to normal and to preselect the even side for the next call. Relay SR3O–2707 locks over its contact 1 and contact 7 of relay RS3O–2703 to off-normal ground on conductor 2609. The third line connector relay A00–8800 is thereupon operated (assuming that the third line is properly read by the reading relays and that the A digit thereof is properly a zero) from ground on the A digit zero lead 0–1320 of Fig. 27, over contact 2 of relay SR3O–2707, conductor A0–2715, cables 2712, 27–149 to Fig. 149 and 2712, conductor A0–2715, contact 2 of relay OAOUC–12306, conductor A0–12313, cables 12311, 12310, 123–96, 96–94, 94–92, 9205, 92–91, 9104, 91–90, 9001 and 90–88 to Fig. 88, where conductor A0–12313 emerges to operate connector relay A00–8800, which thereupon locks over its contact 27 of the reading relay up-check conductor UC–1510.

The B, C, D, E and F digits of this third line are registered out of cable 8408 in Figs. 87 and 88. The B digit comes out of cable B–1319 in Fig. 87 and extends over contacts 1 to 5 of connector A00–8800 to operate two of the relays OCA0 to OCA7. The C digit extends from cable C–1414 in Fig. 87 over contacts 6 to 10 of connector A00–8800 to operate two of relays OCNI0–8700 to OCNI7–8704. The D digit extends out of cable D–1416 in Fig. 87 over contacts 11 to 15 of connector A00–8800 to operate two of relays OCOFFA0 to OCOFFA7 of Fig. 87. The E and F digits come out of cables E–1511 and F–1512 in Fig. 88 and extend over contacts 16 to 20 and 22 to 26 of connector A00–8800 to operate two of each of the groups of relays OCOFFB0 to OCOFFB7 and OCOFFC0 to OCOFFC7 of Fig. 88. These relays all lock over their locking contacts to the grounded locking conductor L3L–8803, which extends over cables 8801, 90–88, 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96 and 123–126, conductor L3L–8803, contact 9 of relay ORLS–12605, to ground over the contact of relay ORONG–12604.

Relay OAODC–12302 releases when any of these register relays operates and when they are all properly operated relay OAOUC–12306 operates in a circuit extending from ground in Fig. 87, through a two-out-of-five up-check path through relays OCA0 to OCA7 of Fig. 87, an up-check path over contacts of relays OCNI0–8700 to OCNI7–8704, an up-check path through relays OCOFFA0 to OCOFFA7 of Fig. 87, conductor 8706, and through an up-check path through the two groups of relays OCOFFB0 to OCOFFB7 and OCOFFC0 to OCOFFC7 of Fig. 88, to the up-check conductor UC3–8804, over cables 8801, 90–88, etc., cable 96–94 of Fig. 96, cables 123–96 and 12310, conductor UC3–8804, to relay OAOUC–12306, which thereupon locks to conductor A0–2715 which carries the previously described ground which operated connector A00–8800.

The up-check ground on conductor UC3–8804 in Fig. 88 also extends over contact 21 of connector A00–8800, conductor RS3–8805, cables 88–86A and 86–83, conductor RS3–8805, cables 8307 and 27–83 to Fig. 27, conductor RS3–8805, to operate reader step relay RS3O–2703. This causes the reader to step, the reading relays to release, relay SR3O–2707 to release and the connector A00–8800 to release. During the ensuing open reader cycle the ground on conductor KB8 in Fig. 27 extends over contact 5 of relay RS3O–2703 to operate relay SR4O–2708 to steer the fourth line into the odd register, relay SR4O–2708 locking over its contact 1 and contact 7 of relay RS4O–2704 to ground on conductor 2609.

Upon the reading of the fourth line, the A digit of zero grounds lead 0–1320 in Fig. 27, which extends over contact 2 of relay SR4O–2708, conductor CD–2716, cables 2712, 27–149 to Fig. 149 and 2712, conductor CD–2716, contact 2 of relay OCDUC–12307, conductor CD–12314, cables 12311, 12310, 123–96, 96–94, 94–92, 9205, 92–91, 9104 and 91–90, conductor CD–12314, to operate connector CD0–9000, which locks over its contact 27 to the reading relay up-check ground on conductor UC–1510.

The B, C, D, E and F digits of this fourth line are registered out of cable 8408 in Fig. 89. The B digit

comes out of cable 8408 by means of cable B–1319 in Fig. 89 and extends over contacts 1 to 5 of connector CD0–9000 to operate two of relays OCTH0 to OCTH7 of Fig. 89. The C, D, E and F digits extend over cable 8901 in Fig. 89 where the C digit emerges out of cable C–1414 and over contacts 6 to 10 of connector CD0–9000 to operate two of relays OCH0 to OCH7 of Fig. 89. The D, E and F digits extend over cable 8902 in Fig. 89 where the D digit emerges out of cable D–1416 and over contacts 11 to 15 of connector CD0–9000 to operate two of relays OCT0 to OCT7 of Fig. 89. The E and F digits extend over cable 89–90 to Fig. 90 where the respective E and F digits emerge out of respective cables E–1511 and F–1512 and over respective contacts 16 to 20 and 22 to 26 of connector CD0–9000 to operate two of each of the respective groups of relays OCU0 to OCU7 and OCST0 to OCST7 of Fig. 90. These relays all lock over their locking contacts to conductor L4L–8903 which extends over cables 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96 and 123–126, conductor L4L–8903, contact 10 of relay ORLS–12605, to ground over the contact of relay ORONG–12604.

Relay OCDDC–12303 releases and when all relays are properly operated relay OCDUC–12307 operates in a circuit extending from ground in Fig. 89, through a two-out-of-five up-check path through relays OCTH0 to OCTH7 and OCH0 to OCH7 and OCT0 to OCT7, all of Fig. 89, conductor 8904 into Fig. 90, an up-check path through relays OCU0 to OCU7 and OCST0 to OCST7 in Fig. 90, conductor UC4–9003, cables 9001, 91–90, 9104, 92–91, 9205, 94–92, 96–94, 123–96 and 12310, conductor UC4–9003, to relay OCDUC–12307, which operates and locks over its locking contact to the operating ground (for connector CD0–9000) on conductor CD–2716.

The ground on the up-check conductor UC4–9003 in Fig. 90 also extends over contact 21 of connector CD0–9000, conductor RS4–9004, cables 88–86A and 86–83, conductor RS4–9004, cables 8307 and 27–83 to Fig. 27, conductor RS4–9004, to operate reader step relay RSO–2704. This causes the reader to step, the reading relays to release, relay SR4O–2708 to release and the connector relay CD0–9000 to release. During the ensuing open reader cycle, the ground on conductor KB8 in Fig. 27 extends over contact 5 of relay RS4O–2704, conductor 2L–1109 to operate relay SR1E–2605, which locks to conductor 2609 over its contacts 1 and contact 7 of relay RS1E–2601.

With relay SR1E–2605 operated, the machine is returned to normal so that it may read and act upon any type of tape entries, the next initial entry being read being steered into the even register.

4.124 *Releasing assembling register*

The operated check relays OAUC–12403 or OADC–12401 and ODUC–12507 or ODDC–12506 from the answer and disconnect registers (Figs. 77 to 82) and the operated relays OAU–12503 or OAD–12502 and ODU–12501 or ODD–12500 from the selected assembling register being read out (Figs. 56 and 57) and the operated relay ONES–12602 or OES–12603 open a path to permit the release of the answer-disconnect register connector relays ARO–8200 and DRO–7900 if the corresponding relays operate. That is, the ground on conductor ADRL–8204 in Fig. 124, which is the lock conductor (see locking contact 29 of connector ARO–8200) for these connector relays, will be removed. This ground is obtained from off-normal conductor ON–1120 shown in Figs. 124, 125 and 126. An inspection of Figs. 124, 125 and 126 will show that this connection between grounded off-normal conductor ON–1120 and the locking conductor ADRL–8204 occurs only when both of relays OADC–12401 (contact 12) and OAD–12502 (contact 4) or both of relays OAUC–12403 (contact 7) and OAU–12503 (contact 5) are operated and both of relays ODDC–12506 (contact 9) and ODD–12500 (contact 6) or both of relays ODUC–12507 (contact 7) and ODU–12501 (contact 5) are operated and relay ONES–12602 (contacts 6 and 7) or relay OES–12603 (contacts 7 and 8) is operated.

With the release of the answer-disconnect register connector relays ARO–8200 and DRO–7900, a path is closed through the aforementioned check relays to operate the release relay RLS99–5602 in the selected assembling register No. 99. Relay RLS–6108 of the assembling register connector control (Fig. 61) also operates over this path. This circuit may be traced from off-normal ground on conductor ON–1120 in Fig. 124; (1) over contact 11 of relay OADC–12401 and conductor 12411 and contact 2 of relay OAD–12502 to conductor 12514 or (2) over contact 4 of relay OAUC–12403 and conductor 12412 and contact 3 of relay OAU–12503 to conductor 12514, thence from conductor 12514 (3) over contact 7 of relay ODDC–12506 and contact 3 of relay ODD–12500 to conductor RLS–12513 or (4) over contact 6 of relay ODUC–12507 and contact 3 of relay ODU–12501 to conductor RLS–12513, thence from conductor RLS–12513 over cables 12510, 12509, 124–125, 82–124 to Fig. 82, 8201, 82–79, 7903 and 7906, conductor RLS–12513, contact 34 of connector DRO–7900, conductor RLS–7908, cable 5607 to Fig. 56, conductor RLS–7908, contact 35 of the disconnect connector DISC99–5603 of assembling register No. 99, to the lower winding of the release relay RLS99–5602, which operates and locks over its contact 3 to the conductor RLS–7908, which also extends in Fig. 61 to operate the assembling register connector control release relay RLS–6108.

The operation of the relay RLS99–5602 of the assembling register No. 99 releases the entire registration being held therein, including the relay FC99–5601, if operated. Thus, only one call may be read out of an assembling register once the first call relay FC99–5601 has been operated. Once the relay FC99–5601 releases it will not be operated again until a new central office recorder tape or emergency recorder tape section on the feedback method of straddle operation is processed. The operated ones of the relays OAU–12503, OAD–12502, ODU–12501 and ODD–12500 lock to their multiple leads from the assembling registers independently of the answer-disconnect register connector as previously mentioned. These relays may release only after the relay RLS99–5602 has been effective in restoring the assembling register No. 99 to normal.

The answer-disconnect connectors AD0–6110 to AD9–6109, which have been providing the path (over conductor 6126 in Fig. 61) for holding operated the selected assembling register answer and disconnect connectors ANS99–5701 and DISC99–5603, are locked operated by a path from any one of the operated OAU–12503, OAD–12502, ODU–12501 and ODD–12500 relays (as well as the previously described locking path through the operated answer-disconnect register connector relays DRO–7900 and ARO–8200, now released). This circuit extends from the locking conductor ADL–6125 in Fig. 125 (see Fig. 61 for locking contacs of the answer-disconnect connectors AD0–6110 to AD9–6109) over contact 3 of relay OAD–12502 to off-normal ground on conductor ON–1120 or over contact 2 of relay OAU–12503 to ground or over contact 5 of relay ODD–12500 to off-normal ground on conductor ON–1120 or over contact 1 of relay ODU–12501 to ground..

When the OAU–12503, OAD–12502, ODU–12501 and ODD–12500 relays have all released, the relays AD0–6110 to AD9–6109 may release, thereby restoring the answer and disconnect connectors ANS99–5701 and DISC99–5603 of the assembling register No. 99 to normal.

Relays ADD–6107 and RLS–6108 are operated during the read out and release of an assembling register to prevent the selection of a new assembling register when

a new entry is read from th tape, until such time as the RLS–7908 lead (Figs. 61, 56, 62 and 69) to the assembling registers is found to be ungrounded and until such time as the answer-disconnect connector relays AD0–6110 to AD9–6109 are restored to normal for at least a complete open period of the reader cycle.

It will be appreciated, of course, that these operations, while having been described in connection with only one call entry register (the odd one) of two and only one assembling register (No. 99) of a hundred, are equally descriptive of other such combinations.

4.13 *Computing chargeable time*

The computer portion of the machine is used on every call regardless of whether it is registered in the odd or even call register. The operation of relay –ADR of either the odd or even register control, such as relay OADR–12404 of the odd size, operates its associated –CCR relay, such as relay OCCR–12405 of the odd side, to indicate that this call register portion of the machine desires connection with the computer portion. The operation of these relays OADR–12404 and OCCR–12405 has been described previously. The operation of the computer connector will be described as though the odd call entry register were the one desiring such a connection, inasmuch as the odd side is shown in detail in the drawings. It will be understood, of course, that the operations are performed similarly for the even side. If the computer connector for the even portion of the machine is normal the computer connector for the odd portion of the machine will operate simultaneously with the operation of the corresponding answer-disconnect register connector relays DRO–7900 and ARO–8200, as previously described. Upon the operation of relay OCCR–12405, ground extends from the off-normal conductor ON–1120 in Fig. 124, over contacts 1 of relays OODUC–12406 and OOUC–12402, contacts 1 and 2 of relay OCCR–12405, contact 2 of relay OOUC–12402, conductor CC–12413, contact 11 of the even side computer connector relay CCCE–14900, conductor CC0–14901 into Figs. 96, 94, 92, 136, 133 and 130 to operate the various relay sections of the odd computer connectors CCC0–9600, CCB0–9400, CCA0–9200, CCD0–13600, CCE0–13300 and CCF0–13000. As a result, the information read out of the assembling registers and into the call register also operates the translators of the computer as soon as the computer connector relays are operated. Thus, no time is lost in starting the computation of chargeable time.

The connector relays CCF0–13000 and CCE0–13300 transfer the disconnect and answer times to the input part of the computer comprising the translator relays of Figs. 181 to 189, inclusive. These translator relays are then used to actuate the various subtractor relays of Figs. 196 to 204, inclusive, to provide an elapsed time output. The disconnect and answer minute tens registrations in Figs. 78 and 81 are used to actuate the subtractor relays of Figs. 199 and 200 without the use of intermediate translator relays.

When the disconnect time is being or has been registered in the disconnect portion of the odd register (Figs. 77 to 79) through the disconnect register connector DRO–7900, the operating or locking grounds on relays ODTR–7902 and ONTR–7901 of Fig. 79 extend into cable 7909, which joins with the minute parts (tenths) grounds of cable MP–7910 into 79–78 to Fig. 78, where the minute units grounds of cable MU–7811 join into cable 7812, there joining the minute tens bi-trinary output grounds of cable MT–7813 into cable 78–77 into Fig. 77, where the hour units grounds of cable HU–7716 joins into cable 7717, the hour tens grounds of cable HT–7718 joining into cable 7719, which is joined by the day units grounds of cable D–7720 into cable 77–130 to Fig. 130. In Fig. 130 cable 77–130 terminates all of these grounded leads on armatures 1 to 30 of the connector CCF0–13000.

With connector CCF0–13000 operated, the disconnect day units digit extends over contacts 1 to 5 of connector CCF0–13000 into cable D–13001 into Fig. 60 where two of the five disconnect day translator relays DDT0–6010 to DDT7–6017 are operated. Cable D–13001 in Fig. 130 also extends over cables 130–156 and D–13001 into Fig. 181 where two of the disconnected day translator relays DDT0–18100 to DDT7–18104 are operated. The disconnect hour tens digit extends over contacts 6 to 8 of connector CCF0–13000, cables HT–13002, 130–156 and HT–13002 to Fig. 182 to operate one of the disconnect hour tens translator relays DHTT0–18200 to DHTT2–18202. The disconnect hour units digit extends over contacts 9 to 13 of connector CCF0–13000, cables HU–13003, 130–156 and HU–13003 into Fig. 184 to operate two of the disconnect hour units translator relays DHUT0–18400 to DHUT7–18404. The disconnect minute units digit extends over contacts 19 to 23 of connector CCF0–13000, cables MU–13005, 130–156 and MU–13005 into Fig. 186 to operate two of the disconnect minute units translator relays DMUT0–18600 to DMUT7–18604. The disconnect minute parts (tenths) digit extends over contacts 24 to 28 of connector CCF0–13000, cables MP–13006, 130–156 and MP–13006 into Fig. 188 to operate two of the disconnect minute tenths translator relays DMMPT0–18800 to DMMPT7–18804. The timed release indication extends over contacts 29 and 30 of connector CCF0–13000, cables 13007, 130–156A, 13007, 156–199, 199–200 and 13007 to Fig. 203 to operate one of the timed release index subtractor relays NTR–20301 and DTR–20302 in the subtractor.

The disconnect minute tens registers of Fig. 78 supply into cables MT–7813, etc., an output which represents the registered digit (0 to 5) of the two-out-of-four code in a bi-trinary coded output—or a high and low three. That is, the respective digits 0, 1 and 2 are represented by the grounding of the lead 00 into cable MT–7813 and the grounding of respective leads 0, 1 and 2 into cable MT–7813—as the "low" three; whereas, the respective digits 3, 4 and 5 are represented by the grounding of the lead 3 into cable MT–7813 and the grounding of respective leads 0, 1 and 2 into cable MT–7813—as the "high" three. This, then, represents this digit by a combined binary-trinary or bi-trinary code. This digit, the disconnect minute tens digit, extends over contacts 14 to 18 of connector CCF0–13000, cables DMT–13004, 130–156A, DMT–13004, 156–199 to Fig. 199, where the 3 or the 00 lead comes out of cable 19905 to operate one of the disconnect minute tens binary subtractor relays DMTB3–19903 and DMTB00–19900. The trinary leads continue over cables 199–200 and 20006 into Fig. 200 where one of the leads 0, 1 and 2 out of cable 20006 operates one of the disconnect minute tens trinary subtractor relays DMTT0–20000, DMTT1–20001 and DMTT2–20002.

With connector CCEO–13300, the answer time in the odd registers of Figs. 80 to 82 is transferred to the computer in a manner similar to the above-described transfer of the disconnect time. In Fig. 82, the answer minute parts grounds enter cable MP–8209 which joins with the answer minute units grounds of cable MU–8210 into cable 82–81 to Fig. 81, where the bi-trinary answer minute tens output of cable MT–8106 joins into cable 81–80 to Fig. 80. In Fig. 80, the answer hour units grounds of cable HU–8006 join into cable 8007, which picks up the answer hour tens grounds of cable HT–8008 into cable 8009, which, in turn, enters cable 80–133 along with the answer day grounds of cable D–8010. Cable 80–133 extends to Fig. 133 where it terminates on the armatures of connector CCEO–13300.

With connector CCEO–13300 operated, the answer day digit extends over contacts 1 to 5 of connector CCEO–13300 and cable D–13301 to Fig. 181 where two of the

answer day translator relays ADT0–18105 to ADT7–18109 are operated. The cable D–13301 also extends into Fig. 60 where two of the answer day translator relays ADT0–6000 to ADT7–6007 are operated. The answer hour tens digit extends over contacts 6 to 8 of connector CCEO–13300 and cable HT–13302 into Fig. 183 where one of the answer hour tens translator relays AHTT0–18300 to AHTT2–18302 is operated. The answer hour units digit extends over contacts 9 to 13 of connector CCEO–13300 and cable HU–13303 into Fig. 185 where two of the answer hour units translator relays AHUT0–18500 to AHUT7–18504 are operated. The answer minute tens digit (bi-trinary) extends over contacts 14 to 18 of connector CCEO–13300 and cable AMT–13304 into Fig. 199, where the binary part (lead 3 or 00) emerges out of cable 19906 to operate the complementary one of the minute tens binary subtractor relays AMTB00–19910 and AMTB3–19913, the trinary part (leads 2, 1 and 0) emerging by means of cable 199–200A into Fig. 200 where the complementary one of the answer minute tens trinary subtractor relays AMTT0–20010, AMTT1–20011 and AMTT2–20012 is operated. The answer minute units digit extends over contacts 19 to 23 of the connector CCEO–13300 and cable MU–13305 into Fig. 187 where two of the answer minute units translator relays AMUT0–18700 to AMUT7–18704 are operated. The answer minute parts (tenths) digit extends over contacts 24 to 28 of connector CCEO–13300 and cable MP–13306 into Fig. 189 where two of the answer minute parts (tenths) translator relays AMMPT0–18900 to AMMPT7–18904 are operated.

The chargeable time is computed by subtracting the answer from the disconnect time and rounding off the result to take into account an allowance of from .2 to .5 second in determining the charges to be applied on each call. Subtracting with relays is accomplished by a process known as "complementary addition." With complementary addition the nine's complement of the answer time is added to the disconnect time with a carry-in of 1 (.1 minute) and a carry-out of 1 from the highest time order.

In the subtraction, as performed in this machine, digits representing one of 10 days, the hour tens and units of the day and minute tens, units and tenths of the hour are provided for both the answer and disconnect time. The normal decimal subtraction of digits representing these time orders does not produce the correct result since there are but six 10 minute intervals in an hour and 24 hour intervals in a day. Hence, the subtracting is carried out in this machine by changing the arithmetic base of the calculation so that the carrying and borrowing for the hour time order is in terms of six ten minutes and the carrying or borrowing for the day time order is in terms of 24 hours.

It has been found convenient in the design to use the following codes in the computing circuit for enabling the type of calculating described above.

Day	Bi-quinary.
Hour	Quaternary, binary and trinary.
Minute tens	Bi-trinary.
Minute units	Bi-quinary.
Minute tenths	Bi-quinary.

Binary indicates one-out-of-two, trinary indicates one-out-of-three, quaternary indicates one-out-of-four and quinary indicates one-out-of-five.

The translators of the computer portion of the machine (Figs. 181 to 189) are use primarily for converting the digits registered in the assembling and call entry registers on a two-out-of-five basis into the required calculating codes given above.

The minute tens bi-trinary translator is made in the call register portions of the machine (Figs. 78 and 81) and connects directly through the computer connector relays CCFO–13000 and CCEO–13300 to the associated subtractor relays of Figs. 199 and 200 as above described.

The trinary portion of the hour translation is taken from an hour units call register through a computer connector. The decimal output of the disconnect hour units register of Fig. 77 extends by one of the leads T0 to T9 into cable 77–130A in Fig. 77 to Fig. 130 and over one of contacts 31 to 40 of connector CCFO–13000, cables 13008, 130–156 and 13008 to Fig. 182, thence over a contact of one of the disconnect hour tens translator relays DHTT0–18200 to DHTT2–18202, out over one of the three trinary leads D0 to D2 (according to the table in Section 3.060) into cable 182–198, one of conductors D0 to D2 in Fig. 198, thence over cable 19810 to operate one of the disconnect hour trinary subtractor relays DHT0–19802 to DHT2–19804. Similarly the decimal output of the answer hour units register of Fig. 80 extends by one of the leads T0 to T9 into cable 80–133A in Fig. 80 to Fig. 133 and over one of contacts 29 to 38 of connector CCEO–13300, over cable 13307 to Fig. 183, thence over a contact of one of the answer hour tens translator relays AHTT0–18300 to AHTT2–18302, out over one of the three trinary leads A0 to A2 into cable 183–198 to Fig. 198 where the complementary one of the answer hour trinary subtractor relays AHT0–19807 to AHT2–19809 is operated.

The answer and disconnect day, minute units and minute tenths digits are translated in the computer portion of the machine each to a bi-quinary code. Four sets of two grounded leads extend from contacts 7 to 14 of the connector CCDO–13600, each set containing a B and a Q lead into separate cables 13601, 13602, 13603 and 13604, over cable 136–189 to Fig. 189. In Fig. 189, cable 13601 emerges and grounded conductors B and Q thereof extend over contacts of the operated answer minute parts translator relays AMMPT0–18900 to AMMPT7–18904 to ground one of the binary leads A00 and A5 into cable 189–203 and one of the quinary leads A0 to A4 into cable 189–204 all according to the table in Section 3.058. The binary cable 189–203 extends from Fig. 189 into Fig. 203 where the complementary one of the answer minute parts (or tenths) binary subtractor relays AMMPB00–20310 and AMMPB5–20315 is operated. The quinary cable 189–204 extends from Fig. 189 into Fig. 204 where the complementary one of the answer minute parts quinary subtractor relays AMMPQ0–20410 to AMMPQ4–20414 is operated. The binary and quinary grounded leads B and Q out of cable 13601 in Fig. 189 extend into Fig. 188 where they extend over contacts of the disconnect minute parts translator relays DMMPT0–18800 to DMMPT7–18804 to ground one of the binary leads D00 and D5 into cable 188–203 to Fig. 203 to operate one of the disconnect minute parts binary subtractor relays DMMPB00–20300 and DMMPB5–20305, and to ground one of the quinary leads D0 to D4 into cable 188–204 into Fig. 204 to operate one of the disconnect minute parts quinary subtractor relays DMMPQ0–20400 to DMMPQ4–20404. The other three pairs of binary-quinary grounded leads B and Q continue from cable 136–189 in Fig. 189 over cable 189–187 to Fig. 187 where cable 13602 emerges, whereby a binary and a quinary output is obtained from the answer minute units translator relays of Fig. 187 out over cables 187–201 and 187–202 to Figs. 201 and 202 to operate the complementary one of the answer minute units binary subtractor relays AMUB00–20110 and AMUB5–20115 and the complementary one of the answer minute units quinary subtractor relays AMUQ0–20210 to AMUQ4–20214. The B and Q leads out of cable 13602 in Fig. 187 extend into Fig. 186 where they extend over contacts of the disconnect minute units translator relays to produce binary and quinary outputs into respective cables 186–201 and 186–202 into respective Figs. 201 and 202 to operate one of the disconnect minute units binary subtractor relays DMUB00–20100 and DMUB5–20105 and one of the disconnect minute units quinary subtractor relays DMUQ0–20200 to DMUQ4–20204. The remaining two sets of grounded B and Q leads continue from cable

189–187 in Fig. 187 over cable 187–185 into Fig. 185 where the set in cable 13603 emerges for a purpose to be described presently. The remaining set in cable 13604 continues from Fig. 185 to Fig. 181 where the grounded B and Q leads extend over contacts of the disconnect and answer day translator relays to produce bi-quinary outputs therefrom into respective cables 181–196 and 181–196A into Fig. 196 to operate one of the disconnect day binary subtractor relays DDB00–19606 and DDB5–19605 and one of the disconnect day quinary subtractor relays DDQ0–19600 to DDQ4–19604 and the complementary one of the answer day binary subtractor relays ADB00–19616 and ADB5–19615 and the complementary one of the answer day quinary subtractor relays ADQ0–19610 to ADQ4–19614.

The hour tens translator (Figs. 182 and 183) together with the hour units translator (Figs. 184 and 185) in the computer portion of the machine translates hour, tens and units digits into the required quaternary and trinary codes. The fourth set of grounded B and Q leads comes out of cable 13603 in Fig. 185 and over the contacts of the answer and disconnect hour units translator relays of Figs. 185 and 184. There are two sets of outputs from each of these two sets of relays. Each output set is a decimal set of ten leads corresponding to the B or Q input: for instance, there are ten output leads B0 to B9 into cable B–18506 in Fig. 185, etc. The decimal outputs of cables B–18506 and Q–18505 of Fig. 185 extend over cable 185–183 to armatures of the answer hour tens translator relays of Fig. 183; while the decimal outputs of cables B–18405 and Q–18406 of Fig. 184 extend over cable 184–182 to armatures of the disconnect hour tens translator relays of Fig. 182. The units digit of the answer hour, leads B0 to B9 out of cable 185–183 in Fig. 183, extends over contacts of the relays of Fig. 183 to provide a binary output (see table in Section 3.060) on conductor A00 or A3 into cable A–18303, which extends into Fig. 198 to operate the complementary one of the answer hour binary subtractor relays AHB00–19805 and AHB3–19806. Likewise, the units digit of the disconnect hour, leads B0 to B9 out of cable 184–182 in Fig. 182, extends over contacts of the relays of Fig. 182 to provide a binary output (see table in Section 3.060) on conductor D00 or D3 into cable D–18203, which extends into Fig. 198 to operate one of the disconnect hour binary subtractor relays DHB00–19800 and DHB3–19801. Similarly, the answer hour units digit, leads Q0 to Q9 out of cable 185–183 in Fig. 183, extends over contacts of the relays of Fig. 183 to provide a quaternary output (see table in Section 3.060) on conductors A000, A6, A12 and A18 into cables 183–197 and 19708, conductors A000, A6, A12 and A18, cable 19709, to operate the complementary one of the answer hour quaternary subtractor relays AHQ000–19704 to AHQ18–19707 of Fig. 197. Also, the disconnect hour units digit, leads Q0 to Q9 out of cable 184–182 in Fig. 182, extends over contacts of the relays of Fig. 182, to provide a quaternary output (see table in Section 3.060) on one of the leads D000, D6, D12 and D18 into cable 182–197, which extends into Fig. 197 to operate one of the disconnect hour quaternary subtractor relays DHQ000–19700 to DHQ18–19703 of Fig. 197. These relays also detect the appearance of the fictitious hour value 25 which may have been stored in an assembling register while no regular hour has registered in the odd or even hour register. The Q5 lead out of cable 185–183 in Fig. 183 will, under the hour value 25 suitation, extend over contact 9 of the answer hour tens translator relay AHTT2–18302 to conductor A25–18304, which extends into Fig. 195 to operate the answer apology relay AAP–19515. Likewise, the Q5 lead out of cable 184–182 in Fig. 182 will, under the condition of a disconnect hour of 25, extend over contact 9 of the disconnect hour tens translator relay DHTT2–18202 to conductor D25–18204 into Fig. 195 to operate the disconnect apology relay DAP–19516.

The operation of the subtractor relays has been described except for the following relays and parts: the two switches 20303 and 20304 may be set to any desired position manually (see Section 3.064) to permit a prescribed number of tenths of a minute to be allowed for switching delays so as not to overcharge a customer; relays UQ0–20205 to UQ2–20207 repeat the carry-in from the minute tenths binary subtractor of Fig. 203; relays UB0–20101 to UB2–20103 repeat the carry-in from the minute units quinary subtractor of Fig. 202; relays TT0–20003 to TT2–20005 repeat the carry-in from the minute units binary subtractor of Fig. 201; and, relays TB0–19904 to TB2–19902 repeat the carry-in from the minute tens trinary subtractor of Fig. 200.

The minute tenths binary and quinary relays of Figs. 203 and 204 consist of contact networks which merely determine the carry into the minute units portion of Fig. 202 of the subtractor since the chargeable time result is given in terms of whole minutes.

The other digits of the subtractor in Figs. 196 to 202 contain two networks, one for determining the resulting chargeable time output and the other for determining the carry between digits.

Normally the carry-out from one coded portion of a digit carries-in to the coded portion of the next digit of higher time order to determine the subtraction result. The carry-in operates relays which repeat the carry-in to the network on these relays, which then determine the carry-out.

In computing the quaternary portion in Fig. 197 of the chargeable time, the carry-in from the minute tens trinary subtractor of Fig. 200 first enters the trinary portion of the hour subtractor of Fig. 198 before entering the minute tens binary portion of Fig. 199 as will be explained.

The round off of the elapsed time is accomplished by using additional carry leads between subtractor digits used in forming the chargeable time. This avoids the extra set of relays and relay operating times required in rounding off the elapsed time to form the chargeable time.

The timed release index translator relays NTR–20301 and DTR–20302 are interposed between the minute tenths binary (Fig. 203) and minute units quinary (Fig. 202) subtractors and plays a part in determining the required carry.

The following tables give the translations which are made in each of these contact networks on the subtractor relays. Ground from computing and carry purposes is supplied to the computer relays from ground over contact 15 of connector relay CCDO–13600 to conductor CG–13605 which extends throughout the subtractor of Figs. 195 through 204, etc.

MINUTE TENTHS QUINARY—FIG. 204—(CARRY-OUT—LOWER LEFT)

Disconnect	Answer				
	0	1	2	3	4
0	0	1	2	3	4
1	1	2	3	4	5
2	2	3	4	5	6
3	3	4	5	6	7
4	4	5	6	7	8

MINUTE TENTHS BINARY—FIG. 203—(CARRY-OUT—UPPER LEFT)

Disconnect	Answer	Carry-in (lower right)								
		0	1	2	3	4	5	6	7	8
00	00	0	0	2-01	3-01	4-01	5-01	1	1	1
5	00	5-01	1	1	1	1	1	1	2-12	3-12
00	5	5-01	1	1	1	1	1	1	2-12	3-12
5	5	1	1	2-12	3-12	4-12	5-12	2	2	2

TIMED RELEASE INDEX—FIG. 203—(CARRY-OUT—UPPER LEFT) (ASSUME OPTION v)

Carry-In	NTR	DTR
0	0	0
1	1	1
2-01*	1	0
3-01*	1	0
4-01	1	0
5-01	1	0
2-12*	2	1
3-12*	2	1
4-12	2	1
5-12	2	1
2	2	2

*Affected by option.

CHARGEABLE TIME UNITS QUINARY—FIG. 202 (CABLE 30-202)

Carry-In (upper right)	Disconnect Minutes Units Quinary	Answer Minutes Units Quinary				
		0	1	2	3	4
0	0	0	1	2	3	4
0	1	1	2	3	4	0
0	2	2	3	4	0	1
0	3	3	4	0	1	2
0	4	4	0	1	2	3
1	0	1	2	3	4	0
1	1	2	3	4	0	1
1	2	3	4	0	1	2
1	3	4	0	1	2	3
1	4	0	1	2	3	4
2	0	2	3	4	0	1
2	1	3	4	0	1	2
2	2	4	0	1	2	3
2	3	0	1	2	3	4
2	4	1	2	3	4	0

MINUTE UNITS QUINARY—FIG. 202 (UPPER LEFT)—(CARRY-OUT)

Carry-In (upper left)	Disconnect	Answer				
		0	1	2	3	4
0	0	0	0	0	0	0
0	1	0	0	0	0	1
0	2	0	0	0	1	1
0	3	0	0	1	1	1
0	4	0	1	1	1	1
1	0	0	0	0	0	1
1	1	0	0	0	1	1
1	2	0	0	1	1	1
1	3	0	1	1	1	1
1	4	1	1	1	1	1
2	0	0	0	0	1	1
2	1	0	0	1	1	1
2	2	0	1	1	1	1
2	3	1	1	1	1	1
2	4	1	1	1	1	2

CHARGEABLE TIME UNITS BINARY—FIG. 201 (CABLE 30-201)

Carry-In (upper right)	Disconnect Minutes Units Binary	Answer Minutes Units Binary	
		00	5
0	00	00	5
0	5	5	00
1	00	5	00
1	5	00	5
2	00	00	5
2	5	5	00

MINUTE UNITS BINARY—FIG. 201 (UPPER LEFT)—(CARRY-OUT)

Carry-In (upper left)	Disconnect	Answer	
		00	5
0	00	0	0
0	5	0	1
1	00	0	1
1	5	1	1
2	00	1	1
2	5	1	2

CHARGEABLE TIME TENS TRINARY—FIG. 200 (CABLE 29-200)

Carry-In (upper right)	Disconnect Minute Tens Trinary	Answer Minutes Tens Trinary		
		0	1	2
0	0	0	1	2
0	1	1	2	0
0	2	2	0	1
1	0	1	2	0
1	1	2	0	1
1	2	0	1	2
2	0	2	0	1
2	1	0	1	2
2	2	1	2	0

MINUTE TENS TRINARY—FIG. 200 (CABLE 200-195)—(CARRY-OUT)

Carry-In (upper left)	Disconnect	Answer		
		0	1	2
0	0	0	0	0
0	1	0	0	1
0	2	0	1	1
1	0	0	0	1
1	1	0	1	1
1	2	1	1	1
2	0	0	1	1
2	1	1	1	1
2	2	1	1	2

CHARGEABLE TIME TENS QUATERNARY—FIGS. 198 AND 199 (CABLE 29-199)

Carry-In (Cable 195-199)	Disconnect		Answer					
	Hour Trinary	Minute Tens Binary	Hour Trinary					
			0	1	2	0	1	2
			Minute Tens Binary					
			00	00	00	3	3	3
0	0	00	0	6	MTOC	3	MTOC	MTOC
0	1	00	6	MTOC	0	MTOC	MTOC	3
0	2	00	MTOC	0	6	MTOC	3	MTOC
0	0	3	3	MTOC	MTOC	6	MTOC	0
0	1	3	MTOC	MTOC	3	MTOC	0	6
0	2	3	MTOC	3	MTOC	0	6	MTOC
1	0	00	3	MTOC	MTOC	6	MTOC	0
1	1	00	MTOC	MTOC	3	MTOC	0	6
1	2	00	MTOC	3	MTOC	0	6	MTOC
1	0	3	6	MTOC	0	MTOC	MTOC	3
1	1	3	MTOC	0	6	MTOC	3	MTOC
1	2	3	0	6	MTOC	3	MTOC	MTOC
2	0	00	6	MTOC	0	MTOC	MTOC	3
2	1	00	MTOC	0	6	MTOC	3	MTOC
2	2	00	0	6	MTOC	3	MTOC	MTOC
2	0	3	MTOC	MTOC	3	MTOC	0	6
2	1	3	MTOC	3	MTOC	0	6	MTOC
2	2	3	3	MTOC	MTOC	6	MTOC	0

MINUTE TENS BINARY—FIG. 199 (LOWER LEFT)—(CARRY-OUT)

Carry-In (upper left)	Disconnect	Answer	
		00	3
0	00	0	0
0	3	0	1
1	00	0	1
1	3	1	1
2	00	1	1
2	3	1	2

HOUR TRINARY—FIG. 198 (UPPER MIDDLE)—(CARRY-OUT)

Carry-In (lower right)	Disconnect	Answer		
		0	1	2
0	0	0	0	0
0	1	0	0	1
0	2	0	1	1
1	0	0	0	1
1	1	0	1	1
1	2	1	1	1
2	0	0	1	1
2	1	1	1	1
2	2	1	1	CC2

HOUR BINARY OUTPUT—FIG. 198 (LOWER MIDDLE)

Carry-In (upper middle)	Disconnect	Answer	
		00	3
0	00	0	NO
0	3	NO	0
1	00	NO	0
1	3	0	NO
CC2	00	NO	NO
CC2	3	NO	NO

HOUR BINARY—FIG. 198 (UPPER LEFT)—(CARRY-OUT)

Carry-In (upper middle)	Disconnect	Answer	
		00	3
0	00	0	0
0	3	0	1
1	00	0	1
1	3	1	1
CC2	00	0	1
CC2	3	1	1

HOUR QUATERNARY OUTPUT—FIG. 197 (CABLE 197—195)

Carry-In (upper right)	Disconnect	Answer			
		000	6	12	18
0	000	0	NO-0	NO-0	NO-0
0	6	NO-0	NO-0	NO-0	0
0	12	NO-0	NO-0	0	NO-0
0	18	NO-0	0	NO-0	NO-0
1	000	NO-1	NO-1	NO-1	0
1	6	NO-1	NO-1	0	NO-1
1	12	NO-1	0	NO-1	NO-1
1	18	0	NO-1	NO-1	NO-1

HOUR QUATENARY—FIG. 197 (UPPER LEFT)—(CARRY-OUT)

Carry-In (upper right)	Disconnect	Answer			
		000	6	12	18
0	000	0	0	0	0
0	6	0	0	0	1
0	12	0	0	1	1
0	18	0	1	1	1
1	000	0	0	0	1
1	6	0	0	1	1
1	12	0	1	1	1
1	18	1	1	1	1

DAY QUINARY OUTPUT—FIG. 196 (CABLE 196-195)

Carry-In (upper right)	Disconnect	Answer				
		0	1	2	3	4
0	0	0	NO-0	NO-0	NO-0	NO-0
0	1	NO-0	NO-0	NO-0	NO-0	0
0	2	NO-0	NO-0	NO-0	0	NO-0
0	3	NO-0	NO-0	0	NO-0	NO-0
0	4	NO-0	0	NO-0	NO-0	NO-0
1	0	NO-1	NO-1	NO-1	NO-1	0
1	1	NO-1	NO-1	NO-1	0	NO-1
1	2	NO-1	NO-1	0	NO-1	NO-1
1	3	NO-1	0	NO-1	NO-1	NO-1
1	4	0	NO-1	NO-1	NO-1	NO-1

DAY QUINARY—FIG. 196 (UPPER LEFT)—(CARRY-OUT)

Carry-In (upper right)	Disconnect	Answer				
		0	1	2	3	4
0	0	0	0	0	0	0
0	1	0	0	0	0	1
0	2	0	0	0	1	1
0	3	0	0	1	1	1
0	4	0	1	1	1	1
1	0	0	0	0	0	1
1	1	0	0	0	1	1
1	2	0	0	1	1	1
1	3	0	1	1	1	1
1	4	1	1	1	1	1

DAY BINARY—FIG. 196 (CABLE 196-195A) OUTPUT

Carry-In (upper left)	Disconnect	Answer	
		00	5
0	00	0	NO
0	5	NO	0
1	00	NO	0
1	5	0	NO

DAY BINARY—FIG. 196 (CABLE 196-195A)—(CARRY-OUT)

Carry-In (upper left)	Disconnect	Answer	
		00	5
0	00	CR0	CR0
0	5	CR0	CR1
1	00	CR0	CR1
1	5	CR1	CR1

The following are two examples which show the use of these contact networks and tables in determining in a single subtracting operation the chargeable time from the answer and disconnect times. These examples have been chosen so as to illustrate most of the carrying and borrowing conditions.

TYPICAL SUBTRACTOR CALCULATIONS

Example I

	Day		Hour			Minute				Timed Release Index	Minute Tenths	
						Tens		Units				
Answer	3		19			1		6		-------	9	
Disconnect	3		19			3		1		NO	6	
	B	Q	Q	B	T	B	T	B	Q	-------	B	Q
Answer	5	1	000	3	1	3	1	00	3	-------	00	0
Disconnect	00	3	18	00	1	3	0	00	1	NTR	5	1
Carry-Out	CR1	1	1	1	1	1	0	0	1	1	1	1
Output	0	0	0	0	----	0	1	5	0	-------	----	----
						(Chargeable Time)						

The disconnect day digit of 3 is registered on a two-out-of-five basis in relays DDT1–18101 and DDT2–18102, thereby operating the binary relay DDB00–19606 and the quinary relay DDQ3–19603. The answer day digit of 3 is registered on a two-out-of-five basis in relays ADT1–18106 and ADT2–18107, thereby operating the binary relay ADB5–19615 and the quinary relay ADQ1–19611. The disconnect hour tens digit 1 operates relay DHTT1–18201; the answer hour tens digit 1 operates relay AHTT1–18301; the respective units digits of 9 operate the respective pairs of relays DHUT2–18402, DHUT7–18404 and AHUT2–18502, AHUT7–18504; the disconnect hour units digit 9 and the disconnect hour tens digit 1 operates the disconnect hour trinary relay DHT1–19803; likewise, the answer hour trinary relay AHT1–19808 operates; the corresponding disconnect and complementary answer hour binary and quaternary relays DHB00–19800, AHB3–19806 and DHQ18–19703, AHQ000–19704 are operated. The disconnect minute tens digit of 3 causes the operation of the disconnect minute tens binary relay DMTB3–19903 and the tens trinary relay DMTT0–20000; the answer minute tens digit of 1 causes the operation of the answer minute tens binary relay AMTB3–19913 and the tens trinary relay AMTT1–20011. The disconnect minute units digit of 1 operates relays DMUT0–18600 and DMUT1–18601, thereby operating the disconnect minute units binary and quinary relays DMUB00–20100 and DMUQ1–20201; the answer minute units digit of 6 operates the relays AMUT2–18702 and AMUT4–18703, thereby operating the answer minute units binary and quinary relays AMUB00–20110 and AMUQ3–20213. Since there is "no" timed release on the disconnect time the no-timed-release relay NTR–20301 is operated. The disconnect minute parts digit of 6 operates the relays DMMPT2–18802 and DMMPT4–18803, thereby causing the operation of the disconnect minute parts binary and quinary relays DMMPB5–20305 and DMMPQ1–20401; likewise, the answer minute parts digit of 9 operates the relays AMMPT2–18902 and AMMPT7–18904, causing the operation of the answer minute parts binary and quinary relays AMMPB00–20310 and AMMPQ0–20410.

The ground on conductor CG–13605 in Fig. 204 extends over the contact of relay AMMPQ0 and contact 5 of relay DMMPQ1 to lead 1 into Fig. 203, where lead 1 extends over contact 8 of relay AMMPB00 and contact 2 of relay DMMPB5 to the carry-out lead 1 into Fig. 202. This lead 1 extends to and operates the units quinary carry relay UQ1–20206. This lead 1 also extends over contact 2 of relay DMUQ1 and contact 8 of relay AMUQ3 to lead 0 into cable 30–202. This represents the quinary part of the minute units of chargeable time. The ground on conductor CG–13605 in Fig. 202 extends over the contact of relay UQ1 and contact 2 of relay AMUQ3 and contact 4 of relay DMUQ1 to the minute units quinary 1 carry-out lead into Fig. 201, which thereupon operates the units binary carry relay UB1–20102. The 1 carry-out lead also extends over contact 2 of relay DMUB00 and contact 4 of relay AMUB00 to the lead 5 into cable 30–201. This is the binary part of the minute units of chargeable time.

The grounded lead CG–13605 in Fig. 201 extends over the contact of relay UB1–20102 and contact 2 of relay AMUB00 and contact 4 of relay DMUB00 to the units binary 0 carry-out lead into Fig. 200, where it operates the tens trinary carry relay TT0–20003. The lead 0 extends over contact 3 of relay DMTT0 and contact 5 of relay AMTT1 to the 1 lead into cable 29–200, which is the trinary part of the chargeable time tens output. The ground on conductor CG–13605 in Fig. 200 extends over the contact of relay TT0 and contact 1 of relay AMTT1 and contact 6 of relay DMTT0 to the 0 carry-out lead into cable 200–195 to Fig. 195, over contact 2 of relay AP–19518, carry lead OB, cable 195–199 to Fig. 199, to operate the tens binary carry relay TB0–19904. The lead OB also extends over contact 4 of relay DHT1–19803, contact 4 of relay AHT1–19808, conductor 19812, contact 3 of relay DMTB3–19903 and contact 7 of relay AMTB3–19913 to the 0 conductor cable 29–199. This represents the tens binary output of chargeable time.

The ground on conductor CG–13605 in Fig. 199 extends over the contact of relay TB0 and contact 1 of relay AMTB3 and contact 7 of relay DMTB3 to the tens binary carry-out lead 1 into Fig. 198, where it extends over contact 8 of relay AHT1 and contact 3 of relay DHT1 to the hour trinary carry-out lead 1 connected to the contact 2 of relay CC2–19810. This 1 lead extends over contacts 4 and 2 of relays DHB00 and AHB3 to lead 0 into cable 198–195A to Fig. 195 to operate relay HB0–19500, indicating a zero result of hour binary subtraction.

The lead 1 also extends over contact 5 of relay DHB00 and contact 4 of relay AHB3 to the hour binary carry-out lead 1 into Fig. 197, where it extends over contact 6 of relay DHQ18 and contact 4 of relay AHQ000 to conductor 0 into cable 197–195, which extends to Fig. 195 where relay HQ0–19502 is operated to indicate that the result of hour quaternary subtraction is zero.

The lead 1 also extends over contact 7 of relay DHQ18 and contact 6 of relay AHQ000 to the hour quaternary carry-out lead 1 into Fig. 196, where it extends over contact 7 of relay DDQ3 and contact 4 of relay ADQ1 to lead 0 into cable 196–195 to Fig. 195 where relay DQ0–19505 operates to indicate that the day quinary subtraction is zero.

The lead 1 also extends over contact 8 of relay DDQ3 and conductor 19607 and contact 6 of relay ADQ1, to the day quinary carry-out lead 1 to the upper left part of Fig. 196, where it extends over contact 3 of relay DDB00 and contact 4 of relay ADB5 to lead 0 into cable 196–195A into Fig. 195 to operate relay DB0–19508

to indicate that the day binary subtraction result is zero. The conductor **1** also extends over contact **4** of relay **DDB00** and contact **1** of relay ADB5 to lead CR1 into cable **196–195**A to Fig. 195, where it operates relay **CR1–19511**, thereby to indicate that the carry-out from the subtractor is one and hence that the result is positive.

Thus the outputs from the subtractor are four: grounded conductor **0** into cable **30–202** in Fig. 202 represents the quinary part of the chargeable time minute units; the grounded lead **5** into cable **30–201** of Fig. 201 is the binary part of the minute units; the grounded lead **1** into cable **29–200** of Fig. 200 is the one trinary part of the minute tens; and, the grounded lead **0** into cable **29–199** of Fig. 199 is the other trinary part of the minute tens. The following tables show the chargeable time to be 15 minutes:

Decimal	Bi-quinary	Tri-trinary
0	00–0	0–0.
1	00–1	0–1.
2	00–2	0–2.
3	00–3	3–0.
4	00–4	3–1.
5	5–0	3–2.
6	5–1	6–0.
7	5–2	6–1.
8	5–3	6–2.
9	5–4	(overcapacity—MTOC).

This result of 15 minutes conforms to the arithmetic subtraction of (answer) 16.9 minutes from (disconnect) 31.6 minutes, which is 14.7, the seven tenths being considered as another full minute for billing purposes.

Example II

	Day		Hour			Minute				Timed Release Index	Minute Tenths	
						Tens		Units				
Answer	3		22			4		1		-------	0	
Disconnect	4		00			0		1		NO	9	
	B	Q	Q	B	T	B	T	B	Q	-------	B	Q
Answer	5	1	000	00	1	00	1	5	3	-------	5	4
Disconnect	00	4	000	00	0	00	0	00	1	NTR	5	4
Carry-Out	CR1	1	0	0	0	0	0	1	1	2	2	8
Output	0	0	0	0	----	6	2	00	1	-------	----	----
						(Chargeable Time)						

In Example II the arithmetic subtraction of (answer) 3 days 22 hours and 41.0 minutes from (disconnect) 4 days 00 hours and 1.0 minute should be 1 hour and 20.9 minutes or 80.9 minutes exactly. The result appears in four parts: units quinary 1 into cable **30–202** in Fig. 202; units binary 00 into cable **30–201** in Fig. 201; tens trinary 2 into cable **29–200** in Fig. 200; and, tens trinary 6 into cable **29–199** in Fig. 199. From the above table this result is 81 minutes, having rounded off the .9 minute to the next full minute.

The chargeable time output from the subtractor operates the chargeable time translator relays of Figs. 29 and 30. The chargeable time tens digit translator of Fig. 29 consists of two trinary parts and an overcapacity indication. The chargeable time units digit operates the chargeable time units translator relays of Fig. 30 in a bi-quinary combination.

The operation of the **0** relays, such as relays **CTT00–2900**, **CTT0–2903**, **CTU00–3010** and **CTU0–3000**, in all portions of the chargeable time translator of Figs. 29 and 30 is avoided by carrying the chargeable time units 0 output from the minute units quinary subtractor (in cable **30–202** from Fig. 202 to Fig. 30) through the chargeable time tens and chargeable time units binary translator, which operates the relay **CTU1–3001** if all of the remaining chargeable time translations indicate that the resultant chargeable time is 0. This circuit would, under these circumstances, extend from the grounded **0** lead out of cable **30–202** in Fig. 30 into Fig. 29, over contact **6** of relay **CTT00–2900**, contact **7** of relay **CTT0–2903**, conductor **2907**, contact **2** of relay **CTU00–3010** and contact **2** of relay **CTU5–3005** to relay **CTU1–3001**.

The subtractor control of Fig. 195 contains relays for recording the output from the day and hour portions of the subtractor as described in Section 3.077. For a chargeable time to remain within the limits of the capacity of the machine to compute these outputs must all be 0. That is, for instance, the zero output relays **HB0–19500**, **HQ0–19502**, **DQ0–19505** and **DB0–19508** (hour binary, hour quaternary, day quinary and day binary outputs) must be operated.

The operation of one of the not-zero output relays **HBN0–19501**, **HQN00–19504**, **HQN01–19503**, **DQN00–19507**, **DQN01–19506** and **DBN0–19509** of the subtractor control of Fig. 195 or the operation of the chargeable time tens over-capacity relay **CTOC–2906** of the chargeable time tens translator of Fig. 29 indicates that the resulting chargeable time computation exceeds the capacity of the machine for normal processing of the call and consequently an operate path for relay **OV–19513** of the subtractor control is closed. Relay **NOV–19512** operates under all other conditions to indicate that a directly usuable result has been computed. This path extends from ground on the lead **CG–13605** (previously described) in Fig. 30, over a one only operated of the five quinary relays **CTU4–3004** to **CTU0–3000**, over a one only operated of the two binary relays **CTU5–3005** and **CTU00–3010**, conductor **3006**, over a one only operated of the three trinary relays **CTT2–2905** to **CTT0–2903** and over a one only operated of the four relays **CTT00–2900** to **CTOC–2906** to one of two leads **CR–2908** and **OC–2909**, to lead **OC–2909** if relay **CTOC–2906** is operated, otherwise to lead **CR–2908**. These leads extend to Fig. 28 and thence over cable **28–195** to Fig. 195, where leads **CR–2908** and **OC–209** emerge. An inspection of the top row of relays in Fig. 195 shows that if conductor **OC–2909** is grounded, then relay **OV–19513** is operated provided that relay **99–19514** is released and provided that one of the relays **CR0–19510** and **CR1–10511** is operated. Furthermore, if lead **CR–2908** is grounded and if only the zero output relays are operated and if one of relays **CR0–19510** and **CR1–19511** is operated and if relay **99–19514** is released, then relay **NOV–19512** is operated. If any not-zero output relay is operated, then the grounded lead **CR–2908** will ground lead **OC–2909** to operate relay **OV–19513**.

The two subtracting networks on the hour trinary (Fig. 198) and minute tens binary (Fig. 199) digit deal in terms of minute tens to convert hours into six minute tens.

The chargeable time tens and units digit (if the tens

digit does not exceed 8) are registered on a two-out-of-five basis in the odd call entry register in Figs. 93 and 94. Grounds extend over contacts 2 and 3 (Fig. 93) of connector CCB0–9400, conductors CTT and CTU, cable 29–93 to Fig. 29 where conductor CTT comes out of cable 2910 and conductor CTU continues in cable 29–30 to Fig. 30. Conductor CTT in Fig. 29 extends over contacts of the operated one of relays CTT0 to CTT2 and the operated one of relays CTT00 to CTT6 to ground two of the five leads entering cables 2911 and 29–93. The CTU lead in Fig. 30 likewise extends over contacts of the operated one of relays CTU0 to CTU4 and the operated one of relays CTU00 and CTU5 to ground two of the five leads entering cables 30–29 and 29–93.

These two sets of two-out-of-five grounded leads extend via cable 29–93 to Fig. 93, where the five tens leads emerge from cable 2911 and extend over contacts 5 to 9 of connector CCB0–9400 to operate two of the five chargeable times tens relays OCHTT0 to OCHTT7 of Fig. 93. These operated relays lock to ground on the lock lead LO2–9301, which extends over cables 96–94, 123–96 and 123–126, conductor LO2–9301 to ground over contact 12 of relay ORLS–12605 and the contact of relay ORONG–12604. The units leads come out of cable 29–93 in Fig. 93 into cable 30–29 into Fig. 94 and over contacts 10 to 14 of connector CCB0–9400 to operate two of the chargeable time units relays OCHTU0 to OCHTU7 of Fig. 94, these relays then locking to the lock conductor LO2–9301.

4.14 *Billing index translation*

The tens and units digits of the billing index as registered in Figs. 83 and 84 from the first line of the initial entry is translated in the computer portion of the machine to determine the formula to be used in computing message or toll units as required.

The billing index units digit (Fig. 84) is translated from two-out-of-five to decimal basis in a call register and the decimal leads are brought through a computer connector CCD0–13600 to the billing index tens translator relays of Fig. 20. The billing index tens translator relays of Fig. 20 are operated from a corresponding set of decimal leads coming through a computer connector CCD0–13600 from the two-out-of-five decimal translation on the billing index tens call register of Fig. 83. The billing index tens digit registered on a two-out-of-five basis in relays OBIT0 to OBIT7 of Fig. 83 provides a decimal output of ground on one of the 0 to 9 leads into cable 83–136 and the billing index units digits registered on a two-out-of-five basis in relays OBIU0 to OBIU7 of Fig. 84 provides a decimal output of ground on one of the 0 to 9 leads into cable 84–136. These two cables extend to Fig. 136 where the tens digit extends over one of the contacts 16 to 25 of connector CCD0–13600 into cable T–13606 and cable 20–136 to Fig. 20 and where the units digit extends over one of the contacts 26 to 35 of connector CCD0–13600 into cable U–13607 and cable 20–136 to Fig. 20. In Fig. 20 the tens digit emerges from cables 20–136 and T–13606 to operate one of the billing index tens translator relays BIT0–2000 to BIT9–2009 and the units digit emerges from cables 20–136 and U–13607 and over a contact of the operated tens translator relay to ground one of the terminals designated 00 to 99. Also, the ground on conductor CG–13605, previously described, will extend over contact 1 of the operated translator relay to ground one of the terminals designated 0 to 9.

Each group of ten billing indices is cross-connected to indicate the class of call as indicated in Section 3.078. That is, the grounded terminal 0 to 9, depending upon the tens relay operated, will be cross-connected to one of the terminals MUT to T depending upon the class of call assigned to that tens digit. These nine punchings MUT to T are connected to nine leads similarly designated and extending over cable 20–46 where the nine leads emerge thus to cause the operation of one of the relays MUT–4602, MUE2–4601, MUE1–4600 and MUL–4700 and one of the relays MU–4702 and MUD–4703 or to cause the operation of only relay TOLL–4701. For instance, if lead MUTD or MUE2D or MUE1D or MULD is grounded, then relay MUT–4602 or MUE2–4601 or MUE1–4600 or MUL–4700 will operate over lead 4603 in series with relay MUD–4703; if lead MUT or MUE2 or MUE1 or MUL1 is grounded, then relay MUT–4602 or MUE2–4601 or MUE1–4600 or MUL–4700 will operate over lead 4604 in series with relay MU–4702; and if lead T is grounded, the only relay TOLL–4701 operates.

Billing indices (punchings 00 to 99 in Fig. 20) which do not require the use of a formula are cross-connected to operate relay DET–19519 of the subtractor control of Fig. 195. That is, any such billing index, represented by a grounded punching 00 to 99 in Fig. 20, will have its punching 00 to 99 cross-connected to the punching DET of Fig. 20, thereby grounding lead DET which extends over cable 28–195 to Fig. 195 to operate relay DET–19519. Otherwise, the individual cross-connections 00 to 99 for each billing index determines the formula to be used in computing message or toll units by operating a formula connector relay such as relays FC00–2800 to FC99–2806 of Fig. 28 or by operating relay SMU–2010 to indicate a charge of only one unit per call regardless of its duration. That is, if the relay SMU–2010 is to be operated, then the particular billing index punching 00 to 99 is cross-connected to the punching SMU in Fig. 20 to operate relay SMU–2010 and, if one of the formula connectors of Fig. 28 is to be operated, then the particular billing index punching 00 to 99 is cross-connected to one of the punchings FC00 to FC99 of Fig. 20 thereby to ground one of the conductors FC00 to FC99 extending into Fig. 28 to operate the corresponding connector FC00–2800 to FC99–2806.

The relay DET–19519 should be operated on billing indices which do not indicate a message unit or message unit detail or toll unit detail call. This means that the group of ten billings indices (punchings 0 to 9 in Fig. 20) for each units cross-connection (punchings 00 to 99 in Fig. 20) which operates relay DET–19519 must also operate relay TOLL–4701 for the toll calls.

When toll units are to be computed the billing indices do not indicate the toll calls but the billing indices unit is cross-connected to operate a formula connector relay instead of relay DET–19519.

4.15 *Computing message or toll units*

When the chargeable time for a call has been determined it is translated by the chargeable time translator relays to produce on two pairs of leads the tens and unit digits of chargeable time on a decimal basis, as previously described. (The chargeable time tens digit can give values from only 0 to 8 since the subtractor does not permit the computation of chargeable time in excess of 89.9 minutes on regular calls.)

The operation of a formula connector relay of Fig. 28 connects a decimal set of leads from the chargeable time tens translator of Fig. 29 to the formula circuit for operating the desired or selected formula relay, such as relays T000–2801 to T998–2802 of Fig. 28 as follows. Grounds are extended over contacts 1 and 4 (Fig. 93) of connector CCB0–9400 to conductors T and MUT into cable 29–93, which extends to Fig. 29. In Fig. 29, conductor T emerges from cables 29–93 and 2910 and extends over a contact of the operated one of relays CTT00–2900 to CTT6–2902 and a contact of the operated one of relays CTT0–2903 to CTT2–2905 to ground one of the decimal output leads 0 to 8 into cables 29–28. This chargeable time tens decimal indication extends via cable 29–28 to Fig. 28 where the grounded lead 0 to 8 emerges and extends over a contact of the operated formula connector

relay FC00–2800 to FC99–2806 thereby to operate one of the formula relays T000–2801 to T998–2802. The operated formula relay connects one decimal set of chargeable time units leads to the decimal leads entering the message unit units register of Fig. 38. The other set of decimal leads from the chargeable time units translator of Fig. 30 passes through the operated formula relay to operate a message unit tens register relay of Fig. 37. The previously mentioned grounded lead MUT (from Fig. 93) comes out of cable 29–93 in Fig. 29 and extends over cable 29–30 to Fig. 30 where it emerges to extend over two contacts of the operated one of relays CTU00–3010 and CTU5–3005 and two contacts of the operated one of relays CTU0–3000 to CTU4–3004 to ground two of the leads 0 to 9 and the corresponding two 0′ to 9′ leads entering cable 30–28 and extending to Fig. 28. Here the non-prime lead 0 to 9 extends over a control of the operated formula relay T000 to T998 to ground one of the "A" punchings and the prime lead 0′ to 9′ extends over a control of the same formula relay to ground over one of the "B" punchings. Each "A" punching is cross-connected to a suitable punching 0 to 9 entering cable MUT at the upper right of Fig. 28 (representing the tens digit of the message units or toll units) and each "B" punching is cross-connected to one of the punchings 0 to 9 included in cable MUU at the upper right of Fig. 28 (representing the units digit of the message units or toll units), all according to the desired formula for converting chargeable time into chargeable message or toll units. The cables MUT and MUU extend from Fig. 28 to respective Figs. 37 and 38 where the appropriate one of the message unit tens relays MUT0–3700 to MUT9–3709 and of the message unit units relays MUU0–3800 to MUU9–3809 are operated to register the tens and units of chargeable message or toll units. These connections between the formula relays of Fig. 28 and the message unit tens and units translators of Figs. 37 and 38 represent the number of message units to be charged for each number of minutes of chargeable time.

The message unit tens and units translators of Figs. 37 and 38 indicate the number of message units to be charged on bulk-billed calls or the number of 5-cent toll units to be priced on toll calls from the chargeable time as computed above. The relays of Figs. 37 and 38 will not be operated on a detail call because no formula connector (Fig. 28) or SMU–2010 will be operated under this condition.

If the relays of Figs. 37 and 38 are operated, then the number of message units registered therein is transferred to the message units tens and units relays of the odd call entry register in Fig. 94. Ground extends over contacts 5 and 6 of connector CCD0–13600 in Fig. 136 to conductors MT and MU into cable 37–136 to Fig. 37. In Fig. 37, conductor MT emerges from cable 37–136 and extends over contacts 1 and 2 of the operated message unit tens translator relay MUT0–3700 to MUT9–3709 to ground two of the five conductors MUT0 to MUT7 entering cables 37–38A and 38–94. In Fig. 37, conductor MU emerges from cable 37–136 and extends into Fig. 38 and over contacts 1 and 2 of the operated message unit units translator relays MUU0–3800 to MUU9–3809 to ground two of the five conductors MUU0 to MUU7 entering cables 3810 and 38–94. Cable 38–94 extends to Fig. 94 where conductors MUT0 to MUT7 emerge out of cable 37–38A and extend over contacts 15 to 19 of connector CCB0–9400 to operate two of the message unit tens relays OMUT0 to OMUT7 of Fig. 94 and where conductors MUU0 to MUU7 emerge out of cable 3810 and extend over contacts 20 to 24 of connector CCB0–9400 to operate two of the message unit units relays OMUU0 to OMUU7 of Fig. 94. These relays then lock to conductor LO2–9301 which extends to ground as previously described.

If this is a detail call, then the relays of Figs. 37 and 38 will not be operated but relay DET–19519 will be operated. Then grounds on conductors MT and MU in Fig. 136 will extend over conductors MT and MU into and over cables 13608, 162–195 and 19521 to conductors MT and MU. In Fig. 195, conductor MT will extend over contacts 5 and 6 of relay DET–19519 to conductors MUT7 and MUT4 into cable 19522 and conductor MU will extend over contacts 3 and 4 of relay DET–19519 to conductors MUU7 and MUU4 into cable 19522. These four conductors extend over cables 19522, 162–195 and 147–162 to Fig. 147 where conductors MUU4 and MUU7 emerge and extend into cable 3810 to Fig. 94 and where conductors MUT4 and MUT7 emerge and extend over cable 37–38A into Fig. 94. These four conductors then emerge from cables 37–38A and 3810 in Fig. 94 and extend over contacts 15, 16, 20 and 21 of connector CCB0–9400 to operate relays OMUT4, OMUT7 and OMUU4, OMUU7 to register zero-zero for the message units.

4.16 *Determining output class and number of lines*

Each call register portion of the circuit contains a register for recording the number of lines to be perforated, if any, and the class of output to be used. For the odd register, the number of lines to be perforated is indicated by the operation of one of the relays O1L–9506 to ODISL–9511 in Fig. 95 and the output class is indicated by the operation of one of the relays of Figs. 96 and 97. The various output classes and the entries which they cause to be formed are set forth in the table in Section 2.47. The output class consists in determining the tape or tapes on which the entry lines are to be perforated and for associating each line to be perforated with a pattern connector.

These two registers are controlled by two separate pairs of leads which weave through the odd or even register control, odd or even computer connector, the subtractor control and the message unit translator of the computer portion of the machine.

The input class translator of Fig. 98 for the odd register indicates the number of lines which were read as the initial entry and this information is used together with that in the input class register of Fig. 83 for determining in part the output class.

Included in the two networks which determine output class and number of lines are a pair of relays ODISL–9511 and ODISW–9706 which indicate when the odd call register registration is to be discarded. Discarding is a process of releasing the registered call information on unanswered, busy and free line calls so that no output entries are perforated.

In order to describe the circuit operations which enter into the determination of output class and number of lines, it is necessary to consider three groups of relays heretofore not described in detail. The first group of relays includes the relays O2LI–9800 and O4LI–9801 of Fig. 98 which are the input class translator relays for the odd call entry register. The operation of one of these relays indicates whether the initial entry was a 2 or a 4 line input. The second group of relays comprises relays OIT0–12700 to OIT7–12707 of Fig. 127 which are the office index translator relays. The third group of relays comprises the relays A2L–19206 and 12L–19207 of Fig. 192. The operation of these three groups of relays will be described in detail prior to the description of the actual operation of the output class relays of Figs. 96 and 97 and the number of lines relays in Fig. 95.

Input class translator.—The input class will be represented by a digit of 1 or a 3 or a 4 registered in the relays OCL0–8300 to OCL4–8303 of Fig. 83 according to Section 2.13. A 1 represents a bulk-billed call (relays OCL0 and OCL1 operated) and identifies a two-line input, a 3 represents a detail billed call (relays OCL1 and OCL2 operated) and identifies a four-line input and a 4 represents an observed call (relays OCL0 and OCL4

operated) and identifies a four-line input. Ground extends from the locking lead L1L–8305 in Fig. 83 over contacts 8 and 6 of relays OCL1 and OCL0 to lead 2LI or over contact 8 or 6 of relay OCL2 or OCL4 to lead 4LI, cables 8311, 8310, 83–120, 12001, 120–122, 122–124 and 124–98, conductor 2LI or 4LI to operate relay O2LI–9800 or O4LI–9801 depending upon whether the input class specifies a two or a four-line input.

Office index translator.—Two of the five relays OOI0 to OOI7 of Fig. 85 will have been operated according to the B digit in the second line of the initial entry pertaining to the call under consideration. The two locking grounds will extend therefrom over two of the conductors 0 to 7 into cable 85–136 to Fig. 136, thence over contacts 36 to 40 of connector relay CCD0–13600, conductors 0 to 7, over cables 136–162 and 162–127 to Fig. 127 to operate two of the office index translator relays OIT0–12700 to OIT7–12707.

Message unit output line translators.—One of the two relays A2L–19206 and 12L–19207 will be operated, depending upon the condition of the various relays in the sort class translator of Figs. 192, 193, 207 and 208 and in the message unit type translator relays of Figs. 46 and 47, as an indication, respectively, that all message unit output entries are to be two-line entries or that the number of lines in a message unit output entry will be determined by the number and type of message units involved.

If the sort class translator indicates that the sorting is by message unit type in a single office marker group, relays SBUT–20803 and SO–19204 will have been operated as previously described. Under this condition ground extends from the off-normal ground on conductor MON–1236 of Fig. 208, over contact 6 of relay SBUT–20803, conductor 20812, contact 5 of relay SO–19204 to conductor 12L to operate the relay 12L–19207. If, on the other hand the marker group comprises a multi-office marker group, relay MO–19205 will have been operated instead of relay SO–19204. Under this condition ground will extend from conductor MON–1236 in Fig. 208, over contact 6 of relay SBUT–20803, conductor 20812, contact 5 of relay MO–19205, conductor L into cables 19220, 37–192 to Fig. 37 and 37–39, and over conductor L to the message unit type translator circuit of Figs. 46 and 47. If relay MUL–4700 is operated, conductor L will extend over the contact 7 thereof to conductor 12L into cable 37–29. If, on the other hand, one of the relays MUE1–4600, MUE2–4601 and MUT–4602 is operated, the conductor L will extend over the respective contact 7, 1 and 7 thereof to conductor A2L into cable 37–39. One or the other of these conductors 12L or A2L into cable 37–39 extends over cable 37–192 of Fig. 192 to operate one of the relays 12L–19207 and A2L–19206.

If the sort class translator indicates that the sort is by calling office and message unit type, then relay SBOUT–20801 will have been operated as previously described. Under this condition ground will extend from conductor MON–1236 of Fig. 208, over contact 7 of relay SBOUT–20801 to conductor 12L to operate the relay 12L–19207.

If the sort class translator indicates that the sort is by the thousands digit of the calling line number or by the calling office or by the units digit of the calling line number, one of the respective relays SBTH–20800, SBO–20701 and SBU–20703 will have been operated as previously described. Under this condition ground will extend from conductor MON–1236 in Figs. 207 and 208, over the respective contact 5, 10 or 5 of one of these three relays and conductor 20813 into Fig. 193. If only one type of message unit is involved in the sort, relay 1T–19300 will be operated, whereupon conductor 20813 will extend over contact 5 of this relay to conductor 12L to cause the operation of relay 12L–19207 as above described. If on the other hand the sort involves more than one type of message unit, relay 25T–19301 will have been operated, whereupon conductor 20813 will extend over contact 5 thereof to conductor L entering cables 19220 and 37–192, etc. to cause the operation of one of the relays 12L–19207 and A2L–19206 as above described, depending upon the condition of the message unit type translator of Figs. 46 and 47.

If the sort class translator indicates that no sort is to take place, then relay NS–20700 will have been operated. Under this condition ground will extend from conductor MON–1236 of Fig. 207, over contact 5 of relay NS–20700 to conductor 20710 into Fig. 192. If a multi-office marker group is involved, the relay MO–19205 will be operated, whereupon conductor 20710 will extend over contact 4 of this relay to conductor L into cables 19220 and 37–192, etc., to perform relay operations above described. If on the other hand a single office marker group is involved, relay SO–19204 will be operated, whereupon conductor 20710 will extend over the contact 4 of this relay to conductor 20813, and thence over conatct 5 of one of the relays IT–19300 (single message unit type involved) or 25T–19301 (more than one type of message unit involved) to conductor 12L or L to cause the relay operations previously described.

In the event that the sort class translator indicates that the sort is to be by principal office, relay SOPO–20702 will have been operated as previously described, whereupon ground will extend from conductor MON–1236 in Fig. 207, over contact 5 of relay SOPO–20702 to conductor L1 into cable 193–127 to Fig. 127. In Fig. 127, depending upon the operation of the office index translator relays, conductor L1 will extend over contact 8 of relay OIT4–12704 and contact 6 of relay OIT7–12707 (digit of zero registered) to conductor A2L into cable 193–127 or conductor L1 will extend over the respective contact 10, 8 or 6 of respective relays OIT0–12700, OIT1–12701 or OIT2–12702 (any digit except zero) to conductor L into cable 193–127. The one or the other of these two conductors A2L and L extends over cable 193–127 to Fig. 193 where conductor A2L emerges to operate relay A2L–19206 or where conductor L emerges and extends over contact 6 of one of the relays 1T–19300 and 25T–19301 to respective conductors 12L and L to cause relay operations previously described.

Output class and number of output lines.—Based upon the relay operations above described involving the input class translator of Fig. 98, the office index translator of Fig. 127 and relays A2L–19206 and 12L–19207 of Fig. 192, there are twelve separate circuit conditions numbered and described below for operating certain ones of the number of lines and output class relays of Figs. 95 to 97. These circuit conditions may be described briefly as follows with the detail circuit descriptions thereof to follow in each instance.

(1) This circuit condition indicates that a straddle call is involved, that the disconnect time is registered in the call entry register, and that the answer time either is or is not registered therein. Under these conditions circuits will be completed for operating either the output class (hereafter referred to as class) relay O2T–9704 and the number of lines (hereafter referred to as lines) relay O6L–9509 or the class relay O1T–9705 and the lines relay O3L (not shown) in Fig. 95. The class relay is operated over a circuit extending from ground over the contact of the relay ORONG–12604, contact 4 of relay ORLS–12605, contact 4 of relay OES–12603, conductor 12607, contact 8 of relay ODUC–12507, conductor 12516 and conductor 12516 will extend either over contact 8 of relay OAUC–12403 (if an answer time is registered) and over conductor O2T to operate the class relay O2T–9704 or over contact 9 of relay OADC–12401 (if no answer time is registered) to conductor O1T to operate class relay O1T–9705. The lines relay is operated in a circuit extending from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 5 of relay OES–12603, conductor 12608.

contact 5 of relay ODUC–12507 to conductor 12517. Conductor 12517 thereupon will extend over contact 1 of relay OAUC–12403 (if an answer time is registered) to conductor 6L extending into cables 97–95 and 9513 to conductor 6L to operate lines relay O6L–9509 or conductor 12517 will extend over contact 1 of relay OADC–12401 (if no answer time is registered) to conductor 3L extending over cables 97–95 and 9513 to conductor 3L to operate the lines relay O3L (not shown) in Fig. 95.

(2) This circuit condition indicates that this is not a straddle call, that it is not a first call, that no answer time is registered, that no disconnect time is registered, and that the call either is or is not an observed call. Under these conditions, circuits will be completed for operating either the class relay OLODA–9604 and lines relay O5L–9508 or class relay ODISW–9706 and lines relay ODISL–9511. The circuit for operating the class relay extends from ground over the contact of the relay ORONG–12604, contact 4 of relay ORLS–12605, contact 3 of relay ONES–12602, contact 3 of relay OFCD–12600, conductor 12609, contact 2 of relay OCLUC–12304, conductor 12315, contact 4 of relay ODDC–12506, conductor 12518, contact 5 of relay OADC–12401, conductor DAW into cables 12314, 12315, 122–124, 120–122, 12001, 83–120, 8310 and 8312 into Fig. 83 to conductor DAW. Conductor DAW will thereupon extend over contact 8 of relay OCL4–8303 (if the call is an observed call) to conductor LODA extending into cables 8313, 8310, 83–120, 12001, 120–122, 122–124 and 124–97 into Fig. 97 where conductor LODA emerges to operate class relay OLODA–9604. Conductor DAW out of cable 8312 in Fig. 83 will extend over contact 10 of relay OCL1–8301 (if the call is not observed) to conductor DISW extending over cables 8313, 8310, etc., and 124–97 into Fig. 97 where conductor DISW emerges to operate the class relay ODISW–9706. The circuit for operating the lines relay extends from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 2 of relay ONES–12602, contact 2 of relay OFCD–12600, conductor 12610, contact 1 of relay OCLUC–12304, conductor 12316, contact 3 of relay ODDC–12506, conductor 12519, contact 4 of relay OADC–12401 to conductor DAL which extends into and over cables 12314, 12315, 122–124, 120–122, 12001, 83–120, 8310 and 8312 into Fig. 83 where conductor DAL emerges. Conductor DAL in Fig. 83 will extend over contact 9 of relay OCL1–8301 (if the call is not observed) to conductor DISL which extends over cables 8314, 8310, 83–120, 12001 and 120–122, conductor DISL to Fig. 95 to operate lines relay ODISL–9511. The conductor DAL, emerging from cable 8312 in Fig. 83, will extend over contact 7 of relay OCL4–8303 (if the call is an observed call) to conductor 5L extending over cables 8314, 8310, etc., and out of cable 120–122 in Fig. 122, conductor 5L into Fig. 95 to operate the lines relay O5L–9508.

(3) This circuit condition indicates that the call is not a straddle call, that it is a first call, that the first line of the initial entry is registered, that no answer time is registered, that the disconnect time is registered, and that the initial entry input comprises either two or four lines. Under these conditions circuits are completed for operating either class relay O1T2I–9703 and lines relay O5L–9508 or class relay O1T4I–9700 and lines relay O7L–9510. The circuit for operating the class relay will extend from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 2 of relay ONES–12602, contact 9 of relay OFCU–12601, conductor 12612, contact 4 of relay OCLUC–12304, conductor 12318, contact 7 of relay OADC–12401, conductor 12417, contact 1 of relay ODUC–12507 to conductor 1TW which extends over cable 125–98 into Fig. 98. Conductor 1TW will thereupon extend over contact 6 of relay O4LI–9801 (if the initial entry for this call is a four-line entry) to conductor 1T4I extending over cables 98–97A and 9709 into Fig. 97 where conductor 1T4I will emerge to operate the class relay O1T4I–9700. The conductor 1TW, extending out of cable 125–98 in Fig. 98, will extend over contact 6 of relay O2LI–9800 (if the initial energy is a two-line entry) to conductor 1T2I extending over cables 98–97A and 9709 to Fig. 97 where conductor 1T2I emerges to operate the class relay O1T2I–9703. This circuit for operating the lines relay extends from ground over the contact of the relay ORONG–12604, contact 4 of relay ORLS–12605, contact 3 of relay ONES–12602, contact 8 of relay OFCU–12601, conductor 12611, contact 3 of relay OCLUC–12304, conductor 12317, contact 8 of relay OADC–12401, conductor 12416, contact 2 of relay ODUC–12507 to conductor 1TL which extends over cable 125–98 into Fig. 98 where conductor 1TL emerges. The conductor 1TL, out of cable 125–98 in Fig. 98, will extend over contact 10 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor 7L which extends over cables 98–97, 9708, 97–95 and 9513 to Fig. 95 where conductor 7L emerges to operate lines relay O7L–9510. The conductor 1T, out of cable 125–98 in Fig. 98, will extend over contact 10 of relay O2LI–9800 (if the initial entry is a two-line entry) to conductor 5L into cables 98–97, 9708, 97–95 and 9513 to Fig. 95 where conductor 5L emerges to operate lines relay O5L–9508.

(4) This circuit condition represents a non-straddle call, a first call, the first line of the initial entry registered, no answer time, no disconnect time, and two or four lines of initial entry input. Under these conditions circuits will be completed for operating either the class relay O4I–9701 and the lines relay O4L (not shown in Fig. 95) or the class relay O2I–9702 and the lines relay O2L–9507. The circuit for operating the class relay extends from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 2 of relay ONES–12602, contact 9 of relay OFCU–12601, conductor 12612, contact 4 of relay OCLUC–12304, conductor 12318, contact 7 of relay OADC–12401, conductor 12417, contact 12 of relay ODDC–12506 to conductor OTW which extends over cable 125–98 into Fig. 98. Conductor OTW, out of cable 125–98 in Fig. 98, will extend over contact 5 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor 4I which extends over cables 98–97A and 9709 into Fig. 97 where conductor 41 emerges to operate the class relay O4I–9701. Conductor OTW, out of cable 125–98 in Fig. 98, will extend over contact 5 of relay O2LI–9800 (if the initial entry is a two-line entry) to conductor 2I extending over cables 98–97A and 9709 into Fig. 97 where conductor 2I emerges to operate the class relay O2I–9702. The circuit for operating the lines relay extends from ground over the contact of relay ORONG–12604, contact 4 of relay ORLS–12605, contact 3 of relay ONES–12602, contact 8 of relay OFCU–12601, conductor 12611, contact 3 of relay OCLUC–12304, conductor 12317, contact 8 of relay OADC–12401, conductor 12416, contact 11 of relay ODDC–12506 to conductor OTL extending over cable 125–98 into Fig. 98. Conductor OTL, out of cable 125–98 in Fig. 98, will extend over contact 9 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor 4L which extends over cables 98–97, 9708, 97–95 and 9513 to Fig. 95 where conductor 4L emerges to operate the lines relay O4L (not shown). The conductor OTL, out of cable 125–98 in Fig. 98, will extend over contact 9 of relay O2LI–9800 (if the initial entry is a two-line entry) to conductor 2L extending over cables 98–97, 9708, 97–95 and 9513 to Fig. 95 where conductor 2L emerges to operate the lines relay O2L–9507.

(5) This circuit condition represents a non-straddle call, not a first call, the first line of initial entry registered, disconnect time registered, overcapacity call, and a two or a four-line initial entry input. Under these conditions circuits will be completed for operating the

lines relay O6L–9509 and either of the class relays OOM–9606 or OOD–9605. The circuit for operating the lines relay extends from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 2 of relay ONES–12602, contact 2 of relay OFCD–12600, conductor 12610, contact 1 of relay OCLUC–12304, conductor 12316, contact 3 of relay ODUC–12507, conductor C–L, cable 125–96, conductor C–L, contact 19 of connector relay CCC0–9600, conductor C–L, cable 96–149, conductor C–L, cables 149–147, 147–162, 162–195 and 19520, conductor C–L, contact 2 of relay OV–19513, conductor 6L, cables 19520, 162–195, 147–162 and 147–95 into Fig. 95 where conductor 6L emerges and extends over contact 1 of the connector relay CCC0–9600 to conductor 6L to operate the lines relay O6L–9509. The circuit for operating the class relay extends from ground over the contact of relay ORONG–12604, contact 4 of relay ORLS–12605, contact 3 of relay ONES–12602, contact 3 of relay OFCD–12600, conductor 12609, contact 2 of relay OCLUC–12304, conductor 12315, contact 4 of relay ODUC–12507, conductor C–W, cable 125–96, conductor C–W, contact 18 of the connector relay CCC0–9600, conductor C–W, cable 96–149, conductor CW, cables 149–147, 147–162, 162–195 and 19520 into Fig. 195 where conductor C–W emerges and extends over contact 1 of relay OV–19513 conductor O–W into cables 19520, 162–195, etc., and out of cable 96–149 in Fig. 96 to conductor O–W extending over contact 16 of the connector relay CCC0–9600, conductor OW, cable 96–98 to Fig. 98 where conductor OW emerges. The conductor OW, out of cable 96–98 in Fig. 98, will extend over contact 2 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor OD extending over cables 98–97A and 97–96A into Fig. 96 where conductor OD emerges to operate the class relay OOD–9605. The conductor OW, out of cable 96–98 in Fig. 98, will extend over contact 2 of relay O2LI–9800 (if the initial entry is a two-line entry), conductor OM, cables 98–97A and 97–96A to Fig. 96 where conductor OM emerges to operate the class relay OOM–9606.

(6) This circuit condition represents a non-straddle call, a first call, the first line of initial entry registered, answer time registered, disconnect time registered, over-capacity, and a two or a four-line initial entry input. Under these conditions circuits will be completed for operating the lines relay O6L–9509 and either of the class relays OOM–9606 or OOD–9605. The circuit for operating the lines relay extends from ground over the contact of relay ORONG–12604, contact 4 of relay ORLS–12605, contact 3 of relay ONES–12602, contact 8 of relay OFCU–12601, conductor 12611, contact 3 of relay OCLUC–12304, conductor 12317, contact 2 of relay OAUC–12403 and to conductor 12316, the circuit thereafter being exactly the same as previously described under condition No. 5 above, thereby to operate the lines relay O6L–9509. The circuit for operating the class relay extends from ground over the contact of relay ORONG–12604, contact 5 of relay ORLS–12605, contact 2 of relay ONES–12602, contact 9 of relay OFCU–12601, conductor 12612, contact 4 of relay OCLUC–12304, conductor 12318, contact 3 of relay OAUC–12403 and to conductor 12315, the rest of the circuit being exactly as previously described under condition No. 5 above, thereby to operate the class relay OOM–9606 (if the initial entry involved two lines) or the class relay OOD–9605 (if the initial entry involved four lines).

(7) This circuit condition represents a non-straddle call, not a first call, the first line of initial entry registered, disconnect time registered, not over-capacity, and a detail call. Under these conditions circuits are completed for operating the class relay OD–9603 and the lines relay O5L–9508. The circuit for operating the class relay is described exactly the same as in situation No. 5 above, down to the point where conductor C–W emerges from cable 19520 in Fig. 195. Thereafter, conductor C–W extends over contact 1 of relay NOV–19512, conductor MW, contact 2 of relay DET–19519, conductor D, cables 19521, 162–195, etc., and out of cable 96–149 in Fig. 96 to conductor D, over contact 21 of the connector relay CCC0–9600 to operate the class relay OD–9603. The circuit for operating the lines relay is exactly as previously described under situation No. 5 above, down to the point where conductor C–L emerges out of cable 19520 in Fig. 195. Conductor C–L then extends over contact 2 of relay NOV–19512, conductor ML, contact 1 of relay DET–19519 to conductor 5L extending over cables 19521, 162–195, 147–162 and 147–95 into Fig. 95 where conductor 5L emerges and extends over contact 2 of the connector relay CCC0–9600 to conductor 5L to operate the lines relay O5L–9508.

(8) This circuit condition represents a non-straddle call, not a first call, the first line of initial entry registered, disconnect time registered, not over-capacity, all message unit calls involve two-line outputs, and two or four-line initial entry input. Under these conditions circuits are completed for operating either the class relay O2MD–9601 and lines relay 07L–9510 or class relay O2M–9607 and lines relay O2L–9507. The circuit for operating the class relay is the same as previously described under situations 5 and 7 above, down to the point where conductor C–W emerges from cable 19520 in Fig. 195. Conductor C–W then extends over contact 1 of relay NOV–19512, conductor MW, cable 192–195, conductor MW, contact 2 of relay A2L–19206, conductor 2MW, cables 14902 and 149–96, conductor 2MW, contact 15 of connector relay CCC0–9600, conductor 2MW, cable 96–98 to conductor 2MW in Fig. 98. Conductor 2MW, out of cable 96–98 in Fig. 98, will extend over contact 3 of relay O2LI–9800 (if the initial entry is a two-line entry) to conductor 2M extending over cables 98–97A and 97–96A into Fig. 96 where conductor 2M emerges to operate the class relay O2M–9607. The conductor 2MW, out of cable 96–98 in Fig. 98, will extend over contact 3 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor 2MD extending over cables 98–97A and 97–96A to Fig. 96 where conductor 2MD emerges to operate the class relay O2MD–9601. The circuit for operating the lines relay is exactly as previously described under situations 5 and 7 above, down to the point where conductor C–L emerges from cable 19520 in Fig. 195. Conductor C–L then extends over contact 2 of relay NOV–19512, conductor ML, cable 192–195, conductor ML, contact 1 of relay A2L–19206, conductor 2ML, cables 14902 and 149–196, conductor 2ML, contact 13 of connector relay CCCO–9600, conductor 2ML into cable 96–98 to Fig. 98 where conductor 2ML emerges. Conductor 2ML, out of cable 96–98 in Fig. 98, will extend over contact 8 of relay 02LI–9800 (if the initial entry is a two-line entry) to conductor 2L extending over cables 98–97, 9708, 97–95 and 9513 into Fig. 95 where conductor 2L emerges to operate the lines relay O2L–9507. The conductor 2ML, out of cable 96–98 in Fig. 98, will, on the other hand, extend over contact 8 of relay O4LI–9801 (if the initial entry is a four-line entry) to conductor 7L which extends over cables 98–97, 9708, 97–95 and 9513 to Fig. 95 where conductor 7L emerges to operate the lines relay O7L–9510.

(9) This circuit condition represents a non-straddle call, not a first call, the first line of initial entry registered, disconnect time registered, not over-capacity, the number of message units determines the number of output lines for message unit calls, and a two or a four-line input. Under these conditions circuits are completed for operating either the class relay O1M–9608 and lines relay O1L–9506 or class relay O1MD–9602 and lines relay O6L–9509 or class relay O2M–9607 and lines relay O2L–9507 or class relay O2MD–9601 and lines relay O7L–9510. The circuit for operating the

class relay extends exactly as described previously for situations 5, 7 and 8, down to the point where conductor C–W extends out of cable **19520** in Fig. 195. Thereafter, conductor C–W extends over contact **1** of relay NOV–**19512**, conductor MW, cable **192–195**, conductor MW, contact **2** of relay **12L–19207**, conductor MW, cable **37–192** to Fig. 37, conductor MW, thence alternatively over contact **3** of any one of the relays MUT**9–3709** to MUT**1–3701** (if the tens digit of the computed message units is anything from 9 to 1), to conductor **2**MW into cable **37–38** or over contact **3** of relay MUT**0–3700** (if the tens digit of the computed message units is zero) to conductor **1**MW into cable **37–38**, thence over cables **37–38**, **38–94** and **94–96** to Fig. 96 where conductors **1**MW and **2**MW emerge and extend over respective contacts **14** and **15** of the connector relay CCC**0–9600** to respective conductors **1**MW and **2**MW entering cable **96–98** extending into Fig. 98. Conductor **1**MW, out of cable **96–98** in Fig. 98, will extend over contact **4** of relay O**2**LI–**9800** (if the initial entry is a two-line entry) to conductor **1**M entering cable **98–97A**. Conductor **1**MW out of cable **96–98** in Fig. 98, will extend over contact **4** of relay O**4**LI–**9801** (if the initial entry is a four-line entry) to conductor **1**MD into cable **98–97A**. On the other hand, if conductor **2**MW, out of cable **96–98** in Fig. 98, is effective, it will extend over contact **3** of relay O**2**LI–**9800** (if the initial entry is a two-line entry) to conductor **2**M into cable **98–97A**. Conductor **2**MW, out of cable **96–98** in Fig. 98, will extend over contact **3** of relay O**4**LI–**9801** (if the initial entry is a four-line entry) to conductor **2**MD into cable **98–97A**. These four conductors **1**M, **1**MD, **2**M and **2**MD will extend over cables **98–97A** and **97–96A** to Fig. 96 where the grounded one thereof will emerge to selectively operate the respective class relay O**1**M–**9608**, O**1**MD–**9602**, O**2**M–**9607** or O**2**MD–**9601**. The circuit for operating the lines relay is exactly the same as described in situations 5, 7 and 8, down to the point where conductor C–L emerges out of cable **19520** in Fig. 195. Conductor C–L then will extend over contact **2** of relay NOV–**19512**, conductor ML, cable **192–195**, conductor ML, contact **1** of relay **12L–19207**, conductor ML, cable **37–192** to Fig. 37 where conductor ML emerges and extends alternatively over contact **4** of the operated one of relays MUT**9–3709** to MUT**1–3701** (if the tens digit of the computed message units is anything from 9 to 1), to conductor **2**ML entering cable **37–38** or over contact **4** of relay MUT**0–3700** (if the tens digit of the computed message units is zero), to conductor **1**ML into cable **37–38**. These two conductors **1**ML and **2**ML extend over cables **37–38**, **38–94** and **94–96** to Fig. 96 where they emerge and extend over respective contacts **12** and **13** of the connector relay CCC**0–9600** to respective conductors **1**ML and **2**ML entering cable **96–98** and emerging therefrom in Fig. 98. If conductor **1**ML, out of cable **96–98** in Fig. 98, is effective, it will extend over contact **7** of relay O**2**LI–**9800** (if the initial entry is a two-line entry) to conductor **1**L into cable **98–97** or conductor **1**ML, out of cable **96–98** in Fig. 98, will extend over cable **7** of relay O**4**LI–**9801** (if the initial entry is a four-line entry) to conductor **6**L into cable **98–97**. In the event that the conductor **2**ML is effective out of cable **96–98** in Fig. 98, it will extend over contact **8** of relay O**2**LI–**9800** (if the initial entry is a two-line entry) to conductor **2**L into cable **98–97** or conductor **2**ML, out of cable **96–98** in Fig. 98, will extend over contact **8** of relay O**4**LI–**9801** (if the initial entry is a four-line entry) to conductor **7**L entering cable **98–97**. The energized conductor **1**L, **2**L or **7**L will extend from Fig. 98 over cables **98–97**, **9708**, **97–95** and **9513** to Fig. 95 where the energized conductor **1**L, **2**L or **7**L will emerge to operate the respective lines relay O**1**L–**9506**, O**2**L–**9507** or O**7**L–**9510**; the conductor **6**L in Fig. 98, if energized, will extend over cable **98–97**, conductor **6**L and cables **97–95** and **9513** to Fig. 95 where it will emerge to operate the lines relay O**6**L–**9509**.

(10) This circuit condition represents a non-straddle call, a first call, the first line of initial entry registered, answer time registered, disconnect time registered, not overcapacity, and a detail call. Under these conditions circuit will be completed for operating the class relay OD–**9603** and the lines relay O**5**L–**9508**. The circuit for operating the class relay is exactly the same as previously described under situation No. 6 above, down to the point where conductor C–W in Fig. 195 connects to the contacts **1** of both of the relays OV–**19513** and NOV–**19512**. Thereafter, conductor C–W will extend over contact **1** of the relay NOV–**19512** as described in detail above in situation No. 7 to operate the class relay OD–**9603**. The circuit for operating the lines relay is exactly the same as previously described in situation No. 6 above, down to the point where conductor C–L connects in Fig. 195 to the contacts **2** of both of the relays OV–**19513** and NOV–**19512**. Conductor C–L then extends over contact **2** of relay NOV–**19512** exactly as described in situation No. 7 above, to operate the lines relay O**5**L–**9508**.

(11) This circuit condition represents a non-straddle call, a first call, the first line of the initial entry registered, answer time registered, disconnect time registered, not overcapacity, all message unit calls involve two-line outputs, and a two or a four-line input. Under these conditions circuits are completed for operating the same class and lines relays as are operated under situation No. 8 above. The circuit for operating the class relay is exactly the same as previously described under situation No. 6 above, down to the point where conductor C–W in Fig. 195 connects to the contacts **1** of both of relays OV–**19513** and NOV–**19512**. Conductor C–W then will extend over contact **1** of relay NOV–**19512** exactly as described under situation No. 8 above, to operate either of the class relays O**2**M–**9607** or O**2**MD–**9601**, depending upon whether the initial entry involved two or four lines. The circuit for operating the lines relay is exactly the same as described under situation No. 6 above, down to the point where the conductor C–L connects to the contacts **2** of both of the relays OV–**19513** and NOV–**19512**. Conductor C–L then will extend over contact **2** of relay NOV–**19512** exactly as described under situation No. 8 above, to operate either of the lines relays O**2**L–**9507** or O**7**L–**9510**, depending upon whether the initial entry involved two or four lines.

(12) This circuit condition represents a non-straddle call, a first call, the first line of the initial entry registered, answer time registered, disconnect time registered, not overcapacity, the number of message units determines the number of output lines for message unit calls, and a two or a four-line initial entry input. Under these conditions circuits are completed for operating the same class and lines relays as previously described under situation No. 9 above. The circuit for operating the class relay is exactly the same as previously described under situation No. 6 above, down to the point where conductor C–W connects in Fig. 195 to the contacts **1** of both of the relays NOV–**19512** and OV–**19513**. Conductor C–W will then extend over contact **1** of relay NOV–**19512** exactly as described in situation No. 9 above, to operate one of the class relays O**1**M–**9608**, O**1**MD–**9602**, O**2**M–**9607** and O**2**MD–**9601**, depending upon whether the tens digit of the computed message units is a zero or not zero and whether the initial entry involved two or four lines. The circuit for operating the lines relay is exactly the same as previously described in situation No. 6, down to the point where conductor C–L in Fig. 195 connects to the contacts **2** of both of the relays OV–**19513** and NOV–**19512**. The conductor C–L then will extend over contact **2** of relay NOV–**19512** exactly as described under situation No. 9, to operate one of the lines relays O**1**L–**9506**, O**2**L–**9507**, O**6**L–**9509** and

O7L–9510, depending upon whether the tens digit of the computed message units is a zero or not zero and whether the initial entry involved two or four lines.

4.17 *Determining answer and disconnect calendar day*

The day registered in the assembling registers in indicative of the calendar day units digit except in certain special cases covered in Section 3.087. These day digits as read out of the assembling registers are used in the computer portion of the machine for subtracting day values in determining the chargeable time. In addition, they are used to aid in reconstructing the tens and units digits of the answer and disconnect calendar days.

The disconnect day digit is registered, as previously described, in such relays as relays DDU99–0 to DDU99–7 of Fig. 56 for the No. 99 assembling register. The answer day digit is likewise recorded in similar relays ADU99–0 to ADU99–7 of Fig. 57 for the No. 99 assembling register.

For this process the day translators of Fig. 181 (as described) are provided in the computer portion of the machine for interpreting the value of the answer and disconnect days taken from the assembling register. The carry-out from the binary part of the day subtractor (conductors CR0, CR1, N0 and 0 into cable 196–195A in Fig. 195) indicates whether the answer day is greater or less than the disconnect day taken from the assembling register, and this also plays a part in the day reconstruction process.

The day translator of Figs. 67 and 68 combines the aforementioned factors for operating the proper output connectors of Figs. 48 and 66 for the day translators of Fig. 60 and the calendar day register of Figs. 40 and 41.

The translated output from these connectors passes through the operated computer connector to register the answer and disconnect day tens and units digits in the call entry register (such as Figs. 91 and 92 of the odd call entry register) to be used in forming call entries. The call register portion of the machine also contains a disconnect and an answer day register (such as Figs. 77 and 80 of the odd side) for recording the day taken from the assembling register should the computer connector not be operated at the time of reading out of the assembling register.

The tables of Section 3.087 are built into the day translator (Figs. 67 and 68), answer and disconnect translator (Fig. 60) and the subtractor control (Fig. 195) so that the proper output day tens and units digits are registered as described above. This is a two-step operation consisting of interpreting the input information for operating the proper output connector and then reading out of the day translators (Fig. 60) and current day tens register (Fig. 40) to form the correct answer and disconnect calendar day tens and units digits.

The circuitry involved in determining the answer and disconnect day values is in itself an extremely complicated network. It is, therefore, considered advisable to discuss the operation of the various parts of this circuit in sections under appropriate headings below.

Cabling arrangement.—Three main circuits of interest are the subtractor control circuit of Fig. 195, the day translator circuit of Figs. 67 and 68 and the day register tens output connector circuit of Fig. 48 along with the answer and disconnect day tens and units registers of Figs. 91 and 92 in the odd call entry register, which are all interconnected by means of a spiderweb of conductors and cables circuit paths over which circuit tracing would need to be repeated many times in describing the operation of these circuits. It is considered advisable at the start to describe the cabling and conductor interconnections involved in the circuitry so that in describing the detailed circuits one may omit unnecessary repetition description which would follow the same leads back and forth in the cabling.

In Fig. 136 ground extends over contacts 1, 2 and 3 of connector CCDO–13600 to respective conductors DU, DT and AU extending over cable 136–68 and reappearing out of this cable in Fig. 68. In addition, in Fig. 136 ground extends over contact 4 of connector CCDO–13600 to conductor AT which extends over cables 13608 and 162–195, conductors DT and AU joining therewith into cable 162–195 in Fig. 162. These three conductors, DT, AU and AT, then extend over cable 162–195 and cable 19523 into Fig. 195. In Fig. 48 three conductors, DDUAR, ADUARS and ADUAR, enter cable 48–66 and reappear in Fig. 66. Conductor DDUAR in Fig. 66 and conductor DDU1 extend into Fig. 67 and then into cable 67–195. In Figs. 67 and 68, conductor DDUAR also appears and extends into cable 67–195 in Fig. 67. Furthermore, in Fig. 67 conductor DDU1 extends into cable 67–195. These two conductors, DDU1 and DDUAR, entering cable 67–195 in Fig. 67, reappear from this cable in Fig. 195.

In Fig. 68, six conductors, AUA<D, AUA>D, ATA<D, ATA>D, DTA<D and DTA>D, enter cable 60–68A extending into Fig. 60 and into cable 60–67B to Fig. 67 and thence over cable 67–195 into Fig. 195 where these six conductors reappear.

In Fig. 67, a conductor, ADTAR, extends into Fig. 68, there joining five other conductors, DDTS1, DDTAR, DDTP1, FRAU and FRDU and entering cable 67–68 into Fig. 67, there entering cable 60–67 extending over Fig. 60 and thence into cable 48–60 into Fig. 48 where these six conductors reappear from cable 48–60 or out of cable 48–14.

In Fig. 67, a conductor ADT0 enters cable 60–67. In Fig. 68, three conductors, DDT0, DDTS3 and DDTS4 extend into Fig. 67 and then into cable 60–67. In Fig. 67, six conductors, 203, 2, 300A, DDT0, 300B and OB enter cable 6707 and thence into cable 60–67. In Fig. 68, a conductor DDTS2 extends into Fig. 67 and then over cable 6706 and into cable 60–67. In Fig. 67, three conductors, DDT3, 3 and DDUS extend over cable 6706 and into cable 60–67. These conductors extend over cable 60–67 into Fig. 60 where conductors ADTAR, DDTP1, DDTS1, DDT0 and ADT0 reappear and extend into cables 48–60 to Fig. 48 where they reappear directly or out of cable 4814. These five conductors coming out to cable 60–67 in Fig. 60 also extend over cables 60–67B and 67–195 to Fig. 195 where they reappear.

In Fig. 68, a conductor, DTAR0, extends into Fig. 67 and there joins three other conductors, DUAR1, DT0P1 and DTS10, into cables 60–67A, 60–67B and 67–195 into Fig. 195 where conductor DUAR1 reappears directly and where the other three conductors reappear out of cable 19524.

In Fig. 48, four conductors, DDT0, DDT1, DDT2 and DDT3 enter cable 4818 which extends over cable 48–91 to Fig. 91 where these four conductors reappear in cable DDT and emerge therefrom at contacts of the connector CCA0–9200.

In Fig. 48, four conductors, ADT0, ADT1, ADT2 and ADT3, enter cable 4819 which extends over cable 48–91 to Fig. 91 where these four conductors reappear in cable ADT which extends into Fig. 92 and out of which these four conductors emerge to appear before contacts of the connector CCAO–9200.

In the circuit description to follow, the description will be simplified by eliminating the unnecessary tracing of circuit paths over conductors extending throughout this complicated cabling arrangement. The circuit descriptions will jump from a conductor of a given designation on one figure to a conductor of the same designation on a different figure without tracing the path in between, it being understood that when the previously described cabling arrangement is well in mind such paths will be obvious to those skilled in the art.

Day translators of Fig. 60.—The two sets of translator relays, DDT0–6010 to DDT7–6017 and ADT0–

6000 to ADT7–6007 in Fig. 60, are operated on a two-out-of-five basis according to the respective disconnect and answer day digits taken from the pertinent assembling register and deposited in the odd call entry register in Figs. 77 and 80.

In Fig. 77, the locking grounds from the disconnect day register relays ODD0–7708 to ODD7–7712 extend over two of the five conductors D0 to D7, cables D–7720, 77–130 and D–7720, conductors D0 to D7, contacts 1 to 5 of connector CCF0–1300, conductors D0 to D7, cable D–13001 into Fig. 60 where conductors D0 to D7 reappear to operate two of the 5 disconnect day translator relays DDT0–6010 to DDT7–6017.

In Fig. 80, the locking grounds from two of the operated answer day digit registers OAD0 to OAD7 extend over conductors D0 to D7, cables D–8010, 80–133 and D–8010, conductors D0 to D7, contacts 1 to 5 of connector CCE0–13300, conductors D0 to D7, cable D–13301 and conductors D0 to D7 into Fig. 60 to operate two of the answer day translator relays ADT0–6000 to ADT7–6007.

Day register tens output connectors of Fig. 48.—Connector relay DTL1–4801 or DTAR1–4800 will be operated depending upon whether or not there is any day change indication presently in effect in the day register control circuit of Fig. 58. The operating circuit of these connectors extends from ground on conductor DON–1233 in Fig. 58 over contact 2 of relay NCD–5801 and contact 8 of relay CD–5802 to conductor DTAR if no change is indicated, or over contact 1 of relay NCD–5801 and contact 9 of relay CD–5802 to conductor DTL1 if a day change is indicated. These two conductors DTAR and DTL1 extend over cables 49–58 and 49–48 into Fig. 48 where conductors DTAR and DTL1 reappear to operate the respective connector relay DTAR1–4800 or DTL1–4801.

One of the connector relays DTAR2–4802 or DTP1–4803 will be operated depending upon whether the answer day translator of Fig. 60 indicates the answer day digit taken from the odd call entry register of Fig. 80 is 0 or is other than 0 and whether or not the calendar day units digit registered in Fig. 40 is 0. This circuit extends from ground in Fig. 130 over contact 41 of connector CCFO–13000, conductor B, cable 130–60 to Fig. 60, conductor B and over contact 1 of any one of the three translator relays ADT0–6000, ADT1–6001 and ADT2–6002 to conductor DTAR2 to operate relay DTAR2–4802, or conductor B out of cable 130–60 in Fig. 60 extends over contact 1 of relay ADT4–6004 and contact 1 of relay ADT7–6007 to conductor 6003. Conductor 6003 may extend over contact 9 of relay DU0–4010 to conductor DTAR2 to operate relay DTAR2–4802 or it may extend over contact 10 of relay DU0–4010 to conductor DTP1 into Fig. 48 to operate relay DTP1–4803.

Day translator of Fig. 68.—The disconnect and answer day translators of Fig. 68 are operated from the respective answer and disconnect day translators of Fig. 60 to change the two-out-of-five registration in the latter to a decimal registration in the former and simultaneously therewith to provide an indication in Fig. 68 as to whether the answer and disconnect day digits taken from the odd call entry registers of Figs. 77 and 80 are 0, 1, 2 or 9 or any one of the other digits (such as any digit from 3 to 8, inclusive).

The circuit for operating the answer translator relays A0T–6800 to A9T–6804 extends from ground in Fig. 130 over contact 42 of connector CCFO–13000, conductor A, cable 130–60 into Fig. 60, conductor A over contacts of the operated translator relays ADT0–6000 to ADT7–6007 to one of the five conductors A0, A1, A2, A3–8 and A9, thence over cables 6006, 60–68 and 6006 to operate one of the relays A0T–6800 to A9T–6804.

The circuit for operating the disconnect translator relays D0T–6805 to D9T–6809 extends from ground in Fig. 130 over contact 43 of connector CCFO–13000, conductor D, cable 130–60 to Fig. 60 where conductor D extends over contacts of the operated ones of the disconnect translator relays DDT0–6010 to DDT7–6017 to one of the five conductors D0, D1, D2, D3–8 or D9 extending into and over cables 6005, 60–68 and 6005 in Fig. 68 to operate one of the disconnect translator relays D0T–6805 to D9T–6809.

Day register tens output connector of Fig. 48.—One of the connector relays DDTAR–4808, DDTP1–4809, DDTS1–4810, DDTS2–4811, DDTS3–4812, DDTS4–4813 and DDT0–4815 will be operated to provide the disconnect day tens digit for registration in Fig. 91 which is the odd call entry register. Connector relay DDT0–4815 provides a tens digit of 0 independently of the current day registration of Fig. 40 and independently of the day digit which may have been obtained from an assembling register. The other relays reconstruct the disconnect day tens digit from the current day registration and/or from values thereof which may have been taken from an assembling register.

There are seven separate circuit conditions any one of which may operate the connector relay DDTAR.

(1) Ground on conductor DT of Fig. 195 may extend over contact 9 of relay CR1–19511 to conductor DTA<D which extends into Fig. 68 and over contact 2 of relay IR–6811 to conductor DDTAR to operate this connector relay.

(2) Ground on conductor DTA<D in Fig. 68 may also extend over contact 4 of relay FR–6812 to conductor 6828. This grounded conductor 6828 may then extend over contact 6 of relay D0T–6805 to conductor DDTAR.

(3) Conductor 6828 in Fig. 68, if grounded, may extend into Fig. 67 and then over contact 17 of relay 31–6703, conductor 6708, and then over contact 8 of any one of the three relays D1T–6806, D2T–6807 and D3–8T–6808 and over contact 5 of any one of the relays A1T–6801, A2T–6802, A3–8T–6803 and A9T–6804 to conductor DDTAR.

(4) The conductor 6828 in Fig. 67, if grounded, may extend over contact 17 of relay 30–6702, conductor 6709, and then over contact 7 of any one of the relays D1T–6806, D2T–6807, D3–8T–6808 and D9T–6809 and over contact 5 of any one of the relays A1T–6801, A2T–6802, A3–8T and A9T–6804 as above-described to conductor DDTAR.

(5) Conductor 6828 in Fig. 67, if grounded, may extend over contact 17 of relay 31–6703, conductor 6708, contact 8 of relay D9T–6809 and contact 4 of relay A9T–6804 to conductor DDTAR.

(6) Conductor 6828 in Fig. 67 may extend over contact 17 of either of relays 29–6701 or 28–6700 to conductor 6710 thence over contact 6 of any one of the relays D1T–6806 to D9T–6809 and contact 6 of any one of the relays A1T–6801 to A9T to conductor DDTAR.

(7) The grounded conductor DT in Fig. 195 may extend over contact 9 of relay CR0–19510 to conductor DTA>D into Fig. 68 and thence over contact 5 of relay FR–6812 to conductor 6829 which may extend over contact 18 of either of the relays 29–6701 and 28–6700 to conductor 6712 and over contact 3 of relay D0T–6805 to conductor DDTAR.

There are six different circuit conditions, any one of which may operate connector relay DDTP1–4809.

(1) The grounded conductor DT in Fig. 195 may extend over contact 9 of relay CR0–19510, conductor DTA>D into Fig. 68 and over contact 3 of relay IR–6811 to conductor DDTP1 to operate the associated connector relay DDTP1–4809.

(2) The grounded conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D0T–6805, conductor 6824, contact 9 of relay 29–6701, conductor DTOP1 into Fig. 195 over contact 8 of relay CR0–19510 to conductor DDTP1.

(3) The grounded conductor DT in Fig. 68 may also

extend over contact 5 of relay LR–6810, contact 1 of relay D9T–6809, conductor 6827, contact 12 of relay 28–6700, conductor DTOP1 to Fig. 195 and over contact 8 of relay CR0–19510 to conductor DDTP1.

(4) The grounded conductor DT in Fig. 195 may extend over contact 9 of relay CR0–19510 to conductor DTA>D into Fig. 68 and over contact 5 of relay FR–6812 to conductor 6829. Conductor 6829 may extend over contact 18 of relay 31–6703 in Fig. 67 to conductor 6713 thence over contact 5 of any one of the relays D1T–6806 to D3–8T in Fig. 68 to conductor DDTP1.

(5) Conductor 6829 in Fig. 67, if grounded, may also extend over contact 18 of relay 30–6702 to conductor 6711 into Fig. 68 and over contact 4 of relay D0T–6805 to conductor DDTP1.

(6) Conductor 6829 in Fig. 67, if grounded, may extend over contact 18 of either of relays 29–6701 and 28–6700 to conductor 6712 into Fig. 68 and over contact 3 of any one of the relays D1T–6806 to D9T–6809 to conductor DDTP1.

There are three circuit conditions any one of which may operate the connector relay DDTS1–4810.

(1) The grounded conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810 and over contact 1 of relay D1T to conductor 6825 thence over contact 10 of relay 30 to conductor DTS10 into Fig. 195 and over contact 7 of relay CR0–19510 to conductor DDTS1 to operate the corresponding connector relay DDTS1–4810.

(2) The grounded conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D2T to conductor 6826 thence over contact 11 of relay 31 to conductor DTS10 into Fig. 195 and over contact 7 of relay CR0 to conductor DDTS1.

(3) Conductor DT in Fig. 195 may extend over contact 9 of relay CR0–19510, conductor DTA>D into Fig. 68 and over contact 5 of relay FR–6812 to conductor 6829 into Fig. 67 and over contact 18 of relay 30–6702 to conductor 6711 into Fig. 68 and over contact 4 of any one of the relays D1T–6806 to D9T–6809 to conductor DDTS1.

There is one circuit condition which will cause the operation of connector relay DDTS2–4811. This circuit extends from the grounded conductor DT in Fig. 195 over contact 9 of relay CR0–19510, conductor DTA>D into Fig. 68 and over contact 5 of relay FR–6812, conductor 6829 into Fig. 67 and over contact 18 of relay 31–6703, conductor 6713 to Fig. 68, contact 5 of relay D0T–6805 to conductor DDTS2.

There are two circuit conditions either of which may cause the operation of the connector relay DDTS3–4812. Ground on conductor DT in Fig. 195 may extend over contact 9 of relay CR1–19511, conductor DTA<D to Fig. 68 and over contact 4 of relay FR–6812 to conductor 6828.

(1) The grounded conductor 6828 in Fig. 67 may extend over contact 17 of relay 31 to conductor 6708 into Fig. 68 and over contact 8 of any one of the relays D1T to D3–8T and over contact 5 of relay A0T–6800 to conductor DDTS3 to operate the associated connector relay DDTS3–4812.

(2) The grounded conductor 6828 in Fig. 67 may extend over contact 17 of relay 30–6702 to conductor 6709 into Fig. 68 and thence over contact 7 of any one of the relays D1T to D9T and over contact 5 of relay A0T to conductor DDTS3.

There is one circuit condition which will cause the operation of the connector relay DDTS4–4813 and which extends from the grounded conductor DT in Fig. 195 over contact 9 of relay CR1–19511, conductor DTA<D to Fig. 68 and over contact 4 of relay FR–6812 to conductor 6828 into Fig. 67 over contact 17 of relay 31–6703 to conductor 6708 into Fig. 68 and over contact 8 of relay D9T and contact 4 of any one of the relays A0T to A9T to conductor DDTS4 to operate connector relay DDTS4–4813.

There are five circuit conditions any one of which may cause the operation of the relay DDT0–4815.

(1) The grounded conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D0T–6805, conductor 6824 into Fig. 67 and thence over contact 9 of relay 29–6701 to conductor DTOP1 into Fig. 195 and over contact 8 of relay CR1–19511 to conductor DDT0 to operate the relay DDT0–4815.

(2) Conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D9T–6809 to conductor 6827 extending into Fig. 67 and over contact 12 of relay 28–6700 to conductor DTOP1 into Fig. 195 over contact 8 of relay CR1–19511 to conductor DDT0.

(3) Conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D1T, conductor 6825 into Fig. 67 and over contact 10 of relay 30 to conductor DTS10 into Fig. 195 and over contact 7 of relay CR1 to conductor DDT0.

(4) Conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810, contact 1 of relay D2T, conductor 6826 to Fig. 67 over contact 11 of relay 31 to conductor DTS10 into Fig. 195 and over contact 7 of relay CR1 to conductor DDT0.

(5) Conductor DT in Fig. 195 may extend over contact 9 of relay CR1–19511, conductor DTA<D to Fig. 68 and over contact 4 of relay FR–6812 to conductor 6828 into Fig. 67 thence over contact 17 of either one of the relays 29 and 28 to conductor 6710 into Fig. 68 thence over contact 6 of any one of the relays D1T to D9T and over contact 6 of relay A0T to conductor DDT0.

One of the connector relays ADTAR–4804 and ADT0–4805 is operated to provide the answer day tens digit. Connector relay ADTAR–4804, if operated, reconstructs the answer day tens digit from the current day registration in Fig. 40. Connector relay ADT0–4805, if operated, provides an answer day tens digit of 0 independently of the current day registration.

There are thirteen circuit conditions any one of which may operate the connector relay ADTAR–4804.

(1) Ground on conductor AT in Fig. 195 may extend over contact 10 of relay CR1–19511, conductor ATA<D to Fig. 68 thence over either contact 5 of relay IR–6811 or contact 1 of relay FR–6812 to conductor ADTAR to operate the associated connector relay ADTAR–4804.

(2) Conductor AT in Fig. 195 may exend over contact 10 of relay CR0–19510 to conductor ATA>D to Fig. 68 thence over either contact 7 of relay LR–6810 or contact 6 of relay IR–6811 to conductor ADTAR.

The grounded conductor DT in Fig. 68 may extend over contact 5 of relay LR–6810 appearing before contacts 1 of all of the relays D0T–6805 to D9T–6809.

(3) Ground may extend over contact 1 of relay D0T, conductor 6824 into Fig. 67 thence over contact 9 of any one of the relays 31–6703, 30–6702 and 28–6700 to conductor DTAR0 into Fig. 195 thence over contact 6 of relay CR0–19510 to conductor ADTAR.

(4) Ground may extend over contact 1 of relay D1T in Fig. 68 to conductor 6825 into Fig. 67 thence over contact 10 of any one of the relays 31, 29 and 28 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR0 to conductor ADTAR.

(5) Ground may extend over contact 1 of relay D2T in Fig. 68 to conductor 6826 into Fig. 67 thence over contact 11 of any one of the relays 30, 29 and 28 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR0–19510 to conductor ADTAR.

(6) Ground may extend over contact 1 of relay D3–8T in Fig. 68 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR0–19510 to conductor ADTAR.

(7) Ground may extend over contact 1 of relay D9T in Fig. 68 to conductor 6827 into Fig. 27 thence over contact 12 of any one of the relays 31, 30 and 29 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR0–19510 to conductor ADTAR.

Ground may extend from the conductor AT in Fig. 195 over contact 10 of relay CR1–19511 to conductor ATA<D to Fig. 68 thence over contact 4 of relay LR–6810 and appearing before contact 2 of all of the relays A0T–6800 to A9T–6804.

(8) Ground may extend over contact 2 of relay A0T in Fig. 68 to conductor 6820 into Fig. 67 thence over contact 8 of any one of the relays 31, 30 and 28 to conductor ADTAR to operate the associated connector relay ADTAR–4804.

(9) Ground may extend over contact 2 of relay A1T in Fig. 68 to conductor 6821 extending into Fig. 67 and over contact 7 of any one of the relays 31, 29 and 28 to conductor ADTAR.

(10) Ground may extend over contact 2 of relay A2T in Fig. 68, conductor 6822 into Fig. 67 and over contact 6 of any one of the relays 30, 29 and 28 to conductor ADTAR.

(11) Ground may extend over contact 2 of relay A3–8T in Fig. 68 directly to conductor ADTAR.

(12) Ground may extend over contact 2 of relay A9T in Fig. 68 to conductor 6823 extending into Fig. 67 and over contact 5 of any one of the relays 31, 30 and 29 to conductor ADTAR.

(13) Ground may extend from conductor AT in Fig. 195 over contact 10 of relay CR0–19510, conductor ATA>D into Fig. 68 and over contact 2 of relay FR–6812 thence over contact 3 of any one of the relays A1T to A9T to conductor ADTAR.

There are nine circuit conditions any one of which may operate connector relay ADT0–4805. Ground may extend from conductor DT in Fig. 68 over contact 5 of relay LR–6810 and appearing before the contacts 1 of all of the relays D0T to D9T in Fig. 68.

(1) Ground may extend over contact 1 of relay D0T in Fig. 68, conductor 6824 into Fig. 67 thence over contact 9 of any one of the relays 31, 30 and 28, conductor DTAR0 into Fig. 195 and over contact 6 of relay CR1–19511 to conductor ADT0 to operate the associated connector relay ADT0–4805.

(2) Ground may extend over contact 1 of relay D1T in Fig. 68, conductor 6825 into Fig. 67 thence over contact 10 of any one of the relays 31, 29 and 28 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR1 to conductor ADT0.

(3) Ground may extend over contact 1 of relay D2T in Fig. 68, conductor 6826 into Fig. 67 over contact 11 of any one of the relays 30, 29 and 28 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR1 to conductor ADT0.

(4) Ground may extend over contact 1 of relay D3–8T in Fig. 68 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR1 to conductor ADT0.

(5) Ground may extend over contact 1 of relay D9T in Fig. 68, conductor 6827 into Fig. 67 over contact 12 of any one of the relays 31, 30 and 29 to conductor DTAR0 into Fig. 195 and over contact 6 of relay CR1 to conductor ADT0.

The grounded conductor AT in Fig. 195 may extend over contact 10 of relay CR1–19511 to conductor ATA<D into Fig. 68 and over contact 4 of relay LR–6810 appearing before contacts 2 of all of the relays A0T–6800 to A9T–6804.

(6) Ground may extend over contact 2 of relay A0T in Fig. 68 to conductor 6820 extending into Fig. 67 and over contact 8 of relay 29 to conductor ADT0 to operate the associated connector relay ADT0–4805.

(7) Ground may extend over contact 2 of relay A1T in Fig. 68 to conductor 6821 into Fig. 67 and over contact 7 of relay 30 to conductor ADT0.

(8) Ground may extend over contact 2 of relay A2T in Fig. 68 and over conductor 6822 into Fig. 67 and over contact 6 of relay 31 to conductor ADT0.

(9) Ground may extend over contact 2 of A9T in

Fig. 68, conductor 6823 into Fig. 67 and over contact 5 of relay 28 to conductor ADT0.

Day tens call entry register of Figs. 91 and 92.—One of the relays OADT0–9201, OADT1–9202, OADT2–9203 and OADT3–9204 will be operated to register in the odd call entry register the tens digit of the answer day as determined by the circuits previously described. In the event that relay OADT2–9203 is operated to indicate an answer day tens digit of 2, the associated control relay ADT2–4806 will also be operated for control purposes. Likewise, in the event that relay OADT3–9204 is operated to indicate an answer day tens digit of 3, the companion relay ADT3–4807 will also be operated for control purposes.

There are six circuit conditions, any one of which will cause the operation of relay OADT0–9201.

(1) Ground may extend over contact 9 of relay DT0–4000 in Fig. 40 to conductor 4014, contact 1 of relay DTAR1–4800, contact 2 of relay DTAR2–4802, conductor OB, contact 4 of relay ADTAR–4804 to conductor ADT0 into Fig. 92 and over contact 13 of the connector CCA0–9200 to operate the answer day tens relay OADT0–9201.

(2) Ground may extend over contact 9 of relay DT0–4000 in Fig. 40, conductor 4014, contact 1 of relay DTL1–4801, contact 1 of relay DTP1–4803, conductor OB, contact 4 of relay ADTAR–4804 to conductor ADT0.

(3) Ground may extend over contact 7 of relay DT3–4003 in Fig. 40, conductor 4017, contact 4 of relay DTAR1–4800, contact 5 of relay DTP1–4803, conductor OB, contact 4 of relay ADTAR–4804 to conductor ADT0.

(4) Ground may extend over contact 8 of relay DT1–4001 in Fig. 40, conductor 4015, contact 2 of relay DTL1–4801, contact 2 of relay DTAR2–4802, conductor OB, contact 4 of relay ADTAR–4804 to conductor ADT0.

(5) Ground may extend over contact 8 of relay DT2–4002, conductor 4016, contact 3 of relay DTAR1–4800, contact 4 of relay DTP1–4803 to conductor 300B extending into Fig. 67, thence over contact 21 of either of the relays 29–6701 and 28–6700 to conductor OB into Fig. 48 and over contact 4 of relay ADTAR–4804 to conductor ADT0.

(6) Ground may extend over the contact of relay ADT0–4805 in Fig. 48 to conductor ADT0.

There are four circuit conditions, any one of which will cause the operation of the answer day tens relay OADT1–9202.

(1) Ground may extend over contact 9 of relay DT0–4000, conductor 4014, contact 1 of relay DTAR1–4800, contact 2 of relay DTP1–4803, contact 3 of relay ADTAR–4804 to conductor ADT1 extending into Fig. 92 and over contact 12 of connector CCA0–9200 to operate the relay OADT1–9202.

(2) Ground may extend over contact 8 of relay DT1–4001, conductor 4015, contact 2 of relay DTL1–4801, contact 2 of relay DTP1–4803 and contact 3 of relay ADTAR–4804 to conductor ADT1.

(3) Ground may extend over contact 8 of relay DT1–4001, conductor 4015, contact 2 of relay DTAR1–4800, contact 3 of relay DTAR2–4802, contact 3 of relay ADTAR–4804 to conductor ADT1.

(4) Ground may extend over contact 8 of relay DT2–4002, conductor 4016, contact 3 of relay DTL1–4801, contact 3 of relay DTAR2–4802, contact 3 of relay ADTAR–4804 to conductor ADT1.

There are five circuit conditions, any one of which will cause the operation of the answer day tens digit relay OADT2–9203 and its companion control relay ADT2–4806.

(1) Ground may extend from conductor 4014 in Fig. 48, over contact 1 of relay DTL1–4801, contact 1 of relay DTAR2–4802, conductor 203 into Fig. 67 over contact 19 of either one of the relays 29–6701 and 28–6700 to

conductor 2 into Fig. 48 and over contact 2 of relay ADTAR–4804 to conductor ADT2 to operate the control relay ADT2–4806 directly and extending into Fig. 92 and over contact 11 of connector CCA0–9200 to operate the register relay OADT2–9203.

(2) Ground may extend from conductor 4015 in Fig. 48, over contact 2 of relay DTAR1 and contact 3 of relay DTP1, conductor 2 and over contact 2 of relay ADTAR to conductor ADT2.

(3) Ground may extend from conductor 4016 in Fig. 48, over contact 3 of relay DTL1, contact 3 of relay DTP1, conductor 2 and contact 2 of relay ADTAR to conductor ADT2.

(4) Ground may extend from conductor 4016 in Fig. 48, over contact 3 of relay DTAR1 over contact 4 of relay DTAR2, conductor 2 and contact 2 of relay ADTAR to conductor ADT2.

(5) Ground may extend from conductor 4017 in Fig. 48, over contact 4 of relay DTL2, contact 4 of relay DTAR2, conductor 2 and contact 2 of relay ADTAR to conductor ADT2.

There are four circuit conditions any one of which will cause the operation of the answer day tens relay OADT3–9204 and its companion control relay ADT3–4807.

(1) Ground may extend over contact 9 of relay DT0–4000 in Fig. 40 to conductor 4014 into Fig. 48 over contact 1 of relay DTL1–4801, contact 1 of relay DTAR2–4802 to conductor 203 extending into Fig. 67, thence over contact 19 of either one of the relays 31–6703 and 30–6702 to conductor 3 extending into Fig. 48 and thence over contact 1 of relay ADTAR–4804 to conductor ADT3 to operate directly the control relay ADT3–4807 and extending into Fig. 92 and thence over contact 10 of the connector CCA0–9200 to operate relay OADT3–9204.

(2) Ground may extend over contact 7 of relay DT3–4003 in Fig. 40 to conductor 4017 into Fig. 48 over contact 4 of relay DTAR1, contact 5 of relay DTAR2 and contact 1 of relay ADTAR to conductor ADT3.

(3) Ground may extend over contact 8 of relay DT2–4002 in Fig. 40 to conductor 4016 into Fig. 48 and over contact 3 of relay DTAR1, contact 4 of relay DTP1–4803 to conductor 300B extending into Fig. 67 and thence over contact 21 of either one of the relays 31 and 30 to conductor 3 extending into Fig. 48 and thence over contact 1 of relay ADTAR to conductor ADT3.

(4) Ground may extend over contact 7 of relay DT3–4003 to conductor 4017 into Fig. 48 and over contact 4 of relay DTL1–4801, contact 4 of relay DTP1, conductor 300B into Fig. 67 and over contact 21 of either one of the relays 31 and 30 to conductor 3 extending into Fig. 48 and thence over contact 1 of relay ADTAR to conductor ADT3.

One of the relays ODDT0–9100, ODDT1–9101, ODDT2–9102 and ODDT3–9103 will be operated to register in the odd call entry register the tens digit of the disconnect day as determined by the circuits previously described. In the event that the relay ODDT2–9102 is operated to indicate a disconnect day tens digit of two, the associated control relay DDT3–4817 will also be operated. Likewise, in the event that relay ODDT3–9103 is operated to indicate a disconnect day tens digit of three, the companion relay DDT2–4816 will also be operated for control purposes.

Relay ODDT0–9100 may be operated over either of two circuits if conductor OB in Fig. 48 is grounded, as presently to be described. If conductor OB in Fig. 48 is grounded, this ground will extend over contact 4 of either of the relays DDTAR–4808 and DDTS4–4813 to conductor DDT0 which extends into Fig. 91 and over contact 4 of connector CCA0–9200 to operate relay ODDT0–9100.

There are six circuits any one of which may ground conductor OB into Fig. 48.

(1) Ground may extend from Fig. 40 over contact 9 of relay DT0–4000 to conductor 4014 into Fig. 48, thence over contact 1 of relay DTAR1–4800 and contact 2 of relay DTAR2–4802 to conductor OB.

(2) Ground may extend over contact 8 of relay DT1 in Fig. 40 to conductor 4015 into Fig. 48, over contact 2 of relay DTL1 and contact 2 of relay DTAR2 to conductor OB.

(3) Ground may extend over contact 9 of relay DT0 in Fig. 40, conductor 4014 into Fig. 48, over contact 1 of relay DTL1 and contact 1 of relay DTP1 to conductor OB.

(4) Ground may extend over contact 7 of relay DT3 in Fig. 40 to conductor 4017 into Fig. 48 over contact 4 of relay DTAR1, contact 5 of relay DTP1 to conductor OB.

(5) Ground may extend over contact 7 of relay DT3 of Fig. 40, conductor 4017 into Fig. 48, contact 4 of relay DTL1, contact 4 of relay DTP1, conductor 300B into Fig. 67 thence over contact 21 of either of the relays 26–6701 and 28–6700 to conductor OB extending into Fig. 48.

(6) Ground may extend over contact 8 of relay DT2 in Fig. 40 to conductor 4016 into Fig. 48, thence over contact 3 of relay DTAR1 and contact 4 of relay DTP1 to conductor 300B into Fig. 67 thence over contact 21 of either of the relays 29 and 28 to conductor OB extending into Fig. 48.

There are two ways of operating relay ODDT0–9100 when and if conductor 2 of Fig. 48 is grounded. One of these circuits extends from conductor 2 in Fig. 48, over contact 2 of relay DDTS1–4810 to conductor DDT0 and the second circuit extends from conductor 2 in Fig. 48, over contact 2 of relay DDTP1–4809 to conductor 300A extending into Fig. 67 and thence over contact 20 of either one of the relays 29 and 28 to conductor DDT0 extending into Fig. 48.

There are five circuits any one of which may ground the conductor 2 in Fig. 48.

(1) Ground may extend over contact 9 of relay DT0 in Fig. 40 to conductor 4014 into Fig. 48 and over contact 1 of relay DTL1, contact 1 of relay DTAR2, conductor 203 into Fig. 67 and thence over contact 19 of either one of the relays 29 and 28 to conductor 2 extending into Fig. 48.

(2) and (3) Ground may extend over contact 8 of relay DT1 or relay DT2 in Fig. 40 to respective conductor 4015 or 4016 into Fig. 48, thence respectively over contact 2 of relay DTAR1 or contact 3 of relay DTL1 and over contact 3 of relay DTP1 to conductor 2.

(4) and (5) Ground may extend over either contact 8 of relay DT2 in Fig. 40 or contact 7 of relay DT3 in Fig. 40 to respective conductor 4015 or 4017 into Fig. 48, thence respectively over contact 3 of relay DTAR1 or contact 4 of relay DTL1 and over contact 4 of relay DTAR2 to conductor 2.

There are three circuit means for operating relay ODDT0–9100 when and if conductor 3 in Fig. 48 is grounded. These three circuits extend alternatively from conductor 3 in Fig. 48 over contact 1 of either relay DDTP1–4809 or DDTS3–4812 or DDTS4–4813 to conductor DDT0.

There are four circuits any one of which may ground conductor 3 in Fig. 48.

(1) Ground may extend over contact 9 of relay DT0 in Fig. 40 to conductor 4014 extending into Fig. 48, thence over contact 1 of relay DTL1, contact 1 of relay DTAR2, conductor 203 into Fig. 67 thence over contact 19 of either one of the relays 31 and 30 to conductor 3 extending into Fig. 48.

(2) Ground may extend over contact 7 of relay DT3 in Fig. 40 to conductor 4017 extending into Fig. 48, thence over contact 4 of relay DTAR1 and contact 5 of relay DTAR2 to conductor 3.

(3) and (4) Ground may extend alternatively over

contact 8 of relay DT2 in Fig. 40 or contact 7 of relay DT3 in Fig. 40, to either conductor 4016 or 4017 into Fig. 48, thence alternatively over contact 3 of relay DTAR1 or contact 4 of relay DTL1, and over contact 4 of relay DTP1 to conductor 300B into Fig. 67, and thence over contact 21 of either one of the relays 31 and 30 to conductor 3 extending into Fig. 48.

Relay ODDT0–9100 may also be operated in a circuit extending from ground over the contact of relay DDT0–4815 in Fig. 48 to conductor DDT0.

Relay ODDT1–9101 may be operated over any one of the above-described six circuits whereby conductor OB in Fig. 48 is grounded; namely by having this grounded conductor OB in Fig. 48 extend over contact 4 of any one of the relays DDTP1–4809, DDTS1–4810 and DDTS2–4811 to conductor DDT1 extending into Fig. 91 and thence over contact 3 of the connector CCA0–9200 to operate the register relay ODDT1–9101.

There are four other circuits by means of any one of which this relay ODDT1–9101 may be operated.

(1) and (2) Ground may extend alternatively over either contact 9 of relay DT0 of Fig. 40 or contact 8 of relay DT1 in Fig. 40 to either conductor 4014 or conductor 4015 into Fig. 48, thence over either contact 1 of relay DTAR1 or contact 2 of relay DTL1 and over contact 2 of relay DTP1 and contact 3 of either of the relays DDTAR–4808 and DDTS3–4811 to conductor DDT1.

(3) and (4) Ground may extend alternatively over contact 8 of relay DT1 or contact 8 of relay DT2 in Fig. 40 to either conductor 4015 or 4016, and respectively over contact 2 of relay DTAR1 or contact 3 of relay DTL1 and contact 3 of relay DTAR2 and contact 3 of either of the relays DDTAR and DDTS3 to conductor DDT1.

Relay ODDT2–9102 and its companion control relay DDT3–4817 may be operated over any one of the above-described four circuits for operating relay ODDT1–9101, by having the grounded conductor previously described in Fig. 48 extend over contact 3 of either one of the relays DDTP1–4809 and DDTS1–4810 in Fig. 48 to conductor DDT2 to operate the control relay DDT3–4817 directly and extending into Fig. 91 and over contact 2 of connector CCA0–9200 to operate the register relay ODDT2–9102.

Relays ODDT2–9102 and DDT3–4817 may be operated over any one of the above-described five circuits whereby conductor 2 in Fig. 48 is grounded, by having this grounded conductor extend over contact 2 of either of the relays DDTAR–4808 and DDTS3–4812 to conductor DDT2.

Register relay ODDT3–9103 and its companion control relay DDT2–4816 may be operated over any one of the above-described five circuits whereby conductor 2 in Fig. 48 is grounded, by having this grounded conductor 2 extend over contact 2 of either one of the relays DDTS2–4811 and DDTS4–4813 to conductor DDT3 to operate relay DDT2–4816 directly and extending into Fig. 91 and over contact 1 of connector CCA0–9200 to operate the register relay ODDT3–9103.

These two relays may also be operated in any one of the five circuits which may ground the conductor 2 into Fig. 48, by having this grounded conductor 2 extend over contact 2 of relay DDTP1 to conductor 300A extending into Fig. 67, and thence over contact 20 of either one of the relays 31 and 30 to conductor DDT3 extending into Figs. 48 and 92.

These two relays may also be operated over any one of the four circuits whereby conductor 3 in Fig. 48 is grounded, as above described, by extending this grounded conductor 3 over contact 1 of either one of the relays DDTAR–4808 and DDTS2–4811 to conductor DDT3.

Day register units output connector of Fig. 66.—Connectors A–1–6602 and D–1–6607, if operated, will provide respectively answer and disconnect day units digits of one, independently of any other value of the answer and disconnect day.

There are four circuits any one of which may operate the connector D–1–6607. Ground may extend over contact 1 of connector CCD0–13600 in Fig. 136 to conductor DU into Fig. 68 and thence over contact 6 of relay LR–6810 and appearing before contact 2 of each of the relays D0T–6805, D1T–6806, D2T–6807, D3–8T–6808 and D9T–6809.

(1) Ground may extend over contact 2 of relay D0T in Fig. 68 to conductor 6830 into Fig. 67 and thence over contact 13 of relay 29–6701 to conductor DDU1 into Fig. 66 to operate the relay D–1–6607.

(2) Ground may extend over contact 2 of relay D1T in Fig. 68 to conductor 6831 into Fig. 67 and over contact 14 of relay 30–6702 to conductor DDU1.

(3) Ground may extend over contact 2 of relay D2T in Fig. 68 to conductor 6832 into Fig. 67 and thence over contact 15 of relay 31–6703 to conductor DDU1.

(4) Ground may extend over contact 2 of relay D9T in Fig. 68 to conductor 6833 into Fig. 67 and thence over contact 16 of relay 28–6700 to conductor DUAR1 extending into Fig. 195 and thence over contact 11 of relay CR1–19511 to conductor DDU1 extending into Fig. 66.

There are four circuits any one of which may operate the connector A–1–6602. Ground may extend over contact 3 of the connector CCD0–13600 in Fig. 136 to conductor AU extending into Fig. 95, thence over contact 5 of relay CR1–9511 to conductor AUA<D into Fig. 68, and over contact 1 of relay LR–6810 and appearing before contact 1 of all of the relays A0T–6800 to A9T–6804.

(1) Ground may extend over contact 1 of relay A0T in Fig. 68 to conductor 6816 into Fig. 67 and over contact 1 of relay 29 in Fig. 67 to conductor A–1 extending into Fig. 66 to operate connector A–1–6602.

(2) Ground may extend over contact 1 of relay A1T–6801 in Fig. 68 to conductor 6817 into Fig. 67 and thence over contact 2 of relay 30–6702 to conductor A–1.

(3) Ground may extend over contact 1 of relay A2T–6802 to conductor 6818 into Fig. 67 and thence over contact 3 of relay 31–6703 to conductor A–1.

(4) Ground may extend over contact 1 of relay A9T in Fig. 68 to conductor 6819 extending into Fig. 67 and thence over contact 4 of relay 28–6700 to conductor A–1.

Connector relay ARA–6600, if operated, utilizes the day register units value as registered in the day register of Figs. 40 and 41 for the purpose of providing the answer day units value for registration in the call entry register. The circuit for operating the connector relay ARA–6600 extends from ground in Fig. 136 over contact 3 of connector CCDO–13600, conductor AU into Fig. 68, thence over contact 7 of relay FR–6812 to conductor FRAU extending into Fig. 48, and thence alternatively either over contact 1 of relay ADT2–4806 to conductor ADUARS or contact 2 of relay ADT2–4806 and contact 1 of relay ADT3–4807 to conductor ADUARS extending to Fig. 66 to operate connector ARA–6600.

Connector AR–6601, if operated, provides the answer day units digit from the answer day as read from the associated assembling register.

There are eight circuits any one of which is capable of operating the connector relay AR–6601.

(1) The above-described grounded conductor FRAU in Fig. 48 may extend over contact 2 of relay ADT2–4806 and contact 2 of relay ADT3–4807 to conductor ADUAR extending into Fig. 66 to operate connector AR–6601.

(2) Ground may extend over contact 3 of connector CCDO–13600 to conductor AU into Fig. 68 and thence over contact 1 of relay IR–6811 to conductor ADUAR.

(3) Ground may extend over contact 3 of connector

CCDO–13600 to conductor AU into Fig. 195 and thence over contact 5 of relay CR0–19510 to conductor AUA>D into Fig. 68 and thence over contact 3 of relay LR–6810 to conductor ADUAR.

(4), (5), (6), (7) and (8) Ground may extend over contact 3 of connector CCDO–13600 to conductor AU into Fig. 195 and thence over contact 5 of relay CR1–19511 to conductor AUA<D into Fig. 68 and thence over contact 1 of relay LR–6810 and appearing before contact 1 of all of the relays A0T–6800 to A9T–6804. One circuit may extend over contact 1 of relay A0T to conductor 6816 into Fig. 67 and thence over contact 1 of any one of the relays 31, 30 and 28 to conductor ADUAR. A second circuit may extend over contact 1 of relay A1T to conductor 6817 into Fig. 67 and thence over contact 2 of any one of the relays 31, 29 and 28 to conductor ADUAR. A third circuit may extend over contact 1 of relay A2T to conductor 6818 extending into Fig. 67 and thence over contact 3 of any one of the relays 30, 29 and 28 to conductor ADUAR. A fourth circuit may extend over contact 1 of relay A3–8T in Fig. 68 directly to conductor ADUAR. A fifth circuit may extend over contact 1 of relay A9T in Fig. 68 to conductor 6819 into Fig. 67 and thence over contact 4 of any one of the relays 31, 30 and 29 to conductor ADUAR.

Connector relay AT–6603, if operated, will reform the disconnect day units value the same as the actual disconnect day. Connectors P1–6604, L1–6605 and L2–6606 respectively will reform the disconnect day units value one more than, one less than and two less than the actual disconnect day value.

There are eight circuits any one of which may operate the connector AT–6603.

(1), (2), (3), (4) and (5) Ground may extend over contact 1 of connector CCDO–13600 in Fig. 136 to conductor DU extending in Fig. 68, over contact 6 of relay LR–6810 and appearing before contact 2 of all of the relays D0T to D9T. A first circuit may extend over contact 2 of relay D0T to conductor 6830 into Fig. 67 and thence over contact 13 of any one of the relays 31, 30 and 28 to conductor DDUAR into Fig. 66 to operate connector AT–6603. A second circuit may extend over contact 2 of relay D1T to conductor 6831 extending into Fig. 67 and thence over contact 14 of any one of the relays 31, 29 and 28 to conductor DDUAR. A third circuit may extend over contact 2 of relay D2T to conductor 6832 into Fig. 67 and thence over contact 15 of any one of the relays 30, 29 and 28 to conductor DDUAR. A fourth circuit may extend over contact 2 of relay D3–8T directly to conductor DDUAR. A fifth circuit may extend over contact 2 of relay D9T to conductor 6833 extending into Fig. 67 and thence over contact 16 of any one of the relays 31, 30 and 29 to conductor DDUAR.

(6) Ground may extend over contact 1 of connector CCDO–13600 to conductor DU extending into Fig. 68, over contact 6 of relay LR–6810 over contact 2 of relay D9T–6809, conductor 6833 into Fig. 67 and over contact 16 of relay 28–6700 to conductor DUAR1 into Fig. 195 and thence over contact 11 of relay CR0–19510 to conductor DDUAR.

(7) Ground may extend over contact 1 of connector CCDO–13600 in Fig. 136 to conductor DU extending into Fig. 68 and thence over contact 6 of relay FR–6812 to conductor FRDU extending into Fig. 48 and thence over contact 2 of relay DDT2–4816 and contact 2 of relay DDT3–4817 to conductor DDUAR.

(8) The grounded conductor FRDU, above described, in Fig. 48 may extend over contact 1 of relay DDT2–4816 to conductor DDUS extending in Fig. 67 and thence over contact 24 of relay 30–6702 to conductor DDUAR.

The circuit for operating connector relay P1–6604 extends from ground over contact 1 of connector CCDO–13600, conductor DU extending into Fig. 68 and thence over contact 6 of relay FR–6812 to conductor FRDU extending into Fig. 48 and thence alternatively over contact 2 of relay DDT2–4816 and contact 1 of relay DDT3–4^17 to conductor DDUS or over contact 1 of relay DDT2–4816 to conductor DDUS extending into Fig. 67 and thence over contact 22 of relay 31–6703 to conductor P1 extending into Fig. 66 to operate the connector P1–6604.

The same circuit above described for operating the connector relay P1–6604 will operate the connector relay L1–6605 if the grounded conductor DDUS in Fig. 67 extends over contact 26 of relay 29–6701 to conductor L1 extending into Fig. 66 to operate connector L1–6605.

Similarly, the connector relay L2–6606 will be operated from the same circuit provided the grounded conductor DDUS in Fig. 67 is extended over contact 26 of relay 28–6700 to conductor L2 extending into Fig. 66.

Day units call entry register (*Figs. 91 and 92*).—The answer day unit register relays OADU0 to OADU7 of Fig. 92 and the disconnect day units register relays ODDU0 to ODDU7 of Fig. 91 are operated to record respectively the units digits of the answer and disconnect days associated with the particular call being processed at this moment in the odd call entry register.

If the connector relay AR–6601 is operated, as above described, then the locking grounds on two of the five conductors D0 to D7 in Fig. 80 may extend over cables D–8010, 80–133 and D–8010 into Fig. 133, where conductors D0 to D7 emerge and extend over contacts 1 to 5 of the connector relay CCEO–13300 to conductors D0 to D7, cable D–13301 into Fig. 66 where conductors D0 to D7 emerge and extend over contacts 1 to 5 of the connector relay AR–6601 to conductors ADU0 to ADU7, cables ADU and 66–91 into Fig. 91 and ADU to Fig. 92 where conductors ADU0 to ADU7 emerge and extend over contacts 14 to 18 of connector CCA0–9200 to operate two of the five register relays OADU0 to OADU7 of Fig. 92.

In the event that connector A–1–6602 is operated, as above described, ground will extend over contacts 1 and 2 thereof to respective conductors ADU1 and ADU0 which extend over cables ADU etc., as above described, into Fig. 92 to operate the associated register relays OADU1 and OADU0 of Fig. 92.

In the event that the connector ARA–6600 is operated, as above described, two of the five register relays OADU0 to OADU7 of Fig. 92 will be operated depending upon which ones of the register relays are operated in the day units section of the day register of Figs. 40 and 41, namely relays DU0–4010 to DU2–4012 of Fig. 40 and relays DU3–4113 to DU9–4119 of Fig. 41. Ground in Fig. 40 may extend over contact 8 of relay DU0–4010 to conductor U0A or over contact 11 of relay DU1–4011 to conductor U1A or over contact 9 of relay DU2–4012 to conductor U2A into cables A4009 and A4104. Ground in Fig. 41 may extend over contact 9 of any one of the relays DU3–4113 to DU8–4118 to one of the respective conductors U3A to U8A or contact 8 of relay DU9 to conductor U9A all into cables A4102 and A4104. Ground also may extend in Fig. 40 alternatively over respective contacts 7, 10 or 8 of relay DU0, DU1 or DU2 to conductor U0B, U1B or U2B into cables B4011 and B4105. Ground may extend in Fig. 41 over contact 8 of any one of the relays DU3 to DU8 to a respective conductor U3B to U8B or over contact 7 of relay DU9 to conductor U9B all into cables B4103 and B4105. The corresponding U–A and U–B leads grounded in this manner and extending over respective cables A4104 and B4105 further extend over cable 49–66 into Fig. 66 where the U–A and U–B leads emerge out of respective cables A4104 and B4105 and extend over suitable contacts of the connector ARA–6600 to ground two of the five conductors ADU0 to ADU7 ex-

tending (as previously) over cables ADU, etc. into Fig. 92, to operate two of the register relays OADU0 to OADU7.

In the event that the connector D–1–6607 is operated, as previously described, ground will extend over the respective contacts 2 and 1 thereof to respective conductors DDU0 and DDU1 and over cables DDU, 66–91 into Fig. 91 and DDU into Fig. 91 where conductors DDU0 and DDU1 emerge and extend over contacts 9 and 8 of connector CCA0–9200 to operate the associated register relays ODDU0 and ODDU1 of Fig. 91.

In the event that one of the connector relays P1–6604, AT–6603, L1–6605 and L2–6606 is operated, as previously described, two of the five register relays ODDU0 to ODDU7 of Fig. 91 will be operated depending upon the operated condition of the disconnect day translator relays DDT0–6010 to DDT7–6017 of Fig. 60 and the particular one of the above-mentioned four connectors in the left portion of Fig. 66. Ground will extend over contact 41 of the connector CCFO–13000 in Fig. 130 to conductor B which extends over cable 130–60 to Fig. 60 and thence extends over a contact of the two operated ones of the translator relays DDT0 to DDT7 to one of the ten conductors U0B to U9B extending over cable 60–66 into Fig. 66. Ground also extends over contact 42 of the connector CCF0 in Fig. 130 to conductor A which extends over cable 130–60 into Fig. 60 where the conductor A emerges and extends over contacts of the two operated ones of the translator relays DDT0 to DDT7 to one of the ten conductors U0A to U9A extending over cable 60–66A into Fig. 66. The respective grounded conductors U0B to U9B and U0A to U9A out of respective cables 60–66 and 60–66A in Fig. 66 will extend over two contacts of the operated one of the connectors in the left portion of Fig. 66 to ground 2 of the five conductors DDU0 to DDU7 into cables DDU, etc. into Fig. 91, and over contacts 5 to 9 of connector CCAO–9200 to operate the associated two of the register relays ODDU9 to ODDU7 of Fig. 91.

Locking circuit for day registers.—The register relays of Figs. 91 and 92 representing the answer and disconnect day tens and units values associated with the particular call being processed through the odd call entry register will lock to conductor LO1–9106 which extends over cables 94–92, 96–94, 123–96 and 123–126 into Fig. 126 where conductor LO1–9106 emerges and extends over contact 11 of relay ORLS–12605 to ground over the contact of relay ORONG–12604.

4.18 *Determining units class and sort digit*

The computer portion of the machine also includes a control from the sort class translator of Figs. 192, 193, 207 and 208 for indicating to the connected call register portion of the machine, such as the odd call entry register, the interpretation to place on the various types of message units which are indicated by the billing index translation and for forming a digit, known as the "sort digit," for use in controlling the sorting of message unit messages. The sort digit may be merely a duplication of the office index (Fig. 85) for office sorting of message unit entries or it may be an arbitrary digit assigned for a particular type of message unit or a combination of message unit type and office index.

When the office index is to be copied into the sort digit register without change, relay OIO–12703 of the office index translator output connector (Fig. 127) is operated.

The billing index tens digit indicates on a cross-connectable basis the output class as registered in the output class registers of Figs. 96 and 97, as previously described. The class of the call indicates on message unit calls the type of message units represented as registered in the message unit type translator of Figs. 39, 46 and 47, as previously described. The message unit type translator records, on each call, from the billing index tens digit, the type of message unit and provides the arbitrary digital information required for forming the sort digit when required. The path for forming this digit through the message unit type translator is through the office index translator relay 500–12708, one of the message unit type relays of the message unit type translator of Figs. 46 and 47 and through one of the relays of the message unit type translator of Fig. 39 (which indicates the number of types of message units required in processing the particular marker group). In the case of toll message units for interstate calls the path includes contacts on the message unit tens and units translators of Figs. 37 and 38 so that a different sort digit may be assigned for calls which exceed four message units in value.

These paths start from the office index translator of Fig. 127 as two decimal translations for the offices of the 5 office indices 0 to 4. The leads leaving the relays of the message unit type translator (Figs. 39, 46 and 47), which indicate the number of types of message units which may occur in the marker group being processed, translate these 0 to 4 office index pairs of leads from the decimal base to the required sort digit two-out-of-five base.

The office index translator also provides two pairs of leads OA, OB and NOA, NOB for indicating whether the office index is zero or is not zero. These leads pass through relay P00–12705 to be given the sort digit values zero and one, respectively.

Relay 000–12706 of the office index translator output connector is operated to enable the sort digit to be constructed on the basis of the message unit type only, independently of the office index value.

When sorting out local message units from other types of messages the sort class translator operates the 2T–3900 relay of the message unit type translator of Fig. 39 so that only two types of message units are indicated for forming the sorting digit, although the billing index translation may operate more than two types of message unit type relays.

The message unit type translator also indicates to the call register portion of the circuit (odd side in the example) the type of message units (Fig. 95) involved on the call so that this information may be perforated as part of the call entries. This information, together with the class as translated from the billing index tens digit, is registered in the units class register (Fig. 95) of the connected call register portion of the machine.

Units class.—One of the units class relays OTOLL–9500 to OMUT2–9505 in Fig. 95 will be operated depending upon the condition of the message unit type translator of Figs. 46 and 47 and the message tens and units translators of Figs. 37 and 38.

If any one of the relays of Figs. 46 and 47, except relay MUT–4602, is operated a circuit will be completed for operating one of the relays in Fig. 95 except relay OMUT1 (not shown) and OMUT2–9505. Ground may extend from the grounded conductor CG–13605 in Fig. 46 or 47 and alternatively either over contact 2 of relay MUE2–4601 or contact 8 of relay MUE1–4600 or contact 8 or relay MUL–4700 or the contact of relay MUD–4703 or MU–4702 or TOLL–4701 to one of the respective conductors MUE2, MUE1, MUL, MUD, MU, and TOL, extending into and over cables 9514, 46–127 to Fig. 127 and cable 9514 into Fig. 95 and over one of the contacts 5 through 10 of connector CCCO–9600 to operate the associated one of the units class relays in Fig. 95.

In the event that the relay MUT–4602 in Fig. 46 is operated, a circuit will extend from ground on conductor CG–13605 in Fig. 46, thence over contact 8 of relay MUT–4602 to conductor 2ML into and over cables 39–46, 38–39, 37–38B into Fig. 37 to conductor 2ML. If the message units tens relay MUT0–3700 is operated (indicating a tens digit of zero) then the ground on conductor 2ML will extend over contact 5 thereof to conductor MUT which extends over cable 38–37 into

Fig. 38. In the event that one of the message unit units translator relays MUU1–3801, MUU2–3802, MUU3–3803 and MUU4–3804 is operated, the grounded conductor MUT will extend over contact 3 of the operated one of these four relays (indicating a message unit units digit of from 1 to 4) to conductor MUT1 into cable 3811. In the event that one of the other message unit units relays of Fig. 38 is operated (indicating a units digit of zero or five through nine) then the grounded conductor MUT will extend over contact 3 thereof to conductor MUT2 into cable 3811. In Fig. 37, in the event that a message units tens relay other than relay MUT0–3700 is operated (indicating a message units tens digit other than zero), the grounded conductor 2ML will extend over contact 5 of this operated relay to conductor MUT2 which extends into Fig. 38 and then into cable 3811. These two conductors MUT1 and MUT2 extend by means of cable 3811 and cable 38–94 into Fig. 94 where conductors MUT1 and MUT2 emerge and extend into Fig. 95 and over contact 4 or contact 3 of connector CCC0–9600 to operate relay OMUT1 (not shown) or relay OMUT2–9505.

The operated unit class relay of Fig. 95 locks to ground on conductor LO3–9302.

Sort digit register.—In Fig. 93 two of the five relays OSD0 to OSD7 will be operated on a two-out-of-five coded basis to register the sort digit.

One of the office index translator output conductor relays OIO–12703, P00–12705, 000–12706 and 500–12708 in Fig. 127 will be operated depending upon the condition of the sort class translator relays of Figs. 192, 193, 207 and 208. Ground may extend from the grounded off-normal conductor MON–1236 in Fig. 208 over contact 4 of relay SBUT–20803 to conductor 000 into cables 19326 and 193–153. Ground may also extend from conductor MON–1236 in Fig. 208 over contact 6 of relay SBTH–20800 to conductor OIO into cables 19395 and 193–153. This same ground may extend over contact 4 of relay SBU–20703 to conductor OIO or over contact 7 of relay SBO–20701 to conductor OIO or over contact 6 of relay SOPO–20702 to conductor P00 or over either contact 7 of relay SOLU–20802 or contact 3 of relay SBOUT–20801 to conductor 500 all into cables 19325 and 193–153. The grounded conductor MON–1236 in Fig. 207 may however extend over contact 4 of relay NS–20700 to conductor 20711, which may extend over either contact 3 of relay SO–19204 to conductor OIO or over contact 3 of relay MO–19205 to conductor 19221. The grounded conductor 19221 may then extend over either contact 3 of relay 1T–19300 to conductor OIO or over contact 3 of relay 25T–19301 to conductor 500 all into cables 19325 and 193–153. These four conductors then extend over cables 193–153, 15300, 153–127 and 12712 into Fig. 127 to operate the associated one of the connector relays OIO–12703 to 500–12708.

One of the message unit type translator relays 2T–3900, 3T–3901, 4T–3902 and 5T–3903 in Fig. 39 will be operated also depending upon the condition of the relays in the sort class translator of Figs. 192, 193, 207 and 208. Ground may extend from the off-normal conductor MON–1236 in Fig. 208 over contact 5 of relay SOLU–20802 to conductor 20814 extending into Fig. 192 and thence alternatively over contact 1 of one of the relays 2T–19200, 3T–19201, 4T–19202 or 5T–19203 to ground the respective conductor 2TT, 3TT, 4TT or 5TT extending into cable 19220. On the other hand, ground on conductor MON–1236 in Fig. 208 may extend over either contact 5 of relay SBUT–20803 or contact 4 of relay SBOUT–20801 to conductor 2T entering cable 19220. These four conductors will extend over cables 19220, 37–192 to Fig. 37 and 37–39 into Fig. 39 where the four conductors 2TT, 3TT, 4TT and 5TT emerge to operate one of the four translator relays 2T–3900 to 5T–3903.

The operating circuits for the sort digit register relays of Fig. 93 may partially be traced from battery through the windings of these five relays in the left portion of Fig. 93 over contacts 1 through 5 of connector CCBO–9400 to conductors 0, 1, 2, 4 and 7 into and over cable 146–93 to Fig. 146 to conductors 0 to 7 and thence over cable 127–146 into Fig. 127 where conductors 0 to 7 emerge and appear before contacts of the connectors P00–12705 and OIO–12703. These five conductors 0 through 7 emerging from cable 127–146 in Fig. 127 also extend over cables 12709 and 46–127 into Fig. 46 and cable 12709 out of which emerge the five conductors 0 to 7 to appear before contacts of relays MUT–4602, MUE2–4601 and MUE1–4600 in Fig. 46 and before contacts of the relay MUL–4700 in Fig. 47 and before contacts of the translator relays 2T–3900 to 5T–3903 in Fig. 39. In the circuit description to follow the operating paths for operating two of the five sort digit register relays of Fig. 93 will be described insofar as is necessary to describe the grounding of two of these five conductors 0 to 7 above described as appearing before contacts of various of the relays in Figs. 39, 46 and 47 and before the connectors of Fig. 127. It will be understood that when the circuit description to follow terminates in the grounding of respective conductors 0 to 7, this is equivalent to causing the operation of two of the respective register relays OSD0 to OSD7 in Fig. 93.

In the event that connector OIO–12703 in Fig. 127 is operated, as above described, ground will extend from the grounded conductor CG–13605 in Fig. 127 over contacts of the two operated office index translator relays OIT0–12700 to OIT7–12707 to ground two of the conductors 0 to 7 into cable 12711 and over contacts 1 to 5 of the connector OIO–12703 to ground two of the conductors 0 to 7 entering cable 127–146.

In the event that the connector P00–12705 in Fig. 127 is operated, as above described, ground will extend from the conductor CG–13605 over contacts 5 and 6 of relay OIT4–12704 and contacts 1 and 2 of relay OIT7–12707 (if the office index translator digit is zero) to conductors OA and OB over contacts 4 and 3 of connector P00–12705 to ground conductors 7 and 4 into cable 127–146. Ground may also extend from the conductor CG–13605 in Fig. 137 over contacts 3 and 4 of relay OIT2–12702 or contacts 5 and 6 of relay OIT1–12701 or contacts 7 and 8 of relay OIT0–12700 (if the office index translator digit is other than zero) to conductors NOA and NOB over contacts 2 and 1 of connector P00–12705 to conductors 1 and 0 into cable 127–146.

Ground may extend from conductor CG–13605 in Fig. 127 over pairs of contacts on the two operated ones of the office index translator relays OIT0–12700 to OIT7–12707 to ground a different pair of leads for each one of the five possible office index digits 0 to 4. If the registered digit is zero the leads 00A and 00B into cable 12710 will be grounded. Likewise for the successive digits 1 through 4, the respective pairs of leads 01A and 01B, 02A and 02B, 03A and 03B, 04A and 04B will be grounded. These ten conductors enter cable 12710 and appear before contacts 1 through 10 of the connector 500–12708. If connector 500–12708 is operated, the grounded pair of conductors will extend over a pair of contacts of this connector to ground the associated pair of leads 00A and 00B etc. entering cable 12713. It will be noted that in the event that connector 000–12706 is operated instead of connector 500–12708, then ground will extend from the conductor CG–13605 over contacts 1 and 2 of the connector 000–12706 to ground the pair of conductors 00A and OOB into cable 12713. These five pairs of conductors extend over cables 12713 and 46–127 into Fig. 46 where the three pairs of leads 00A etc. to 02A etc. emerge out of cable 4605 and extend across Figs. 46 and 47

to appear before contacts of each of the message unit type translator relays MUT–4602, MUE2–4601, MUE1-4600 and MUL–4700. The other two pairs of conductors 03A etc. and 04A etc. continue through cable 46–39 into Fig. 39 and appear before contacts of the message unit type translator relay 2T–3900, which if operated, will extend these two pairs of conductors over the contacts 27 through 30 thereof to the two pairs of conductors 03A0 etc. and 04A0 etc. extending into Figs. 46 and 47 to appear before contacts of each of the aforementioned translator relays in Figs. 46 and 47.

The manner and means whereby the grounded pair of these five pairs of conductors may ground two of the five conductors 0, 1, 2, 4 and 7 in Figs. 39, 46 and 47 for the purpose of operating two of the sort digit register relays in Fig. 93 depends upon the operated condition of the message unit type translator relays of Figs. 39, 46 and 47 and of the message tens and units translator relays of Figs. 37 and 38.

If relay MUT–4602 is operated, the three pairs of leads 00A etc. to 02A etc. emerging from cable 4605 in Fig. 46 will extend over contacts 1 to 6 of this relay to the three pairs of leads 00A0 etc. to 02A0 etc., thence into cables 39–46, 38–39 and 37–38B into Fig. 37. If the relay MUT0–3700 is operated, these three pairs of leads will extend over contacts 6 to 11 thereof to the three pairs of leads 00A5 etc. to 02B5 into cable 38–27 into Fig. 38 to appear before contacts of the relays MUU0–3800 to MUU9–3809. If any one of the relays MUU1–3801 to MUU4-3804 is operated (indicating a message unit units digit of one to four) the grounded ones of these three pairs of leads 00A5 to 02B5 will extend over contacts 4 to 9 of this relay to ground one of the three pairs of leads 00A1 to 02B1 entering cables 3812 and 38–39. If one of the relays MUU0–3800 or MUU5–3805 to MUU9–3909 is operated, the grounded pair of leads 00A5 to 02B5 out of cable 38–37 will extend over contacts 4 to 9 of this operated relay to ground one of the three pairs of leads 00A2 to 02B2 extending into Fig. 37 and thence into cables 37–38B and 38–39. In the event that one of the relays MUT1–3701 to MUT9–3709 is operated, instead of relay MUT0–3700 as described above, the grounded pair of leads 00A0 to 02B0 out of cable 37–38B in Fig. 37 will extend over contacts 6 to 11 of this operated relay to ground a pair of leads 00A2 to 02B2 into cables 37–38B and 38–39.

These six pairs of leads entering cable 38–39 in Fig. 38 (leads 00A1 to 02B1 out of cable 3812 and leads 00A2 to 02B2 out of cable 37–38B) extend over cables 38–39 and 3904 into Fig. 39 where these 12 conductors emerge and appear before various contacts of each of the four translator relays 2T to 5T in Fig. 39. Depending upon which one of these relays may be operated, the particular grounded pair of conductors will extend over contacts of 1 to 8 of relay 5T or 4T or over contacts 1 to 12 of relay 3T or 2T, thereby to ground two of the five conductors 0 to 7 previously described.

If the grounded pair of leads represents an office index of 3 or 4 then the grounded pair of leads 03A–03B or 04A–04B entering cable 12713 in Fig. 127 will extend over cable 46–127 to Fig. 46 and then as above described over cable 46–39 into Fig. 39 where, if translator relay 2T–3900 is operated, the grounded pair of leads will extend over contacts 27 to 30 thereof to ground a pair of leads 03A0 to 04B0 extending into Figs. 46 and 47. The grounded pair of these leads will then extend over contacts 9 to 12 of relay MUT–4602 or relay MUE1–4600 or MUL–4700 or over contacts 3 to 6 of relay MUE2–4601 to ground two of the five conductors 0 to 7.

In the event that the office index digit is a zero or a one or a two and the relay MUT–4602 is not operated, that is, one of the other three relays MUE2–4601 or MUE1–4600 or MUL–4700 in Figs. 46 and 47 is operated, then the grounded pair of conductors 00A to 02B out of cable 4605 in Fig. 46 will extend over contacts 7 to 12 of the relay MUE2–4601 to a pair of leads 00A to 02B extending into Fig. 39 and appearing before contacts of the relays 2T to 5T in Fig. 39 or over contacts 1 to 6 of relay MUE1–4600 to ground two of the five conductors 0 to 7 or to ground one of the two pairs of leads 01A3–02A3 and 01B3–02B3 extending into Figs. 39 etc. or over contacts 1 to 6 of relay MUL–4700 to ground two of the five leads 0 to 7 or to ground one of the two pairs of leads 01A4–02A4 and 01B4–02B4 extending into Fig. 39 etc. Depending upon which one of these various circuit conditions exists a pair of leads 0 to 7 will be grounded immediately or through the agency of contacts 9 to 16 of the translator relay 5T–3903 or 4T–3902 or contacts 13 to 26 of one of the relays 3T–3901 and 2T–3900.

The operated sort digit relays of Fig. 93 lock to ground on conductor LO3–9302.

4.19 *Registering computed information*

The items of information calculated, translated or constructed by the computer portion of the machine that are useful in forming entries to be perforated on the calls handled by either (the odd side in the example) call register are registered in these portions of the circuit. The following items, as previously described, are registered on a two-out-of-five basis: chargeable time tens and units digits (Figs. 93 and 94) from the chargeable time translator; message unit tens and units digits (Fig. 94) from the message unit translator; disconnect day units (Fig. 91) from the disconnect day units connector; answer day units (Fig. 92) from the answer day units connector; disconnect and answer day tens (Figs. 91 and 92) from the day register tens output connector; and, the sort digit (Fig. 93) from the office index translator output connector or message unit type translator. The output class (Figs. 96 and 97), number of lines (Fig. 95) and units class (Fig. 95) are registered on a decimal basis. All registrations from the computer to the call register portion of the machine are through the odd or even computer connector.

When all of the aforementioned items are registered from the computer portion into a call register, relay OOUC–12402 or OODUC–12406 of the associated register control (odd side) of Figs. 123 to 126 is operated to indicate that a registration has been made.

Relay OODC–12400 releases since these registers are no longer normal.

Two up-check relays OOUC–12402 and OODUC–12406 are provided for these output registers to distinguish a check when the call requires perforation (OOUC) from the case where the call registered is to be discarded (OODUC).

The circuits whereby one or the other of relays OODUC–12406 and OOUC–12402 is operated involves in one way or the other the grounding of conductor 9512 extending between Figs. 95 and 96. The initial part of the detailed description to follow deals with the means whereby conductor 9512 is grounded and the subsequent description will be concerned with circuits which are made effective after the grounding of conductor 9512 to operate one or the other of these two relays.

Ground may extend from the off-normal conductor ON–1120 in Fig. 126 over contact 5 of relay ONES–12602 to conductor UCDD. If relay OAUCT–12504 is operated (indicating that only one timing entry has been taken from an assembling register so that the answer time registers in the odd call entry register have been filled with the same information as the disconnect registers) then the grounded conductor UCDD will extend over contact 7 of this relay to conductor UCDU extending into Fig. 98 and appearing before contacts 1 of both of the relays O4LI–9801 and O2LI–9800. In the event that the relay OAUCT–12504 is not operated, then

the grounded conductor UCDD in Fig. 126 will extend from Fig. 126 into Fig. 123 and thence over cables **12310, 123–96, 96–94, 94–92, 9205, 92–91** and **9104** into Fig. 91 where conductor UCDD emerges and extends over an up-check path over contacts of the register relays of Fig. 91 to conductor UCDU, which then extends over cables **92–91, 9205, 94–92, 96–94, 97–96, 9707, 97–98** and **9802** into Fig. 98 to appear before contacts **1** of the relays in Fig. 98. The grounded conductor UCDU in Fig. 98 may extend over contact **1** of either of the relays O2LI–**9800** and O4LI–**9801** to either conductor **2L** or **4L** and over cable **98–123** into Fig. 123 where conductors **2L** and **4L** emerge. If conductor **4L** is energized (indicating that the initial entry involved in this call comprised four lines of information) then the grounded conductor **4L** will extend over contact **3** of relay OCDUC–**12307** (indicating that the fourth line of the initial entry is registered), over contact **3** of relay OAOUC–**12306** (indicating that the third line of the initial entry is registered), over contact **3** of relay OCGUC–**12305** (indicating that the second line of the initial entry is registered) and over contact **10** of relay OCLUC–**12304** (indicating that the first line of the initial entry is registered) to ground the conductor UCDT. If, on the other hand, the conductor **2L** emerging out of cable **98–123** in Fig. 123 is grounded (indicating that the associated initial entry included only two lines of information), then the conductor **2L** will extend over the respective contacts **3** and **10** of relays OCGUC–**12305** and OCLUC–**12304** to ground the conductor UCDT. The grounded conductor UCDT will extend over cables **12310, 123–96, 96–94, 94–92** and **9205** into Fig. 92 where conductor UCDT emerges and extends over an up-check path through contacts of the operated register relays of Fig. 92, thence over conductor **9207** into Fig. 93 and over an up-check path through the relays of Fig. 93 thence over conductor **9303** into Fig. 94 and over an up-check path of the three groups of relays in Fig. 94 to the up-check conductor UC–**9402** which extends into Fig. 95.

The above circuit description, as will be remembered, involved the operation of the relay ONES–**12602** which, by its operation, indicates that the situation involves the normal reading of an input tape. In the event that the relay OES–**12603** is operated instead of relay ONES–**12602** (indicating that the tape-reading operation is involved with clearing out straddle-end calls), then ground will extend from the off-normal conductor ON–**1120** in Fig. 126 over contact **3** of relay OES–**12603** to conductor UC–**9402**, cable **98–97**, conductor UC–**9402** and thence over cables **97–95** and **9515** into Fig. 95 to the above-mentioned conductor UC–**9402**. The grounded conductor UC–**9402** in Fig. 95, irrespective of how it may have been grounded as above described, extends over an up-check path through contacts of each of the two groups of register relays in Fig. 95 to conductor **9512** which extends into Fig. 96.

If all of the output class relays of Fig. 96 are normal and if all of the output class relays of Fig. 97 are normal, except relay ODISW–**9706** which will therefore be operated, the grounded conductor **9512** into Fig. 96 will extend over a down-check path through back contacts of each of the relays of Fig. 96, over conductor **9601** which extends into Fig. 97 and thence over back contacts of all of the relays of Fig. 97, and over contact **3** of relay ODISW–**9706** to conductor ODUC1, which extends over cables **97–95** and **9515** to conductor ODUC1 in Fig. 95 and thence over contact **1** of relay ODISL–**9511** to conductor ODUC, which extends over cables **9515** and **97–95** into Fig. 97 where conductor ODUC emerges and extends into Fig. 124 to operate the relay OODUC–**12406**, thereby to indicate that this call is to be discarded.

If all of the relays of Fig. 96 are normal and if one of the relays of Fig. 97 except relay ODISW–**9706** is operated, then a circuit will be completed for operating the relay OOUC–**12402** as follows: ground will extend from the grounded conductor **9512** in Fig. 96 over back contacts of all of the register relays of Fig. 96, to conductor **9601** extending into Fig. 97, and thence over back contacts of the unoperated relays of Fig. 97 and over the front contact of the operated one of these relays and over contact **1** of relay ODISW–**9707** to conductor OUC which extends into Fig. 124 to operate the relay OOUC–**12402**, thereby to indicate that the output side of the odd call entry register is full and is ready for the next operation.

In the event that one of the relays in Fig. 96 is operated and that none of the relays of Fig. 97 is operated, a circuit may be completed for operating the relay OOUC–**12402** extending from ground on the conductor **9512** in Fig. 96 over back contacts of the unoperated ones of the relays of Fig. 96 and over the front contact of the operated one of these relays, to conductor **9602** extending into Fig. 97 and over back contacts of all of the relays of Fig. 97 including contact **1** of relay ODISW–**9706** to conductor OUC, thereby to operate the relay OOUC–**12402**.

4.20 *Release of computer connector*

The operation of either relay OOUC–**12402** or OODUC–**12406** unlocks relay OCCR–**12405** which in turn opens the circuit which has operated the computer connector relays CCAO–**9200**, CCBO–**9400**, CCCO–**9600**, CCDO–**13600**, CCEO–**13300** and CCFO–**13000**.

The computer connector relays, in releasing, open all ground sources (CG leads) for the computer portion of the circuit used in forming information on each call in the computer portion of the machine. Thus, it is possible to completely restore the computer portion of the machine and make it available for use on a new call within two relay steps. The release of a computer connector, such as the odd call entry connectors, prepares a path for the opposite computer connector, such as the even ones, which may operate as soon as the relay ECCR (not shown in Fig. 176) of the other (even) register control circuit is operated when that (even) call register portion of the machine receives the next call.

4.21 *Discarding of calls*

The complete operate path for relay OODUC–**12406** includes the two discard relays ODISL–**9511** and ODISW–**9706** (as above described) indicating that both the number of lines and the output class networks have found that the call is to be discarded and that no other class is indicated.

Relay OODUC–**12406**, in operating, in addition to releasing the computer connector by unlocking relay OCCR–**12405**, operates relay ORLS–**12605**, which opens the locking leads for all registers in the associated (odd) call register. This circuit extends from ground, over contact **2** of relay OODUC–**12406** to conductor **12418** which extends into Fig. 126 to operate relay ORLS–**12605**. Relay ORLS–**12605**, in operating, opens up (such as at its contacts **7** to **13**) the previously described locking paths for the odd call entry register relays.

Relay ORLS–**12605**, in operating, locks to the back contacts of all of the odd register down-check relays of Figs. 123, 124 and 125 so that the locking grounds are removed from all register relays in the associated (odd) call register until all of these register relays have been indicated as being normal. The odd call register is then ready to receive a new call after the other (even) call register has handled a call. This locking path for relay ORLS–**12605** extends over contact **6** of relay ORLS–**12605** to conductor **12613**, which extends into Figs. 125, 124 and 123 and to ground on conductor ON–**1120** over the following relay contacts: **10** of relay ODDC–**12506**;

10 of relay OADC–12401; 2 of relay OODC–12400; and, 2 of any one of relays OCLDC–12300, OCGDC–12301, OAODC–12302 and OCDDC–12303.

4.22 *Operation of output connector*

As soon as an initial entry is read into a call register portion of the machine, such as the odd side in the example, the register control of Figs. 123 to 126 attempts to seize the output or perforate portion of the machine for use on this call. This path may be traced from relay OCLUC–12304 operated, through relay ORLS–12605 normal, relay ODC–5903 of the perforate control operated and the output connector EOCA–15200 for the other (even) call register normal, to operate the OOCA–9903 and OOCB–9904 relays of the associated (odd) output connector of Fig. 99. This circuit may be traced from ground, over contact 8 of relay OCLUC–12304, conductor 12319, contact 1 of relay ORLS–12605, conductor LOCO into Fig. 178, thence over cable 59–178 to Fig. 59, conductor LOCO, contact 1 of relay ODC–5903, conductor OOCE, cable 59–178 to Fig. 178, conductor OOCE, contact 21 of relay EOCA–15200, conductor 15202 to operate relays OOCA–9903 and OOCB–9904, which lock over contact 1 of relay OOCB–9904 to conductor LOCO.

Relay ODC–5903 is operated as a result of the perforator line count of Fig. 64, the perforator register of Fig. 101 and other portions of the perforate control being normal, as previously described.

The odd call register portion of the machine may receive calls for which no initial entry is registered when clearing call ends from the assembling registers. In this case, the operation of the output connector relays OOCA–9903 and OOCB–9904 is from a path starting with ground through the two-out-of-five up-check of the tens and units digits of the call identity index registers of Fig. 84, through the associated answer disconnect register connector DRO–7900 normal, relay OADC–12401 and/or ODDC–12506 normal, relay ORLS–12605 normal, relay ODC–5903 operated and connector relay EOCA–15200 of the other (even) output connector normal. This circuit may be traced in detail from ground in Fig. 84, over two-out-of-five operated ones of the relays OCIIT0 to OCIIT7 of Fig. 84 and two-out-of-five operated ones of the relays OCIIU0 to OCIIU7 of Fig. 84, conductor UC–8405 into Fig. 79, over contact 36 of connector DRO–7900, conductor CLDUC, cables 7903, 82–79, 8201, 82–124 to Fig. 124, cable 12410, conductor CLDUC, and alternatively over either contact 2 of relay OADC–12401 to conductor 12319 or over contact 3 of relay OADC–12401 and conductor 12419 and contact 1 of relay ODDC–12506 to conductor 12319. The grounded conductor 12319, as previously described, will cause the operation of connector relays OOCA–9903 and OOCB–9904 as above set forth.

The operation of the output connector relays OOCA–9903 and OOCB–9904 may assume to have taken place prior to the registration of the number of lines and output class in Fig. 95, as previously described. Therefore, when these register relays operate they control directly the perforate portion of the machine as described in the following sections.

The indications of the number of lines to be perforated passes through the output connector to operate one of the relays PLA1–6421 to PLA7–6427 of the perforate line count circuit of Fig. 64, which relay prepares a path for operating the pattern relay (associated with the first line of the entry) through the output connector relays and the output class register. The locking ground from the operated one of the number of lines register relays of Fig. 95 may ground any one of the seven leads 1L to 7L entering cable 9513 in Fig. 95. These leads extend over cables 9513, 97–95, 9708 and 98–97, conductors 1L to 7L, and cable 98–99, conductors 1L to 7L, contacts 11 to 17 of connector OOCA–903, conductors 1L to 7L into cables 9905 and 64–99 to Fig. 64, where conductors 1L to 7L emerge to operate the appropriate perforate line count relay PLA1–6421 to PLA7–6427, as previously described.

4.23 *Perforator register and connector*

The operated output class register relay of Figs. 96 and 97 indicates the particular tape or class of tapes on which the entry is to be perforated.

Class relays O2I–9702, O4I–9701, O1T2I–9703, O1T4I–9700, O2T–9704 and OIT–9705 ground a lead through the output connector OOCB–9904 to operate relay P0D–10100 of the perforator register of Fig. 101 and to operate connector relay PA0–17900 of the perforator connector of Fig. 179, thereby to select the perforator making the straddle tape for these classes. In Fig. 97, when the output up-check conductor OUC is grounded, as previously described, this ground will extend over contact 1 of any one of the output class relays O1T4I–9700 to O1T–9705, if operated, to conductor S–9710 which extends into Fig. 96 and into cable 96–99. Cable 96–99 extends into Fig. 99 where conductor S–9710 emerges out of cables 96–99 and 9906 and over contact 11 of connector OOCB–9904 to conductor S–6425, which, as previously described, appears in Fig. 101 to operate the perforator register relay P0D–10100 in series with the perforator connector relay PA0–17900.

Output class register relays OD–9603, OOD–9605, OOM–9606 and OLODA–9604 ground a lead to operate, through the output connector OOCB–9904, relays P1D–10101 and PA1–17901 in series for registering and connecting the output leads to the perforator making the detail tape on these classes of calls. In Fig. 96, the grounded output up-check lead OUC extends over contact 1 of the operated one of relays OD–9603 to OOM–9606, if operated, to conductor D–9603, which extends over cables 96–99 and 9906, conductor D–9603, contact 12 of connector OOCB–9904 to conductor P2–10312, which, as previously described, appears in Fig. 101 to operate the perforator register relay P1D–10101 in series with the perforator connector relay PA1–17901.

Output class register relays O1M–9608 and O2M–9607 ground a lead through the output connector OOCB–9904 and the sort class translator of Figs. 192, 193, 207 and 208 to operate relays P2D–10102 and PA2–17902 when the sort class indicates that no sort of message unit entries is to be made. For all other sort classes the message unit entries are sorted according to the units, thousands or sort digit as predetermined by the operated OUS–9900, OTHS–9901 or OSDS–9902 relays of the output connector of Fig. 99, which are operated (and remain operated through all of the processing) by the control of the sort class translator. These relays connect the decimal outputs of the units (Fig. 86), thousands (Fig. 85) and sort digits (Fig. 93) of the odd call register through the output connector OOCA–9903 to the perforator register (Fig. 101) and connector relays (Fig. 179) for the correspondingly numbered message unit perforators (relays P2D–10102 and PA2–17902 to P11D–10111 and PA11–17911). The ground on this lead from the output class register of Fig. 96 goes directly to the inputs of the decimal translating networks on the aforementioned digit registers. In Figs. 207 and 208, ground may extend from the off-normal conductor MON–1236 as follows: over contact 9 of relay SBO–20701 or 3 of relay SOPO–20702 or 3 of relay SBUT–20803 or 6 of relay SOLU–20802 or 5 of relay SBOUT–20801 to conductor SDS entering cable 208–152 in Fig. 208; over contact 3 of relay SBTH–20800 to conductor THS into cable 208–152; or over contact 3 of relay SBU–20703 to conductor US into cable 208–152. These three conductors SDS, THS and US extend over cables 208–152 and 152–99 into Fig. 99 where the grounded one thereof will operate, and maintain operated, one of the relay connectors OSDS–9902, OTHS–9901 and OUS–9900. With relay O1M–9608 or relay O2M–9607 oper-

ated, the grounded output up-check lead OUC in Fig. 96 will extend over contact **1** of one of these relays to ground the lead M–**9604**. If the sort class translator of Figs. 192, 193, 207 and 208 indicates that no sort is to be made then relay NS–**20700** will be operated as previously described. The lead M–**9604** of Fig. 96 will thereupon extend over cables **96–99** and **9906**, over contact **10** of connector OOCB–**9904**, conductor M into cable **152–99** into Fig. 152, conductor M, cable **208–152** to Fig. 208, conductor M into Fig. 207, over contact **7** of relay NS–**20700** to conductor P2D, over cables 207–**192**, **192–193A**, **102–193** into Fig. 102, and cable **10130** into Fig. 101 where conductor P2D emerges to operate perforator register relay P2D–**10102** in series with perforator connector relay PA2–**17902**, according to previous description. If, on the other hand, one of the sort class translator relays SBO–**20701**, SOPO–**20702**, SBUT–**2803**, SOLU–**20802**, SBOUT–**20801**, SBTH–**20800** and SBU–**20703** is operated (to indicate a specific sort class), then, as above described one of the output connector relays OUS–**9900**, OTHS–**9901** and OSDS–**9902** will be operated. The grounded conductor M–**9604** in Fig. 96 will thereupon extend into Fig. 85 to contacts of the calling subscriber's thousands digit register relays OCLTH**0** to OCLTH**7** and into Fig. 86 to contacts (not shown) of the calling subscriber's units digit register relays (not shown) and Fig. 93 to contacts of the sort digit register relays OSD**0** to OSD**7**. In Fig. 85, the grounded conductor M–**9604** will extend over contacts of the operated ones of the thousands' digit relays to ground one of the ten conductors **0** to **9** entering cable TH–**8503**, which extends into Fig. 86 and into cable **86–93**. In Fig. 86, the grounded conductor M–**9604** extends over contacts (not shown) of the units' digit relays (not shown) to ground one of the ten conductors **0** to **9** entering cables U–**8606** and **86–93**. The cable **86–93** extends into Fig. 93 and then into cable **93–99**. In Fig. 93, the grounded conductor M–**9604** extends over contacts of the sort digit relays to ground one of the conductors **0** to **9** entering cables SD–**9304** and **93–99**. These three groups of ten conductors extend over cable **93–99** to Fig. 99 where they emerge out of respective cables U–**8606**, TH–**8503** and SD–**9304** to terminate on the contacts of the respective connectors OUS–**9900**, OTHS–**9901** and OSDS–**9902**. Depending upon which connector is operated and which of the thirty conductors is grounded, ground will extend over one of the contacts of one of these three connectors and then over one of the contacts **1** to **10** of connector OOCA–**9903** to ground one of the ten conductors **0** to **9** into cable **10221**, which extends into Fig. 101 to cause the operation of the appropriate one of the perforator register relays P2D–**10102** to P11D–**10111** in series with the respective perforator connector relay PA2–**17902** to PA11–**17911**, all as previously described.

When output class register relays O1MD–**9602** and O2MD–**9601** are operated, the perforator register and connector relays which are operated are different for the first one or two lines being perforated than for the last five lines which are perforated. The first one or two lines are perforated on a message unit tape, as indicated by the grounding of the above-described lead M into the digit being used for sorting purposes (Figs. 85, 86 and 93). Relays PLA**7**–**6427** and PLA**6** (not shown in Fig. 64) close the grounded lead MD–**9605** from these output class register relays through the output connector to the M lead while these lines are being perforated. With relays PLA**1**–**6421** to PLA**5** (not shown in Fig. 64) operated, the MD–**9605** lead ground is closed to lead P2–**10312** to operate the register relay P1D–**10101** and connector relay PA**1**–**17901** for perforating these last five lines on the detail tape. In Fig. 96, if one of the relays O2MD–**9601** and O1MD–**9602** is operated, the grounded up-check lead OUC in Fig. 96 will be extended over contact **1** thereof to conductor MD–**9605** extending over cable **96–99** into Fig. 99 and over contact **9** of connector **00**CB–**9904** to conductor MD–**9907**. Conductor MD–**9907** then extends over cables **9908** and **64–99** into Fig. 64 where conductor MD–**9907** emerges out of cable **6404** to appear before contacts **3** of relays PLA**1**–**6421**, PLA**2**–**6422**, PLA**3** to PLA**6** (not shown) and PLA**7**–**6427**. While relays PLA**1**–**6421** and PLA**2**–**6422** are operated (during perforation of the first two lines of output), the grounded conductor MD–**9907** is extended over contact **3** of one of these relays to ground the conductor P**2**–**10312** into cables **6404** and **64–99** to Fig. 99. While relays PLA**3** to PLA**6** (not shown in Fig. 64) and PLA**7**–**6427** are operated (during perforation of the third through the seventh lines of output), the grounded lead MD–**9907** is extended over contact **3** of one of these relays to conductor M extending over cables **6404** and **64–99** to Fig. 99. In Fig. 99, conductor P**2**–**10312** emerges out of cable **64–99** and, if grounded, extends to Fig. 101 to operate relay P1D–**10101** in series with the perforator connector relay PA**1**–**17901**. In Fig. 99, conductor M emerges out of cables **64–99** and **9908** and extends as previously described, if grounded, into Figs. 85, 86 and 93 to cause the operation of one of the perforator register relays P2D–**10102** to P11D–**10111** in series with the respective perforator connector relay PA**2**–**17902** to PA**11**–**17911** depending upon the registered units or thousands digit of the calling subscriber's directory numericals or the sort digit.

4.24 *Pattern connector relays*

The information to be perforated on an output line is gathered from various of the registers in a call register portion of the machine (such as the odd side in the example) by pattern connector relays associated with each call register. Each pattern is determined by relay operations controlled over a path through the output class register, such as Figs. 96 and 97, the output connector **00**C– of Fig. 99, the perforate line count relays of Fig. 64 and relay CK–**5906** normal or relay OP–**5907** operated in the perforate control of Fig. 59.

Relay OP–**5907** operates during the open period of the reader cycle if relay CK–**5906** is normal and locks during the closed period, as previously described. Relay CK–**5906** operates through the operated pattern relay, at the start of the closed period of the reader cycle, as a check that a pattern relay has operated and is thus ready to perforate a line pattern. With relay CK–**5906** operated, the operate ground for the pattern relays is the same as the locking ground for the OP–**5907** relay.

Should a pattern relay remain operated falsely during the open period between reader cycles, relay CK–**5906** will remain locked through relay OP–**5907** normal and will prevent the reoperation of relay OP–**5907** until a new reader open period occurs. This insures that a pattern relay is operated only during the open period of the reader cycle, thus allowing a full closed period for perforating the line pattern.

The various line pattern connector relays used in connection with the call registers are enumerated in Section 3.099 together with information as to the source from which the information is obtained.

Common pattern connectors are provided as described previously in Sections 4.09 and 4.10 for perforating non-call entries. However, in perforating the overcapacity message unit class (output class relay OOM–**9606** operated) of call two lines (third and fourth lines) require all 0's to be perforated. Since these digits are independent of any call register source, a common pattern relay OB–**7210** (for perforating all 0's) is used by either call register in perforating these line patterns as part of overcapacity message unit entries.

The operation and control of the various perforator connector relays of Fig. 179 has been discussed in considerable detail in Section 4.23. The operation and control of the perforator check relays and advanced mag-

nets of Fig. 194 has been adequately covered in detail in the discussion in Sections 4.09 and 4.10 in connection with the discussion and description of the common pattern connectors. The perforate magnet and advance check relay controls will be alluded to briefly again in Section 4.25 with respect to their particular operation in connection with the specific description of the pattern connector relays. Likewise, in Sections 4.09 and 4.10 considerable detailed description has been set forth in the discussion of the common pattern connectors as regards the operation of the perforate line count relays and control circuits of Fig. 64, etc. Additional brief description will be provided in Section 4.25 concerning the particular action of the perforate line count controls in connection with the operation of the various ones of the call entry pattern connectors.

Whereas, in Sections 4.09 and 4.10 dealing with the determination of the output class and number of lines of output, the number of lines indication for determinating the starting point of the perforate line count circuit of Fig. 4 came from the common class translator circuit of Fig. 65 over cable **65–64** into Fig. 64 and over contacts of the computer connector COC–**6400** and over cable **6412**; the number of lines indication with respect to operation of call entry pattern connectors is derived from the locking grounds on the register relays in the left-hand portion of Fig. 95, the operation of one of which, as described in Section 4.16, indicates the number of lines to be perforated for the particular output class involved at the moment. For instance, ground will extend from the locking contact of any one of the relays O1L–**9506** to O7L–**9510** over one of the conductors **1L** through **7L** into and over cables **9513**, **97–95**, cable **9708** and conductors **3L** and **6L** into cable **98–97** into Fig. 98 where the conductors **1L** to **7L** reappear and further extend over cable **98–99** into Fig. 99 and thence over contacts **11** through **17** of the output connector relay OOCA–**9903**, conductors **1L** through **7L** into cable **9905** and over cable **64–99** into Fig. 64 where conductors **1L** through **7L** reappear to initiate the perforate line count operation similar to that described in Sections 4.09 and 4.10.

The pattern relays for the odd call entry register, with which the machine is concerned at the moment, are the following: Pattern relays OT3A–**10800**, OI1–**11000**, **006–11100**, ODOI2–**11200**, OMU1–**11201**, ODOI3–**11400**, ODOI4–**11600**, OT2D–**11800**, OT2A–**11900**, OD5–**12000**, OMU2–**12200**, OT1A–**10700**, ODO2–**10701**, **005–10600**, OT3D–**10500**, OT1D–**10400**, ODO3–**11402**, **00–11401** and OI3–**11403** and certain subpattern connectors OOI–**10000**, OTMU–**10001**, OSD–**10002**, OMUU–**10003** and OB0–**10004**. One or more of these pattern connector relays will be operated to set up the proper information for the proper output line of the proper output entry depending upon the starting point in the perforate line count circuit of Fig. 64 and the particular relay or relays operated in the output class circuit of Figs. 96 and 97 and, in some cases, the condition of the relays in the sort class translator circuit of Figs. 192, 193, 207 and 208.

If either of relays O2MD–**9601** and O2M–**9607** is operated in the output class circuit, ground will extend over the respective contact **12** or **8** thereof to conductor MU12 which extends over cables **96–99** and **99–100** into Fig. 100 to conductor MU12, through the winding of one of the relays OB0–**10004**, OOI, OTMU and OSD in Fig. 100 to one of the four conductors BO, OI, TMU and SD extending over cables **100–127** and **153–127** into Fig. 153, conductors BO through SD, thence over cable **193–153** into Fig. 193 where conductor TMU continues through cable **19325** into Fig. 192 where conductor TMU emerges and extends over contact **7** of relay SO–**19204** (if operated) to conductor **19222**, and thence into Fig. 193 and over contact **8** of relay **25T–19301** (if operated) to conductor **20712** into Figs. 207 and 208 and to battery alternatively over either contact **7** of relay SBTH–**20800** (if operated) or contact **7** of relay SBU–**20703** (if operated) or contact **10** of relay NS–**20700** (if operated). In Fig. 193 the three conductors BO, OI and SD extend from cable **193–153** over cable **19326** and emerge in Fig. 193. Conductor BO may extend into Fig. 208 and to battery over contact **9** of relay SBOUT–**20801** (if operated) or it may extend over contact **9** of relay **1T–19300** (if operated) to conductor **20713**, and thence into Fig. 207 and to battery over contact **11** of relay SBO–**20701** (if operated). The conductor OI emerging from cable **19326** in Fig. 193 may extend over contact **8** of relay **1T–19300** (if operated) to conductor **20712** to battery as above described. The conductor SD emerging from cable **19326** in Fig. 193 may extend over contact **9** of relay **25T–19301** to conductor **20713** into Fig. 207, and thence over contact **11** of relay SBO–**20701** (if operated) or it may extend into Fig. 192 and thence over contact **7** of relay MO–**19205** (if operated) to conductor **19222** and over contact **8** of relay **25T–19301** (if operated) to conductor **20712** extending to battery, as above described, or conductor SD may extend into Figs. 207 and 208 and alternatively over either contact **8** of relay SOLU–**20802** (if operated) or contact **8** of relay SBUT–**20803** (if operated) or contact **7** of relay SOPO–**20702** (if operated) to battery.

In the event that one of the relays O1MD–**9602** and O1M–**9608** in the output class circuit is operated, ground will extend over the respective contact **12** or **7** thereof to conductor MU11 extending over cables **96–99** and **99–100** into Fig. 100 where conductor MU11 emerges and extends to battery through the winding of the subpattern connector relay OMUU–**1003**.

The circuits for operating the various pattern connector relays of Figs. 104 through 122 may be described partially as follows. In Fig. 104 the operating lead T1D for relay OT1D–**10400** extends into Fig. 105 and joins with conductor T3D from relay OT3D–**10500** into cable **105–106** into Fig. 106, which joins with conductor **05** for relay **005–10600** into cable **106–107** into Fig. 107 there to join up with conductors **T1A** and **D02** for relays OT1A–**10700** and ODO2–**10701**, thence into cable **107–108** into Fig. 108 to join up with conductor T3A for relay OT3A–**10800** and into cable **108–110** into Fig. 110 to join up with conductor I1 for the relay OI1 of Fig. 110, thence over cable **110–111** into Fig. 111 joining up with conductor **06** of relay **006** of Fig. 111 and into cable **111–112** extending into Fig. 112 and there joining up with conductors DOI2 and MU1 for the relays ODOI2 and OMU1 of Fig. 112, thence continuing over cable **112–114** into Fig. 114 and joining up with the four conductors DOI3, **0**, D03 and I3 for the relays ODOI3, **00**, OD03 and OI3 of Fig. 114, thence over cable **114–116** into Fig. 116 and joining up with conductor DOI4 for the relay ODOI4–**11600**, thence continuing over cable **116–118** into Fig. 118 and joining up with conductor T2D for the relay OT2D of Fig. 118, thence over cable **118–119** into Fig. 119 and joining up with conductor T2A for the relay OT2A–**11900** and continuing over cable **119–120** into Fig. 120 and joining up with conductor D5 for the relay OD5 of Fig. 120, thence over cable **120–122A** into Fig. 122 and joining up with the conductor MU2 for the relay OMU2–**12200** and continuing over cable **122–96** into Fig. 96. These nineteen conductors emerge from cable **122–96** in Fig. 96 and extend by means of the three cables **9606**, **9607** and **96–97** to various of the contacts of the output class relays of Figs. 96 and 97.

It is to be noted that whenever either of the relays OLODA–**9604** and OD–**9603** is operated, ground will extend over contact **11** thereof to conductor DO3 entering cables **9606** and **122–96**, etc. to operate the relay ODO3–**11402** in Fig. 114. Whenever either of the relays OOD–**9605** and OOM–**9606** is operated, ground will extend

over the contact 12 thereof to the conductor 0 which extends over cables 9606 and 122–96, etc. into Fig. 114 to operate the relay 00–11401, which, whenever operated, will extend a ground over its contact 3 to the conductor DO3 to operate the relay ODO3–11402. Furthermore, whenever any one of the relays O1T4I–9700, O4I–9701, O2I–9702 and O1T2I–9703 is operated, a ground will extend over the respective contact 13, 10, 8 and 11 thereof to the conductor I3 extending over cables 96–97 and 122–96, etc. to operate the relay O13–11403 in Fig. 114.

As will be recalled in the detailed description in Sections 4.09 and 4.10, a ground on the conductor PAT–5909 in Fig. 59 will initiate or cause the output perforation of a line of information as determined by the condition and status of the perforate line count relays of Fig. 64. As was mentioned above regarding the condition of the perforate line count circuit of Fig. 64 at the start of the pattern connector relay control operation being described here, one of the relays PLA7–6427 through PLA1–6421 will have been operated by the number of lines register of Fig. 95 to indicate the number of lines to be perforated in the particular output entry of interest at the moment. Furthermore, as has been described previously, the perforate control circuit of Fig. 59 in conjunction with the perforate line count circuit of Fig. 64 will advance from the last line to be perforated through the first line under a controlled set of conditions. The ground on conductor PAT–5909 in Fig. 59 will be extended over that conductor and over cable 64–59A into Fig. 64 to the conductor PAT–5909 and over the contact 1 of the operated relay PLA7 to PLA1, depending upon the particular line being perforated at the moment, to ground one of the conductors L7 through L1 into cable 6429. This grounded conductor will extend over cables 6429 and 64–99 into Fig. 99 and over cable 9908 to conductors L1 to L7 and over contacts 2 through 8 of the output connector OOCB–9904 to conductor L1 through L7 and over cables 9906 and 96–99 into Fig. 96 where the conductors L1 through L7 emerge and appear before the contacts of all or most of the output class relays of Figs. 96 and 97. Depending upon the condition of the output class relay circuit of Figs. 96 and 97, and depending upon which one of the conductors L1 through L7 is grounded, one of the nineteen conductors comprising cables 9606, 9607 and 96–97 entering cable 122–96 in Fig. 96, as above described, will be grounded thereby to operate one of the pattern connector relays of Figs. 104 through 122, etc.

In Section 2.47 the table entitled "Forming call entries" shows the nature and content of each of the line entries for each of fourteen output classes and in Section 3.099 is a table which shows sixteen pattern designations, the content of the information therein and the line of output entry in which such information is used. In Fig. 128 is a cable termination designated 156–128 out of which, as previously described, extend a number of cables and conductors throughout Figs. 128, 154 and 179 and over contacts of various ones of the perforator connectors PA0–17900 to PA11–17911 for purposes of actuating the perforate magnets in Fig. 194 in accordance with information which may be on these cables and conductors. This cable termination 156–128 in Fig. 128 comes from Fig. 156. This cable 156–128 in Fig. 156 is fed by cable 104–156 extending from Fig. 156 up to Fig. 104 to and from the twenty-eight conductors A0, A1, A2, B0, B1, B2, etc. to and including the cable F comprising conductors F0, F1, F2, F4 and F7. These twenty-eight conductors extend over cable 10401 to twenty-eight horizontal conductors extending in whole or in part across Figs. 104 through 122 and appearing before contacts of all of the pattern connector relays of these figures as above described.

The description to follow sets forth in general detail the source of the invention which is applied to the twenty-eight conductors A2 to F0 extending across the pattern connector relays of Figs. 104 through 122.

If relay OT1D–10400 is operated, a line 2812EF will be caused to be perforated as follows. Ground on the reader perforate conductor PA2, out of cable 78–104 in Fig. 104, will extend over contact 1 of the relay OT1D to ground the conductor A2, thereby causing the perforation of an A digit of 2. Ground on the perforate reader conductors PB7 and PB1 in Fig. 104 will extend over contacts 2 and 3 of relay OT1D to ground the conductors B7 and B1, thereby to cause the perforation of the digit 8 in the B position. Ground on the perforate reader conductors PC1 and PC0 in Fig. 104 will extend over contacts 4 and 5 of the relay OT1D to cause the perforation of a C digit of 1 by grounding the conductors C1 and C0. Likewise, the grounding of the two perforate reader conductors PD2 and PD0 will cause the perforation of a D digit of 2 by grounding the conductors D2 and D0 over contacts 6 and 7 of the relay OT1D. The E digit of this particular line pattern represents the disconnect hour tens digit as registered in the disconnect hour tens register in Fig. 77. In Fig. 77 ground on the two miscellaneous reader perforate conductors M0 and M1 out of cable M–7814 will extend over two contacts of the operated disconnect hour tens relay ODHT0–7700, ODHT1–7701 or ODHT2–7702 to ground two of the conductors 0 to 7 entering cable DHT in Fig. 77. The two grounded ones of these five conductors emerge from cable DHT in Fig. 104 and extend over two of the contacts 8 to 12 of the relay OT1D to ground two of the conductors E0 to E7, thereby to cause the perforation of the E digit in accordance with the disconnect hour tens digit. Likewise, the F digit will represent the disconnect hour units digit as registered in the disconnect hour unts register of Fig. 77. Ground will extend from the grounded reader perforate conductors PF0 to PF7 out of cable PF–810 in Fig. 77, thence over contacts of two of the operated disconnect hour units register relays ODHU0–7703 to ODHU7–7707, thereby to ground two of the five conductors 0 to 7 entering cable DHU in Fig. 77 and extending into Fig. 104 and over two of the contacts 13 to 17 of the relay OT1D, thereby to ground two of the conductors F0 to F7 to cause the perforation of the F digit in accordance with the registered disconnect hour units digit.

If the pattern relay OT3D–10500 is operated, a pattern ABCDEF will be perforated as follows. The A digit will be the timed release index as registered in one of the relays ONTR–7901 and ODTR–7902 in Fig. 79. This digit will be a 1 or a 3 depending upon whether the disconnect timing entry involved has associated with it a no-timed release or a timed release. Ground on the reader perforate conductors PA0, PA1 and PA2 in Fig. 79 will extend over one or more contacts of the operated one of the timed release register relays ONTR and ODTR of Fig. 79 to ground the conductor 1 or all three of the conductors 0, 1 and 2 entering cable DTR in Fig. 79 which extends into Fig. 105 and over one or all of the contacts 1, 2 and 3 of relay OT3D, thereby to cause the perforation of an A digit of 1 or 3. The B digit represents the disconnect minute tens digit as registered in the disconnect minute tens relays of Fig. 78. Ground on the reader perforate conductors PB0 to PB4 in Fig. 78 will be extended over contacts of the operated ones of the disconnect minute tens relays ODMT0–7800 to ODMT4–7803, thereby to ground the appropriate ones of the five conductors 0 to 7 entering cable DMT in Fig. 78 and extending into Fig. 105 and over two of the contacts 4 through 8 of the relay OT3D, thereby to ground two of the conductors B7 to B0 to cause the perforation of a B digit representing the disconnect minute tens digit. Likewise, the C digit represents the disconnect minute units as registered in the disconnect minute units register relays of Fig. 78. By a similar process to

that described above, two of the five conductors 0 to 7 entering cable DMU in Fig. 78 will be grounded and will extend over cable DMU into Fig. 105 and over two of the contacts 9 to 13 of the relay OT3D, thereby to ground two of the conductors C0 to C7 causing the perforation of a C digit in accordance with the disconnect minute units register digit. The D digit represents the disconnect minute parts or tenths. This information is derived from the disconnect minute parts register of Fig. 79 over cable DMP extending from Fig. 79 into Fig. 105 and over contacts of the relay OT3D in an obvious fashion. The E and F digit represents respectively the call identity index tens and units digits. This information is derived from the call identity index tens and units digit registers of Fig. 84 over respective cables CIIT and CIIU extending from Fig. 84 into Fig. 105 and over contacts of the relay OT3D in a fashion similar to that above described.

If the pattern relay 005–10600 is operated, a line pattern 0BCDEF will be perforated as follows. The A digit will be 0 as determined by the fact that the grounded reader perforate conductor PA0 in Fig. 106 is extended over contact 1 of the relay 005 to ground the conductor A0. The composition of the B digit will be described at the end of this paragraph due to the fact that certain auxiliary relay operations must be described in connection therewith. The C digit represents the disconnect minute tens information out of cable DMT in Fig. 106. The D and E digits respectively represent the disconnect minute units and disconnect minute parts information out of respective cables DMU and DMP in Fig. 106. The F digit represents the answer minute parts information derived from the answer minute parts register of Fig. 82 by means of two grounded ones of the five conductors 0 to 7 entering cable AMP in Fig. 82 and extending by means of this cable into Fig. 106 and over two out of five of the contacts of the relay 005 to ground two of the five conductors F0 to F7, thereby to cause the perforation of an F digit representing the answer minute parts. The B digit represents an observing index which is determined by the condition of the input class register of Fig. 83 and/or by the condition of the register control circuit of Figs. 123, 124 and 125. If the input class register relay OCL1–8301 is operated (indicating a registered input class digit of 1 or 3) the two grounded reader perforate conductors PB1 and PB4 in Fig. 83 will be extended over contacts 11 and 12 of this register relay to ground the two conductors 4 and 7 entering the cable OI in Fig. 83. If, on the other hand, input class relay OCL4–8303 is operated (indicating an input class digit of 4) then the reader perforate conductors PB1 and PB4 in Fig. 83 will extend over contacts 9 and 10 of this relay to conductors OBSA and OBSB and over cables 8312, 8310, 83–120, 12001, 120–122, 122–124, 12315 and 12314 in Fig. 124 where conductors OBSB and OBSA emerge and appear before the armatures associated with contacts 5 and 6 of relay OAUC–12403, contacts 2 and 3 of relay OADC1–12505 and contacts 3 and 4 of relay OAUCT–12504. If relay OAUC–12403 is operated as previously described, the grounded conductors OBSA and OBSB will extend over contacts 5 and 6 thereof to conductors 12420 and 12421 into Fig. 125 and over contacts 11 and 10 of relay ODUC–12507 (if operated as previously described), thereby to ground the two conductors 0 and 2 entering cable 12520 in Fig. 125. If, on the other hand, relay OADC1–12505 is operated, as previously described, the conductors OBSA and OBSB will extend over contacts 2 and 3 thereof and over respective contacts 6 and 8 of relay ODDC–12506 (if operated as previously described) to ground the two conductors 1 and 0 entering cable 12520. If, on the other hand, relay OAUCT–12504 is operated, as previously described, then the two conductors OBSA and OBSB will extend over respective contacts 3 and 4 of this relay to ground the two conductors 2 and 1 into cable 12520. These three conductors 0, 1 and 2 will extend over cables 12520, 12315, 122–124 and 120–122 into Fig. 120 where the three conductors 0, 1 and 2 emerge to appear before contacts of the pattern relay OD5–12000 and where the three conductors 0, 1 and 2 continue through cable 83–120 into Fig. 83 where these three conductors 0, 1 and 2 emerge and combine with the previously-described conductors 4 and 7 to comprise the cable OI extending into Fig. 106 and appearing before the B digit contacts of the pattern relay 005–10600.

If the pattern relay OT1A–10700 is operated, a line pattern of 2812EF will be perforated as follows. The A, B, C and D digits are perforated as previously described. The E digit will represent the answer hour tens information as provided over the cable AHT from the answer hour tens register of Fig. 80. The F digit represents the answer hour units information as supplied over cable AHU from the answer hour units register of Fig. 80.

If the pattern relay OD02–10701 is operated, a line pattern 0BCDEF will be perforated as follows. The A digit of 0 is perforated as previously described. The B digit is a composite digit representing the answer minute tens and answer day tens information as registered in the answer minute tens register of Fig. 81 and the answer day tens register of Fig. 92. The grounded miscellaneous reader perforate conductors M0 and M1 out of cable M–8107 in Fig. 81 will extend over contacts of the operated ones of the answer minute tens relays of Fig. 81 to the conductors MHA, MHB, MLA and MLB into cable 81–92 extending into Fig. 92 and over contacts of the operated ones of the answer day tens relays OADT0–9201 to OADT3–9204 to ground two of the five conductors 0 to 7 entering cable ADTB in Fig. 92. These five conductors extend over cables ADTB in Fig. 92, 92–91A, 9107, 91–87, 87–84 and 84–107 into Fig. 107 where the cable ADTB emerges and appears before the B digit contacts of the pattern relay ODO2–10701. The C digit is a composite digit representing the answer hour tens and the answer minute tens digits as registered in the answer hour tens relays OAHT0–8000 to OAHT2–8002 and the answer minute tens relays OAMT0–8100 to OAMT4–8103. Ground on the miscellaneous reader perforate conductors M2 and M4 out of cable M–8107 in Fig. 81 are extended over contacts of the operated ones of the answer minute tens relays of Fig. 81 to conductors MT25A, MT03A, MT03B, MT14B, MT25B and MT14A into cable 81–80A which extends into Fig. 80 where these six conductors extend over operated contacts of the answer hour tens relays to ground two of the conductors 0, 1, 2, 4 and 7 entering cable AHMT which extends into Fig. 107 and appears before the C digit contacts of the pattern relay OD02–10701. The D digit represents the answer day units as registered in the answer day units register of Fig. 92 and as indicated by the grounding of two of the five conductors 0, 1, 2, 4 and 7 entering cable ADU in Fig. 92 and extending over cables 9208, 92–91A, 9107, 91–87, 87–84 and 84–107 into Fig. 107 where cable ADU emerges and appears before the D digit contacts of the pattern relay ODO2–10701. The E digit represents the answer hour units value as obtained over cable AHU from the answer hour units register in the right-hand portion of Fig. 80. The F digit represents the answer minute units value as obtained out of cable AMU originating at the answer minute units register in the left-hand portion of Fig. 82. In some instances when the output class relay OLODA–9604 is operated, the F digit for the pattern relay ODO2–10701 is a 0 derived as follows. The two grounded miscellaneous reader perforate conductors M0 and M1 out of cable M0,1 in Fig. 96 will extend over contacts 14 and 15 of the relay OLODA–9604 to ground the two conductors 7 and 4 entering cable 96–107 in Fig. 96. This cable 96–107 extends into Fig. 107 where the conductors 7 and 4 emerge and appear be-

fore two of the F digit contacts of the pattern relay ODO2–10701.

The operation of the pattern relay OT3A–10800 will cause the perforation of a pattern 1BCDEF as follows. The A digit of 1 is produced as previously described. The B digit represents the answer minute tens information as obtained out of cable AMT from the answer minute tens register of Fig. 81. The C digit represents the answer minute units digit out of cable AMU from the answer minute units register of Fig. 82. The D digit represents the answer minute parts digit out of cable AMP extending from the answer minute parts register of Fig. 82. The E and F digits represent respectively the tens and units digits of the call identity index out of cables CIIT and CIIU as previously described.

Th operation of the pattern relay OI1–11000 will cause the perforation of a pattern 2BCDEF as follows. The A digit of 2 is caused by the extension of ground on the reader perforate conductor PA2 in Fig. 110 over contact 1 of the pattern relay OI1–11000 to ground the conductor A2. The B digit represents the input class as registered in the input class relays of Fig. 83 from which the cable ICL extends in Fig. 110. The C digit represents the billing index units digit out of cable BIU which extends from the billing index units register of Fig. 84. The D digit likewise represents the billing index tens digit, as transmitted over cable BIT from the billing index tens register of Fig. 83. The E and F digits represent respectively the tens and units digits of the call identity index out of cables CIIT and CIIU, as previously described.

The operation of the pattern relay 006–11100 will cause the perforation of a line pattern 0BCDEF as follows. The A digit of 0 is perforated as previously described. The B digit represents the billing index units out of cable BIU. The C and D digits respectively represent the disconnect day tens and units digits out of cables DDT and DDU which extend from the disconnect day tens and units registers of Fig. 91 over the cables DDT and DDU and cables 9107, 91–87 and 87–84 into Fig. 84 where the two cables DDT and DDU emerge and extend into Fig. 111. The E and F digits represent respectively the disconnect hour tens and units digits out of cables DHT and DHU in Fig. 111. This information is derived from the disconnect hour tens and units registers of Fig. 77 by means of cables DHT and DHU which extend from Fig. 77 into Fig. 104 and thence over cable DHTU into Fig. 111.

If the pattern relay ODOI2–11200 is operated, a line pattern ABCDEF will be caused to be perforated as follows. The A digit is supplied over cable A012 from Fig. 114 depending upon which of the relays 00–11401, ODO3–11402 and OI3–11403 is operated, as previously described. Ground on the reader perforate conductors out of cable PA–805 in Fig. 114 will be extended over contacts of the operated one or ones of these three relays to ground the 0, the 1 or all three of the leads entering cable A012. The B digit represents the office index as registered in the office index register in the left-hand portion of Fig. 85 and as indicated by the grounded pair of conductors out of cable OI in Fig. 112. The C digit is perforated by a pair of grounded conductors out of cable CLTH in Fig. 112 and represents the calling line thousands digit as registered in Fig. 85. The D, E and F digits respectively represent the calling line hundreds, tens and units digits out of respective cables CLH, CLT and CLU from the respective calling line hundreds, tens and units registers of Fig. 86.

If the pattern relay OMU1–11201 is operated, a pattern ABCDEF will be perforated as follows. The A and B digits are perforated by grounds over cable 112–100 from Fig. 100, the subpattern connector, depending upon the condition of operation of the relays in this subpattern connector as has been described previously. The C, D, E and F digits represent respectively the calling line thousands, hundreds, tens and units digits out of respective cables CLTH, CLH, CLT and CLU as previously described.

If the pattern relay ODOI3–11400 is operated, a pattern 0BCDEF will be caused to be perforated as follows. The A digit of 0 is perforated in a manner similar to that described above. The B digit represents the called area as determined by grounds out of cable CA which extends to Fig. 114 from the called area register at the left-hand side of Fig. 87. The C digit represents the called number index as registered in the called number index register in the center of Fig. 87 if the relay OI3–11403 is operated. In Fig. 87, under these circumstances, the reader perforate grounds out of cable PC–807 will extend over contacts of the called number index register to ground two of the five conductors 0, 1, 2, 4 and 7 into cable CNIB which extends into Fig. 114 and over contacts of the relay OI3–11403, thence over cable CO7 and contacts of the pattern relay ODOI3–11400 to cause the perforation of the C digit as a called number index. The C digit will represent a composite called number index and message unit class index if the relay ODO3–11402 is operated. Under this condition the reader perforate grounds out of cable PC–807 in Fig. 87 will extend over contacts of the operated ones of the called number index register in the center part of Fig. 87, thence out over two of the five conductors 0 to 7 into cable CNIA which extends over cables 91–87, 9107, 92–91A, 9208 and 92–95 into Fig. 95, thence out of cable CNIA and over contacts of one of the input class relays OMUD–9502, OMU–9501 and OTOLL–9500 to ground two of the conductors 0 to 7 into cable UCR which extends via cables 92–95, etc. and out of cable 91–87 in Fig. 87, thence via cable UCR into Fig. 114 and over contacts of the relay ODO3–11402 and by means of cable CO7 to the C digit contacts of the pattern relay ODOI3–11400. The D, E and F digits represent respectively the called office A, B and C digits out of respective cables COFA, COFB and COFC which extend into Fig. 114 from the A, B and C digit office relay registers respectively in the right-hand portion of Fig. 87 and in the left and right portions of Fig. 88.

If the pattern relay ODOI4–11600 is operated, a line pattern 0BCDEF will be perforated as follows. The A digit of 0 will be perforated as previously described. The B digit represents the called line thousands digit out of cable CDTH extending from the called line thousands digit register of Fig. 89 into Fig. 116. Similarly, the C, D, E and F digits represent respectively the call line hundreds, tens, units and station digits out of respective cables CDH, CDT, CDU and CDST extending into Fig. 116 from the respective called line hundreds, tens, units and station registers in Figs. 89 and 90.

If the pattern relay OT2D–11800 is operated, a line pattern 2822EF will be perforated as follows. The A, B, C and D digits of 2822 will be perforated as previously described. The E and F digits represent respectively the disconnect day tens and units digits out of respective cables DDT and DDU extending into Fig. 118 from the respective disconnect day tens and units registers of Fig. 91.

If the pattern relay OT2A–11900 is operated, a line pattern 2822EF will be perforated as follows. The first four digits will be perforated in an obvious manner. The E and F digits represent respectively the answer day tens and units digits out of respective cables ADTA and ADU extending into Fig. 119 from the respective answer day tens and units registers of Fig. 92.

If the pattern relay OD5–12000 is operated, a pattern 0BCDEF will be perforated as follows. The A digit of 0 is perforated in an obvious manner. The B digit is perforated according to the condition of the input class register in the left-hand portion of Fig. 83 and/or the register control circuit of Figs. 123, 124 and 125, as described previously in connection with the B digit for the pattern relay 005–10600. The C and D digits represent respectively the chargeable time tens and units

digits out of respective cables CHT and CHU extending into Fig. 120 from the respective chargeable time tens and units registers in the right-hand portion of Fig. 93 and the left-hand portion of Fig. 94. The E and F digits represent respectively the message unit tens and units digits out of respective cables MUT and MUU extending into Fig. 120 from the respective message unit tens and units digit registers of Fig. 94.

If the pattern relay OMU**2–12200** is operated, a pattern 0B00EF will be perforated as follows. The A, C and D digits of 0 are perforated in an obvious fashion. The B digit represents the message unit type out of cable MU which extends into Fig. 122 from the message unit type or class register in the right-hand portion of Fig. 95. The E and F digits represent respectively the message unit tens and units digits out of respective cables MUT and MUU as described in connection with the pattern relay OD**5–12000**.

4.25 *Perforate magnet and advance checks*

With the operation of the pattern connector relays a path is established on closed reader cycles for operating perforator magnets to emboss (i.e., to perforate) the required information on the selected output tape.

The path for operating these magnets may be traced from the reader perforate contacts, through the call entry registers, operated pattern connector, perforate magnet check relay windings, selected perforator connector and the perforator magnets, all as previously described.

Another path is closed through the operated pattern connector from a make reader contact through the winding of relay PM–**5901**, the operated perforator connector, winding of a perforator advance magnet check relay to the perforator advance magnet. This circuit energizes the perforate advance magnet so that upon the completion of a successful check of the line being perforated the tape may be advanced and prepared for perforating a new line. This action is similar to that described in Section 4.09 regarding the common pattern connector operation and control. The only difference here is that the ground on the reader make conductor JM**1–815** out of cable **10601** in Fig. 106 is extended over a contact of the operated pattern connector relay of Figs. 104 to 122 to ground the conductor PM–**5919**, which extends from Fig. 108 into Fig. 71 and over cable **59–71** into Fig. 59 as previously described to control the perforate magnet and advance checks, the conductor KM**6–816** in Figs. 104 to 122 being extended over a contact of one of the pattern connectors to conductor CKP–**5924** extending from Fig. 108 to Fig. 71 and, as before, over cable **59–71** into Fig. 59.

A check path is closed starting with the one and one only check on the perforator register, through the perforate magnet check relay contacts (which checks for a valid combination of holes being perforated), through the perforate advance magnet check relays (to insure that only one perforator is being stepped), to operate the PS–**5900** relay of the perforate control, as previously described.

The operation of relay PS–**5900** indicates that a line has been successfully perforated on only one tape and that the perforator is ready for an advance. A contact on relay PS–**5900** holds the perforate advance magnet path through the operated relay PM–**5901** independently of the pattern relay contact since the pattern relay may release when the perforate line count is advanced.

4.26 *Perforate line count*

The operation of relay CK–**5906**, indicating that a pattern connector has operated, operates one of the relays PL**6** (not shown) to PL**1–6401** of the perforate line count circuit of Fig. 64 during the closed interval of the reader cycle while the perforate magnets are energized, as previously described.

The PL– relay (Fig. 64) is operated over a path through the lower numbered PLA– relays (Fig. 64) normal and the first operated PLA– relay which, for the first line of an entry, is the one operated from the number of lines register through the output connector as previously described.

The PL– relay, in operating, locks and prepares a path for operating the associated PLA– relay, with relay PS–**5900** operated during the start of the open period of the reader cycle following the successful perforation of the preceding line.

The relay PLA–, in operating, releases the previously operated PLA– relay which, in turn, releases the previously operated pattern connector relay.

In addition, the operation of a new PLA– relay prepares a circuit to operate the next required pattern connector relay through a path similar to that described previously for the other pattern connector relays.

The count by the perforate line count relays of Fig. 64 is from a higher number down to one, the number of lines to be perforated being chosen so that the last line being perforated is always selected by the operation of relay PLA**1–6421**, as previously described. During the perforation of the last line the operate path for relay PPRL–**5904** is closed and this relay locks to await the operation of relay PS–**5900** and the open period following the successful perforating of the last line, thereby to close a path for operating relay PRL–**5905**, all as previously described.

Relay PRL–**5905**, in operating, indicates that the perforating of the required line entries has been completed and grounds the lead RLS–**5927** extending over cable **59–178** to Fig. 178 and then into Fig. 99 and then over contact **19** of the output connector OOCA–**9903** to conductor **12418** to the register control circuit to operate relay ORLS–**12605** (for the odd register) for restoring to normal the odd call registers (in the example) which have controlled the perforating of the entry.

4.27 *Releasing call entry registers*

Relay ORLS–**12605** of the odd register control of Figs. 124, 125 and 126 operates over the lead **12418** from the operated odd output connector OOCA–**9903** and opens the locking paths for all of the associated call registers comprising Figs. 77 to 98.

Relay ORLS–**12605** locks over its contact **6** and conductor **12613** to the normal down-check relays of all the registers associated with this register control so that the locking grounds may not be reapplied until all registers are normal.

4.28 *Release output connector, perforate register and line count*

The operation of relay ORLS–**12605** also opens the circuit over conductor LOCO in Figs. 99 and 126 which has held the output connector relays of Fig. 99 operated. These relays may now release, in turn releasing relay PON–**5902** which has been holding the perforate line count relays of Fig. 64 off-normal. The release of the output connectors of Fig. 99 also opens the path which has been holding operated the selected perforator register relay of Fig. 101 and the perforator connector relay of Fig. 179 so that these relays may release.

The other perforator control and check relays will have released during the open period following the perforating of the last entry line.

A down-check path is closed through the perforator registers (Fig. 101), perforate line count (Fig. 64) and perforate walking control circuit (Fig. 103) to operate relay ODC–**5903** (as previously described), which permits the output connector relays EOCA–**15200** and EOCB–**15201** of Fig. 152, associated with the opposite (even) call register portion of the machine, to operate when it (the even side) receives an initial entry or other similar condition.

If during the perforating of a call entry a window has been detected in a tape, relay CCUC–**10300** will be operated in the perforate walking control circuit of Fig. 103 to permit the operation of relay CODC–**10301** over contact **2** of relay CCUC–**10300**, in place of relay ODC–**5903** as previously described. In Fig 194 are shown a number of contacts, such as contacts S**10** and S**11** for the perforators No. **10** and No. **11**. These contacts are arranged on either surface side of the supply of tape for a perforator. The tape holds the contacts open but if the supply fails or if a hole is detected (this is a "window") in the tape, these contacts will close. This will apply ground to the appropriate one of the leads WS**0** to WS**11** entering cable **194–101** and extending into Fig. 101 to operate the appropriate window lock-out detecting relay WSS–**10112** to WS**9**–**10129** in series with relay CWS–**5908** to initiate the window splice pattern perforation as more fully described in Section 4.38. Briefly, the WS– relay of Fig. 101 operates in series over lead CWS into cable **101–103**, cable **64–103** to Fig. 64, cable **64–59**, lead CWS, to battery through relay CWS–**5908**. Ground on the off-normal conductor MON–**1201** in Fig. 65 then extends over the contacts **1** of relays TTI–**6500** to TE–**6507** and contact **3** of relay WS–**6502**, to conductor **6529** into Fig. 59, over contact **3** of relay CWS–**5908** to conductor WS. Conductor WS extends over cables **64–59, 64–103** to Fig. 103, and **101–103** into Fig. 101 where it extends over contact **1** of all unoperated relays WS**9**–**10129** to WSD–**10113** and contact **1** of relay WSS–**10112** (operated if a window was detected on the straddle tape) or contact **2** of the operated relay WS**9**–**10129** to WSD–**10113** to ground conductor STWS into cable **103–101** or conductor RWS into cable **101–103**. These two conductors STWS and RWS extend over cables **64–103** into Fig. 64 and **65–64** into Fig. 65 where they emerge to operate relay STWS–**6509** or relay WS–**6502**. The special condition of the operation of the straddle tape window relay STWS–**6509** is discussed in Section 4.38. If the ordinary window relay WS–**6502** operates, the aforementioned ground on conductor MON–**1201** in Fig. 65 is extended over contact **4** of relay WS–**6502** to conductor CCUC–**6510** which, as previously described, extends into Fig. 103 to operate relay CCUC–**10300**. The output down-check ground on conductor ODC–**6403**, as previously described, will then extend over contact **2** of relay CCUC–**10300** to operate relay CODC–**10301**, instead of over contact **3** of relay CCUC–**10300** to operate relay ODC–**5903** as previously described.

The operation of relay CODC–**10301** permits the operation of the common output connector COC–**6400**, as previously described, and enables the perforating of non-call entries on output tapes. Since relay ODC–**5903** does not reoperate as long as relay CCUC–**10300** is operated, no further call entries may reach the perforation stage until the window situation is properly cleared up.

4.29 *Reading and perforating end-of-tape groups—day progress*

Each recorder tape from the central office contains an end-of-tape group at the 3 a.m. cutting point each day. This machine is arranged for processing a number of consecutive days of tape from each central office recorder before it is cut. The consecutive days progress in the order starting from the last day of the last round through the first day of the last round to the highest day of the next to the last round, etc., until the first day of the first round is reached. The first and last round set-up switches **19004** and **19000** may be set to give the same identical values, in which case the processing is confined to only that one round.

The day of round and round set-up switches (first day of round—**19003**, last day of round—**19100**, first round—**19004** and last round—**19000**) indicate the days which are being processed directly from the central office tape for

the first time. Under the feedback method of straddle operation, the day progress may go beyond the first day of the first round, since the end-of-tape groups on the input straddle tapes indicate days of rounds in the previous cutting period.

The day progress switch **3112** takes one step for each elapsed day of round. Its arcs or translator relays operated therefrom indicate both the calendar day, day of round and round being processed at all times. The day of round and round arcs of the day progress switch are translated by the round size translator of Figs. 129 and 155, according to whether the marker group being processed used 6 or 10 rounds per month.

At the beginning of processing of each recorder, the day progress switch is set to the last day of the last round as described in Section 4.05 for the initial run. Thereafter, the circuit checks that the day of round and round from each successive end-of-tape group either agrees with the day of round and round from the day progress switch arcs or is one less.

In the latter case the change in day of round is noted, but the stepping of the day progress switch is deferred until the complete end-of-tape group has been read and checked.

A change in round is indicated when the day of round changes from day one to the highest day of the previous (in time) round.

When the processing of a recorder's tape is completed, the next end-of-tape group should be that of a new recorder starting with the last day of the last round. Since this change in day is not one less than the preceding day, the circuit recognizes in particular the last day of the last round as set on the set-up switches and expects a recorder number change at this point.

The path for checking the round, when reading the 284DEF line (D is round; E and F are tens and units of marker group) of the end-of-tape group, is established as described in detail in Section 4.08 from ground at contact **3** of relay L**4–2100** operated, through the E digit translator relays of Fig. 23, marker group tens set-up switch **20600**, contact **10** of relay L**4–2100** operated, marker group units set-up switch **19101**, F digit translator relays of Fig. 24, contact **2** of relay L**4–2100** operated, and the D digit reading relays of Fig. 14 to one of the ten leads **0** to **9** into cables D**14–32** in Fig. 14. These leads extend via cables D**14–32**, **32–190** to Fig. 190 and D**14–32** in Fig. 180 to conductor D**0** to D**9** appearing on contacts of the round translator relays R**0–18000** to R**9–18009**, which, as will be recalled, will be operated one at a time to indicate the round being processed. As will be recalled from the description in Section 4.08, if the D digit lead D**0** to D**9** out of cable D**14–32** in Fig. 180 corresponds to the operated relay R**0–18000** to R**9–18009** (that is, the round has not changed), then the conductor D**0** to D**9** will be extended over a contact of the corresponding round translator relay to conductor **R18019**, which, as previously described, extends to the reader step conductor RS–**1808** to step the reader. If the D digit represents one less than the round number registered in the round translator of Fig. 180, then relay DCR–**1704** in the tape identity progress control circuit of Fig. 17 is operated, followed by the operation of the reader step relay RS–**2600**. For instance, assuming that in a ten round month (rounds 0 to 9) the relay R**7–18007** of Fig. 180 is operated indicating that round eight was last processed, if the lead D**6** out of cable D**14–32** in Fig. 180 is grounded indicating a D digit of the 284DEF entry of 6, then this ground will extend over contact **5** of relay R**6–18006** and contact **6** of relay R**7** to conductor C entering cable **18020** and continuing over cables **18020**, **18018**, **21–180** to Fig. 21 and **18020**, where conductor C emerges and extends over contact **8** of relay L**4–2100** to conductor DCR extending over cables **2111**, **21–25**, **25–22** and **25–17** into Fig. 17 where conductor DCR emerges to operate relay DCR–**1704**. Relay DCR–**1704**, in operating, extends its

operating ground on conductor DCR over its contact 4 to conductor R18019 which extends over cables 25–17, 25–22 and 21–25 into Fig. 21 where conductor R18019 emerges and extends over contact 1 of relay L4–2100 to the reader step conductor RS–1808 to step the reader. As another example, assuming that in a ten round month (rounds 0 to 9) the previously processed round had been round seven, indicated by the operated relay R6 in Fig. 180, then if the D5 lead out of cable D14–32 is grounded, this ground will extend over contact 4 of relay R5–18005 to conductor R extending via cable 155–180C into Fig. 155 where conductor R will emerge and extend over contact 1 of relay 10R–15502 to conductor 10R and back to Fig. 180 over cable 155–180C, where conductor 10R emerges and extends over contact 7 of relay R6 to conductor C, etc. Relay DCR–1704 locks over its contact 3, conductor DSL, cables 25–17A, 25–31 and 3114, conductor DSL, contact 2 of relay DPS–3109 (the operation of which, when the day progress switch 3112 is stepped, releases relay DCR–1704), conductor DRSL, to ground over contact 1 of relay LR–3108 or relay LDR–3107.

If the round being read is the last round, a path is established over the D reading relay contacts of Fig. 14 and through the last round set-up switch 19000 to operate relay RLR–1705 if relay FR–3104 is operated. Relay FR–3104 will be operated if the round read on the previous end-of-tape group is the first round as set on the first round set-up switch 19004. That is, if the round previously processed had been the first round as set up on the first round set-up switch 19004, ground would be extended from the round translator relay in Fig. 180 to one of the ten leads R0 to R9 entering cable 180–190 and extending into Fig. 190 where the grounded lead R0 to R9 emerges and extends over the wiper of arc 1 of the first round switch 19004 to conductor FR, thence over cables 32–190 to Fig. 32, and 32–31 into Fig. 31 where conductor FR emerges to operate relay FR–3104, which thereupon locks over its contact 1 to conductor FDRL extending over contact 1 of the connector RR–3301 and conductor MON–1240, which extends over cables 35–33, 12–35 and 1215 into Fig. 12 where conductor MON–1240 emerges and extends to ground over contact 16 of the master off-normal relay MON–1201. Now if the round being read in the 284DEF entry is the last round as indicated by the last round set-up switch 19000 ground will be applied at the D digit reading relays of Fig. 14 to one of the ten conductors 0 to 9 into cable D14–32 and into Fig. 190, where the grounded conductor D0 to D9 emerges from cable D14–32 and extends to the wiper of arc 3 of the last round switch 19000, thence to conductor RLR, over cables 32–190 to Fig. 32 and 32–31 into Fig. 31 where conductor RLR emerges and extends over contact 3 of relay FR–3104 to conductor RLR1, which extends over cables 3114, 25–31 and 25–17A into Fig. 17 where conductor RLR1 emerges to operate relay RLR–1705. Relay RLR–1705 locks over its contact 3 to conductor DRSL which extends over cables 25–17, 25–31 and 3114 into Fig. 31 where, as above described, conductor DRSL is grounded over contact 1 of relay LR–3108 or relay LDR–3107. Relay RLR–1705, if operated, thus should not release until the day progress switch 3112 is reset to the last day of the last round.

Relay RLR–1705, in operating, closes a path for operating the reader step relay RS–2600 on the 284DEF line when the D digit does not equal the round number or the round number less one. This is apparent because by inspection of Fig. 180 it is readily seen that such a condition will extend the grounded lead D0 to D9 out of cable D14–32 over back contacts of two of these relays R0–18000 to R9–18009 (and perhaps a contact of one of the round size translator relays of Figs. 129 and 155) to conductor NC into cable 18020 in Fig. 180. Conductor NC will then extend over cables 18020, 18018, 21–180 to Fig. 21, and 18020, conductor NC, contact 7 of relay L4–2100, conductor RNC, cables 2111, 21–25, 25–22 and 25–17 into Fig. 17 where conductor RNC emerges and extends over contact 2 of relay RLR–1705 to conductor R18019, which, as above explained, extends to the reader step conductor RS–1808.

When reading the 284DEF line containing the highest round digit (5 or 9 depending upon whether the marker group being processed is divided into 6 or 10 round months) with round 0 recorded in the round translator of Fig. 180, relay DMC–1702 operates to indicate that a month change is to be expected when reading the next line of the end-of-tape group. In Fig. 180 if lead D9 out of cable D14–32 is grounded (indicating the reading of the tenth round from the 284DEF entry), this lead will extend over contact 4 of relay R9–18009 to conductor 6R and over contact 6 of relay R0–18000 to conductor MC into cable 18020. On the other hand, if lead D5 out of cable D14–32 is grounded (indicating the reading of the sixth round from the 284DEF entry), then this lead D5 will extend over contact 4 of relay R5 to conductor R into cable 155–180C to Fig. 155 and thence over contact 24 of the round size translator relay 6R–12900 to conductor 6R extending back over cable 155–180C into Fig. 180 and over contact 6 of relay R0–18000 to conductor MC into cable 18020. Conductor MC extends over cables 18020, 18018, 21–180 into Fig. 21 and 18020, to conductor MC, and thence over contact 6 of relay L4–2100 to conductor DMC, into cables 2111, 21–25, 25–22 and 25–17 into Fig. 17 where conductor DMC emerges to operate relay DMC–1702, which thereupon extends its operating ground over its contact 1 to the conductor R18019 to cause reader step as described.

When reading the next line of an end-of-tape group, 283DEF (D—day of round; EF—tens and units of month), reader step relay RS–2600 is operated normally over a path (as described in Section 4.08) starting from relay L3–2102 operated through the E digit translator relays of Fig. 23, month tens set-up switch 19001, relay L3–2102 operated, relay MCR–1703 normal, month units set-up switch 19002, F digit translator relays of Fig. 24, relay L3–2102 operated, through the D digit reading relays of Fig. 14 to the day of round translator relays of Fig. 180 out of cables D14–32 and 18021 in Fig. 180.

If the day of round as indicated by the operated relay DR1–18011 to DR6–18016 is the same as the D digit of the line being read, relay RS–2600 operates directly by the extension of the grounded D digit lead D1 to D6 out of cables D14–32 and 18021 in Fig. 180 over contact 3 of the corresponding day of round translator relay DR1–18011 to DR6–19016 to conductor DR–18022 which extends, as previously described, over cables 18023, 21–180 to Fig. 21 and 18023, conductor DR–18022, over contact 1 of relay LS–2102 to the reader step conductor RS–1808.

If the day of round being read is one less than the day of round indicated by the setting of the day progress switch 3112, relay DCDR–1706 operates prior to the operation of the reader step relay RS–2600. For instance, if the previous day was day 5 (relay DR5–18015, operated) and the day from the D digit of the 283DEF entry is a 4 (lead D4 out of cables D14–32 and 18021 in Fig. 180 grounded), then conductor D4 will extend over contact 4 of relay DR4–18014 and contact 6 of relay DR5–18015 to conductor C1, cables 18023, 21–180 to Fig. 21 and 18023, conductor C1, contact 7 of relay L3–2102, conductor DCDR, cables 2111, 21–25, 25–22 and 25–17, conductor DCDR to operate relay DCDR–1706, which locks over its contact 4 to conductor DSL as previously described and which extends its operating ground over its contact 5 to conductor DR–18022 which, in turn, extends over cables 25–17, 25–22 and

21–25, conductor DR–18022, contact 1 of relay L3–2102, to the reader step conductor RS–1808.

Relay DCDR–1706, in operating, indicates to the circuit that a change in the day of round has been detected but that the day progress switch 3112 should not be stepped until the reading of the end-of-tape group is completed.

Relay FDR–3105 operates when the day progress switch 3112 steps into a position indicating the first day of the first round as set on the set-up switches. That is, if relay FR–3104 is operated, as above described, to indicate the first round, ground will extend over the wiper of the day of round arc of the day progress switch 3112, out over one of the conductors DR1 to DR22, cables DR–3118, 31–129 to Fig. 129 and DR–3118 into Fig. 155 where the DR1 to DR22 conductor is translated by the contacts of the round size translator relays of Figs. 129 and 155 into a grounded one of the six conductors DR1 to DR6 entering cable 15505 and extending over cable 155–206 into Fig. 206 where cable 15505 emerges and extends to the contacts of arc 3 of the first day of round switch 19003 in Fig. 190. If the day corresponds to the setting of this switch the wiper of arc 3 thereof will be grounded, thereby grounding conductor FDR which extends over cables 19005, 32–190 to Fig. 32 and 32–31, conductor FDR, contact 2 of relay FR–3104 to operate relay FDR–3105, which locks over its contact 1 to conductor FDRL as above described.

Relay RLDR–1707 operates when a change in the day of round on a 283DEF entry does not equal one less than the day of round set on the day progress switch 3112, but is equal to the last day of round value as indicated by the set-up switch 19100. This requires that relays FR–3104, RLR–1705 and FDR be operated; that is, this indication means that the previous round was the first round (relay FR–31040 operated), that this round is the last round (relay RLR–1705 operated), and thus that this day should be the last day of the last round because the previous day was the first day of the first round (relay FDR–3105 operated). This circuit extends from ground on one of the leads D1 to D6 out of cable D14–32 (from the D digit reading relays of Fig. 14) in Fig. 190, cable 19117, wiper of arc 3 of the last day of round switch 19100 if this corresponds, to conductor RLDR1, cables 19005, 32–190 to Fig. 32 and 32–31, conductor RLDR1, contact 2 of relay FDR–3105, conductor RLDR, cables 3120, 25–31 and 25–17A, conductor RLDR, contact 4 of relay RLR–1705 to operate relay RLDR–1707, which thereupon locks over its contact 3 to ground on conductor DRSL as previously described. With relay RLDR–1707 operated, the circuit may accept a day of round which is neither equal to nor one less than the day of round of the day progress switch 3112 by operating the reader step relay RS–2600 through relays RLDR–1707 and L3–2102 operated. This circuit extends from ground on one of the day conductors D1 to D6 out of cables D14–32 and 18021 in Fig. 180, over back contacts of two unoperated ones of the day of round translator relays DR1–18011 to DR6–18016 (with or without the help of the contacts 49 and 25 of the round size translator relays 6R–12900 and 10R–15502 of Figs. 129 and 155—via conductors R, 6R and 10R in cable 180–155) to conductor NC1, cables 18023, 21–180 to Fig. 21 and 18023, conductor NC1, contact 6 of relay L3–2102, conductor DRNC, cables 2111, 21–25, 25–22 and 25–17, conductor DRNC, contact 2 of relay RLDR–1707 to conductor DR–18022, which, as described above, eventually grounds the reader step conductor RS–1808.

The remainder of the end-of-tape group is read and registered or compared as described in earlier and in later subsections. When the last line of the end-of-tape group has been read and checked, a path is closed for starting its perforation depending upon whether or not an end-of-tape group is to be perforated on the output straddle tape, as described in Section 4.311.

Should relay DCDR–1706 have been operated, indicating a change in the day of round, relay DPS–3109 would have operated after reading the 2811EF entry when relay CL1–2201 operates, followed by the operation of relay DPS1–3110 and of the step magnet STP–3113 for the day progress switch 3112 to permit the advance of day progress. This circuit would extend from ground, over contact 1 of relay CL1–2201, conductor 2217, contact 2 of relay DCDR–1706, conductor DPS1, cables 25–17A, 25–31 and 3114, conductor DPS1, to relay DPS–3109, which, in operating, extends its operating ground over its contact 1 to operate relay DPS1–3110. Relay DPS1–3110, in operating, extends ground over its contacts 2 and 1 to operate the step magnet STP–3113.

The operation of relay DPS–3109 releases relay DCDR–1706 (and relay DCR–1704 if operated) and then relay DPS–3109 releases after relay DPS1–3110 is satisfied that the step magnet STP–3113 has been sufficiently energized to insure the advance of the day progress switch 3112. Then relay DPS1–3110 also releases, permitting the step magnet STP–3113 to release to step the switch 3112.

When the perforating or skipping of the perforating of end of tape has been determined, or the perforating completed, a path is closed ultimately to indicate the conclusion of the reading and the taking of action on the end-of-tape group.

A path is now closed through the unoperated relays DCDR–1706, DCR–1704, DPRS–3106, DPS–3109, FDR–3105 and RP–3202 to operate the ETE–2502 relay. As will be recalled from the detailed description in Section 4.08, etc. and as will be seen in Section 4.311, dealing with the reading, checking, registering and perforating of tape identities, the grounding of conductor ETE–4213 (which appears throughout the circuit) is indicative of completion of such action. Conductor ETE–4213 in Fig. 17 is thus grounded and extends over contact 3 of relay DCDR–1706, contact 2 of relay DCR–1704, conductor ETE–1709, cables 25–17A, 25–31 and 3114, conductor ETE–1709, contact 3 of relay DPRS–3106, contact 3 of relay DPS–3109, contact 7 of relay FDR–3105, conductor ETE–3119, cable 32–31A, conductor ETE–3119, contact 4 of relay RP–3202, conductor ETE–3223, cables 2204 and 25–22, conductor ETE–3223 to relay ETE–2502. Should relay DCR–1704 have operated without an indication of a day change (by the operation of relay DCDR–1706), the path for operating relay ETE–2502 would be open and the machine would block.

Relay ETE–2502, in operating, locks to the operated off-normal relays of the tape identity progress control circuit of Fig. 25 as previously described and, at the same time, opens their locking grounds so that the entire tape identity progress control circuit may be restored to normal, all as previously described.

The day progress switch 3112 is reset to its last round and last day of round position only at the beginning of processing as described in Section 4.05 and at the time the recorder progress switch 3205 is stepped as described in Section 4.31. When the recorder progress switch 3205 is stepped, relay RP–3202 operates, in turn operating relay DPRS–3106 over a path through the operated relays RLR–1705 and RLDR–1707. As will be described in Section 4.31 the recorder change condition, which eventually effects the stepping of the recorder progress switch 3205, causes relay CCR–1913 in the recorder register control circuit of Fig. 19 to operate. Ground is thereupon extended over contact 6 of relay CCR–1913, conductor RP1, cable 27–19, 26–27, 24–26, 22–24 and 21–22, conductor RP1, contact 4 of relay FDR–3105 (operated because processing of the first day of the first round for the old recorder number has been done), conductor RP, cable 32–31A, conductor RP, to relay RP–3202. Ground thereupon extends over contact 3 of relay RP–3202, conductor DPRS, cables 22–32

and 25–22, conductor DPRS into Fig. 17, contact 4 of relay RLDR–1707, contact 5 of relay RLR–1705, conductor DPRS1, cables 25–17A, 25–31 and 3114, conductor DPRS1, to relay DPRS–3106, which operates and locks to the DRSL conductor as previously described. These two relays (RLR–1705 and RLDR–1707) indicate that the last round and the last day of round were detected when reading the first two lines of the end-of-tape group even though the day progress was not changed at that time.

With relay DPRS–3106 operated, relay DPS1–3110 is operated from the ETE path (conductor ETE–1709 in Fig. 31 as above described) through relays LDR–3107 and LR–3108 normal and over the interrupter contact of the day progress switch (back contact of step magnet STP–3113). The previously described ground on conductor ETE–1709 out of cable 3114 in Fig. 31 is extended over contact 2 of relay DPRS–3106 to conductor STDP–2507 and thence over contact 2 of relay LR–3108 or relay LDR–3107 and the contact of the step magnet STP–3113 to relay DPS1–3110.

Relay DPS1–3110 operates and releases with the closing and opening of the step magnet STP–3113 interrupter contact, etc. The day progress switch 3112 thus runs until its arcs indicate that it is on the terminals which indicate the last day of round and round by operating the LDR–3107 and LR–3108 relays. Relay DPRS–3106 releases at this time closing at its contact 3 the path to the winding of relay ETE–2502 through relays DPS–3109, FDR–3105 and RP–3202 normal as previously described.

When processing tapes by the feedback method of straddle operation, days of round prior to the first day of the first round are made acceptable by operating relay CDPC–3111 before operating relay ETE–2502 when relay FDR–3105 is found operated. This circuit extends from ground on the lead ETE–1709 out of cable 3114 in Fig. 31, as described above, over contact 3 of relay DPRS–3106, contact 3 of relay DPS–3109, contact 6 of relay FDR–3105, conductor ETE–1926, cables 3211, 32–33, 33–34, 34–35, 35–19, 1919 and 1920, conductor ETE–1926, contact 8 of relay F–1918 (operated, as previously described, when the straddle class switch 20500 is in its "F" or feedback position), conductor CDPC, cables 1920, 1919, 35–19, 34–35, 33–34, 32–33 and 3211, conductor CDPC to relay CDPC–3111, which locks over its contact 1 to the FDRL conductor and extends its operating ground over its contact 2 to the conductor ETE–3119 to eventually operate the relay ETE–2502. The operation of relay CDPC–3111 bypasses the check for the round and day of round on the first two entry lines of the end-of-tape group until the last day of the last round is detected. The previously described check path for the round when the conductor NC into cable 18020 in Fig. 180 was grounded (indicating an unsatisfactory check of the new round against the old round—no match and no less-one indication) extended over conductor NC, over cables 18020, 18018, 21–180 to Fig. 21 and 18020, conductor NC, contact 7 of relay L4–2100, conductor RNC, cables 2111 etc. and out of cable 25–17 in Fig. 17, conductor RNC, contact 2 of relay RLR–1705 (operated in the normal situation to indicate that the last round has been detected after a first round), conductor R18019, cables 25–17, etc. and out of cable 21–25 in Fig. 21, conductor R18019, contact 1 of relay L4–2100 to the reader step conductor RS–1808. Here, however, the last round may not be detected and if relay CDPC–3111 has operated, as above described, then the check will be permitted (actually cancelled) so that any round may be accepted. The conductor RNC out of cable 25–17 in Fig. 17 may then extend over contact 1 of relay RLR–1705 to conductor R–1710, cables 25–17A, 25–31 and 3114, conductor R–1710, contact 4 of relay FR–3104, contact 4 of relay CDPC–3111, conductor R18019 and over contact 1 of relay L4–2100 to the reader step conductor RS–1808. The same situation will pertain to the check of the day of round in that the no-check conductor DRNC out of cable 25–17 in Fig. 17 (grounded when the day of round fails to check in the translator relays at the top of Fig. 180—no match and no less-one indication) may extend over contact 1 of relay RLDR–1707 (instead of contact 2 as previously), conductor DR–1711, cables 25–17A, 25–31 and 3120, conductor DR–1711, contact 3 of relay FDR–3105, contact 3 of relay CDPC–3111, to conductor DR–18022 and over contact 1 of relay L3–2102 to the reader step conductor RS–1808. It is assumed that this condition occurs only when a change in recorder number will be detected when reading and comparing the third line (280DEF) of the end-of-tape group. The day progress switch 3112 is controlled when working on the calendar days of the latter part of a month to by-pass the 31st, 30th or 29th day according to the number of days in the month as indicated by the day translator of Fig. 67. That is, a circuit is completed over the top wiper of switch 3112 to step the switch 3112 when the No. 2 or 3 or 4 contact is to be skipped under these conditions. For instance, if the switch were to start on its second transit the upper arc arm would be on contact 1. Ground would then extend from off-normal ground on conductor MON–1201, over the lowest arc, contact 1 thereof, and contact 7 of relay FA–3100 to conductor DPS to step the switch 3112 to its No. 2 contacts. Here, ground on the lowest wiper would extend over contact 2 of that arc and over contact 2 of relay OPR–3102 to operate relay LA–3101. Ground would also extend from the off-normal conductor MON–2205 in Fig. 25, over contact 1 of relay FI–2500 (released when the first tape identity was checked), conductor DPO, cables 25–31 and 3120, conductor DPO to the upper wiper of switch 3112. The contacts 2, 3 and 4 of this arc extend over conductors 2, 3 and 4, cables 3121, 31–67 and 6713 into Fig. 67 where conductor 2 may extend over contact 22 of relay 30–6702 or contact 22 of relay 29–6701 or contact 22 of relay 28–6700 to conductor DPS into cable 6713 and where conductor 3 may extend over contact 23 of relay 29–6701 or contact 23 of relay 28–6700 to conductor DPS and where conductor 4 may extend over contact 24 of relay 28–6700 to conductor DPS. Conductor DPS then extends over cables 6713 and 31–67 into Fig. 31 where it emerges as the day progress step conductor. Thus, if the month is a 28 day month (relay 28–6700 operated) contacts 2, 3 and 4 will be skipped leaving the switch in its position 5 corresponding to day 28 in the table of Section 4.05. The other two conditions are similar for months of 29 or 30 days.

Reference to the table in Section 4.05 will refresh the recollection as to the calendar day and round values represented by each position of the day progress switch 3112. It will be seen from the table and from the description provided in Section 4.05 that the following conditions prevail under normal conditions (that is, excepting the above-mentioned feedback straddle operation):

(1) If the last day of the last round were any day less than day 23, then the switch 3112 will operate on its first transit with the mechanical latch of relay OPR–3102 engaged and with relay FA–3100 locked over its contact 1 and contact 2 of relay LA–3101 to off-normal ground on conductor MON–1201;

(2) If the last day of the last round were any day from 31 down to and including day 23, then the switch 3112 will have started its operation on its second transit with its wipers on a contact other than contact 1, with the mechanical latch of relay OPR–3102 engaged and with relay LA–3101 locked over its contact 1 and contact 2 of relay FA–3100 to off-normal ground on conductor MON–1201; and,

(3) Under condition (2) the switch 3112 will operate

only on its second transit for days down to and including day 11.

4.30 *Skipping splice pattern*

The skipping of splice pattern on the input tapes was described in connection with the skipping of the initial splice pattern in Section 4.07.

The skip splice control relays SPR–1803, PRRL–1804, RRL–1805 and RRUL–1806 function in the same manner as described in Section 4.07 regardless of where the splice pattern occurs on the tape.

On prior types of central office tapes, splice pattern is introduced by a skip splice entry 286000, while on newer types it is contemplated that this entry line will be eliminated and that the regular splice pattern entry 081010 will introduce all splice pattern sections.

The skip splice control is arranged to function in either case. Relay 286–1800 operates from the C digit reading relays of Fig. 14 when a 286000 entry introduces a spliced portion of the tape. Ground on the up-check conductor UC–2610 in Fig. 13 is extended over contact 6 of relay B1–1304 and contact 4 of relay B7–1307 (to check the B digit of 8), contact 4 of relay A1–1301 and contact 6 of relay A2–1302 and contact 4 of relay A0–1300 (to check the A digit of 2), conductor 1310, contacts 7 of relays C4–1403 and C2–1402 (to check the C digit of 6), conductor 286. cables 1417 and 14–18, conductor 286, to relay 286–1800. Relay 286–1800, in operating, operates relay SPR–1803, which thereupon functions as previously described.

It is important to recognize that the skip splice control, by locking in the reading relays, performs two additional functions.

For one thing, the locking of the reading relays prevents any splice pattern other than the one which originated the skipped to occur on the far side of the splice. If the splice pattern should change, additional reading relays would be operated as occurs at the end of splice pattern. However, under this condition the entry being read is not introduced with an A digit of 1 or 2 and hence relay RRL–1805 will not release; consequently the reading relays will not release and an alarm condition will persist. It will be remembered that when relay PRRL–1804 operated it was locked in a circuit extending over its contact 2, conductor RRLL, cables 14–18 and 13–14, conductor RRLL, contact 9 of relay A1–1301, and contact 10 of relay A2–1302 to ground. If the new reading which causes relay RRUL–1806 to operate does not operate relay A1–1301 or relay A2–1302, then relay PRRL–1804 will not release and relay RRL–1805 will not release, thereby retaining all operated reading relays locked. This situation, as described in Section 4.39 dealing with alarm timing will cause the operation of the alarm relay AL–1005 to bring in an alarm of trouble.

The other useful function in locking the reading relays is to enable a line containing a valid combination of operated reading relays to exist in the circuit at the time the blanks at the splice point occur, otherwise the reading relays corresponding to those blanks would release to upset the splice skipping function.

Relay WBY–1802 operates and locks through relay RRUL–1806 when the splice pattern line being read is 081010. With the relay 08–1801 operated (indicating A and B digits of 08), a circuit extends from ground in Fig. 14, over contact 10 of relay C1–1401 and contact 9 of relay C0–1400 (C digit of 1), contact 10 of relay D4–1408 and contact 9 of relay D7–1409 (D digit of 0), conductor 1418, contact 6 of relay TE1–2301 (E digit of 1), conductor 2305, contact 8 of relay TF0–2400 (F digit of 0), conductor 2414, contact 1 of relay 08–1801, to relay WBY–1802. Relay WBY–1802. Relay WBY–1802 locks over its contact 1 to the RRLL conductor, etc. as previously described. Window pattern on the central office tape consists of two end-of-tape groups separated by the splice pattern which covers the window. Relay WBY–1802, in operating on this type of splice pattern, by-passes the check contacts of the reading relays which are operated by the window. The reading relay up-check path, as has been described on numerous occasions previously, includes the circuit on Fig. 14 extending from conductor 1308 at the left, through a two-out-of-five operated contact check of the C digit reading relays and through a two-out-of-five operated contact check of the D digit reading relays to conductor 1410, etc. When a window splice occurs, however, the 0, 1, 2 and 4 code positions of the D digit are cut out by the window as are the 4 and 7 code positions of the C digit. Therefore, under a window splice skipping condition it is necessary to eliminate the relays C4–1403, C7–1404, D0–1405, D1–1406, D2–1407 and D4–1408 from the reading relay up-check path. The up-check path will then include the circuit from conductor 1308 in Fig. 14, contact 2 of relay C0–1400 and contact 4 of relay C1–1401 and contact 5 of relay C2–1402 (to check the C digit of 1), conductor UCBY, cables 1417 and 14–18, conductor UCBY, contact 2 of relay WBY–1802, conductor UCBY1, cables 14–18 and 1417, conductor UCBY1, contact 1 of relay D7–1409 (which should be operated for a D digit of 0), to conductor 1410, etc.

When reading an input straddle tape section with the feedback method of straddle operation, the regular and emergency recorder straddle tape sections are spliced together with a special so-called "grooved" splice pattern. With the check which this skip splice method affords the splice patterns at each side of these splices are checked to insure that the emergency straddle tape sections have been spliced into the regular recorder straddle tape sections at the proper point; that is, a check is made that the splice pattern (08CDEF—C and D are the recorder number and E and F are the hour—see Section 4.10) on both sides of the window are the same.

Relay RRL–1805, in operating, closes a path for operating relay TEG2–2503 of the tape identity progress control circuit of Fig. 25, which indicates that a splice pattern immediately following the reading of an end-of-tape group has been detected. This circuit extends from ground on the off-normal conductor MON–2205 in Fig. 25, over contact 3 of relay ETE–2502, conductor IL–2511 into Fig. 18, over contact 7 of relay RRL–1805, conductor 1810 to relay TEG2–2503, which locks over its contact 7 and contact 3 of relay FI–2500 to the ground on the lock conductor IL–2511. The operation of relay TEG2–2503, as more fully explained in Section 4.31, in effect permits the skipping of duplicate end of-tape groups without any action being taken in perforating end-of-tape groups on the straddle tape—that is relay ETE–2502 is operated under the control of the operated relay TEG2–2503.

The cancellation of alarm timing while skipping splice pattern cannot be kept under the control of the reader step relay RS–2600 since it is held up almost constantly. Therefore, the operation of relay PRRL–1804 is used to insert a make contact of relay A0–1300 into the reader step cancel timing path from the relay RS–2600. The matter of cancellation of alarm timing will be dealt with in detail in Section 4.39. However, as a brief introduction to that subject reference is here made to the cancel timing relay CT–1013 in the alarm timing circuit of Fig. 10. Briefly, with relay CT–1013 released the tube T–1014 will be fired through the relay T0–1008 when condenser C–1023 becomes charged to the tube's firing potential. If the tube T–1014 fires relay T0–1008 will operate and in an obvious circuit will operate the alarm relay AL–1005. All throughout the circuit operation, as will be more definitely specified in Section 4.39, relay CT–1013 is operated and released, etc. When relay CT–1013 is operated, whatever charge may have accumulated on condenser C–1023 will be dissipated through resistance R–1024 and over contact 1 of relay CT–1013. This, in effect, cancels that particular timing interval

and when relay CT–1013 is released a new timing interval is initiated, etc. The cancel timing conductor (see Fig. 10) CT threads throughout the circuit for the purpose of permitting certain key relay operations to cancel the alarm timing as the result of a satisfactory progression of events. Reader stepping is normally one of these events. That is, whenever any one of the reader step relays of Figs. 26 and 27 operates to step the reader, conductor **2618** in Figs. 26 and 27 is grounded in an obvious fashion. This ground extends over contact **8** of relay PRRL–**1804** (unoperated except for skipping splice pattern), to the conductor CT to operate the cancel timing relay CT–**1013**. During splice skipping the relay **RS–2600** is kept operated almost constantly; therefore, the cancel timing control is transferred (by the operation of relay PRRL–**1804**) to a make cam on the reader thereby to give a periodic operation and release to the relay CT–**1013** as desired. This circuit extends from ground, over the K5 contact (Fig. 8) of the reader, conductor KM5, cables **8–9**, **9–18** and **18–26**, conductor KM5, contact **10** of relay RS–**2600**, conductor CT**1**, cable **26–15**, conductor CT**1**, cable **15–13**, conductor CT**1**, contact **7** of relay A**0–1300**, conductor CT**2**, cables **13–14** and **14–18**, conductor CT**2**, contact **7** of relay PRRL–**1804** to conductor CT. This operates and releases relay CT–**1013** once each cycle of reader operation, as desired, in substitution for control by reader step relays.

Relay RRL–**1805**, in operating, opens the path for shunting relay RSR–**1011** of the alarm circuit, since relay RS–**2600** may be operated for prolonged periods, but this does not indicate that relay RSR–**1011** is falsely operated. Hence, relay RRL–**1805** prevents the alarm from occurring due to a release of relay RSR–**1011**. This is another alarm condition which may be referred to briefly at this point but which is more fully dealt with in Section 4.39. If relay RLR–**1805** were released the alarm relay AL–**1005** would operate in a circuit extending from ground, over contact **28** of the master offnormal relay MON–**1201**, conductor MON–**1241**, contact **10** of relay ST**4–1103**, conductor **1121**, over the contact of relay RSR–**1011** to relay AL–**1005**. Therefore, relay **RSR–1011** is necessarily normally held operated in a circuit extending from resistance battery, over contact **10** of relay MON–**1201** and over conductor RSR to relay RSR–**1011**. Conductor RSR also extends into Fig. 18 and normally over contact **6** of relay RRL–**1805** (released while not skipping splice pattern) and over conductor **2619** into Figs. 26 and 27 where it is grounded by each operation of a reader step relay. This shunts the winding of relay RSR–**1011** and starts the release thereof. However, it is a slow release relay and normally the shunt is removed before the alarm can be brought in. During splice skipping, when relay **RS–2600** is almost constantly operated, unless special arrangements are made relay RSR–**1011** undoubtedly would release and cause the operation of the alarm relay AL–**1005** even though the circuit were in no trouble. Such a special arrangement is made by taking the RSR shunt from control by relay RS–**2600** thereby to permit relay RSR–**1011** to remain operated while relay RRL–**1805** is operated. This is effected by the opening of the lead RSR at contact **6** of relay RRL–**1805**.

4.31 *Reading and perforating ends-of-tape groups—recorder change*

Once the first recorder number is registered in the recorder number register of Figs. 42 and 43 as described in Sections 4.06 and 4.081, all succeeding recorder numbers, which are the third line of the end-of-tape group, 280DEF (D—recorder type; E and F—recorder number), are merely compared with the registered one to determine whether or not a change in recorder number has occurred.

A change in the tens or units digits of the recorder number is an obvious indication of the progress from one recorder to another. However, with both the feedback and spliced-in emergency modes of straddle operation, significant action must be taken with respect to changes in the D digit of the 280DEF entry to check that the various portions of the same recorder's tapes are presented to the machine in the proper order.

When the 280DEF entry is read following the reading and checking of the 283DEF entry, as previously described, conductor **280–2112** out of cable **27–19** in Fig. 19 is grounded. It extends over contact **1** of relay RDC–**1916** to conductor RC–**1928** and over cables **1922**, **1919**, **35–19**, **34–35** and **34–33** into Fig. 33 where conductor RC–**1928** emerges to operate the recorder check connector relay **RC–3302**, which locks over its contact **20** to the reading relay up-check conductor UC–**1510**, previously described. Upon the operation of connector RC–**3302** the D, E and F digits of the 280DEF entry being read are handled as follows:

(1) Ground extends over contact **23** of connector RC–**3302** to conductor **2106** into Fig. 14, thence over contacts of the operated D digit reading relays, to one of the conductors **5**, **6**, **7** and **8** into cable D**14–32** to Fig. 32, thence over one of the conductors D**5–3215**, D**6–3216**, D**7–3217** and D**8–3218** into cable **32–33A** into Fig. 33 where conductors D5 to D8 emerge and extend over contact **19**, **18**, **17** and **16** of the recorder check connector relay RC–**3302**, conductors CC**5**, CC**6**, CC**7** and CC**8**, cables **33–42B** and **4420** into Fig. 42 where conductors CC5 to CC88 emerge and appear before contacts of relays C**5–4203** to C**8–4206**, the conductor CC**5**, CC**6**, CC**7** or CC**8** being grounded depending upon whether the D digit is a 5 (regular central office tape), a 6 (emergency central office tape), a 7 (straddle tape produced from a regular central office tape) or an 8 (straddle tape produced from an emergency central office tape);

(2) And, ground extends over contact **22** of connector RC–**3302** to conductor DROE–**3307**, which extends over cable **33–23** into Fig. 23 where conductor DROE–**3307** emerges and extends over a contact of the operated E digit reading relay translators of Fig. 23 to one of the three conductors **0**, **1**, and **4** which returns over cable **33–23** to Fig. 33 where these three conductors emerge and extend over contacts **14**, **13** and **12** of connector RC–**3302** to conductors CT**0**, CT**1** and CT**4**, cables **33–42B** and **4220** into Fig. 42 where conductors CT**0**, CT**1** and CT**4** emerge and appear before contacts of the recorder tens register relays T**0–4200**, T**1–4201** and T**4–4202**, the conductor CT**0**, CT**1** or CT**4** being grounded depending upon the tens digit of the recorder number being read in the E digit position;

(3) Ground extends over contact **21** of conductor RC–**3308**, conductor DROF–**3311** into Fig. 24, over a contact of the operated F digit translator relay of Fig. 24 to one of the ten conductors F**0** to F**9** and over cable **24–34** into Fig. 34 where these ten conductors F**0** to F**9** emerge and extend into Fig. 33 and over contacts **10** to **1** of connector RC–**3302**, conductors CU**0** to CU**9**, cables **33–42B** and **42–43A** into Fig. 43 where conductors CU**0** to CU**9** emerge and appear before contacts of the recorder units register relays of Fig. 43, the grounded one of conductors CU**0** to CU**9** depending upon the units digit of the recorder number being read in the F digit position.

As will be described in more detail later, the four conductors CC**5** to CC**8** out of cable **4220** in Fig. 42 are used to ground one of the leads **5** or **6** into cable **42–33** or one of the leads CA, CA**6** and NRP into cable **42–34**; the three conductors CT**0**, CT**1** and CT**4** out of cable **4220** in Fig. 42 are used to ground one of the leads TA or TNC into cable **42–34**; and, the ten conductors CU**0** to CU**9** out of cable **42–43A** in Fig. 43 are used to ground one of the leads UA or UNC into cable **43–34**. Cable **42–33** extends into Fig. 33 and over cable **33–34** into Fig. 34 where it joins up with cables **42–34** and

43–34 into cable 34–35 and over cables 35–19 and 1919 into Fig. 19. Out of cable 1919 conductors NRP, TNC, UNC, CA, CA6, TA and UA emerge and, if grounded, operate the associated recorder register control relays NRP–1909, TNC–1904, UNC–1905, CA–1902, CA6–1903, TA–1900 and UA–1901. Conductors 5 and 6 continue from cable 1919 over cable 1920 where they emerge and appear before contacts of the straddle class connector relays F–918 and SIE–1917. If connector SIE–1917 is operated, a grounded conductor 5 or 6 will operate the corresponding control relay NRP5–1906 or NRP6–1907. If relay F–1918 is operated, a grounded conductor 6 has no effect, whereas a grounded conductor 5 will operate the associated control relay RP–1908.

A few observations may be made which have a bearing on relays EF–1910 and EL–1911. In Fig. 32, the wiper of arc 1 of switch 3205 will ground one of ten units leads U0 to U9 for each position of the switch. Leads U0 to U9 are fed over cables 191–206 and 32–190 to Fig. 190, 190–205A, 205–206 and 191–206 into Figs. 206 and 191 to appear before contacts of arcs 3 of the first and last recorder units switches 19103 and 19105, before contacts of arc 1 of the emergency at previous cutting period units switch 20602 and before contacts of arc 1 of the emergency at current cutting period units switch 20604. These switches 20602 and 20604 are used only when the spliced-in emergency straddle class is specified by switch 20500. If the units setting of the recorder progress switch 3205 corresponds to the setting of switch 19105 the wiper of arc thereof will be grounded and this ground will extend to arm 19118 of the last recorder tens switch 19104 and over contact 2 or 3 thereof to conductor LT0 or LT1 into cables 206–191, 20607 and 205–206. If the units setting of the recorder progress switch 3205 corresponds with the setting of switch 20602 the wiper of arc 1, 2 thereof will be grounded and this ground will extend to the wiper of arc 2 of switch 20601 and over contact 2 or 3 to conductor ELT0 or ELT1 into cables 20612, 20607 and 205–206. Likewise, if the units setting of the recorder progress switch 3205 corresponds with the setting of arc 1 of switch 20604 the wiper 1 thereof will be grounded and this ground will extend to the wiper of arc 2 of switch 20603 and over contact 2 or 3 to conductor EFT0 or EFT1 into cables 20612, 20607 and 205–206. These six conductors LT0, LT1, ELT0, ELT1, EFT0 and EFT1 extend over cables 205–206, 190–205A, 32–190 to Fig. 32 and 3209 where they emerge and appear before contacts of the recorder tens zero and tens one relays RT0–3200 and RT1–3201. Thus, when the recorder progress switch 3205 is in the position corresponding to the last recorder number, conductor LT0 or LT1 will extend over contact 4 of relay RT0–3200 or relay RT1–3201 to operate relay LRS–3204. Likewise, if the emergency recorder was in operation at the current or previous cutting period and if the recorder progress switch is in the position corresponding to the recorder number for which the emergency was then acting, conductor EFT0 or EFT1 will ground conductor EF or conductor ELT0 or ELT1 will ground conductor EL. Conductor EL or EF extends over cables 22–24, 24–26, 26–27 and 27–19 into Fig. 19 where conductor EL or EF emerges to operate relay EL–1911 or relay EF–1910.

FEEDBACK METHOD

With the feedback method (relay F–1918 operated) of straddle operation, the D digit of the recorder number entry indicates whether the central office tape is made on the regular (D–5) or emergency (D–6) recorder of a given number and whether the tape being read is a previously processed straddle tape from either an emergency (D–8) or a regular (D–7) central office tape. The following table indicates for this method of operation the possible conditions which are detected by changes in the D digit of the recorder number registered on the relays

C5–4203 to C8–4206 compared with the D digit being read from the tape:

Input D Digit Value	Operated C Relay of Fig. 42			
	C5 (C.O. Reg.)	C6 (C.O. Emg.)	C7 (Stdl. Reg.)	C8 (Stdl. Emg.)
5 (C.O. Reg.)	NCC	RP	RP	RP
6 (C.O. Emg.)		NCC		
7 (Stdl. Reg.)	NRP		NCC	NRP
8 (Stdl. Emg.)		NRP	NRP	NCC

With the feedback straddle operation (relay F1918 operated) the entire central office emergency tape (D digit of the 280DEF entries is always a 6) for all recorders is fed to the machine first. The order of recorder numbers on this section of tape will normally not be in any definite order. Thus, throughout this section of tape a succession of tape portions will be read where the D digit of the 280DEF entry is always a 6 and where the E and F digits are more or less arbitrary as to the order of their appearance or repetition. This situation then represents an NCC condition for this whole central office emergency tape section since the D digit of 6 for each entry 280DEF always checks with the D digit of 6 for the immediately preceding entry 280DEF. Thus relay CA6–1903 will operate and remain operated for this whole tape section. As each 280DEF entry is read and checked the relays TA–1900 and UA–1901 will operate if the recorder number is the same or one or both of relays TA–1900 and UA–1901 will be released and one or both of relays TNC–1904 and UNC–1905 will be operated if the recorder number changes.

If the relays TA–1900 and UA–1900 are operated (recorder number has not changed) a circuit is completed for stepping the reader without any change in the recorder number registered in Figs. 42 and 43 and without any change in the recorder progress switch 3205. This circuit extends from ground, over contacts 1 of relays NRP–1909, NRP6–1907, NRP5–1906, RP–1908, TNC–1904, UNC–1905, CA6–1903, TA–1900 and UA–1901, conductor RS–1927, cables 1919, 35–19, 34–35 and 34–33, conductor RS–1927 and over contacts 11 and 15 of connector RC–3302 to conductors RS–1808 (to step the reader) and CL0–3314 (to operate relay CL0–2200), both as previously described.

If, on the other hand, either of the tens and units digits of the recorder number as read from the 280DEF entry does not check with the registers of Figs. 42 and 43 (relay TA–1900 or UA–1901 or both released and relay TNC–1904 or UNC–1905 or both operated), then the circuit for grounding conductor RS–1927 (as above described) is open. A circuit is completed from off-normal ground on conductor RON–1924 in Fig. 19, over contact 3 of relay CR–1915, contact 2 of either or both of relays TNC–1904 and UNC–1905, contact 2 of relay CA6–1903, contact 1 of relay F–1918, to operate relay C–1914, which locks over its contact 2 and contact 3 of relay CR–1915 to conductor RON–1924. Relay C–1914, in operating, operates relay CR–1915 in a circuit extending from ground at the reader of Fig. 8, over the contact H9 (during the reader open cycle following the reading of the 280DEF line), conductor HB9, cables 8–9 and 9–18, conductor HB9, contact 1 of relay C–1914, to relay CR–1915, which locks over its contact 2 and contact 4 of relay RDC–1916 to the conductor RON–1924. Relay CR–1915, in operating, extends ground over its contact 5 to conductor RRL–1925, which extends over cables 19–36, 36–59 and 58–59 into Fig. 58, where conductor RRL–1925 emerges to energize the upper windings of the magnetically polarized relays LC5–5807 to LC8–5810 to release them (move their armatures to the left) as mentioned in Section 4.081. At contact 4 of relay CR–1915 ground is removed from the lock conductor L–4209 thereby releasing all of the relays of the recorder register of

Figs. 42 and 43. The removal of off-normal ground at contact 3 of relay CR–1915 releases relay C–1914. Relay RDC–1916 operates when all of the recorder register relays of Figs. 42 and 43 have restored to normal, as previously described. With relay RDC–1916 operated, the recorder number in the instant 280DEF entry may be recorded in the register relays of Figs. 42 and 43 and the relays LC5–5807 to LC8–5810 of Fig. 58, as described in Section 4.081. Upon the operation of relay RDC–1916 relay CR–1915 releases and when the reader step relay RS–2600 and the relay CLO–2200 have been operated and relay CL3–2103 released as a result of an up-check in the registers of Figs. 42 and 43, etc., as previously described, relay RDC–1916 will release to return the recorder control circuit of Fig. 19, etc. to normal.

This process continues throughout the entire section of central office emergency recorder tape until the first sectio nof central office regular recorder tape is reached. This tape will begin with an end of tape group containing a 280DEF entry where the D digit is a 5 and where the E and F digits should correspond with the first recorder as set up on switches 19102 and 19103 as previously described. As far as the D digit is concerned the change is from a 6 to a 5, representing an RP condition with relay RP–1908 operated, which, as before, prevents immediate reader step. Irrespective of whether or not the new recorder number checks with the one registered in Figs. 42 and 43 relay CCR–1913 is operated in a circuit extending from ground on conductor RON–1924, over contact 3 of relay CR–1915 and either over contacts 2 of relays TA–1900 and UA–1901 (if the recorder number checks) and over contact 3 of relay RP–1908, or over contact 2 of one or both of relays TNC–1904 and UNC–1905 (if the recorder number does not check) and over contact 2 of relay RP–1908, to operate relay CCR–1913, which locks over its contact 4 and contact 3 of relay CR–1915 to conductor RON–1924.

Relay CCR–1913, in operating, extends the locking ground on conductor IL–2511 from the tape identity progress control circuit of Fig. 25 over its contact 8 to conductor CR1, extending over cable 19–17 into Fig. 17 where conductor CR1 emerges and extends into Fig. 25 to operate relay CR1–2505, which locks over its contact 1 to the lock conductor IL–2511. With relay CR1–2505 operated, when the end of reading and checking an end-of-tape group arrives (as indicated by the grounding of lead TE–2215 out of cable 2512 in Fig. 25), relay CRC–7610 will be operated to start a series of events described in Section 4.33 regarding a check that all assembling registers are normal, the setting of the assembling registers to receive call starts and the perforating of leading end-of-tape group on the straddle tape as described in Section 4.10. The circuit for operating relay CRC–7610 will extend from ground on the lead TE–2215 in Fig. 25, over contact 7 of relay FI–2500, contact 3 of relay CR1–2505, conductor CRC–2518, cables 25–36, 36–59, 59–72, 72–73, 7315, 7322, conductor CRC–2518, cable 73–76, conductor CRC–2518, to relay CRC–7610.

Relay CCR–1913, in operating, causes the operation of the relay RP–3202 in the recorder progress switch circuit of Fig. 32. Ground extends over contact 6 of relay CCR–1913, conductor RP1, cables 27–19, 26–27, 24–26, 22–24 and 21–22, conductor RP1, contact 4 of relay FDR–3105 (operated because the end of the central office emergency tape will have indicated in an end-of-tape group the first day of the first round), conductor RP, cable 32–31A, conductor RP to relay RP–3202. Relay RP–3202, in operating, operates the step magnet STP–3206 by extending the RP operating ground over contact 1 of relay RP–3202 and the contact of the magnet STP–3206 to the winding thereof. The magnet STP–3206 locks over contact 2 of relay LRS–3204 to ground over contact 2 of relay RP–3202. Assuming that the 284DEF and 283DEF entries preceding the instant 280DEF entry properly indicated the last round and the last day of round, as should be the case, relays RLR–1705 and RLDR–1707 will be operated; thus, the operation of relay RP–3202 will be able to operate relay DPRS–3106 in the day progress circuit of Fig. 31 to set the switch 3112. This circuit extends from ground, over contact 3 of relay RP–3202, conductor DPRS, cables 22–32 and 25–22, conductor DPRS into Fig. 17, contact 4 of relay RLDR–1707, contact 5 of relay RLR–1705, conductor DPRS1, cables 25–17A, 25–31 and 3114, conductor DPRS1 to operate relay DPRS–3106, which, as previously described, locks and causes the switch 3112 to advance until the last day of the last round is reached (operation of relays LR–3108 and LDR–3107). Relay RP–3202 remains operated as long as relay FDR–3105 remains operated. Relay FDR–3105 will release, thereby to release relay RP–3202 and to permit step magnet STP–3206 to release, when the recorder register connector RR–3301 is operated as described presently.

Relay CCR–1913, in operating, operates relay CR–1915 from ground on the reader open period grounded conductor HB9 in Fig. 19, over contact 1 of relay CCR–1913 and over contact 2 of relay F–1918. Relay CR–1915, as above described, initiates the series of events whereby the recorder register relays of Figs. 42, 43 and 58 are released and whereby the circuit is prepared to register the recorder number now being read and compared, which, of course, should be the first recorder 00 specified by switches 19102 and 19103.

Relay RDC–1916 operates when all the recorder register relays of Figs. 42 and 43 have restored to normal after the operation of relays CR–1915. With relay RDC–1916 operated, the recorder number entry may be recorded in the recorder register as above described.

Relay CCR–1913 releases upon the operation of relay CR–1915 and relay CR–1915 releases upon the operation of relay RDC–1916, provided relay CCR–1913 has released.

The various regular central office tape parts for recorder 00 will be processed under the condition where of the successive 280DEF entries, the D digit remains a 5 and the E and F digits remain 00. This is an NCC condition where, as above described in connection with the central office emergency tape (D digit of 6), the reader is stepped immediately provided the recorder number remains the same (relays TA–1900 and UA–1901 operated). If the recorder number does not check (one or both of relays TA–1900 and UA–1901 released and one or both of respective relays TNC–1904 and UNC–1905 operated—with relay CA–1902 operated), relay CCR–1913 will operate in a circuit from ground on conductor RON–1924, over contact 3 of relay CR–1915, contact 2 of one or both of relays TNC–1904 and UNC–1905, contact 2 of relay CA–1902 to relay CCR–1913. As above described, this operates relay CR–1915, which releases the recorder number registers and causes relay RDC–1916 to operate to record the instant number, etc. Also, provided that the last tape section processed represented the first day of the first round, then relay CCR–1913, in operating, would, as above described, reset the day and recorder progress switches 3112 and 3205 to the next recorder number 01. If this checks with the one registered from the instant 280DEF entry, the machine advances properly—if not, it will block, etc.

It is highly probable, however, that at the end of the regular central office tape for recorder 00 there will be spliced on thereto a section of straddle tape from the previous processing. This straddle tape will have been produced from the processing of the previous emergency and regular tapes. Therefore, the 280DEF entry for the regular central office tape for recorder 00 (D—5 and EF—00) may be expected to be followed by a straddle tape section beginning and ending with an entry 280DEF

(D—7 and EF—00) representing straddle tape produced for regular recorder 00 in the previous processing. In the middle of this tape may be, and very probably will be, spliced (by grooved or special splice pattern 08CDEF—CD recorder—EF hour) a section or sections of straddle tape produced for the emergency recorder acting for regular recorder 00 during the previous processing. Thus when the regular 00 tape (280500) is ended there may be a jump to regular 00 straddle tape (280700), then to emergency 00 straddle tape (280800), then back to regular 00 straddle tape (280700). All of these changes of the D digit—5 to 7, 7 to 8 and 8 to 7 represent NRP conditions which operate the relay NRP–**1909**.

With relay NRP–**1909** operated, reader step must await certain circuit operations to be described presently. As will be recalled from the discussion in Section 4.29, relay CDPC–**3111** is operated to cancel the round and day of round checks when reading this feedback straddle tape and that relays DCR–**1704** and DCDR–**1706** will be normal (even if they may have operated on the respective 284DEF and 283DEF entries because they subsequently will have been released after reader step).

If the recorder number changes (one or both of relays TA–**1900** and UA–**1901** released and the respective one or both of relays TNC–**1904** and UNC–**1905** operated), then the control circuit of Fig. 19 is open and the machine will block.

If the recorder number checks, then relay CCR–**1913** operates in a circuit extending from ground on conductor RON–**1924** in Fig. 19, over contact **3** of relay CR–**1915**, contacts **2** of relays TA–**1900** and UA–**1901**, contact **2** of relay NRP–**1909**, conductor CCH1, cable **19–17**, conductor CCH1, contacts **1** of relays DCR–**1704** and DCDR–**1706**, conductor CCH, cable **19–17**, conductor CCH, to relay CCH–**1912**, which locks over its contact **3** and contact **3** of relay CR–**1915** to conductor RON–**1924**.

A check is made under these conditions to insure that no change in hour value occurs when the next 2811EF entry is read from the tape. Relay CHS–**3506** is operated to effect this check—more accurately to cancel the cancellation of the check. In Section 4.114, concerning the checking of successive hour entries (2810EF—regular and 2811EF—end-of-tape hours), it was indicated that for normal reading of successive end-of-tape hour entries (2811EF) relay SDC–**3509** was operated to cancel the hour check but that for cases like the instant one, where relay CHS–**3506** is operated, this cancel-check is nullified. The circuit for operating relay CHS–**3506** extends from ground, over contact **1** of relay CCH–**1912**, conductor CHS, cables **1929**, **35–19** and **3530**, conductor CHS, to relay CHS–**3506**, which locks over its contact **1** to the lock conductor IL–**2511** (which, as previously described, extends into Fig. 25 and over contact **3** of relay ETE–**2502** to off-normal ground on conductor MON–**2205**). At its contact **5**, relay CHS–**3506**, in operating, opens up the circuit which operates relay SDC–**3509**, thereby to cancel the cancel-check (that is, to cause the check to be made) by extending conductor **3531** in Fig. 35 over contact **4** of relay CHS–**3506** to conductor **3524**. Relay CHS–**3506**, in operating, extends ground over its contact **2** to conductor ETEL, which extends into Fig. 25 to lock relay ETE–**2502** operated if and when it is operated. Relays CCH–**1912** and CHS–**3506**, in operating, operates relay CR–**1915** to start the cycle of events which permits the release of the present recorder number and the substitution of the recorder number being read into the register. Ground is extended from the HM2 conductor in Fig. 35 (grounded at the reader during the reader closed cycle, over contact **3** of relay CHS–**3506**, conductor CR, cables **3530**, **35–19** and **1929**, conductor CR, contact **2** of relay CCH–**1912** to relay CR–**1915**, which locks as previously described.

When the recorder number is registered, relays CCH–**1912**, CR–**1915** and RDC–**1916** release and relay CHS–**3506** will release when relay ETE–**2502** is operated at the conclusion of end-of-tape operations, all as previously described.

When the straddle tape for recorder 00 is finished there will be a transition from an entry 280700 (straddle tape for regular recorder 00) or an entry 280800 (straddle tape for emergency recorder acting for regular recorder 00) to an entry 280501 (regular tape from 01 recorder). That is, the next section of tape should be from the next higher numbered (one greater) regular recorder from regular recorder 00. This is an RP condition causing the operation of relay RP–**1908**. This, coupled with the operation of relay UNC–**1905** (because the units digit of the recorder number has changed) operates relay CCR–**1913**, as previously described, to cause a resetting of the day progress switch **3112** to the last day of the last round and an advance of the recorder progress switch **3205** to its terminal **3** corresponding to recorder number 01. The above-described processes for recorder 00 are repeated for recorder 01 etc. until the last recorder per switches **19104** and **19105** has been processed.

SPLICED-IN EMERGENCY METHOD

With the spliced-in emergency method of straddle operation, the current sections of central office emergency tape are spliced into the corresponding sections of tape from the regular central office recorders. Straddle tapes left over from previous operations, if any, are handled manually. The straddle class switch **20500** will be in position 3, thereby operating relay SIE–**1917** instead of relay F–**1918** for the feedback method. Likewise, switches **20601**, **20602** and/or **20603**, **20604** will, as above described, be set as and if required.

Under the splice-in emergency method (relay SIE–**1917** operated) of straddle operation, the D digit of the recorder number entry should change at each point where the emergency tape splice occurs but without a change in the tens and units digits of the recorder number and without a change in the 2811EF end-of-tape hour entry. The change from regular to emergency tape is a change in the D digit from a 5 to a 6. This operates relay NRP**6**–**1907**. A change from emergency to regular is a D digit change from a 6 to a 5. This operates relay NRP**5**–**1906**. If the emergency recorder was in operation at the current cutting period switches **20603** and **20604** will be set to the recorder number for which the emergency was so acting. Switches **20601** and **20602** specify the recorder number, if any, for which the emergency recorder may have been acting at the previous cutting period. As previously described, relay EF–**1910** or EL–**1911** or both will operate when the recorder progress switch setting corresponds to the settings of the respective switch pairs **20603**, **20604** and **20601**, **20602**, if any. Under this type of tape handling, as has been mentioned previously, the sequence of recorder tapes must conform to a definite sequence of numbers from first recorder through last recorder.

If the emergency recorder was in operation for the first recorder at the current cutting period the first tape section to be processed will start with a recorder number entry 2806EF, where the EF designation is the number of the first recorder corresponding to the initial setting of the recorder progress switch **3205**—and relay EF–**1910** will be operated. This tape section will be followed by a regular tape for the regular first recorder (2805EF) with other sections, if any, of emergency tape (2806EF) spliced therein. Otherwise 2805EF will occur first, etc.

Throughout the emergency tape, if it is first, the D digit of 6 (relay CA**6**–**1903** operated) and the same recorder number causes immediate reader step. The change to the regular recorder of the same number (D digit of 5 and E and F digits the same) causes relays CCH–**1912** and CHS–**3506** etc. to operate as in the case

of the NRP condition previously described (relay NRP–**1909** operated). Relay CCH–**1912** is operated over contact **3** of relay NRP**5**–**1906** instead of over contact **2** of relay NRP–**1909** in this instance. Changes from the regular to the emergency tape for the recorder operate relay NRP**6**–**1907**, which also causes the operation of relay CCH–**1912**, etc.

Upon a change from a regular recorder (D–5) to an emergency recorder (D–6) with a number change, the machine will block unless the emergency is operating for the next recorder number at the current cutting period (relay EF–**1910** operated), in which case ground will extend from conductor RON–**1924**, over contact **3** of relay CR–**1915**, contact **2** of either or both of relays TNC–**1904** and UNC–**1905**, contact **2** of relay NRP**6**–**1907**, contact **1** of relay EF–**1910**, to relay CCR–**1913**, which operates and locks as before. Likewise, any change from an emergency tape (D–6) to a regular tape (D–5) with a recorder number change, will block the machine unless the emergency recorder was operating for the previous regular recorder at the previous cutting period (relay EL–**1911** operated), in which case ground will extend over contact **2** of relay NRP**5**–**1906** and contact **1** of relay EL–**1911** to relay CCR–**1913**.

Relay CCR–**1913** operates, as previously, to permit the recorder number to progress and the recorder number registered to be changed. However, in this case (relay SIE–**1917** operated instead of relay F–**1918**, as previously), relay CAR–**7608** in the assembly register walking control circuit is operated in place of relay CR–**1915**.

The circuit for operating relay CAR–**7608** extends from ground, over contact **7** of relay CCR–**1913**, contact **1** of relay SIE–**1917**, conductor CAR into Fig. 25, cables **25–36**, **36–59**, **59–72**, **72–73**, **7315**, **7322**, conductor CAR, cable **73–76**, conductor CAR, to relay CAR–**7608**. Relay CAR–**7608**, in operating, initiates a course of action which takes the call ends from the assembling registers and perforates them on the straddle tape as described in Section 4.32. When these perforating actions are completed, trailing end-of-tape group is perforated on the straddle tape using the old day of round and round information and recorder number. Relay CR–**1915** operates over contact **3** of relay CCR–**1913** from the grounded conductor ETE–**1930** in Fig. 19 (see Section 4.32 for description of the clearing out operation which grounds this conductor at the conclusion).

4.311 *Perforating end-of-tape groups*

Throughout the input tapes various types of end-of-tape groups will be encountered. Except at the very beginning of the input tape (see Sections 4.09 and 4.10) and at the very end thereof (see Section 4.35) the end-of-tape groups are in pairs separated by splice pattern (either regular or grooved). The first one of each pair encountered is designated "odd" and the second one (across the splice) is designated the "even" group.

Between odd and even groups of a pair the circuit will, as explained in Section 4.30, skip the splice pattern and in so doing will operate relay TEG**2**–**2503**. Relay TEG**2**–**2503** will be unoperated while reading the odd groups and will be operated while reading the even groups.

If a recorder change occurs across a splice, relay CR**1**–**2505** will be operated, as described in Section 4.31, thereby causing the operation of relay CRC–**7610** to initiate a series of events described in Section 4.33.

Assuming that no recorder change occurs across the splice, relay TEG**2**–**2503** will be operated and relay CR**1**–**2505** will be released. This eliminates the even end-of-tape groups from consideration for perforation on the output straddle tape, as described under the heading "Eliminating duplication of tape ends on straddle tape" below, no matter what type of straddle operation is used.

At the end of reading the odd groups relays CR**1**–**2505** and TEG**2**–**2503** will be released. This presents four main situations as follows:

(1) Under the spliced-in-emergency type of straddle operation (relay SIE–**1917** operated) one of the common class relays TFE–**6508** and TE–**6507** will be operated depending upon whether or not a transfer code (285DEF—D is 5 or 7 for a synchronous or a non-synchronous transfer—EF is recorded number) was received as part of the odd group, as described below under "SIE—transfer or no transfer";

(2) Under the feedback method of straddle operation (relay F–**1918** operated) an odd end-of-tape group on a regular or emergency tape containing no transfer code (285DEF) will operate the common class relay TE–**6507**, as described below under "F—no transfer—regular or emergency";

(3) Under the feedback method of straddle operation odd end-of-tape groups containing a transfer code (285DEF) are arranged to operate relay CRC–**7610** (to produce call starts) at the beginning of an emergency tape section and to operate relay CAR–**7608** (to produce call ends) at the end of an emergency tape section and to operate relay CAR–**7608** upon a transfer in a regular tape section and to operate relay CRC–**7610** at the resumption of calls on the regular tape, as described below under "F—call starts and call ends"; and,

(4) Under the feedback method of straddle operation an odd end-of-tape group on a regular straddle or emergency straddle tape will cause the operation of relay ETE–**2502** (to end tape identity progress without perforating an end-of-tape group on the straddle tape) or will operate one of the common class relays TFE–**6508** or TE–**6507**, depending upon whether or not an entry was placed on the straddle tape between this end-of-tape group and the previous one, as described below under "F—straddle tape input."

ELIMINATING DUPLICATION OF TAPE ENDS ON STRADDLE TAPE

Relay TEG**2**–**2503** operates from the skip splice control (as described in Section 4.30) to eliminate the even alternate end-of-tape groups from consideration for possible duplication on the output straddle tape. This is because these odd and even end-of-tape groups are duplicates and there is no use in repeating the duplication. This action is the same for both types of straddle operation.

Relay TEG**2**–**2503** operates on reading the spliced pattern between an odd and even end-of-tape group. This relay remains locked to relay ETE–**2502** normal so that it is not released until the tape identity progress control had concluded action after reading and checking the succeeding (even) end-of-tape group.

With relay TEG–**2503** operated and relay CR**1**–**2505** normal (as a result of no change in the recorder number), the completion of reading and checking the even end-of-tape group causes the operation of relay ETE–**2502** in a circuit extending from ground on conductor ON–**1117** in Fig. 22, over contacts **4** of of relays CL**2**-**2202**, CL**1**–**2201** and CL**0**–**2200**, conductor **2108**, contact **3** of relay CL**3**–**2103**, contact **2** of relay CL**4**–**2101** (all normal because the reading and checking of the odd-first one encountered at a splice-end-of-tape group is finished), conductor **2113**, contact **4** of relay STE–**2203** (released because no straddle timing entry is being received), conductor TE–**2215**, cables **2204**, **25–22** and **2512**, conductor TE–**2215**, contact **7** of relay FI–**2500** (released when the first end-of-tape has been read and checked), contact **4** of relay CR**1**–**2505**, conductor TE–**2516**, cables **42–25** and **4214**, conductor TE–**2516**, contact **3** of relay C**5**–**4203** (if the recorder tape is regular) to conductor **5**–**4221** or contacts **3** of relays C**6**–**4204** (if the tape is an emergency tape) and T**0**–**4200** or T**1**–**4201** to conductor **6**–**4215** or contact

3 of one of relays C7–4205 and C8–4206 (if the tape is a straddle tape) to conductor 78, cables 4214 and 42–25 into Fig. 25 where conductors 5–4221 and 6–4215 and 78 emerge and extend alternatively over contact 6 or 4 or 2 of relay TEG2–2503 to conductor ETE–4213, thence into Fig. 17, over contact 3 of relay DCDR–1706 and contact 2 of relay DCR–1704 (both released because no change in round or day of round occurs across the splice), conductor ETE–1709, cables 25–17A, 25–31 and 3114, conductor ETE–1709, contacts 3 of relays DPRS–3106 and DPS–3109 (no change in day across the splice), to the armature of relay FDR–3105 which cooperates with contacts 6 and 7 thereof. Contact 6 is effective, as described in Section 4.29, only when the feedback method of straddle operation (relay F–1918 operated) is being used and when relay FDR–3105 is operated as an indication that the first day of the first round has been processed—that is, relay CDPC–3111 will be operated to cancel the day progress check prior thereto, the operation of relay CDPC–3111 extending its operating ground over its contact 2 to conductor ETE–3119. Otherwise ground will extend over contact 7 of relay FDR–3105 to conductor ETE–3119. The grounded conductor ETE–3119 extends over cable 32–31A, conductor ETE–3119, contact 4 of relay RP–3202, conductor ETE–3223, cables 2204 and 25–22, conductor ETE–3223 to relay ETE–2502. Relay ETE–2502 in operating, releases relay TEG2–2503 which releases relay ETE–2502.

SIE—TRANSFER OR NO TRANSFER

Under the spliced-in-emergency method of straddle operation (relay SIE–1917 operated) at the end of an odd end-of-tape group and before splice skipping is started relay TEG2–2503 will be released. The grounded conductor TE–2516 out of cable 4214 in Fig. 42 will be extended either over contact 3 of relay C5–4203 (if the recorder was a regular recorder—D digit of the 280DEF entry was a 5) to conductor 5–4221 into cable 4214 or conductor TE–2516 will be extended over contact 3 of relay C6–4204 (emergency recorder—D digit of 280DEF entry was a 6) and over contact 3 of relay T0–4200 or relay T1–4201 (emergency recorder not idle) to conductor 6–4215 into cable 4214. Conductors 5–4221 and 6–4215 extend over cables 4214 and 42–25 into Fig. 25 where they emerge and extend over contacts 5 and 3 of relay TEG2–2503 to conductors 51 and 61–2517, cable 25–19, conductors 51 and 61–2517, contacts 5 and 6 of relay SIE–1917 to conductor TE–1925, over cable 25–19, conductor TE–1925, contact 6 of relay EPW–2504, conductor TE–2520, cables 25–36, 36–59, 59–72, 72–73, 7315 and 7323 into Fig. 73, conductor TE–2520 and either over contact 7 of relay 285R–7303 (if no transfer code 285DEF was in the end-of-tape group) to conductor TE into cable 73–65 or over contact 6 of relay 285R–7303 (if a transfer code 285DEF was received) to conductor TFE into cable 73–65.

These two conductors TE and TFE extend over cable 73–65 into Fig. 65 to operate respective common class translator relay TE–6507 or TFE–6508. In Sections 4.09 and 4.10 the perforating of leading end-of-tape patterns on regular and on straddle tapes was described in detail in connection with the alternative operation of one of the relays LTI–6501, LTE–6504 and LTFE–6506. The action is the same for relay TE–6507 or TFE–6508. For relay TE–6507, contact 9 thereof grounds conductor 5L–6530 into cable 65–64 to specify a five-line entry which, as specified by contacts 4 through 8 of relay TE–6507, is 284DEF, 283DEF, 280DEF, 281DEF and 282DEF. That is, conductors 284, 283, 280, 281 and 282 into cable 6527 are successively grounded and extend over cables 6527, 65–72 and 72–71 into Fig. 71 where they emerge to successively operate relays 284–7108, 283–7107, 280–7104, 281–7105 and 282–7106 of the common pattern connector. These latter relays, as previously described, set up the proper information to fill in the D, E and F digits of the lines to be perforated on the straddle tape without a transfer entry (285DEF) and without splice pattern. For relay TFE–6508, contact 10 thereof grounds conductor 6L–6528 into cable 65–64 to specify a six-line entry, which, as specified by contacts 4 through 9 of relay TFE–6508 is 284DEF, 283DEF, 280DEF, 285DEF, 281DEF and 282DEF. That is, conductors 284, 283, 280, 285, 281 and 282 into cable 6527 are successively grounded and extend over cables 6527 and 65–72 into Fig. 72 where these conductors, except 285, extend via cable 72–71 into Fig. 71 as described for relay TE–6507, conductor 285 emerging from cable 7212 in Fig. 72 to operate relay 285–7206. These relays, as previously described, set up the proper information to fill in the D, E and F digits of the lines to be perforated on the straddle tape with a transfer entry (285DEF) and without splice pattern.

When the output entry group is finished (relay PRL–5905 operated as previously described) relay ETE–2502 is operated to revert the tape identity progress, checking, etc. circuits to normal and to permit advance of the reader, etc.

F—NO TRANSFER—REGULAR OR EMERGENCY

Under the feedback method of straddle operation (relay F–1918 operated) an odd end-of-tape group on a regular (2805EF) or an emergency (2806EF) tape with no transfer code (285DEF) will cause the operation of relay TE–6507 as follows. Conductor 51 or 61–2517 out of cable 25–19 in Fig. 19 (as previously described) will extend over contact 6 or 7 of relay F–1918, conductor 5–1931 or 6–1924, cable 25–19, conductor 5–1931 or 6–1924, contact 2 or 4 of relay TF–2506, conductor TE–1925, contact 6 of relay EPW–2504, conductor TE–2520, cables 25–36, 36–59, 59–72, 72–73, 7315 and 7323, conductor TE–2520, contact 7 of relay 285R–7303, conductor TE, cable 73–65, conductor TE, to relay TE–6507.

F—CALL STARTS AND CALL ENDS

Under the feedback method of straddle operation whenever there is a transfer to or from an emergency or regular recorder relay CAR–7608 or relay CRC–7610 will be opeated at the end of odd end-of-tape groups. Relay CRC–7610 will be operated at the beginning of an emergency tape section to set up the assembling registers to accept and produce call starts as described in Section 4.33. Relay CAR–7608 will be operated at the end of an emergency tape section to clear call ends from assembling registers as described in Section 4.32. The same actions occur at the time a regular recorder transfers to an emergency (CAR–7608) and when calls are resumed on the regular tape (CRC–7610). This causes corresponding call-starts and call-ends to be placed on the straddle tape.

In order for this arrangement to function properly there must be means for discriminating between alternate end-of-tape groups so that the beginning of tape sections (regular or emergency) may be identified. The means provided for this purpose is a well-known W–Z relay combination embodied in relays TFW–1700 and TFZ–1701 and their related circuits. The relay TFZ–1701 is the working relay and whether it is operated or released specifies whether a beginning or an end of a tape section is encountered. As a starting point, the winding of relay TFZ–1701 is shunted down in a circuit extending from the right side of the winding thereof over contact 2 thereof and over contact 2 of relay TFW–1700 to the left side of the winding of relay TFZ–1701. Although relay TFW–1700 is not shunted down, nevertheless conductor WZ is open at contact 5 of relay TF–2506 and so relay TFW–1700 is also released.

Under the feedback method relay F–1918 is operated. This applies ground over its contact 4 to conductor WZP,

which extends over cable 25–19 into Fig. 25 where conductor WZP emerges and appears before contact 2 of relay TI–2501. Relay TI–2501 operates upon the reading of a tape identity end-of-tape group and locks under the control of relay ETE–2502. This extends conductor WZP over contact 2 of relay TI–2501 to contact 9 of relay TEG2–2503, which, as previously described, operates upon the skipping of splice pattern between end-of-tape groups. In the meantime, if a transfer code (285DEF) is encountered during the reading of the odd end-of-tape group, relay TF–2506 will have been operated. Thus, at the splice pattern conductor WZP will be extended over contact 2 of relay TI–2501, contact 9 of relay TEG2–2503, contact 5 of relay TF–2506 to conductor WZ into Fig. 17. At the time that relay ETE–2502 is operated subsequent to the reading and skipping of splice pattern and the reading and checking of the even end-of-tape group relays TI–2501 and TEG2–2503 release and conductor WZ in Fig. 17 is opened again. This action is repeated for each pair of odd and even end-of-tape groups containing a transfer code.

The effect of the aforementioned grounding and ungrounding of conductor WZ in Fig. 17 for each respective odd and even end-of-tape transfer groups is to operate relay TFW–1700 on the first odd group, to operate relay TFZ–1701 and to hold operated relay TFW–1700 on the first even group, to release relay TFW–1700 and to hold relay TFZ–1701 operated on the next odd group and to release relay TFZ–1701 on the next odd group, etc. The first grounding of conductor WZ in Fig. 17 operates relay TFW–1701 by extending conductor WZ over contact 2 of relay TFW–1701 to the left side of relay TFW–1701, the right side being returned to resistance battery. Relay TFZ–1701 remains shunted down over contact 2 of relay TFZ–1701 and contact 2 of relay TFW–1700. Relay TFW–1701 operates and in doing so disconnects conductor WZ from the transfer contact 1 of relay TFW–1701 and applies ground from conductor MON–2205 over its contact 1 to maintain the shunt across relay TFZ–1701 until ground is removed from conductor WZ. The next end-of-tape group (even one of the pair) will, by virtue of the operation of relay ETE–2502 and the resulting release of relays TI–2501 and TEG2–2503, remove ground from conductor WZ. This permits relay TFZ–1701 to operate in a circuit extending from ground on conductor MON–2205, over contact 1 of relay TFW–1700, relay TFZ–1701 to resistance battery, relay TFW–1700 remaining operated. When the next odd transfer group is read, conductor WZ is again grounded. This shunts down relay TFW–1700 over contact 1 of relay TFZ–1701, relay TFZ–1701 remaining operated. The next end-of-tape group (even) releases relays TEG2–2503, etc. thereby shunting down relay TFZ–1701, etc. This process than repeats itself. The net result is that on alternate odd transfer groups relay TFZ–1701 is released and on the intermediate ones relay TFZ–1701 is operated.

Thus, at the beginning of an emergency tape section where there is a transfer code (285DEF) an alternate odd group—relay TFZ–1701 is released, thereby to operate relay CRC–7610: at the end of such a section—an intermediate odd group—relay TFZ–1701 is operated, thereby to operate relay CAR–7608. Likewise, at the time of a transfer from a regular to an emergency tape—an alternate odd group—relay TFZ–1701 is released, thereby to operate relay CAR–7608: at the time of a transfer back to the regular tape—an intermediate odd group—relay TFZ–1701 is operated, thereby to operate relay CRC–7610.

These circuits for operating relay CRC–7610 and CAR–7608 are as follows. Conductor 5–1931 out of cable 25–19 in Fig. 25 (regular recorder tape) extends over contact 1 of relay TF–2506 and conductor 2522 into Fig. 17 where it extends over either contact 6 or 5 of relay TFZ–1701 to either conductor CAR or CRC–2518, into Fig. 25 and over cables 25–36, 36–59, 59–72, 72–73, 7315 and 7322, conductors CAR and CRC–2518 into and over cable 73–76 to Fig. 76 where they emerge to operate respective relays CAR–7608 and CRC–7610. Conductor 6–1924 out of cable 25–19 in Fig. 19 (emergency recorder tape) extends over contact 3 of relay TF–2506 to conductor 2523 into Fig. 17 and over either contact 4 or 3 of relay TFZ–1701 to either conductor CRC–2518 or CAR, etc.

F—STRADDLE TAPE INPUT

When the feedback method is in operation and the regular or emergency straddle tapes are being read it will or will not be necessary to cause tape end groups to be perforated on the output straddle tapes depending respectively upon whether or not an entry was placed on the straddle tape between the reading and checking of successive end-of-tape groups. Relay SR–2507 is the means for detecting this alternative condition. If the system is between end-of-tape groups relays TI–2501 and ETE–2502 will be released. If during this time an entry is placed on the straddle tape (the straddle perforator register relay P0D–10100 operated), then relay SR–2507 operates in a circuit from ground, over contact 1 of relay TI–2501, conductor SR1, cables 25–103 to Fig. 103, cable 103–101, conductor SR1, contact 3 of relay P0D–10100, conductor SR, cables 103–101 and 25–103 into Fig. 25, conductor SR, to relay SR–2507, which operates and locks over its contact 1 to conductor IL–2511 until relay ETE–2502 is operated.

With relay SR–2507 operated and relay TEG2–2503 released at the end of an odd end-of-tape group ground will extend from the aforementioned grounded conductor TE–2516 out of cable 4214 in Fig. 42, over contact 3 of relay C7–4205 (for a regular straddle tape) or relay C8–4206 (for an emergency straddle tape) to conductor 78, cables 4214 and 42–25, conductor 78, contact 1 of relay TEG2–2503, contact 3 of relay SR–2507, conductor TE–1925, contact 6 of relay EPW–2504, to conductor TE–2520 into cable 25–36, etc. as previously described, to operate relay TFE–6508 or relay TE–6507 depending upon whether or not a transfer code (285DEF) has been detected by the operation or not of relay 285R–7303. This, as previously explained, will cause an end-of-tape group respectively with or without a transfer code to be perforated on the output straddle tape at this time.

With relay SR–2507 released relay ETE–2502 is operated over one of a number of paths to end the tape identity progress without causing the perforation of an end-of-tape group on the output straddle tape. The above-described circuit (which extended over the contact 3 of relay SR–2507) will extend over contact 4 of relay SR–2507 to conductor TE–2521 and over cables 42–25, 4219 and 42–61 into Fig. 61 where conductor TE–2521 emerges.

If any one or more of the first call relays of the assembling registers (such as relay FC00–6201 of assembling register No. 00 and relay FC99–5601 of assembling register No. 99, etc.) be released, then, as described in Section 4.33, relay FCCD–6113 will be operated. Likewise, if any one or more of the first call relays be operated, relay FCCU–6112 will be operated.

If no first call relays are operated (relay FCCD–6113 operated and relay FCCU–6112 released), the grounded conductor TE–2521 out of cable 42–61 in Fig. 61 will extend over contact 2 of relay FCCD–6113 and contact 3 of relay FCCU–6112 to conductor ETE–4213 into cables 42–61, etc. to operate relay ETE–2502, as previously described.

If all first call relays are operated (relay FCCD–6113 released) or if less than all first call relays are operated (relays FCCD–6113 and FCCU–6112 operated), the grounded conductor TE–2521 out of cable 42–61 in Fig. 61 will extend respectively either over contact 3 of relay

FCCD–6113 to conductor TE–6127 into cable 72–61 or over contact 2 of relays FCCD–6113 and FCCU–6112 to conductor TE–6127 into cable 72–61. Conductor TE–6127 extends over cables 72–61, 72–73, 7315 and 7323 into Fig. 73 where it emerges and appears before contacts of the relays NSTF–7302, STF–7300 and NSMB–7301, which, as previously described, operate if and when a respective non-synchronous transfer (2857EF), a synchronous transfer (2855EF) or an non-synchronous make-busy (2856EF) may have been received as a transfer code (285DEF) in an end-of-tape group.

If no transfer code was received (relays NSTF–7302, NSMB–7301 and STF–7300 released) or if a synchronous transfer code was received (relay STF–7300 operated), then the grounded conductor TE–6127 out of cable 7323 in Fig. 73 will extend over either contact 10 of relay NSTF–7302 and contact 9 of relay NSMB–7301 and contact 9 of relay STF–7300 to conductor ETE–4213 or over contact 8 of relay STF–7300 to conductor ETE–4213, to operate relay ETE–2502.

If a non-synchronous transfer or make-busy was received (2857EF or 2856EF), the grounded conductor TE–6127 out of cable 7323 in Fig. 73 will extend over contact 9 of relay NSTF–7302 or contact 8 of relay NSMB–7301 to the lower winding of relay DCE–7314 to operate same. Relay DCE–7314, in operating, extends its operating ground over its contact 2 to conductor ETE–4213 to be sure that relay DCE–7314 operates fully before relay ETE–2502 can be operated. Other functions for relay DCE–7314 are discussed in Section 4.37 regarding "Cancelling timing entries," etc.

4.32 *Clearing assembling registers of call ends and forming call end straddle entries*

Under the feedback straddle method when a point is reached in the processing of a regular recorder tape where the regular recorder was transferred to the emergency recorder, any timing entries which may be then still registered in the assembling registers must be cleared out to the output straddle tape as call-end entries. The associated call-starts will have been perforated on the straddle tape at the time the emergency recorder tape section was processed as described in Section 4.34. A similar condition (clearing out call-ends) occurs when ending the processing of an emergency recorder tape section (where a transfer back to the regular recorder is indicated). Call-starts for the latter situation are handled at the start of an emergency tape section as described in Section 4.34.

With the feedback method of straddle operation the assembling registers should contain no timing entries when a change in recorder number occurs since all previous straddle call elements should have been automatically assembled from the input straddle tape section for the old recorder number and read just previous to detecting such a change.

With the spliced-in emergency method of straddle operation, however, the clearing of timing entries from assembling registers to the output straddle tape occurs whenever a change in recorder number is detected but does not occur when a change to or from the emergency recorder occurs since these latter straddle type of call elements are placed in proper order on the input tape as a result of the physical spliced-in operation.

When clearing assembling registers, relay CAR–7608 is operated from the tape identity progress control circuit of Fig. 25 or from the recorder register control circuit of Fig. 19, as described in Sections 4.31 and 4.311. Relay CAR–7608, in operating, releases the relay RC–900 and prepares to operate relay WC–901, as described in Section 4.33. Relay SW–7609 operates, followed by the operation of relay WC–901 and then relay WST–7607 operates through relays WC–901, UDC–7603 and TDC–7602 operated as in Section 4.33.

With relay CRC–7610 normal and relays WST–7607 and UDC–7603 operated, a path is closed to operate relay U0–7500 of the assembling register units walking circuit of Fig. 75. Ground extends over contact 4 of relay CRC–7610, contact 2 of relay WST–7607 and contact 2 of relay UDC–7603 to conductor 7618 to operate relay U0–7500, which operates and locks over its contact 7 and contact 9 of relay U1–7501 to conductor L–913 previously traced to ground over contact 17 of relay WC–901. Relay GT–7410 of the assembling register tens lockout circuit of Fig. 74 operates and, assuming that at least one of a group of 10 assembling registers contains a timing entry, at least one of the relays T0–7400 to T9–7409 will operate and will lock through relays TS–7604 normal and relay WC–901 operated. The operating circuit for relay GT–7410 is described in Section 4.33. The operating leads for the relays T0–7400 to T9–7409 of Fig. 74, T0 to T9 extend back over cable 7413, conductors T0 to T9, contacts 2 to 11 of relay GT–7410, leads 00–09 to 90–99 and over cable 63–74 into Fig. 63 where conductors 00–09 to 90–99 emerge. Since the disclosure shows details only of assembling registers No. 00 (Figs. 62 and 63) and No. 99 (Figs. 56 and 57), conductor 10–19 to 80–89 are not extended since the conductors 00–09 and 90–99 which are connected into assembling registers Nos. 00 and 99 adequately illustrate the situation. Conductor 00–09 connects in Fig. 63 to contact 1 of key 00 for register 00, connects to contacts 1 of keys 01 to 08 (not shown) for registers 01 to 08 (not shown) and connects in Fig. 57 to contact 1 of key 09 for register 09 (not shown); whereas, conductor 90–99 connects in Fig. 57 to contact 1 of key 90 for register 90 (not shown), connects to contacts 1 of keys 91 to 98 (not shown) for registers 91 to 98 (not shown) and connects in Fig. 57 to contact 1 of key 99 for register 99. According to previous description, if a disconnect timing entry is in a register, such as register 00 or 99, its relays DS00–6200 or DS99–5600 will be operated and if an answer timing entry is in a register the relay AS00–6300 or AS99–5700 will be operated. Relay DS00–6200, over its contact 6, or relay AS00–6300, over its contact 1 grounds conductor R0–6303 which extends over contact 1 of key 00 to ground conductor 00–99. Similar relays in registers 01 to 09 will under similar circumstances also ground conductor 00–09. Likewise, similar relays (not shown) in registers 10 to 19 (not shown) will ground conductor 10–19, etc. and similar relays DS99–5600 and AS99–5700 in register 90 to 99 will ground conductor 90–99. Returning to Fig. 74 it will be apparent that a relay T0–7400 to T9–7409 will operate for each associated group of ten assembling registers wherein any one register contains at least one timing entry.

The operation of one of the relays of Fig. 74 releases relay TDC–7602 which thereupon holds relay SW–7609 from releasing in a circuit extending from relay SW–7609, over contact 1 of relay CAR–7608, contact 1 of relay SW–7609, and over contact 3 of relay TDC–7602 to off-normal ground on conductor WON–914 and permits relays WST–7607 and GT–7410 to release in turn.

Only one relay T0–7400 to T9–7409 may lock operated at any one time, the lowest numbered one being preferred. For instance, if relay T0–7400 had operated, it would lock over its contact 4, conductor TL and contact 1 of relay TS–7604 to conductor WON–914. The locking circuit for any other relay T1–7401 to T9–7409 would be open at contact 3 of relay T0–7400, if not elsewhere. Any other relay, such as relay T5–7405 for instance, may lock only if all lower numbered relays are released, as is obvious. A one and only check circuit through the relays of Fig. 74 operates relay TUC–7600 in a circuit from off-normal ground on conductor MON–1237 in Fig. 74,

over an obvious circuit over contact 1 or 2 of relay T0–7400, contact 1, 2 or 3 of relays T1–7401 to T8–7408 and contact 2 or 3 of relay T9–7409, depending upon which one is locked operated, to conductor TUC into Fig. 76 to operate relay TUC–7600.

With relay U0–7500 of the assembling register units walking circuit of Fig. 75 operated, relay UDC–7603 releases and relay UUC–7601 operates over a one-and-one only path from ground, over contact 2 of relayU0–7500, contacts 3 of relays U1–7501 to U7–7507, contacts 5 of relays U8–7508 and U9–7509 to conductor UUC into Fig. 76 to relay UUC–7601.

A path is closed through relays TUC–7600 and UUC–7601 operated, relay US–7605 normal, relay U0–7500 operated and relay WSRO–7612 normal to operate relay WSRE–7611. This circuit extends from ground on the lock conductor L–913 in Fig. 76, over contacts 1 of relays TUC–7600 and UUC–7601, contact 2 of relay US–7605, conductor 7619, contact 8 of relay U0–7500, conductor UE, contact 4 of relay WSRO–7612 to relay WSRE–7611.

With a units relay (Fig. 75) and a tens relay (Fig. 74) operated and the relay WC–901 operated, the E and F digit reading relays of Fig. 15 are now receiving on a two-out-of-five basis the call identity index for an assembling register in a group which is known to contain at least one assembling register with a timing entry. Off-normal ground on conductor WON–914 (from conductor MON–1242 of Fig. 12 over contact 19 of relay WC–901) in Fig. 76 extends over contacts 5 and 6 of relay US–7605 and contacts 2 and 3 of relays UUC–7601 and TUC–7600 to conductors 7620 and 7621 into Figs. 75 and 74. In Fig. 74, conductors 7620 and 7621 extend over contacts 5 and 6 or 6 and 7, as the case may be, of the operated tens relay to ground the corresponding two of the five conductors E0 to E7 into cables E–7414 and 9–75 to Fig. 9. In Fig. 75, conductors 7620 and 7621 extend over contacts 9 and 10 of relay U0–7500 to ground conductors F4 and F7 into cables F–7511 and 9–75 to Fig. 9. In Fig. 9 cables E–7414 and F–7511 emerge out of cable 9–75 and the two sets of two-out-of-five grounded conductors emerge and extend over contacts 2 to 6 (E digit) and 7 to 11 (F digit) of relay WC–901 to the E and F reading relays of Fig. 15 to operate same. Relay WC–901, in operating, operates relay A2–1302, by grounding conductor A2–738 at its contact 1, to aid in simulating the reading condition while selecting and reading into an assembling register.

A path may now be traced to close ground to the start lead to start the operation of the connectors of the assembling register to be selected by the number of the call identity index now operating the E and F digit reading relays. This path is from off-normal ground on conductor WON–914 in Fig. 9, over cables 903, 9–75 to Fig. 75 and 76–75, conductor WON–914, contact 8 of relay US–7605, conductor US–7622, cables 76–75, 9–75 to Fig. 9 and 903, conductor US–7622, contact 14 of relay WC–901, conductor BN8–916, cables 9–18 and 18–26, conductor BN8–916, contact 10 of relay FI–2500, conductor BN8–2519, cable 23–25, conductor BN8–2519, contact 8 of relay A2—1302, conductor CST–1312, cable 14–61, conductor CST–1312, to relay CST–6100. Upon the operation of relay CST–6100, a series of operations occur whereby the selected assembling register is connected to the even call entry register to transfer the timing entry (or entries) thereto and to effect the release of the assembling register. Then the walking circuit of Figs. 75 and 76 advances to the next higher numbered assembling register. When the assembling register and the connector control therefor have been restored to normal relay WSRE–7611 is released. Relay WSRO–7612 is thereupon operated to select the odd call entry register to read out the call end from the next higher numbered assembling register. This process (WSRE–7011, WSRO–7612) alternates the call ends from the odd to the even, etc. call registers until all assembling registers have been taken care of.

The detailed description to follow will skip the even call entry register operation because only the odd side has been disclosed in detail. It will be assumed, therefore, that the units walking circuit of Fig. 75 has released relay U0–7500 and has operated relay U1–7501 in its stead and that relay WSRO–7612 is operated and relay WSRE–7611 is released, the first selected assembling register having been cleared and released. This action will have come about as follows. Conductor UCWE in Fig. 76 is grounded under the control of an up-check in the call identity index register of the even side (Fig. 138). The grounded conductor UCWE extends over contact 5 of relay WSRE–7611, conductor S–7623 into Fig. 75, over contact 1 of relay U9–7509, conductor US–7512 to Fig. 76 to operate relay US–7605, which locks over conductor US–7512, contact 1 of relay U9–7509, conductor S–7623, contact 7 of relay US–7605 and the contact of relay U2UC–7606 to ground on conductor WON–914. The operation of relay US–7605 indicates a successful use of the call identity index produced by the assembling register tens lockout (Fig. 74) and units walking (Fig. 75) circuit. The even call register receives the timing information and restores the assembling register to normal. In the meantime, relay US–7605, in operating, causes the release of the E and F digit reading relays and operates relay U1–7501 in a circuit extending from off-normal ground on conductor WON–914 in Fig. 76, over contact 3 of relay US–7605, conductor U–7513 into Fig. 75, over contact 7 of relay U9–7509, contact 6 of relay U0–7500 to relay U1–7501. Relay U1–7501 locks over its contact 7 and contact 10 of relay U2–7502 to conductor L–913 and maintains relay U0–7500 locked over contact 7 of relay U0–7500, contact 8 of relay U1–7501, conductor UH into Fig. 76 to conductor WON–914 over contacts 4 and 3 of relay US–7605. With two consecutive units walking relays (Fig. 75) operated, relay U2UC–7606 operates in a circuit extending from ground, over contact 2 of relay U0–7500, contact 4 of relay U1–7501 to conductor 7514 to operate relay U2UC–7606. Relay U2UC–7606, in operating, releases relay US–7605 provided the ground on conductor UCWE at contact 5 of relay WSRE–7611 has been removed by the release of the even side answer-disconnect connector DRE–13200 of Fig. 132. Relay UUC–7601 releases when relay U1–7501 operated because the one-and-one-only check was broken. This opens the operating path for relay WSRE–7611 which does not release, however, until ground is removed from the lock lead WSRH which extends over cable 73–76, conductor WSRH, cables 7322, 7315, 72–73, and 72–61, conductor WSRH, to the locking and operating grounds for relays ADD–6107 and RLS–6108 of the assembling register connector control.

Relay WSRE–7611 will release when relays ADD–6107 and RLS–6108 are released and relay UUC–7601 operates. With the release of relay US–7605, relay U0–7500 releases. Relay UUC–7601 then reoperates closing a path to operate relay WSRO–7612 in a circuit extending from ground on the lock conductor L–913 in Fig. 76, over contacts 1 of relays TUC–7600 and UUC–7601, contact 2 of relay US–7605, conductor 7619, into Fig. 75, over contact 10 of relay U1–7501, conductor U0 into Fig. 76 and over contact 4 of relay WSRE–7611 to operate relay WSRO–7612, which operates and prepares over its contact 3 a locking circuit on conductor WSRH, previously mentioned. Relay CST–6100 is now operated as above described. In addition, a path through relay A1–1301 normal and relays WC–901 and WSRO–7612 operated closes to operate relay connector CLCO–8401 associated with the odd call entry register and another path closes through relay SR1O–2705 to operate relay ADCN–6106 of the assembling register connector control of Fig. 61. Ground on the conductor BN8–2519, above described,

in Fig. 13 also extends over contact 8 of relay A1–1301 (A digit is not a 1 or a 3), conductor 2–1318, cable 15–13 to conductor 2–1318. Conductor 2–1318 extends from Fig. 15 into Fig. 9 and over contact 16 of relay WC–901, conductor 2–919, cables 903, 9–75 to Fig. 75, 9–75 and 76–75, conductor 2–919, contact 1 of relay WSRO–7612, conductor CL–12309, cables 8601, 8602, 8603, 86–84, conductor CL–12309 to relay CLCO–8401. Conductor 2–1318 in Fig. 15 also extends over cable 26–15, conductor 2–1318, contact 3 of relay SR1O–2705, conductor AD–2617, cables 42–25, 4219 and 42–61, conductor AD–2617 to relay ADCN–6106.

The operation of relay CLCO–8401 operates relay OADR–12404 followed by the operation of the odd side answer-disconnect register connector relays ARO–8200 and DRO–7900, all as previously described. These connector relays, on operating, connect the answer and disconnect multiples ANSMUL and DISMUL from the assembling registers to the answer and disconnect registers in the odd call register portion of the machine (in Figs. 77 to 82), as indicated by the operated relay WSRO–7612.

The answer and disconnect connectors of the selected assembling register, such as relays ANS00–6301 and DISC00–6203 for assembling register No. 00, are operated through the E and F digit reading relay translators of Figs. 23 and 24 and the answer-disconnect connectors, as described in Sections 4.121 and 4.122.

Relay OES–12603 operates (to indicate that the information being registered is for straddle call ends) in a circuit extending from ground, over contact 20 of relay WC–901, conductor ES, cables 9–17, 17–58 and 5824 to Fig. 82 where conductor ES emerges and extends over contact 34 of connector ARO–8200, conductor ES into cables 8203 and 82–124 to Fig. 124, 124–125, 12509 and 125–126, conductor ES, to relay OES–12603, which operates and locks over its contact 6 to ground on the lock lead L–8004 as previously described.

A circuit is closed through the call identity index tens and units digit registers of Fig. 84, the operated answer-disconnect register connector relay DRO–7900 and relay WSRO–7612 operated and through relay U9–7509 normal to operate relay US–7605, indicating the successful use of the call identity index produced by the assembling register tens lockout and units walking circuit of Figs. 74 and 75. This circuit extends from ground in Fig. 84, over a two-out-of-five check circuit of the call identity index tens and units registers of Fig. 84 to conductor UC–8405, thence over contact 35 of relay DRO–7900, conductor UCWO, cables 79–82, 82–84, 8402, 86–84, 8603, 8602 and 8601, conductor UCWO, contact 5 of relay WSRO–7612, conductor S–7623, contact 1 of relay U9–7509, conductor US–7512, to relay US–7605. The call register and its control continue to receive and to register from the selected assembling register any timing entries which may be contained therein and to control the restoration to normal of the assembling register in the usual manner as described in Sections 4.121 and 4.122.

In the meantime, the assembling register walking circuit of Fig. 75 is steered to the next higher numbered assembling register as follows: Relay US–7605 operates releasing the E and F digit reading relays of Fig. 15 by opening at its contacts 5 and 6 the ground supplied to the translating networks on the assembling register tens lockout and units walking circuits of Figs. 74 and 75.

Relay US–7605, in operating, also closes a path through relay U9–7509 normal and relay U1–7501 operated to operate relay U2–7502 from ground on conductor WON–914 in Fig. 76, over contact 3 of relay US–7605, conductor U–7513, contact 5 of relay U0–7500, contact 6 of relay 7501, to relay U2–7502, which operates and locks over its contact 8 and contact 10 of relay U3–7503 to the lock conductor L–913, which, as previously described, extends eventually to ground over contact 17 of relay WC–901. Relay U1–7501 remains operated over its contact 7, contact 9 of relay U2–7502, conductor UH and over contacts 4 and 3 of relay US–7605 to ground on conductor WON–914.

With two consecutive walking relays such as relays U1–7501 and U2–7502 operated, a path is closed to operate relay U2UC–7606 from ground, over contact 1 of relay U0–7500, contact 2 of relay U1–7501, contact 5 of relay U2–7502, conductor 7514, to relay U2UC–7606. This relay, in operating, opens at its contact a circuit which holds relay US–7605 locked operated so that relay US–7605 may release if the answer-disconnect register connector relay DRO–7900 has released as a result of the completion of the registration process in the odd call register portion of the machine.

Relay UUC–7601 releases when relay U2–7502 operates. This action opens the operate path for the relay WSRO–7612. This relay WSRO–7612 is held operated, however, (over conductor WSRH and contact 3 of relay WSRO–7612) by either of relays ADD–6107 or RLS–6108 of the assembling register connector control (Fig. 61) being operated. When the assembling register previously selected and the assembling register connector control of Fig. 61 have been fully restored to normal, the WSRO–7612 relay may release.

Relay UUC–7601 reoperates when relay U1–7501 releases, thereby closing a path for operating relay WSRE–7611 through relay WSRO–7612 normal. This circuit will extend from ground on the lock conductor L–913 in Fig. 76, over contacts 1 of relays TUC–7600 and UUC–7601, contact 2 of relay US–7605, conductor 7619, contact 11 of relay U2–7502, conductor UE, contact 4 of relay WSRO–7612 to relay WSRE–7611. This action selects the other (even again) call register for handling the read out from the next higher number assembling register as indicated by the two-out-of five code produced by the operated relay U2–7502 in turn operating the reading relays FO–1505 and F2–1507.

The operation of relay WSRE–7611 operates relay CLCE–13701 of the even call register connector, which in turn controls the relay EADR (not shown—corresponds to relay OADR–12404 for the odd side) of the even register control of Figs. 175 to 178 and the answer-disconnect register connector relays ARE–13500 and DRE–13200 for the even call register.

The process described above continues for each step from the operation of relay U1–7501 to the operation of relay U9–7509. When the information registered in the call register portion of the machine is found to be nothing more than the call identity index, a path is closed through the answer-disconnect register connector relay, such as DRO–7900, normal and the OADC–12401 and ODDC–12506 relays operated to operate relay ORLS–12605, releasing the registered call identity index and the OES–12603 and OFCD–12600 or OFCU–12601 relays. This circuit extends from ground on the call identity index register up-check conductor UC–8405 of Fig. 84, over conductor UC–8405, contact 36 of relay DRO–7900, conductor CLDUC, cables 7903, 82–79, 8201 and 82–124 to Fig. 124, and cable 12410, conductor CLDUC, contact 3 of relay OADC–12401 (no answer time registered), conductor 12419, contact 2 of relay ODDC–12506 (no disconnect time registered), conductor 12521, contact 9 of relay OES–12603, conductor 12418 to relay ORLS–12605. (It may be noted in passing that the same effect would be caused if the output class relays OD1SW–9706 and OD1SL–9511 of the output class and number of output line circuits were operated; that is, ground would extend over contact 3 of relay OES–12603, conductor UC–9402, cable 98–97, conductor UC–9402, cables 97–95 and 9515, conductor UC–9402, contacts 1 of relays O1L–9506 to O7L–9510, contact 2 of relay OD1SL–9511, over a one-and-one-only operated circuit through contacts of the unit class register of Fig. 95, conductor 9512, over a down-check circuit through relays O2MD–9601 to O1M–9608, conductor 9601, over a down-check circuit through relays

O1T4I–9700 to O1T–9705, contact 3 of relay OD1SW–9706, conductor ODUC1, cables 97–95 and 9515, conductor ODUC1, contact 1 of relay OD1SL–9511, conductor ODUC, cables 9515 and 97–95, conductor ODUC, to relay OODUC–12406; and, relay OODUC–12406, in operating, grounds conductor 12418 at its contact 2, thereby operating relay ORLS–12605.)

When the registered information consists of at least one timing entry, a path is closed for operating the output connector, such as relays OOCA–9903 and OOCB–9904 for the odd side, and for starting the perforation of the required straddle entries. Under this circumstance, the above-described grounded conductor CLDUC out of cable 12410 in Fig. 124 would extend over contact 2 of relay OADC–12401 (if an answer time were registered) to conductor 12319 into Fig. 126 or over contact 3 of relay OADC–12401 (if no answer time were registered) and conductor 12419 and over contact 1 of relay ODDC–12506 (if a disconnect time were registered) to conductor 12319 into Fig. 126. In Fig. 126, the grounded conductor 12319 extends over contact 1 of relay ORLS–12605 to conductor LOCO into Fig. 178, over cable 59–178, to Fig. 59, cable 59–178, conductor LOCO, contact 1 of relay ODC–5903 (perforate part of the machine being normal), conductor OOCE, cable 59–178 to Fig. 178, cable 59–178, conductor OOCE, contact 21 of the even output connector relay EOCA–15200, conductor 15202, to operate the odd output connector relays OOCA–9903 and OOCB–9904, as previously described. In Section 4.23 is described the circuit for operating the straddle perforator register relay P0D–10100 in series with the straddle perforator connector relay PA0–17900. This circuit extends from ground on the off-normal conductor ON–1120 in Fig. 126, contact 3 of relay OES–12603 (operated as previously described when clearing out straddle call ends), conductor UC–9402, cable 98–97, conductor UC–9402, cables 97–95 and 9515, conductor UC–9402, over a one-and-one-only check circuit through relays O1L–9506 to OD1SL–9511 (relay O3L—not shown—or relay O6L–9509 operated as above set forth), over a one-and-one-only check circuit of the unit class relays OTOLL–9500 to OMUT2–9505, conductor 9512, contacts 2 of relays O2MD–9601 to O1M–9608, conductor 9601, contacts 2 of relays O1T4I–9700 to O1T2I–9703, contact 2 of relay O2T–9704 and contact 3 of relay O1T–9705 or contact 3 of relay O2T–9704 and contact 4 of relay O1T–9705, contact 1 of relay OD1SW–9706, conductor OUC (which operates relay OOUC–12402 in the odd register control circuit to show an operated odd side output register), over contact 1 of relay O1T–9705 or relay O2T–9704, conductor S–9710, cables 96–99 and 9906, conductor S–9710, contact 11 of the odd output connector relay OOCB–9904, conductor S–6425 into Fig. 101 through relay P0D–10100, conductor P0A, cable 101–179, conductor P0A, through connector relay PA0–17900 and to resistance battery. These entries are made under classes 1T or 2T since call ends consist of only one or two timing entries. In Section 4.16 circuit description is set forth in detail as to how relay O1T–9705 or relay O2T–9704 is operated to effect the output perforation of a single or a double straddle timing entry. As set forth in Section 4.16 the corresponding number of lines relay O3L (not shown in Fig. 95) or O6L–9509 is also operated. As explained in Section 4.24 with relays O1T–9705 and O3L (not shown in Fig. 95), three lines of output will be perforated on the straddle tape as follows: 2812EF (pattern relay OT1D–10400) where the E and F digits are the disconnect hour tens and units digits; 2822EF (pattern relay OT2D–11800) where the E and F digits are the disconnect day tens and units digits; and ABCDEF (pattern relay OT3D–10500) where A is a 1 or a 3 depending upon whether there was no or a timed release and B, C and D represent the disconnect minute tens, units and parts (tenths) digits and E and F represent the call identity tens and units digits. Likewise, with relays O2T–9704 and O6L–9509 operated, six lines of output will be perforated on the straddle tape as follows: three lines the same as for the above-described operation of relays OT1–9705 and O3L (not shown in Fig. 95) followed by 2812EF (pattern relay OT1A–10700) where E and F are the answer hour tens and units digits: 2822EF (pattern relay OT2A–11900) where E and F represent the answer day tens and units digits; and, 1BCDEF (pattern relay OT3A–10800) where B, C and D represent the answer minute tens, units and parts (tenths) digits and E and F are the call identity tens and units digits.

When the call identity index is registered, with relay U9–7509 of the assembling register units walking circuit of Fig. 75 operated, the previously described grounded conductor UCWO in Fig. 76 will extend over contact 5 of relay WSRO–7612 (operated for odd units walking relays of Fig. 75), conductor S–7623, contacts 2 of relays U8–7508 and U9–7509, conductor 7515 to operate relay TS–7604.

Relay TS–7604, in operating, releases (at its contact 1 the operated tens lockout relay of Fig. 74. Relay TDC–7602 thereupon operates when all the tens lockout relays are normal as previously set forth and with relay TS–7604 operated a path is closed for reoperating relay GT–7410 from ground on conductor WON–914 in Fig. 76, over contact 2 of relay TS–7604, contact 1 of relay TDC–7602 and over conductor GT–7615 to relay GT–7410.

The reoperation of relay GT–7410 permits the operation of other tens lockout relays if any assembling registers in other groups of ten contain timing entries.

The reoperation of relay GT–7410 also permits the operation of relay US–7605 causing in turn the reoperation of relay U0–7500. The ground on conductor S–7623 is extended over contact 12 of relay GT–7410 to conductor US–7512 and thence to relay US–7605. Relay US–7605, in operating, opens (at its contact 2) the locking ground on conductor L–913 thereby releasing relay U9–7509. This releases relay UUC–7601 and reoperates relay UDC–7603. At the time that relays TDC–7602 and UDC–7603 are both reoperated, relay WST–7607 is reoperated, as previously described, and thus relay U0–7500 can again operate as previously set forth.

The operation of a new tens lockout relay releases relay TDC–7602 followed by the release of the GT–7410 relay.

Relays TS–7604 and US–7605 release when the answer-disconnect connector DRO–7900 releases after relay U0–7500 has operated. This permits the walking to continue in the new group of tens assembling registers.

This action of selecting a new group of ten assembling registers after walking over a previous group of assembling registers continues until the operation of the GT–7410 relay indicates that no further tens lockout relays are to operate. Under this condition relay SW–7609 eventually releases since relay TDC–7602 remains operated and holds the locking circuit of relay SW–7609 open at contact 3 of relay TDC–7602 long enough for the slow-release relay SW–7609 to release to normal. The release of relay SW–7609 closes a path to operate a trailing end-of-tape common output class relay of Fig. 65 thereby to initiate the control of the perforation of a trailing end-of-tape group on the straddle tape as described in Section 4.35. As set forth in Section 4.33, dealing with the setting of the first call relays in the assembling registers, the release of relay SW–7609 with relays WC–901 and CRC–7610 operated and relay AFCU–6114 released operates relay OFC–6111, thereby to cause the operation of all of the first call relays in the assembling registers, such as relay FC00–6201 for assembling register No. 00 of Figs. 62 and 63 and relay FC99–5601 for

assembling register No. 99 of Figs. 56 and 57. When all of the FC– relays are operated relays FCCU–6112 and AFCU–6114 operate, releasing relay OFC–6111. The grounded conductor SFC–7616 out of cable 72–61 in Fig. 61, which operated relay OFC–6111, now will extend over contact 2 of relay AFCU–6114, contact 1 of relay FCCU–6112, conductor LTE–6119, cables 72–61, 72–73, 7315 and 7323, conductor LTE–6119, over contact 5 or 4 of relay 285R–7303 to conductor LTE–7325 or LTFE–7324, cable 73–65, conductor LTE–7325 or LTFE–7324 to operate relay LTE–6504 or relay LTFE–6506, as set forth in Section 4.10, to cause a new suitable leading end-of-tape group to be perforated on the straddle tape.

At the conclusion of perforating this new leading end-of-tape group on the straddle tape as set forth in Section 4.10, the tape identity progress control circuit of Fig. 25 will release relay CAR–7608 in turn reconnecting the reading relays to the reader and releasing the control of the E and F digit reading relays from the assembling register tens lockout and units walking circuits.

4.33 *Setting assembling registers for first calls*

All straddle call starts are indicated by entries which are taken from assembling registers where the first call relays are operated. These relays are such as relay FC00–6201 for the assembling register 00 of Figs. 62 and 63 and relay FC99–5601 for the assembling register 99 of Figs. 56 and 57.

These relays are set in all assembling registers at the time the processing of a new recorder tape section is started. This action is initiated by the operation of relay CRC–7610 under control of the tape identity progress circuit (see Sections 4.10 and 4.31).

Relay CRC–7610, in operating, operates relay CAR–7608, which starts the release of the RC–900 relay and prepares for the operation of the WC–901 relay of the reading relay connector circuit (Fig. 9). Relay CAR–7608 operates from ground over contact 3 of relay CRC–7610. Relay CAR–7608, in operating, opens, at its contact 2 the operating circuit for relay RC–900, which thereupon releases.

Relay CAR–7608, in operating, closes a path to operate relay SW–7609 from ground through relay GT–7410 normal. This circuit extends from ground, over contact 15 of relay MON–1201, conductor MON–1237, cables 1215, 12–35 and 35–58, conductor MON–1237, contact 1 of relay GT–7410, conductor SW–7411, contact 1 of relay CAR–7608, to relay SW–7609.

With relays CAR–7608 and SW–7609 operated and relay RC–900 normal, relay WC–901 is operated in a circuit extending from ground on conductor RC–1108 in Fig. 76 (this ground was used to operate relay RC–900), contact 3 of relay CAR–7608, contact 3 of relay SW–7609, conductor WC–7614, cables 76–75, 9–75 (to Fig. 9), and 903, conductor WC–7614, contact 29 of relay RC–900, to operate relay WC–901, which locks over its contact 13, conductor WCL–912, cables 903, 9–75 (to Fig. 75) and 76–75, conductor WCL–912 and contact 3 of relay CAR–7608 to ground on conductor RC–1108, independently of relay SW–7609.

Relay WC–901 operated closes ground through relays UDC–7603 and TDC–7602 operated to operate relay WST–7607. Relays TDC–7607 and UDC–7603 are operated since the assembling register tens lockout and units walking relays (Figs. 74 and 75) are normal. Relay UDC–7603 is operated in a circuit extending from ground, over contacts 1 of relays U0–7500 to U7–7507, contacts 3 of relays U8–7508 and U9–7509, and conductor 7510, to relay UDC–7603. Relay TDC–7602 operates in a circuit from ground on conductor MON–1237, contacts 1 of relays T0–7400 to T9–7409 and conductor TDC–7412, to relay TDC–7602. Relay WST–7607 thereupon operates from ground, over contact 17 of relay WC–901, conductor L–913, cables 903, 9–75 (to Fig. 75) and 76–75, conductor L–913, contact 1 of relay UDC–7603 and contact 2 of relay TDC–7602, to relay WST–7607.

Relay WST–7607, in operating, closes ground from relay WC–901 to operate relay GT–7410 of the assembling register tens lockout circuit of Fig. 74. Ground extends over contact 19 of relay WC–901, conductor WON–914, cables 903, 9–75 (to Fig. 75) and 76–75, conductor WON–914, contact 1 of relay WST–7607 and conductor GT–7615, to operate relay GT–7410.

With relay GT–7410 operated, the T0–7400 to T9–7409 relays, representing the ten groups of ten assembling registers, may operate if any assembling register in any such group contains timing entries. This should not be the case at the beginning of the processing of a recorder tape section and hence the operation of relay CAR–7608, with relay CRC–7610 operated, is merely to check that no assembling registers contain timing entries before the setting of the first-call relays therein, such as FC00–6201 to FC99–5601, etc.

Relay SW–7609 is slow in releasing and starts to release when relay GT–7410 operates. The release time of relay SW–7609 allows the operation of any of the T0–7400 to T9–7409 relays and the consequent release of the TDC–7602 relay.

Since no tens lockout relay should operate when checking that the assembling registers contain no timing entry registrations, relay SW–7609 will release and a path will be closed to operate relay OFC–6111 as follows: Ground from relay WC–901 operated through relay SW–7609 normal, relay CRC–7610 operated and relay AFCU–6114 normal. This circuit extends from ground, over contact 18 of relay WC–901, conductor TTE–915, cables 903, 9–75 (to Fig. 75) and 76–75, conductor TTE–915, contact 2 of relay SW–7609, contact 1 of relay CRC–7610, conductor SFC–7616, cable 73–76, conductor SFC–7616, cables 7322, 7315, 72–73 and 72–61, conductor SFC–7616, contact 1 of relay AFCU–6114, to relay OFC–6111.

Relay OFC–6111, in operating, closes a circuit to operate the first call relays (such as FC00–6201 and FC99–5601) of all assembling registers. Ground extends over the contact of relay OFC–6111, conductor OFC–6115 into cable FC–6116 into Figs. 62, 56 and 69, where conductor OFC–6115 branches out and extends over contacts 7 of relay FC00–6201 and FC99–5601 to operate these relays for respective assembling registers 00 and 99. The relays FC01 to FC98 (not shown) for the other 98 assembling registers (not shown) are likewise operated, as are the FC100 to FC103 relays (not shown) for the four spare assembling registers shown in Figs. 69 and 70.

With all FC– relays operated relay FCCD–6113 should be normal and relays FCCU–6112 and AFCU–6114 will operate. With the FC– relay of any assembling register released, a circuit is completed for operating relay FCCD–6113 extending from off-normal resistance battery, contact 13 of relay MON–1201, conductor MONB–1238, cables 1215, 12–35, 35–33 and 33–42, conductor MONB–1238, relay FCCD–6113, conductor FCCD–6117 into cable FC–6116 into Figs. 62, 56 and 69, where ground is reached over contact 9 of any one or more released relays FC00–6201 to FC99–5601, etc. When all of these FC– relays are operated, as above described, relay FCCD–6113 is released. Ground is then extended over contact 10 of any or all operated FC– relays to conductor FCCU–6118 into cable FC–6116 to operate relay FCCU–6112 (indicating that at least one assembling register has its FC– relay operated) and over contact 1 of relay FCCD–6113 to operate relay AFCU–6114 (to indicate that the FC– relays in all assembling registers are operated). (The grounded conductor FCCU–6118 in Fig. 69 also extends over cable 73–70 to operate relay FCCU1–7311 in the cancel timing entry control circuit of Fig. 73.)

Relay AFCU–6114, in operating, opens the operating

path for relay OFC–6111, which releases, and closes a path through relays AFCU–6114 and FCCU–6112 operated to operate one of the common output class relays LTE–6504 or LTFE–6506. This starts the perforating of a leading end-of-tape group on the output straddle tape (tape 0) as described in Section 4.10.

Relays FC00–6201, FC99–5601, etc. lock to the associated RLS– relay (such as RLS00–6202, RLS99–5602, etc.) in their associated assembling registers to the ground which locks the disconnect timing entry and which is checked on the first read-in of a timing entry. Relay FC00–6201, for instance, locks over its contact 8 to ground over contact 2 of its associated relay RLS00–6202. Relay FC99–5601 locks over its contact 8 to ground over contact 2 of its associated relay RLS99–5602.

Each FC– relay is double wound to permit the holding of this relay operated when a cancellation entry operates the associated RLS– relay before the first call has been read out of an assembling register. (See Section 4.39.)

4.34 *Forming call start straddle entries*

When an initial entry is read and registered from the tape, the assembling register used on that call is read out regardless of whether it contains any timing registrations.

The register control (Figs. 123 to 126 for the odd register) for the call register portion of the machine (odd side in the example) into which the initial entry was read receives a positive indication as to whether or not the first call relay of the assembling register is operated. These first call relays, as described in Section 4.33, are such as relay FC00–6201 of assembling register No. 00 of Figs. 62 and 63 and relay FC99–5601 of assembling register No. 99 of Figs. 56 and 57. For instance, for assembling register No. 00 ground may extend over contact 1 of relay FC00–6201 (if unoperated) or over contact 2 of relay FC00–6201 (if operated), over contact 32 or 31 of the disconnect connector relay D1SC00–6203, conductor FCD or FCU, cable 5607 into Fig. 79, conductor FCD or FCU, contact 31 or 30 of the odd call entry register disconnect connector relay DRO–7900, conductor FCD or FCU, cables 7906, 7903, 82–79, 8201, 82–124 to Fig. 124, 82–124, 124–125, 12509 and 125–126, conductor FCD or FCU to relay OFCD–12600 or relay OFCU–12601.

If relay OFCD–12600 is operated, the call involved cannot involve a possible straddle call. The description here relates to straddle call-start entries and so relay OFCU–12601 will be assumed to be operated and relay OFCD–12600, released.

It will be remembered that call starts may involve an initial entry only or an initial entry and one timing entry. With relay OFCU–12601 of the odd call register control circuit operated, a possible call-start straddle entry is indicated. There are three situations which may arise with the first call relay OFCU–12601 operated:

(1) Two timing entries may be received from the assembling register, whereupon this complete call is not considered as a straddle call;

(2) Only one timing entry may be received, whereupon output class relay O1T2I–9703 and number of lines relay O5L–9508 or output class relay O1T4I–9700 and number of lines relay O7L–9510 will be operated depending upon the number of lines in the initial entry, as set forth in Section 4.16; and,

(3) No timing entries may be received, whereupon output class relay O2I–9702 and number of lines relay O2L–9507 or output class relay O4I–9701 and number of lines relay O4L (not shown in Fig. 95) will be operated depending upon the number of lines in the initial entry.

Under situation 1, if a complete call consisting of an initial entry and two timing entries is registered in the odd call entry register, the call is not considered a straddle call even though relay OFCU–12601 is operated. Section 4.16 describes how regular output class and number of lines information is registered in the odd register for handling this call on a regular basis, as previously described.

Under situation 2, the fact that relay OFCU–12601 is operated prevents the operation of relays OAUCT–12504 and AMO–6105 as described in Section 4.122 to permit the use of only one timing entry on a non-straddle call as both answer and disconnect time, thereby to cancel all overcharges. Instead, one of the sets of output class and lines relays O1T2I–9703 and O5L–9508 or O1T4I–9700 and O7L–9510 will be operated depending upon whether the initial entry contains two or four lines, as set forth in Section 4.16.

As in situation 3, should no timing entires be taken from an assembling register at the time that an initial entry is read and registered, then either of the output class and lines relays pairs O2I–9702 and O2L–9507 or O4I–9701 and O4L (not shown in Fig. 95) is indicated, as set forth in Section 4.16, since this call start may be followed by a timing entry on another tape. As a result, with the feedback method of straddle operation, non-answered, busy and free line calls occurring immediately after the start of a recorder tape section are treated as straddle call starts until a new call start is found in processing this tape section.

The perforating of these various call start entries on the output straddle tape proceeds through the computer and perforator portions of the machine in the same manner as previously described.

For the case of a two-line initial entry and one timing entry, the operation of the relay O5L–9508 starts the perforating line count on conductor L5 in Fig. 97 and causes it to proceed down to line count conductor L1. The operation of relay O1T2I–9703 operates relay OI3–11403 as previously described and causes the successive grounding of the five codnuctors T1D, T2D, T3D, I1 and DOI2 corresponding to the five successive line count conductors L5 to L1. This action, as previously described, causes the successive operation of the five pattern connectors OT1D–10400, OT2D–11800, OT3D–10500, OI1–11000 and ODOI2–11200 to form the five-line straddle entry 2812EF, 2822EF, ABCDEF, 2BCDEF and ABCDEF as described in Section 4.24.

For the case of the four-line initial entry and one timing entry relays O7L–9510 and O1T4I–9700 (and relay OI3–11403) are operated to cause the successive operation of the pattern connectors OT1D–10400, OT2D–11800, OT3D–10500, OI1–11000, ODOI2–11200, ODOI3–11400 and ODOI4–11600 to form the seven-line straddle entry 2812EF, 2822EF, ABCDEF, 2BCDEF, ABCDEF, 0BCDEF and 0BCDEF as set forth in Section 4.24.

For the case of a two-line initial entry and no timing entry, relays O2L–9507 and O2I–9702 (and relay OI3–11403) are operated to cause the successive operation of the pattern connectors OI1–11000 and ODOI2–11200 to form the two-line straddle entry 2BCDEF and ABCDEF as set forth in Section 4.24.

For the case of a four-line initial entry and no timing entry, relays O4L (not shown in Fig. 95) and O4I–9701 (and relay OI3–11403) are operated to cause the successive operation of the pattern connectors OT1–11000, ODOI2–11200, ODOI3–11400 and ODOI4–11600 to form the four-line straddle entry 2BCDEF, ABCDEF, 0BCDEF, and 0BCDEF as set forth in Section 4.24.

On the line patterns used in perforating straddle timing entries the calendar day digits are normally taken from the disconnect and answer day tens and units registers of Figs. 91 and 92 as described in Section 4.24. This is the case where disconnect and answer timing entries are available in the subtractor section of the computer whereby the subtractor of Figs. 196 to 204 can

produce a result into the subtractor control circuit of Fig. 195, particularly the operation of one of the relays CR0–19510 and CR1–19511, the operation of which enters into the detailed description in Section 4.17 concerning the determining of the calendar day disconnect and answer tens and units values to be registered in Figs. 91 and 92. However, where, as described in this section, call-start straddle entries are being produced from an initial entry and only one timing entry, the computer must reconstruct the answer day tens and units digits without the benefit of the result from the subtractor since the subtractor does not receive two timing entries.

Relay CR1–19511 of the subtractor control of Fig. 195 is operated directly over lead HC1 entering cable 125–96 in Fig. 125 to take care of this condition. Since only one timing entry comes from the assembling register to the call register (say the odd side), relays ODD–12500, ODDC–12506 and OAUCT–12504 will be released and relay ODUC–12507 will be operated. Relay ODD–12500 is released because there is a timing entry in the disconnect part of the assembling register; relay ODDC–12506 is released because there is a timing and first call indication in the disconnect part of the odd call entry register; relay OAUCT–12504 is released because the answer section of the odd call entry register is not to be filled with the same timing entry as the disconnect section; and, relay ODUC–12507 is operated because there is a timing and first call indication in the disconnect part of the odd call entry register. This condition permits relays OADC–12401 and OADC1–12505 to operate in series in a circuit extending from ground, through relay OADC–12401, over conductor 12511, and through relay OADC1–12505 to battery. Ground thereupon extends over contact 5 of relay OFCU–12601, conductor 12614 and contact 1 of relay OADC1–12505 to conductor HC1 which extends over cable 125–96 to Fig. 96 where conductor HC1 emerges and extends over contact 20 of connector CCCO–9600 to conductor HC1 into cable 149–96 to Fig. 149, conductor HC1, cable 149–202, conductor HC1 to Fig. 196 where it joins with conductor CR1 into cable 196–195A into Fig. 195, where conductor CR1 emerges out of cable 196–195A to operate relay CR1–19511.

The message units and chargeable time are not required on straddle entries since the call information is incomplete. Hence the output register of a call register portion of the machine, such as the odd side, is checked only for number of lines, units class and output class, the up-check for the disconnect and answer day, chargeable time and message unit being by-passed by the operated relay OFCU–12601. This up-check path may thus be traced from ground on off-normal conductor ON–1120 in Fig. 126, over contact 1 of relay OFCU–12601, conductor UC–9402, cable 98–97, conductor UC–9402, cables 97–95 and 9515, conductor UC–9402, thence through a one-and-one-only check of the number of lines and units class registers of Fig. 95, conductor 9512 to Fig. 96, through a one-and-one-only check of the output class relays of Fig. 96, conductor 9601 or 9602 to Fig. 97, over a one-and-one-only check of relays O1T4I–9700 to O1T–9705, contact 1 of relay OD1SW–9706, and over conductor OUC into Fig. 124 to operate the odd output up-check relay OOUC–12402.

The operation of the release relay of an assembling register, such as relay RLS–99–5602 of register No. 99, occurs when the relays OADC–12401, OAD–12502, OAUC–12403, OAU–12503, ODDC–12506, ODD–12500, ODUC–12507 and ODU–12501 of the register control of Figs. 123 to 126 agree in their operated or released conditions as set forth in Section 4.124. The release relay of the assembling register, in operating as described in Section 4.124, releases the associated operated first call relay, such as relay FC99–5601 for register No. 99, among other releasing functions.

4.35 Perforating trailing end of tape and tape identity groups

After the processing of the business from the last recorder has been completed, the tape being read will run out of the reader and thereby will bring in an alarm. Such an alarm may be visual or audible or both and would, in an obvious manner, be operable due to an absence of tape being fed into the reader. The operator responds to the alarm, notes that the last tape has been read and operates the tape end key 1243 in Fig. 12.

The operation of this key 1243 permits the perforating of the trailing tape identification group of entries on the detail and assigned message unit tapes and the completion of the perforating on the output straddle tape.

Under the feedback method of straddle operation no timing entries should be registered in the assembling registers when the input tape runs out since with the feedback method all calls are automatically cleared and assembled from the straddle tape sections of the previous processing period.

However, in the case of the spliced-in emergency method of straddle operation the ends of calls appearing on the last recorder tape are still in the assembling registers and must be read out and perforated as straddle call ends before the trailing end-of-tape group may be perforated on the straddle tape.

The operation of the tape end key 1243 operates relay PTTI–10306 provided the first day of the first round of the last recorder is indicated as having been processed, as indicated by the operation of the relays FR–3104, FDR–3105 and LRS–3204. This circuit extends from master off-normal ground on conductor MON–1218 in Fig. 32, over contact 1 of relay LRS–3204, conductor PTT1, cable 32–31A, conductor PTT1, contact 5 of relay FDR–3105, conductor 3123, the contacts of the tape end key 1243, conductor 1244, cable 25–103 to Fig. 103, conductor 1244, to relay PTTI–10306, which thereupon operates and locks over its contact 3, to ground on the master off-normal conductor MON–1245, which extends over cables 10315, 25–103 to Fig. 25, and 11–25A to Fig. 11, where conductor MON–1245 emerges and extends to ground over contact 1 of relay MON–1201.

When the machine is restarted by operation of the machine start key 1200, the off-normal and start circuit of Figs. 11 and 12 is brought into operation as described previously. Upon the operation of relay ST4–1103 as a result of this restart procedure, a circuit is closed through relay PTTI–10306 operated and relay STWP–10309 normal to operate relay CAR–7608. This circuit extends from off-normal ground on conductor ON–1119 in Fig. 103 (grounded by contact 7 of relay ST4–1103), over contact 4 of relay PTTI–10306, contact 3 of relay STWP–10309 and conductor CAR, cable 73–128 to Fig. 73, conductor CAR, cable 73–76, conductor CAR, to relay CAR–7608.

The operation of relay CAR–7608 clears the assembling registers of call ends, if they contain any, and causes the perforation of trailing end-of-tape group on the output straddle tape.

The perforating of the call end straddle timing entries proceeds through the use of the regular call register portions of the machine, as described in Section 4.32. The perforating of the trailing end-of-tape group on the straddle tape is accomplished through the use of the common class translator and common output connector in a manner similar to that described in Section 4.10 concerning the leading end-of-tape group perforating on straddle tape. As mentioned in Section 4.32, the release of relay SW–7609, at the end of the assembling register walking control operation whereby call-ends were cleared from assembling registers, is the signal to initiate the control of the perforating of trail-

ing end-of-tape group information on the straddle tape. A circuit is thereupon completed for operating one of the relays TTE–6503 or TTFE–6505 in the common class translator circuit of Fig. 65 depending upon whether relay 285R–7303 is released or operated (no transfer or a transfer condition). This circuit extends from ground, over contact 18 of relay WC–901 in Fig. 9, conductor TTE–915, cables 903, 9–75 to Fig. 75 and 76–75, conductor TTE–915, contact 2 of relay SW–7609, contact 2 of relay CRC–7610, conductor 7624, contact 3 or 2 of relay 285R–7303, conductor TTE or TTFE, cable 73–65, conductor TTE or TTFE, to relay TTE–6503 or relay TTFE–6505. The operation of one of these relays, as will be apparent from previous description, causes the perforation of a prescribed end-of-tape group to be perforated on the straddle tape. Relay TTE–6503 will cause the five lines 284DEF, 283DEF, 280DEF, 281DEF and 282DEF to be perforated, followed by a sixth line comprising a measured amount of regular splice pattern 081010. Relay TTFE–6505, on the other hand, causes the perforation of the six lines 284DEF, 283DEF, 280DEF, 285DEF, 281DEF and 282DEF followed by a measured amount of special or "grooved" splice pattern 08CDEF.

When the release signal (grounding of lead RLS–5927 in Fig. 59) is received from the perforate control circuit of Fig. 59 as previously described, after perforating the end-of-tape group on the straddle tape, relay ESP–10307 operates over a path from ground on lead RLS–5927 in Fig. 59, cables 64–59A and 6409, conductor RLS–5927, contact 23 of the common output connector relay COC–6400, conductor RLS–6423, cable 64–73, conductor RLS–6423, contact 1 of relay CG–7312, conductor RLS–7321, cable 73–128 to Fig. 128, conductor RLS–7321, contact 2 of relay P10D–10110 or P11D–10111, conductor RLS–10133, cables 10131, 103–101A and 10313, conductor RLS–10133, contact 3 of relay PW–10303, contact 6 of relay PTTI–10306, contact 4 of relay STWP–10309, to relay ESP–10307. As previously explained, this release signal also releases the operated common class translator relay, such as relay TTFE–6505 or relay TTE–6503.

Relay ESP–10307 in operating, extends ground on conductor ON–1119 over contact 5 of relay PTTI–10306 and contact 1 of relay ESP–10307 to operate relay ESPL–10308, which locks over its contact 1 to ground on conductor MON–1245.

Relay CCUC–10300 releases when the common class translator of Fig. 65 releases. This releases the common class connector relay COC–6400, which thereupon releases relay ESP–10307. The release of relay ESP–10307 with relay ESPL–10308 locked operated, operates relay STWP–10309 from ground on conductor ON–1119 in Fig. 103, over contact 5 of relay PTTI–10306, contact 2 of relay ESP–10307 and contact 2 of relay ESPL–10308, to relay STWP–10309.

Relay STWP–10309, in operating, permits the release of relay CAR–7608 to indicate the conclusion of the clearing out process and operates relay TTI–6500 of the common class translator of Fig. 65 to indicate that trailing tape identity is to be perforated on the required output tapes. The circuit for relay TTI–6500 extends from ground on conductor ON–1119 in Fig. 103, over contact 4 of relay PPTI–10306, contact 2 of relay STWP–10309, conductor TTI, cable 64–103 to Fig. 64, conductor TTI, to relay TTI–6500.

Relay TTI–6500, in operating, performs a function similar to that performed by the operation of relay LTI–6501, as described in Section 4.09, except that the tape identity group is followed by timed spliced pattern instead of preceded by it. That is, relay TTI–6500, in operating, will cause the nine lines 2891EF, 2892EF, etc. to 2899EF to be perforated followed by the skip splice code 286DEF and a section of time splice pattern 081010.

As before, connector COC–6400 is operated, followed by the operation of the perforator register relay P1D–10101 for the detail perforator and relay P1D1–10302. Relay PW–10303 then operates as before to indicate that perforator walking is in operation. Relay PWS–10304 operates at the end of perforating each tape identity group. Each operation of relay PWS–10304 causes the next perforator register relay, such as relay P2D–10102 (for the first message unit perforator, if assigned) followed by the operation of the relay PD2U–10305, etc.

When the end of the perforating of the last tape identity group has been concluded, as indicated by the grounding of conductor EPW–10222 in Fig. 102 or Fig. 101 as previously described, relay EPW–2504 of the tape identity progress control circuit of Fig. 25 is operated in a circuit from ground on conductor EPW–10222 into cable 10131 in Fig. 101, over cables 103–101A and 10317, conductor EPW–10222, contact 1 of relay PW–10303, conductor EPW–10318, cables 10315, 25–103 to Fig. 25, conductor EPW–10318 to relay EPW–2504, which locks over its contact 2 to the lock conductor IL–2511. This stops the perforator walking procedure. Relay MRL–1003 of the motor control circuit of Fig. 10 is also operated in an extension of this circuit from the contact 1 of relay PW–10303, over contact 2 of relay PTTI–10306, contact 1 of relay STWP–10309, conductor MRL, cables 10315, 25–103 to Fig. 25 and 11–25A, conductor MRL, to relay MRL–1003.

Relay MRL–1003, in operating, operates the tape cutter magnets associated with all perforators to automatically sever the completed tapes from the tape supply. This circuit extends from ground, over contact 4 of relay MRL–1003, conductor C–1025, cable 21–180 to Fig. 180, conductor C–1025, to Fig. 209 where it operates all of the tape cut relays 0–20913 to 5–20914, which, in turn operate the twelve cut magnets OCUT–19415 to 11CUT of Fig. 194. For instance, cut relay 0–20913, in operating, connects the charged condenser 20901 across the winding of cut magnet OCUT–19415 over contact 2 of relay 0–20913 and via conductors 20903 and 20904, etc.

Relay MRL–1003, in operating, also opens the locking path for the master off-normal relay MON–1201, thereby releasing this relay and all other relays of the machine to normal and allowing relay FI–2500 to reoperate in a circuit previously described.

Relay MRL–1003, in operating, also operates the release magnet RLS–3103 of the mechanical interlocking relay OPR–3102 associated with the day progress switch of Fig. 32 to restore that relay OPR–3102 to normal. Ground extends over contact 3 of relay MRL–1003 and over conductor 1026 to magnet RLS–3103, which, when operated, releases the armature of relay OPR–3102.

4.36 *Skipping mutilated entries*

There are two conditions under which the central office recorder indicates to the assembler-computer that the following line or lines of an entry are known to have been perforated incorrectly.

The first of these conditions is indicated by the occurrence of 287DEF cancel entries. When one of these entries occurs on the central office tape, the next entry line on the tape is to be skipped and any subsequent supplementary lines of an entry are also skipped (that is, any next lines having an A digit of zero).

Relay 287–1606 operates when such a cancel entry occurs as indicated by a path through the A, B and C digit reading relays. This circuit extends from ground on the reading relay up-check conductor UC–2610 in Fig. 13, over contact 6 of relay B1–1304 and contact 4 of relay B7–1307 (B digit 8), contact 4 of relay A1–1301 and contact 6 of relay A2–1302 and contact 4 of relay A0–1300 (A digit 2), conductor 1310, contact 4 of relay C7–1404 and contact 4 of relay C0–1400 (C digit 7), conductor 287, cable 14–16, conductor 287, to relay

287–1606. Relay 287–1606 will release when the reader is stepped off of the 287DEF line.

Relay 287–1606, in operating, operates reader step relay RS–2600 directly in order that the tape may be stepped off of the cancel entry line. This is accomplished by grounding reader step conductor RS–1808 over contact 1 of relay 287–1606.

Relay 287–1606, in operating, also operates relay 287R–1607 in an obvious circuit of contact 3 of relay 287–1606. Relay 287R–1607 locks over its contact 3 and conductor JKB89 to the two reader cam break contacts J8 and K9 of Fig. 8, one regular and one late break. In addition, a separate locking path for relay 287R–1607 is established over contact 4 of relay 287R–1607, conductor H, cables 14–16 and 14–13, conductor H to ground over contact 12 of relay A0–1300 when operated.

Relay 287–1606, in operating, operates relay 2819R–1609 in an obvious circuit over contact 2 of relay 287–1606. Relay 2819R–1609 locks over its contact 1 to the two reader break cam contacts feeding ground to conductor JKB89.

On the first reader cycle after skipping the 287DEF entry, relay 2819M–1613 operates in a circuit extending from ground, over the H5 make contact of the reader in Fig. 8, over conductor HM5 and over contact 2 of relay 2819R–1609, relay 2819M–1613 thereupon locking over its contact 1 to conductor HM5 independently of relay 2819R–1609, which, along with relay 287R–1607, will release when the late break reader cam opens, ungrounding conductor JKB89.

A path through relay 2819M–1613 operated or through relay 287R–1607 and 2819M–1613 operated, will operate reader step relay RS–2600 through relay 2819–1608 normal, if the next line being read contains an A digit of 2 or 1 respectively. In Fig. 13, if the A digit is a 2, ground is applied over contact 9 of relay A2–1302 to conductor A2 into cable 14–13 and if the A digit is a 1, ground is applied over contact 12 of relay A1–1301 and over conductor A1 into cable 14–13. Conductors A2 and A1 extend over cables 14–13 and 14–16 into Fig. 16 where conductor A2 emerges and extends over contact 2 of relay 2819M–1613 to the reader step conductor RS–1808 and where conductor A1 emerges and extends over contact 2 of relay 287R–1607 and contact 2 of relay 2819M–1613 to the reader step conductor RS–1808. Thus, if the A digit of the first line to be skipped is a 2 (first line of an initial entry) the reader step relay RS–2600 will be operated irrespective of the condition of relay 287R–1607 and if the A digit is a 1 (timing entry) the reader step relay RS–2600 will be operated through the relay 287R–1607 which will be held operated by the late break ground on conductor JKB89 long enough to close the circuit for relay RS–2600.

During the open period of the reader cycle relay 2819M–1613 releases and relay 287R–1607 holds to the break reader cams.

On the closed period of the next reader cycle relay 287R–1607 will hold if the relay A0–1300 operates. Reader step relay RS–2600 will be operated through relay 287R–1607 operated if an A digit of zero is read. The ground is applied over contact 9 of relay A0–1300 to conductor RS extending over cables 14–13 and 14–16 to Fig. 16 where conductor RS will emerge and extend over contact 1 of relay 287R–1607 to the reader step conductor RS–1808. Relay 287R–1607 remains operated during the break period under control of the break cam contacts and remains operated during the make period under the control of the relay A0–1300 so long as supplementary lines (A digits of zero) continue to appear on the tape. On the first closed period where an A digit of zero does not appear, relay 287R–1607 will release thereby stopping the skipping operation.

The other cancel entry signal which may be received from central office is received in conjunction with irregular hour entries. The 281999 irregular hour entry, in addition to controlling the hour registers to progress the hour by one, also indicates that the entry line which follows is a mutilated hour entry and should be skipped. Relay 2819–1608 operates when either of the relays OHA–3402 and EHA–3403 for the irregular hour register connector of Fig. 34 is operated. This indicates that the irregular hour is of the 281999 variety, as described in Section 4.114.

Relay 2819–1608, in operating, operates relay 2819R–1609 in an obvious circuit, which relay 2819R–1609 locks over its contact 1 as before to conductor JKB89 grounded by the two reader break cams, the same as relay 287R–1607. Relay 2819M–1613 also operates as before. However, the operation of relay 2819–1608 does not permit the reader step relay RS–2600 to operate on this entry since the action taken in the hour registers will, if properly checked, operate relay RS–2600 as explained in Section 4.114. Relay 2819R–1609 locks operated for only one cycle and, provided the reading relay A2–1302 is operated during the closed period of that cycle, relay RS–2600 will operate through relay 2819M–1613 as before, permitting the entry line to be skipped.

4.37 *Canceling timing entries*

When the non-synchronous make busy or transfer entry 2856EF or 2857EF entry is read as part of an end-of-tape group, or whenever the 2854EF charge guard entry is read, one or all of the timing entries which are then registered in the assembling registers must be released in order to prevent over-charging on the calls in progress. These cancel indications must also be passed along to the straddle tape when perforating end-of-tape groups thereon, so that with the feedback method of straddle operation the charges on straddle calls may be automatically limited as a result of these cancel entries.

Relay 285C–7304 operates, as has been described previously, whenever a cancel entry or transfer indication is read from the input tape either at the proper point in an end-of-tape group or during the regular call entry processing.

The operation of relay 285C–7304 connects the leads from the decimal read-out of the D digit reading relays of Fig. 14 to the cancel entry control relays of Fig. 73. As previously explained, this D digit will be a 4 or a 6 or a 7, as the case may be, out of cable 67–73 in Fig. 73 and appearing on conductors D4, D6 and D7 before the contacts of relay 285C–7304.

If at least one assembling register contains at least one timing entry, such as assembling register No. 99 of Figs. 56 and 57, relay DS99–5600 will be operated. Ground will then extend over contact 2 of the register release relay RLS99–5602 and contact 7 of relay DS99–5600 to conductor 5608 into Fig. 57. If register No. 99 contains only one timing entry relay AS99–5700 will be released and conductor 5608 will extend over contact 2 of relay AS99–5700 to ground conductor NSRC into cable 5708. If, on the other hand, two timing entries are contanied in register No. 99, relay AS99–5700 will be operated and conductor 5608 will extend over contact 3 of relay AS99–5700 to ground conductor CCRC into cable 5708. All of the conductors NSRC and CCRC for all assembling registers are connected together in multiple into cable 5708 which extends through Figs. 57, 63 and 70 and into cable 73–70 to Fig. 73, where conductors NSRC and CCRC emerge. Conductors CCR and NSR in the circuits of the assembling registers of Figs. 57, 63 and 70 also extend over cables 5708 and 73–70 into Fig. 73. These conductors will be referred to in more detail hereinafter.

If at least one assembling register contains only one timing entry conductor NSRC out of cable 73–70 in Fig. 73 will be grounded, thereby operating relay NSRC–7306. If at least one assembling register contains two timing entries conductor CCRC out of cable

73–70 in Fig. 73 will be grounded, thereby operating relay CCRC–7305.

Non-synchronous entries (2856EF and 2857EF) have a value of 6 or 7 in the D digit position. This will operate relay NSR–7309 if at least one assembly register contains only one timing entry as indicated by the operation of relay NSRC–7306. This circuit will extend from ground on one of the conductors D6 and D7 out of cable 67–73 in Fig. 73, over contact 4 or 5 of relay 285C–7304 and contact 3 or 1 of relay NSRC–7306, to relay NSR–7309, which locks over its contact 1 and contact 8 of relay NSRC–7306 to conductor ON extending over cables 7320, 72–73, 59–72, 36–59, 25–36 and 11–25, conductor ON, to ground over contact 4 of relay ST4–1103.

Relay NSR–7309, in operating, operates relay NSR1–7310 in an obvious circuit. This closes a path to all assembling registers with only one timing entry registered, thereby to operate their associated release relays. Ground is extended over the contact of relay NSR1–7310 to conductor NSR, which extends via cables 73–70 and 5708 into all assembling registers, such as register No. 99 of Figs. 56 and 57, where, if there is only one timing entry, as indicated by relay AS99–5700 being released, the grounded conductor NSR will extend over the contact 4 of relay AS99–5700, conductor 5709, contact 5 of relay DS99–5600, contacts 5 and 3 or 6 and 4 of relay FC99–5601 to relay RLS99–5602, which thereupon operates to release the registration in the register. Should the first call relay be operated in any of these assembling registers, such as relay FC99–5601 in register No. 99, a second winding on this relay maintains it operated when the timing entries are released under this condition.

When the single timing entries in all assembling registers have released, relay NSRC–7306 releases, provided reader cam contact H7 in Fig. 8 is not closed. Cam contact H7, if closed would ground conductor HM7 into and over cables 8–17, 17–58 and 58–64, conductor HM7, contact 3 of relay NSR–7309 to relay NSRC–7306, to maintain relay NSRC–7306 operated until the end of the reader closed cycle. The release of relay NSRC–7306 permits the release of relay NSR–7309 and prepares the circuit to register, during the next closed reader cycle, an indication of the particular type of cancel signal which was received, as has been explained in Section 4.082.

The receipt of a charge guard entry 2854EF releases all timing entries registered in assembling registers. Should any assembling registers contain two timing entries, relay CCRC–7305 is operated as above described. The D digit of the 2854EF entry operates relay CCR–7307 over contact 2 of relay CCRC–7305, which in turn operates relay CCR1–7308 in an obvious manner, to operate the release relays in all the assembling registers containing two timing entries. Ground extends over the contact of relay CCR1–7308 to conductor CCR over cables 73–70 and 5708 to the assembling registers, such as register No. 99 of Figs. 56 and 57. In Fig. 57, for instance, the grounded conductor CCR will be extended over contact 5 of relay AS99–5700 (if two timing entries are contained in register No. 99), conductor 5709, etc. to operate relay RLS99–5602, thereby to release both registrations. Relay CCR–7307, in operating, also operates relay NSR1–7310 in an obvious manner, to operate the release relays of all assembling registers which contain only one timing entry, as above described. Thus, all timing entries are eliminated.

Relay CCR–7307 is locked operated under the control of both the CCRC–7305 and NSRC–7306 relays and hence does not release until all assembling registers indicate that no timing entries are registered. These circuits extend from the winding of relay CCR–7307, over the contact 2 thereof, and in parallel over contact 9 of relay NSRC–7306 and contact 3 of relay CCRC–7305 to the off-normal ground on conductor ON. These relays cannot release until an open portion of a reader cycle occurs, since they are also held by the ground on conductor HM7 from the reader contact H7 of Fig. 8.

It is of interest to point out here that a certain manual key operation can operate relay CCR–7307. For instance, as the result of an alarm condition, which might be caused by a mutilated call identity index in the first line of an initial entry, the machine release key 1200 might be operated, thereby releasing relay RLO–1202. With relay RLO–1202 released, the operation of the assembler register release key 1206 would operate relay CCR–7307 in a circuit from ground, over key 1206, contact 6 of relay RLO–1202, conductor CC, cables 11–25, 25–36, 36–59, 59–72, 72–73 and 7320, conductor CC to relay CCR–7307. Relay CCR–7307, in operating, as before causes the release of all registrations in all assembling registers to insure that no subscriber is overcharged.

With relays CCRC–7305 and NSRC–7306 released, the reading of the 2854EF entry operates relay CG–7312 when reading a regular central office tape section (relay C5–4203 or C6–4204 operated) provided the first call relay, such as relay FC99–5601, is operated in at least one assembling register, as indicated by the operation of relay FCCU1–7311, as previously described.

Relay CG–7312 is operated and locked over its contact 5 and contact 2 of relay CGR–7313 to conductor MON–7319 to control the reperforating of this entry on the output straddle tape, since the existence of operated first call relays indicates that this signal may be necessary to cancel timing entries which will be automatically assembled when reading the output straddle tape.

Should relay FCCU1–7311 be normal, indicating that no assembling registers are expecting straddle calls, a path will be established over contact 2 of relay FCCU1–7311 (instead of contact 1 thereof), contacts 4 of relays NSTF–7302 and NSMB–7301, contact 3 of relay STF–7300 and contact 6 of relay 285C–7304 to conductor RS–1808, which, as previously explained, operates reader step relay RS–2600, thereby advancing the tape off the 2854EF charge guard entry line.

The operation of relay CG–7312 operates relay CCUC–10300 to seize the perforate portion of the machine to perforate a one-line straddle entry. Contacts on relay CG–7312 indicate that one line is to be perforated on the straddle tape and cause the operation of the common pattern relays 8–7119 and 285–7206 to form this line. Ground extends over contact 9 of relay CG–7312 and contact 3 of relay CGR–7313, conductor CCUC–6510, cables 73–128 to Fig. 128, conductor CCUC–6510, to relay CCUC–10300, which operates to seize the perforate portion of the machine including the operation of the common output connector COC–6400, as previously described. Ground is applied over contact 11 of relay CG–7312, conductor S–6526, cable 64–73, conductor S–6526, contact 22 of connector relay COC–6400, conductor S–6425, cables 6426, 64–103 to Fig. 103 and 103–101A, conductor S–6425, to the straddle perforator register relay P0D–10100, which operates to select the straddle perforator for this perforating job. Ground is applied over contact 10 of relay CG–7312, conductor 1L, cable 64–73, conductor 1L, contact 20 of connector relay COC–6400, conductor 1L, cable 6412, conductor 1L, contact 4 of relay PL2–6402, to relay PLA1–6421, which thereupon prescribes a one-line entry. At the proper time, as previously described, the ground on conductor PAT–5909 in Fig. 64 is extended over contact 1 of relay PLA1–6421 to conductor L1, cable 6429, conductor L1, contact 13 of relay COC–6400, conductor L1, cable 64–73, conductor L1, contact 12 of relay CG–7312 and over conductor 285 into Fig. 72 to operate pattern relays 285–7206 and 8–7119 of Fig. 71. The operation of relays 8–7119 and 285–7206 causes the pattern 285400 to be perforated on the straddle tape in a manner previously described. The A digit of 2 is perforated by the ground on the reader-perforate conductor

PA2 in Fig. 72 being extended over contact 1 of relay 285–7206 to conductor A2; the B digit of 8 is produced by grounds on conductors PB1 and PB7 in Fig. 71 being extended over contacts 2 and 1 of relay 8–7119 to conductors B1 and B7; the C digit of 5 is caused by grounds on conductors PC0 and PC1 in Fig. 72 being extended over contacts 3 and 2 of relay 285–7206 to conductors C1 and C4; the D digit of 4 is caused by grounds on conductors PD0 and PD1 in Fig. 73 being extended over contacts 6 and 7 of relay CG–7312, conductors D0 and D4, cable D–7326, conductors D0 and D4, contacts 8 and 5 of relay 285–7206 to conductors D0 and D4 to the perforator; and, the E and F digits of 00 are caused by grounds on conductors PE4, PE7 and PF0, PF1 in Fig. 72 being extended over contacts 10, 9 and 12, 11 of relay 285–7206 to perforate conductors E4, E7 and F4, F7.

With the common pattern relays 8–7119 and 285–7206 operated a one-line entry 285400 will be perforated on the straddle tape as follows: The A digit of 2 is produced by the grounding of conductor A2, into cable 72–104 in Fig. 72, over contact 1 of relay 285–7206 from the reader perforate ground conductor PA2; the B digit of 8 is derived from contacts 1 and 2 of relay 8–7119, thereby grounding conductors B7 and B1; the C digit of 5 is effected by the grounding of conductors C4 and and C1 over contacts 2 and 3 of relay 285–7206; the D digit of 4 comes about by grounds in Fig. 73 on conductors PD0 and PD1 being extended over contacts 6 and 7 of relay CG–7312, conductors D0 and D4, cable D–7326 and contacts 8 and 5 of relay 285–7206 to conductors D0 and D4 into cable 72–104; and, the E and F digits of zero are caused by the grounding of conductors E7, E4 and F7, F4 over contacts 9, 10 and 11, 12 of relay 285–7206.

Relay CGR–7313 operates when the release lead RLS–6423 in Fig. 73 is grounded by the perforate control circuit as previously described.

Relay CGR–7313, in operating, locks over contact 8 of relay CG–7312 and opens at its contact 2 the locking path for relay CG–7312, allowing it to release, thereby in turn releasing relay CGR–7313.

When the 2854EF entry occurs while reading a straddle tape section (relay C7–4205 of C8–4206 operated) under the feedback method of straddle operation and where relay FCCU1–7311 is operated, indicating that at least one assembling register still has its first call relay operated, relay DCE–7314 is operated and locked to delay placing of the charge guard entry on the output straddle tape until its need is determined. In this case, the grounded conductor 2854–7318 leaving contact 1 of relay FCCU1–7311 in Fig. 73 will extend over cables 73–70 and 70–42, conductor 2854–7318, contact 11 of relay C7–4205 or 10 of relay C8–4206, conductor DTE–4213, cables 70–42 and 73–70, conductor DTE–4213 to the middle winding of relay DCE–7314, which thereupon operates and locks over its contact 4 to the lock conductor 285L–7316, previously described. With relay DCE–7314 operated, relay CG–7312 will be operated over contact 1 of relay DCE–7314 only if conductor CG out of cable 73–128 in Fig. 73 is grounded. This will occur only when and if ground extends over contact 9 of relay OCLUC–12304 (first line of initial entry registered in the call entry register, say the odd side), conductor 12613 and over contact 10 of relay OFCU–12601 (first call relay operated in the pertinent assembling register) to conductor CG extending into Fig. 128 and over cable 73–128 to Fig. 73, etc. This delays the perforating of the charge guard entry 285400 on the straddle perforator until it is determined that this is a possible first call condition. The reader step relay RS–2600 is operated to permit stepping off of the 285400 line over a circuit from ground on the middle winding of relay DCE–7314, contact 3 of relay DCE–7314, contacts 4 of relays NSTF–7302 and NSMB–7301, contact 3 of relay STF–7300 and contact 6 of relay 285C–7304 (if these relays are normal) to the reader step conductor RS–1808.

Relays STF–7300, NSMB–7301 and NSTF–7302 register indications of the make busy and transfer 285DEF entries which occur during an end-of-tape group as has been explained. A one-and-one-only path starting from the locking ground on lead 285L–7316 and extending over contact 3 of relay CG–7312, contact 2 or 3 of relay NSTF–7302, contact 2 or 3 or 4 of relay NSMB–7301 and contact 2 or 3 of relay STF–7300 (if one of these relays is operated), and over contact 6 of relay 285C–7304 to the reader step conductor RS–1808, thereby to operate the reader step relay RS–2600 to permit the stepping off of these lines after the necessary timing entry cancellation has been affected. At the same time, as has been explained, relay 285R–7303 is operated by relay 285C–7304 and locks through one of the relays STF–7300, NSTF–7302 and NSMB–7301 to the lead 285L–7316 from the tape identity progress control circuit of Fig. 25.

Relays NSTF–7302, NSMB–7301, STF–7300 and CG–7312 control the digital value to be perforated as the D digit associated with the common pattern 285DEF when perforated on the output straddle tape, as previously described.

Relay 285R–7303, as will be recalled, in operating, transfers the tape end and trailing and leading end-of-tape indications from regular to transfer types of common class translators so that the extra 285DEF line may be included when these end-of-tape groups are perforated.

4.38 *Detecting windows and perforating splice pattern*

A contact on each perforator is constantly applying pressure to the unperforated tape as it enters the perforator drum to determine when a splice point in the unperforated tape occurs. Such contacts are shown on Fig. 194 such as contacts S10 and S11 associated with perforators Nos. 10 and 11. If such a contact closes, the circuit, under these conditions, prevents the perforating of call entries at the splice and moves the paper through the splice by perforating splice pattern, which, during the call entry portion of the detail and message unit tapes, is introduced and finished with the 287020 skip window entry.

Upon a window being detected in any one or more of the tapes one or more of the window contacts S0 to S11 will be closed, thereby placing ground on one or more of the conductors WS0 to WS11 into cable 194–101 in Fig. 194. Those twelve conductors WS0 to WS11 emerge from cable 194–101 in Fig. 101 to operate one of the window detecting lockout relays WSS–10112 to WS9–10129 in series with relay CWS–5908. For instance, if contact S0 (straddle perforator) in Fig. 194 is grounded, conductor WS0 out of cable 194–101 in Fig. 101 will be grounded and will extend through relay WSS–10112 and out over conductor CWS, cables 101–103, 64–103 to Fig. 64 and 64–59, conductor CWS, to relay CWS–5908 whereupon relays WSS–10112 and CWS–5908 operate in series. If any other lead WS1 to WS11 out of cable 194–101 in Fig. 101 is also grounded, nevertheless only relay WSS–10112 can operate, because in so doing it opens at its contact 4 the circuit whereby some other relay of the chain could operate in series with relay CWS–5908 if relay WSS–10112 were not operated. Thus, the relays WSS–10112 to WS9–10129 are preferred in that order. The operated relay locks over its own contact to the CWS conductor independently of relays earlier in the chain.

The control of the straddle perforator (operation of relay WSS–10112) is a special case to be described at the end of the section. The immediate description will be concerned with the control of the detail perforator (relay WSD–10113 operated) or one of the message unit perforators (one of relays WS0–10120 to WS9–10129 operated). Since the action is the same for all of the

perforators except the straddle perforators, it will be assumed for purposes of present discussion that the detail perforator is involved, whereupon relay WSD–**10113** will be operated in series with relay CWS–**5908**.

Relay CWS–**5908**, in operating, closes a path from ground on conductor MON–**1201** in Fig. 65, over contacts **1** of relays TT1–**6500** to TE–**6507** (down-check of the common class translator relays), contact **3** of relay WS–**6502**, conductor **6529**, contact **3** of relay CWS–**5908**, conductor WS, cables **64–59**, **64–103** to Fig. 103 and **101–103**, conductor WS, contacts **1** of unoperated relays WS9–**10129** to WS0–**10120**, contact **2** of relay WSD–**10113**, conductor RWS, cables **101–103**, **64–103** to Fig. 64 and **65–64**, conductor RWS, to relay WS–**6502**, which thereupon operates and locks over its operating conductor **6529** and its contact **2** to conductor MON–**1201**.

Relay WS–**6502**, in operating, controls the perforate portion of the machine in perforating a window pattern on the tape indicated by the preferred operated relay WSD–**10113**. Relay WS–**6502**, in operating, extends ground over its contact **4** to conductor CCUC–**6510**, which, as previously explained, operates relay CCUC–**10300**, which, in turn, causes the operation of the common class output connector relay COC–**6400** when the output circuits are available. Ground extends over contact **11** of relay WS–**6502**, conductor STR, cable **65–64**, conductor STR, contact **21** of connector COC–**6400**, conductor STR, cables **6426**, **64–103** to Fig. 103 and **101–103**, conductor STR, lowermost contacts of all unoperated relays WS9–**10129** to WS0–**10120**, contact **7** of relay WSD–**10113**, to conductor P2–**10312**, to relay P1D–**10101**, which, as previously explained, operates in series with the detail perforator connector PA1–**17901**. Ground extends over contact **10** of relay WS–**6502**, conductor **3L**, cable **65–64**, conductor **3L**, contact **19** of connector COC–**6400**, conductor **3L**, cable **6412**, conductor **3L**, etc. to operate relay PLA3 (not shown in Fig. 64) to prescribe a three-line entry.

The three lines are caused to be perforated by the successive grounds of contacts **6**, **7** and **8** of relay WS–**6502** in a manner fully described previously. During the perforating of lines **3** and **1**, contacts **6** and **7** of relay WS–**6502** ground conductor **287** into cables **6527** and **65–72** to Fig. 72. During the perforating of line **2**, contact **7** of relay WS–**6502** grounds conductor **08–6513** into cables **6515** and **65–72** to Fig. 72. During lines 3 and 1, therefore, relays **8–7119** and **287–7208** of the common pattern connector circuit of Figs. 71 and 72 will be operated and during line 2, relays **08R–7209** and **8–7119** will be operated. An inspection of the contacts of relays **8–7119**, **08R–7209** and **287–7208**, in view of previous description, will show that a code 287020 is perforated for lines 3 and 1 and that the line 2 is composed of a timed section of regular splice pattern 081010.

Relay CWS–**5908**, in operating, opens at its contact **1** a shunt around resistance **5923** in the splice pattern timer of Fig. 59, thereby to extend the splice pattern timing for an almost indefinite period.

As described in Section 4.09, the number of times that the splice pattern line 081010 is perforated as part of an entry is determined by the interval timed by the splice pattern timer of Fig. 59. Hence, the 081010 lines for the window pattern are applied indefinitely until the window contact, such as S1 of Fig. 194, associated with the preferred relay, such as WSD–**10113**, opens. Relay EWD–**5910** then operates in series with the preferred relay WSD–**10113** by virtue of the fact that ground on conductor MON–**1201** in Fig. 65 is extended over contact **1** of relay WS–**6502**, conductor EW, relay EWD–**5910**, contact **2** of relay LOR–**5912**, conductor EW1, cables **64–59**, **64–103** to Fig. 103 and **101–103**, conductor EW1, contacts **3** of the unoperated lockout relays, contact **4** of relay WSD–**10113** to the left side of relay WSD–**10113**.

Relay EWD–**5910**, in operating, indicates that the window portion detected has ended and that the splice pattern timing may be quickly concluded. This is effected by the insertion of resistance **5928** in the splice pattern timer circuit over contact **1** of relay EWD–**5910** in parallel with resistance **5923**. Relay EWD–**5910**, in operating, also operates relay PLOR–**5911** in a circuit extending from ground, over contact **9** of relay ST4–**1103** to the off-normal conductor ON–**1122**, cables **11–17**, **17–58** and **58–59**, conductor ON–**1122**, contact **4** of relay EWD–**5910** to relay PLOR–**5911**.

When the end of perforating the window pattern is reached, indicated by the grounding of the release lead RLS–**10133** in Fig. 103, as described, from the perforate control, relay LOR–**5912** operates over a path extending from ground on this release lead RLS–**10133** out of cable **10313** in Fig. 103, over contact **3** of relay PW–**10303**, contact **7** of relay PTTI–**10306**, conductor ETE–**10319**, cables **64–103** to Fig. 64 and 64–59, conductor ETE–**10319**, contact **2** of relay EWD–**5910** to relay LOR–**5912**, which thereupon operates and locks over its contact **1** and the contact of relay PLOR–**5911** to off-normal ground on conductor ON–**1122**.

Relay LOR–**5912**, in operating, releases relays EWD–**5910** and WSD–**10113**. Relay EWD–**5910**, in releasing, is followed after a short interval by the release of the slow releasing relay PLOR–**5911**, which is followed, in turn, by the release of relay LOR–**5912**. The purpose of this interval is to permit the operated relay WSD–**10113** to release but to give the circuit a chance to pick the next tape which may have detected a window pattern before indicating that the processing of call entries may continue. Relay CWS–**5908**, of course, remains operated until all lockout relays of Fig. 101 (top) have been released.

The detecting of the window on the straddle tape (operation of relay WSS–**10112**) necessitates the production of a different form of window pattern, since on central office tapes, which the straddle tape simulates, a window is indicated by two end-of-tape groups separated by splice pattern which covers the window.

Hence, if relay WSS–**10112** operates, to indicate a window on the unperforated portion of the output straddle tape, the common class translator relay WS–**6502** is not operated when relay CWS–**5908** operates. Relay STWS–**6509** operates instead to control the perforating of the aforementioned pattern on the straddle tape. The ground on conductor MON–**1201** in Fig. 65 will extend, as before, over back contacts **1** of all of the relays TTI–**6500** to TE–**6507**, contact **3** of relay WS–**6502**, conductor **6529**, contact **3** of relay CWS–**5908**, conductor WS, cables **64–59**, **64–103** to Fig. 103 and **101–103**, conductor WS, contacts **1** of all relays WS9–**10129** to WSD–**10113**, contact **1** of relay WSS–**10112**, conductor STWS, cables **103–101A**, **64–103** to Fig. 64 and **65–64**, conductor STWS, to relay STWS–**6509**, which, in operating, operates relay LTE–**6504** in an obvious circuit. The remainder of the perforating and control of the release of the relay WSS–**10112** and the control of splice pattern timing is identical to that previously described for the case when a window is detected on a detail or message unit perforator except for the following:

(1) Grounded contact **12** of relay LTE–**6504** selects the straddle perforator by grounding conductor S–**6526**;

(2) Ground over contact **11** of relay LTE–**6504** and contact **9** of relay STWS–**6509** prescribes an eleven line entry by grounding lead **11L**;

(3) Lines 11, 10, 9, 8 and 7 are controlled over contacts **4**, **5**, **6**, **7** and **8** of relay STWS–**6509** to be 284DEF, 283DEF, 280DEF, 281DEF and 282DEF respectively;

(4) Line 6 is controlled over contact **4** of relay LTE–**6504** to be a measured amount of regular splice pattern 081010 as before; and,

(5) Lines 5, 4, 3, 2 and 1 are controlled over contacts **5**, **6**, **7**, **8** and **9** of relay LTE–**6504** to be 284DEF, 283DEF, 280DEF, 281DEF and 282DEF respectively.

4.39 *Alarm timing*

Alarm conditions for the most part are indicated by an elapse of time during which no part of the machine is functioning. When the machine is not running, relay ST4–1103 of Fig. 11 is released and a circuit is completed from the upper terminal of the condenser C–1023 of Fig. 20, over conductor 1027, contact 13 of relay ST4–1103 and over conductor 1123 to the left terminal of resistance R–1024 of the alarm timing circuit, preventing a build-up in voltage across this condenser C–1023, which controls the firing of the associated gas tube T–1014. The operation of relay ST4–1103 at the start of processing permits the build-up of voltage across condenser C–1023 from the winding of relay T0–1008 through contact 2 of relay CT–1013, condenser C–1023, through resistance R–1028 to the +130 volt supply.

Relay CT–1013 is operated to cancel the timing and to recycle the timing whenever conductor CT (Figs. 10, 59, 76 and 18) is grounded by any one of the following conditions, the operation of relay CT–1013 causing condenser C–1023 to discharge through its contact 1 and resistance R–1024:

(1) If any one of the reader step relays of Figs. 26 and 27 operates whenever relay PRRL–1804 is released (not skipping splice pattern), conductor 2618 in Figs. 26 and 27 will be grounded and this grounded conductor 2618 will extend over contact 8 of relay PRRL–1804 to conductor CT, etc.

(2) While skipping splice pattern (relay PRRL–1804 operated) as long as the A digit zero reading relay A0–1300 and the reader step relay RS–2600 are operated, repeated grounds from the K reader contact in Fig. 8 will be extended over conductor KM5, cables 8–9, 9–18 and 18–26, conductor KM5, contact 10 of relay RS–2600, conductor CT1, cable 26–15, conductor CT1, cable 15–13, conductor CT1, contact 7 of relay A0–1300, conductor CT2, cables 13–14 and 14–18, conductor CT2, contact 7 of relay PRRL–1804 to conductor CT, etc.

(3) Whenever entry lines are being perforated (relay PS–5900 operated) ground extends over contact 3 of relay PS–5900, conductor CT, cable 9–75 to Fig. 9, to conductor CT, etc.

(4) Whenever call ends are being searched for in the assembling registers (relay US–7605 operated) ground will extend over contact 1 of relay US–7605 to conductor CT, etc.

(5) Whenever the motor start relay MST–1001 is released ground is applied over contact 1 thereof to conductor CT, etc.

(6) Whenever the motor start key 1006 is operated ground is applied over contact 4 thereof to conductor CT, etc.

Should relay CT–1003 not operate by the time the gas tube T–1014 fires and operates relay T0–1008, an alarm condition is indicated by the operation of relay AL–1005 in an obvious circuit. The processing of further tape is thereby halted immediately, since the operation of the alarm relay AL–1005 opens at its contact 3 the up-check path through the reading relays.

4.40 *Alarm and normal release*

Relay AL–1005, in operating, locks over its contact 2, contact 3 of the motor start key 1006, conductor 1029, contact 11 of relay ST4–1103 (and/or contact 4 of relay RLO–1202), conductor MON–1241, to ground over contact 28 of relay MON–1201 and releases relay MST–1001 to stop the reader motor of Fig. 7.

The shunt release of relay RSR–1011, as described in Section 4.30, also operates relay AL–1005 to stop the machine if the indications are that a reader step relay (Figs. 26 and 27) is causing the reader to skip lines of tape without completely reading and processing them.

Relay ALS–1009 operates in case of a blown fuse (the melting of fuse 1030 allows the spring element 1031 to make contact with contact 1032) to allow the processing to stop after the entry which is registered or being registered in the call registers have been processed.

Relay ALS–1009, in operating, releases the relays ST1–1100 and ST2–1101 by opening up at its contact 2 their locking circuit and reoperates relay RLM–1002, if it has been released, by extending the locking ground on conductor 1019 in Fig. 10 over contact 1 of relay ALS–1009 to the relay RLM–1002, thereby to enable the machine to stop as indicated. Relay RLS–1104 is operated when a line containing an A digit of zero is read, this being the last initial entry and call which will be processed before the alarm occurs. This circuit extends from ground, over contact 4 of relay ST3–1102, contact 4 of relay ST1–1100, conductor 1033, contact 3 of relay RLM–1002, conductor RLS2, contact 5 of relay A0–1300, conductor RSL1, to relay RLS–1104, which operates and locks over its contact 1 to ground over contact 4 of relay ST3–1102.

Relay RLS–1104, in operating, opens its contact 2 thereby to prepare for the release of relay ST3–1102 when the open portion of a reader cycle occurs when the perforate and call register portions of the machine are normal.

The machine may also be stopped by operation of the machine release key 1200. Under this condition relay RLM–1002 is released followed by the release of relays ST1–1100 and ST2–1101. This permits relay RLS–1104 to operate the next time an end-of-tape group is read and checked as indicated by the operation of relay ETE–2502. This circuit will extend from ground, over contact 4 of relay ST3–1102, contact 4 of relay ST1–1100, conductor 1033, contact 4 of relay RLM–1002, conductor RLS, contact 1 of relay ETE–2502, conductor RLS1, to relay RLS–1104, which operates and locks as above described.

It is to be understood that the above-described arrangements are merely illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, and means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the

recording on one or more of said outgoing record media of information resulting from said processing.

2. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

3. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

4. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information read from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, and means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of a customer charge by said calculator and the recording on one or more of said outgoing record media of information resulting from said processing.

5. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the

same identity index, means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

6. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

7. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity index for reregistering said time information in the one of said time registers characterized by the same identity index, means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the recording on one or more of said outgoing record media of information resulting from said processing.

8. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity index for reregistering said time information in the one of said time registers characterized by the same identity index, means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

9. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and char-

acterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity index for reregistering said time information in the one of said time registers characterized by the same identity index, means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

10. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity index for reregistering said time information in the one of said time registers characterized by the same identity index, and means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of a customer charge by said calculator and the recording on one or more of said outgoing record media of information resulting from said processing.

11. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity index for reregistering said time information in the one of said time registers characterized by the same identity index, means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

12. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by the registration in said reading registers of specific time information characterized by a given identity

index for reregistering said time information in the one of said time registers characterized by the same identity index, means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

13. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections, one of said sections for registering (3) the time at which the use was terminated and the other of said sections for registering (2) the time at which the use was commenced, means controlled by registration in said reading registers of specific time information (3) characterized by a given identity index for reregistering said time information (3) in said one section of the one of said time registers characterized by the same identity index, means controlled by the registration in said reading registers of specific time information (2) characterized by the same identity index for reregistering said time information (2) in the said other section of the said time register characterized by the same identity index, means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information (1) characterized by the same identity index for combining said registered and reregistered specific information (1) and (2) and (3) and said registered general information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator from specific time information (2) and (3), selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selection for recording on one or more of said outgoing record media said new items of information.

14. The invention claimed in claim 13 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, an identity index is a digital component of a plural digit number, reading registers are reading relays, and a calculator is a relay subtracter.

15. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, and means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means.

16. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, selecting means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index, and means including said control means and said selecting means for registering said read time information in a different sec-

tion of said selected time register for each different condition of said control means.

17. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a control circuit individual to each time register and placed in different circuit conditions by the operated and released conditions of a first one of said sections, a selecting circuit controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index, connector means individual to said selected time register and selectively operable to register said read time information in one of the sections of said selected time register, and circuit means including said control circuit and said selecting circuit for selectively operating said connector means according to the circuit condition of said control circuit.

18. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a control relay individual to each time register and operated or released respectively by the operated or released condition of a first one of said sections, a first circuit closed upon the release of said control relay and opened upon the operation of said control relay, a second circuit closed upon the operation of said control relay and opened upon the release of said control relay, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by said reading

means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, a first connector individual to said selected time register and operable over a closed first circuit to register said read time information in said first section of said selected time register, a second connector individual to said selected time register and operable over a closed second circuit to register said read time information in the other section of said selected time register, circuit means including said first circuit and said energized selecting conductor for operating said first connector when said control relay is released, and circuit means including said second circuit and said energized selecting conductor for operating said second connector when said control relay is operated.

19. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections, a first section operable to register a specific item (3) of time information and a second section operable to register a specific item (2) of time information, a disconnect relay individual to each time register and operated or released respectively by the operated or released condition of said first section, a pair of break contacts closed or opened respectively by the release or operation of said disconnect relay, a pair of make contacts closed or opened respectively by the operation or release of said disconnect relay, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, a disconnect connector individual to said selected time register and operable through a closed pair of said break contacts to register said read time information in said first section of said selected time register, an answer connector individual to said selected time register and operable through a closed pair of said make contacts to register said read time information in said second section of said selected time register, a first circuit including an energized selecting conductor and a closed pair of said break contacts for operating said disconnect connector when said disconnect relay is released, and a second circuit including an energized selecting conductor and a closed pair of said make contacts for operating said answer connector when said disconnect relay is operated.

20. The invention claimed in claim 19 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is

a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

21. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information read from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, and means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the recording on one or more of said outgoing record media of information resulting from said processing.

22. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

23. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, means thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

24. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an ac-

counting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, and means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of a customer charge by said calculator and the recording on one or more of said outgoing record media of information resulting from said processing.

25. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

26. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for registering said read time information in a different section thereof for each different condition of said control means, means including said calculator and thereafter controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same identity index for combining said read and registered specific information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

27. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record

media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, and means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the recording on one or more of said outgoing record media of information resulting from said processing.

28. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

29. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, means thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

30. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register

and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, and means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of a customer charge by said calculator and the recording on one or more of said outgoing record media of information resulting from said processing.

31. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, and means controlled by said combining means incident to said combining operation for recording on one or more of said outgoing record media said new items of information.

32. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information, a calculator, a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, control means individual to each time register and conditioned differently by the operated and released conditions of a first one of said sections, means including said control means and controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index for selecting the one of said time registers characterized by the same identity index and for reregistering said time information in a different section thereof for each different condition of said control means, means including said calculator and thereafter controlled by the registration in said reading registers of specific facility information characterized by the same identity index for combining said registered and reregistered specific information and said registered general information in a processing step including the derivation of new items of information therefrom including a customer charge derived by said calculator, selecting means controlled by said combining means incident to said combining operation for selecting one or more of said recording means, and means controlled by said selecting means incident to said selecting operation for recording on one or more of said outgoing record media said new items of information.

33. The invention claimed in claim 32 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, an identity index is a digital component of a plural digit number, reading registers are reading relays, and a calculator is a relay subtracter.

34. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of

information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, and circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register.

35. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of one of the sections thereof, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, and circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the commence or terminate connector of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the commence or terminate section of only said selected time register.

36. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, a control relay individual to each time register and operated or released respectively by the operated or released condition of said terminate section, a first circuit closed upon the release of said control relay and opened upon the operation of said control relay, a second circuit closed upon the operation of said control relay and opened upon the release of said control relay, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by said reading means incident to the reading of said read specific item of information characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, said terminate connector individual to said selected time register operable over a closed first circuit to register said read time information in said terminate section of said selected time register, said commence connector individual to said selected time register operable over a closed second circuit to register said read time information in said commence section of said selected time register, first circuit means including said first circuit and said energized selecting conductor for operating said terminate connector when said control relay is released, and second circuit means including said second circuit and said energized selecting conductor for operating said commence connector when said control relay is operated.

37. The invention claimed in claim 36 wherein an incoming record medium is a perforated tape, an out-

going record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

38. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein, means controlled by said reading means incident to the reading of general items of information from incoming record media to register said read general items in said general registers, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index and for causing certain of said registered general items to be reregistered in said one time register along with and as part of the said registered specific item of information.

39. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having general registers for registering items of general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein, means controlled by said reading means incident to the reading of general items of information from incoming record media to register said read general items in said general registers, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, and means controlled by said reading means incident to the reading of said read specific item of time information read from an incoming record medium for causing certain of said registered general items to be reregistered in said one time register along with and as part of the said registered specific item of information.

40. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having general registers for registering items of general information including day and hour general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein including minutes time information, means controlled by said reading means incident to the reading of day and hour general items of information from incoming record media to register said read day and hour general information thereof in said general registers, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read minutes time information thereof in the one of said time registers characterized by the same identity index and for causing said registered day and hour general information to be reregistered in said one time register along with and as part of the said registered minutes time information.

41. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having general registers for registering items of general information including day and hour general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein including minutes time information, means controlled by said

reading means incident to the reading of day and hour general items of information from incoming record media to register said read day and hour general information thereof in said general registers, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read minutes time information thereof in the one of said time registers characterized by the same identity index, and means controlled by said reading means incident to the reading of said read specific item of time information from an incoming record medium for causing said registered day and hour general information to be reregistered in said one time register along with and as part of the said registered minutes time information.

42. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information including day and hour general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein including minutes time information, means controlled by the registration in said reading registers of day and hour general items of information to reregister said registered day and hour general information thereof in said general registers, means controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index to reregister said registered minutes time information thereof in the one of said time registers characterized by the same identity index and for causing said reregistered day and hour general information to be further reregistered in said one time register along with and as part of the said reregistered minutes time information.

43. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having reading registers for registering items of information, means including said reading means for causing items of information read from incoming record media to be registered in said reading registers, general registers for registering items of general information including day and hour general information, a plurality of time registers each characterized by a different identity index and arranged to register specific items of time information therein including minutes time information, means controlled by the registration in said reading registers of day and hour general items of information to reregister said day and hour general information thereof in said general registers, means controlled by the registration in said reading registers of a specific item of time information characterized by a given identity index to reregister said minutes time information thereof in the one of said time registers characterized by the same identity index, and means controlled by said reading means incident to the reading of said read specific item of time information from an incoming record medium for causing said reregistered day and hour general information to be further reregistered in said one time register along with and as part of the said reregistered minutes time information.

44. The invention claimed in claim 43 wherein in incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

45. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item

of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and arranged to reregister specific items of time information registered in any time register, fourth connector means individual to said common register and operable to connect said common register to both of said channels, and circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index and for operating said fourth connector means, whereby specific items of time information sequentially registered in a time register at different times over said first and second channels are concurrently reregistered in said common register at the same time over both channels.

46. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon

the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and arranged to reregister specific items of time information registered in any time register, fourth connector means individual to said common register and operable to connect said common register to both of said channels, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index, and circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for operating said fourth connector means at the same time as said concurrent operation of said first and second connector means, whereby specific items of time information sequentially registered in a time register at different times over said first and second channels are concurrently reregistered in said common register at the same time over both channels.

47. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of one of the sections thereof, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the commence or terminate connector of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the commence or terminate section of only said selected time register, a register

common to all time registers and arranged to reregister specific items of time information registered in any time register, second connector means individual to said common register and operable to connect said common register to both of said multiples, and circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said commence and terminate connectors in the time register characterized by said same identity index and for operating said second connector means, whereby specific items of time information sequentially registered in a time register at different times over said multiples are concurrently reregistered in said common register at the same time over both multiples.

48. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of one of the sections thereof, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the commence or terminate connector of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the commence or terminate section of only said selected time register, a register common to all time registers and arranged to reregister specific items of time information registered in any time register, second connector means individual to said common register and operable to connect said common register to both of said multiples, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said commence and terminate connectors in the time register characterized by said identity index, and circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for operating said second connector means at the same time as said concurrent operation of said commence and terminate connectors, whereby specific items of time information sequentially registered in a time register at different times over said multiples are concurrently reregistered in said common register at the same time over both multiples.

49. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, a control relay individual to each time register and operated or released respectively by the operated or released condition of said terminate section, a first circuit closed upon the release of said control relay and opened upon the operation of said control relay, a second circuit closed upon the operation of said control relay and opened upon the release of said control relay, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by said reading means incident to the reading of any read specific item of information characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, said terminate connector individual to said selected time register operable over a closed first circuit to register said read time information in said terminate section of said selected time register, said commence connector individual to said selected time register operable over a closed second circuit to register said read time information in said commence section of said selected time register, first circuit means including said first circuit and said energized selecting conductor

for operating said terminate connector when said control relay is released, second circuit means including said second circuit and said energized selecting conductor for operating said commence connector when said control relay is operated, a register common to all time registers and arranged to reregister specific items of time information registered in any time register, second connector means individual to said common register and operable to connect said common register to both of said multiples, and circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for closing both of said first and second circuits independently of the operated or released condition of said control relays and for operating said second connector means, whereby specific items of time information sequentially registered in a time register at different times over said multiples are concurrently reregistered in said common register at the same time over both multiples.

50. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, a control relay individual to each time register and operated or released respectively by the operated or released condition of said terminate section, a first circuit closed upon the release of said control relay and opened upon the operation of said control relay, a second circuit closed upon the operation of said control relay and opened upon the release of said control relay, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by any read specific item of information characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, said terminate connector individual to said selected time register operable over a closed first circuit

to register said read time information in said terminate section of said selected time register, said commence connector individual to said selected time register operable over a closed second circuit to register said read time information in said commence section of said selected time register, first circuit means including said first circuit and said energized selecting conductor for operating said terminate connector when said control relay is released, second circuit means including said second circuit and said energized selecting conductor for operating said commence connector when said control relay is operated, a register common to all time registers and arranged to reregister specific items of time information registered in any time register, second connector means individual to said common register and operable to connect said common register to both of said multiples, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for closing both of said first and second circuits independently of the operated or released condition of said control relays, and circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for operating said second connector means at the same time as the concurrent operation of said commence and terminate connectors, whereby specific items of time information sequentially registered in a time register at different times over said multiples are concurrently reregistered in said common register at the same time over both multiples.

51. The invention claimed in claim 50 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

52. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading

means incident to the reading of any specific item of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and including a time section and a facility section, fourth connector means individual to said common register and operable to connect the time section of said common register to both of said first and second channels, a separate third transmission channel, fifth connector means individual to said common register and operable to connect the facility section of said common register to said third channel, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index and for operating said fourth connector means and for operating said fifth connector means and for applying through said fifth connector means said read specific item of facility information to said third channel, whereby specific items of time information sequentially registered in a time register at different times over said first and second channels are concurrently registered in the time section of said common register at the same time over both of said first and second channels and whereby said read specific item of facility information is registered in the facility section of said common register concurrently with said reregistration.

53. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item

of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and including a time section and a facility section, fourth connector means individual to said common register and operable to connect the time section of said common register to both of said first and second channels, a separate third transmission channel, fifth connector means individual to said common register and operable to connect the facility section of said common register to said third channel, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index, and circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for operating said fourth connector means at the same time as said concurrent operation of said first and second connector means and for operating said fifth connector means at the same time as said concurrent operation of said first and second connector means and for applying through said fifth connector means said read specific item of facility information of said third channel, whereby specific items of time information sequentially registered in a time register at different times over said first and second channels are concurrently reregistered in the time section of said common register at the same time over both of said first and second channels and whereby said read specific item of facility information is registered in the facility section of said common register concurrently with said reregistration.

54. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, a control relay individual to each time register and operated or released respectively by the operated or released condition of said terminate section, a first circuit closed upon the release of said control

relay and opened upon the operation of said control relay, a second circuit closed upon the operation of said control relay and opened upon the release of said control relay, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, a selecting conductor individual to each time register for selecting said time register when energized, a selecting circuit controlled by said reading means incident to the reading of any read specific item of information characterized by a given identity index for energizing the selecting conductor of the time register characterized by the same identity index, said terminate connector individual to said selected time register operable over a closed first circuit to register said read time information in said terminate section of said selected time register, said commence connector individual to said selected time register operable over a closed second circuit to register said read time information in said commence section of said selected time register, first circuit means including said first circuit and said energized selecting conductor for operating said terminate connector when said control relay is released, second circuit means including said second circuit and said energized selecting conductor for operating said commence connector when said control relay is operated, a register common to all time registers and including a time section and a facility section, second connector means individual to said common register and operable to connect the time section of said common register to both of said first and second multiples, a separate third facility conductor multiple, third connector means individual to said common register and operable to connect the facility section of said common register to said third multiple, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for closing both of said first and second circuits independently of the operated or released condition of said control relays, and circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for operating said second connector means at the same time as said concurrent operation of said commence and terminate connectors and for operating said third connector means at the same time as said concurrent operation of said commence and terminate connectors and for applying through said third connector means said read specific item of facility information to said third multiple, whereby specific items of time information sequentially registered in a time register at different times over said first and second multiples are concurrently reregistered in the time section of said common register at the same time over both of said first and second multiples and whereby said read specific item of facility information is registered in the facility section of said common register concurrently with said reregistration.

55. The invention claimed in claim 54 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

56. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of processing registers, each processing register including a facility section arranged to register an item of specific facility information consisting of a number of consecutive sets of coded data read by said reading means from an incoming record medium, each facility section including a number of data registers, each data register arranged to register therein a different set of coded data relating to a specific item of facility information, a transmission channel common to all processing registers, connector means selectively operable to connect a selected data register of a selected processing register to said common channel, a control circuit for selectively controlling said connector means, initial operating means controlled by said reading means incident to the reading of data contained in a first set of coded data relating to a first specific item of facility information from an incoming record medium for causing said control circuit to selectively operate said connector means and for applying said read first set of coded data to said common channel, whereby said first read set of coded data is registered in a first data register of said selected processing register, conditioning means controlled by the registration of data contained in said first registered set of coded data for conditioning said control circuit according to the number of supplementary sets of coded data to be expected relating to said first specific item of facility information, supplementary operating means controlled by said reading means incident to the reading of data contained in each supplementary set of coded data relating to said first specific item of facility information from an incoming record medium and controlled by said conditioning means for causing said control circuit to sequentially and selectively operate said connector means and for applying each successive read supplementary set of coded data to said common channel, whereby each successive read supplementary set of coded data is registered in an additional one of said data registers of said selected processing register, and switching means including said conditioning means effective only after the said expected number of supplementary sets of coded data relating to said first specific item of facility information have been registered in a corresponding number of data registers of said selected processing register to cause said control circuit to register a second read specific item of facility information in another processing register under the control of said initial operating means and said conditioning means and said supplementary operating means.

57. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time

at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having two processing registers, each processing register including a facility section arranged to register an item of specific facility information consisting of a number (two or four) of consecutive sets of coded data read by said reading means from an incoming record medium, each facility section including four data registers, each data register arranged to register therein a different set of coded data relating to a specific item of facility information, a transmission channel common to all processing registers, a connector individual to each data register and operable to connect the associated data register to said common channel, a control circuit for controlling said data register connectors, initial operating means controlled by said reading means incident to the reading of data contained in a first set of coded data relating to a first specific item of facility information from an incoming record medium for causing said control circuit to operate a first data register connector in one of said two processing registers and for applying said read first set of coded data to said common channel, whereby said first read set of coded data is registered in a first data register of said one processing register, conditioning means controlled by the registration of data contained in said first read set of coded data for conditioning said control circuit according to the number (one or three) of supplementary sets of coded data to be expected relating to said first specific item of facility information, supplementary operating means controlled by said reading means incident to the reading of data contained in each supplementary set of coded data relating to said first specific item of facility information from an incoming record medium and controlled by said conditioning means for causing said control circuit to sequentially operate each successive additional data register connector in said one processing register and for applying through each respective additional data register connector each additional respective read supplementary set of coded data to said common channel, whereby each additional respective read supplementary set of coded data is registered in an additional respective one of said data registers of said one processing register, and switching means including said conditioning means effective only after the said expected number (one or three) of supplementary sets of coded data relating to said first specific item of facility information have been registered in a corresponding number (one or three) of data registers of said one processing register to cause said control circuit to register a second read specific item of facility information in the other processing register under the control of said initial operating means and said conditioning means and said supplementary operating means.

58. The invention claimed in claim 57 wherein said initial operating means also includes a first steering relay associated with said one processing register and operated at the start of processing, wherein said conditioning means also includes a line count circuit operated by data contained in said registered first read set of coded data to remember the expected number of supplementary sets of coded data relating to said first read specific item of facility information, wherein said supplementary operating means also includes other steering relays associated with said one processing register and operated sequentially as consecutive and successive sets of coded data relating to said first specific item of facility information are read by said reading means, and wherein said switching means also includes a first and other steering relays associated with said other processing register.

59. The invention claimed in claim 58 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

60. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and having two registration parts for reregistering the two specific items of time information registered in any time register, fourth connector means individual to said common register and operable to connect a first part of said common register to said first channel and a second part of said common register to said second channel, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index and for operating said fourth connector means, whereby a read specific item of time information registered in

a section of a time register over said first or second channel is reregistered in the corresponding part of said common register over the corresponding channel, a check circuit operable to indicate whether any specific items of time information are registered in the sections of the time register associated with said reregistration, and circuit means controlled by said check circuit when only one section contains a registration for operating said third connector, whereby the specific item of time information registered in said one section is reregistered in both parts of said common register at the same time over both channels through said third connector means.

61. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and having two registration sections for registering two specific items of time information, a first transmission channel common to all first sections of said time registers, a separate second transmission channel common to all second sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of the first section thereof, first connector means in each time register operable to connect the first section thereof to said first channel, second connector means in each time register operable to connect the second section thereof to said second channel, third connector means common to all time registers operable to interconnect said first and second channels, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said third connector means and for applying therethrough said read specific item of time information to both of said channels, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the first or second connector means of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the first or second section of only said selected time register, a register common to all time registers and having two registration parts for reregistering the two specific items of time information registered in any time register, fourth connector means individual to said common register and operable to connect a first part of said common register to said first channel and a second part of said common register to said second channel, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said first and second connector means in the time register characterized by said same identity index and for operating said fourth connector means, whereby a read specific item of time information registered in a section of a time register over said first or second channel is reregistered in the corresponding part of said common register over the corresponding channel, a relay check circuit individual to said common register and operable into a plurality of conditions to indicate how many specific items of time information are registered in the sections of the time register associated with said reregistration, and circuit means controlled by said check circuit when the condition thereof indicates that only one section contains a registration for operating said third connector, whereby the one specific item of time information contained in said one section is reregistered in both parts of said common register at the same time over both channels through said third connector means.

62. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and having a commence time registration section and a terminate time registration section for registering two specific items of time information, a commence time conductor multiple common to all commence sections of said time registers, a separate terminate time conductor multiple common to all terminate sections of said time registers, control means individual to each time register and conditioned differently by the operated and released conditions of one of the sections thereof, a commence connector in each time register operable to connect the commence section thereof to said commence multiple, a terminate connector in each time register operable to connect the terminate section thereof to said terminate multiple, connector means common to all time registers operable to interconnect said two multiples, circuit means controlled by said reading means incident to the reading of any specific item of time information from an incoming record medium for operating said connector means and for applying therethrough said read specific item of time information to both of said multiples, circuit means controlled by said reading means incident to the reading of said read specific item of time information characterized by a given identity index for selecting and operating the commence or terminate connector of the time register characterized by the same identity index depending upon the condition of said control means, whereby said read specific item of time information is registered in the commence or terminate section of only said selected time register, a register common to all time registers and having a commence time registration part and a terminate time registration part for registering the two respective specific items of time information registered in any time register, a commence connector individual to said common register and operable to connect said first part of said common register to said commence multiple, a terminate connector individual to said

common register and operable to connect said terminate part of said common register to said terminate multiple, circuit means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by said same identity index for concurrently operating only both of said commence and terminate connectors in the time register characterized by said same identity index, circuit means controlled by said reading means incident to the reading of said same read specific item of facility information for concurrently operating both of said commence and terminate connectors in said common register, whereby each specific item of time information registered in a section of a time register over said commence or terminate multiple is reregistered in the corresponding part of said common register over the said corresponding multiple, a group of relays individual to said common register and selectively operable in response to the interconnection between said common register and one of said time registers to select one of a number of circuit conditions indicating how many specific items of time information are registered in the sections of the time register associated with said reregistration, a switching relay, and an operating circuit for said switching relay selectively energized by said relay check circuit when only one section contains a registration for causing the operation of said switching relay, said operated switching relay arranged to operate said connector means, whereby the commence and terminate multiples are interconnected through said connector means thereby to cause the specific item of time information registered in said one section to be reregistered in both parts of said common register at the same time over both multiples.

63. The invention claimed in claim 62 wherein the said relay check circuit includes an up-check relay and a down-check relay common to each of the commence and terminate sections of all time registers.

64. The invention claimed in claim 63 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

65. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, and means including said control circuit and controlled by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to selectively release none or one or both registrations in all timing registers depending upon the type of read general item of charge canceling information and upon the indication in said control circuit.

66. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a release relay in each time register operable to release all registrations in the registration means thereof, a control circuit common to all time registers and including a first and a second indicating relay operable respectively to indicate respectively whether one or two specific items of time information is or are contained in any time register, first relay means including either or both operated said indicating relays and controlled by said reading means incident to the reading of a first particular type of general item of charge cancelling information from an incoming record medium to cause the operation of only those release relays associated with time registers having at least one specific item of time information registered in the registering means thereof, and second relay means including an operated said first indicating relay and controlled by said reading means incident to the reading of a second particular type of general item of charge cancelling information from an incoming record medium to cause the operation of only those release relays associated with time registers having only one specific item of time information registered in the registering means thereof.

67. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items

for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each release relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, and means controlled by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to selectively energize only said first conductor or both of said first and second conductors or neither of said first and second conductors depending upon the type of read general item of charge canceling information and upon the operated or released condition of said indicating relays.

68. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, a first control relay operable to energize said first conductor, a second control relay operable to energize said second conductor, and means controlled by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to selectively operate one or both or neither of said control relays depending upon the type of read general item of charge canceling information and upon the operated or released condition of said indicating relays.

69. The invention claimed in claim 68 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape. and an identity index is a digital component of a plural digit number.

70. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting

step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, and means including said control circuit and controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium to release all registrations in all timing registers.

71. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers and including first and second indicating means operable respectively to indicate respectively whether one or two specific items of time information is or are contained in any time register, and means including either or both operated indicating means and controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium to release all registrations in all timing registers.

72. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each release relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, and means controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium and by an operated first or second indicating relay to energize both of said first and second conductors.

73. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the

control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each release relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, a first control relay operable to energize said first conductor, a second control relay operable to energize said second conductor, and means controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium and by an operated first or second indicating relay to operate both of said control relays.

74. The invention claimed in claim 73 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

75. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the date from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are are contained in any time register, and means including said control circuit and controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium to release all registrations in all timing registers which contain only one registered specific item of time information.

76. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers and including first and second indicating means operable respectively to indicate respectively whether one or two specific items of time information is or are contained in any time register, and means including said first indicating means and controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium to release all registrations in all timing registers which contain only one registered specific item of time information.

77. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two spe-

cific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each release relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, and means controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium and by an operated first indicating relay to energize only said first conductor.

78. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, a first relay in each time register operated under the control of the first section thereof only when said first section contains a registration, a second relay in each time register operated under the control of the second section thereof only when said second section contains a registration, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index and controlled by the first relay of the time register characterized by the said same identity index for causing said read time information to be registered in the first section of said time register if said first relay is released and to be registered in the second section of said time register if said first relay is operated, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a first indicating relay operated under the control of an operated first relay and a released second relay of any time register to indicate that at least one time register contains only one specific item of time information and including a second indicating relay operated under the control of an operated first relay and an operated second relay of any time register to indicate that at least one time register contains two specific items of time information and including first and second conductors common to all time registers, an operating circuit for each release relay completed under the control of an associated operated first relay and an associated released second relay to said first conductor whereby each such release relay will be operated when said first conductor is energized and completed under the control of an associated operated first relay and an associated operated second relay to said second conductor whereby each such release relay will be operated when said second conductor is energized, a first control relay operable to energize said first conductor, a second control relay operable to energize said second conductor, and means controlled by said reading means incident to the reading of a particular type of general item of charge canceling information from an incoming record medium and by an operated first indicating relay to operate only said first control relay.

79. The invention claimed in claim 78 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

80. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commerced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device each including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers, and means including said control circuit for releasing all registrations in all timing registers.

81. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items

of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers, and means including said control circuit and controlled by an operator at any desired time to release all registrations in all timing registers.

82. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a control circuit common to all time registers, manually operable switch means, and means including said control circuit and said switch means and controlled manually by an operator at any desired time to release all registrations in all timing registers.

83. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a control relay operable to operate all release relays in all time registers containing any registration, manually operable switch means, and means effective upon the operation of said switch means to operate said control relay.

84. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, an indicating relay in each time register operable by said time register to indicate when said time register contains any registration, a release relay in each time register operable when said associated indicating relay is operated to release all registrations therein, a control circuit common to all time registers and including a control relay operable to operate all release relays in all time registers containing operated indicating relays, manually operable switch means, and means effective upon the operation of said switch means to operate said control relay.

85. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of sepecific information including and characterized by identity indices and comprising the data from which customer

charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including registration means for registering two specific items of time information, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for causing said read time information to be registered in the registering means of the one of said time registers characterized by the same identity index, an indicating relay in each time register operated by said time register to indicate when said time register contains at least one registered specific item of time information, a release relay in each time register operable to release all registrations therein, a control circuit common to all time registers and including a control relay, manual switch means operable to operate said control relay, and an operating circuit for each release relay completed through the agency of an operated control relay and an operated associated indicating relay, whereby upon the operation of said switch means all registrations will be released in all time registers whose indicating relays are operated.

86. The invention claimed in claim 85 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforation in a perforated tape, and an identity index is a digital component of a plural digit number.

87. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including means for registering two specific items of time information, circuit means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index to cause said read specific item of time information to be registered in the registering means of the time register characterized by the same identity index, a register common to all time registers and including means for reregistering the time information registered in any time register, circuit means for developing within said device a signal characterized by the said same identity index, circuit means responsive to said signal to cause said common register to be interconnected with the time register characterized by the said same identity index and to cause the time information registered in said same time register to be reregistered in said common register, check circuits effective upon said interconnection and upon said reregistration to indicate whether or not the amount of timing information reregistered in said common register agrees with the amount of timing information registered in said same time register, and circuit means controlled by said check circuits to maintain said interconnection until said agreement is indicated.

88. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, circuit means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index to cause said read specific item of time information to be registered in an empty section of the time register characterized by the same identity index, a register common to all time registers and including two registration parts for reregistering the time information registered in any time register, circuit means for developing within said device a signal characterized by the said same identity index, circuit means responsive to said signal to cause each part of said common register to be interconnected with a different portion of the time register characterized by the said same identity index and to cause the time information registered in each section of said same time register to be reregistered in the corresponding part of said common register, check circuits effective upon said interconnection and upon said reregistration to indicate whether or not the amount of timing information reregistered in each part of said common register agrees with the amount of timing information registered in each corresponding section of said same time register, and circuit means controlled by said check circuits to maintain said interconnection until said agreement is indicated.

89. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items

for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different indentity index and including two registration sections for registering two specific items of time information, circuit means controlled by said reading means incident to the reading of a specific item of time information from an incoming record media and characterized by a given identity index to cause said read specific item of time information to be registered in an empty section of the time register characterized by the same identity index, a register common to all time registers and including two registration parts for reregistering the time information registered in any time register, circuit means for developing within said device a signal characterized by the said same identity index, circuit means responsive to said signal to cause each part of said common register to be interconnected with a different portion of the time register characterized by the said same identity index and to cause the time information registered in each section of said same time register to be reregistered in the corresponding part of said common register, a relay check circuit including a first relay portion associable with a time register and a second relay portion associable with said common register, means effective upon said interconnection to cause said first relay portion to be associated with said same time register and to indicate the nature of the registration therein and to cause said second relay portion to be associated with said common register and to indicate the nature of the reregistration therein, and circuit means controlled jointly by said relay portions to maintain said interconnection until said relay portions indicate the same natures.

90. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including two registration sections for registering two specific items of time information, circuit means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index to cause said read specific item of time information to be registered in an empty section of the time register characterized by the same identity index, a register common to all time registers and including two registration parts for reregistering the time information registered in any time register, circuit means for developing within said device a signal characterized by the said same identity index, circuit means responsive to said signal to cause each part of said common register to be interconnected with a different portion of the time register characterized by the said same identity index and to cause the time information registered in each section of said same time register to be reregistered in the corresponding part of said common register, a relay check circuit individual to said common register and including an up-check relay and a down-check relay for each section of a time register and for each part of said common register, means effective upon said interconnection and upon said reregistration to cause said check relays to be associated with and to be controlled by the two sections of said same time register and by the two parts of said common register whereby for any section or part the corresponding up or down-check relay will be operated respectively depending upon whether the corresponding section or part contains or does not contain a registration or a reregistration, and circuit means controlled jointly by all of said up and down-check relays to maintain said interconnection until either both up-check relays or both down-check relays for interconnected pairs of sections and parts are operated.

91. The invention claimed in claim 90 wherein said circuit means for causing said interconnection includes relay connectors in each time register and relay connectors in said common register and operating circuits for said connectors and wherein said circuit means for maintaining said interconnection under the control of said check relays comprises locking circuits for said connectors.

92. The invention claimed in claim 91 wherein said locking circuits for said connectors includes a locking circuit for the common register connectors controlled directly by said check relays and a locking circuit for the time register connectors controlled by one of the time register connectors.

93. The invention claimed in claim 92 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

94. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information indicating the accounting conditions employed in the process of producing said incoming record, one such general item of identification information comprising identification of the control means employed in the process of producing said incoming record, said device having an identification circuit including a set of switches set-

table whereby said circuit is arranged to permit said device to process only incoming record media containing general items of identification information corresponding to similar information prescribed by the setting of said switches, at least one of said switches settable to permit said device to process at any one time only incoming record media produced through the employment of a control means which is identified by said one general item of identification information as corresponding to the setting of said one switch, conditioning means selectively operable to condition said device to process incoming record media on the basis of billing periods of different durations, and circuit means automatically controlled by the setting of said one switch to selectively operate said conditioning means according to the setting of said one switch.

95. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information indicating the accounting conditions employed in the process of producing said incoming record, one such general item of identification information comprising identification of the control means employed in the process of producing said incoming record, said device having an identification circuit including a set of switches settable whereby said circuit is arranged to permit said device to process only incoming record media containing general items of identification information corresponding to similar information prescribed by the setting of said switches, at least one of said switches settable to permit said device to process at any one time only incoming record media produced through the employment of a control means which is identified by said one general item of identification information as corresponding to the setting of said one switch, translator relay means selectively operable to condition said device to process incoming record media on the basis of billing periods of different durations, semi-permanent circuit connections preset to associate particular selective operations of said translator relay means with particular said one general items of identification information, and circuit means including said semi-permanent circuit connections and automatically controlled by the setting of said one switch to selectively operate said translator relay means according to the setting of said one switch.

96. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information indicating the accounting conditions employed in the process of producing said incoming record, one such general item of identification information comprising identification of the control means employed in the process of producing said incoming record, said device having an identification circuit including a set of switches settable whereby said circuit is arranged to permit said device to process only incoming record media containing general items of identification information corresponding to similar information prescribed by the setting of said switches, at least one of said switches settable to permit said device to process at any one time only incoming record media produced through the employment of a control means which is identified by said one general item of identification information as corresponding to the setting of said one switch, translator relays operable in different manners to condition said device to process incoming record media on the basis of billing periods of different durations, semi-permanent circuit connections preset to associate particular manners of operations of said translator relays with particular said one general items of identification information, and circuit means including said semi-permanent circuit connections and automatically controlled by the setting of said one switch to operate said translator relays in that manner associated with the setting of said one switch.

97. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information indicating the accounting conditions employed in the process of producing said incoming record, one such general item of identification information comprising identification of the control means employed in the process of producing said incoming record, said device having an identification circuit including a set of switches settable whereby said circuit is arranged to permit said device to process only incoming record media containing general items of identification information corresponding to similar information prescribed by the setting of said switches, at least one of said switches settable to permit said device to process at any one time only incoming record media produced through the employment of a

control means which is identified by said one general item of identification information as corresponding to the setting of said one switch, translator relays, at least one different translator relay operable to condition said device to process incoming record media on the basis of each different billing round of a different duration where each different billing round consists of a different number of consecutive calendar days, semi-permanent cross-connections manually preset to associate particular different operations of said translator relays with particular said one general items of identification information, and circuit means including said semi-permanent cross-connections and automatically controlled by the setting of said one switch to operate said translator relays according to the setting of said one switch.

98. The invention claimed in claim 97 wherein the said translator relays are operable in two different ways and wherein the said different billing rounds consist of a three-day round and a five-day round and wherein the said cross-connections are preset such that any operational setting of said one switch associates one of said two relay operations with any operational said one general item of identification information.

99. The invention claimed in claim 98 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

100. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information including the accounting conditions employed in the process of producing said incoming record, certain such general items of identification information comprising identification of the accounting time during which said incoming record was produced, said device having an identification circuit including a set of switches settable whereby said circuit is arranged to permit said device to process only incoming record media containing general items of identification information prescribed by the setting of said switches, certain of said switches settable to prescribe inclusive time limits between first and last accounting times whereby said circuit is arranged to permit said device to process only incoming record media produced during accounting times which are identified by said certain general items of identification as within the inclusive limits thereof prescribed by the setting of said certain switches, registering means operable under the control of said reading means incident to the reading of said certain general items of identification from an incoming record medium to denote at any one time the accounting time pertaining to an incoming record medium then being processed by said device, and circuit means controlled by said registering means and by said identification circuit and by said reading means incident to the reading of said certain general items of identification information from incoming record media to permit said device to process only incoming record media which are identified by said certain general items of identification information as arranged in an order of time between the inclusive accounting time limits thereof as prescribed by said certain switches and to operate said registering means accordingly during the processing of said incoming record media.

101. The invention claimed in claim 100 wherein the said first and last accounting times are respectively the earliest and latest accounting times and wherein the said order of time is the reverse chronological order of time.

102. The invention claimed in claim 101 wherein the latest accounting time is a specified latest calendar day and the earliest accounting time is a specified earliest calendar day.

103. The invention claimed in claim 102 wherein said latest calendar day is a specified day of a specified latest billing period and wherein said earliest calendar day is a specified day of a specified earliest billing period.

104. The invention claimed in claim 103 wherein a billing period is a round consisting of a number of consecutive calendar days in a calendar month, wherein said certain switches prescribe a specified day of a specified latest round of a month as one time limit and a specified day of a specified earliest round of said month as the other time limit, and wherein said registering means includes means for registering the round and the day thereof.

105. The invention claimed in claim 104 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

106. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information including the accounting conditions employed in the process of producing said incoming record, certain such general items of identification information comprising identification of the billing round and of the day thereof during which said incoming record was produced where a calendar month is for accounting purposes divided into a plurality of rounds each consisting of a plurality of consecutive calendar days, said device having an identification circuit including a set of switches settable whereby said circuit is arranged to permit said device to process only incoming record media containing general

items of identification information prescribed by the setting of said switches, a group of said switches settable to prescribe inclusive time limits as a specified latest day of a specified latest round and a specified earliest day of a specified earliest round whereby said circuit is arranged to permit said device to process only incoming record media produced during rounds and days thereof which are identified by said certain general items of identification as within the inclusive limits thereof prescribed by the setting of said group of switches, a round register operable under the control of said reading means incident to the reading of a round general item from an incoming record medium to denote at any one time the round pertaining to an incoming record medium then being processed by said device, a day register operable under the control of said reading means incident to the reading of a day of round general item from an incoming record medium to denote at any one time the day of round pertaining to an incoming record medium then being processed by said device, and circuit means controlled by both of said registering means and by said identification circuit and by said reading means incident to the reading of said certain general items of identification information from incoming record media to permit said device to process only incoming record media which are identified by said certain general items of identification information as arranged in the reverse chronological order of time between the inclusive limits thereof as prescribed by said group of switches and to operate both of said registering means accordingly during the processing of said incoming record media.

107. The invention claimed in claim 106 wherein said group of switches includes four switches individually settable to prescribe respectively a last round and a last day of the last round and a first round and a first day of the first round, wherein said circuit means includes first circuit means effective under the control of said reading means upon the reading of a first incoming record medium to register in said round register and in said day register the respective prescribed last round and last day of last round upon identification thereof by said identification circuit as pertaining to said first incoming record medium, wherein said circuit means includes second circuit means effective thereafter under the control of said reading means upon the reading of subsequent successive incoming record media to successively change the round and day of round registrations according to the reverse chronological order of time upon identification by said identification circuit of such changes as pertaining to said successive incoming record media in the order read.

108. The invention claimed in claim 107 wherein said second circuit means includes checking circuits effective in cooperation with said registers and with said identification circuit as incoming record media are read to permit a change of the day of round registration to the next earlier day of round provided no change in round occurs and to permit a change of the day of round registration from the first day of a round to the last day of a round provided the round changes to the next earlier round.

109. The invention claimed in claim 108 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

110. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information comprising identification of the accounting time during which said incoming record was produced and identification of the serial number of the source of said incoming record, said device having an identification circuit including a set of switches settable to prescribe inclusive time limits between first and last accounting times and inclusive serial number limits between first and last numbered sources of incoming record media whereby said circuit is arranged to permit said device to process only incoming record media produced by sources thereof and during accounting times both of which are identified by said certain general items of identification as within the serial number and accounting time limits thereof prescribed by the setting of said switches, registerering means operable under the control of said reading means incident to the reading of said certain general items from an incoming record medium to denote at any one time the accounting time and the source serial number pertaining to an incoming record medium then being processed by said device, and circuit means controlled by said registering means and by said identification circuit and by said reading means incident to the reading of said certain general items of identification from incoming record media to permit said device to process only incoming record media which are identified by said certain general items of identification information as arranged for each separate source in the same order of time between the inclusive accounting time limits thereof and as arranged in an order of source serial number between the inclusive serial number limits thereof all as prescribed by said switches and to operate said registering means accordingly during the processing of said incoming record media.

111. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information comprising identification of the accounting time during which said incoming record

was produced and identification of the serial number of the source of said incoming record, said device having an identification circuit including a set of switches settable to prescribe inclusive time limits between first and last accounting times and inclusive serial number limits between first and last numbered sources of incoming record media whereby said circuit is arranged to permit said device to process only incoming record media produced by sources thereof and during accounting times both of which are identified by said certain general items of identification as within the serial number and accounting time limits thereof prescribed by the setting of said switches, a time register and a number register each operable under the control of said reading means incident to the reading of said certain general items from an incoming record medium to denote at any one time the respective accounting time and source serial number pertaining to an incoming record medium then being processed by said device, first circuit means controlled by both registers and by said identification circuit and by said reading means incident to the reading of said certain general items of accounting time identification from incoming record media to permit said device to process only incoming record media which are identified by said certain general items of identification as arranged for each separate source in the same order of time between the inclusive accounting time limits thereof prescribed by said switches, second circuit means controlled by both registers and by said identification circuit and by said reading means incident to the reading of said certain general items of source serial number identification from incoming record media to permit said device to process only incoming record media which are identified by said certain general items of identification as arranged in an order of source serial number between the inclusive serial number limits thereof prescribed by said switches, and third circuit means controlled by said first and second circuit means to operate said registers accordingly during the processing of said incoming record media.

112. The invention claimed in claim 111 wherein an alarm circuit is provided operable under the control of said first and second circuit means to stop the processing of incoming record media in the event that an improper succession of incoming record media is attempted to be processed by said device.

113. The invention claimed in claim 112 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an indentity index is a digital component of a plural digit number.

114. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information comprising identification of the accounting day during which said incoming record was produced and identification of the number of the recorder which produced said incoming record, said device having an identification circuit including a set of switches settable to prescribe inclusive time limits between earlier and later accounting days and inclusive recorder number limits between lowest and highest recorder whereby said circuit is arranged to permit said one device to process only incoming record media produced by recorders and during accounting days both of which are identified by said certain general items of identification as within the recorder number and accounting day limits thereof prescribed by the setting of said switches, a time register operable to denote the passage of time in terms of accounting days, a number register operable to denote a succession of incoming record media recorder numbers, means in said device controlled by said reading means and responsive to the reading of accounting day and recorder number information from incoming record media to operate said time register over the entire inclusive limits between said later and earlier accounting days only if changes in accounting days are consecutive for each recorder number, and means in said device controlled by said reading means and responsive to the reading of accounting day and recorder number information from incoming record media to operate said number register over the entire inclusive limits between said lowest and highest recorder number only if changes of recorder number are consecutive and only if such changes occur when the accounting day changes from said earlier to said later accounting day.

115. The invention claimed in claim 114 wherein a billing round is a division of a calendar month consisting of a plurality of consecutive calendar days, wherein said later accounting day is a specified later day of a latest round, wherein said earlier accounting day is a specified earlier day of an earliest round, wherein said time register includes a round register and a day of round register operable to denote the passage of time in terms of rounds and days of round, wherein said means for operating said time register includes a circuit for checking that changes in days of round and rounds are consecutive calendar day changes for each recorder, and wherein said means for operating said recorder number register includes a circuit for checking that changes in numbers are consecutive and that such changes occur only when the accounting day changes from the earlier day of the earliest round to the later day of the latest round.

116. The invention claimed in claim 115 wherein an alarm circuit is provided operable under the control of said checking circuits to stop the processing of incoming record media in the event that an improper succession of incoming record media is attempted to be processed by said device.

117. The invention claimed in claim 116 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

118. The invention claimed in claim 110 wherein a clearing control circuit is provided and is operable to clear all information from said device pertaining to a particular source of incoming record media and wherein said circuit means includes a detecting circuit effective upon detecting a proper change of source serial number to operate said clearing control circuit.

119. The invention claimed in claim 115 wherein a clearing control circuit is provided and is operable to

clear all information from said device pertaining to a particular incoming record media recorder number, wherein said means for operating said timing register includes a time register resetting circuit operable to reset said time register to said later day of said latest round, wherein said means for operating said recorder number register includes a detecting circuit effective upon detecting a proper change in recorder number to operate said clearing control circuit, and wherein a satisfaction circuit is provided effective when said clearing operation is completed to operate said resetting circuit.

120. The invention claimed in claim 119 wherein said clearing control circuit includes circuits effective as part of said clearing operation to cause said recording means to record on at least one outgoing record medium special item information indicative of said clearing operation.

121. The invention claimed in claim 120 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

122. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having means controlled by said reading means incident to the reading of input items for permitting said device to process only incoming record media, said means for processing controlled by said permitting means to process one or more specific items of incomplete customer uses and for causing said recording means to record output items related thereto on one or more special outgoing record media, and means controlled by said processing means for causing said special outgoing record media to be produced by said recording means in such a manner as to characterize same as incoming record media.

123. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input

information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code as a part thereof, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said device to process only record media characterized by incoming record identity, said means for processing controlled by said permitting means to process one or more specific items of incomplete customer uses and for causing said recording means to record output items related thereto on one or more special outgoing record media, and means controlled by said processing means for characterizing special outgoing record media as incoming record media by causing said recording means to record thereon incoming record identity code.

124. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code as part thereof, all record media having incoming record identity being connected in a series whereby such a series may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said one device to process only incoming record media characterized by incoming record identity, said means for processing controlled by said permitting means to process one or more specific items of incomplete customer uses and for causing said recording means to record output items related thereto on one or more special outgoing record media, and means controlled by said processing means for characterizing special outgoing record media as incoming record media by causing said recording means to record thereon incoming record identity code, whereby said special outgoing record media may be connected in and as part of a later processed continuous incoming record.

125. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of in-

formation on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein, all record media having incoming record identity being connected in a series whereby such a series may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said device to process only record media having incoming record identity, means controlled by said processing means to cause said recording means to record outgoing record identity code on regular outgoing record media and to record incoming record identity code on special outgoing record media, and said processing means controlled by said permitting means incident to the reading from said continuous record of specific items of complete customer uses for causing said recording means to record output items related thereto on one or more regular outgoing record media and controlled by said permitting means incident to the reading from said continuous record of one or more specific items of incomplete customer uses for causing said recording means to record output items related thereto on one or more special outgoing record media, whereby special outgoing record media may be connected in and as part of a later processed continuous incoming record.

126. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein, all record media having incoming record identity being connected in a series whereby such a series may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said device to process only record media having incoming record identity, means controlled by said processing means to cause said recording means to record outgoing record identity code on regular outgoing record media and to record incoming record identity code on special outgoing record media, means in said processing means controlled by said permitting means incident to the reading from said continuous record of specific items of complete customer uses for causing said recording means to record output items related thereto on one or more regular outgoing record media, and other means in said processing means controlled by said permitting means incident to the reading from said continuous record of one or more specific items of incomplete customer uses for causing said recording means to record output items related thereto on one or more special outgoing record media, whereby special outgoing record media may be connected in and as part of a later processed continuous incoming record.

127. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein including general item information identifying the source of said incoming record medium, all record media having incoming record identity for a particular source thereof being connected in a tandem group and all such tandem groups of record media being connected in a series whereby such a series of tandem groups of record media may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said device to process only record media having incoming record identity, means controlled by said processing means to cause said recording means to record outgoing record identity code on regular outgoing record media and to record incoming record identity code on special outgoing record media, means in said processing means controlled by said permitting means incident to the reading from a tandem group of said continuous record of specific items of complete customer uses contained within said tandem group for causing said recording means to record output items related thereto on one or more regular outgoing record media, and other means in said processing means controlled by said permitting means incident to the reading from a tandem group of said continuous record of one or more specific items of incomplete customer uses contained within said tandem group for causing said recording means to record output items related thereto on one or more special outgoing record media, whereby special outgoing record media containing output items for incomplete customer uses contained in each tandem group may be connected in and as part of a later process continuous incoming record.

128. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating,

computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium having splice code on the ends thereof and having adjacent said splice code incoming record identity code including general item information identifying the serial number of the source of said incoming record medium, all record media having incoming record identity and pertaining to a particular source number being spliced together at respective splice codes to form a tandem group for each source number, all such tandem groups being spliced together at respective splice codes to form a series of tandem groups whereby such a series may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity code for permitting said device to process only incoming record media having incoming record identity and only incoming record media arranged as a continuous incoming record, means controlled by said reading means incident to the reading of specific items of customer uses from incoming record media for registering said read items in said device preparatory to processing associated specific items for each customer use, means controlled by said processing means to cause said recording means to record outgoing record identity code and splice code on regular outgoing record media and to record incoming record identity and splice code on special outgoing record media, means controlled by the registering in said device of specific items of complete customer uses to cause said recording means to record output items related thereto on one or more regular outgoing record media, means controlled by said reading means incident to the reading of general source number item information from incoming record identity codes for indicating the end of a tandem group of incoming record media, and means responsive to such indication to cause said recording means to record on special outgoing record media output items relating to all specific items of incomplete customer uses then registered in said device, whereby special outgoing record media containing output items for incomplete customer uses for each source number may be spliced in and as part of a later processed continuous incoming record.

129. The invention claimed in claim 128 wherein said incoming record identity code includes general item information identifying the type of said source, wherein said recording means includes first means selectively operable to record regular splice code or special splice code on outgoing record media, and wherein said means for causing said recording means to record splice code on outgoing record media includes means selectively controlled by said reading means incident to the reading of general source type item information from incoming record media to selectively operate said first means according to the source type read.

130. The invention claimed in claim 129 wherein said general source type item information may identify a regular source or a special source, wherein said first means comprises a regular code controller operable to record regular splice code on regular outgoing record media and a special code controller operable to record special splice code on special outgoing record media, wherein said selectively controlled means includes a regular selector controlled by said reading means incident to the reading of regular source type item information to operate said regular code controller, and wherein said selectively controlled means includes a special selector controlled by said reading means incident to the reading of special source type item information to operate said special code controller.

131. The invention claimed in claim 130 wherein said regular code controller includes means for generating a fixed arbitrary splice code whereby any record media having such splice code may be properly spliced together, and wherein said special code controller includes means for generating a variable distinctive splice code comprising source type item information whereby only record media having matching variable distinctive splice codes may be properly spliced together.

132. The invention claimed in claim 131 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

133. In an automatic accounting system wherein records of customer uses of faciilties are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, and wherein an accounting device is provided including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, the method of processing information in continuous record form from discontinuous incoming record media comprising the steps of recording on outgoing record media one or more specific items for each incomplete customer use in incoming record media, splicing said outgoing record media into other incoming record media containing one or more missing specific items for said incomplete customer use, and processing said spliced record media as a continuous incoming record.

134. In an automatic accounting system wherein records of customer uses of faciilties are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, and wherein an accounting device is provided including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, the method of processing information in continuous record form from discontinuous incoming record media comprising the steps of processing specific items for each complete customer use in incoming record media, recording on outgoing record media one or more specific items for each incomplete customer use in said incoming record media, splicing said outgoing record media into other incoming record media containing one or more missing specific items for said incomplete customer use, and processing said spliced record media as a continuous incoming record.

135. In an automatic accounting system wherein rec-

ords of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, and wherein an accounting device is provided including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, the method of processing information in continuous record form from discontinuous incoming record media comprising the steps of connecting a first group of discontinuous incoming record media to form a continuous incoming record, processing specific items for each complete customer use in each of said first group of incoming record media, recording on outgoing record media one or more specific items for each incomplete customer use in each of said first group of incoming record media, connecting said outgoing record media with a second group of discontinuous incoming record media containing one or more missing specific items for said incomplete customer uses, and processing said later connected record media as a continuous incoming record.

136. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, and wherein an accounting device is provided including reading means for reading input items of information from an incoming record medium and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, the method of processing information in continuous record form from discontinuous incoming record media comprising the steps of connecting a first group of discontinuous incoming record media to form a first continuous incoming record, processing specific items for each complete customer use in each of said first group of incoming record media, recording on one or more regular outgoing record media output items related to said processed complete customer uses, recording on special outgoing record media one or more specific items for each incomplete customer use in each of said first group of incoming record media, connecting said special outgoing record media with a second group of discontinuous incoming record media containing one or more missing specific items of said incomplete customer uses to form a second continuous incoming record, and processing said second continuous incoming record.

137. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein including general item information identifying the source of said incoming record medium as either a regular source having a regular serial number or an emergency source acting for a regular source and having the associated regular serial number and including general item information identifying those places in each incoming record medium where a transfer took place between a regular and an emergency source, all record media having incoming regular or emergency record identity for a particular regular serial number source being connected according to a prescribed order of time in a tandem group and all such tandem groups being connected in a series according to a prescribed order of regular serial numbers whereby such a series of tandem groups may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity for permitting said device to process only record media having incoming regular or emergency record identity, a testing circuit in said device controlled by said reading means for checking the prescribed ordered sequence of the record media comprising said continuous incoming record, means in said testing circuit effective upon the reading by said reading means of transfer identity codes in successively connected record media to compare items of transfer identity from both said latter record media, and means effective upon a proper comparison to permit the processing of said continuous incoming record to continue and effective upon an improper comparison to prevent the continued processing of said continuous incoming record.

138. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein including general item information identifying the source of said incoming record medium as either a regular source having a regular serial number or

an emergency source acting for a regular source and having the associated regular serial number and including general item information identifying those places in each incoming record medium where a transfer took place between a regular and an emergency source, all record media having incoming regular or emergency record identity for a particular regular serial number source being connected according to a prescribed order of time in a tandem group and all such tandem groups being connected in a series according to a prescribed order of regular serial numbers whereby such a series of tandem groups may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity for permitting said device to process only record media having incoming regular or emergency record identity, a testing circuit in said device controlled by said reading means for checking the prescribed ordered sequence of the record media comprising said continuous incoming record, means in said testing circuit effective upon the reading by said reading means of a transfer identity code in one record medium to establish a transfer comparison circuit, means in said testing circuit effective upon the reading by said reading means of the transfer identity code in the record medium connected to said one record medium to compare items of transfer identity from both said latter record media, progress means operable to permit the processing of said continuous incoming record to continue, alarm means operable to prevent the continued processing of said continuous incoming record, means effective upon a proper comparison to operate said progress means, and means effective upon an improper comparison to operate said alarm means.

139. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein including general item information identifying the source of said incoming record medium as either a regular source having a regular serial number or an emergency source acting for a regular source and having the associated regular serial number and including general item information identifying those places in each incoming record medium where a transfer took place between a regular and an emergency source, all record media having incoming regular or emergency record identity for a particular regular serial number source being connected by means of splice pattern code according to a prescribed order of time in a tandem group and all such tandem groups being connected by means of splice pattern code in a series according to a prescribed order of regular serial numbers whereby such a series of tandem groups may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity for permitting said device to process only record media having incoming

regular or emergency record identity, a testing circuit in said device controlled by said reading means for checking the prescribed ordered sequence of the record media comprising said continuous incoming record, means in said testing circuit effective upon the reading by said reading means of a transfer identity code ahead of a splice pattern in one record medium to establish a transfer comparison circuit, means in said testing circuit effective upon the reading by said reading means of the transfer identity code after said splice pattern in the record medium connected to said one record medium to compare items of transfer identity from both said latter record media, a reading means progress control operable to indicate a proper comparison and to permit said reading means to continue to read items of information from said continuous incoming record for processing, alarm means operable to indicate an improper comparison and to prevent said reading to continue, means effective upon a proper comparison to operate said progress control, and means effective upon an improper comparison to operate said alarm means.

140. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium characterized by having incoming record identity code therein including general item information identifying the source of said incoming record medium as either a regular source having a regular serial number or an emergency source acting for a regular source and having the associated regular serial number and including general item information identifying those places in each incoming record medium where a transfer took place between a regular and an emergency source, all record media having incoming regular or emergency record identity for a particular regular serial number source being spliced at common splice pattern according to a prescribed order of time in a tandem group and all such tandem groups being spliced at common splice pattern in a series according to a prescribed order of regular serial numbers whereby such a series of tandem groups may be processed by said device as a continuous incoming record, said device having means controlled by said reading means incident to the reading of incoming record identity for permitting said device to process only record media having incoming regular or emergency record identity, a testing circuit in said device for checking the prescribed ordered sequence of the record media comprising said continuous incoming record, registering means in said testing circuit effective upon the reading by said reading means of a transfer identity code ahead of a particular splice pattern in one record medium to register transfer information, comparing means in said testing circuit effective upon the reading by said reading means of the transfer identity code after said particular splice pattern in the record medium connector to said one record medium to compare the latter read transfer information with the former read transfer information as registered

in said registering means, an alarm circuit effective upon a failure of comparison to indicate said failure and to prevent said device from continuing to process said incoming record, and a satisfaction circuit effective upon a proper comparison to temporarily disable said alarm circuit and to permit said device to continue processing said incoming record.

141. The invention claimed in claim 140 wherein said registering means comprises relay registers for registering the nature of and the time of a transfer, said comparing means includes circuits associated with said relay registers for comparing the nature of and the time of a transfer on both sides of a splice pattern, said alarm circuit includes a gas discharge tube energizable upon a failure of comparison, and said satisfaction circuit includes relay means operable upon a proper comparison to prevent the energizing of said tube.

142. The invention claimed in claim 141 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

143. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information including accounting conditions employed in the process of producing said incoming record, said device having a source of electric power and registering means operable under the control of said reading means and of said source of power to denote at any one time an accounting condition pertaining to an incoming record medium then being processed by said device, said registering means including a first and a second register for separately denoting the same accounting condition, said first register being both operated and maintained operated under control of said source and said second register being operated under control of said source and maintained operated independently of said source, and circuit means effective in the event of a failure of said first register to maintain a registration to derive the pertaining accounting condition from said second register into said first register.

144. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output iems of information to said recording means, each incoming record medium including among its general items of information certain record identification information including accounting conditions employed in the process of producing said incoming record, said device having a source of electric power and registering means operable under the control of said reading means and of said source of power to denote at any one time an accounting condition pertaining to an incoming record medium then being processed by said device, said registering means including a first and a second register for separately denoting the same accounting condition, said first register being a relay register both operated and maintained operated under the control of said source and said second register being an electromagnetic register operated under the control of said source and maintained operated independently of said source, and circuit means effective in the event of a failure of said relay register to maintain a registration to derive the pertaining accounting condition from said electromagnetic register into said relay register.

145. The invention defined in claim 144 wherein said circuits means includes a connector and transfer circuits between said registers and key means manually operable to cause said transfer circuits to be connected with said source over said connector whereby the registration in said electromagnetic register is registered in said relay register.

146. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information including accounting conditions employed in the process of producing said incoming record, said device having a source of electric power and registering means operable under the control of said reading means and of said source of power to denote at any one time an accounting condition pertaining to an incoming record medium then being processed by said device, said registering means including a first and a second register for separately denoting the same accounting condition, said first register being a relay register both operated and maintained operated under the control of said source and said second register being an electromechanical stepping register operated under the control of said source and mechanically maintained operated independently of

said source, and circuit means effective in the event of a failure of said relay register to maintain a registration to derive the pertaining accounting condition from said stepping register into said relay register.

147. The invention defined in claim 146 wherein said stepping register is a step-by-step switch and wherein circuit means includes a connector and transfer circuits between said relay register and said switch and key means manually operable to cause said transfer circuits to be connected with said source over said connector whereby the registration in said switch is registered in said relay register.

148. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each incoming record medium including among its general items of information certain record identification information including accounting conditions employed in the process of producing said incoming record, said device having a source of electric power and registering means operable under the control of said reading means and of said source of power to denote at any one time an accounting condition pertaining to an incoming record medium then being processed by said device, said registering means including a first and a second register for separately denoting the same accounting condition, said first register being a neutral relay register both operated and maintained operated under the control of said source and said second register being a polar relay register operated under the control of said source and magnetically maintained operated independently of said source, and circuit means effective in the event of a failure of said neutral relay register to maintain a registration to derive the pertaining accounting condition from said polar relay register into said neutral relay register.

149. The invention defined in claim 148 wherein said polar relay register comprises relays which magnetically maintain whatever condition prevails upon loss of electrical energization and wherein said circuit means includes a connector and transfer circuits between said neutral relay register and said polar relay register and key means manually operable to cause said transfer circuits to be connected with said source over said connector whereby the registration in said polar relay register is registered in said neutral relay register.

150. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means in each time register for indicating whether or not a first use has been made of time information in said register per incoming record medium, means effective upon the start of the processing of each incoming record medium to cause said indicating means in each said time register to indicate no first use, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, release means in each time register operable to release all registrations therein and to cause said indicating means to indicate a first use of said time register, said processing means controlled by said reading means incident to the reading of other information from an incoming record medium for using the time information in a time register in a processing step according to the indication by said indicating means, said processing step including the recording on one or more of said outgoing record media of information resulting from said processing, and circuit means effective upon each use of time information in each time register to operate the associated release means.

151. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, dual condition indicating means in each time register, setting means effective upon the start of the processing of each incoming record medium to cause said indicating means in each said time register to be set into its first condition, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, release means in each time register operable to release all registrations therein and to cause said indicating means to be set into its second condition, said processing means controlled by said reading means incident to the reading of other information from an incoming record

medium for using the time information in a time register in a processing step according to the condition of said indicating means, said processing step including the recording on one or more of said outgoing record media of information resulting from said processing, and circuit means effective upon each use of time information in each time register to operate the associated release means.

152. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, a use relay in each time register, setting means effective upon the start of the processing of each incoming record medium to operate said use relay in each said time register, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, a release relay in each time register operable to release all registrations therein and to release said use relay, said processing means controlled by said reading means incident to the reading of other information from an incoming record medium for using the time information in a time register in a processing step according to the operated or released condition of said use relay, said processing step including the recording on one or more of said outgoing record media of information resulting from said processing, and circuit means effective upon each use of time information in each time register to operate the associated release relay.

153. The invention claimed in claim 152 wherein circuit means is provided and controlled by said setting means to cause said use relay to remain released after the first release thereof until such time as said setting means becomes effective again upon the start of the processing of a succeeding record medium.

154. The invention claimed in claim 153 wherein is provided means operable under the control of said reading means incident to the reading of incoming record information to detect the start of the processing of a succeeding incoming record medium and circuit means controlled by the operation of said detecting means to make said setting means effective again.

155. The invention claimed in claim 154 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

156. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, dual condition indicating means in each time register for indicating whether or not a first use has been made of time information in said register per incoming record medium, means effective upon the start of the processing of each incoming record medium to cause said indicating means in each said time register to indicate no first use, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, release means in each time register operable to release all registrations therein and normally to cause said indicating means to indicate a first use of said time register, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, circuit means controlled by said control circuit and by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to operate the release means in certain time registers depending upon the read type of general item of charge canceling information and upon the indication in said control circuit, and circuit means in each time register effective whenever said release means is operated under charge canceling conditions to cause the indication provided by said indicating means therein to remain the same during the operation of said release means.

157. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, dual con-

dition indicating means in each time register, setting means effective upon the start of the processing of an incoming record medium to cause said indicating means in each said time register to be set into its first condition, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, release means in each time register operable to release all registrations therein and normally to cause said indicating means to be set into its second condition, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, circuit means controlled by said control circuit and by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to operate the release means in certain time registers depending upon the read type of general item of charge canceling information and upon the indication in said control circuit, and circuit means in each time register effective whenever said release means is operated under charge canceling conditions to cause said indicating means therein to remain in its then condition regardless of the operation of said release means.

158. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, a use relay in each time register, an operating circuit for said use relay, setting means effective upon the start of the processing of each incoming record medium to energize said operating circuit to operate said use relay in each said time register, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, a release relay in each time register operable to release all registrations therein and to deenergize said operating circuit thereby normally to release said use relay, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, circuit means controlled by said control circuit and by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to operate the release relay in certain time registers depending upon type of general item of charge canceling information and upon the indication in said control circuit, and circuit means in each time register effective whenever said release means is operated under charge canceling conditions to cause said operating circuit to remain in its then condition (energized or deenergized) regardless of the operation of said release means.

159. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, a use relay in each time register, an operating circuit energizable to operate said use relay and deenergizable normally to release said use relay, a holding circuit effective only when said use relay is operated and energizable when effective to hold said use relay operated, setting means effective upon the start of the processing of each incoming record medium to energize said operating circuit in each said time register, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time information in the one of said time registers characterized by the same identity index, a release relay in each time register operable to release all registrations therein and to deenergize said operating circuit, a control circuit common to all time registers and arranged to indicate whether one or two specific items of time information is or are contained in any time register, circuit means controlled by said control circuit and by said reading means incident to the reading of a general item of charge canceling information from an incoming record medium to operate the release in certain time registers depending upon the read type of general item of charge canceling information and upon the indication in said control circuit, and circuit means in each time register effective whenever said release means is operated under charge canceling conditions to energize said holding circuit during the operation of said release relay.

160. The invention claimed in claim 159 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

161. In an automatic accounting system wherein records of customer uses of facilities are contained in tapes in the form of coded numbers each having a plurality of denominational orders and expressing items of specific information and items of general information, an accounting device including a reader for reading off items of information from an incoming tape, recorders for recording items of information on outgoing tapes and means for processing such information in an accounting step by sorting, translating, computing or otherwise rearranging said information and distributing such processed information to said recorders, said device having an adder

consisting of an augend element and an addend element each having a plurality of denominational orders with carry means therebetween for calculating with compound numbers the various denominational orders of which are on different bases (for example, numbers expressing time periods in terms of days, hours, minutes and decimal fractions of a minute), each said denominational order being a base factor code register calculator divided into sections, each section having as many code places as a factor of the base and each said order having a total number of code places equal to the sum of the factors of the base, each said denominational order having means to derive and to transmit a carry to the next higher denominational order when the value of the said base is reached therein, and a sum element having a plurality of denominational orders for expressing a multidigit simple number on a base of one of the parts of said compound numbers (for example, a two-digit number expressing time periods in minutes).

162. In an automatic accounting system wherein records of customer uses of facilities are contained in tapes in the form of coded numbers each having a plurality of denominational orders and expressing items of specific information and items of general information, an accounting device including a reader for reading off items of information from an incoming tape, recorders for recording items of information on outgoing tapes and means for processing such information in an accounting step by sorting, translating, computing or otherwise rearranging said information and distributing such processed information to said recorders, said device having a calculator consisting of an augend element and an addend element each having a plurality of denominational orders with carry means therebetween for calculating with compound numbers the various parts of which are on different bases (for example, days, hours, minutes and tenths of a minute) and a sum element of limited capacity having a plurality of denominational orders all on the same base (for example, tens and units minutes), means controlled by said reader incident to the reading of specific items of information from an incoming tape for registering said read items in said addend and augend elements, and means responsive to the registration in said addend and augend elements of compound numbers which will produce a sum exceeding the capacity of said sum element for transmitting said compound numbers to a given one of said recorders for recording said compound numbers.

163. In an automatic accounting system wherein records of customer uses of facilities are contained in tapes in the form of coded numbers each having a plurality of denominational orders and expressing items of specific information and items of general information, an accounting device including a reader for reading off items of information from an incoming tape, recorders for recording items of information on outgoing tapes and means for processing such information in an accounting step by sorting, translating, computing or otherwise rearranging said information and distributing such processed information to said recorders, said device having a calculator consisting of an array of different factor base code register calculators with the outgoing carries from each lower order calculator connected to the corresponding incoming carries of each next higher order calculator, means controlled by said reader incident to the reading of specific items of information from an incoming tape for registering said read items in said array, each said calculator consisting of a plurality of factor sections each having a number of code places equal to a factor of the base and all sections of a said calculator having a number of code places equal to the sum of the factors of the said base and having means for producing and transmitting an outgoing carry when the value of the base is reached therein.

164. In an automatic accounting system wherein records of customer uses of facilities are contained in tapes in the form of coded numbers each having a plurality of denominational orders and expressing items of specific information and items of general information, an accounting device including a reader for reading off items of information from an incoming tape, recorders for recording items of information on outgoing tapes and means for processing such information in an accounting step by sorting, translating, computing or otherwise rearranging said information and distributing such processed information to said recorders, said device having a calculator consisting of an array of interconnected different factor base code register calculators with outgoing carries from each lower order calculator connected to the corresponding incoming carries of each next higher order calculator, a subtractor interposed between two of said calculators, means controlled by said reader incident to the reading of specific items of information from an incoming tape for registering said read items in said array, means in said subtractor for subtracting a definite amount from the result calculated in the said next lower order, adding the nine's complement allowance, rounding off any amount other than zero in the units digit of said calculated result to an additional carry value and transmitting said rounded off and processed result as a carry to the said next higher order.

165. In an automatic accounting system wherein records of customer uses of facilities are contained in tapes in the form of coded numbers each having a plurality of denominational orders and expressing items of specific information and items of general information, an accounting device including a reader for reading off items of information from an incoming tape, recorders for recording items of information on outgoing tapes and means for processing such information in an accounting step by sorting, translating, computing or otherwise rearranging said information and distributing such processed information to said recorders, said device having a calculator for calculating elapsed time from time periods expressed in multidigit compound numbers denoting days, hours, minutes and decimal fractions of a minute, said calculator having a factor base code calculator for each digital order of said compound number arranged on different bases (for example, minutes tens order is base 6 and hours order is base 24) with carry means between said orders, means controlled by said reader incident to the reading of specific items of time information from an incoming tape for registering said read items in said calculator, means for rounding off a value in the lowest denominational order (decimal fractions of a minute) into an integral carry to the next higher order and means for translating a derived result in a higher order (hours) to an addend in the next lower order (minutes tens) and a multidigit simple number output (minutes tens and units) as a sum element for said calculator.

166. A calculator for calculating with multidigit compound numbers expressed by decimal digits in a plurality of denominational orders, the numbers in different denominational orders being on different arithmetical bases, said calculator comprising factor base code register calculators each having a number of sections equal to the number of factors of the said base, each said section having a number of code places equal to the value of the factor, each said calculator having incoming and outgoing carry means, the outgoing carry means of one of said calculators extending to and becoming the incoming carry means of the calculator of the next higher denominational order and means in each said calculator for producing and transmitting a carry over its said outgoing carry means.

167. A calculator for calculating with multidigit compound numbers expressed by decimal digits in a plurality of denominational orders, the numbers in different denominational orders being on different arithmetical bases, said calculator comprising factor base code register accumulators each having a plurality of sections equal to

the number of factors whose product equals its base, each said section having a number of code places equal to the value of its factor, each said accumulator having incoming and outgoing carry means, the outgoing carry means of one of said accumulators extending to and becoming the incoming carry means of the accumulator of the next higher denominational order and means in each said accumulator responsive to accumulation therein of a value equal to the arithmetical base thereof for producing and transmitting an outgoing carry therefrom.

168. A calculator for calculating with multidigit numbers expressed by decimal digits in a plurality of denominational orders, each said denominational order comprising a factor base code register calculator operating on any given arithmetical base, each said calculator being divided into sections the number of said sections being equal to the number of factors whose product equals the said given arithmetical base, each said section having therein a number of code places equal to the value of the factor which said section represents, the total number of code places of each said calculator being equal to the sum of the factors of the base thereof, incoming and outgoing carry means for each said calculator, the outgoing carry means of each said calculator extending to and becoming the incoming carry means of the calculator of the next higher denominational order, internal carry means extending between the sections of each said calculator and isolation means in said internal carry means to block all excepting an effective one thereof whereby unauthorized carries are prevented.

169. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said general items including data indicative of the calendar day during which an incoming record was produced, said device having a calendar day register arranged to register calendar day indications therein, said device having switch means set to indicate the month during which an incoming record was produced, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein along with calendar day information relating thereto, means controlled by said reading means incident to the reading of a general item of day information from an incoming record medium to register said read day item in said day register, means controlled by said reading means incident to the reading of a specific item of time information from an incoming record medium and characterized by a given identity index for registering said read time item in the one of said time registers characterized by the same identity index, a translator operable under the control of said day register and of said switch means to provide a single digit representing a particular calendar day of the month indicated by said switch means, and means also controlled by said reading means incident to the said reading of the said specific item for interconnecting said one time register with said day register through said translator whereby said single digit is registered in said one time register as part of the related time item registered therein.

170. The invention defined in claim 169 wherein said general items also include data indicative of the hour of the day during which an incoming record was produced, said device has an hour register arranged to register hour indications therein, each of said plurality of time registers is arranged to register hour information relating to specific time items registered therein, said means for registering read day items in said day register is controlled incident to the reading of a general item of hour information from an incoming record medium to register said read hour item in said hour register, and means is provided and controlled by said hour register to indicate a change of day, and said translator is operable under the additional control of said dry change indicating means.

171. The invention defined in claim 170 wherein said day and hour registers include tens and units sections each, said time registers are arranged to register tens and units digits of the hour value and arranged to register only a single digit for said day value, and said day change indicating means comprises circuits for detecting when the said hour register registers an hour value of 00 following a previous registration of 23.

172. The invention claimed in claim 171 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

173. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items (2) and (3) of time information therein, means controlled by said reading means incident to the reading of each of said specific items (2) and (3) from an incoming record medium and characterized by a given identity index for registering said read time items in the one of said time registers characterized by the same identity index, a calculator common to said time registers and having means to reregister therein two related items (2) and (3) of time information and to calculate therefrom an elapsed time of customer use, said calculator being unable to calculate elapsed times exceeding the capacity thereof and including means to indicate such an overcapacity condition, said processing means controlled by said reading means incident to the reading of a specific item of facility information from an incoming record medium and characterized by the same said identity index for causing said calculator to reregister the related time items therein and to calculate the related elapsed time, said recording means including a plurality of recorders, select-

ing means controlled by said processing means for selecting one or more of said recorders and for controlling same to record on related outgoing record media information resulting from said processing, and means in said processing means controlled by an overcapacity indication to cause said selecting means to select a particular recorder for the recording thereby of all output information related to overcapacity calculations.

174. The invention defined in claim 173 wherein said calculator comprises a subtracter for calculating the difference between the related commence time (2) and terminate time (3) registered in said calculator, and said overcapacity indicating means includes control relays and control circuits therefor arranged to cause said relays to assume different operative conditions for different actions of said subtractor indicative of overcapacity and not-overcapacity conditions.

175. The invention defined in claim 174 wherein said control relays include an overcapacity relay and a not-overcapacity relay, the former being operated and the latter released by said subtracter for an overcapacity condition and the said former relay being released and the said latter relay operated by said subtracter for a not-overcapacity condition.

176. The invention claimed in claim 175 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

177. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register two specific items of time information therein, means controlled by said reading means incident to the reading from an incoming record medium of specific items of time information characterized by a given identity index for registering said read time items in the one of said time registers characterized by the same identity index, a processing register arranged to register therein two related time items and one related facility item and new items related thereto, means controlled by said reading means incident to the reading from an incoming record medium of a specific item of facility information for registering said read facility item in said processing register and for reregistering the related two time items therein from the time register in which said two time items are registered, a calculator including means to reregister therein two related time items and to calculate therefrom new items of information including an elapsed time of customer use, and means in said processing means responsive to the registration and reregistration in said processing register of three related specific items (1) and (2) and (3) to reregister items (2) and (3) in said calculator and to register in said processing register said new items derived from said calculator.

178. The invention claimed in claim 177 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

179. The invention defined in claim 177 wherein said recording means includes a plurality of recorders, said device includes a recorder control circuit controlled by said processing register to select one or more of said recorders and for controlling same to record on related outgoing record media information registered in said processing register and relating to a customer use, and said recorder control circuit is controlled responsive to the registration in said processing register of the said three related specific items (1) and (2) and (3) and of the new items relating thereto.

180. The invention defined in claim 179 wherein said recorder control circuit includes a plurality of connectors and means under the control of said processing register to operate said connectors selectively depending upon the extent and nature of the specific and new items registered in said processing register, said connectors interconnecting said processing register selectively with said recorder or recorders to cause the recording thereby of selected information relating to said customer use.

181. The invention claimed in claim 180 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

182. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register therein two related items (2) and (3) of time information characterized by the same identity index, means controlled by said reading means incident to the reading from an incoming record medium of said two related time items to register same in the related time register, at least one processing register arranged to register therein a specific item of facility information and two specific items (2) and (3) of time information related thereto, means controlled by said reading means incident to the reading from an incoming record medium of a facility item for registering same in said processing register and for reregistering therein from one of said time registers the two registered time

items characterized by the same identity index as said read facility item, a calculator operable to calculate with said items registered in said processing register and to provide new items as a result of said calculation, other registering means in said processing register, means controlled by the registration in said processing register of related facility and time items for causing said calculator to operate thereon and to produce new items therefrom including an elapsed time for the related customer use and to register said new items in said other registering means, a plurality of recorders operable for producing outging record media, a sort switch settable in one of a plurality of positions indicative of the desired extent to which information related to processed customer uses is to be recorded by one or more recorders, a recorder assignment circuit variously operable to assign various recorders to record on various outgoing record media output items related to processed customer uses, and means controlled by the setting of said sort switch and by registrations in said processing register to derive a sorting index for each processed customer use and to cause an operation of said assignment circuit according to said sorting index.

183. The invention claimed in claim 182 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

184. The invention defined in claim 182 wherein said other registering means in said processing register includes a variably operable sort digit register, translating means is provided in said processing register responsive to the registration in said other registering means of said new items to operate said sort digit register according to said translation, and wherein said operation of said sort digit register comprises the said derivation of said sorting index.

185. The invention defined in claim 182 wherein the said specific facility item registered in said processing register includes information comprising a billing index indicative of the type of billing to be used in regard to the related customer use, and wherein said registration of a billing index comprises the said derivation of said sorting index.

186. The invention defined in claim 182 wherein said other registering means in said processing register includes means for registering new items representing the said elapsed time of the customer use, said specific facility item registered in said processing register includes information comprising a billing index indicative of the type of billing to be used in regard to the related customer use, said other registering means includes means jointly controlled by said elapsed time and billing index registrations to register a number of charge units determined thereby, and said sorting index deriving means is controlled by said charge units registration to derive a different sorting index depending upon whether said charge units are over or under a prescribed amount.

187. The invention defined in claim 186 wherein means is provided responsive to charge units registration to determine whether said charge units are above nine or below ten, and said deriving means derives a different sorting index for each of said two determinations.

188. The invention defined in claim 182 wherein means is provided controlled by said processing means incident to the processing of customer uses for determining the type of output items relating thereto to be recorded on outgoing record media, and said sorting index deriving means includes means controlled by said type determining means to derive a sorting index according to said determined output item type.

189. The invention defined in claim 182 wherein the

said specific facility item registered in said processing register includes a plural digit number identifying a customer facility, and said sorting index deriving means includes means controlled by one of said registered identifying digits to derive a sorting index according to the said digit.

190. The invention defined in claim 182 wherein the said processing register includes means controlled by said processing means for registering a number of different criteria upon which a sorting index may be based, said criteria including a customer billing index and an elapsed time indication and a charge units determination and a plural digit customer identity number, and means in said sorting index deriving means for deriving a sorting index according to two or more of said criteria.

191. The invention claimed in claim 190 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

192. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each said incoming record including among its general information a record identity group of items comprising a succession of items of incoming record identity appearing on that part of said record first read by said reading means, said processing means including means enabled to be controlled by said reading means incident to the reading of specific use items (1) and (2) and (3) for assembling such specific items having the same identity indices and for deriving therefrom output use items related thereto, said recording means including a plurality of recorders operable to prepare outgoing record media containing outgoing record identity groups of items and output use items related to processed customer uses, a recorder selecting circuit variably operable to select a recorder, a plurality of manually settable switches set to prescribe circuit conditions corresponding to proper incoming record identity group items, means controlled by said reading means incident to the reading from an incoming record of said incoming identity groups for comparing items thereof with the settings of said switches, means controlled by said switches for prescribing the number of said recorders to be employed during processing of said incoming record, means responsive to said comparing means incident to a proper comparison and controlled by said prescribing means and by said switches for causing said selecting circuit to operate said prescribed recorders in sequence and to formulate outgoing record identity items and to cause said prescribed recorders to record said outgoing record identity items on respective outgoing media, means operable to

indicate when all of said prescribed recorders have finished said outgoing record identity operation, and means responsive to the operation of said indicating means to enable said processing means to process specific items relating to customer uses.

193. The invention defined in claim 192 wherein said formulating means includes a plurality of operable pattern connectors one for each item of outgoing record identity to be formulated and includes a sequencing circuit for operating certain of said connectors in sequence according to a prescribed order of items in said identity group and includes circuits interconnecting said processing means with said pattern connectors for providing to said pattern connectors information pertinent to each item of outgoing record identity, wherein said recorder selecting circuit includes a recorder connector for each recorder, each said recorder connector when operated interconnecting the associated recorder with the outputs of all pattern connectors.

194. The invention claimed in claim 193 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

195. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and arranged to register therein two related items (2) and (3) of time information characterized by the same identity index, means controlled by said reading means incident to the reading from an incoming record medium of said two related time items to register same in the related time register, at least one processing register arranged to register therein a specific item of facility information and two specific items (2) and (3) of time information related thereto, means controlled by said reading means incident to the reading from an incoming record medium of a facility item for registering same in said processing register and for re-registering therein from one of said time registers the two registered time items characterized by the same identity index as said read facility item, other registering means in said processing register, means in said processing means controlled by the registration in said processing register of related facility and time items for processing said items and for producing new items therefrom and for registering said new items in said other registering means, a plurality of recorders operable for producing outgoing record media, a sort switch settable in one of a plurality of positions indicative of the desired extent to which information related to processed customer uses is to be recorded by one or more recorders, means for deriving output items for each processed customer use including said new items, a recorder assignment circuit variously operable to assign various recorders to record on various outgoing record media output items related to customer uses, and means controlled by the setting of said sort switch and by registrations in said processing register to cause an operation of said assignment circuit in some cases whereby all output items for a given customer use are recorded on one outgoing record media and whereby output items for another customer use are recorded partly on one outgoing record media and partly on another.

196. The invention defined in claim 195 wherein said means for causing an operation of said assignment circuit includes an output item counting means controlled by said processing means incident to the processing of specific items of a customer use to predetermine the number of output item parts to be recorded for such use, said deriving means includes connector means operated selectively and sequentially by said item counting means to provide a succession of output item parts for recording, and said assignment circuit operating means includes a recorder transfer circuit effective in response to processing of certain customer use items to cause recording of some of said number of output item parts by one of said recorders and then to cause recording of the rest of said number of output item parts by another of said recorders.

197. The invention claimed in claim 196 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

198. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each said incoming record including therein a succession of distinctive items of splice data consisting each of the same pattern code whereby separate such records may be spliced together for processing as a continuous incoming record, said device including reading registers controlled by said reading means incident to the reading of coded data from an incoming record to register therein all elements of said read code, means for locking said registrations until used for processing, means effective to release said registrations after same are used, means controlled by said reading registers to indicate the released or locked condition thereof, means normally operable under the control of said indicating means for permitting said reading means to register a read set of coded data in said reading registers only when said reading registers are released, means operated under the control of said reading registers to detect whenever a said distinctive pattern code is registered therein, means responsive to the operation of said detecting means to maintain said pattern code locked in said read-

ing registers and to cause the operation of said permitting means as long as successive read data agrees with said maintained locked registration.

199. The invention defined in claim 198 wherein said maintaining means includes a validity check relay, a validity check circuit controlled by said reading registers and effective to operate said check relay as long as the registrations in said reading registers remain the same, and means whereby the continued operation of said check relay causes the operation of said permitting means.

200. The invention defined in claim 199 wherein said reading registers comprise a plurality of reading relays operated in a given manner to register a given read set of coded data, said validity check circuit is a series circuit through contacts controlled by all reading relays, said maintaining means includes a reading relay locking circuit, and wherein continued operation of said check relay by said check circuit causes continued operation of said permitting means as long as successive read sets of coded data agree with said locked reading relay registrations.

201. The invention defined in claim 200 wherein circuit means is provided effective whenever a succeeding read set of coded data does not agree with said locked registration to revert the control of said permitting means back to normal operation.

202. The invention claimed in claim 201 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

203. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, each said incoming record having recorded therein from place to place general items of time information characterized as to type and representing passages of prescribed intervals of time during the process of producing each such incoming record, an odd and an even general time register, means controlled by said reading means incident to the reading from an incoming record of successively occurring general time items for registering same in alternate ones of said general time registers, an adjustable comparison circuit for comparing each such registration with its predecessor in the other general time register, means controlled by said reading means incident to the reading of each said read general item to detect its type and for adjusting said comparison circuit according to said type, and means controlled by a proper comparison according to said type for releasing the said predecessor registered general time item.

204. The invention defined in claim 203 wherein said means for registering successive general time items in alternate general time registers comprises for said registers respective odd and even input connectors, said comparison circuit includes adjustable output connector means and registration check circuits interconnecting both registers through said connector means, and said adjusting means comprises circuits controlled by said detecting means for adjusting said connector means according to the type of general read time item.

205. The invention defined in claim 204 wherein said general time items are hour entries, a succeeding general time item is a type indicating that it should differ from its predecessor by a specified amount, said detecting means is effective upon detecting said type to adjust said connector means to compare for the related difference, and said releasing means comprises a circuit operated by a proper difference comparison to release said predecessor registration.

206. The invention claimed in claim 205 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

207. The invention defined in claim 205 wherein said succeeding hour entry is of a first type indicating that it should not differ from its predecessor, and said detecting means is effective upon detecting said first type to adjust said connector means to compare for the indicated difference of zero (i.e. exact equality).

208. The invention claimed in claim 207 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

209. The invention defined in claim 205 wherein said succeeding hour entry is of a second type indicating that it should differ from its predecessor by one hour, and said detecting means is effective upon detecting said second type to adjust said connector means to compare for the indicated difference of one hour.

210. The invention claimed in claim 209 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

211. The invention defined in claim 205 wherein said succeeding hour entry is of a third or fourth type indicating that an entry of the respective second or first type is missing, means is provided under the control of said detecting means for operating the appropriate input connector and output connector means to transfer the predecessor registration to the other general time register respectively with a one hour change or with no change, and said detecting means effective thereafter to adjust said connector means to compare for the indicated difference.

212. The invention claimed in claim 211 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

213. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items

of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and including means for registering therein a specific item of time information, first connector means, second connector means, a transmission channel common to said time registers, a validity register, a satisfaction circuit, means controlled by said reading means incident to the reading from an incoming record of a specific time item for actuating said first connector means to apply said read item over said common channel and to register said read item in the time register characterized by the same identity index and to actuate said second connector means to register said read item from said channel into said validity register, and means including said satisfaction circuit controlled by a valid registration in said validity register to release said first and second connector means and said validity register.

214. The invention defined in claim 213 wherein said reading means includes an incoming record reader and a set of reading relays operated by said reader incident to the reading of a set of coded data, and a reader advance circuit is provided operated by said release means to release said reading relays and to permit said reader to read a next occurring item.

215. The invention defined in claim 213 wherein said release means includes means primarily responsive to a valid registration in said validity register to release said first connector means, and means secondarily and thereafter responsive to a valid registration to operate said reader advance circuit and to release said validity register.

216. The invention claimed in claim 215 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

217. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index and a selecting conductor individual to each timing register and energizable to select the associated time register, said reading means including a set of reading relays operated by said reading means incident to the reading of specific time items from an incoming record to register in said reading relays the said read time items including their identity indices, selecting means controlled by the registration of a time item for energizing the selecting conductor associated with the time register having the same identity index as said registered time item and for reregistering said registered time item in said selected time register, said processing means effective during the processing of an incoming record to process recorded complete customer uses and for removing from appropriate time registers the reregistered time items relating thereto and for indicating the end of processing of complete customer uses, means associated with each time register to detect the presence of unprocessed time items remaining registered therein, and means including said reading relays controlled by said process end indication and by said detecting means to generate identity indices and to energize corresponding selecting conductors corresponding to the time registers containing unprocessed time items and to cause said processing means to process said latter time items in a special way.

218. The invention defined in claim 217 wherein said detecting means includes a plurality of group relays each common to a different plurality of time registers and operated to detect the presence of an unprocessed time item in any time register in its group.

219. The invention claimed in claim 218 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

220. The invention defined in claim 218 wherein said time registers are characterized by identity indices numbered consecutively, each group relay is common to a different group of consecutively numbered time registers, said detecting means includes circuits controlled by said time registers for operating said group relays in succession, and said generating means includes a walking circuit for successively and sequentially operating said reading relays to simulate the successive sequential registration therein of identity indices corresponding to time registers represented by successively operated group relays.

221. The invention defined in claim 220 wherein said identity indices range from **00** to **99**, ten group relays **0** to **9** are provided each common to ten time registers characterized by a different tens digit and each having its operating circuit common to its group of ten time registers, ten units relays **0** to **9** are provided and are operated in succession by said walking circuit for each operated tens relay.

222. The invention defined in claim 221 wherein said detecting means includes a tens lockout circuit for permitting the operation of only one tens group relay at a time in a preference from lowest to highest tens digits and said walking circuit includes a repeating circuit for causing said units relays to operate one at a time from units relay **0** to units relay **9** for each successively operated tens relay **0** to **9**.

223. The invention defined in claim 222 wherein said means for energizing selecting conductors comprises two reading registers controlled successively by said operated succesion of tens and units relays for energizing successively the selecting conductors corresponding to time registers characterized by said operated tens and units relays.

224. The invention claim in claim 223 wherein an in-

coming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforater, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

225. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said general items including hour entries from place to place in said incoming record to indicate the passage of time during the period in which said incoming record was produced, an hour register for registering therein the hour pertinent to the then processed action of said device, means controlled by said hour register and by said reading means incident to the reading from an incoming record of successive general hour items for adjusting the hour registration from time to time in accordance with read general hour items, a check circuit controlled by said hour register to permit said device to process customer uses only if said hour register contains a complete hour registration and to prevent further processing by said device if said hour register becomes empty or incompletely filled, means effective whenever said check circuit has prevented further processing to cause a fictitious hour entry to be registered in said hour register whereby said check circuit permits said device to continue processing, said adjusting means controlled by said fictitious registration and by said reading means incident to the reading from an incoming record of a general hour item when said fictitious registration is present to adjust the hour registration as though the said fictitious registration represented a registered general hour item.

226. The invention defined in claim 225 wherein said hour register comprises two sections controlled to register therein alternately read general time items, said adjusting means includes a comparison circuit for permitting a new read general hour item to be registered in one section if said new item compares properly with the previously read general hour item then registered in the other section, and said adjusting means including a nullifying circuit for nullifying said comparison circuit whenever said previously read general hour item is represented by a fictitious registration.

227. The invention claimed in claim 226 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

228. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said general items including true general time items occurring from place to place in an incoming record to represent the passage of units of time during the making of said record, a general time register, means controlled by said reading means incident to the reading of successive true general time items to adjust said general time register according to the said passage of units of time, an enabling circuit controlled by said reading means and by said general time register for permitting said device to process customer uses only when said general time register contains a general time registration and for preventing such processing when said general time register is empty or contains an incomplete general time registration, means effective when said empty or incomplete condition exists to register in said general time register a fictitious general time entry whereby said enabling circuit may permit processing to continue, said device having a plurality of time registers characterized by different identity indices, and arranged to register therein two specific time items (2) and (3) including general time information pertinent thereto, means controlled by said reading means incident to the reading from incoming records of specific time items to register same in the specific time registers characterized by the same indices and to reregister therein as part of each specific item the information then registered in said general time register, a calculator, said processing means effective when processing a customer use to interconnect the appropriate specific time register with said calculator for transmission into said calculator of the specific time items including general time parts thereof, means associated with said calculator and effective upon said interconnection to detect whether said general time parts to be transmitted are true or fictitous, means controlled by said detecting means incident to the detection of a fictitious part or parts for modifying the transmission such that said fictitious part or parts are transmitted in an arbitrary amount, means in said calculator for calculating an elapsed time difference between said two specific time items transmitted thereto, and means in said calculator effective upon calculating a negative elapsed time due to the use of said arbitrary part or parts to adjust said calculator to provide a proper positive remainder.

229. The invention defined in claim 228 wherein said calculator comprises a substracter wherein a said specific item (2) is operated on as a stubtrahend and a said specific item (3) is operated on as a minuend to provide a remainder comprising the calculated elapsed time, and said calculator adjusting means includes carry means effective if said remainder is indicated as negative due to the use of a fictitious time item for adjusting the said minuend so that the remainder produced is positive.

230. The invention defined in claim 229 wherein one general time part to be transmitted to said calculator is a true part and the other is fictitious and said modifying

means causes said one part to be transmitted as both parts.

231. The invention claimed in claim 230 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

232. The invention defined in claim 229 wherein both general time parts to be transmitted to said calculator are fictitious and said modifying means causes both parts to be transmitted as zero.

233. The invention claimed in claim 232 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

234. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and characterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said recording means comprising a plurality of recorders for recording outgoing items on separate unrecorded outgoing record media, each unrecorded outgoing record being spliced from place to place to various sections thereof, each splice area including manifestations of the beginning and the end of the splice area, each recorder including means for detecting the beginning and the end of a splice area, said device having a recorder control circuit effective during the processing of customer uses to selectively operate said recorders to record thereby on corresponding outgoing records output items relating to said processing and to said selected outgoing record, means operable to formulate outgoing record splice codes and to cause a recorder to record such formulated codes, means responsive to the detection of a splice area to cause said selective operating means to select the associated recorder and to operate said formulating means according to the recorder selected, said formulating means and said recorder selecting and controlling means so interrelated as to cause said splice codes to extend beyond the beginning and the end of said splice areas.

235. The invention defined in claim 234 wherein said splice codes include a splice information code set and a plurality of successive splice pattern codes, said formulating means is operated differently for at least two recorder selections whereby in one case said splice information code set consists of a single skip splice code preceding the following said splice pattern codes and in the other case said splice information code set consists of a plurality of distinct outgoing identity codes where some precede and some follow said splice pattern codes.

236. The invention defined in claim 235 wherein said formulating means includes a counting circuit for predetermining the number of codes required to be recorded across a splice area and for counting said number of codes as they are recorded, said formulating means includes means controlled by said splice area detecting circuit for formulating and causing to be recorded said splice information set ahead of and after said splice area and includes a timer for formulating and causing to be recorded said splice pattern code repeatedly as a single code count across said splice area.

237. The invention defined in claim 236 wherein said splice area manifestations consist of a beginning and an end of a hole in each said spliced unrecorded outgoing record media, and said detecting means includes an electrical contact controlled by the beginning and the end confines of said hole.

238. The invention claimed in claim 237 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

239. In an automatic accounting system wherein records of customer uses of facilities are contained in record media in the form of sets of coded data expressing items of general information and expressing items of specific information including and charcterized by identity indices and comprising the data from which customer charges are derived, the said items of specific information for each recorded complete customer use including (1) identification of the customer facility used and (2) the time at which the use was commenced and (3) the time at which the use was terminated, the said specific items for any particular customer use including and characterized by the same identity index, an accounting device including reading means for reading input items of information from incoming record media and recording means for recording output items of information on outgoing record media and means for processing input information in an accounting step by sorting, translating, computing or otherwise rearranging said input information and distributing said processed information as output items of information to said recording means, said device having a plurality of time registers each characterized by a different identity index, each time register having two sections for registering two related specific time items, a connector for each section and operable separately or at the same time, means controlled by said reading means incident to the reading from an incoming record medium of a specific time item to operate only one of the connectors at one time of the particular time register characterized by the same identity index as said read specific time item and to register said read specific time item in the corresponding section of said particular time register, means controlled by said reading means incident to the reading from an incoming record medium of a specific facility item to operate both connectors at the same time of the unique time register characterized by the same identity index as said read specific facility item and to read-out the specific time items registered therein, means controlled by said connectors and operable to detect whether one or more than one of said connectors is operated at any one time, alarm means operable by said detecting means whenever more than one connector operation is detected, and means operable in response to the control operations incident to a concurrent operation of said both connectors pursuant to the reading of a specific facility item for preventing the operation of said detecting means.

240. The invention defined in claim 239 wherein said detecting means includes first relay means normally operated whenever more than one connector operates and

released whenever only one connector operates, said alarm means includes second relay means operated by an operated first relay means and released by a released first relay means, and said preventing means effective when operated to prevent said first relay means from operating.

241. The invention defined in claim 240 wherein said means for operating a connector includes a conductor individual to each connector and energizable to operate the corresponding connector and includes a selecting circuit for energizing one or both conductors of a particular or unique time register, said first relay means comprises a marginal current relay and circuit means for supplying current to said marginal relay in series with a parallel arrangement of all energized conductors such that normally said marginal relay cannot operate when only one conductor is energized but can operate when a plurality of conductors are energized in parallel, and said preventing means is effective when operated to change the marginal characteristic of said marginal relay to prevent its operation when two conductors are energized in parallel.

242. The invention defined in claim 241 wherein said

current supply circuit includes a changeable bias current circuit for supplying a changeable bias current to said marginal relay, and said preventing means includes means for changing said bias circuit to cause same to supply a changed bias current to said marginal relay.

243. The invention claimed in claim 242 wherein an incoming record medium is a perforated tape, an outgoing record medium is an unperforated tape, a reading means is a perforated tape reader, a recording means is a tape perforator, a set of coded data is a plural digit number represented by a group of perforations in a perforated tape, and an identity index is a digital component of a plural digit number.

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