

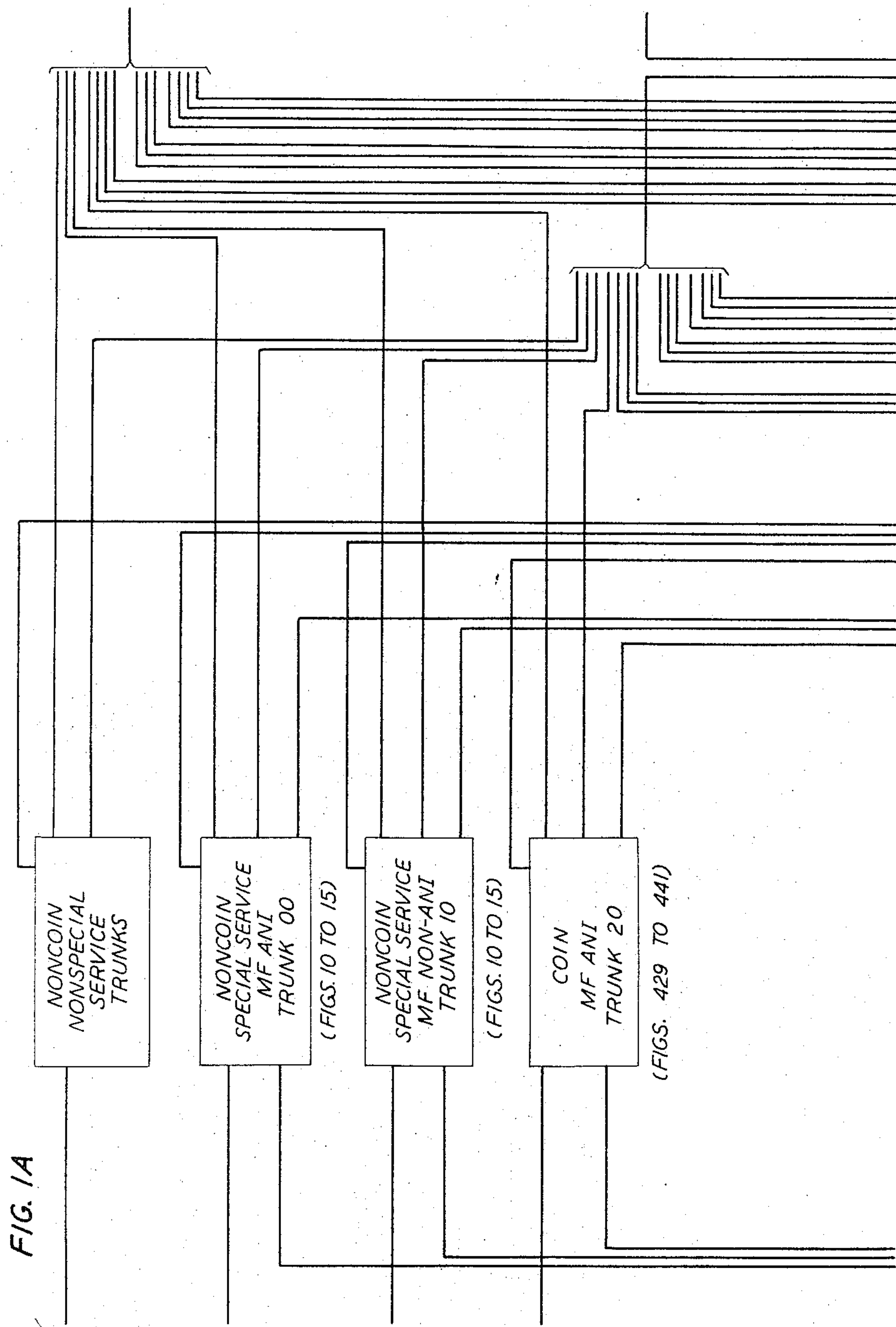
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3,341,662

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570 Sheets-Sheet 1



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O. CESAREO
INVENTORS: R. B. CURTIS
J. G. NIGHTINGALE
F. H. PARKINSON, JR.

BY
Donald M. Suft
ATTORNEY

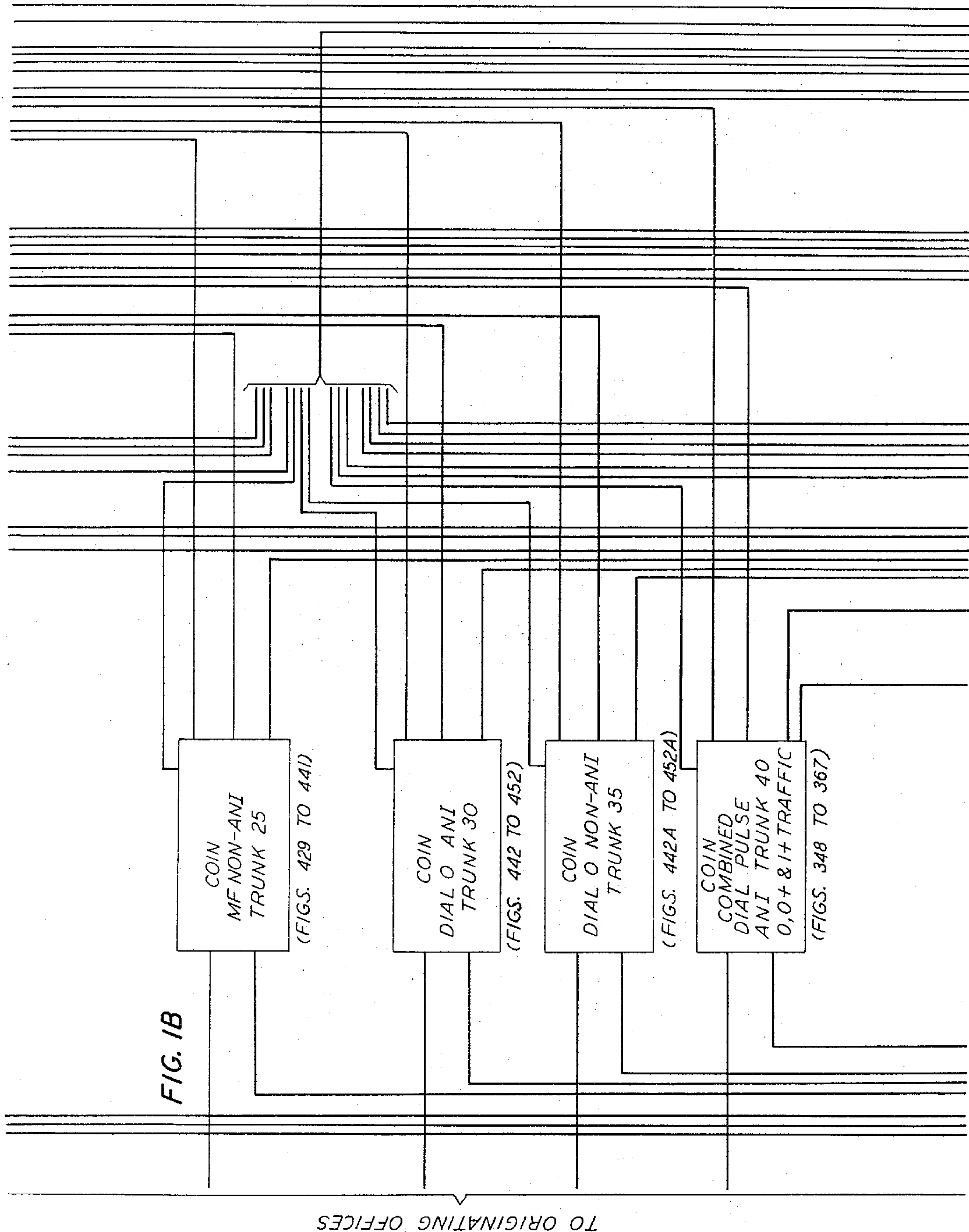
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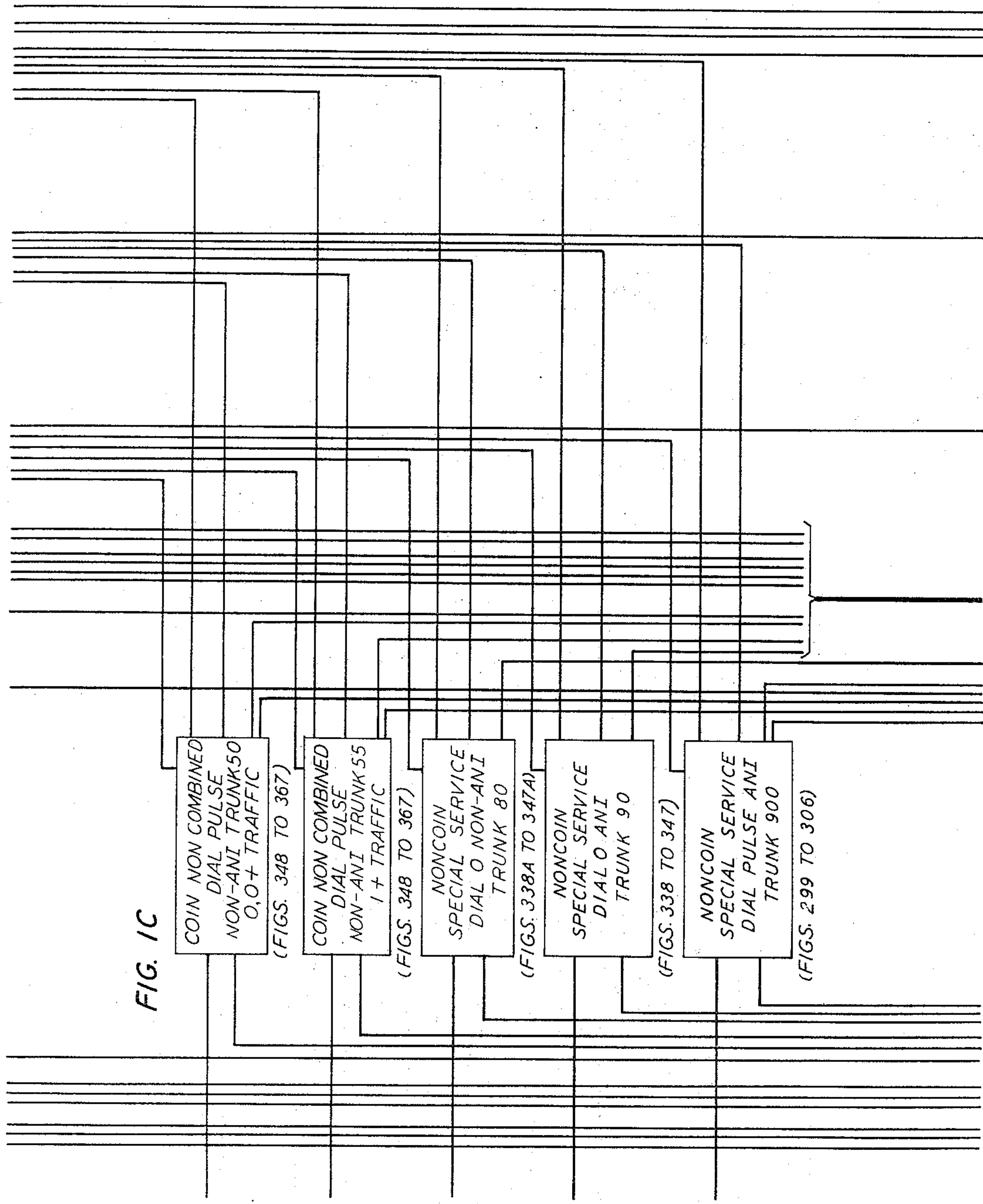
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3,341,662

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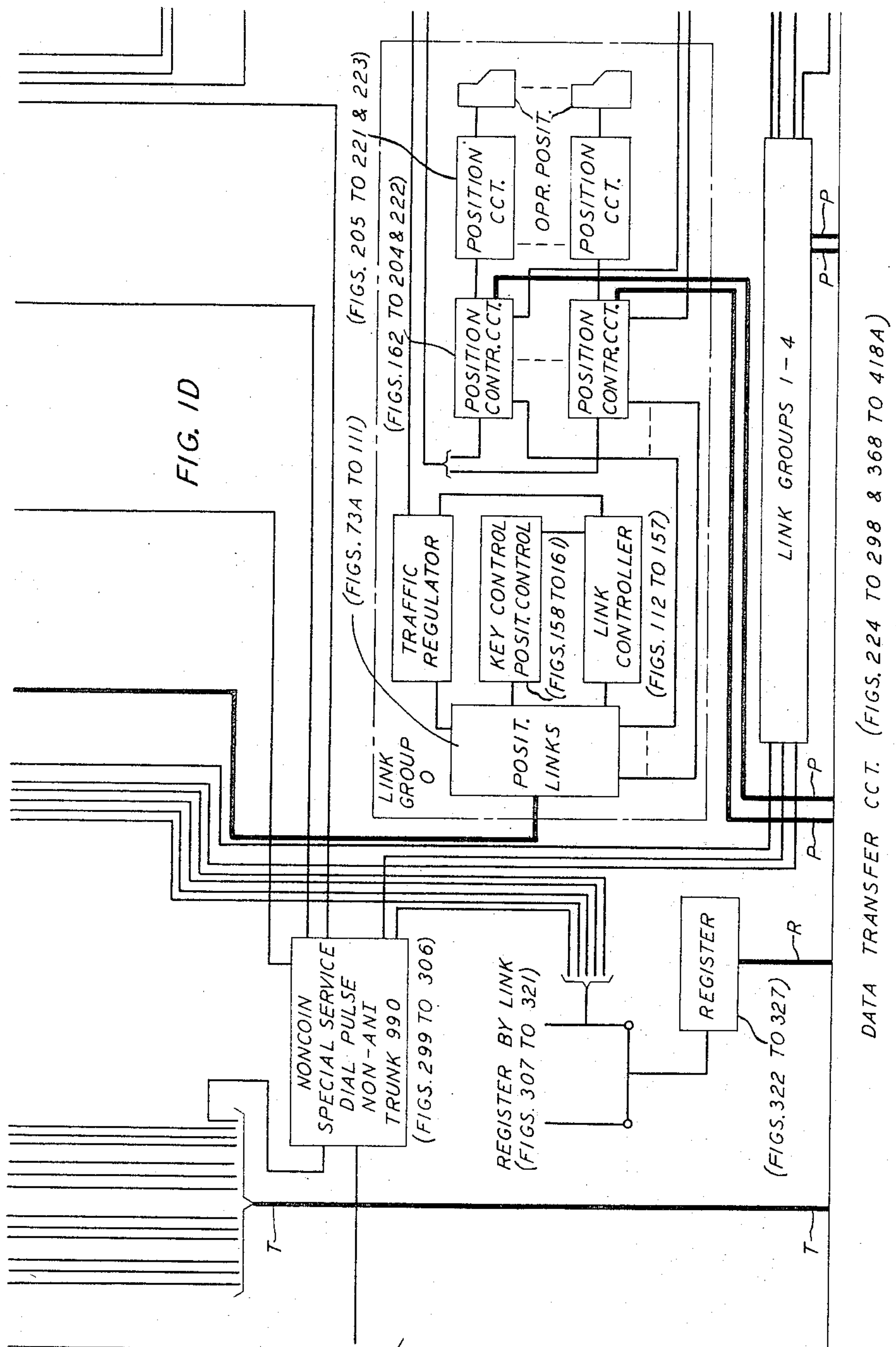
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 4



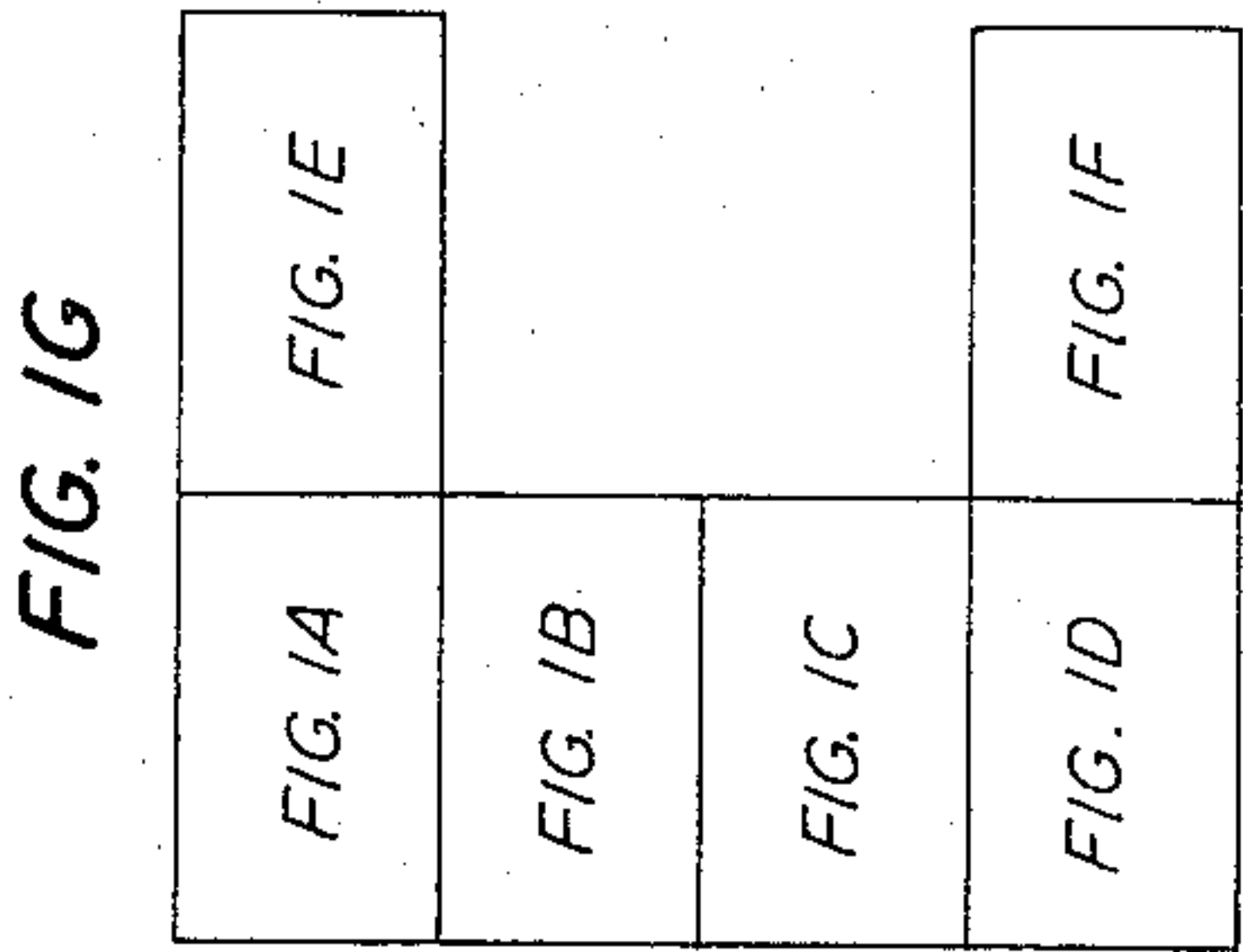
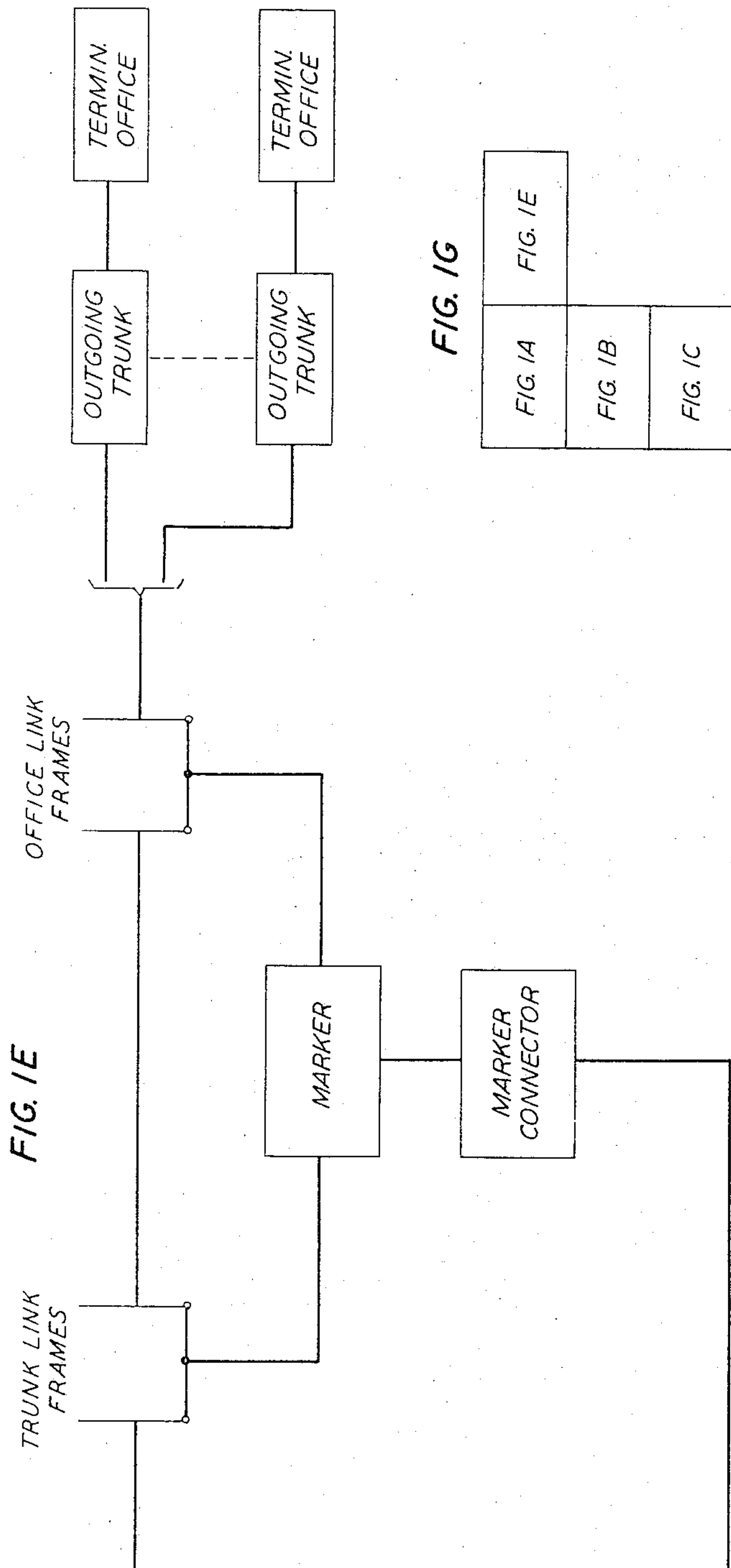
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3,341,662

Filed Nov. 26, 1963

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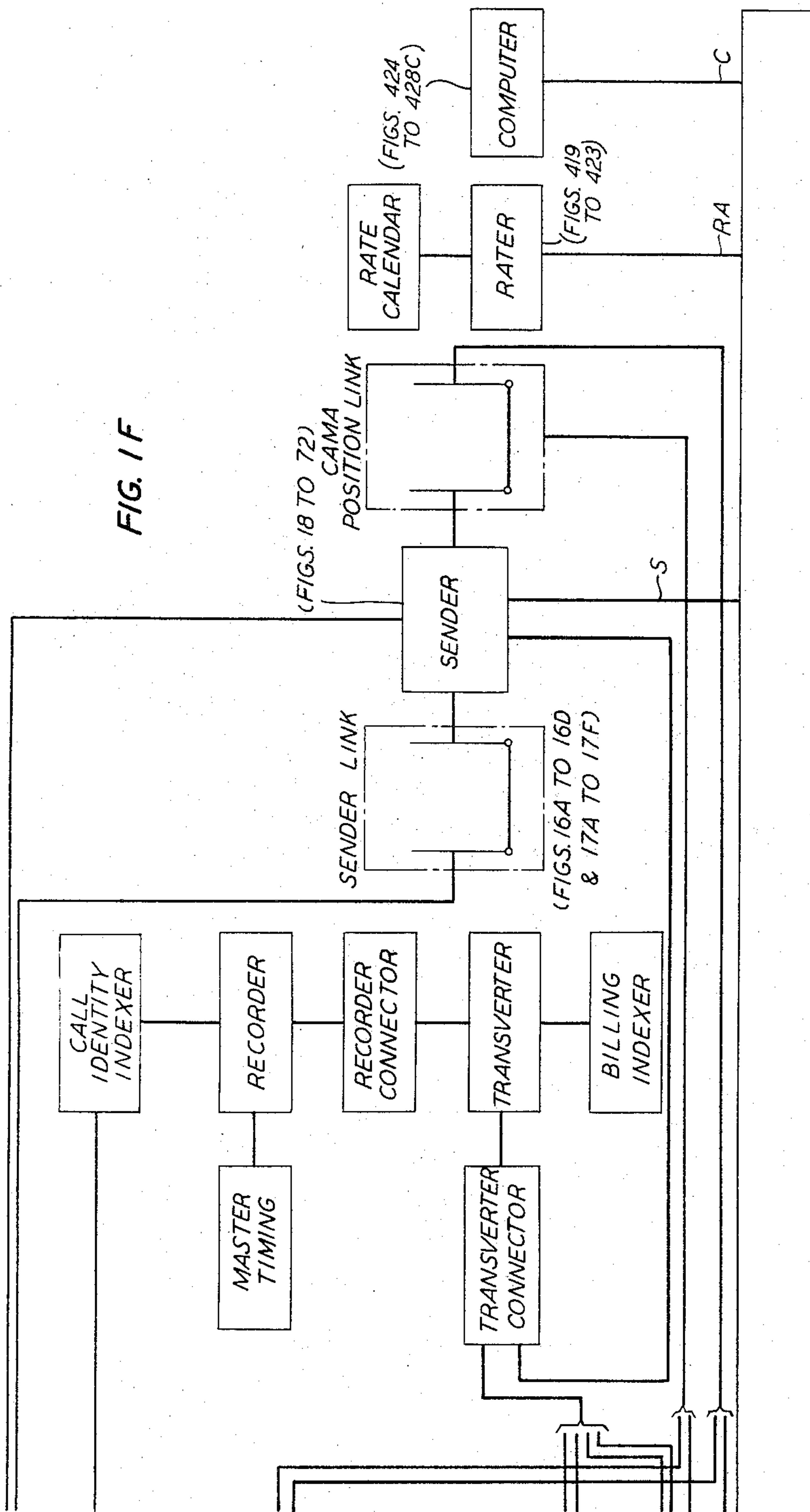
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3,341,662

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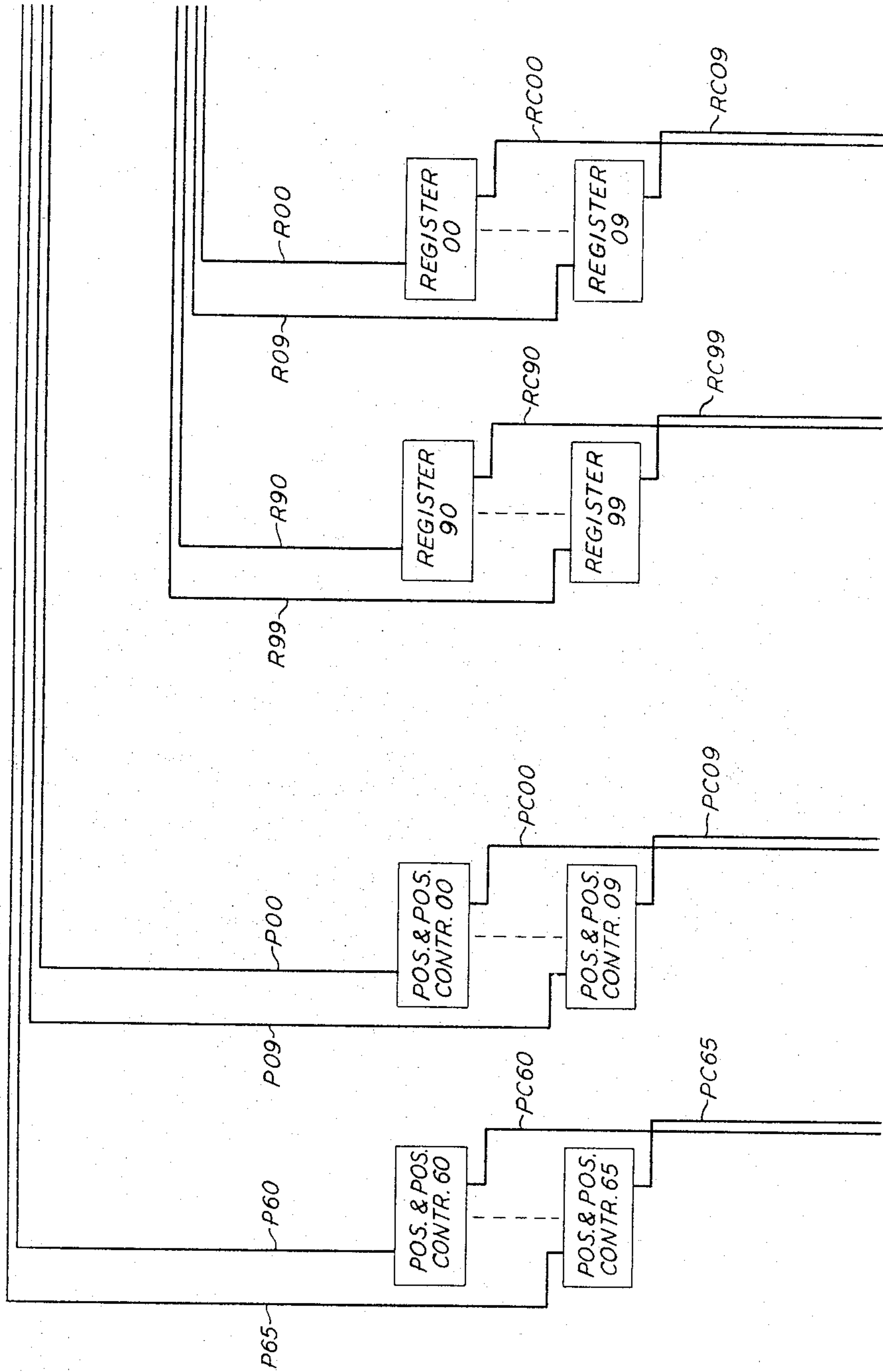
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 7

FIG. 2A



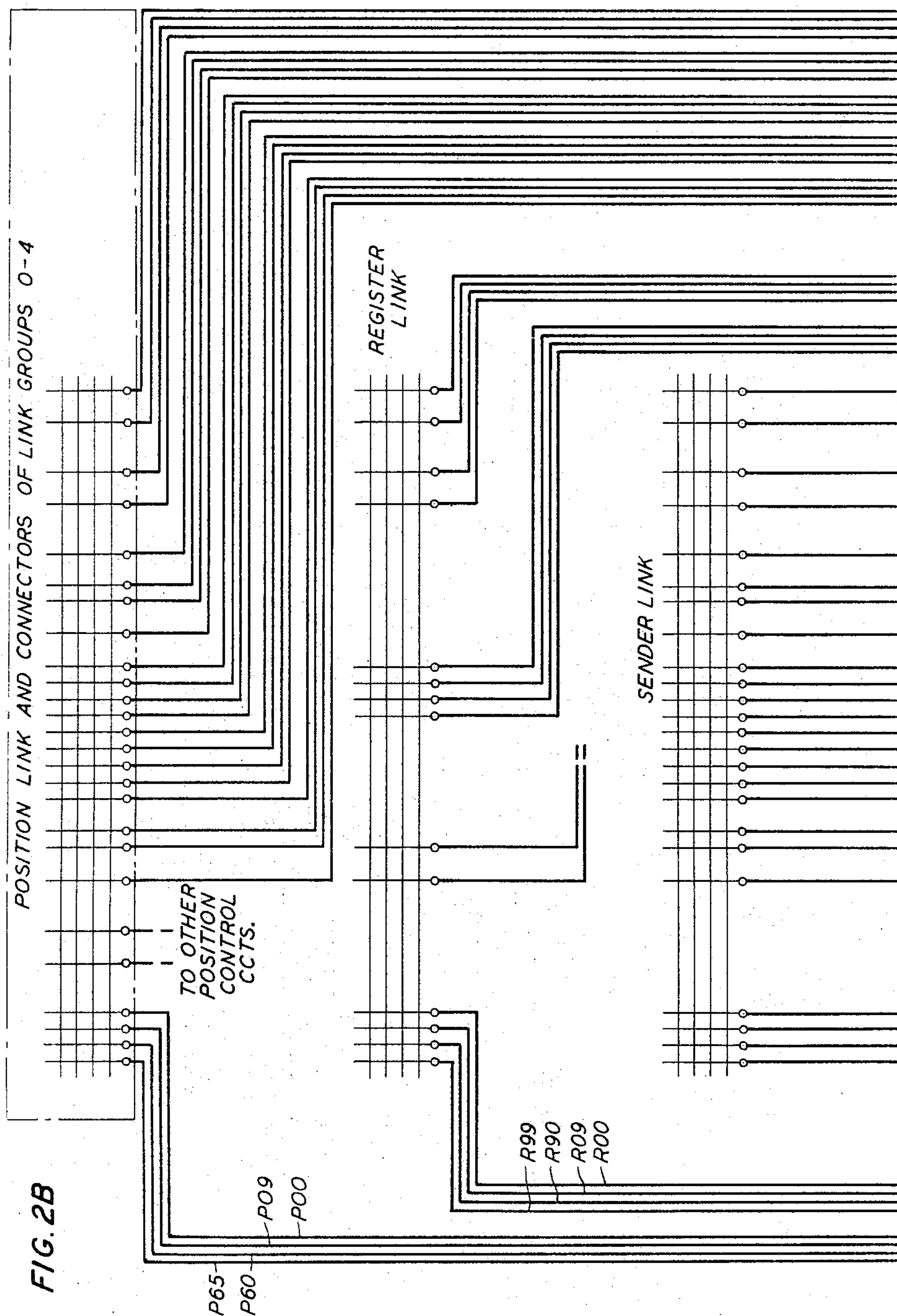
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 8



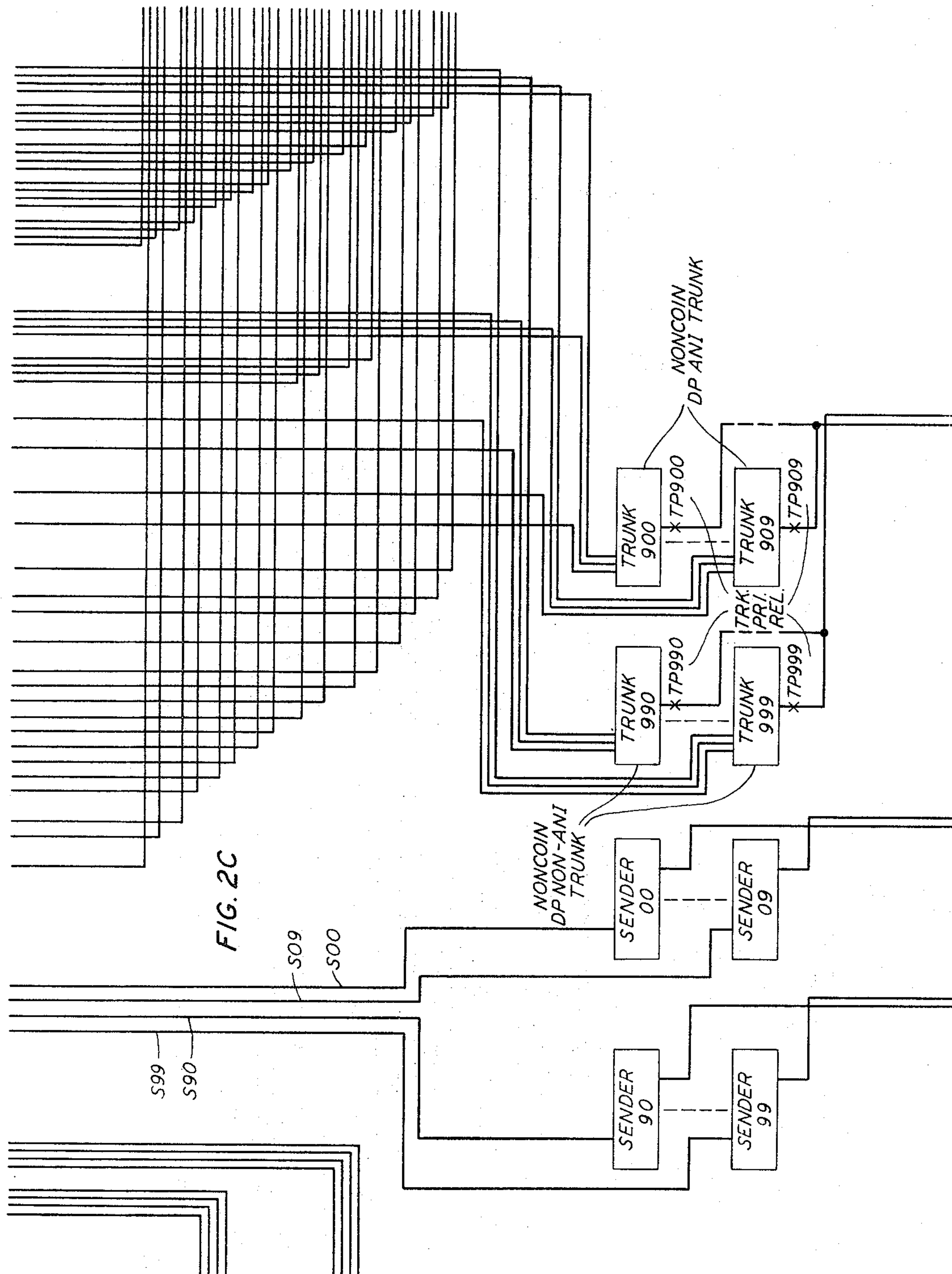
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 9



Sept. 12, 1967

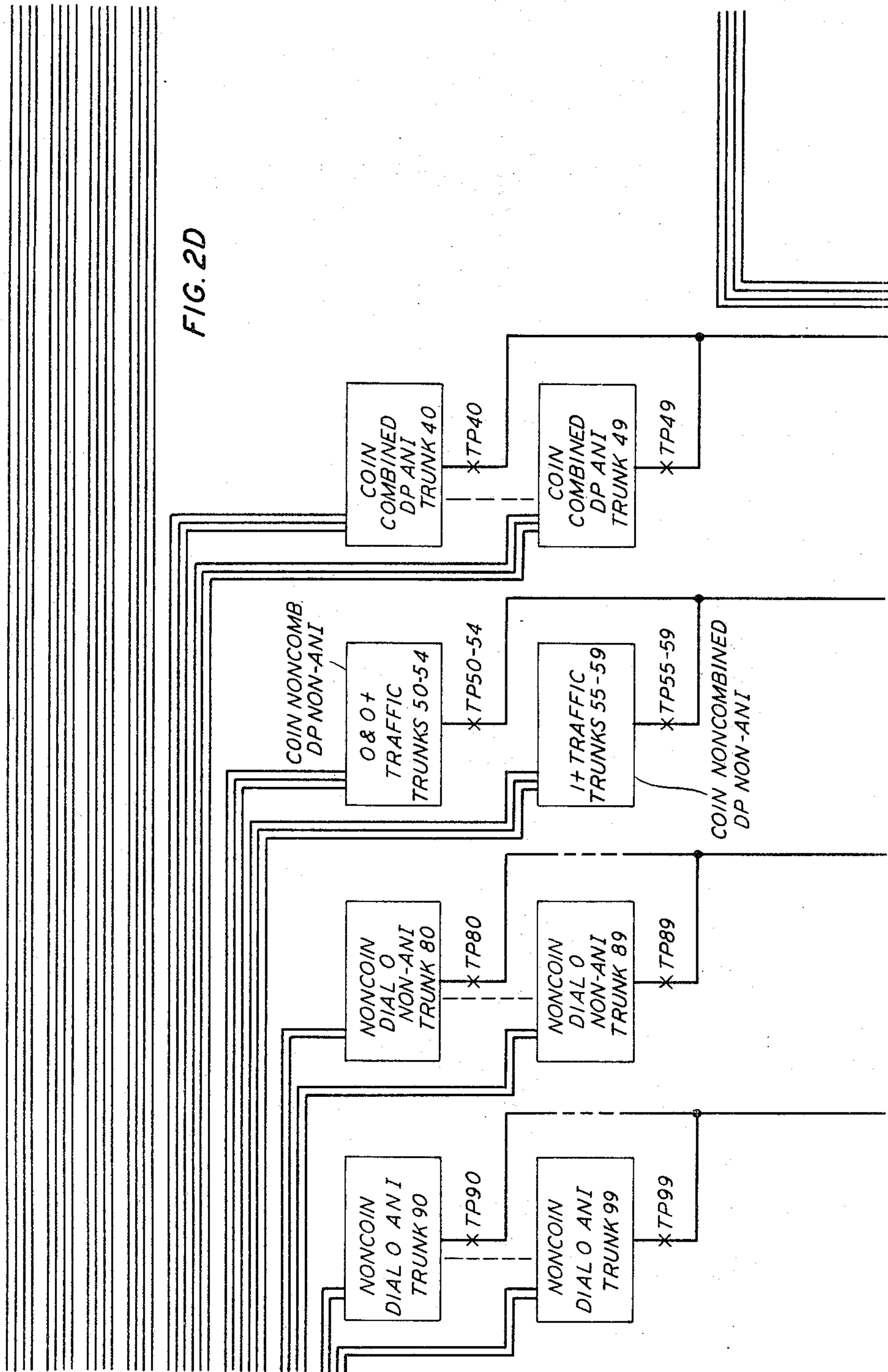
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 10

FIG. 2D



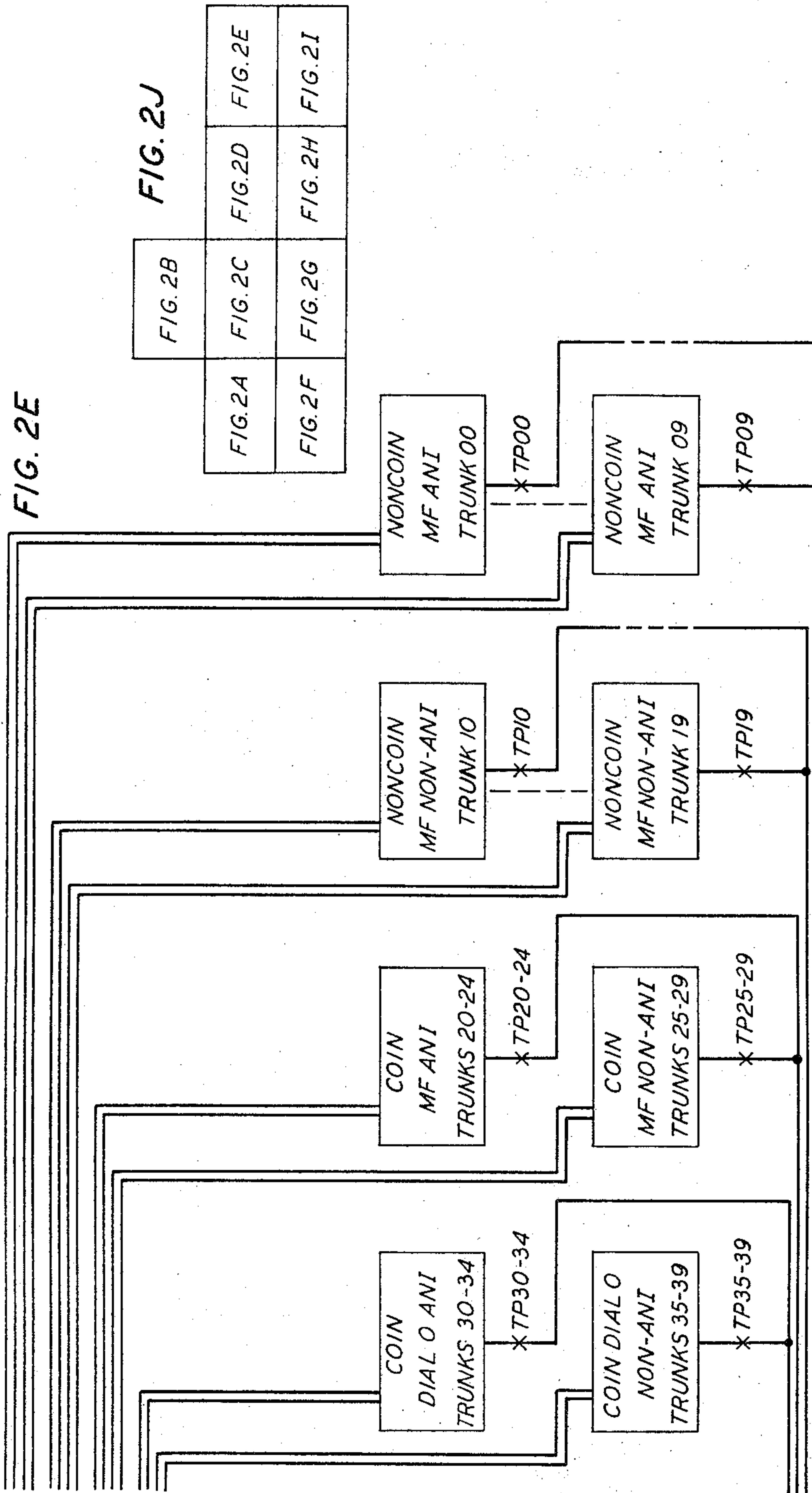
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3,341,662

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570 Sheets-Sheet 11



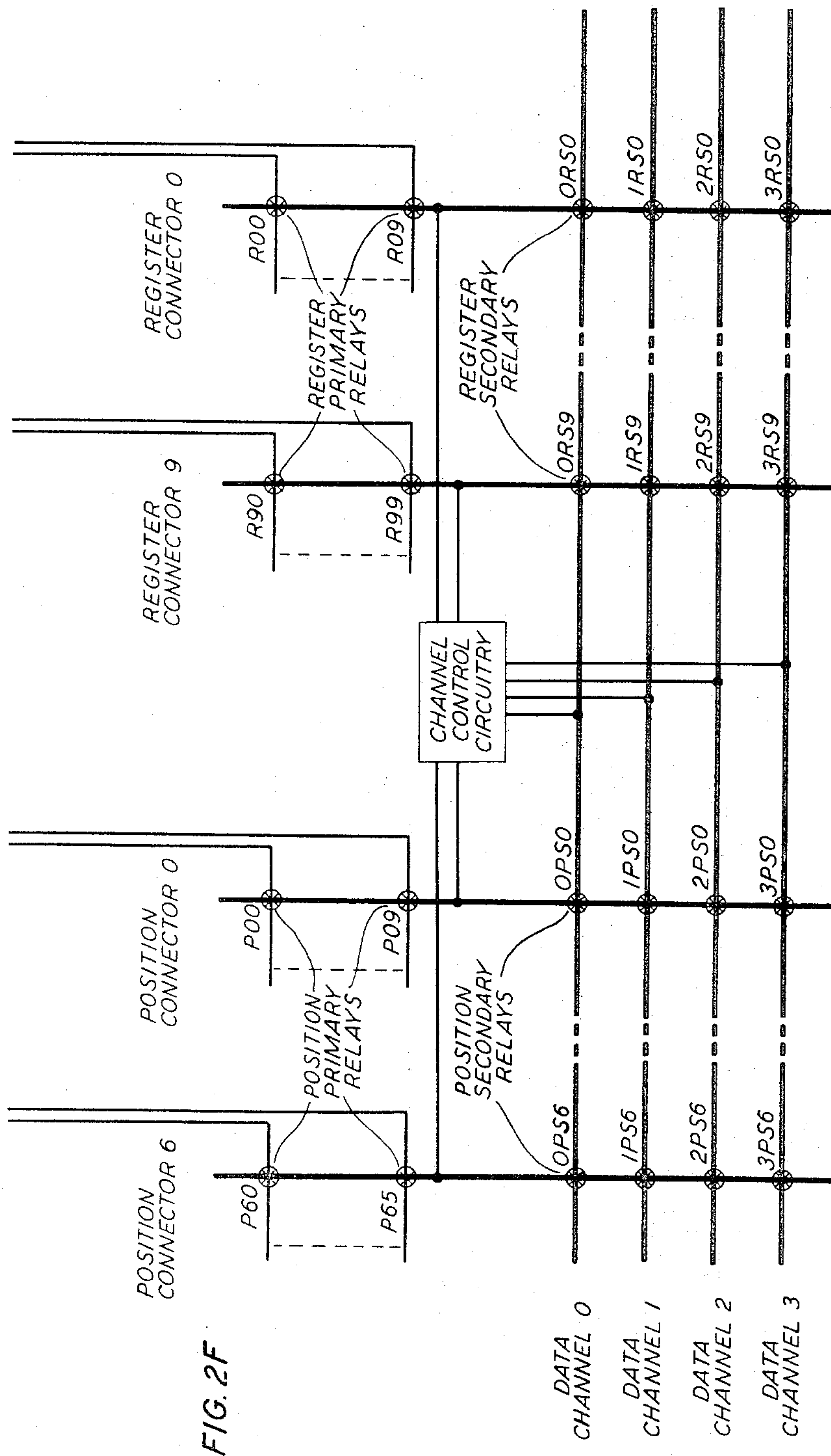
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 12



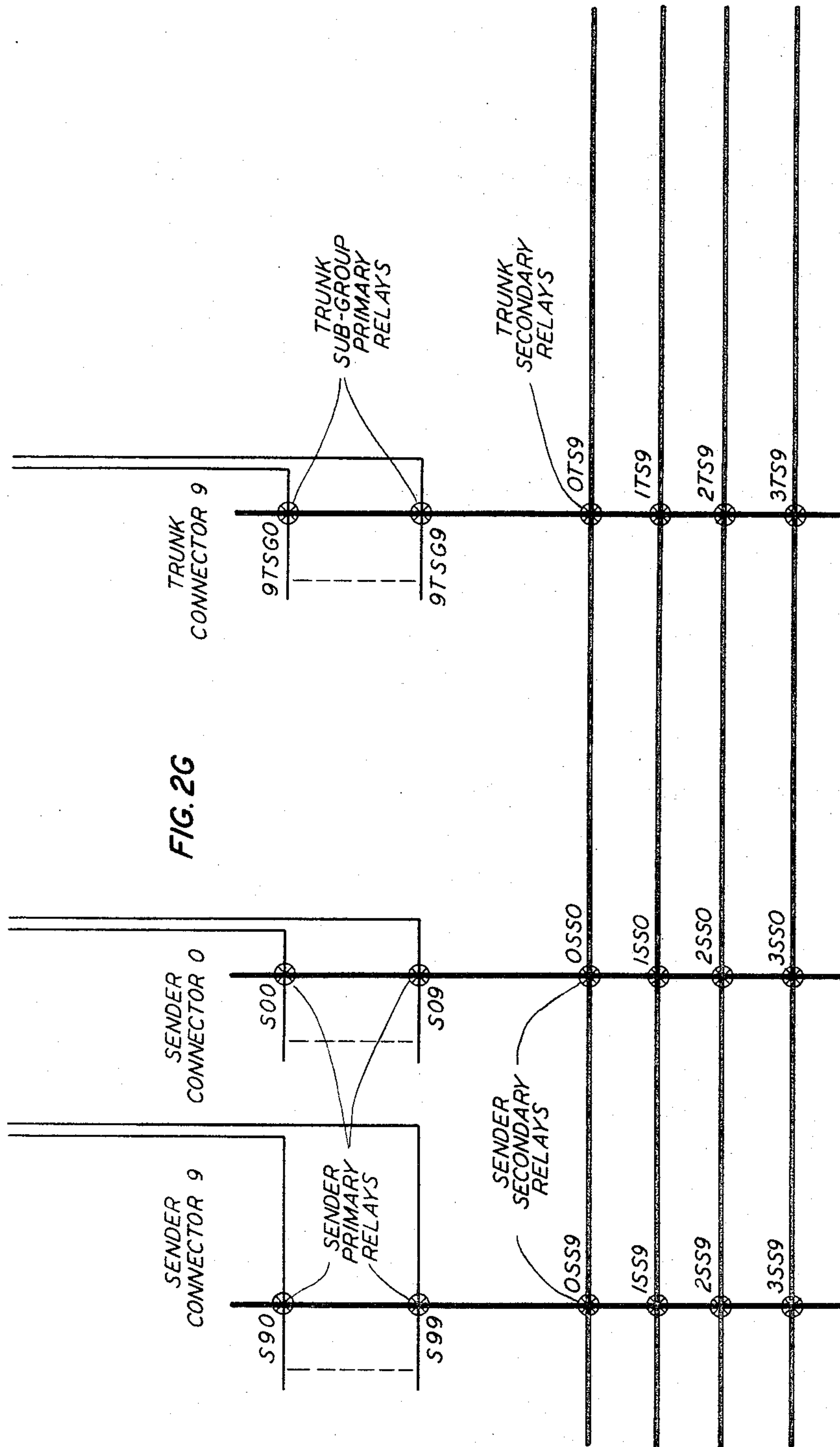
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 13



Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 14

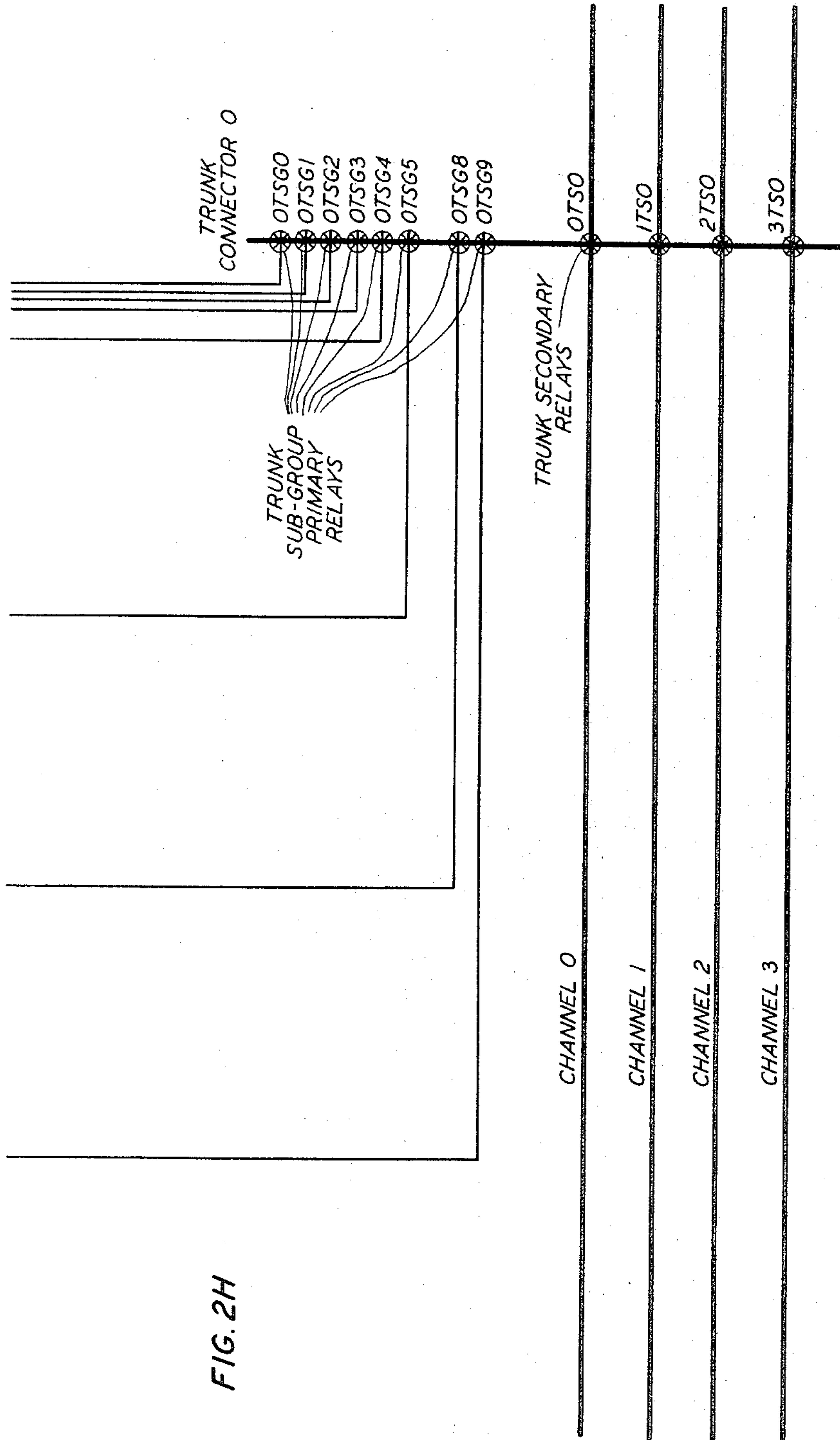


FIG. 2H

Sept. 12, 1967

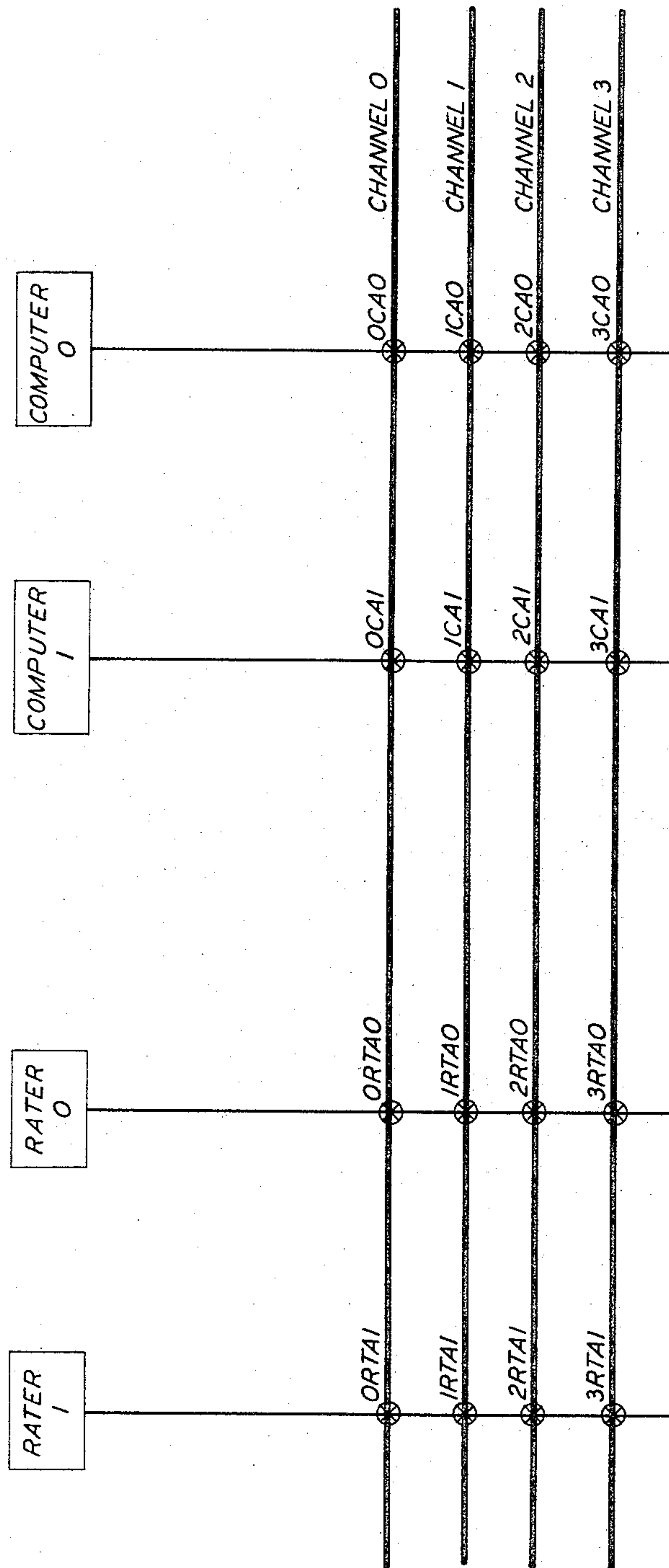
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 15

FIG. 21



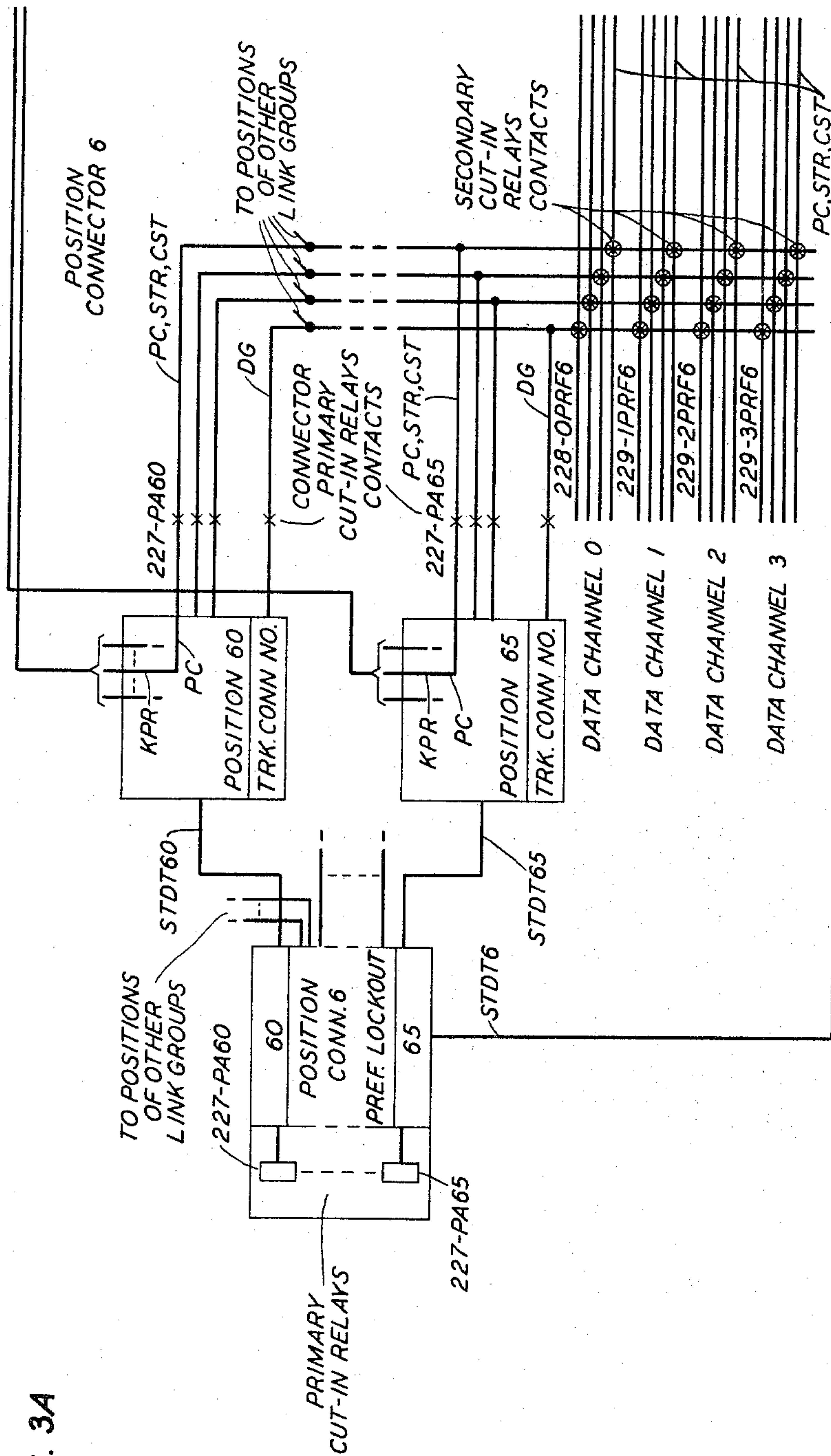
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3,341,662

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570 Sheets-Sheet 16



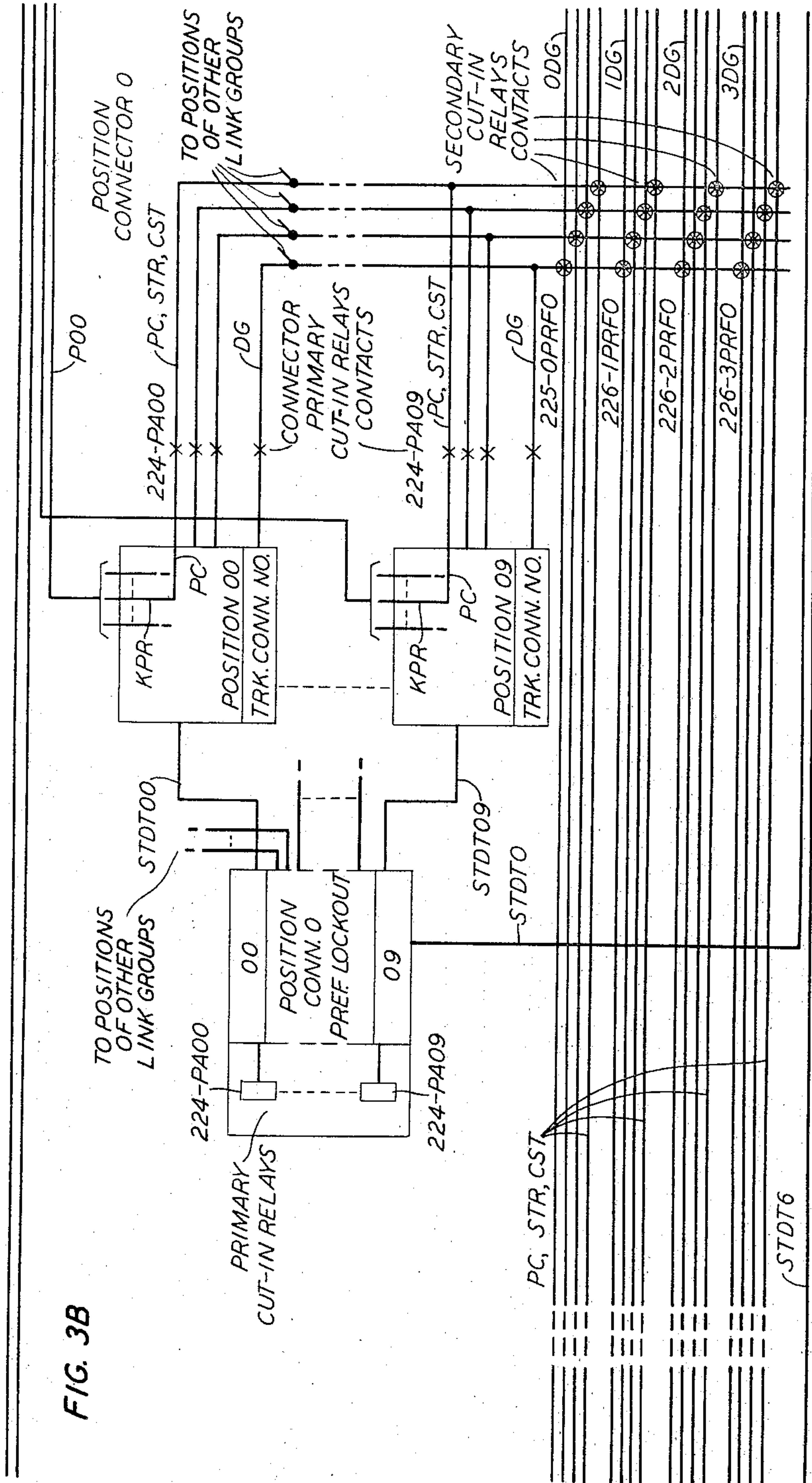
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3,341,662

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570 Sheets-Sheet 17



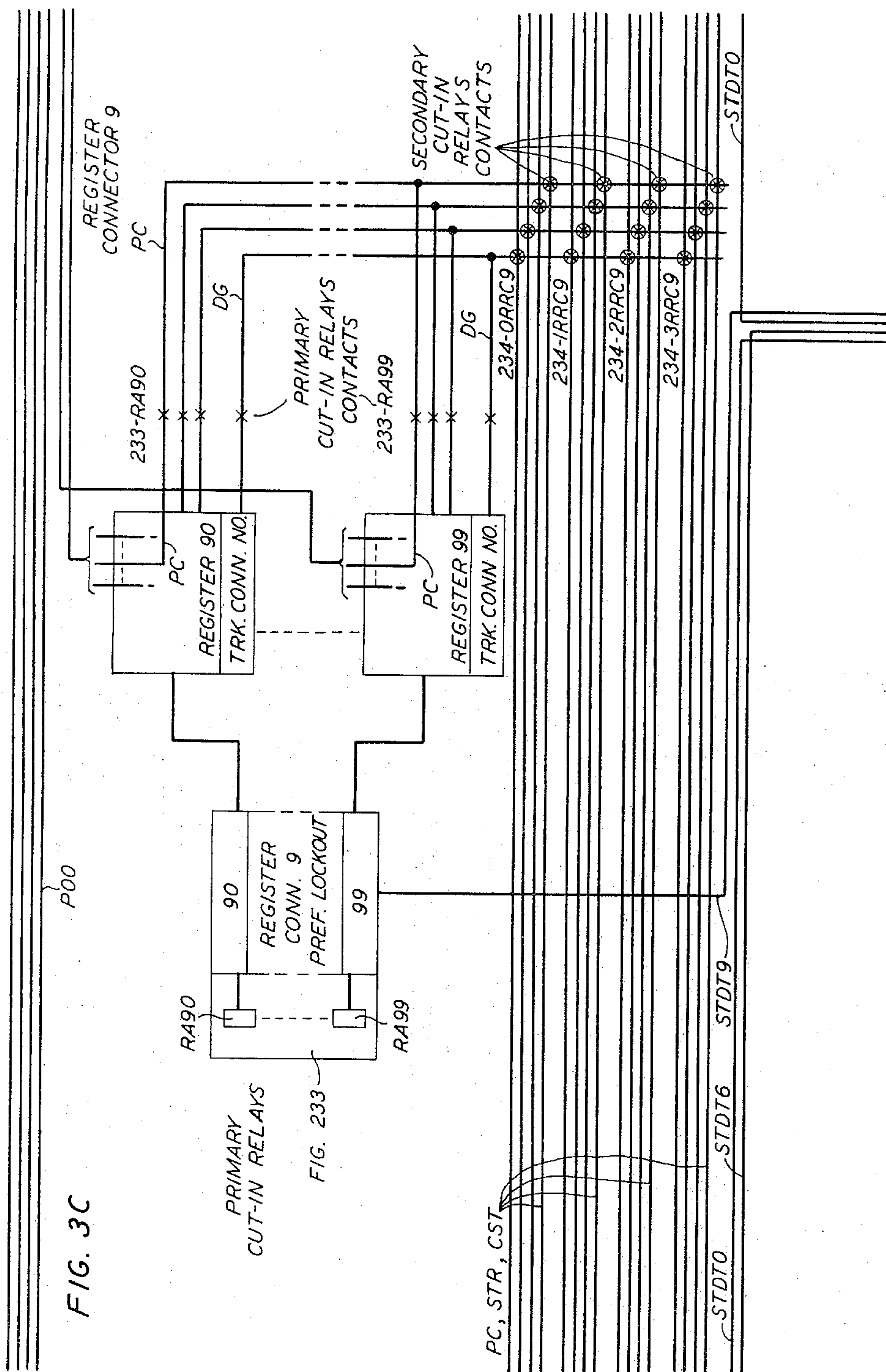
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 18



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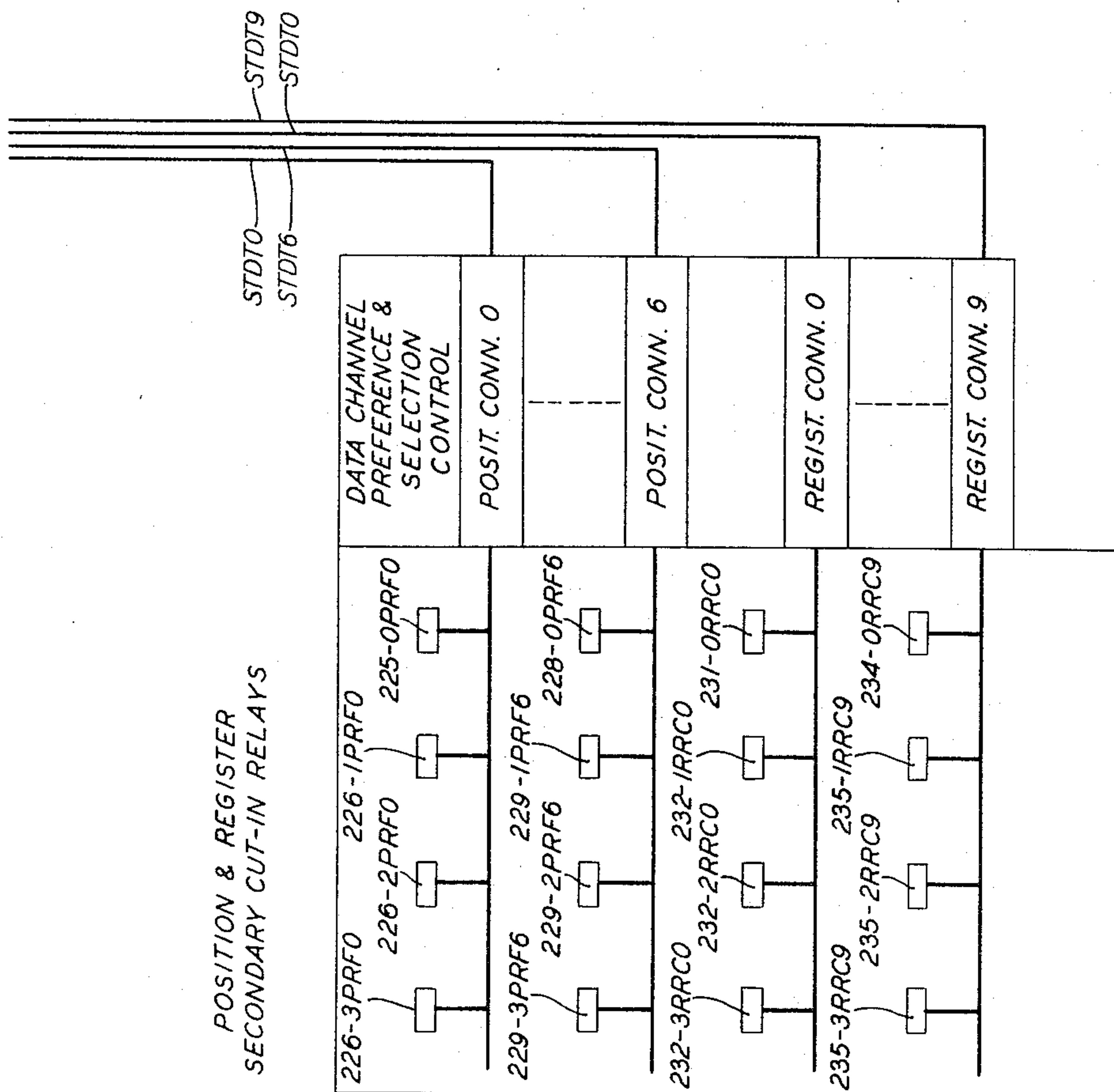
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 19

FIG. 3D



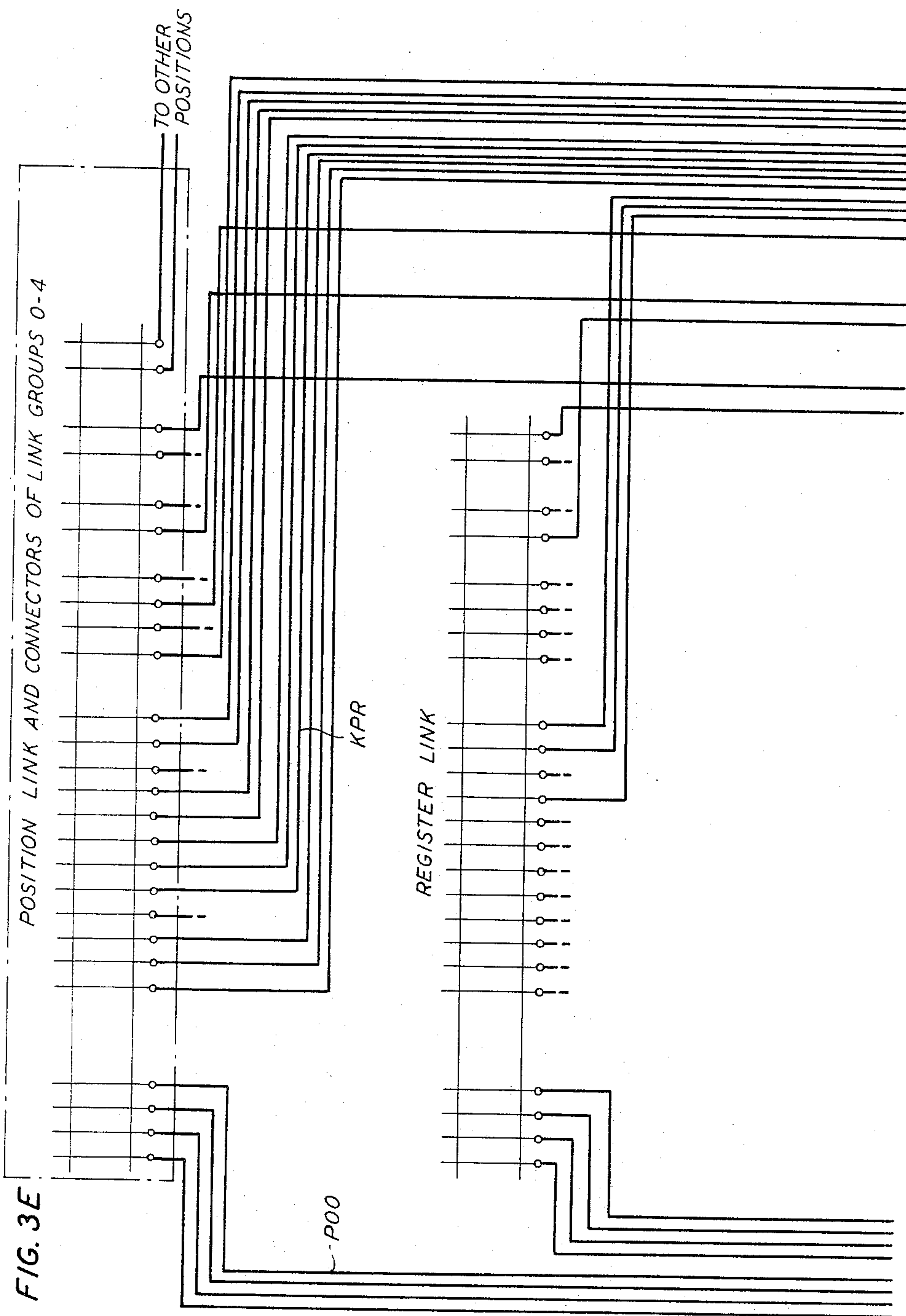
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3,341,662

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570 Sheets-Sheet 20



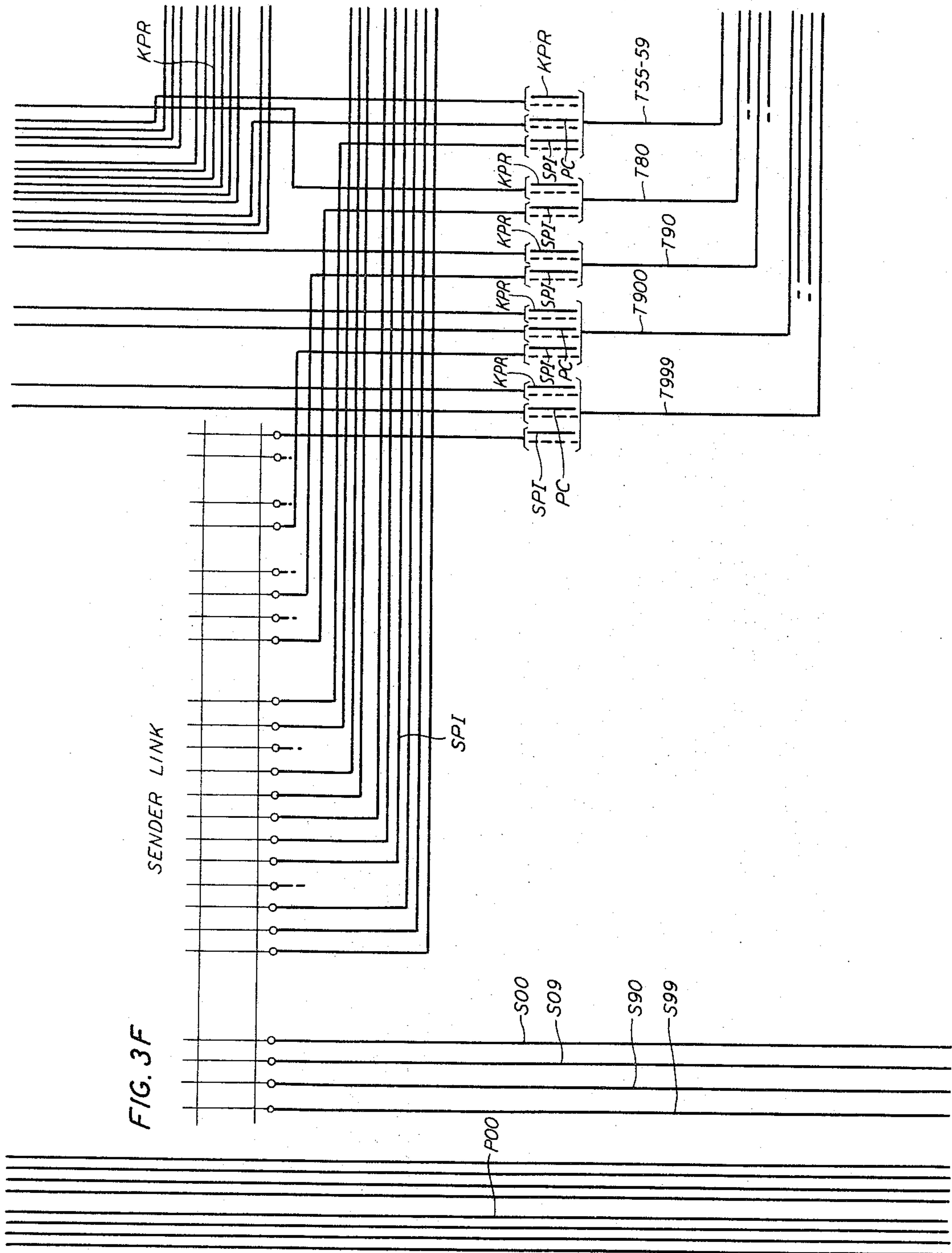
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 21



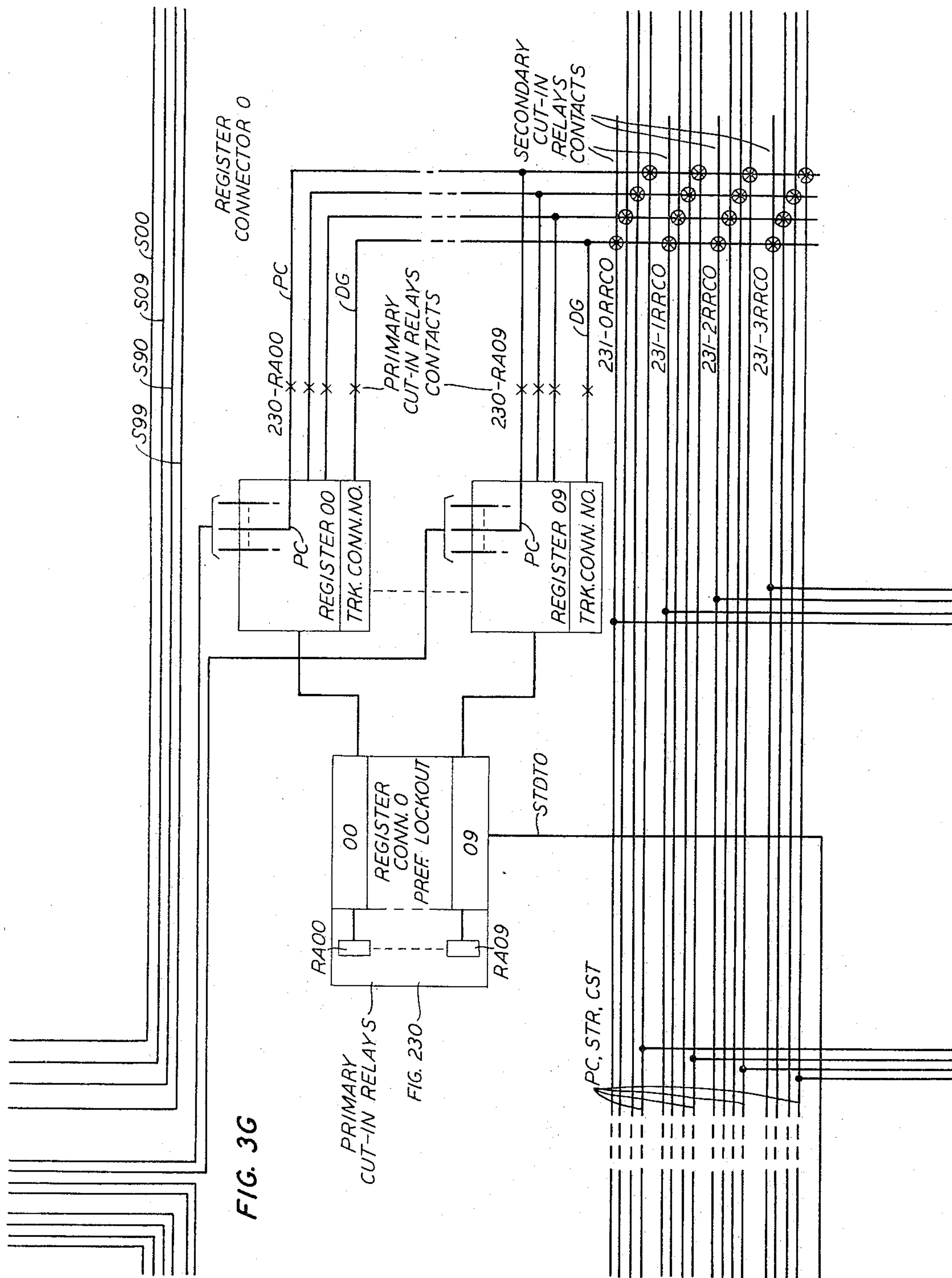
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3,341,662

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570 Sheets-Sheet 23



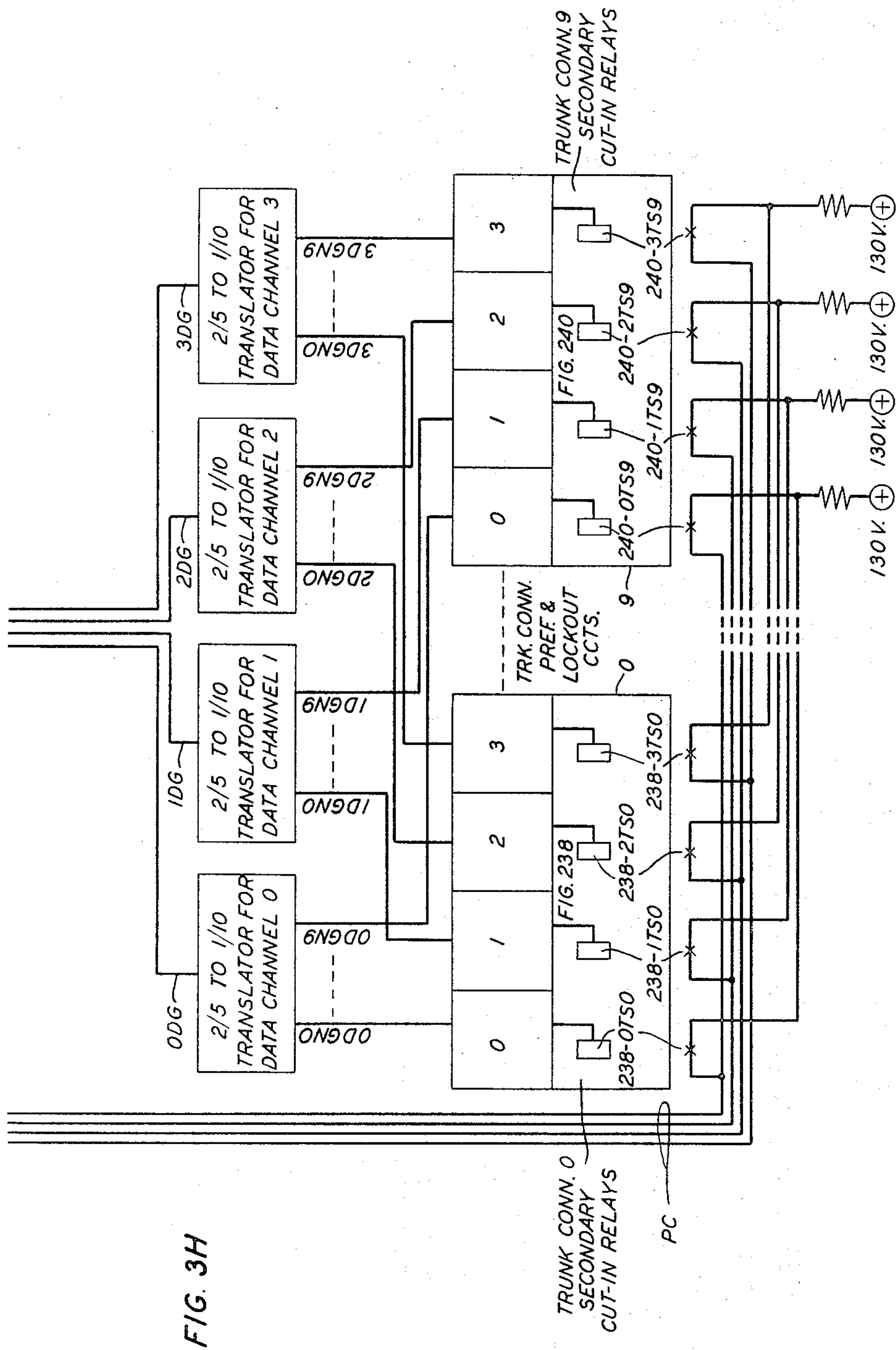
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 23



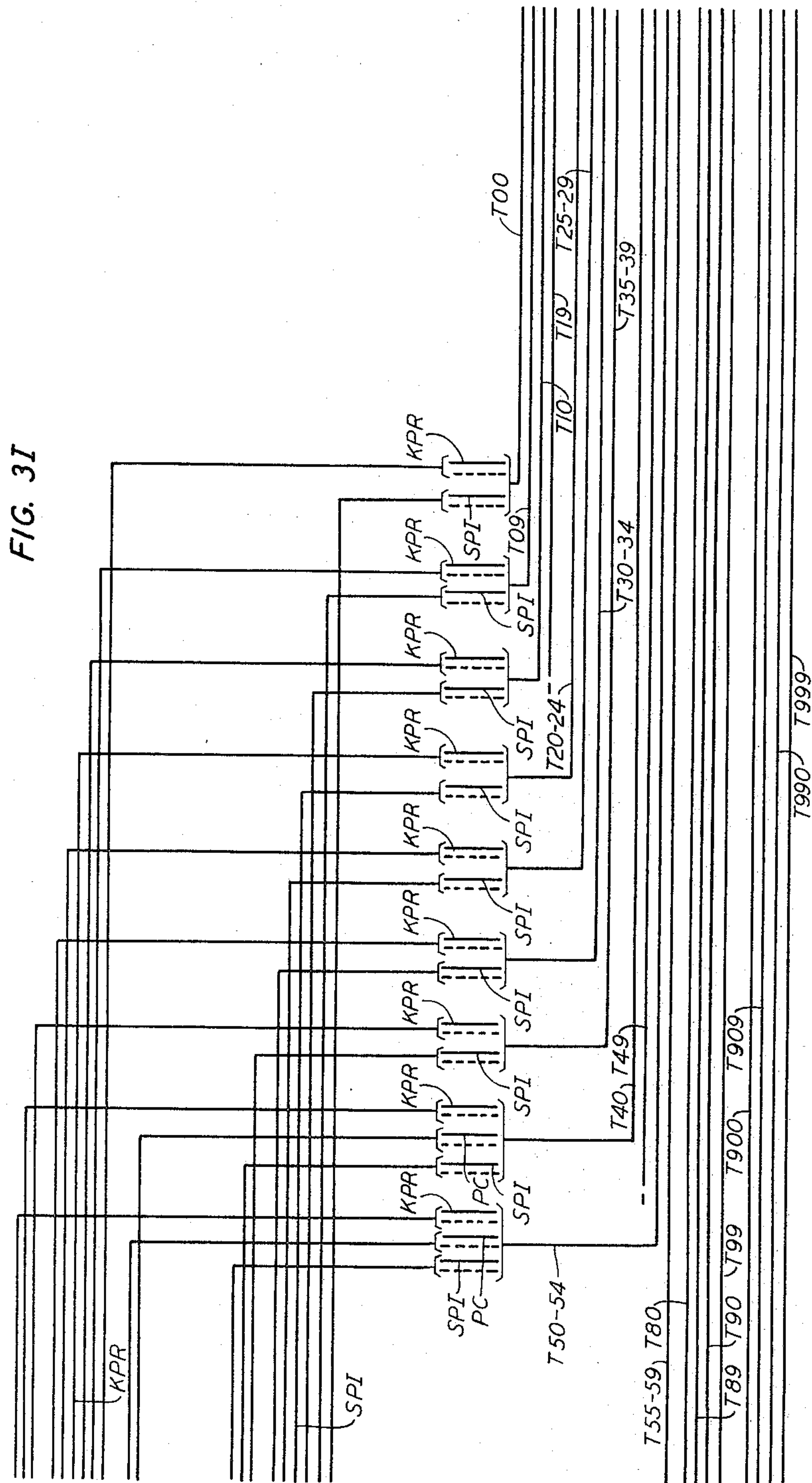
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 24



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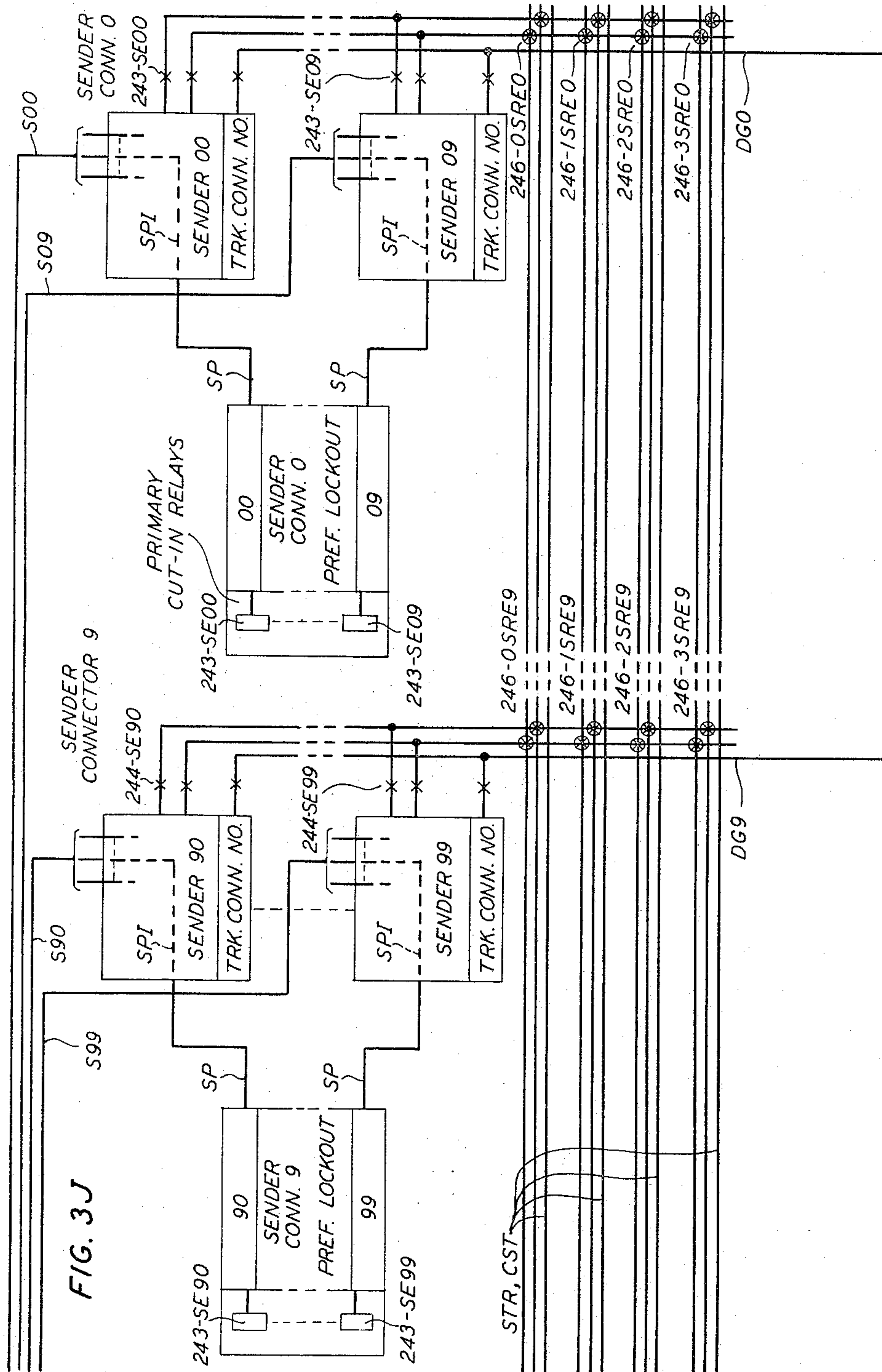
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Filed Nov. 26, 1963

570 Sheets-Sheet 25



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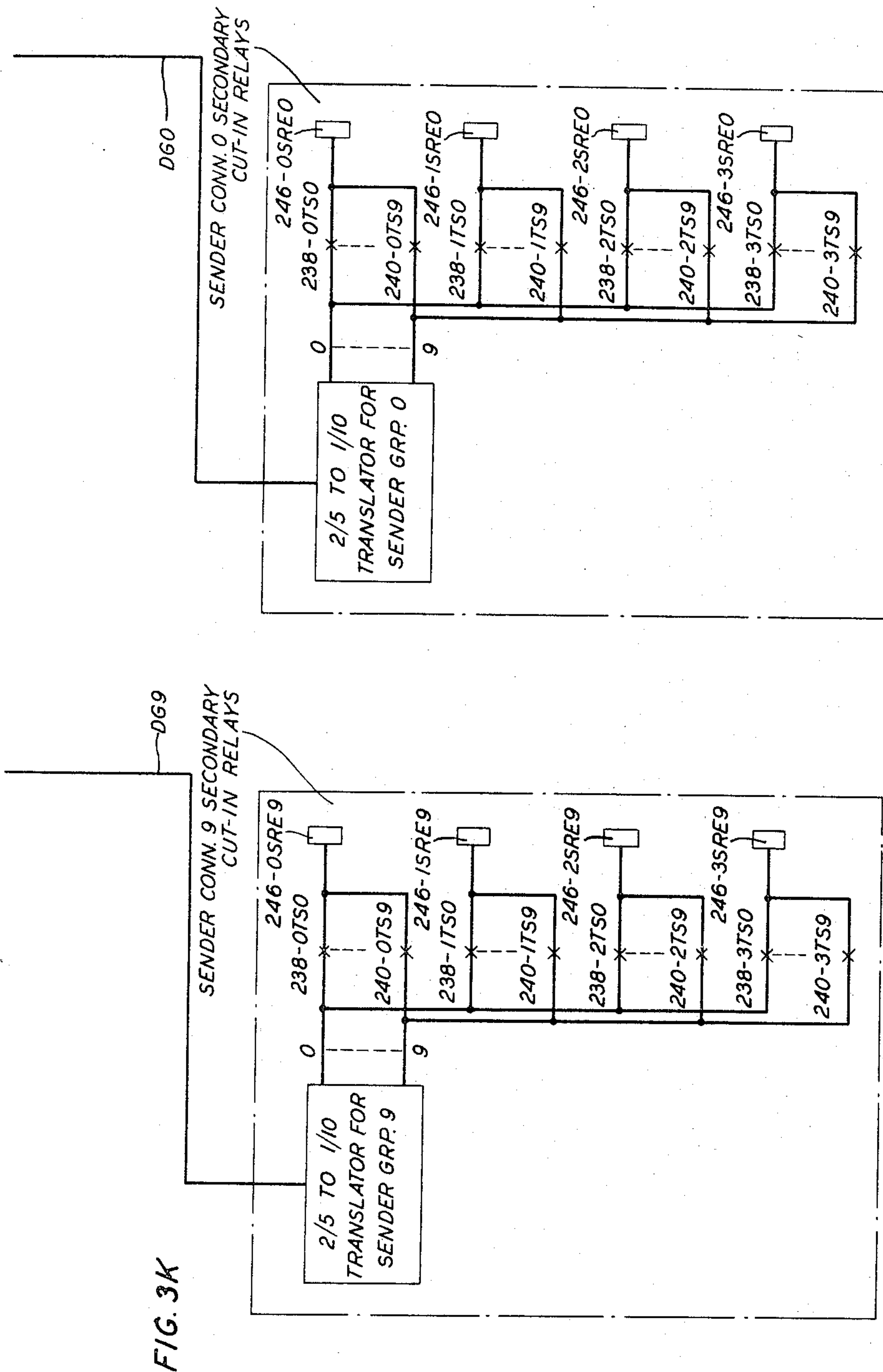
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Filed Nov. 26, 1963

570 Sheets-Sheet 26



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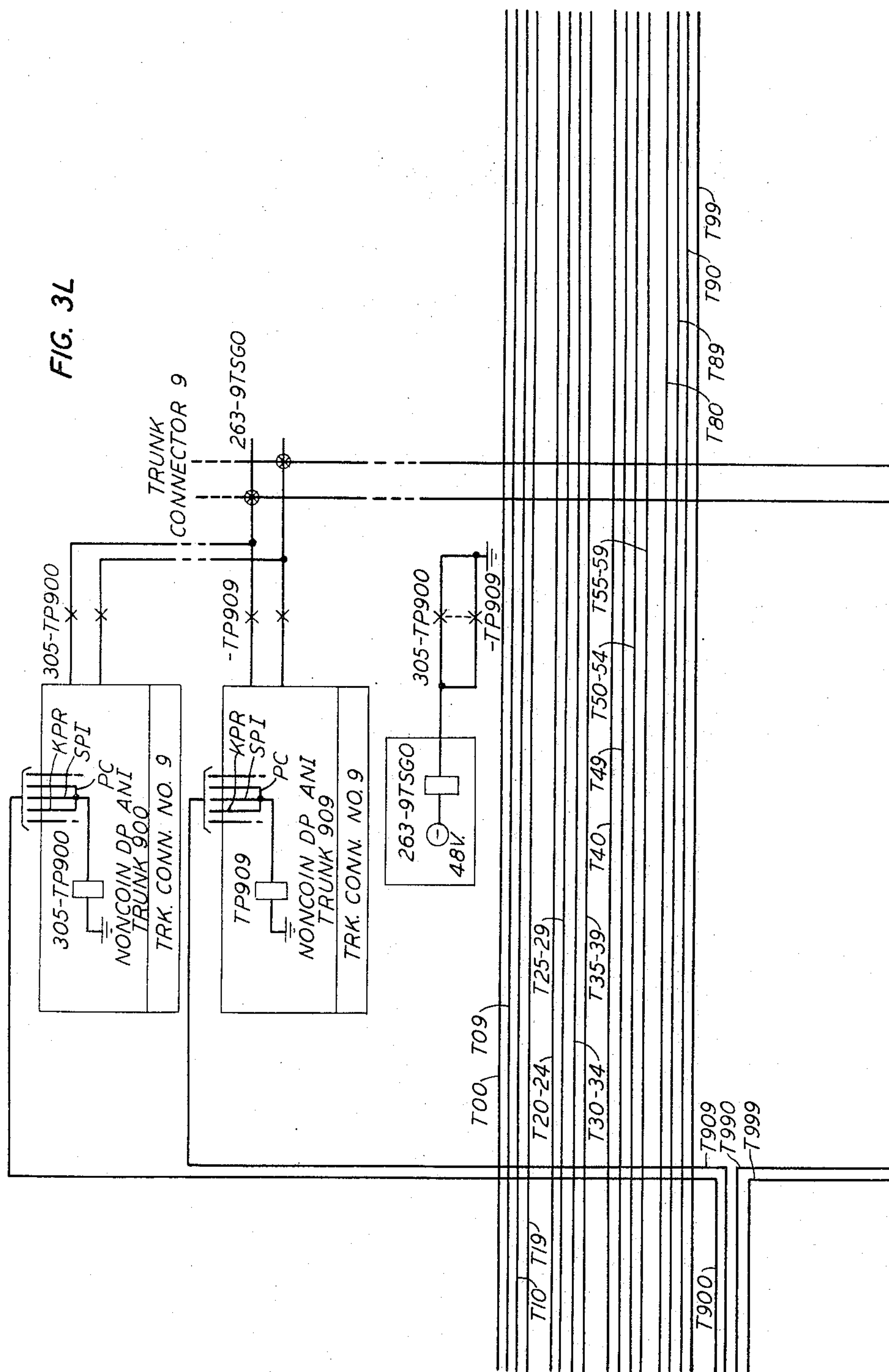
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Filed Nov. 26, 1963

570 Sheets-Sheet 27



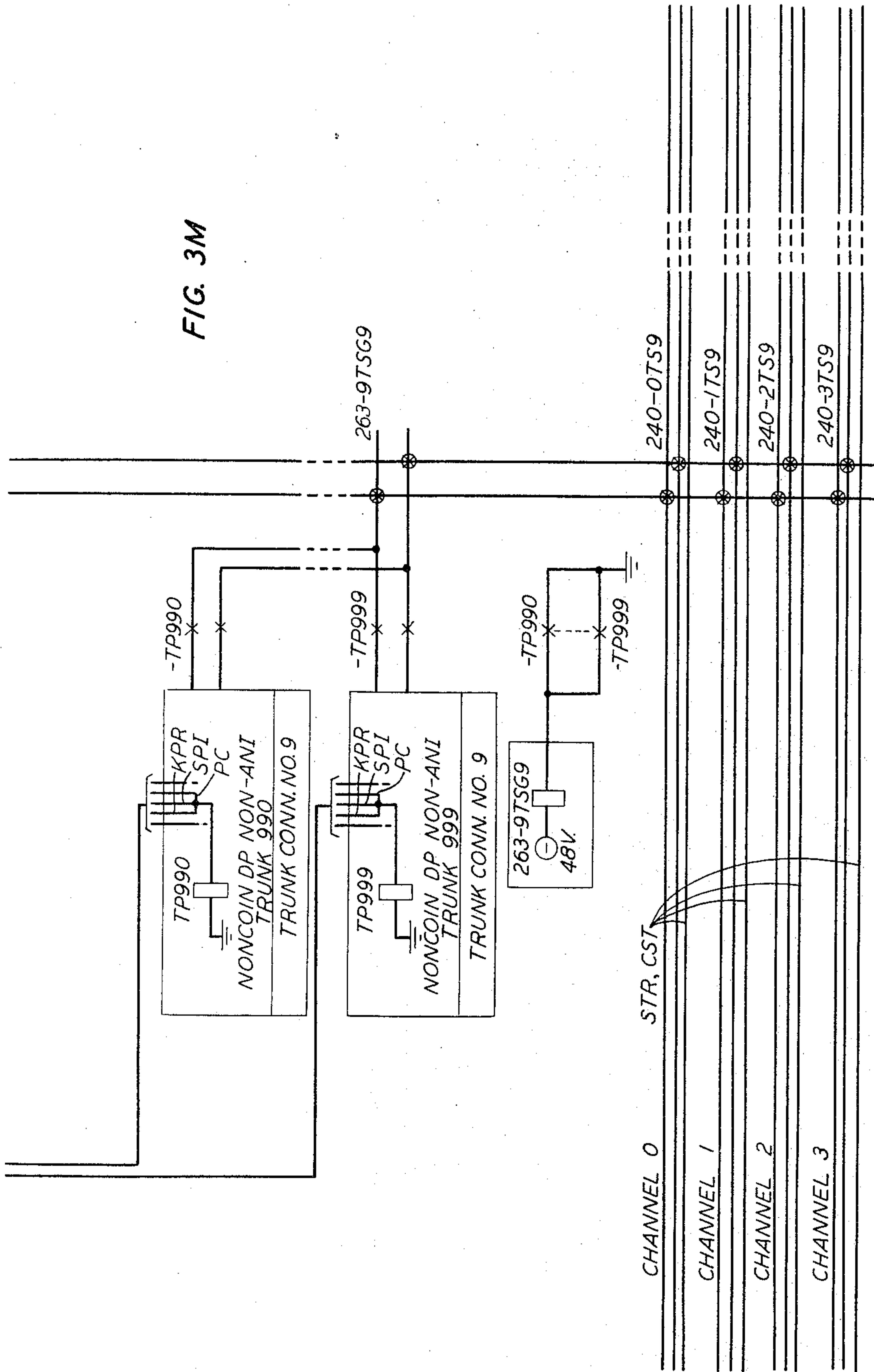
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 28



Sept. 12, 1967

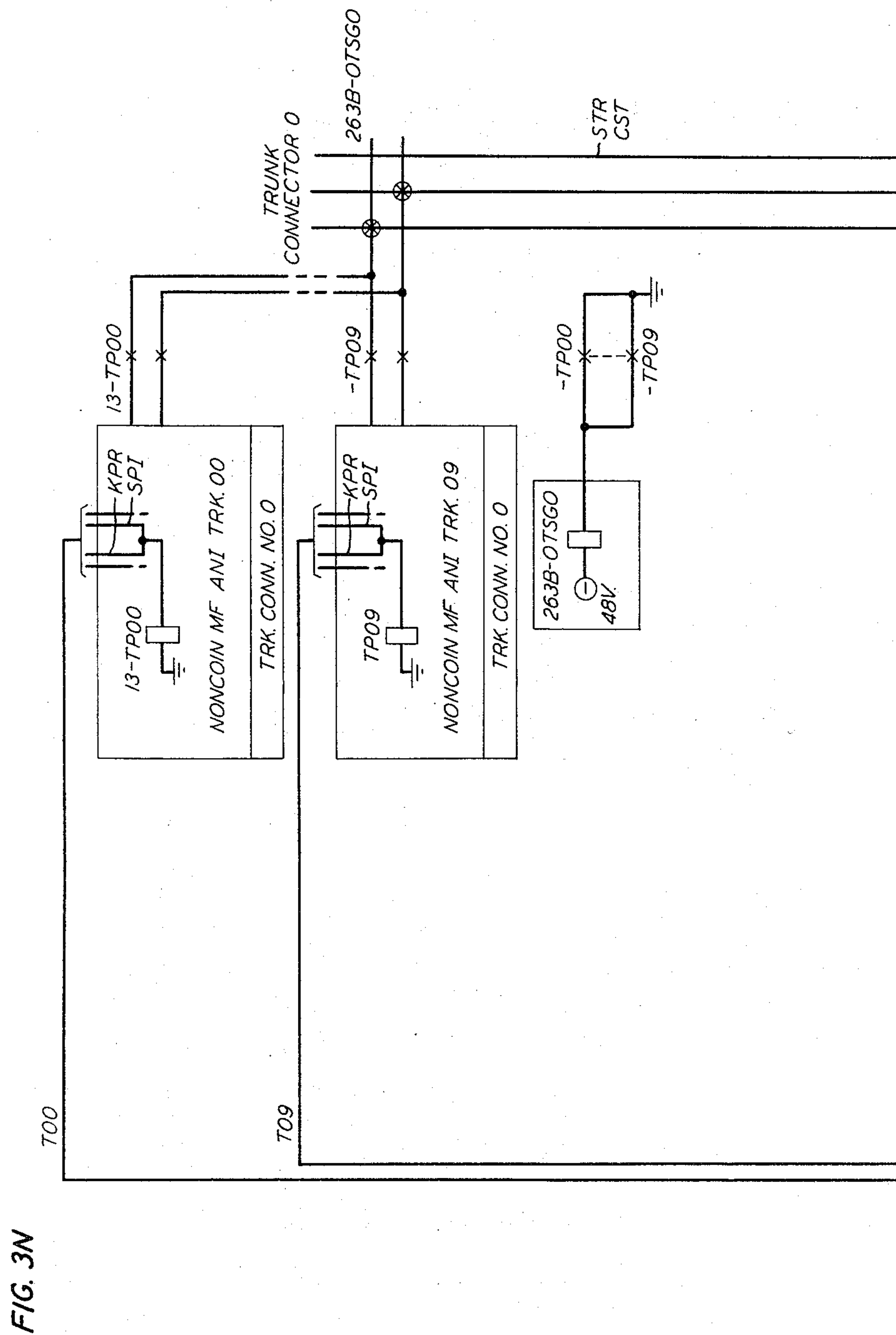
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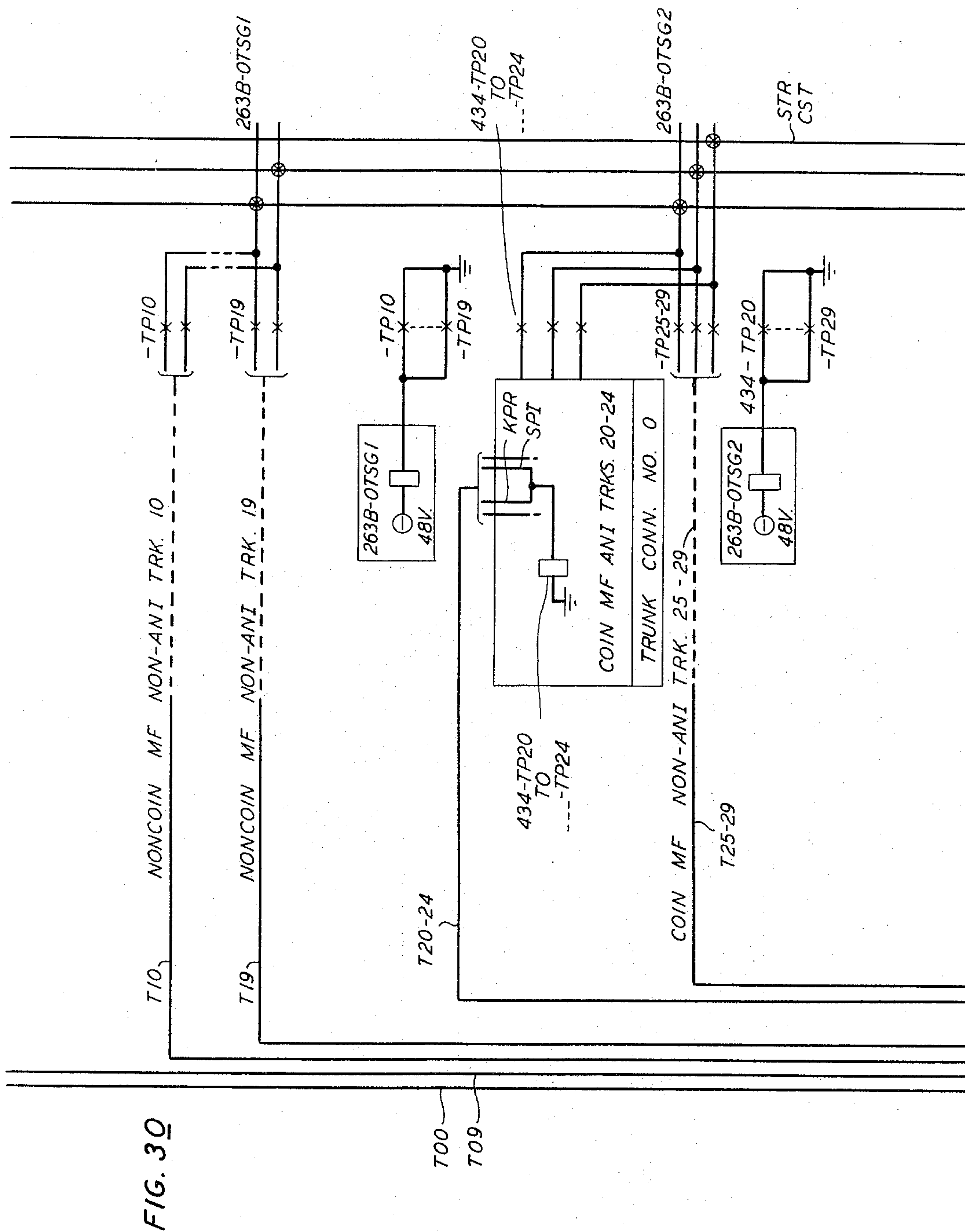
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570 Sheets-Sheet 30



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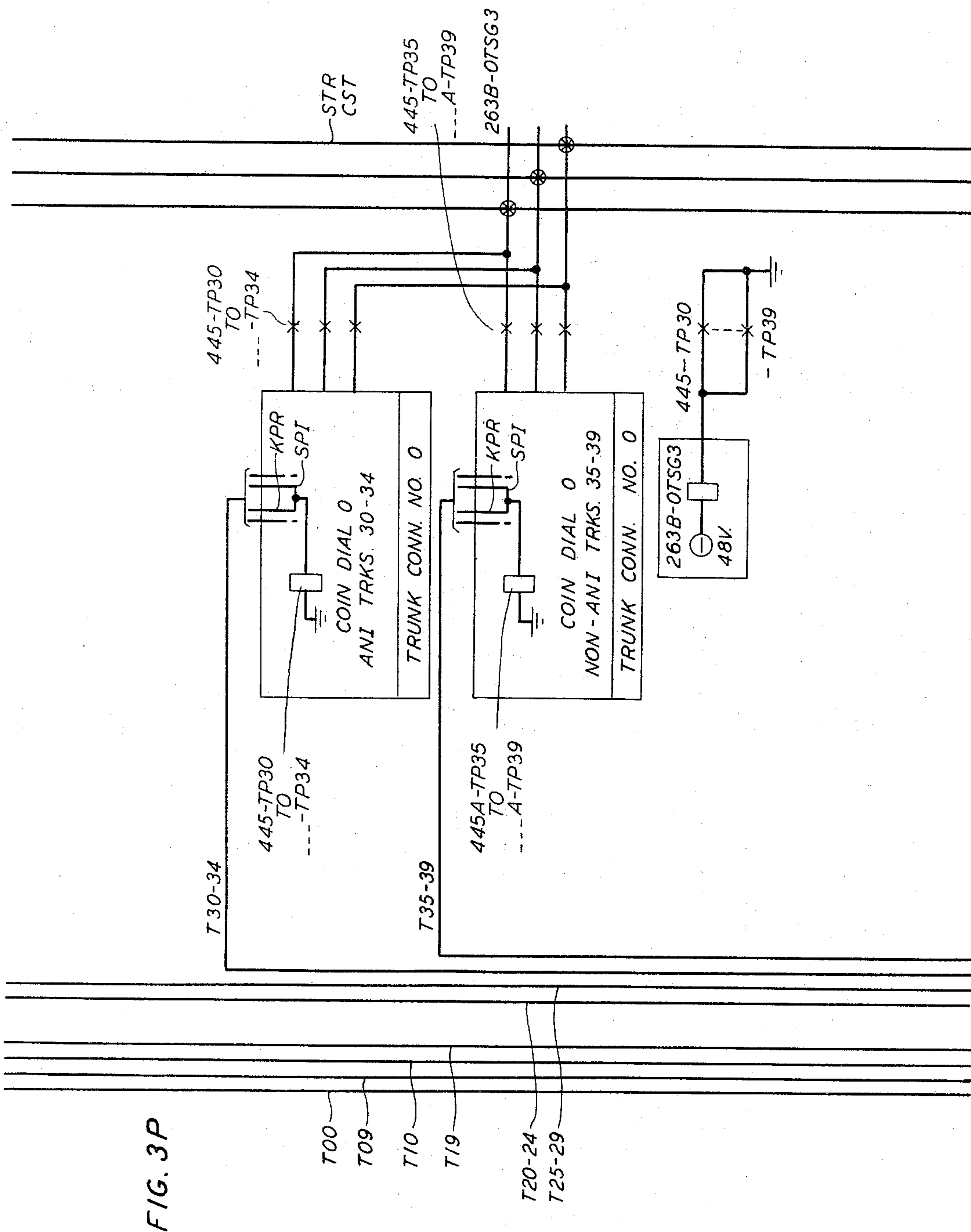
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Filed Nov. 26, 1963

570 Sheets-Sheet 31



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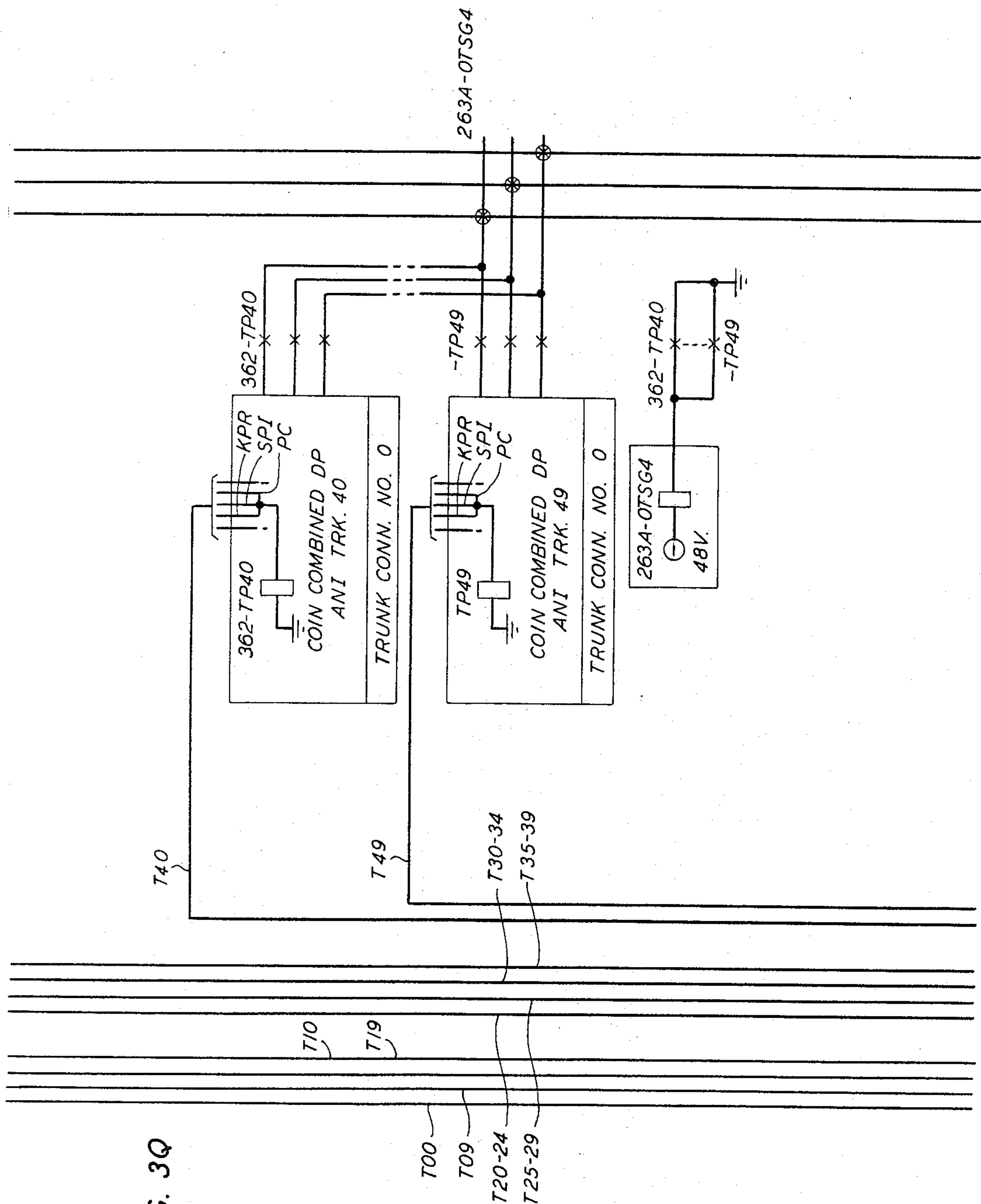
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Filed Nov. 26, 1963

570 Sheets-Sheet 32



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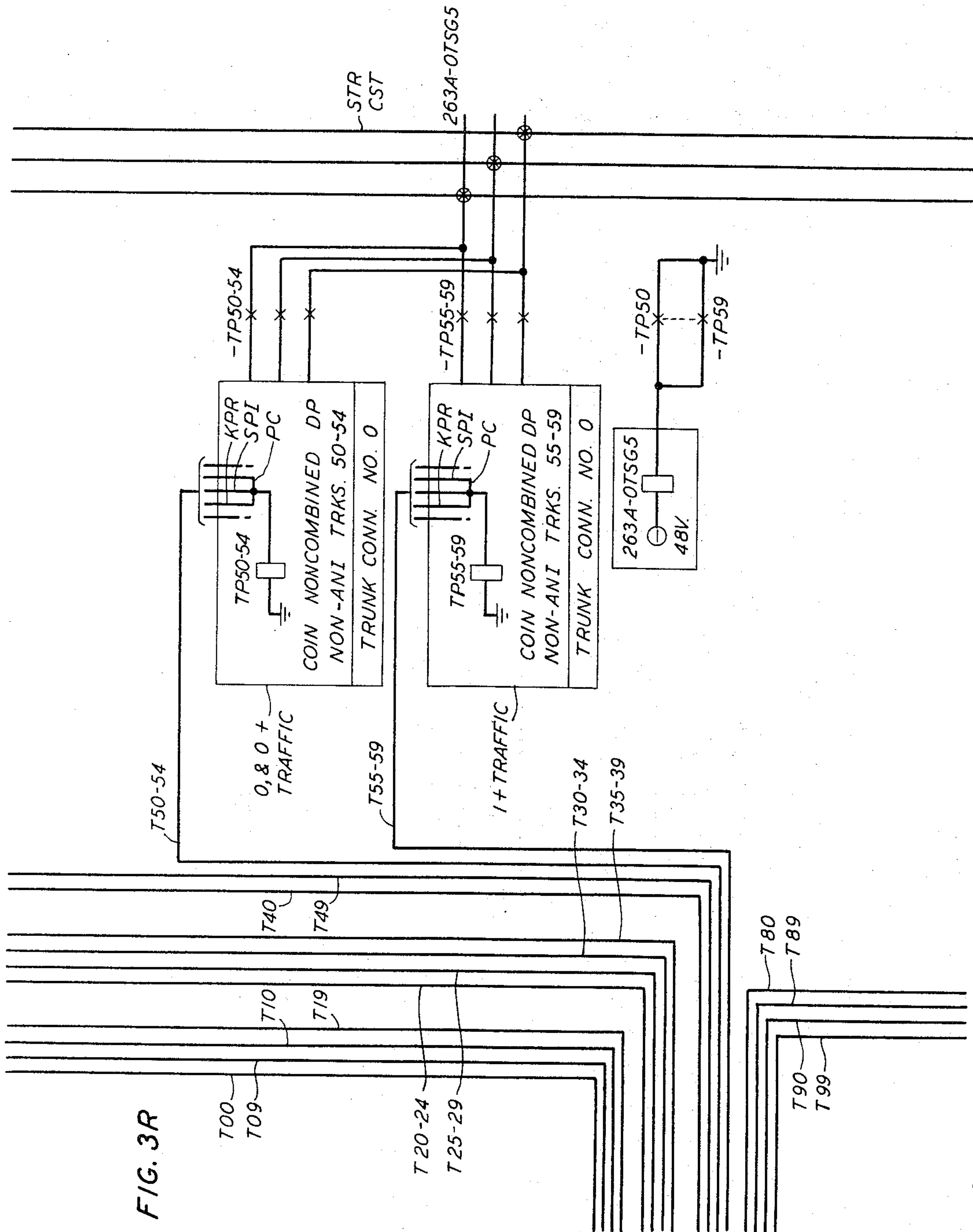
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3,341,662

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INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 33



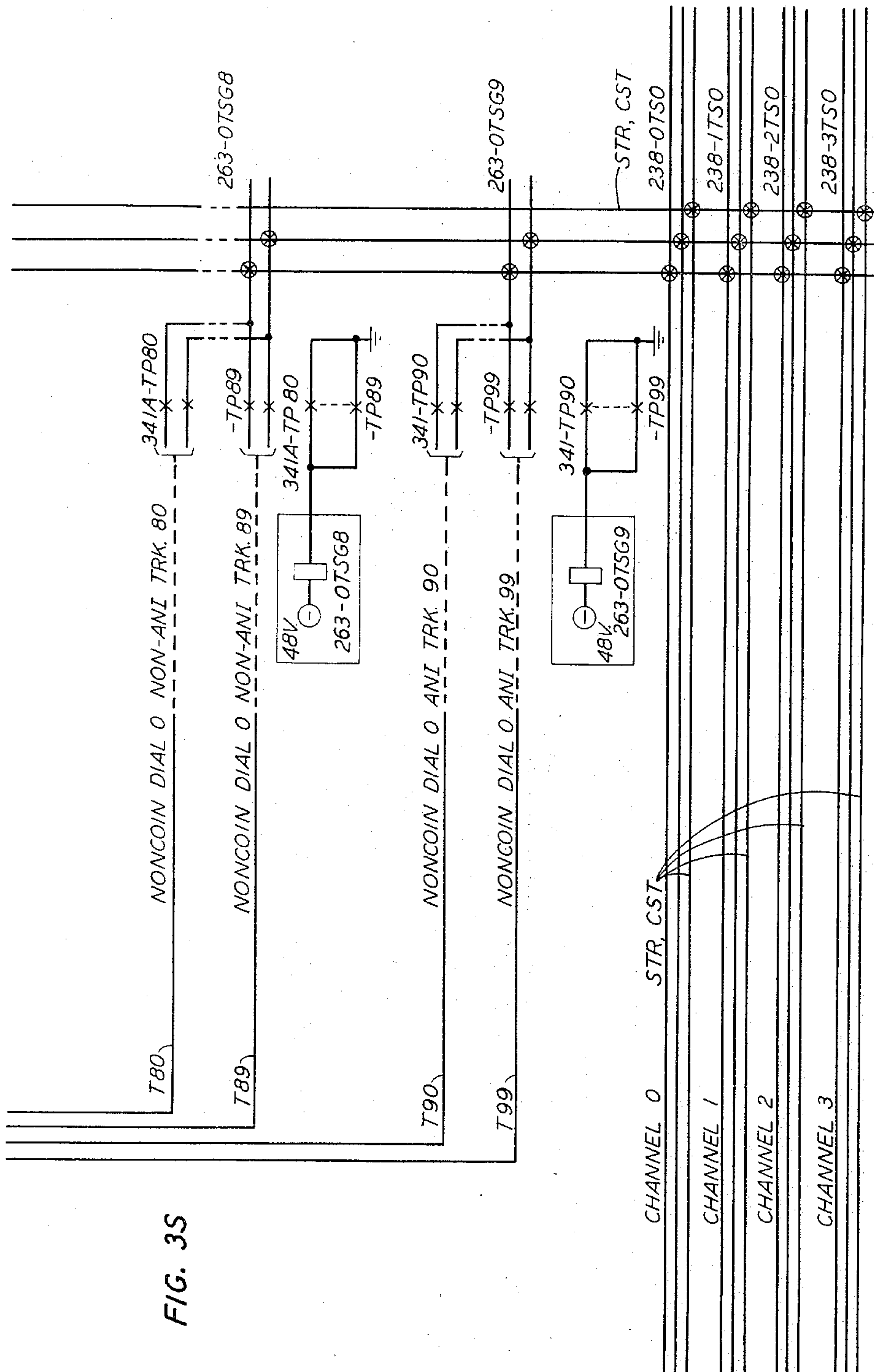
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 34



Sept. 12, 1967

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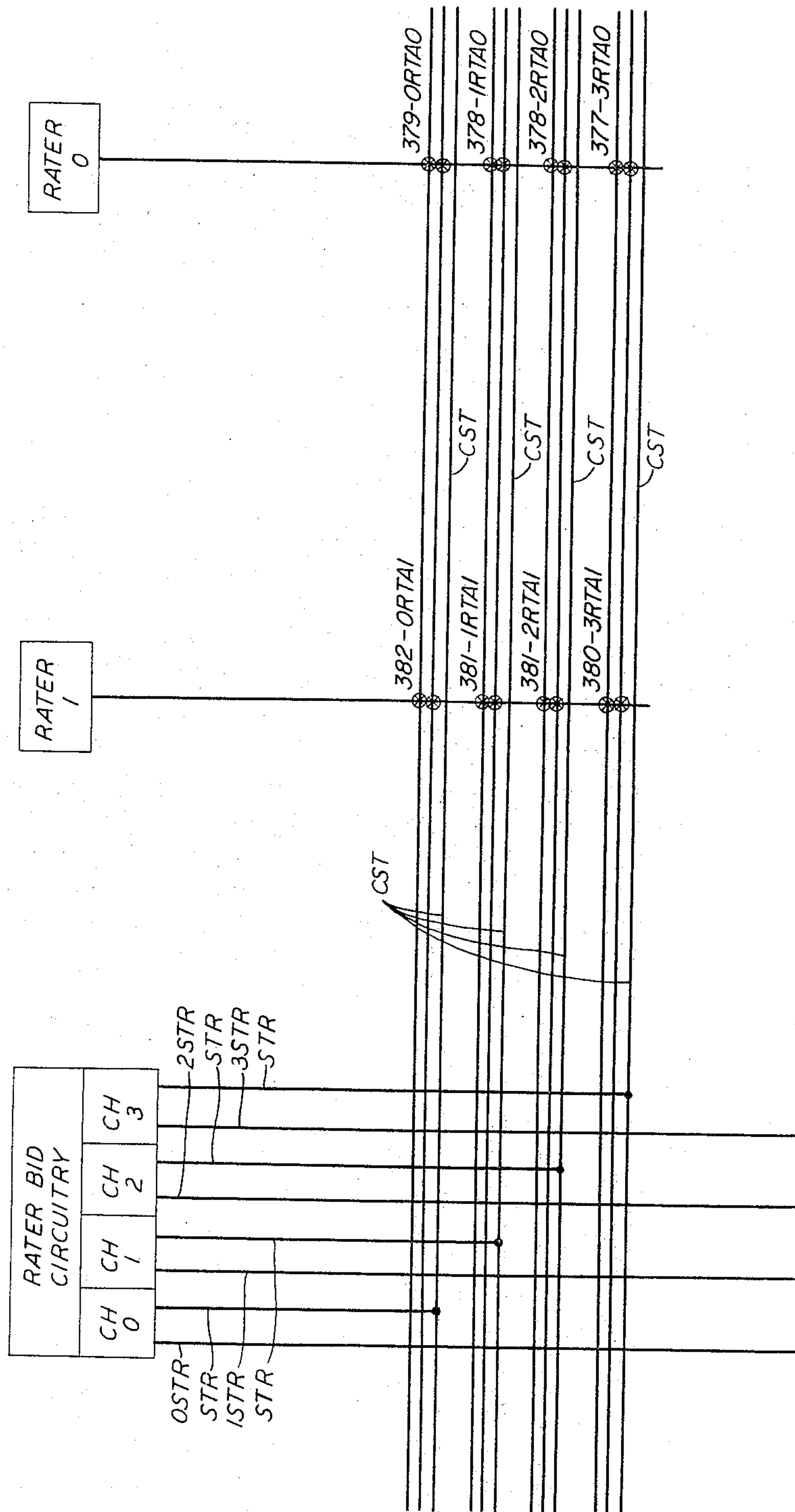
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 35

FIG. 37



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 36

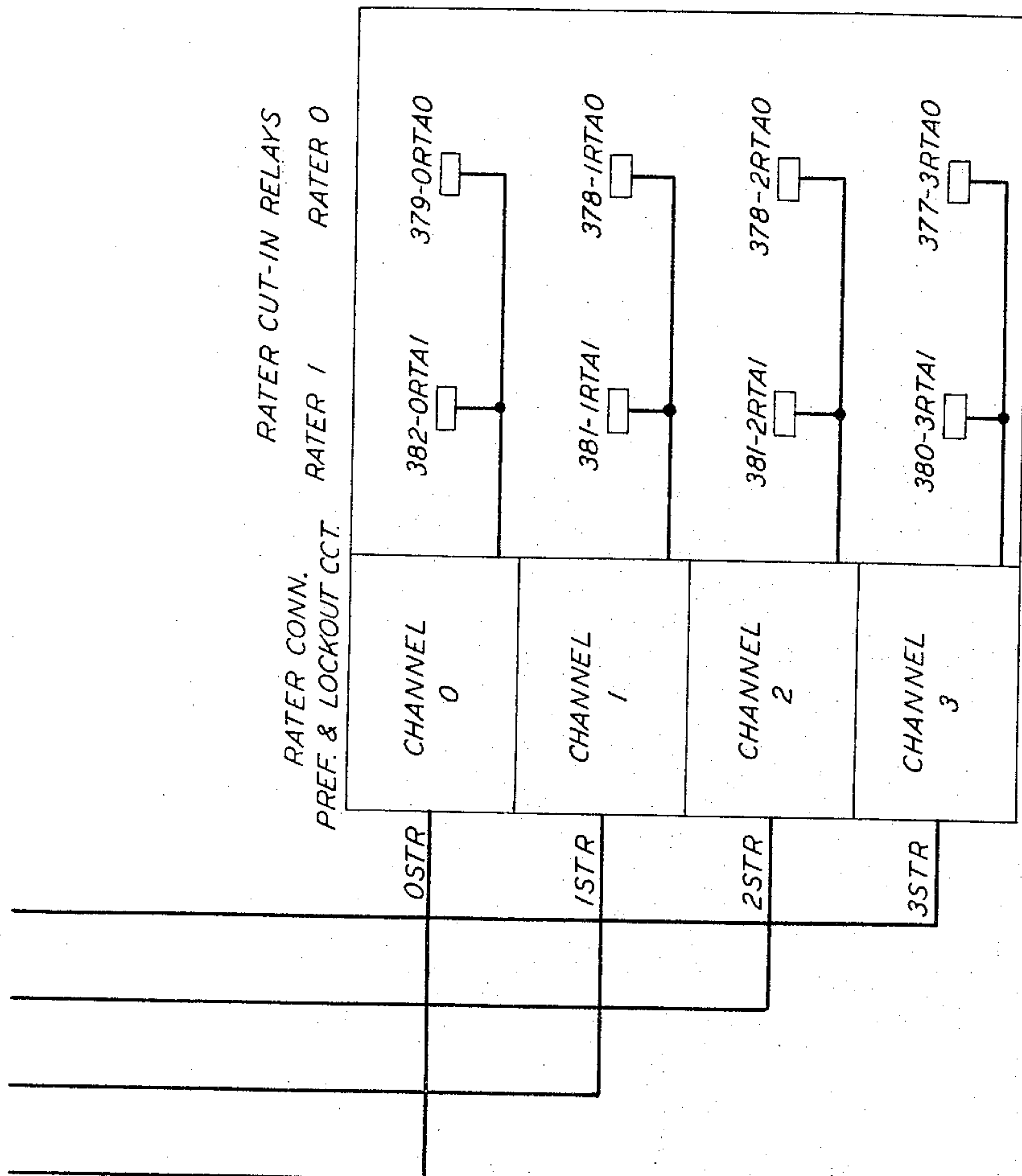


FIG. 3U

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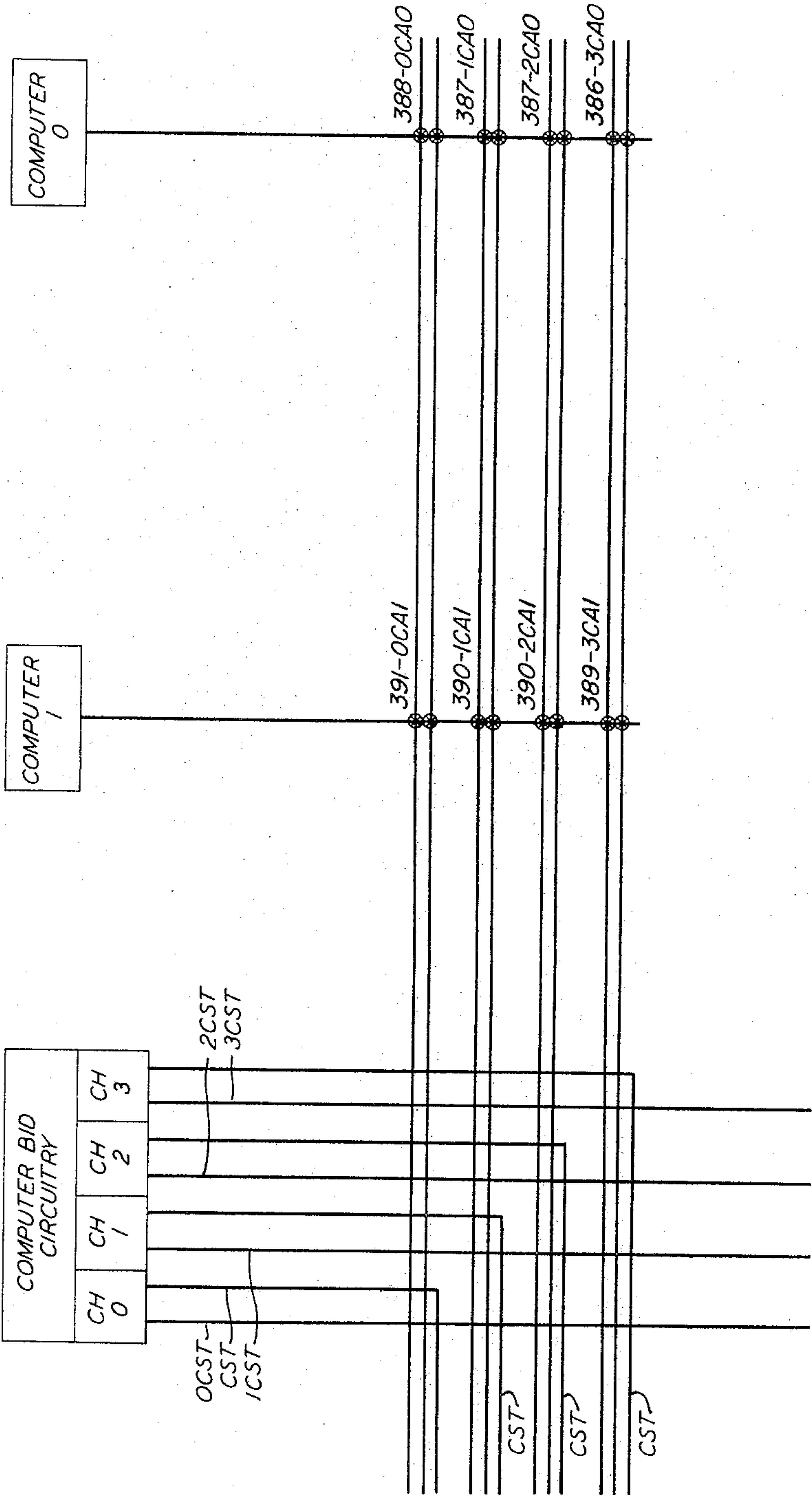
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570 Sheets-Sheet 37

FIG. 3V



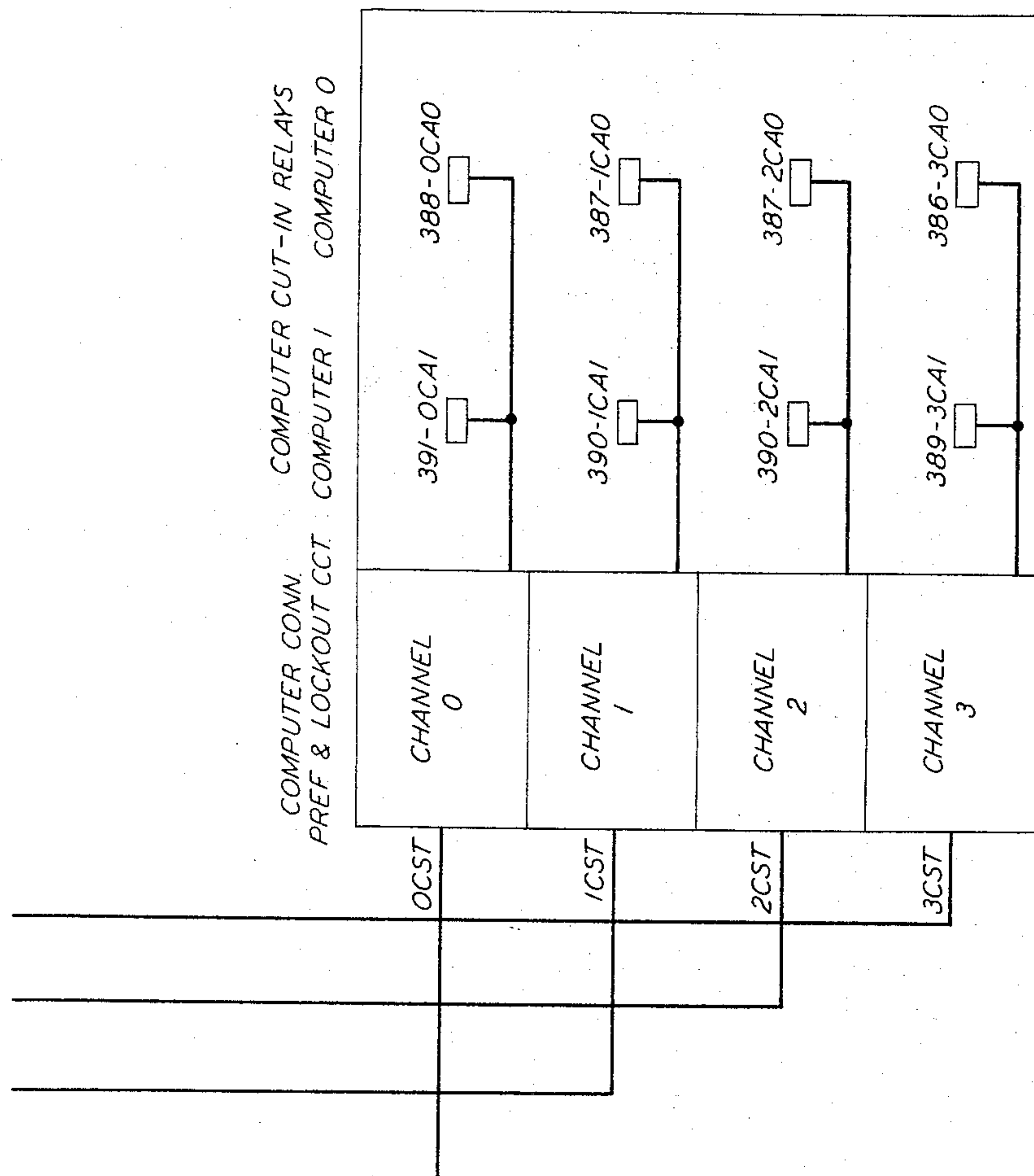
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 38



Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 39

FIG. 3X

FIG. 3A	FIG. 3B	FIG. 3C	FIG. 3D	FIG. 3E	FIG. 3F	FIG. 3G	FIG. 3H	FIG. 3I	FIG. 3J	FIG. 3K	FIG. 3L	FIG. 3M	FIG. 3N	FIG. 3O	FIG. 3P	FIG. 3Q	FIG. 3R	FIG. 3S	FIG. 3T	FIG. 3U	FIG. 3V	FIG. 3W
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 40

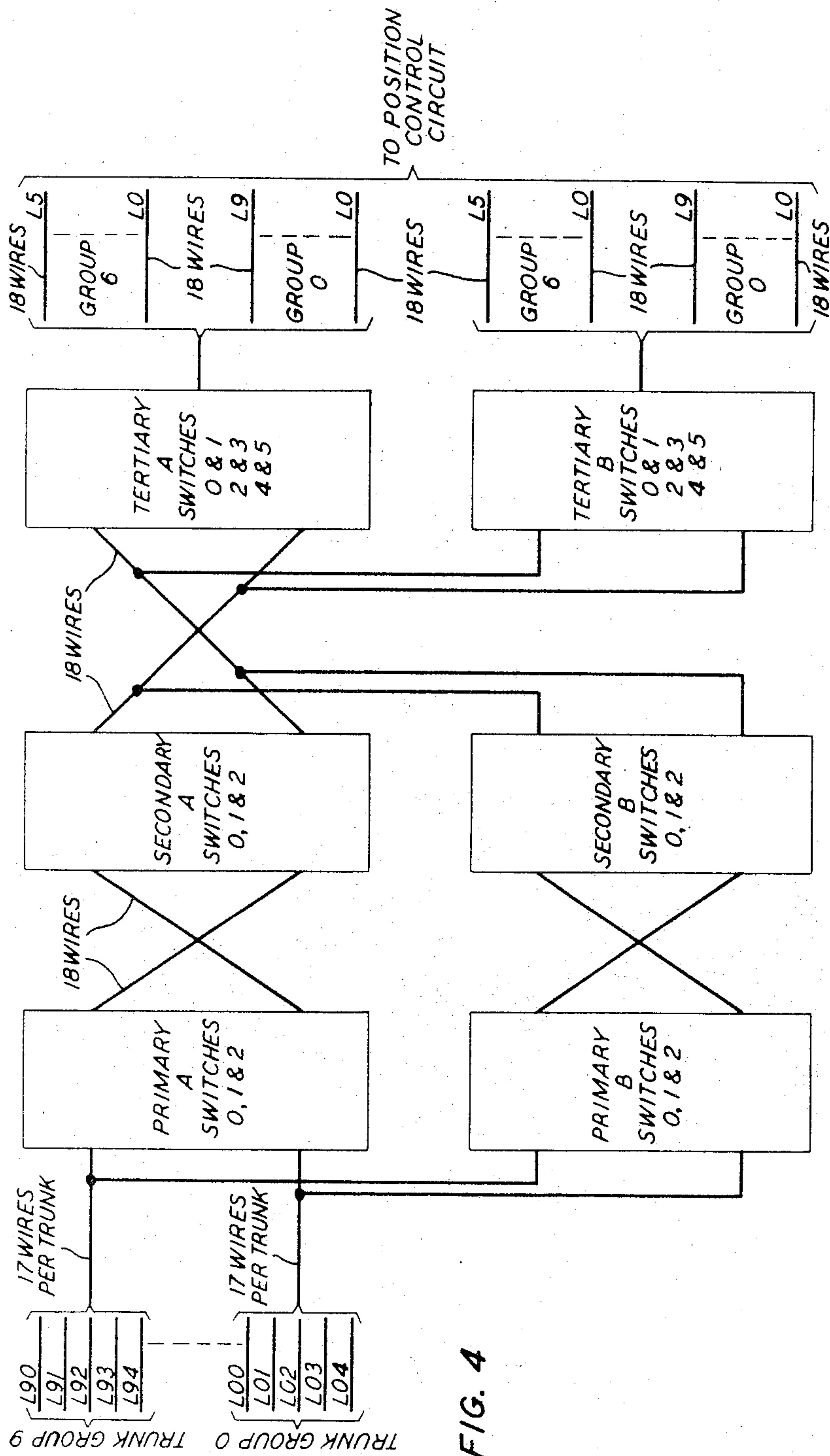


FIG. 4

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 41

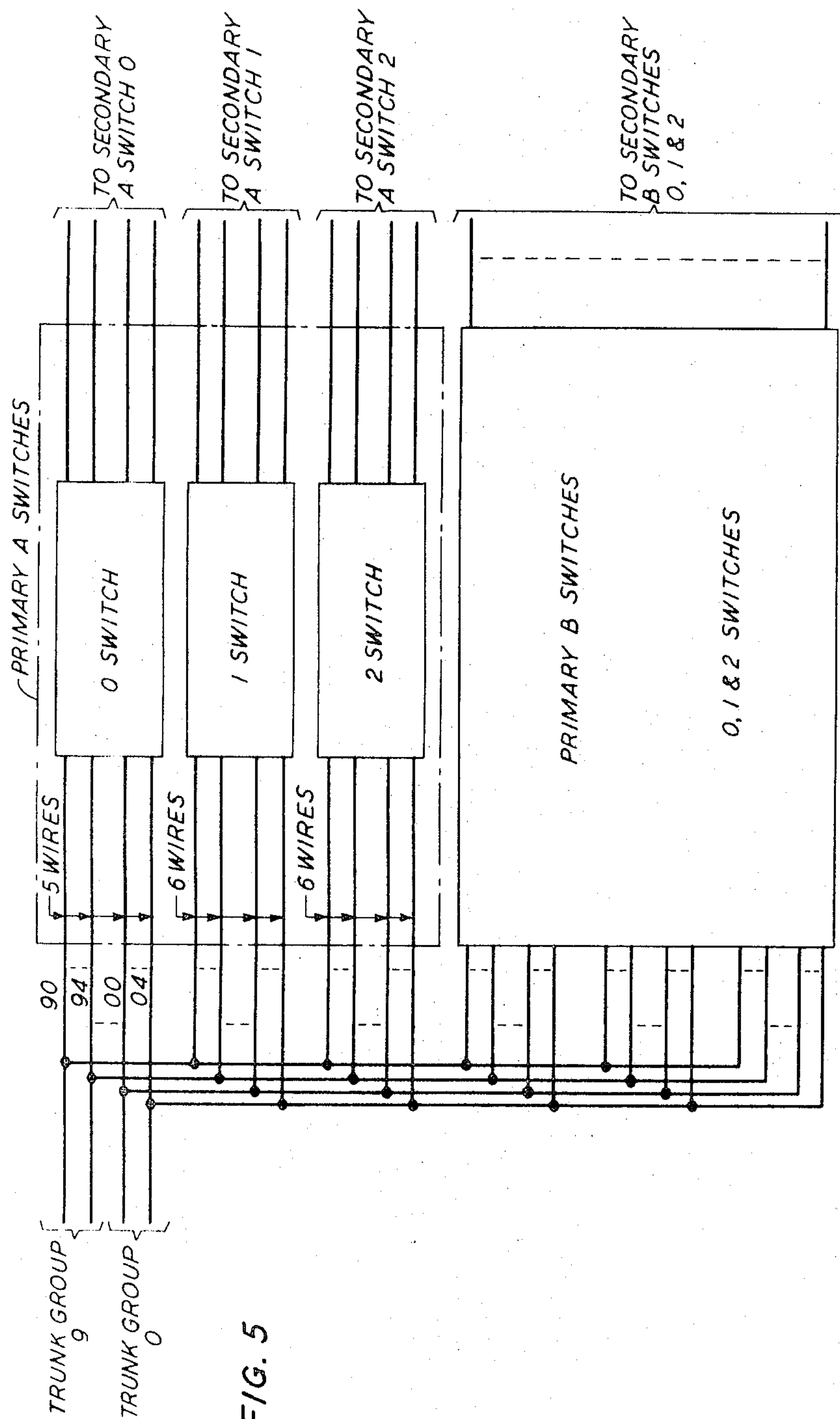


FIG. 5

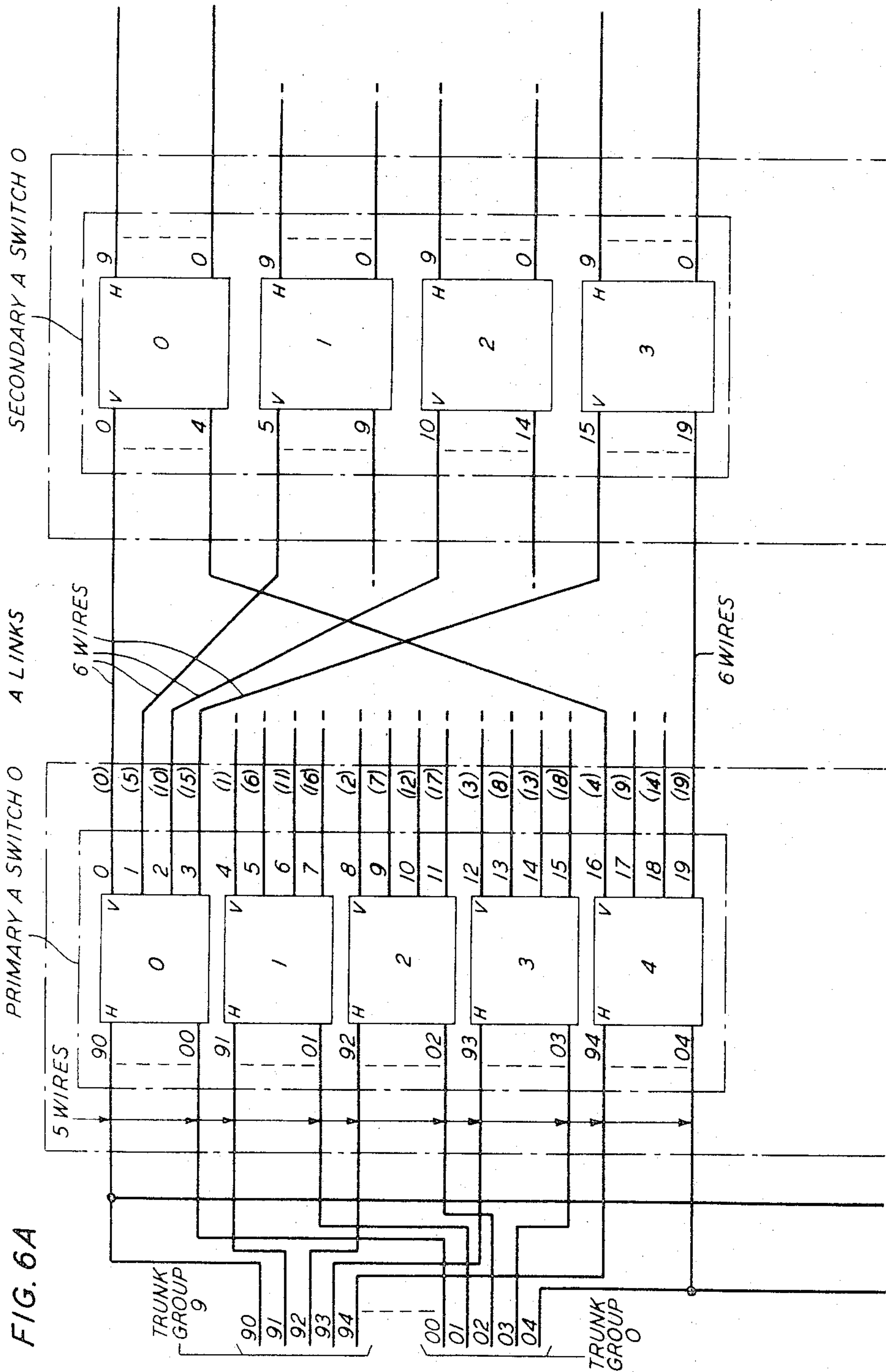
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INTERMEDIATE SWITCHING CENTER.

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 42



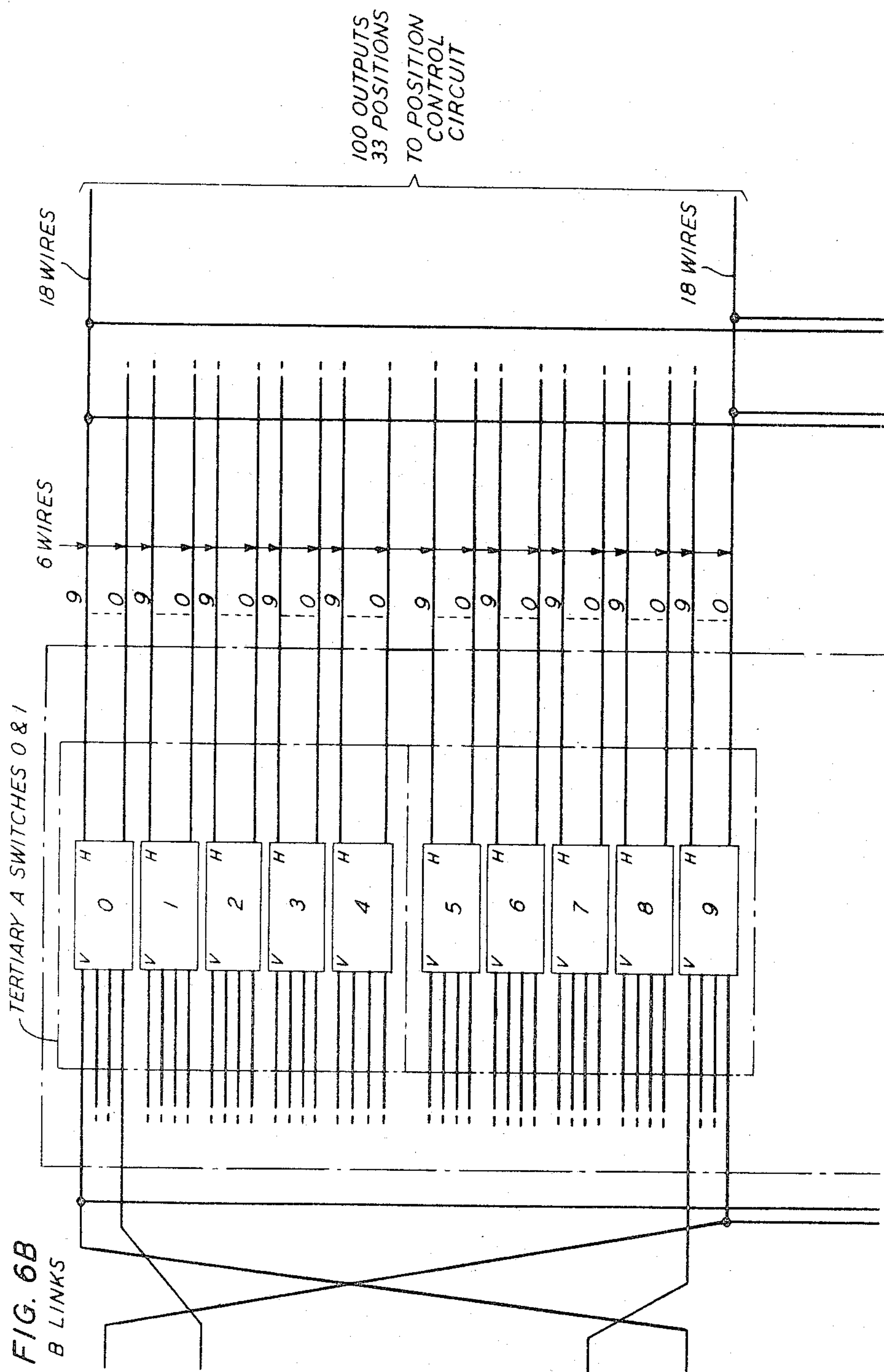
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L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 43



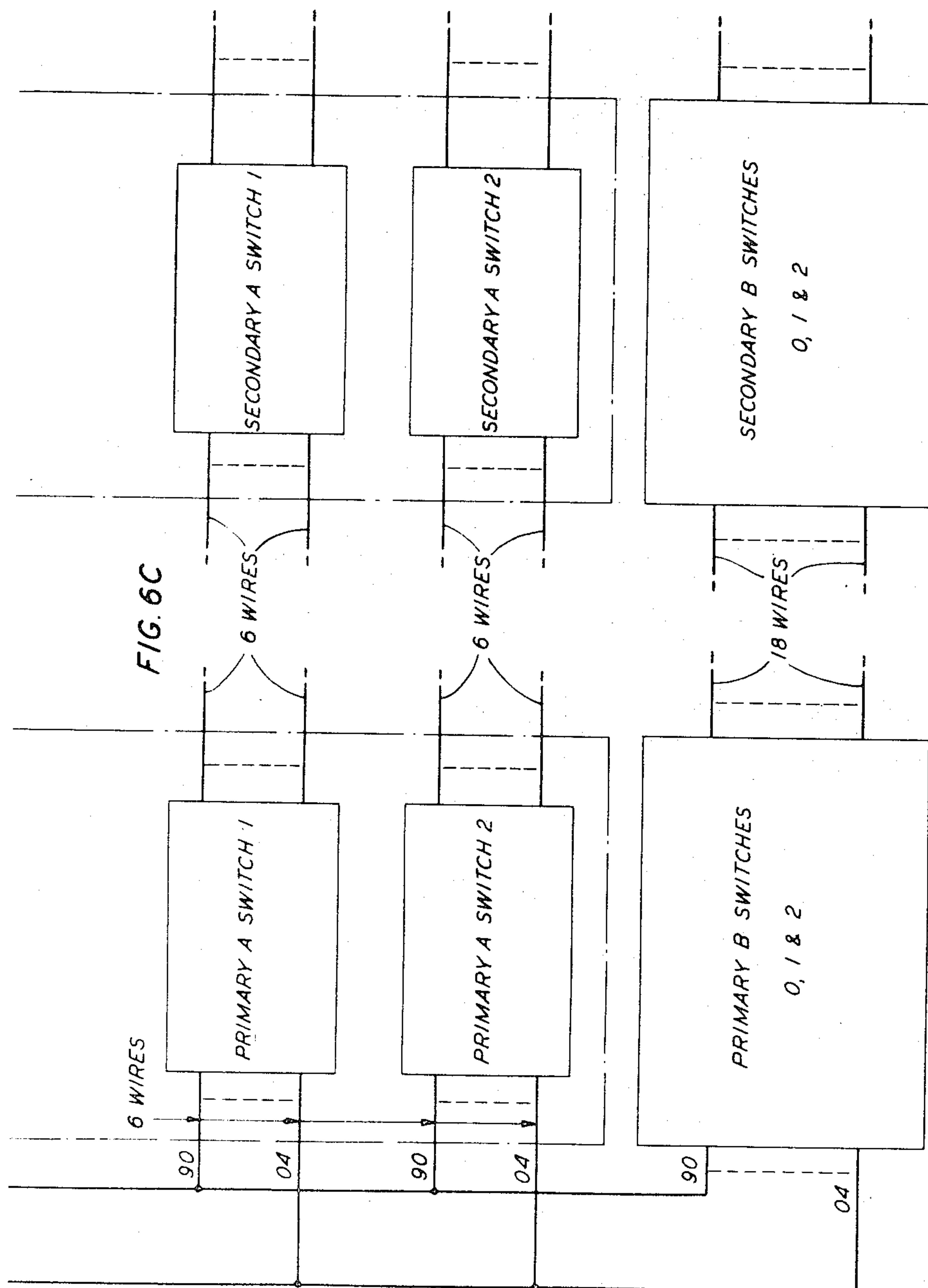
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L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 44



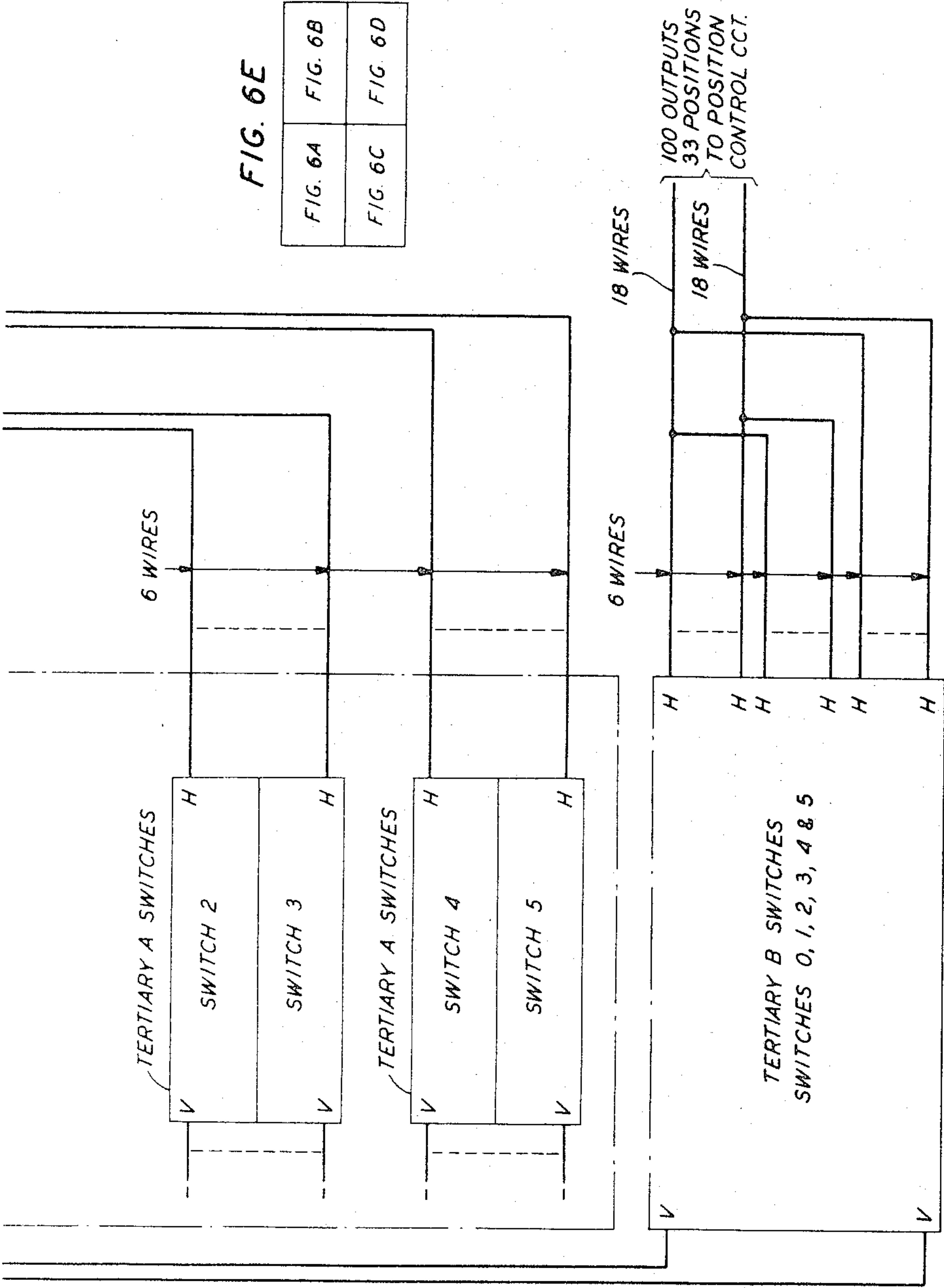
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L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 45



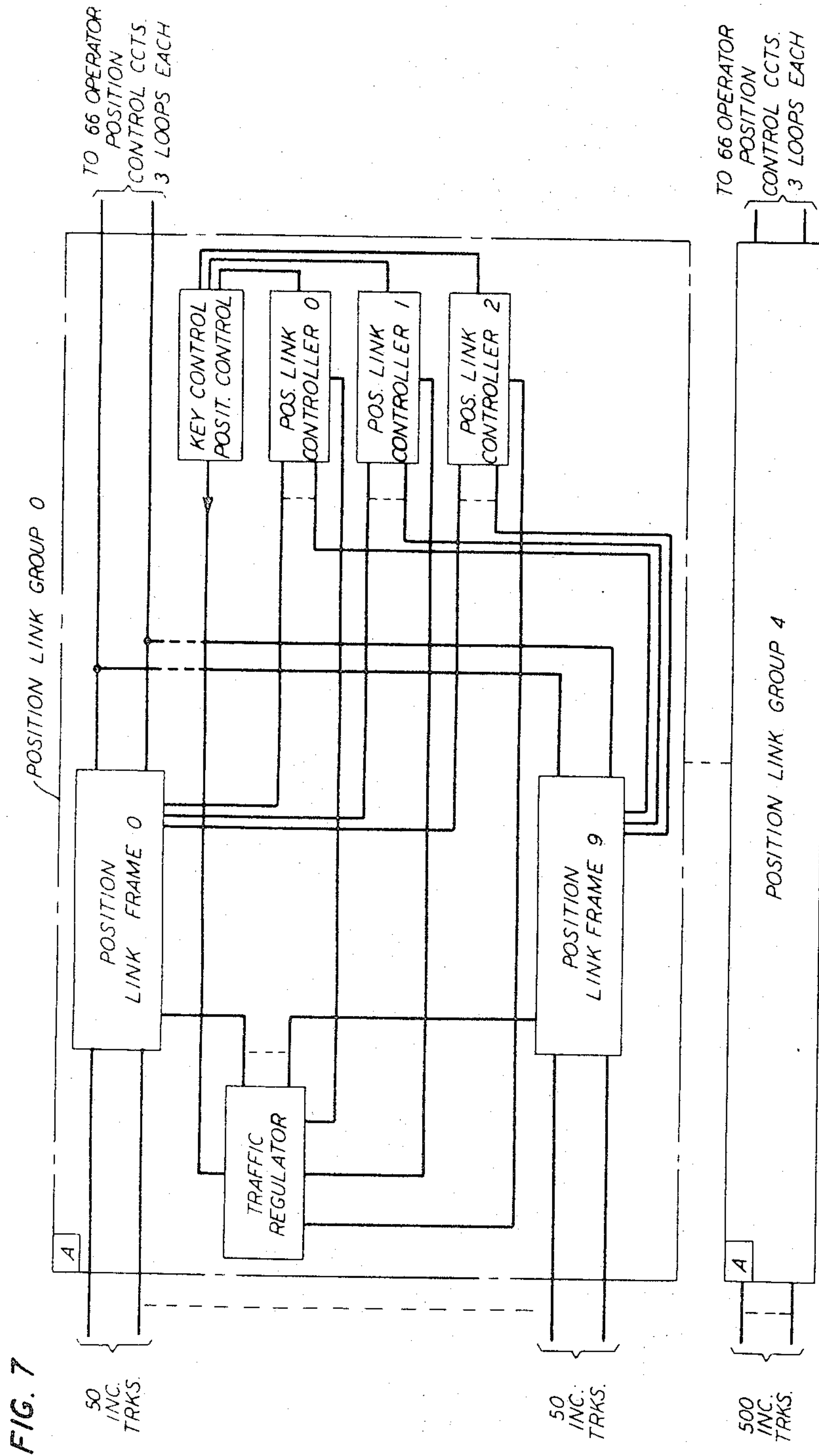
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L. J. CERNY ET AL
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 46



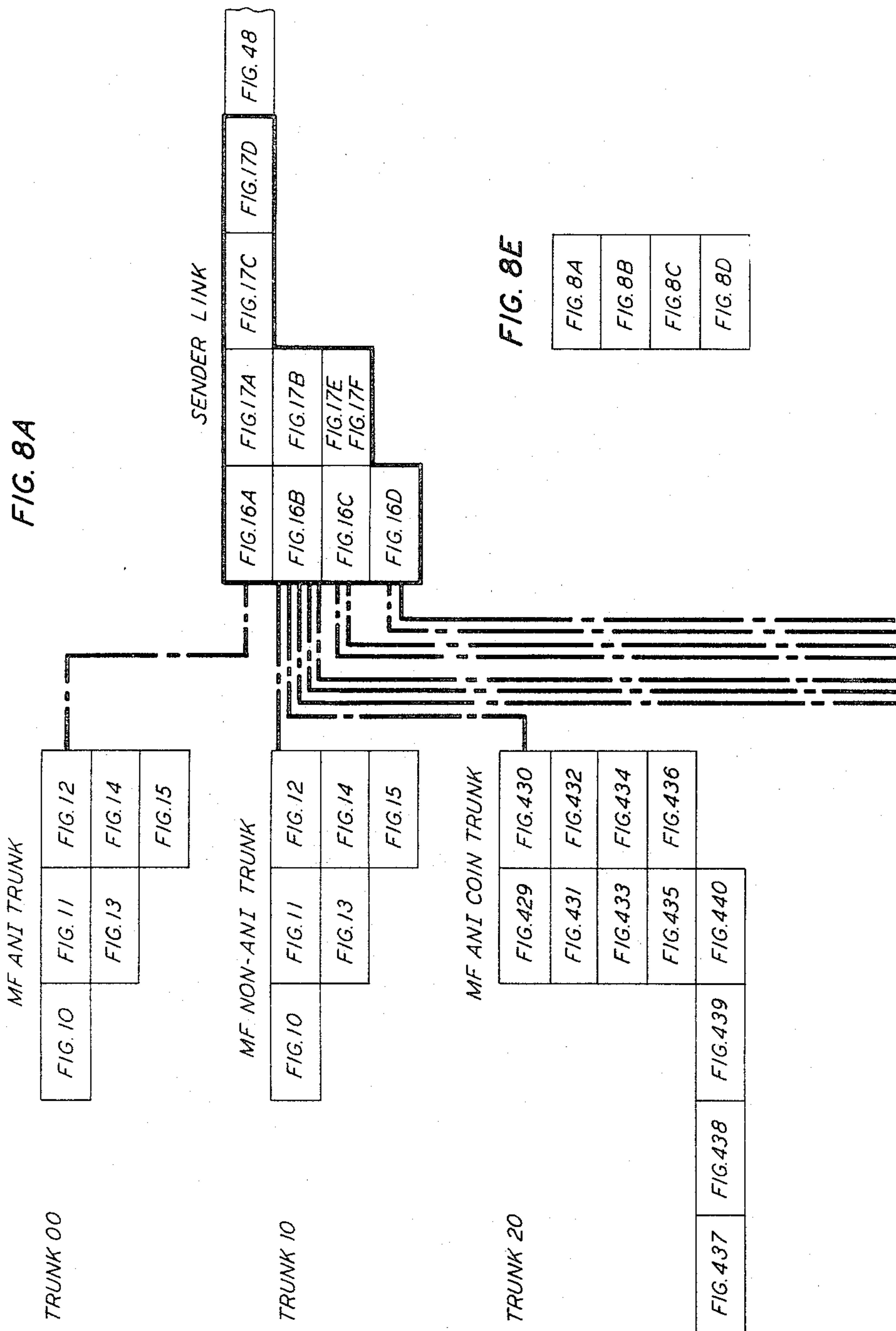
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L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 47



Sept. 12, 1967

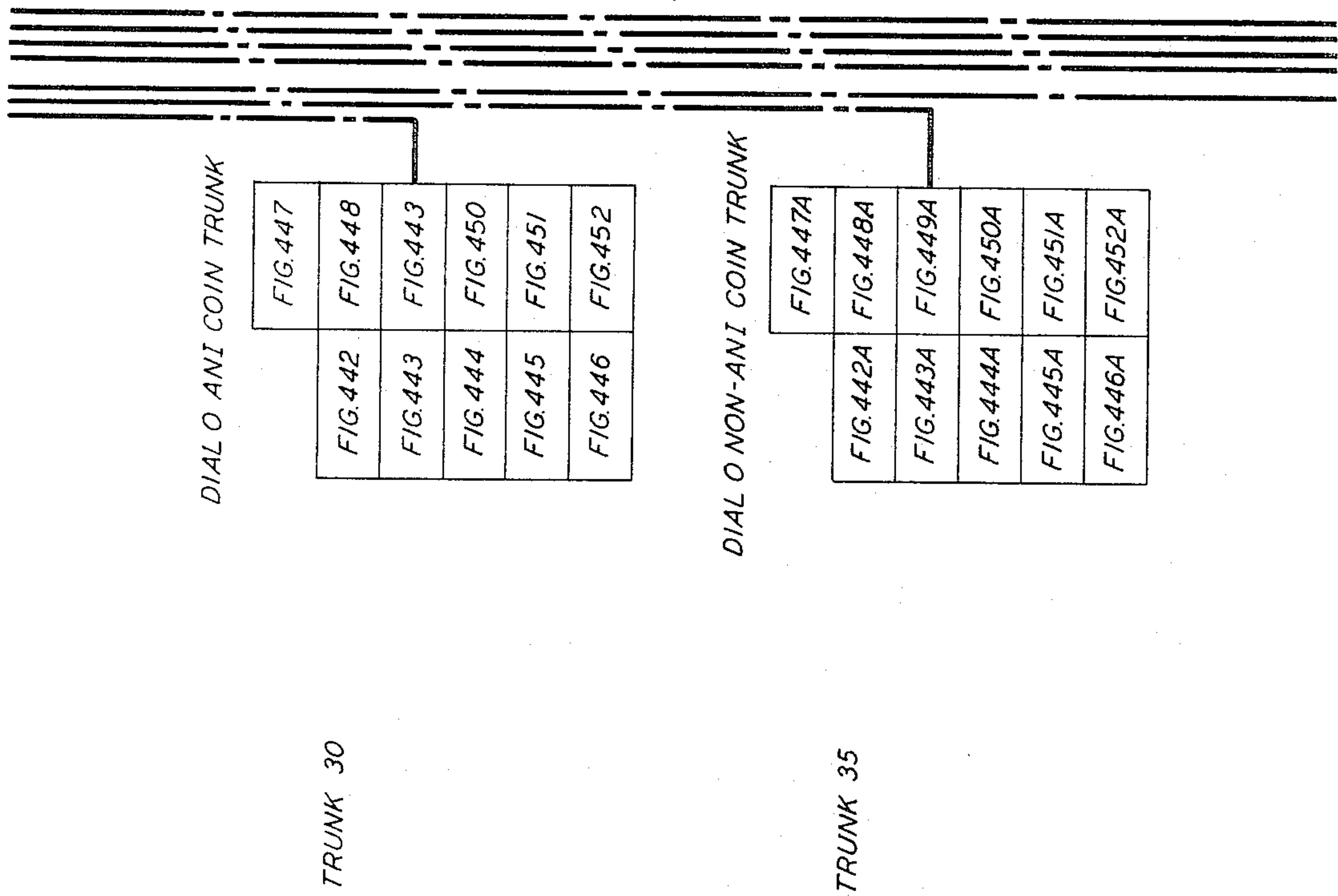
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 48

FIG. 8B



Sept. 12, 1967

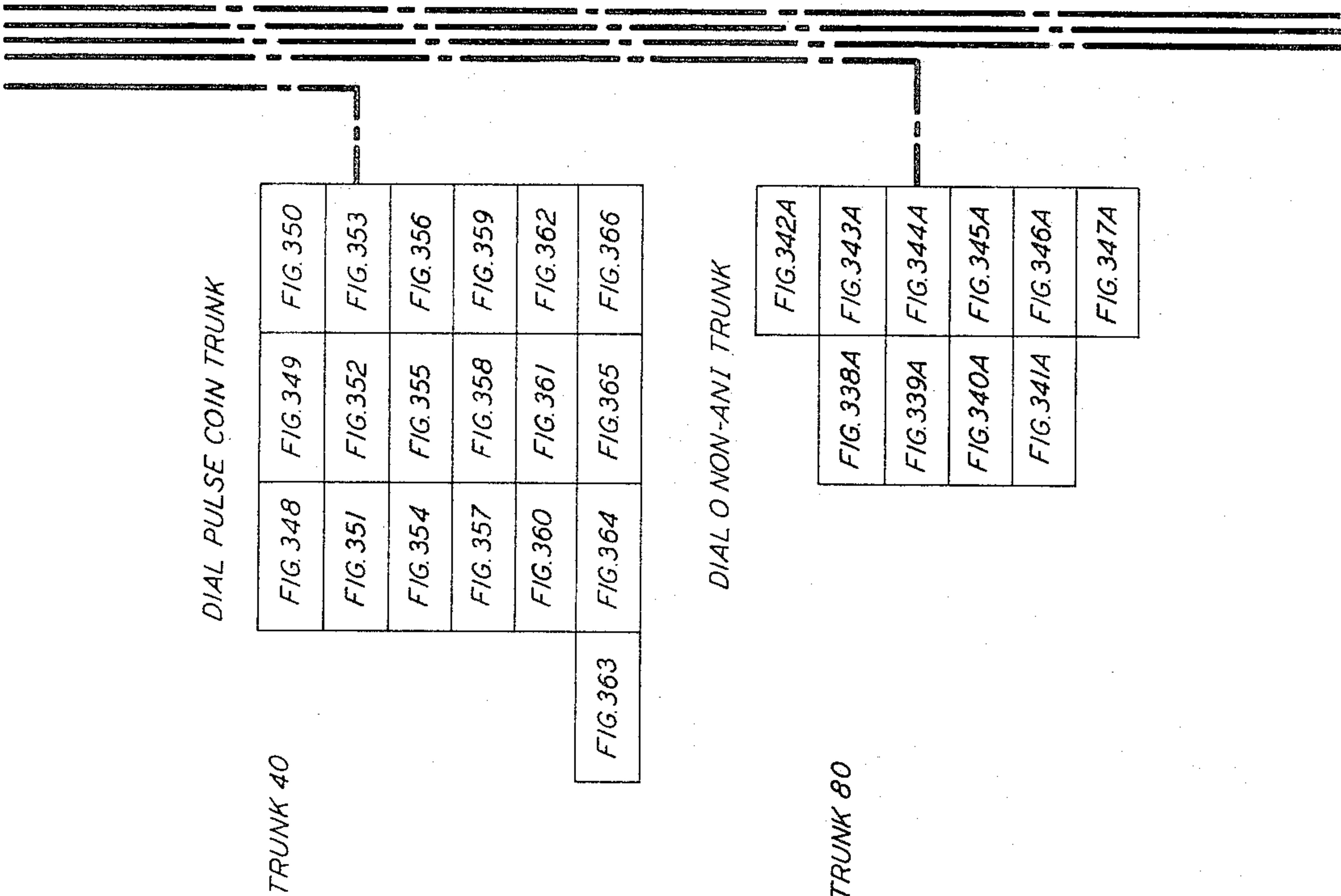
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 49

FIG. 8C



Sept. 12, 1967

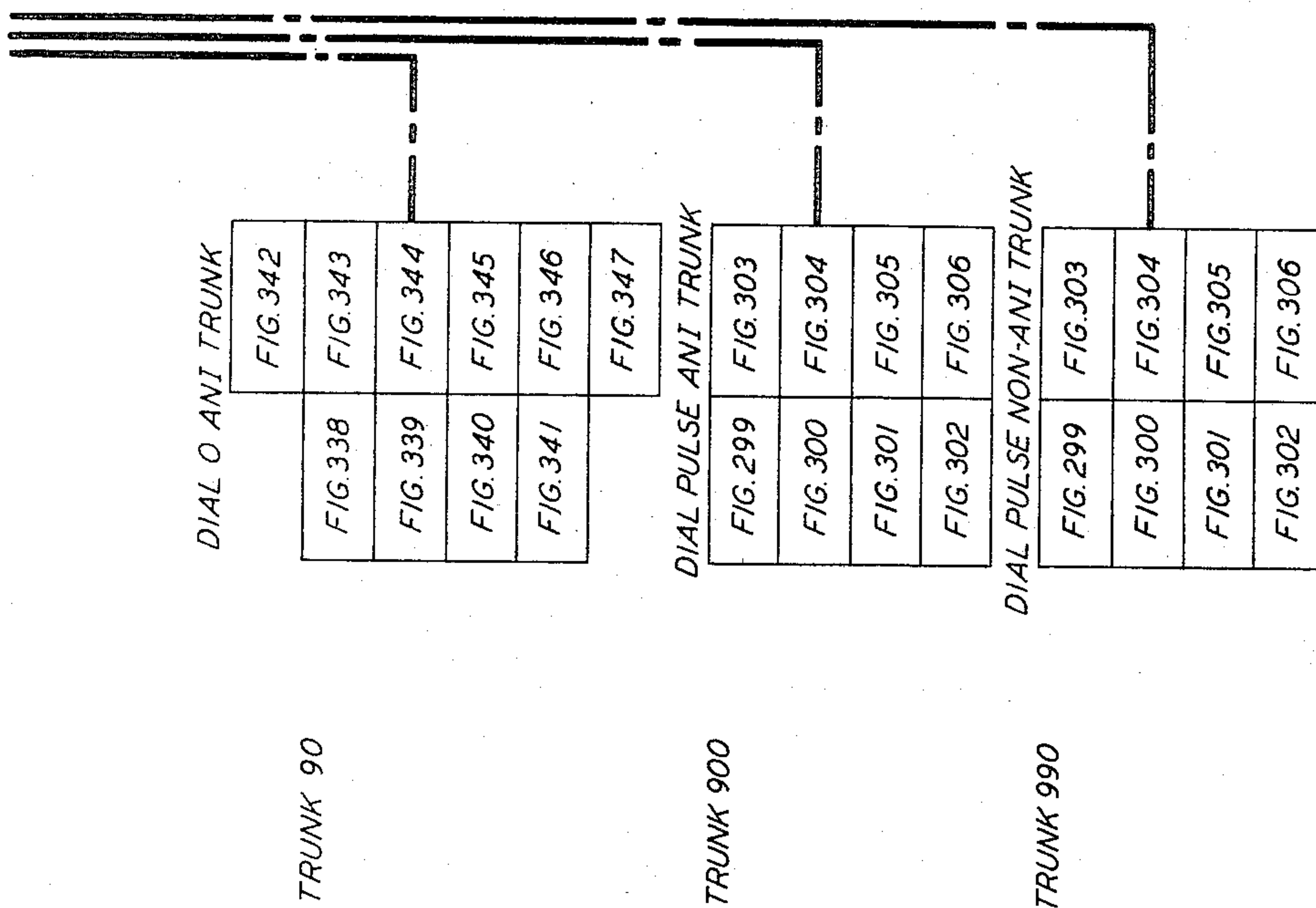
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 50

FIG. 8D



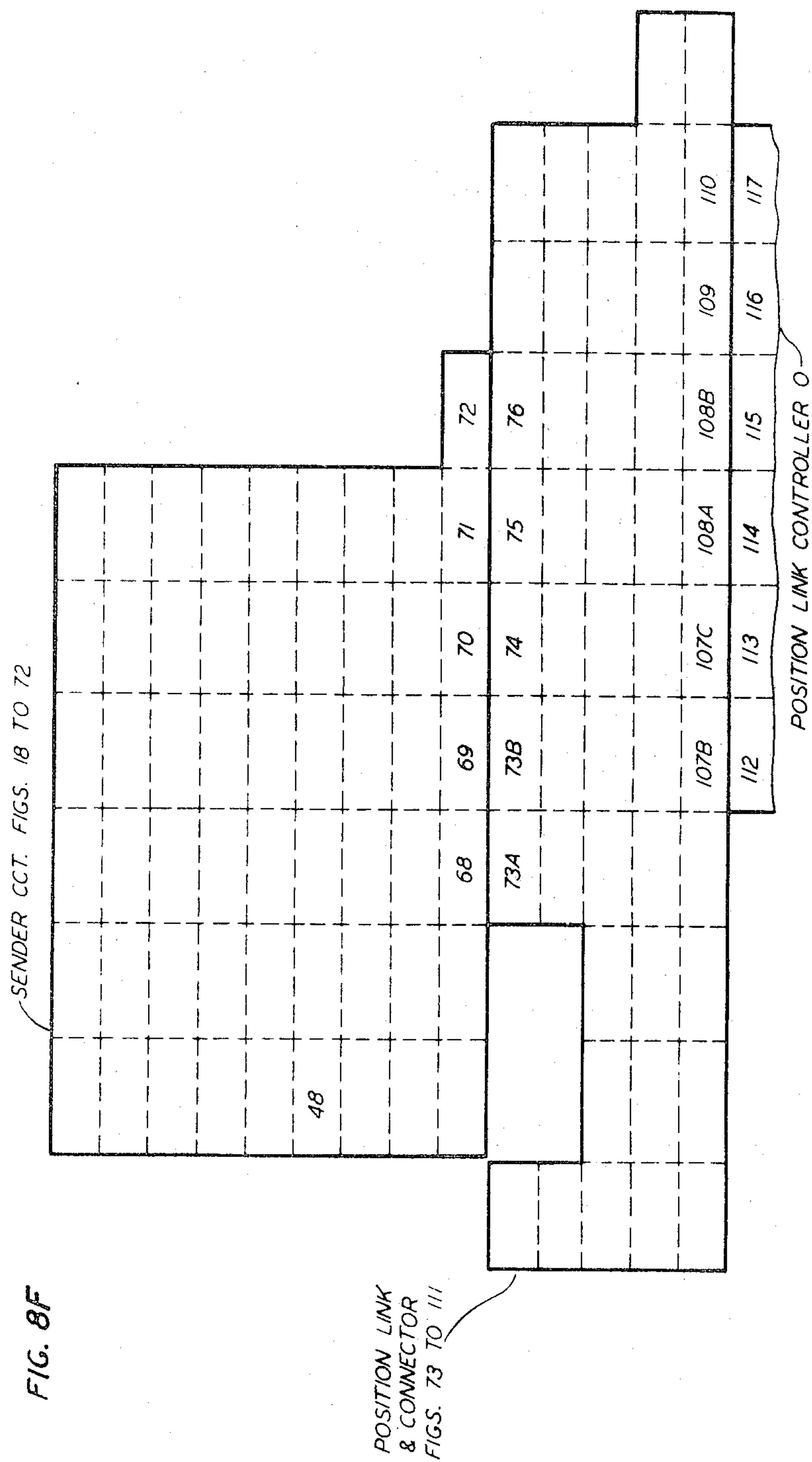
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L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 51



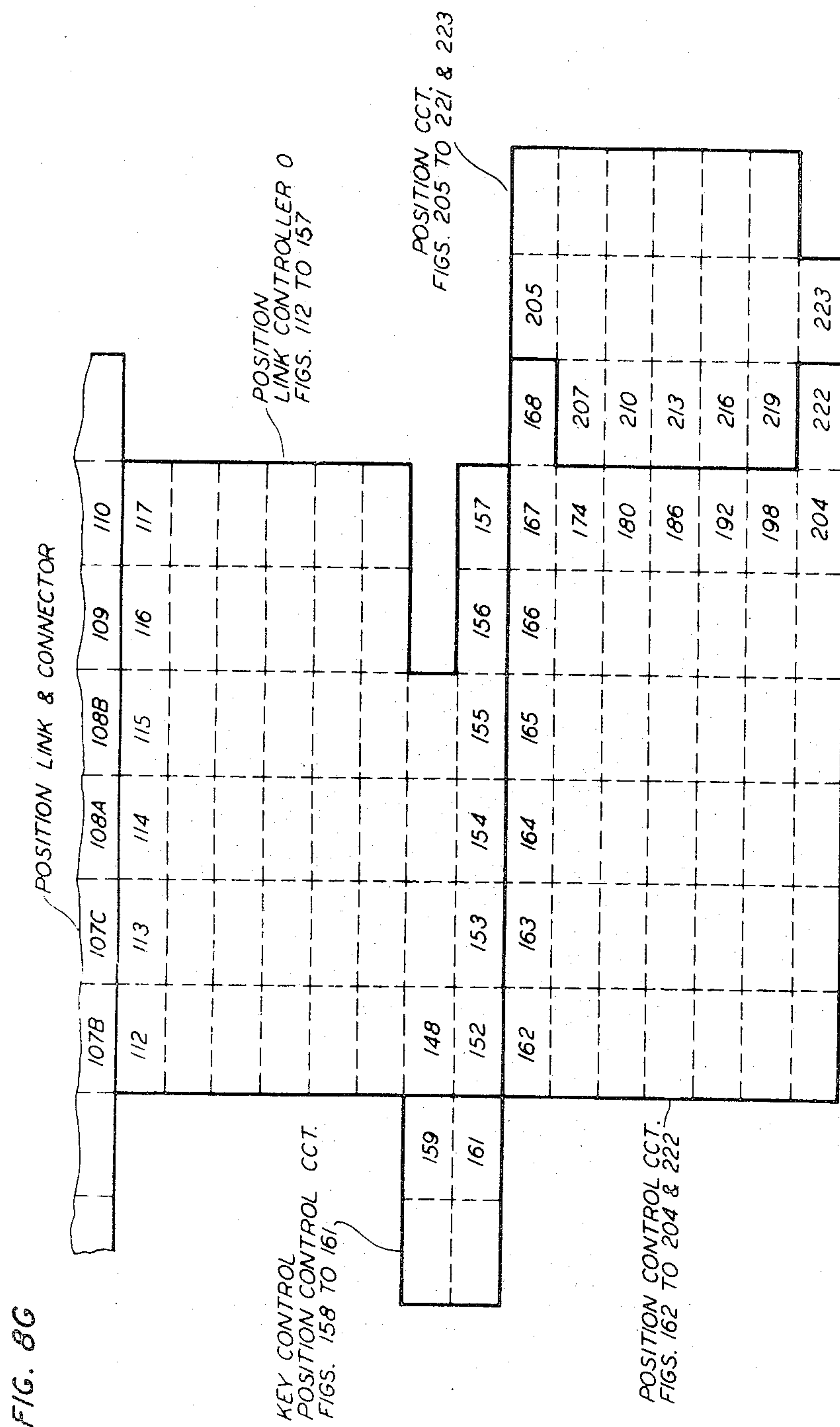
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L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 52



Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 50

FIG. 9A

SENDER CCT.

FIG. 18	FIG. 19	FIG. 20	FIG. 21	FIG. 22	FIG. 23
FIG. 24	FIG. 25	FIG. 26	FIG. 27	FIG. 28	FIG. 29
FIG. 30	FIG. 31	FIG. 32	FIG. 33	FIG. 34	FIG. 35
FIG. 36	FIG. 37	FIG. 38	FIG. 39	FIG. 40	FIG. 41
FIG. 42	FIG. 43	FIG. 44	FIG. 45	FIG. 46	FIG. 47
FIG. 48	FIG. 49	FIG. 50	FIG. 51	FIG. 52	FIG. 53
FIG. 54	FIG. 55	FIG. 56	FIG. 57	FIG. 58	FIG. 59
FIG. 60	FIG. 61	FIG. 62	FIG. 63	FIG. 64	FIG. 65
FIG. 66	FIG. 67	FIG. 68	FIG. 69	FIG. 70	FIG. 71
					FIG. 72

Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 54

FIG. 9B

POSITION LINK & CONNECTOR

FIG. 85A			FIG. 73A	FIG. 73B	FIG. 74	FIG. 75	FIG. 76	FIG. 77	FIG. 78
FIG. 85B			FIG. 79A	FIG. 79B	FIG. 80	FIG. 81	FIG. 82	FIG. 83	FIG. 84
FIG. 85C	FIG. 86	FIG. 87	FIG. 88	FIG. 89	FIG. 90	FIG. 91	FIG. 92	FIG. 93	FIG. 94
FIG. 95A	FIG. 96	FIG. 97	FIG. 98	FIG. 99	FIG. 100	FIG. 101	FIG. 102	FIG. 103	FIG. 104
FIG. 95B	FIG. 106A	FIG. 106B	FIG. 107A	FIG. 107B	FIG. 107C	FIG. 108A	FIG. 108B	FIG. 109	FIG. 110
		FIG. 106C							FIG. 111

Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 55

FIG. 9C

POSITION LINK CONTROLLER O

FIG. 112	FIG. 113	FIG. 114	FIG. 115	FIG. 116	FIG. 117
FIG. 118	FIG. 119	FIG. 120	FIG. 121	FIG. 122	FIG. 123
FIG. 124	FIG. 125	FIG. 126	FIG. 127	FIG. 128	FIG. 129
FIG. 130	FIG. 131	FIG. 132	FIG. 133	FIG. 134	FIG. 135
FIG. 136	FIG. 137	FIG. 138	FIG. 139	FIG. 140	FIG. 141
FIG. 142	FIG. 143	FIG. 144	FIG. 145	FIG. 146	FIG. 147
FIG. 148	FIG. 149	FIG. 150	FIG. 151		
FIG. 152	FIG. 153	FIG. 154	FIG. 155	FIG. 156	FIG. 157
FIG. 158	FIG. 159				
FIG. 160	FIG. 161				

KEY CONTROL
POSITION CONTROL

Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 56

FIG. 9D

POSITION CONTROL CCT.							POSITION CCT.		
FIG. 162	FIG. 163	FIG. 164	FIG. 165	FIG. 166	FIG. 167	FIG. 168	FIG. 205	FIG. 206	
FIG. 169	FIG. 170	FIG. 171	FIG. 172	FIG. 173	FIG. 174	FIG. 207	FIG. 208	FIG. 209	
FIG. 175	FIG. 176	FIG. 177	FIG. 178	FIG. 179	FIG. 180	FIG. 210	FIG. 211	FIG. 212	
FIG. 181	FIG. 182	FIG. 183	FIG. 184	FIG. 185	FIG. 186	FIG. 213	FIG. 214	FIG. 215	
FIG. 187	FIG. 188	FIG. 189	FIG. 190	FIG. 191	FIG. 192	FIG. 216	FIG. 217	FIG. 218	
FIG. 193	FIG. 194	FIG. 195	FIG. 196	FIG. 197	FIG. 198	FIG. 219	FIG. 220	FIG. 221	
FIG. 199	FIG. 200	FIG. 201	FIG. 202	FIG. 203	FIG. 204	FIG. 222	FIG. 223		
	FIG. 199B	FIG. 199A							

Sept. 12, 1967

L. J. CERNY ETAL.
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 57

FIG. 9E

DATA TRANSFER CCT.

REGISTER & POSITION CONNECTOR
& CHANNEL SEIZURE

FIG. 224	FIG. 225	FIG. 226
FIG. 227	FIG. 228	FIG. 229
FIG. 230	FIG. 231	FIG. 232
FIG. 233	FIG. 234	FIG. 235

DATA GROUP-TRUNK SELECTION

FIG. 236	FIG. 237	FIG. 238
	FIG. 239	FIG. 240

FIG. 249	FIG. 250A	FIG. 250
FIG. 251	FIG. 252	
FIG. 253	FIG. 254	
FIG. 255	FIG. 256	
FIG. 257	FIG. 258A	FIG. 258

SENDER PREF. & CONN.

FIG. 241	FIG. 243
FIG. 242	FIG. 244

FIG. 245	FIG. 246
	FIG. 247

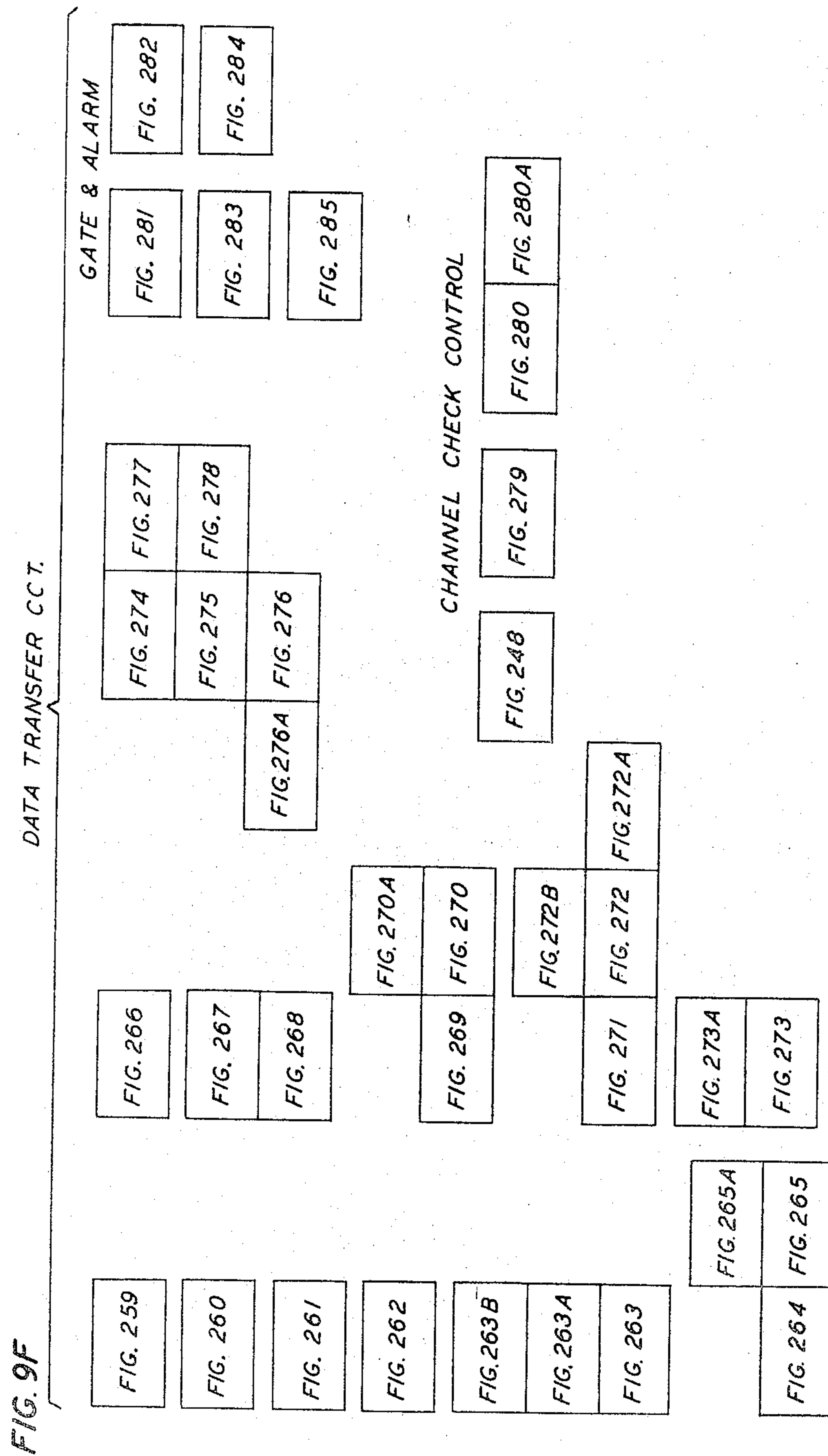
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 58



Sept. 12, 1967

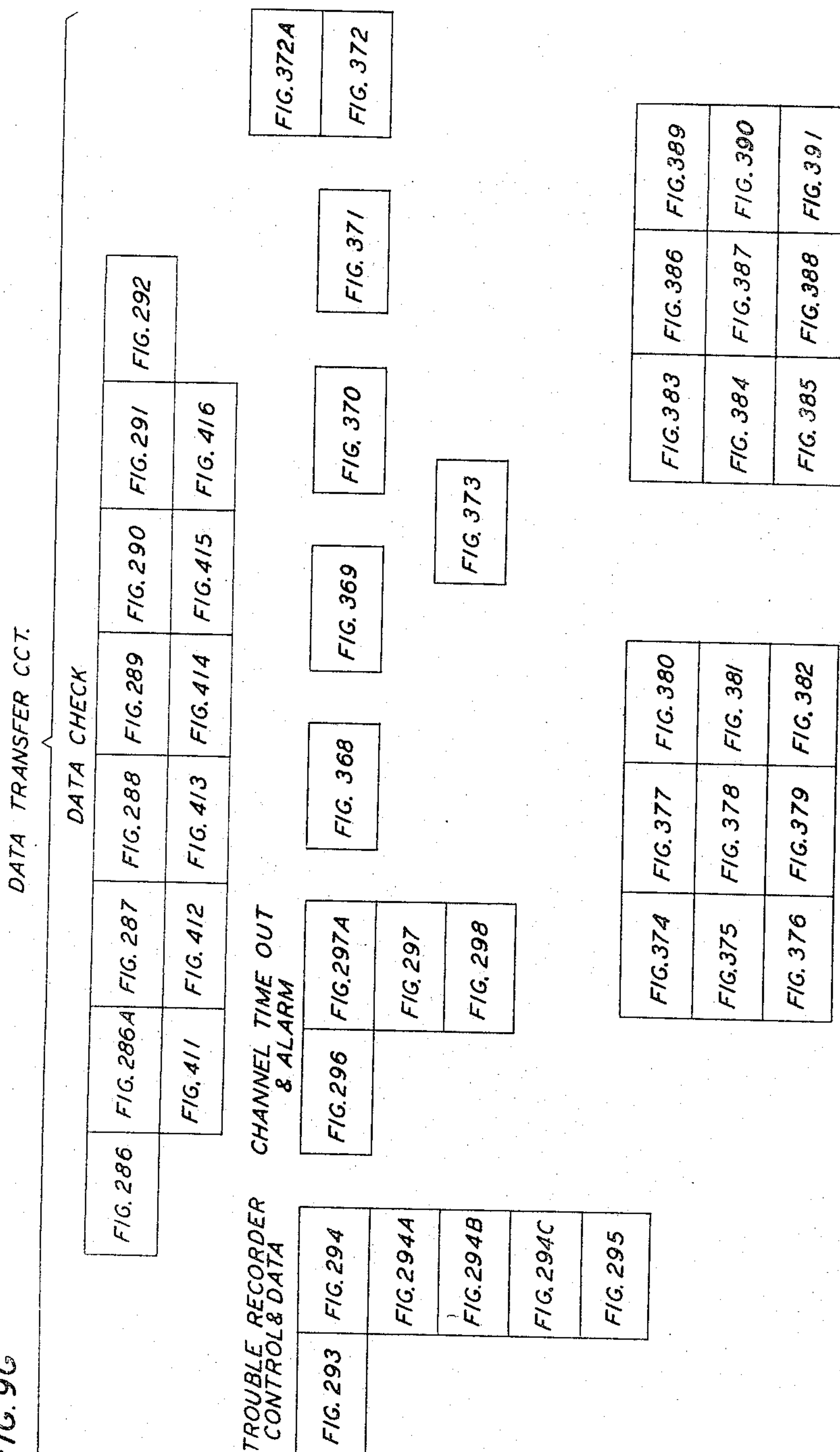
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 59

FIG. 9G



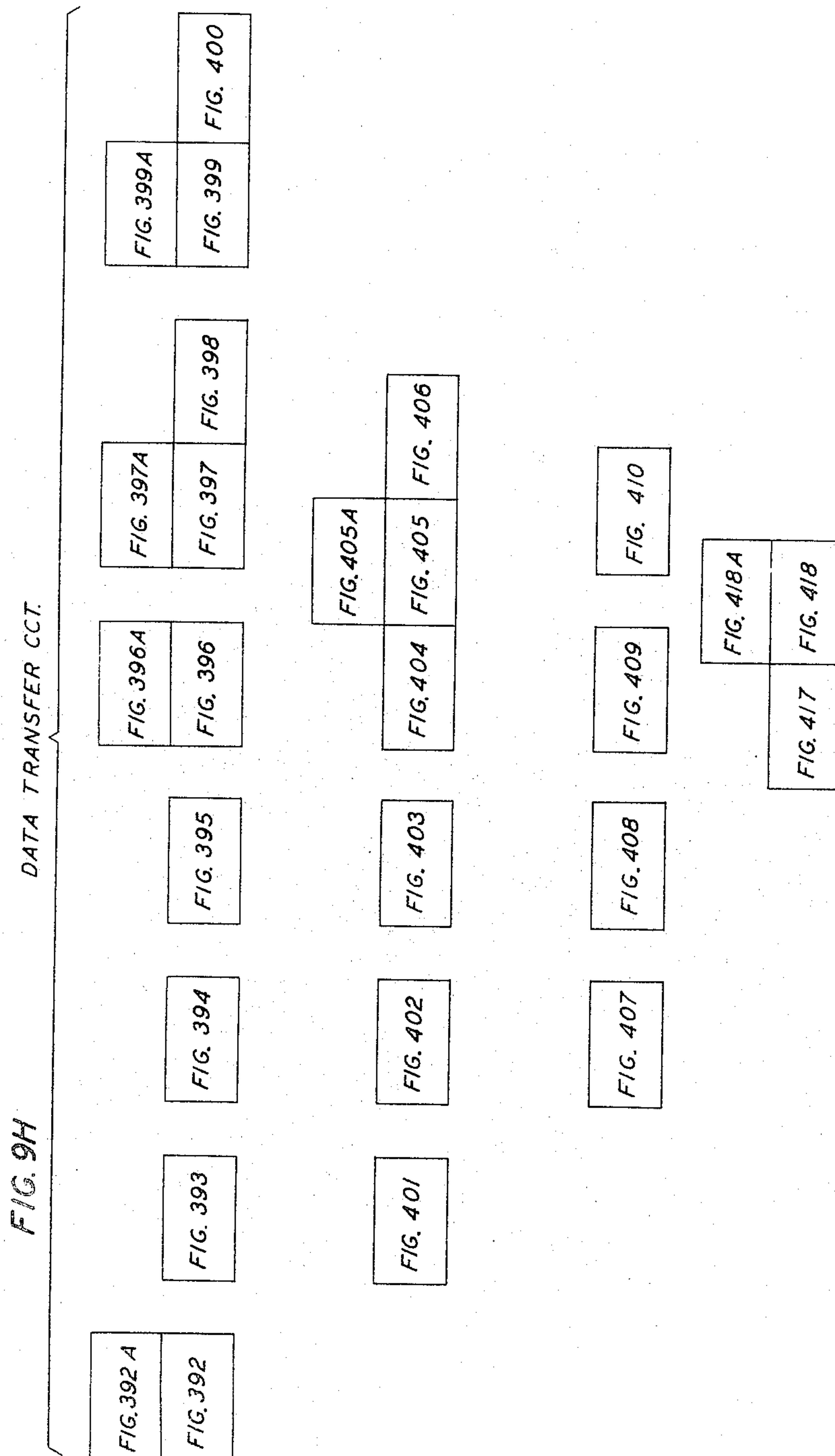
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 60



Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 61

INCOMING REGISTER LINK CCT. FIGS. 307 TO 321

FIG. 307	FIG. 310	FIG. 313	FIG. 316	FIG. 318	FIG. 320
FIG. 308	FIG. 311	FIG. 314	FIG. 317	FIG. 319	FIG. 321
FIG. 309	FIG. 312	FIG. 315		FIG. 319A	

REGISTER CCT. FIGS. 322 TO 337

FIG. 322	FIG. 326	FIG. 330	FIG. 334	FIG. 336
FIG. 323	FIG. 327	FIG. 331	FIG. 335	FIG. 337
FIG. 324	FIG. 328	FIG. 332		
FIG. 325	FIG. 329	FIG. 333		

FIG. 91

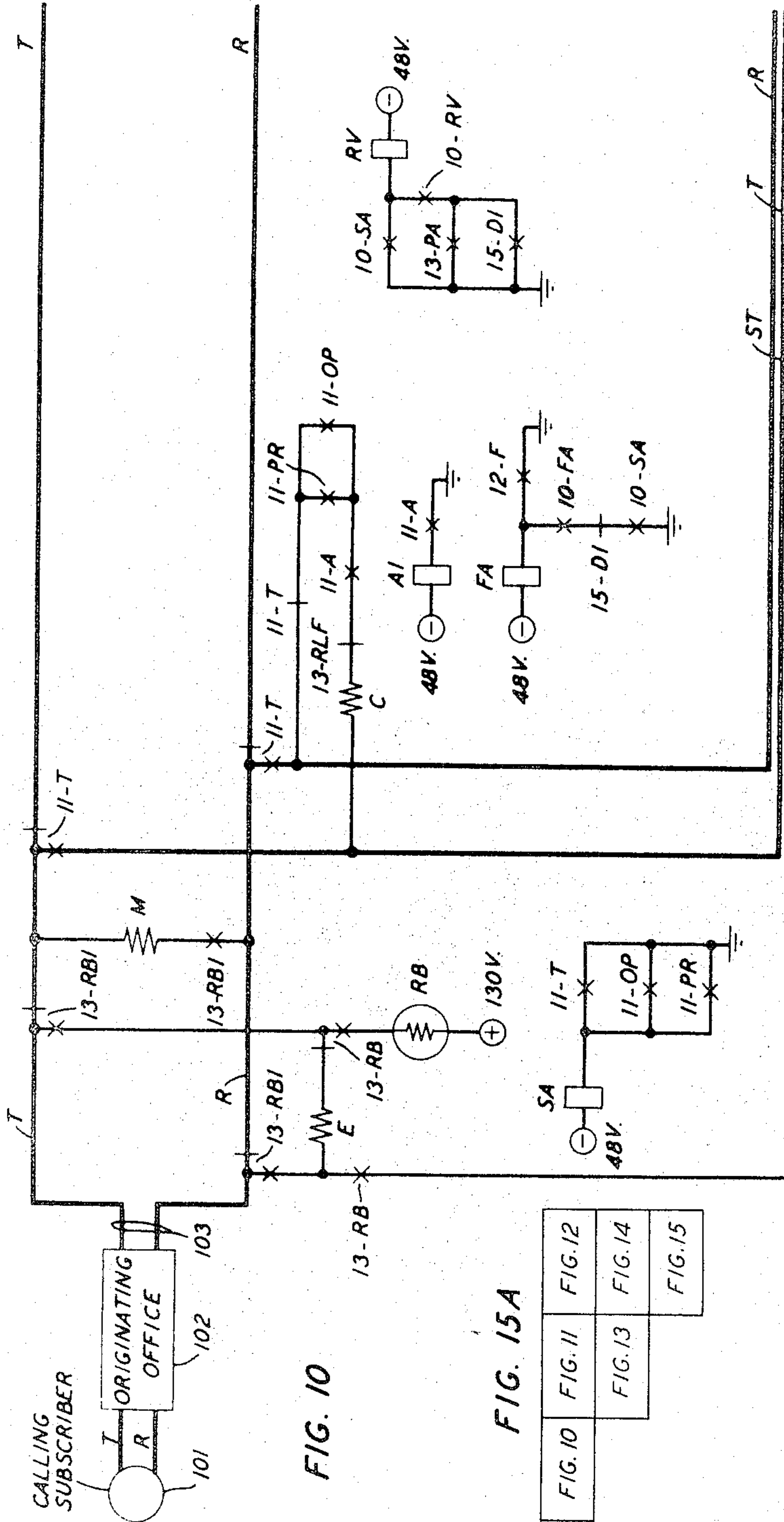
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 62



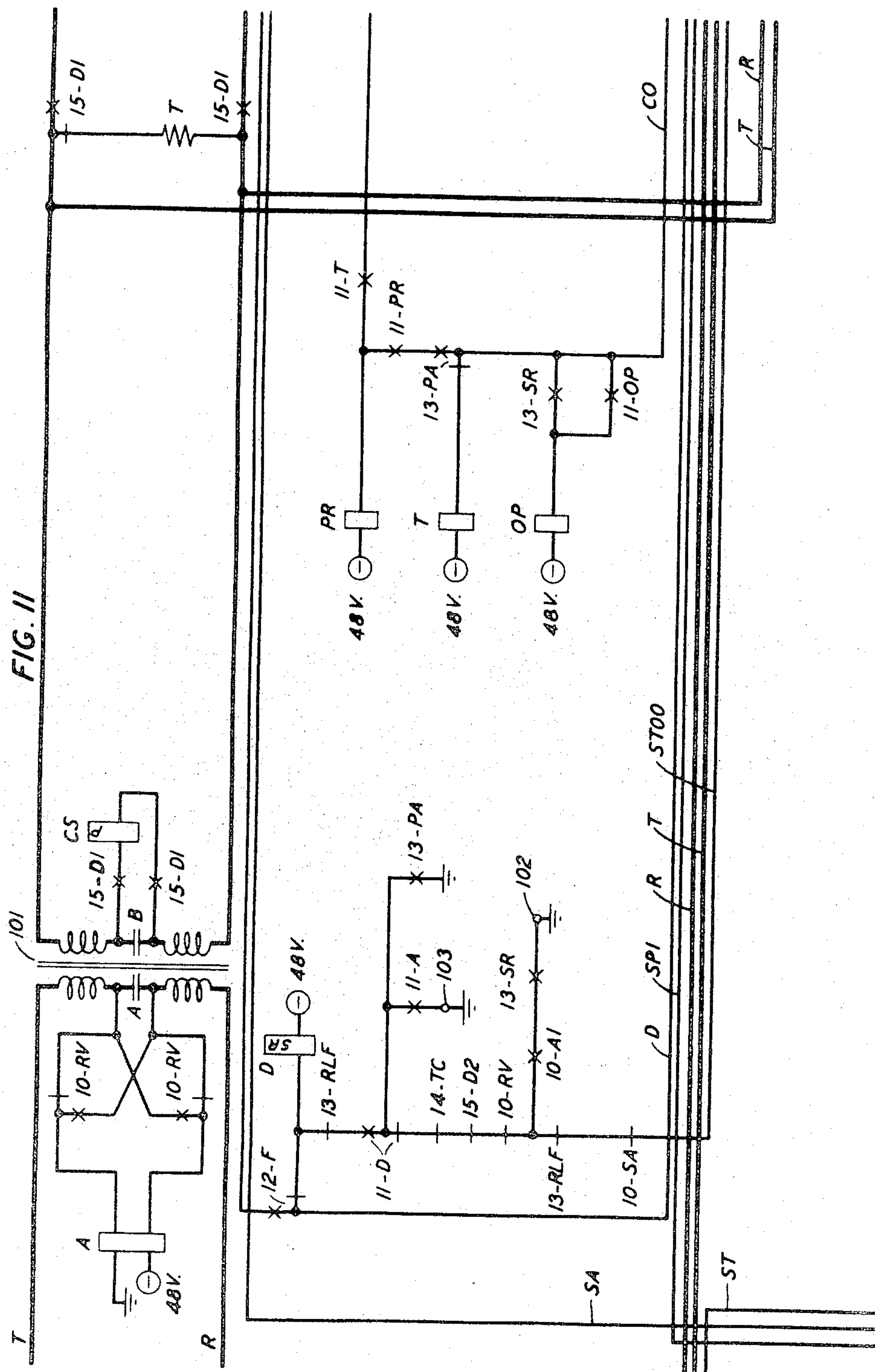
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 63



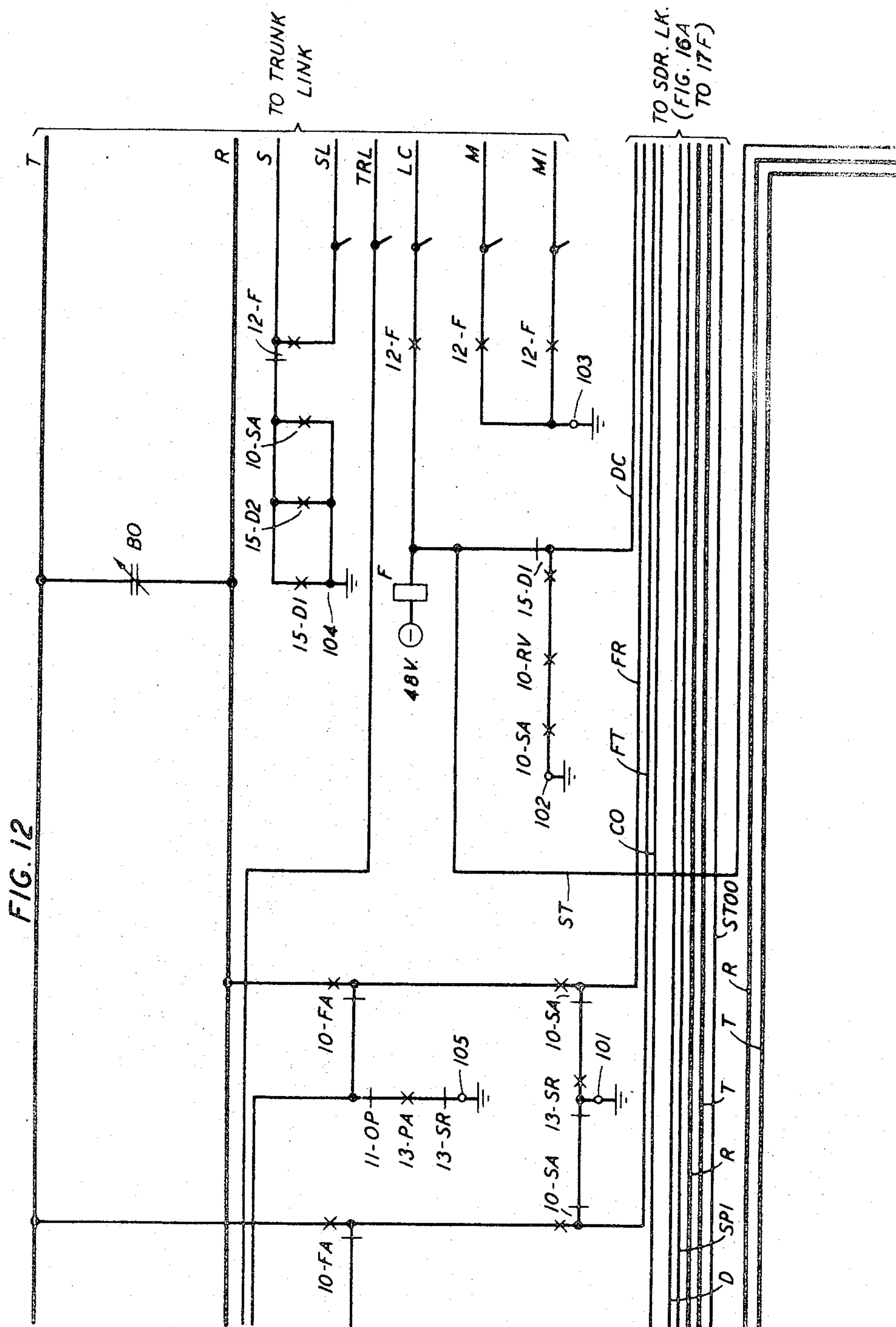
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 64



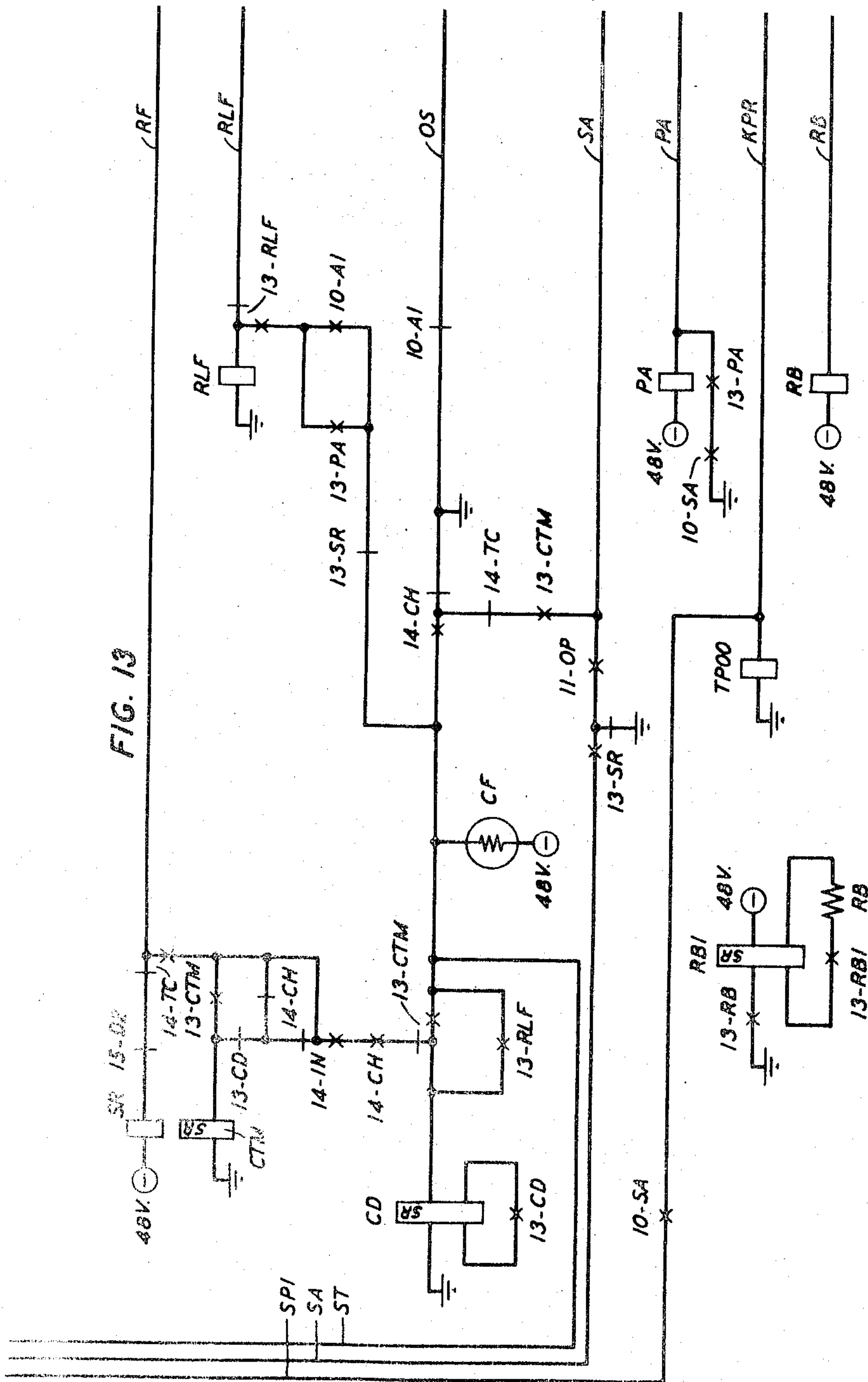
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3,341,662

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570 Sheets-Sheet 65



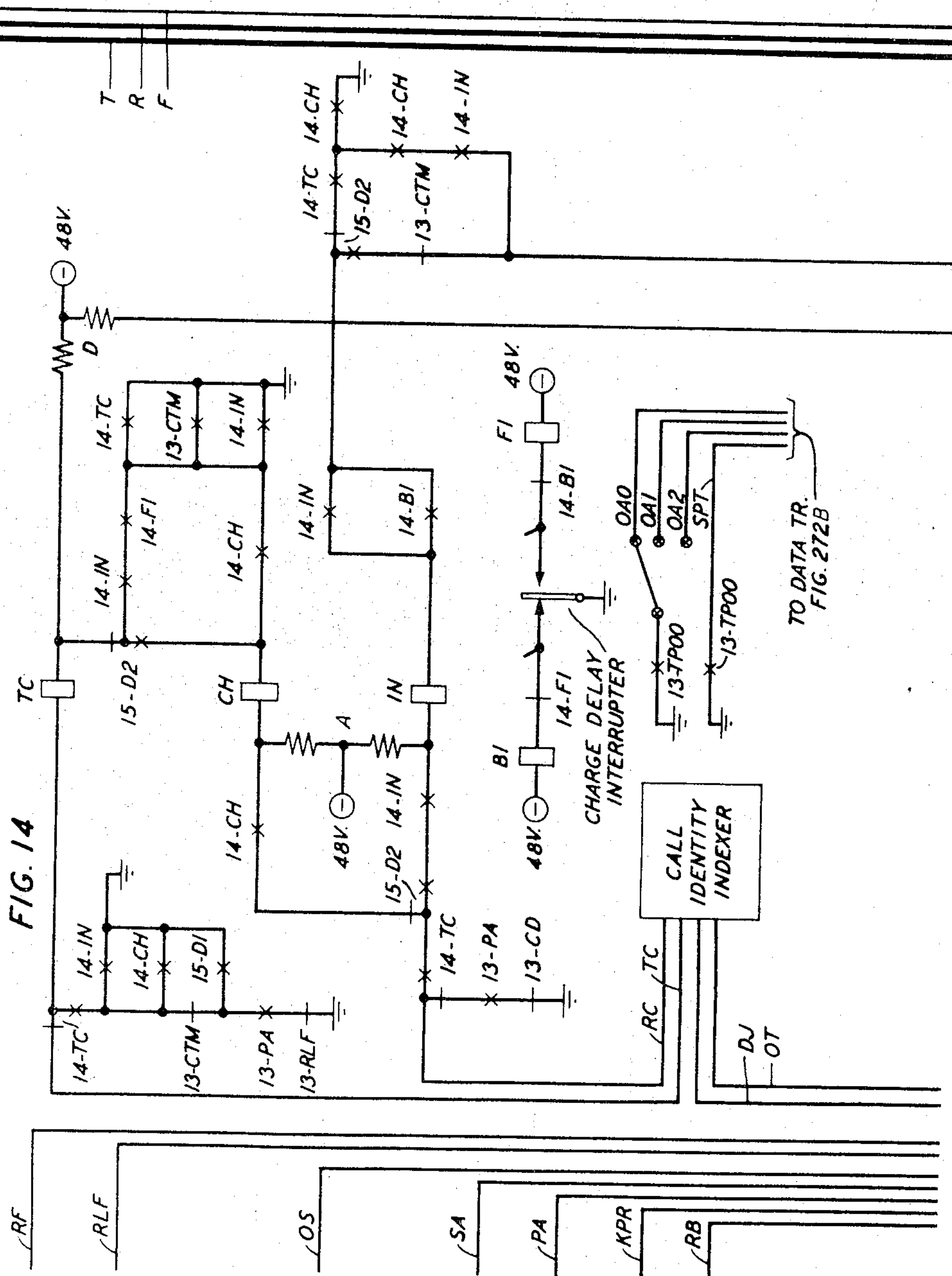
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3,341,662

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570 Sheets-Sheet 66



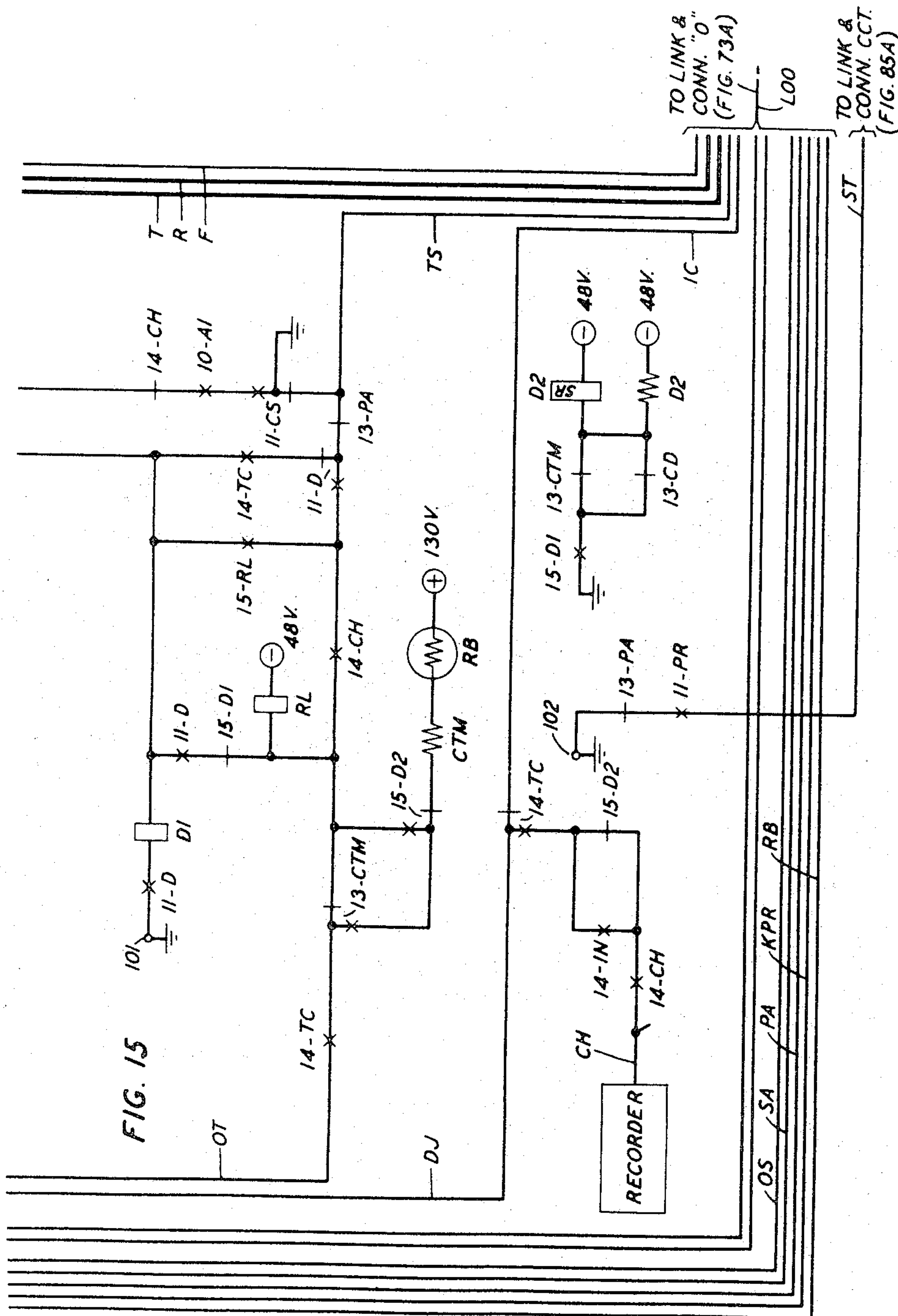
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570 Sheets-Sheet 67

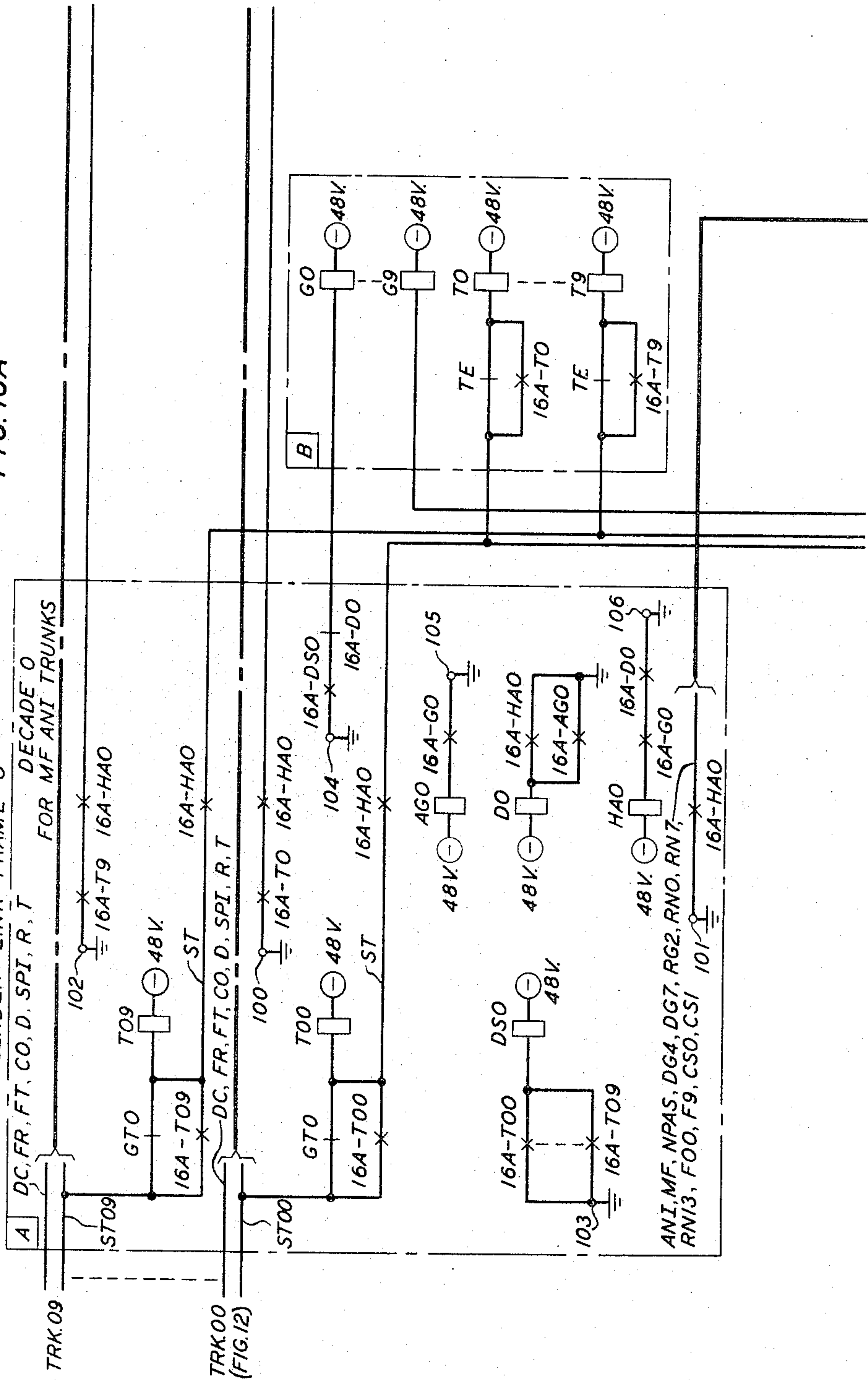


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570 Sheets-Sheet 68

SENDER LINK FRAME 0



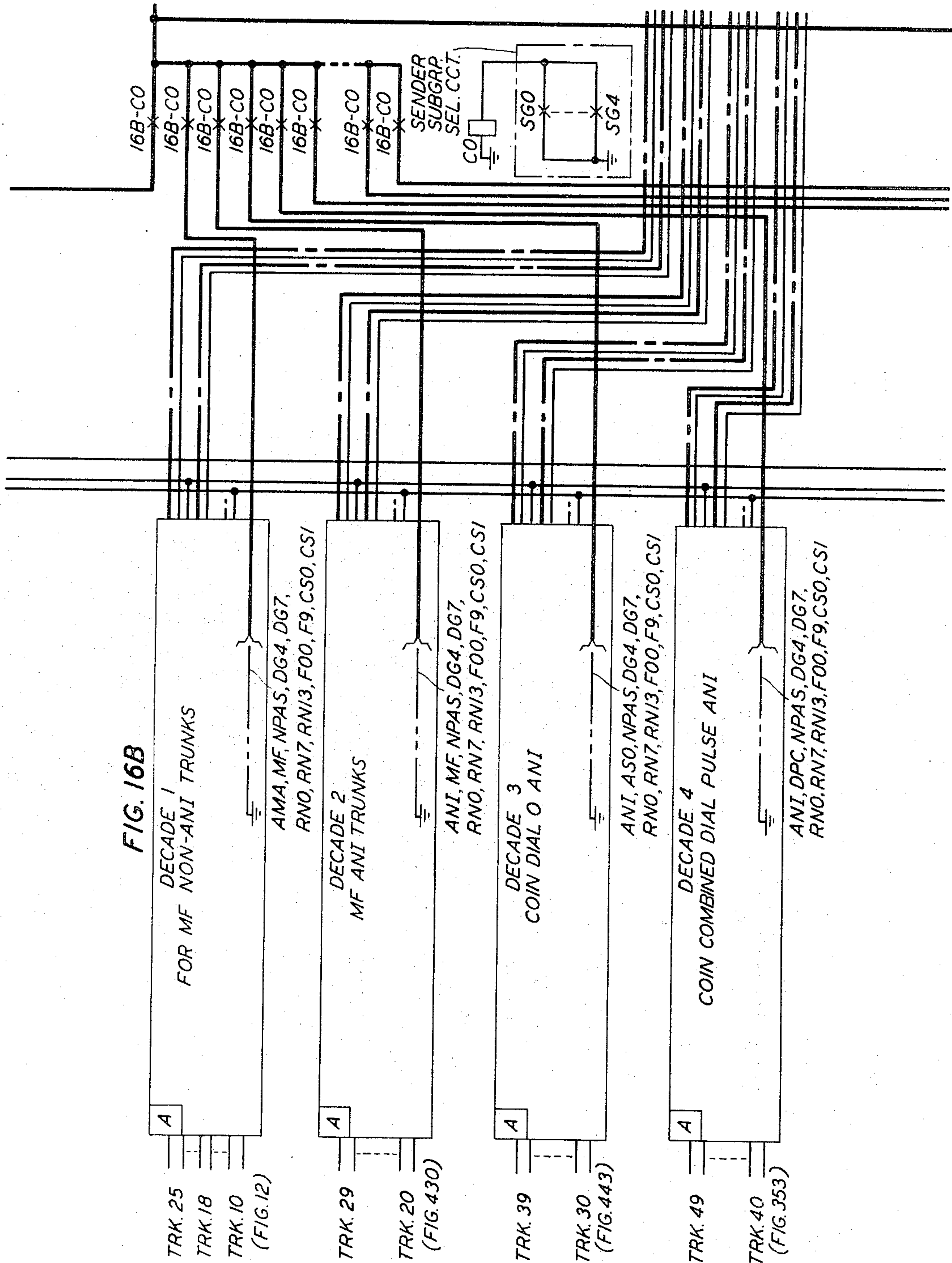
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570 Sheets-Sheet 69



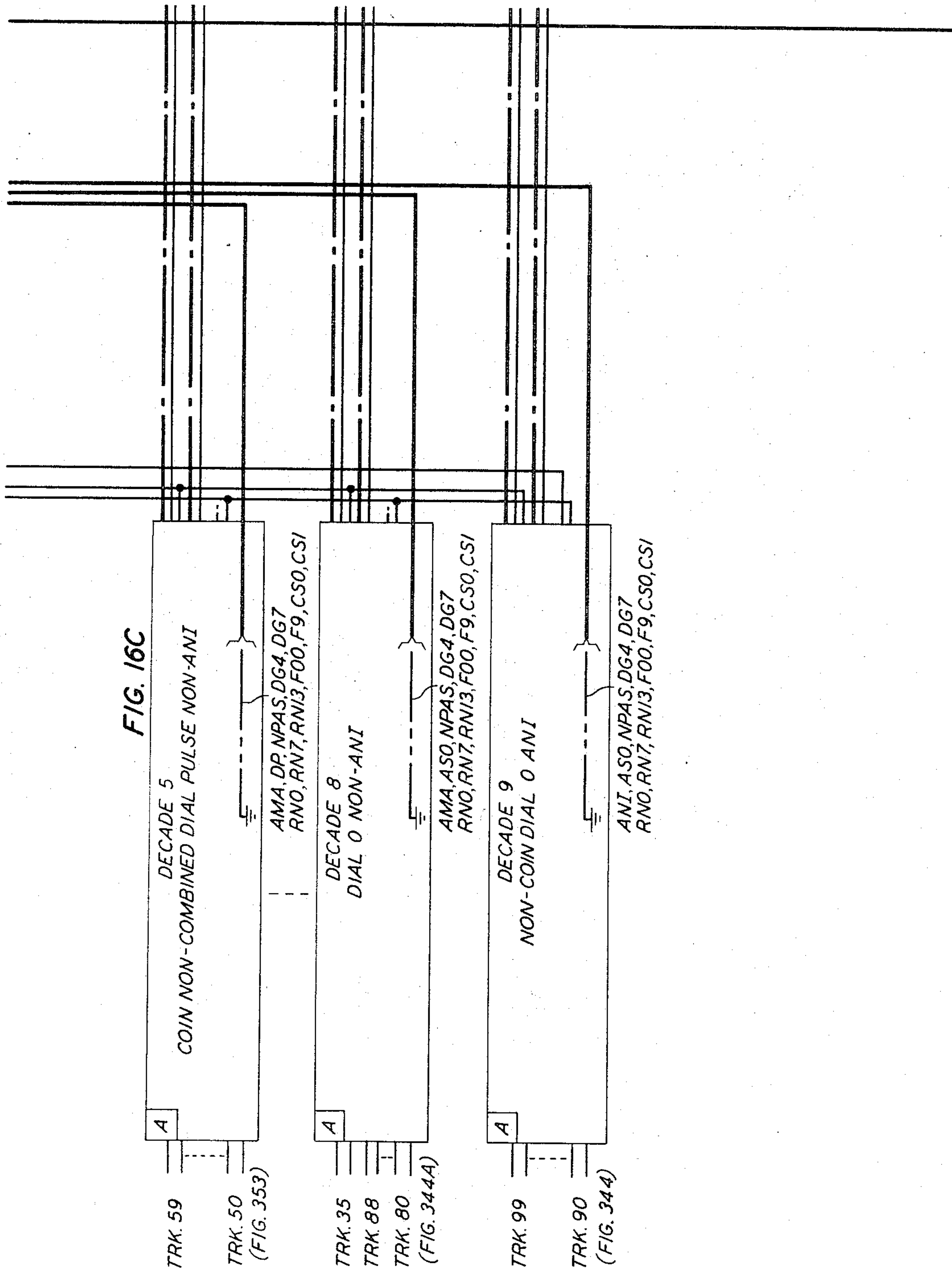
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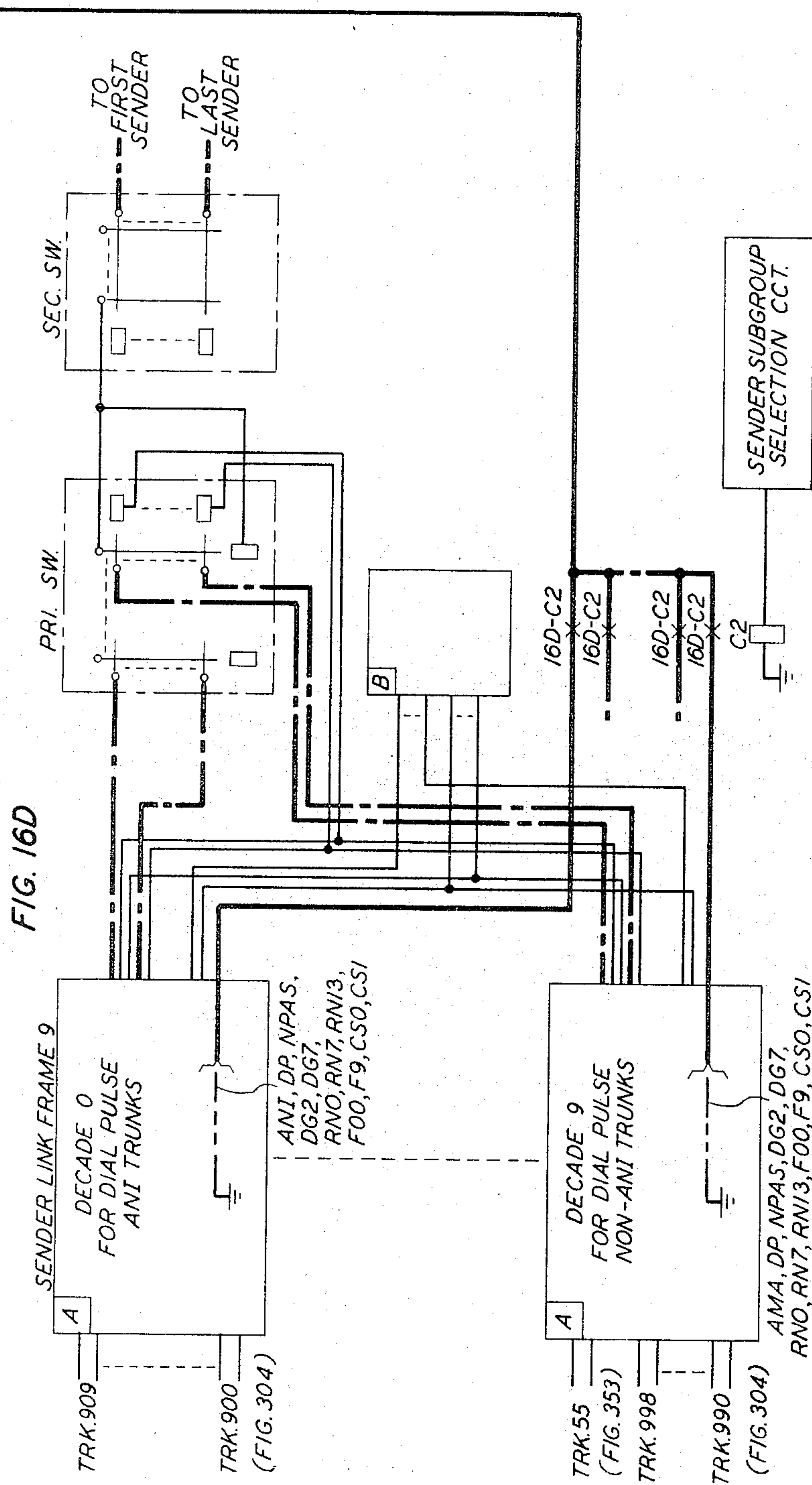
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INTERMEDIATE SWITCHING CENTER.

570 Sheets-Sheet 71



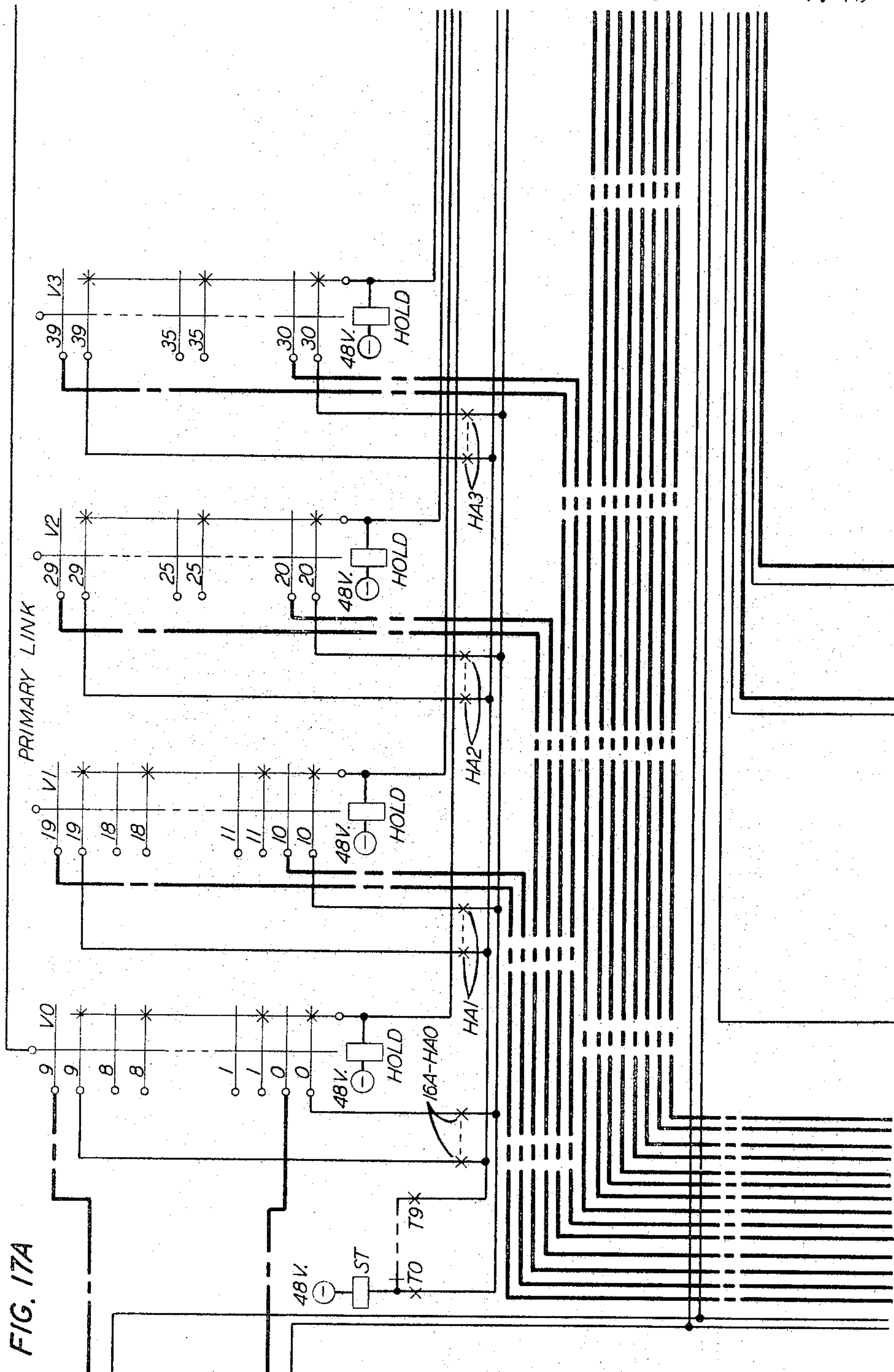
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 73



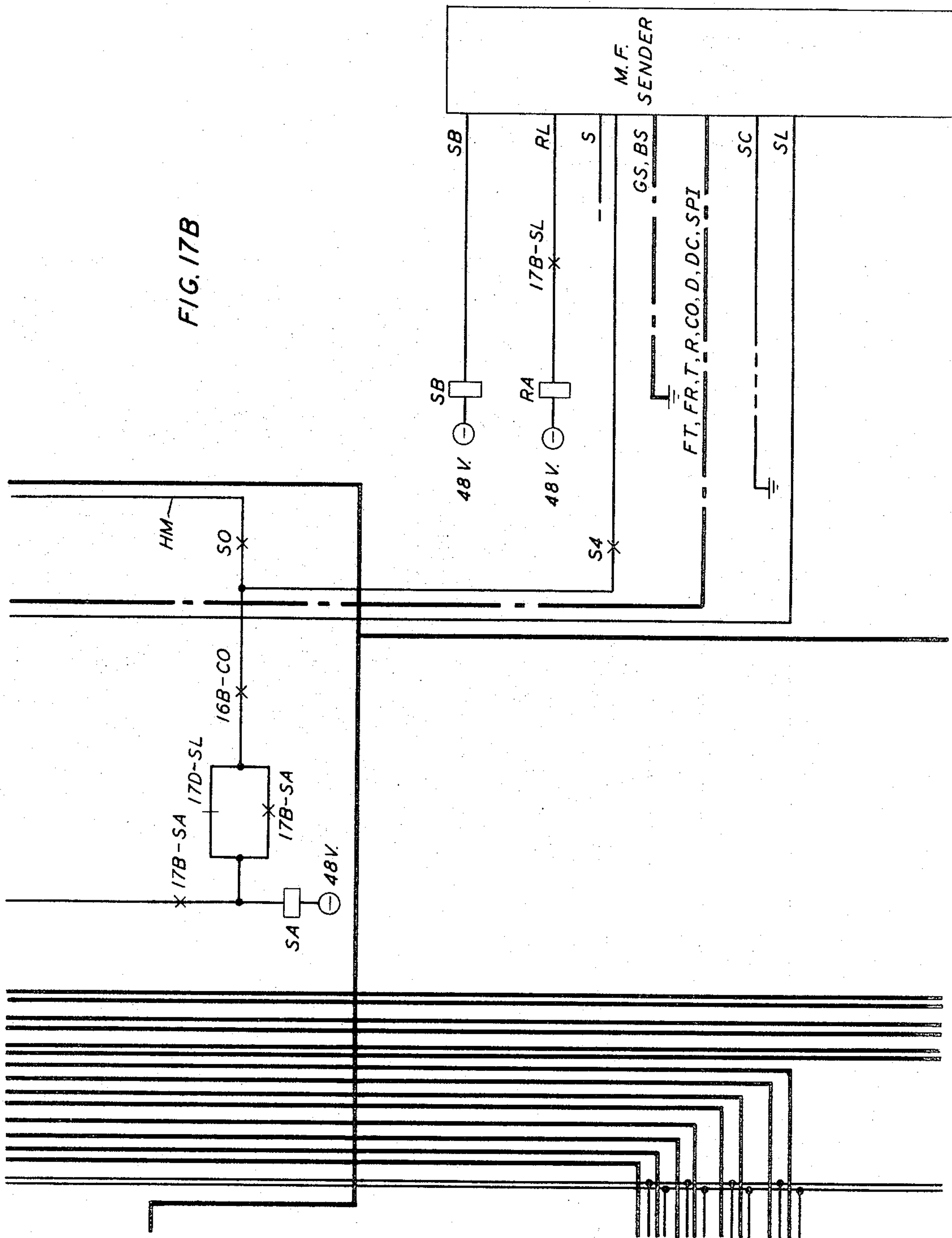
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 73



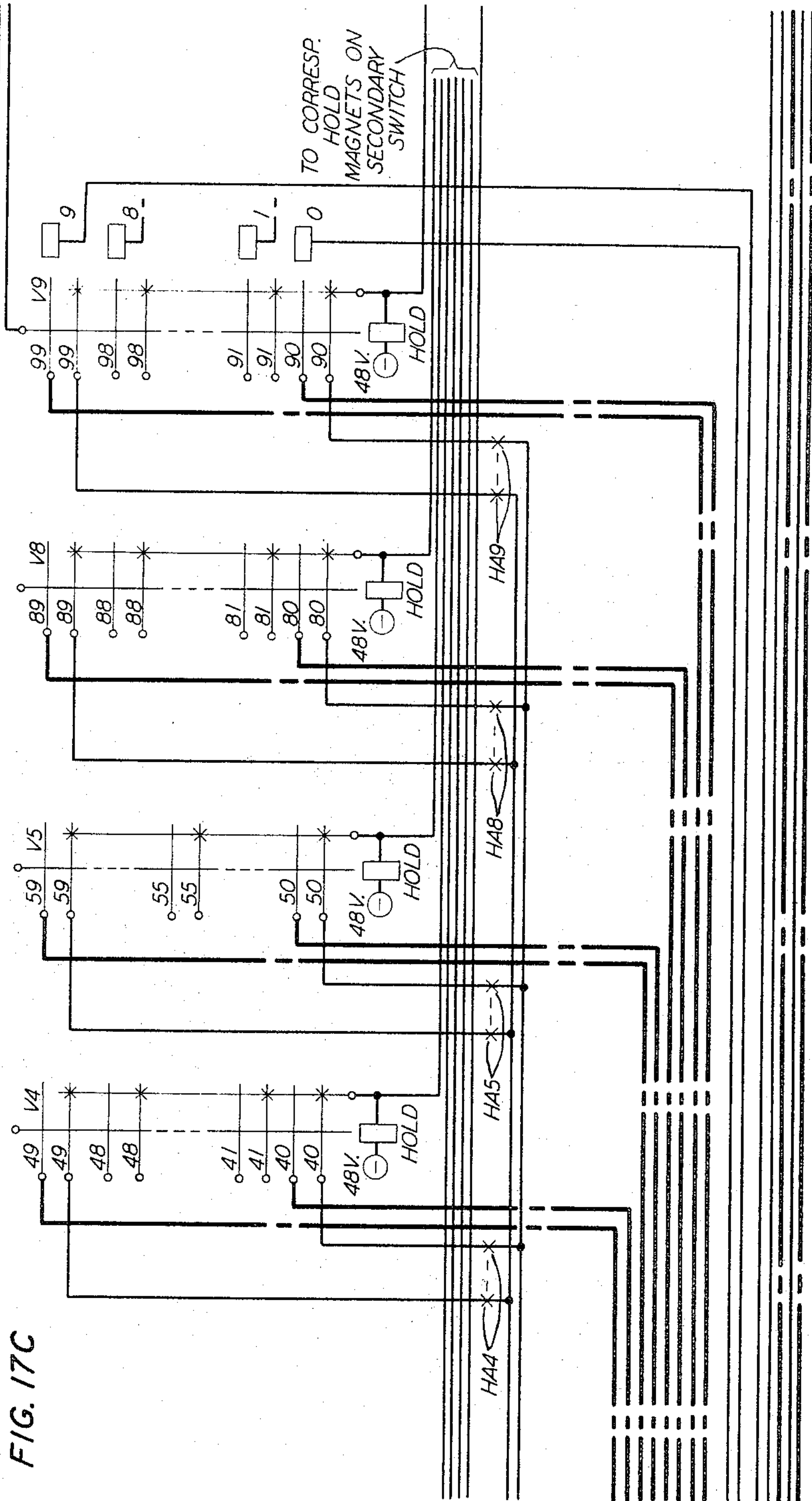
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 74



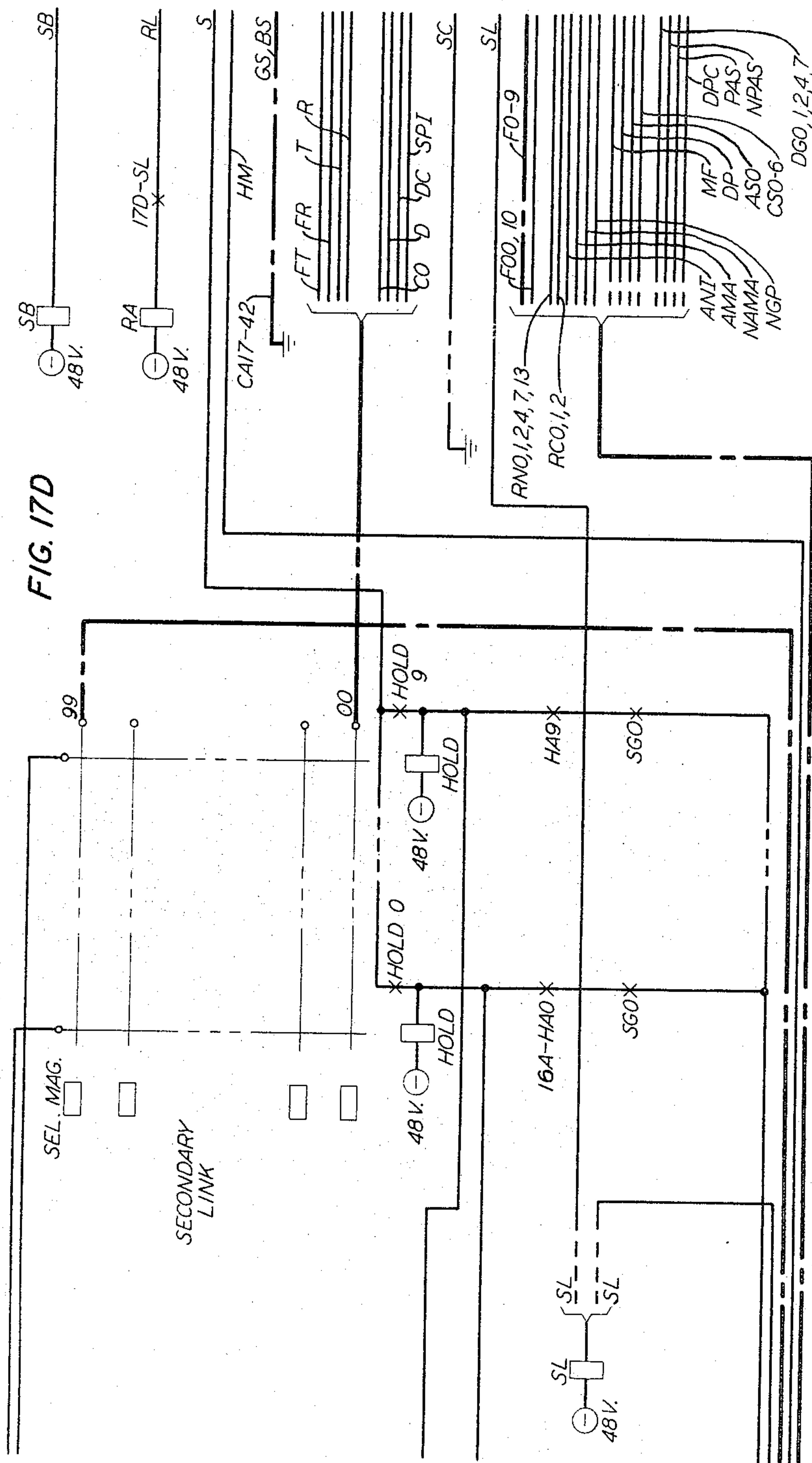
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 75



Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 76

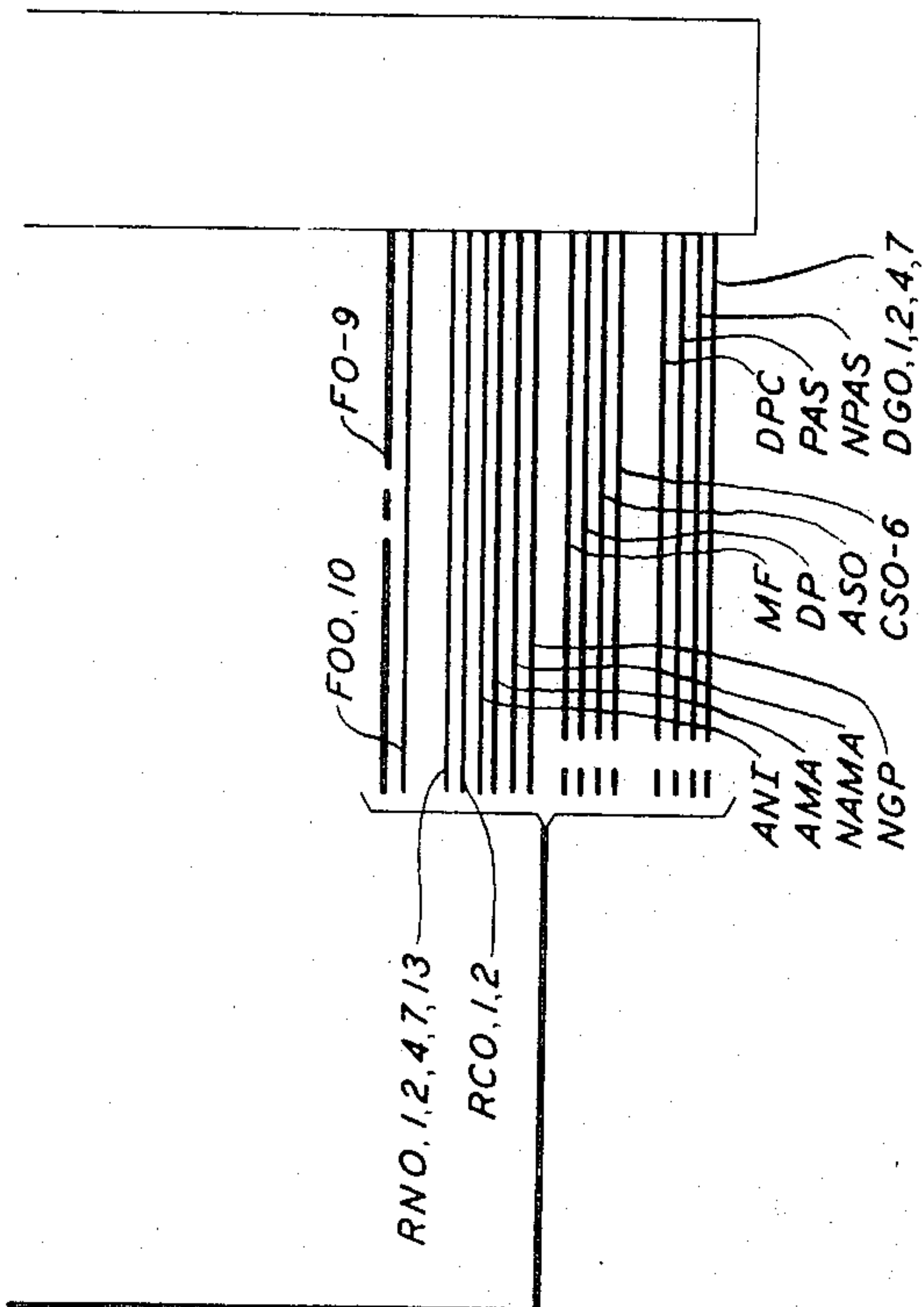


FIG. 17E

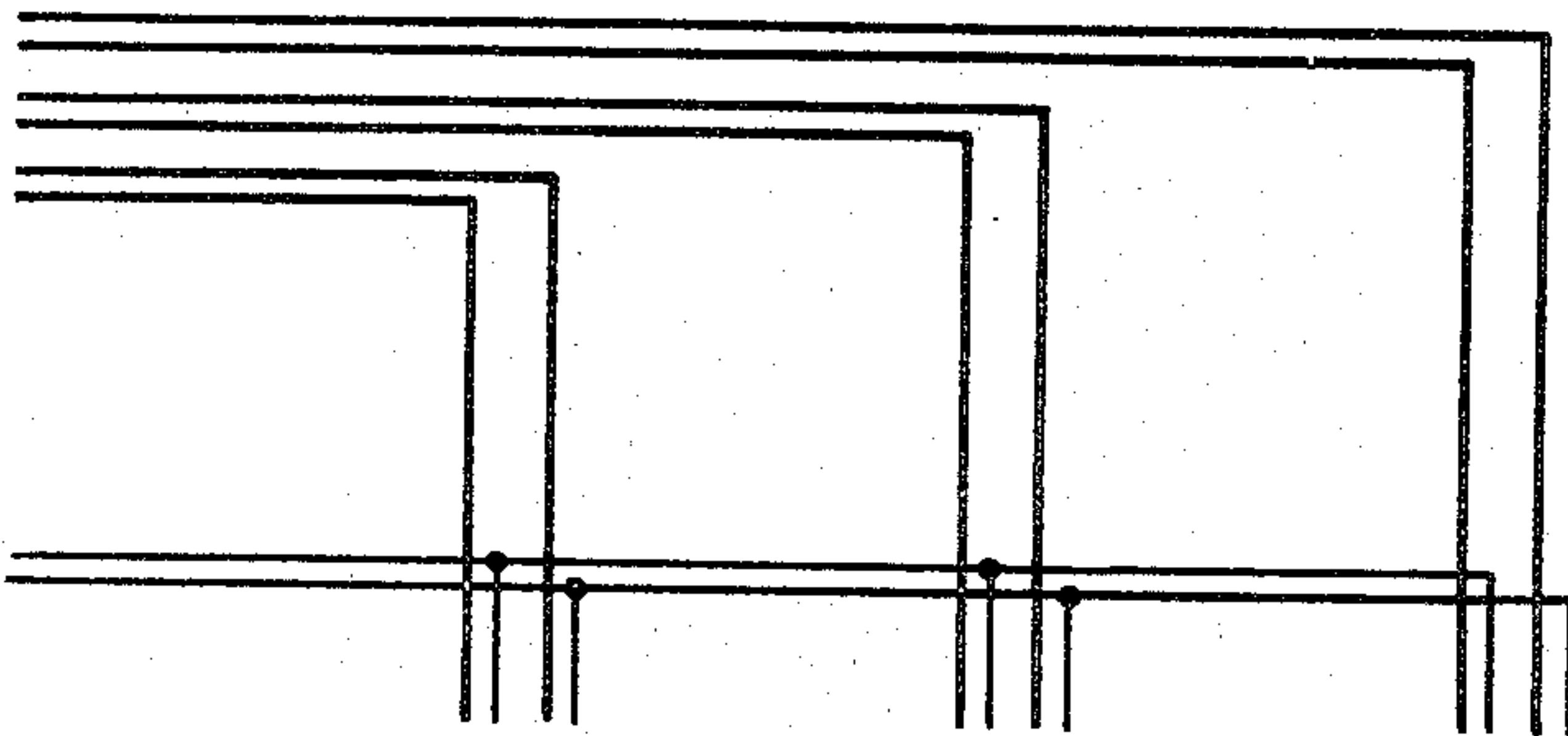


FIG. 17F

FIG. 16A	FIG. 17A	FIG. 17C	FIG. 17D
FIG. 16B	FIG. 17B		
FIG. 16C	FIG. 17E FIG. 17F		
FIG. 16D			

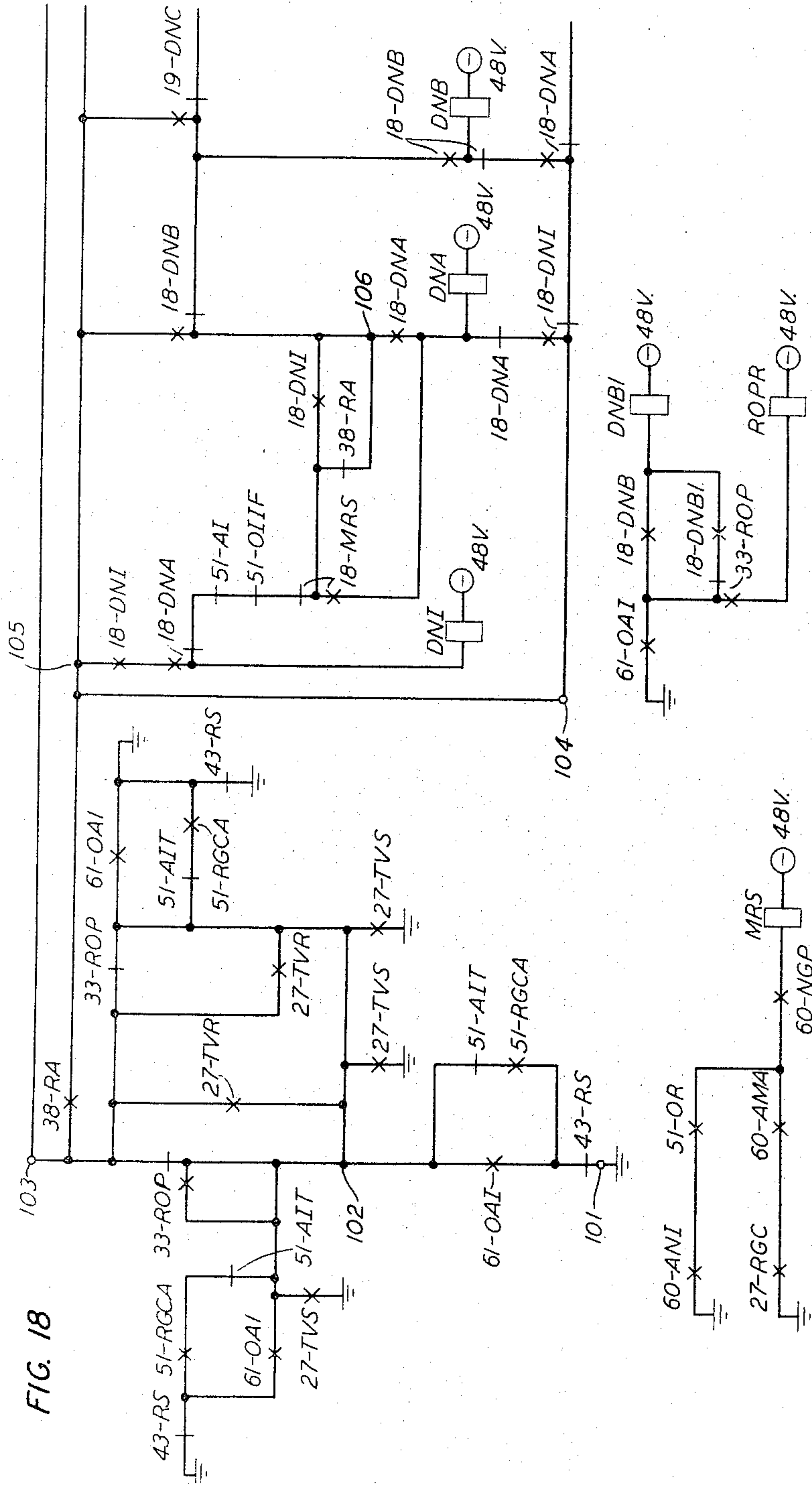
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 77



Sept. 12, 1967

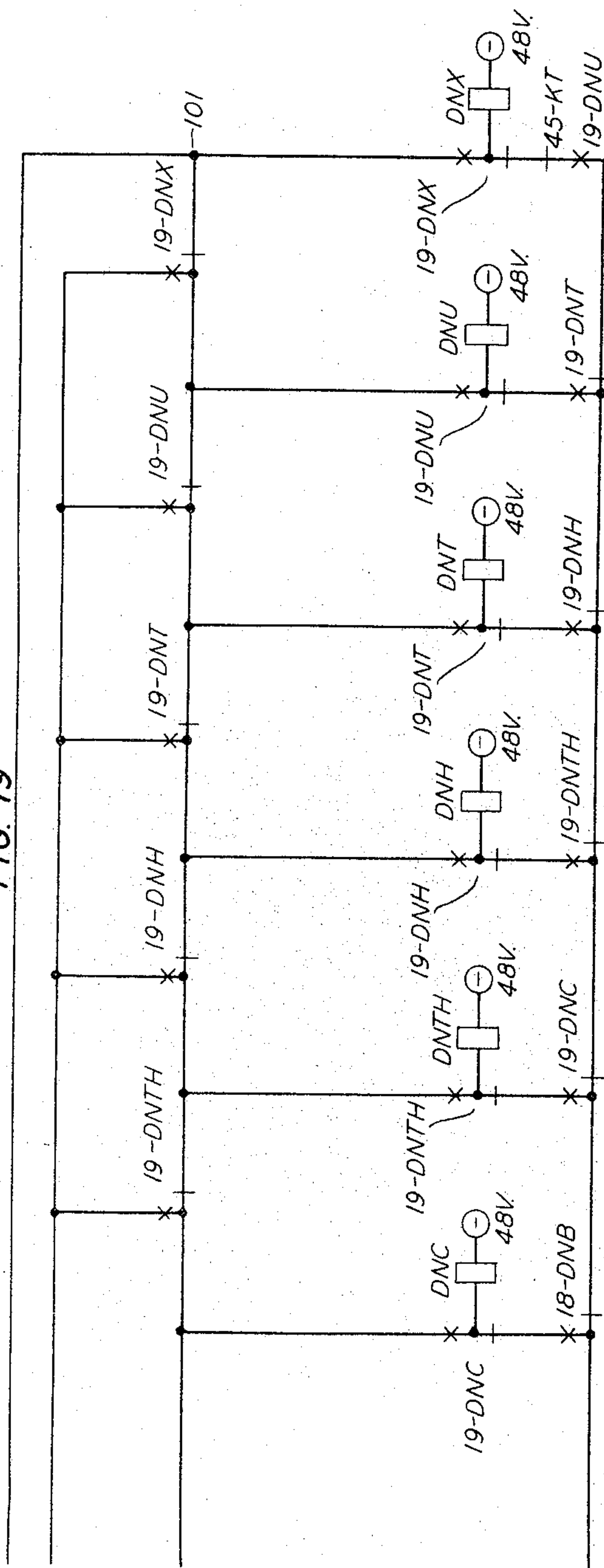
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 78

FIG. 19



Sept. 12, 1967

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3,341,662

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570 Sheets-Sheet 79

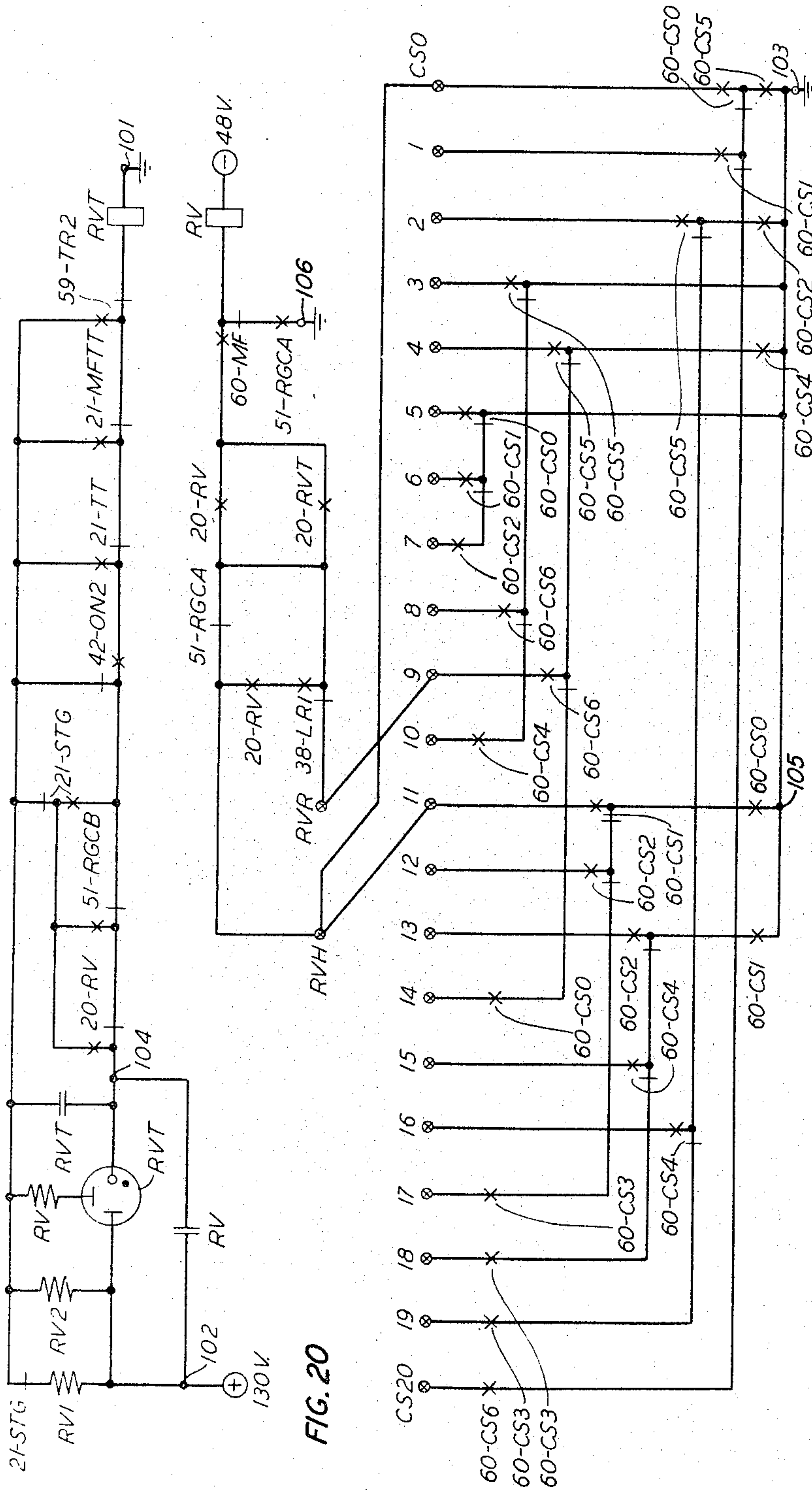


FIG. 20

Sept. 12, 1967

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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 80

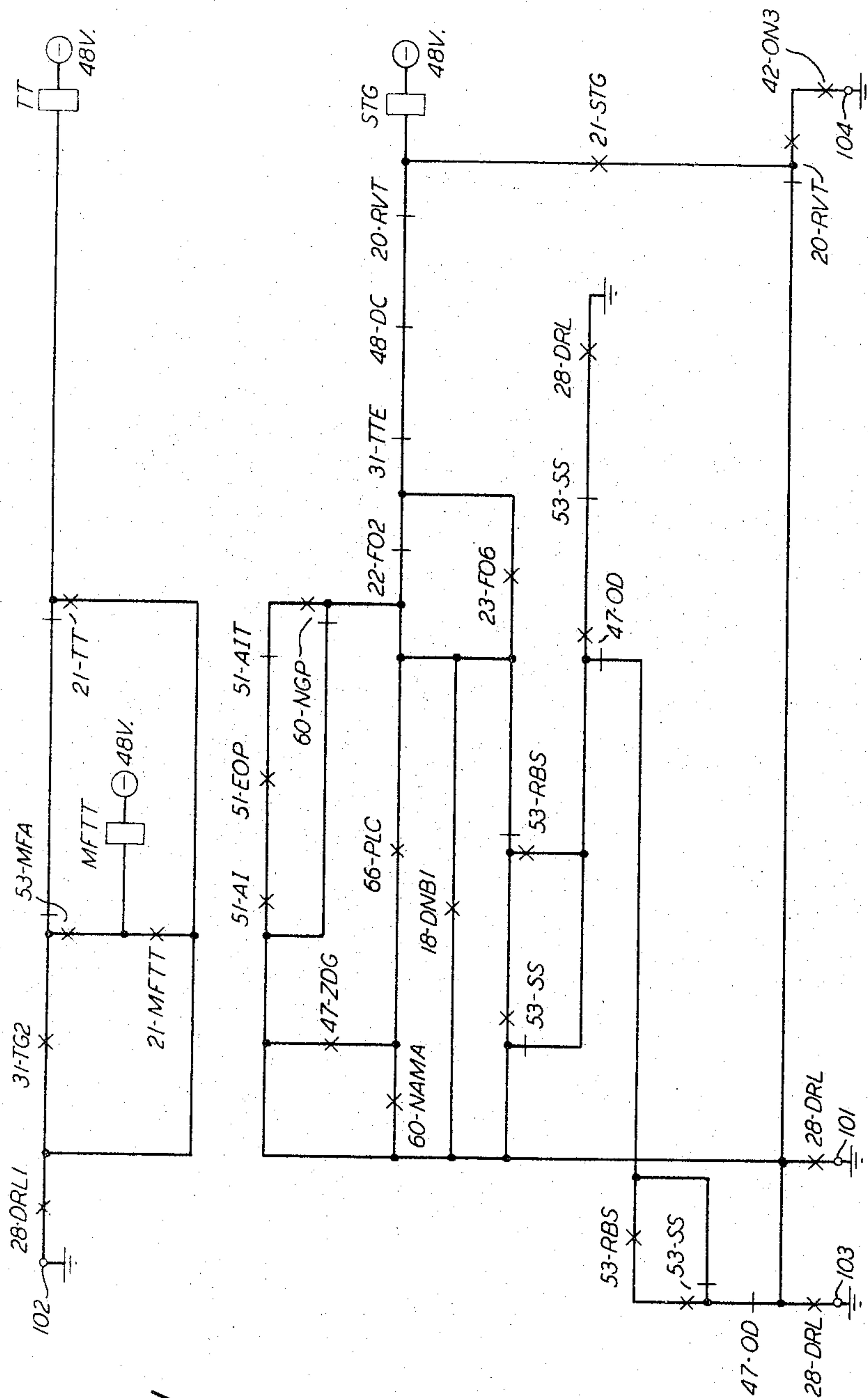


FIG. 21

Sept. 12, 1967

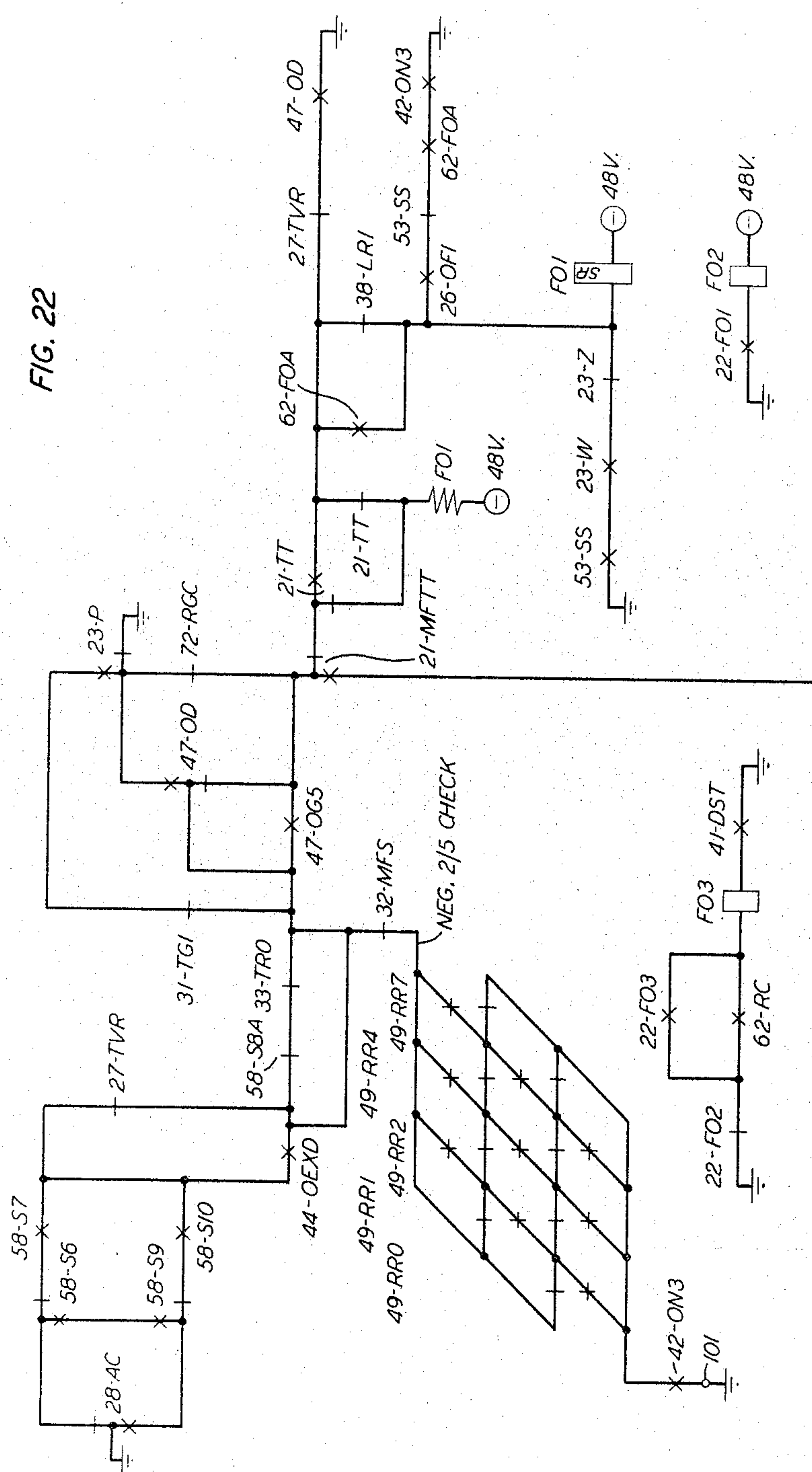
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 81

FIG. 22



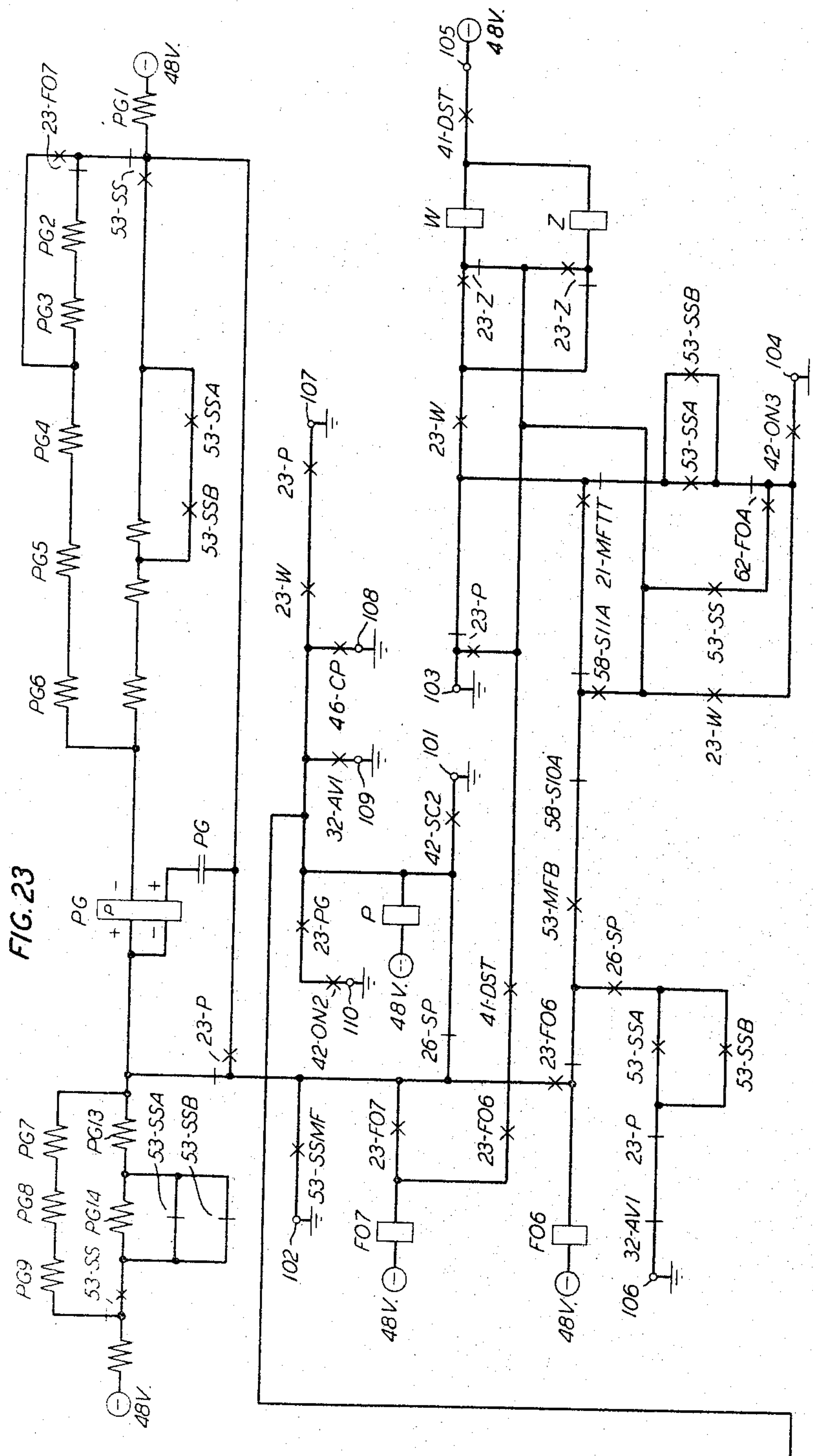
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 82



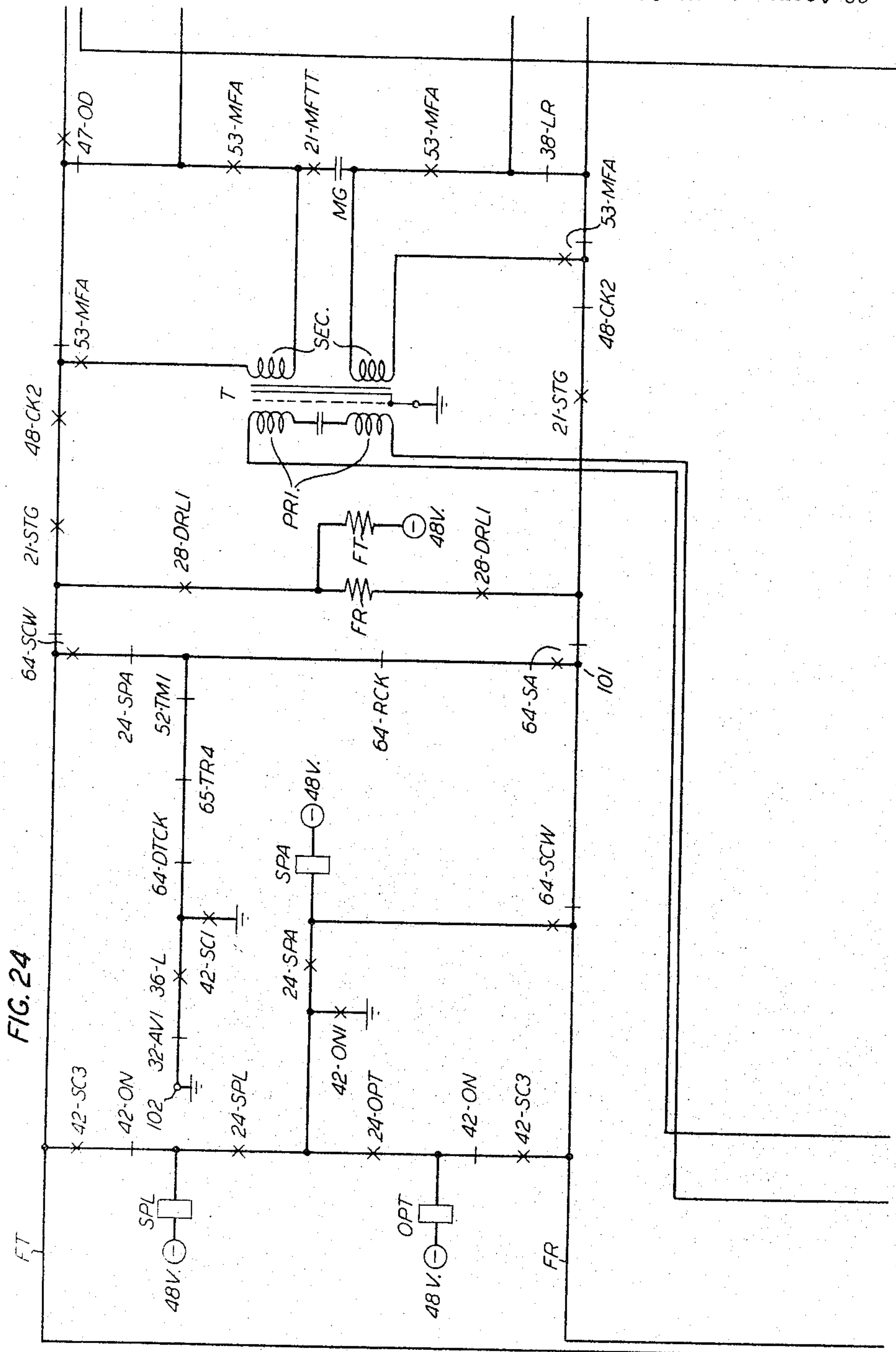
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 83



Sept. 12, 1967

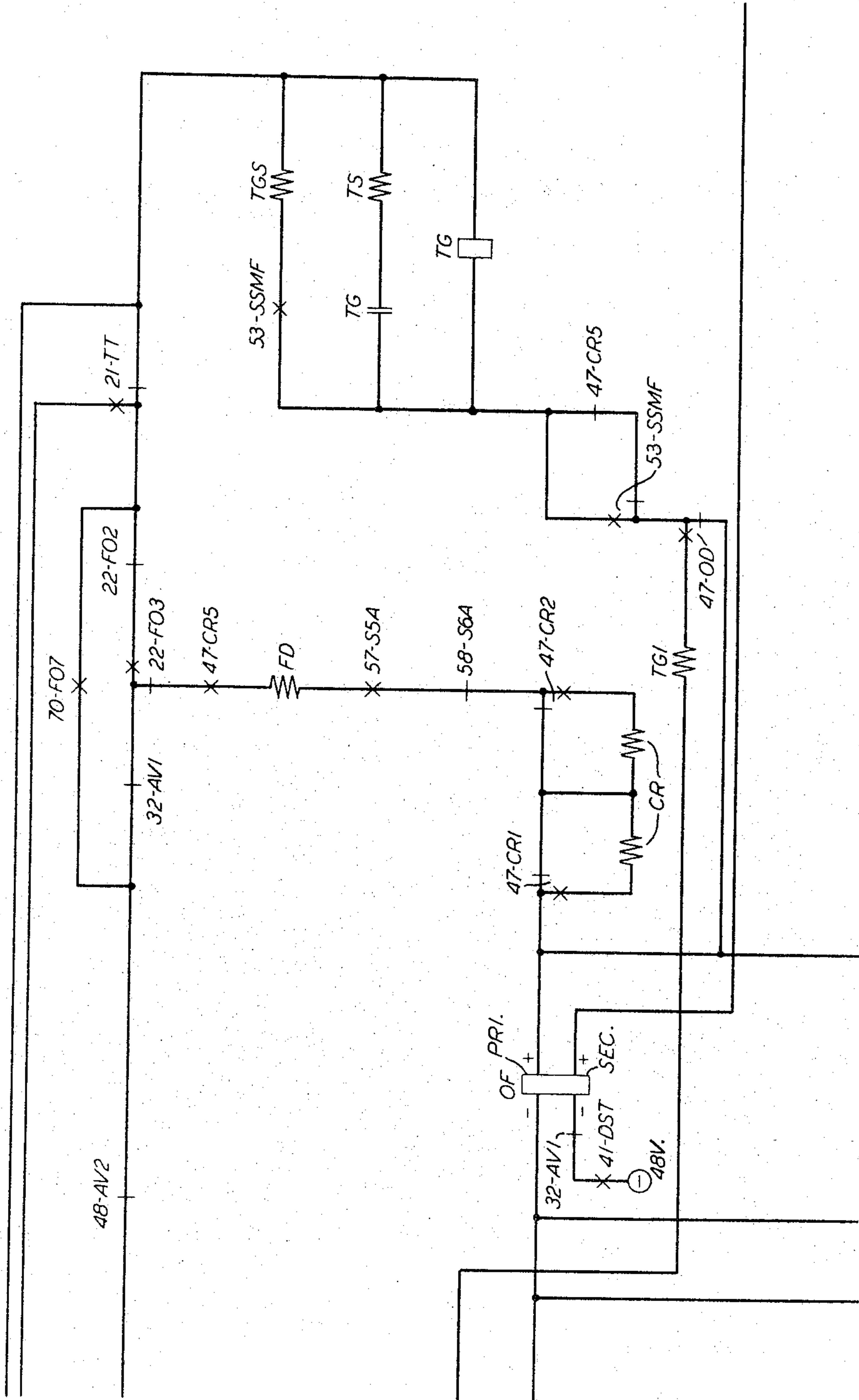
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 84

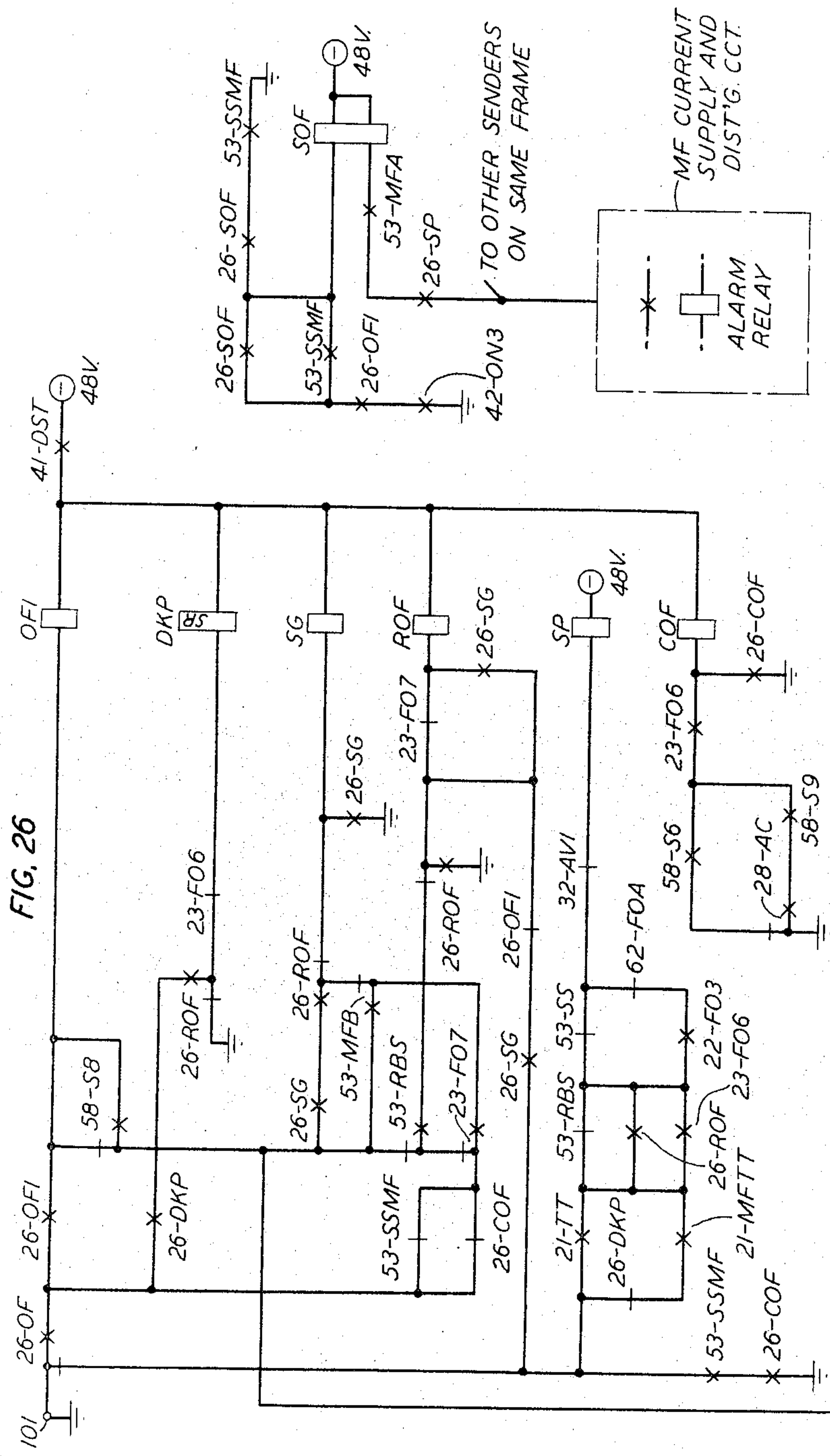
FIG. 25



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570 Sheets-Sheet 85



Sept. 12, 1967

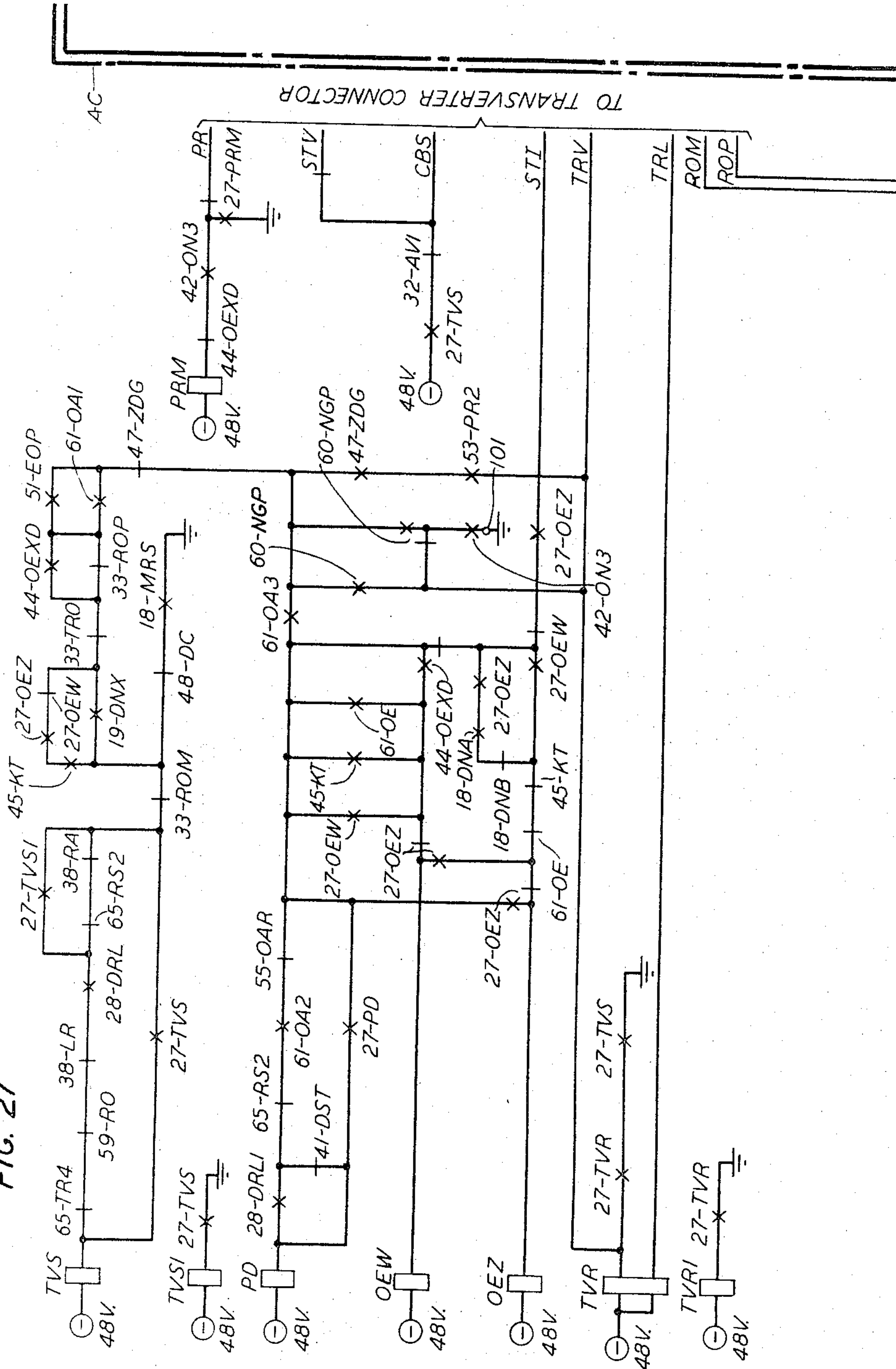
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 86

FIG. 27



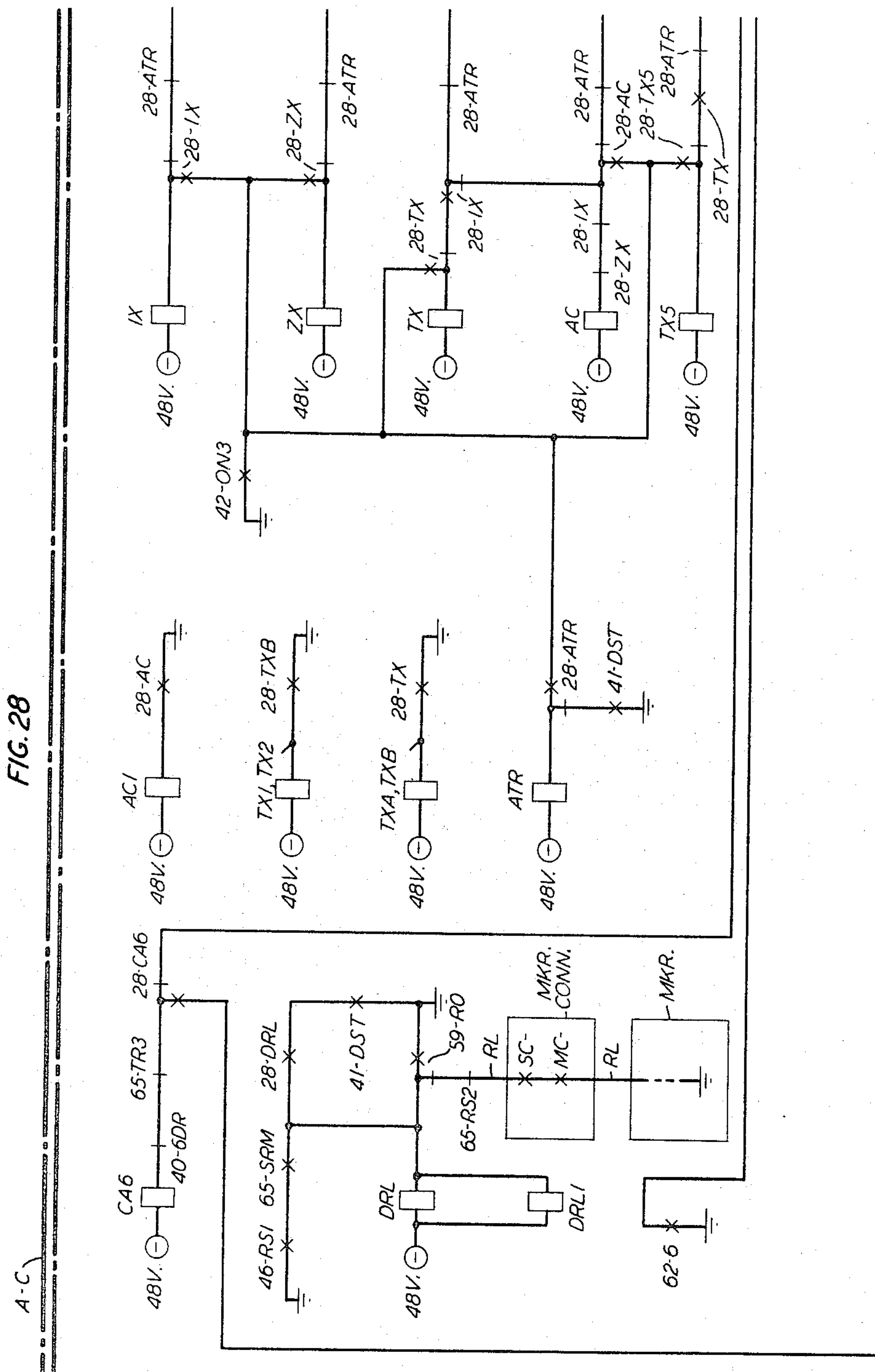
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 87



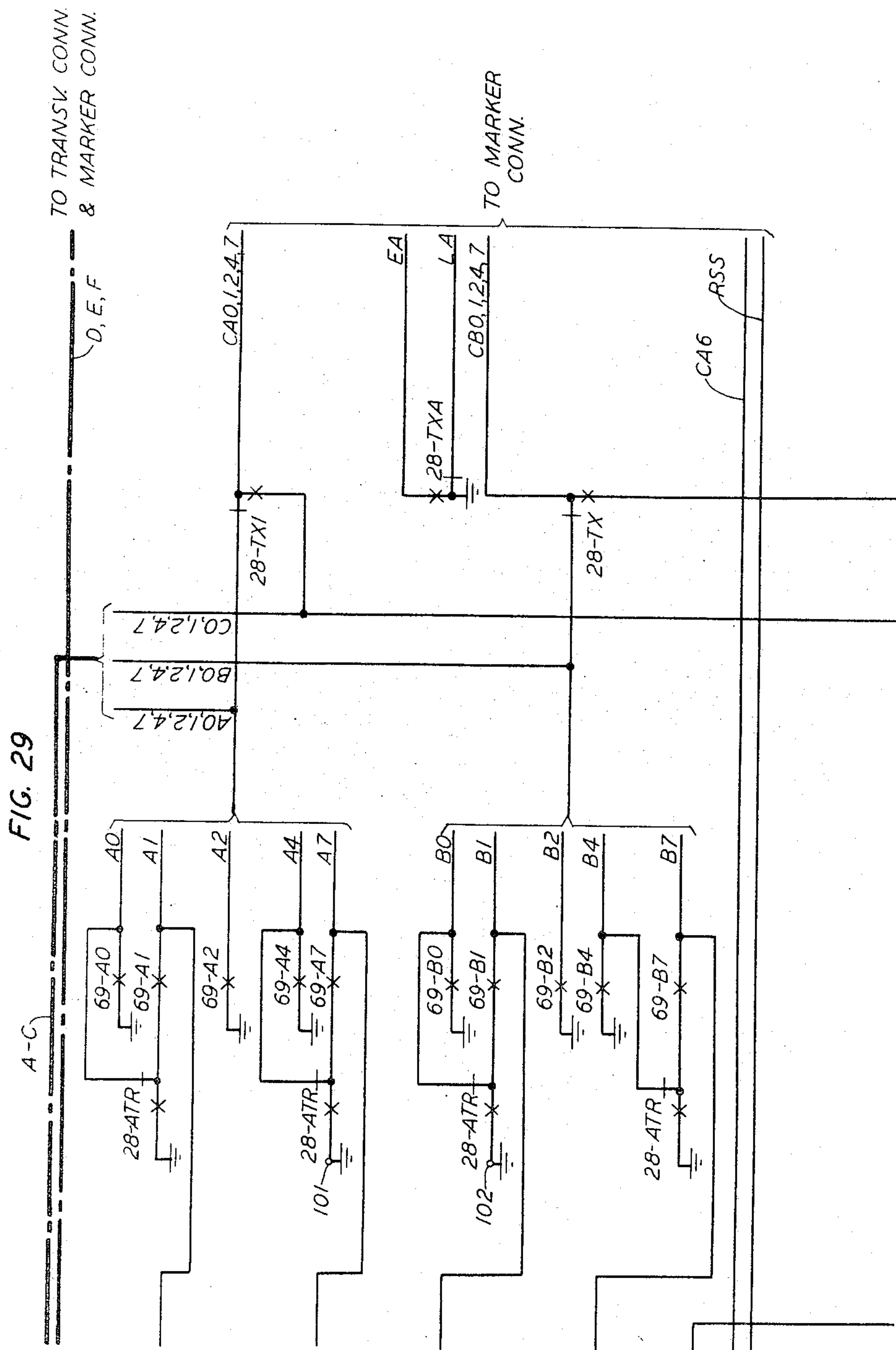
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 88



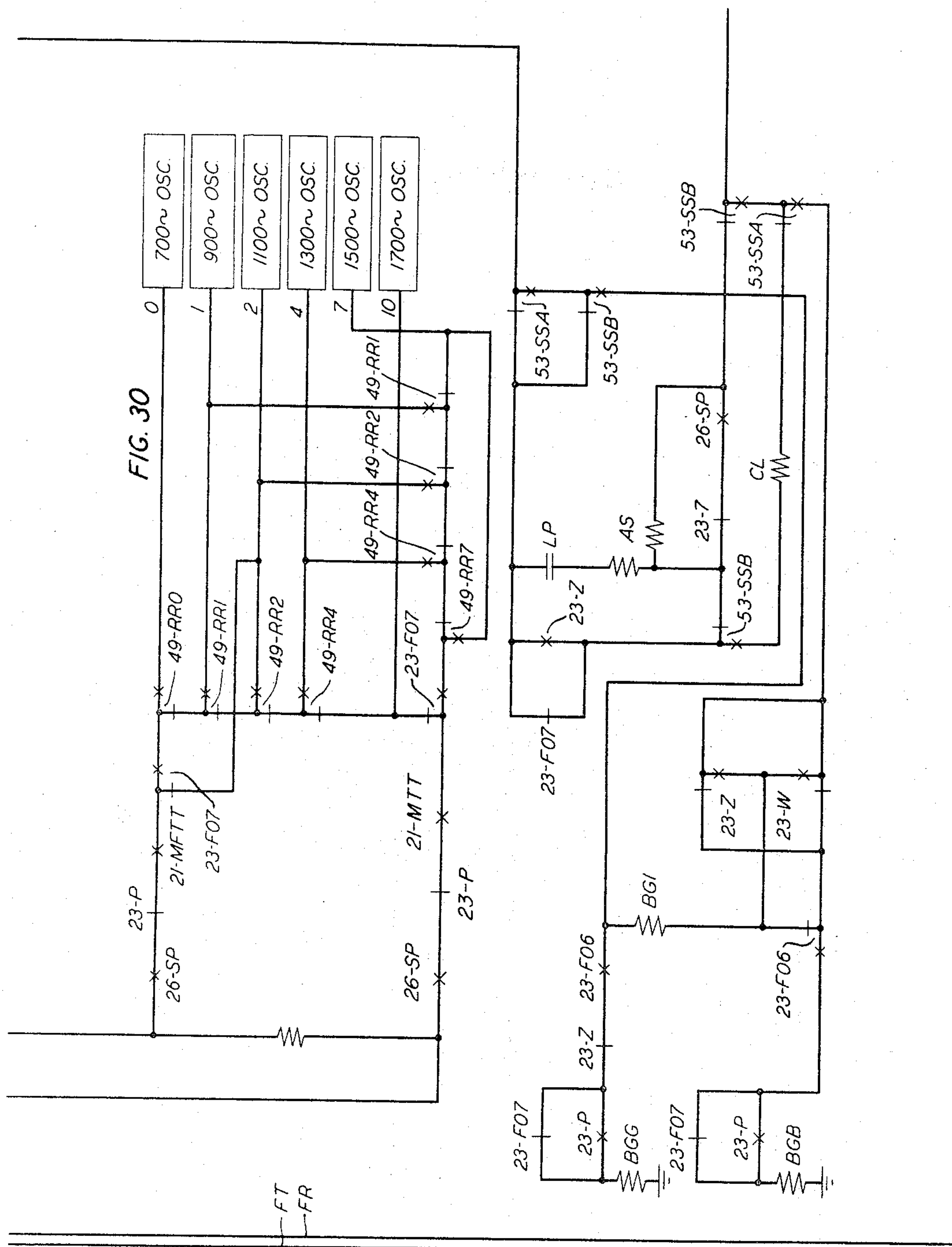
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 89



Sept. 12, 1967

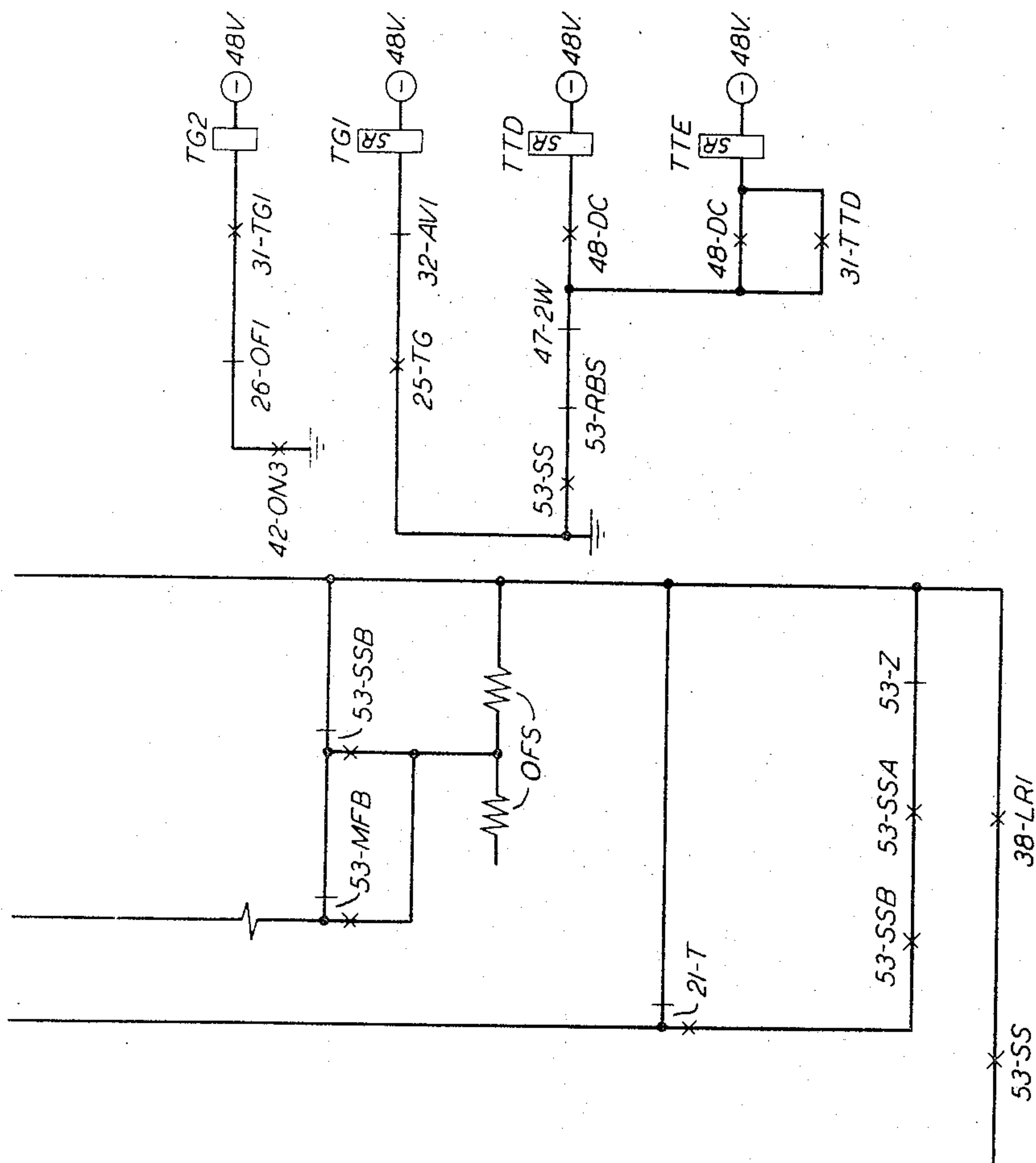
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 90

FIG. 31



Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 91

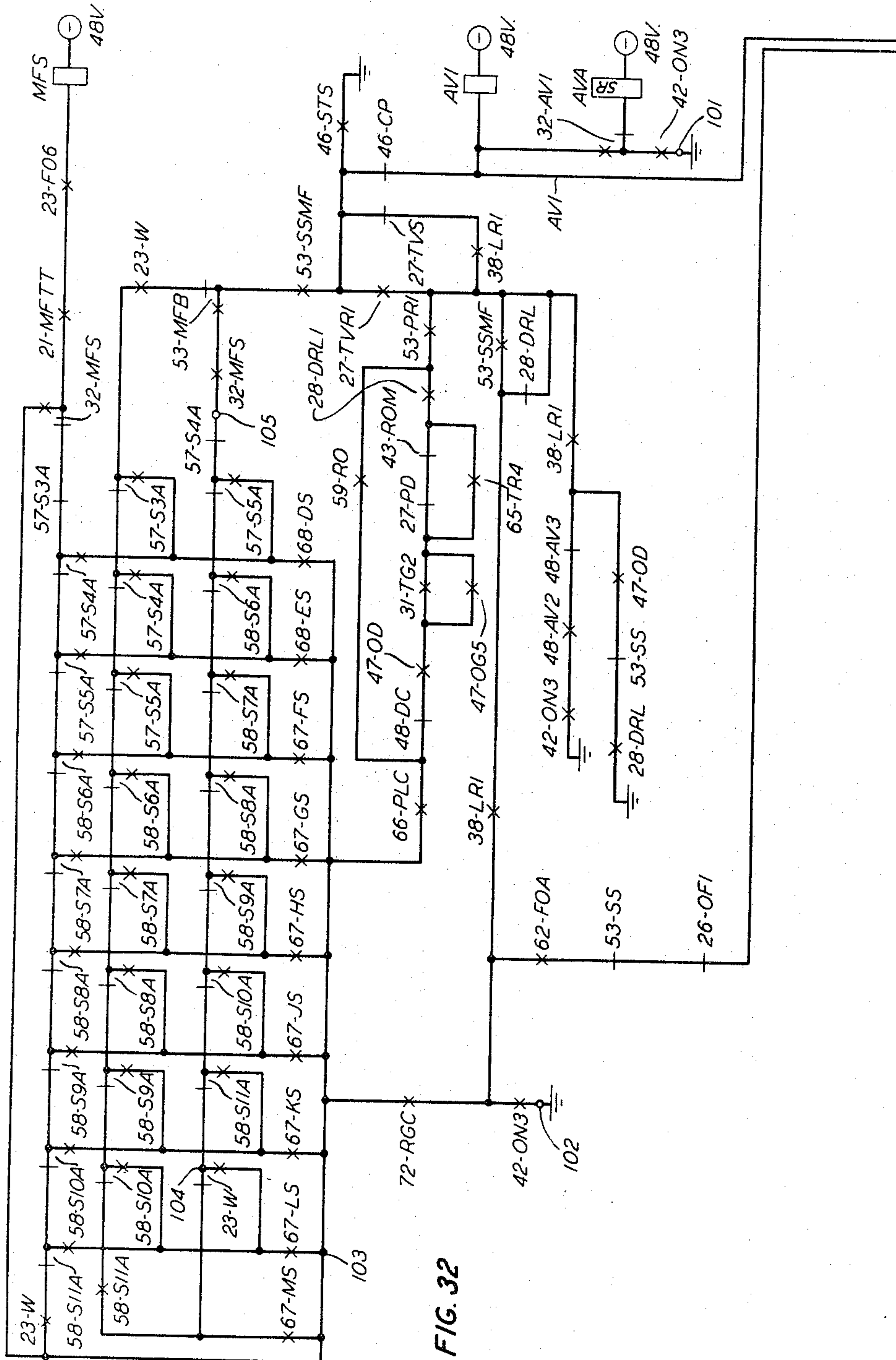


FIG. 32

Sept. 12, 1967

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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 92

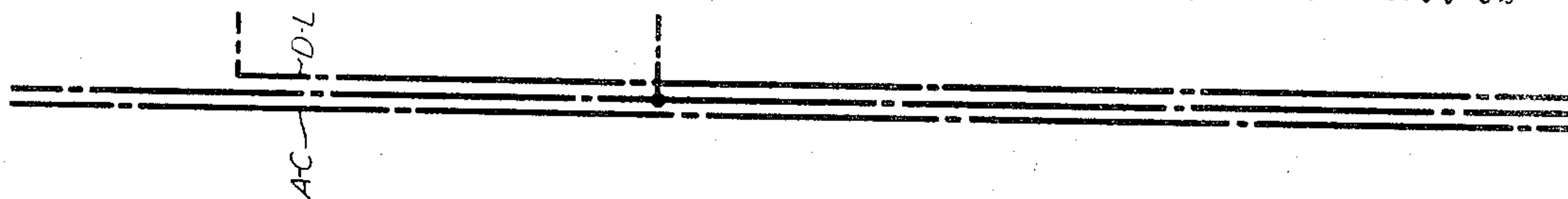
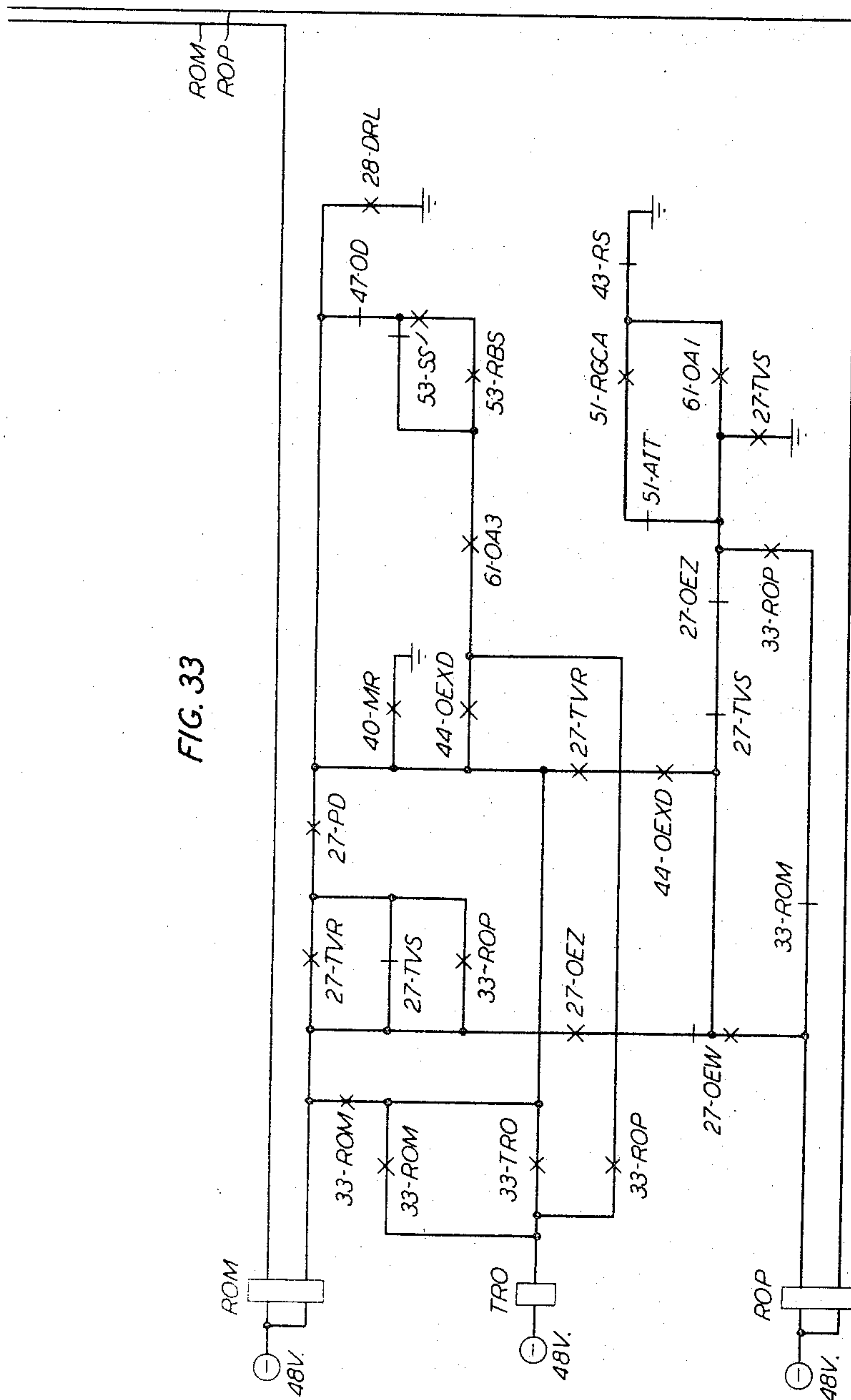


FIG. 33



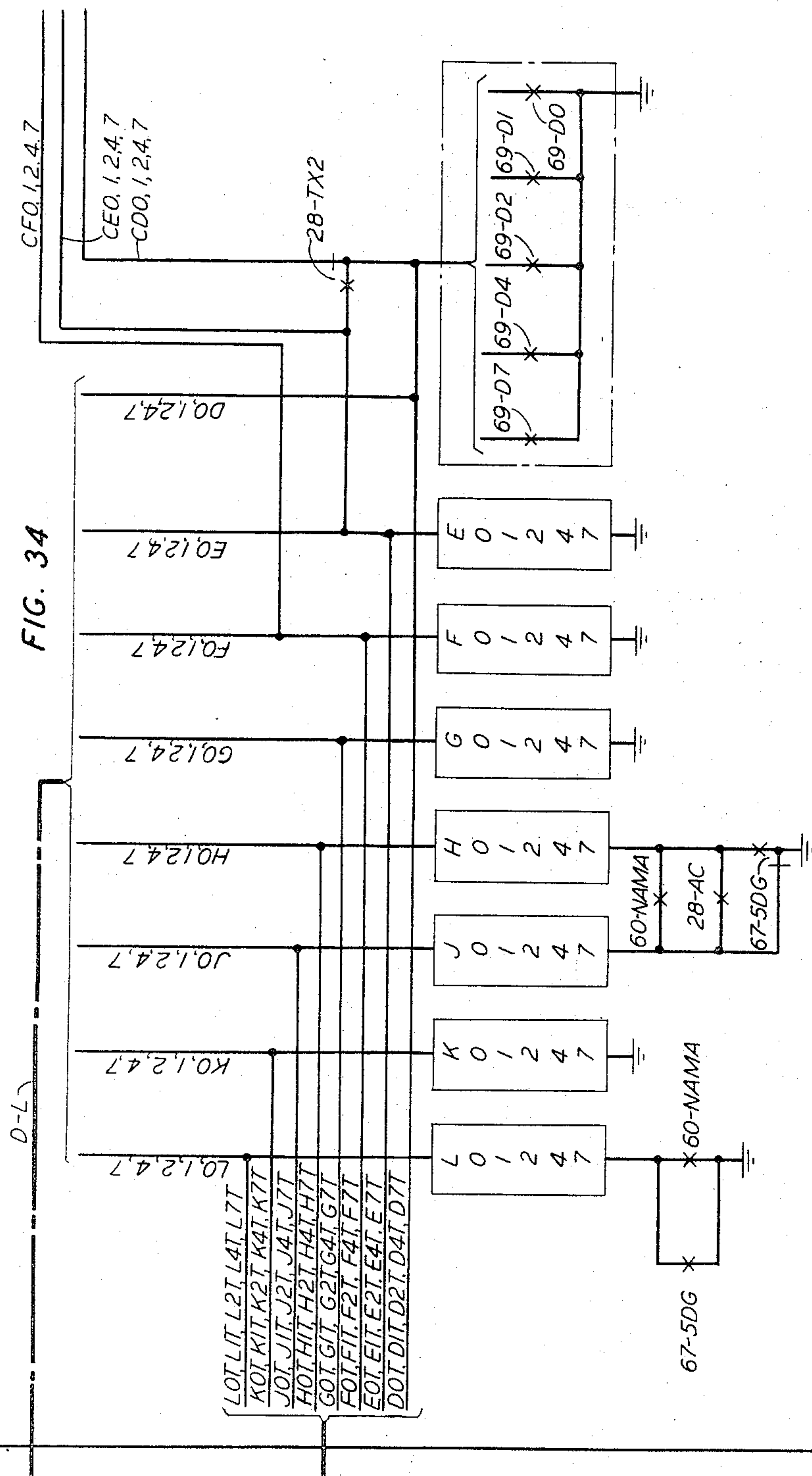
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 93



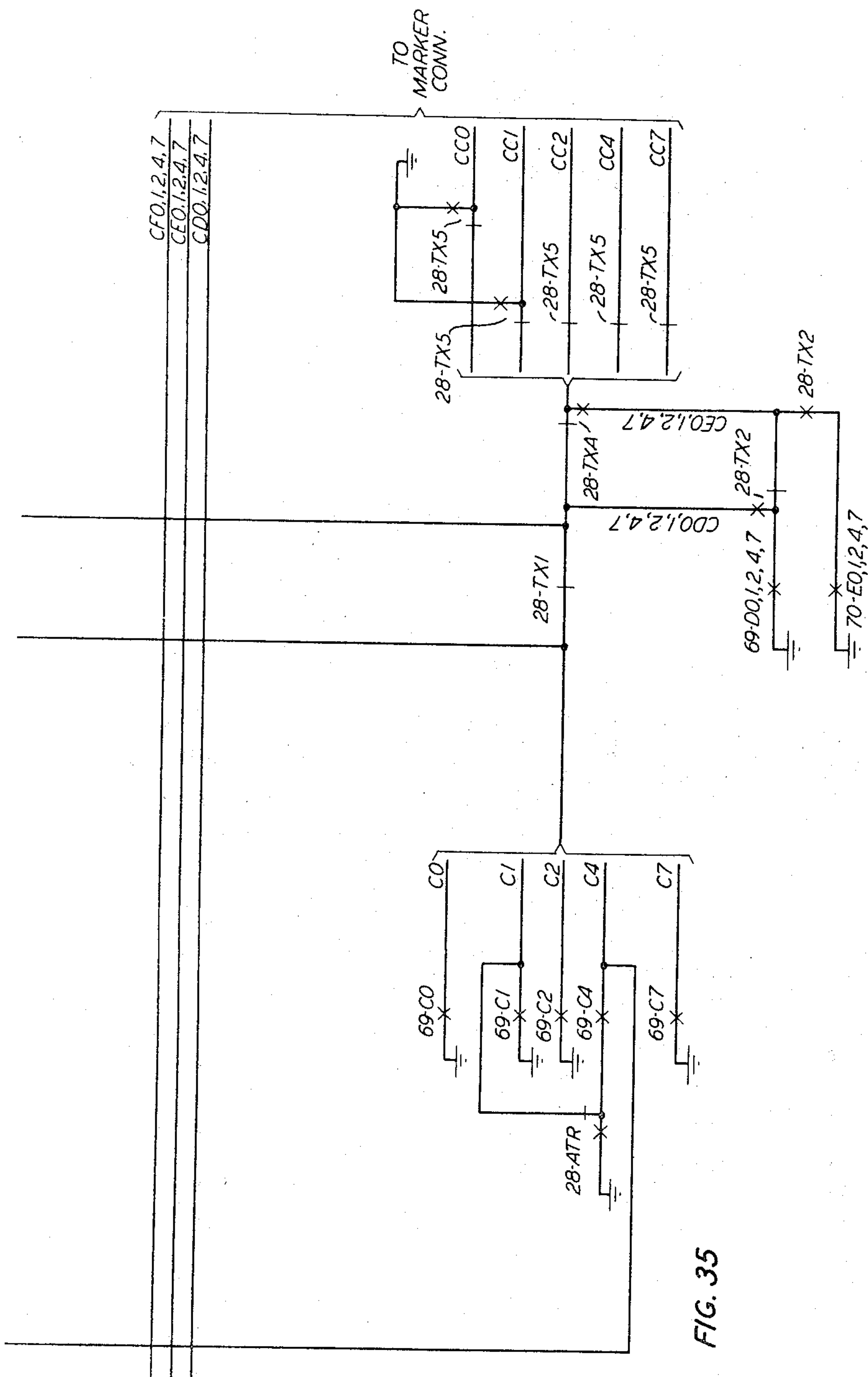
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 94



Sept. 12, 1967

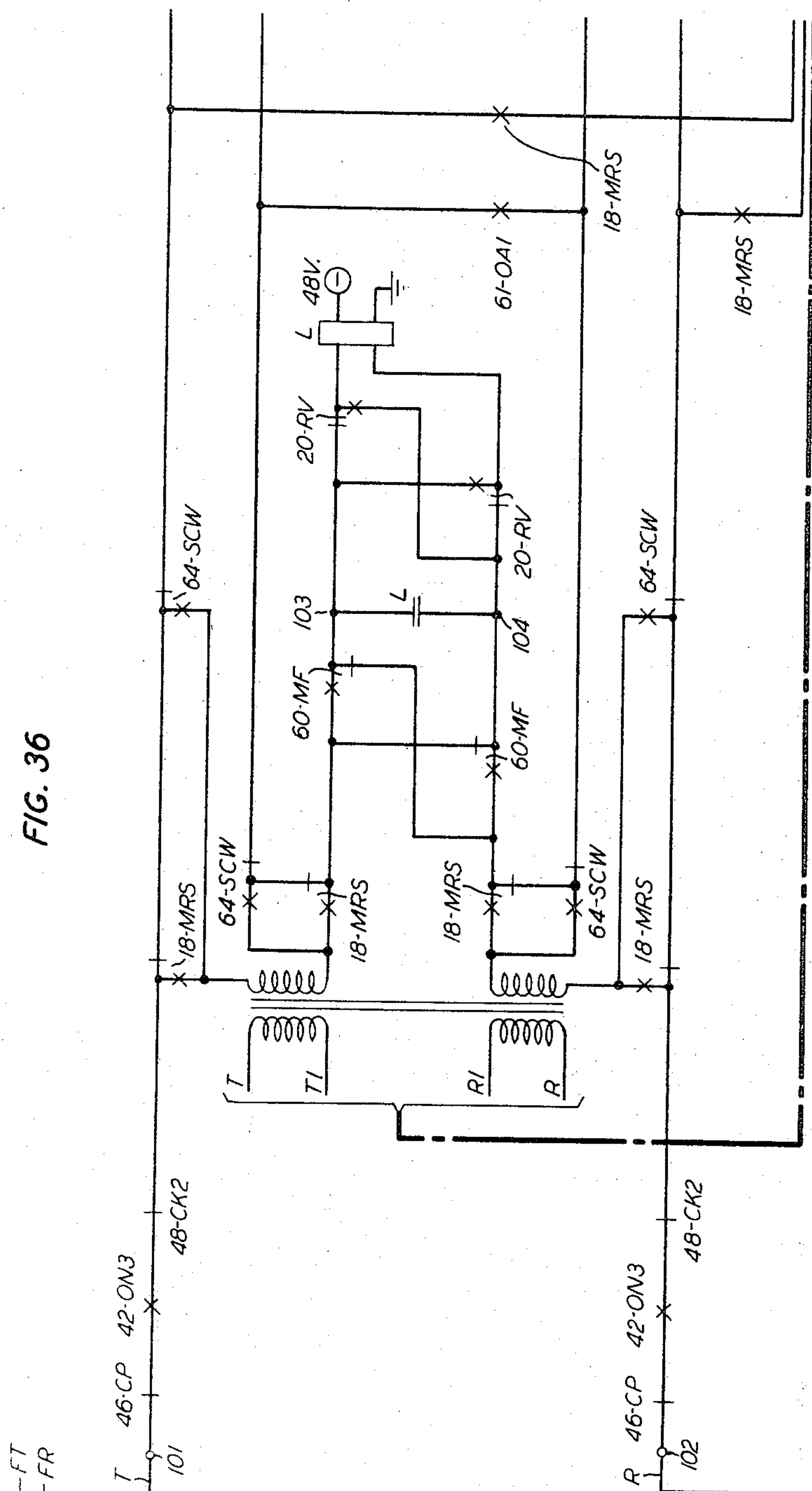
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 95

FIG. 36



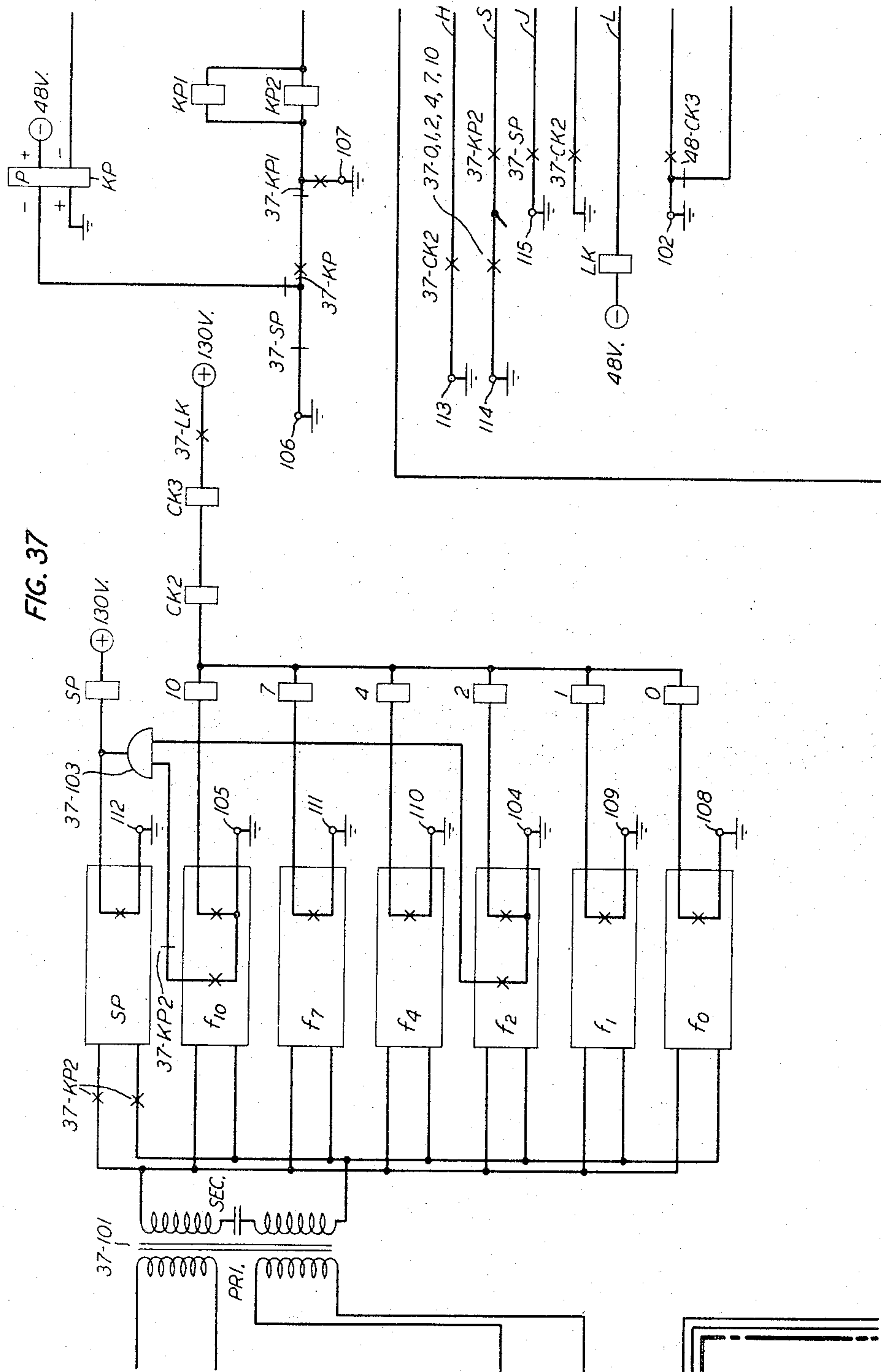
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3,341,662

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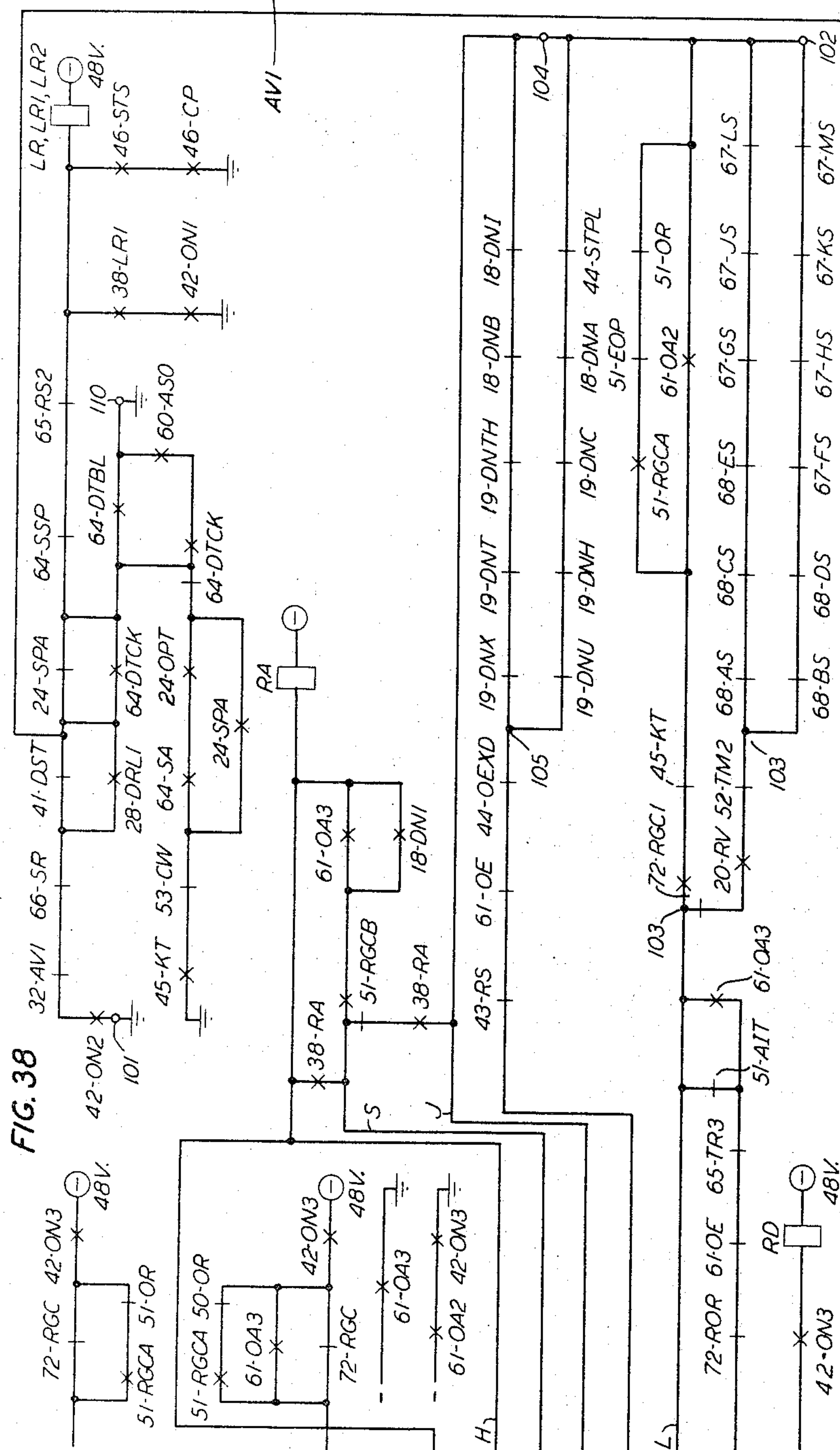
570 Sheets-Sheet 96



Filed Nov. 26, 1963

570 Sheets-Sheet 97

3,341,662



Sept. 12, 1967

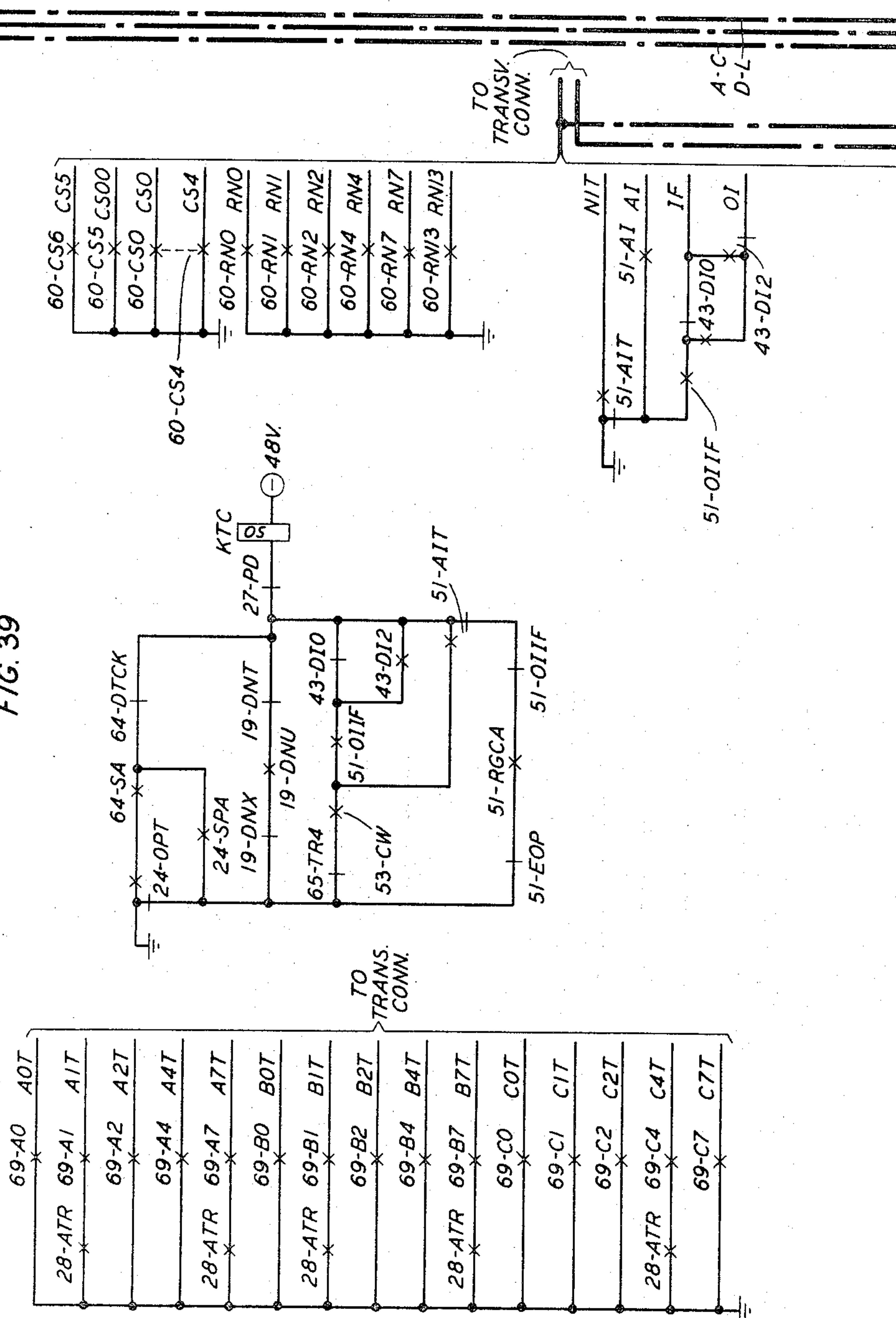
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 98

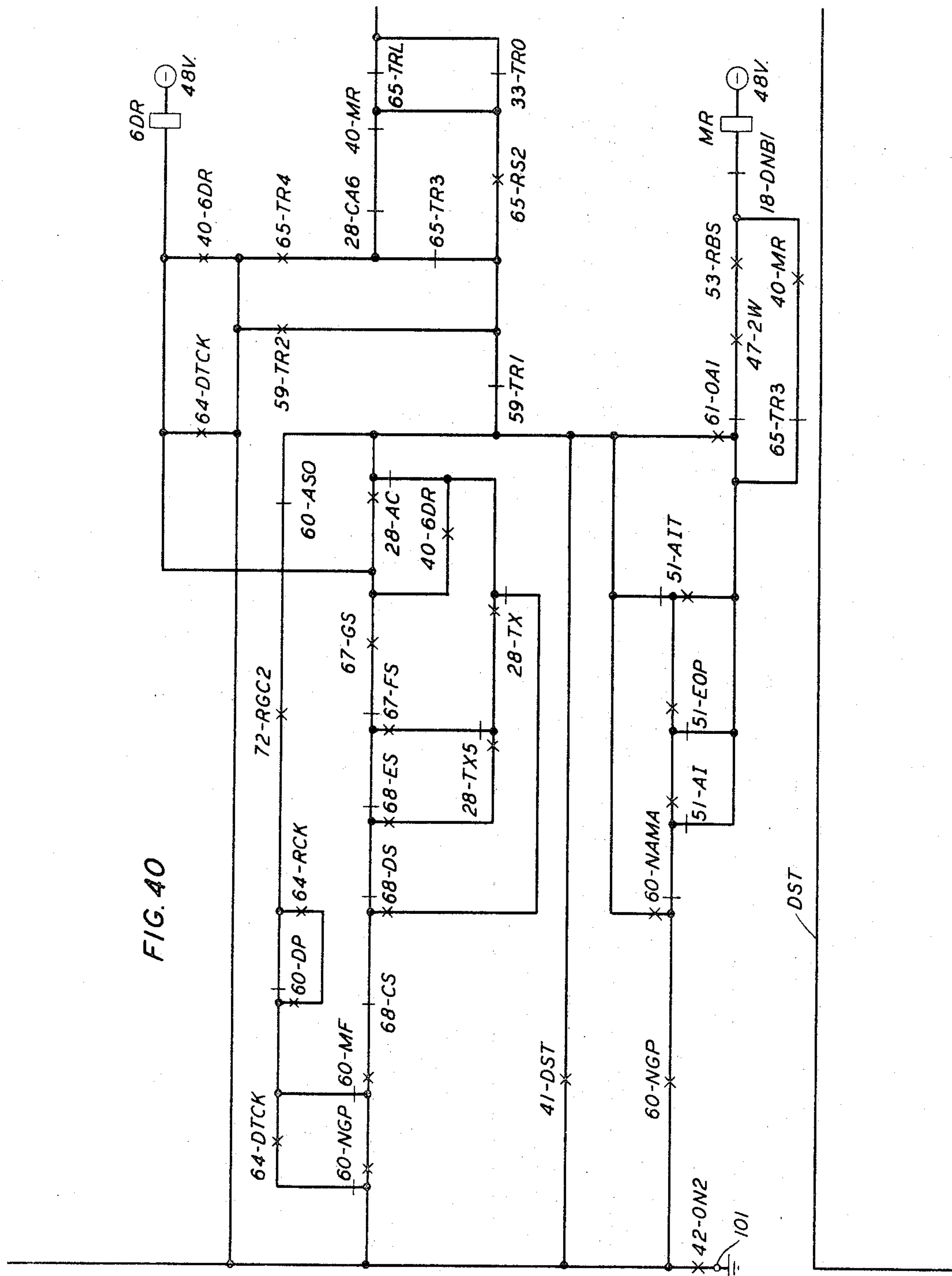
FIG. 39



Filed Nov. 26, 1963

570 Sheets-Sheet 99

570 Sheets-Sheet 99



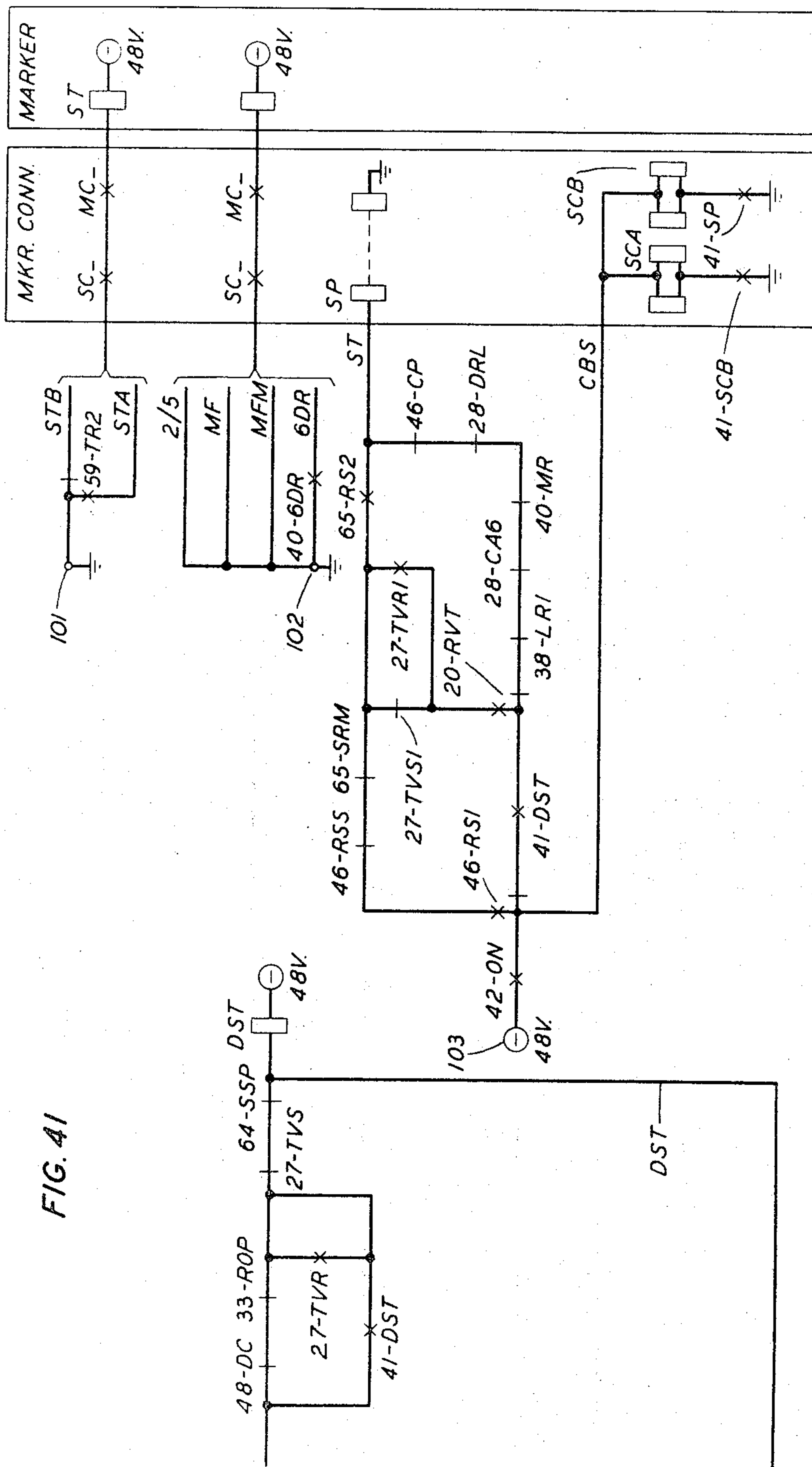
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 100



Sept. 12, 1967

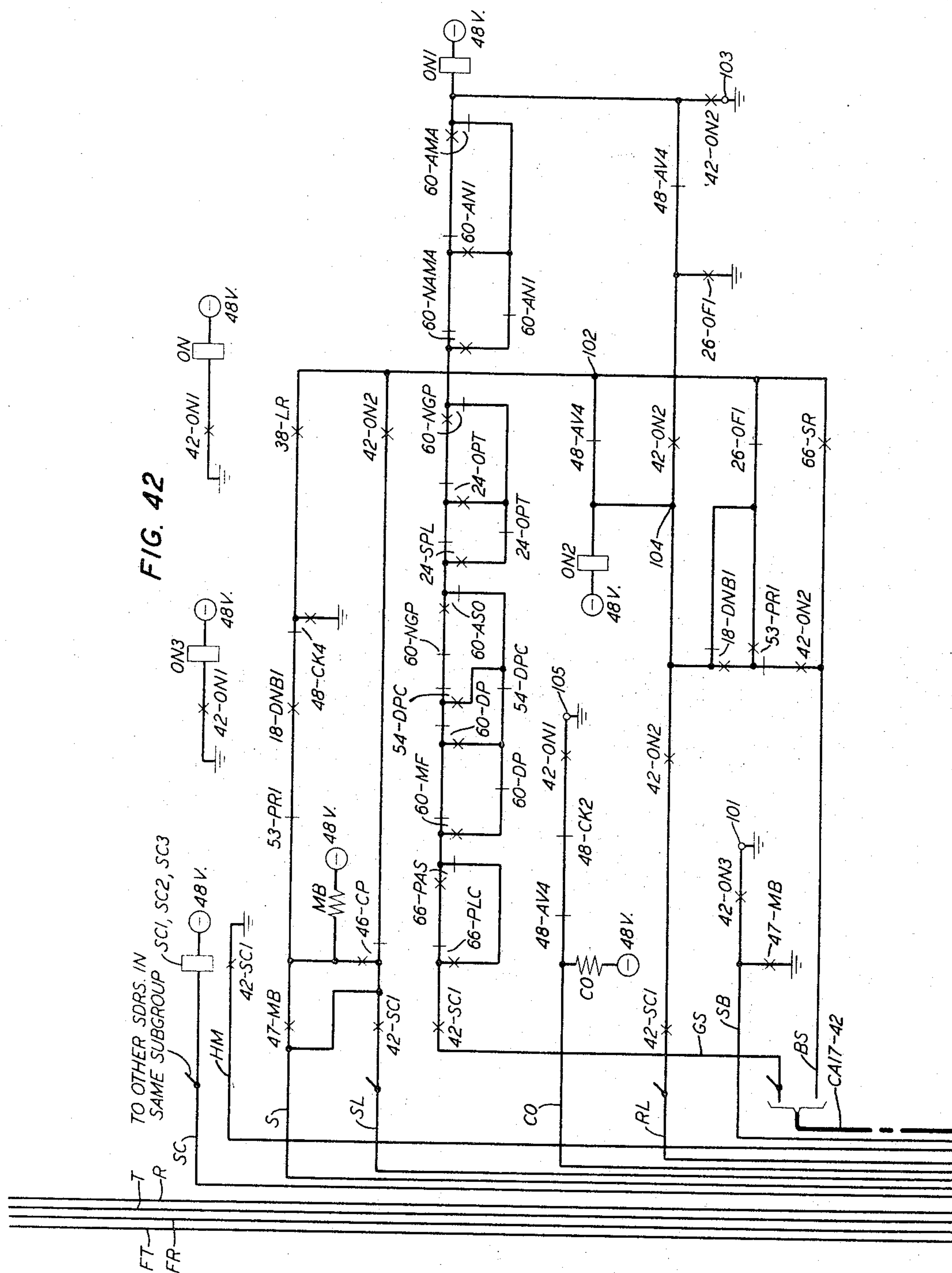
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 101

FIG. 42



Sept. 12, 1967

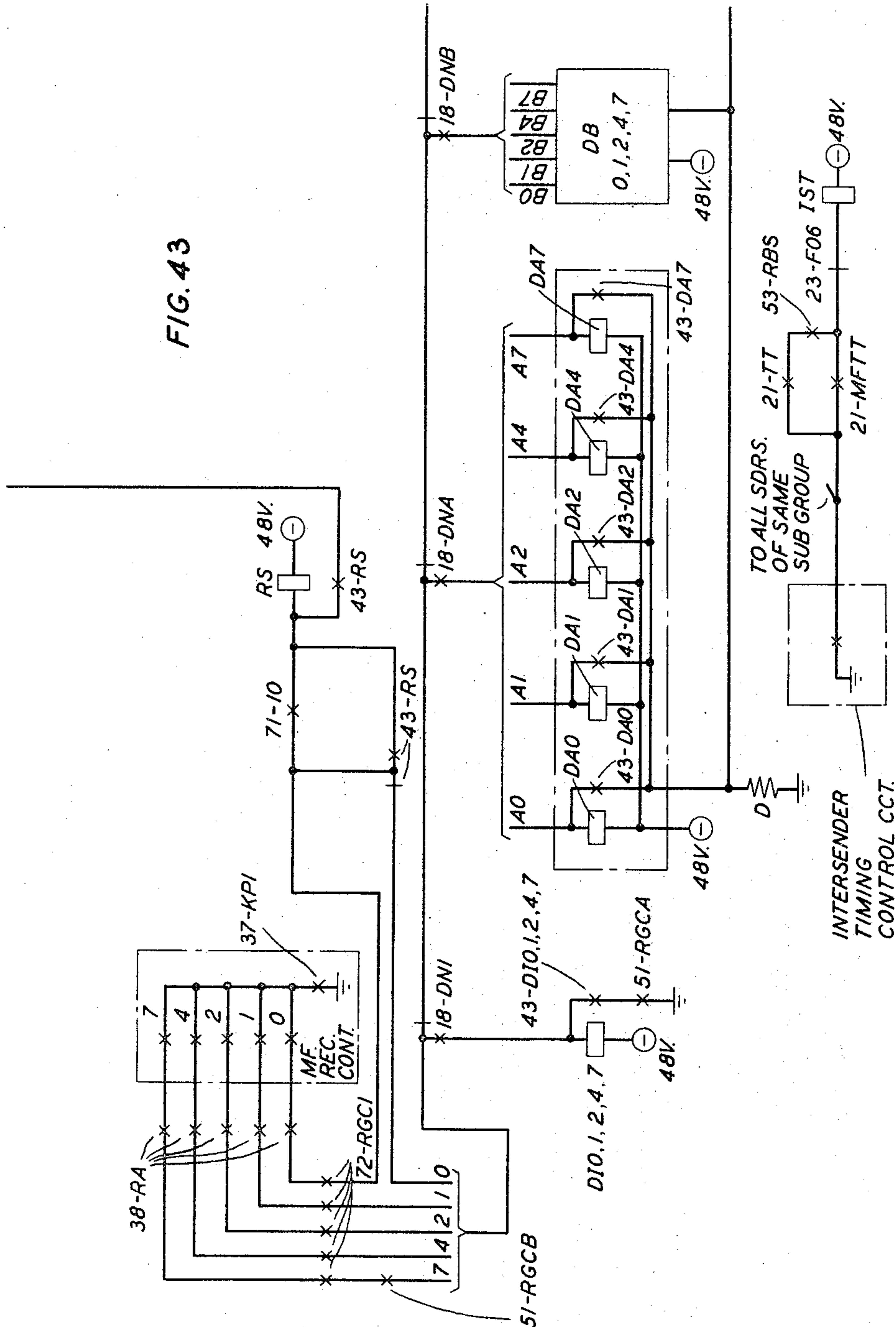
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 102

FIG. 43



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 103

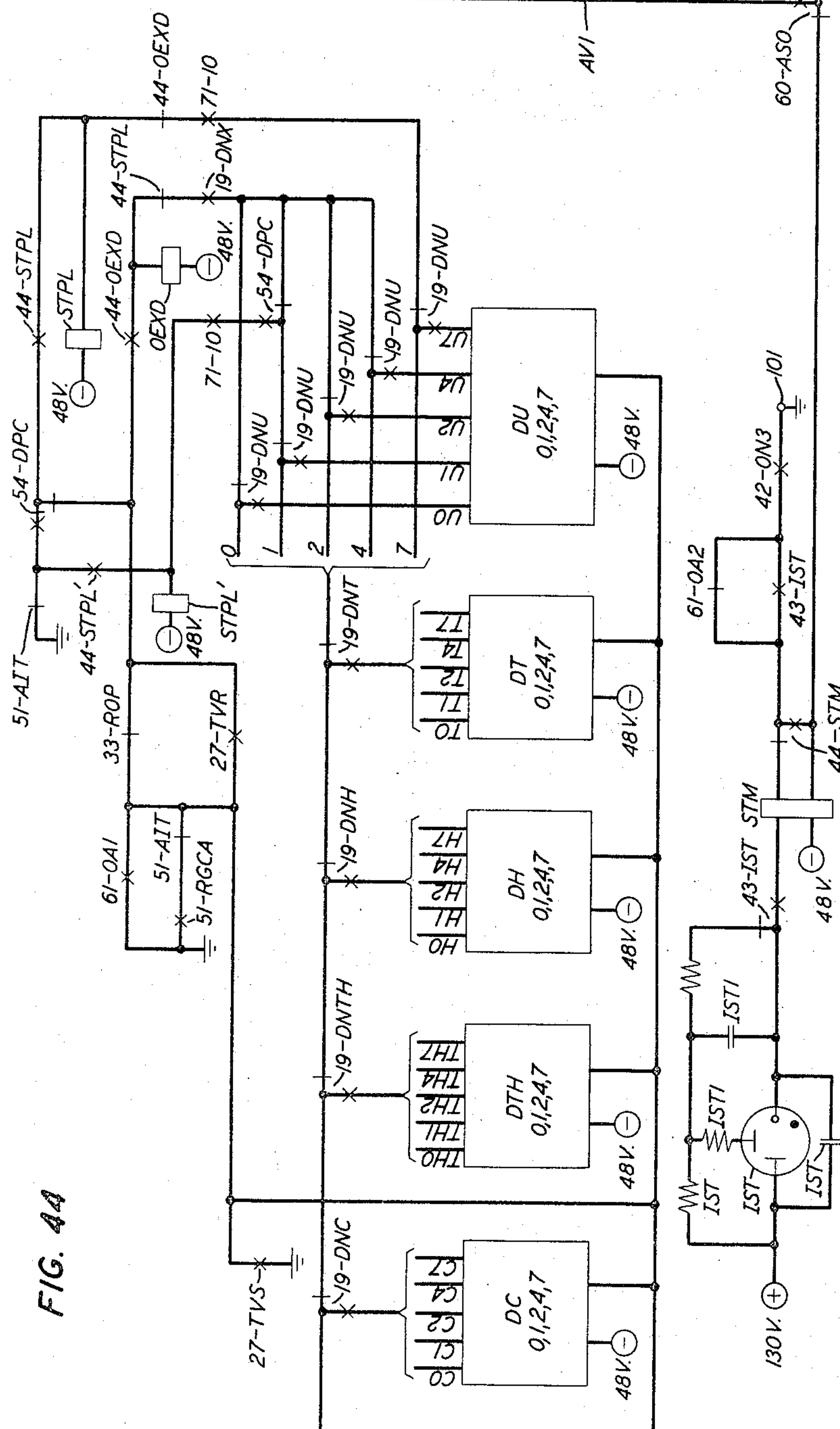


FIG. 44

Sept. 12, 1967.

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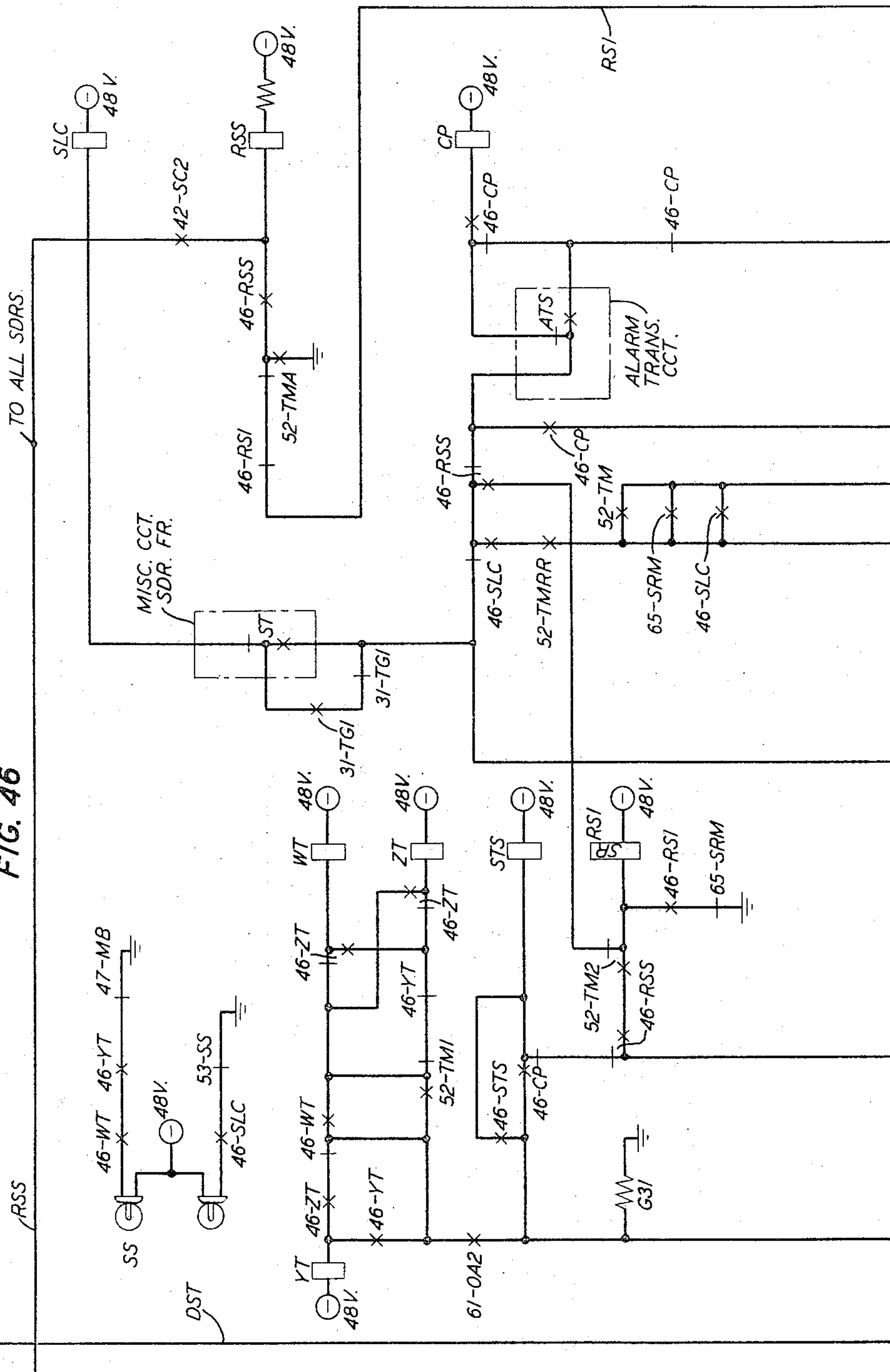
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 105

FIG. 46



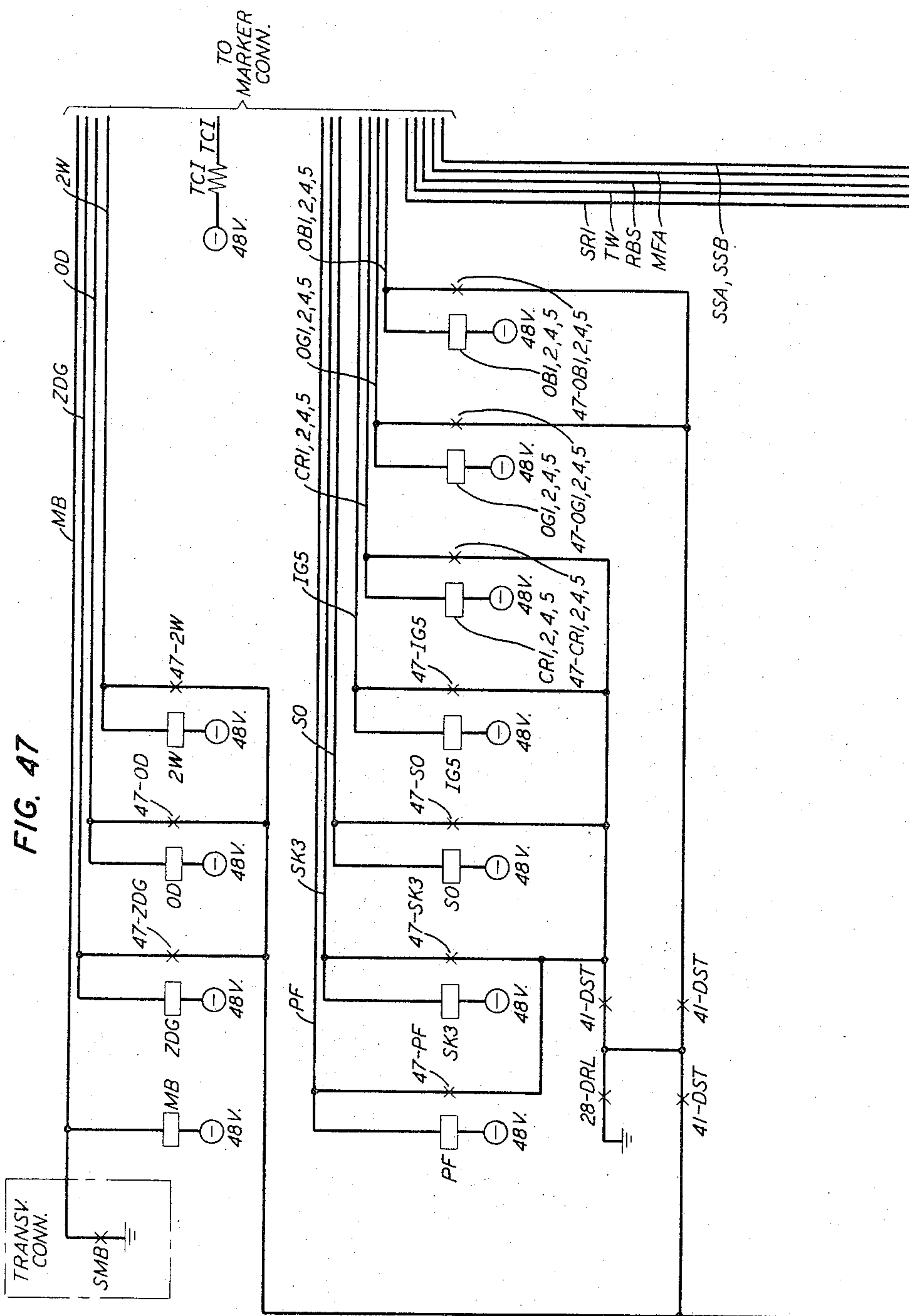
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 106



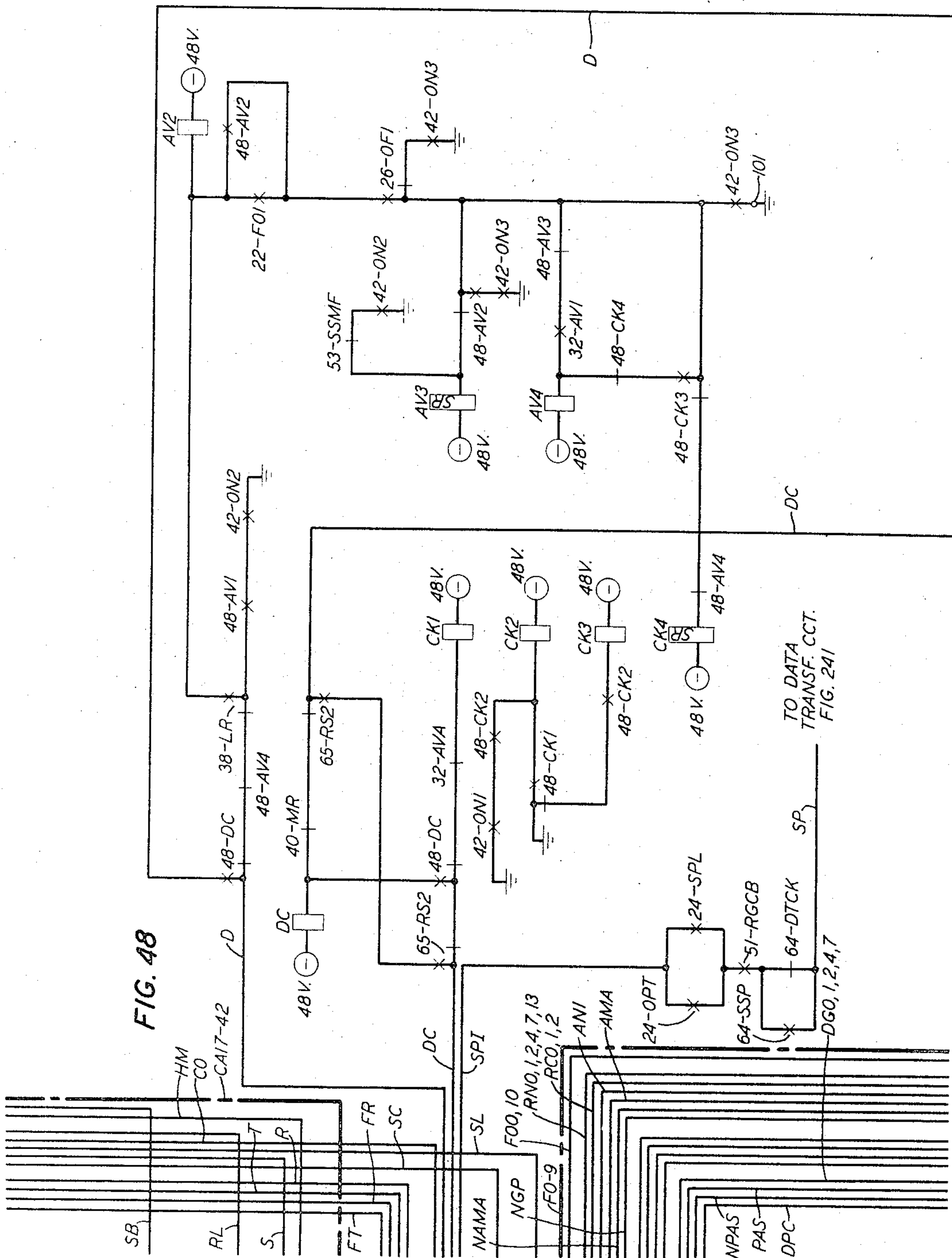
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 107



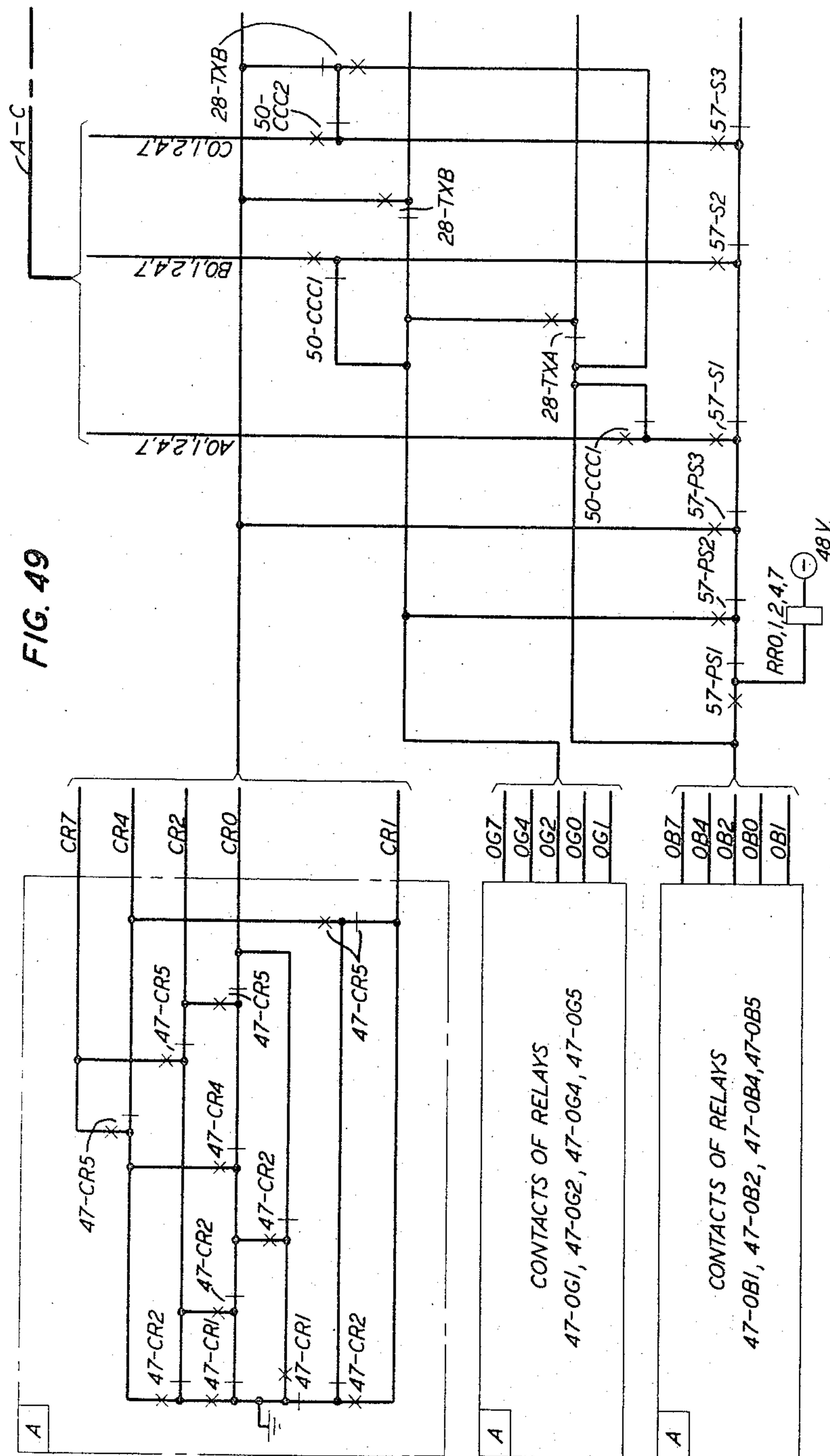
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 108



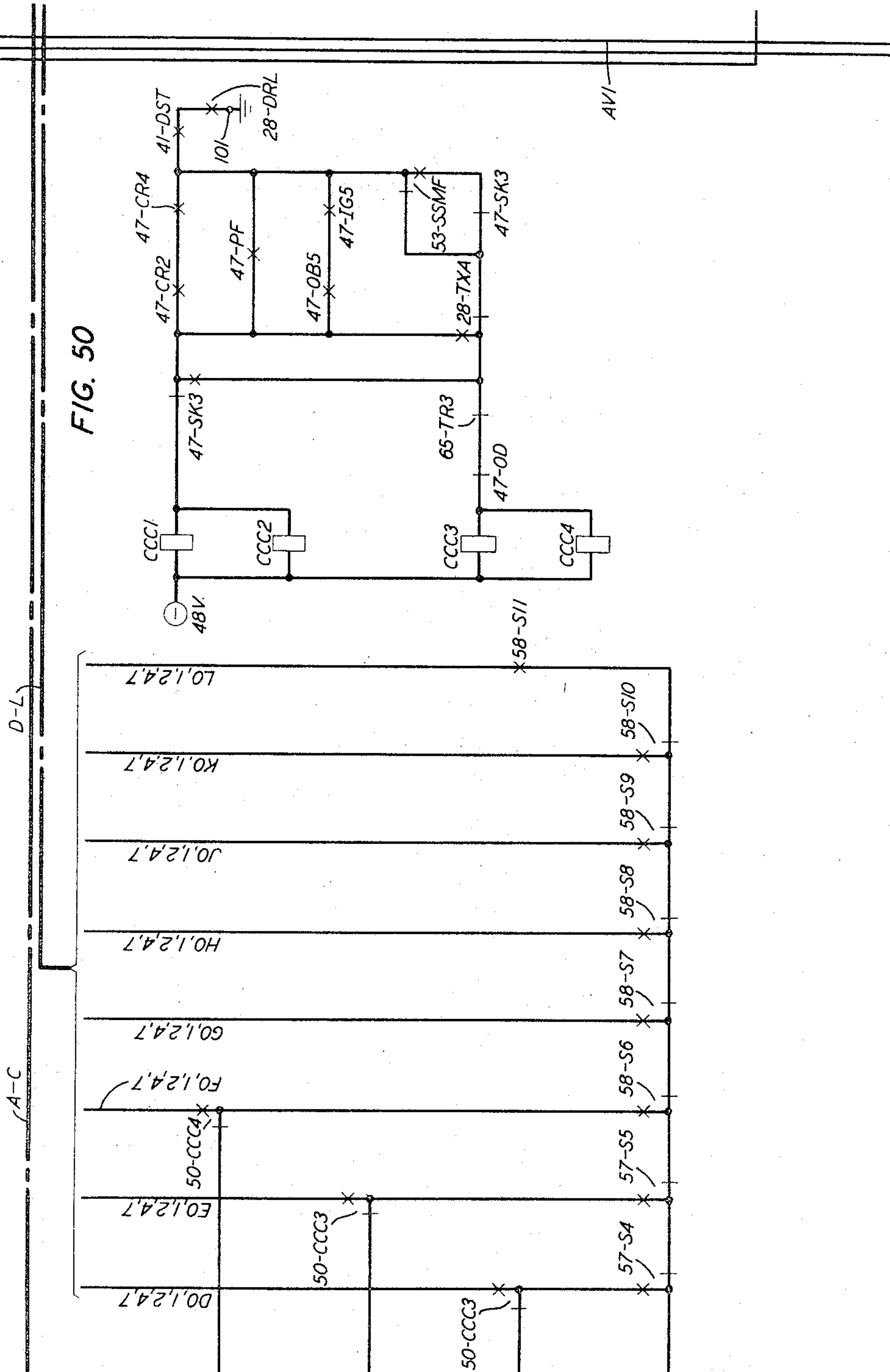
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 109



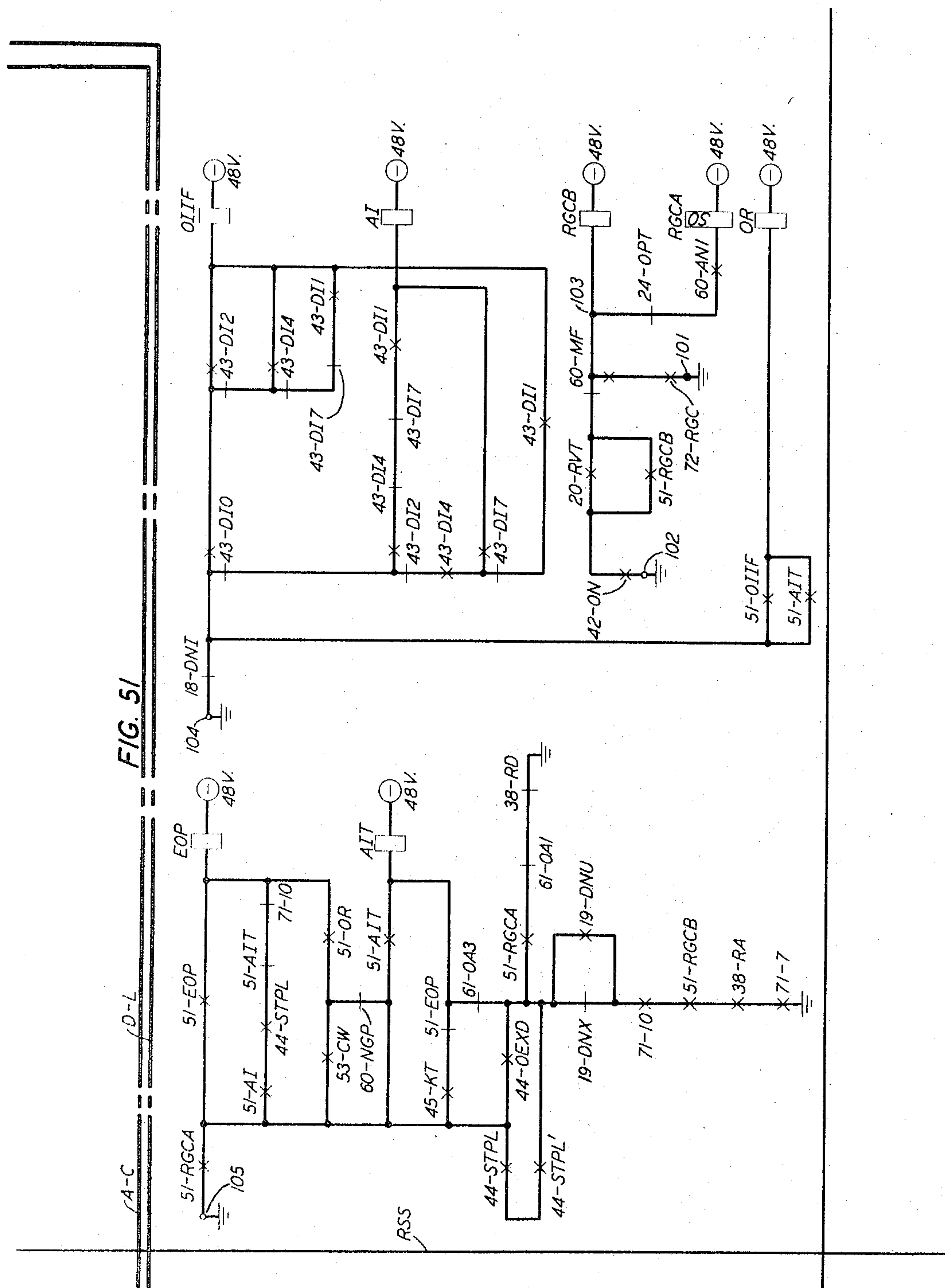
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 110



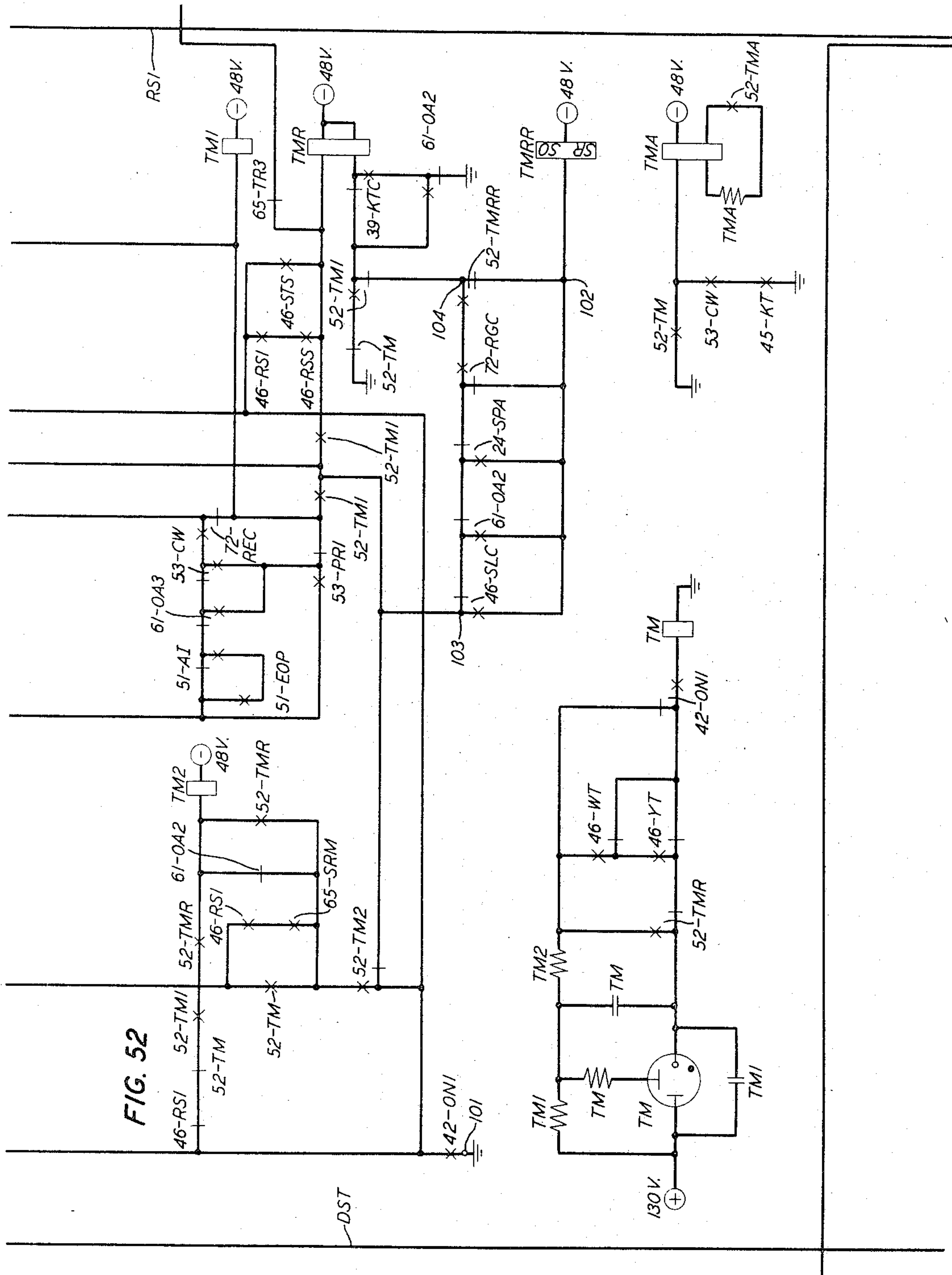
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

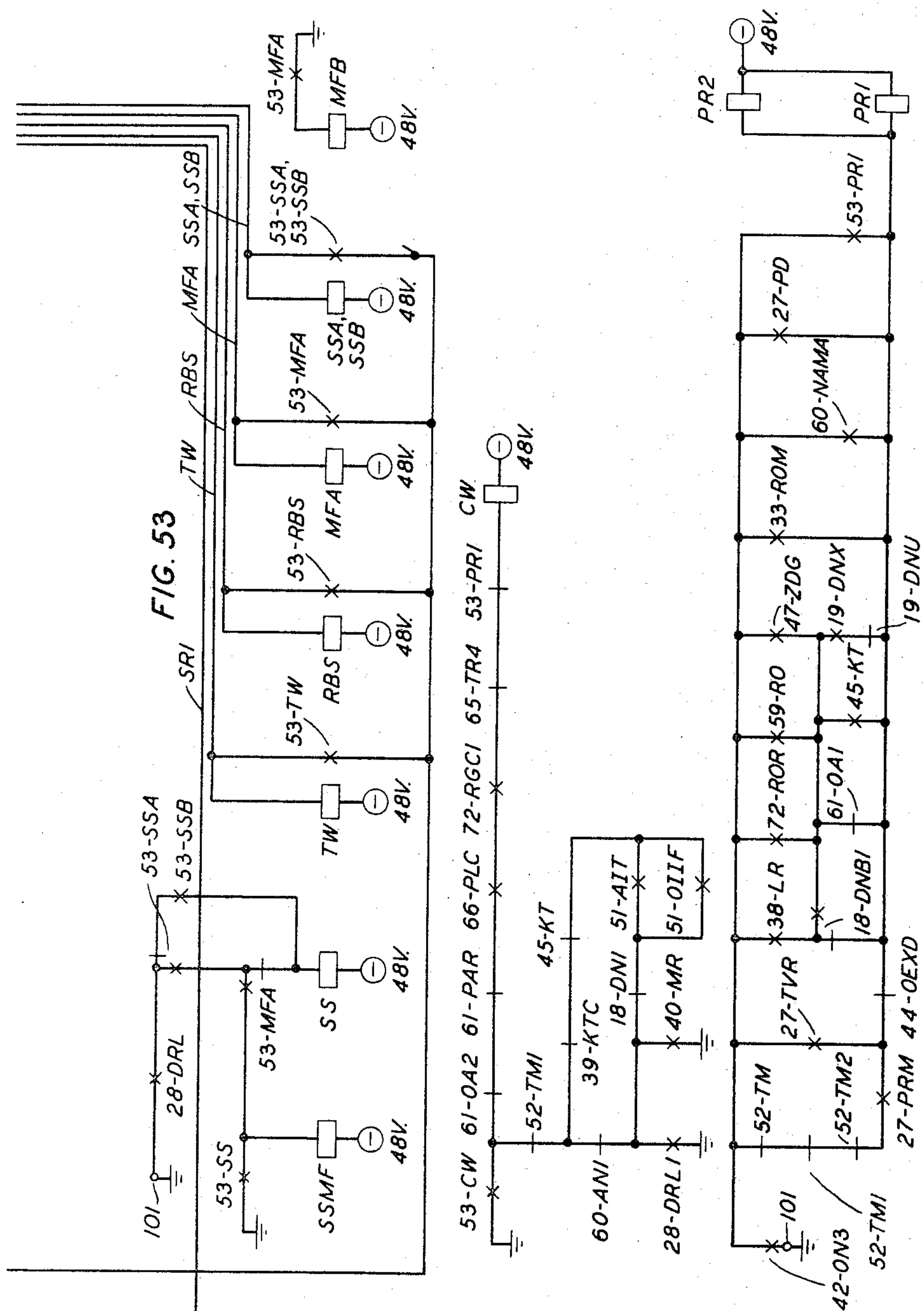
570 Sheets-Sheet 111



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

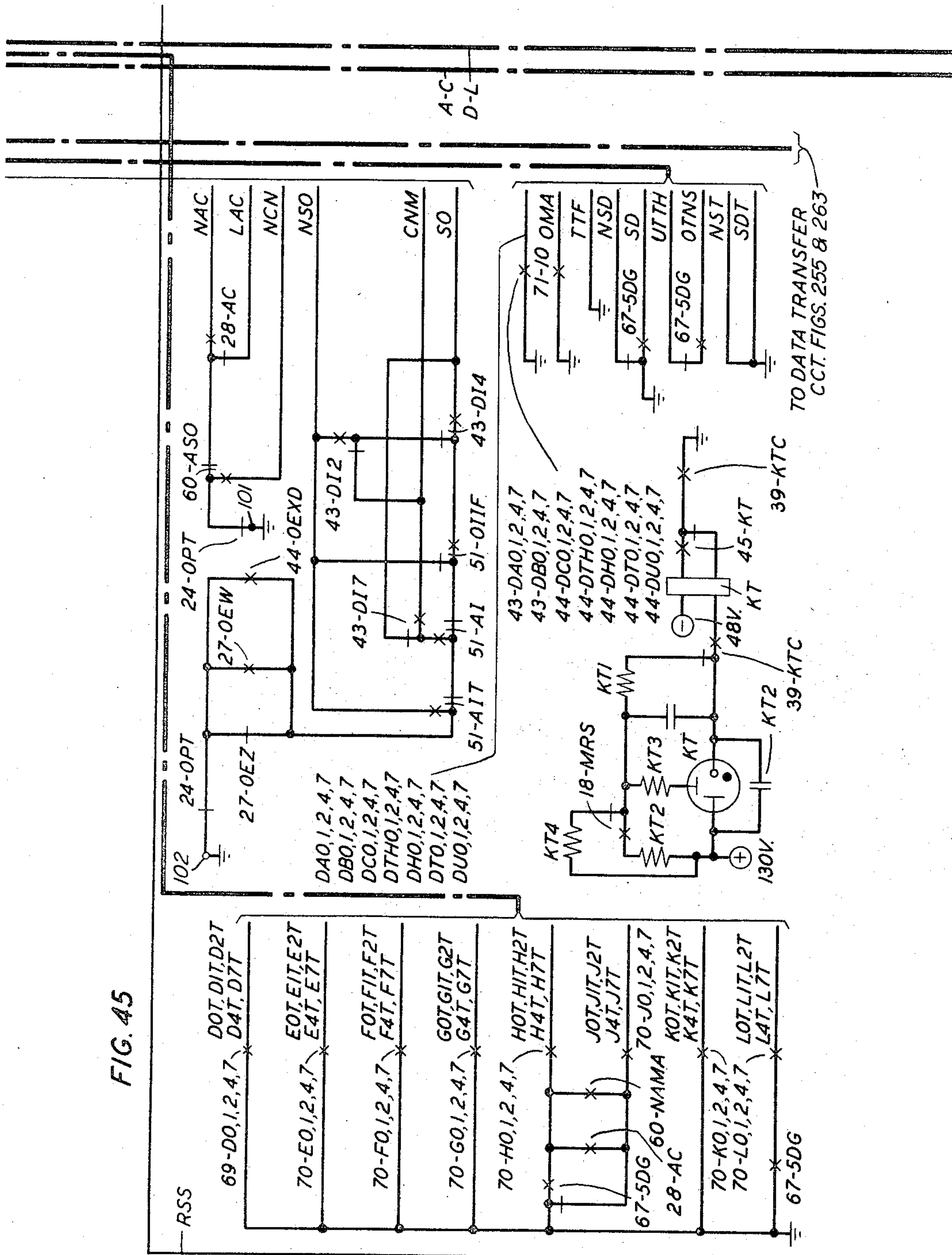
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Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 104



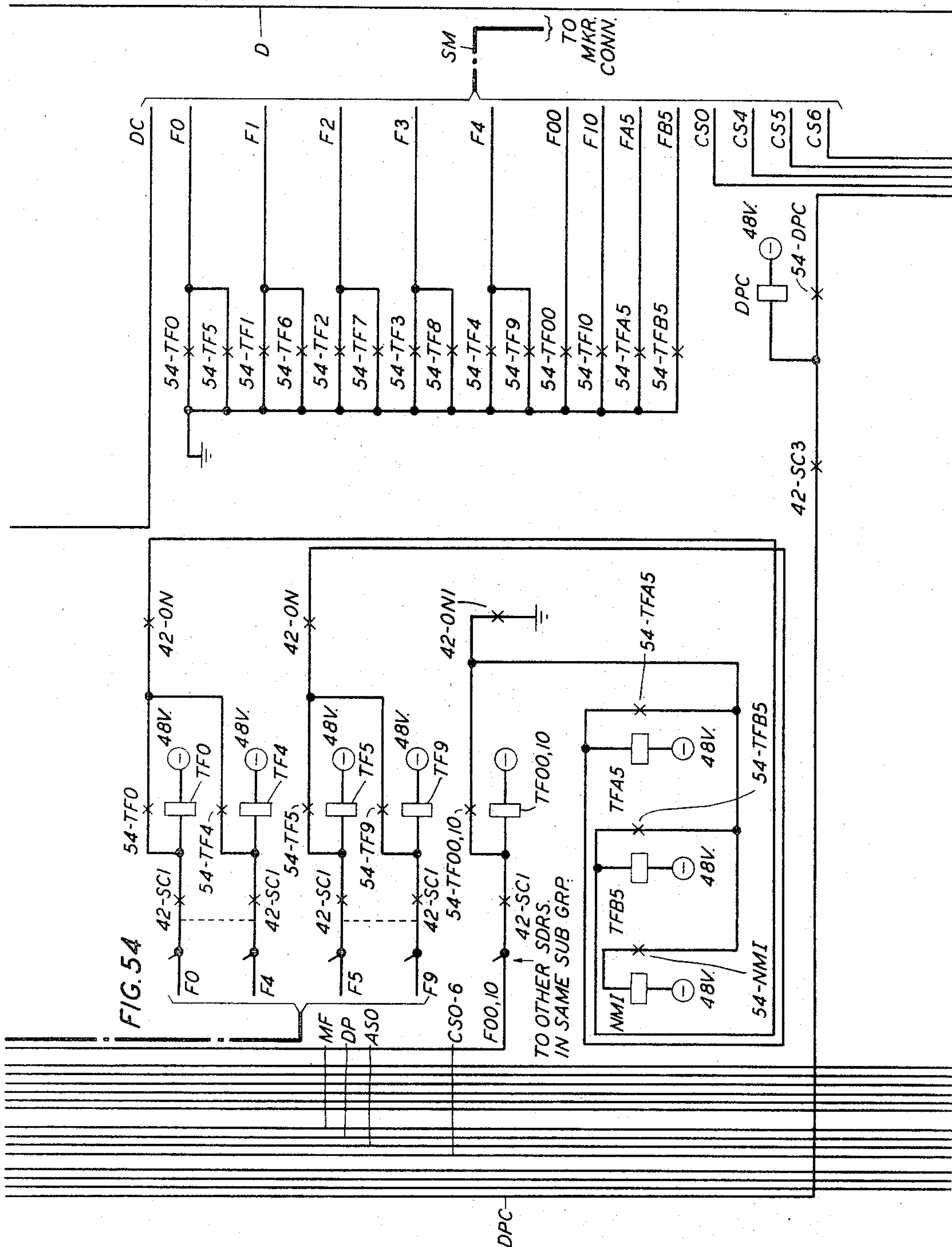
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 113



Sept. 12, 1967

L. J. CERNY ETAL

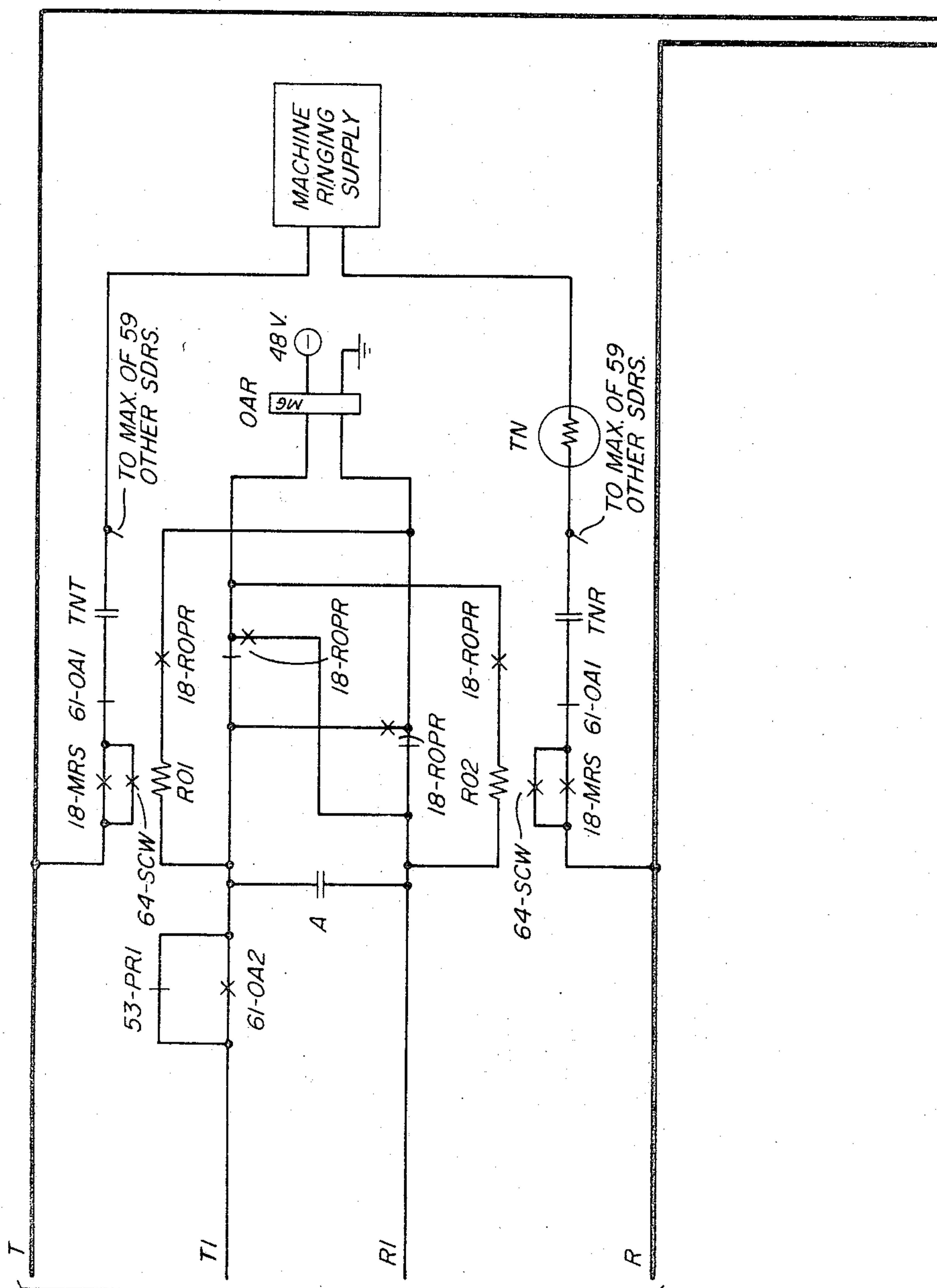
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 114

FIG. 55



Sept. 12, 1967

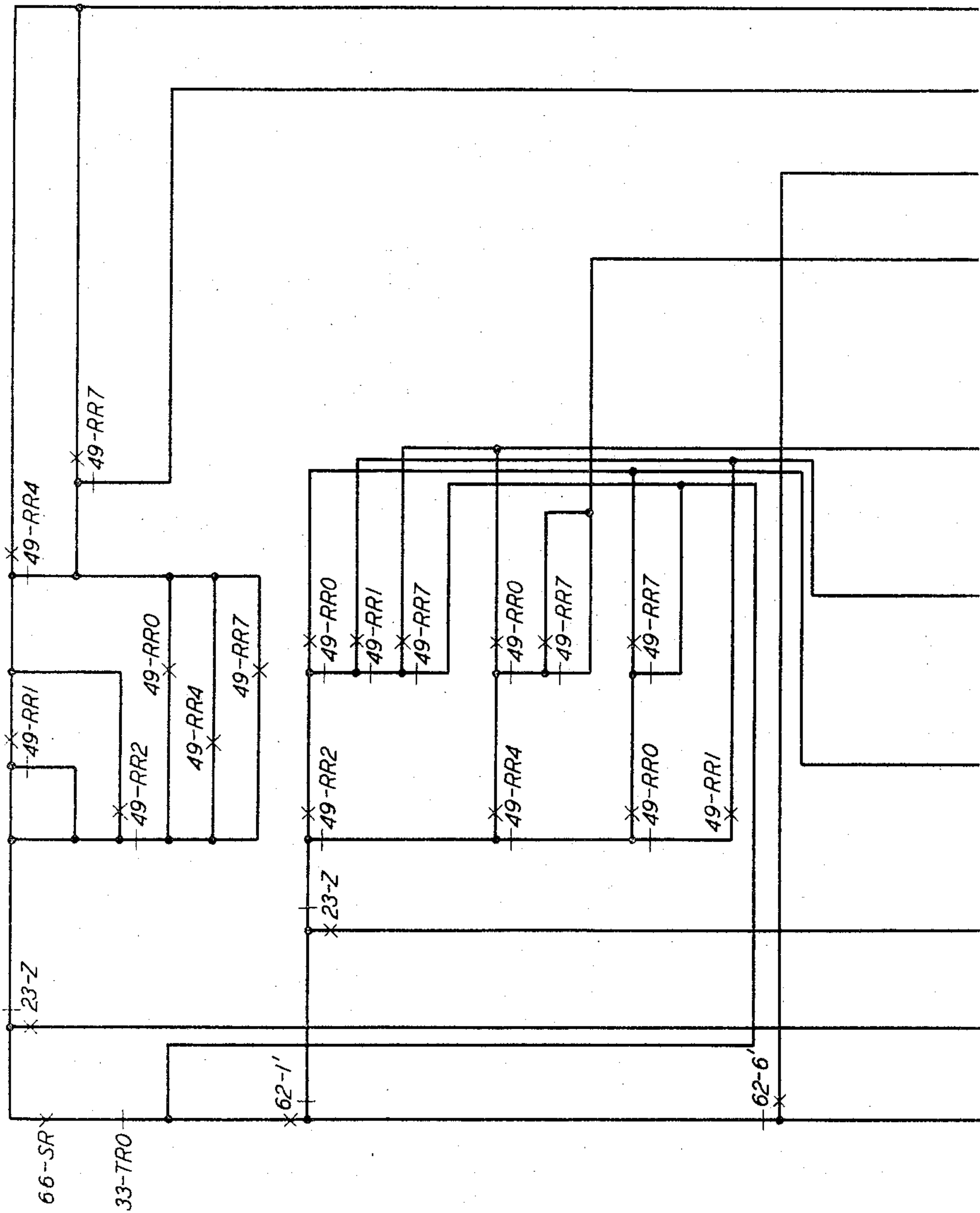
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 115

FIG. 56



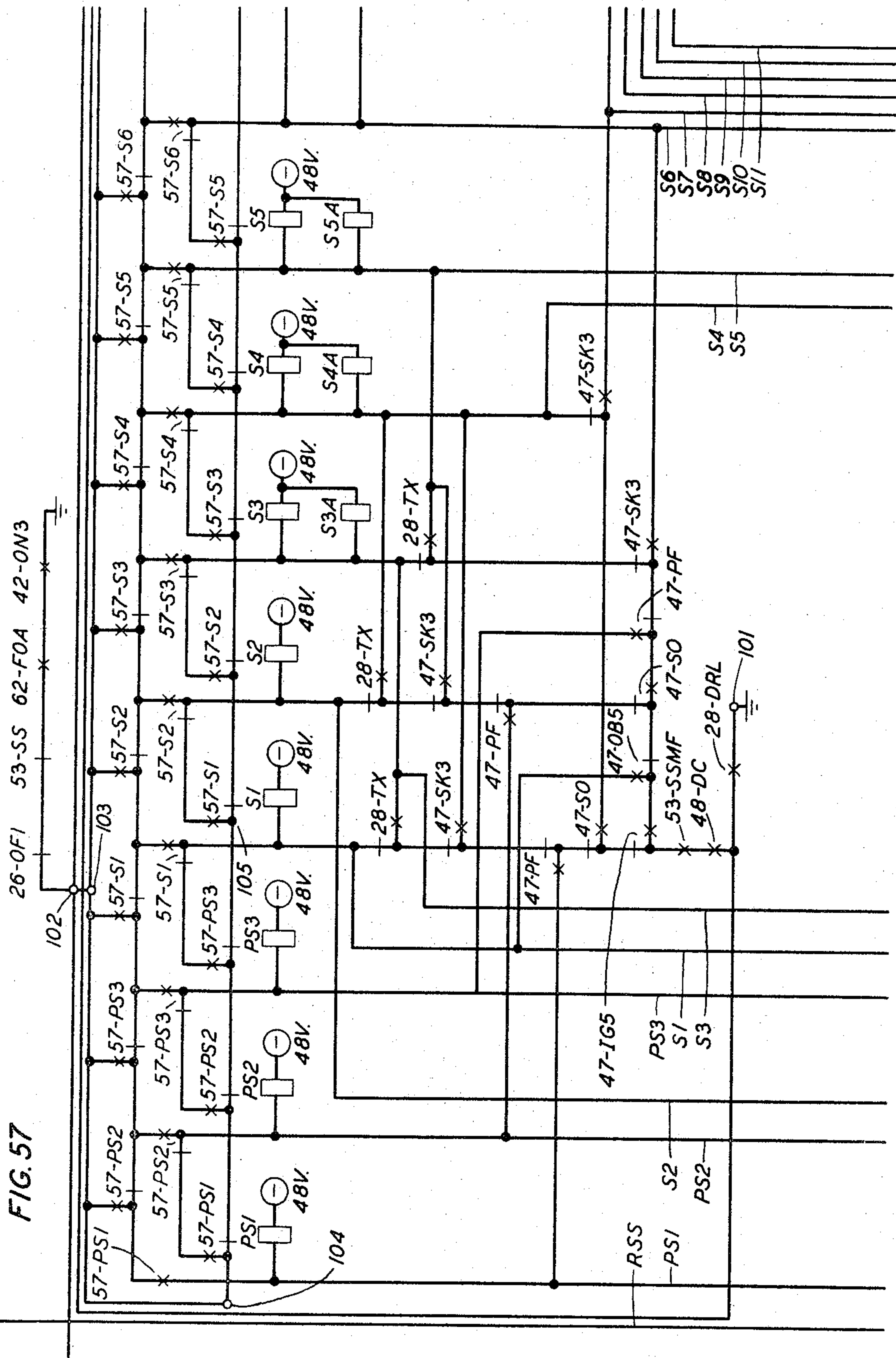
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 116



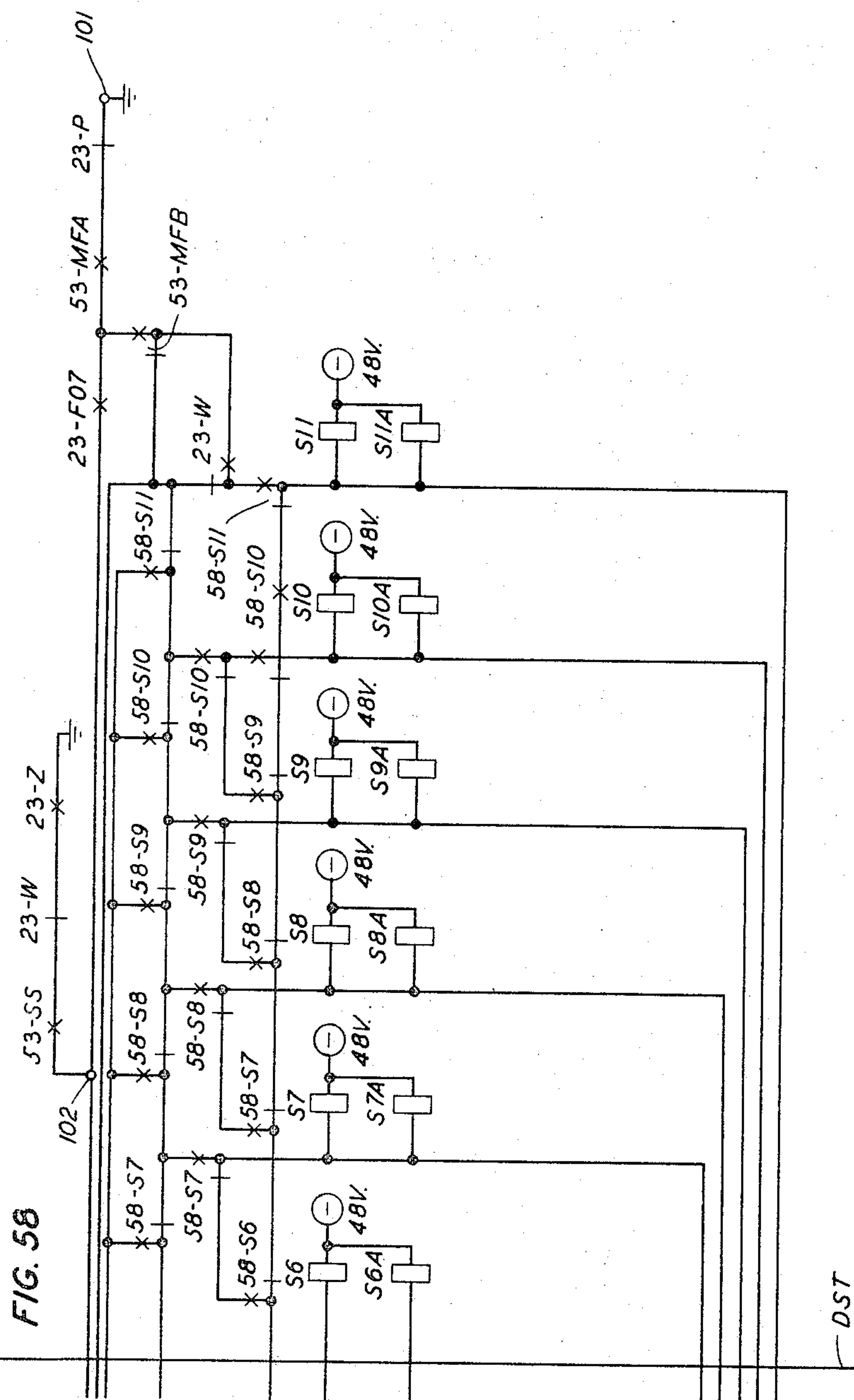
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Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 117



Sept. 12, 1967

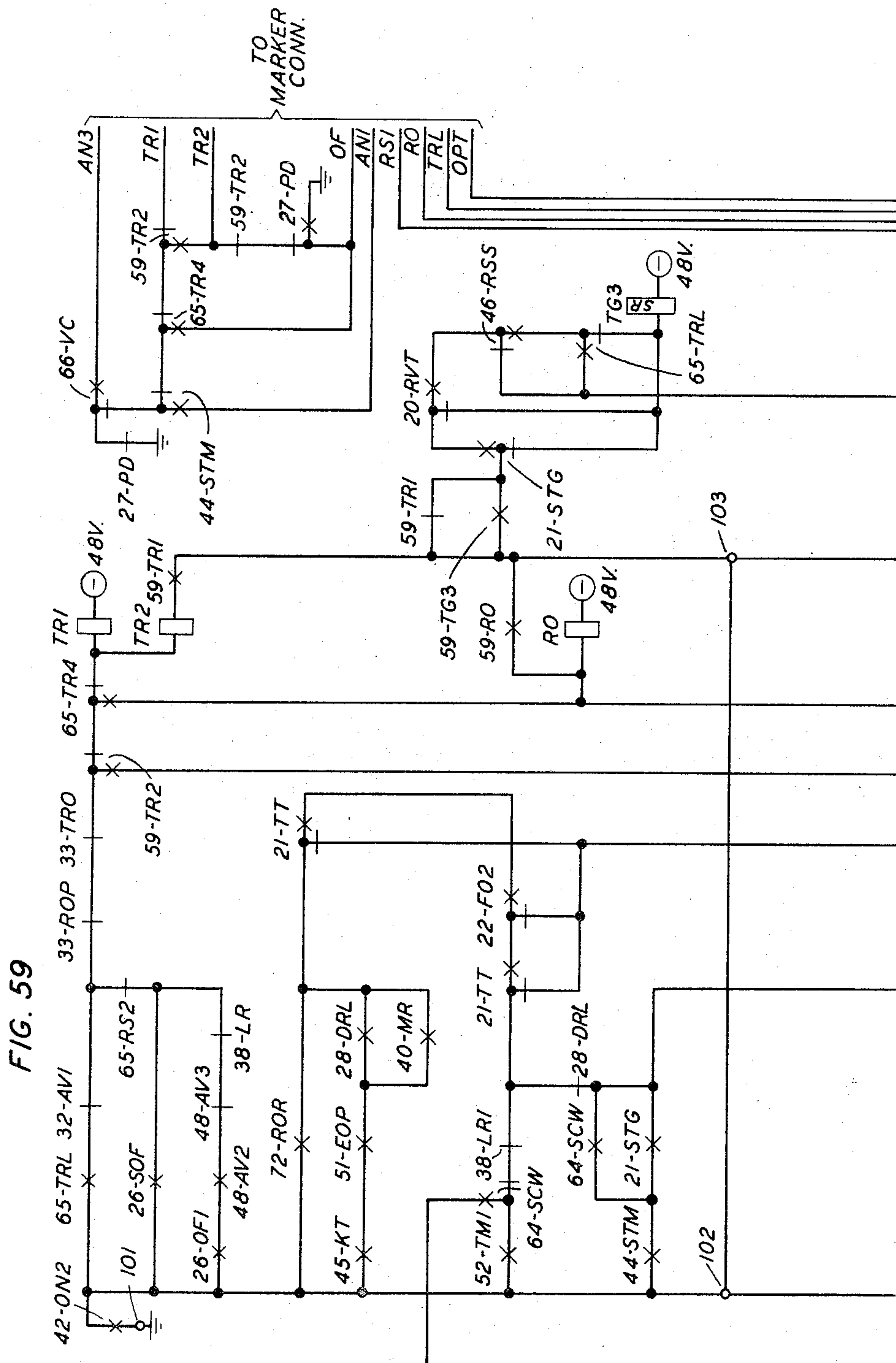
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3,341,662

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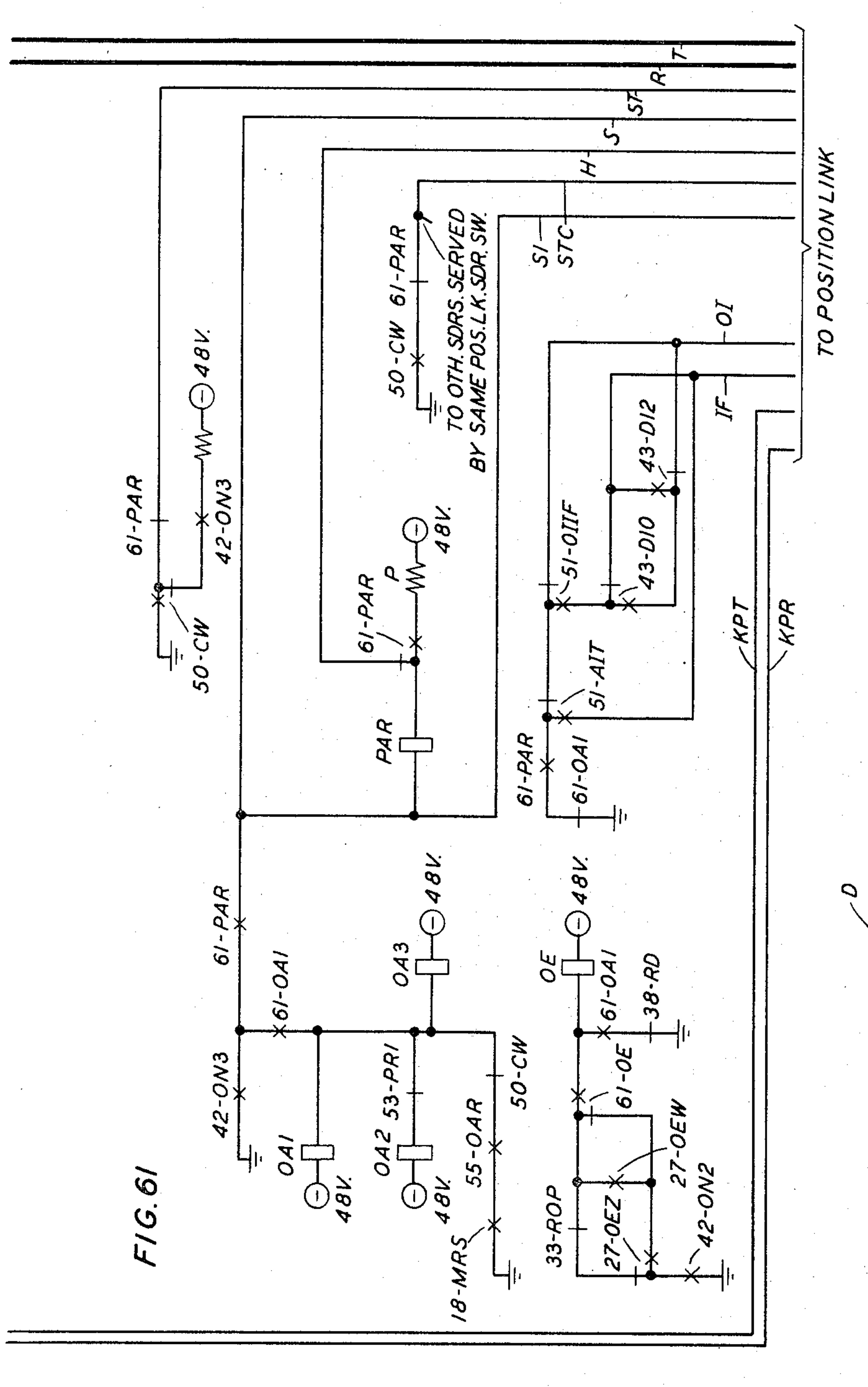
570 Sheets-Sheet 118



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 120



Sept. 12, 1967

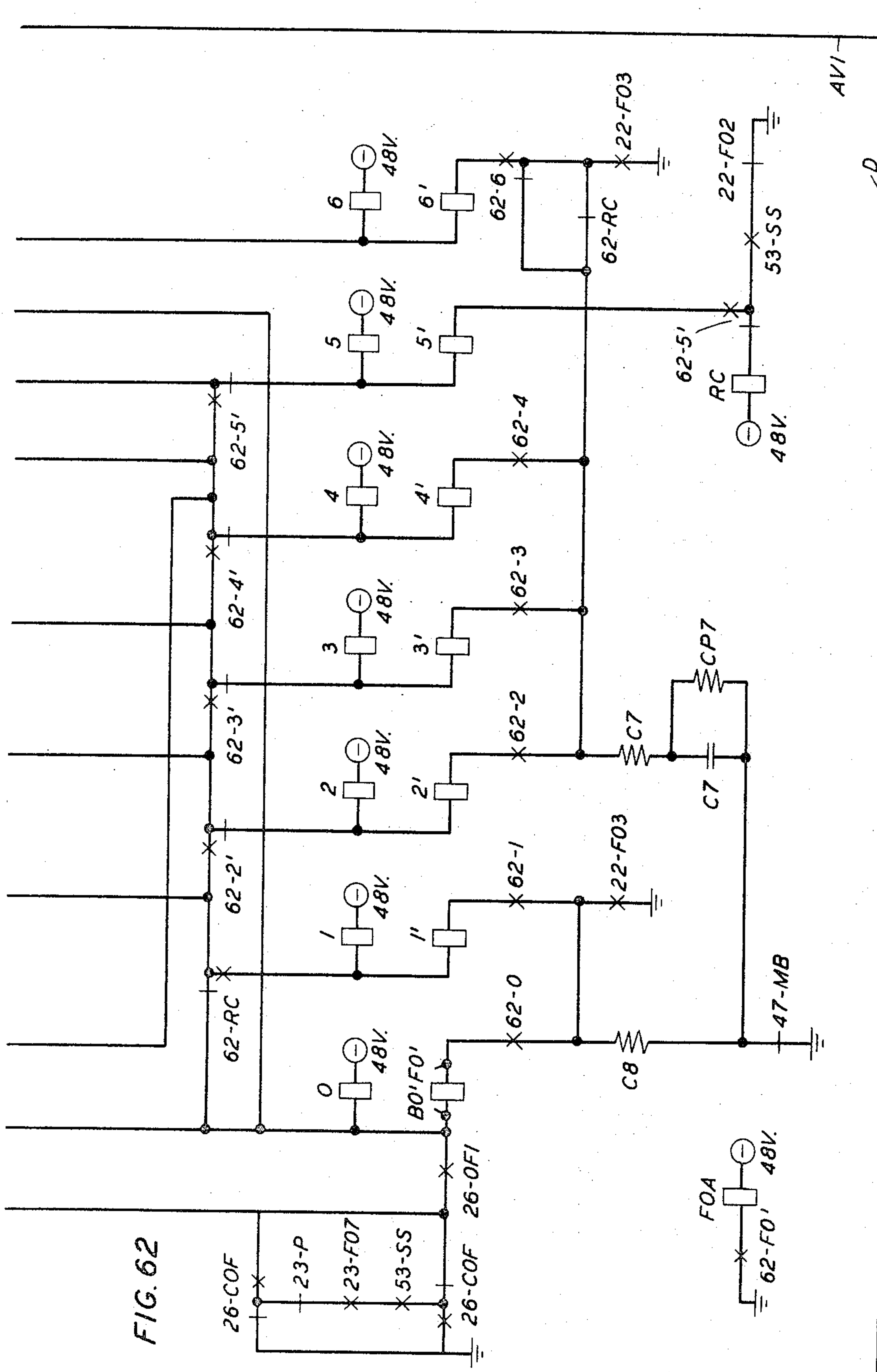
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3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 121



Sept. 12, 1967

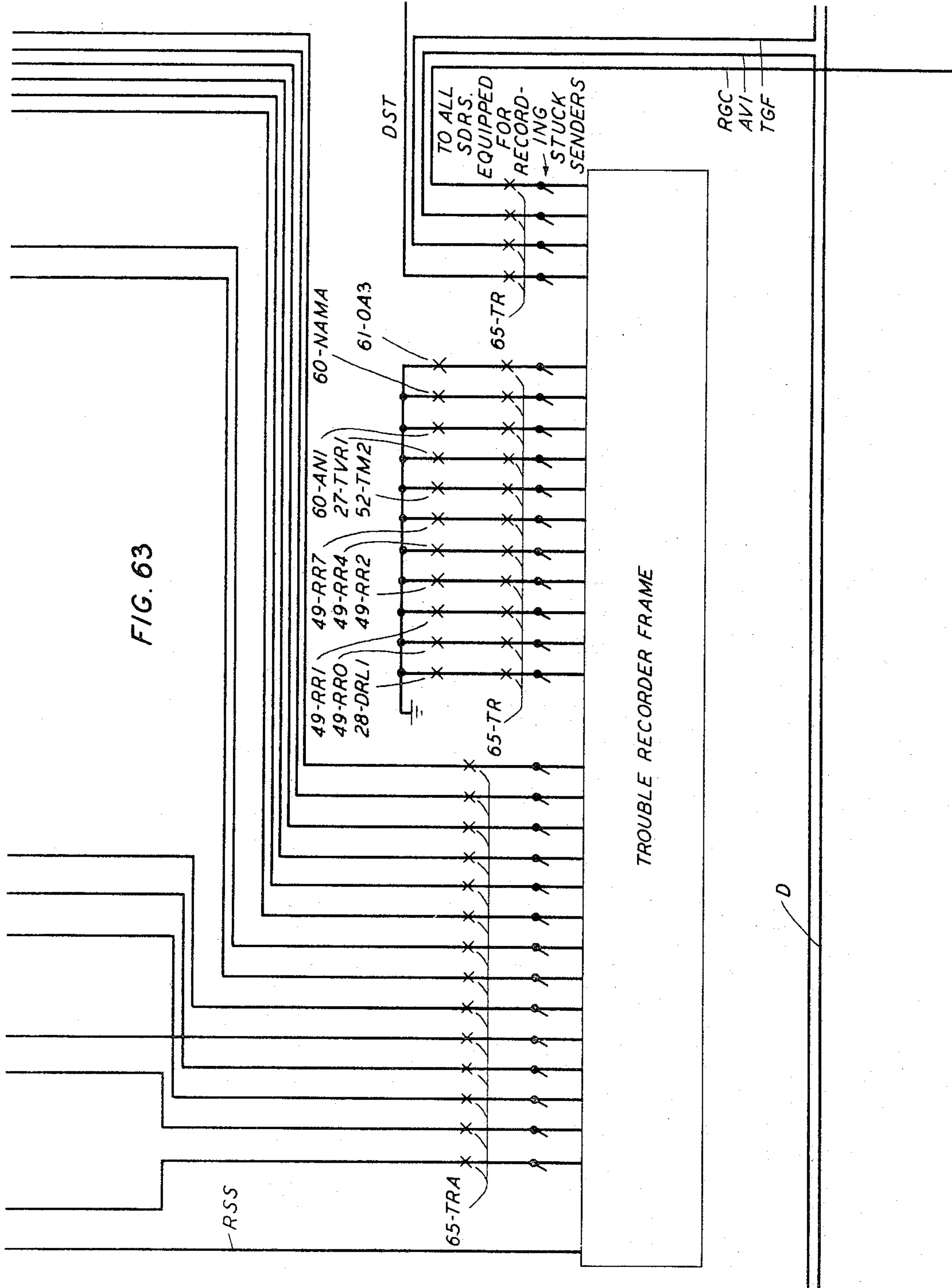
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3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 123



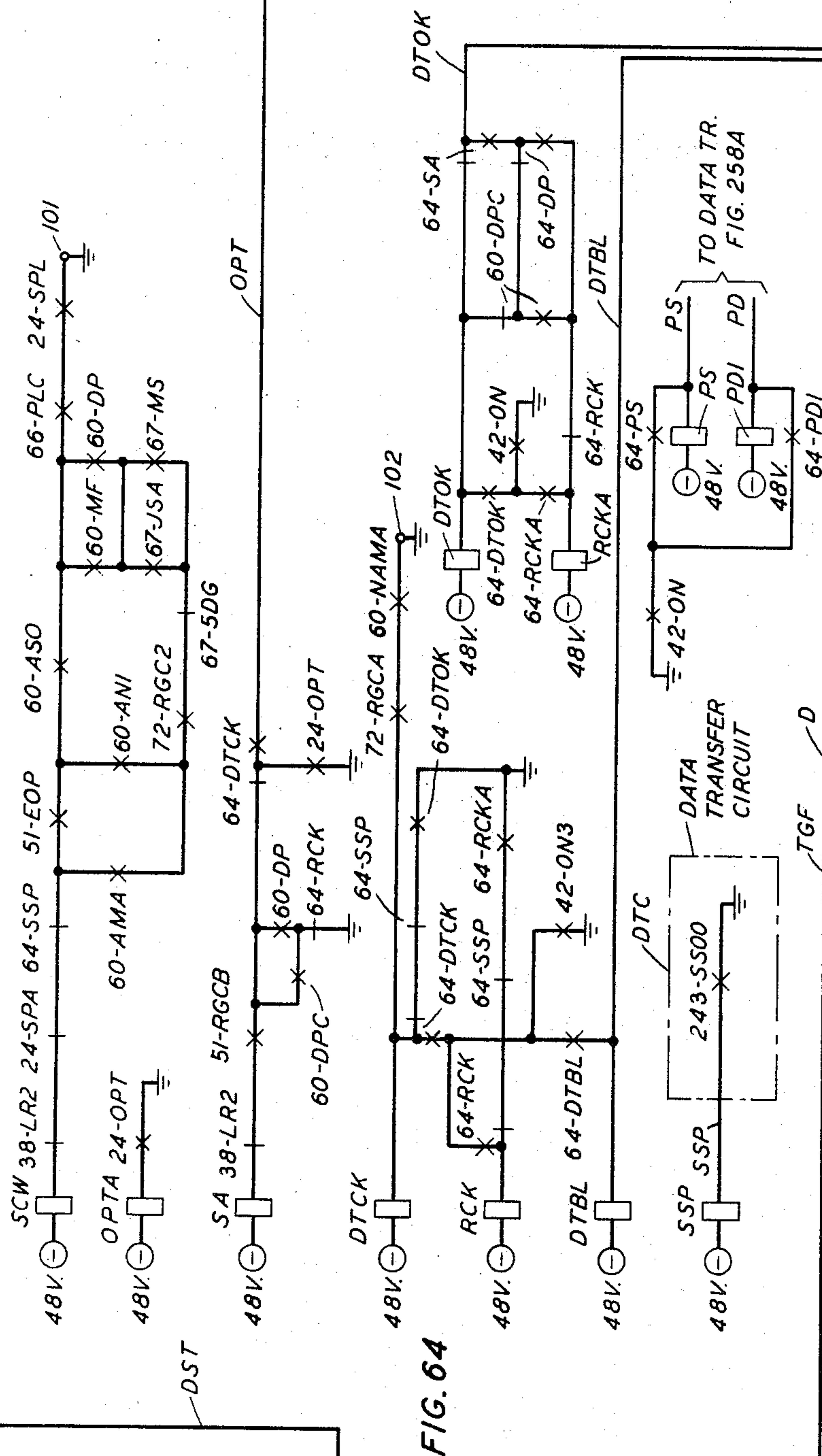
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 123



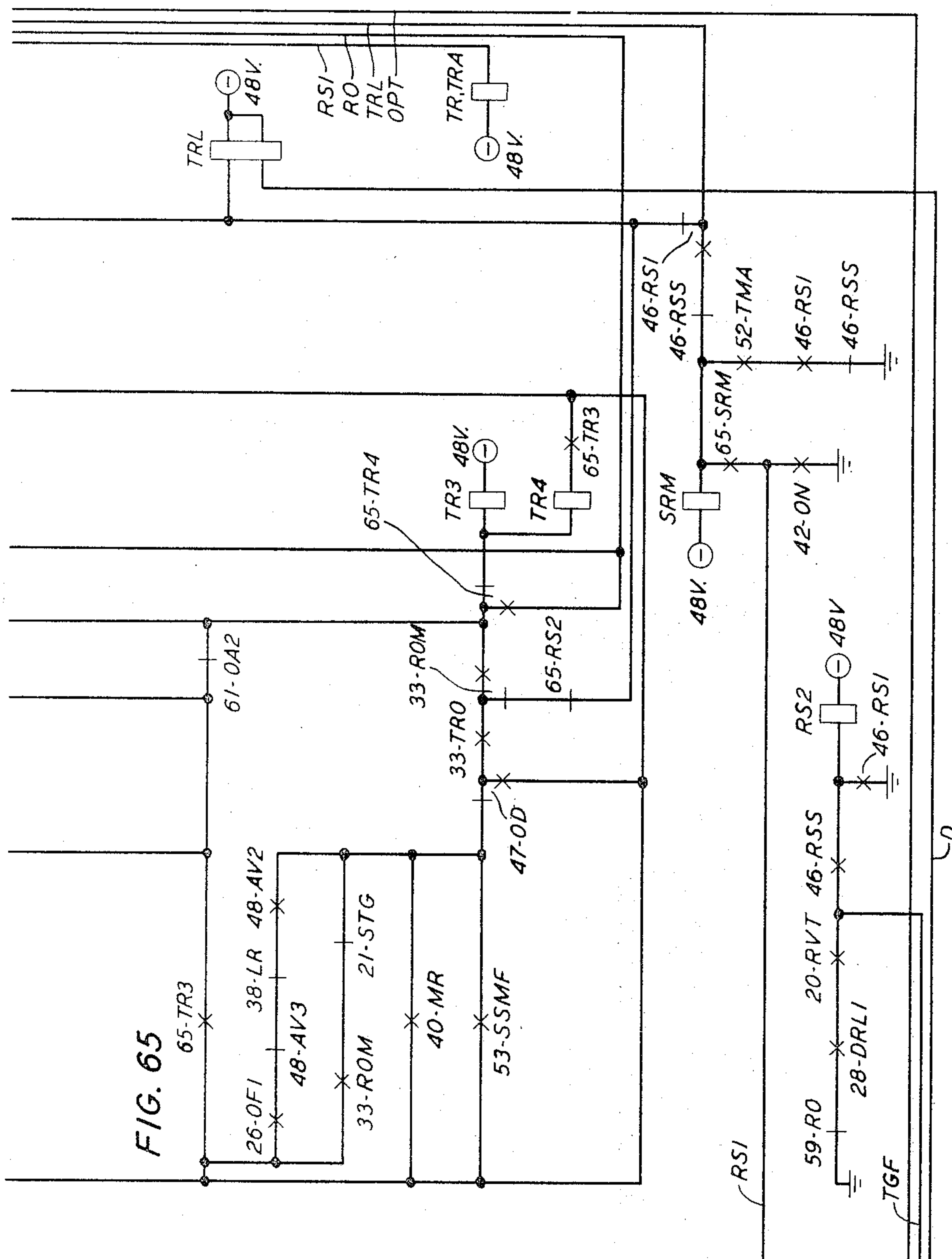
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

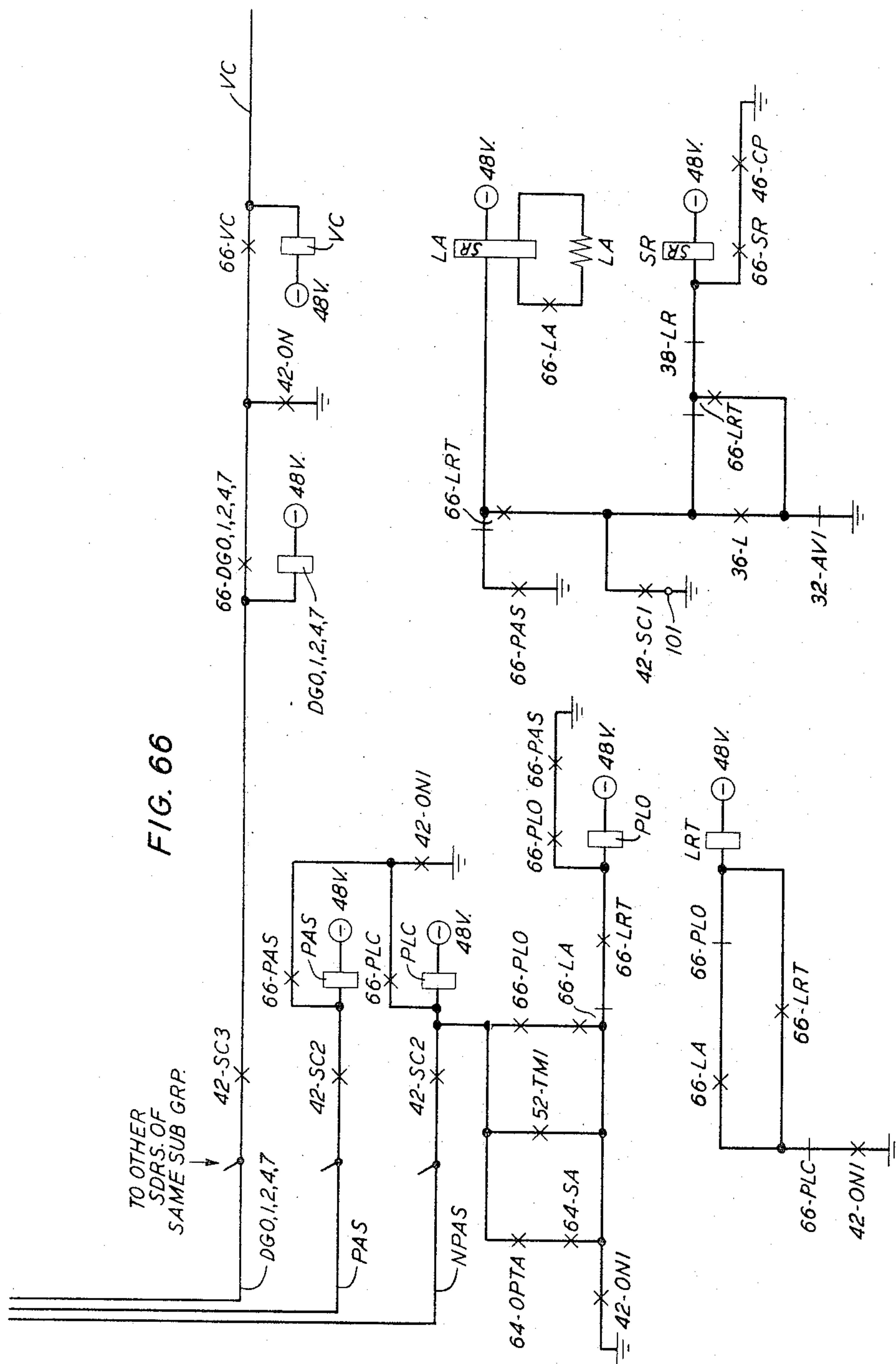
570 Sheets--Sheet 124



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 125



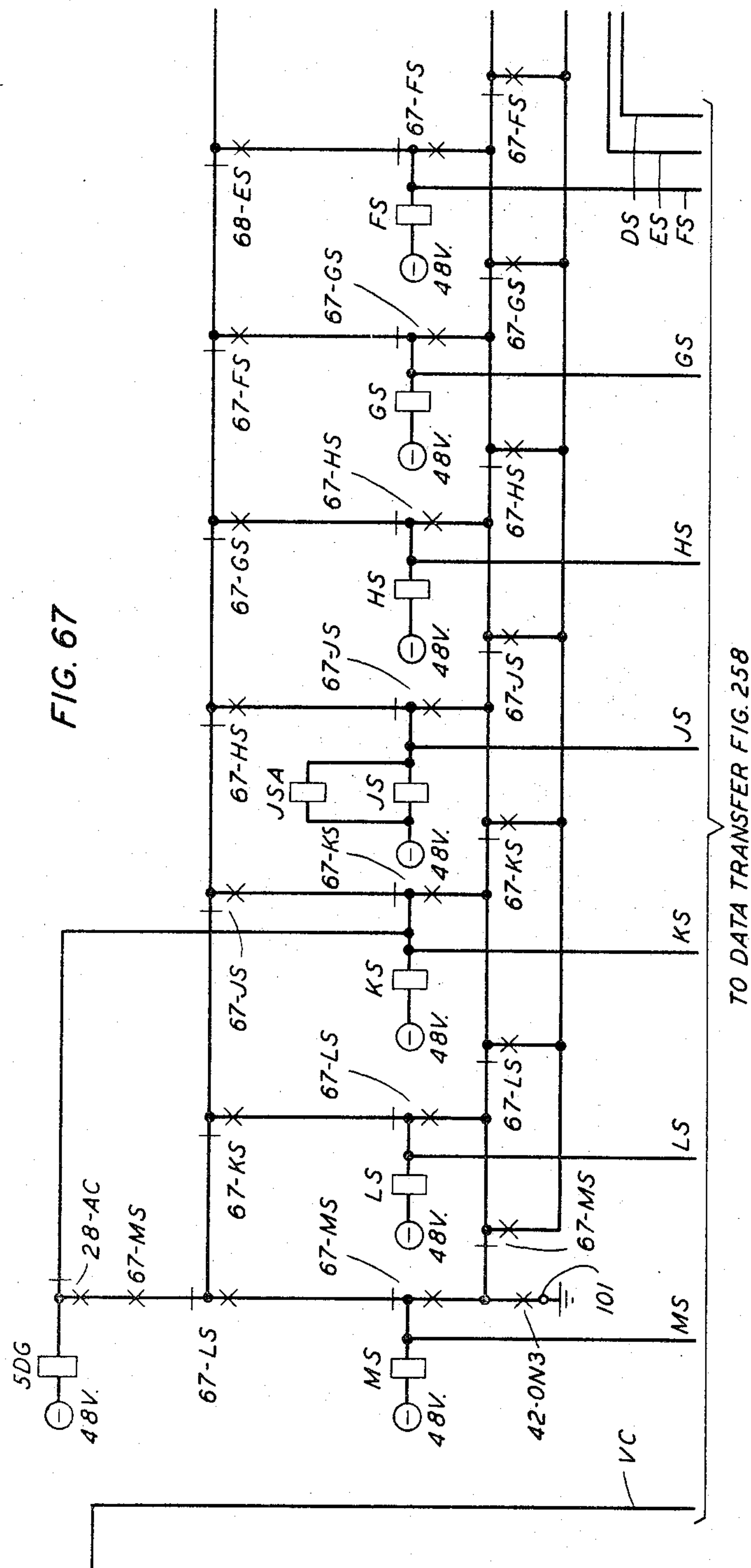
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 126



Sept. 12, 1967

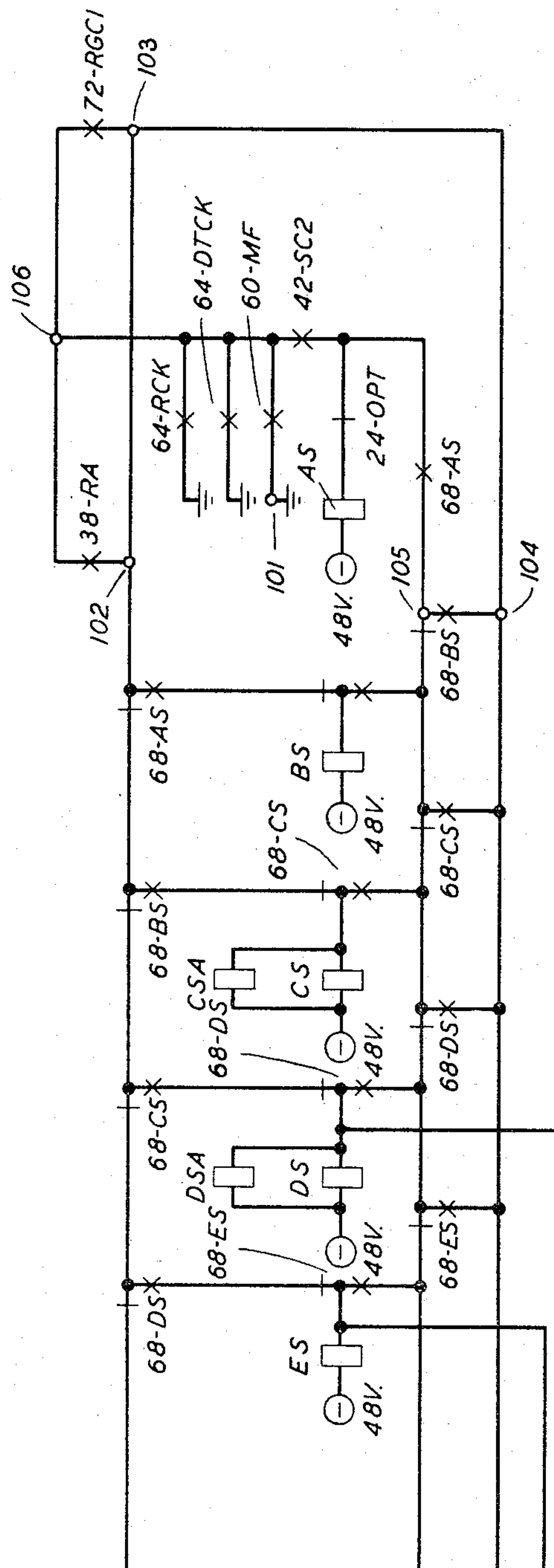
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 127

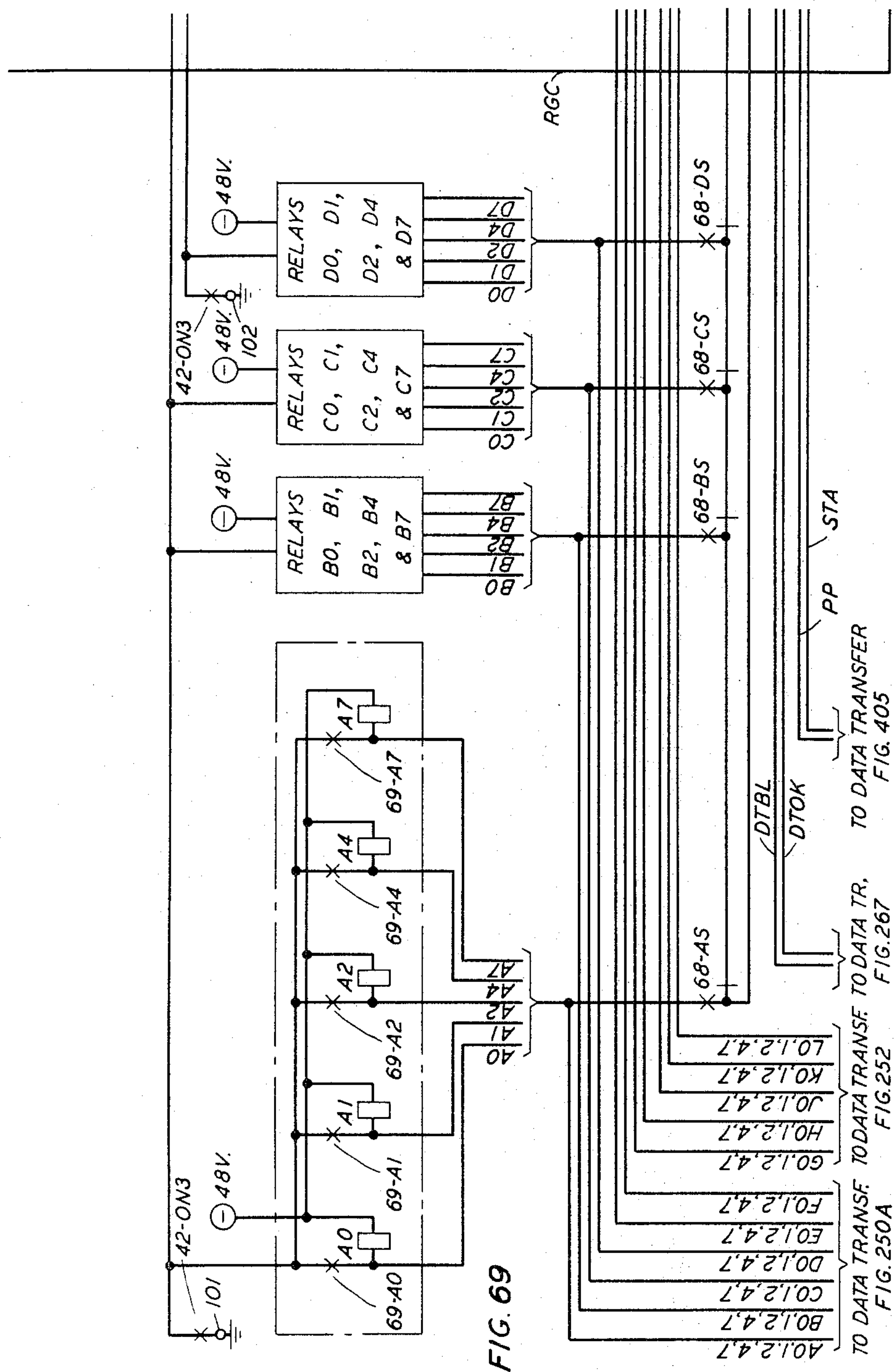
FIG. 68



L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 128



Sept. 12, 1967

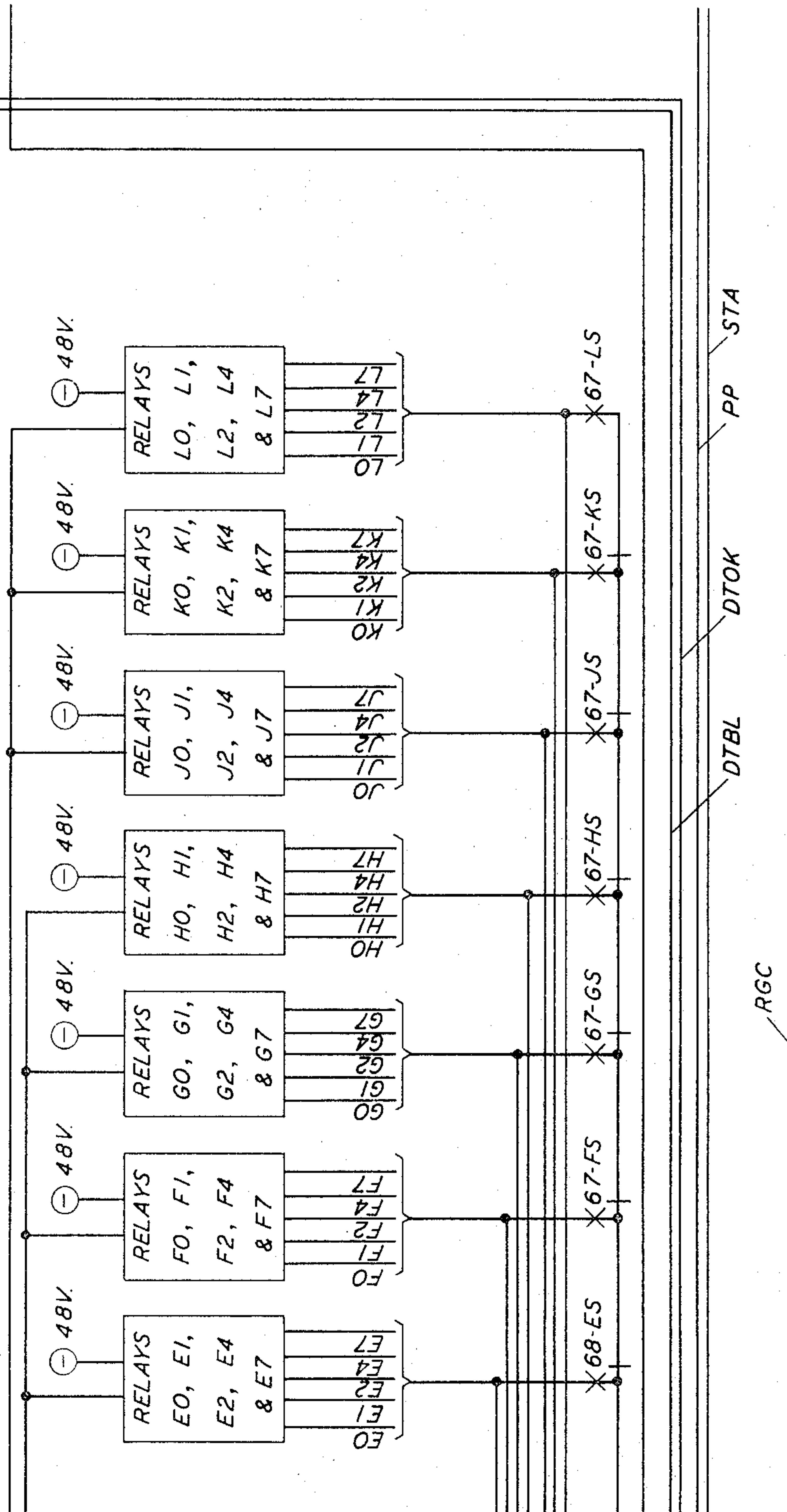
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 129

FIG. 70



Sept. 12, 1967

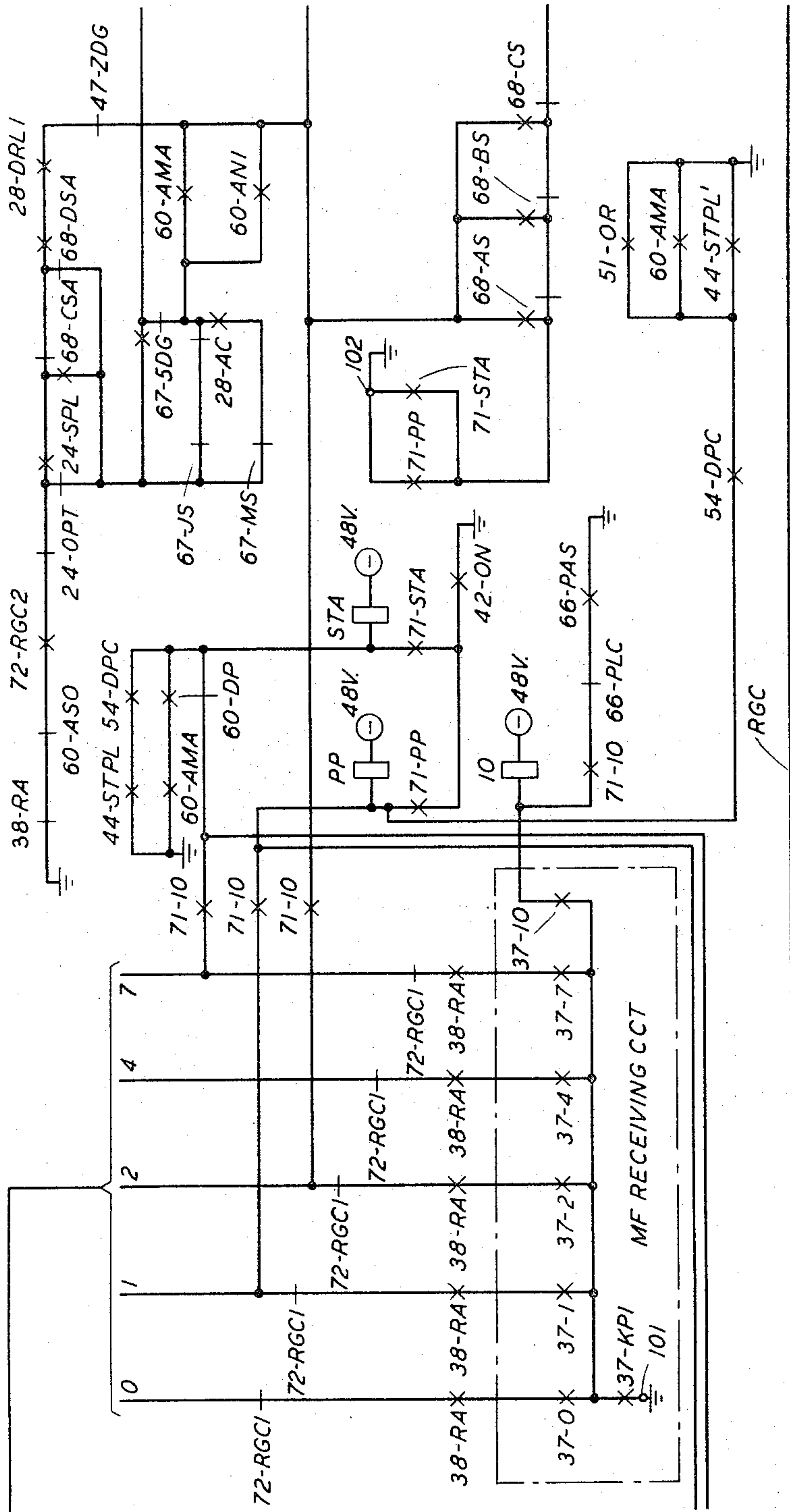
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 130

FIG. 71



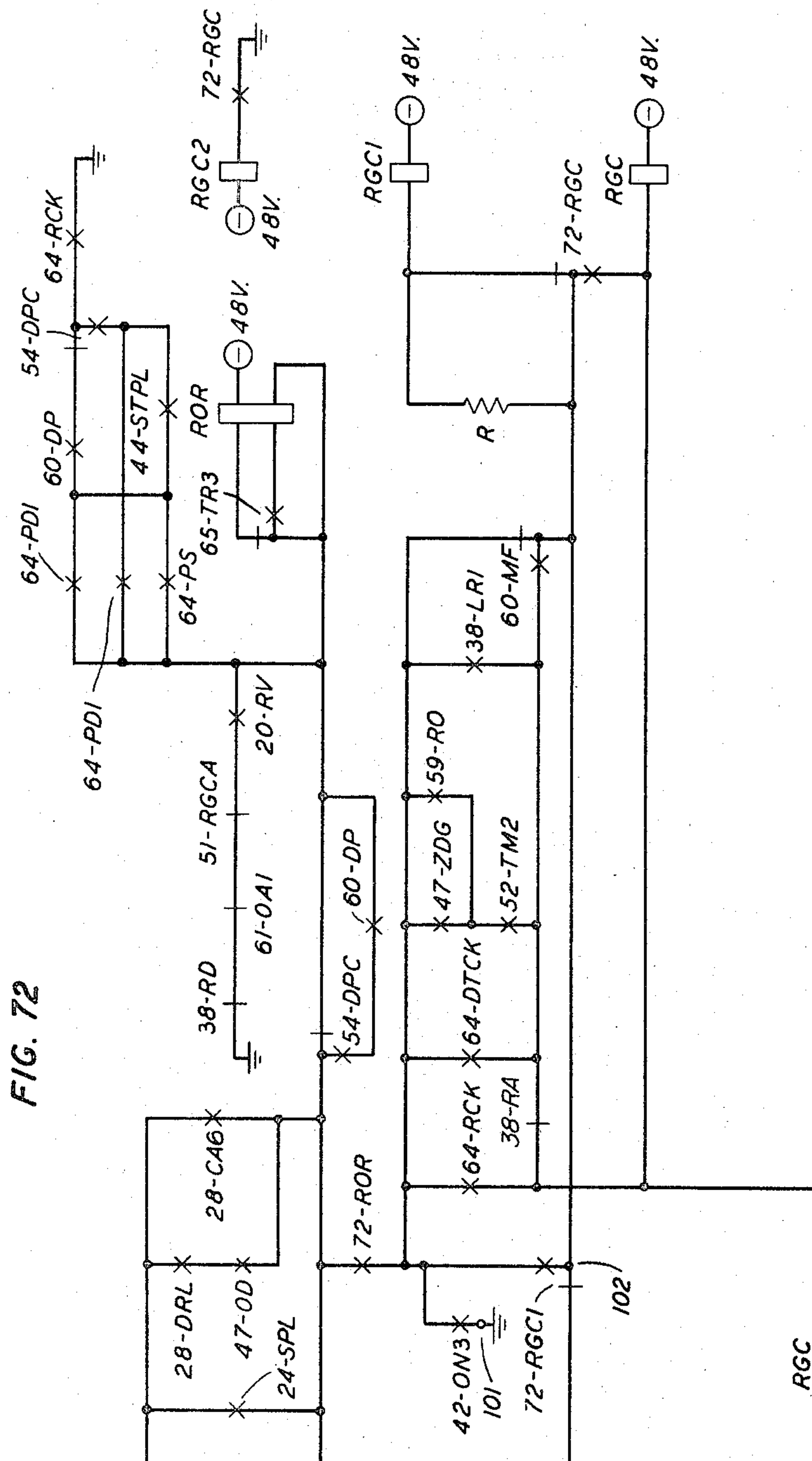
Sept. 12, 1967

L. J. CERNY ETAL

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 131



Sept. 12, 1967

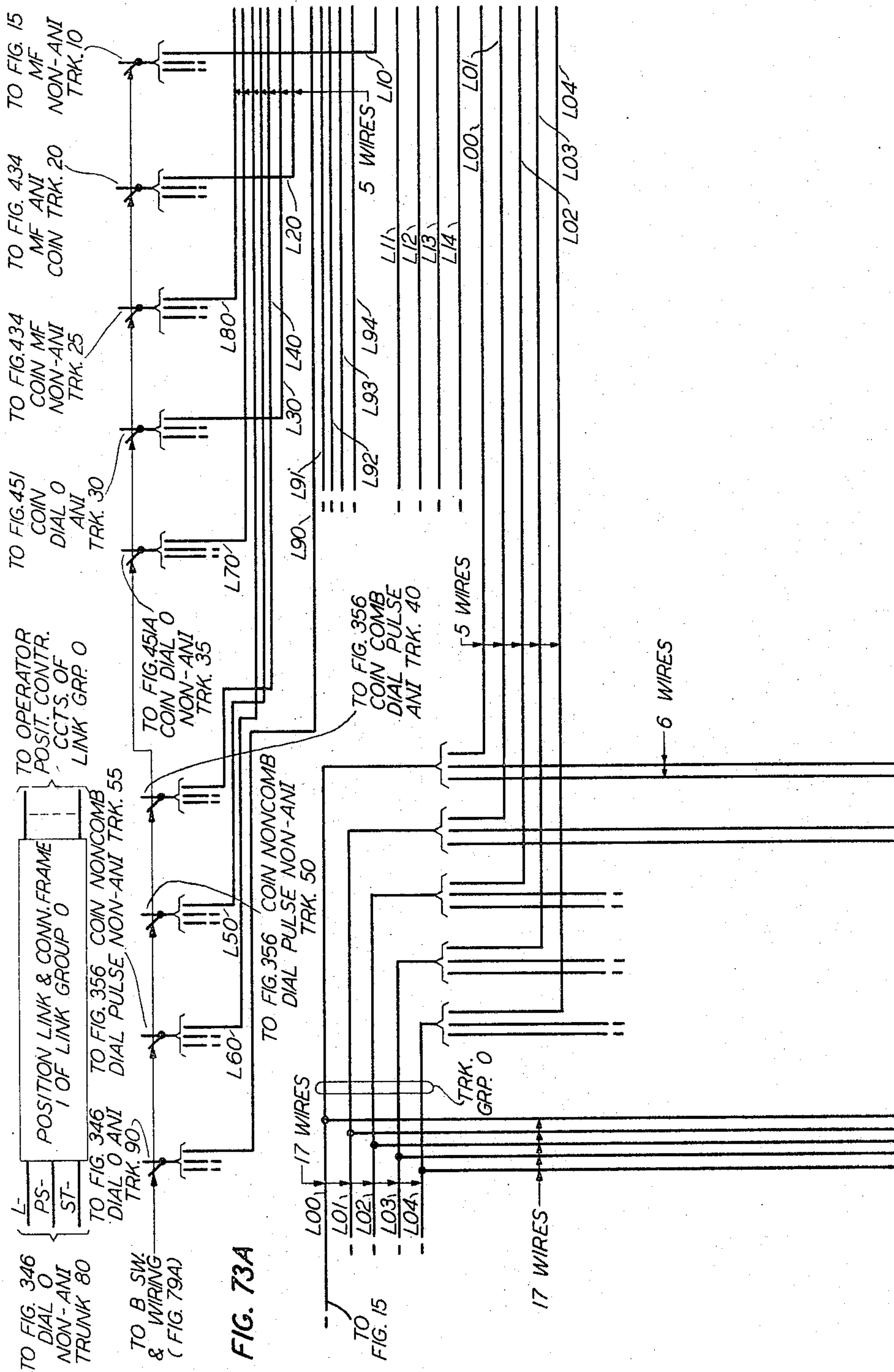
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 132



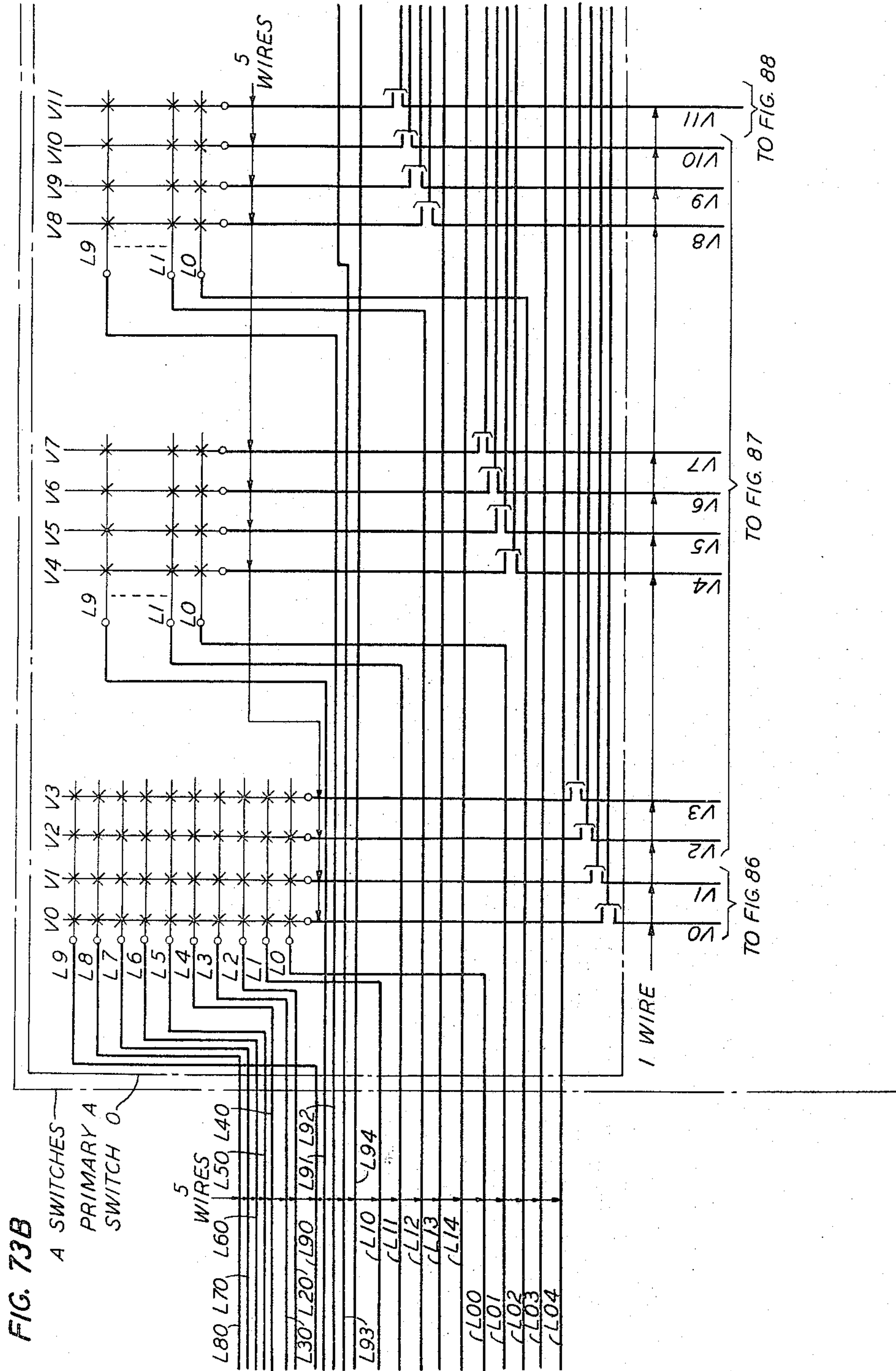
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 133



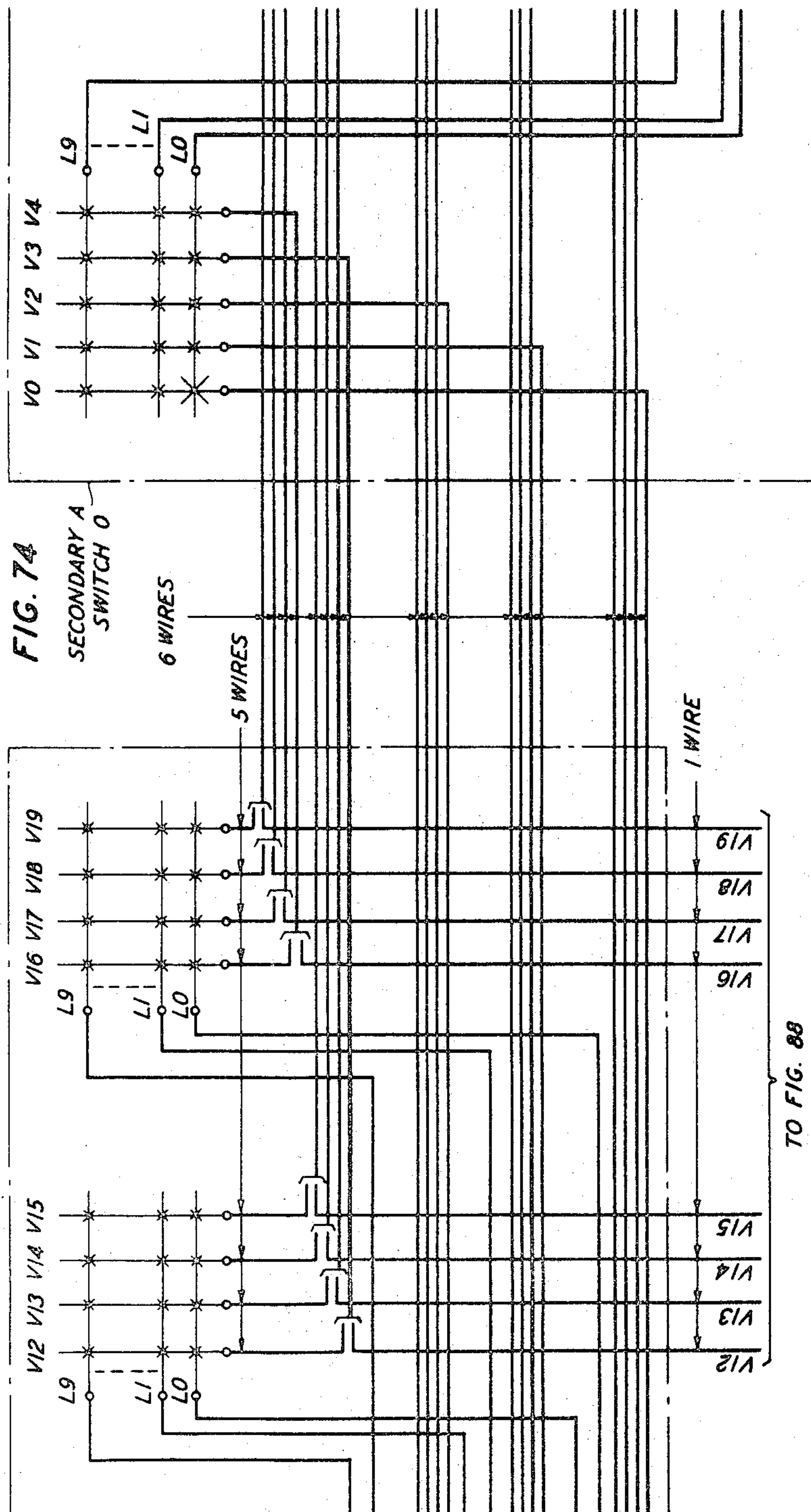
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 134



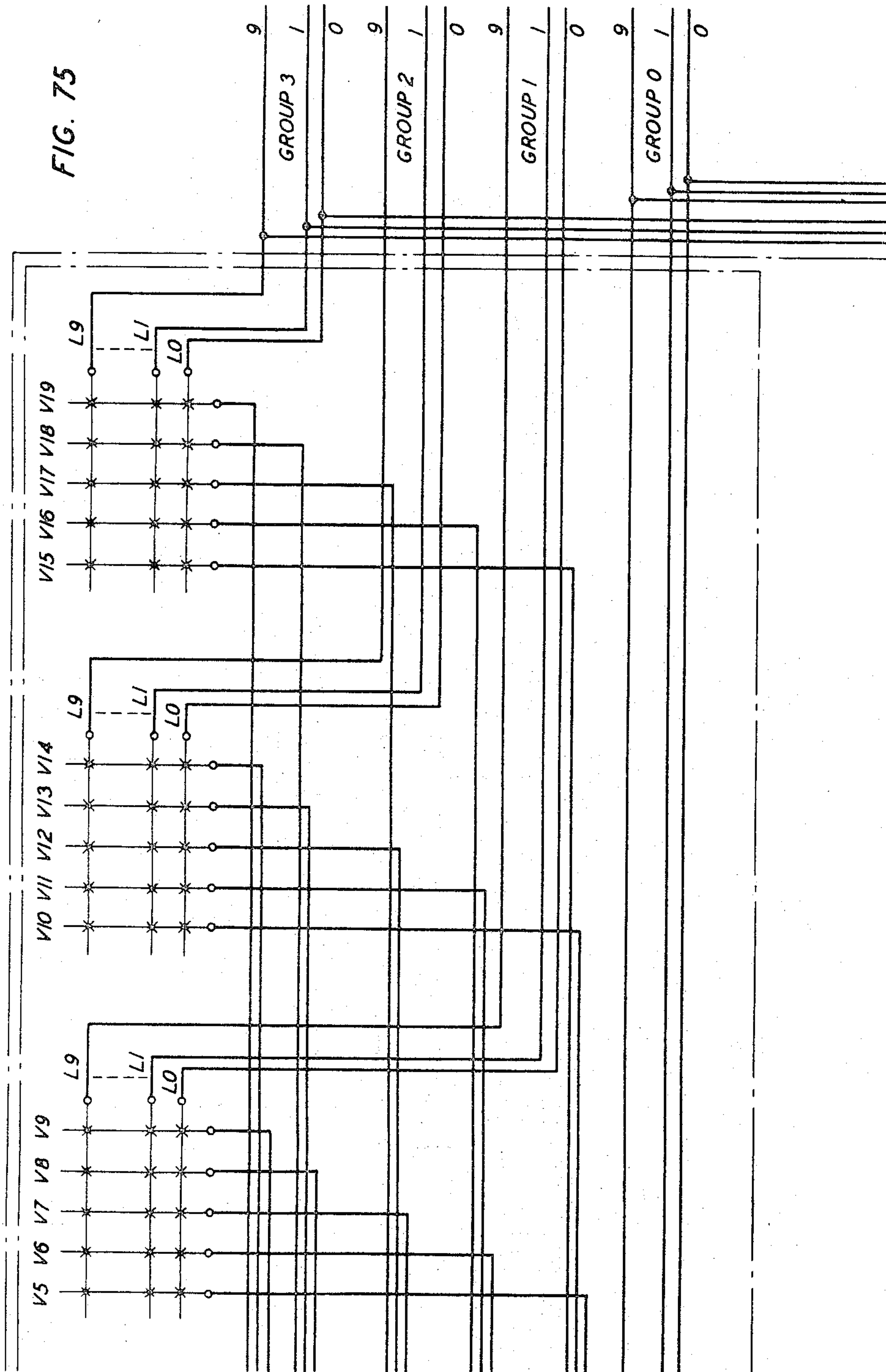
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 135



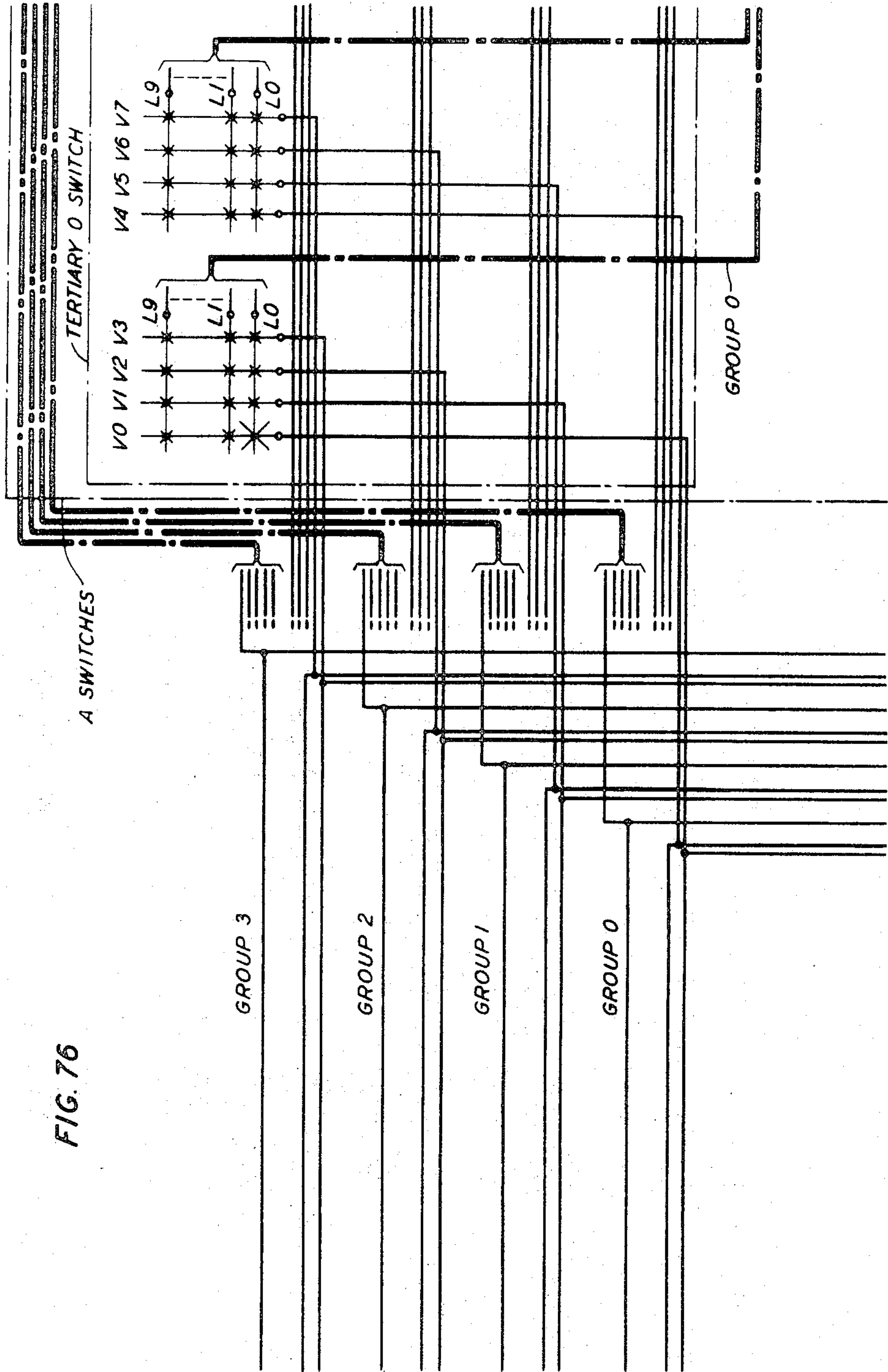
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 136



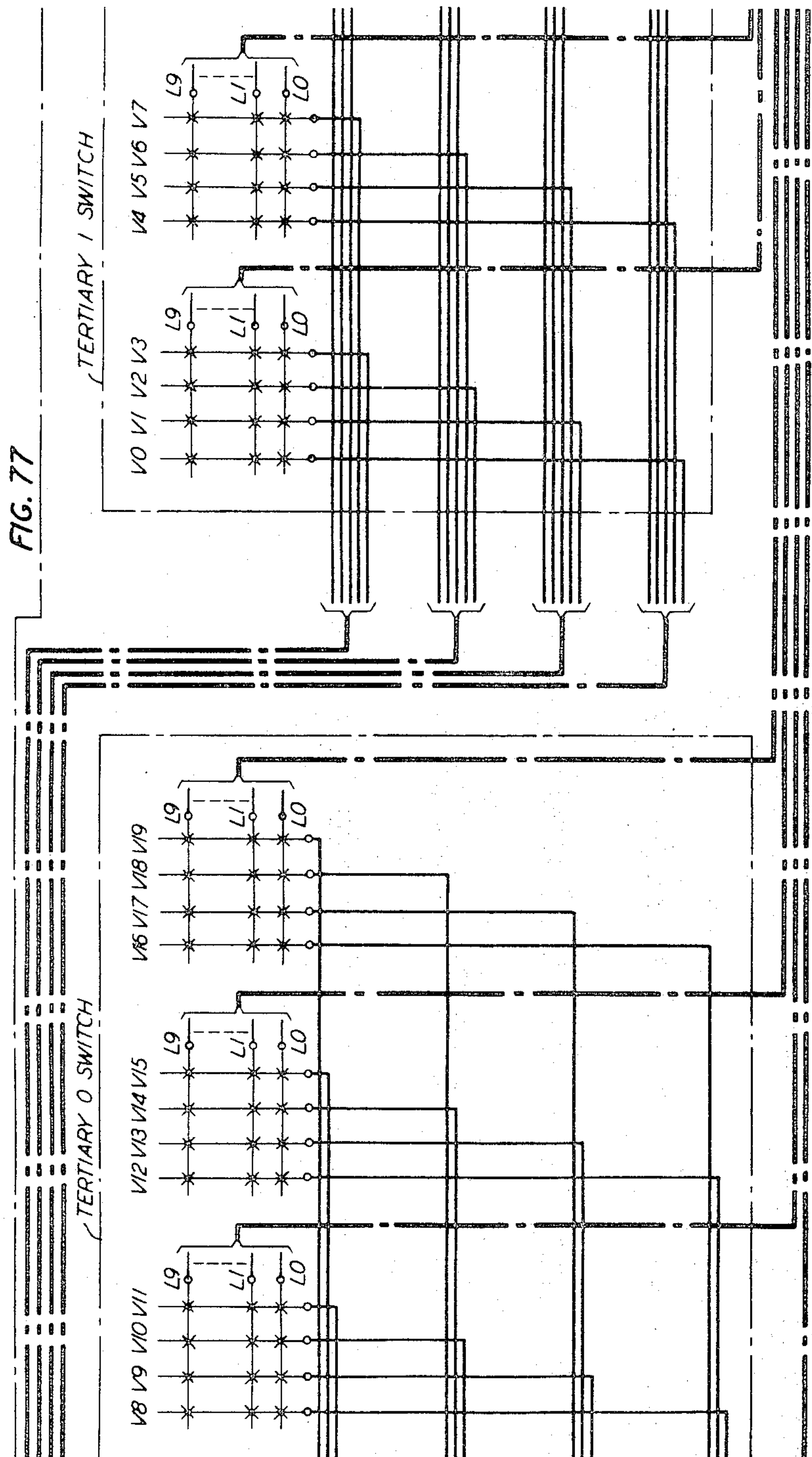
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 137



Sept. 12, 1967

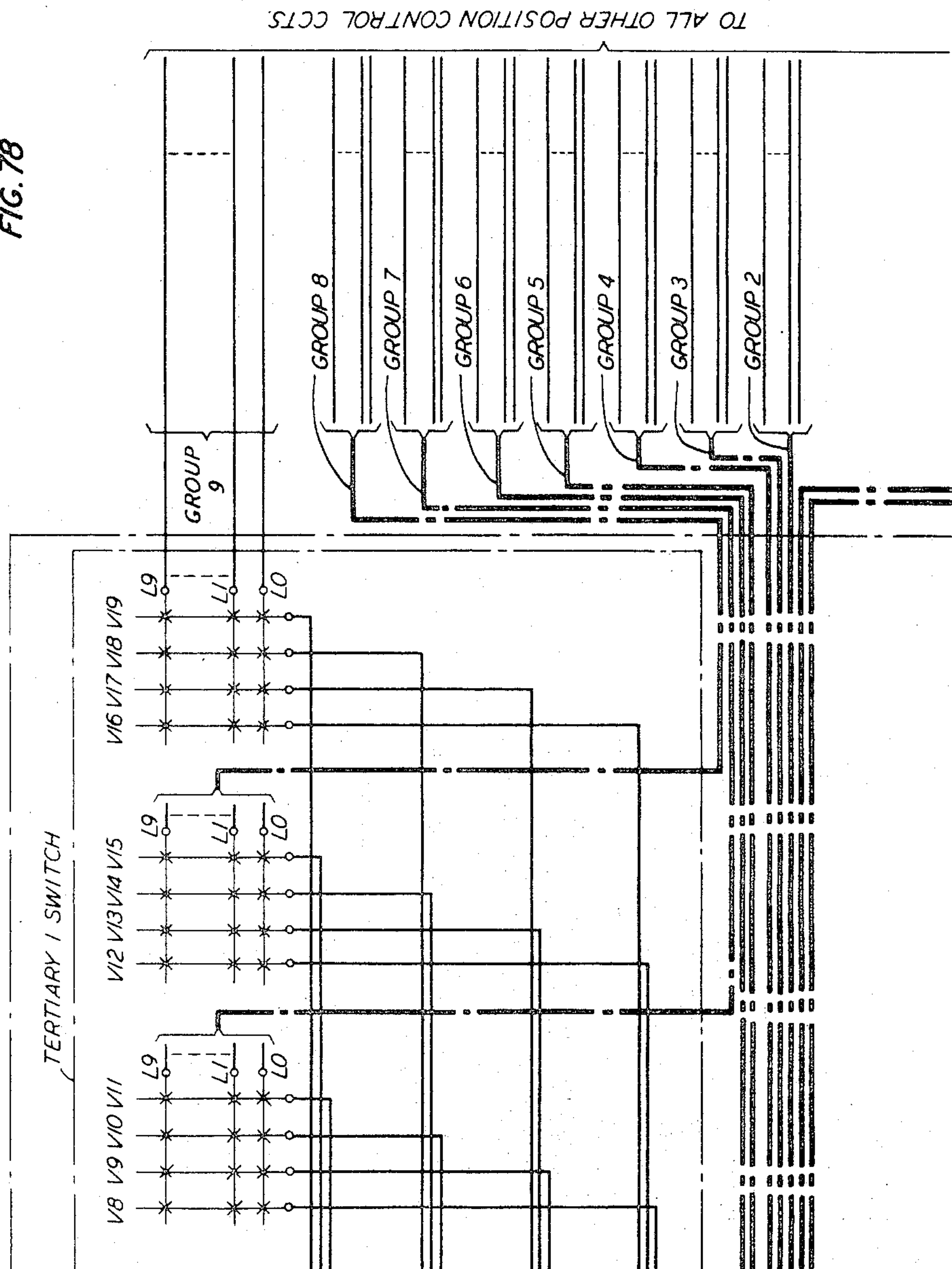
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 138

FIG. 78



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 139

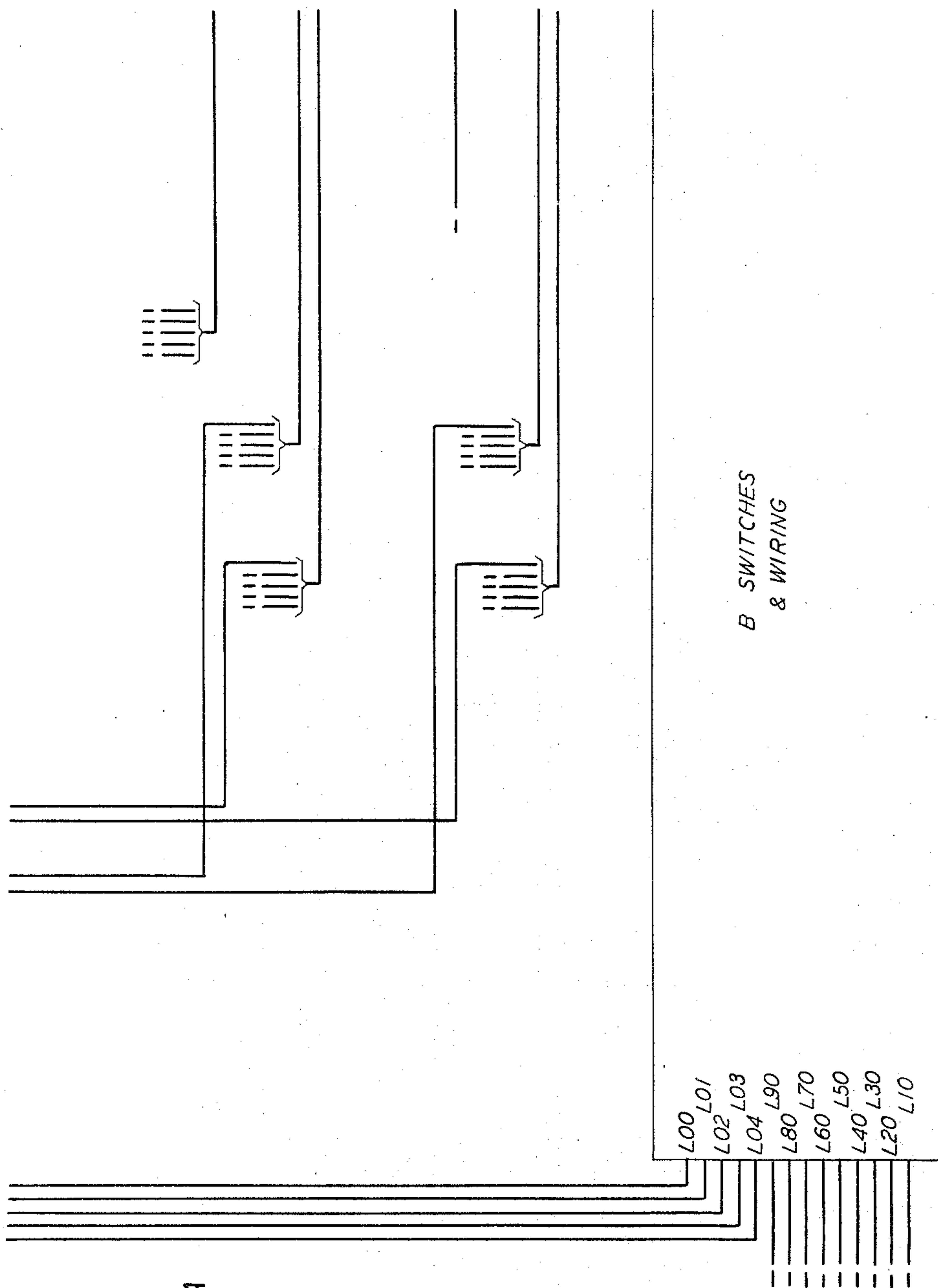


FIG. 79A

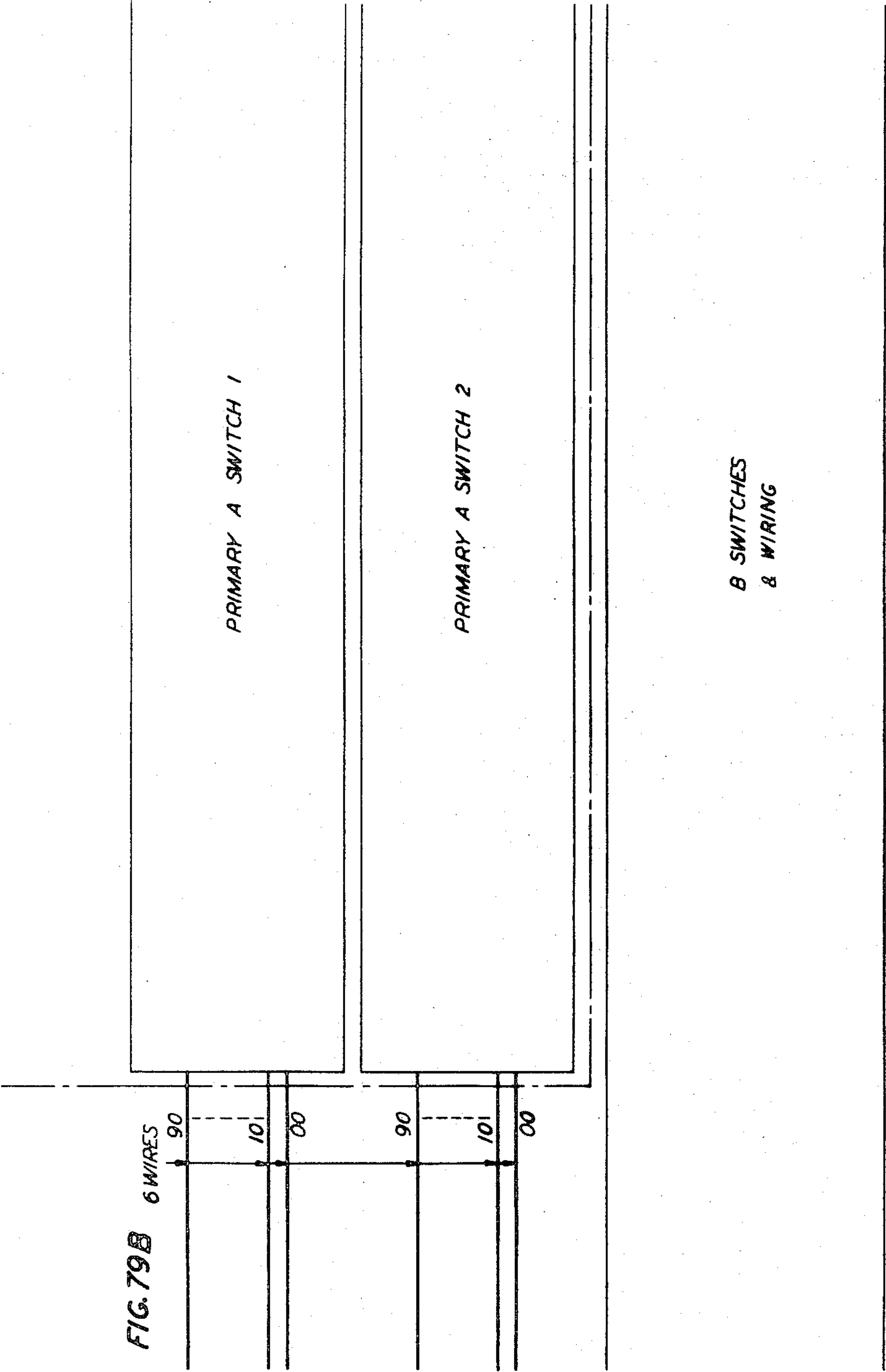
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 140



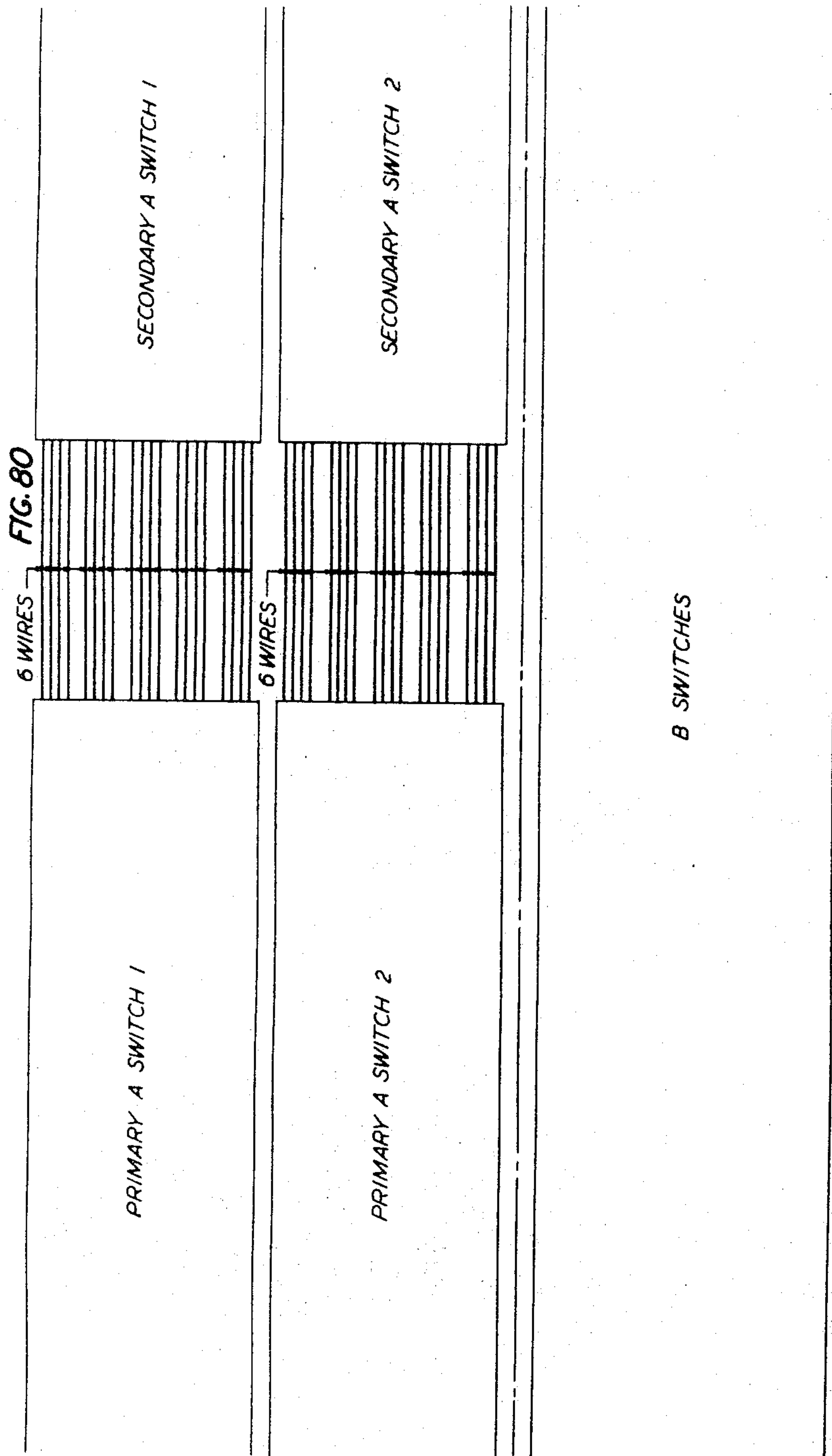
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 141



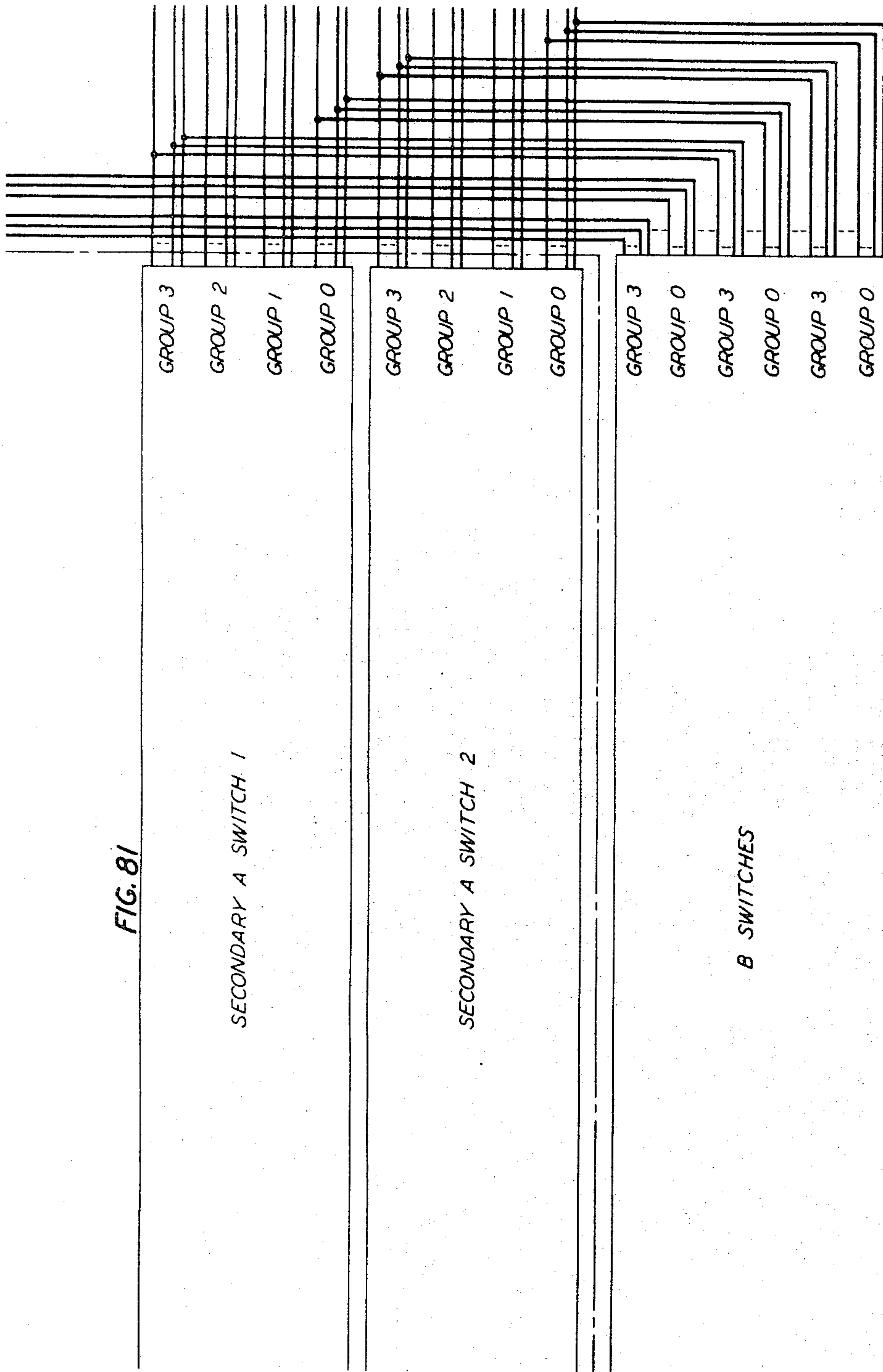
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 140



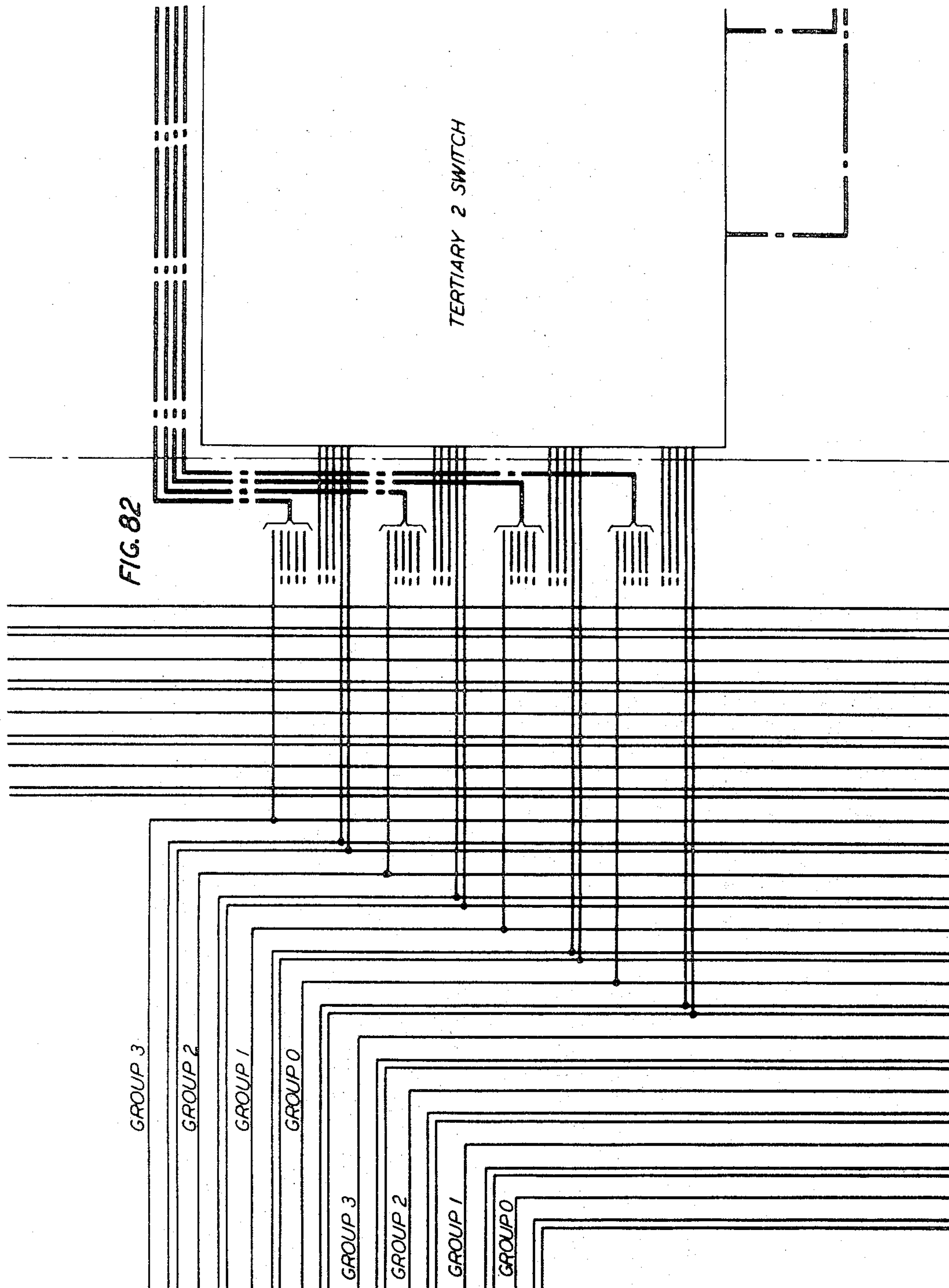
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 143



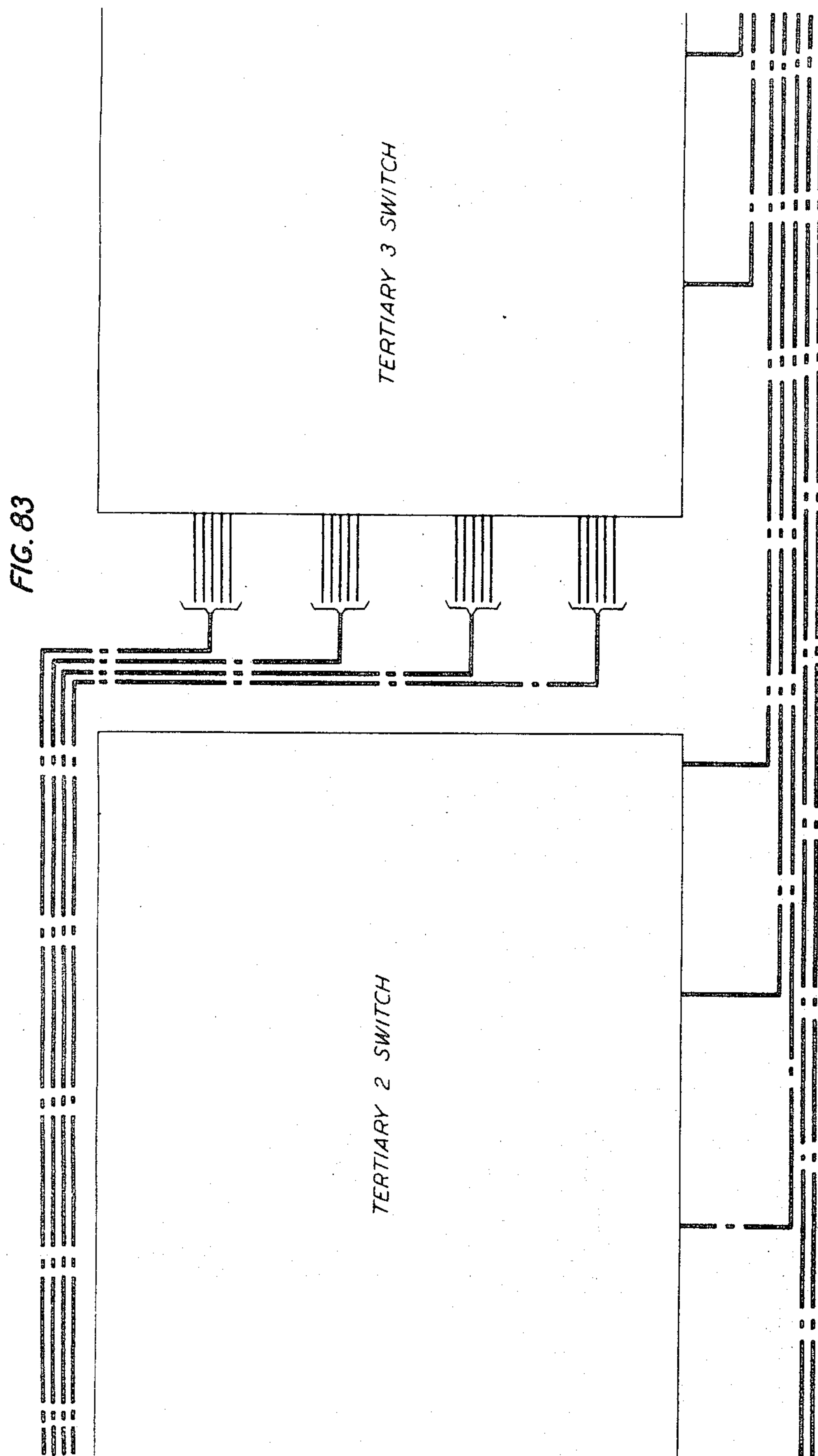
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 144



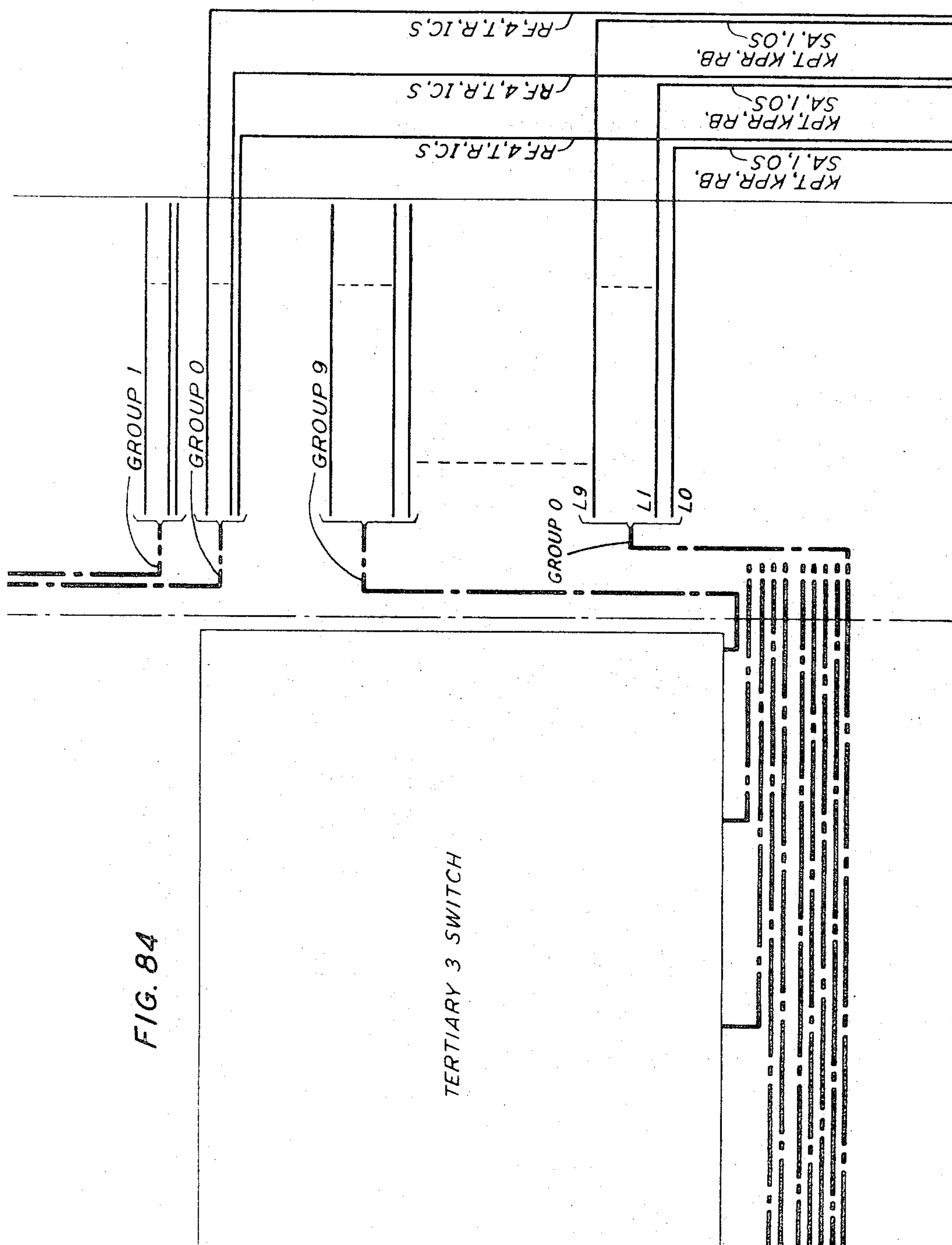
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

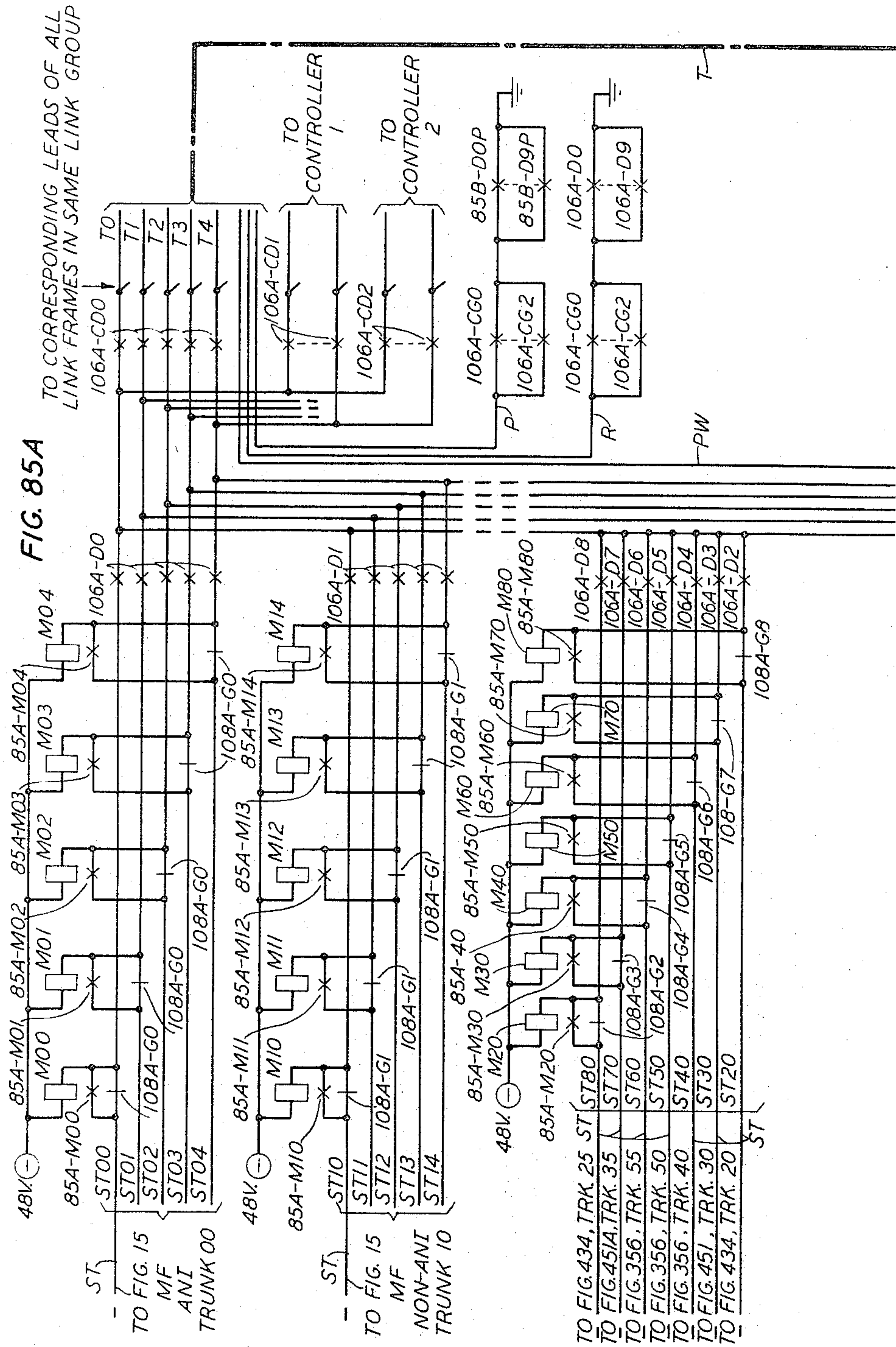
570 Sheets-Sheet 145



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 146



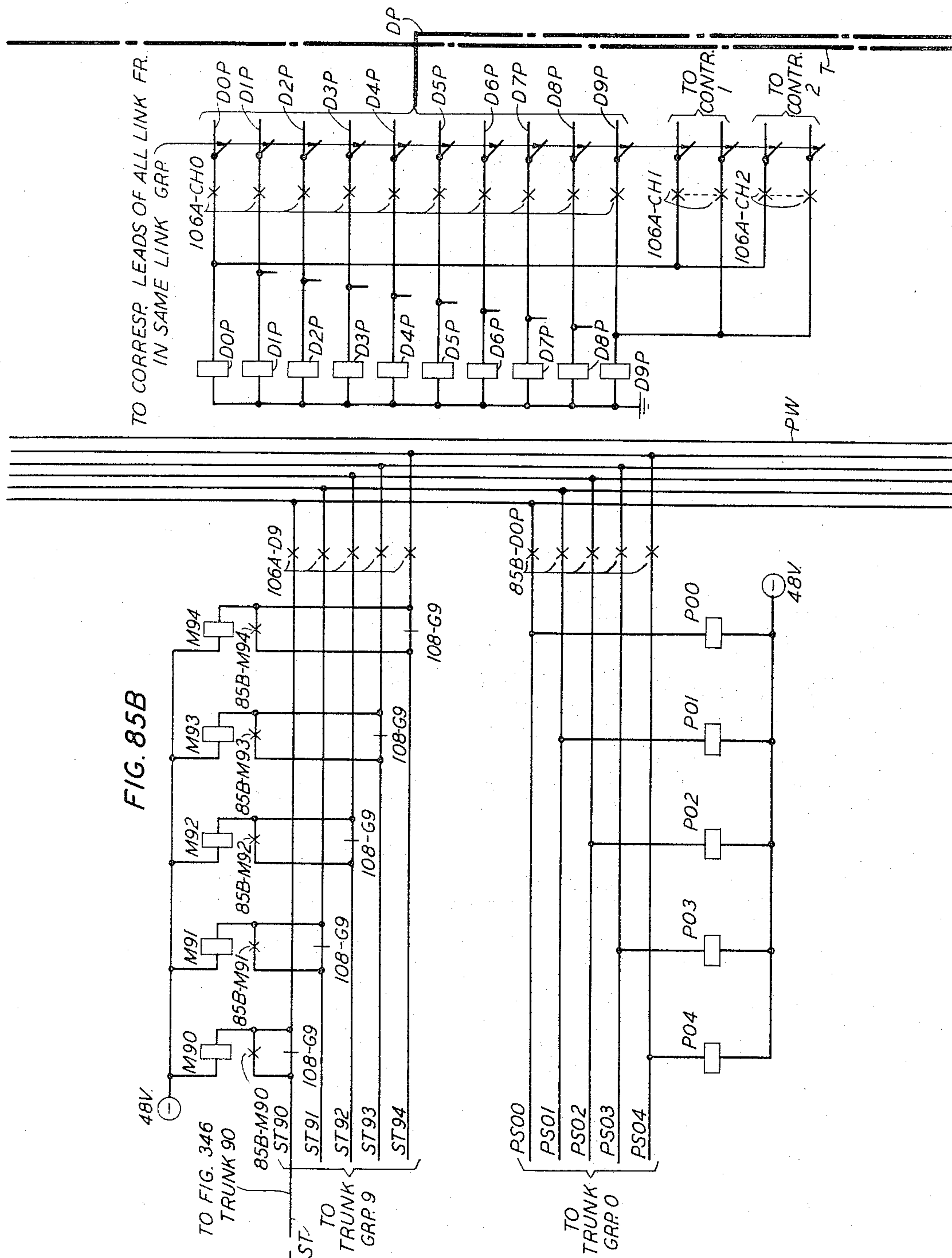
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 147



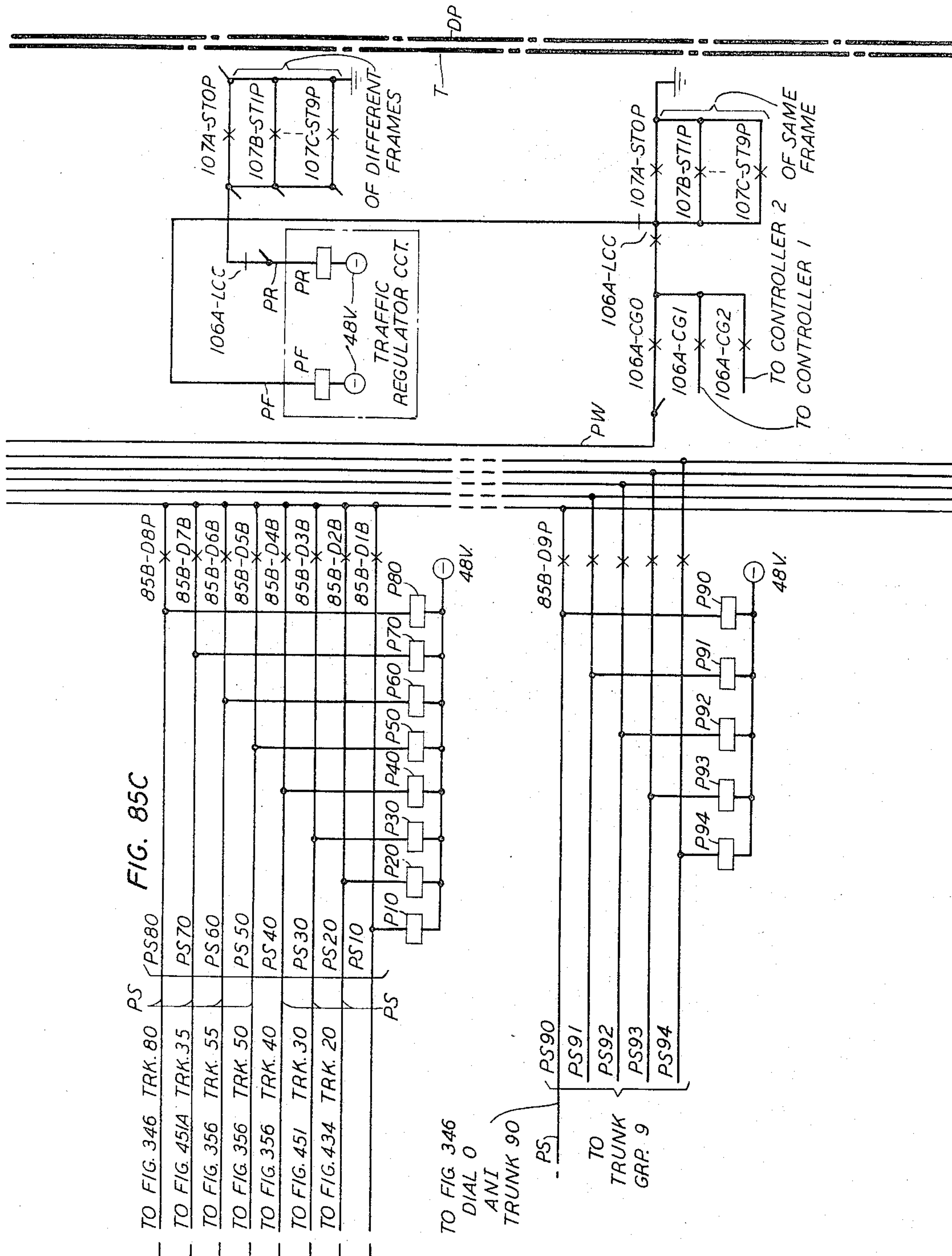
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 148



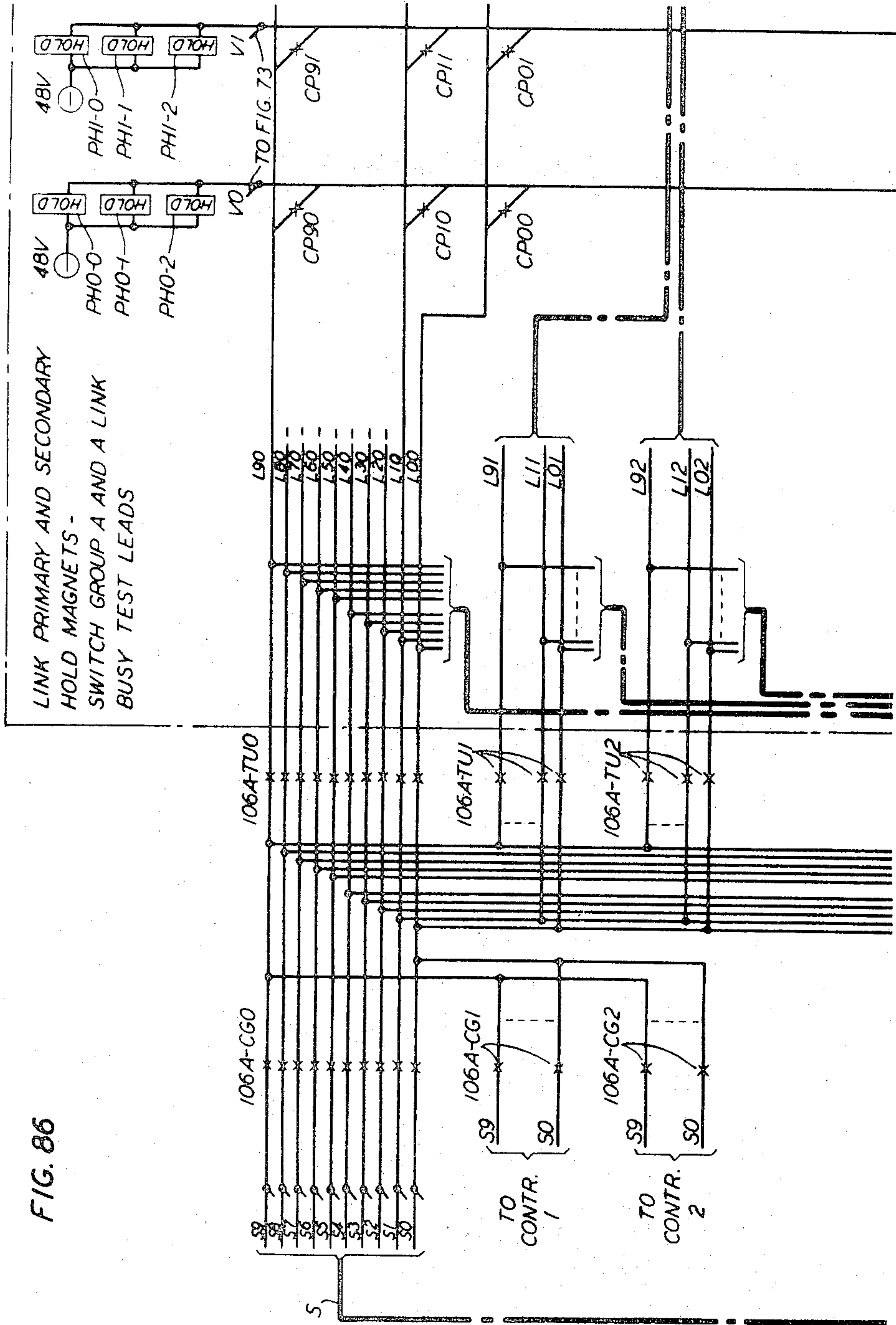
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 149



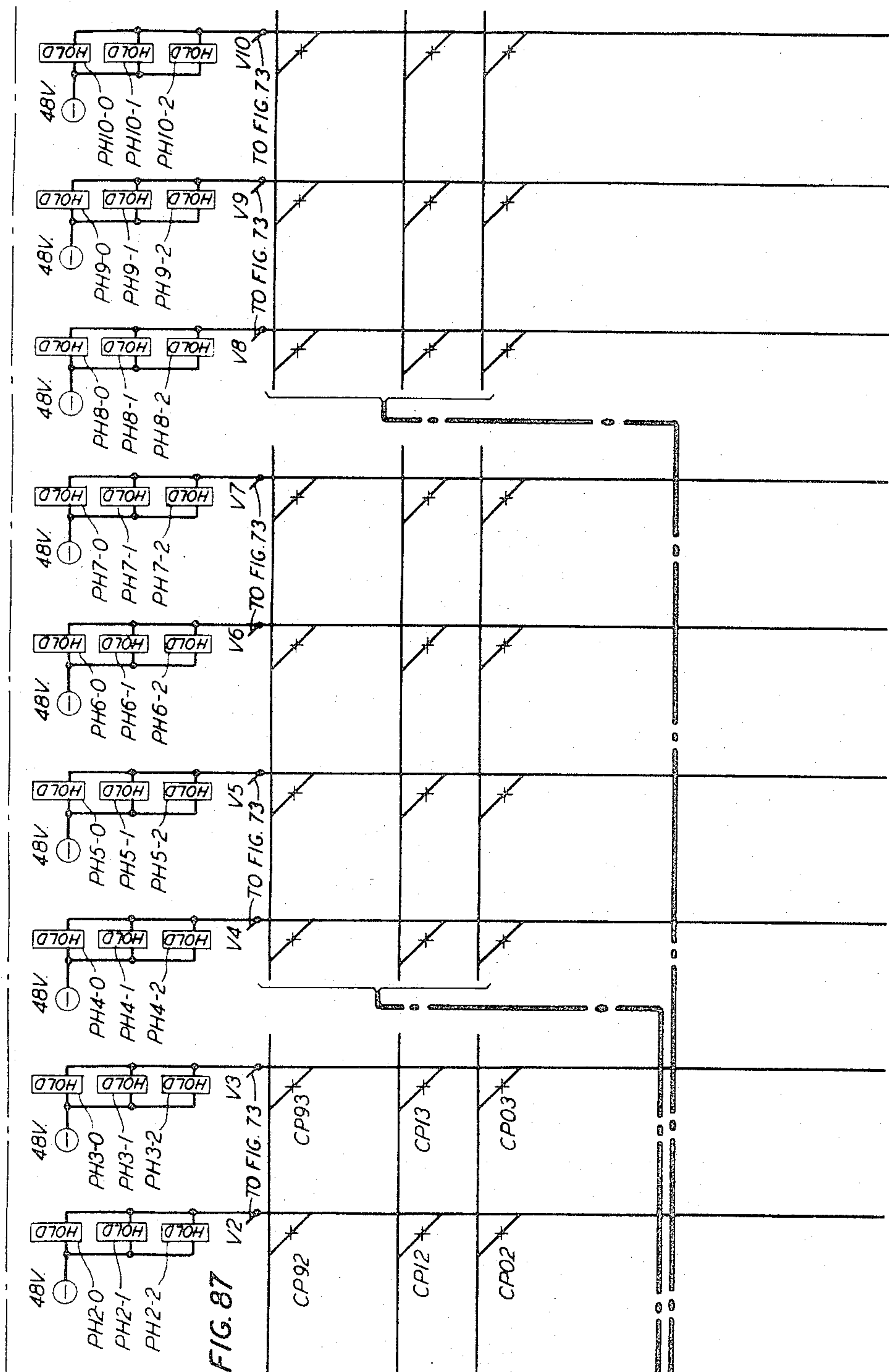
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 150



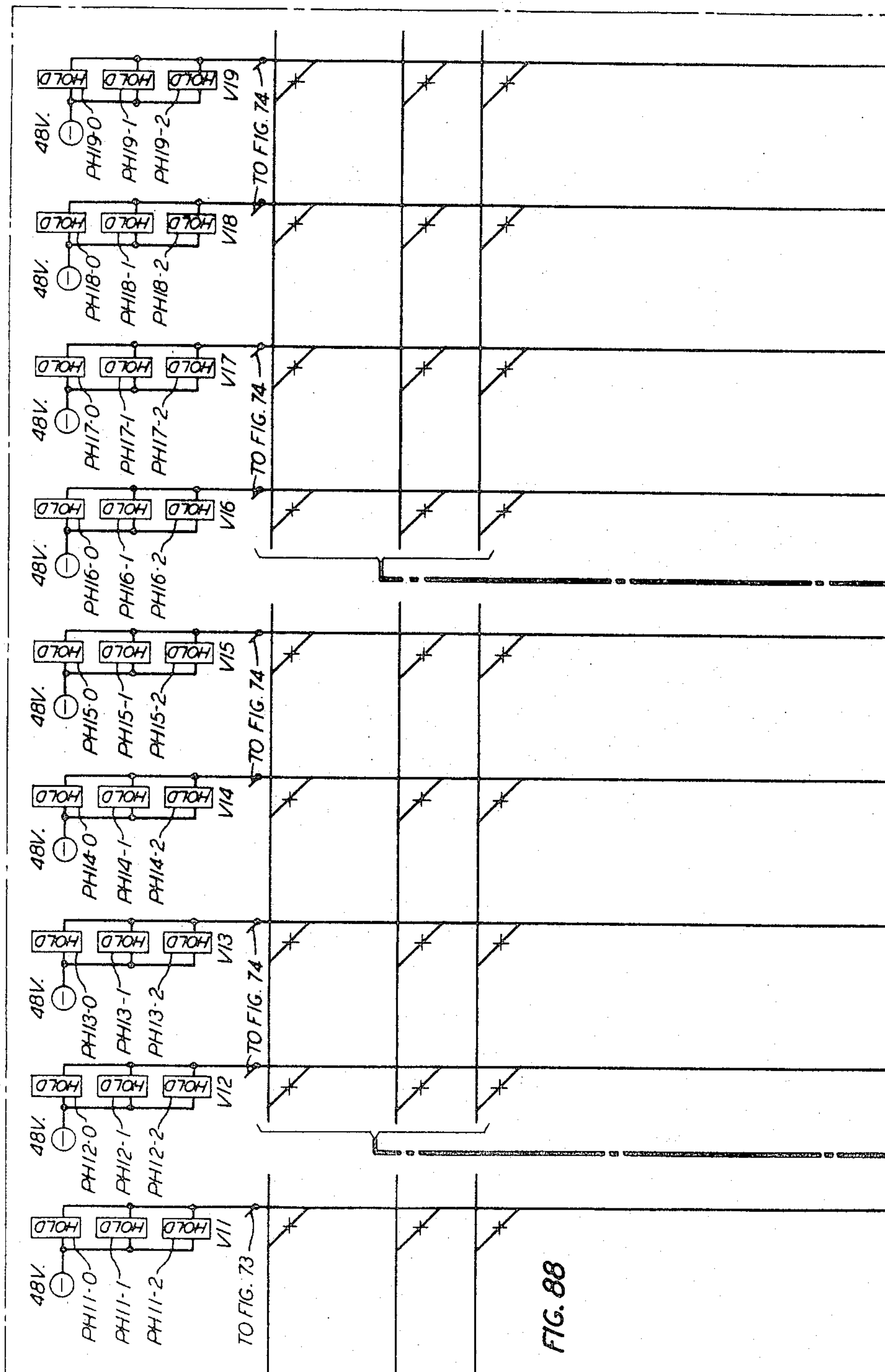
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 151



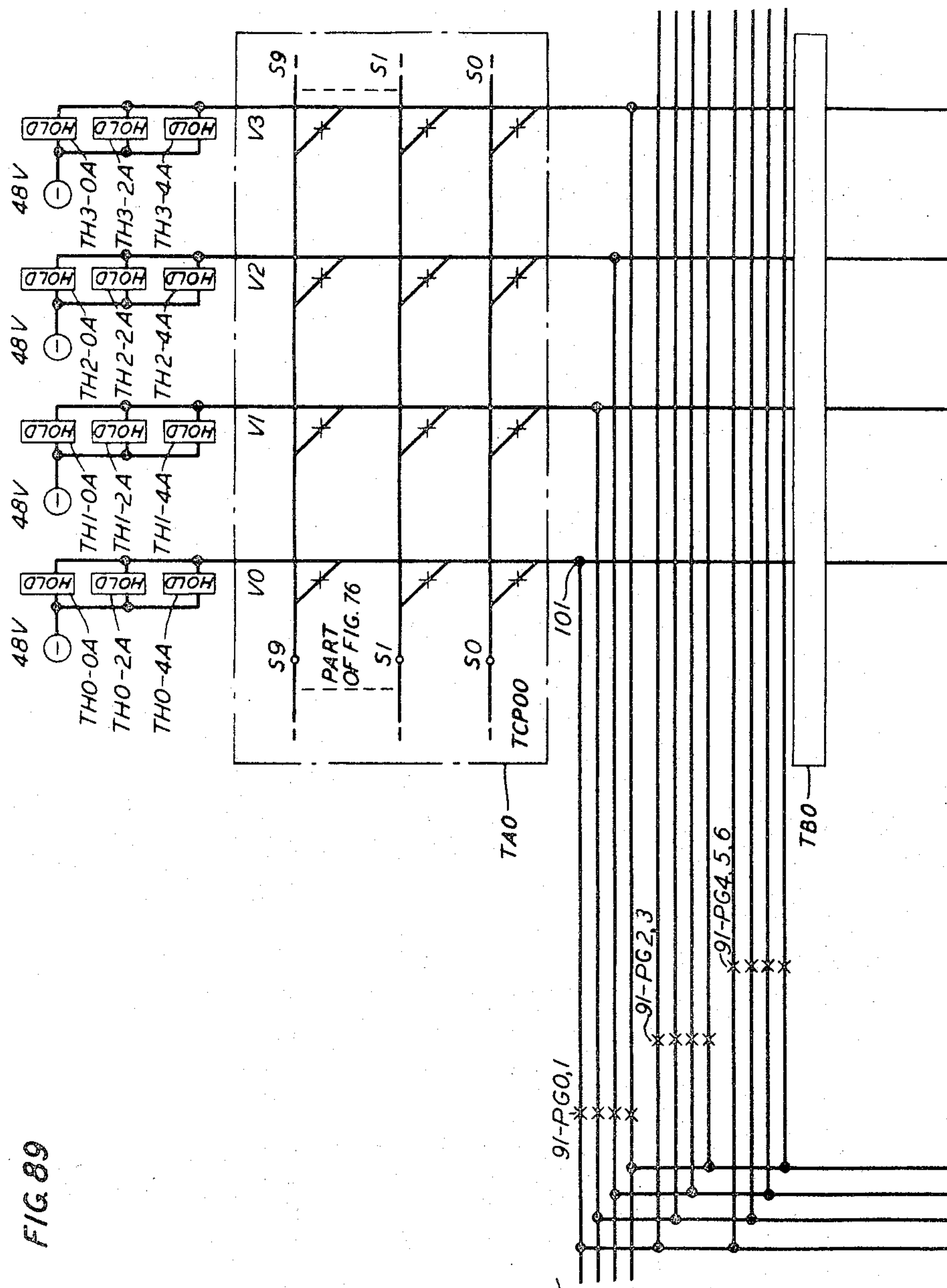
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 150



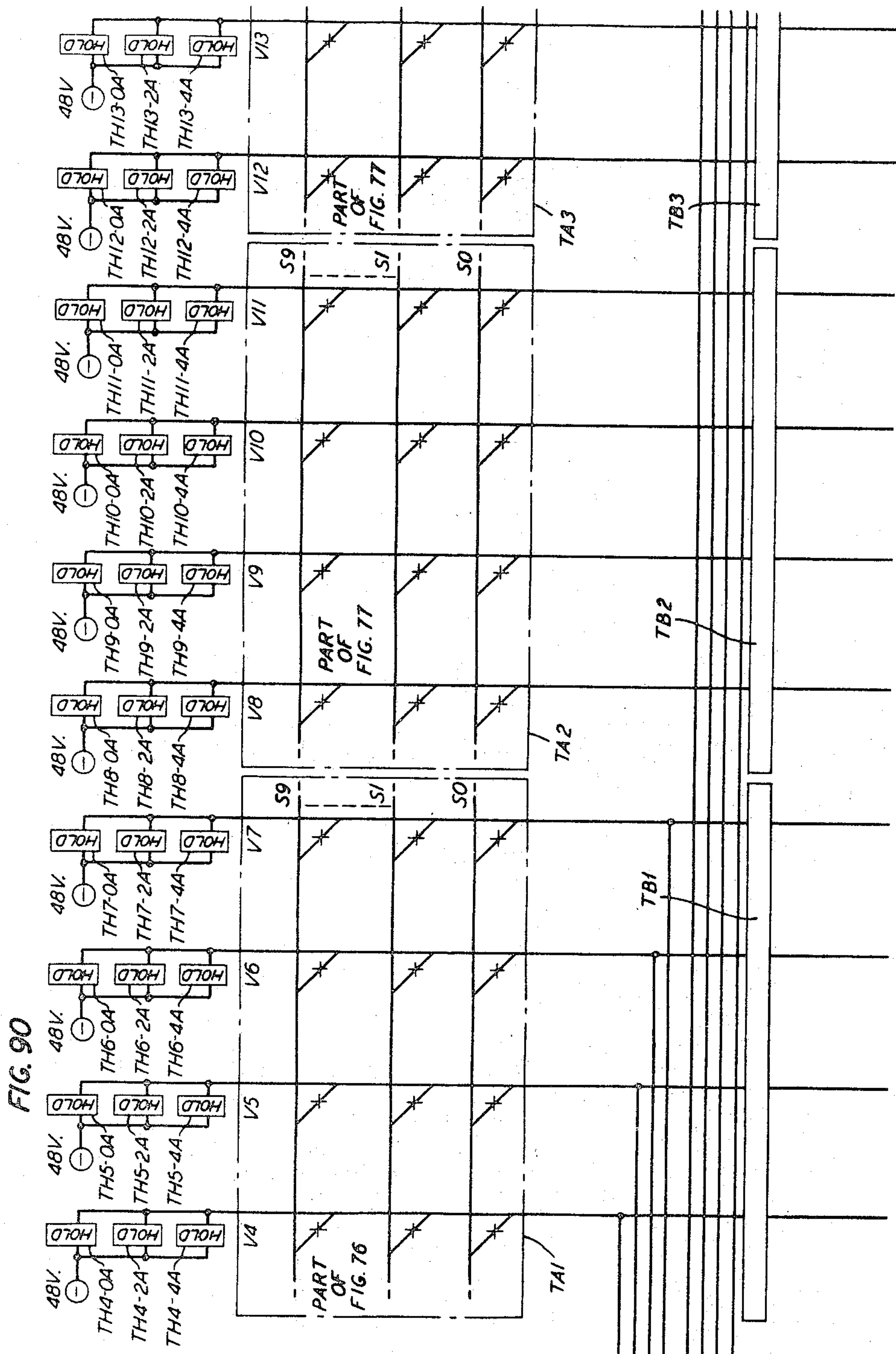
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 153



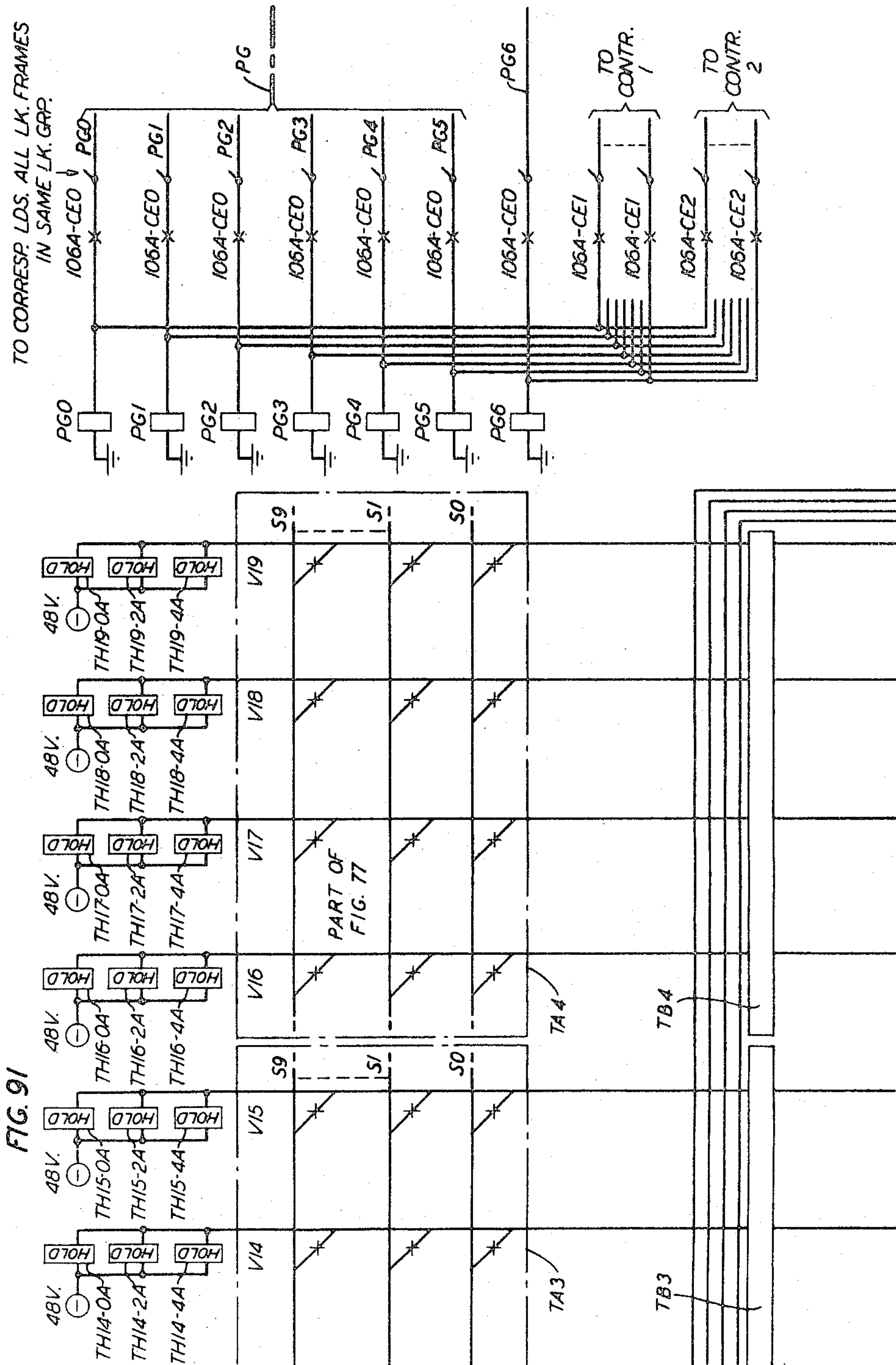
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 154



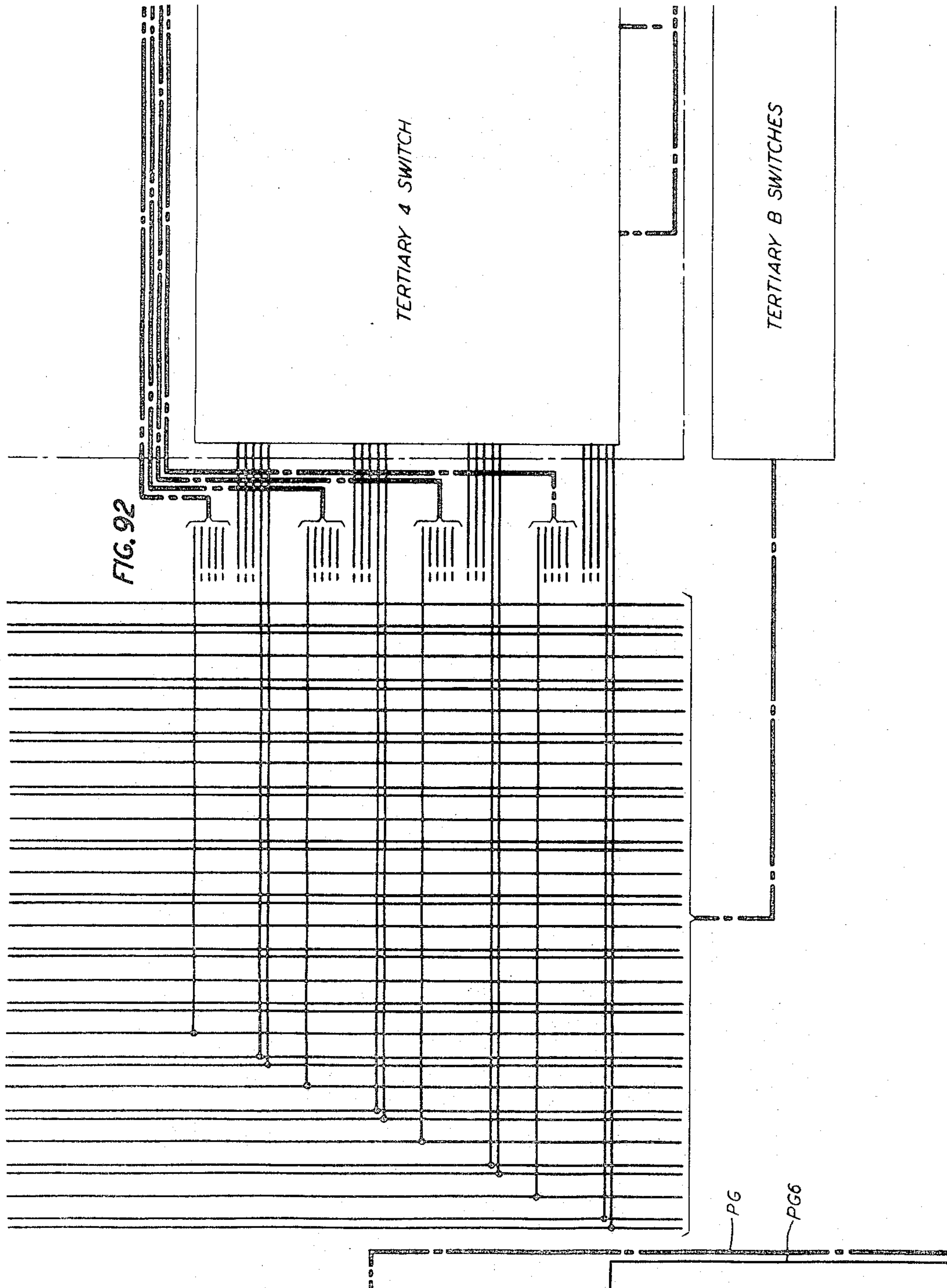
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 155



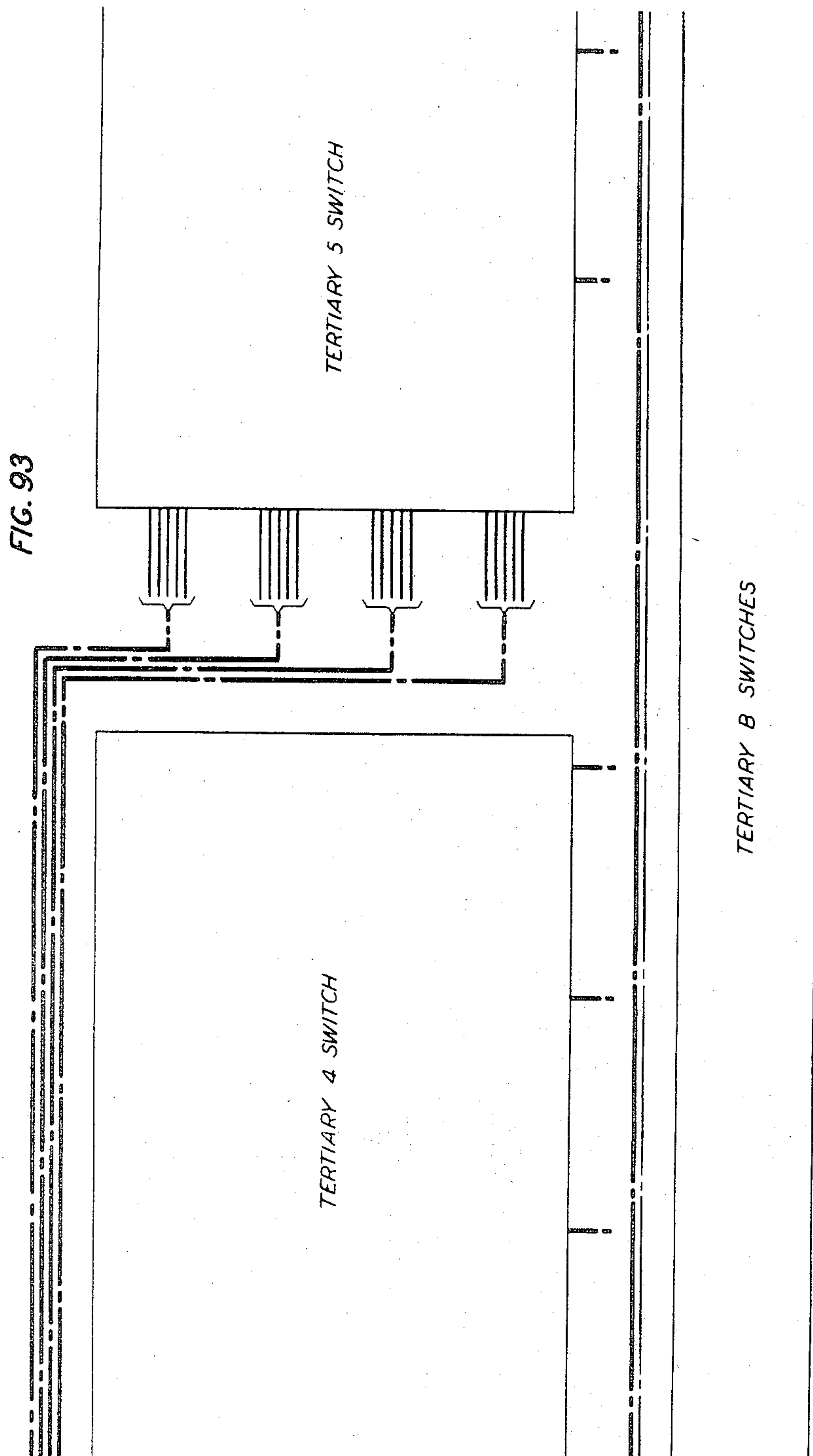
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 156



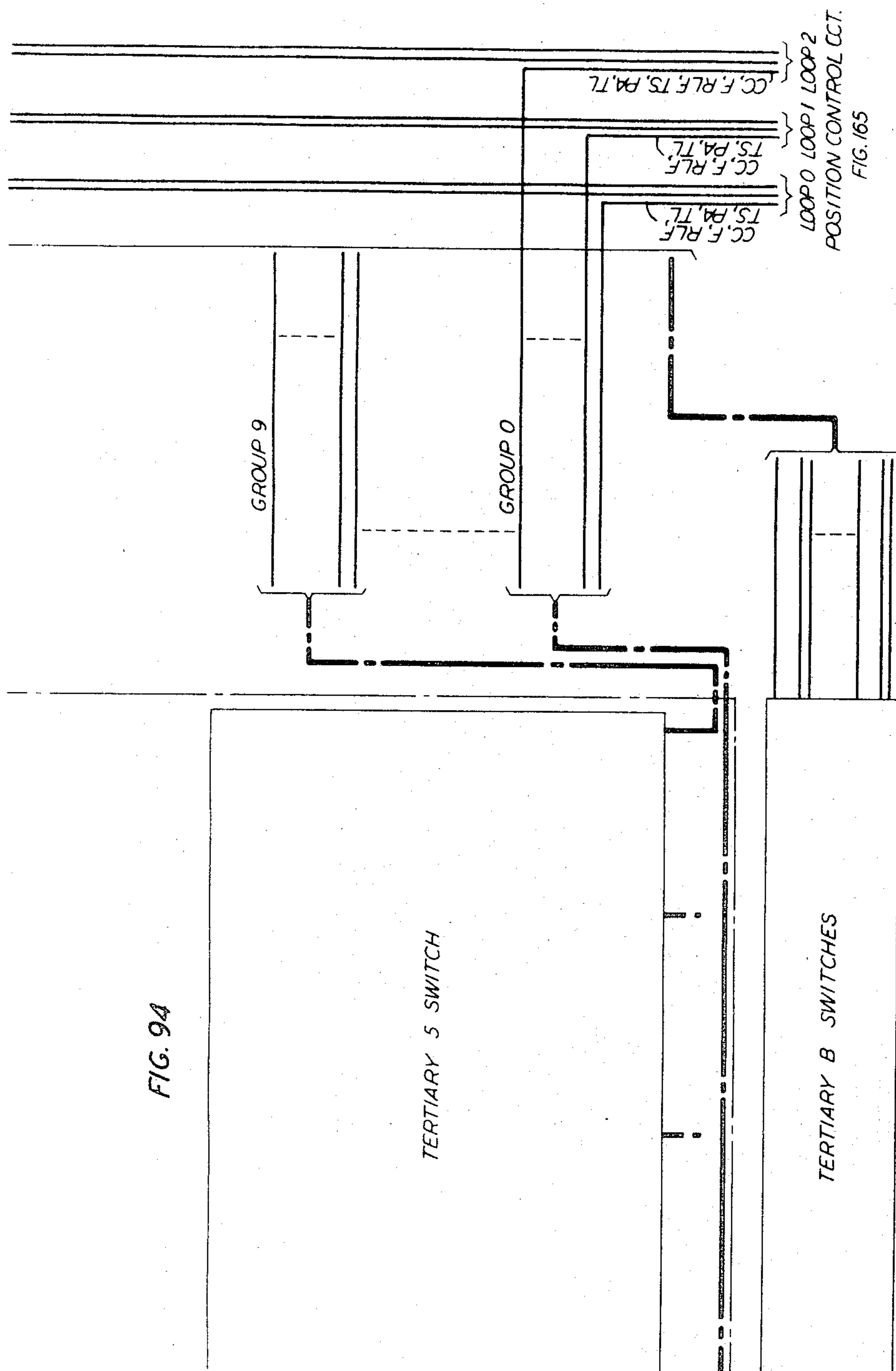
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 157



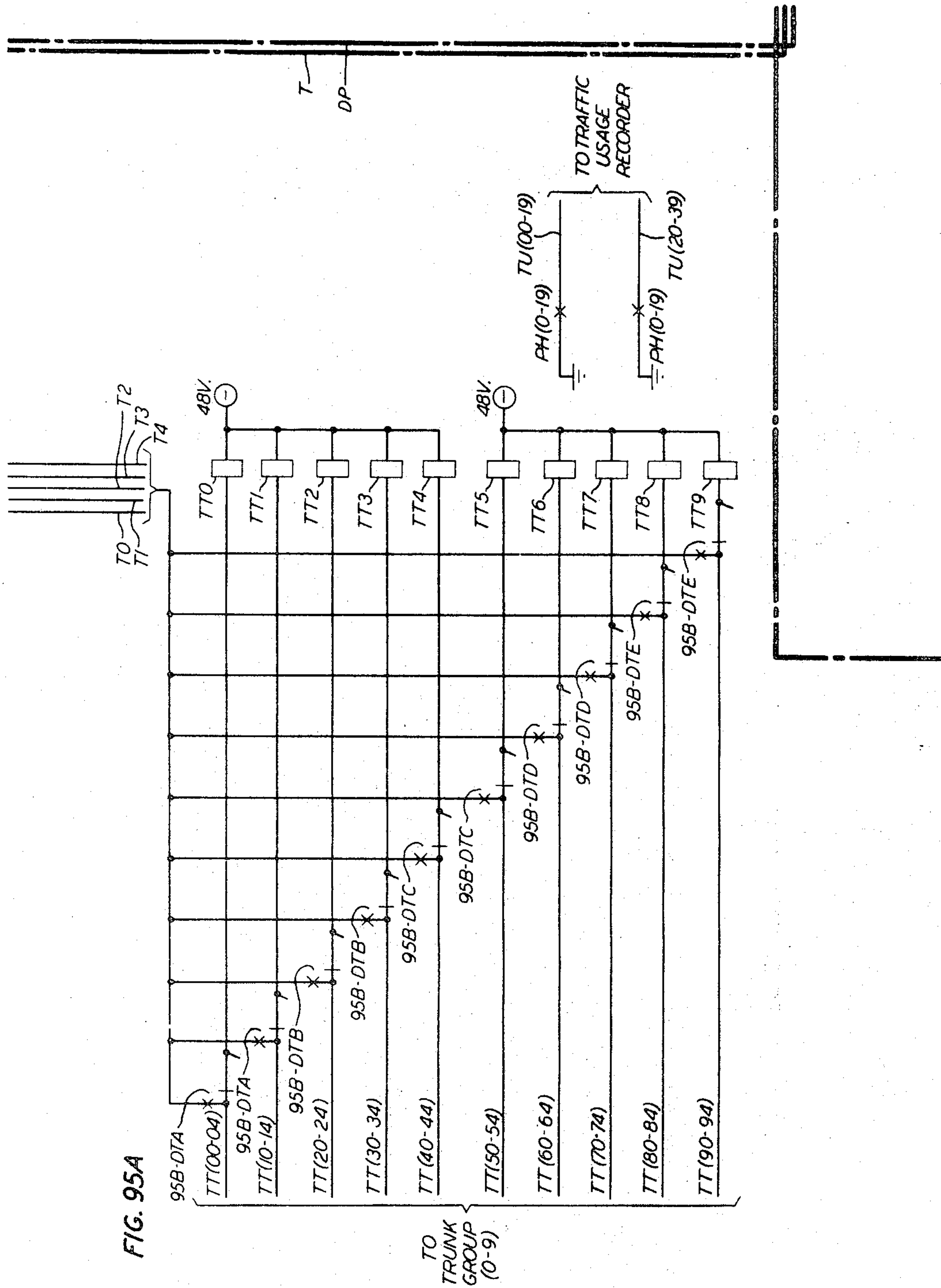
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L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 158



Sept. 12, 1967

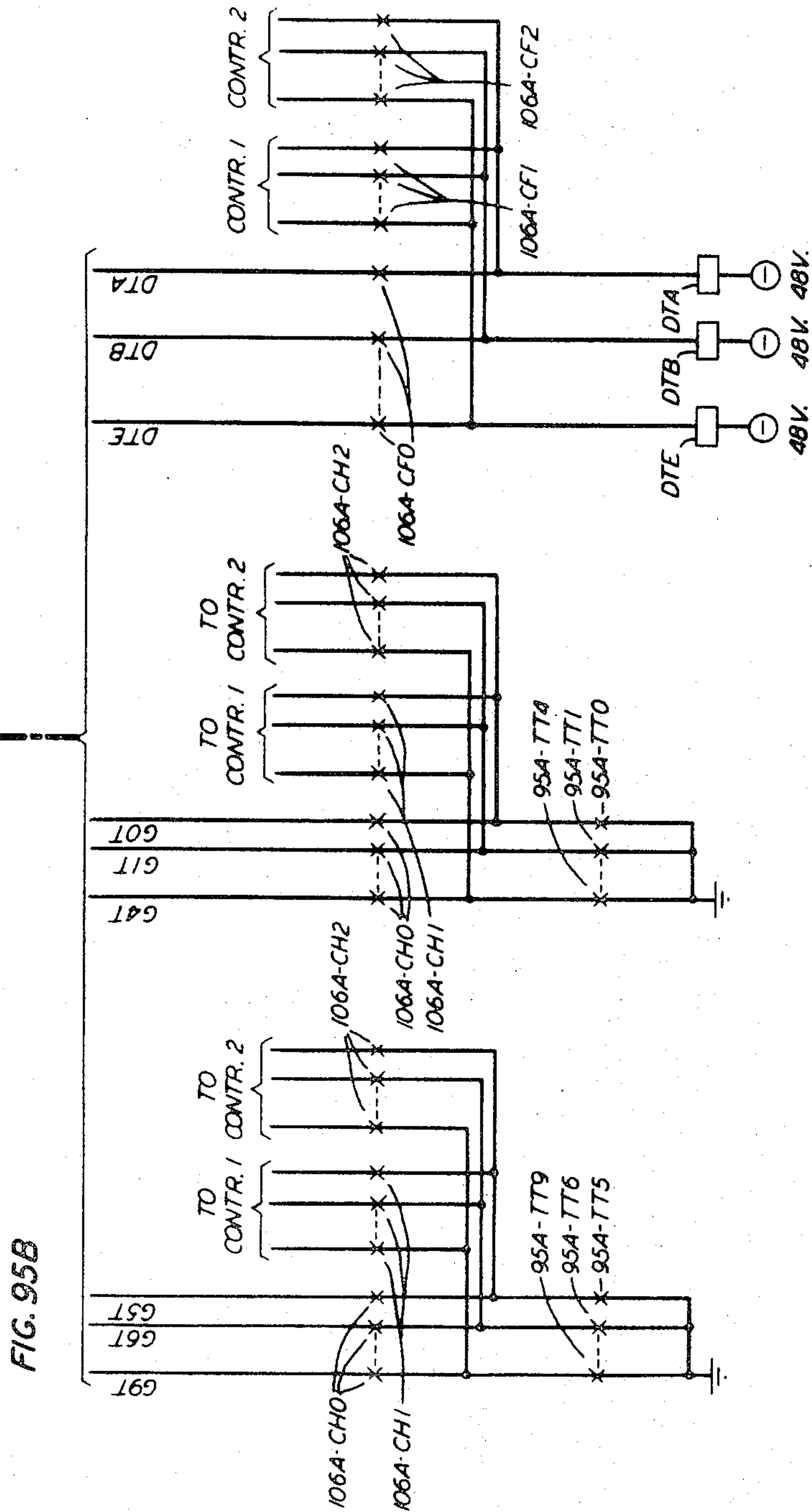
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 159



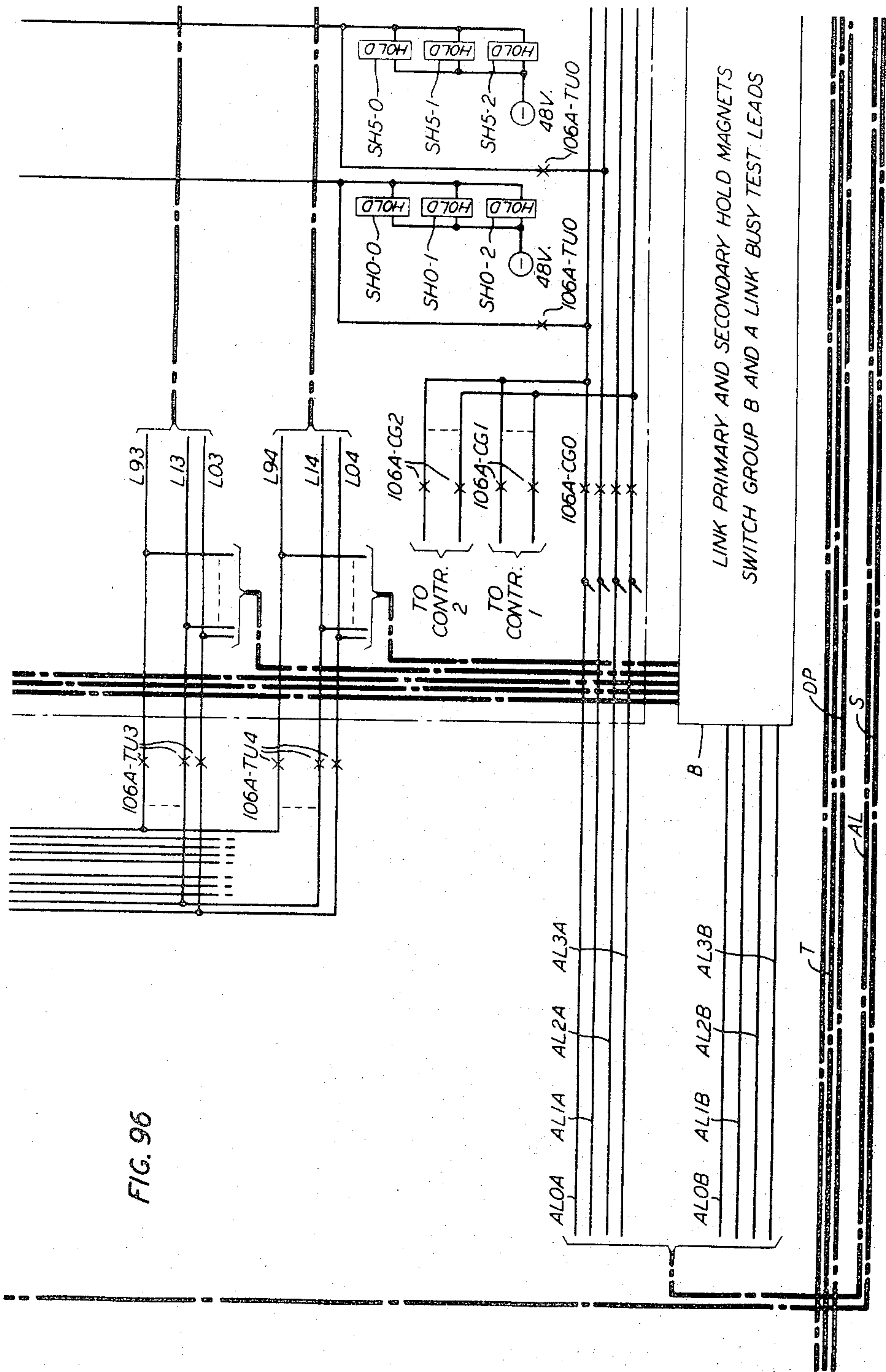
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 160



Sept. 12, 1967

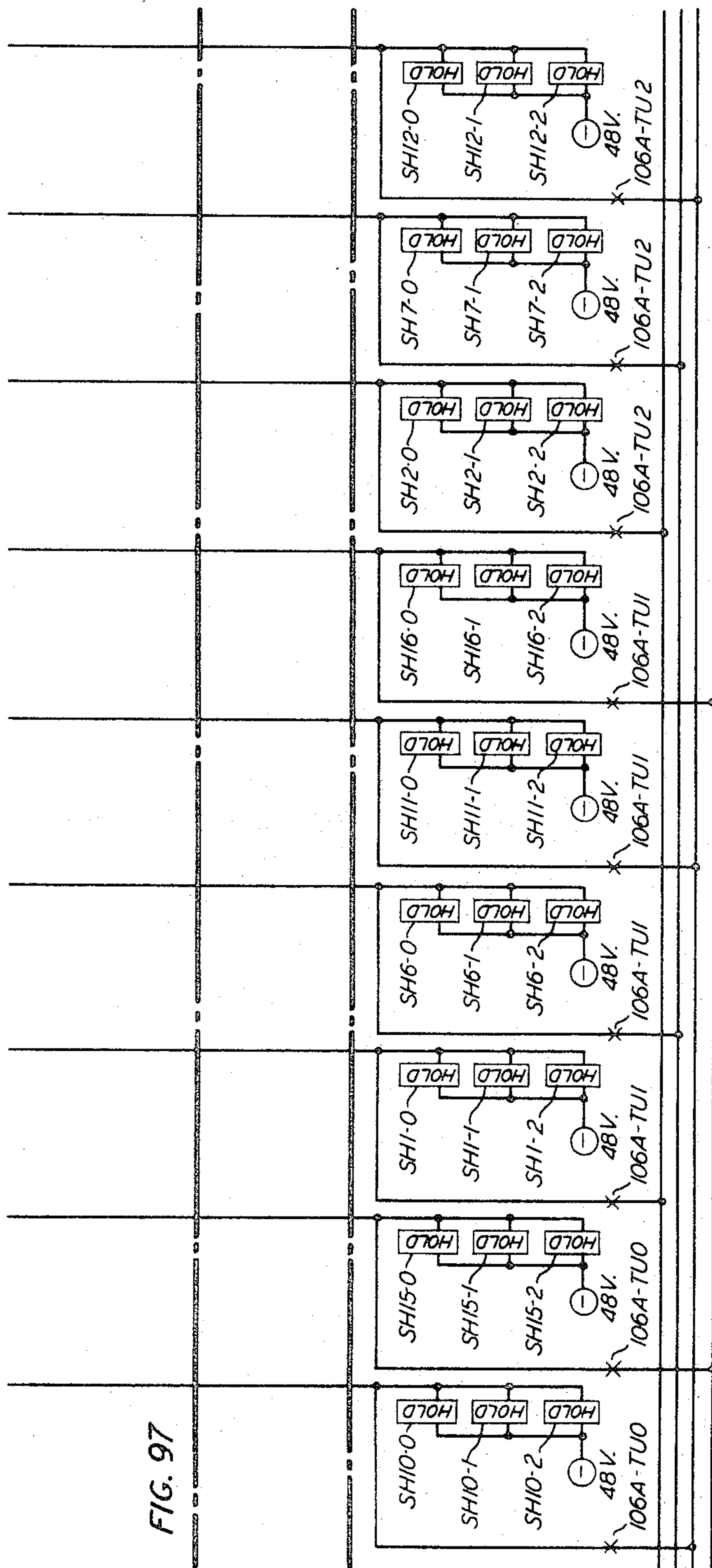
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 161

FIG. 97



LINK PRIMARY AND SECONDARY HOLD MAGNETS
SWITCH GROUP B AND A LINK BUSY TEST LEADS

DP

T

CAL

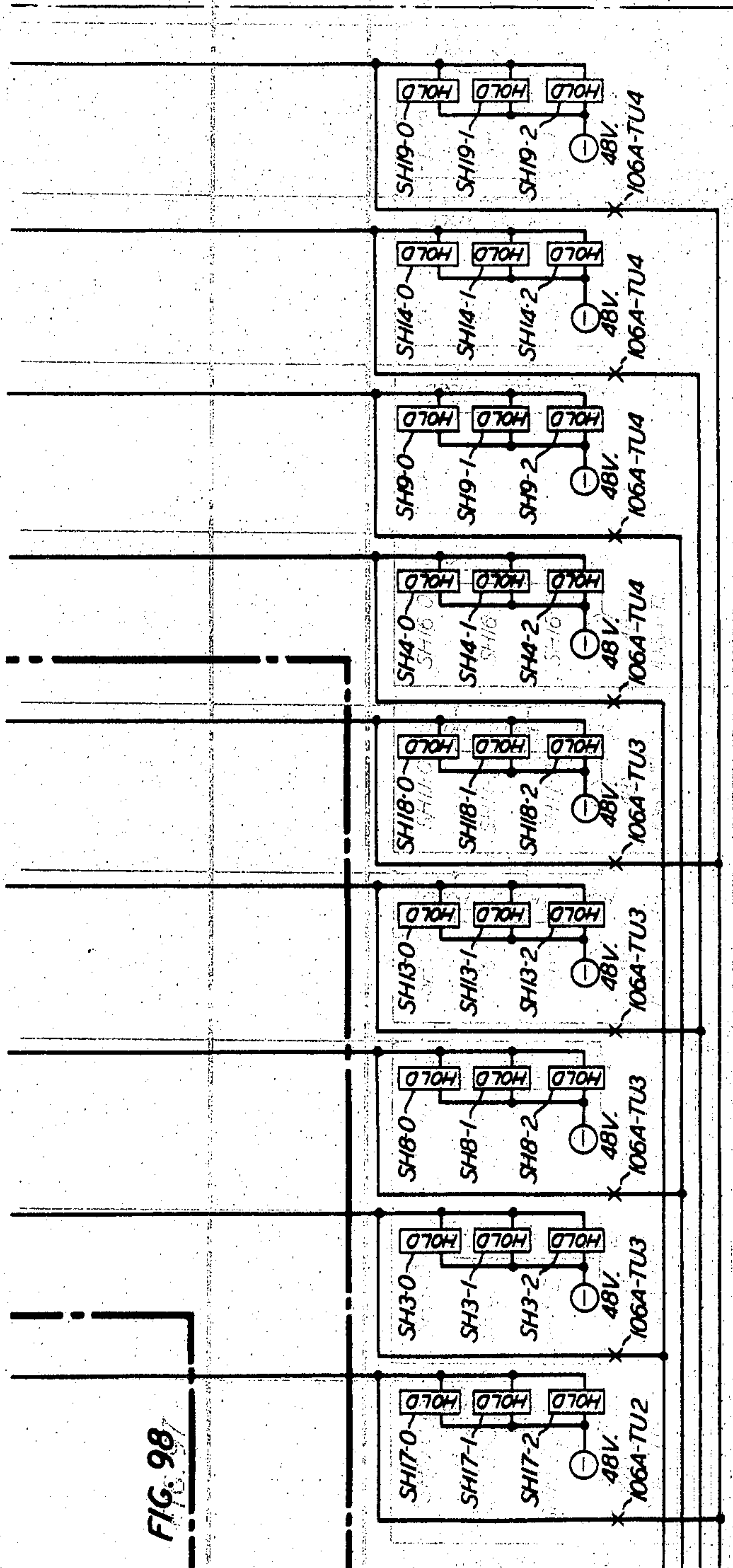
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L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 163



LINK PRIMARY AND SECONDARY HOLD MAGNETS
SWITCH GROUP B AND A LINK BUSY TEST LEADS

DP
CAL CS

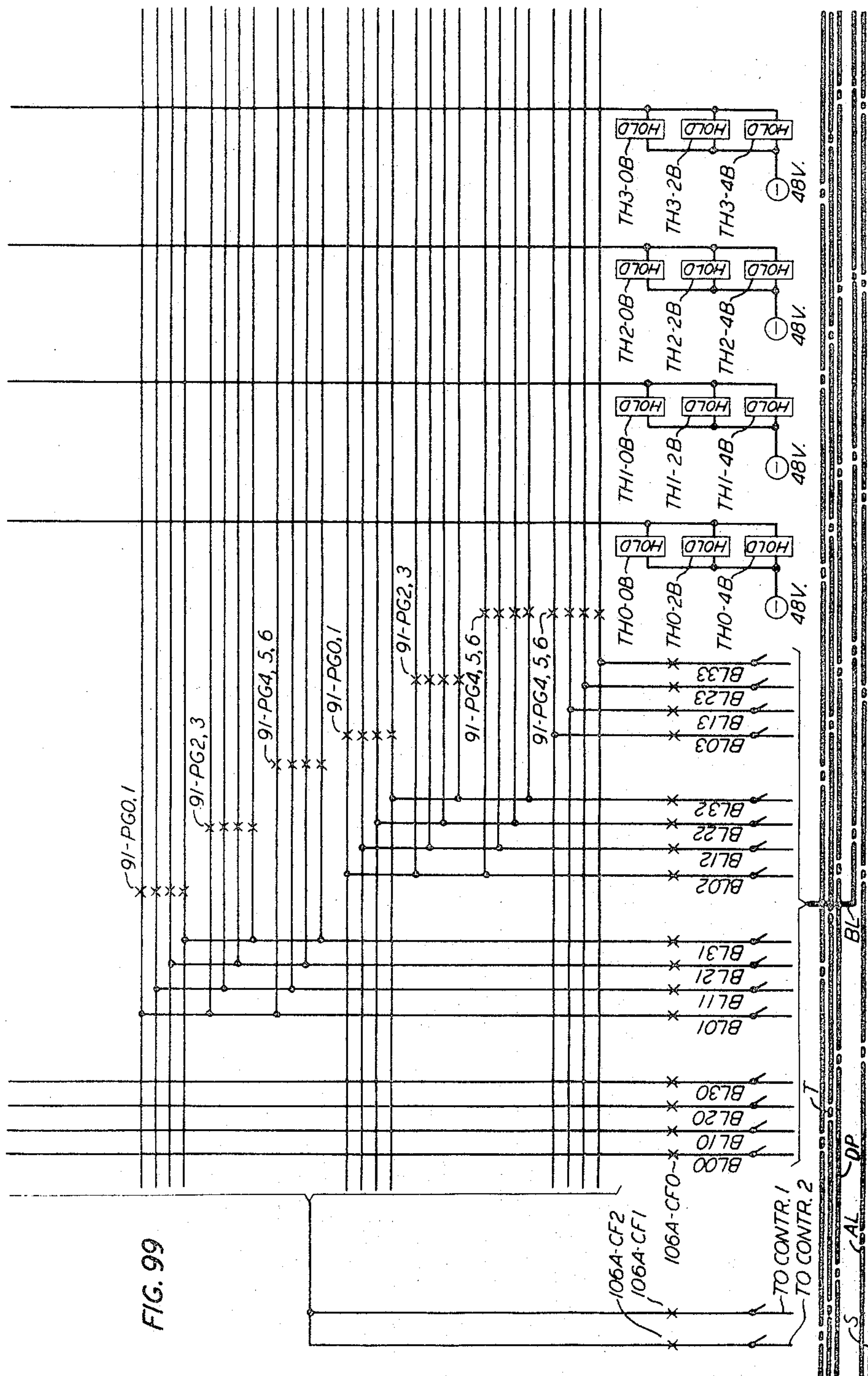
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 163



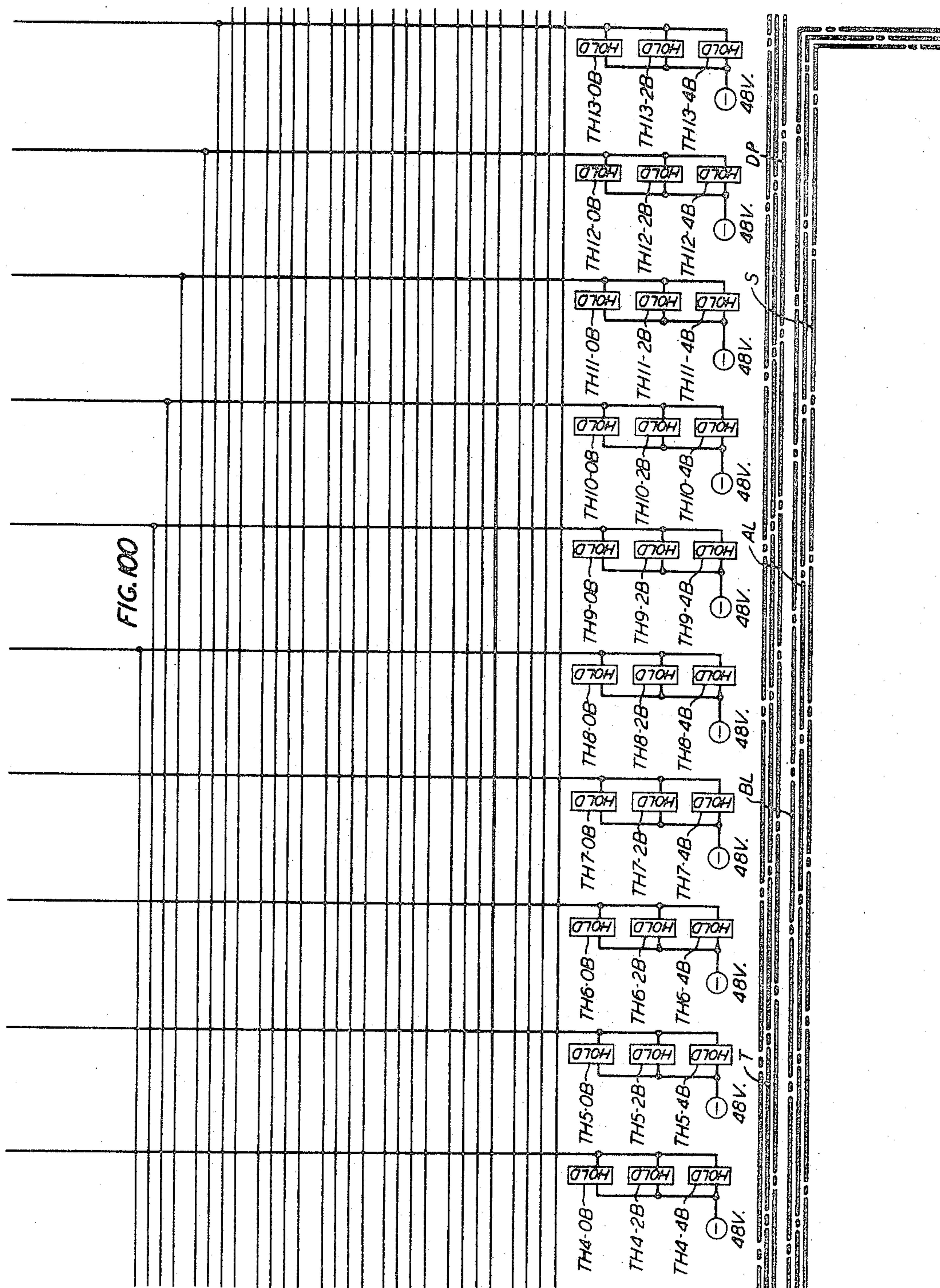
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INTERMEDIATE SWITCHING CENTER.

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 164



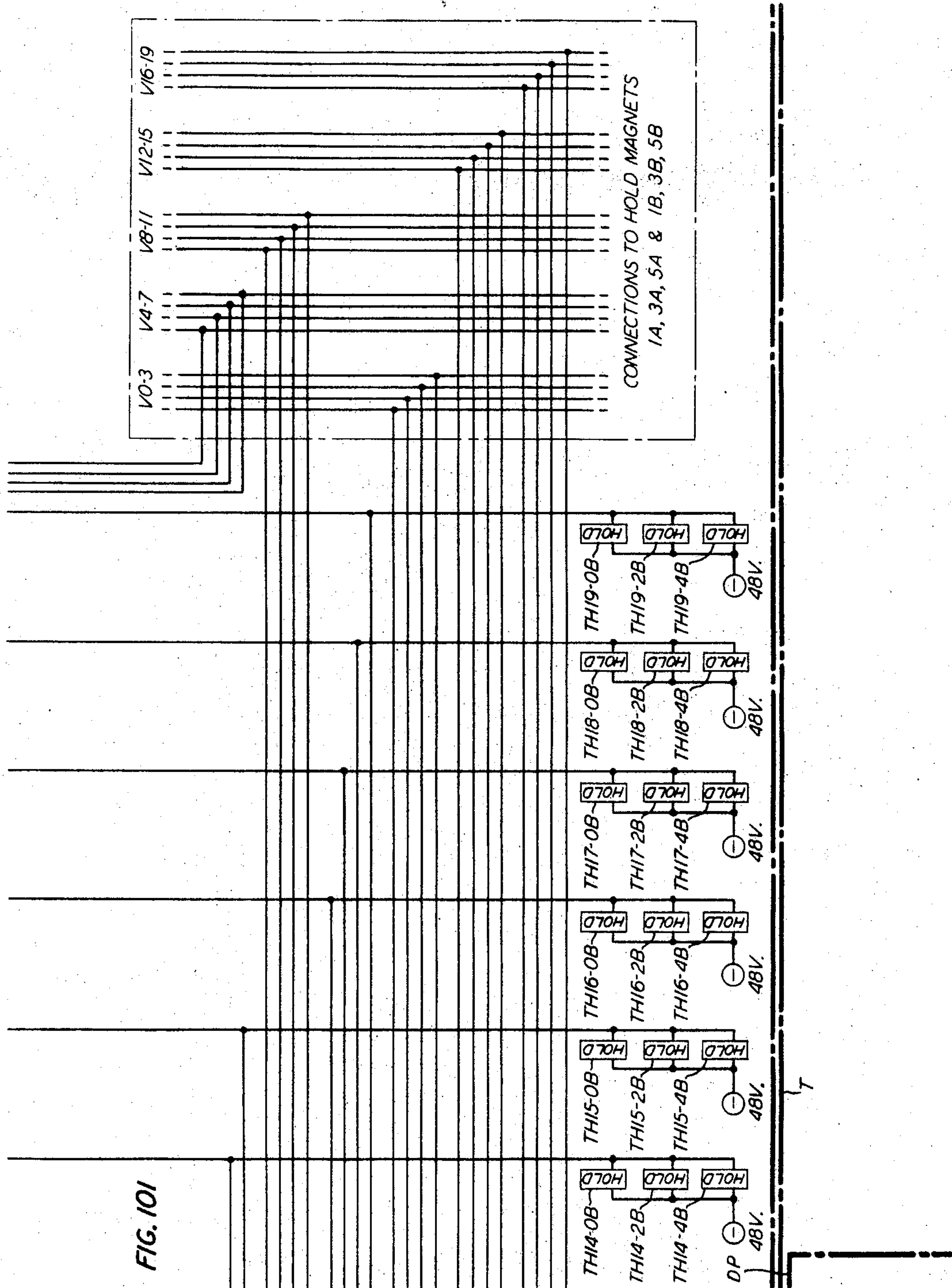
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 165



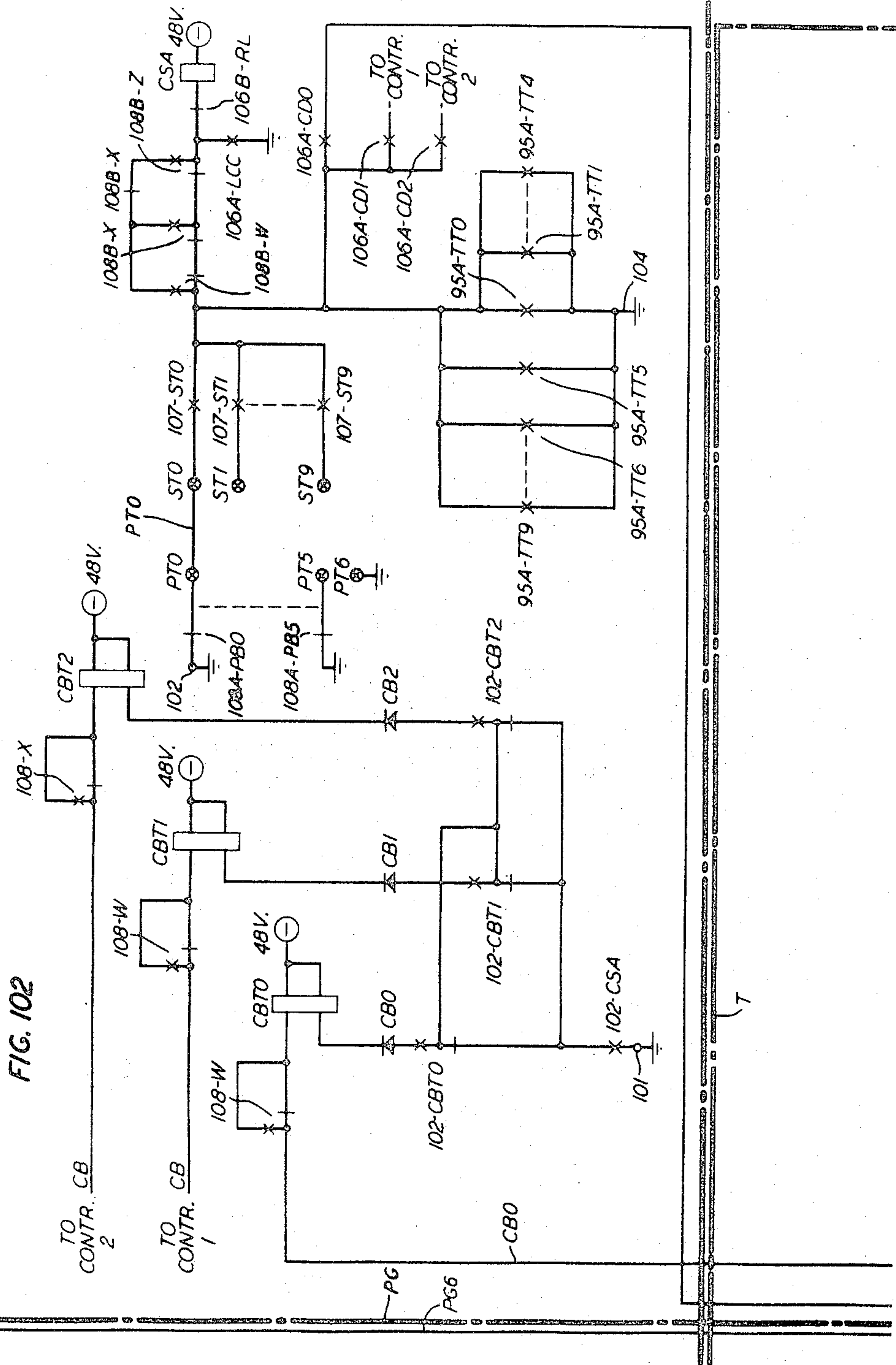
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 166



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 167

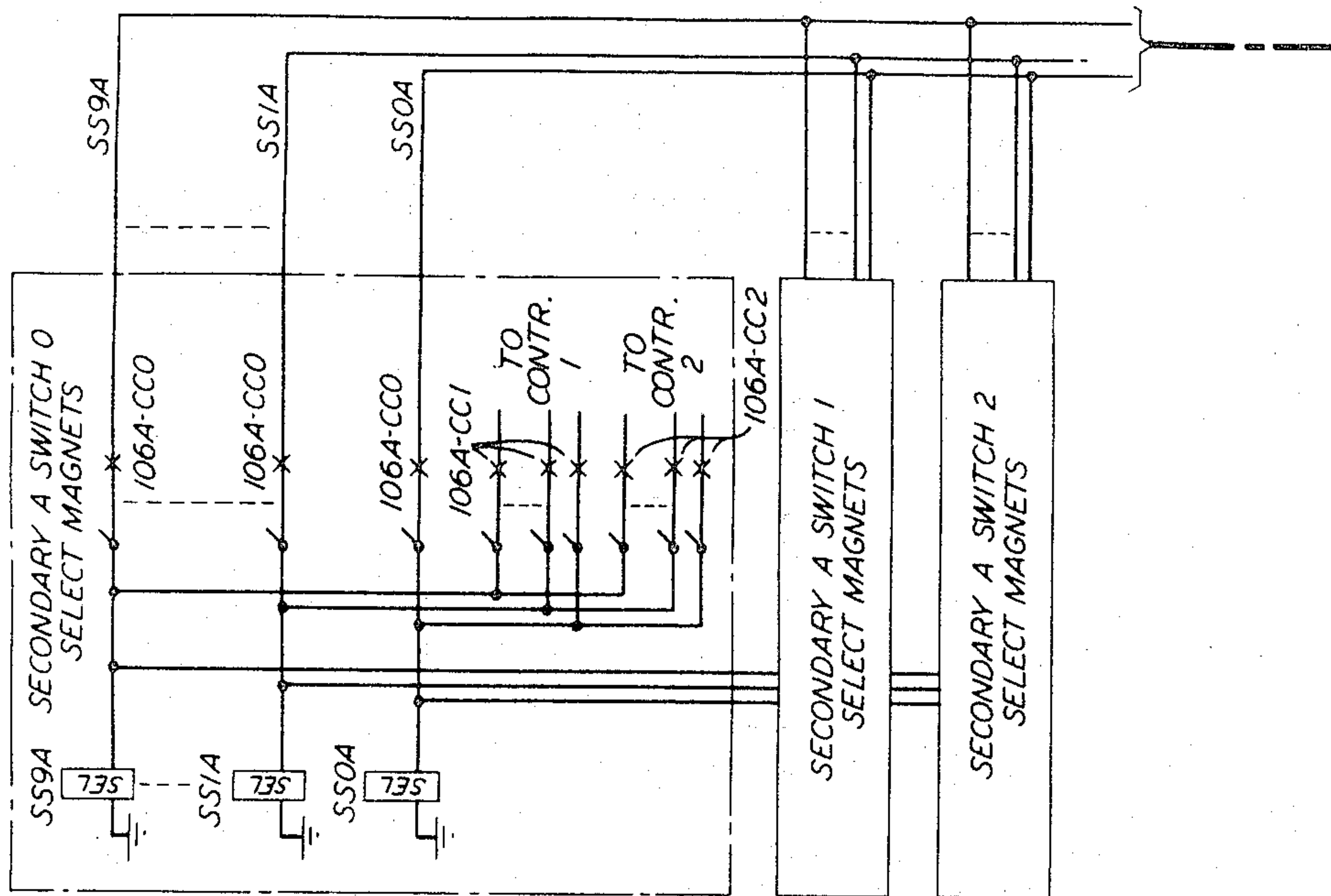
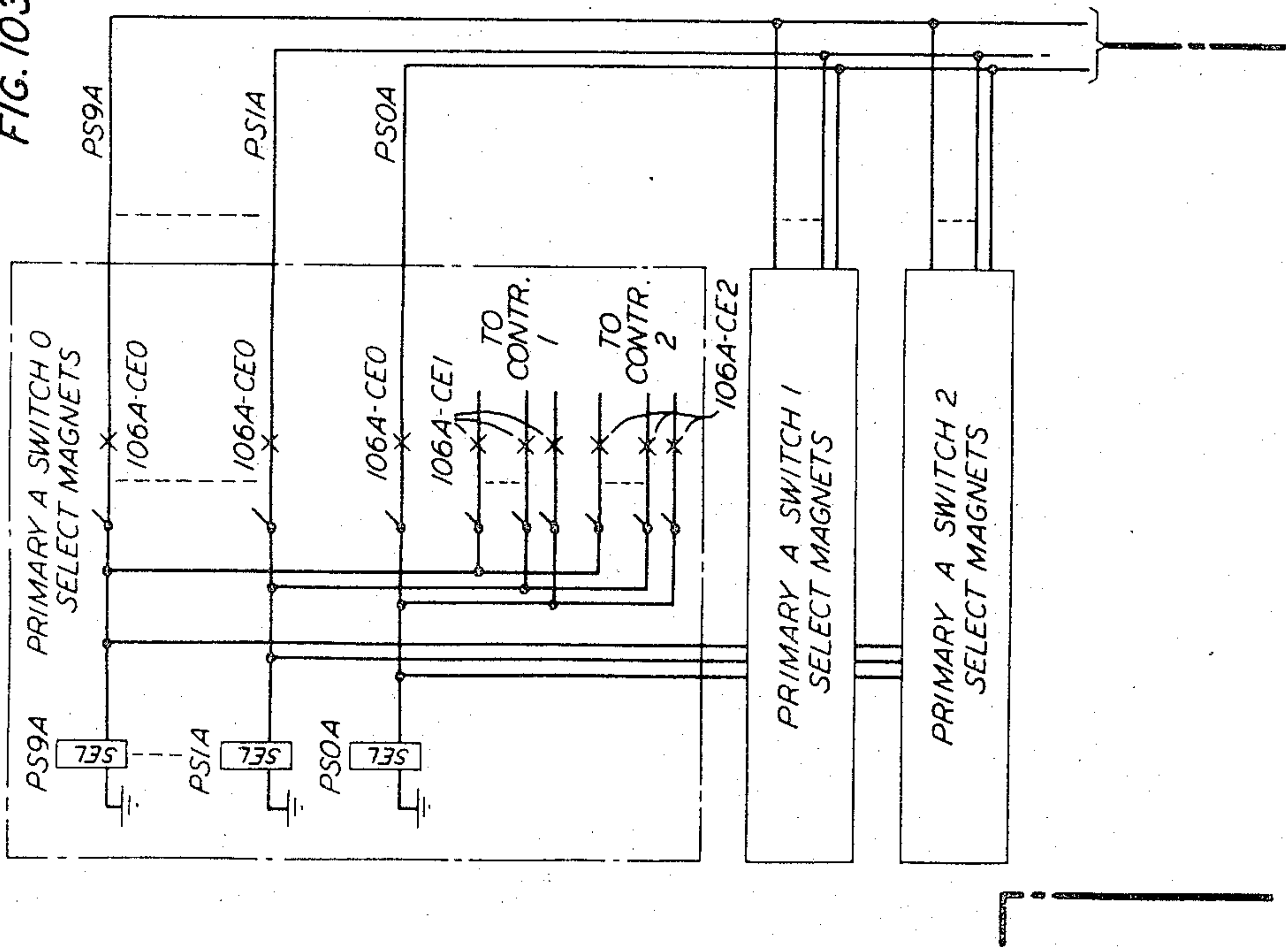


FIG. 103



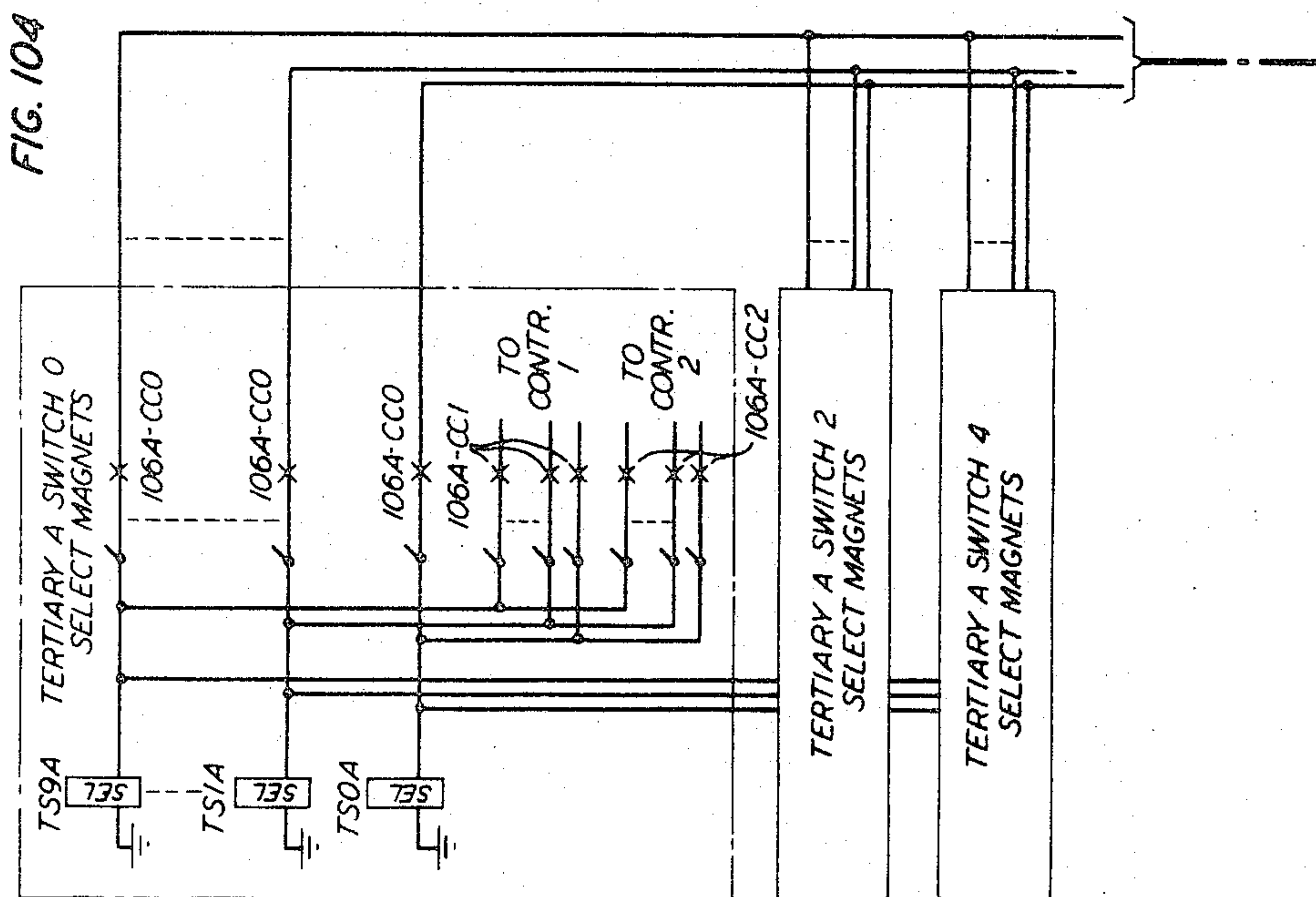
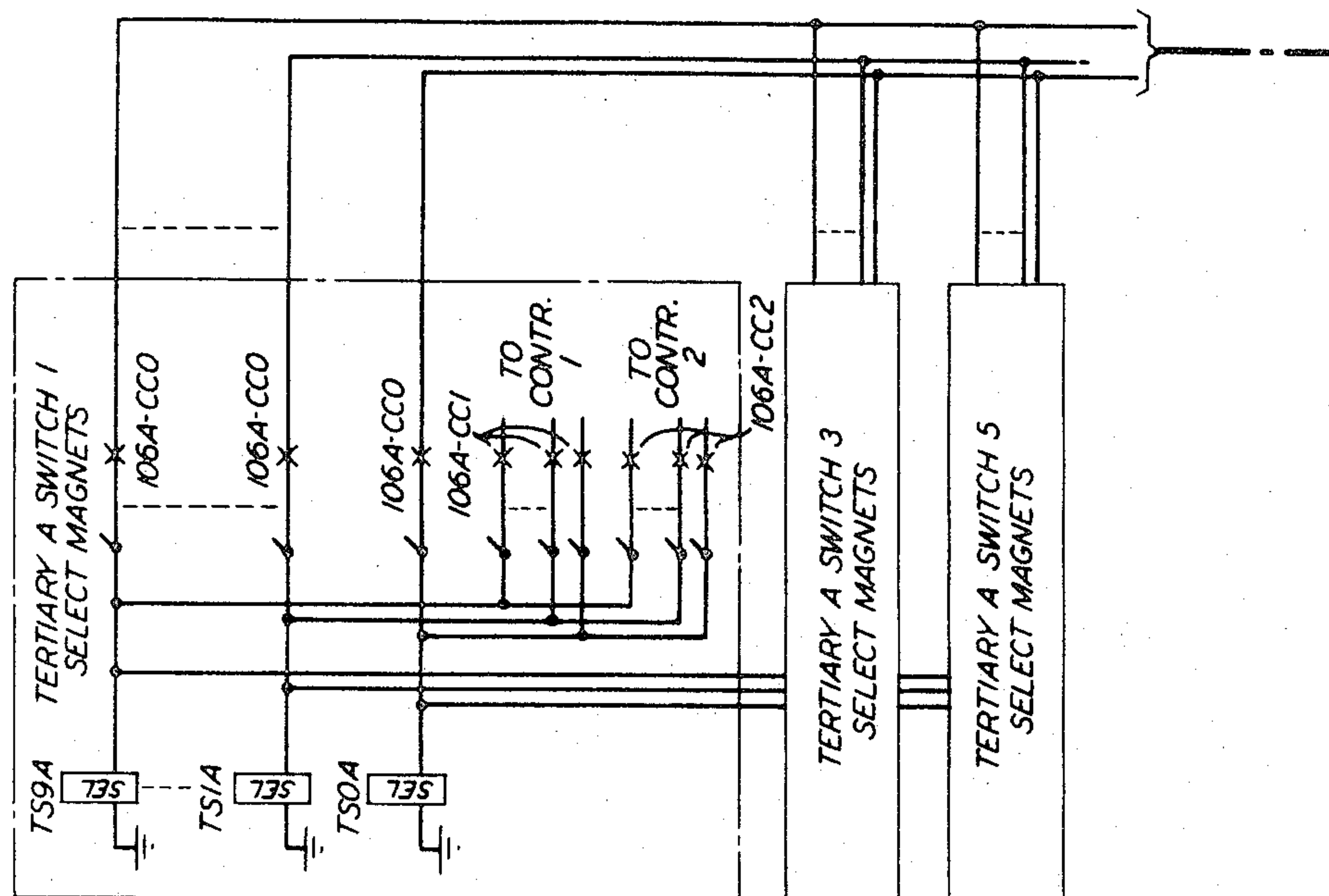
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 168



Sept. 12, 1967

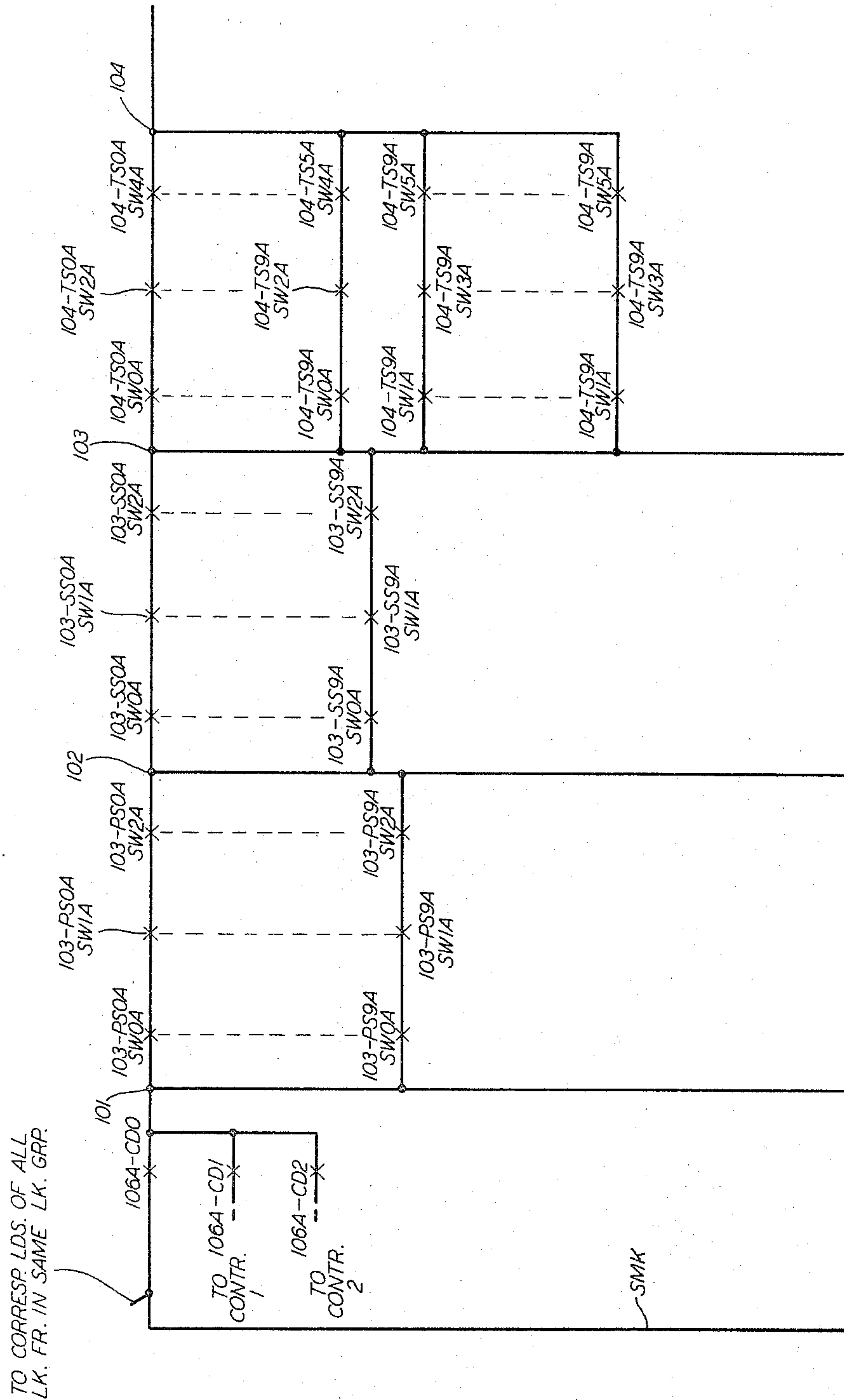
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 169

FIG. 105



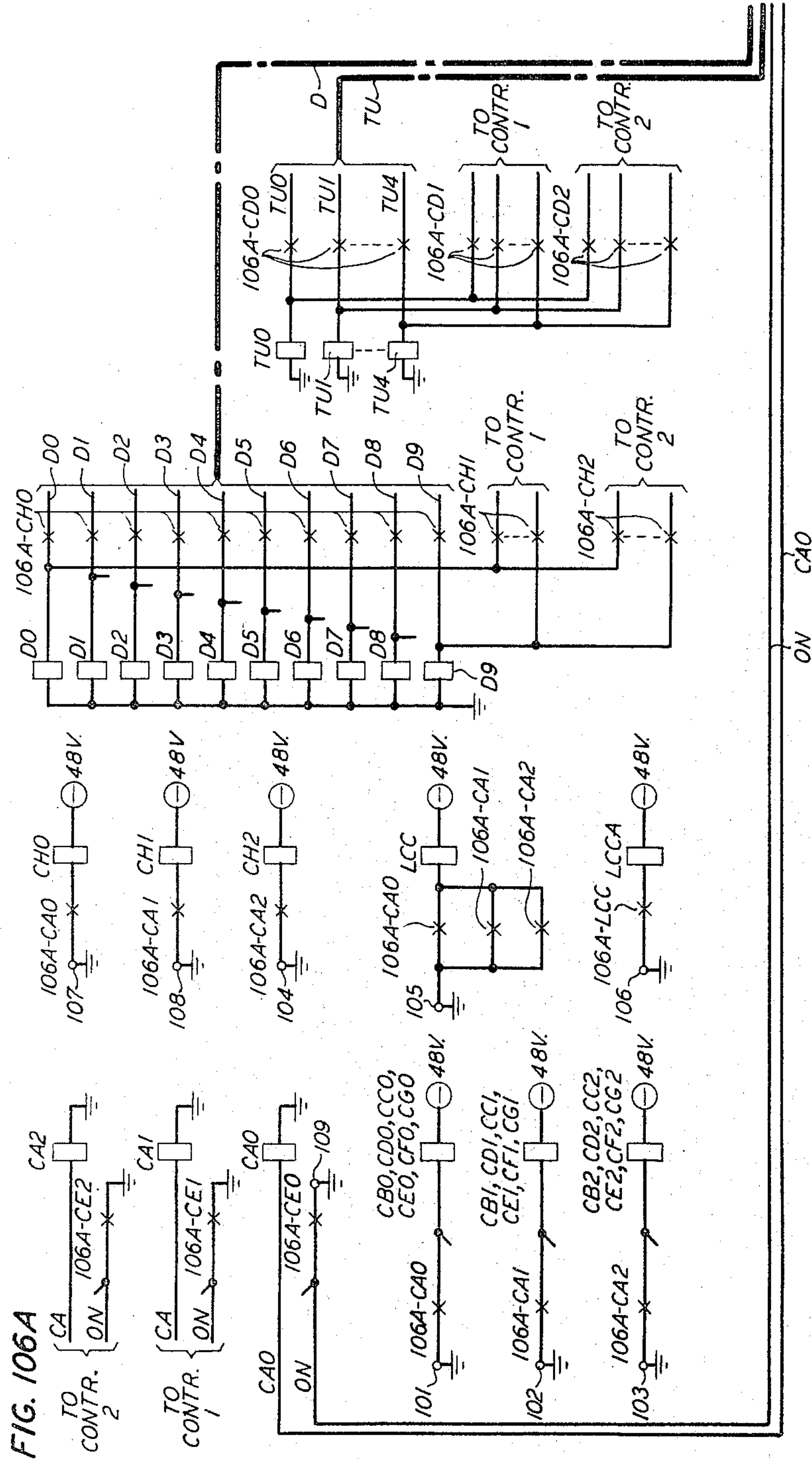
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 170



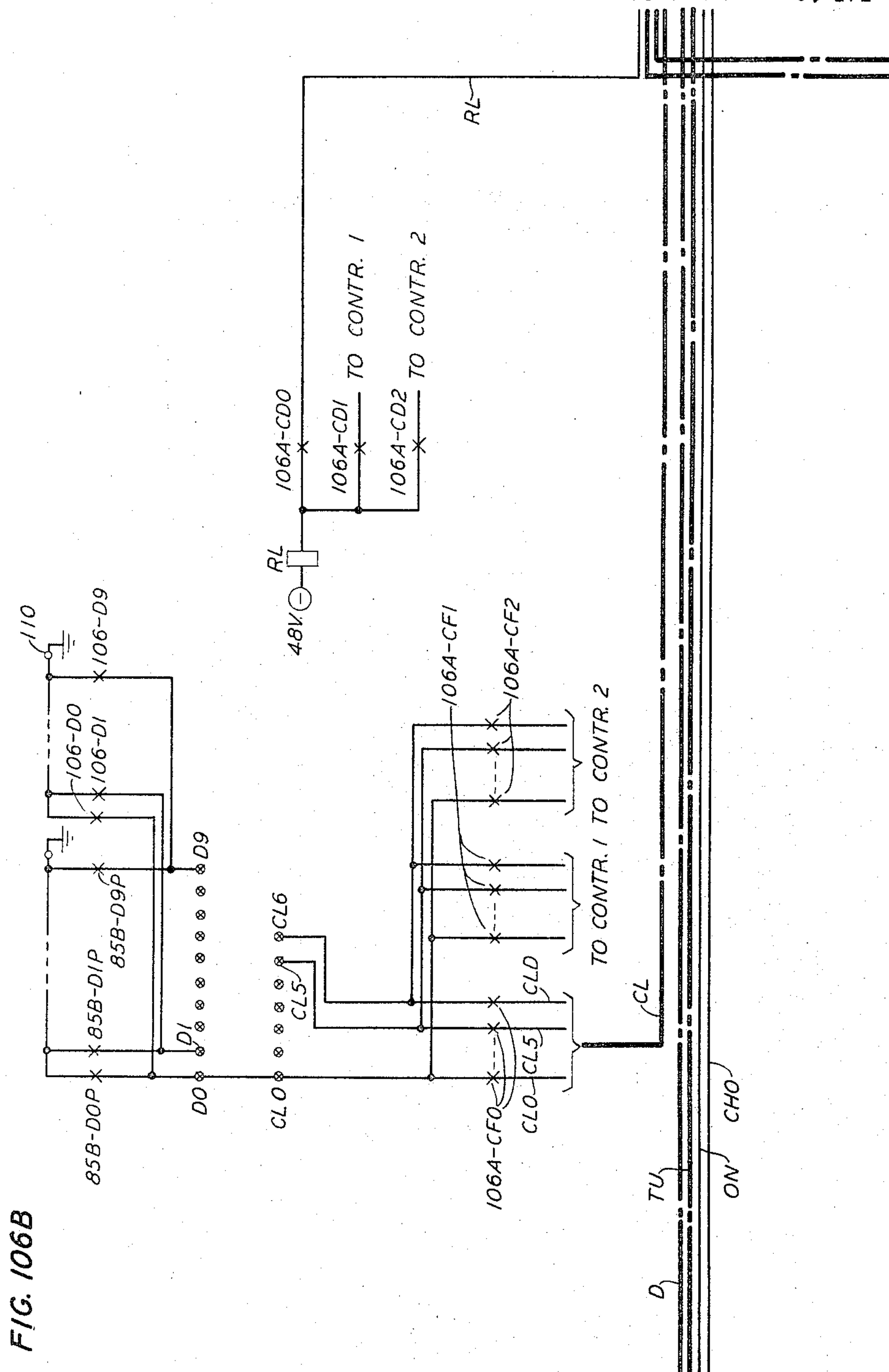
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 171



Sept. 12, 1967

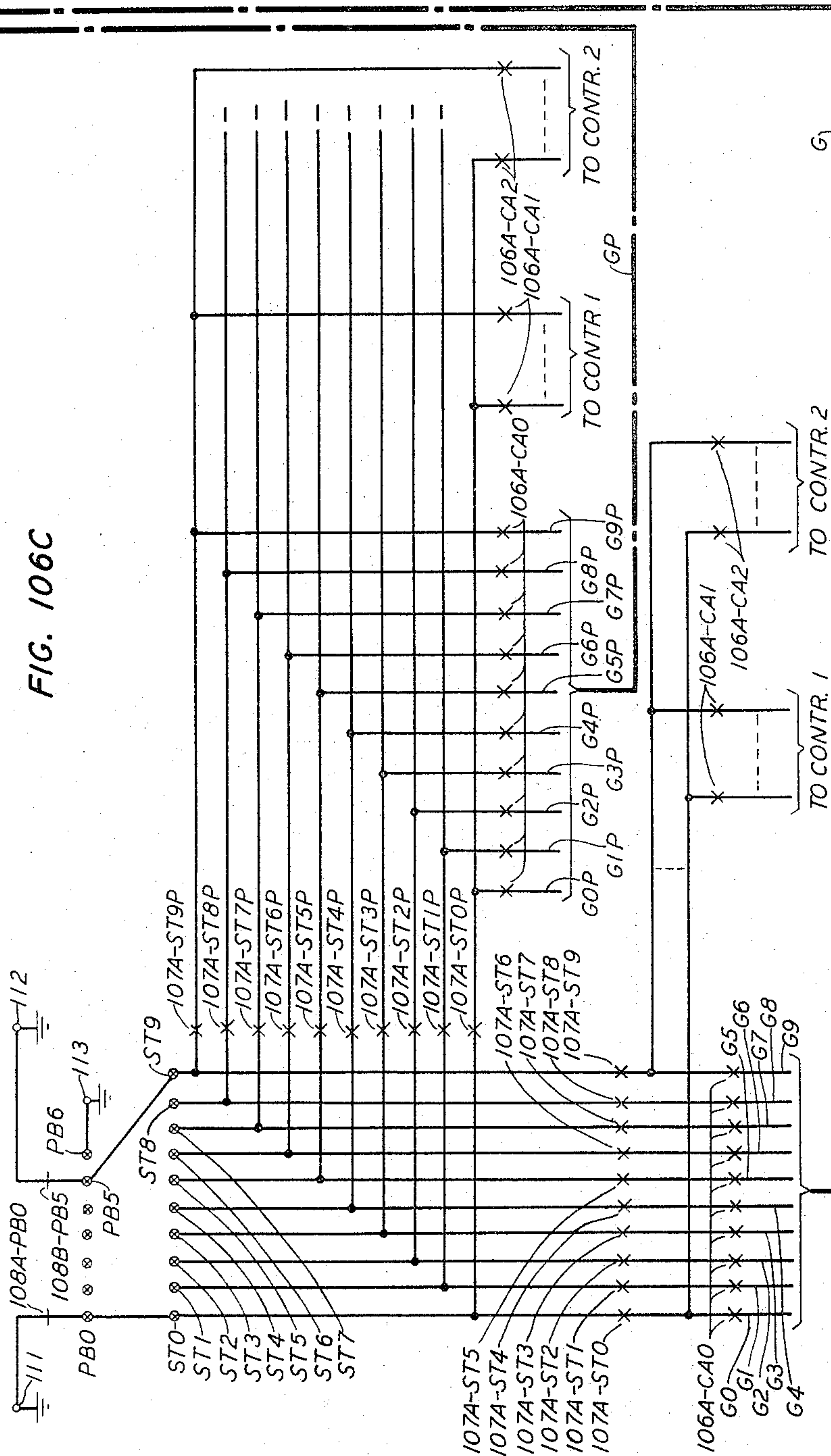
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 170

FIG. 106C



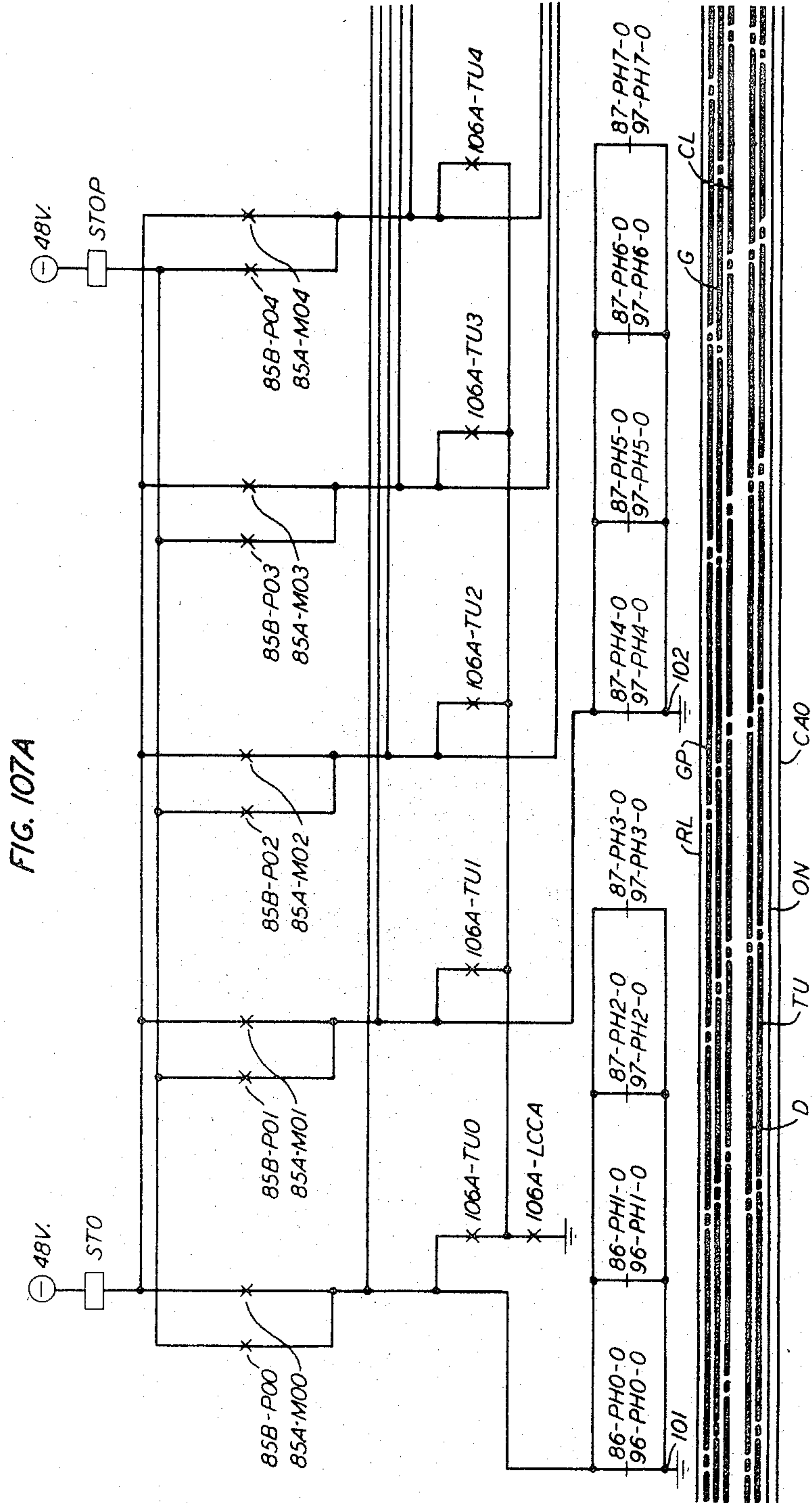
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 173



Sept. 12, 1967

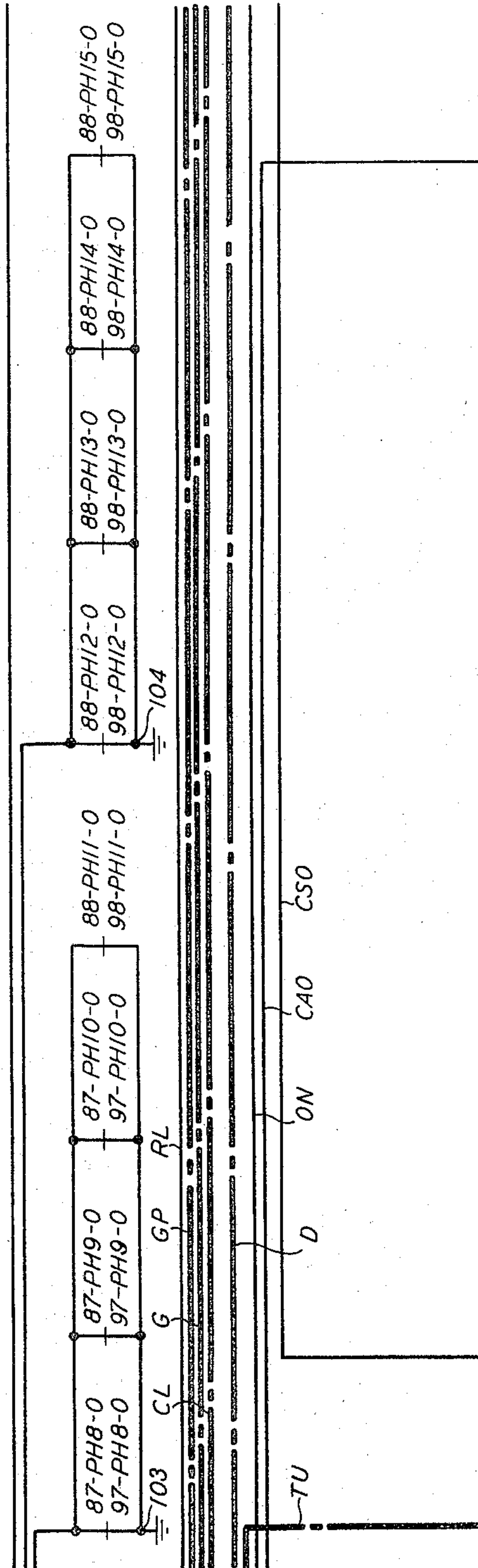
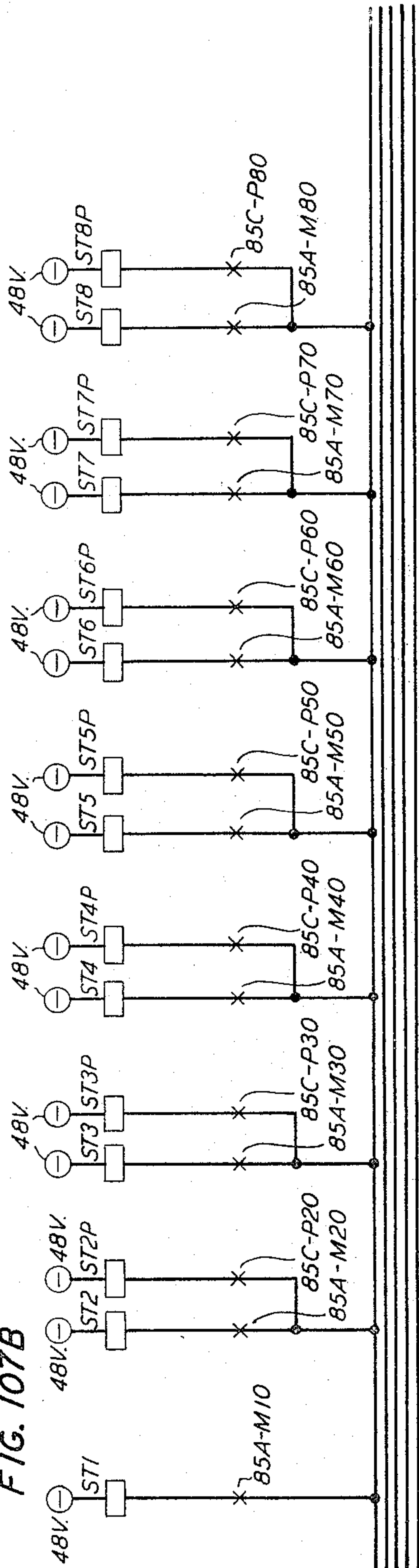
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 174

FIG. 107B



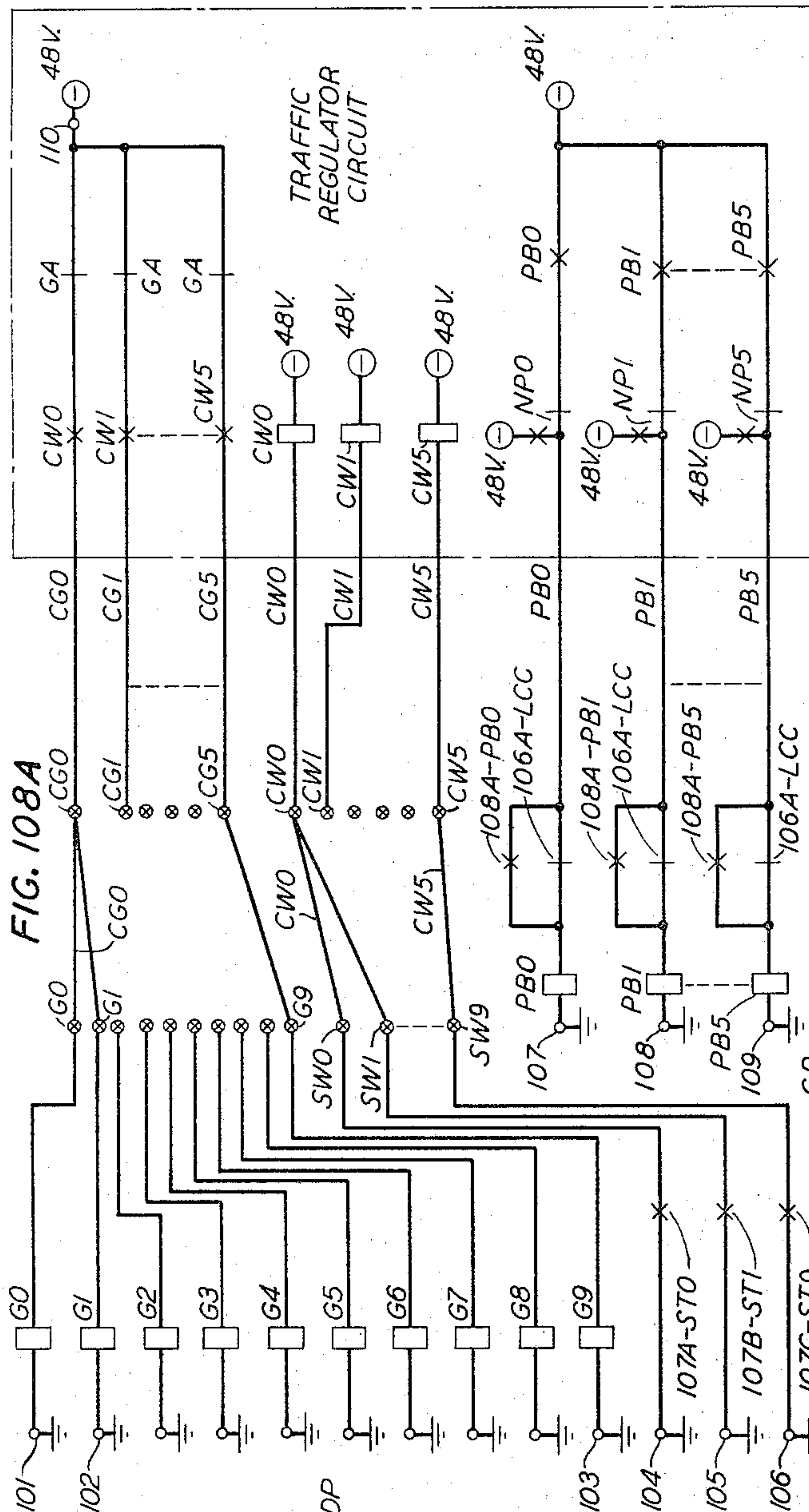
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 176



Sept. 12, 1967

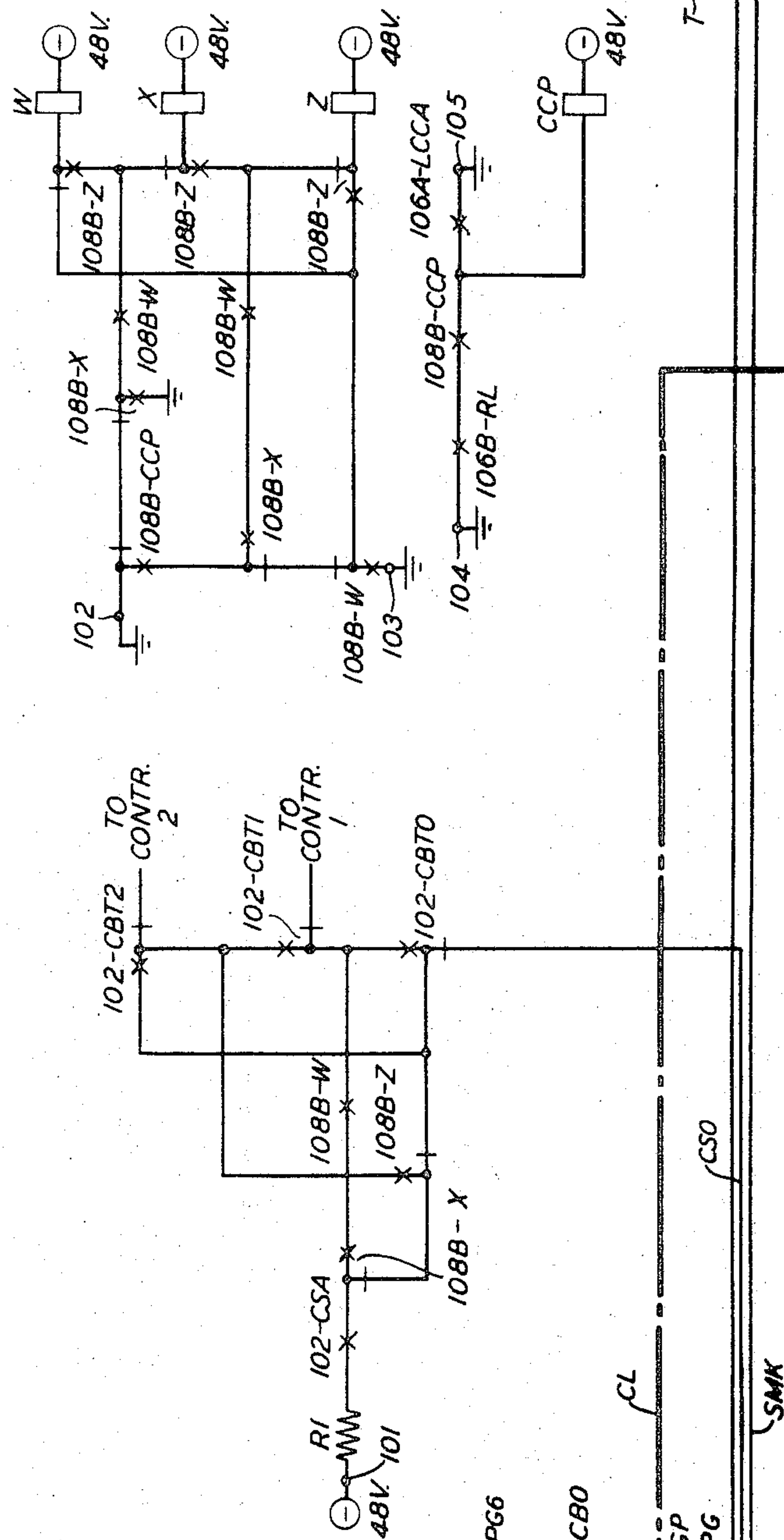
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 177

FIG. 108B



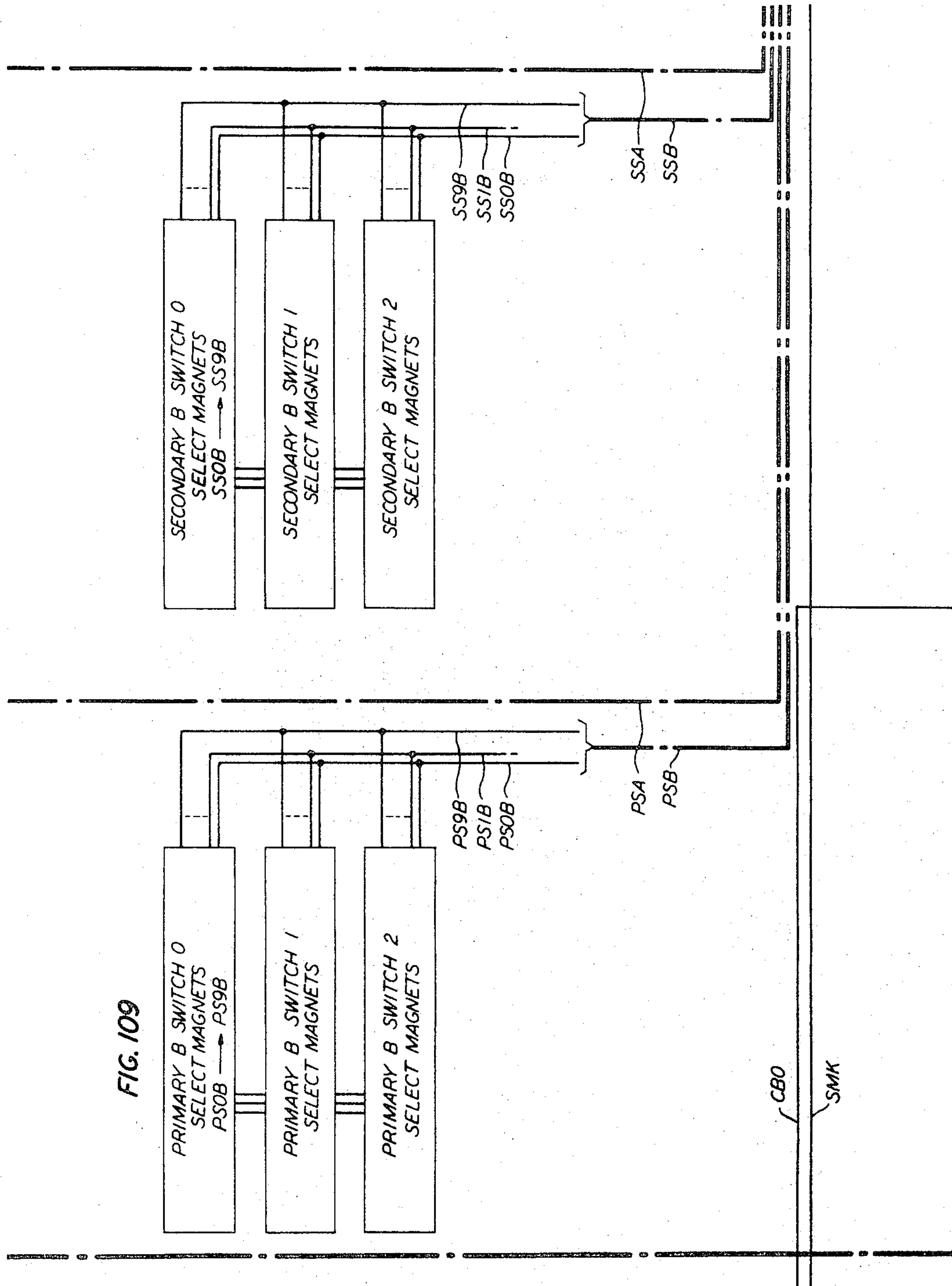
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 178



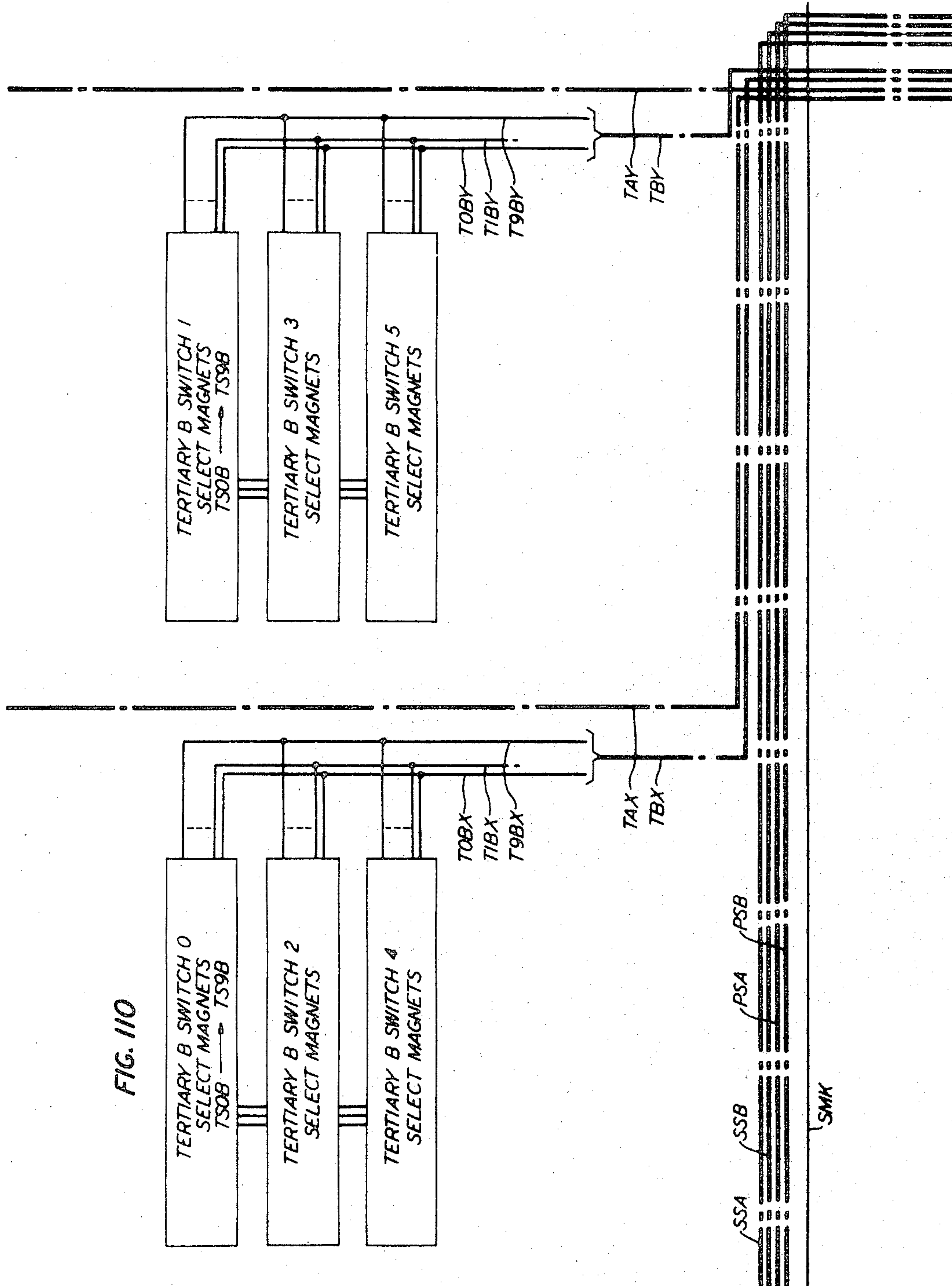
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 179



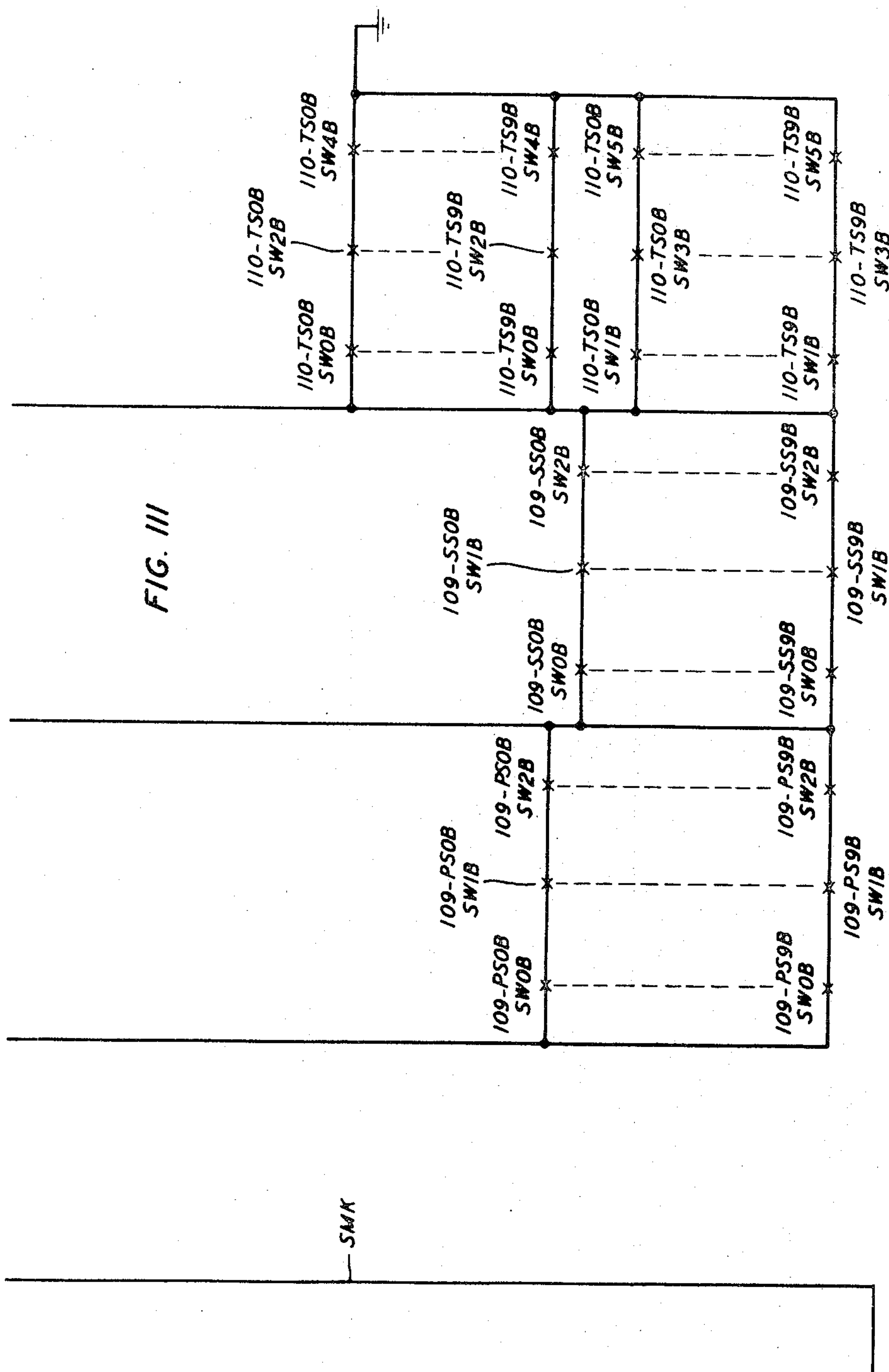
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 180



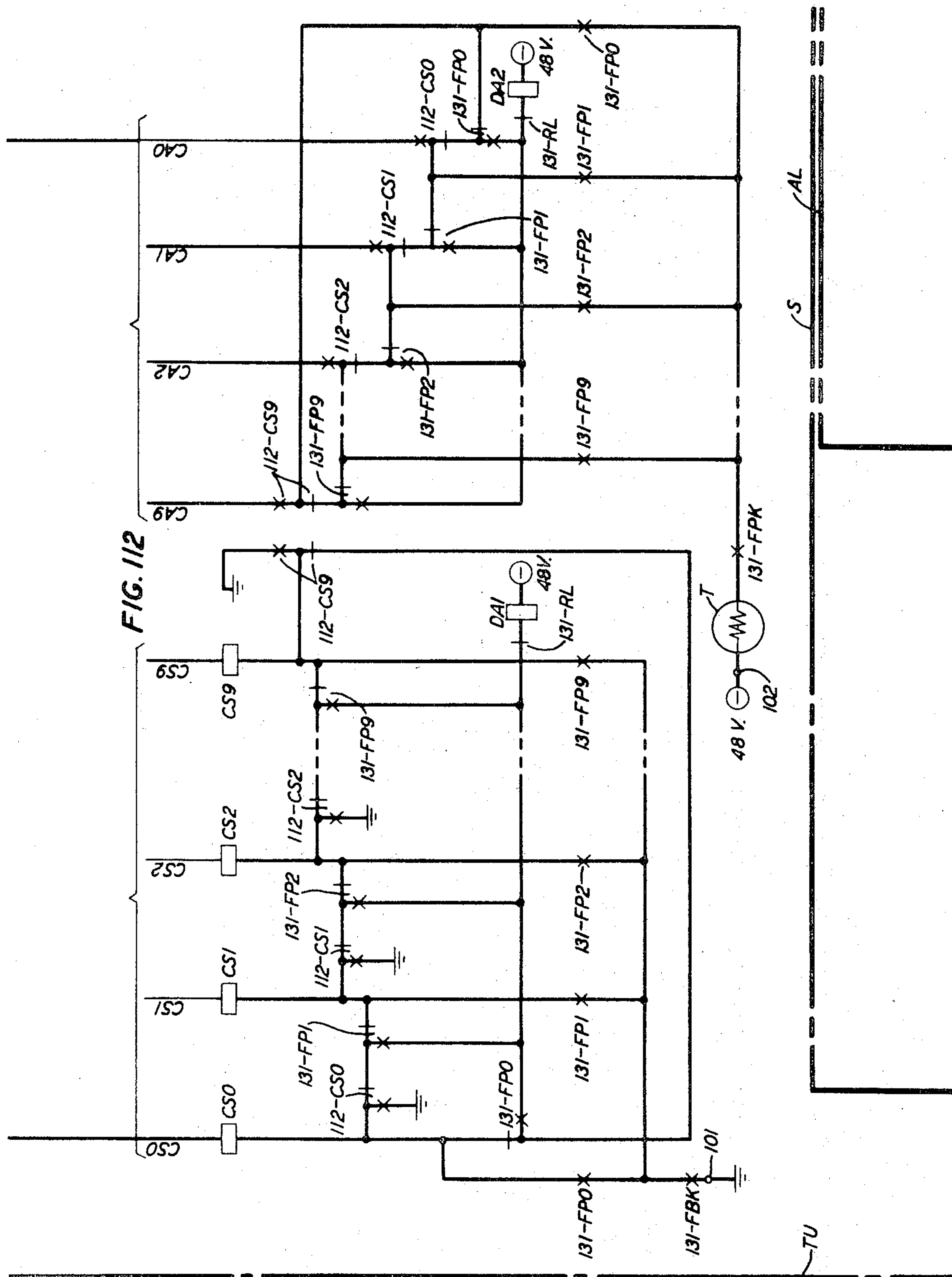
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 181



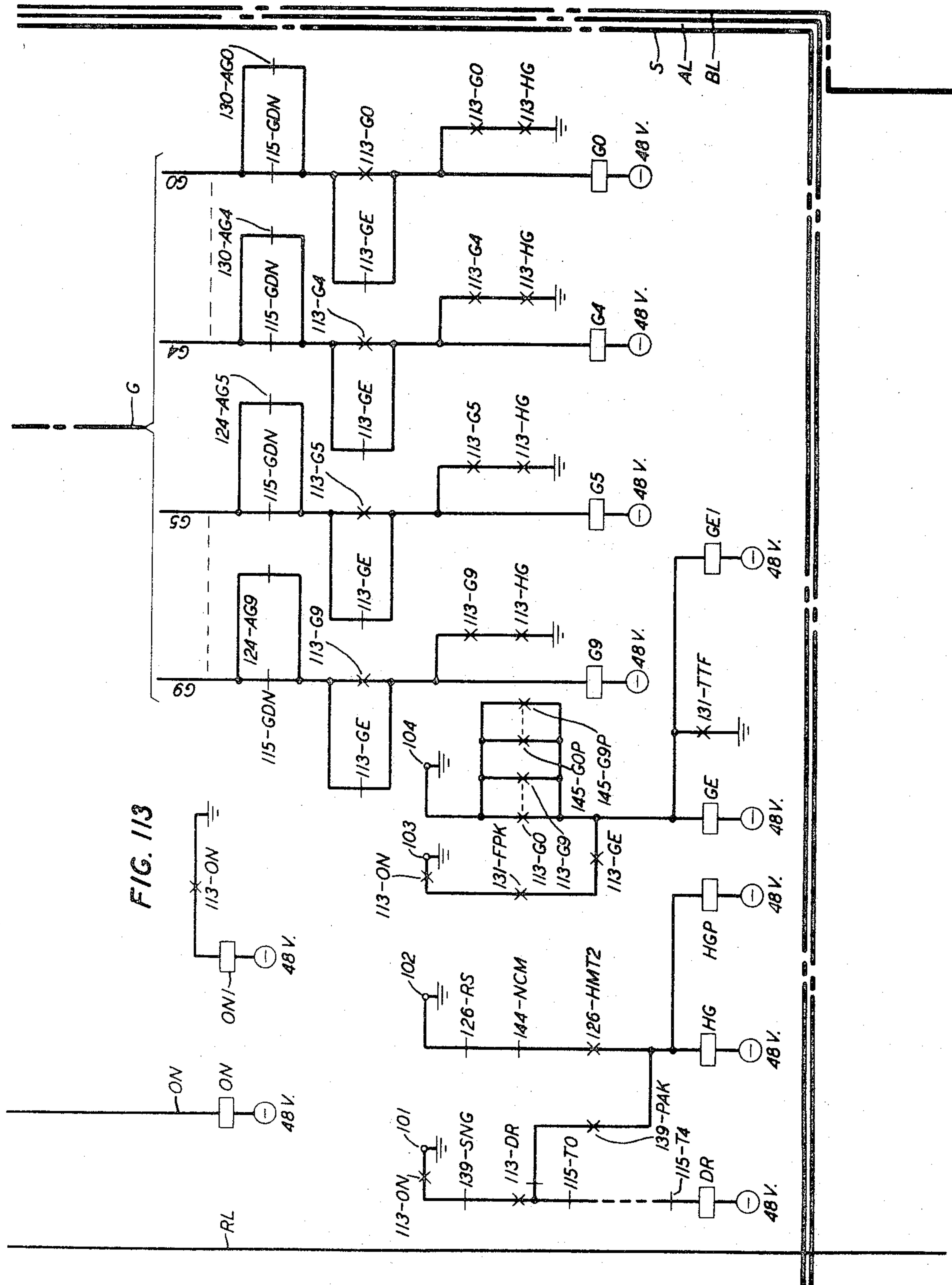
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 182



Sept. 12, 1967

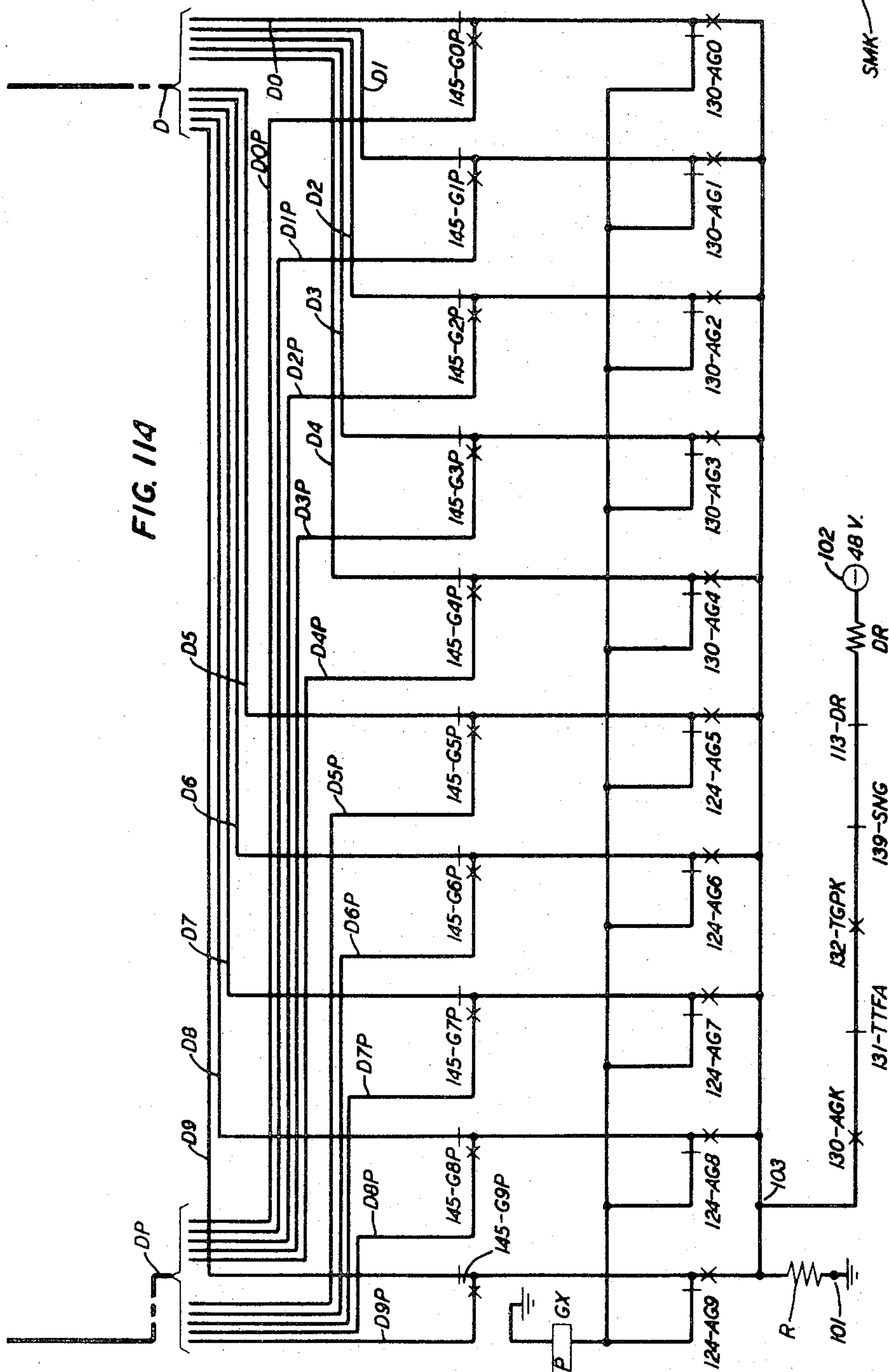
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 183

FIG. 11d



Sept. 12, 1967

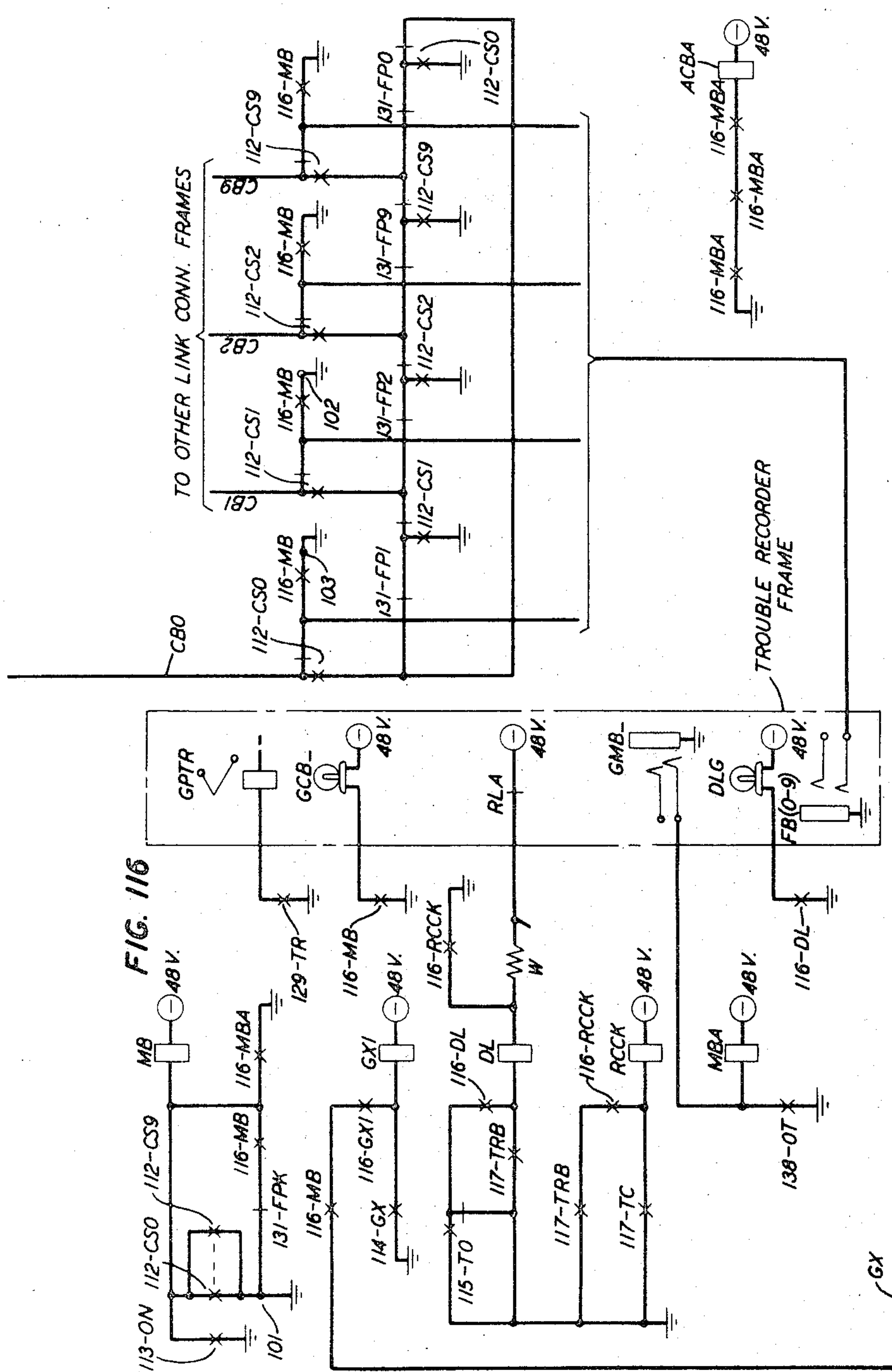
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3,341,662

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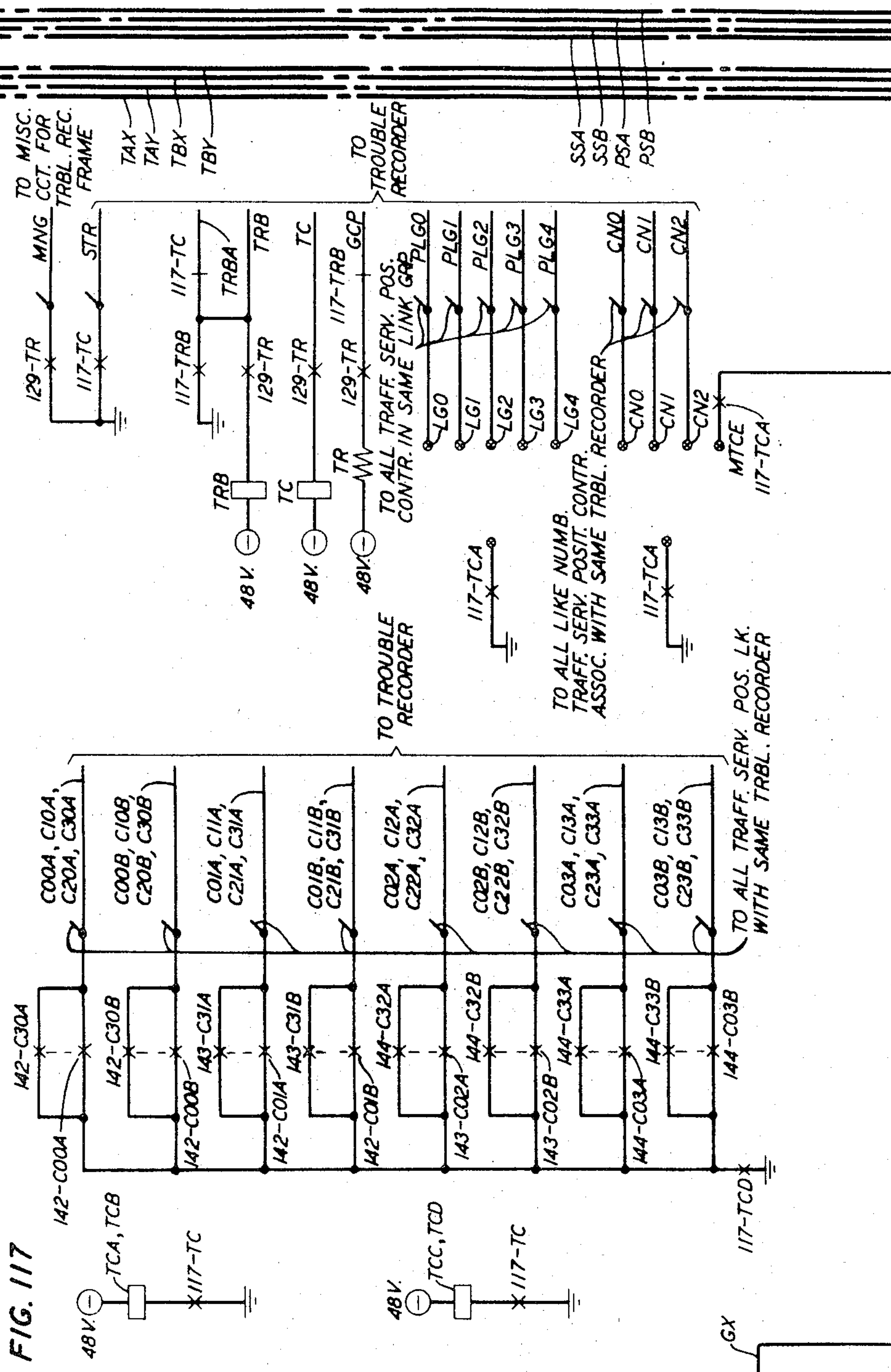
570 Sheets-Sheet 185



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 186



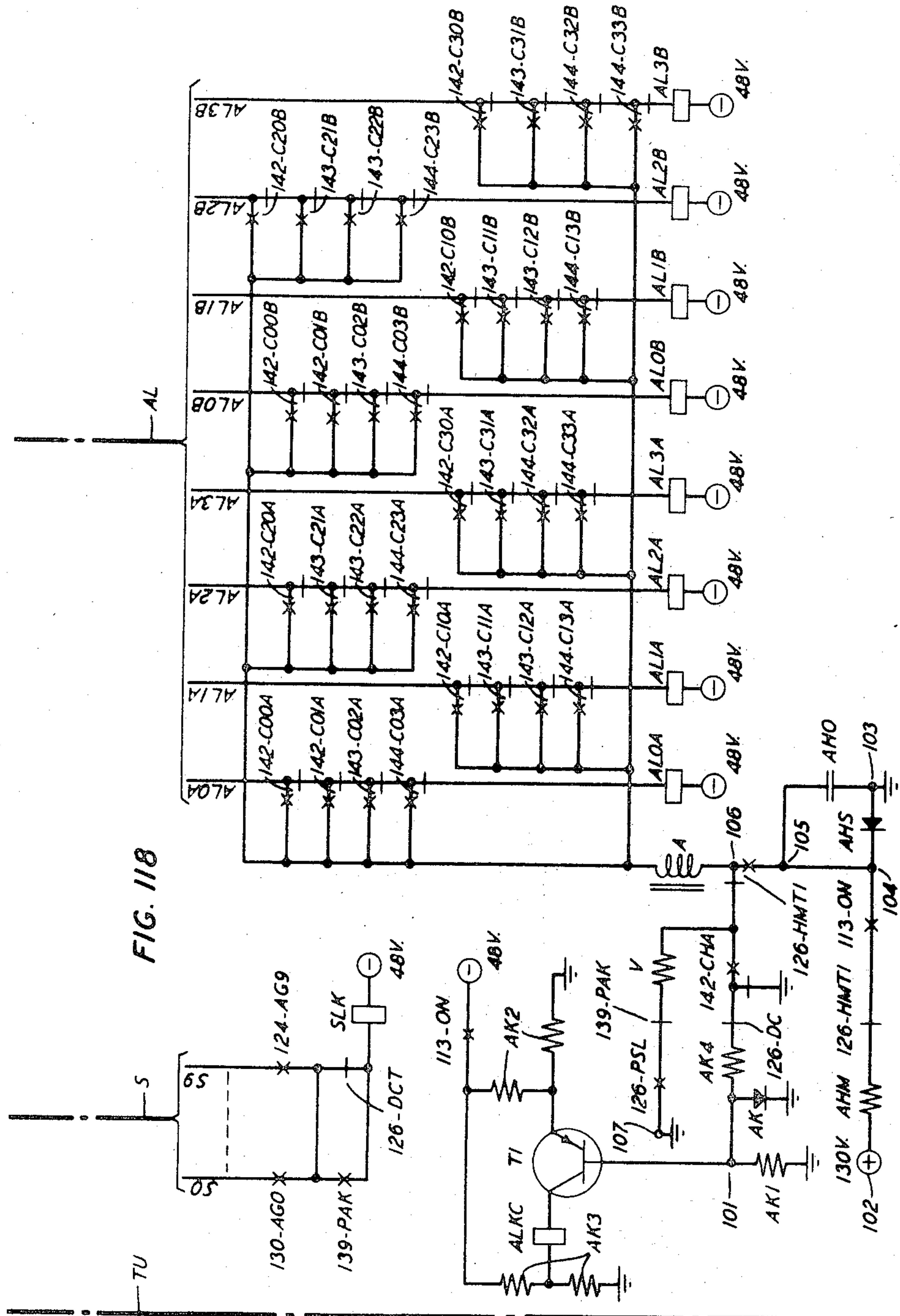
Sept. 12, 1967

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3,341,662

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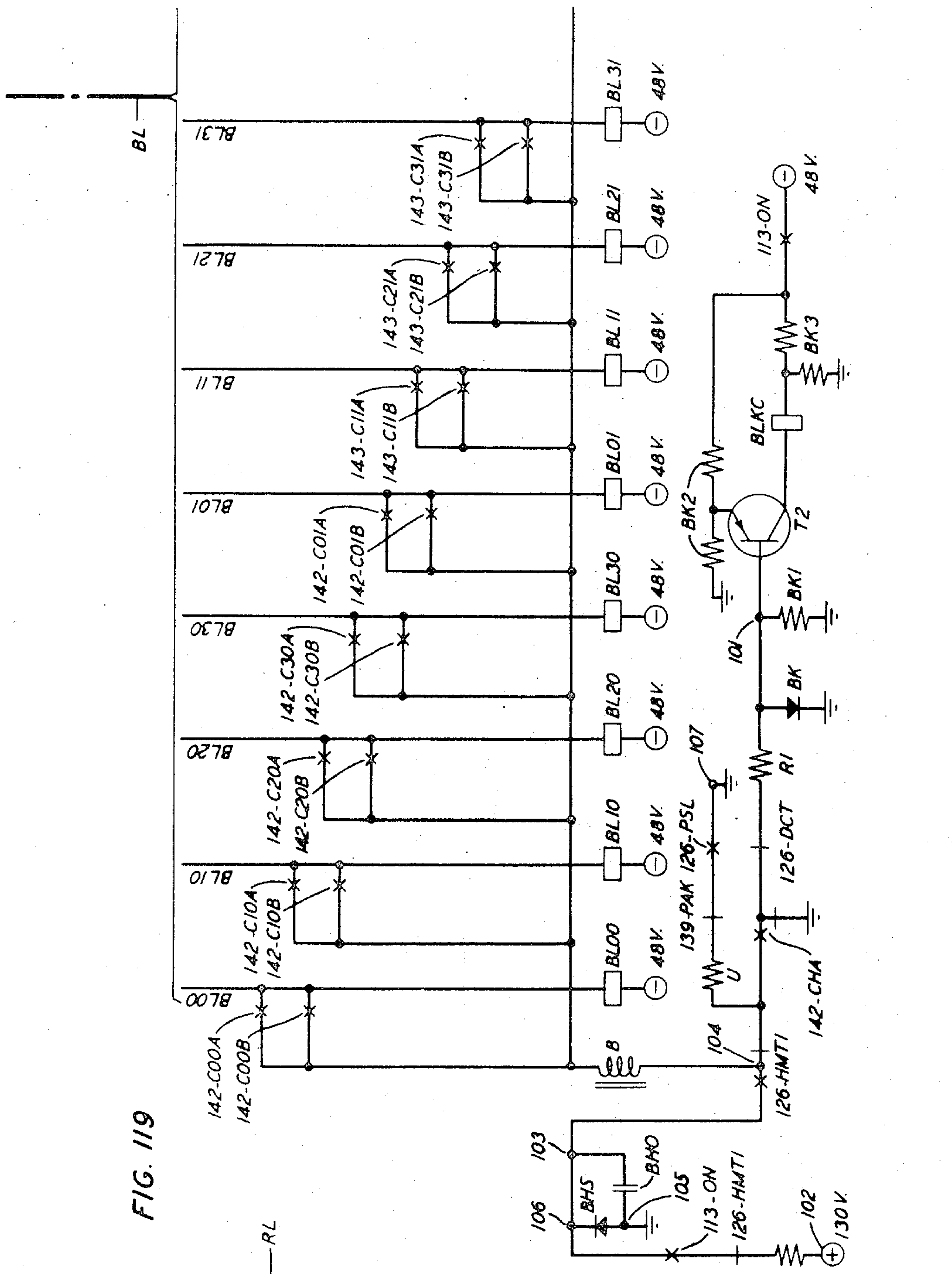
570 Sheets-Sheet 187



L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 188

FIG. 119



Sept. 12, 1967

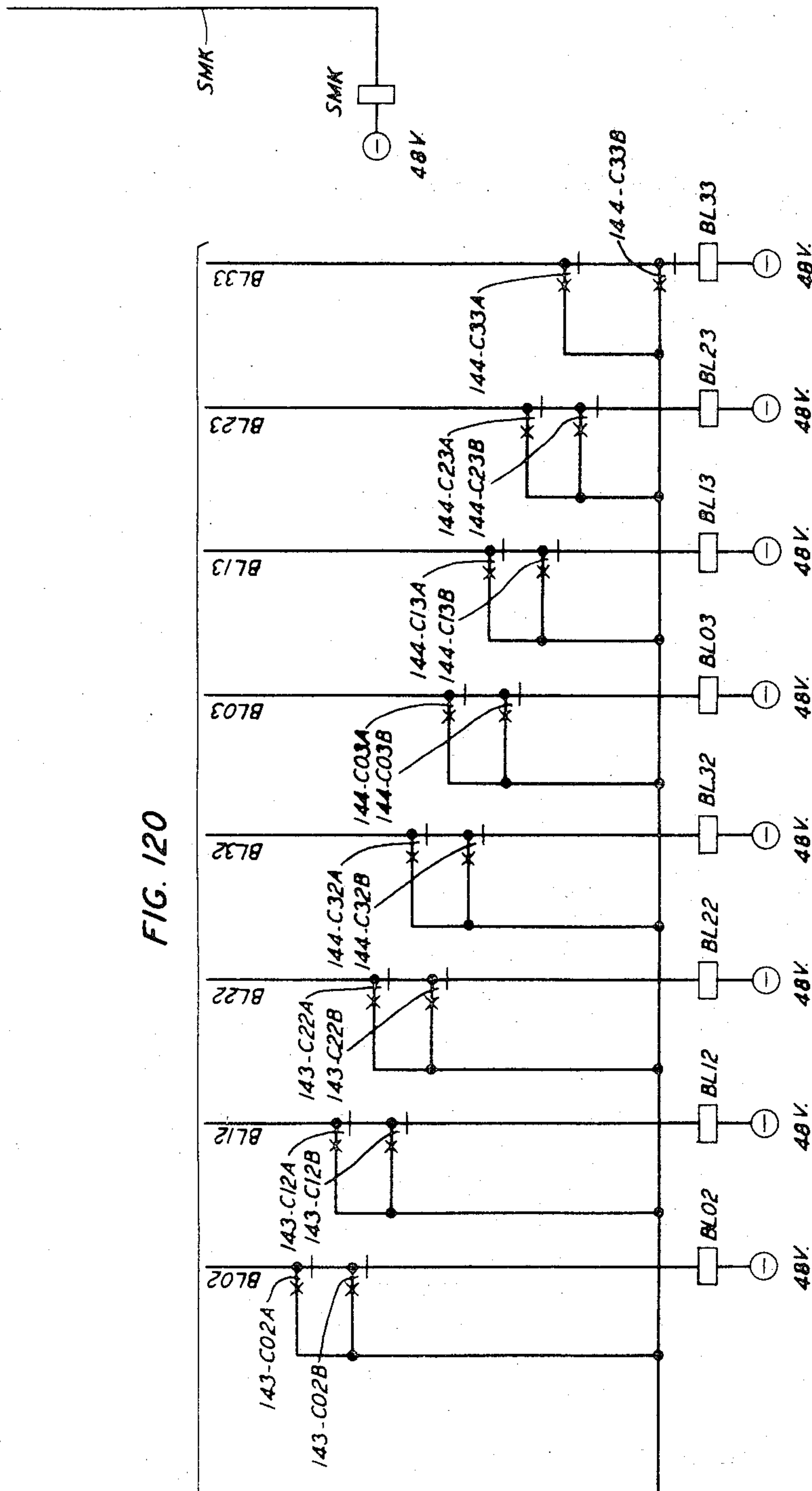
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 189

FIG. 120



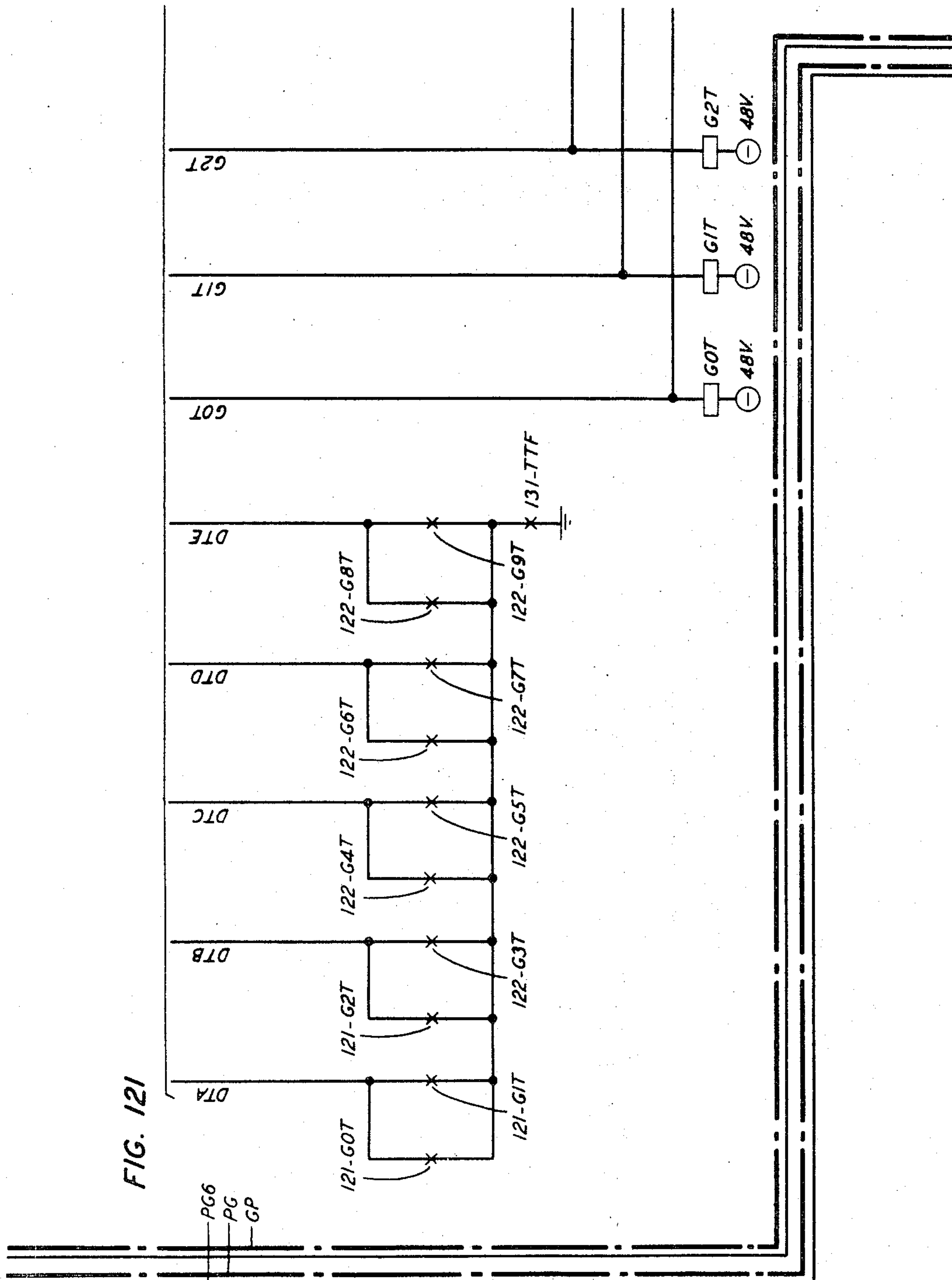
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 190



Sept. 12, 1967

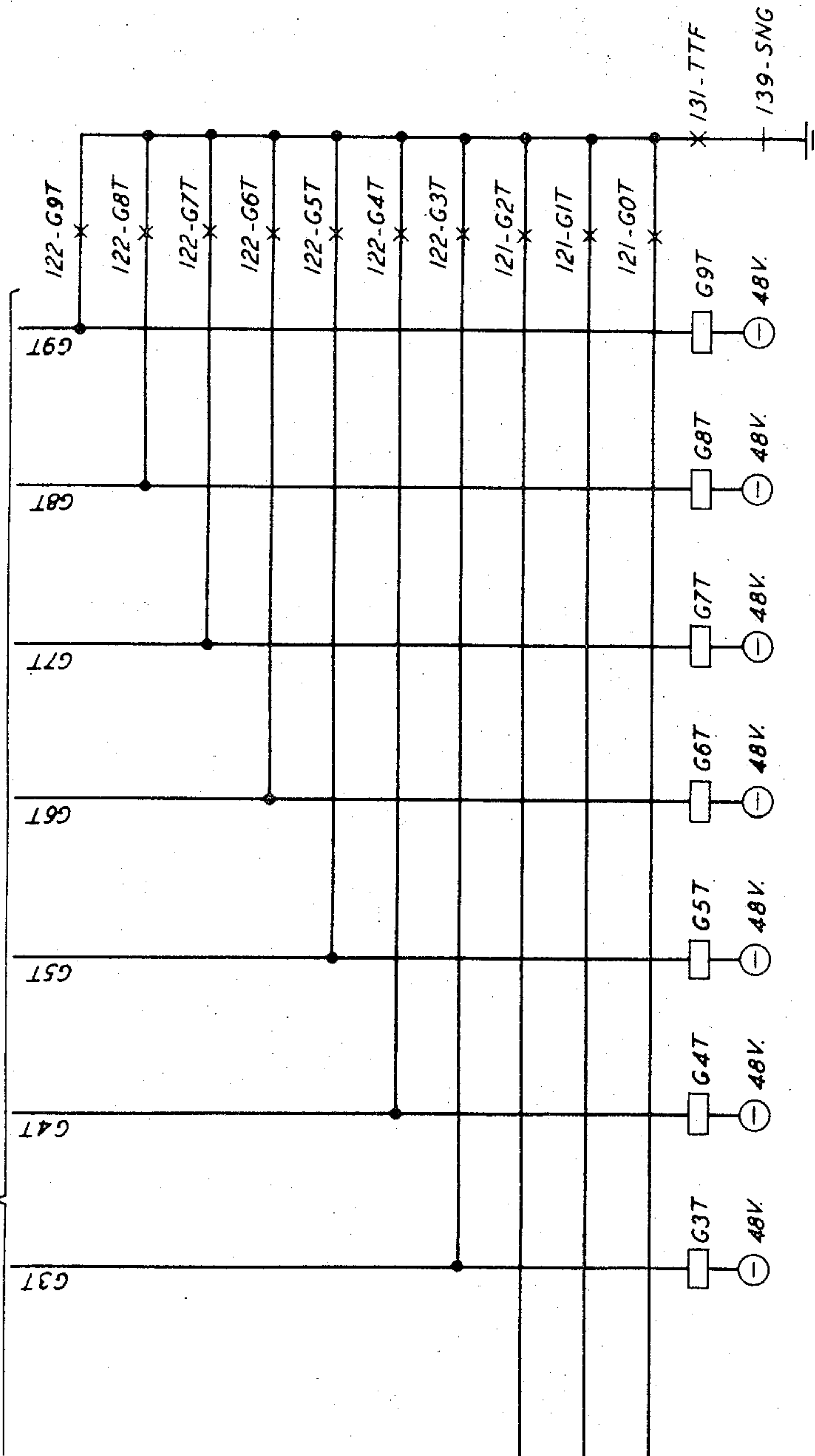
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 191

FIG. 122



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Filed Nov. 26, 1963

570 Sheets-Sheet 192.

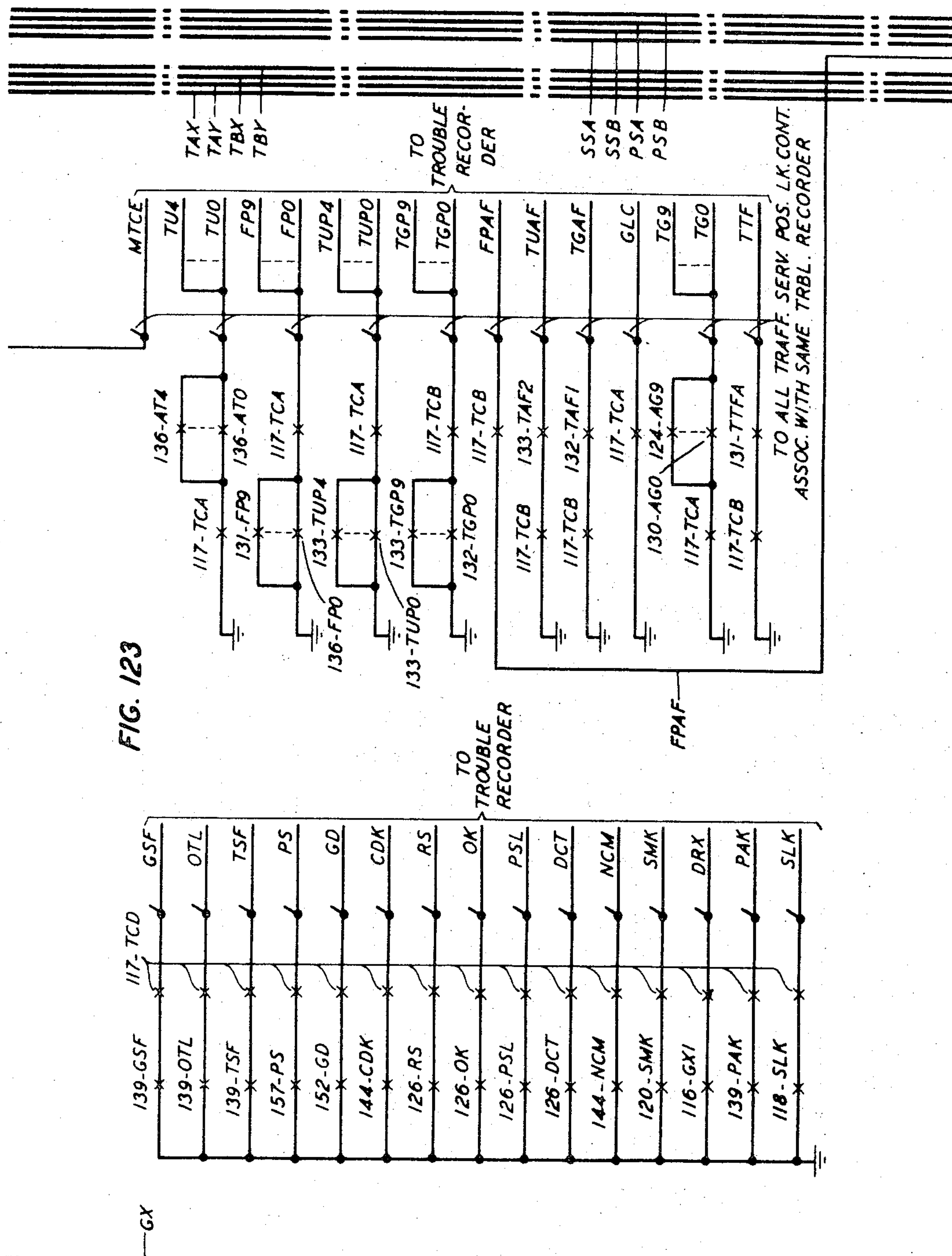


FIG. 123

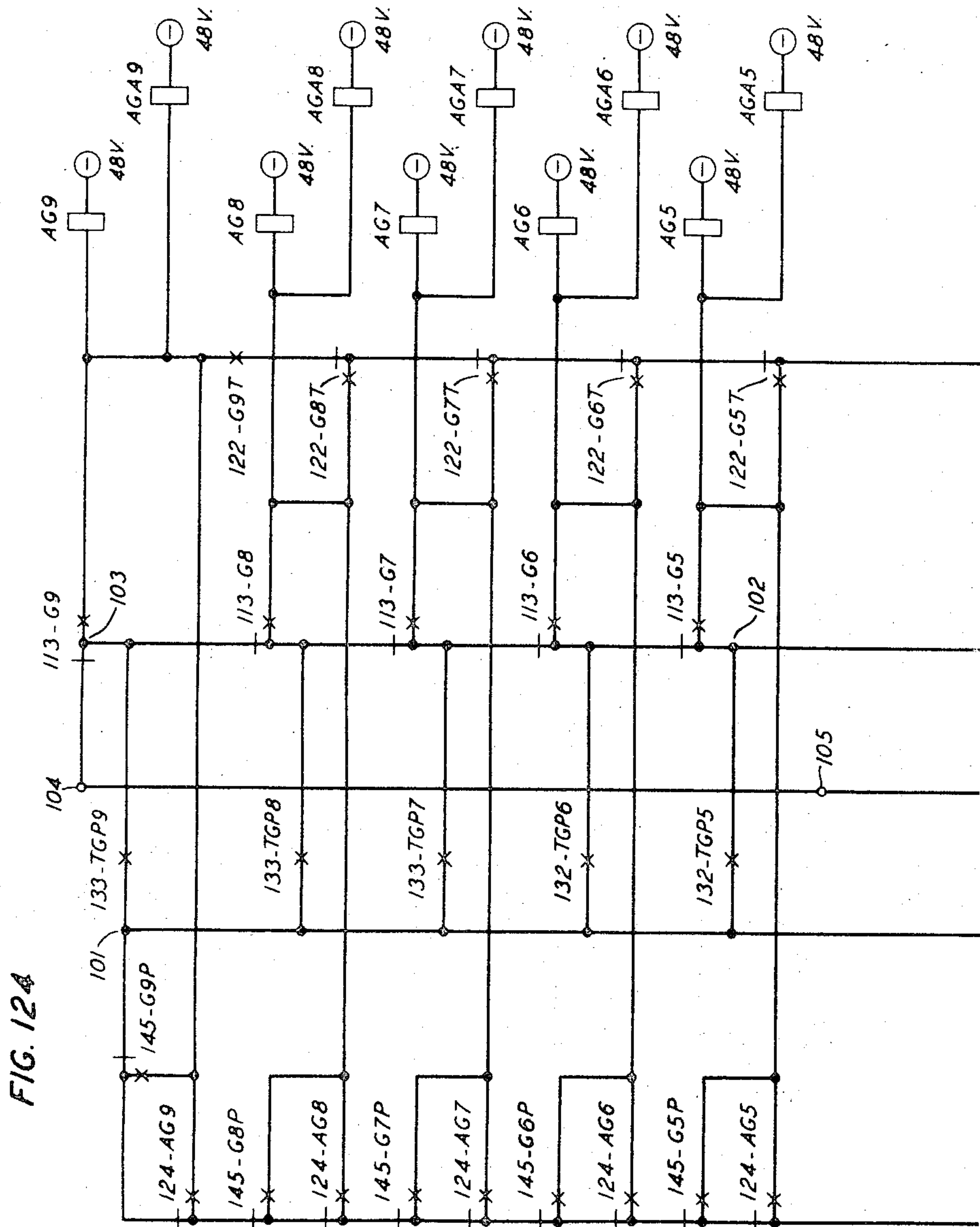
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 193



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Sept. 12, 1967

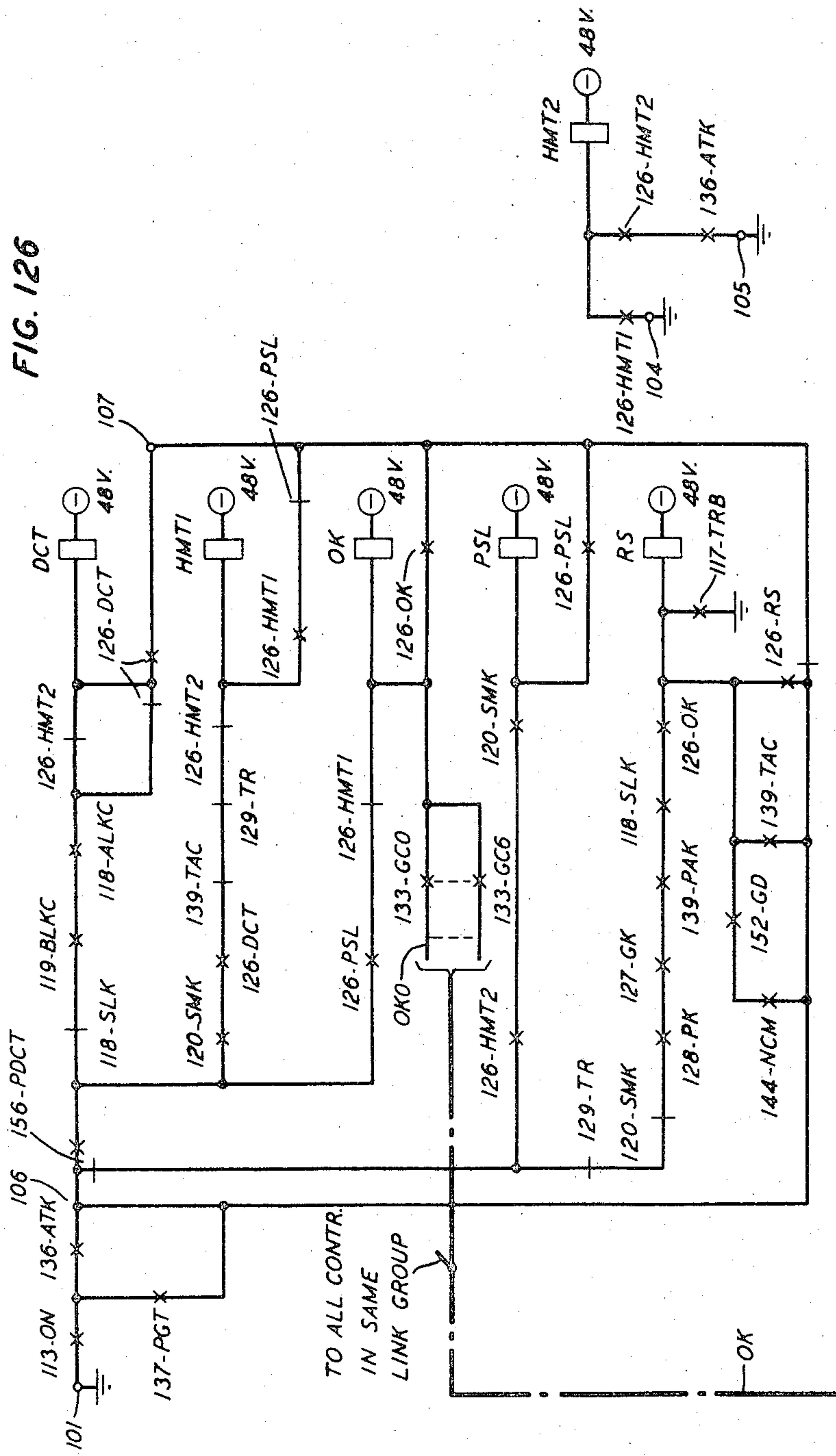
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 195

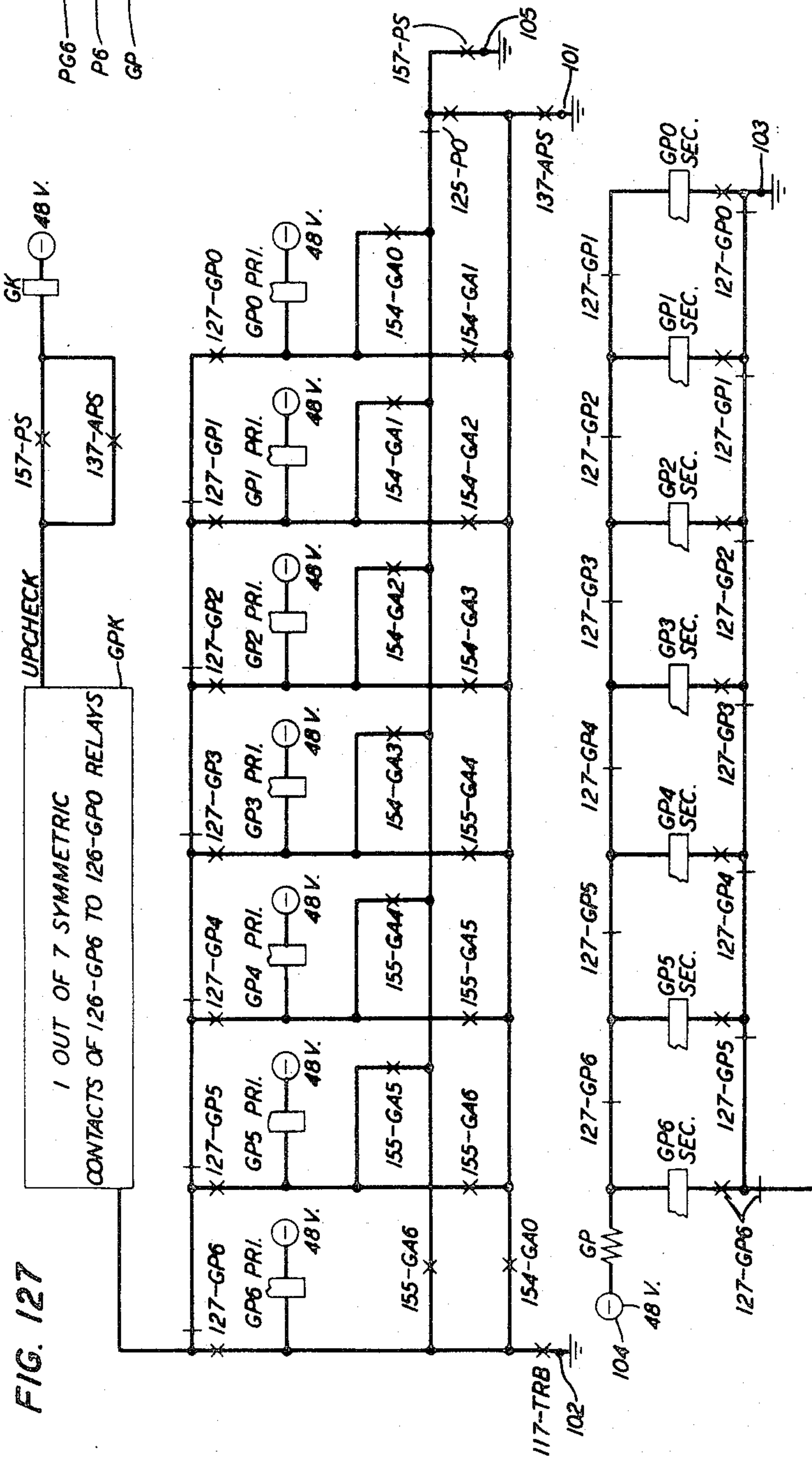
FIG. 126



Filed Nov. 26, 1963

570 Sheets-Sheet 196

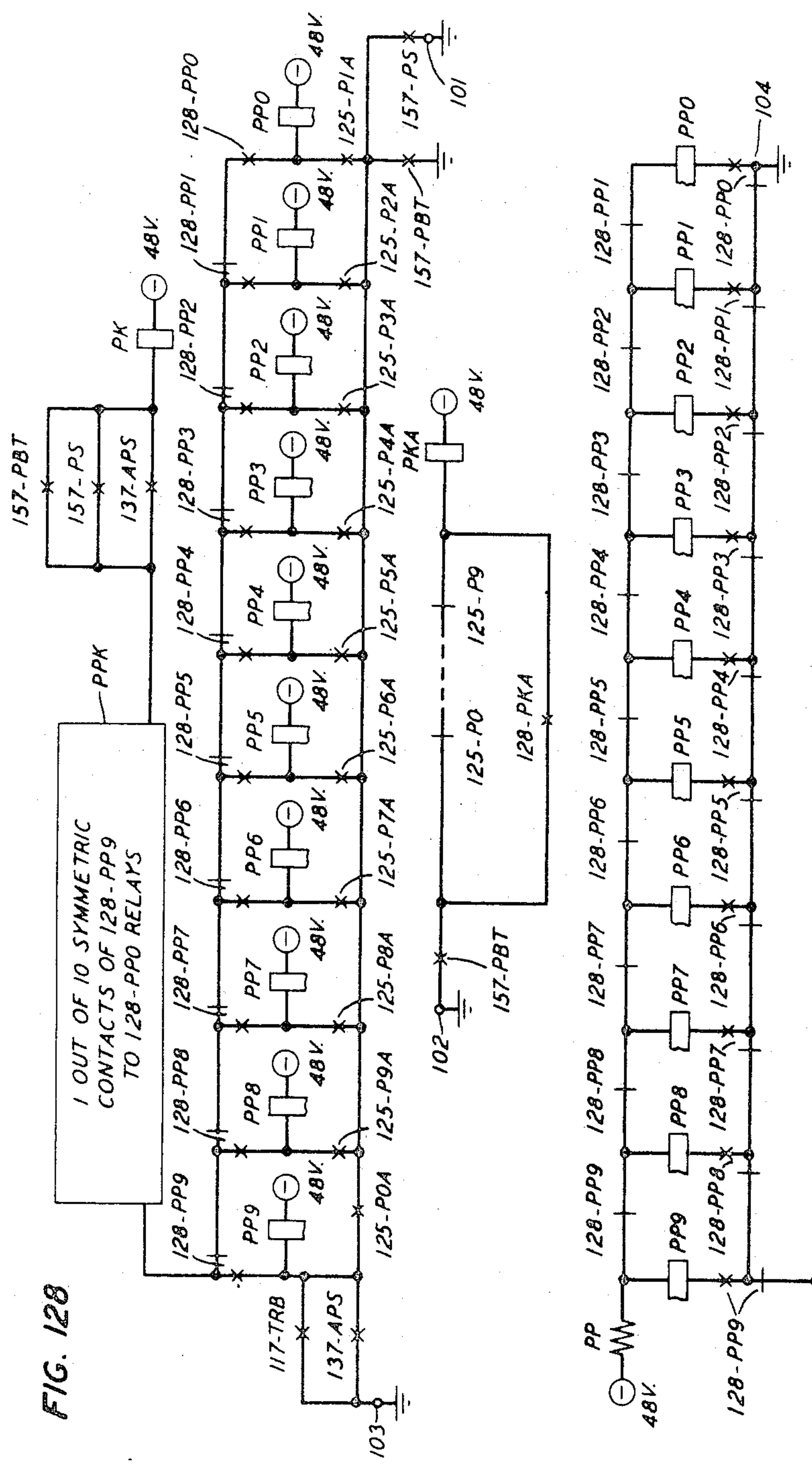
3,341,662



Filed Nov. 26, 1963

INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 197



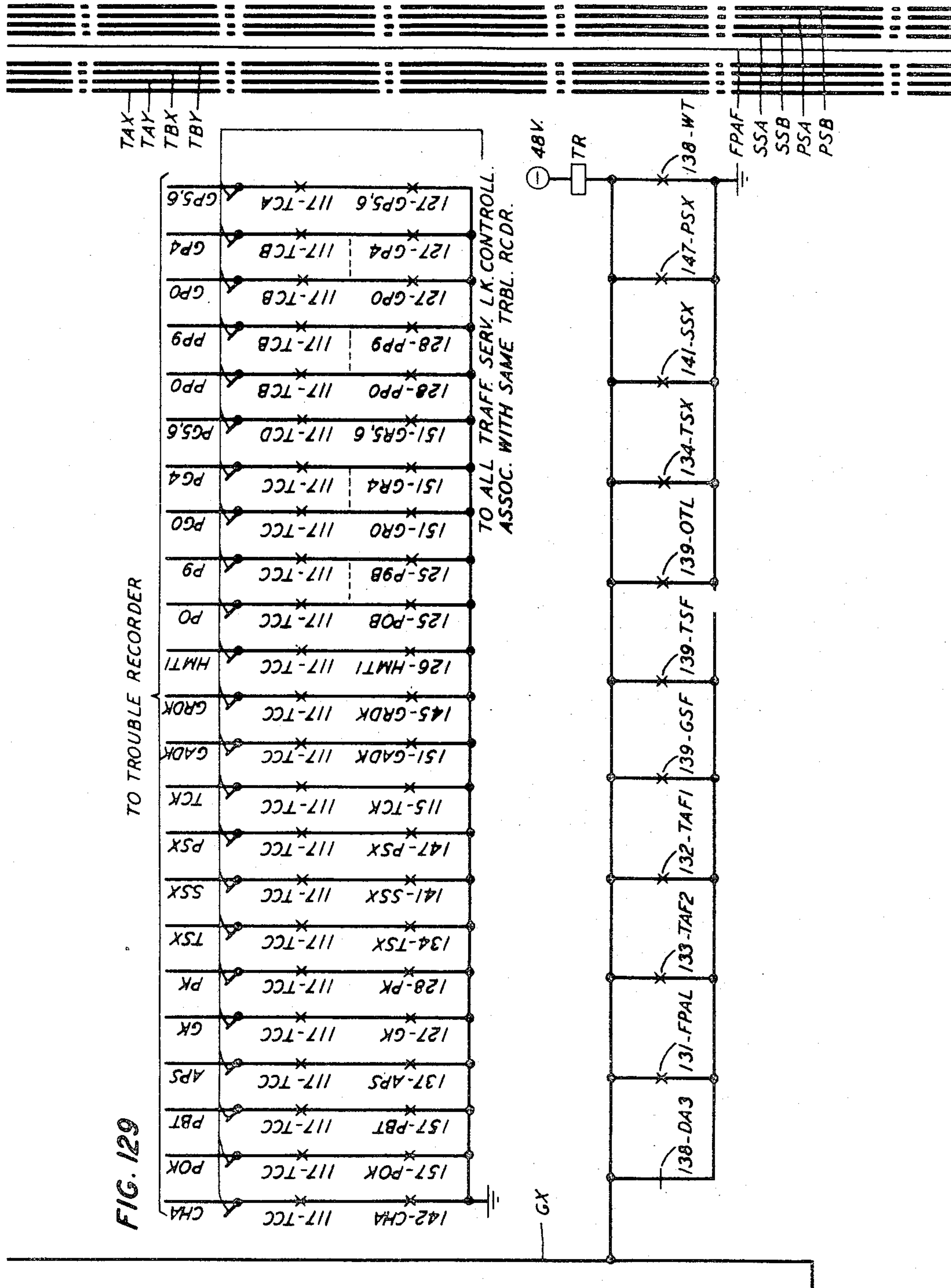
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 198



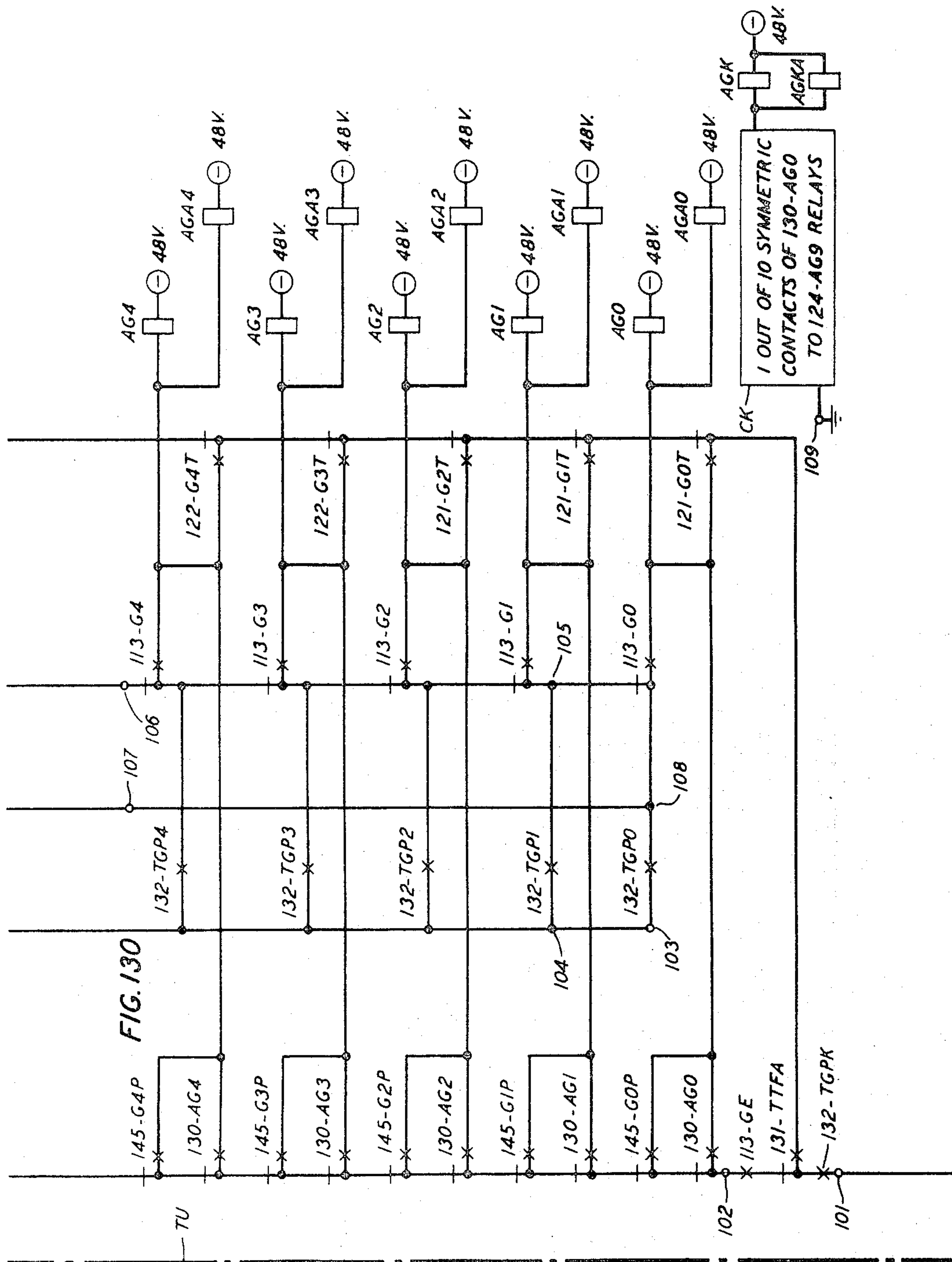
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3,341,662

Filed Nov. 26, 1963

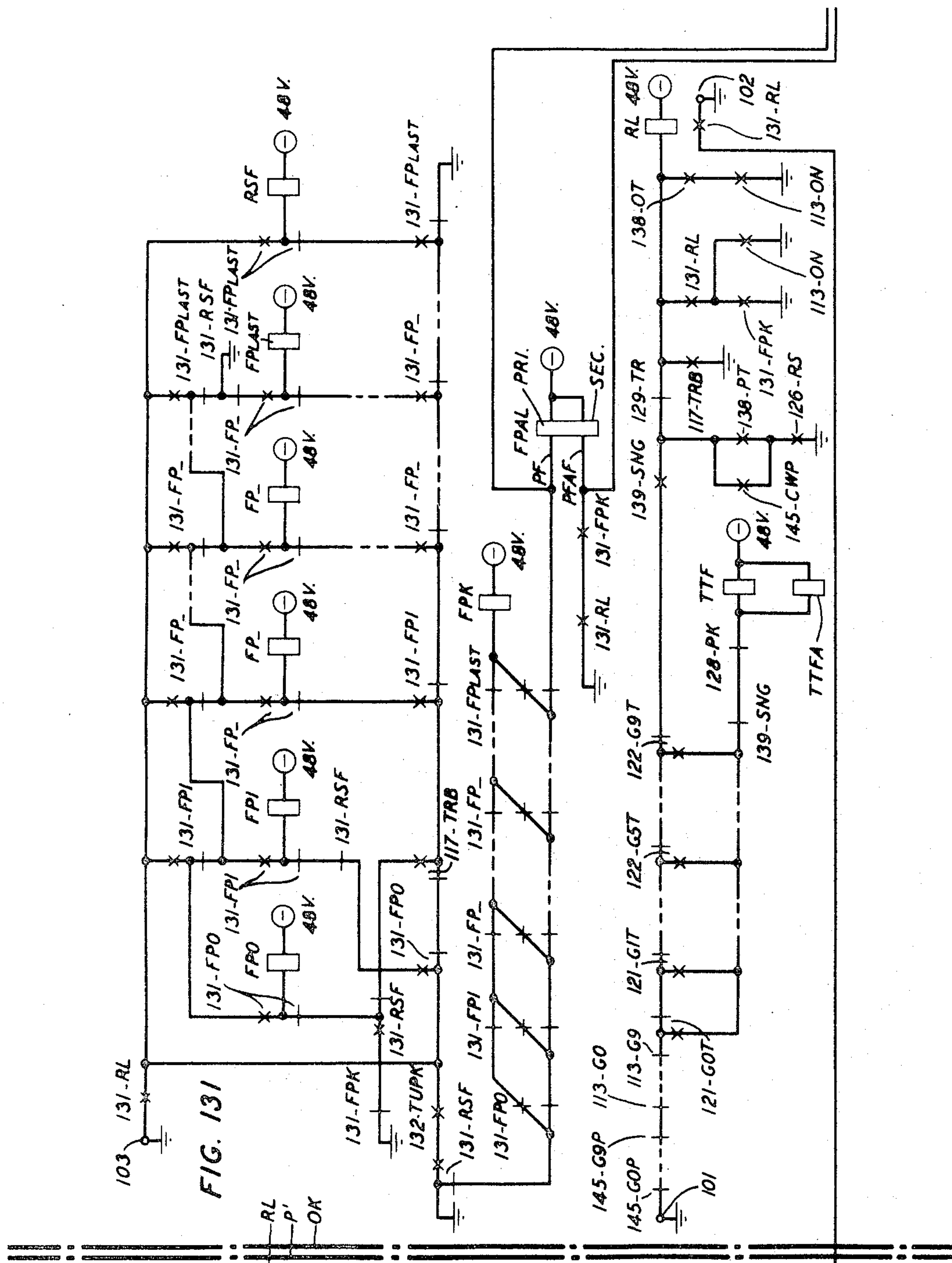
570 Sheets-Sheet 193



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 200



Sept. 12, 1967

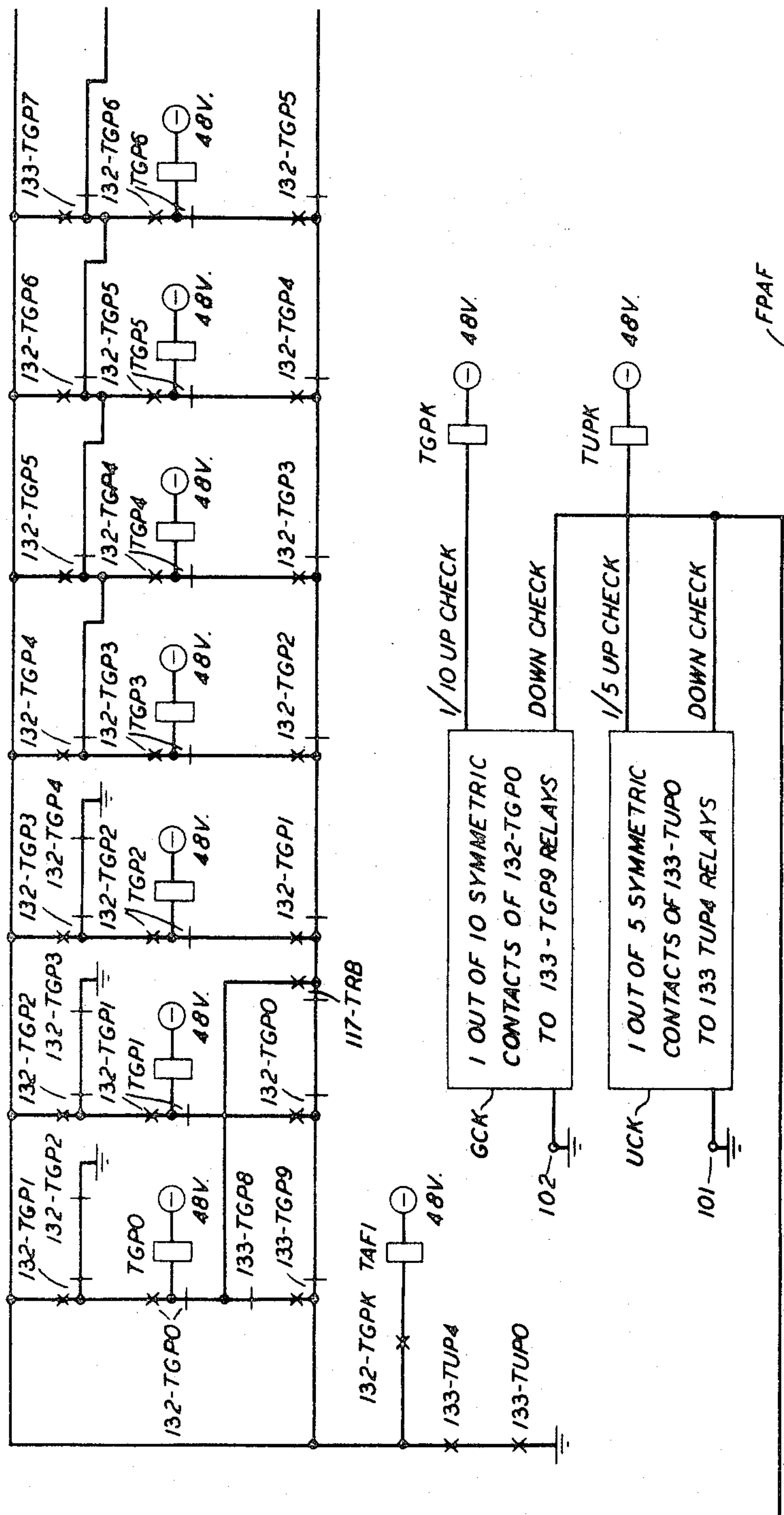
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 201

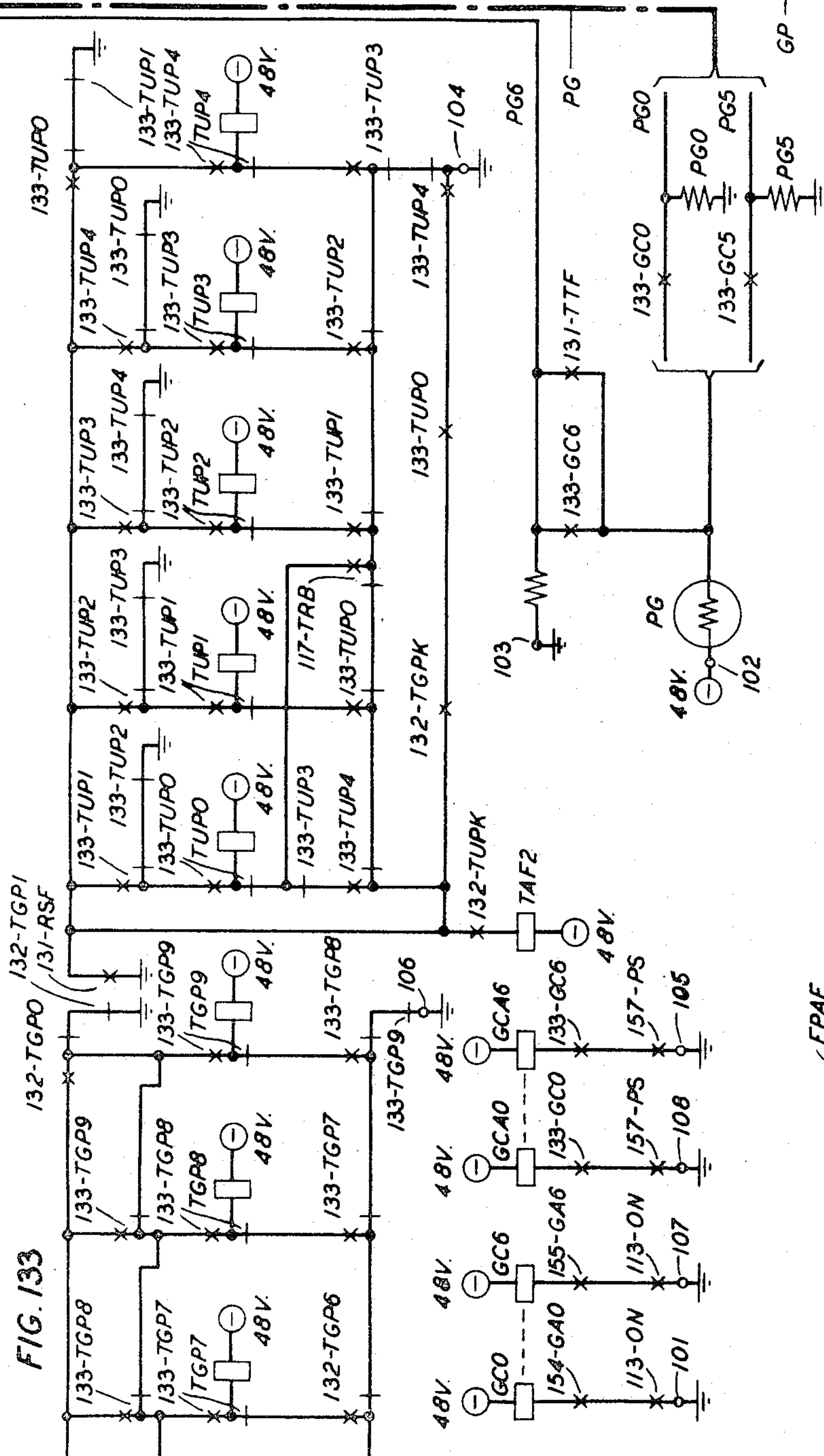
FIG. 132



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 200

570 Sheets-Sheet 200



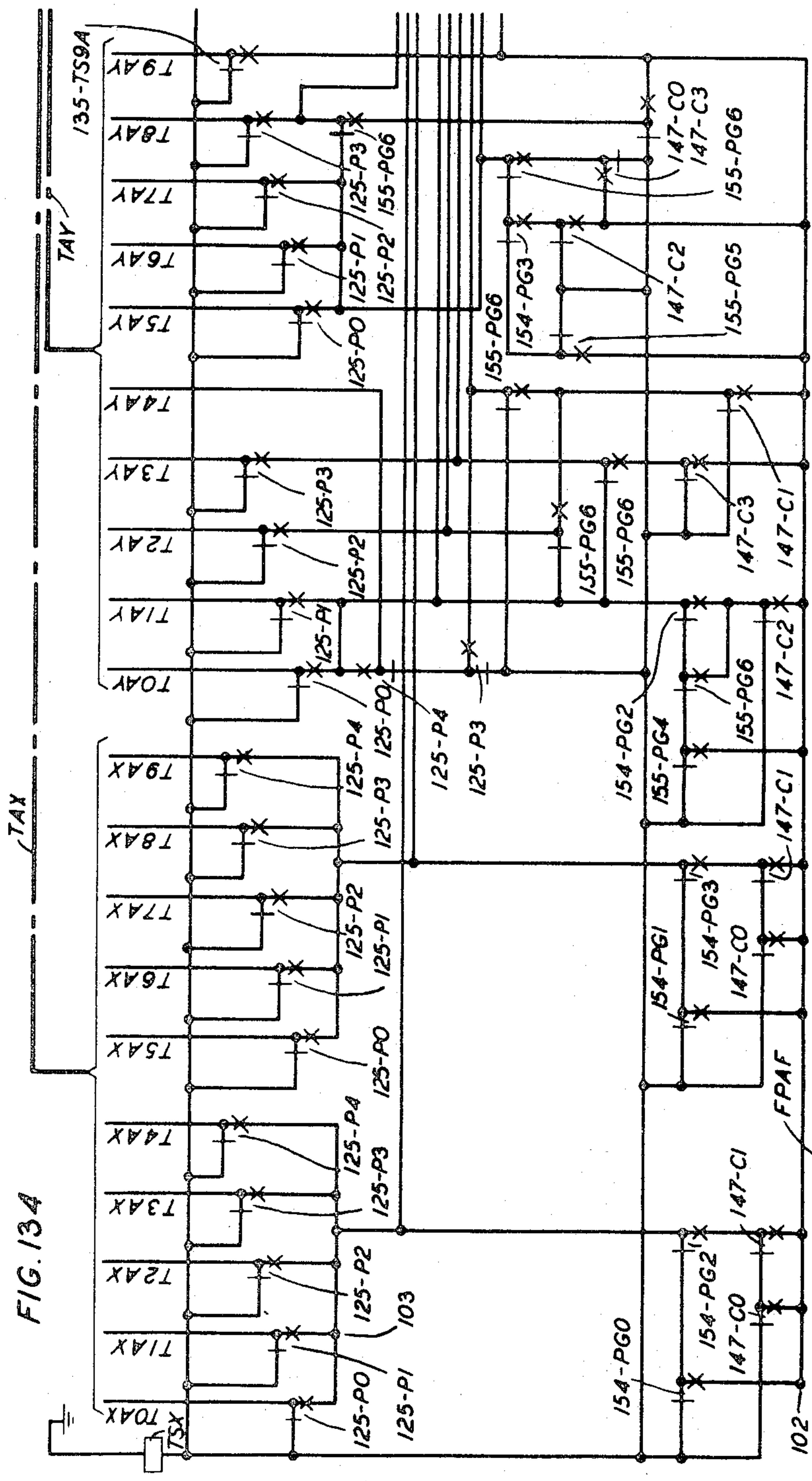
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 203



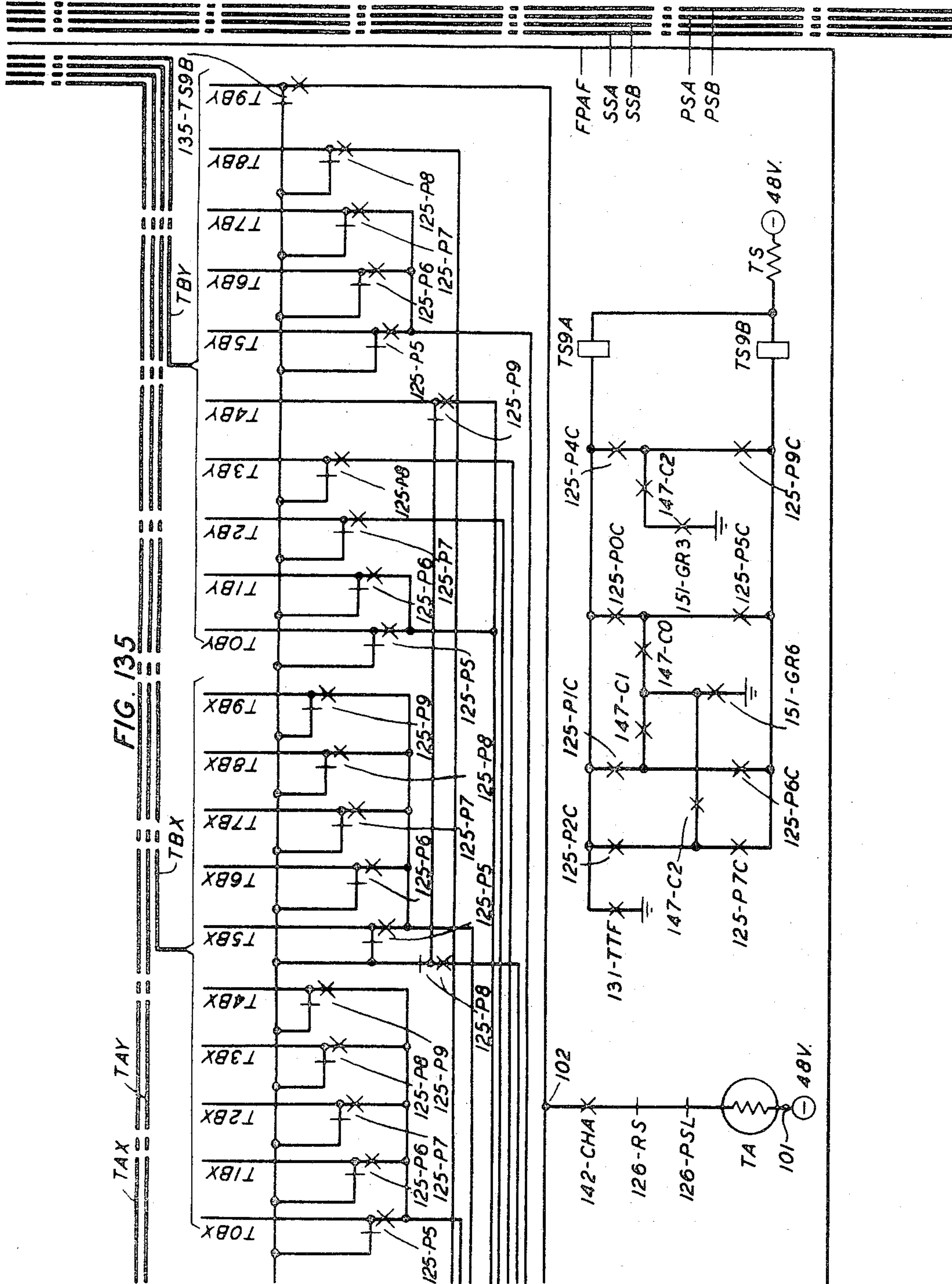
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 204



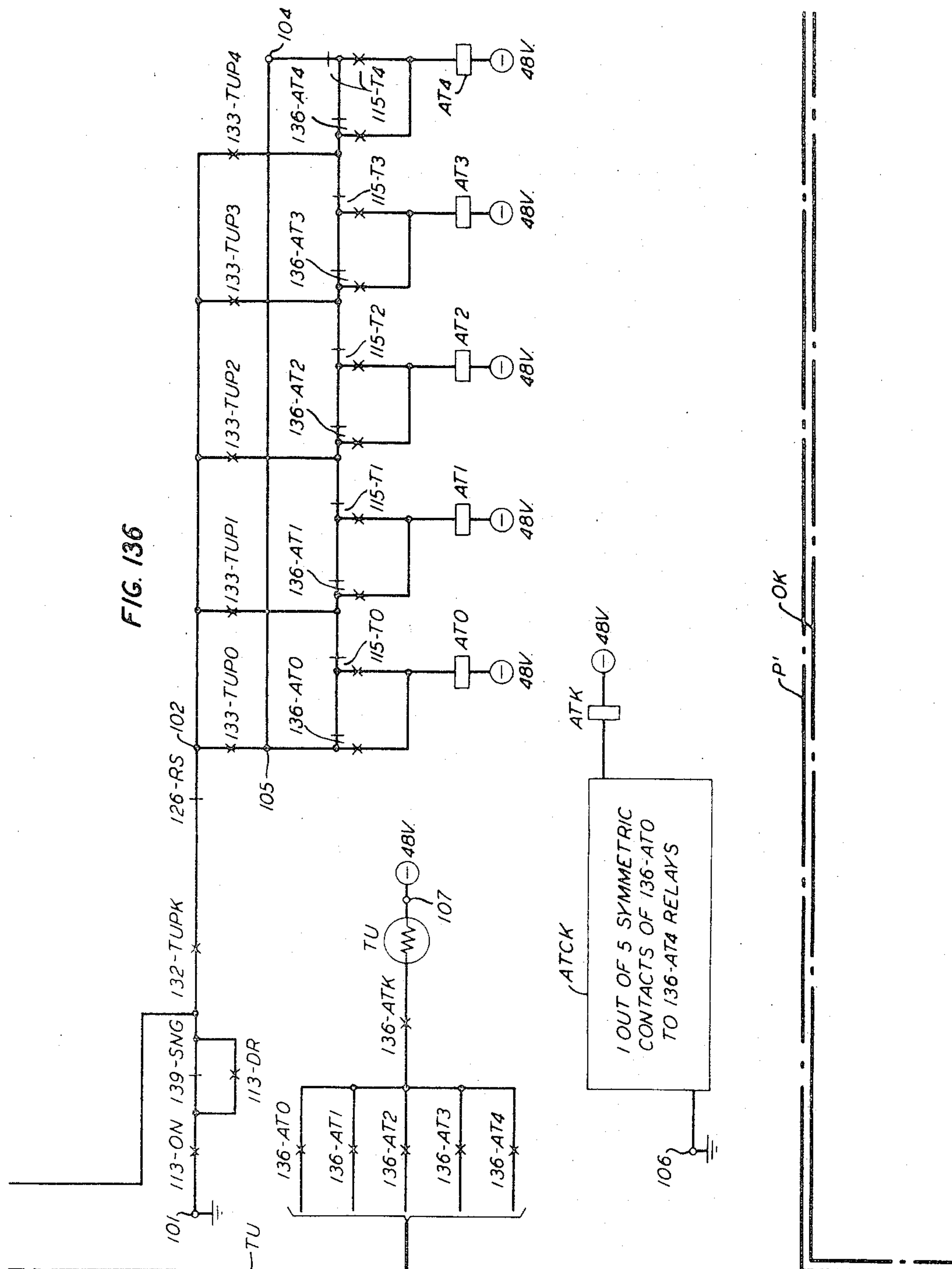
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

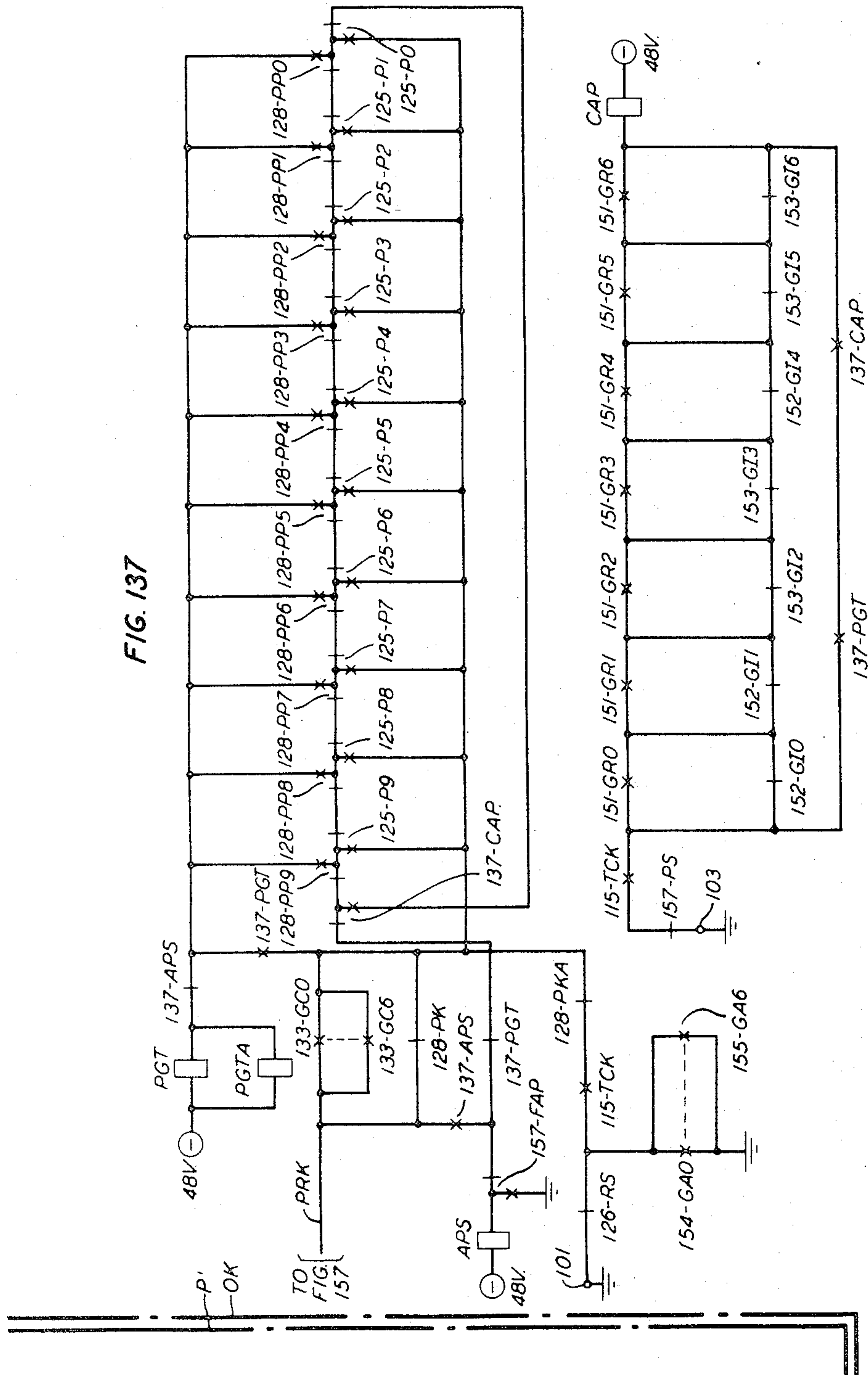
570 Sheets-Sheet 205



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 206



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 203

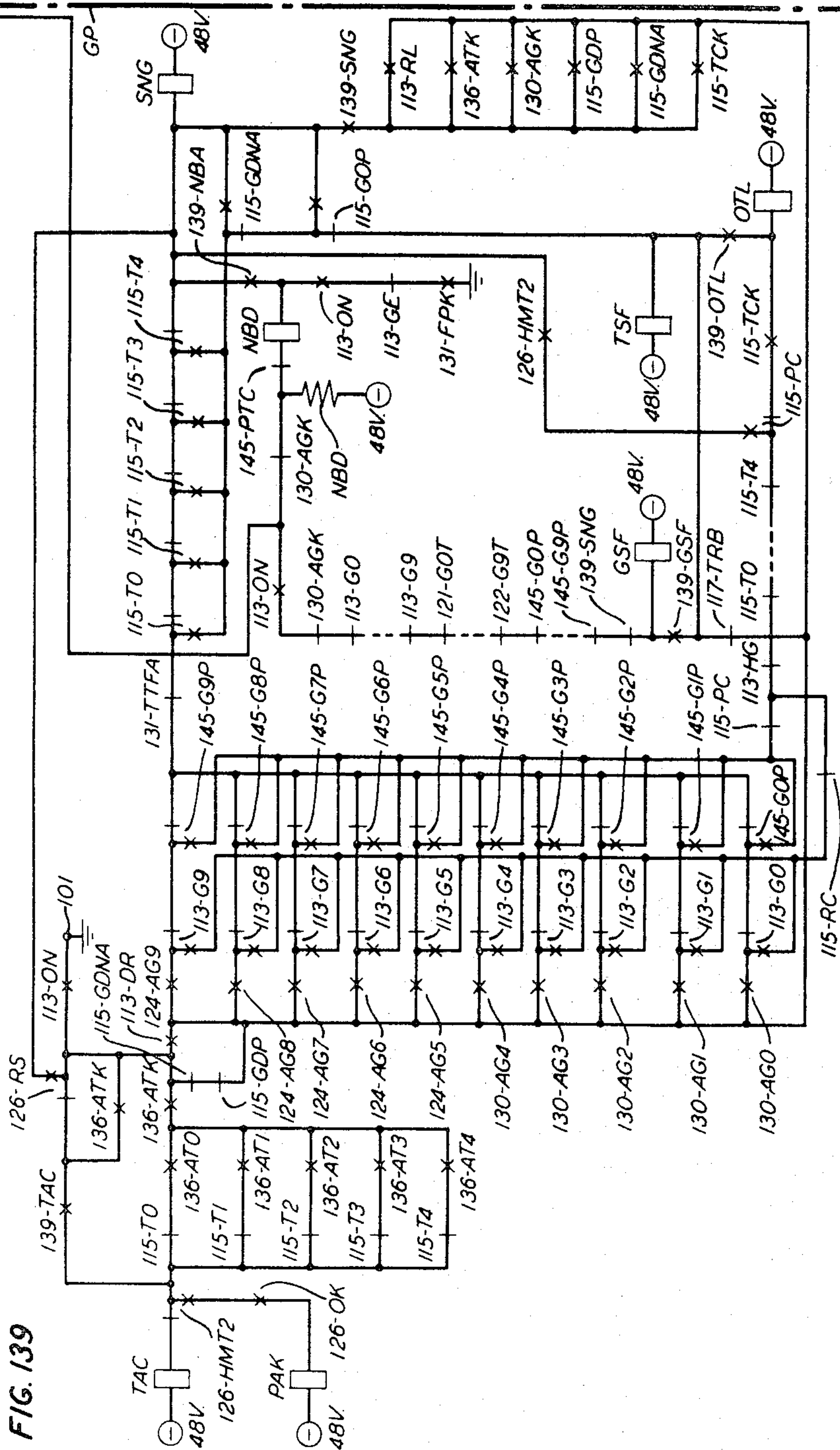


FIG. 139

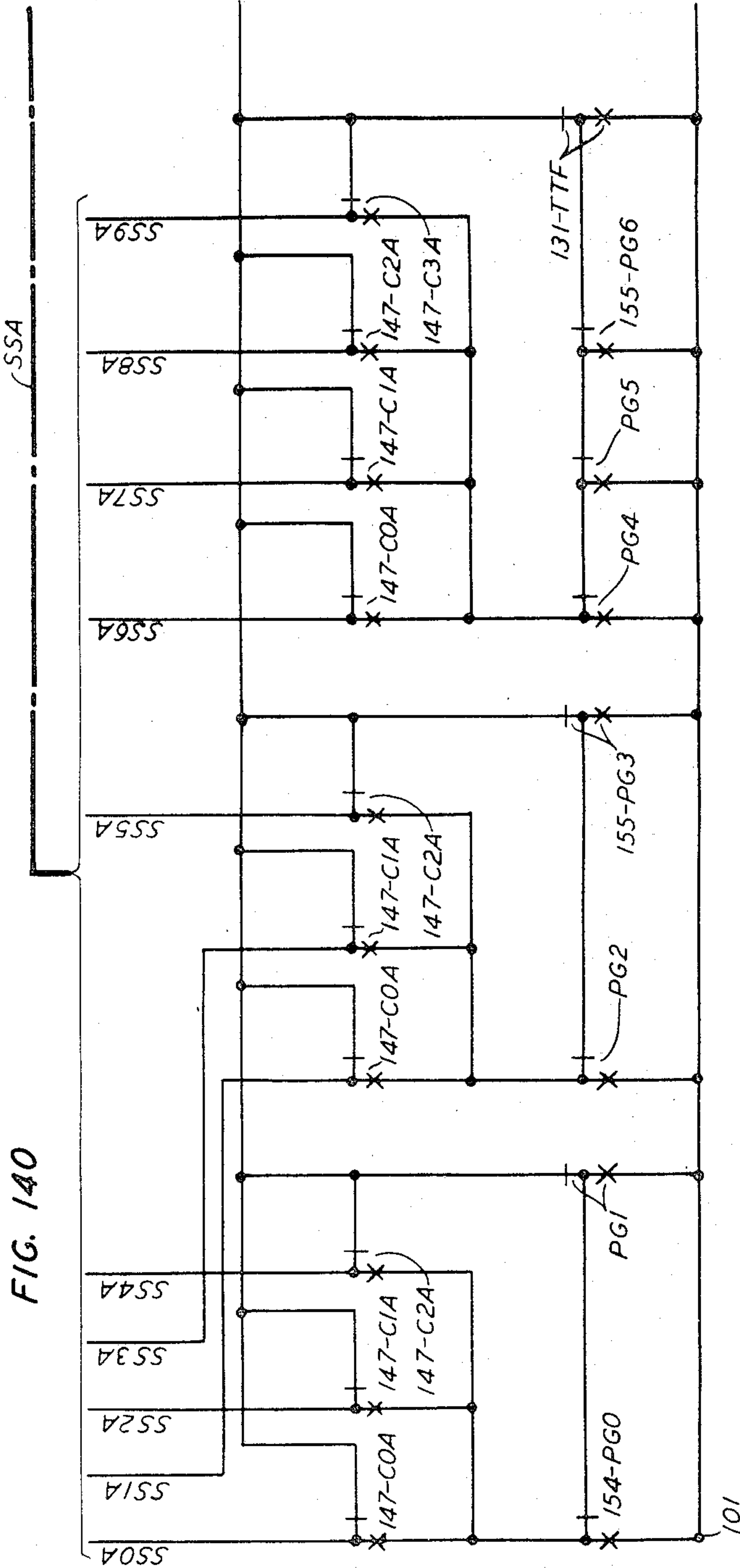
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 200



Sept. 12, 1967

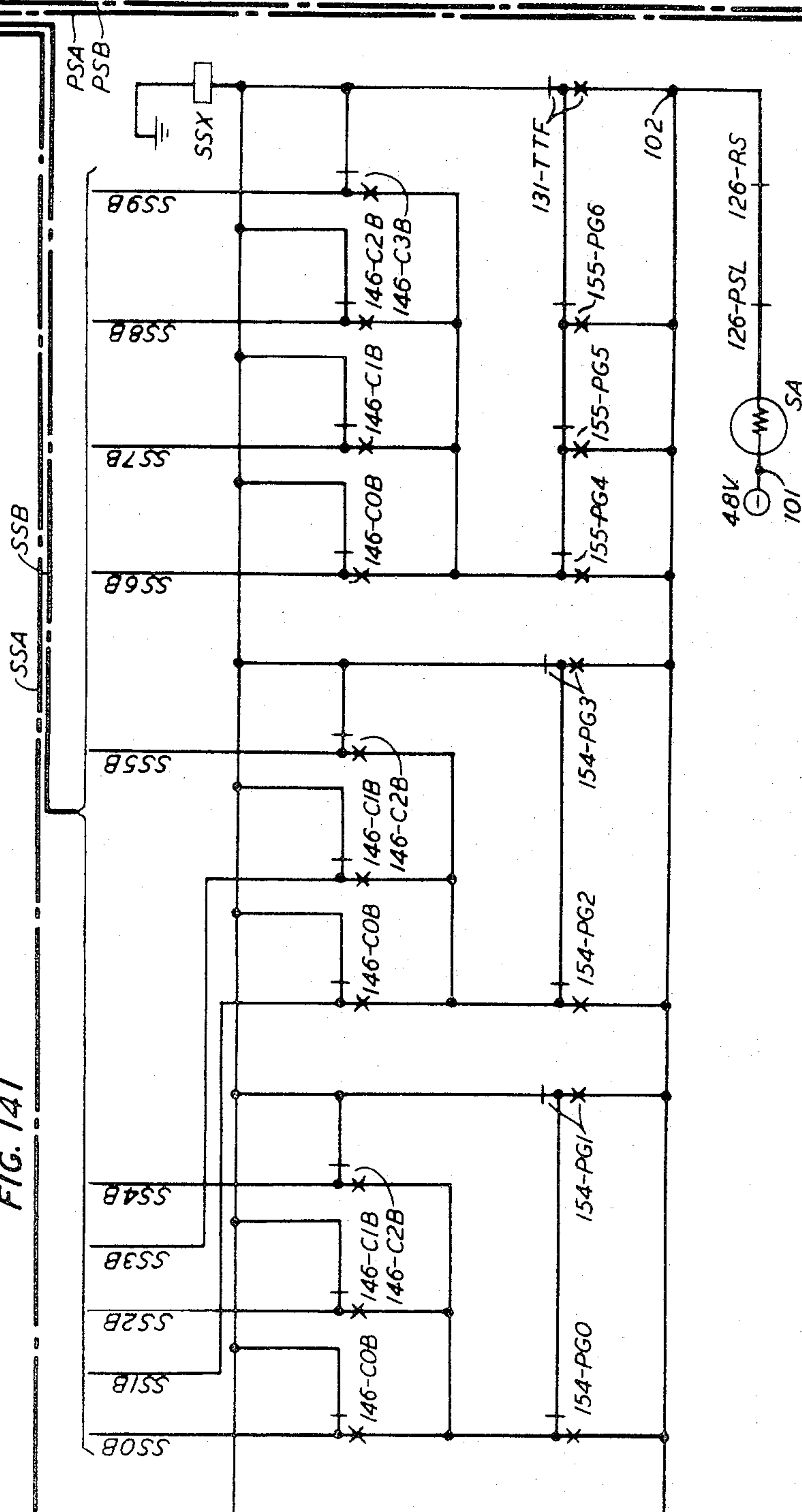
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 210

FIG. 141



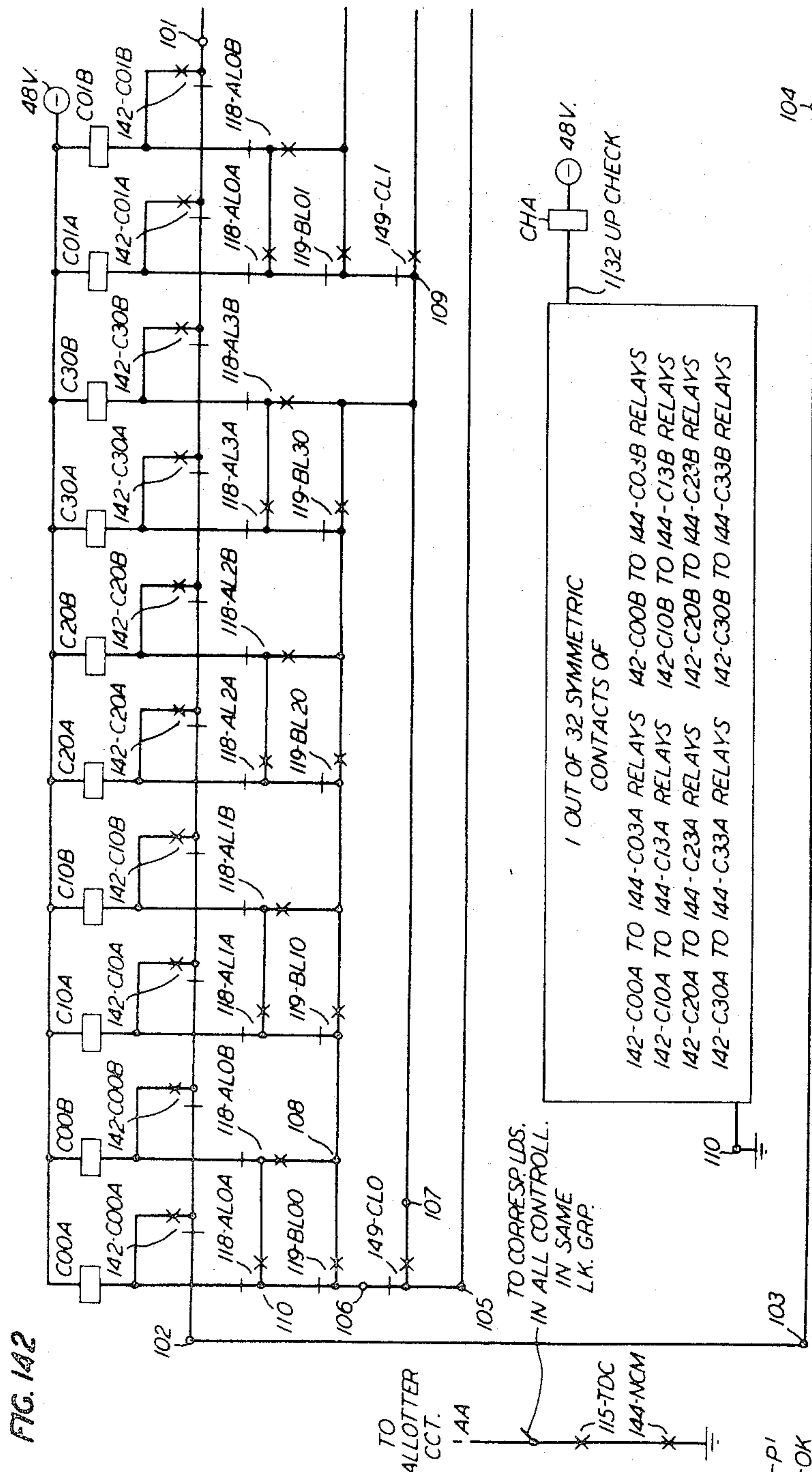
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 211



Sept. 12, 1967

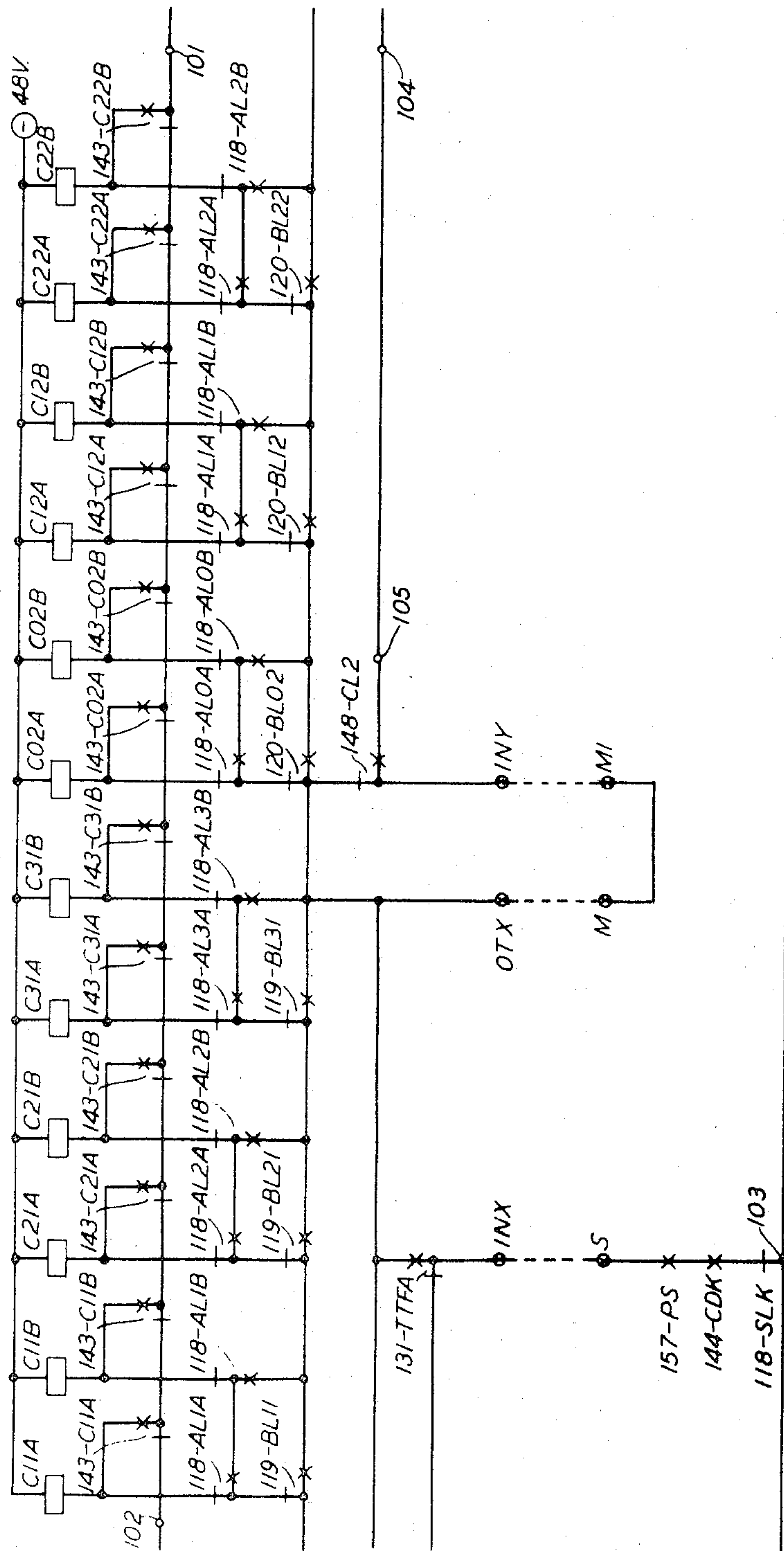
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 218

FIG. 143



Sept. 12, 1967

L. J. CERNY ET AL

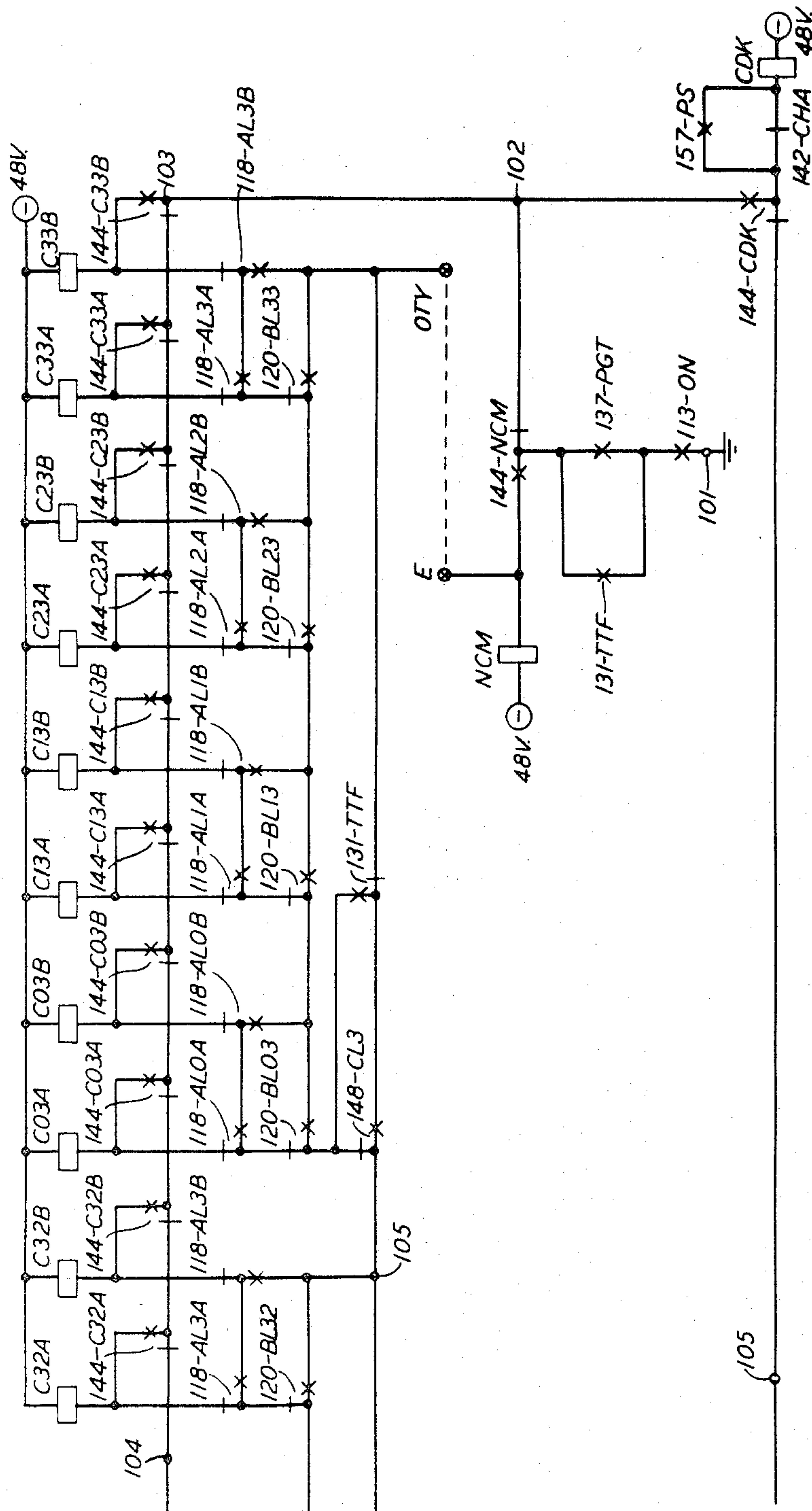
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 213

FIG. 144



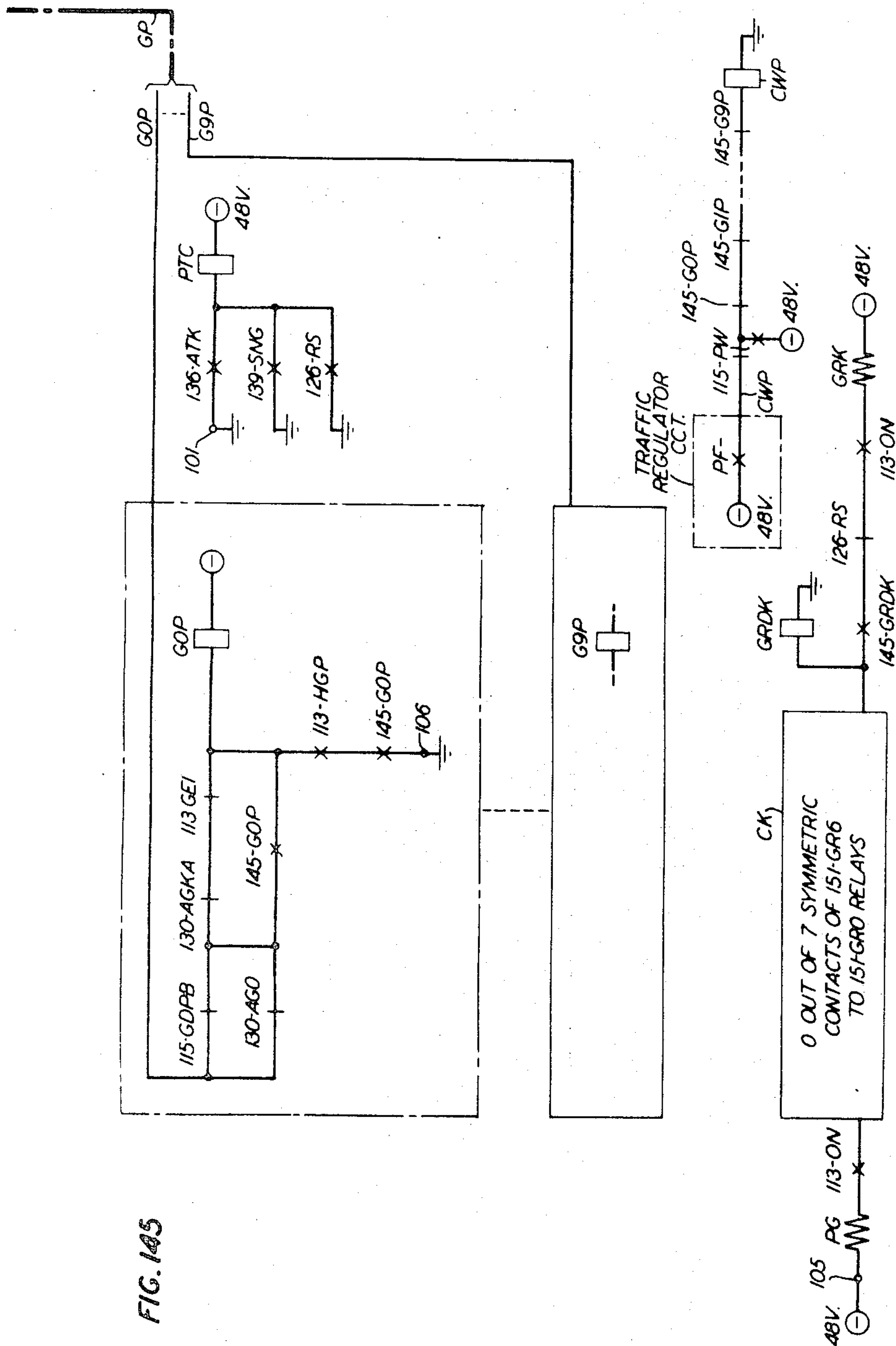
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 214



Sept. 12, 1967

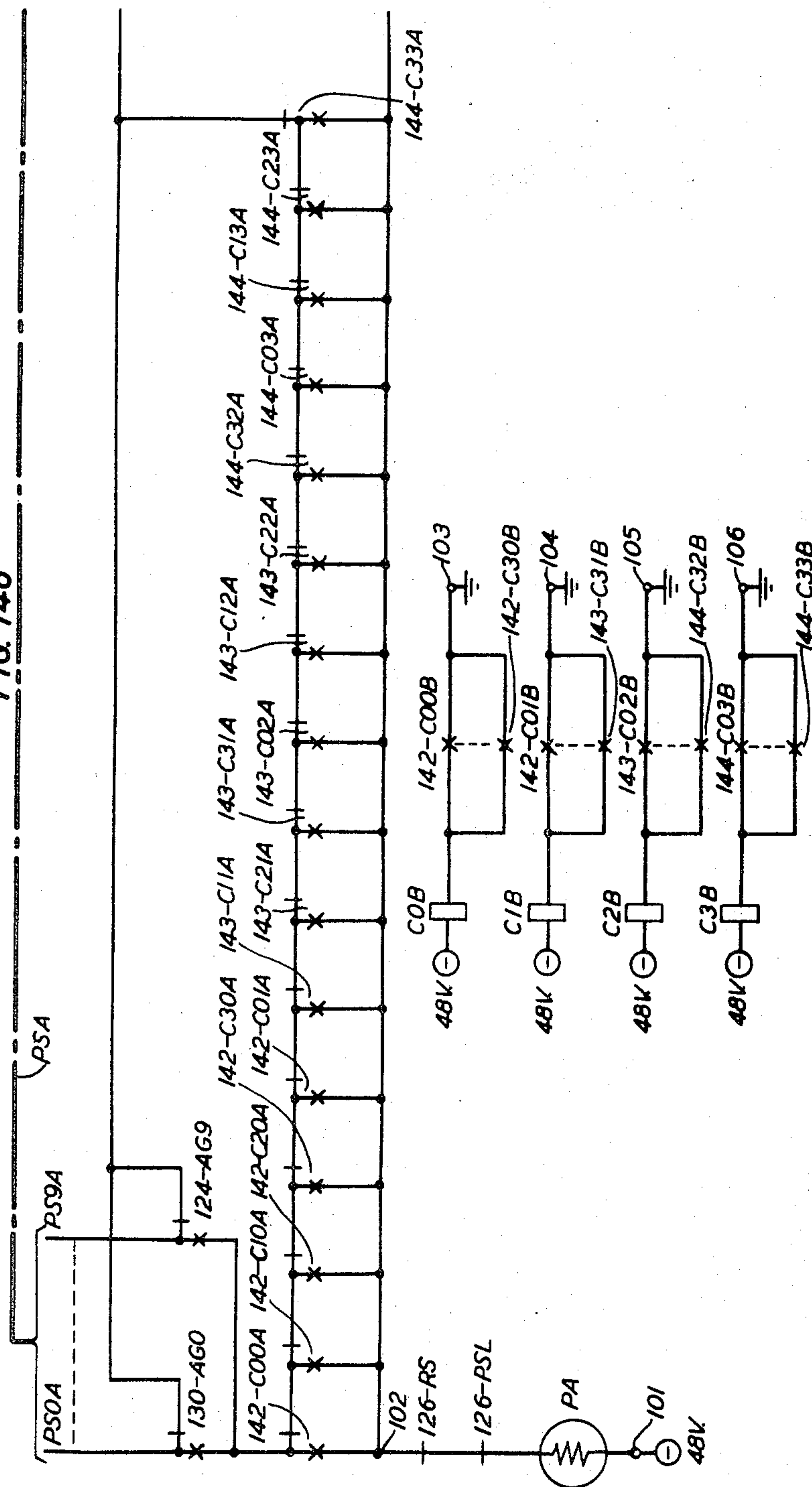
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 215

FIG. 146



Sept. 12, 1967

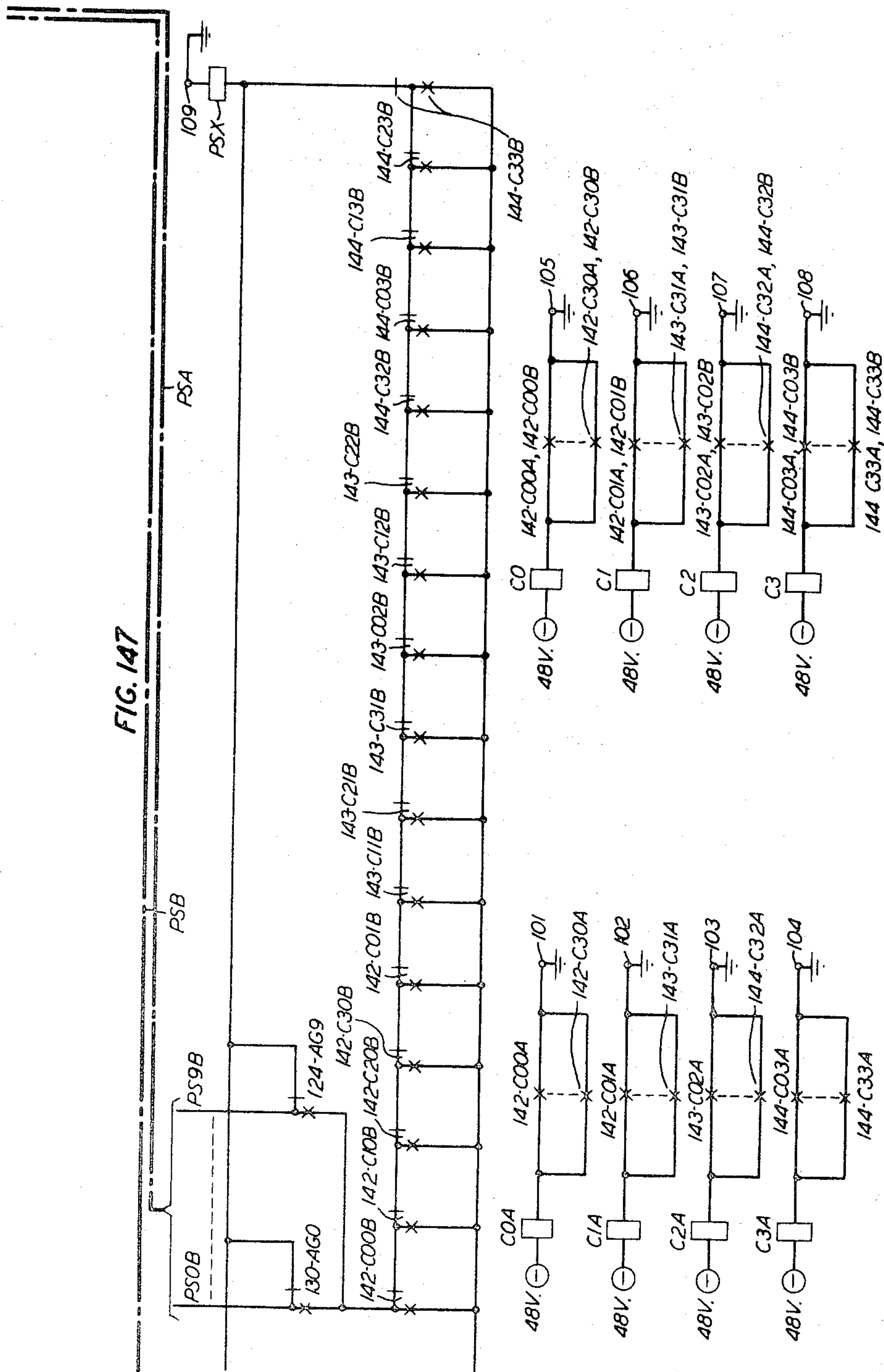
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 216

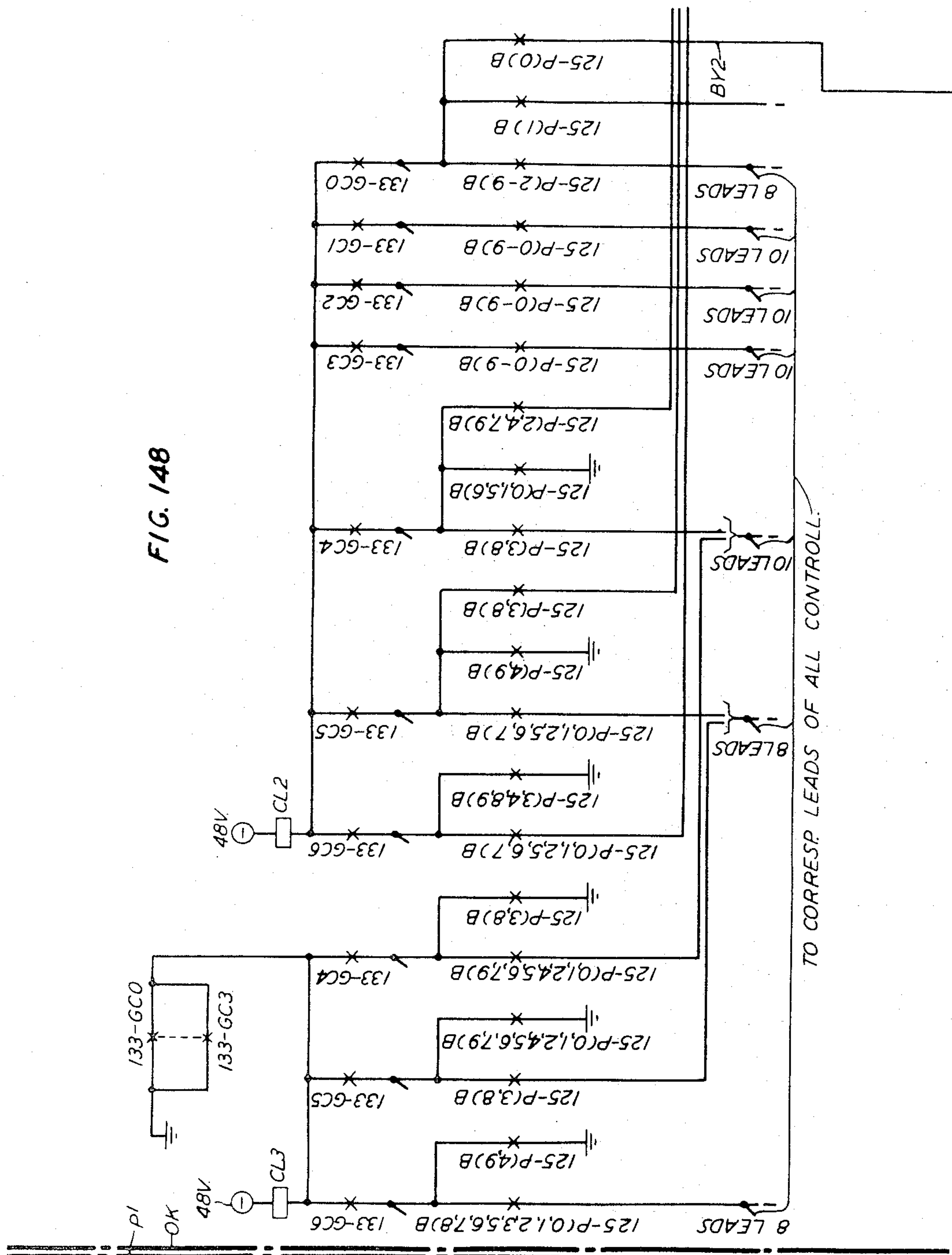
FIG. 147



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 217



Sept. 12, 1967

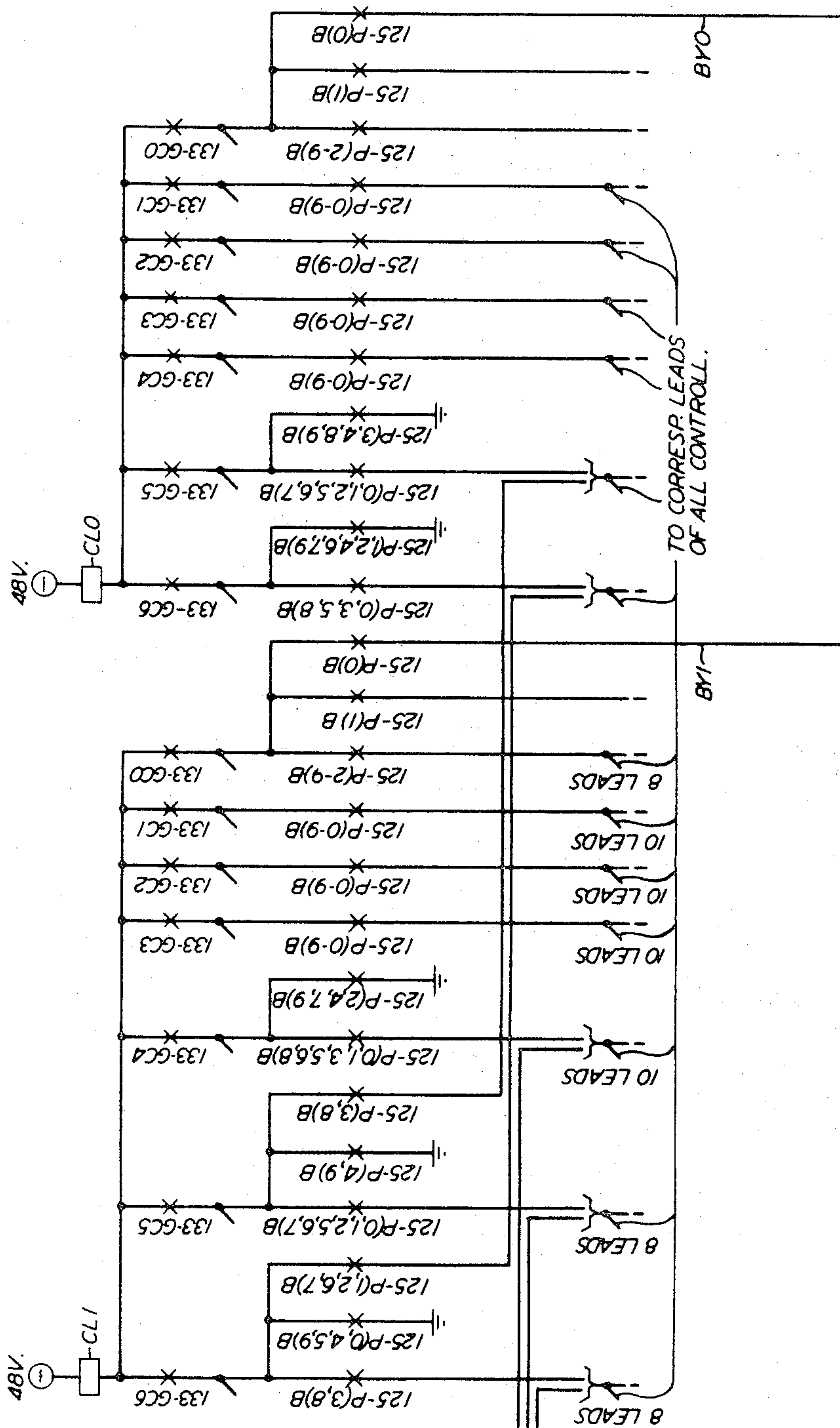
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 218

FIG. 149



Sept. 12, 1967

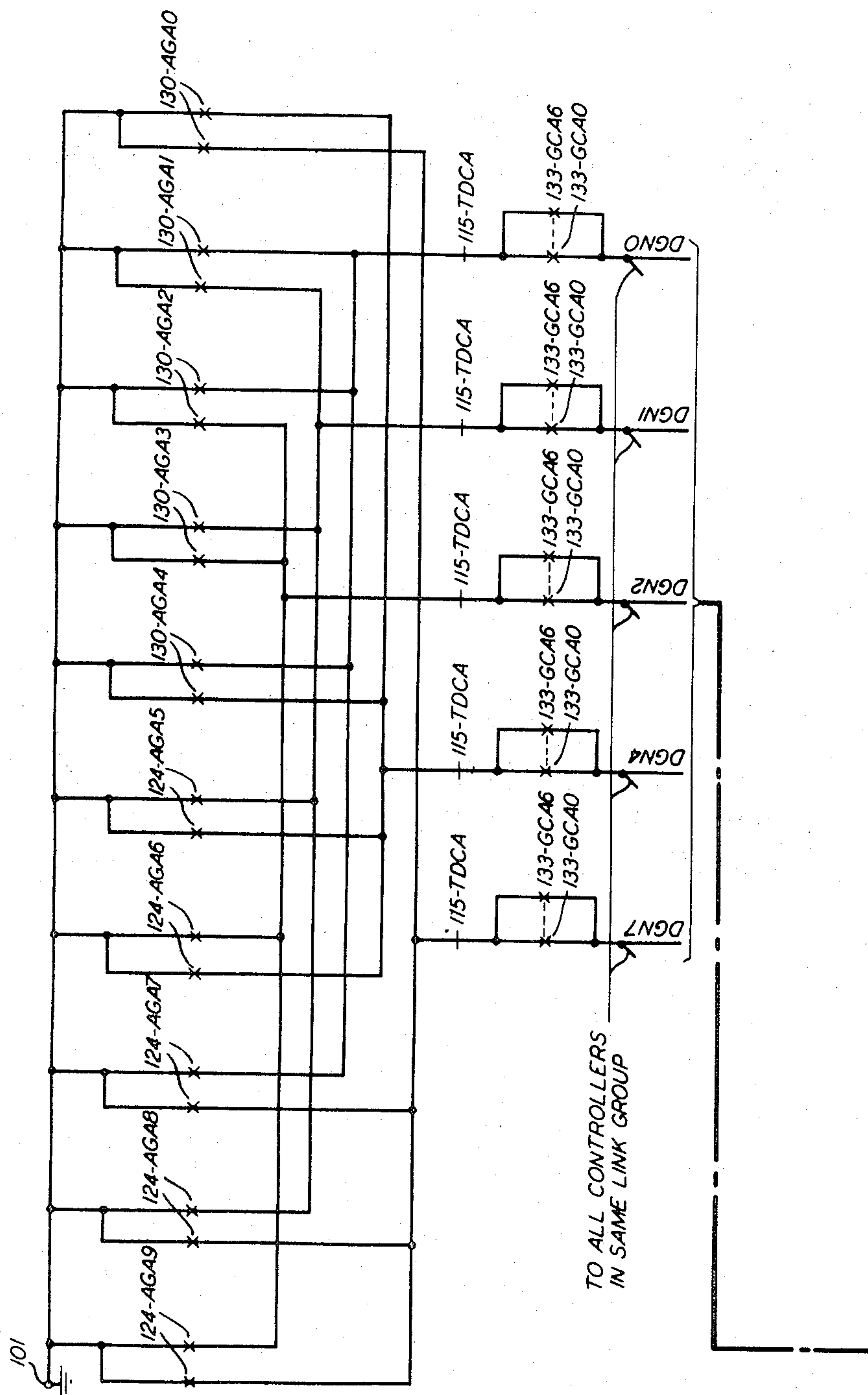
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 219

FIG. 150



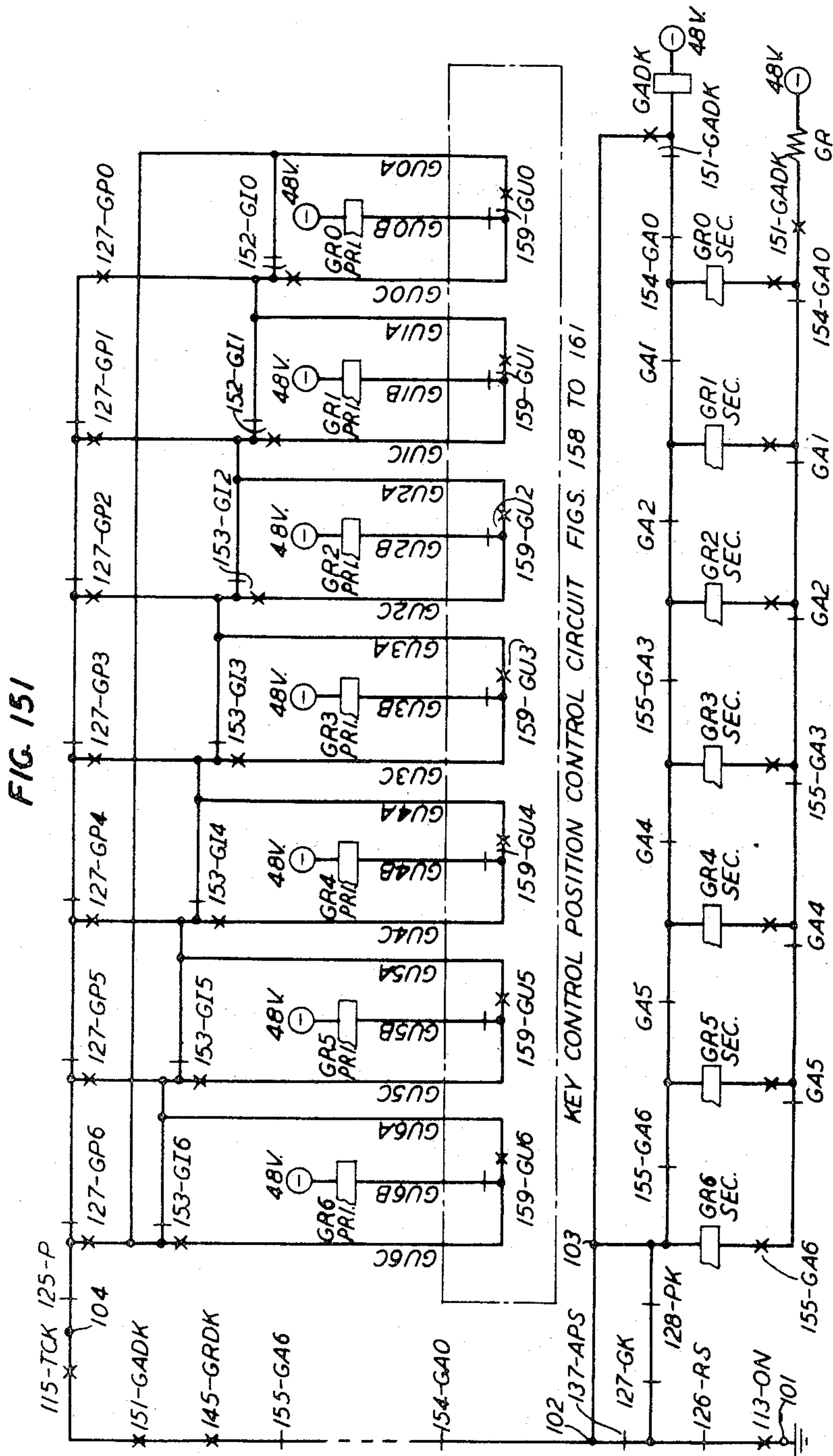
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 250



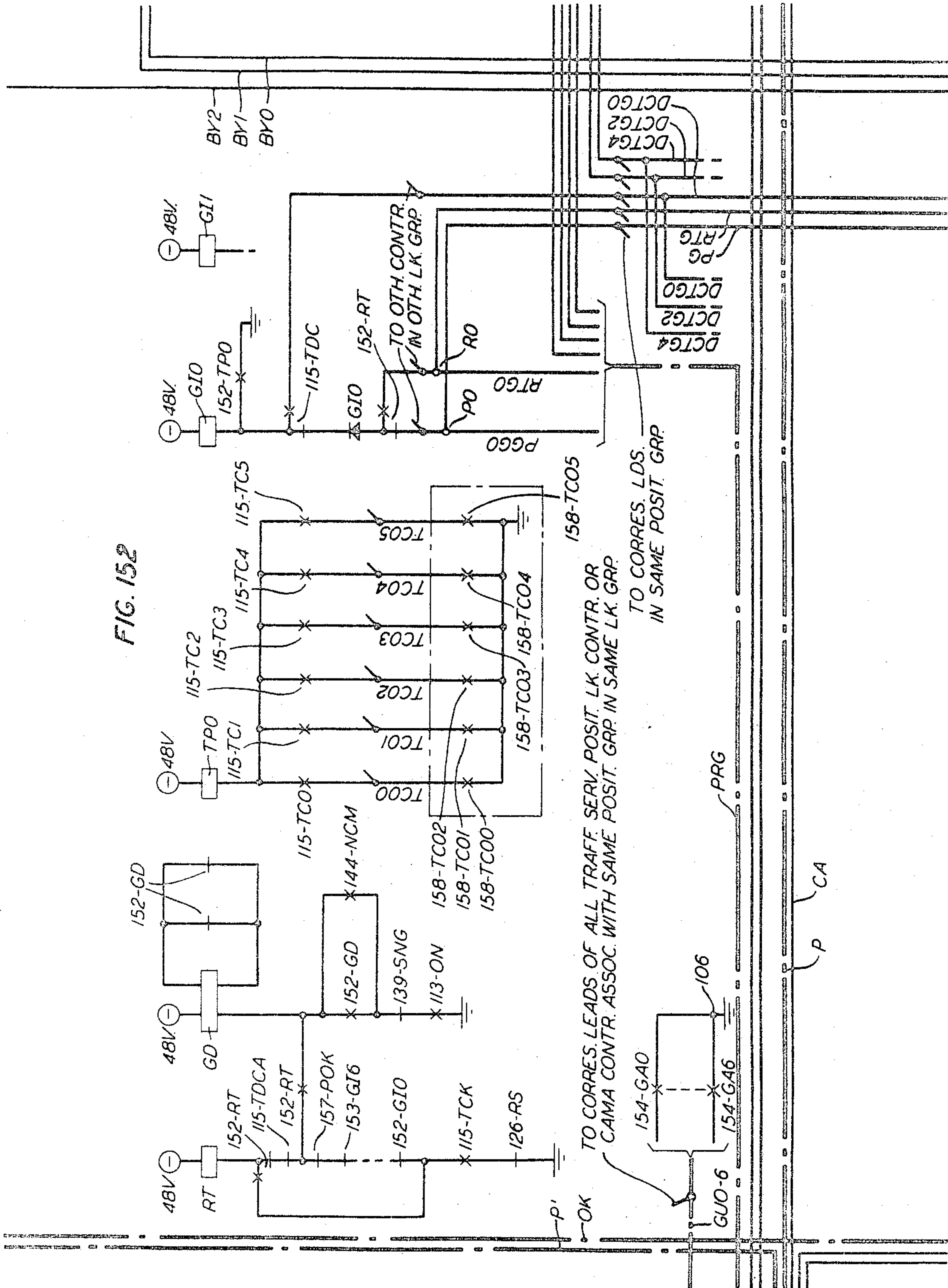
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 221

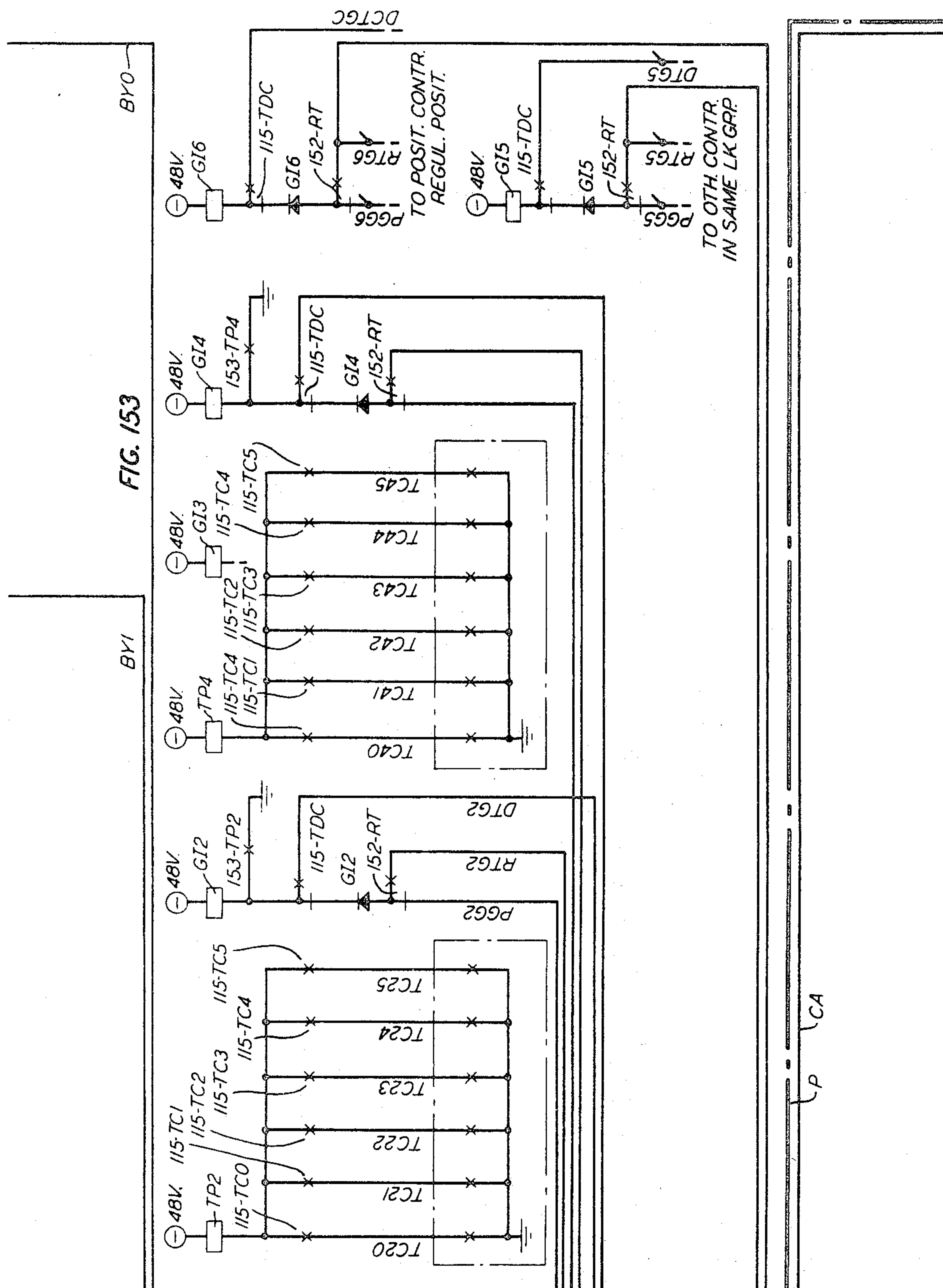


Sept. 12, 1967
E
Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 252



Sept. 12, 1967

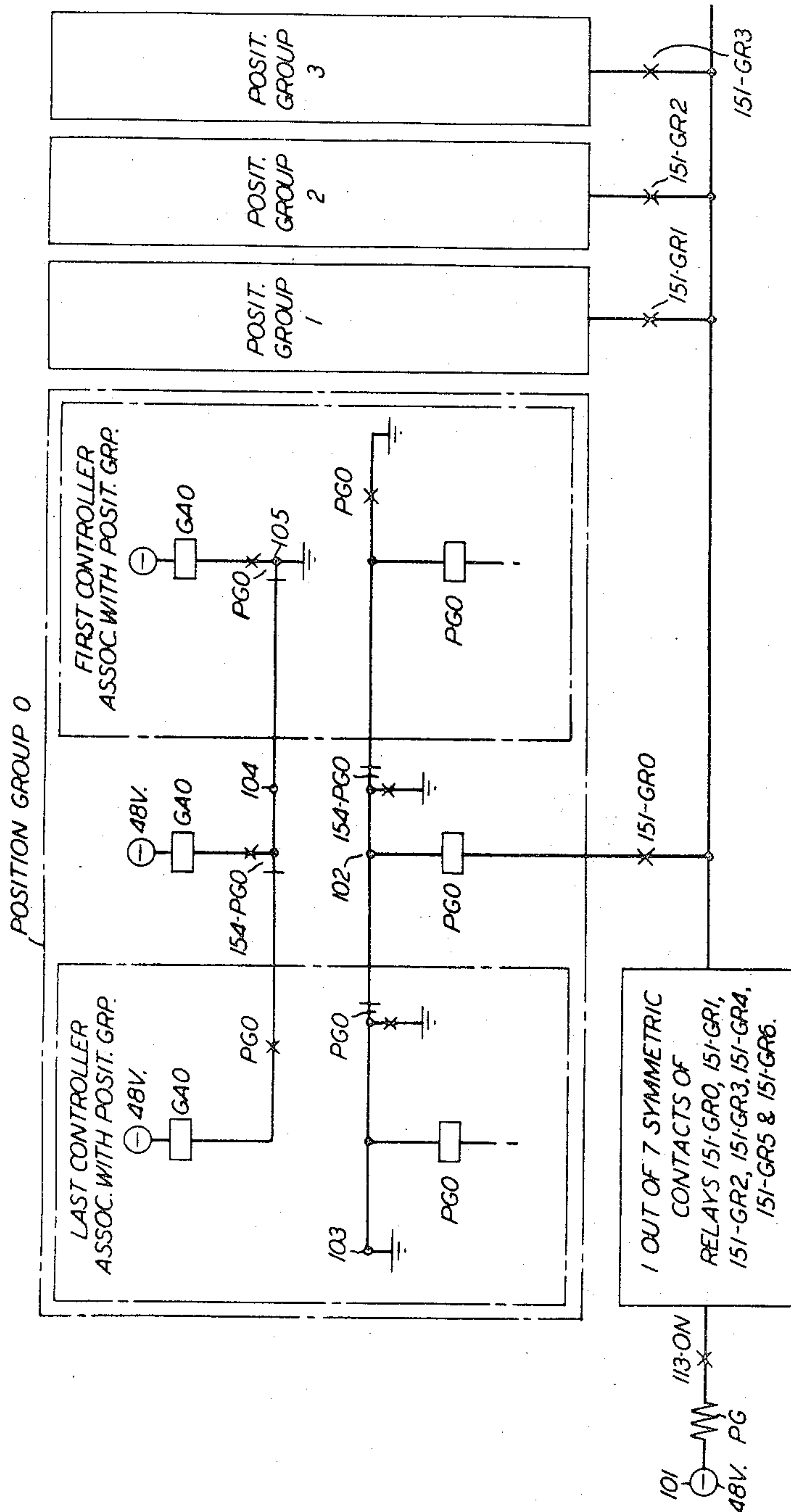
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 233

FIG. 15A



Sept. 12, 1967

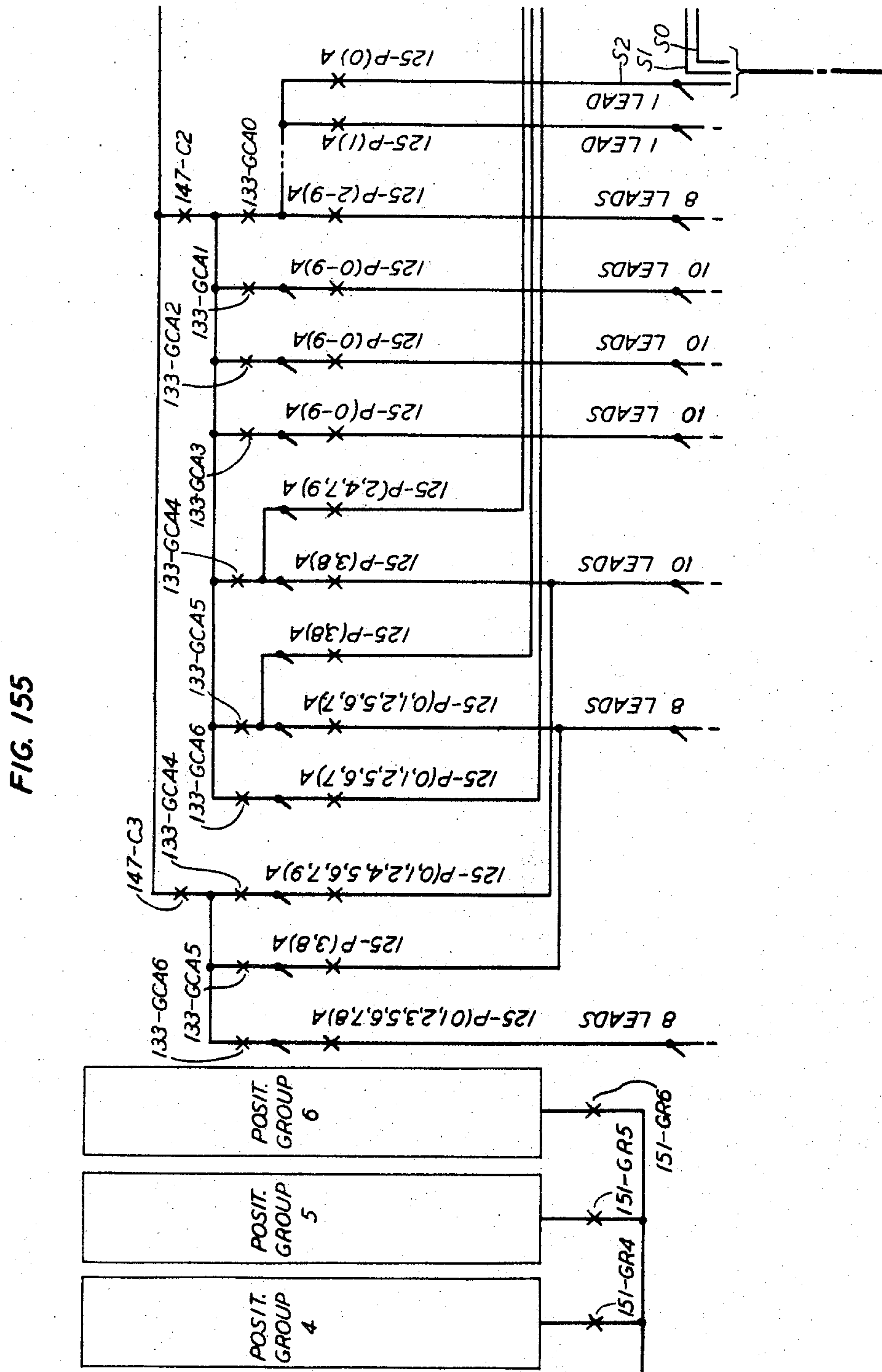
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 224



Sept. 12, 1967

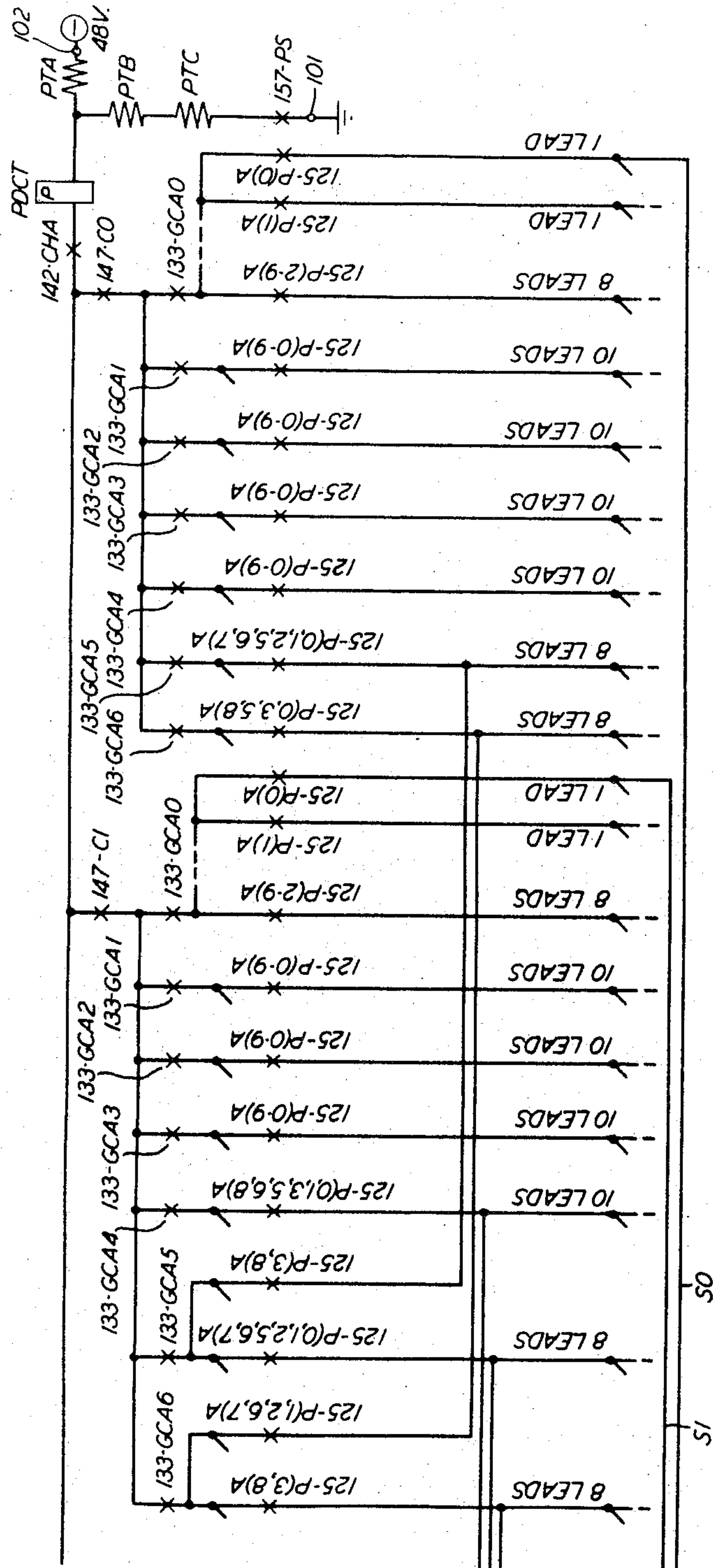
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 225

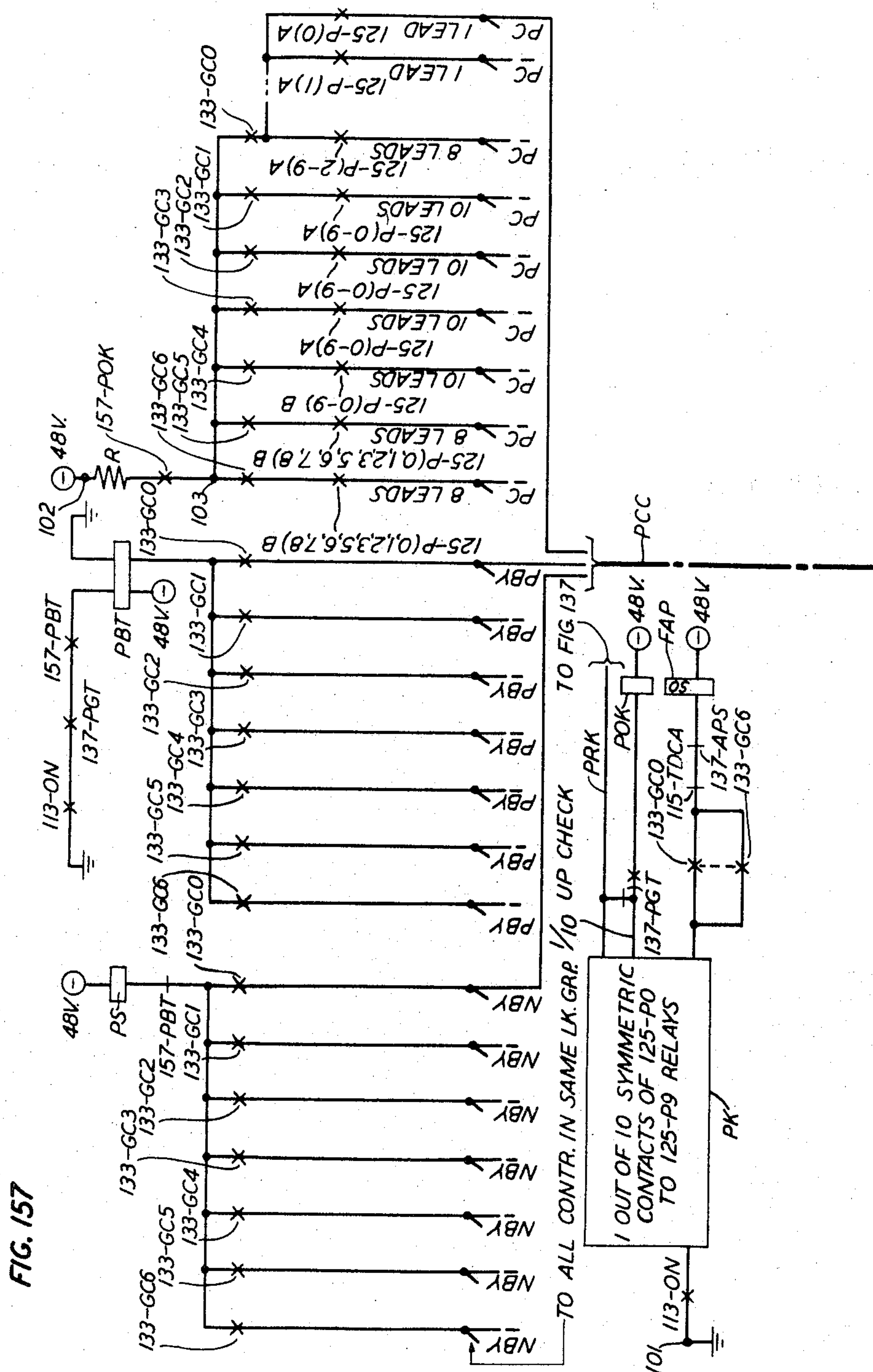
FIG. 156



Filed Nov. 26, 1963

570 Sheets-Sheet 226

570 Sheets-Sheet 226



Sept. 12, 1967

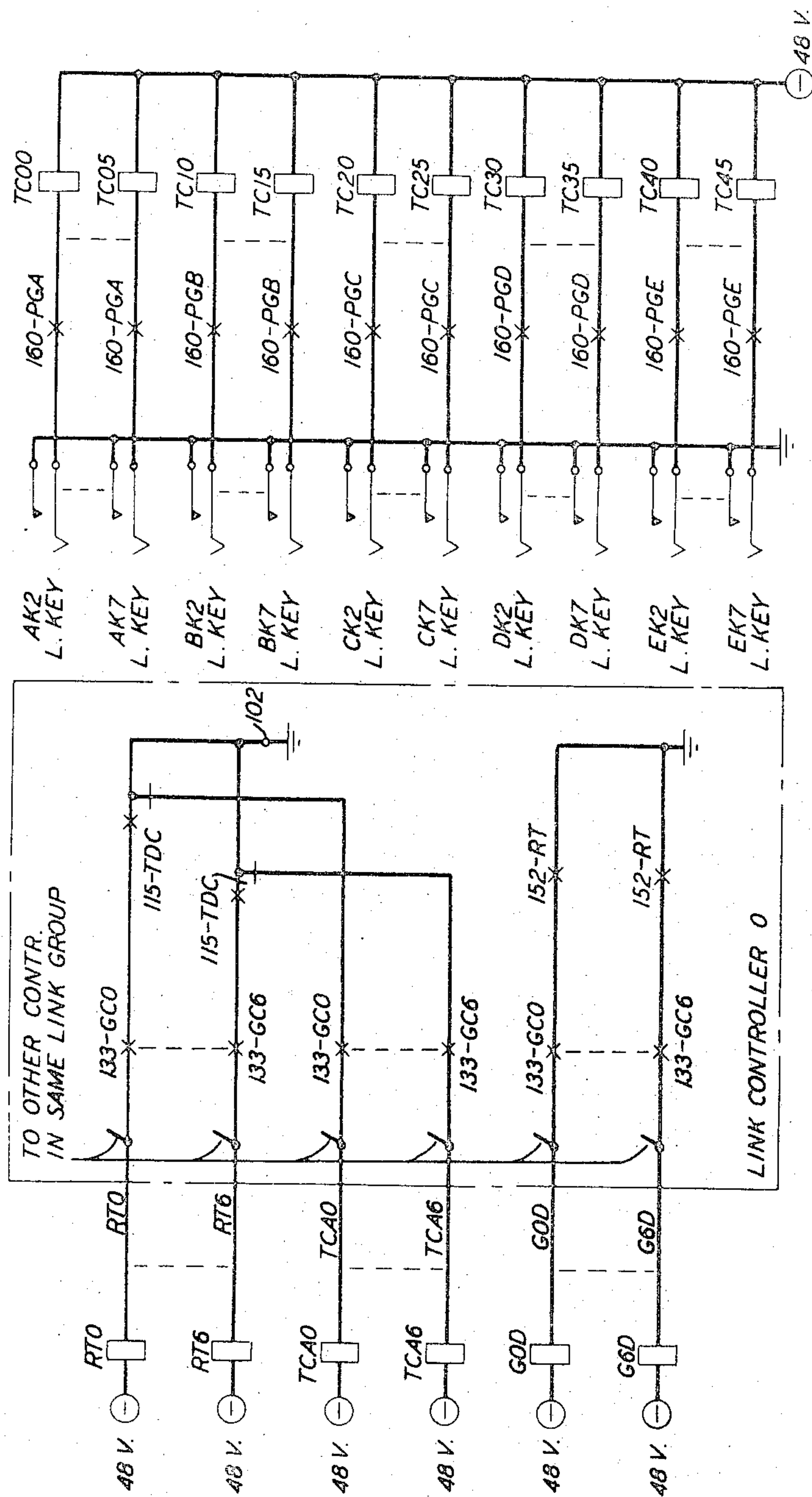
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 227

FIG. 158



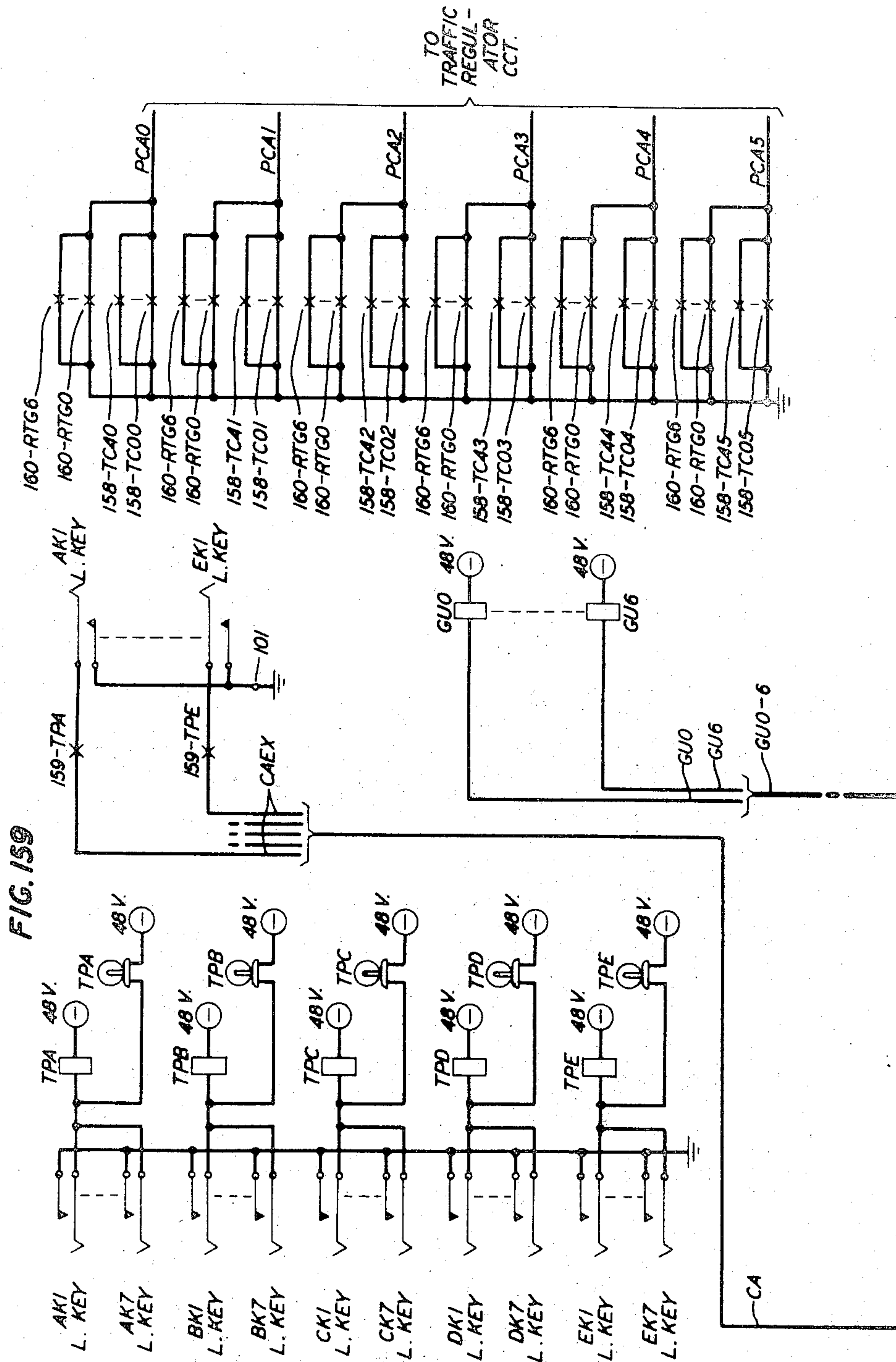
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

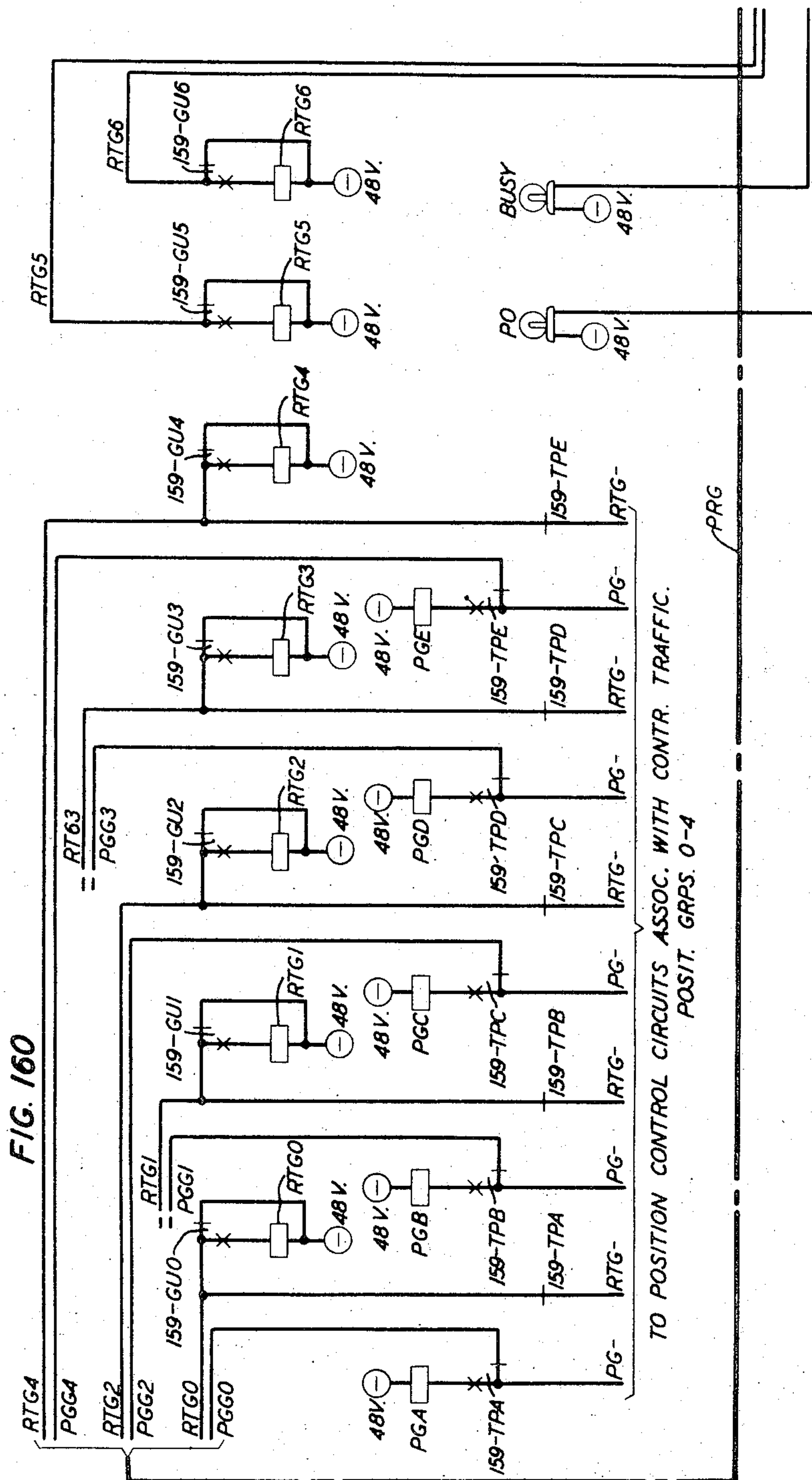
570 Sheets-Sheet 228



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 229



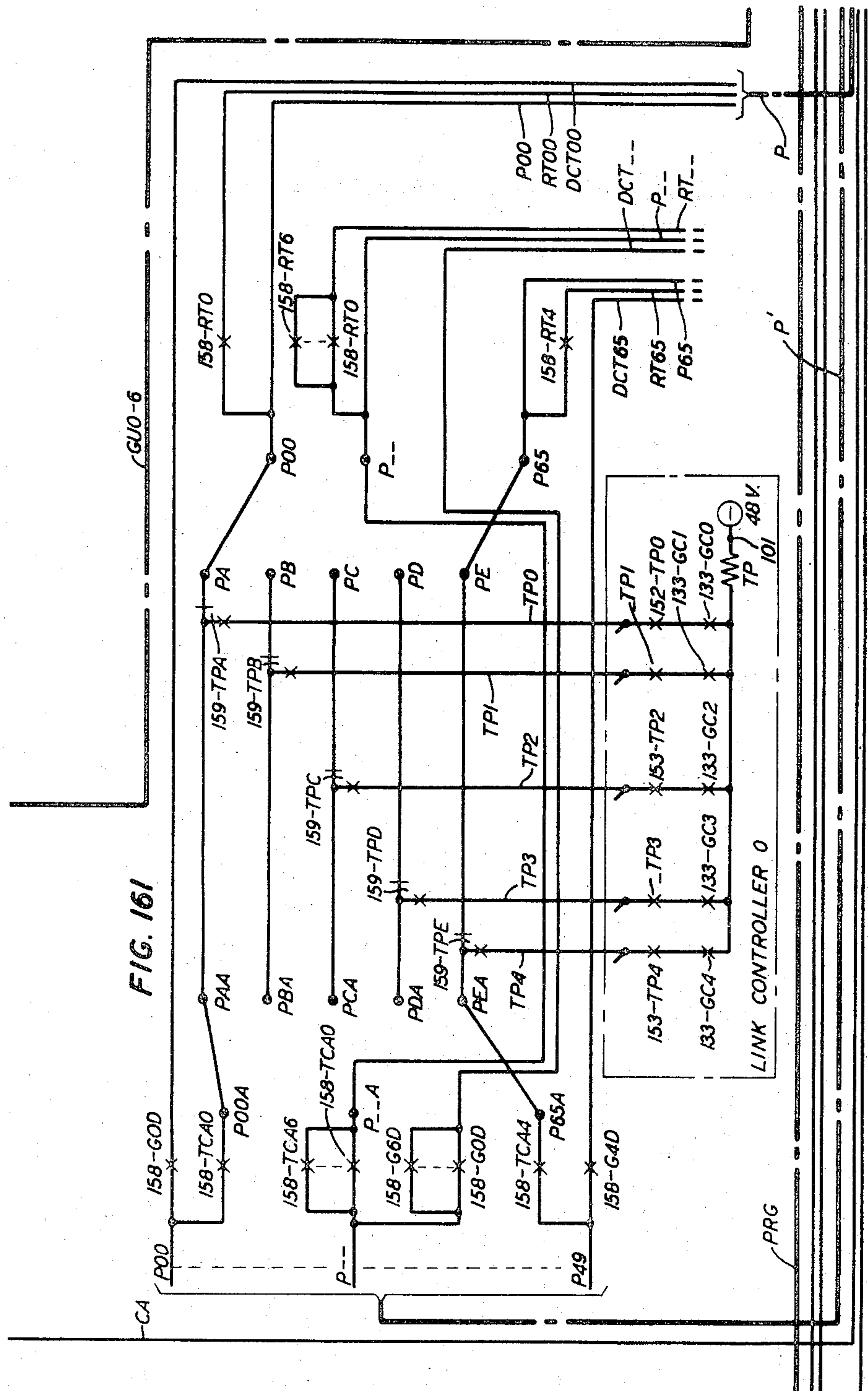
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

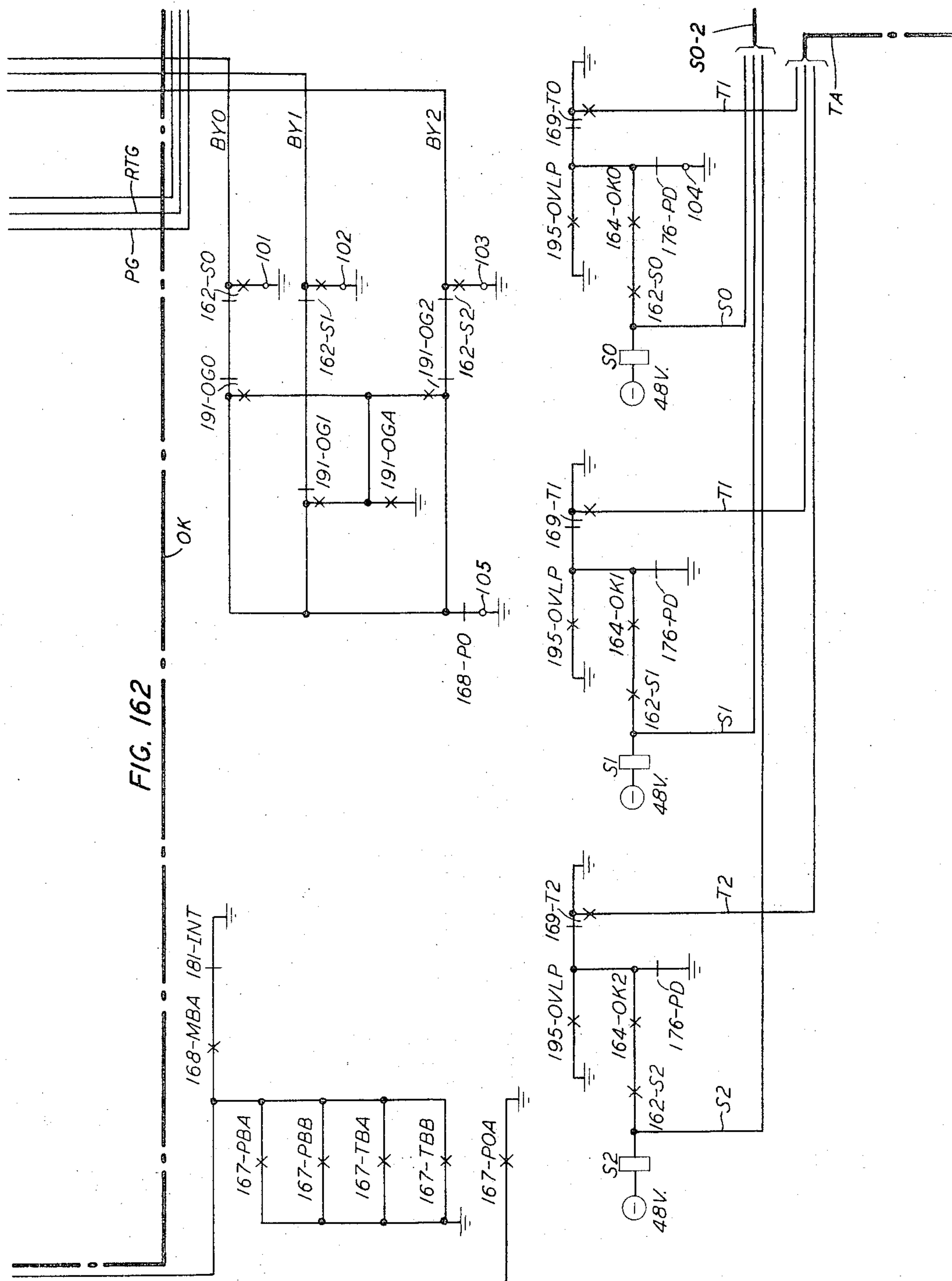
570 Sheets-Sheet 230



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 231

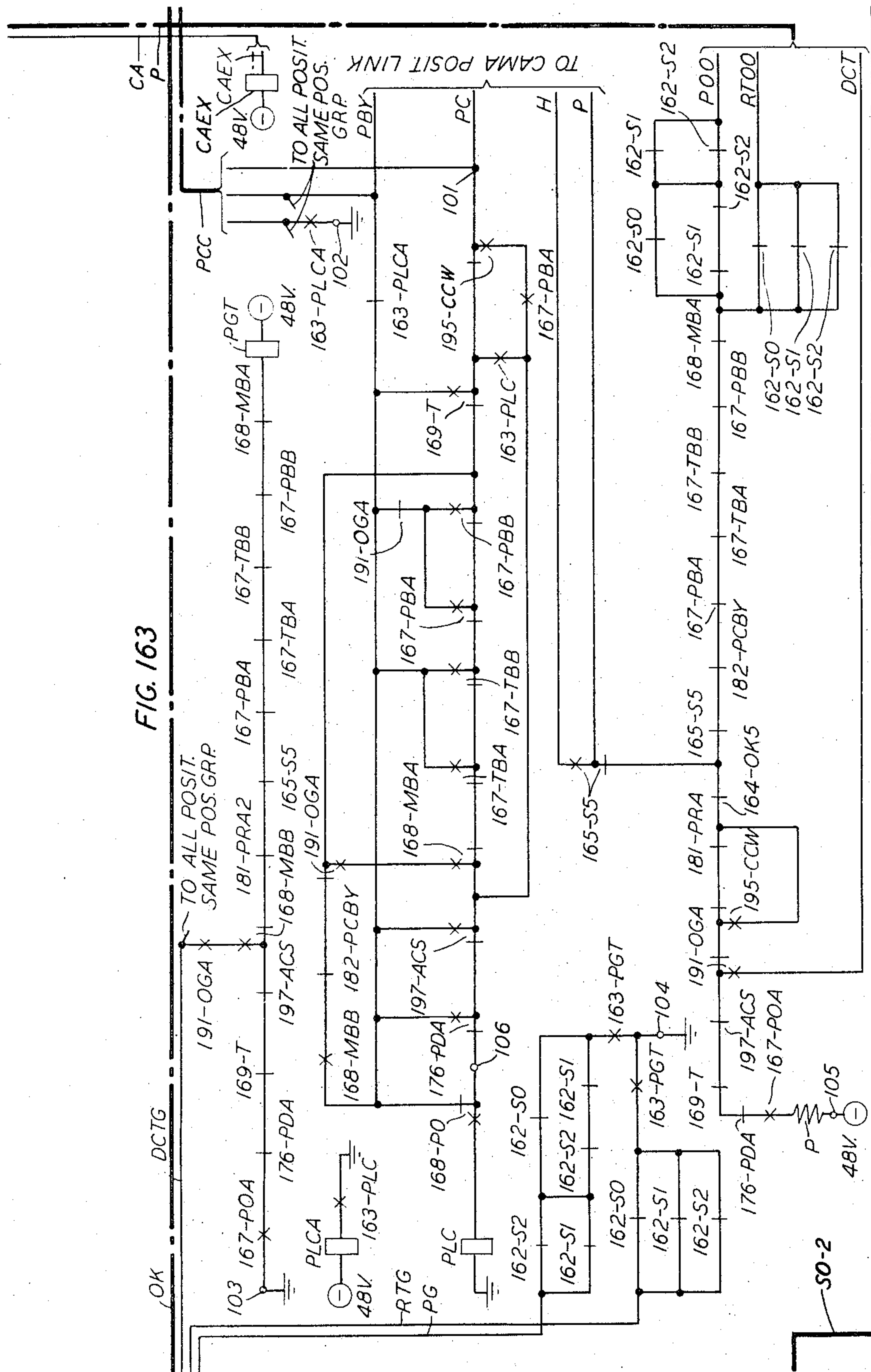
FIG. 162



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 232



Sept. 12, 1967

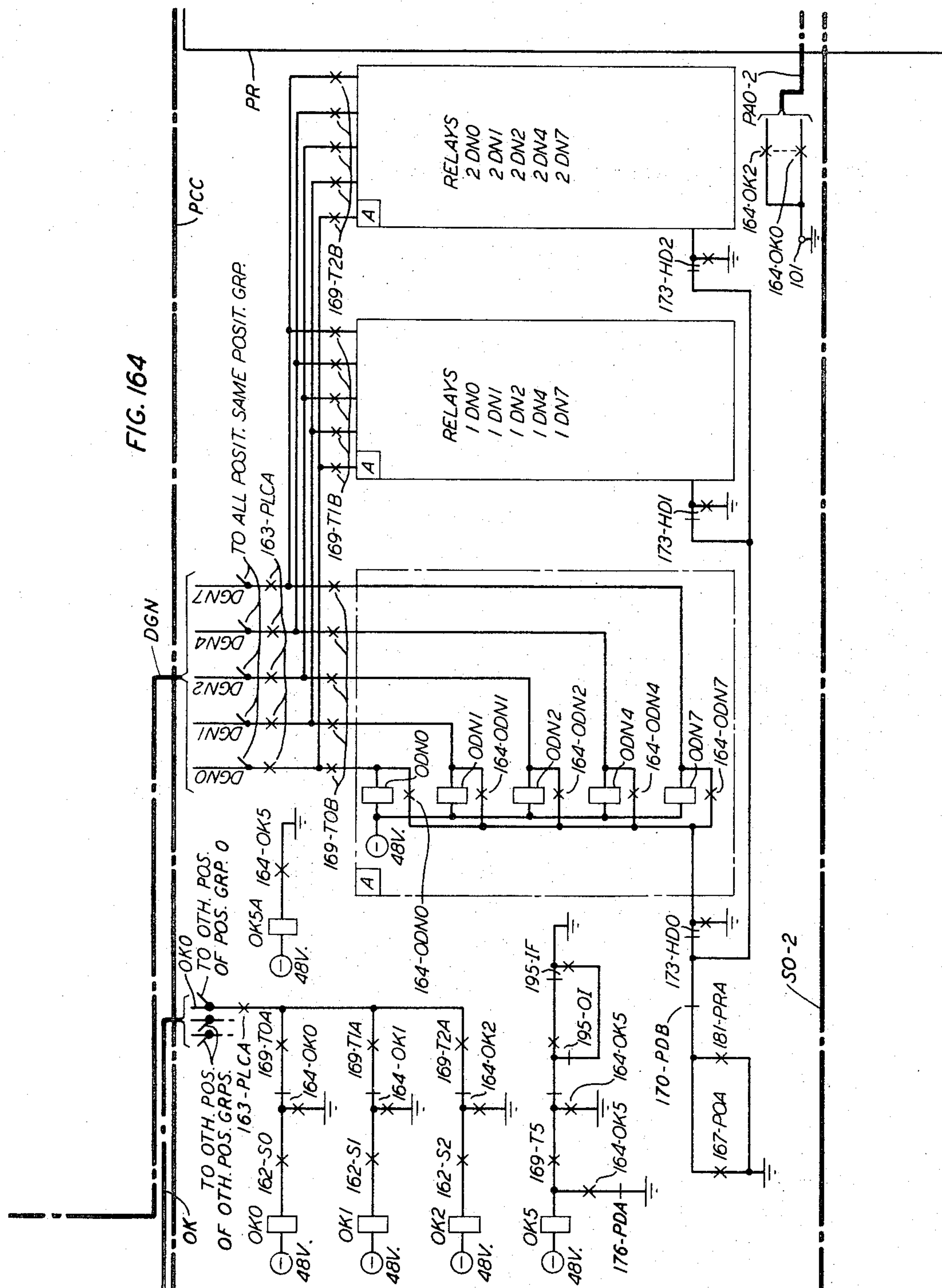
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 233

FIG. 164



Sept. 12, 1967

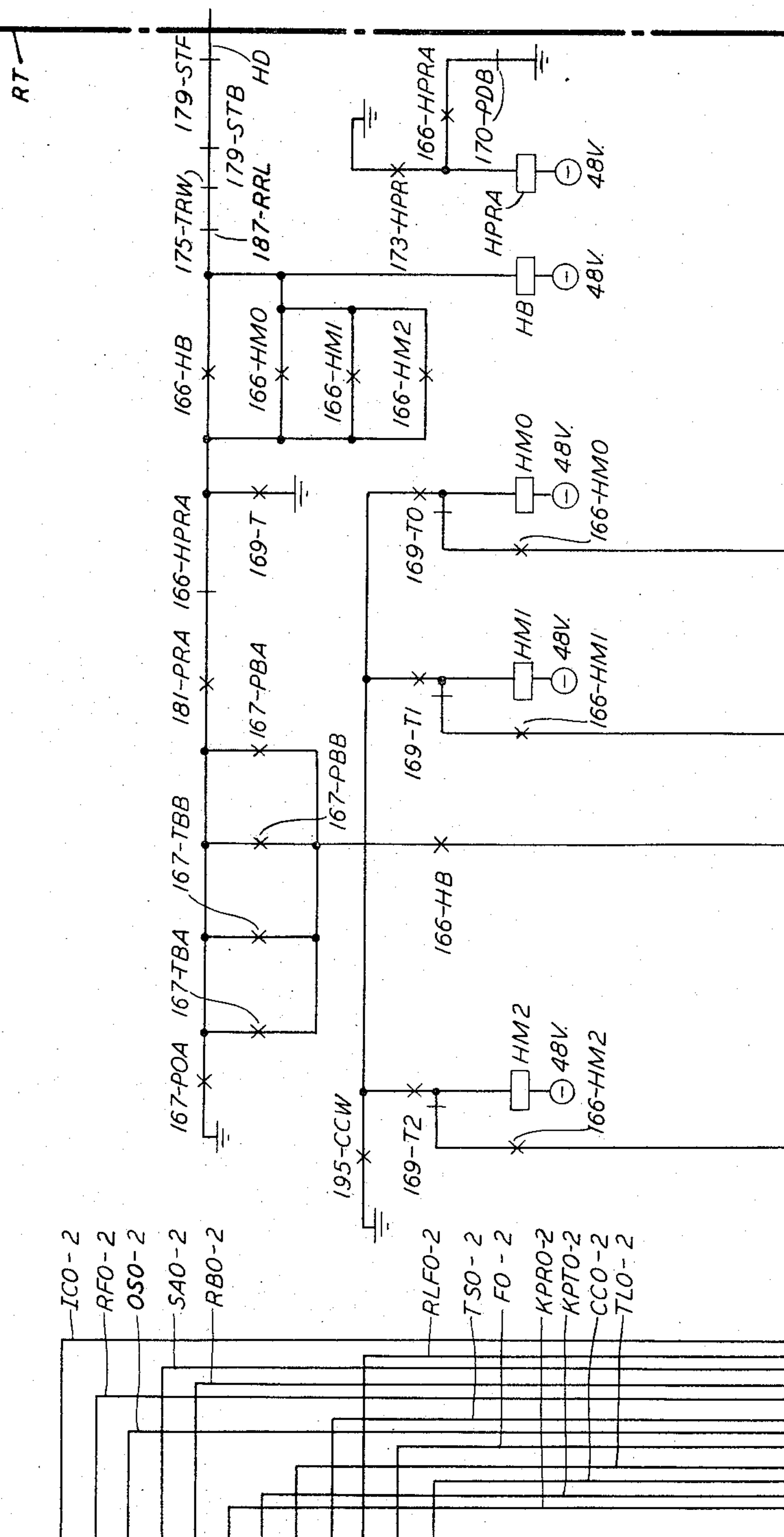
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 235



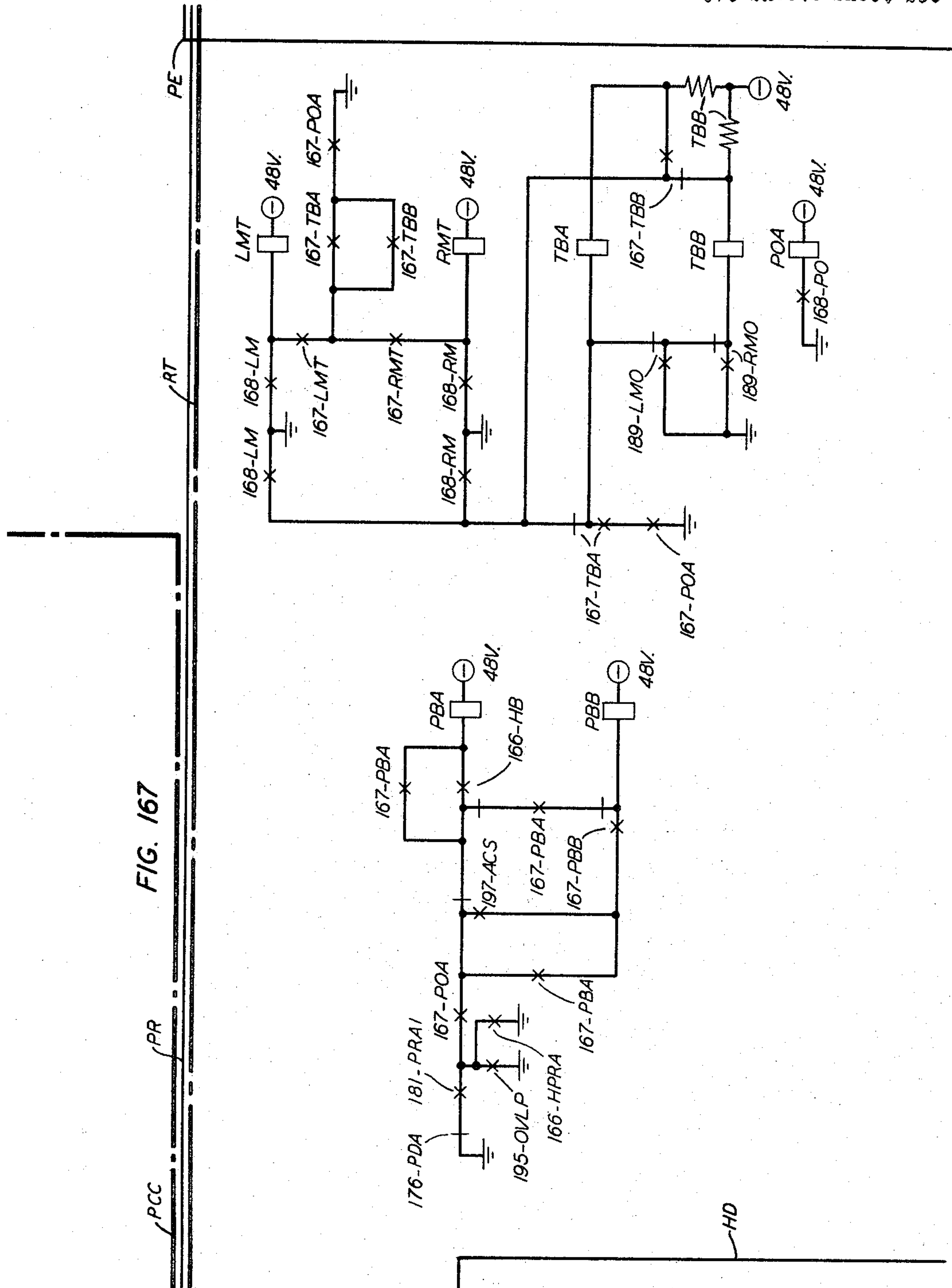
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 236



Sept. 12, 1967

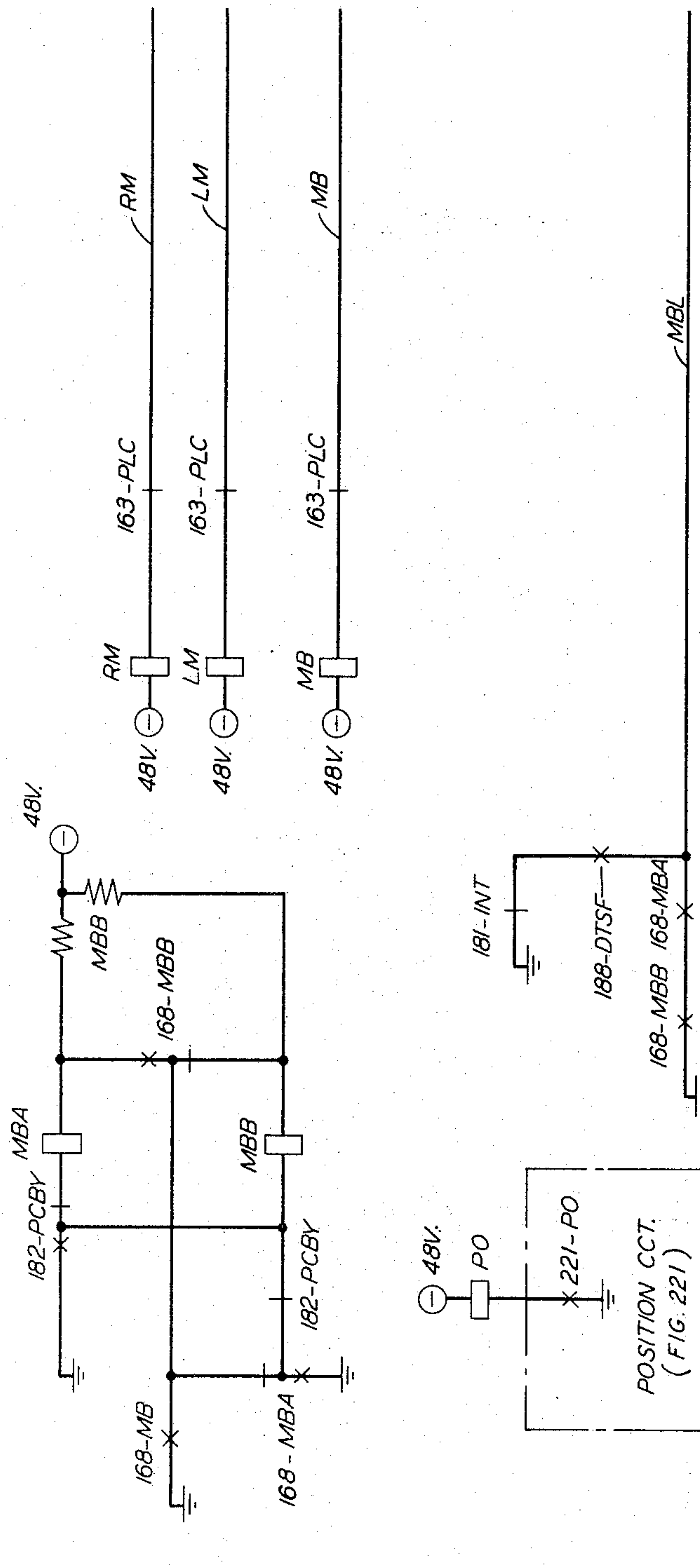
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 237

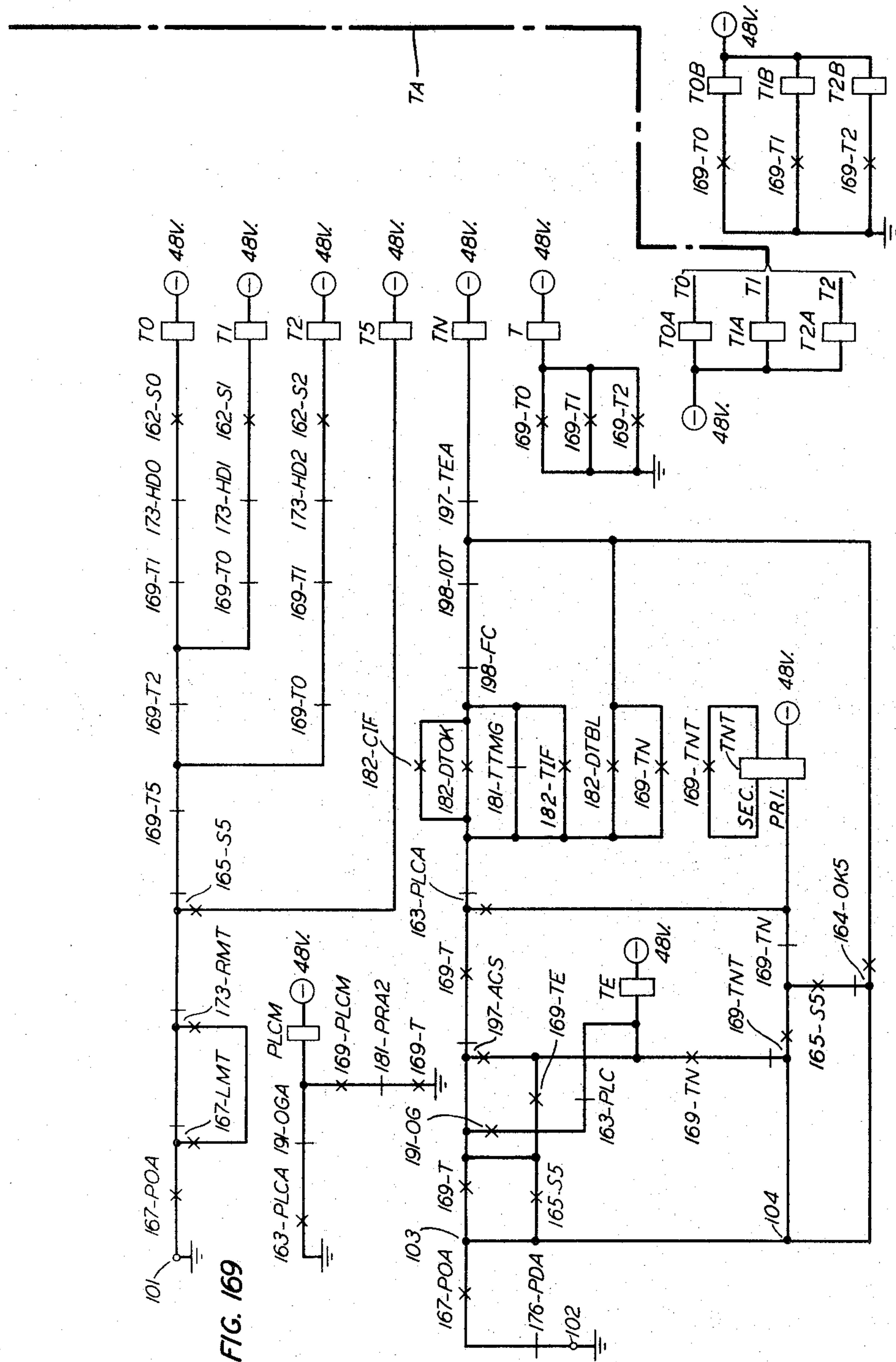
FIG. 168



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 238

Filed Nov. 26, 1963



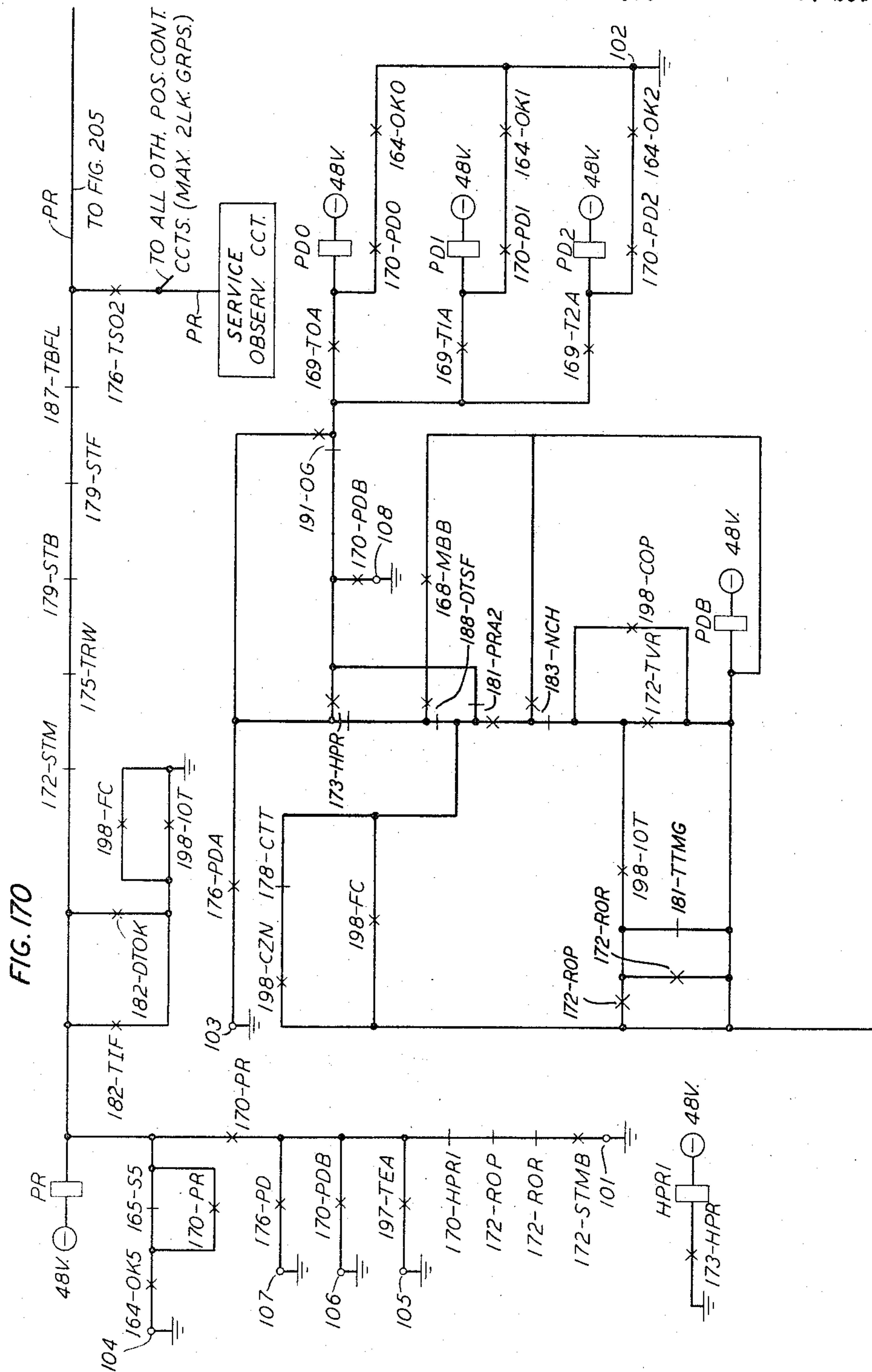
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

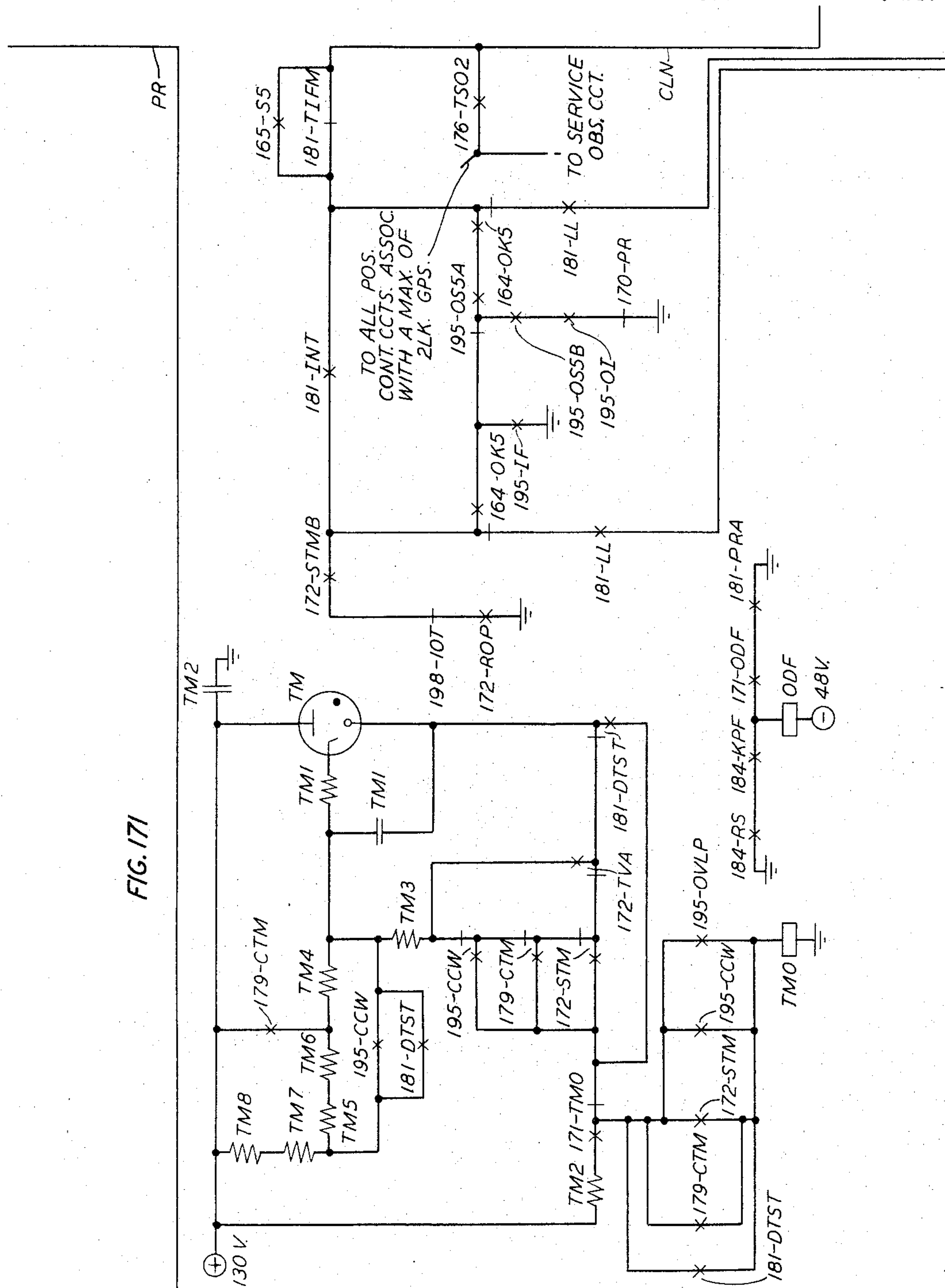
570 Sheets-Sheet 239



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 240



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 241

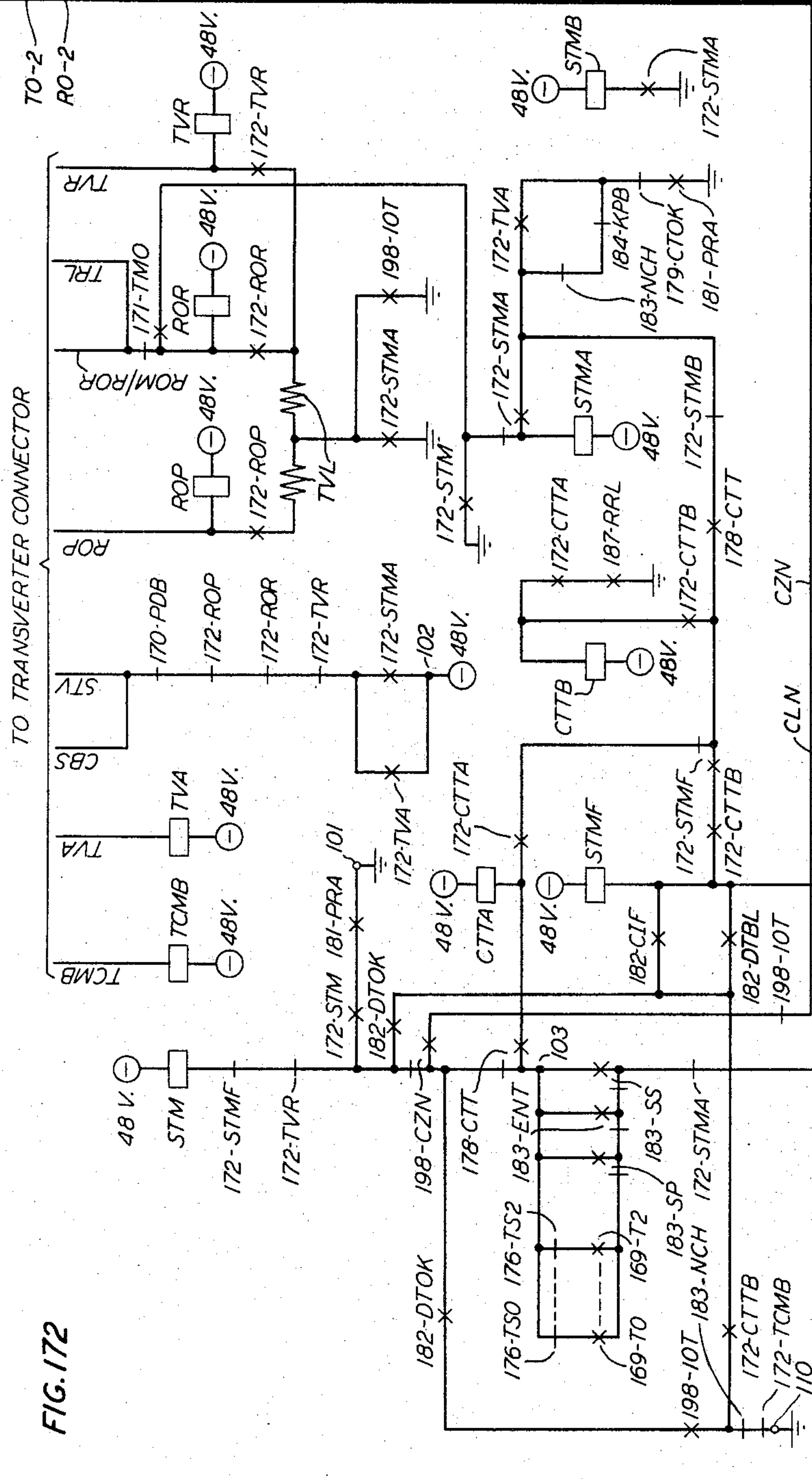


FIG. 172

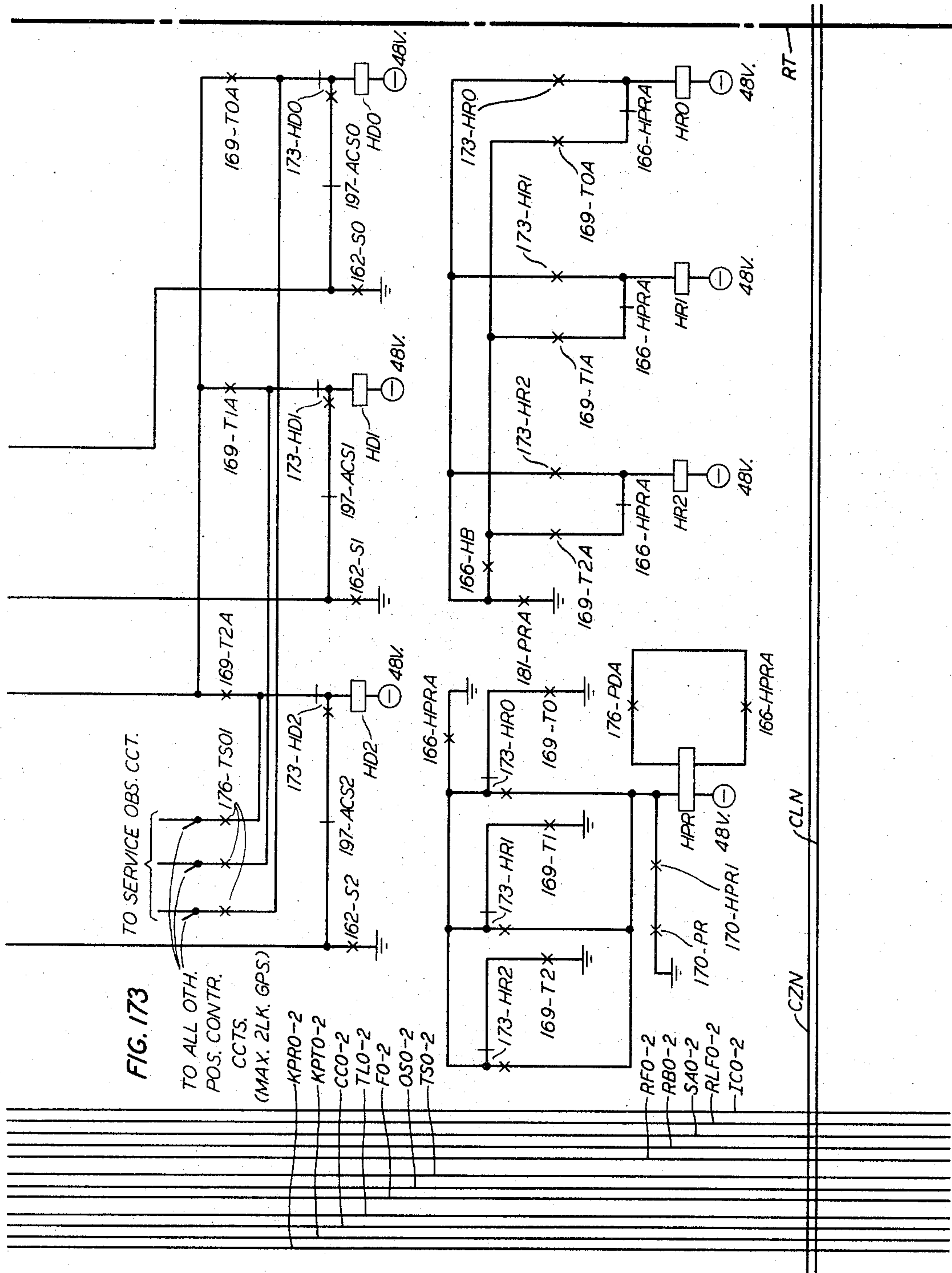
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 242



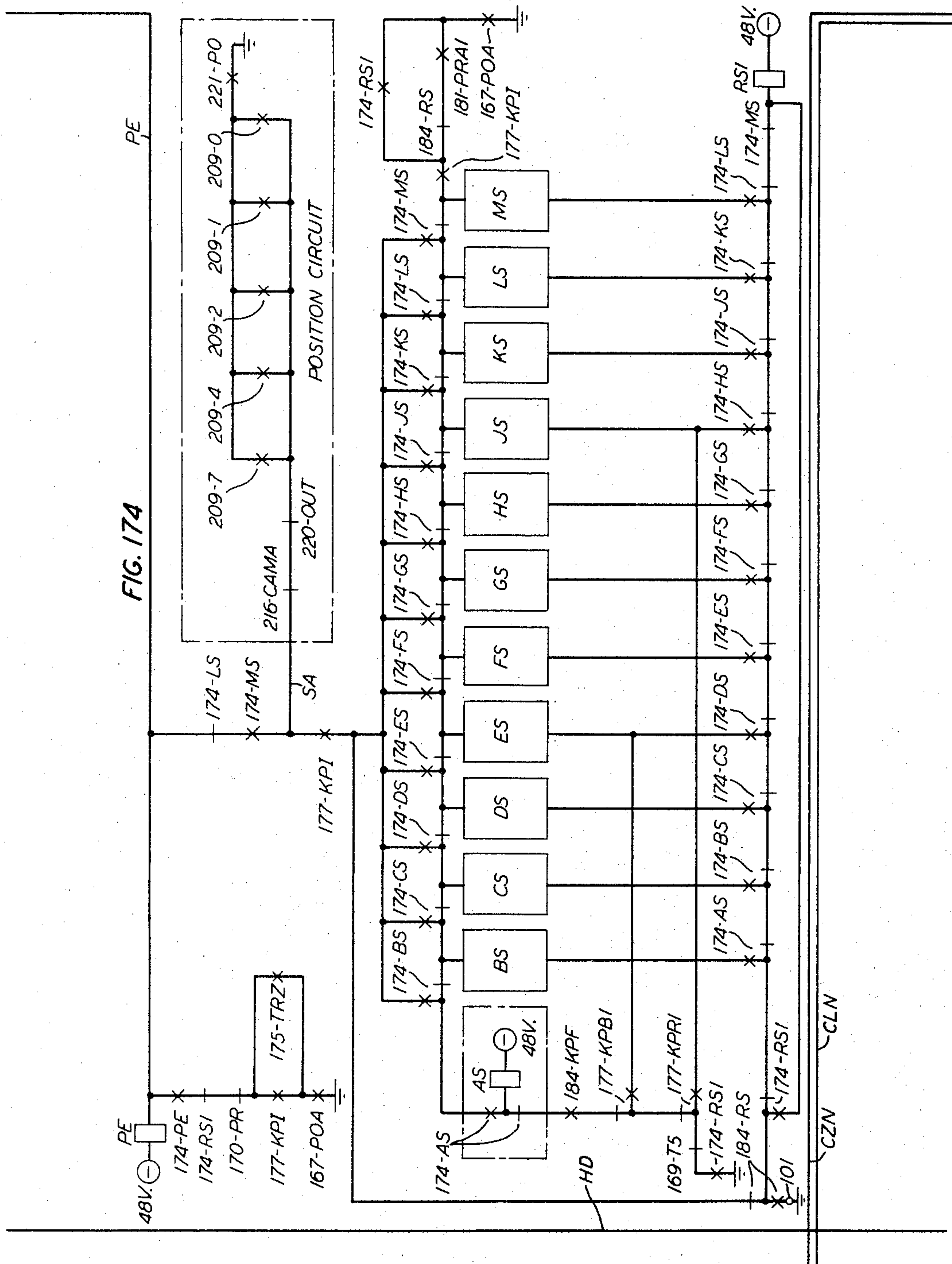
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

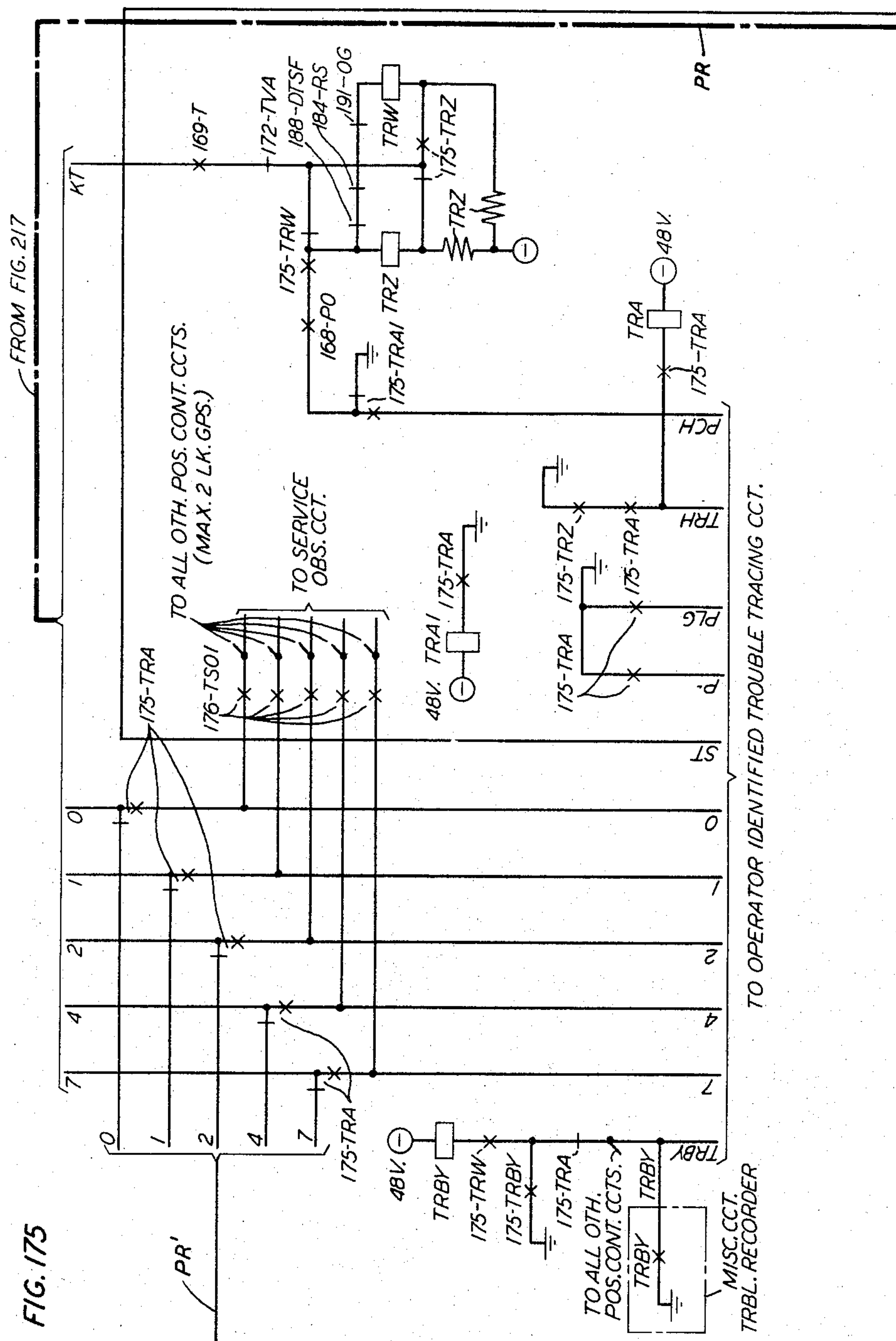
570 Sheets-Sheet 243



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

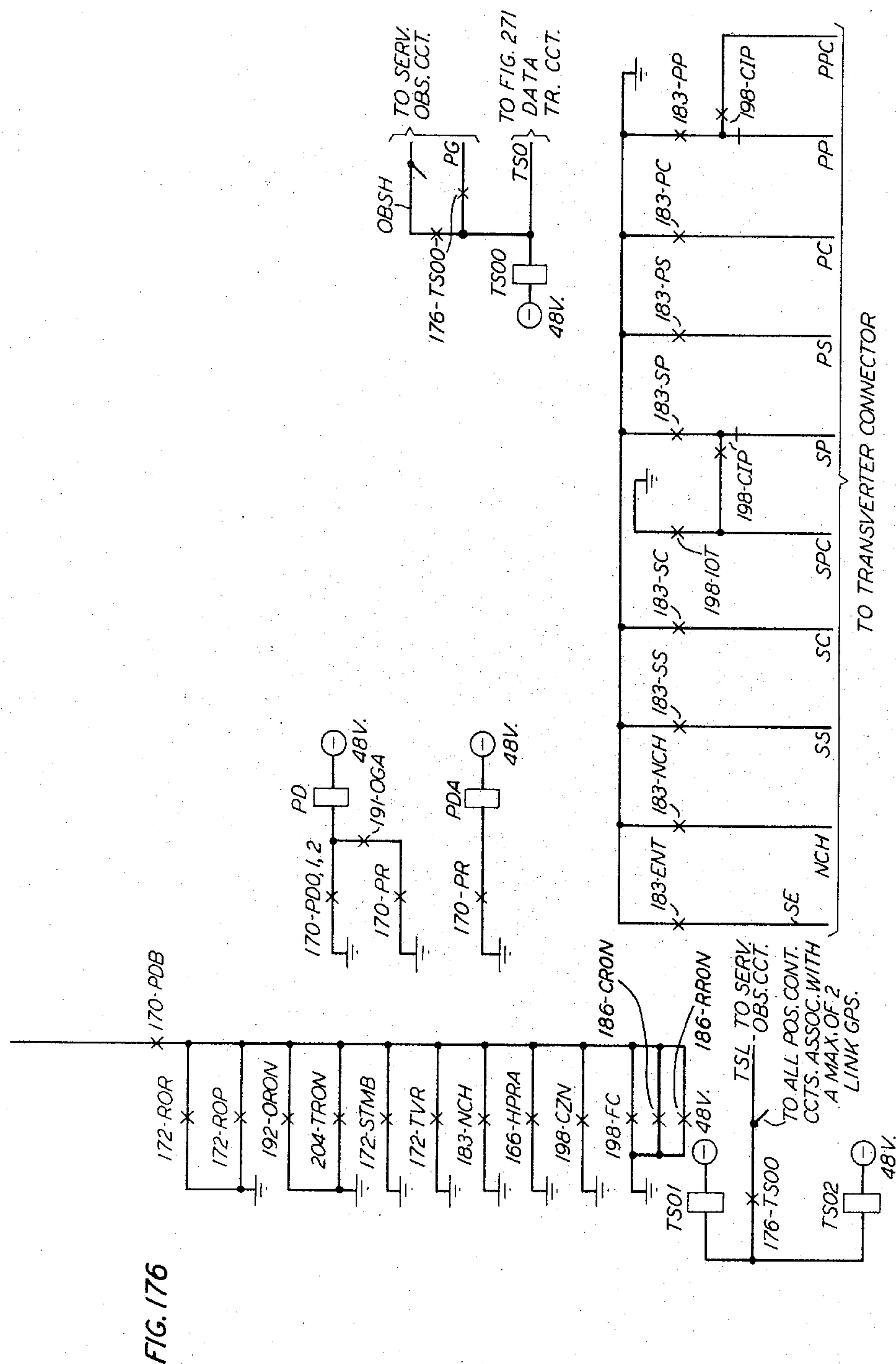
570 Sheets-Sheet 244



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 245



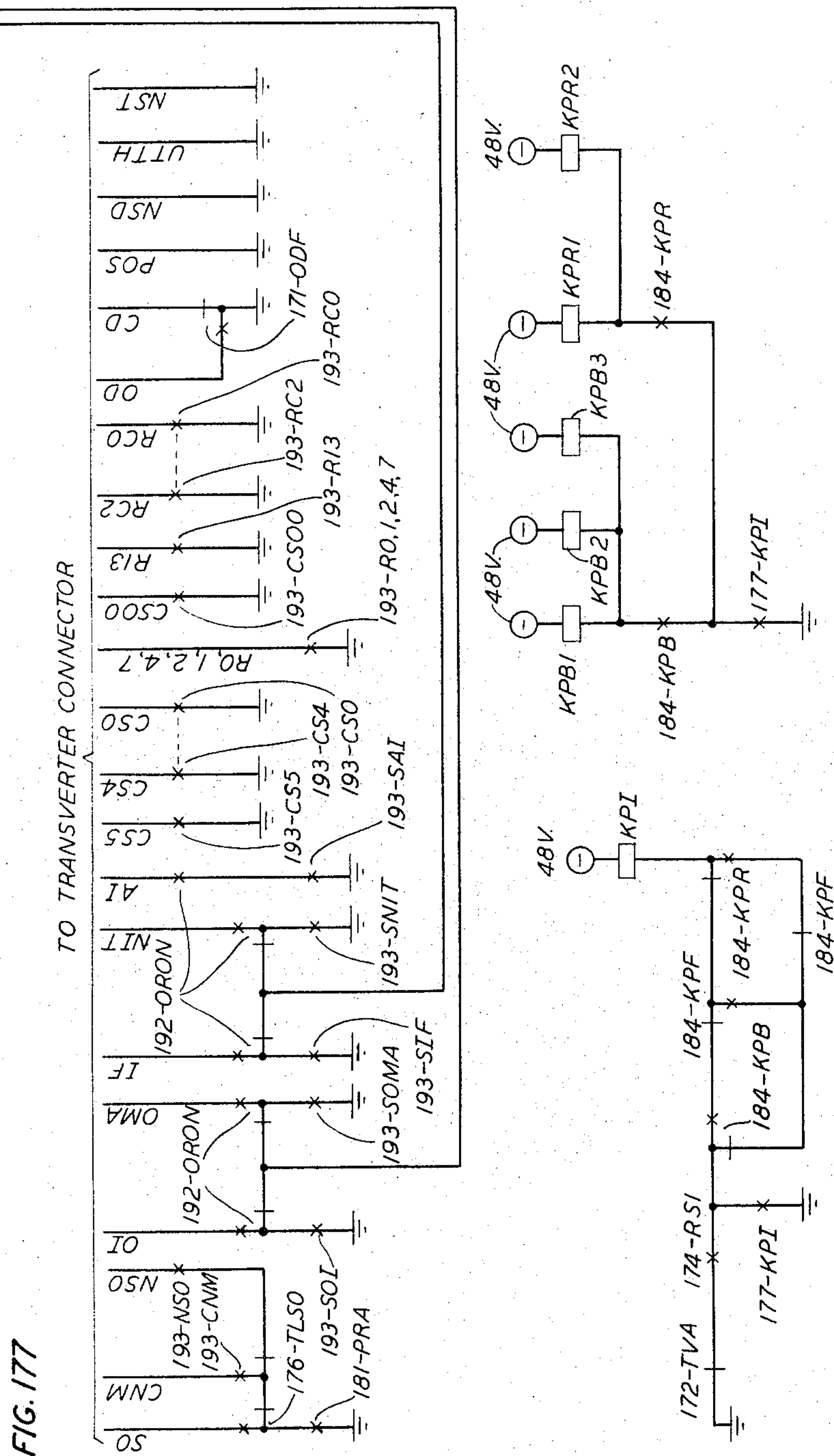
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 246



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 247

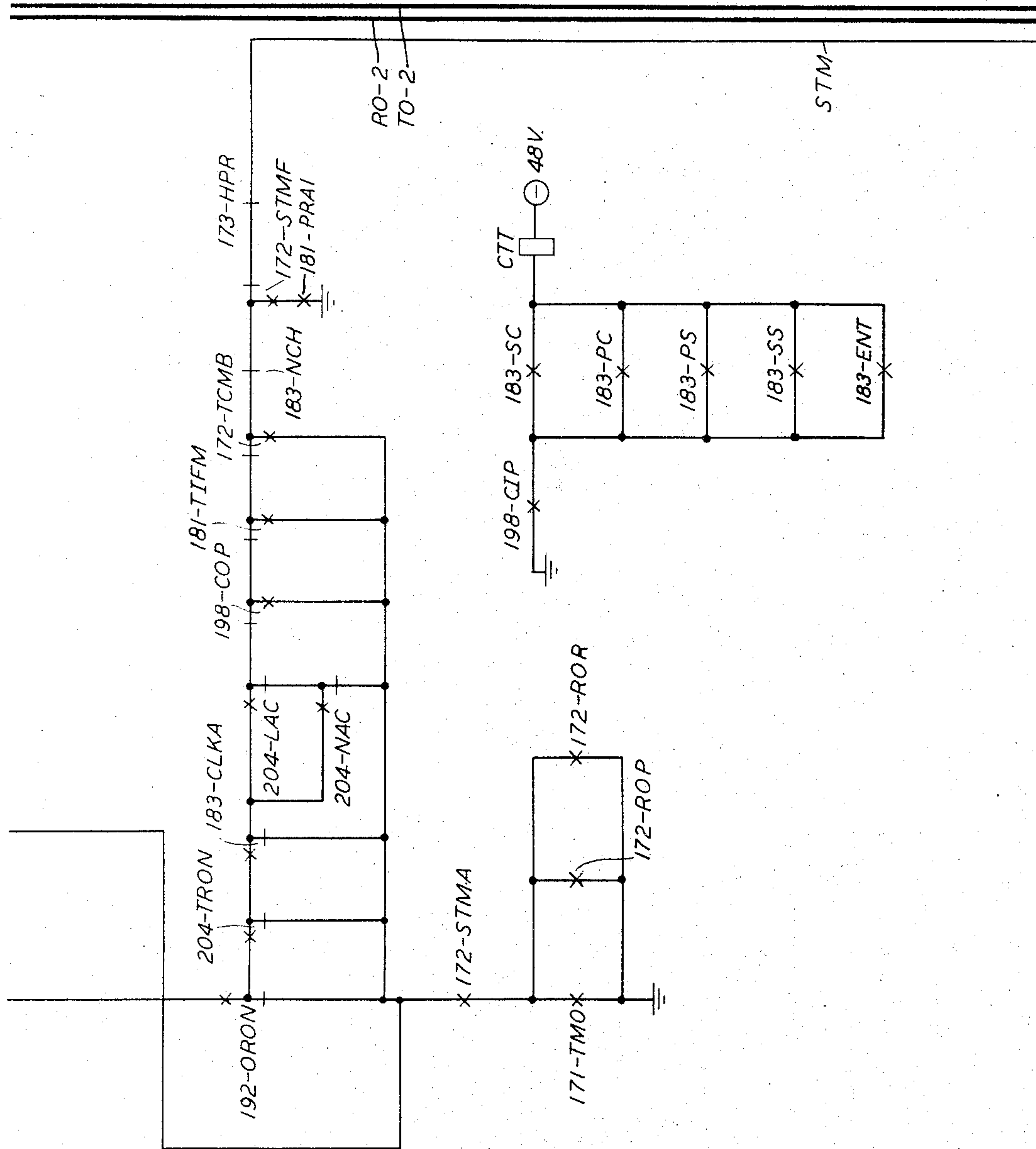
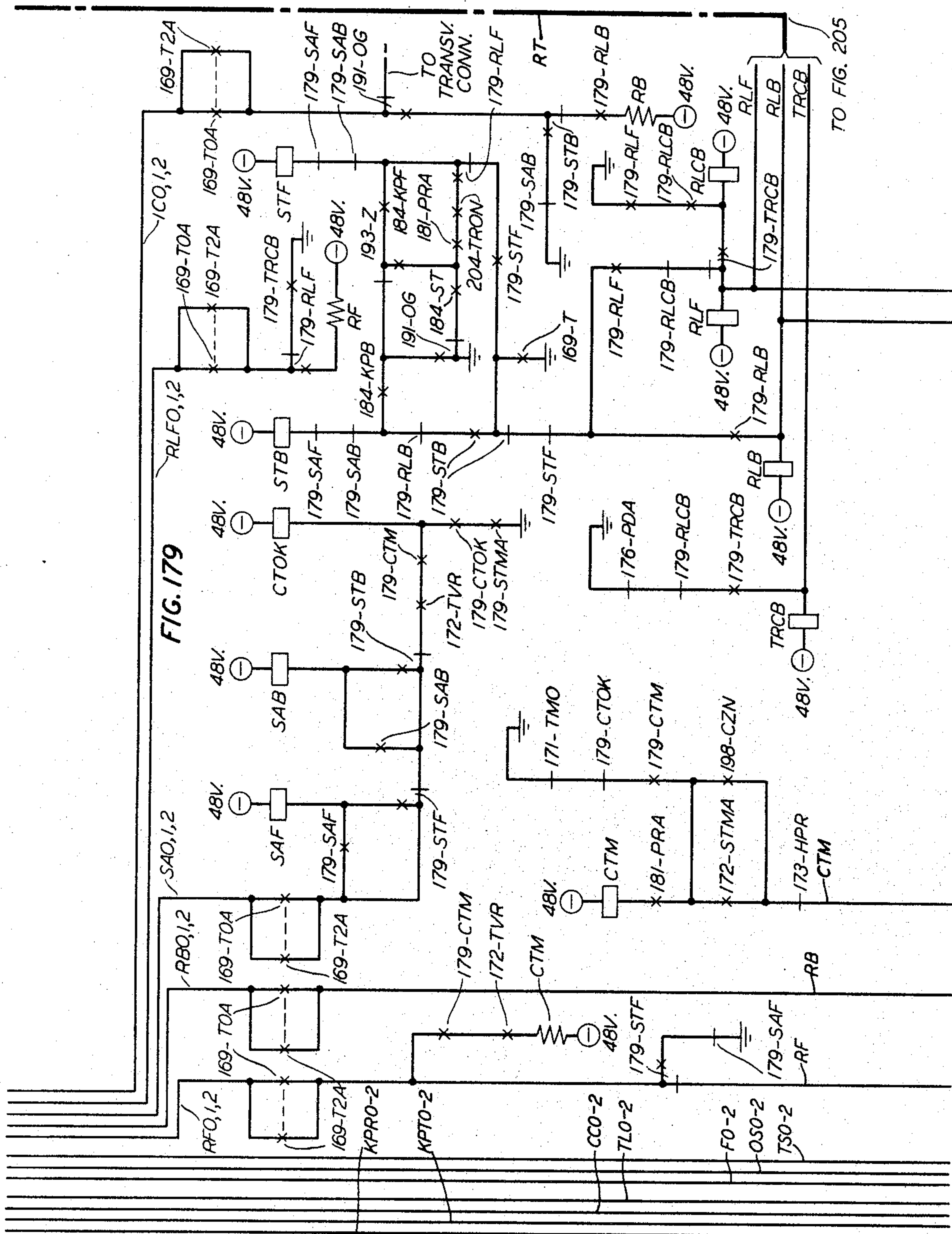


FIG. 178

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 248

570 Sheets-Sheet 248



Sept. 12, 1967

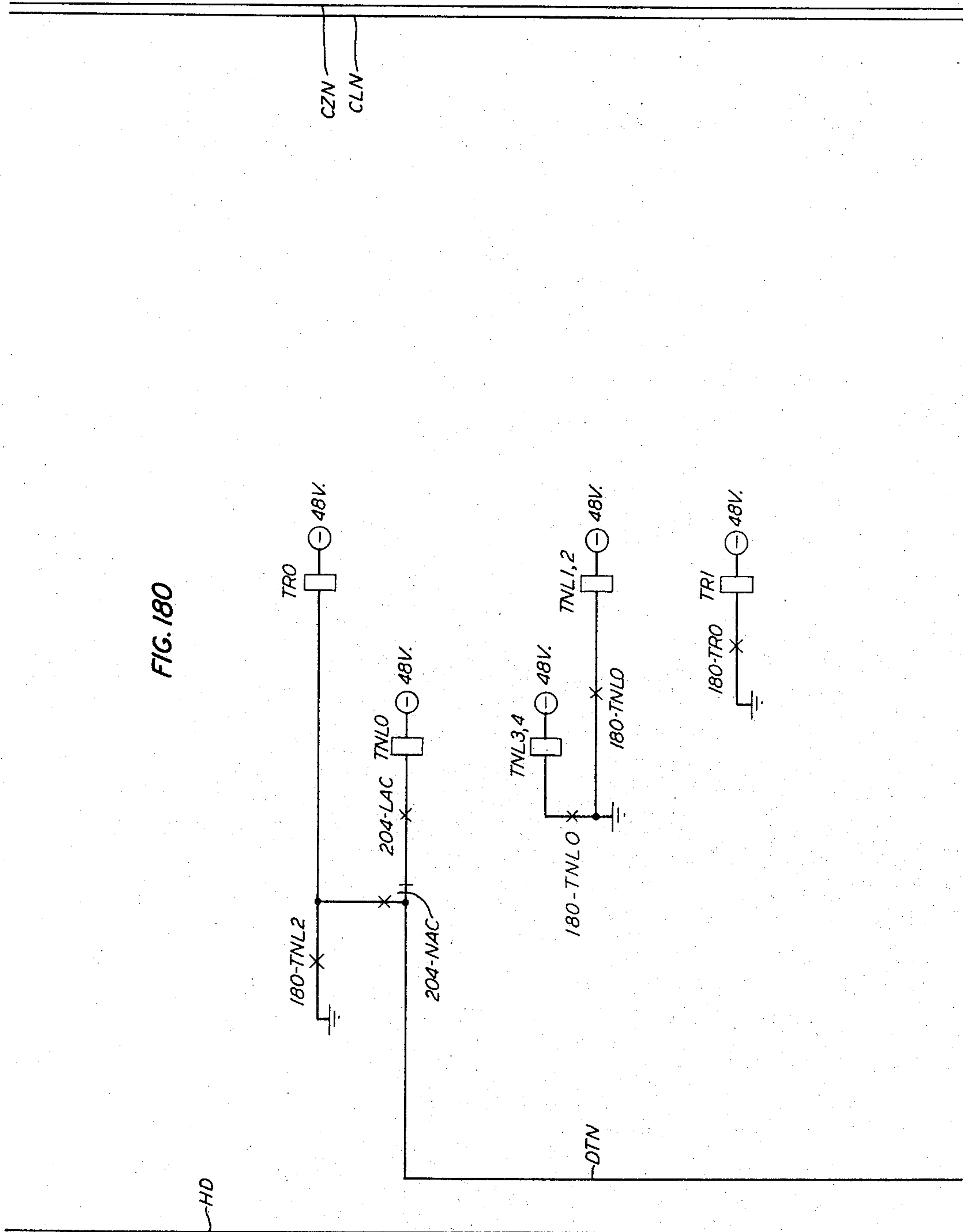
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 249

FIG. 180



Sept. 12, 1967

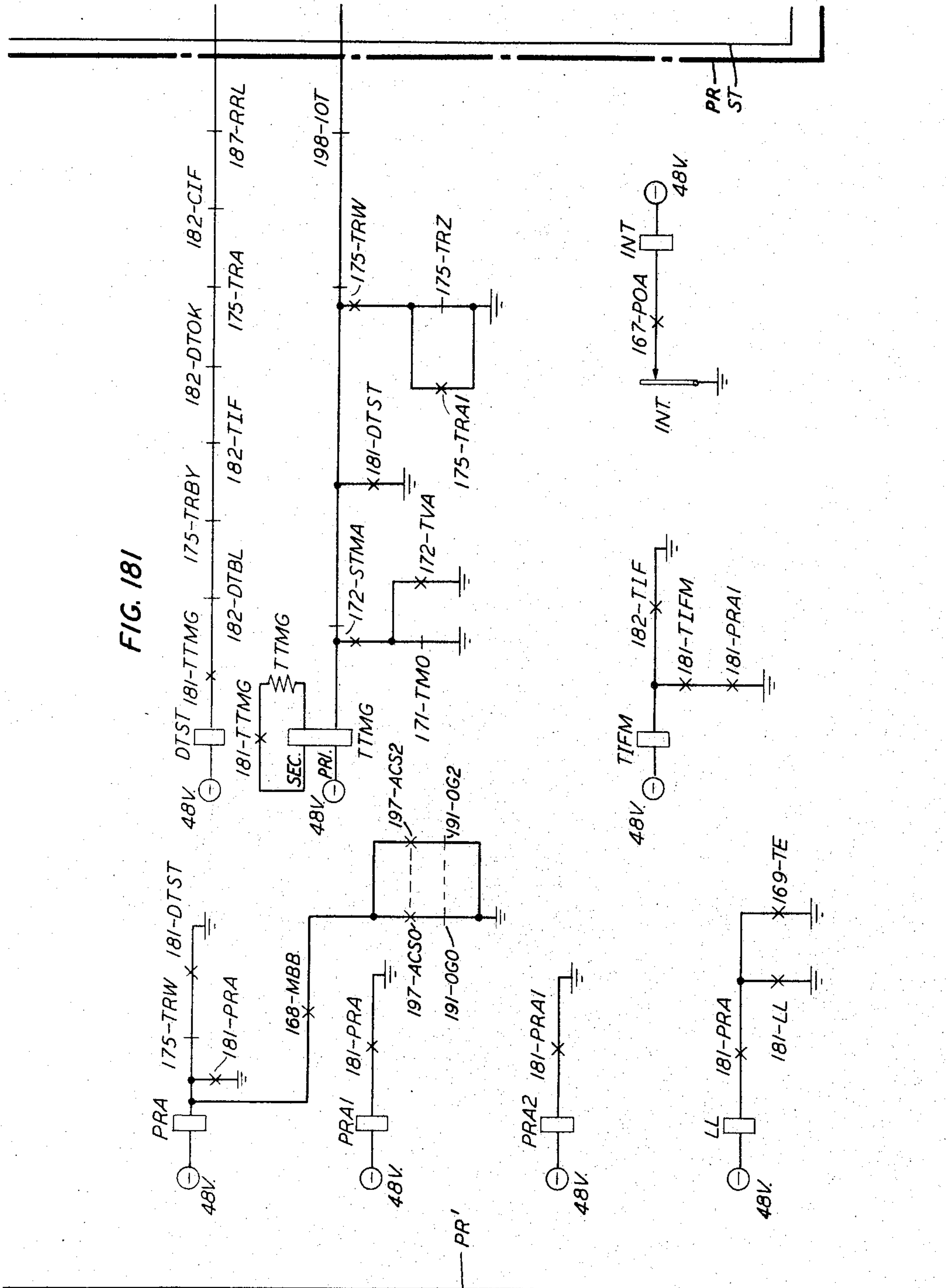
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 250

FIG. 181



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 251

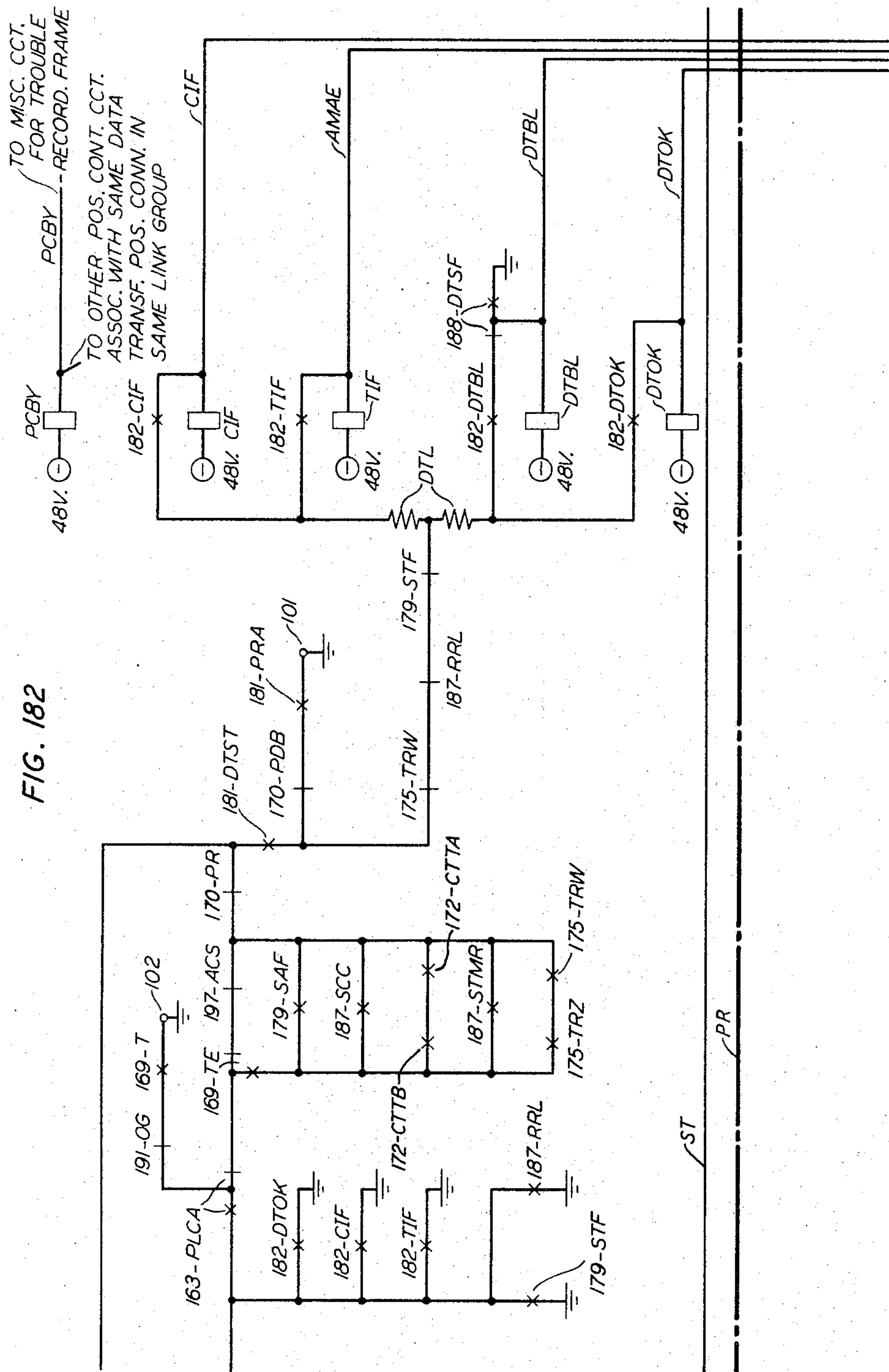


FIG. 182

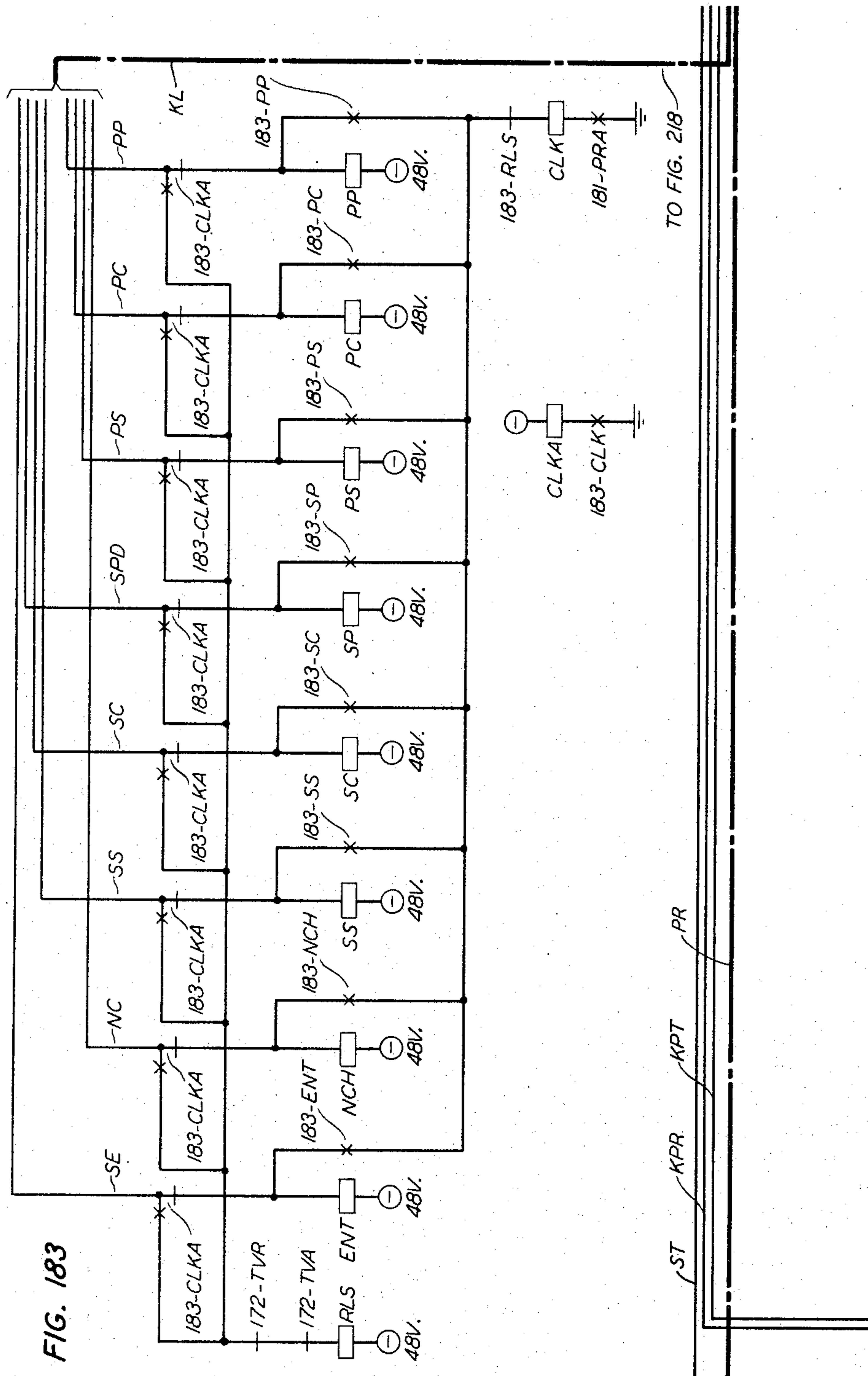
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

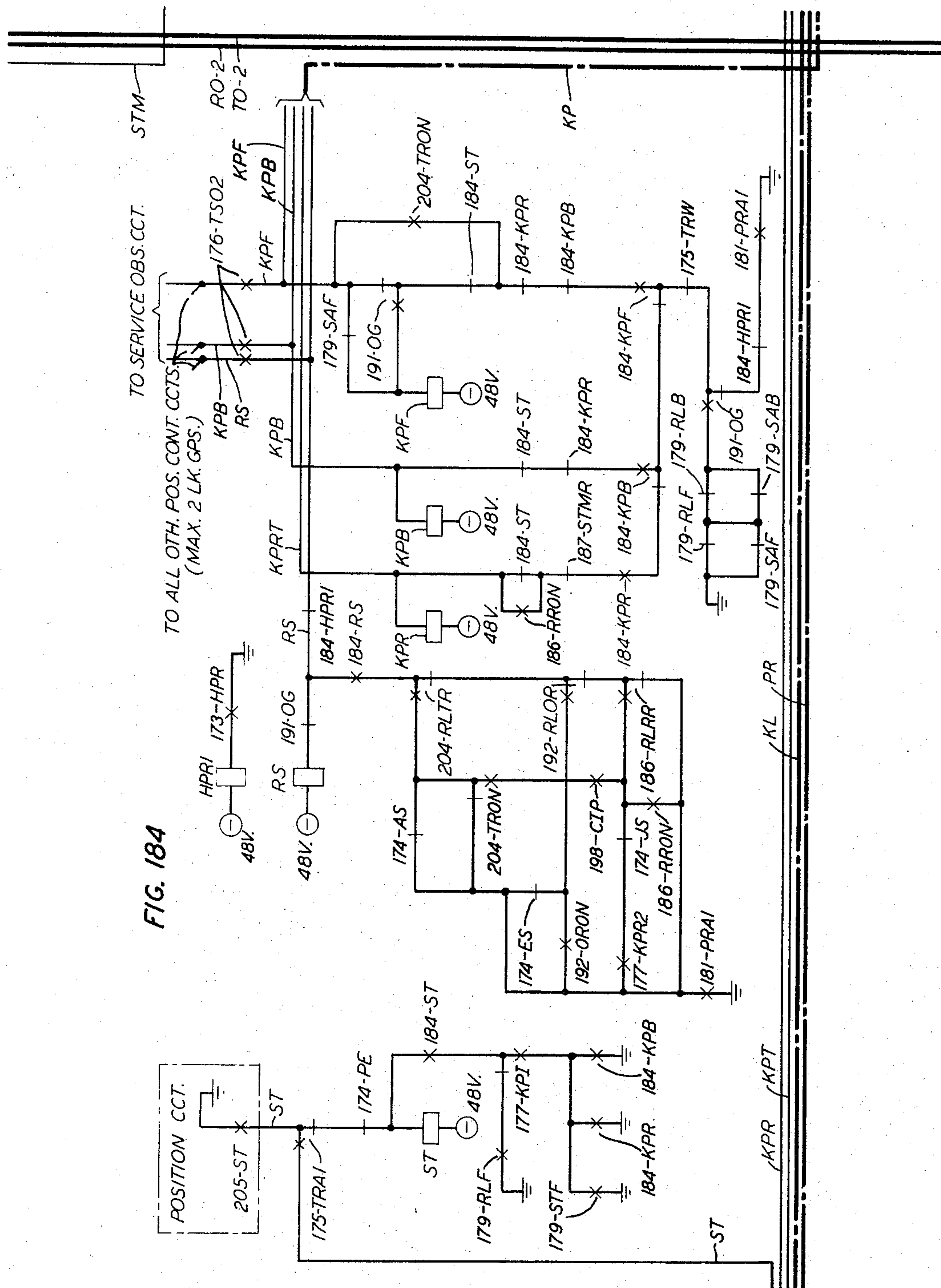
570 Sheets-Sheet 252



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 253



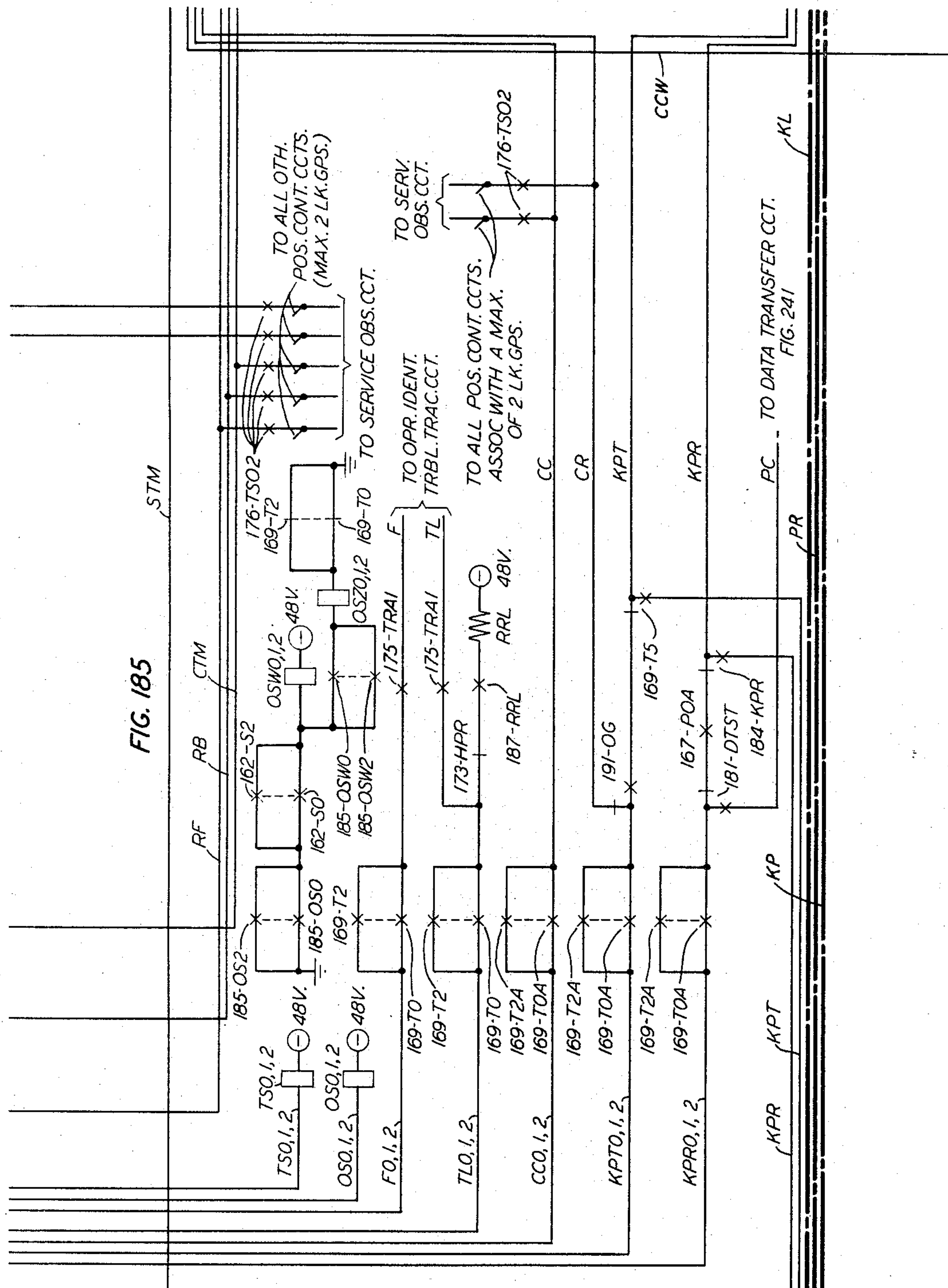
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 254



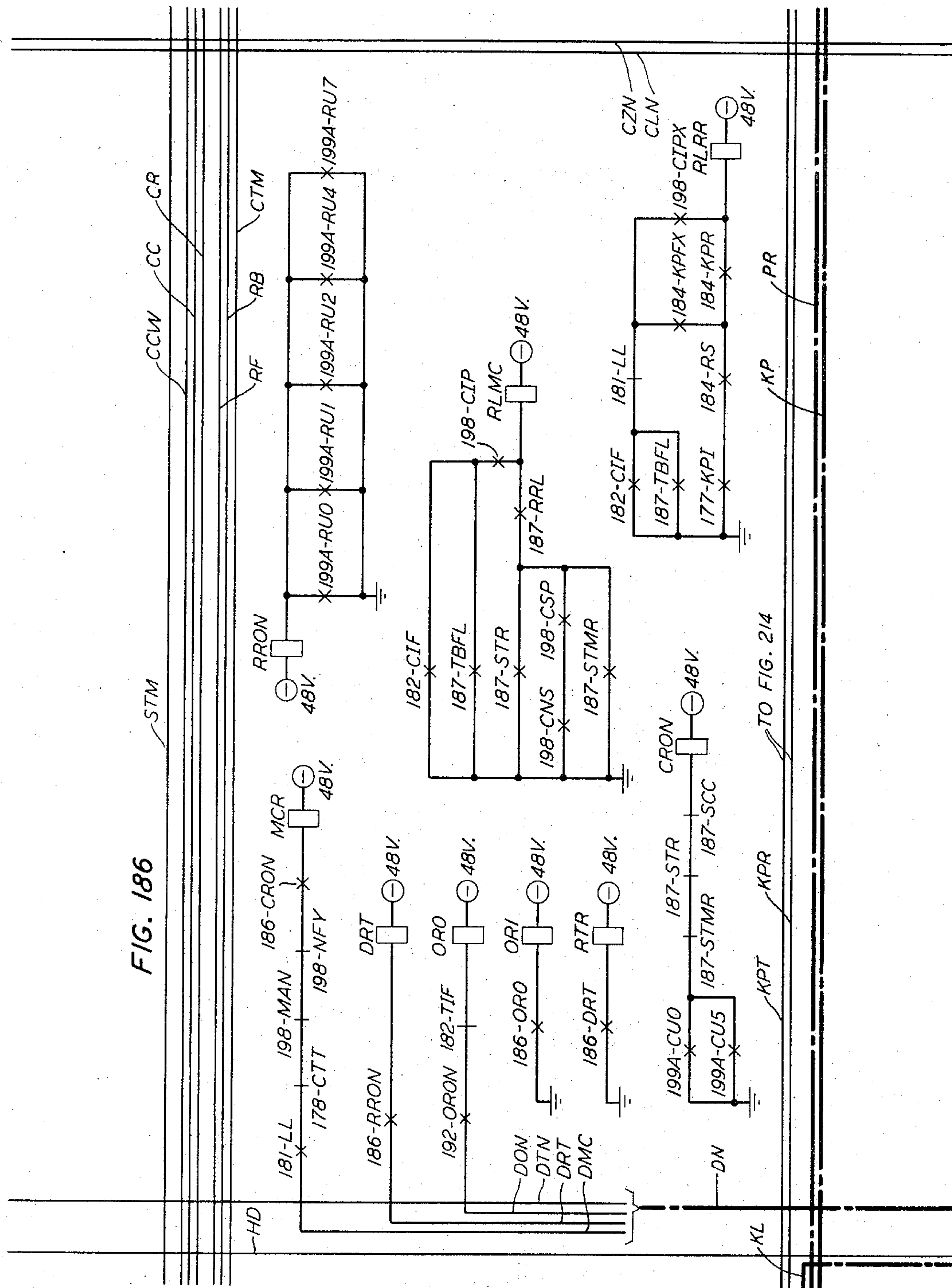
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 255



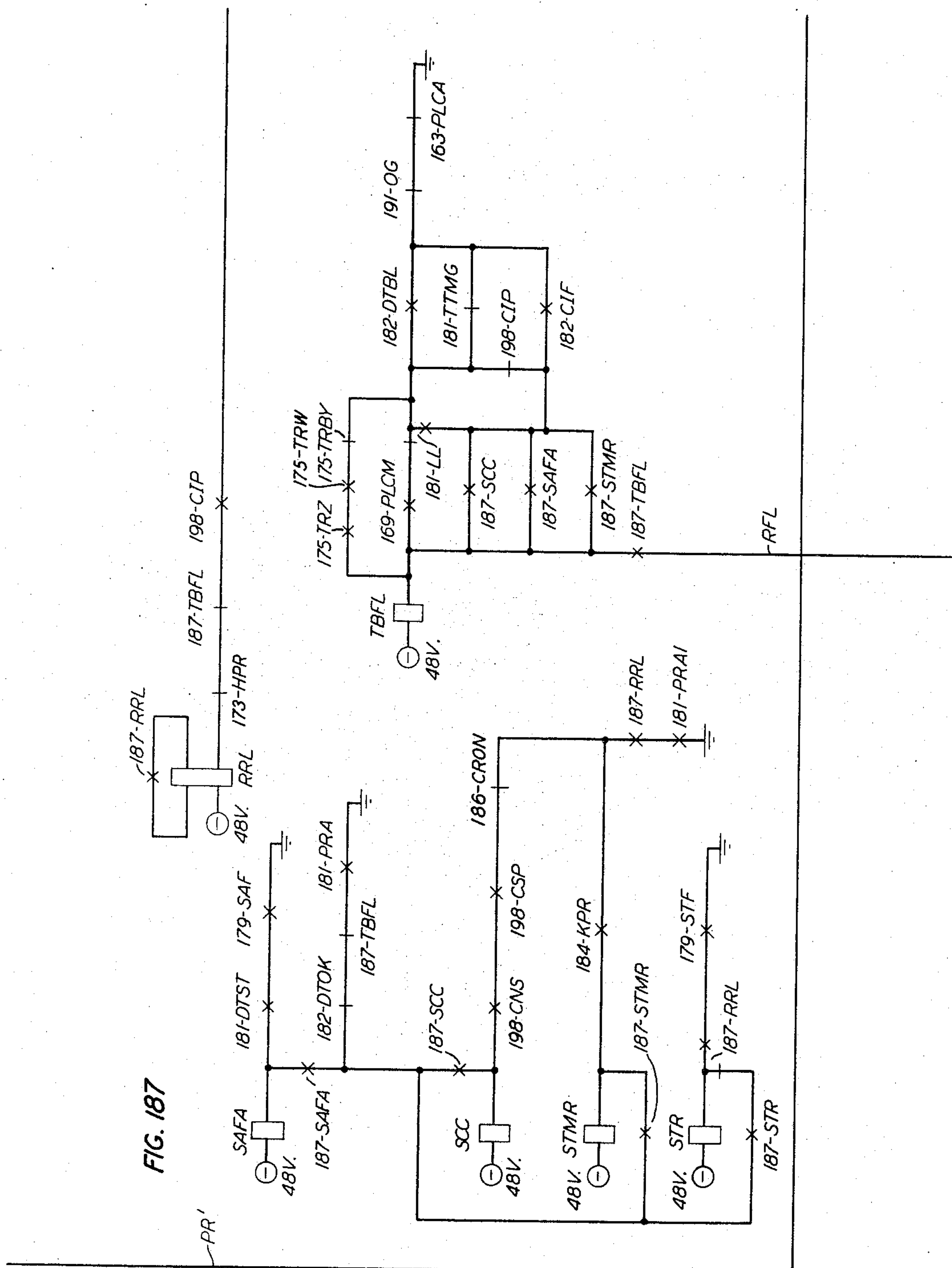
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

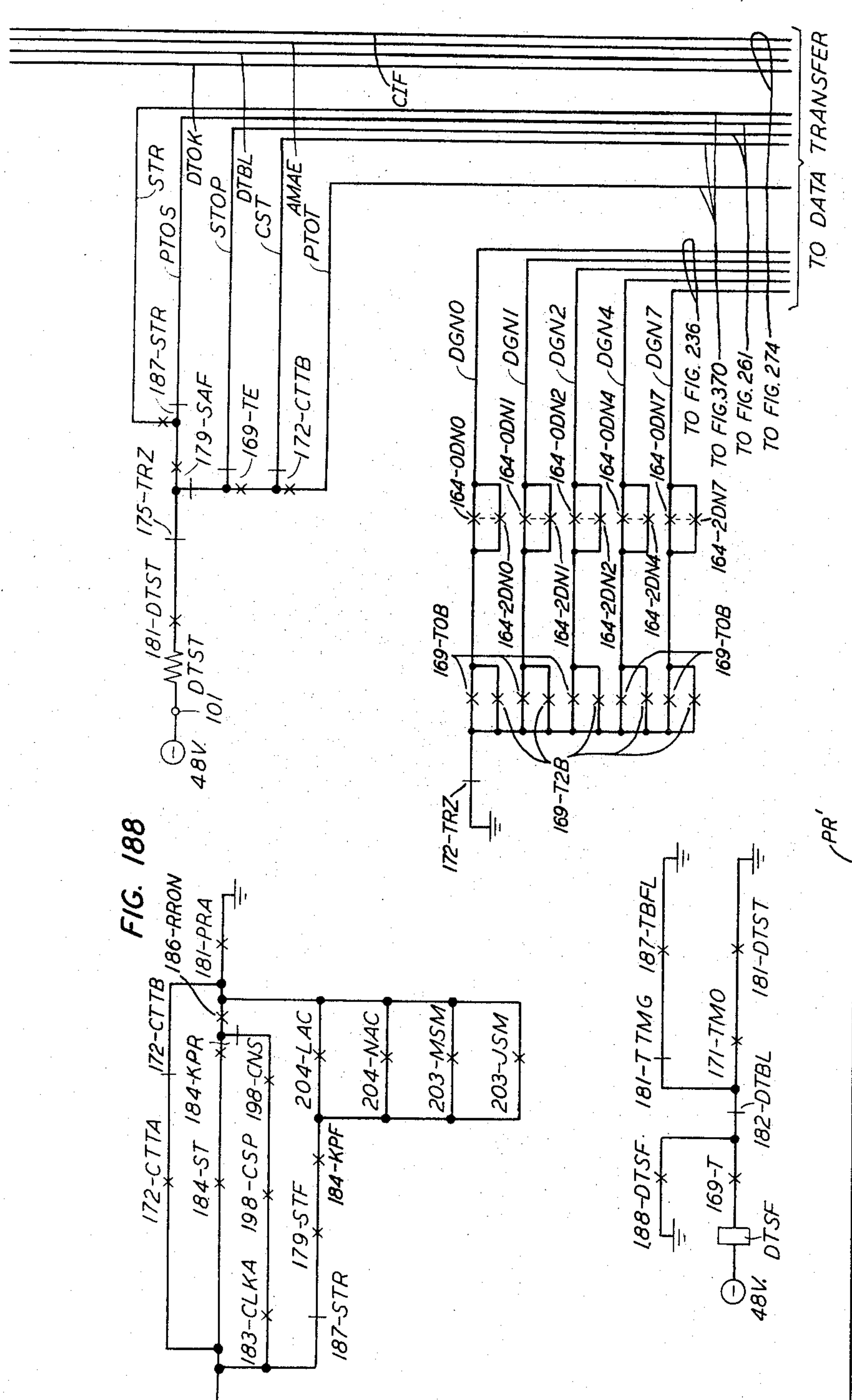
570 Sheets-Sheet 256



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 257

570 Sheets-Sheet 257



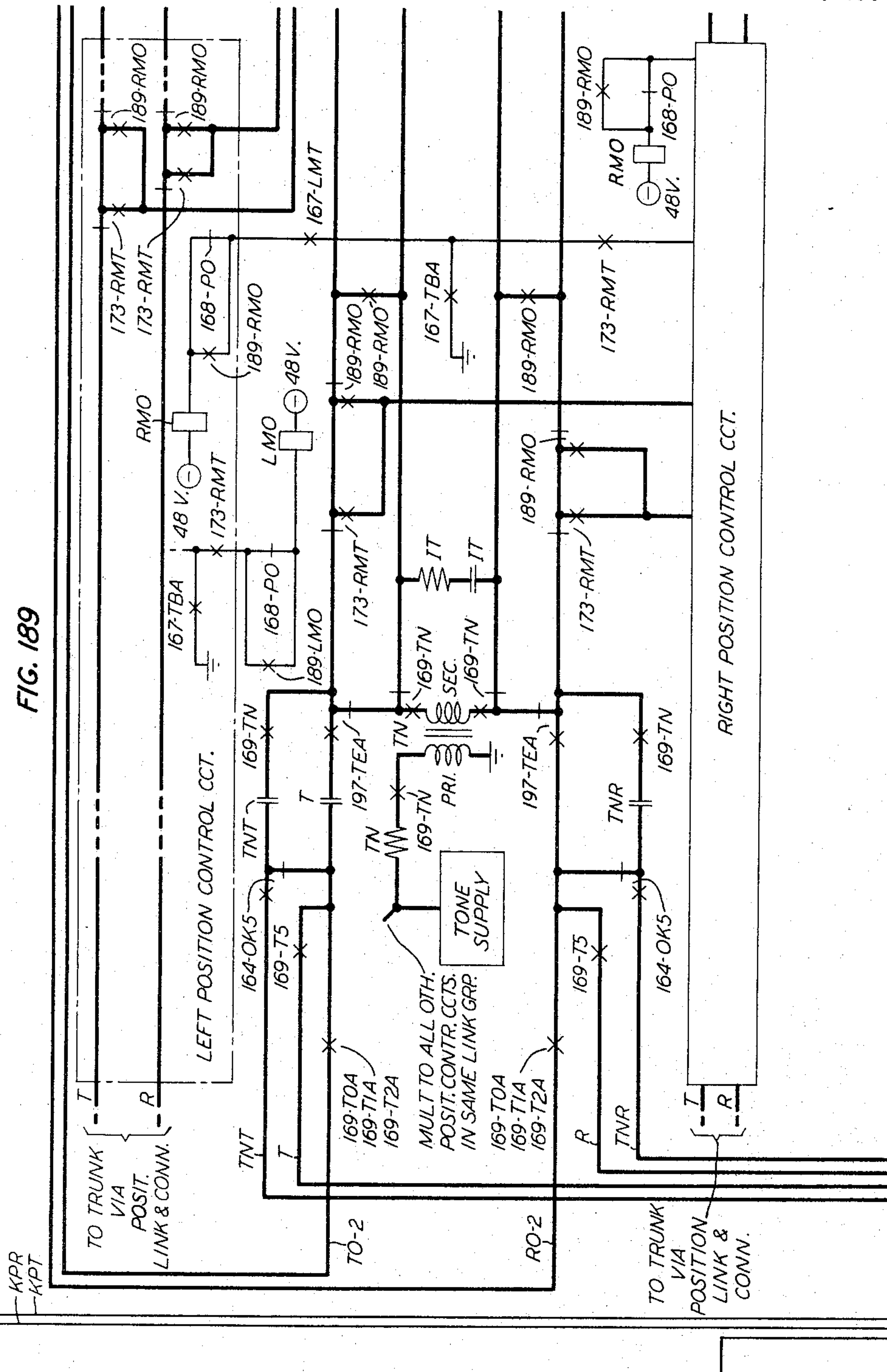
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 258



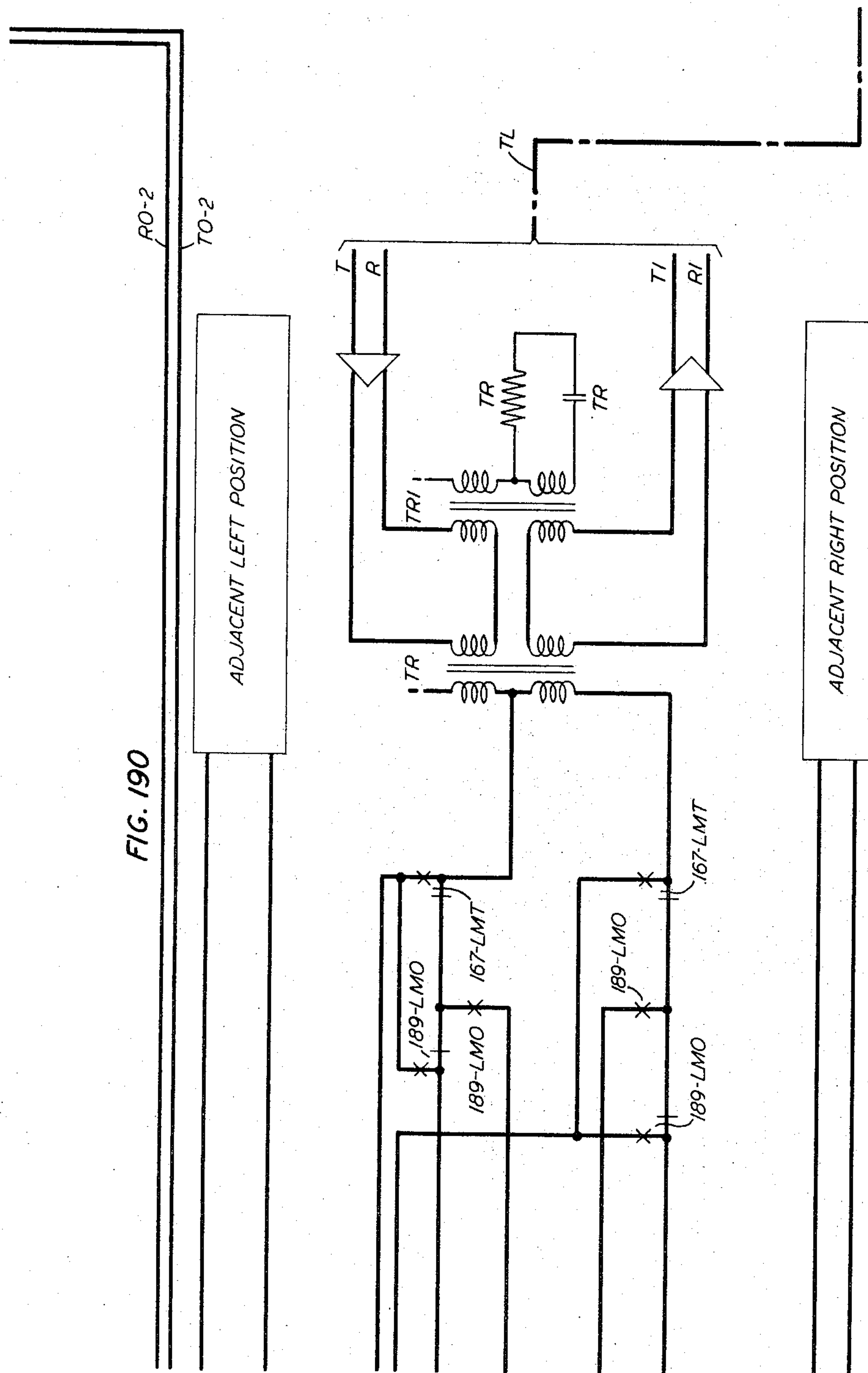
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

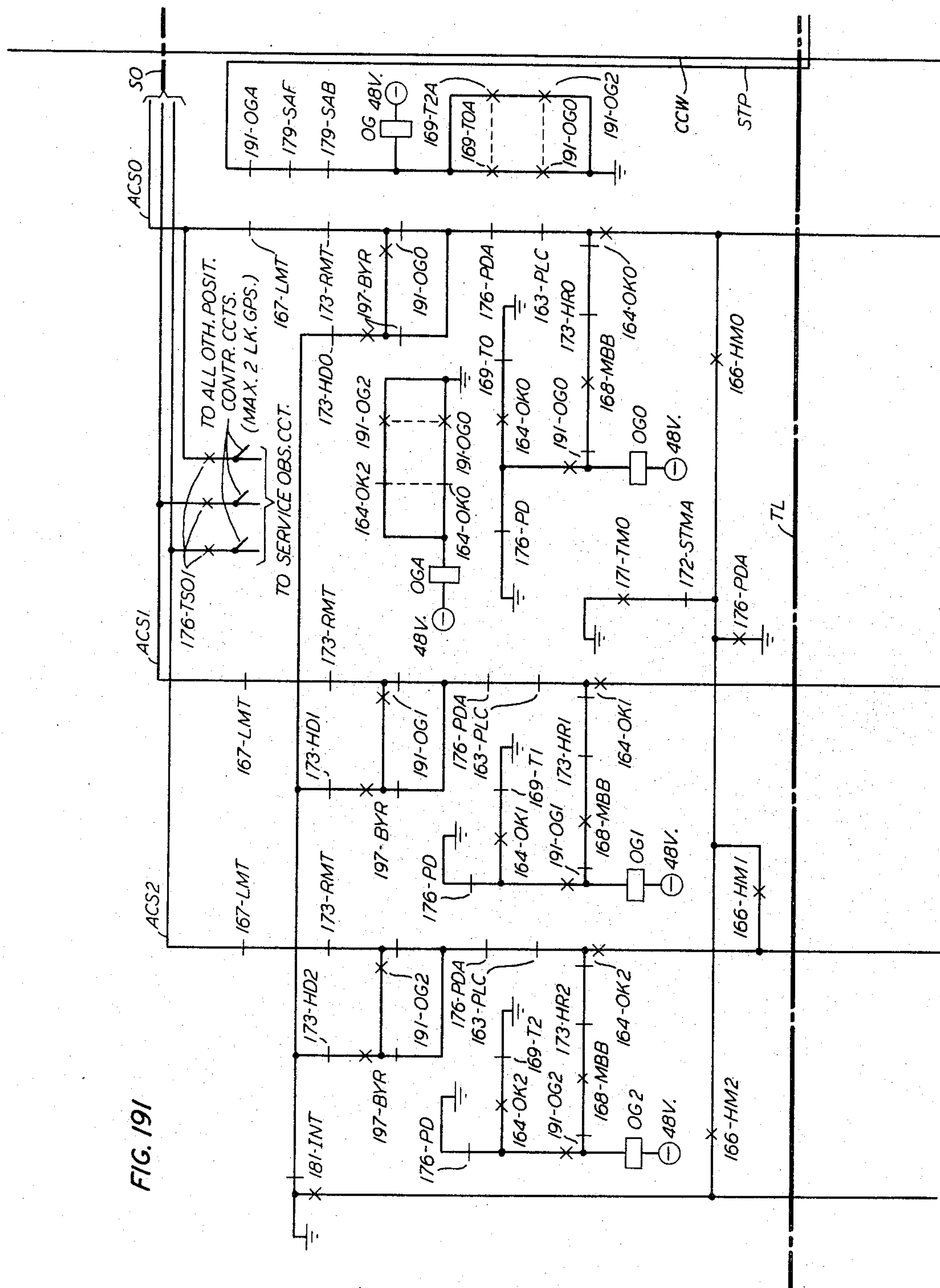
570 Sheets-Sheet 259



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 260



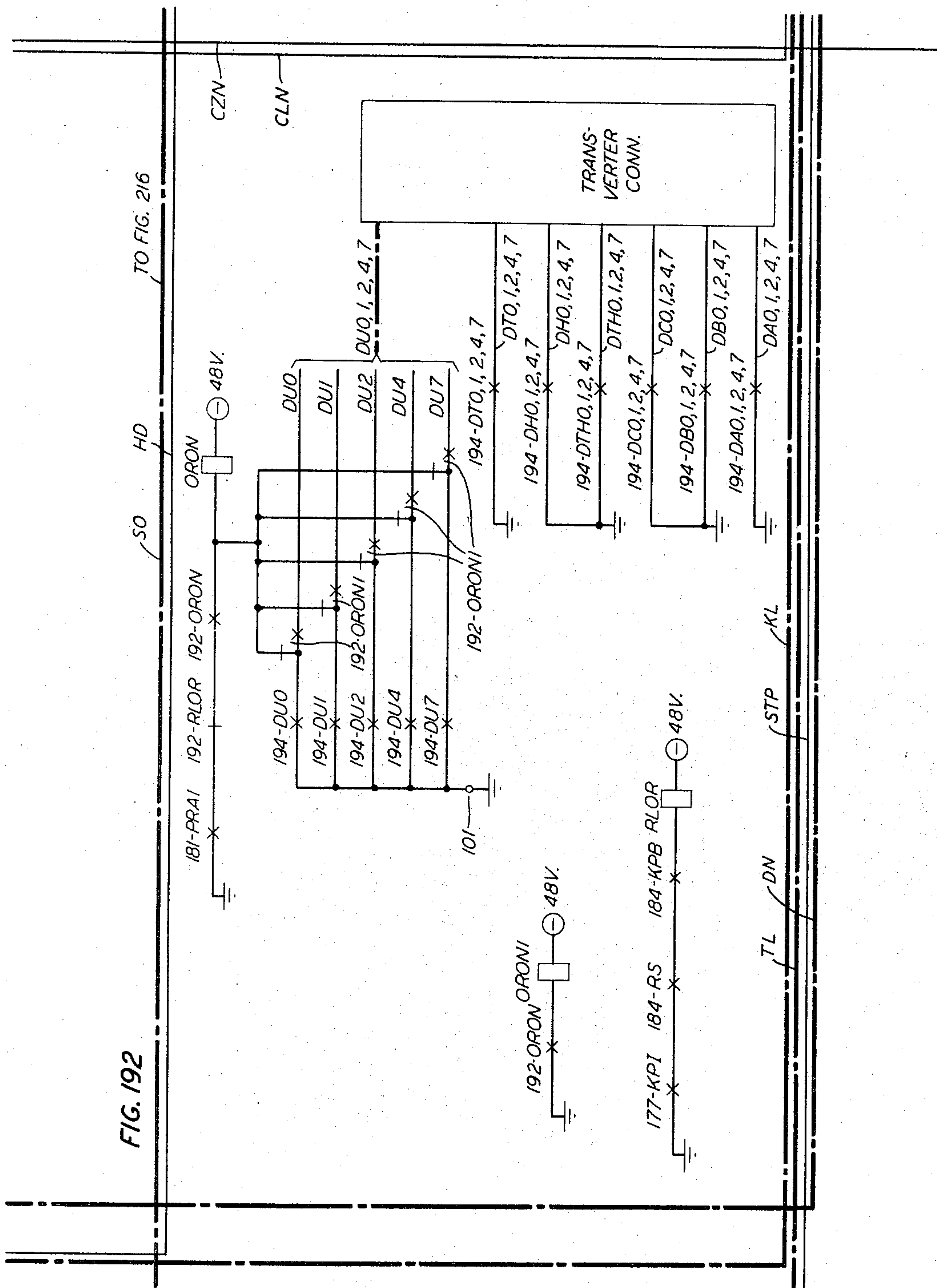
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

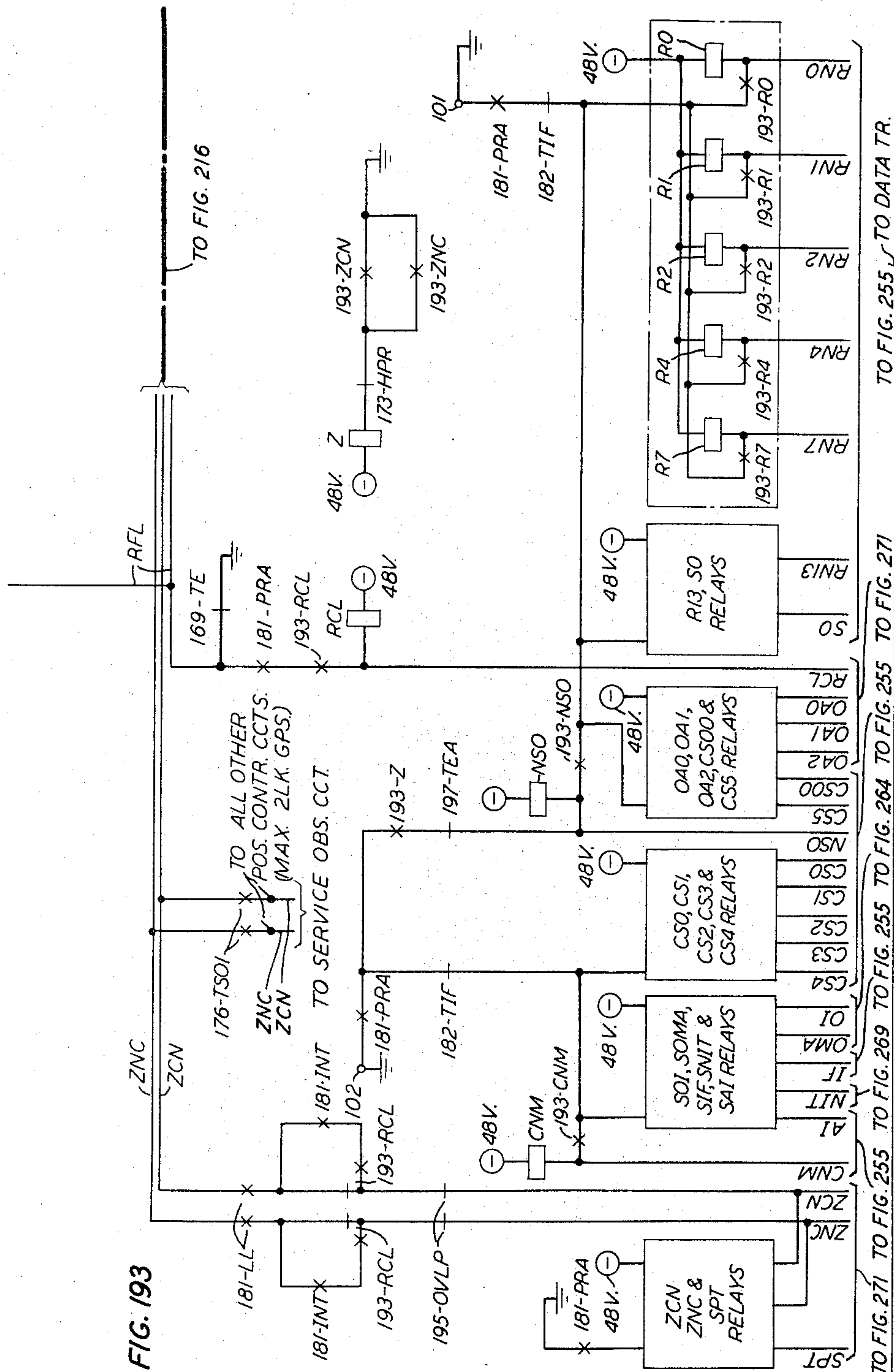
Filed Nov. 26, 1963

570 Sheets-Sheet 261



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 262



Sept. 12, 1967

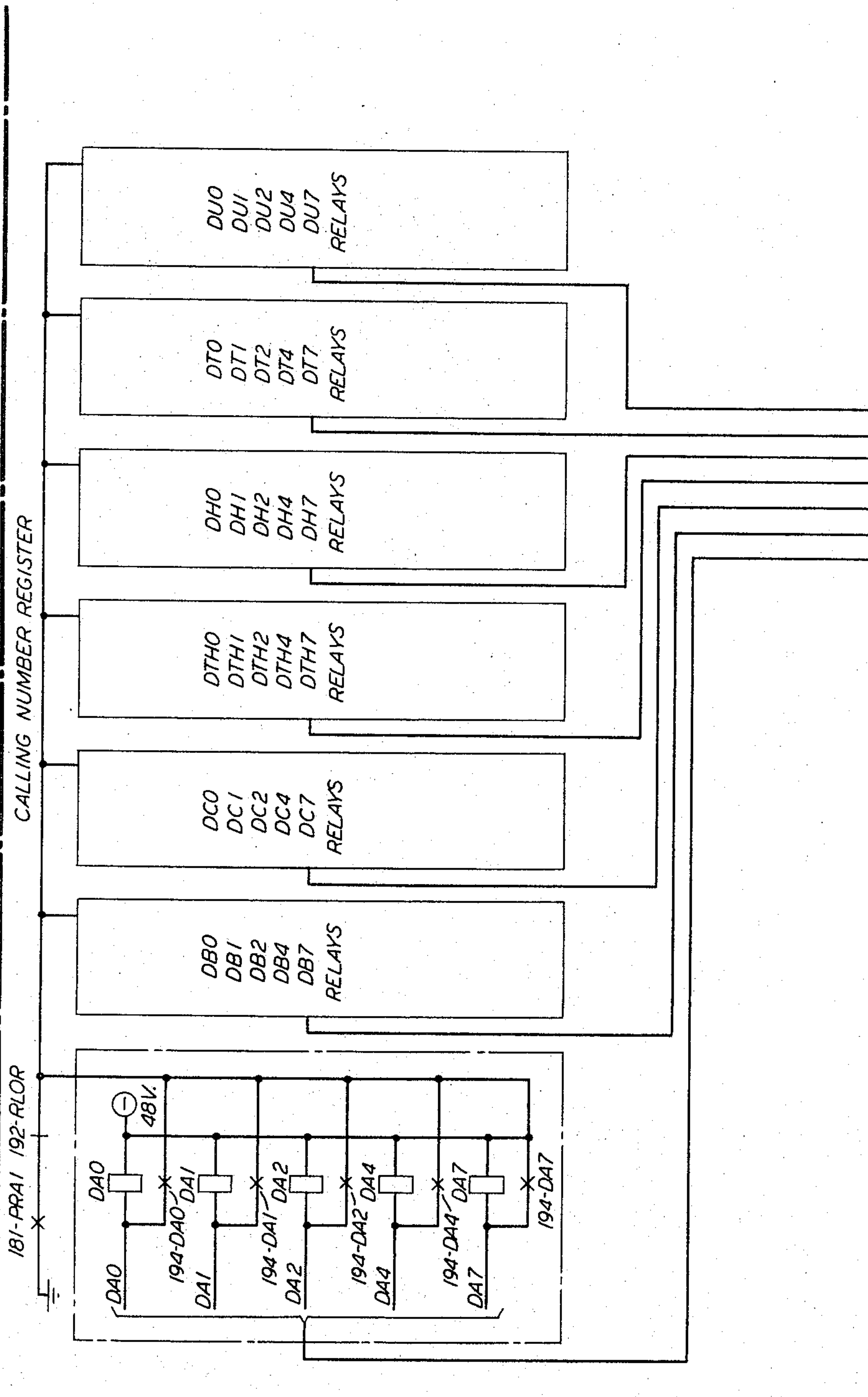
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 263

FIG. 194



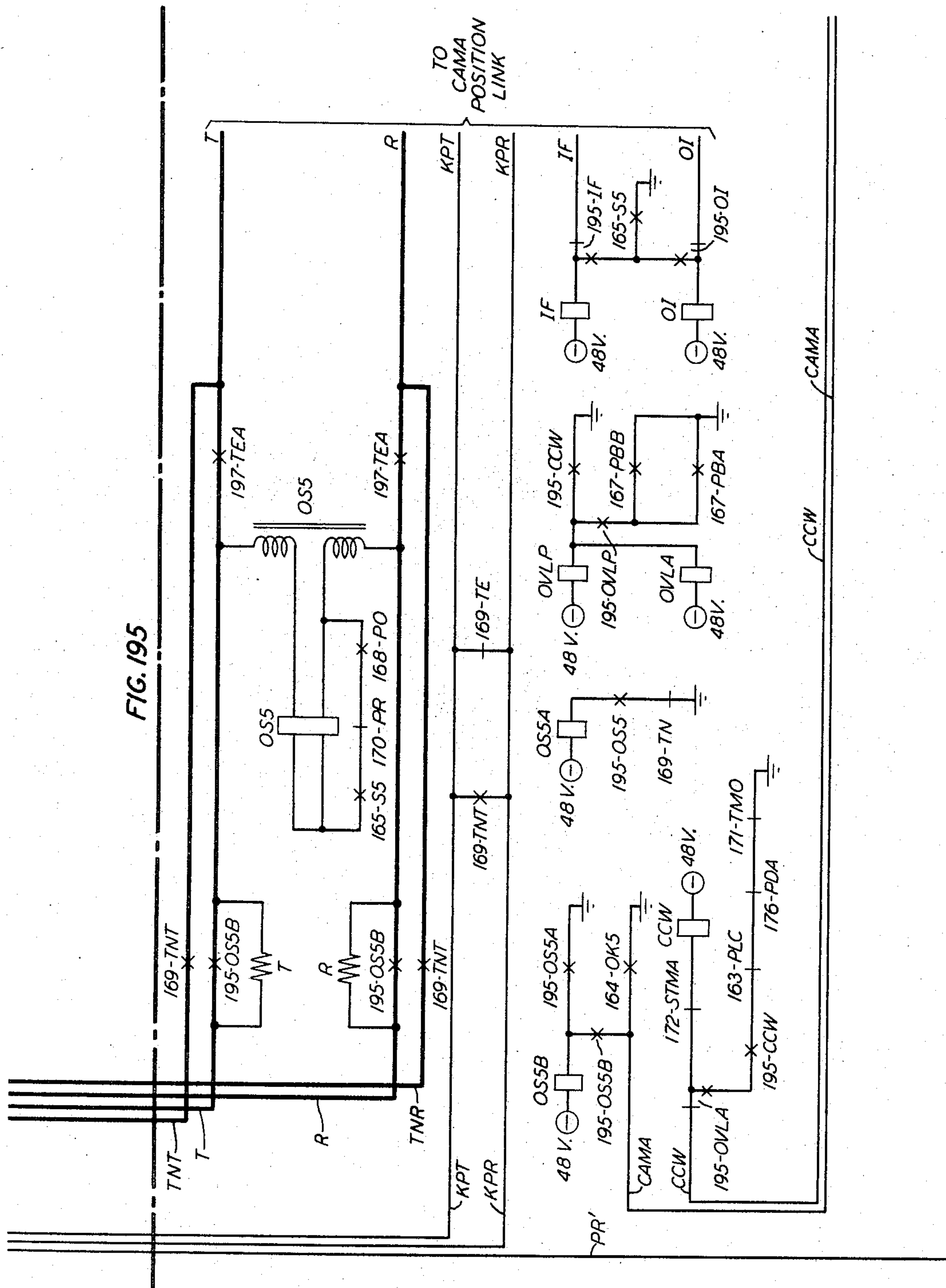
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 264



Sept. 12, 1967

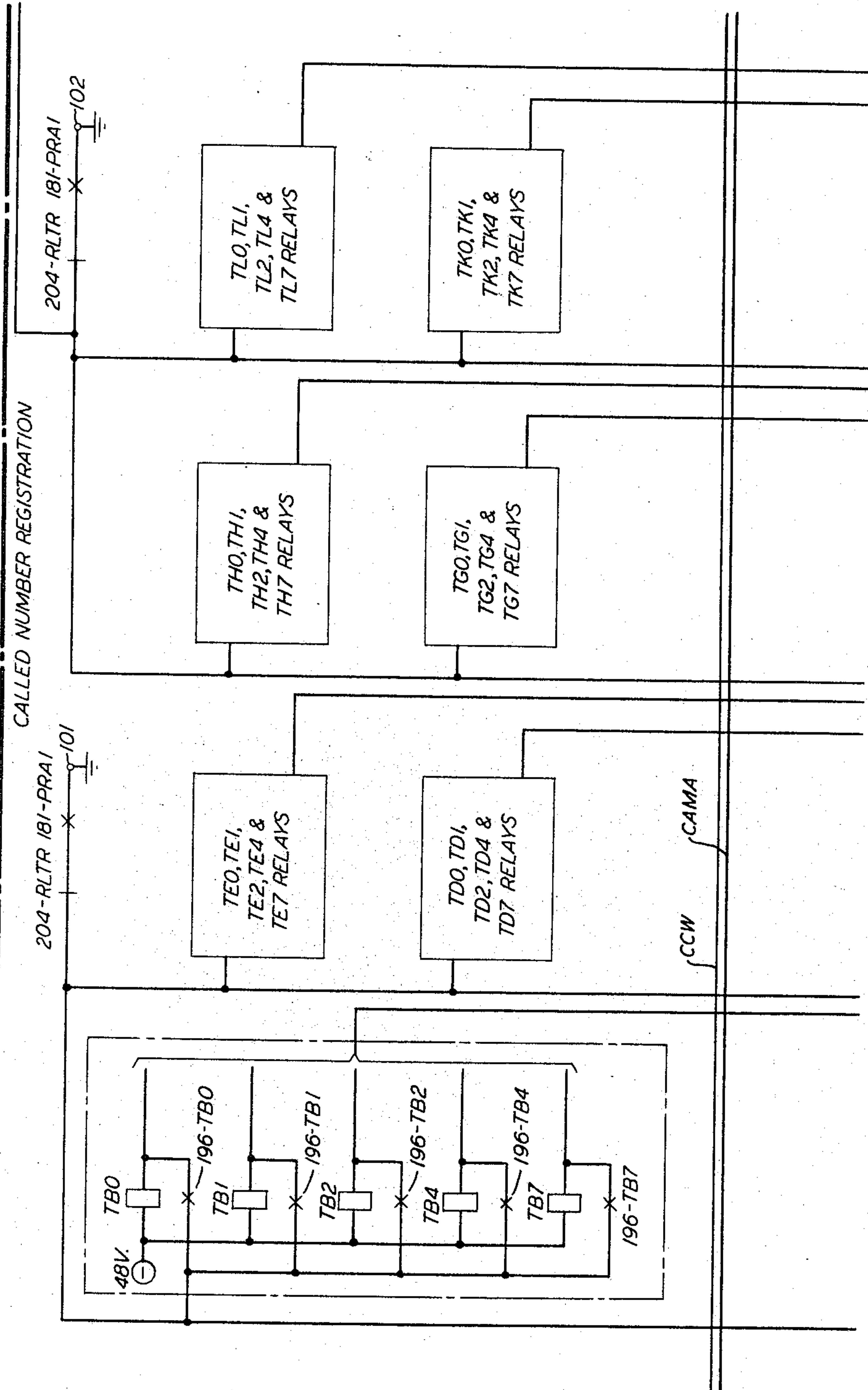
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 265

FIG. 196



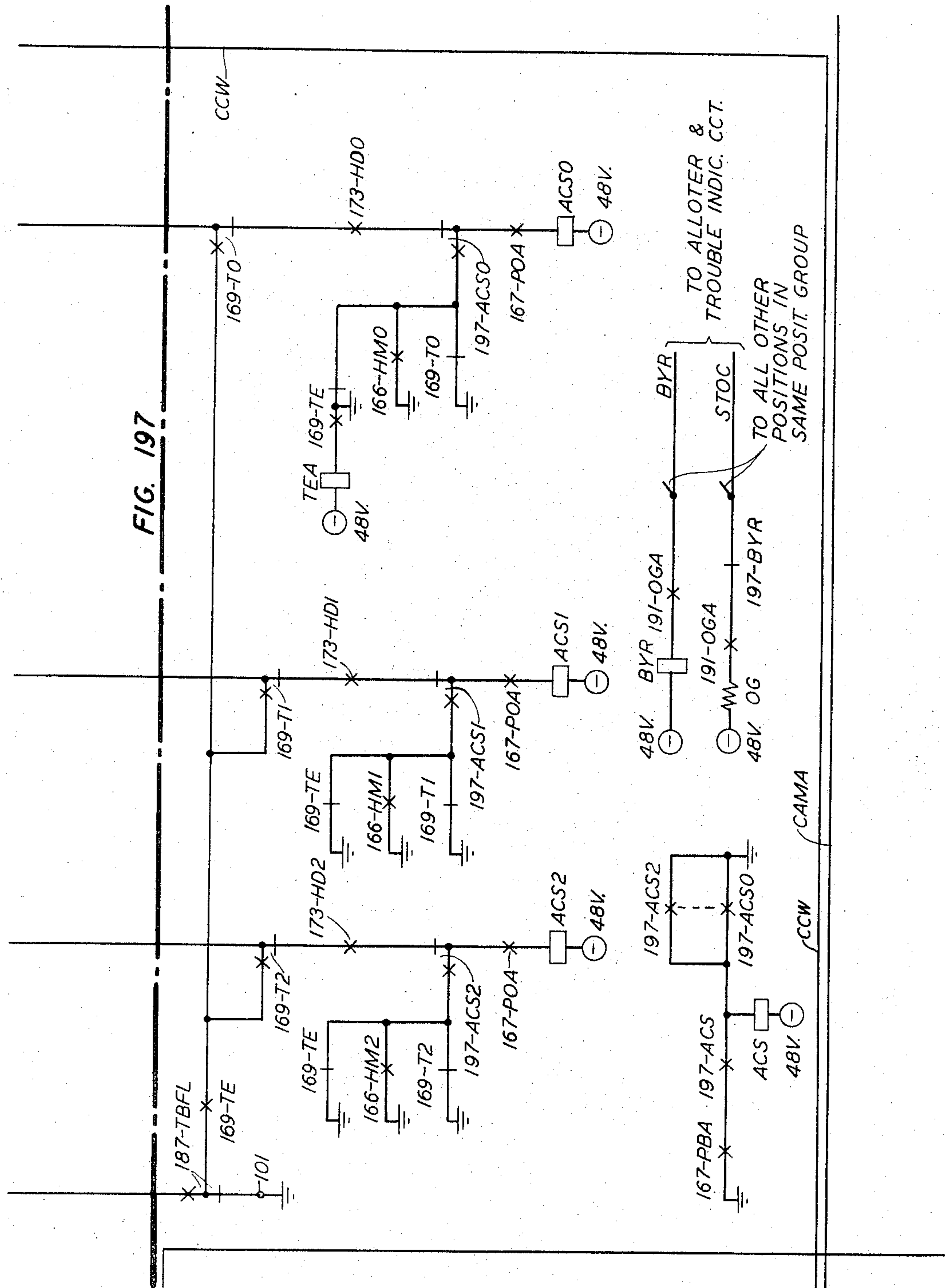
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

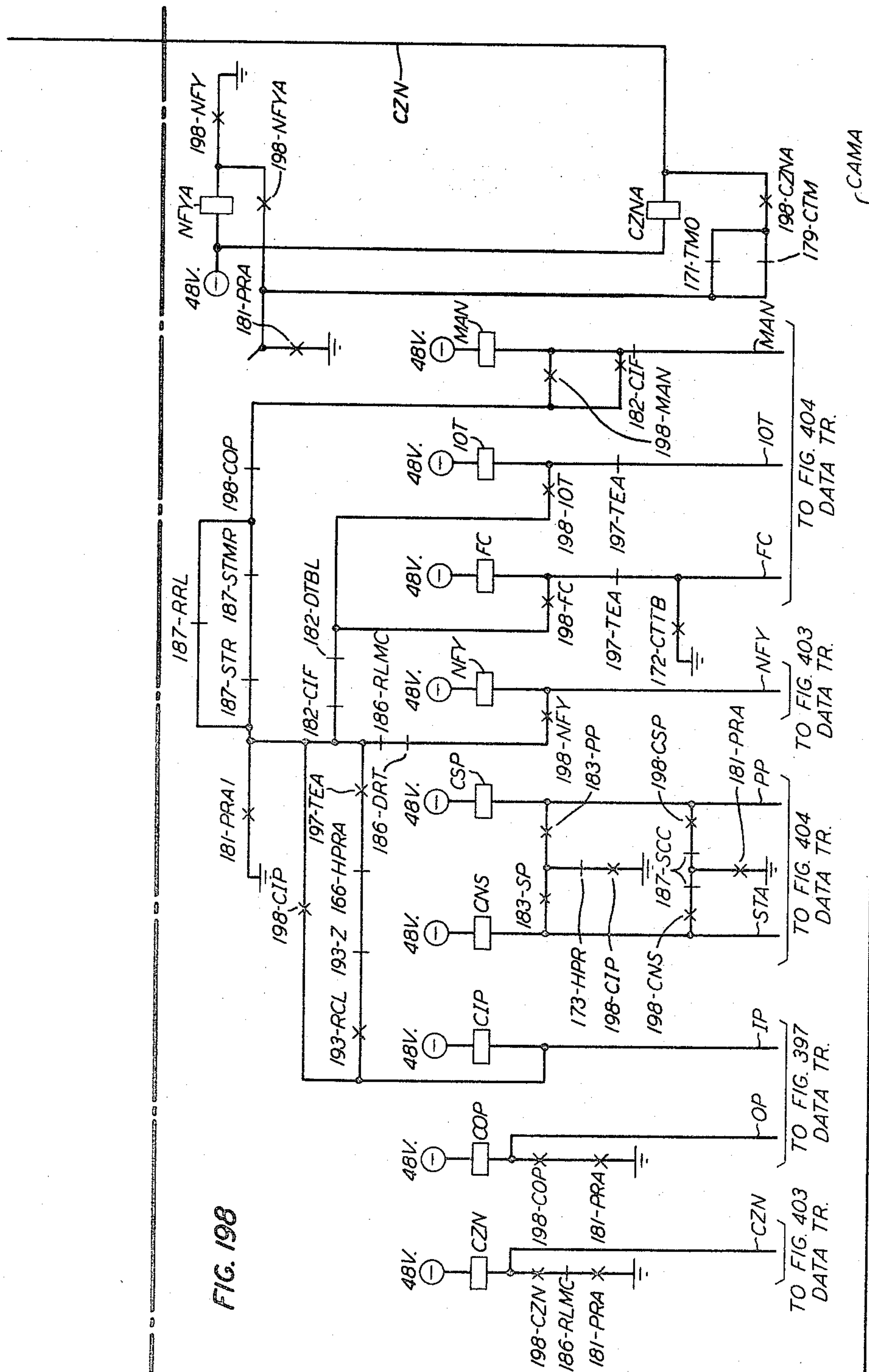
570 Sheets-Sheet 266



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 267

Filed Nov. 26, 1963



Sept. 12, 1967

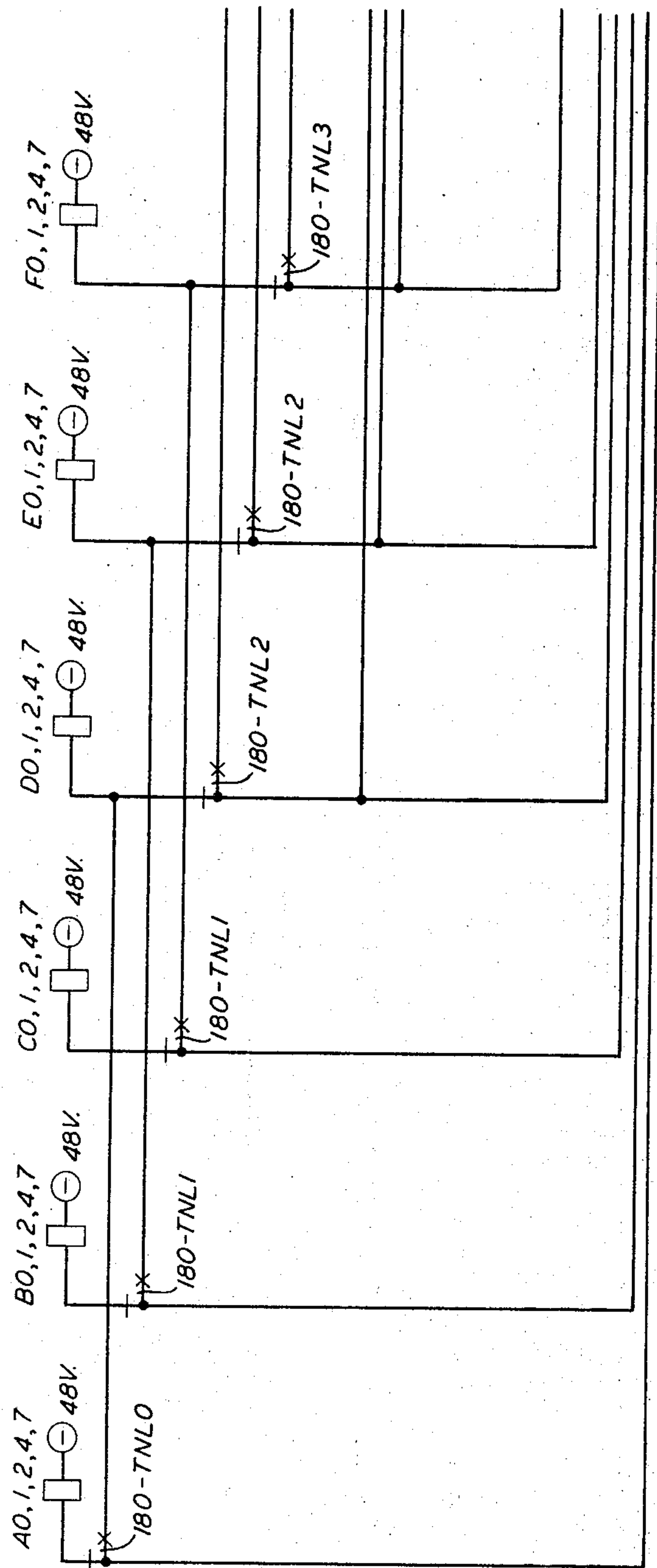
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 268

FIG. 199



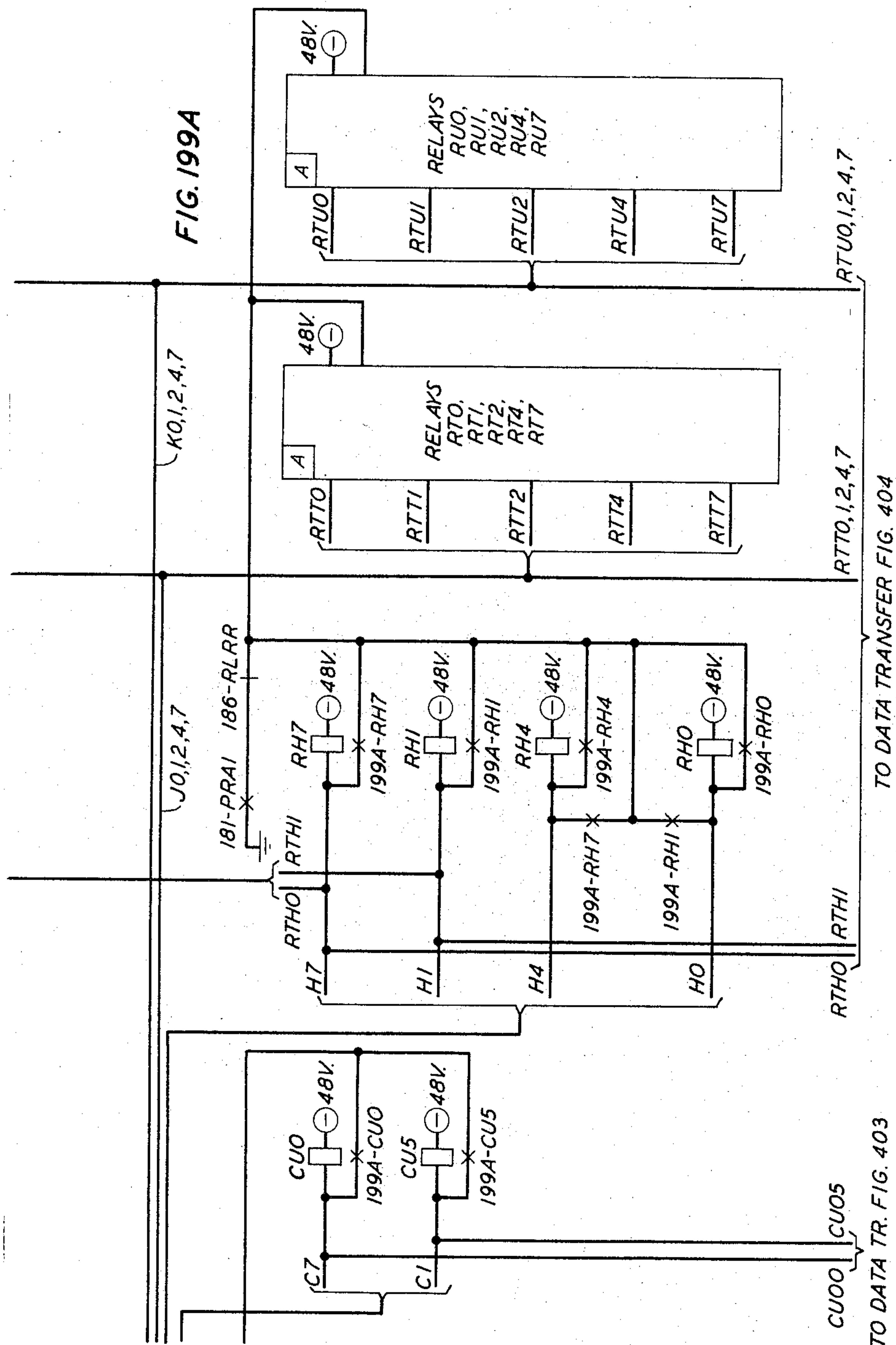
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 269



Sept. 12, 1967

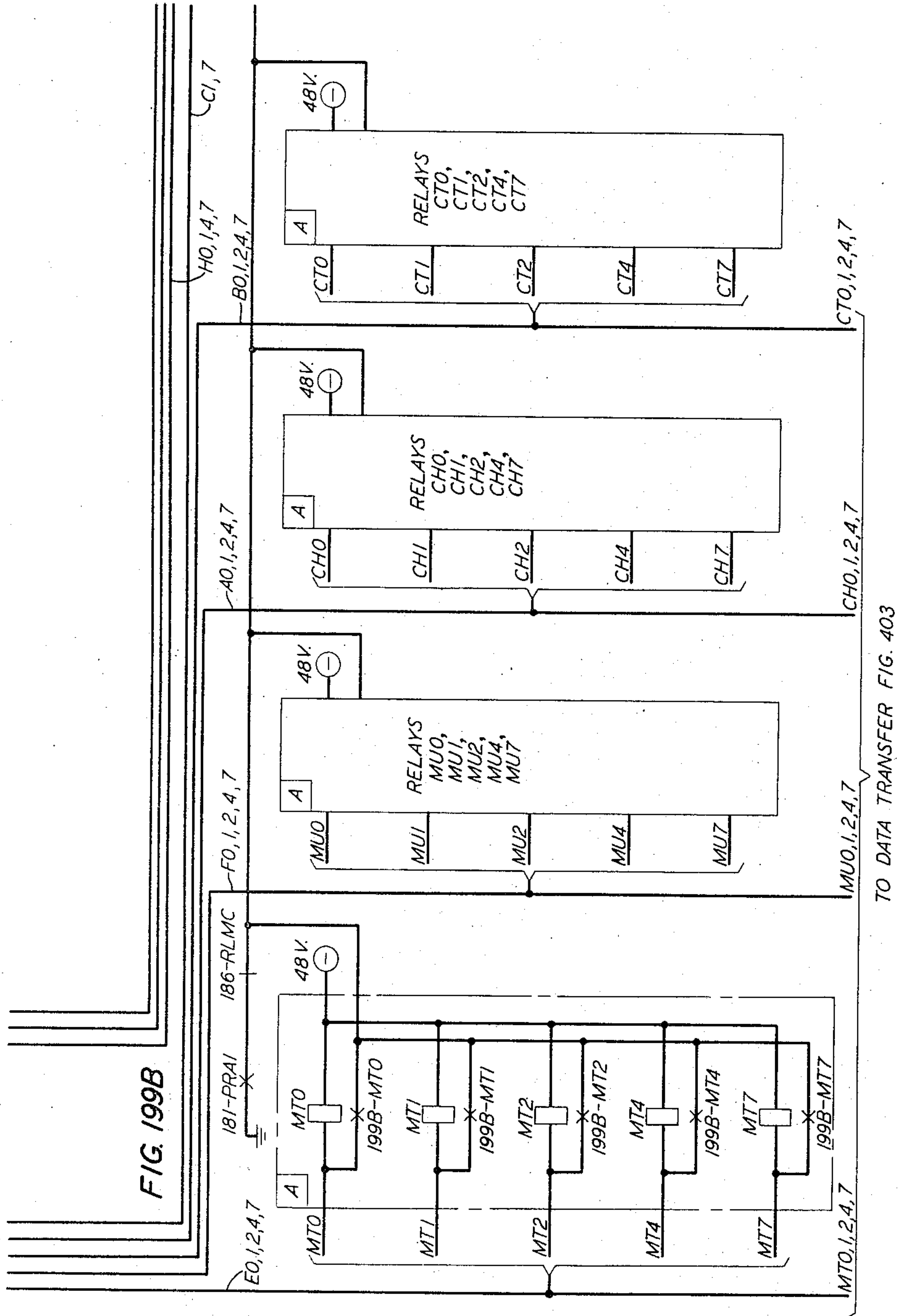
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 270



Sept. 12, 1967

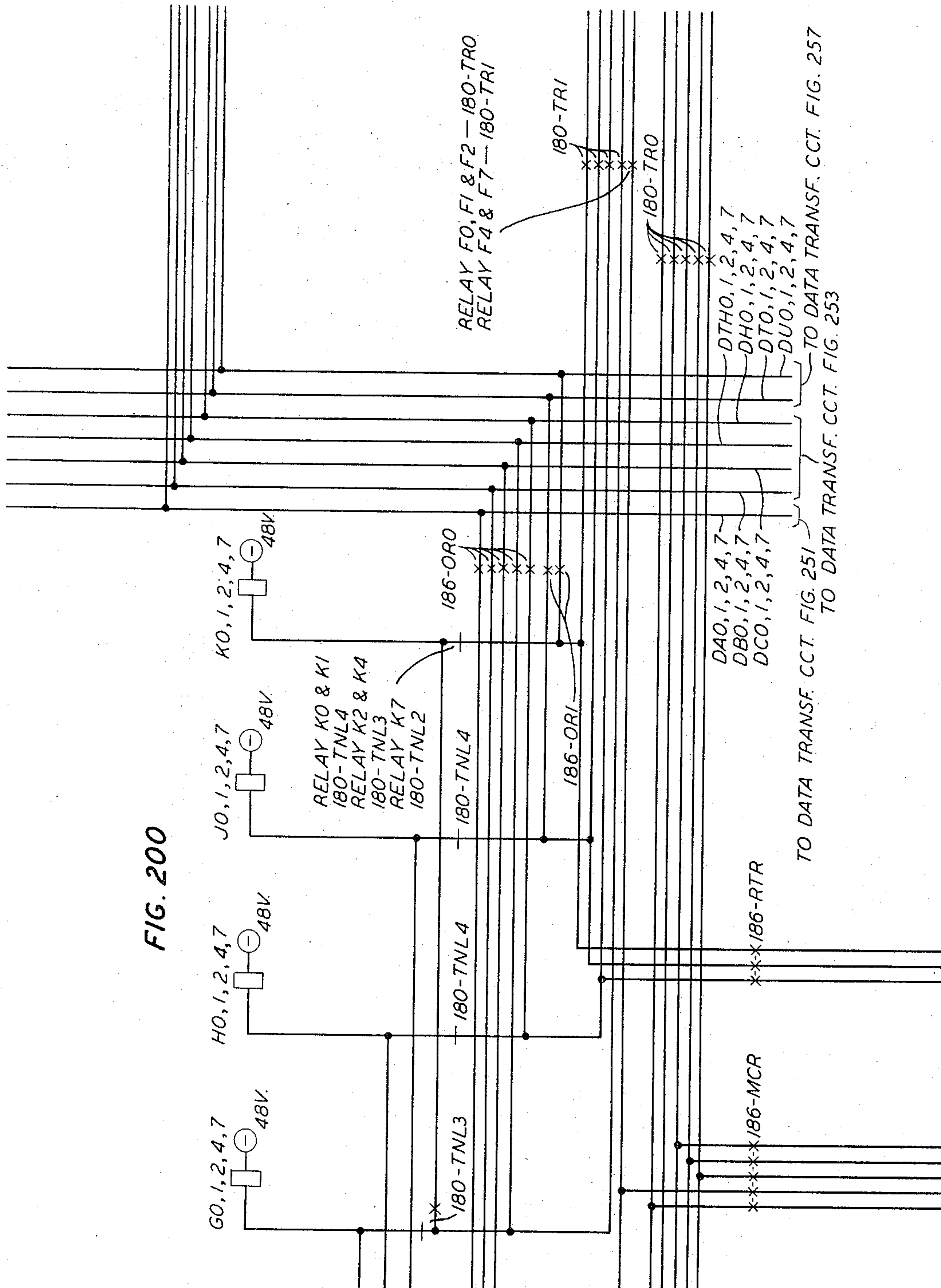
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 271

FIG. 200



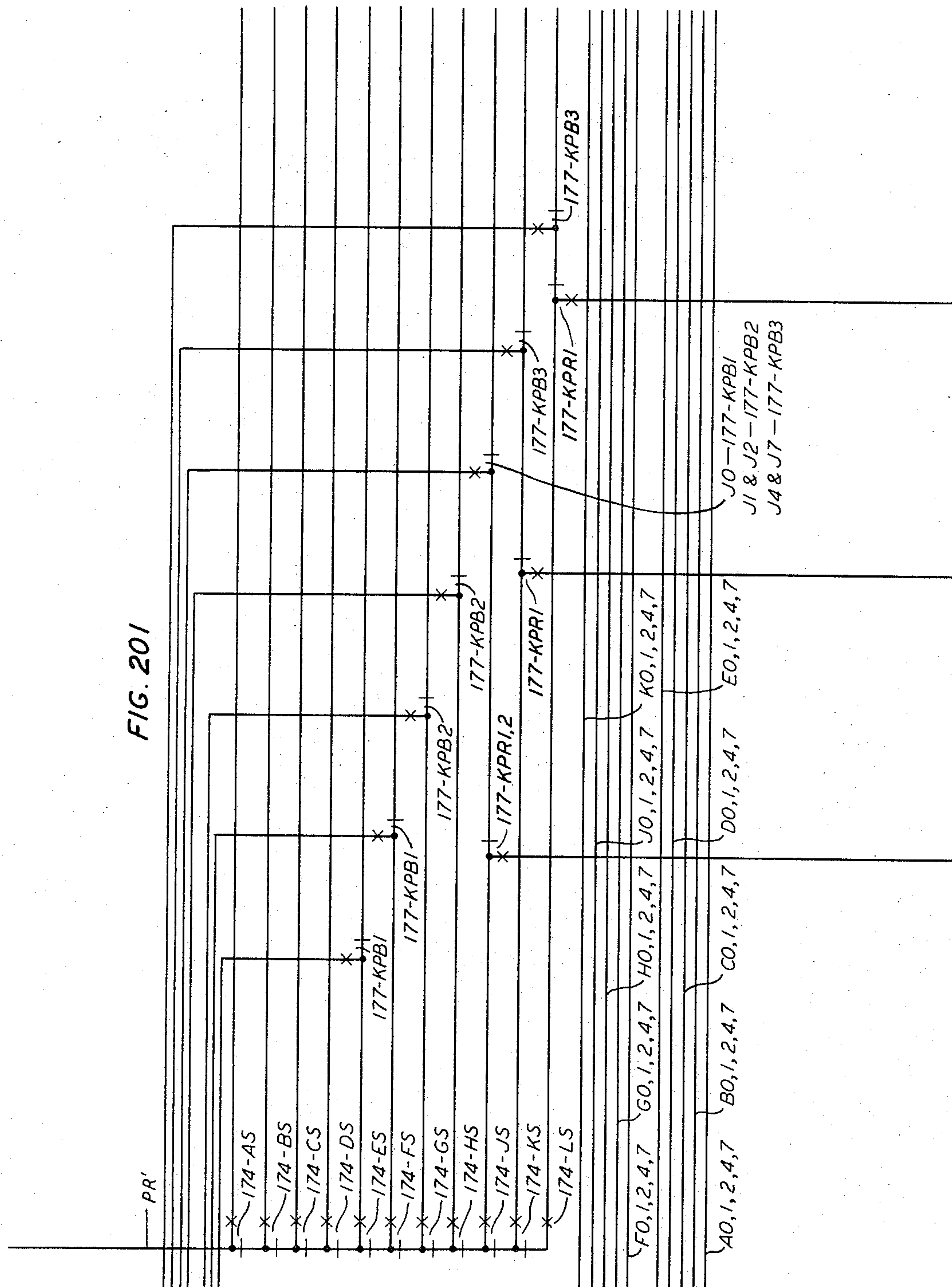
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 272



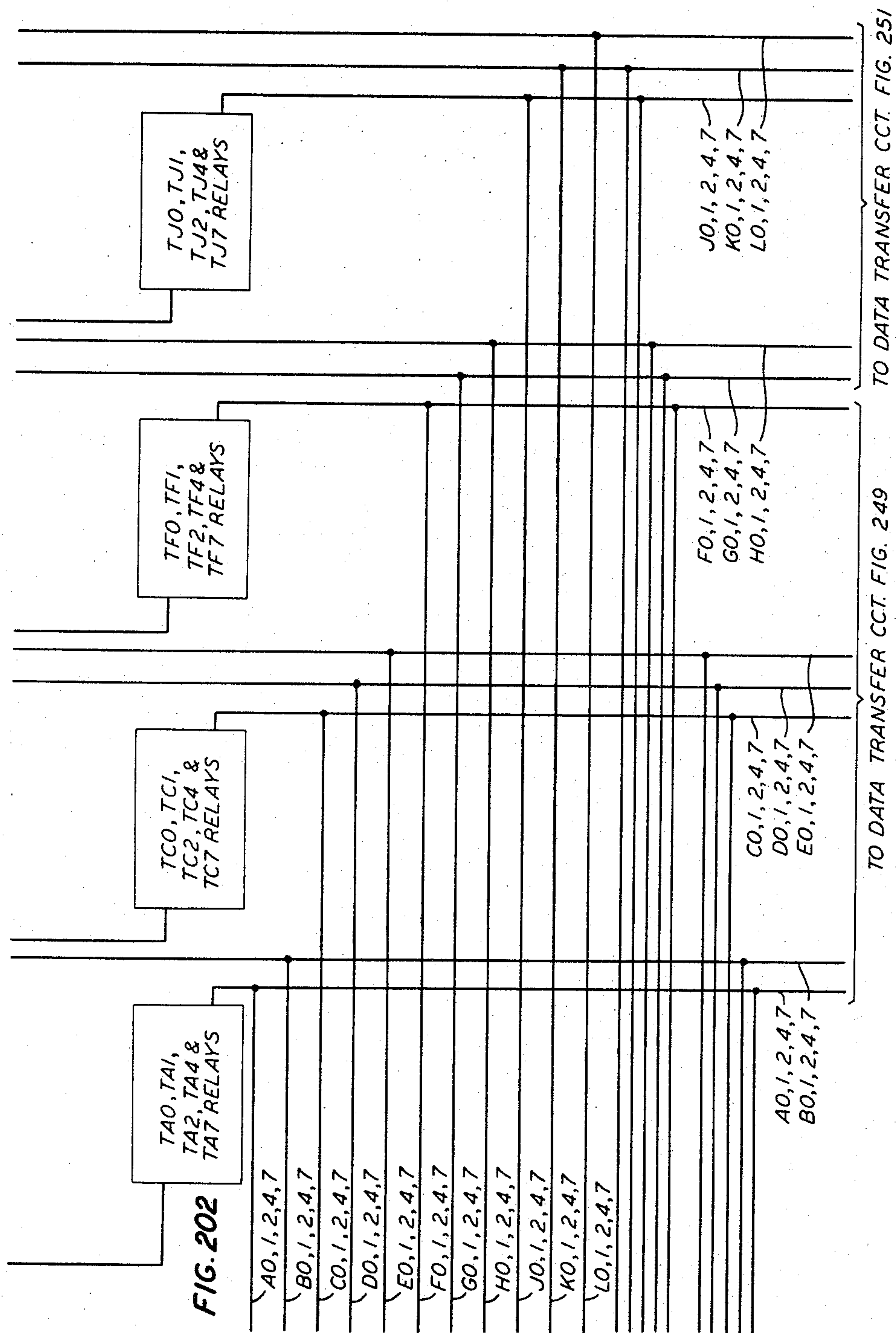
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 273



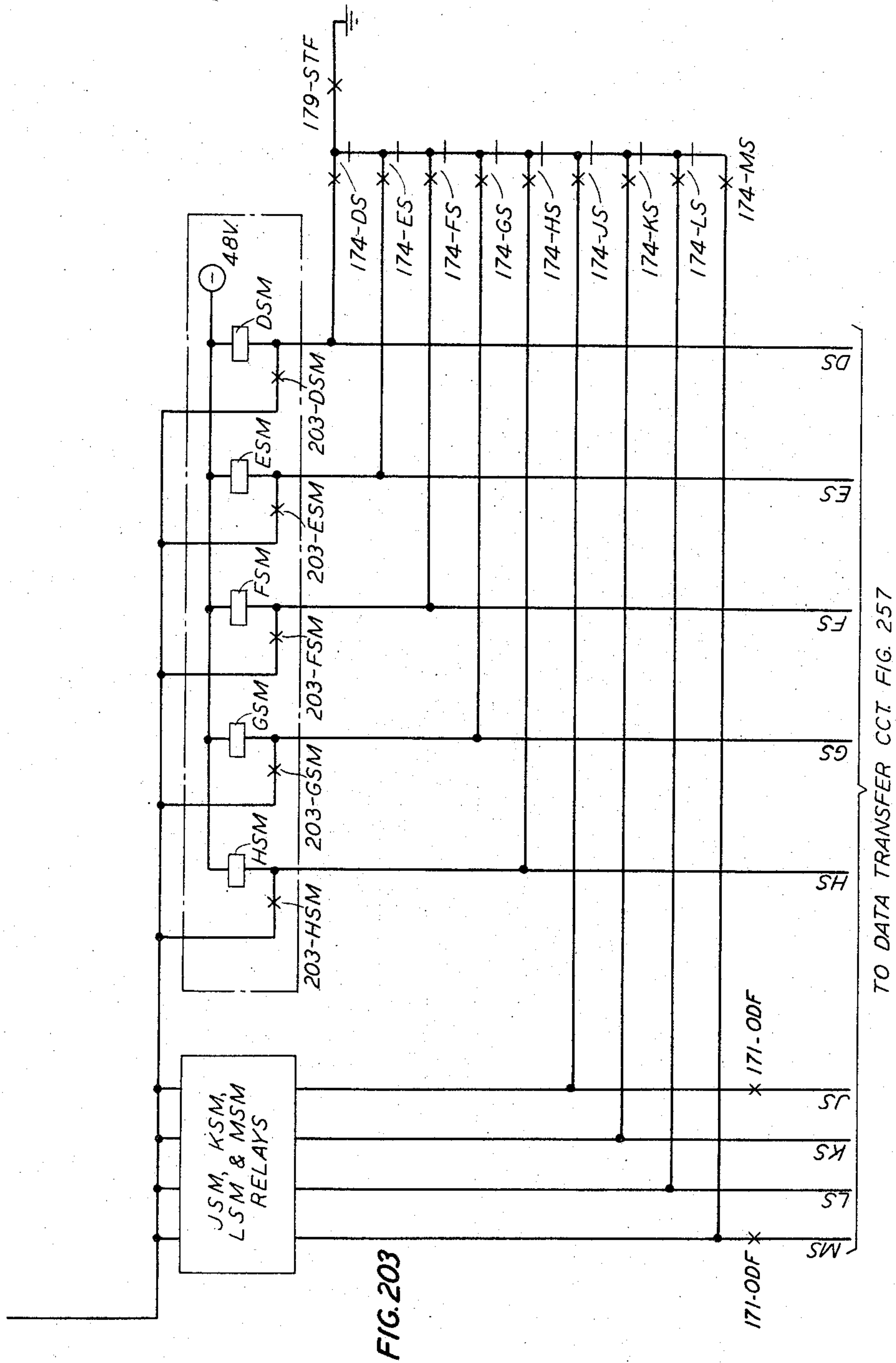
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

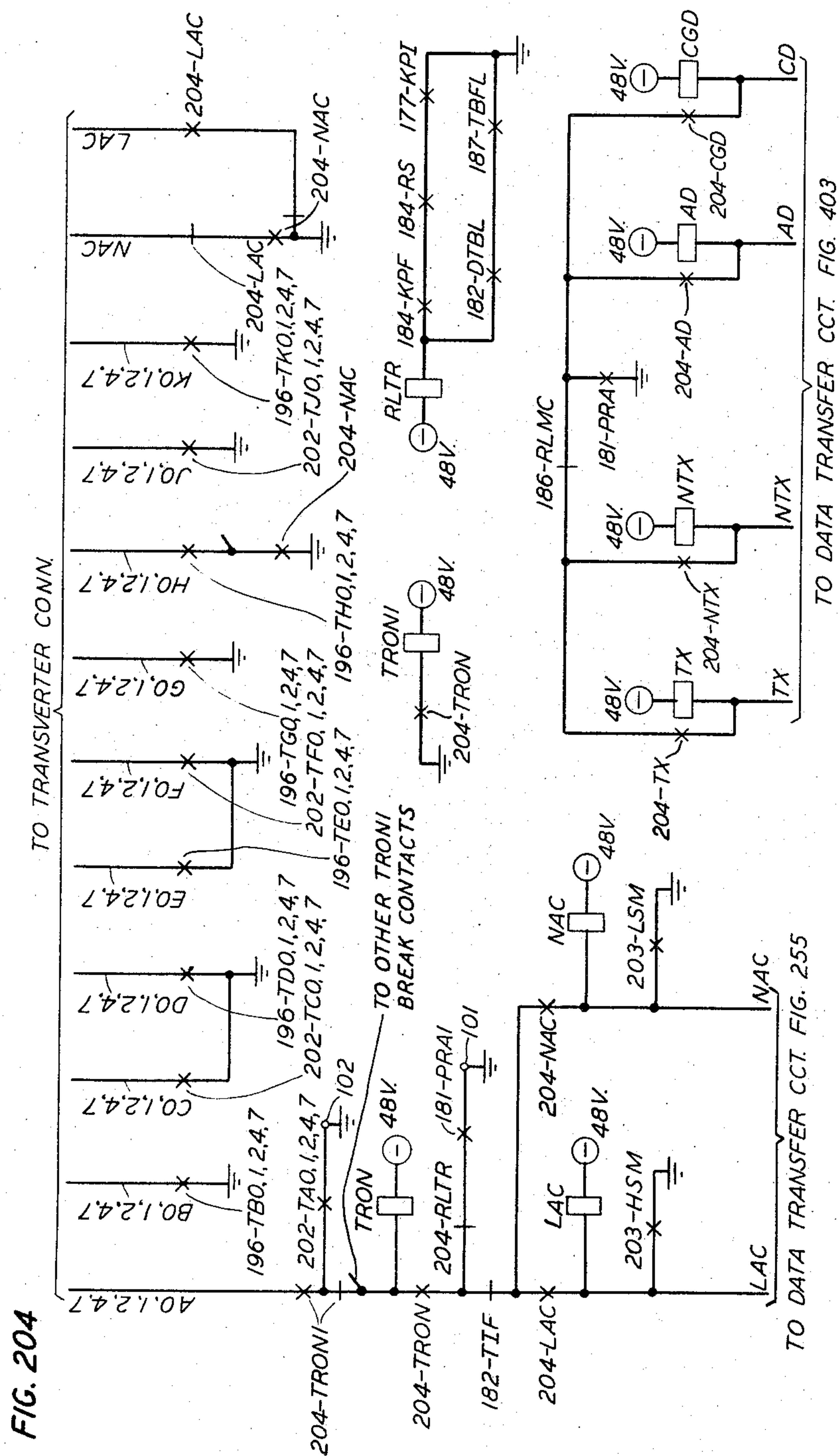
570 Sheets-Sheet 274



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 275



Sept. 12, 1967

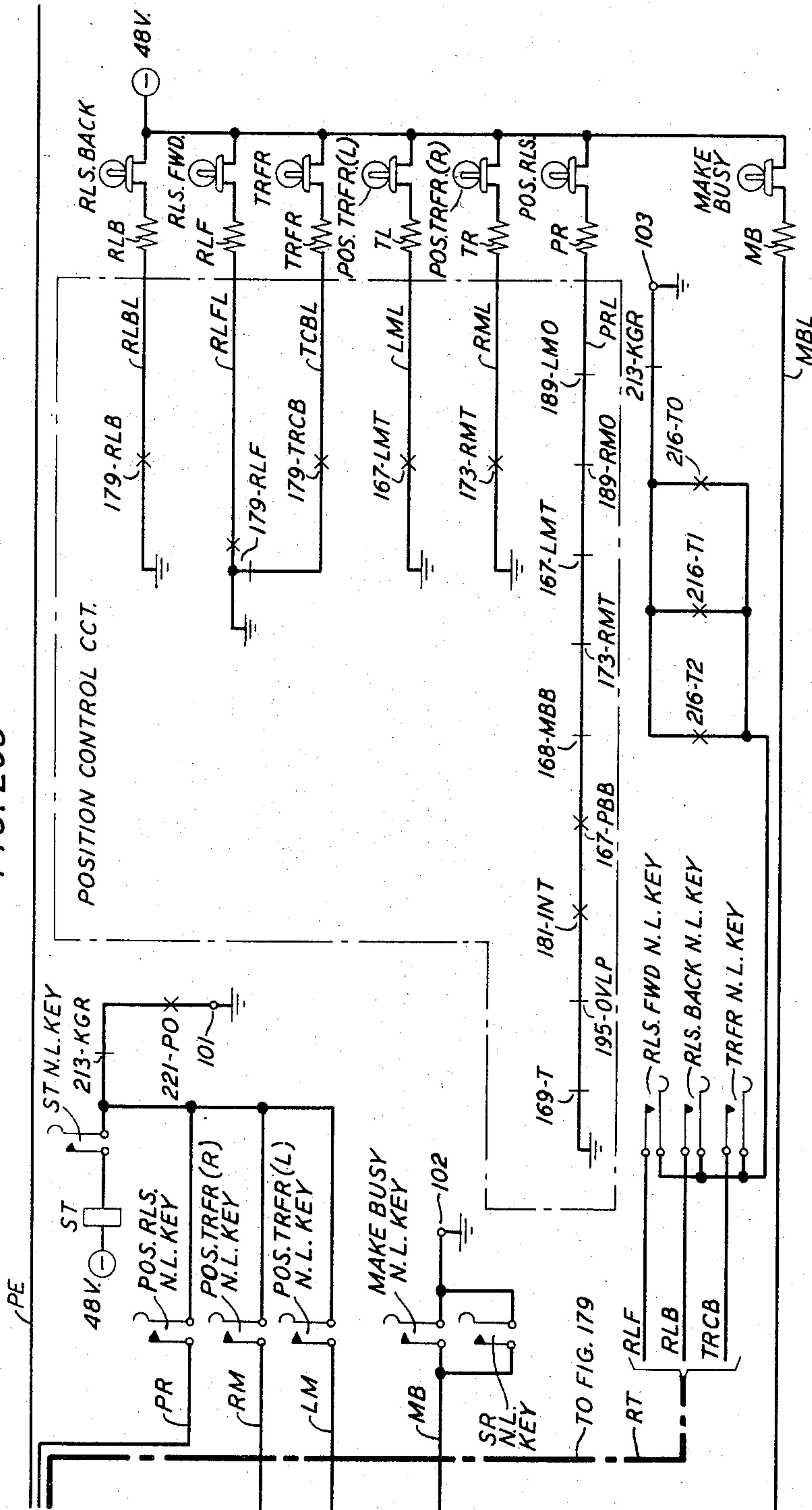
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 276

FIG. 205



Sept. 12, 1967

L. J. CERNY ETAL

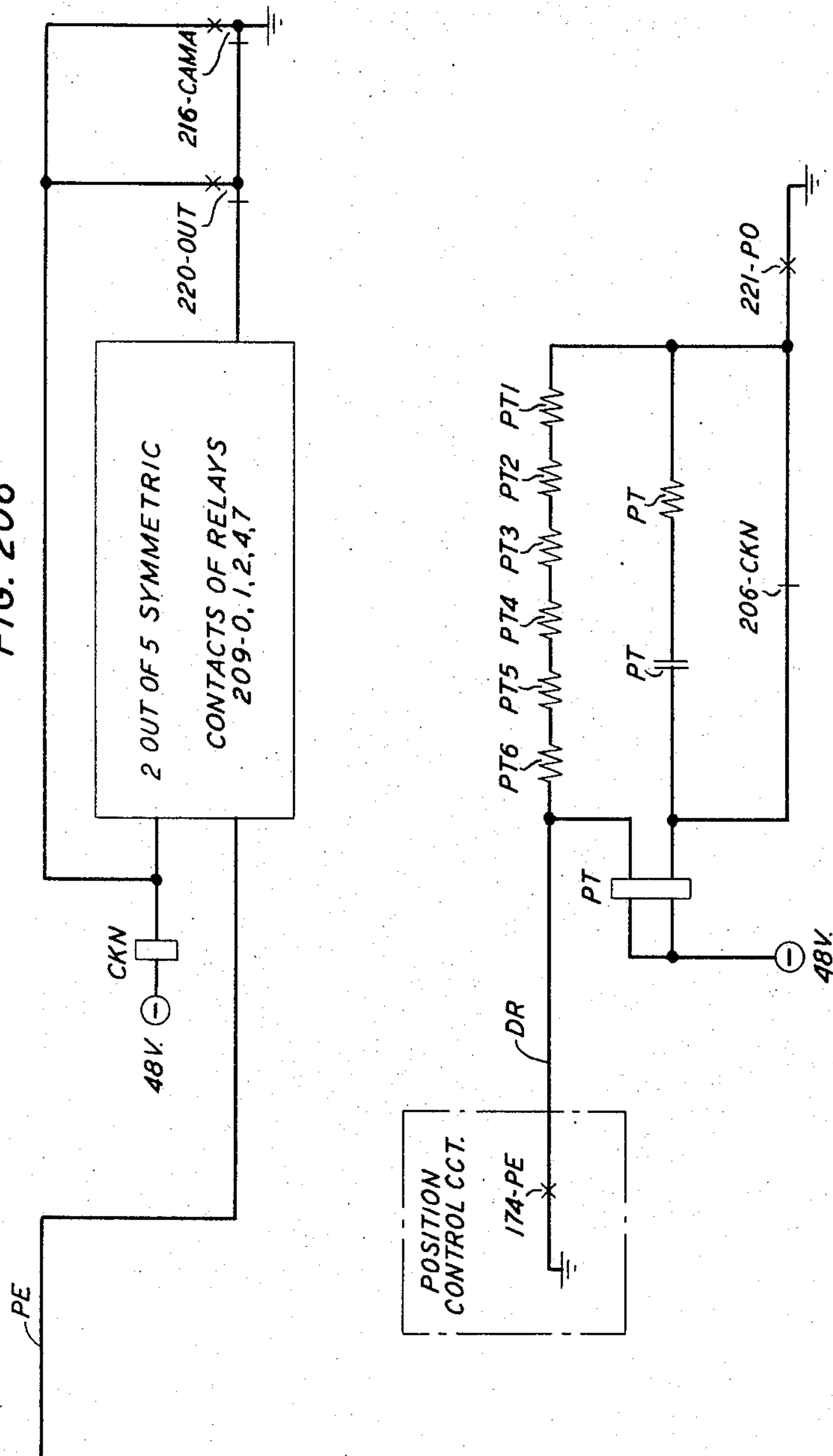
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 277

FIG. 206



Sept. 12, 1967

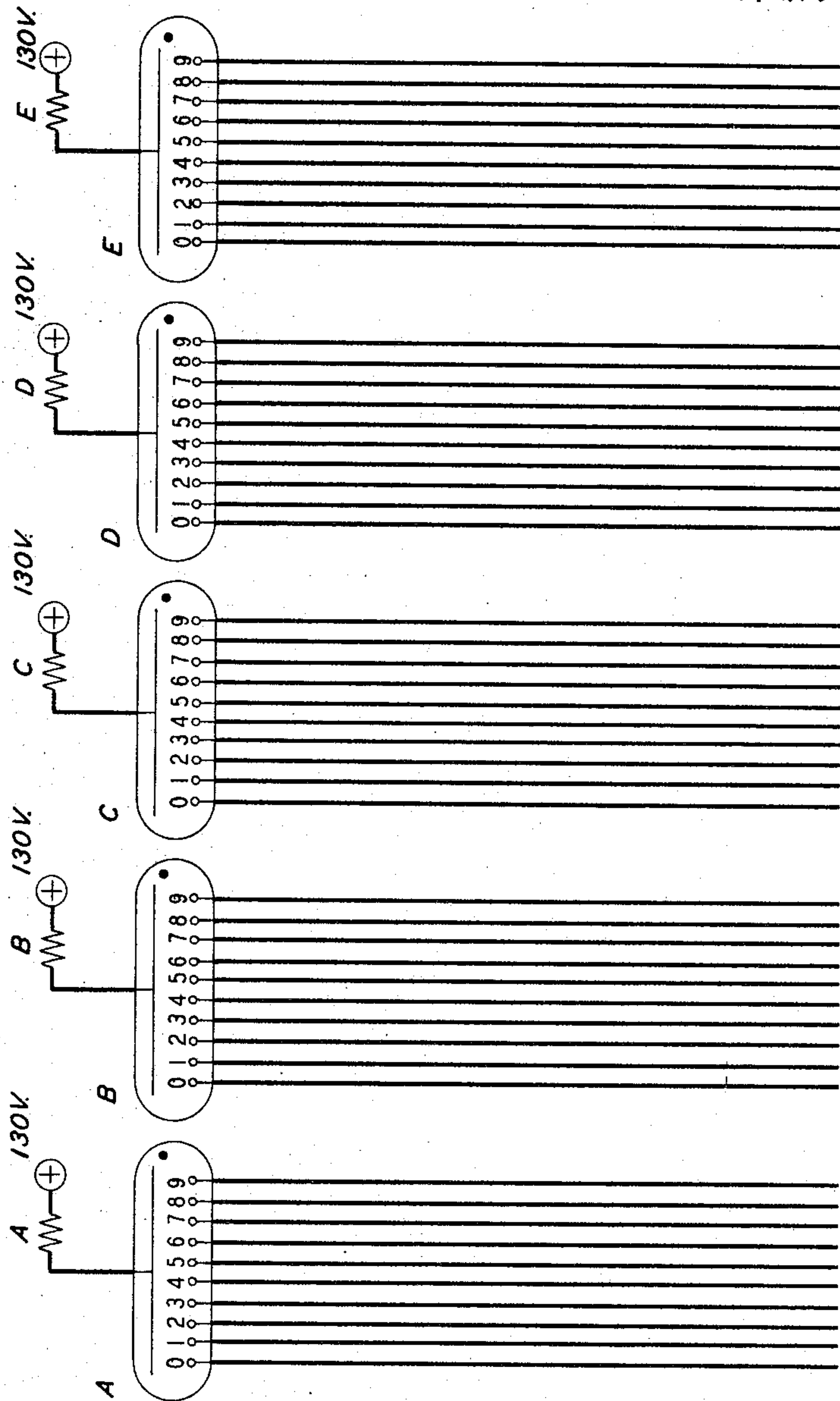
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 278

FIG. 207



Sept. 12, 1967

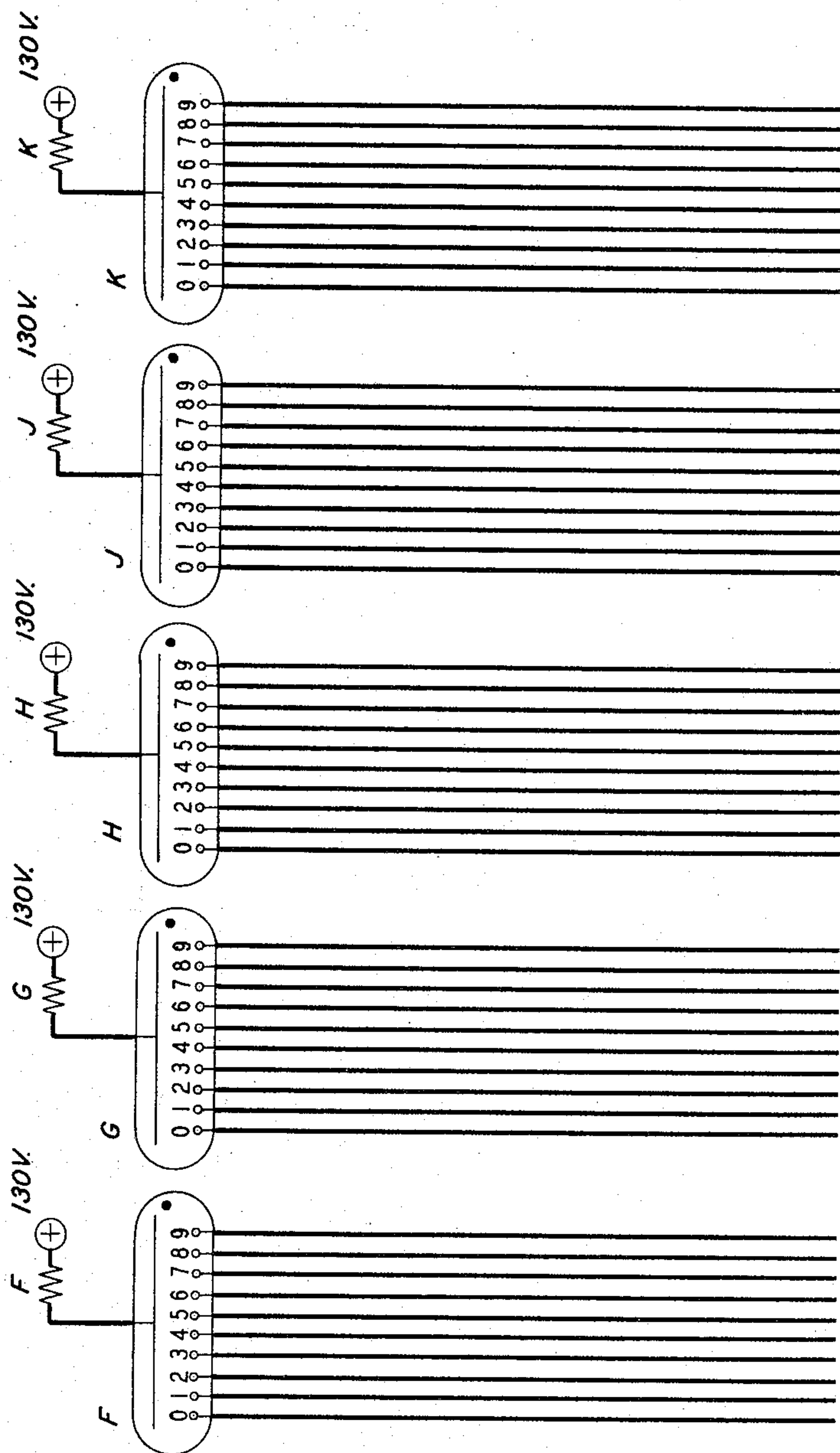
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 279

FIG. 208



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 280

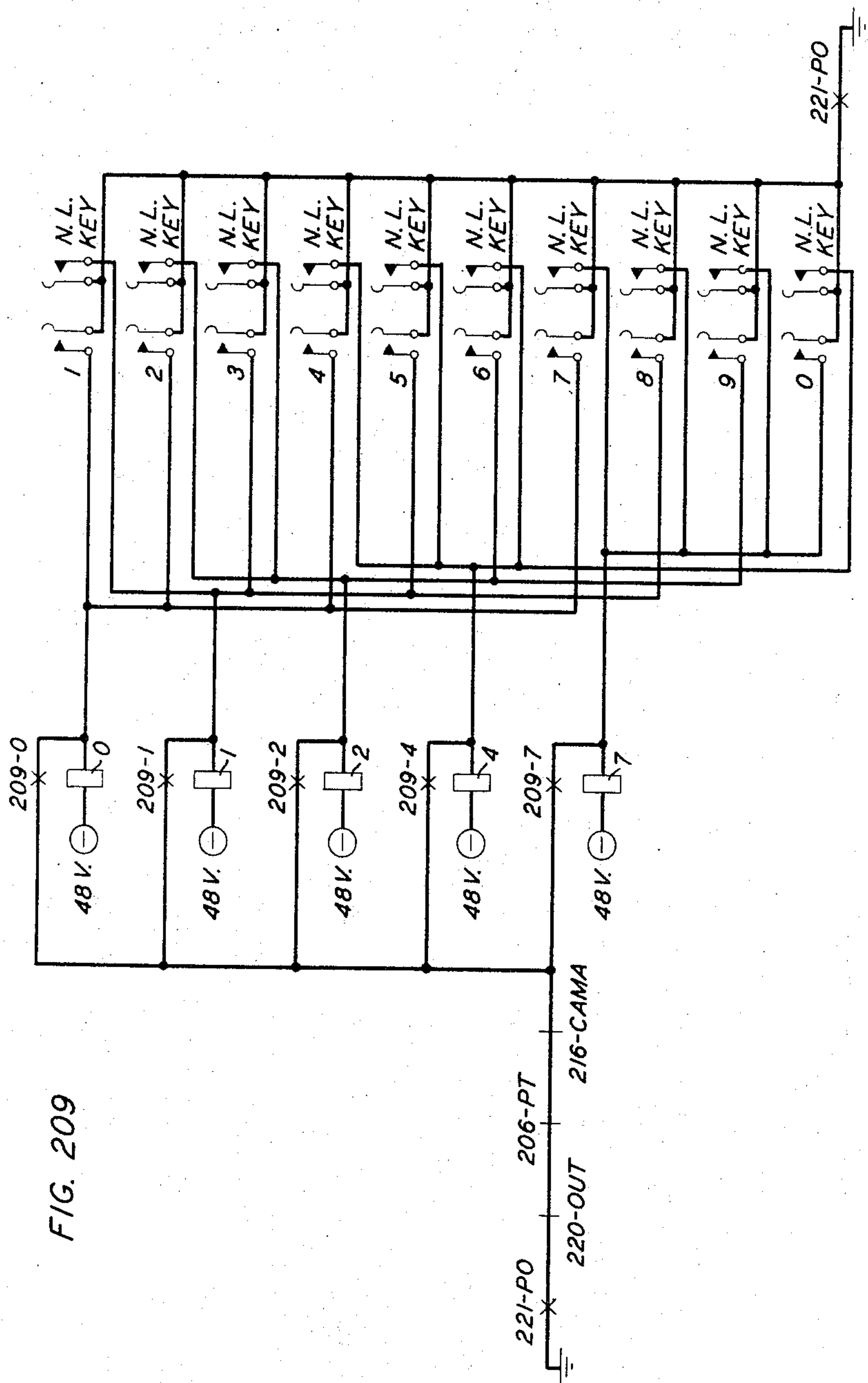


FIG. 209

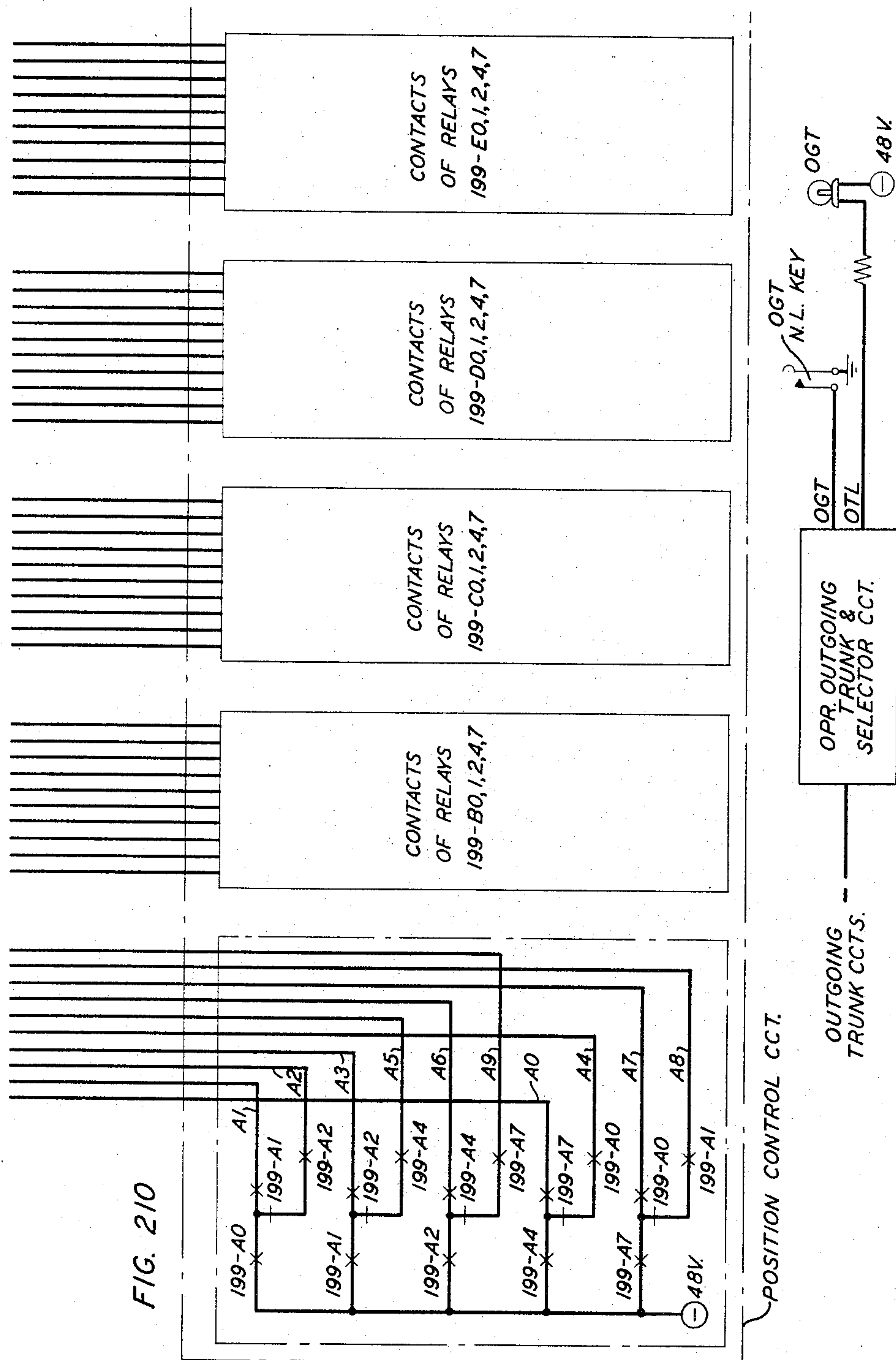
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 281



Sept. 12, 1967

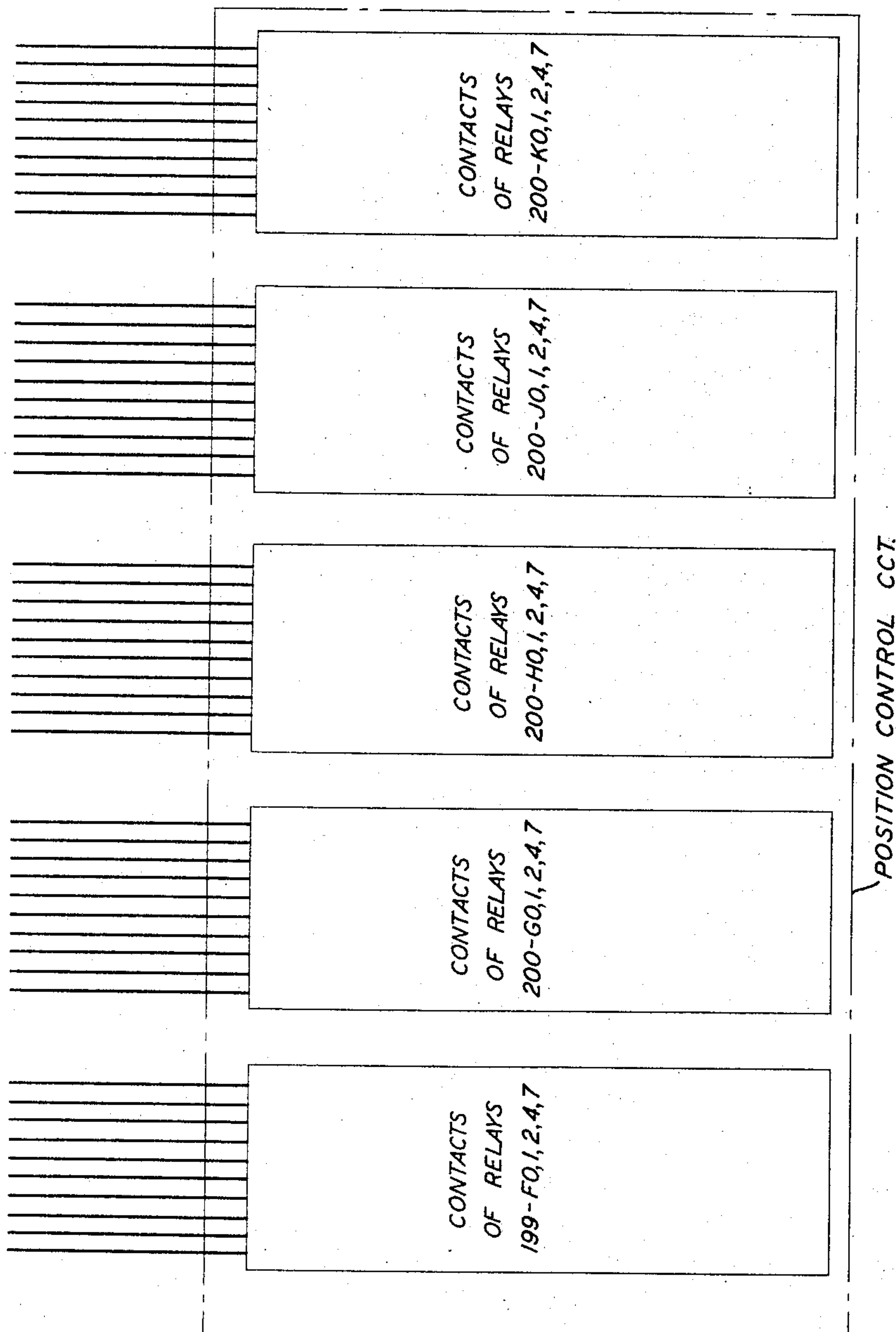
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 282

FIG. 211



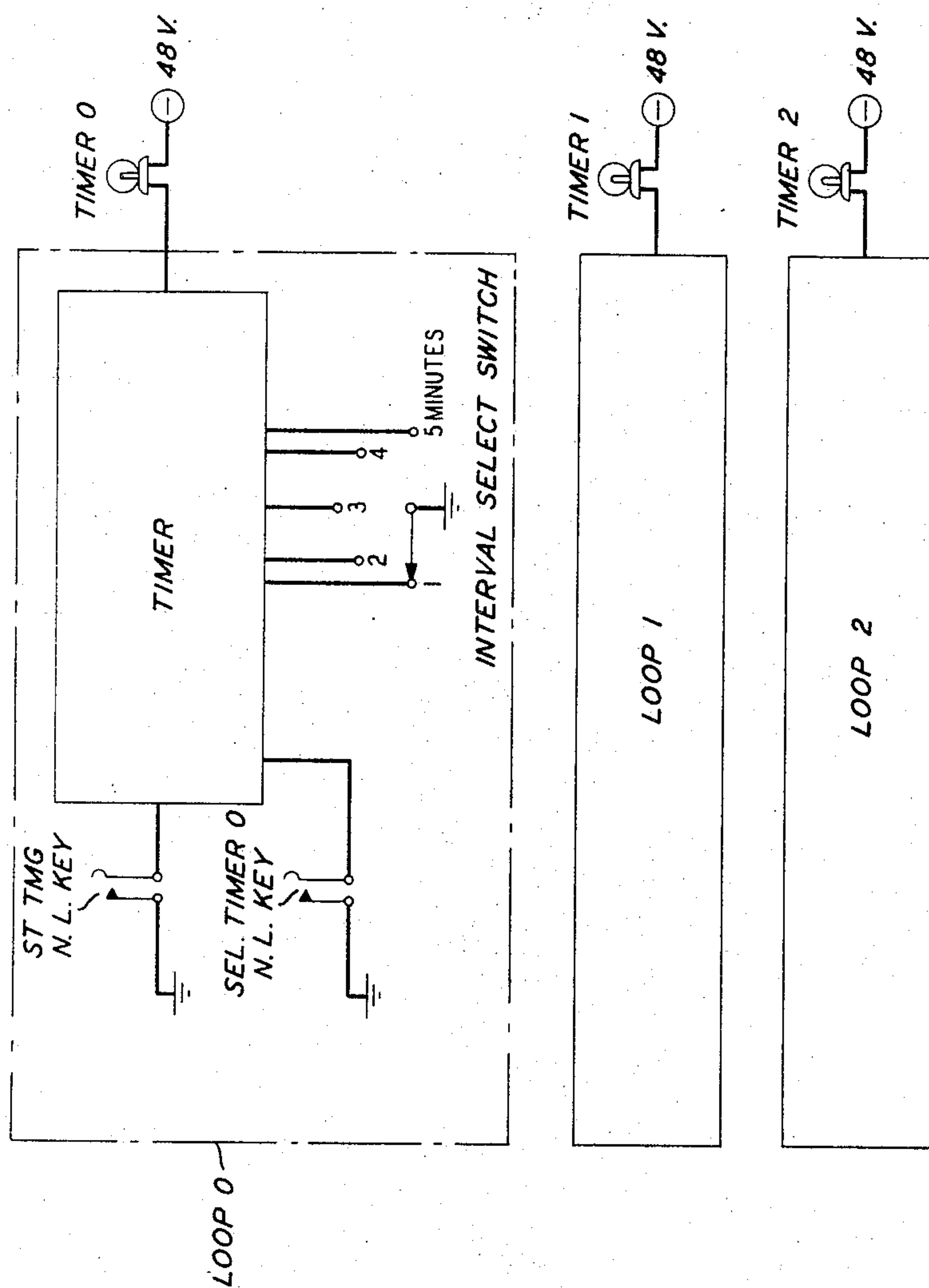
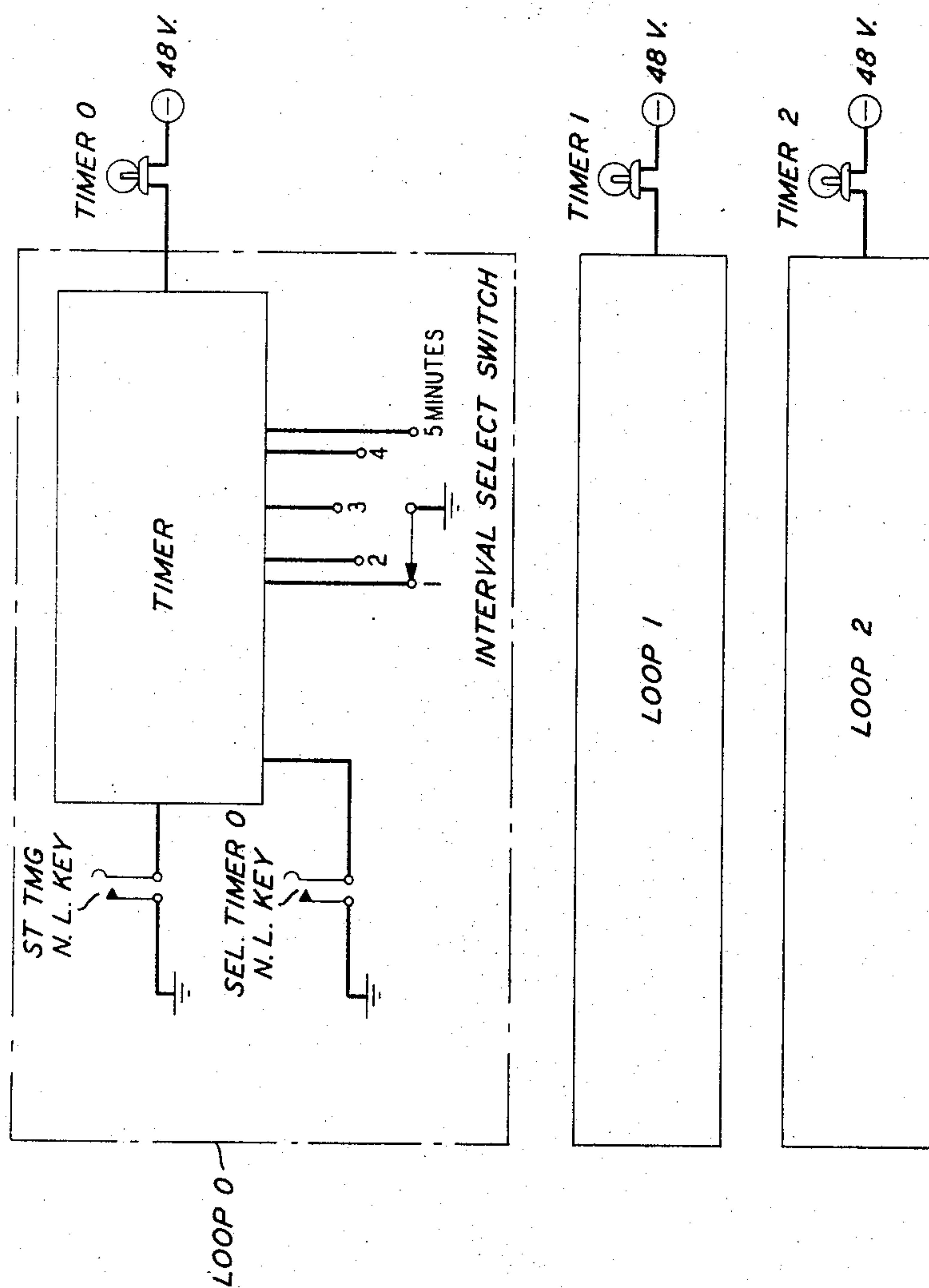
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 283



Sept. 12, 1967

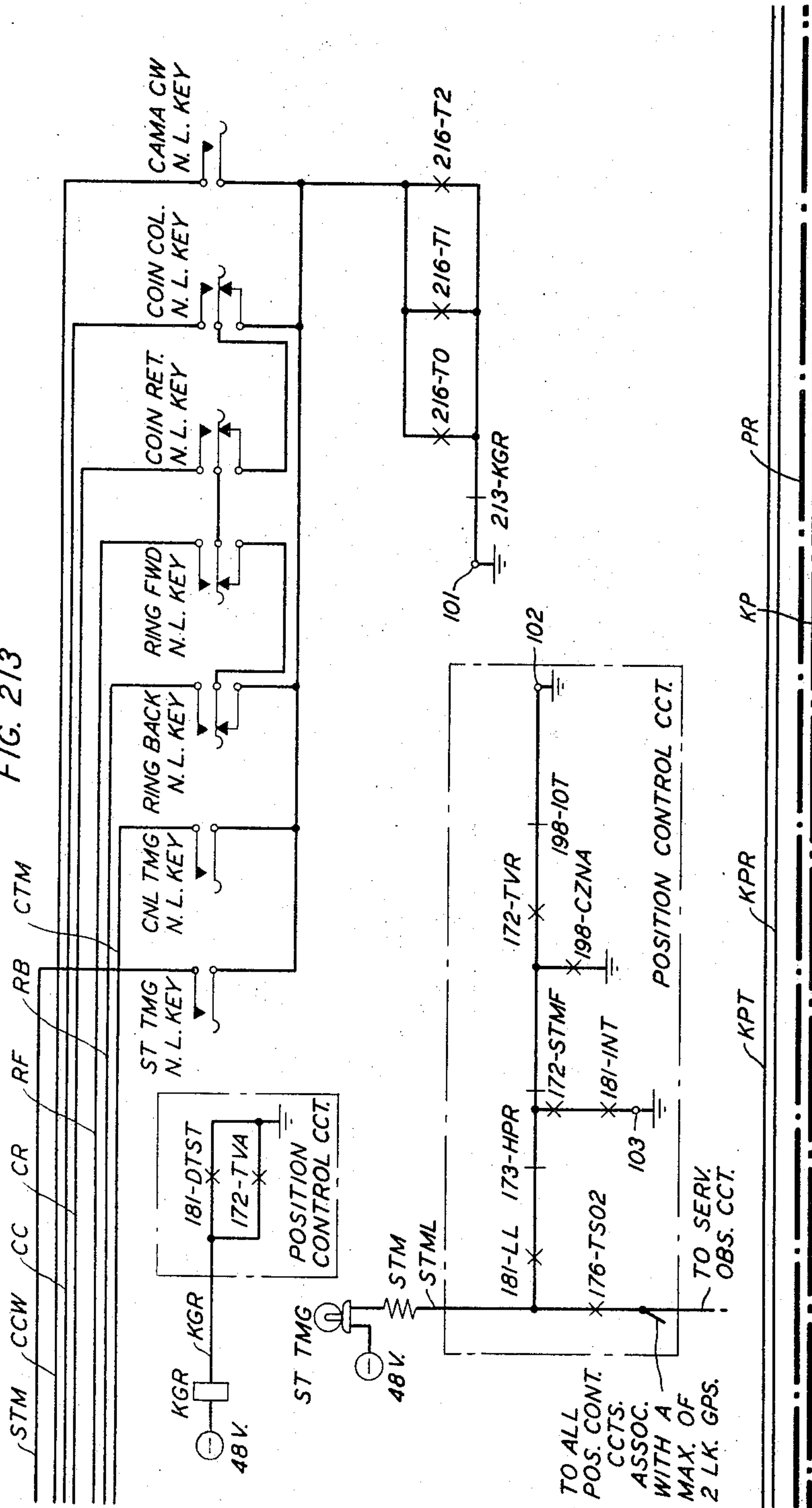
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 284

FIG. 213



Sept. 12, 1967

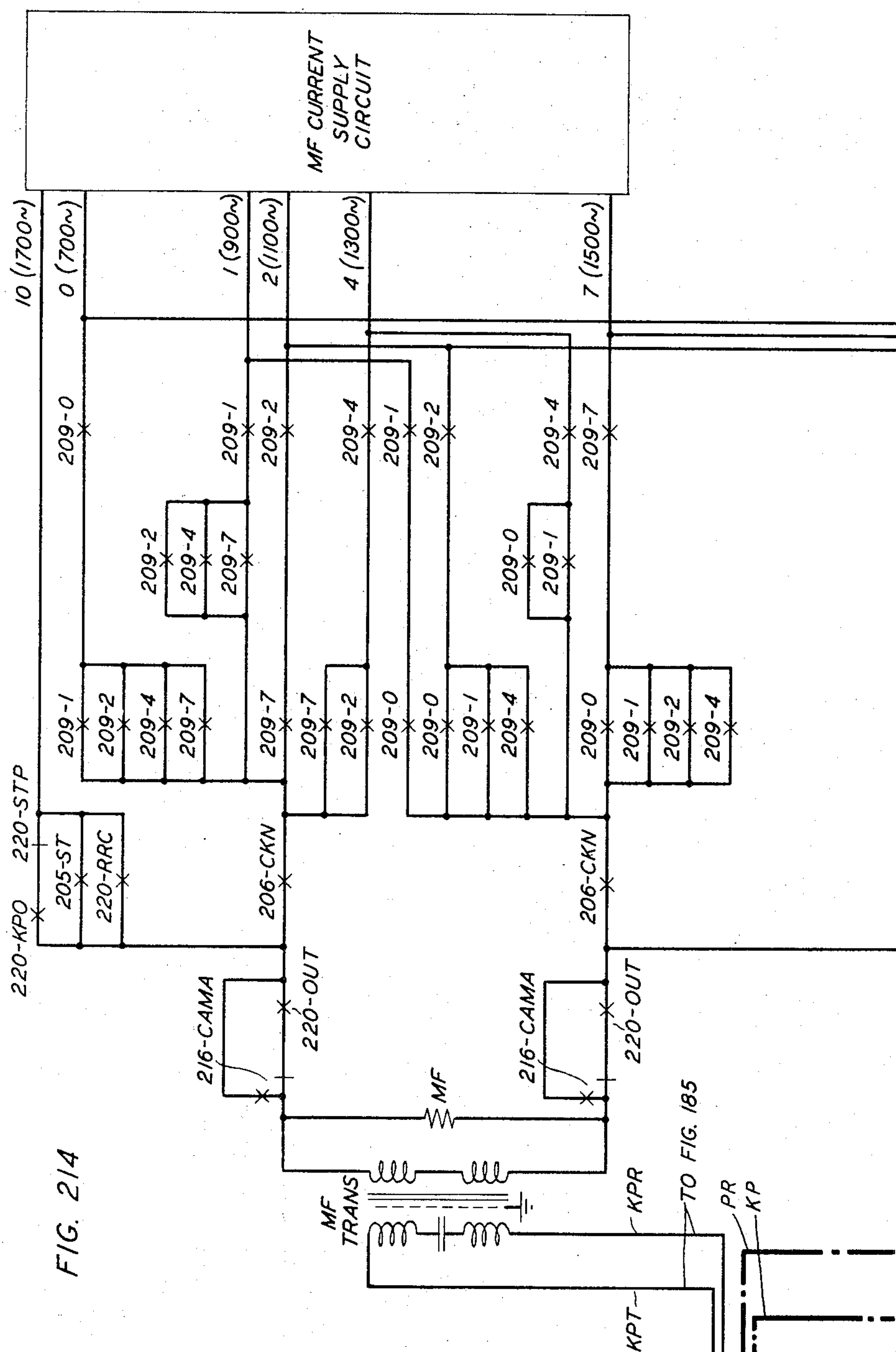
L. J. CERNY ET AL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 285



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 286

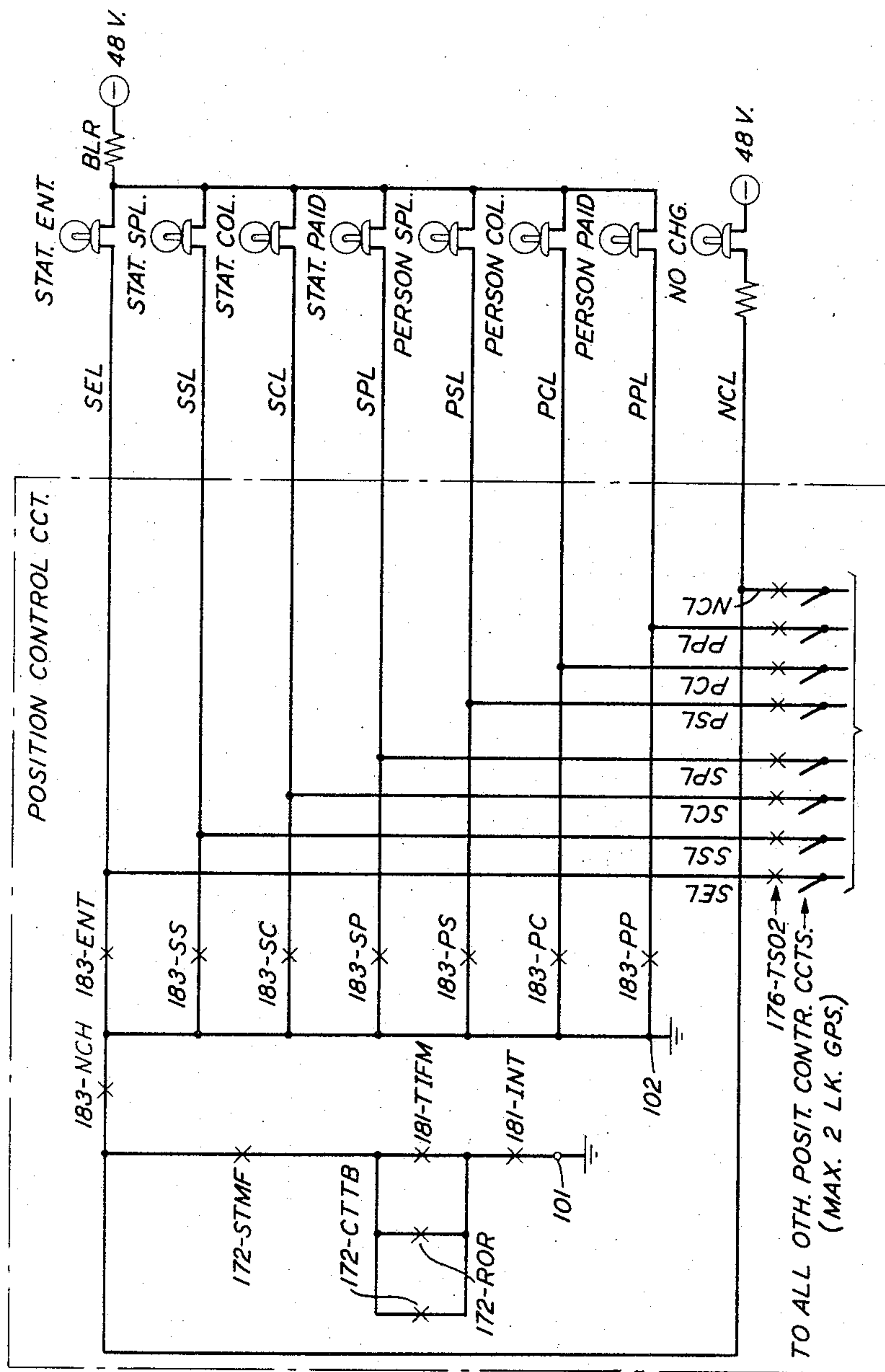


FIG. 215

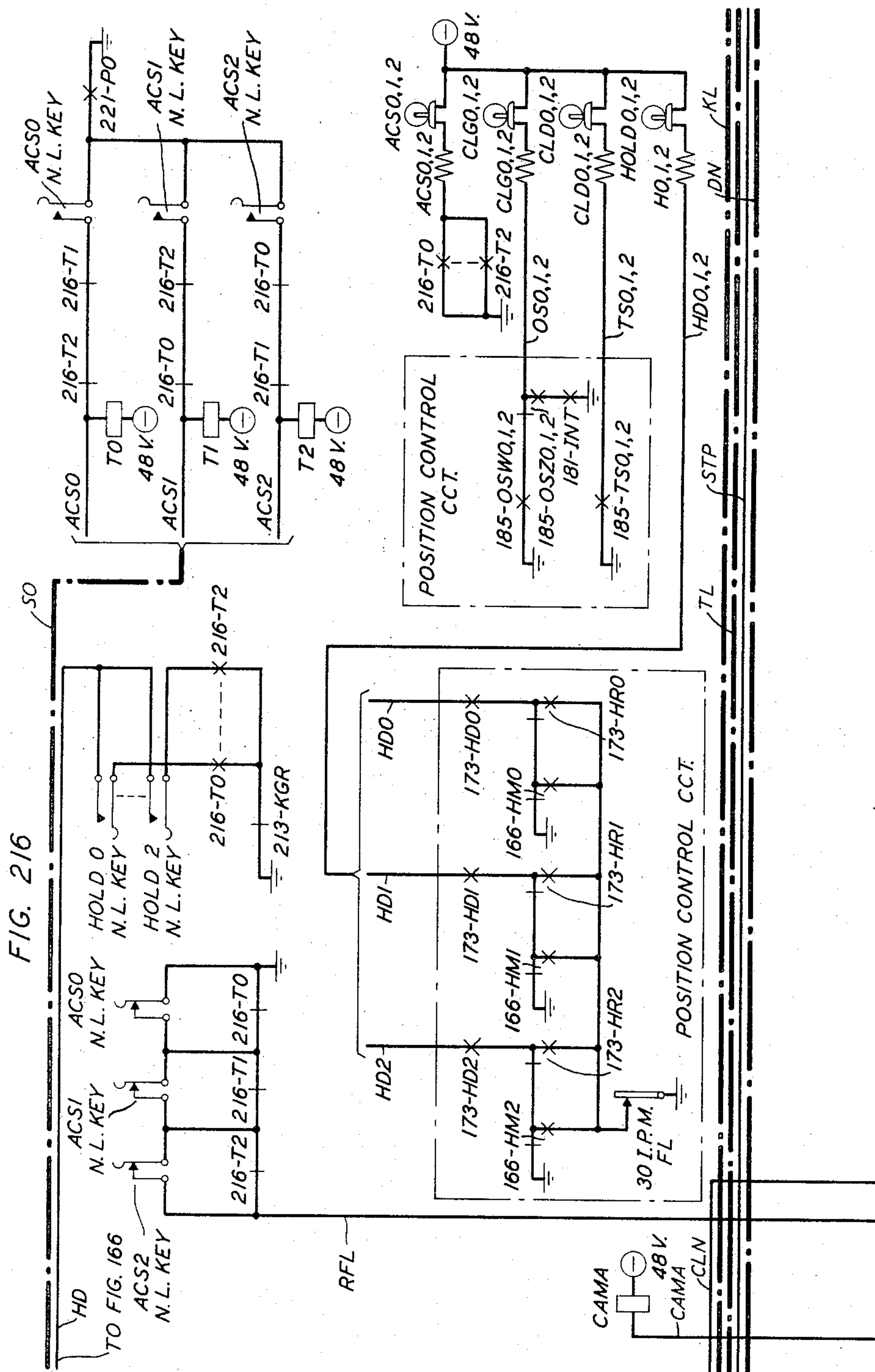
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 287



Sept. 12, 1967

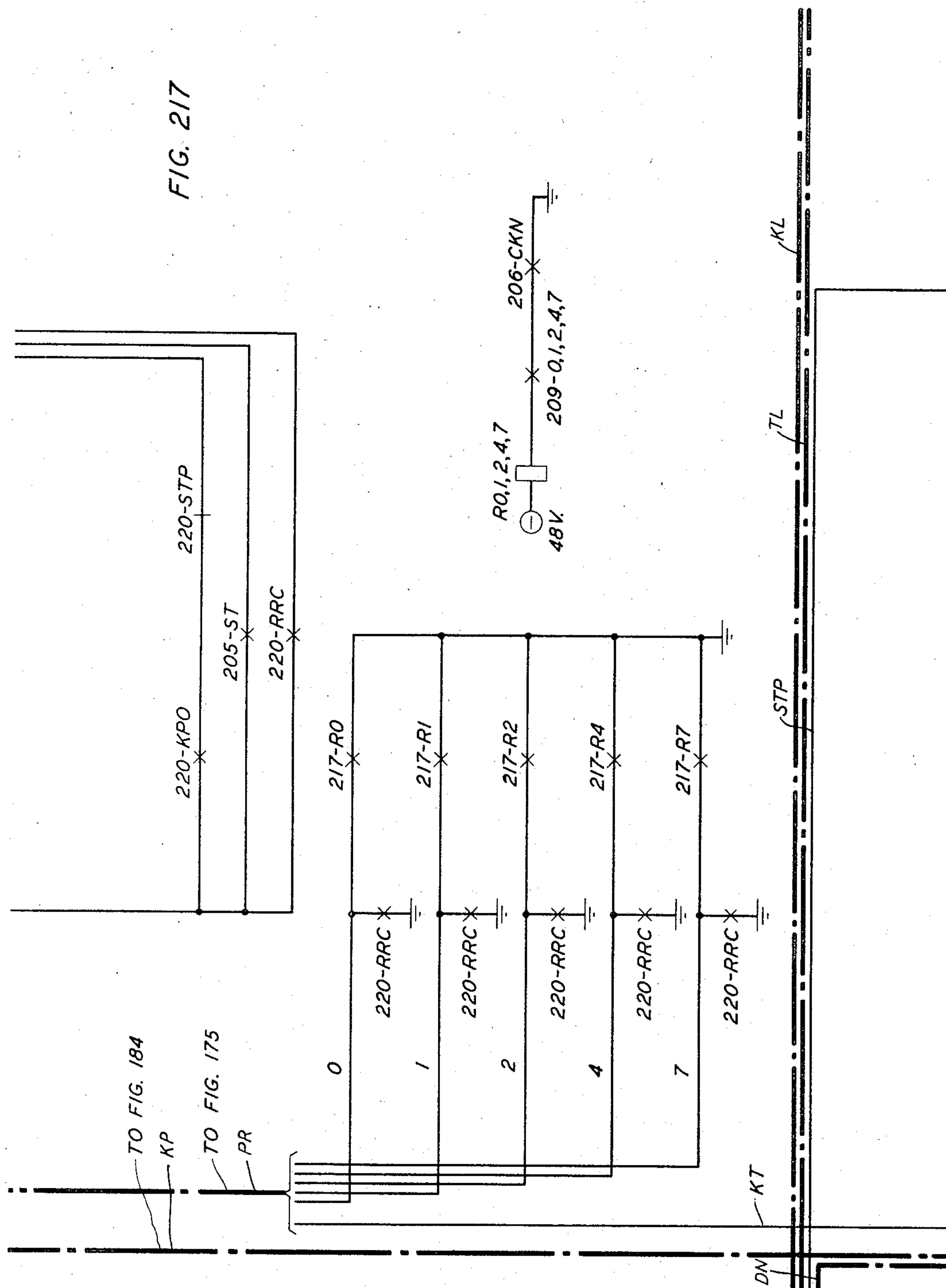
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 288

FIG. 217



Sept. 12, 1967

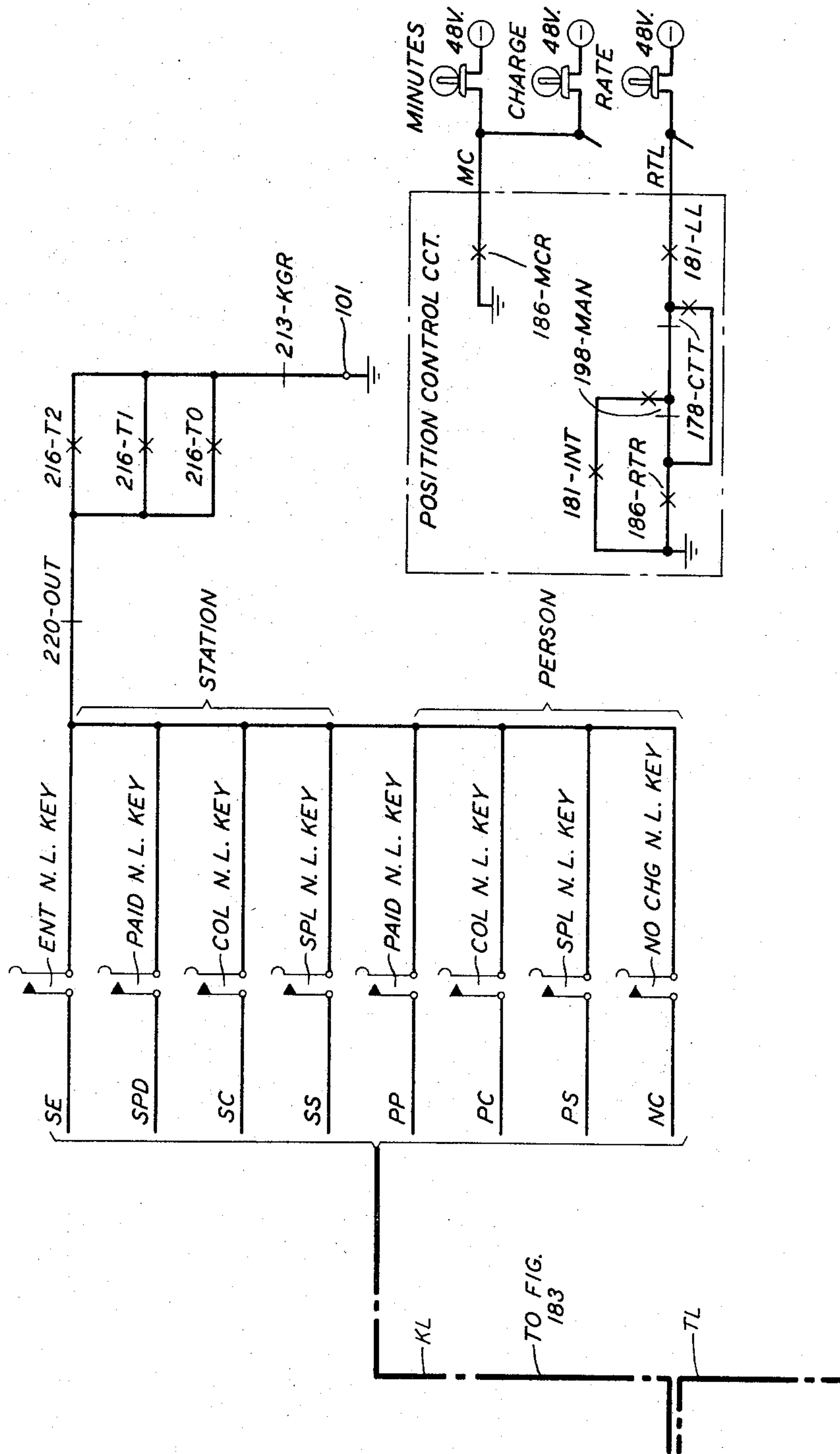
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 289

FIG. 218



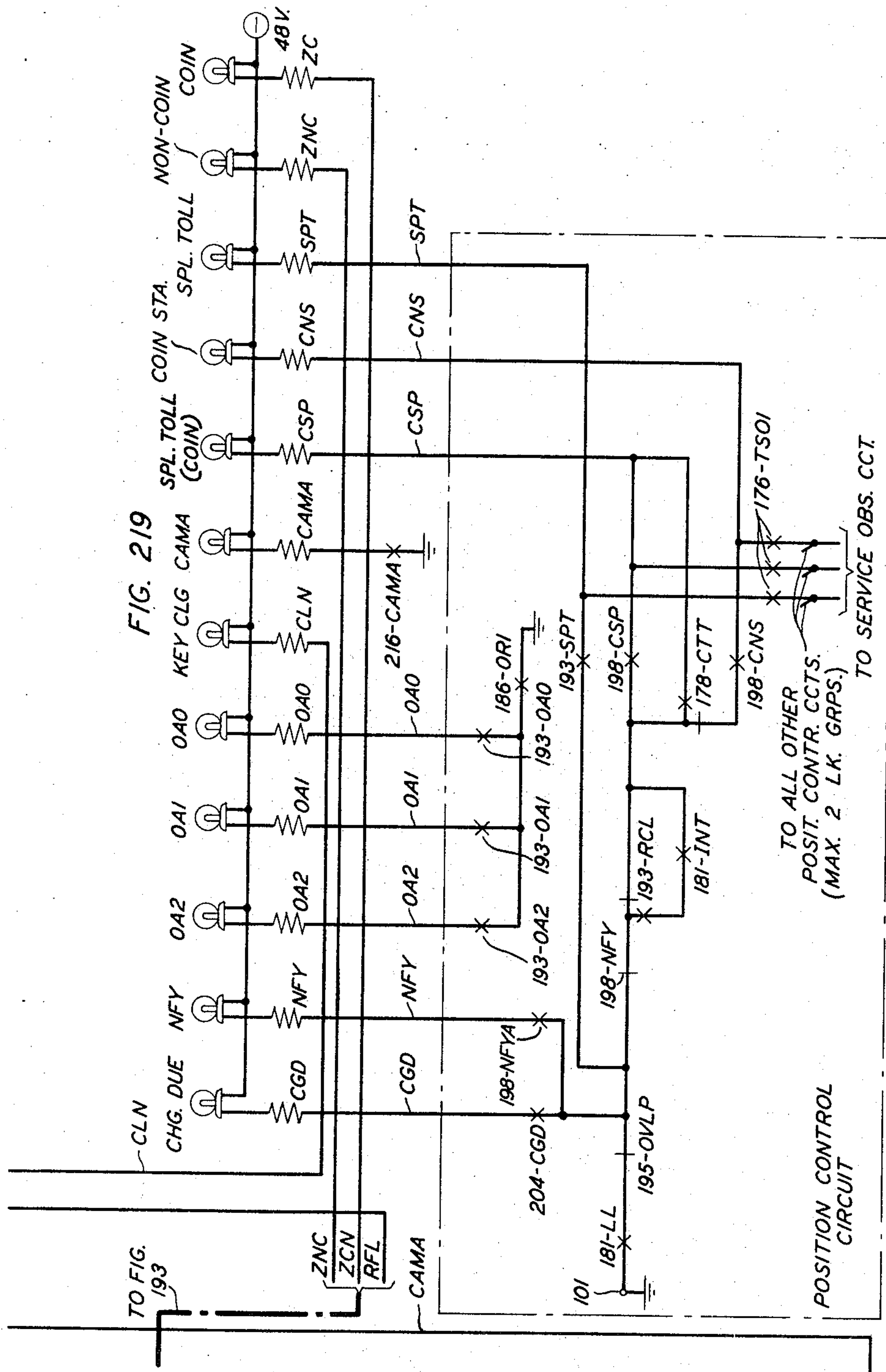
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L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 290



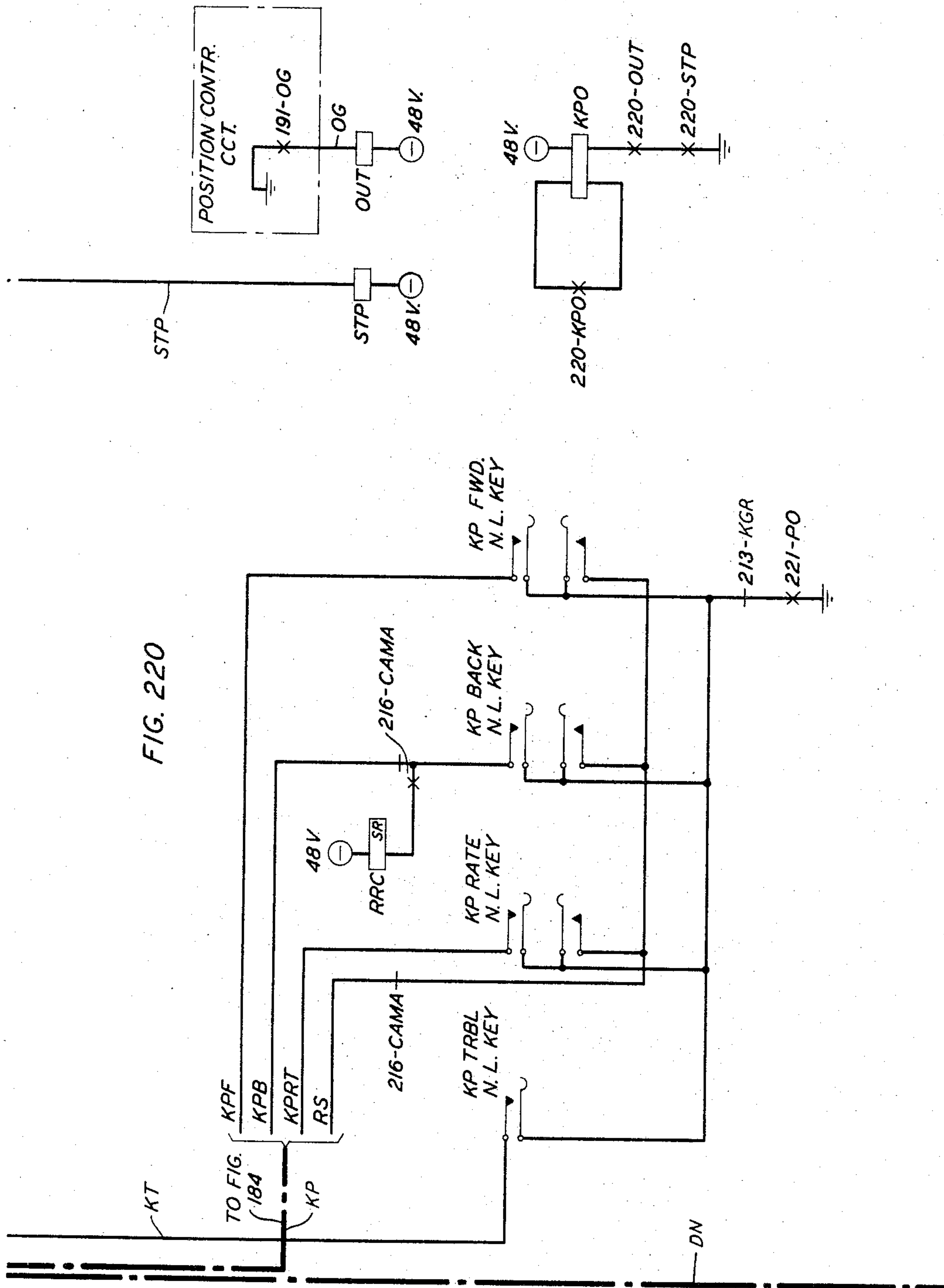
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 291



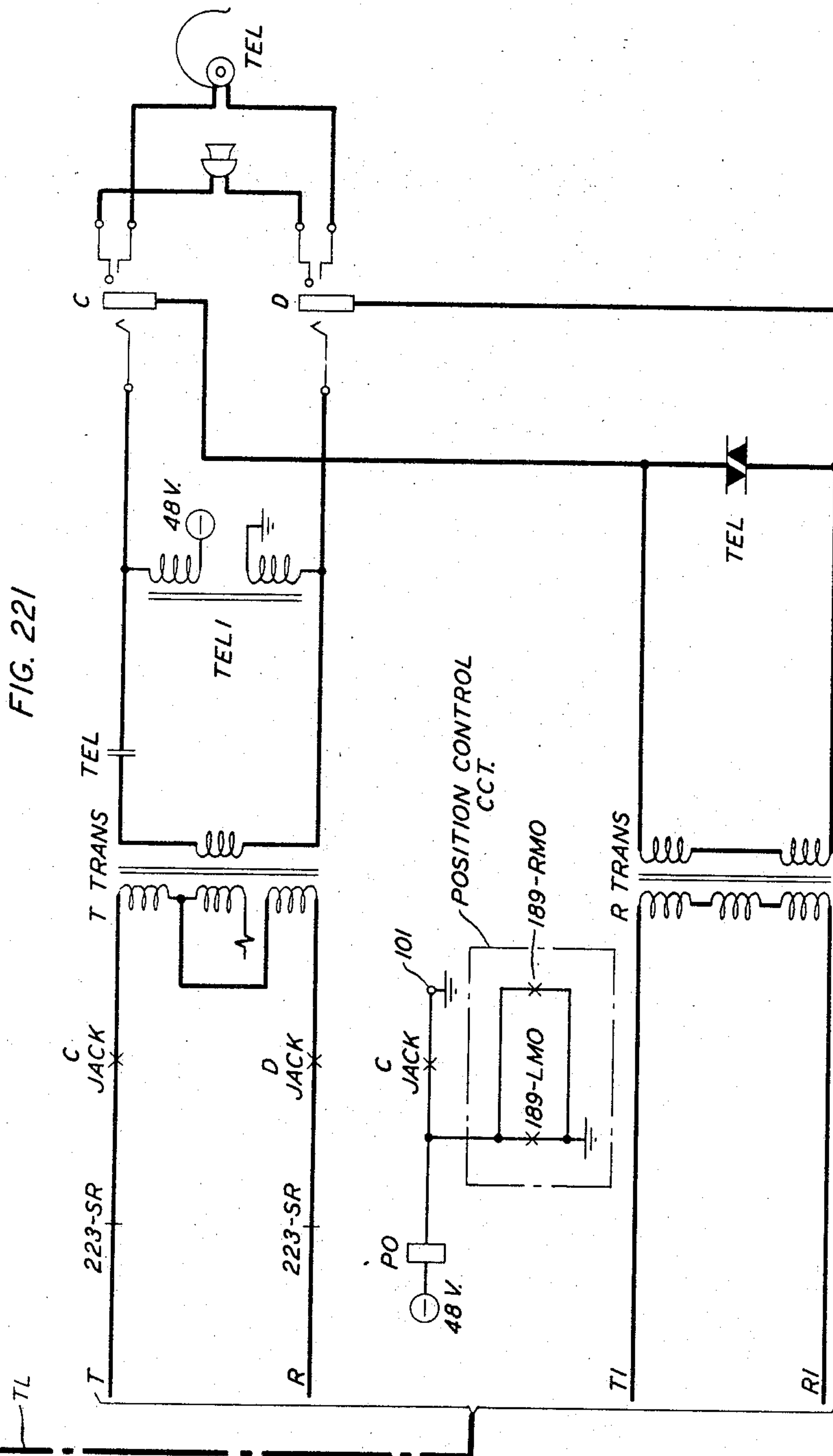
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 293



Sept. 12, 1967

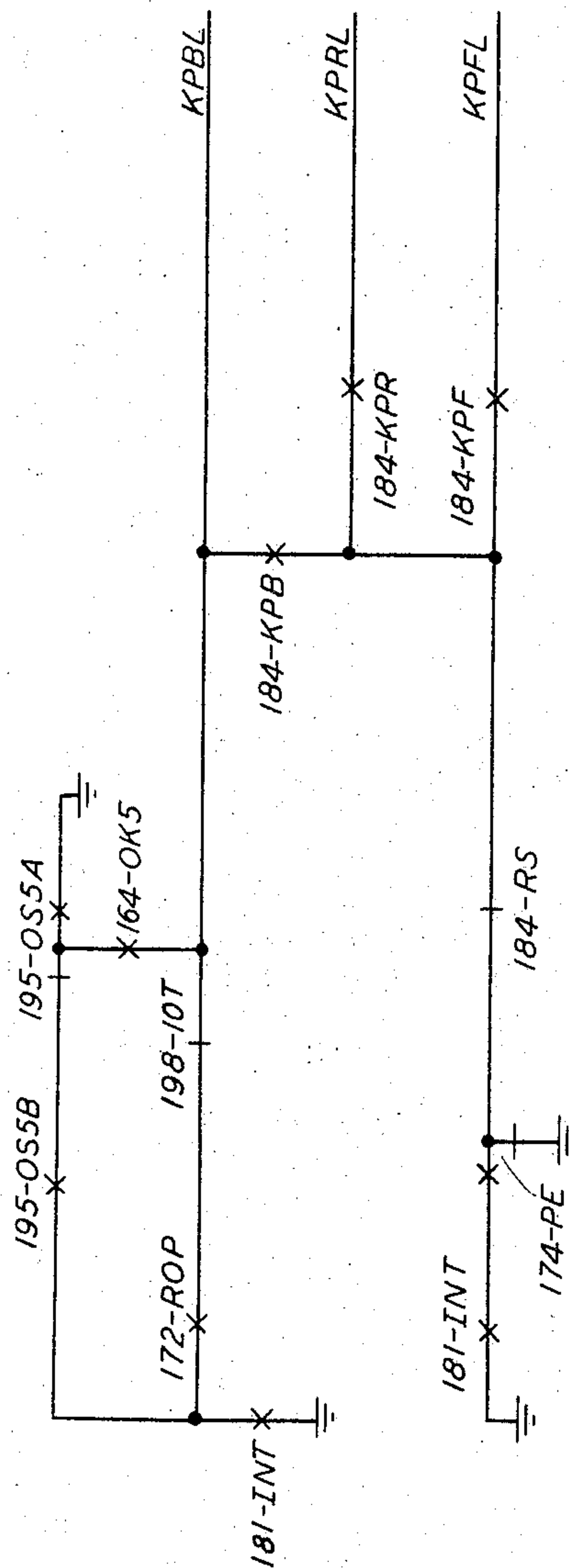
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 293

FIG. 222



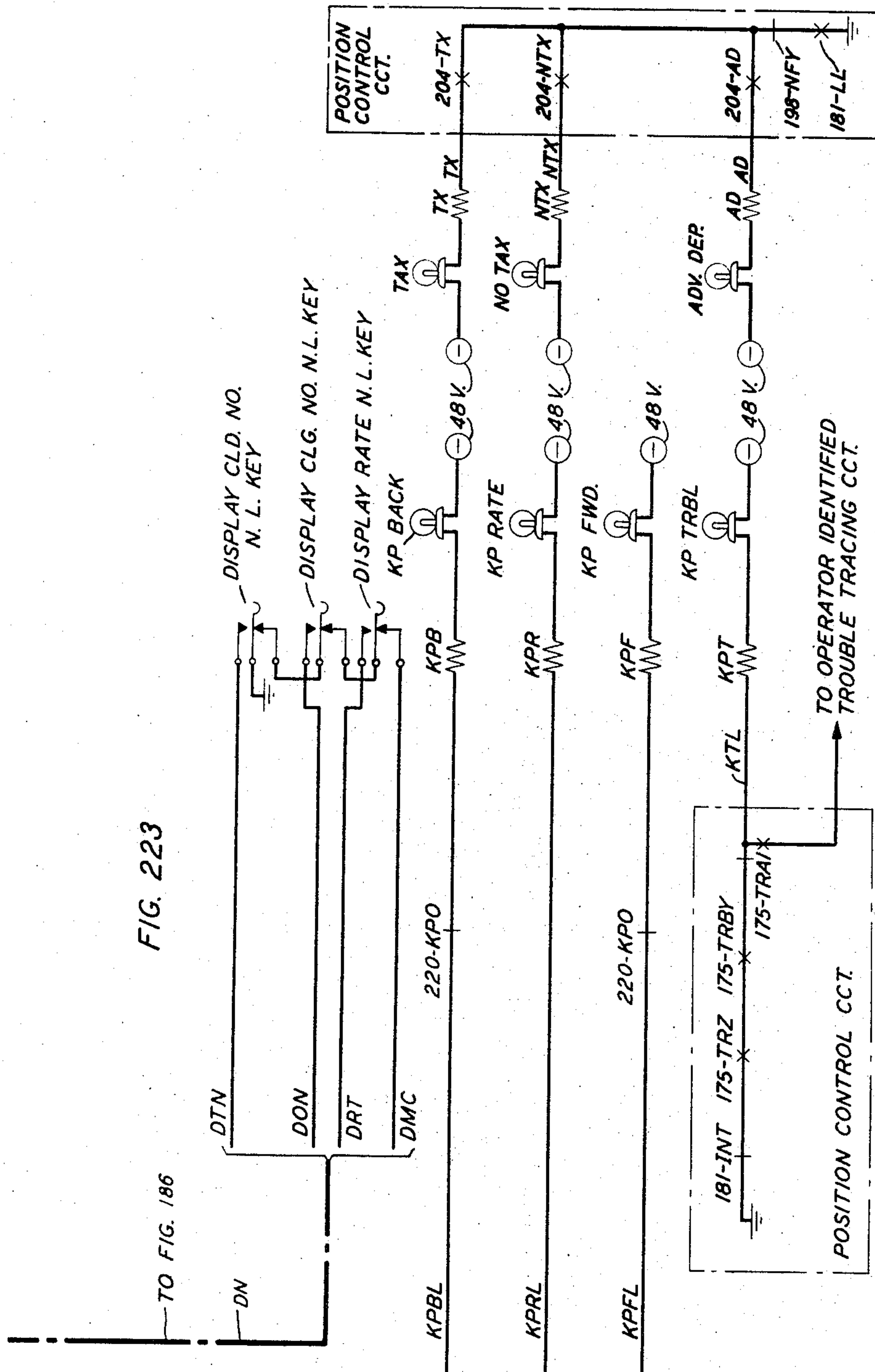
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 294



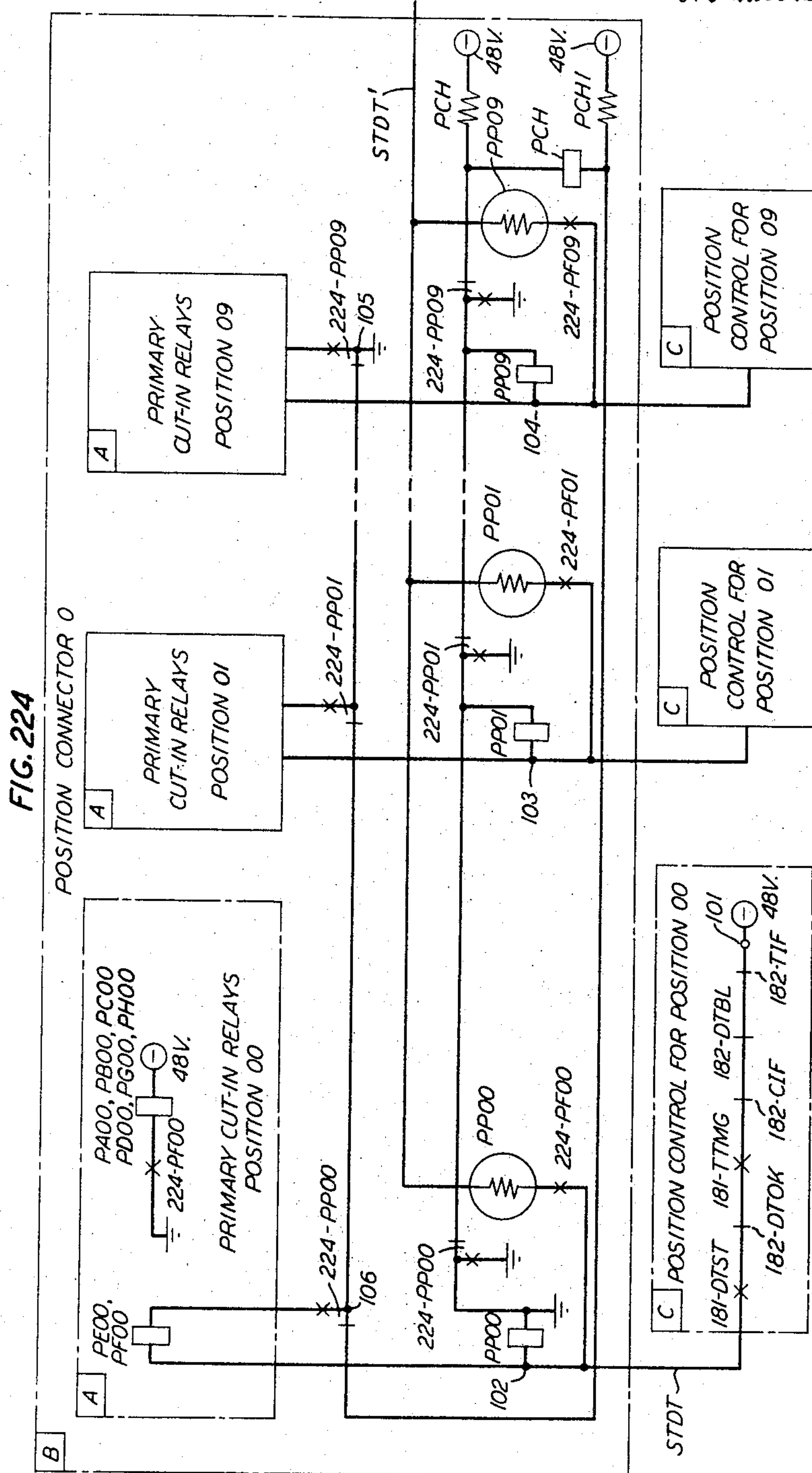
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 295



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 296

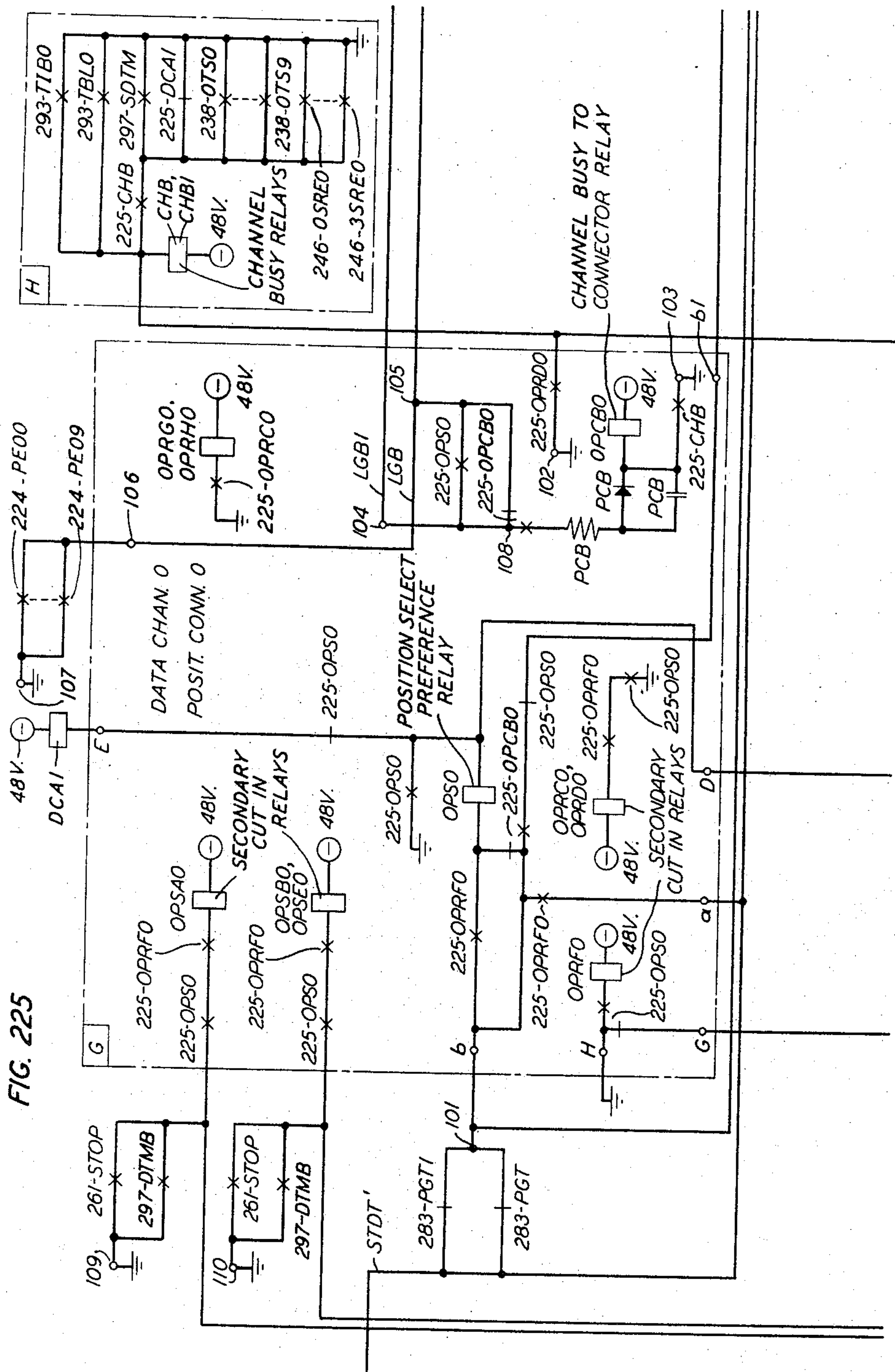


FIG. 225

Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 297

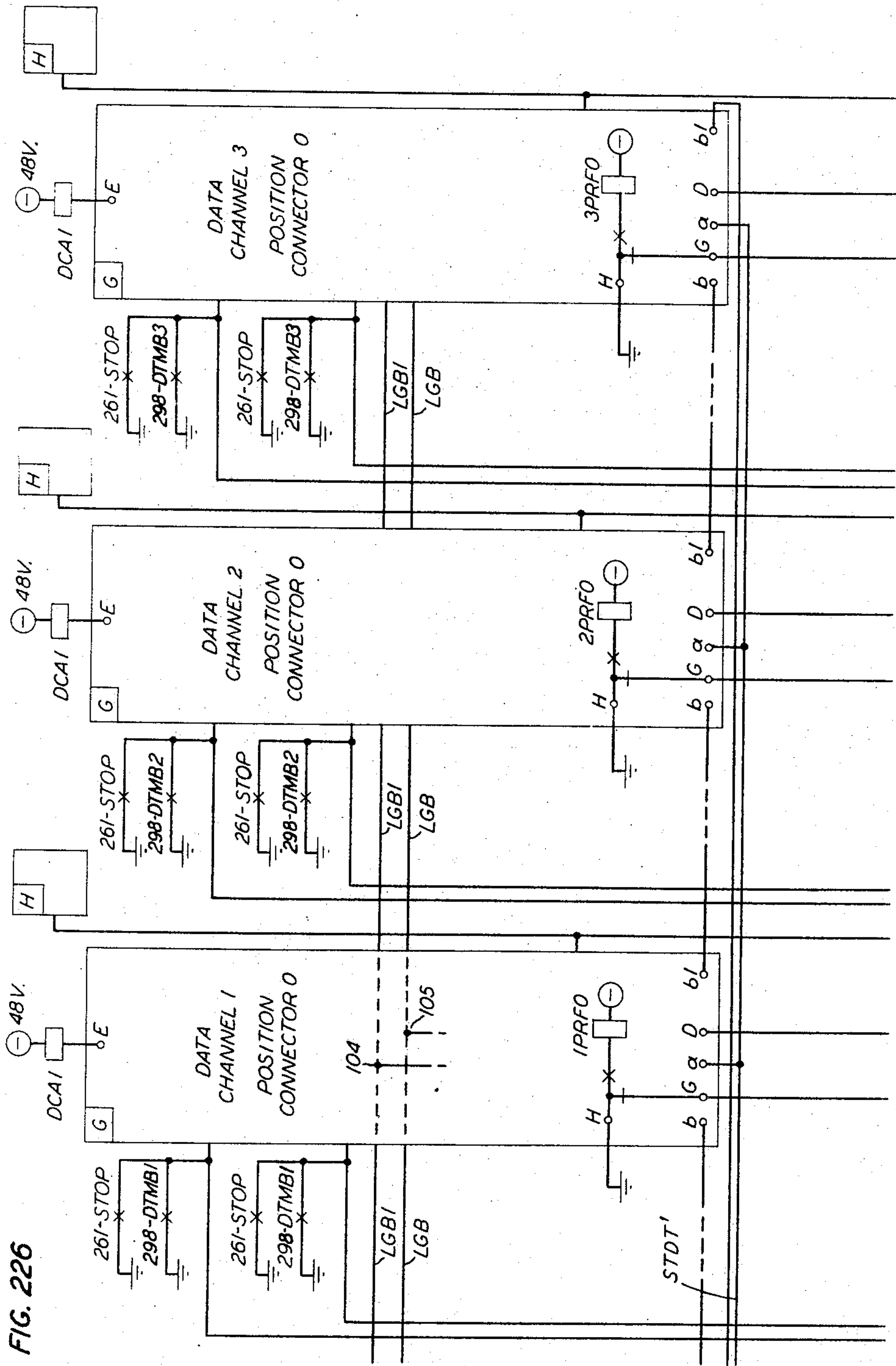


FIG. 226

Sept. 12, 1967

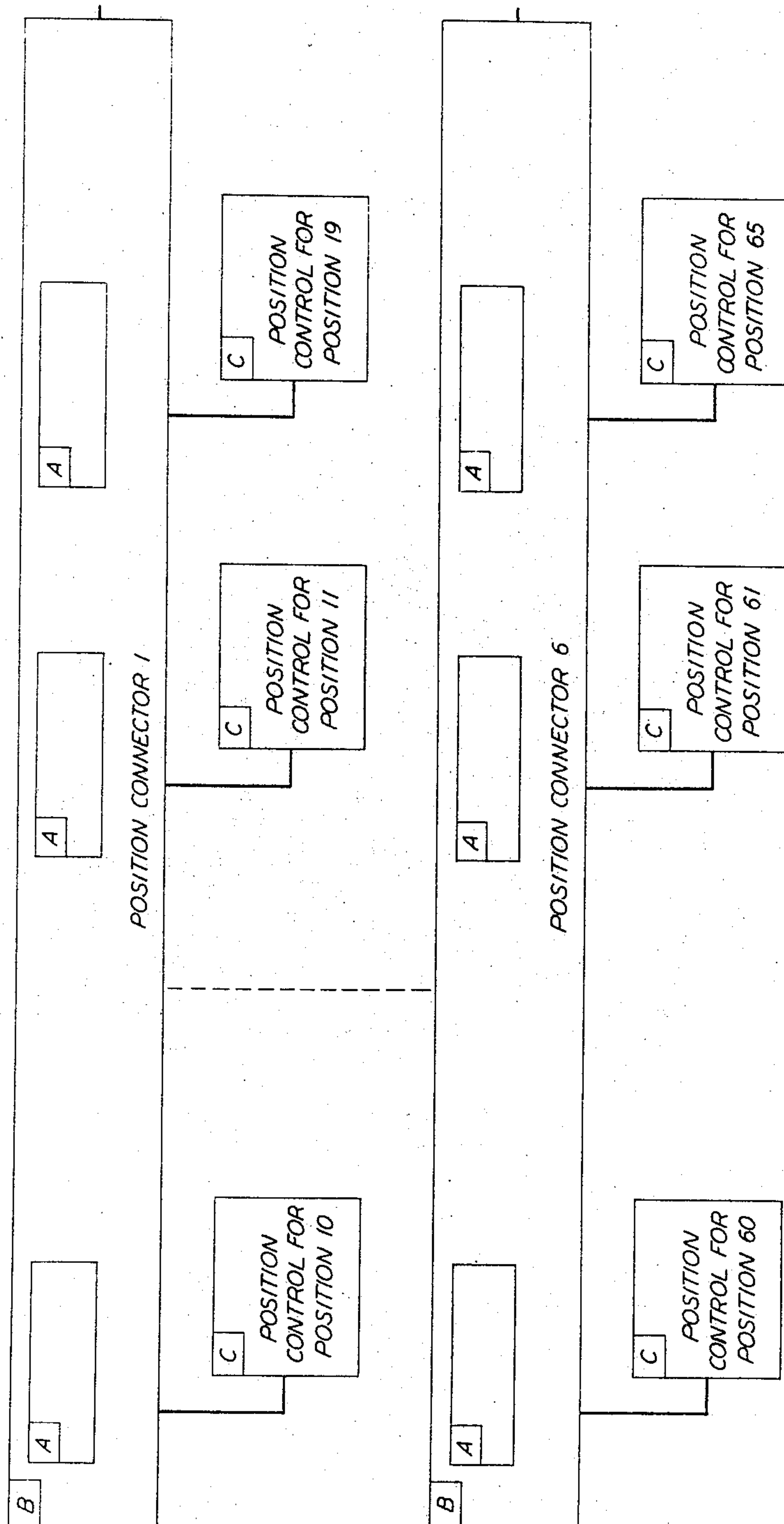
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 298

FIG. 227



Sept. 12, 1967

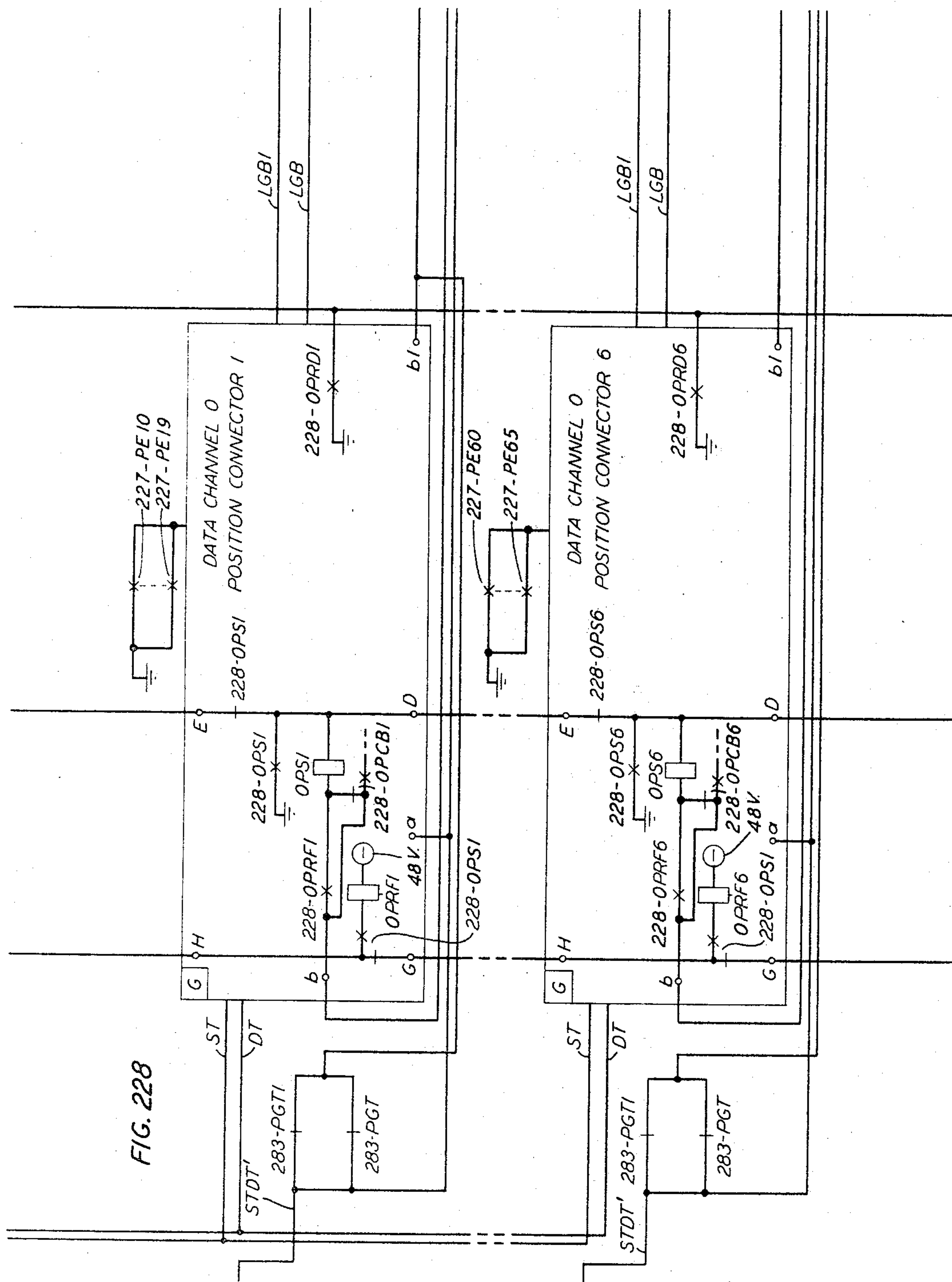
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 299



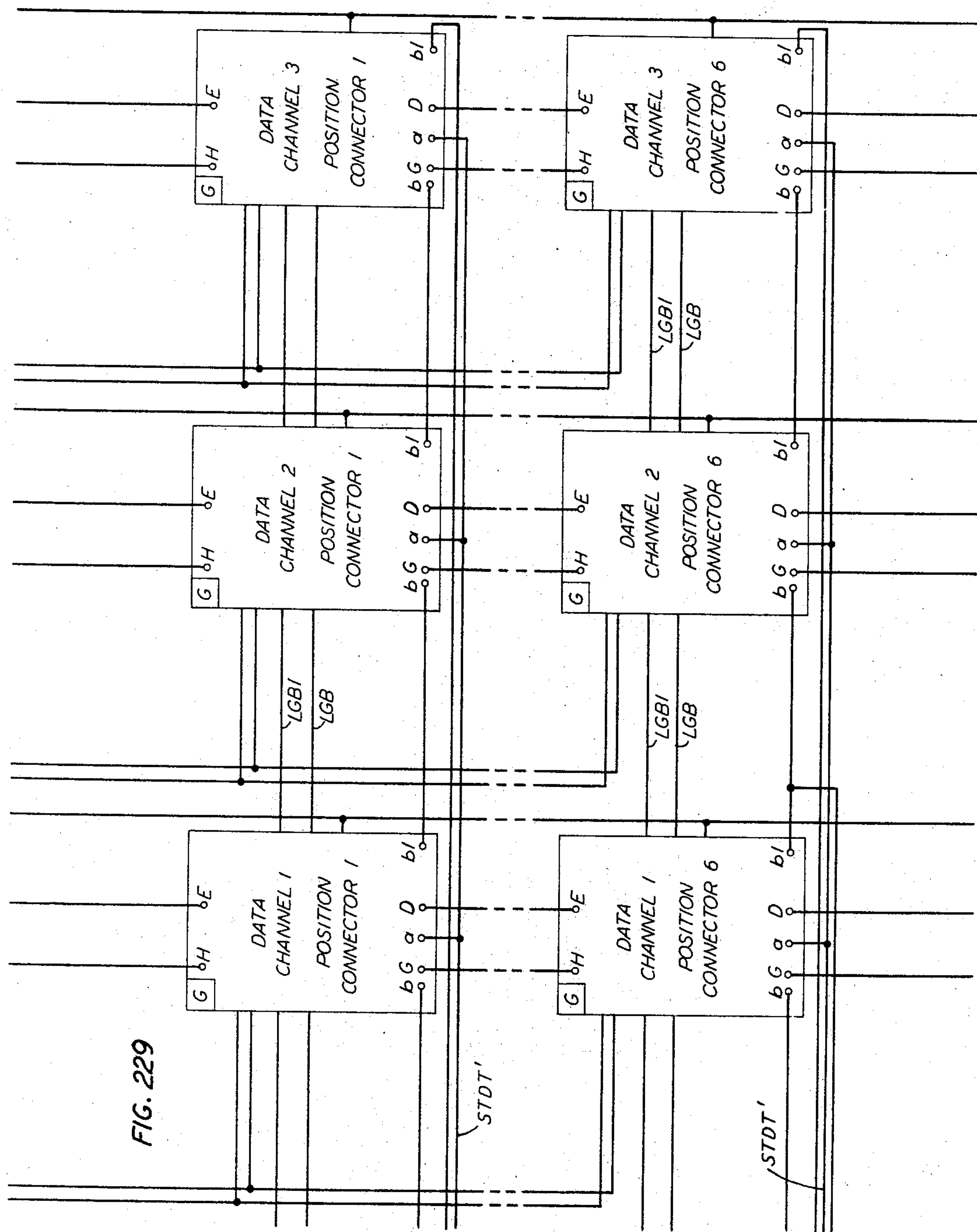
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 300



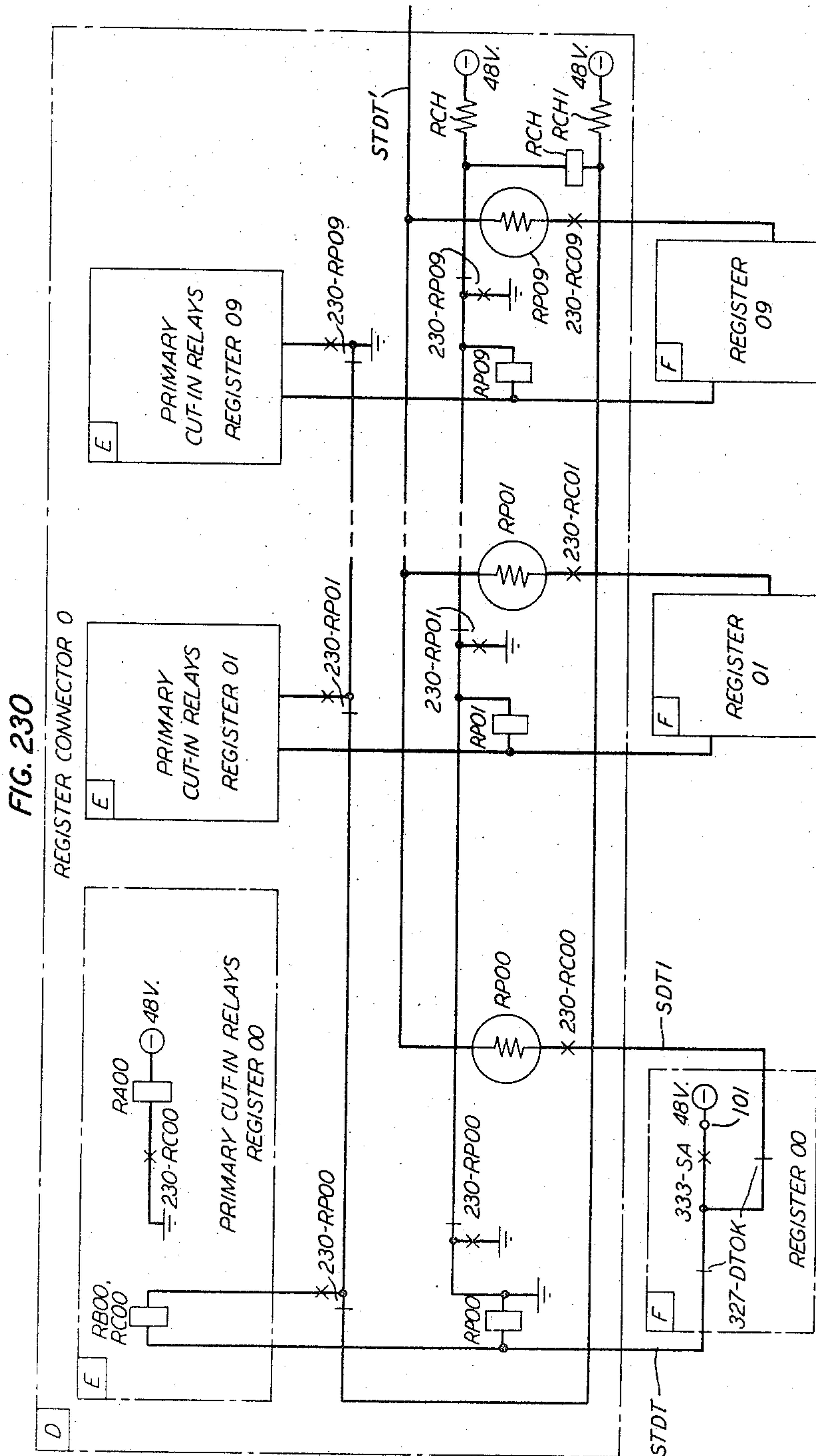
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 301



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 302

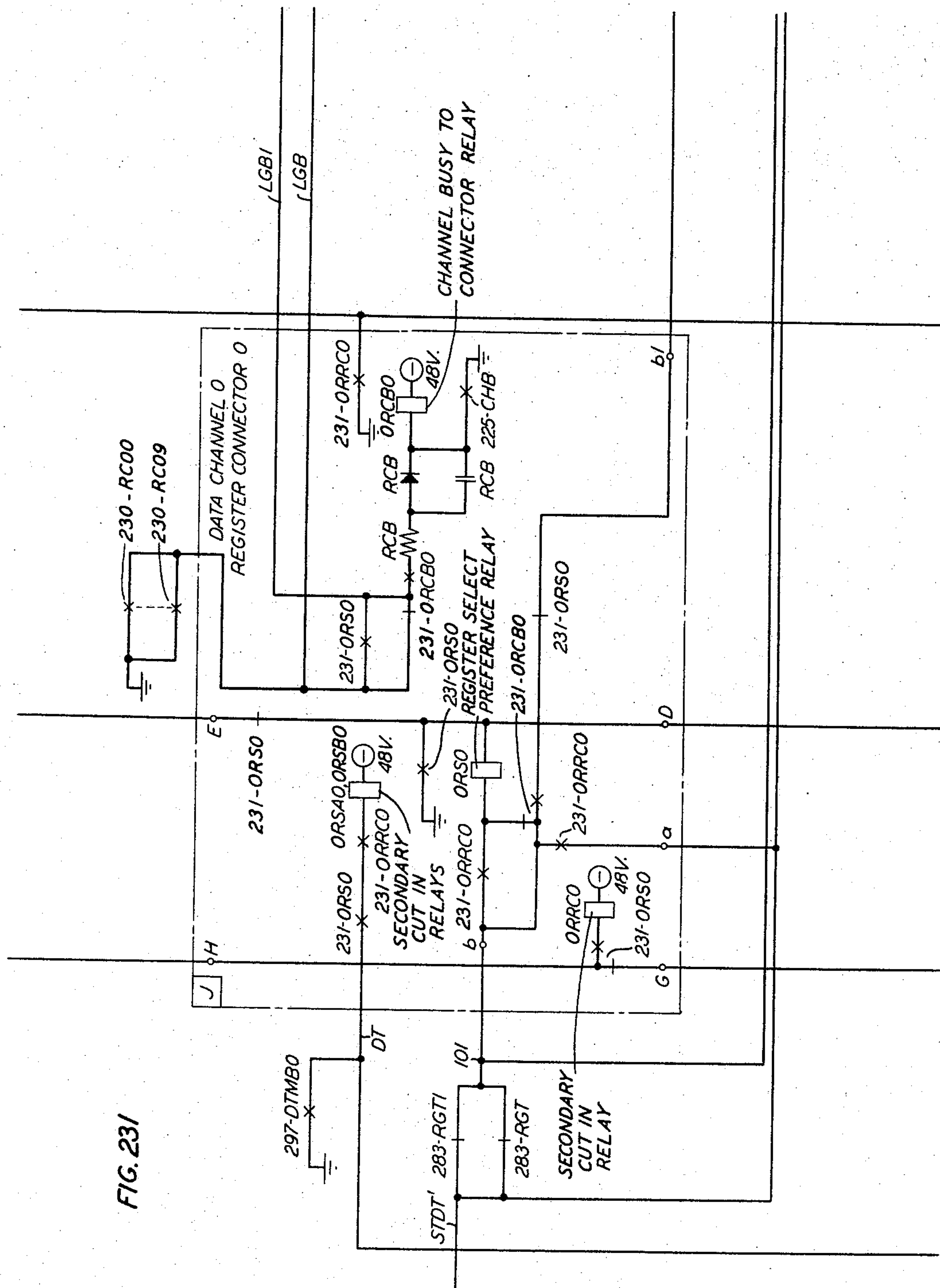


FIG. 231

Sept. 12, 1967

L. J. CERNY ET AL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 303



Sept. 12, 1967

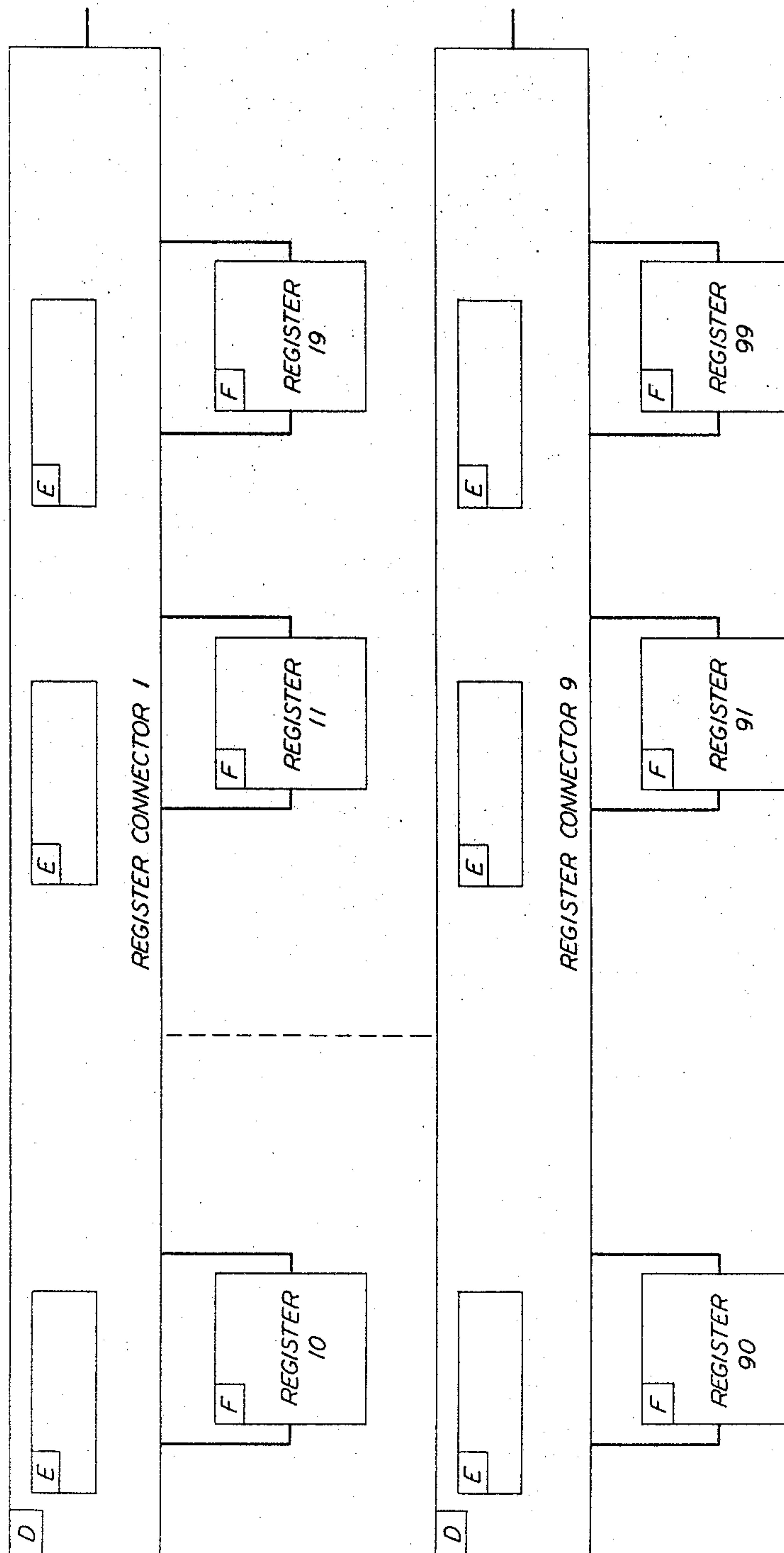
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 304

FIG. 233



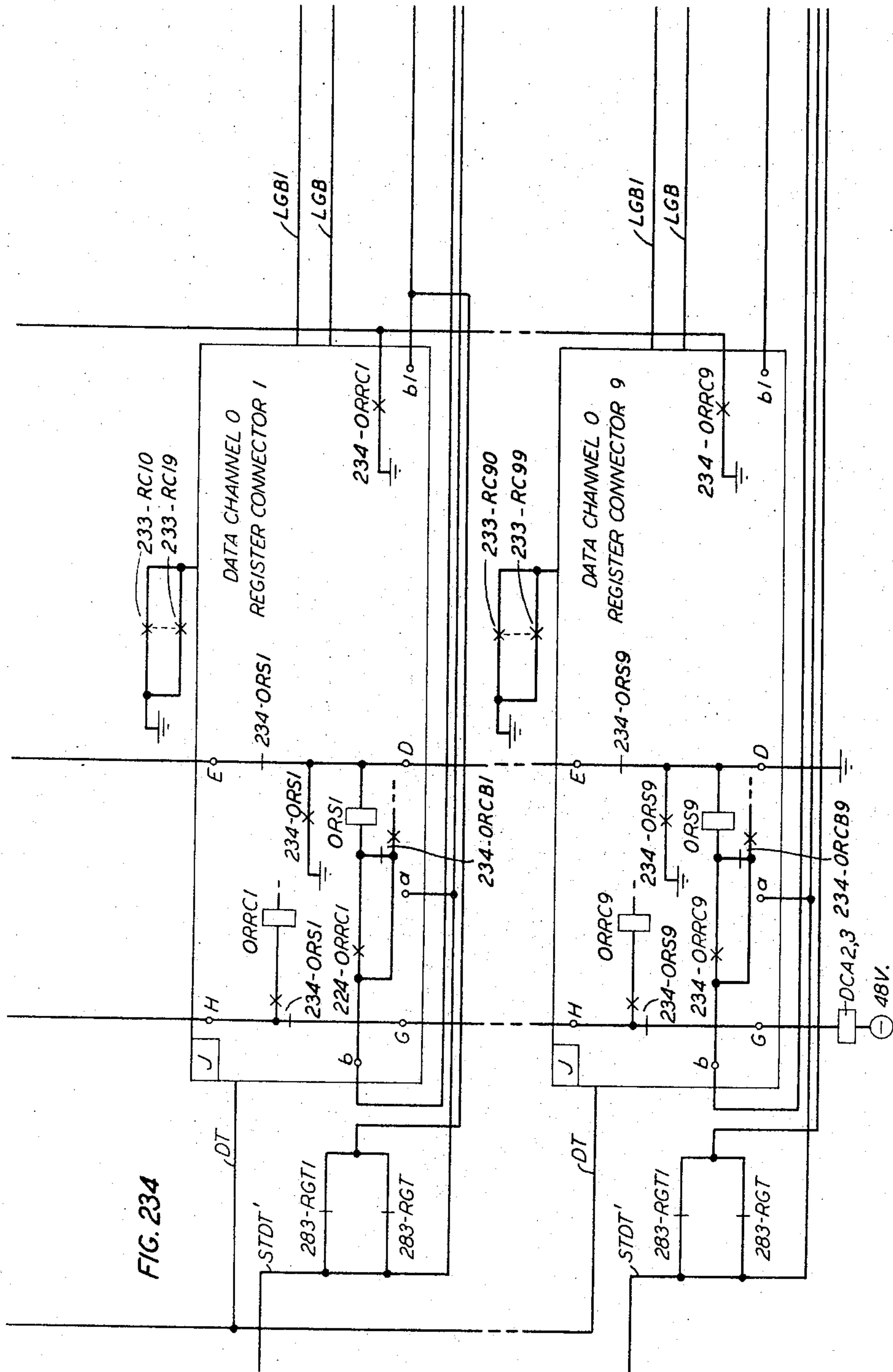
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 305



Sept. 12, 1967

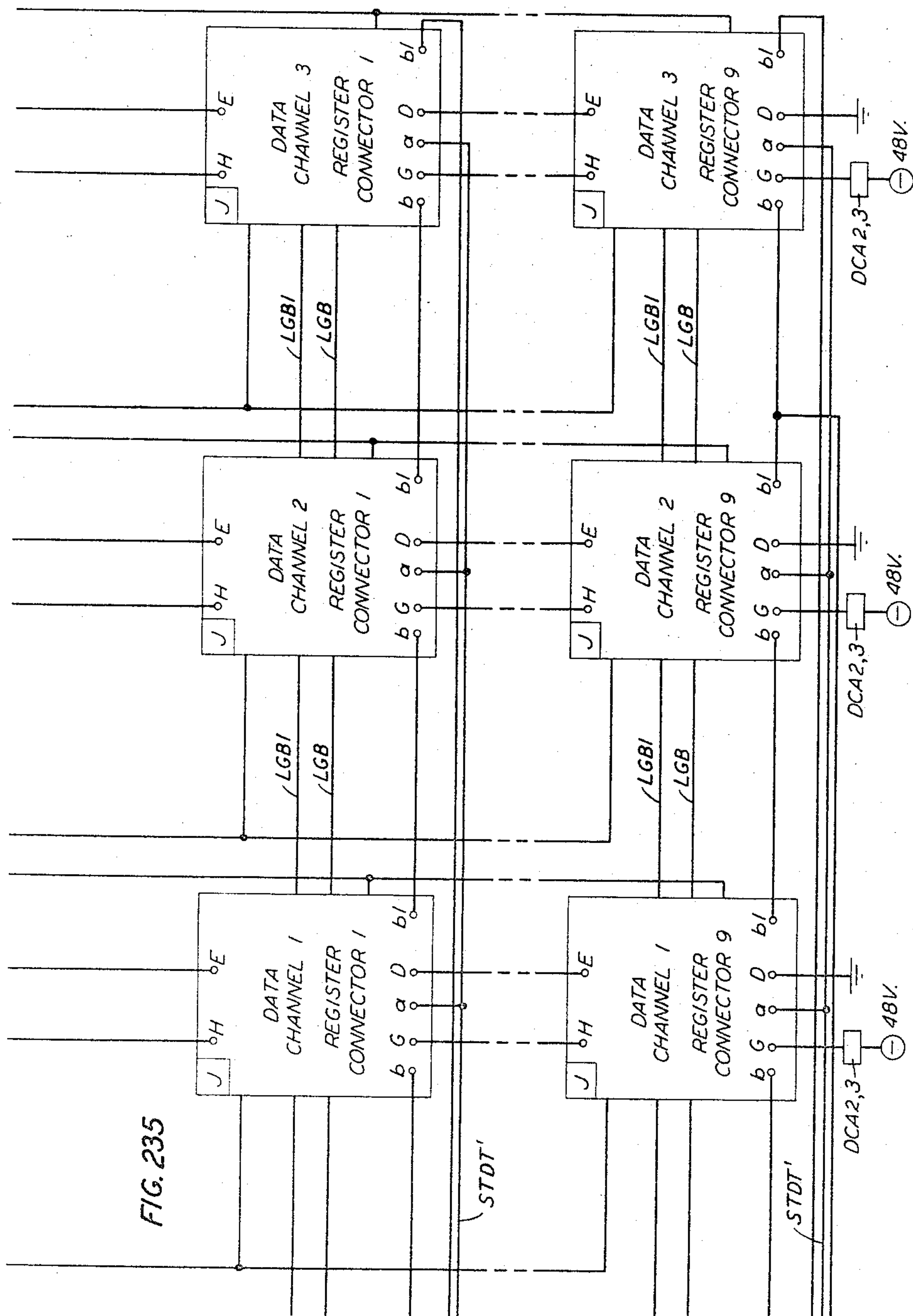
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 306



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 307

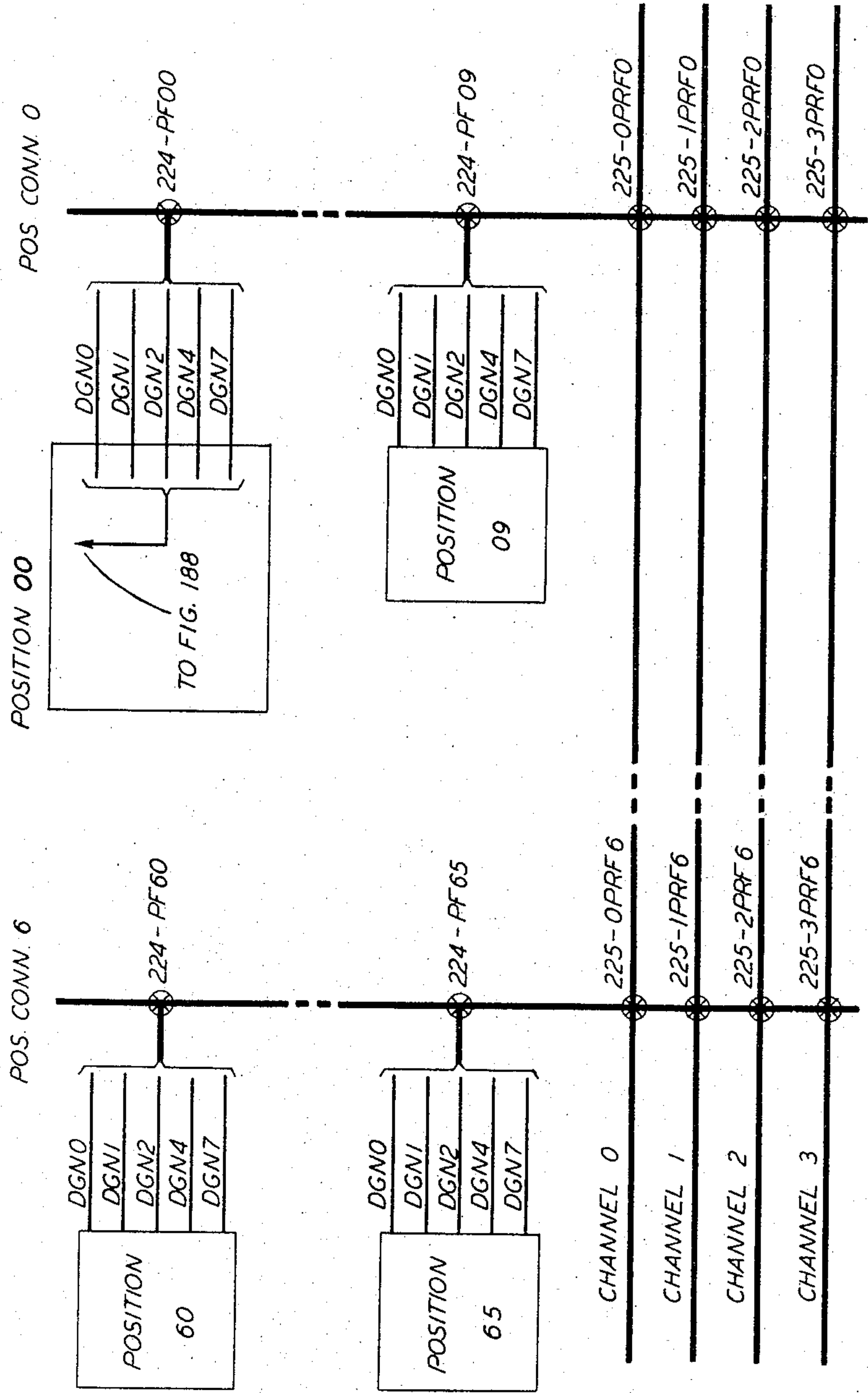


FIG. 236

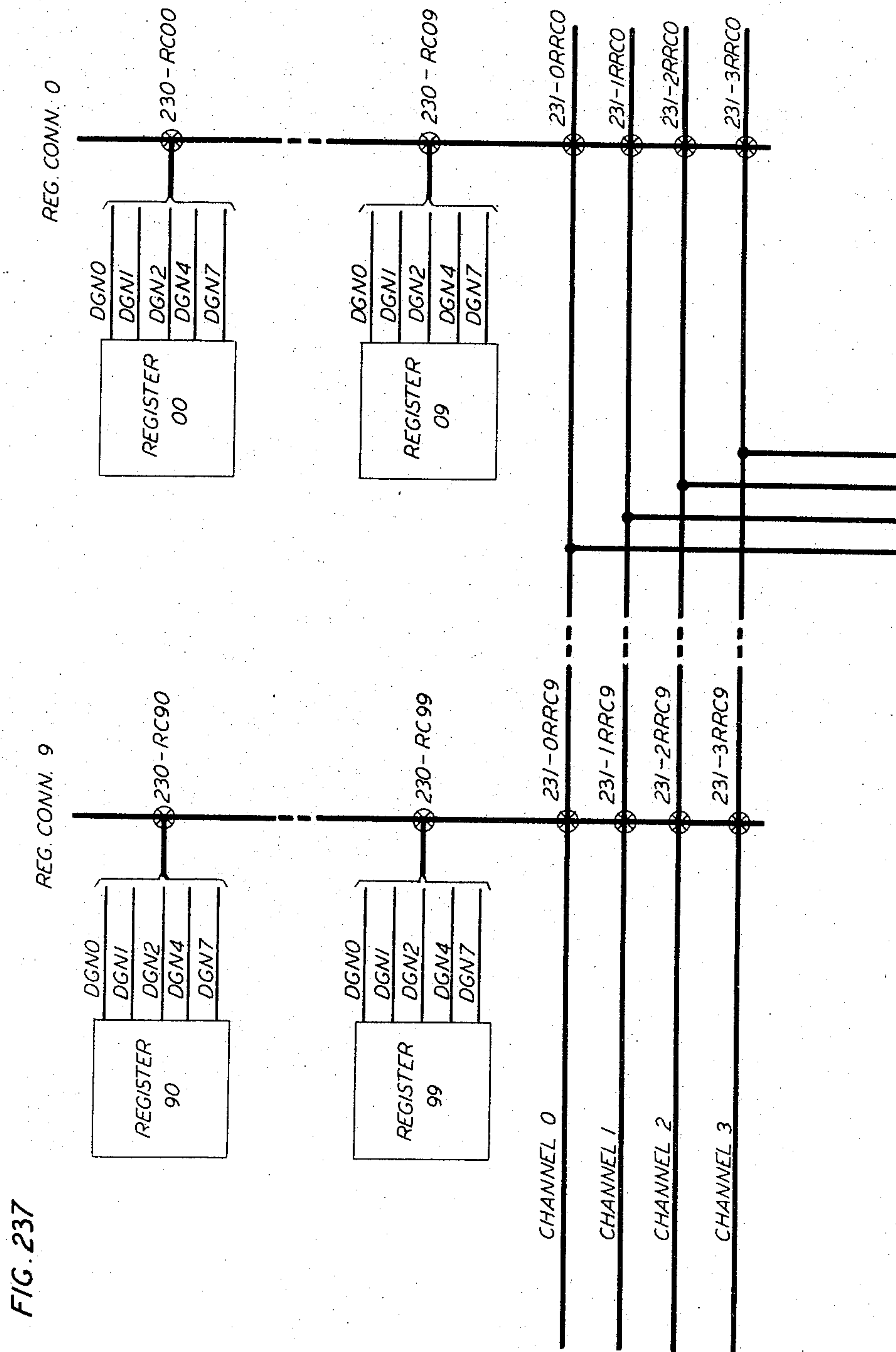
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 308



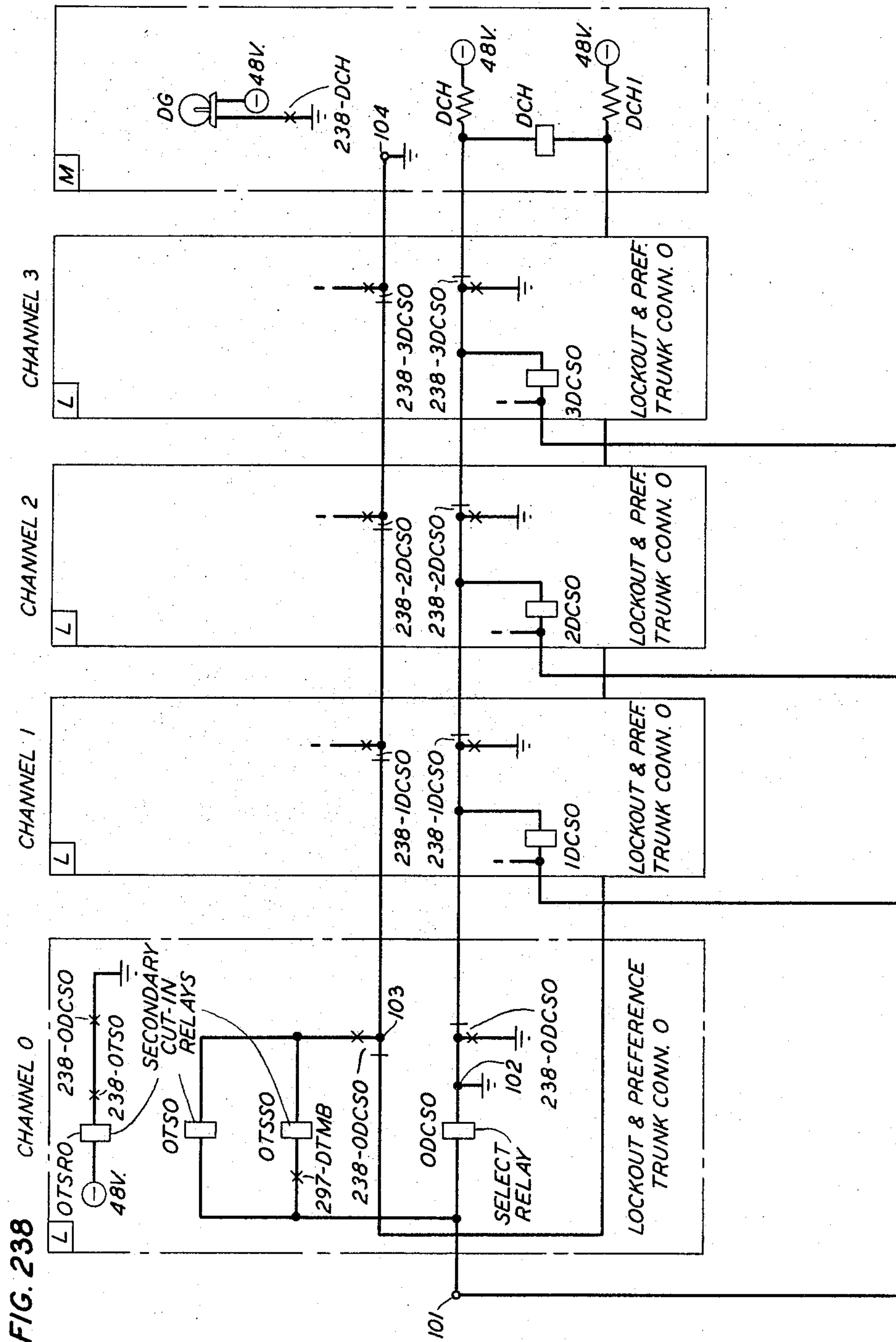
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 309



Sept. 12, 1967

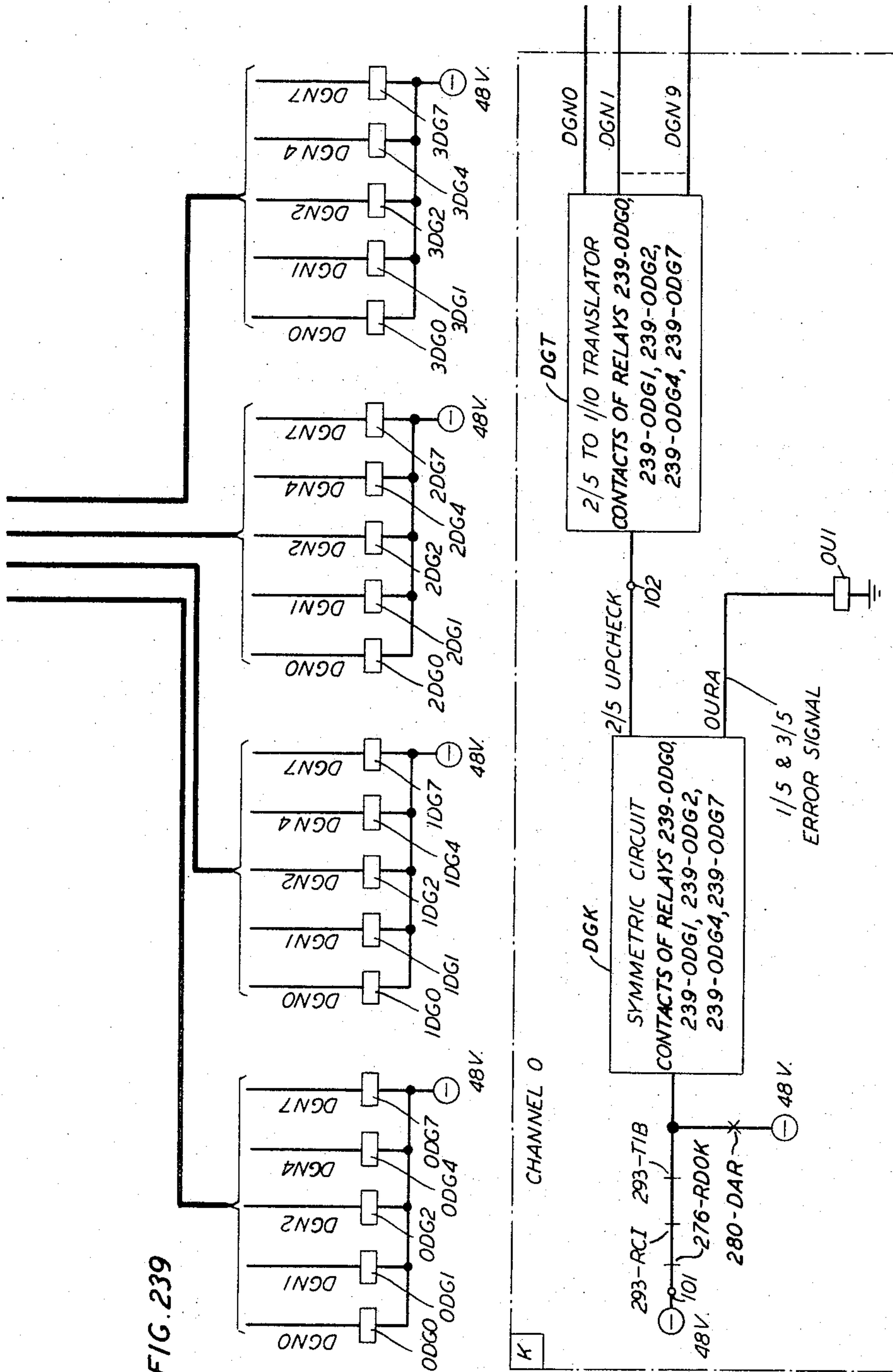
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 310

FIG. 239



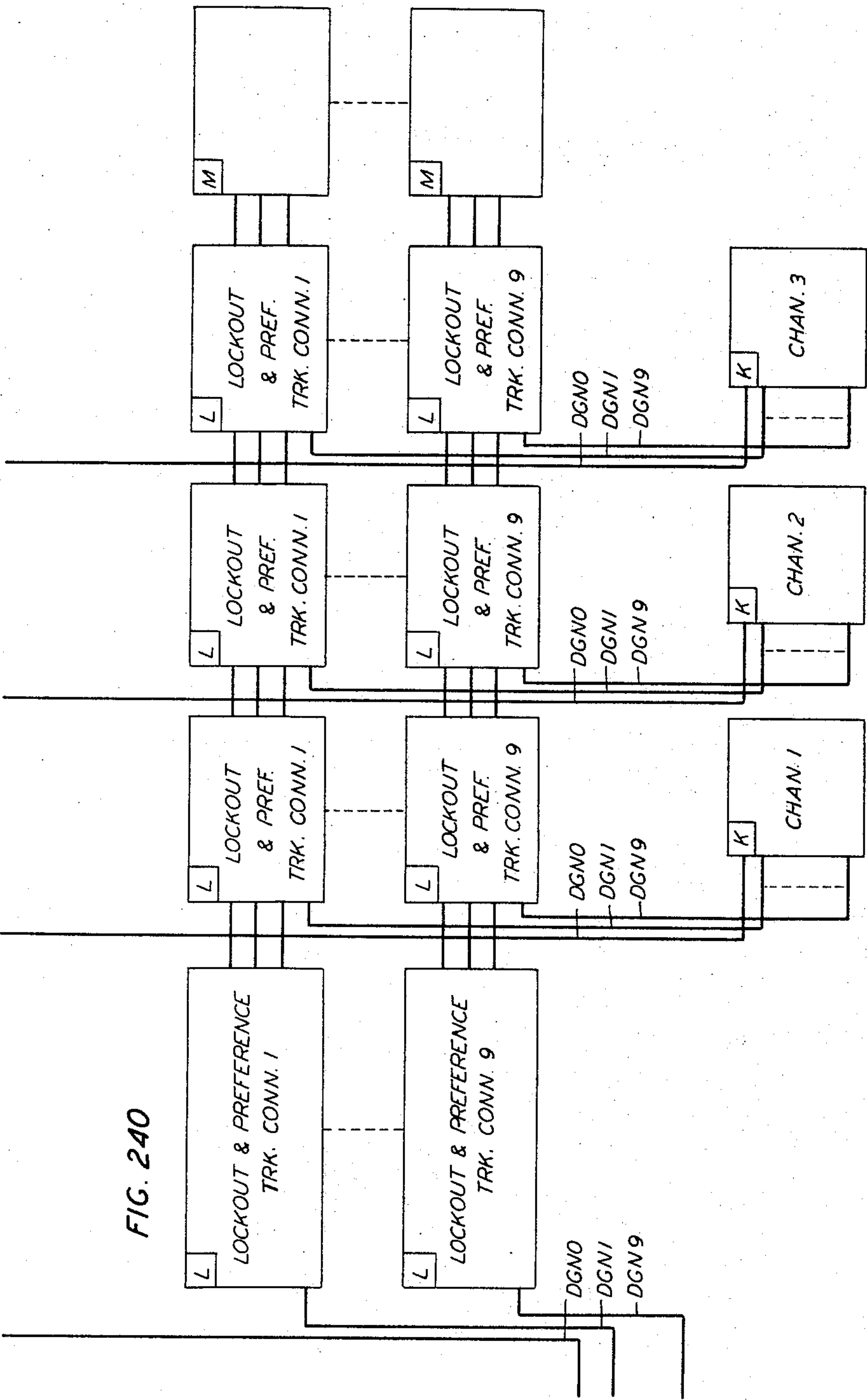
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 311



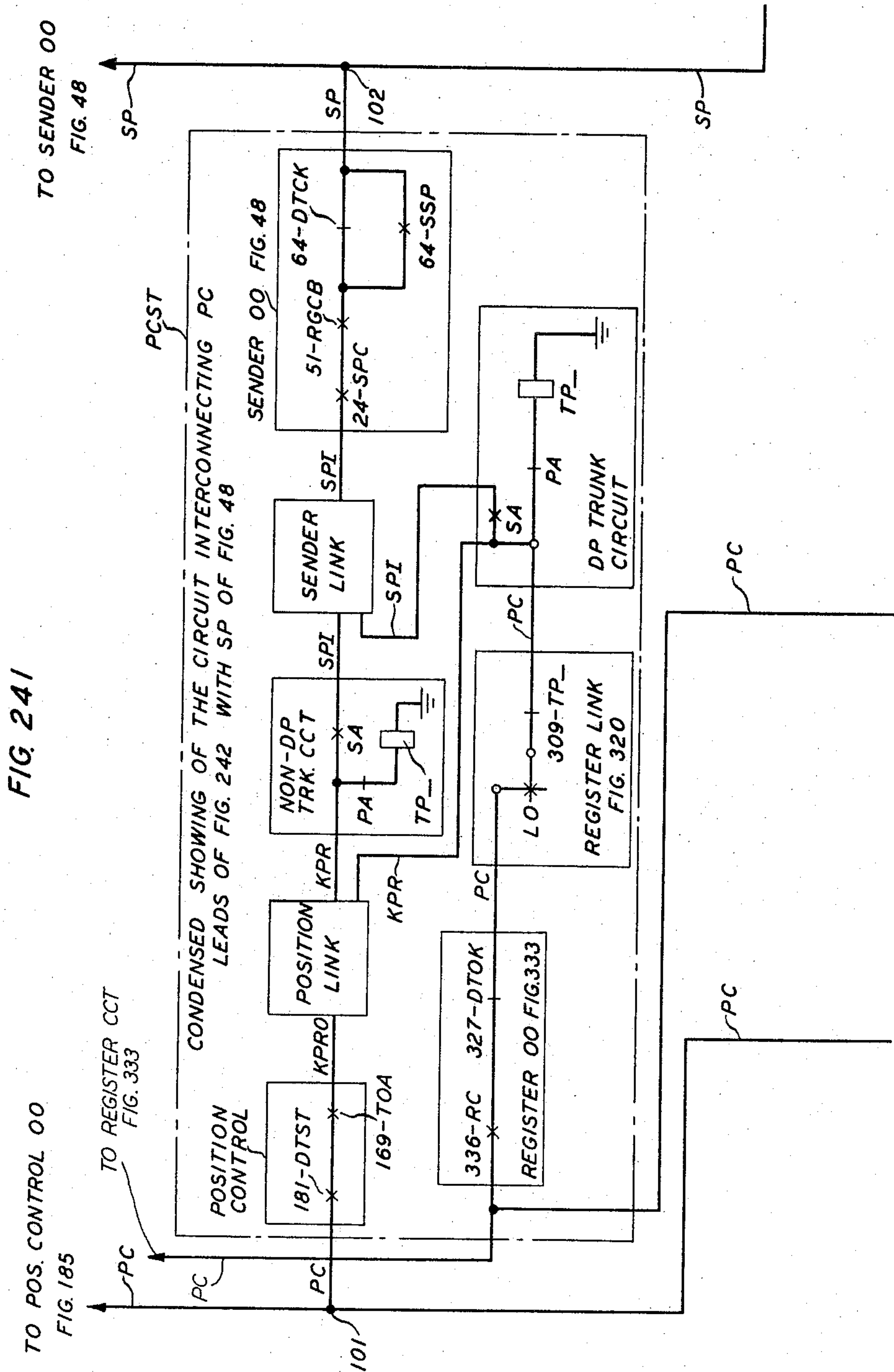
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

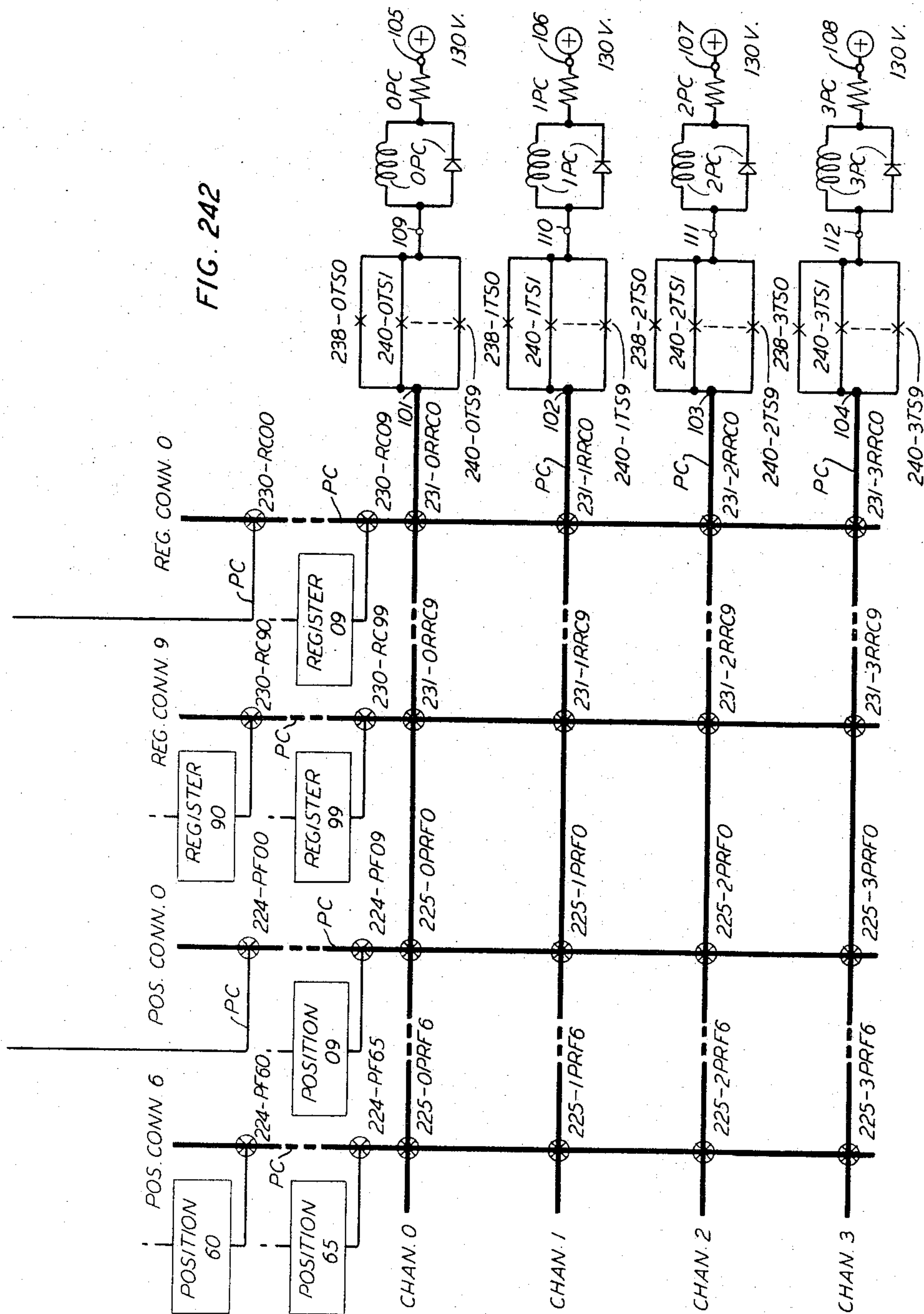
570 Sheets-Sheet 312



Filed Nov. 26, 1963

570 Sheets-Sheet 313

570 Sheets-Sheet 313



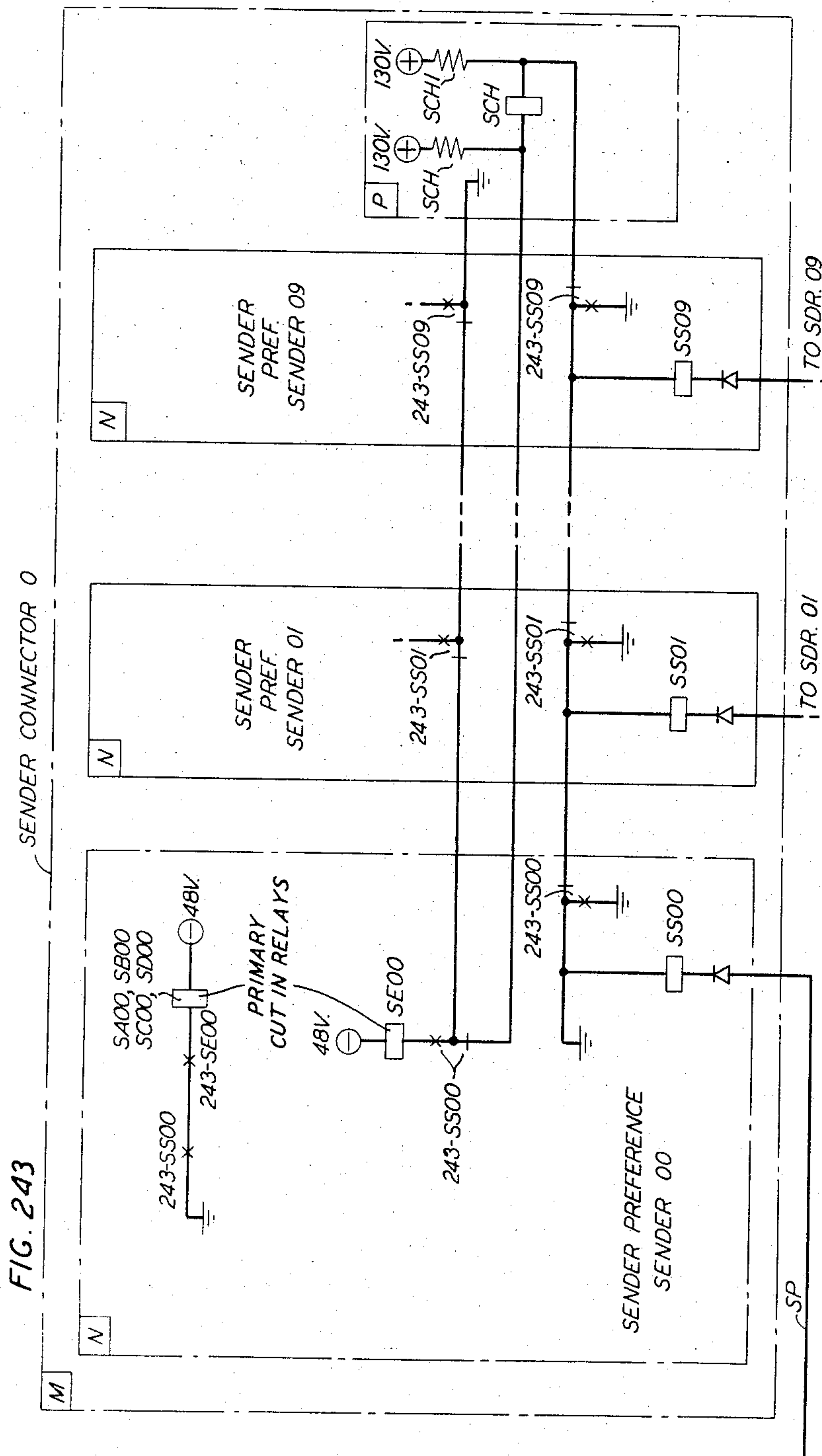
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 314



Sept. 12, 1967

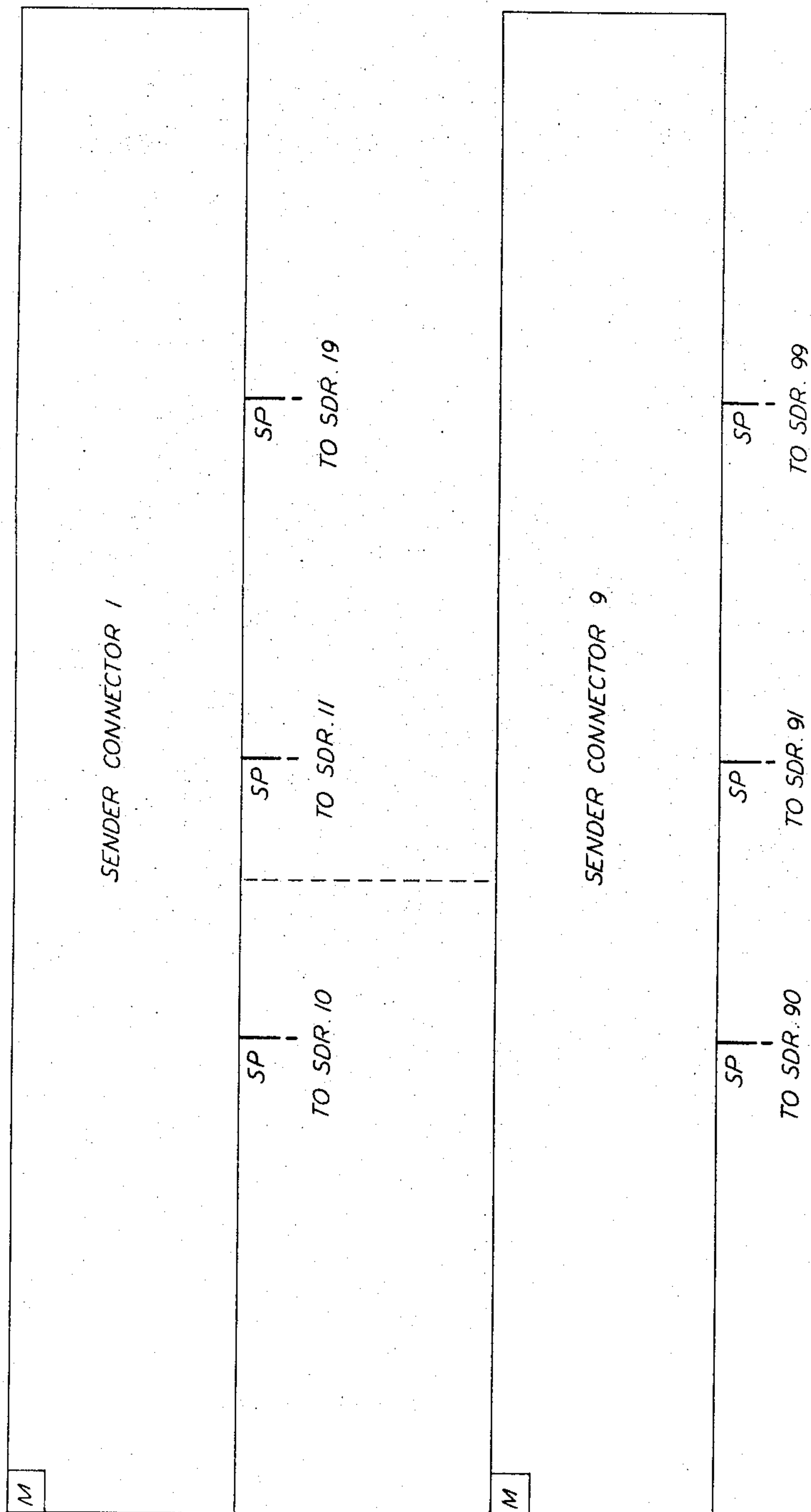
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 315

FIG. 244



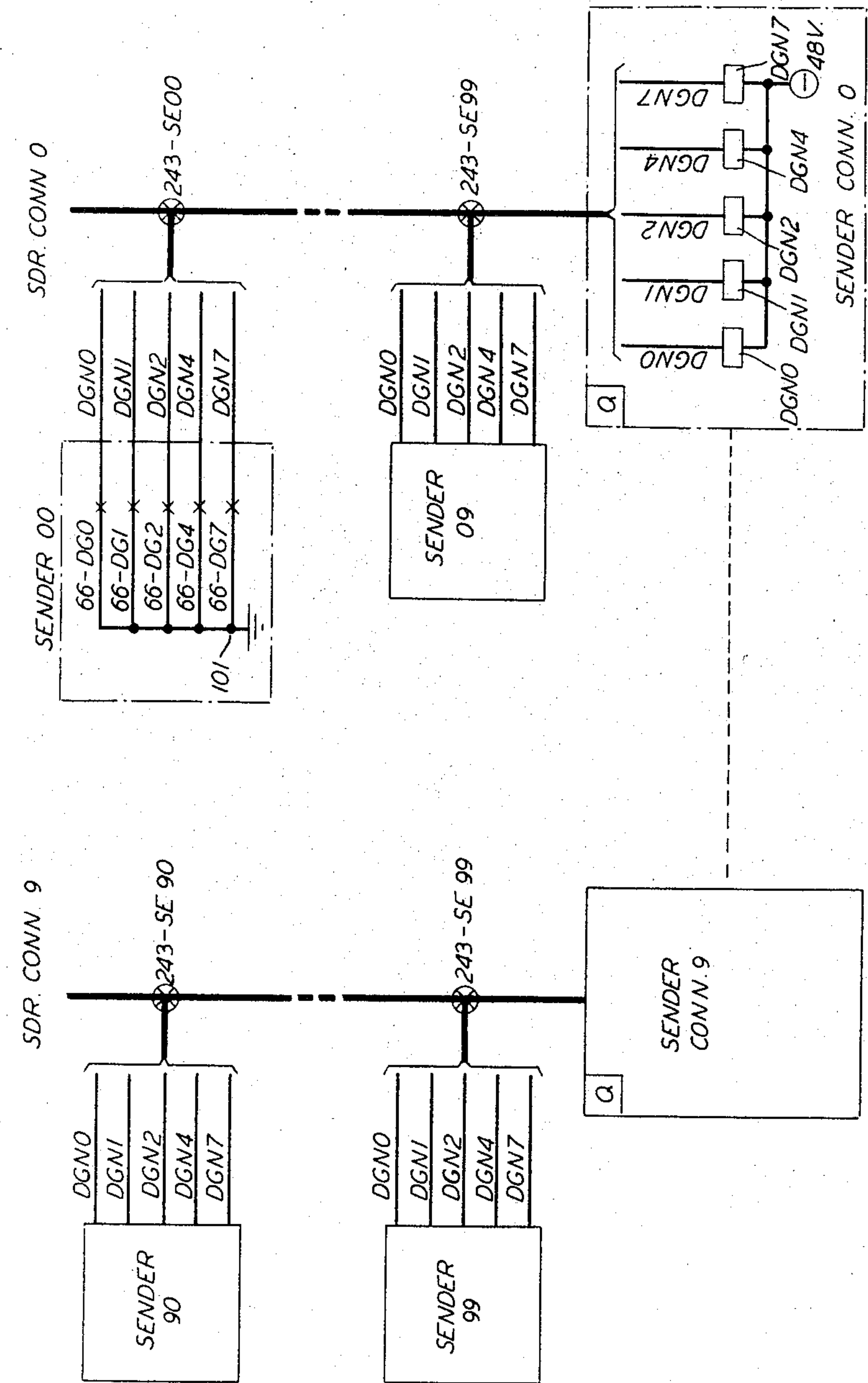
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 316



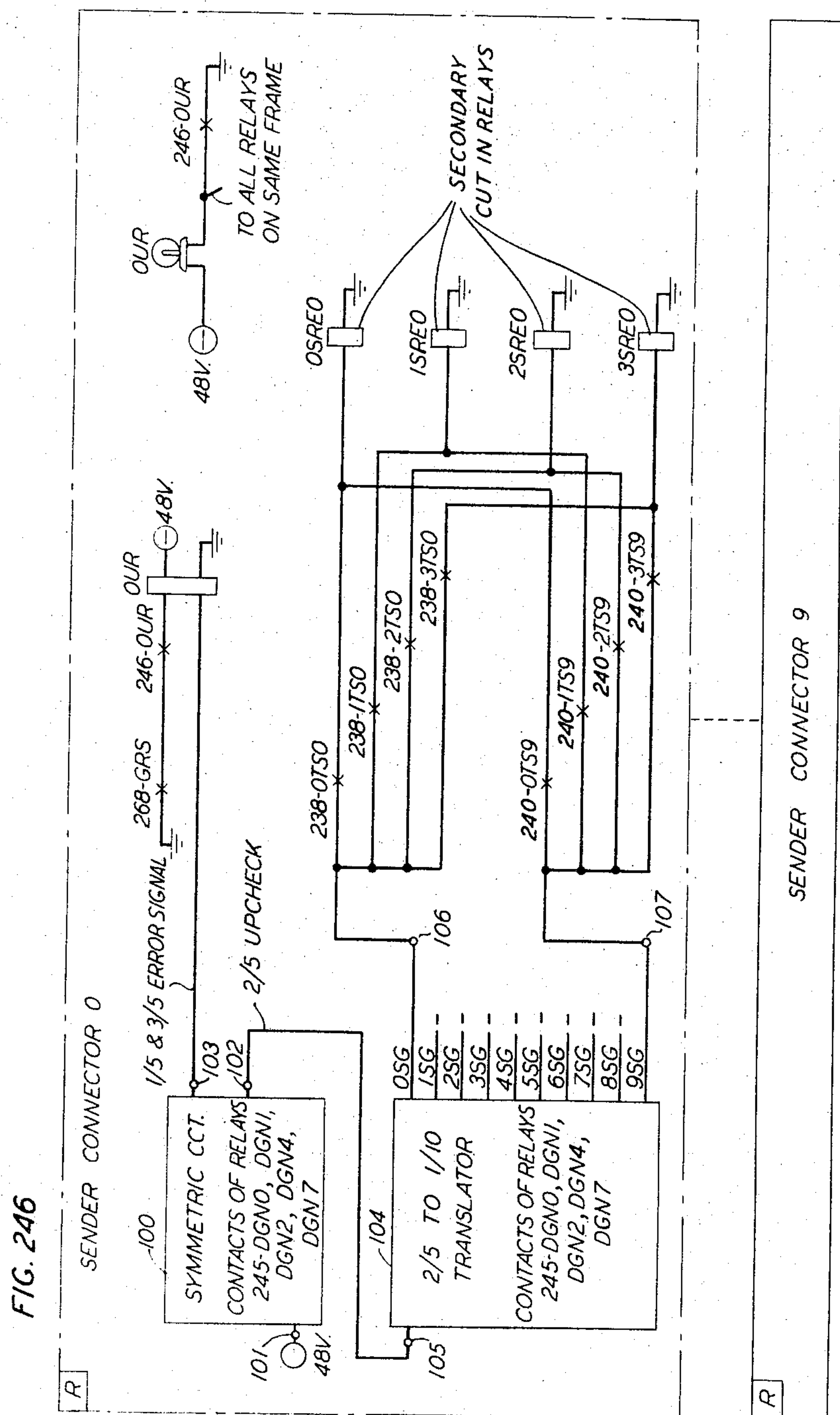
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 317



Sept. 12, 1967

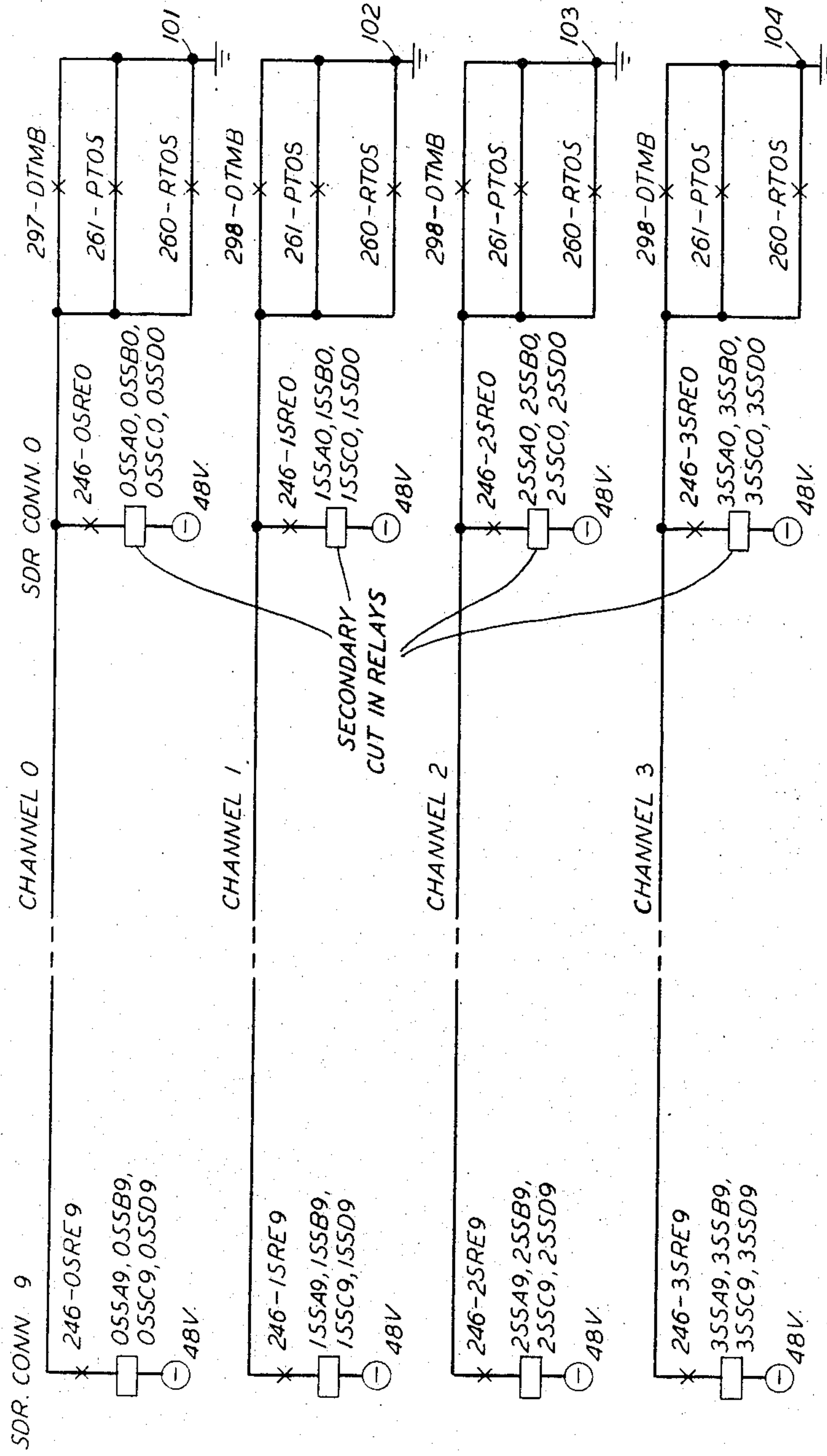
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 318

FIG. 247

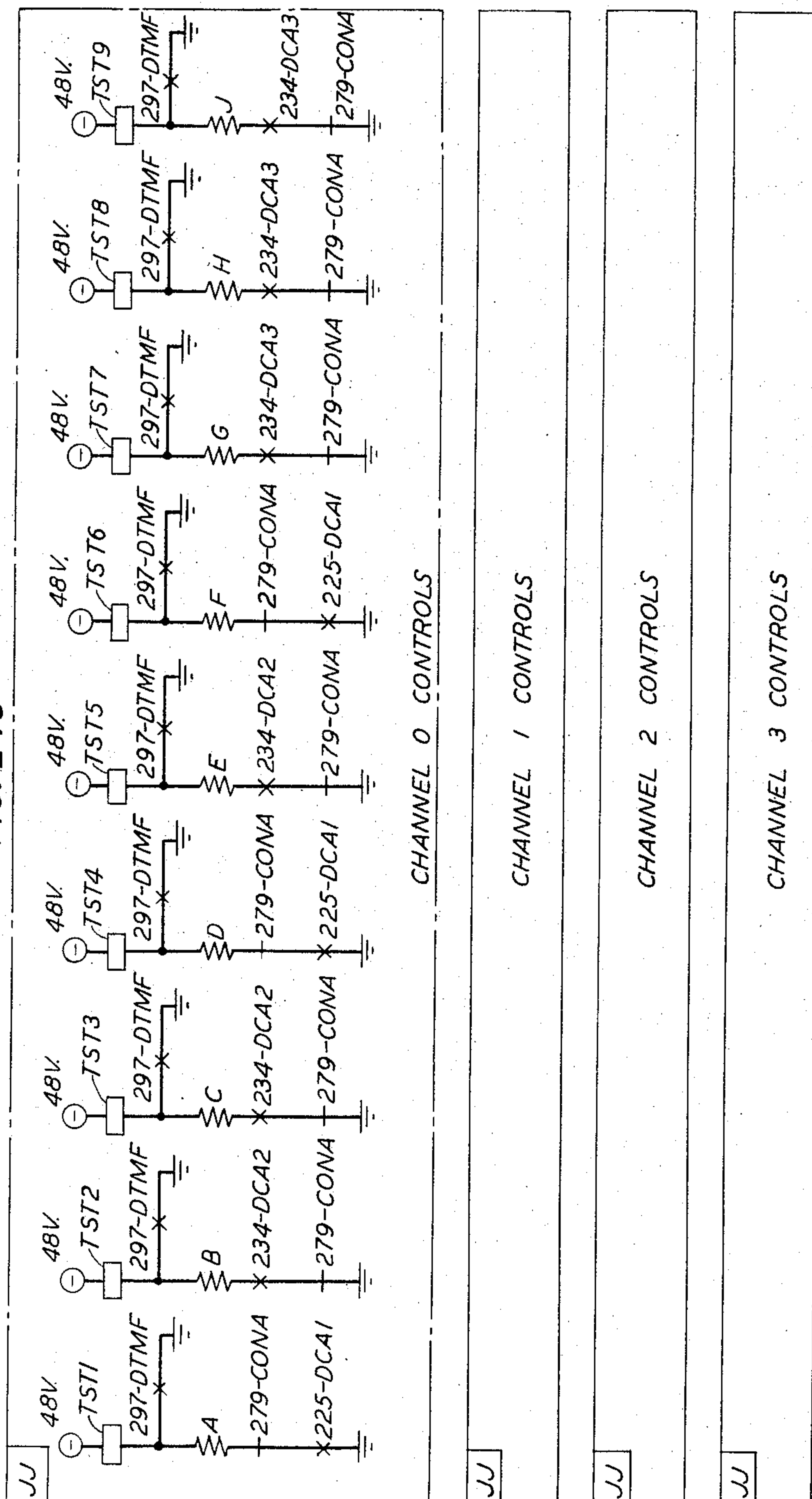


Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 319

FIG. 248



Sept. 12, 1967

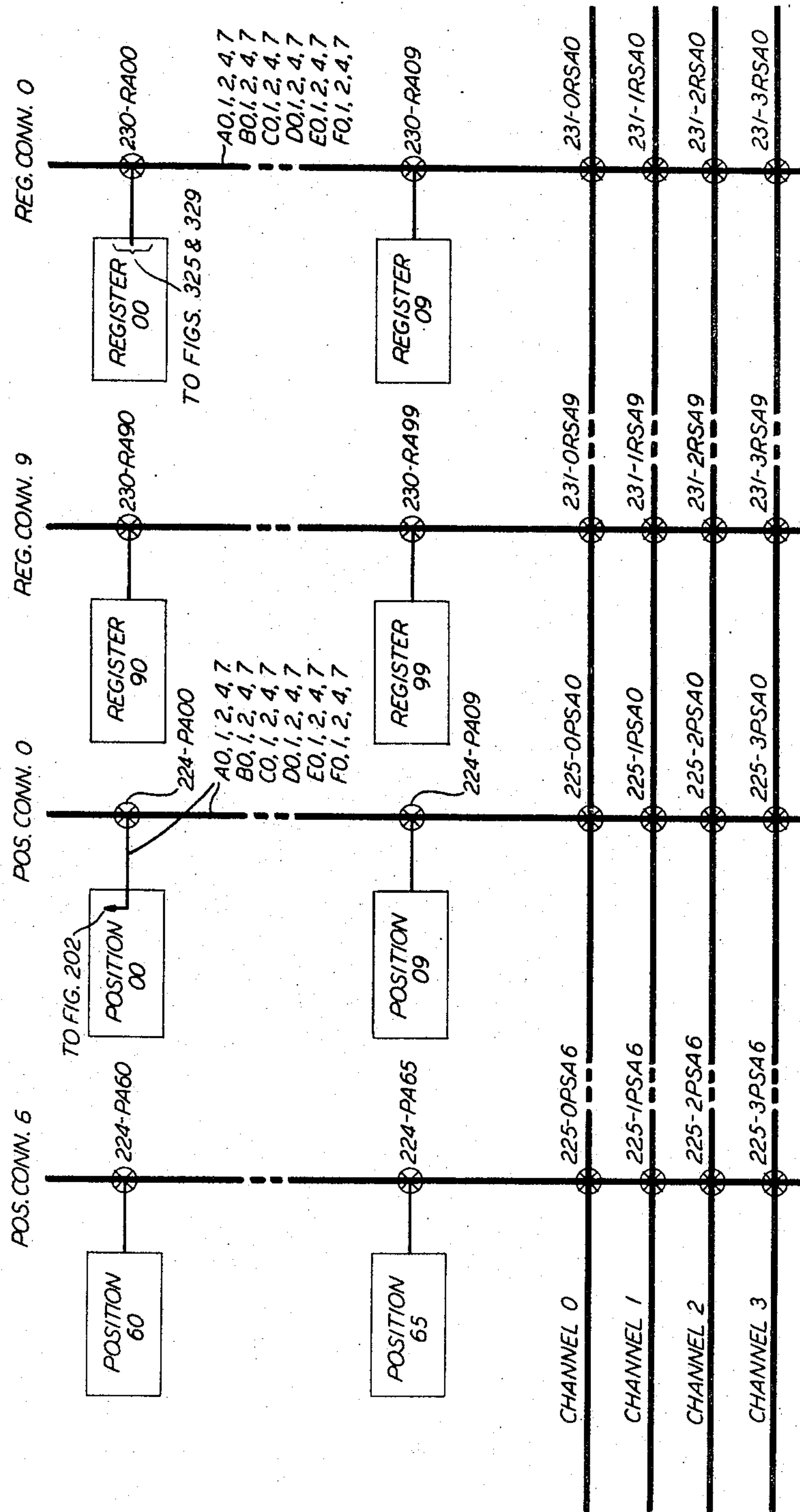
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 320

FIG. 249



Sept. 12, 1967

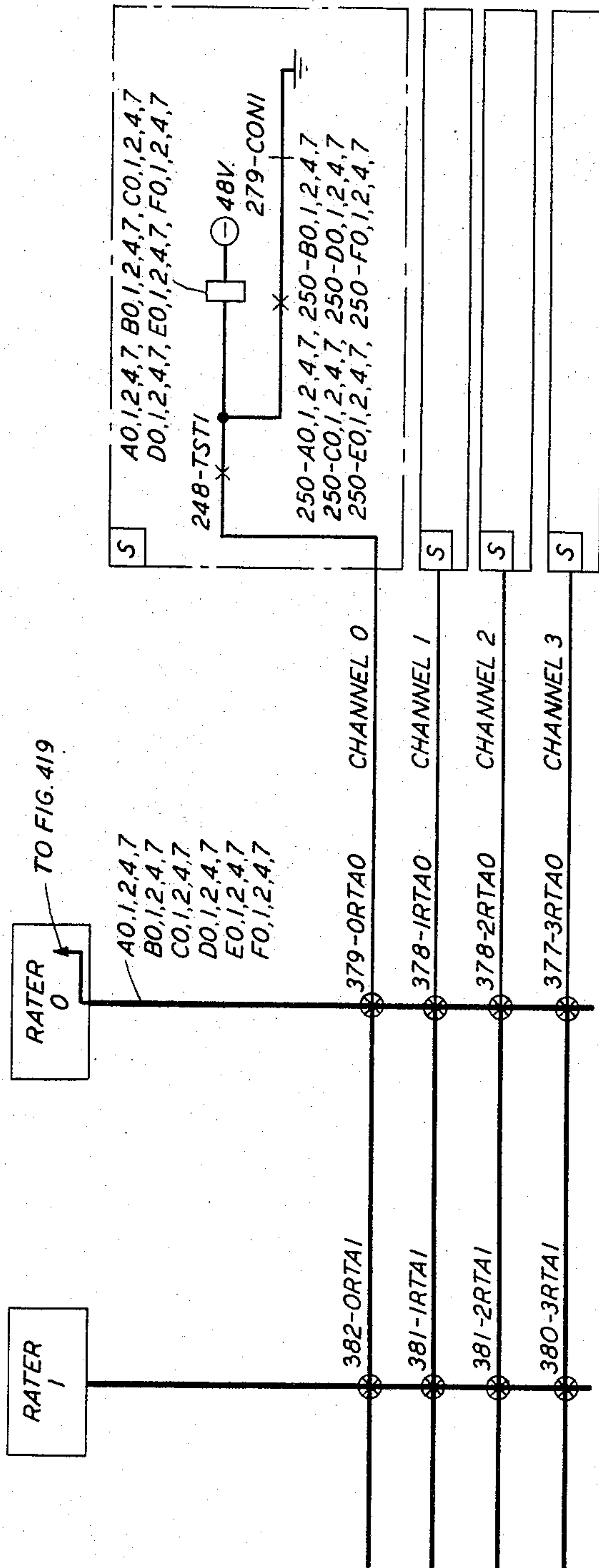
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 321

FIG. 250



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 322

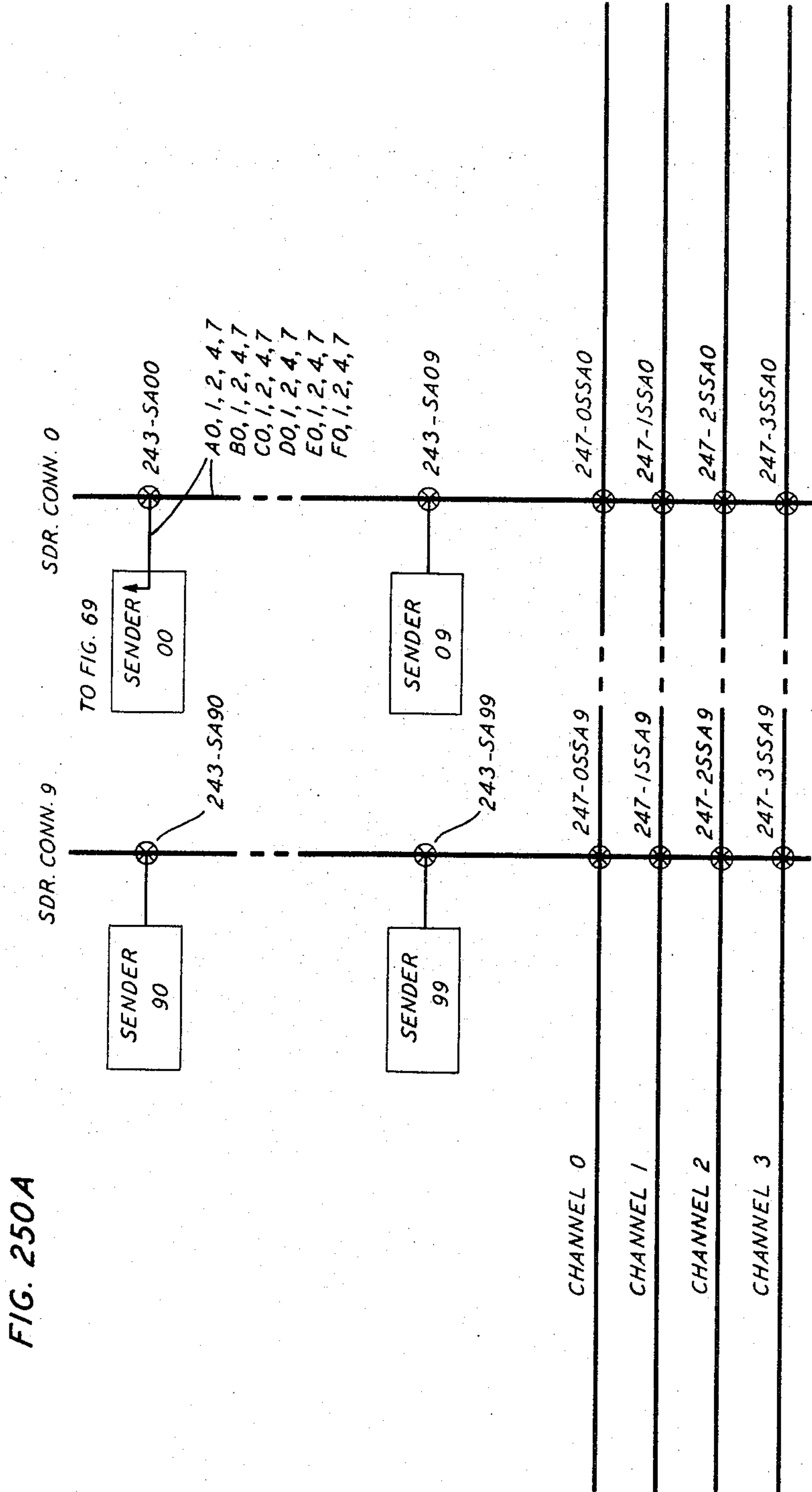


FIG. 250A

Sept. 12, 1967

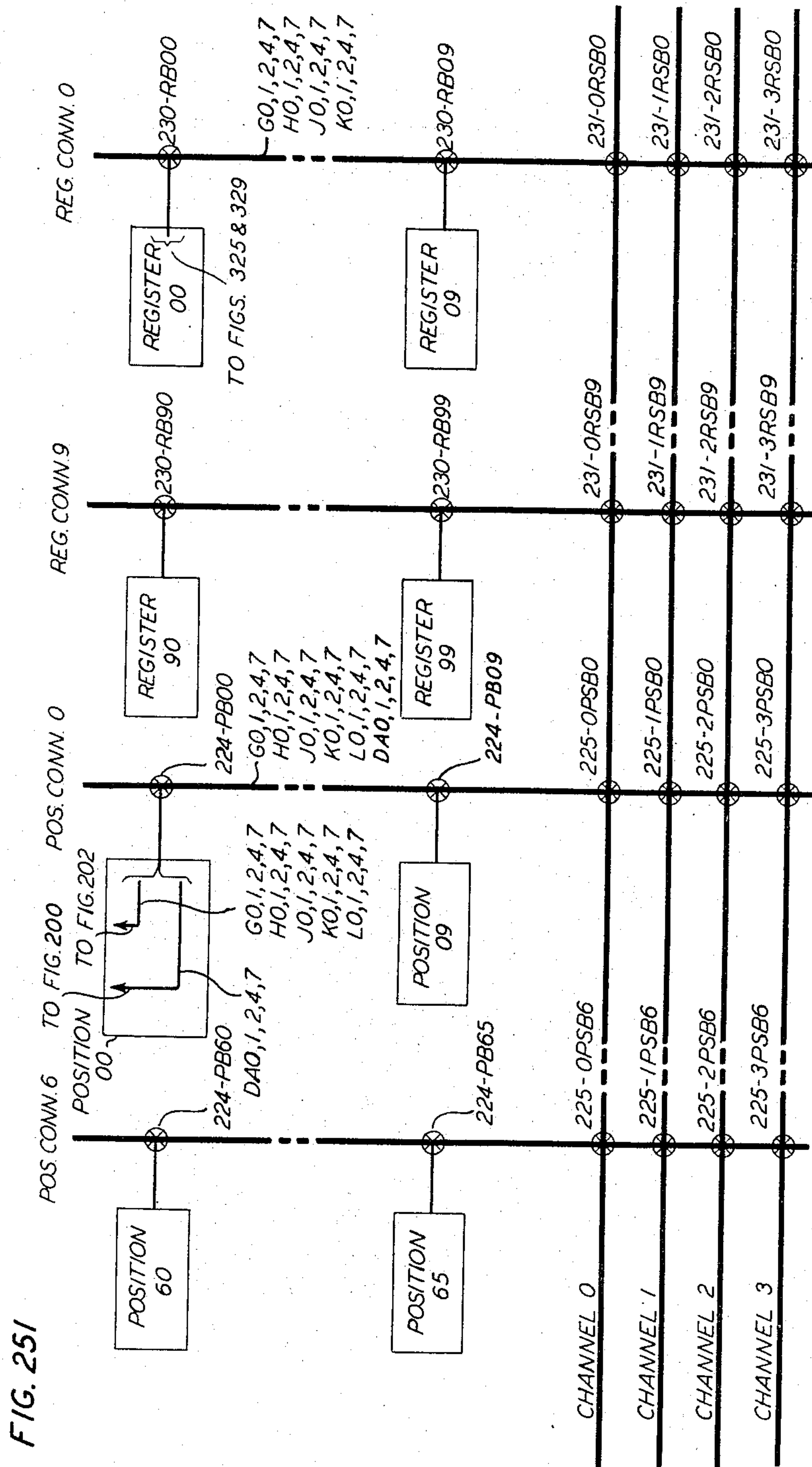
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 323



Sept. 12, 1967

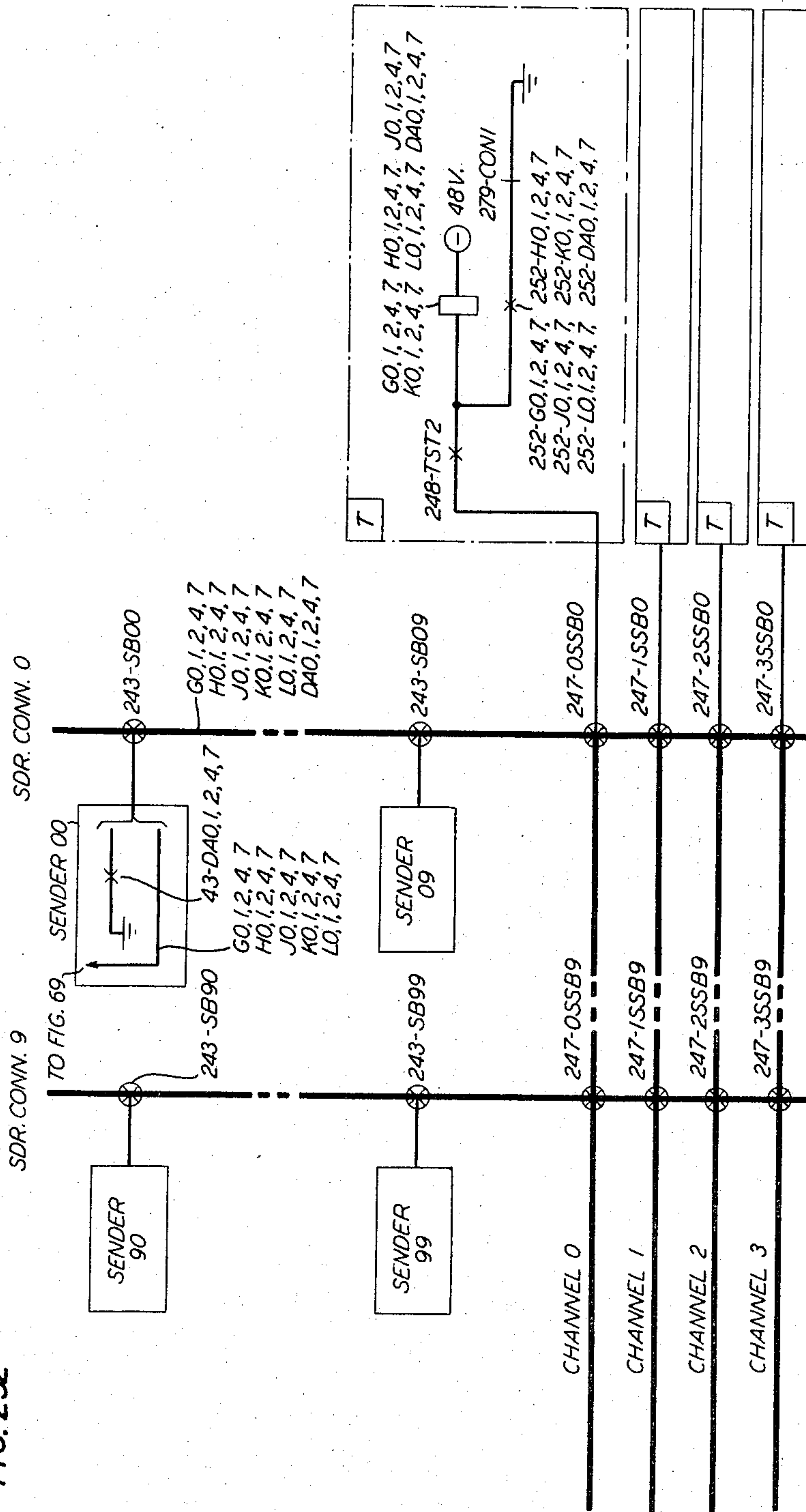
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 324

FIG. 252



Sept. 12, 1967

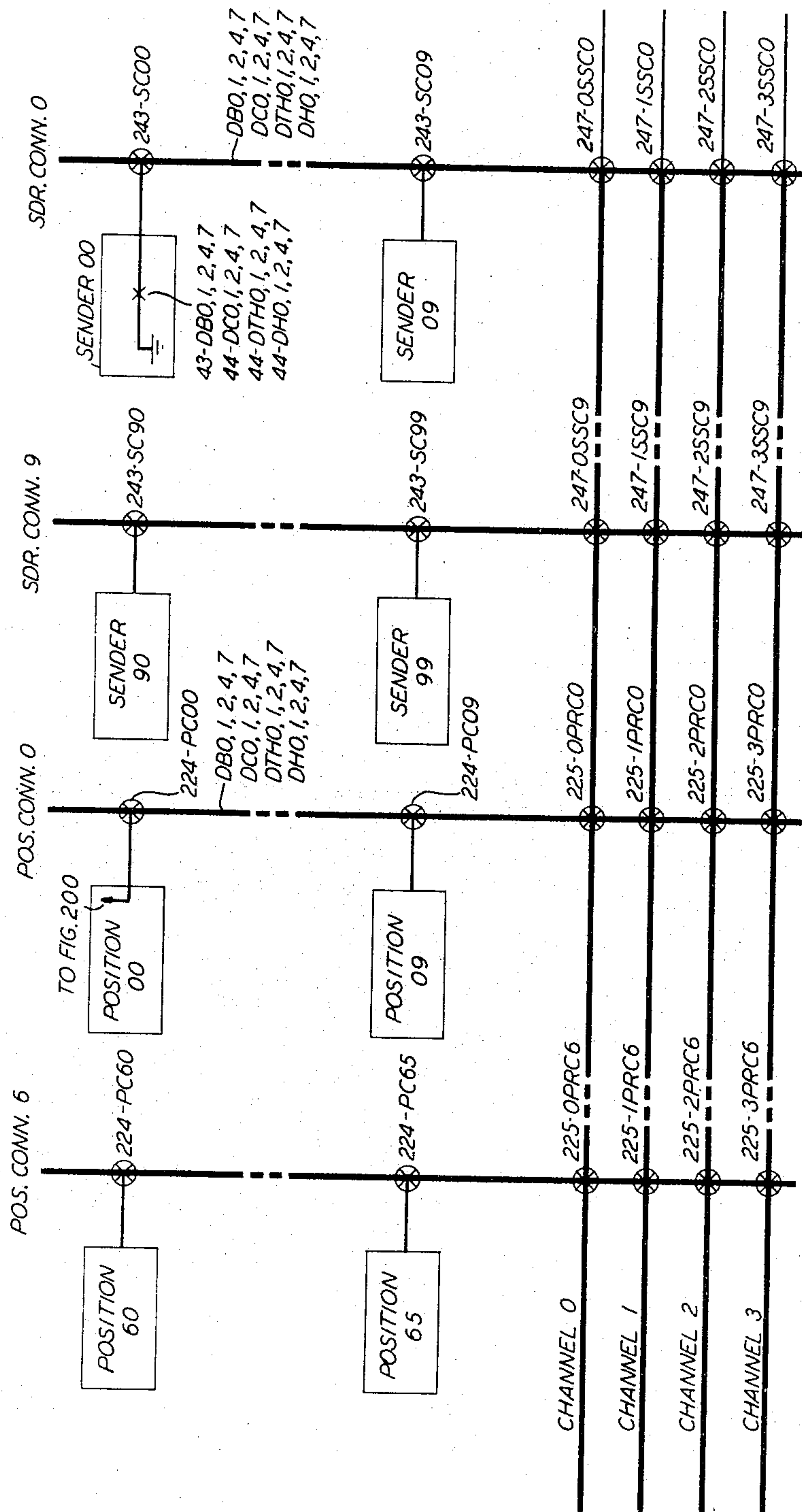
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 325

FIG. 253



Sept. 12, 1967

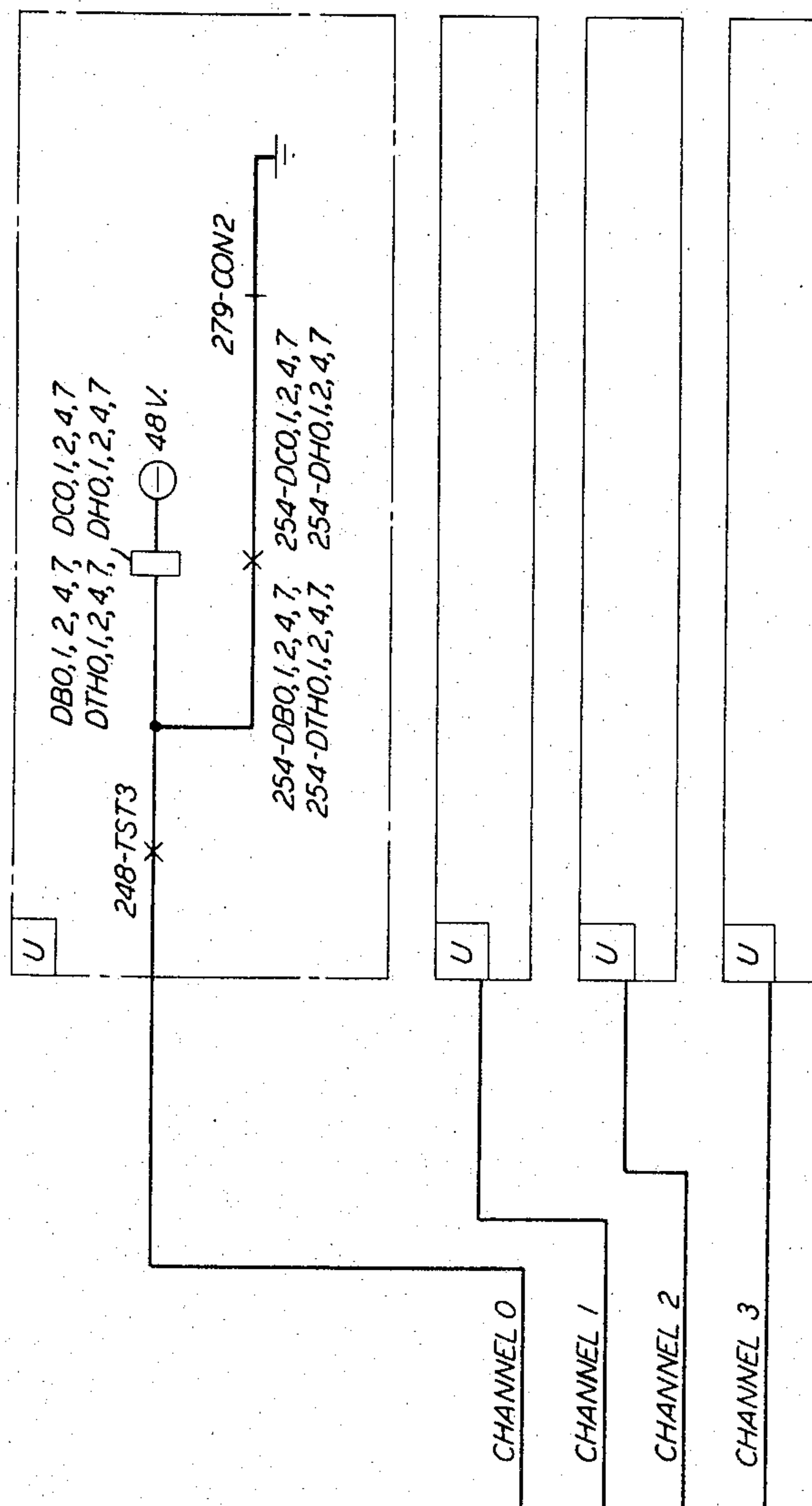
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 326

FIG. 254



Sept. 12, 1967

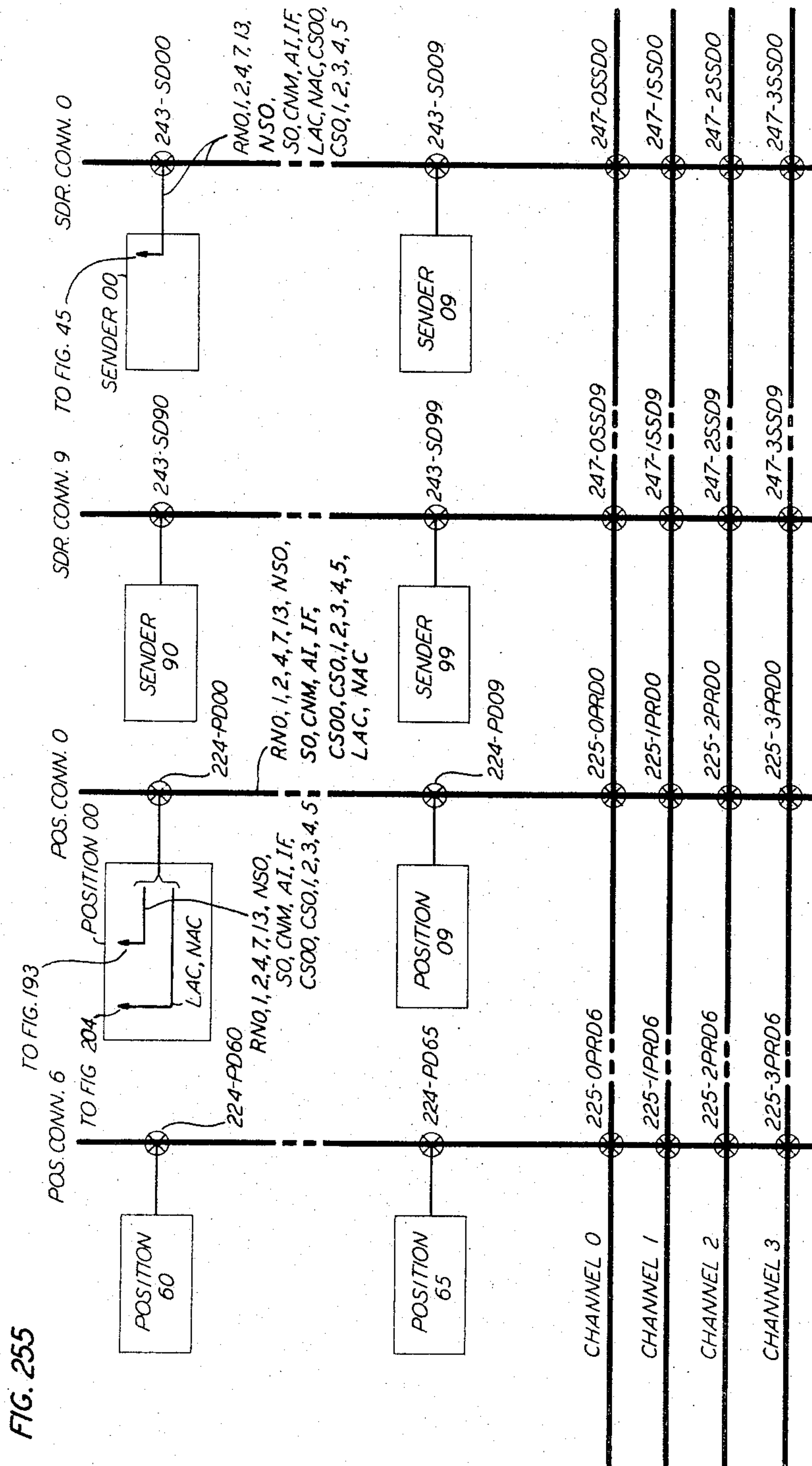
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 327



Sept. 12, 1967

L. J. CERNY ETAL

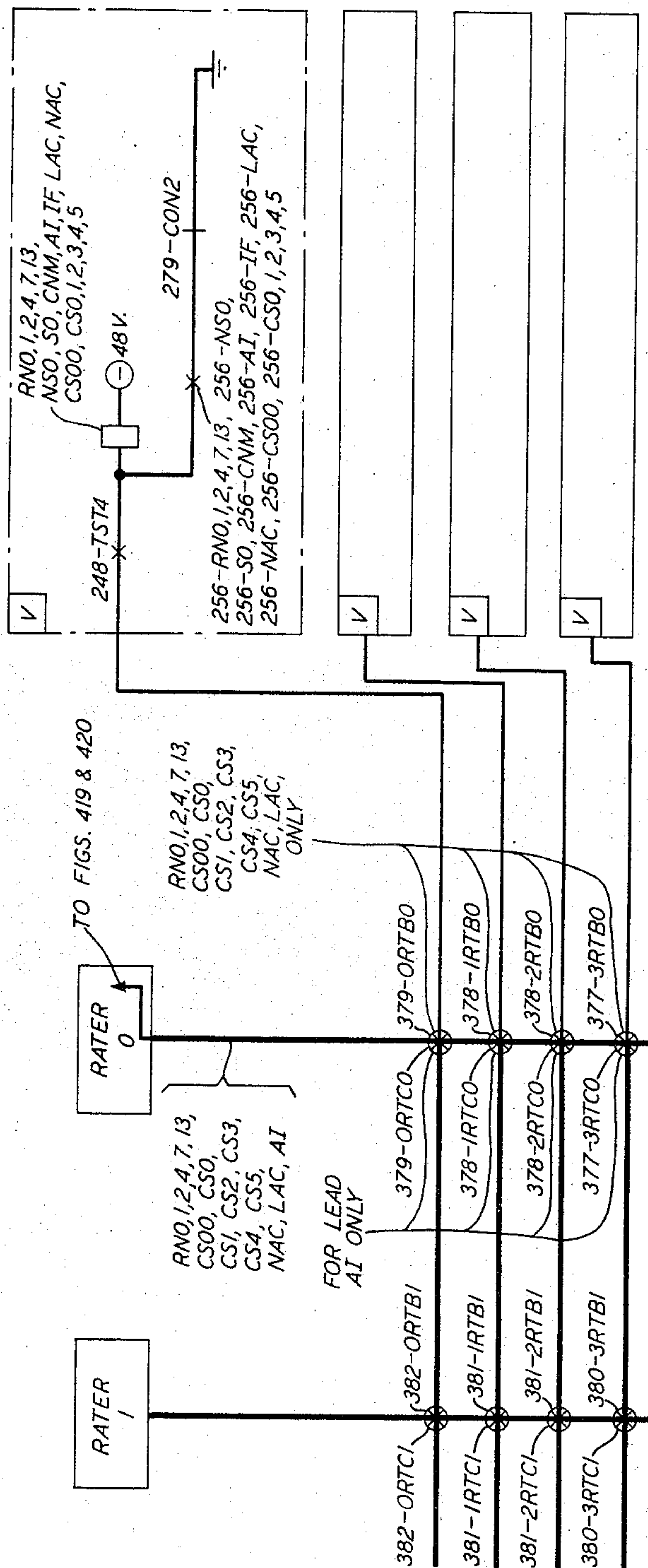
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 328

FIG. 256



Sept. 12, 1967

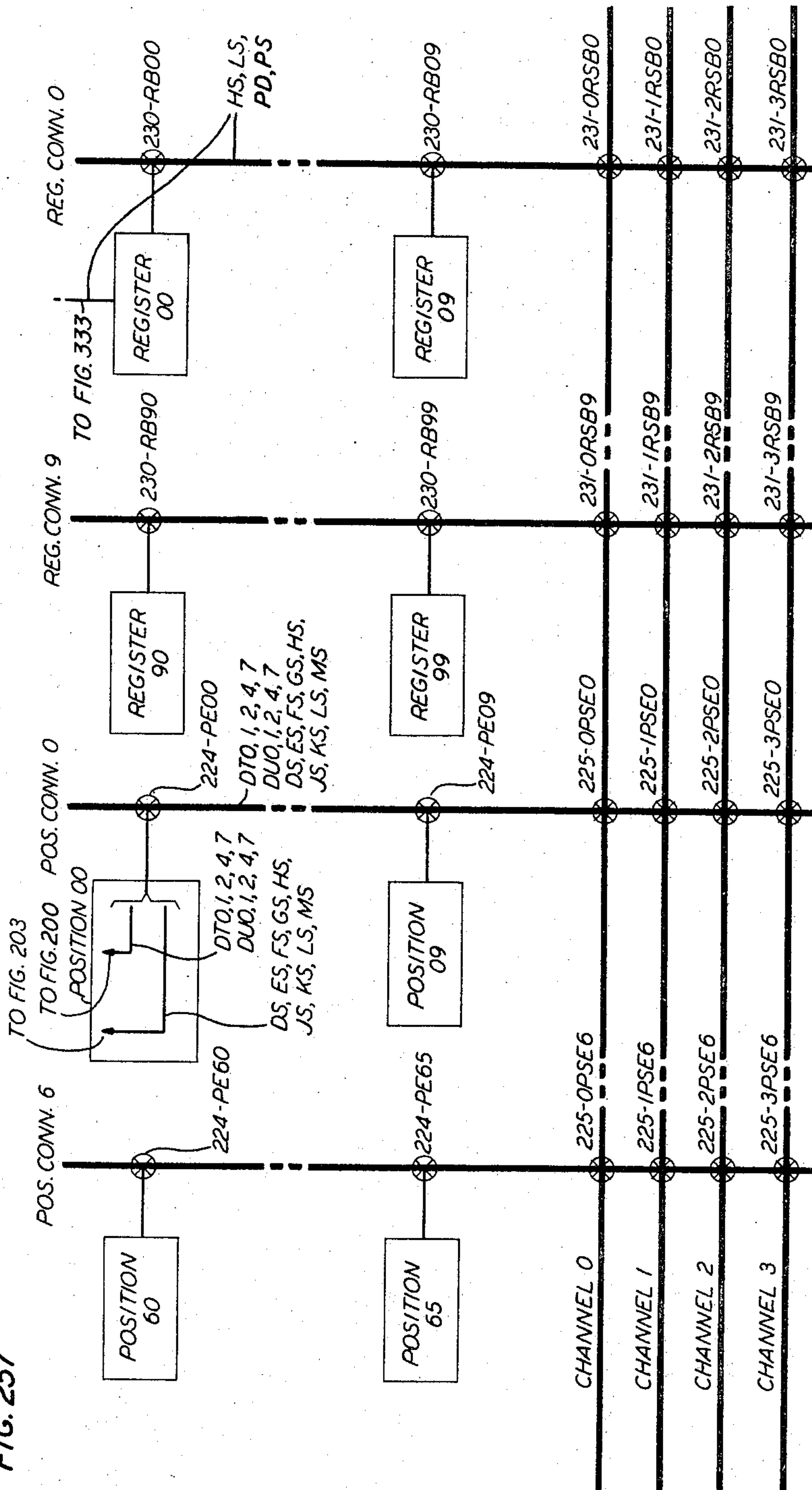
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 329

FIG. 257



Sept. 12, 1967

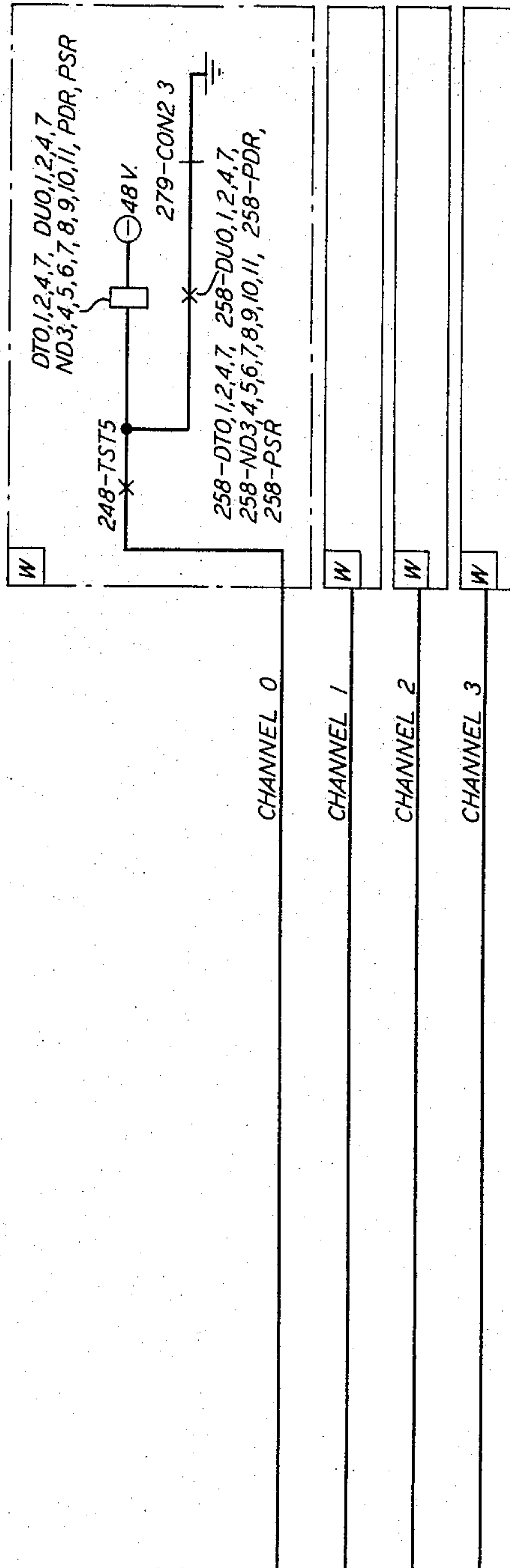
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 330

FIG. 258



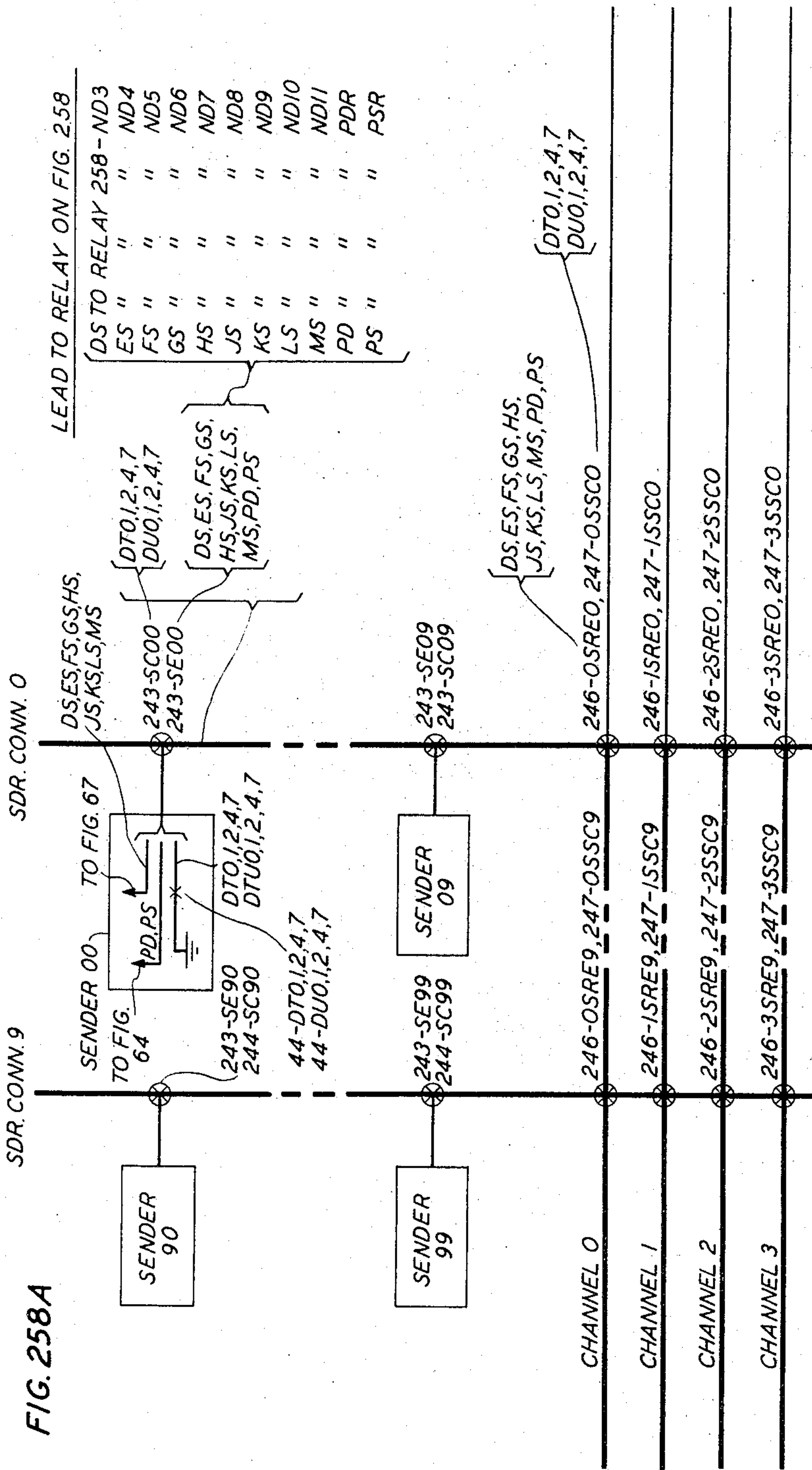
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 331



Sept. 12, 1967

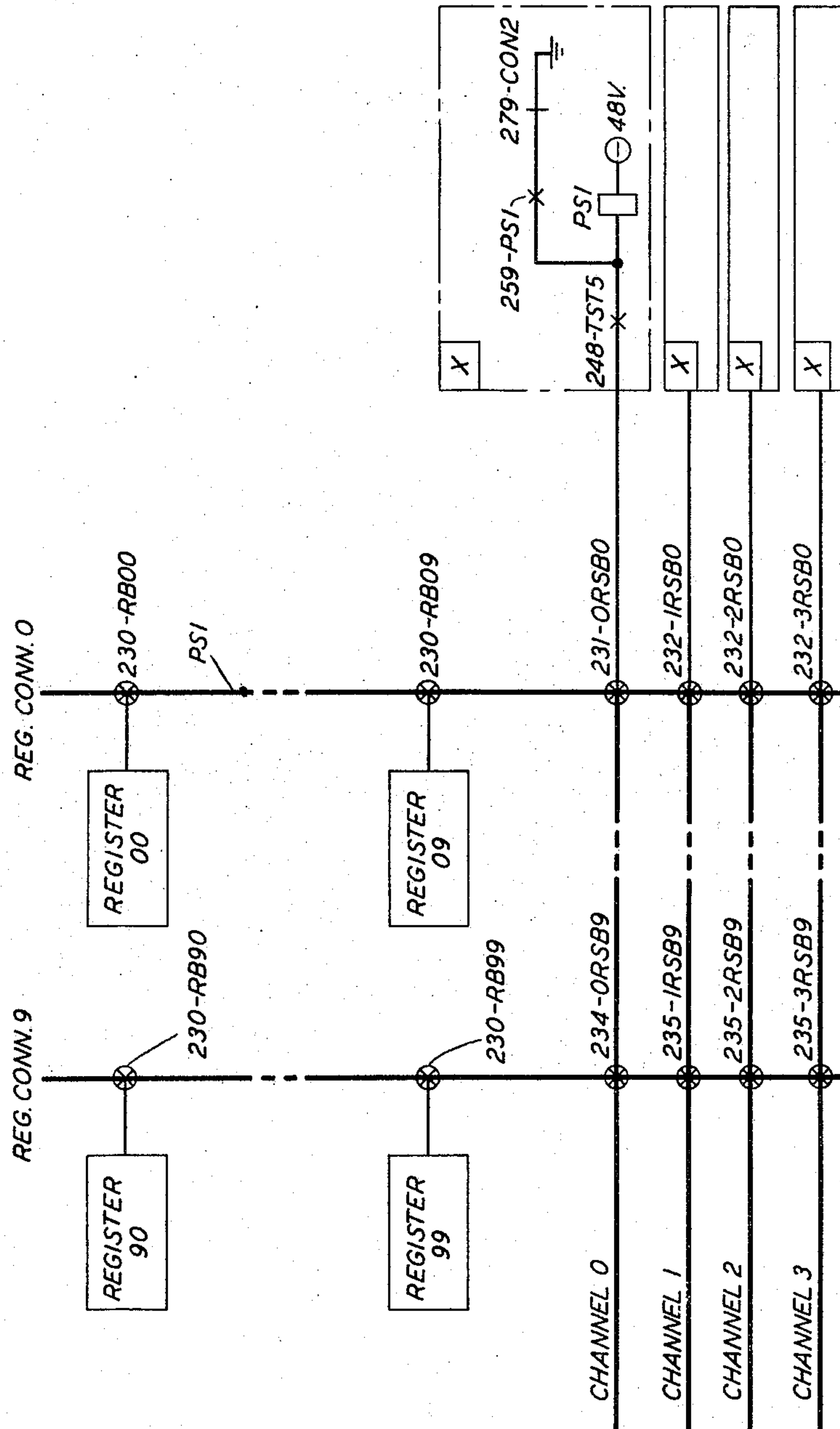
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 332

FIG. 259



Sept. 12, 1967

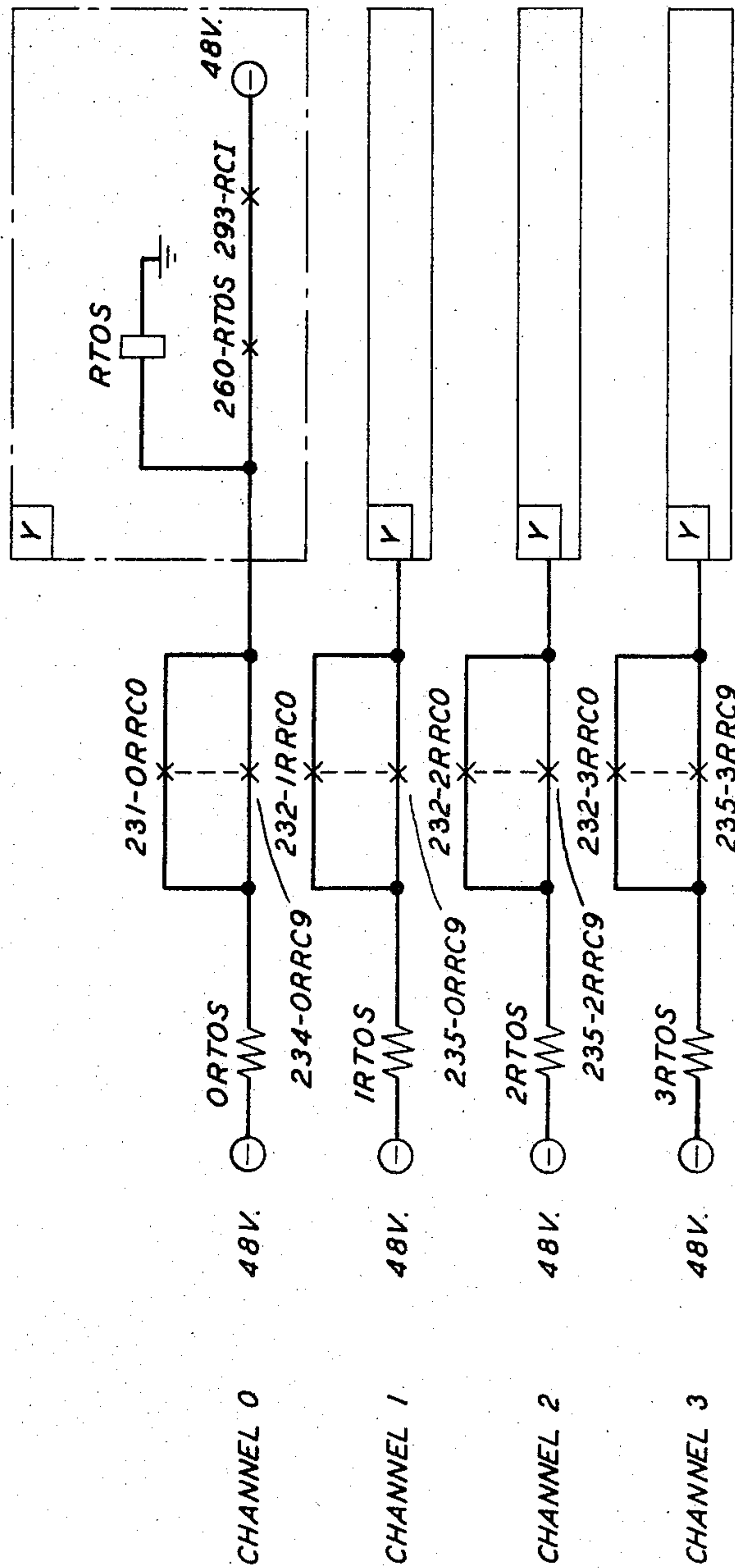
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 333

FIG. 260



Sept. 12, 1967

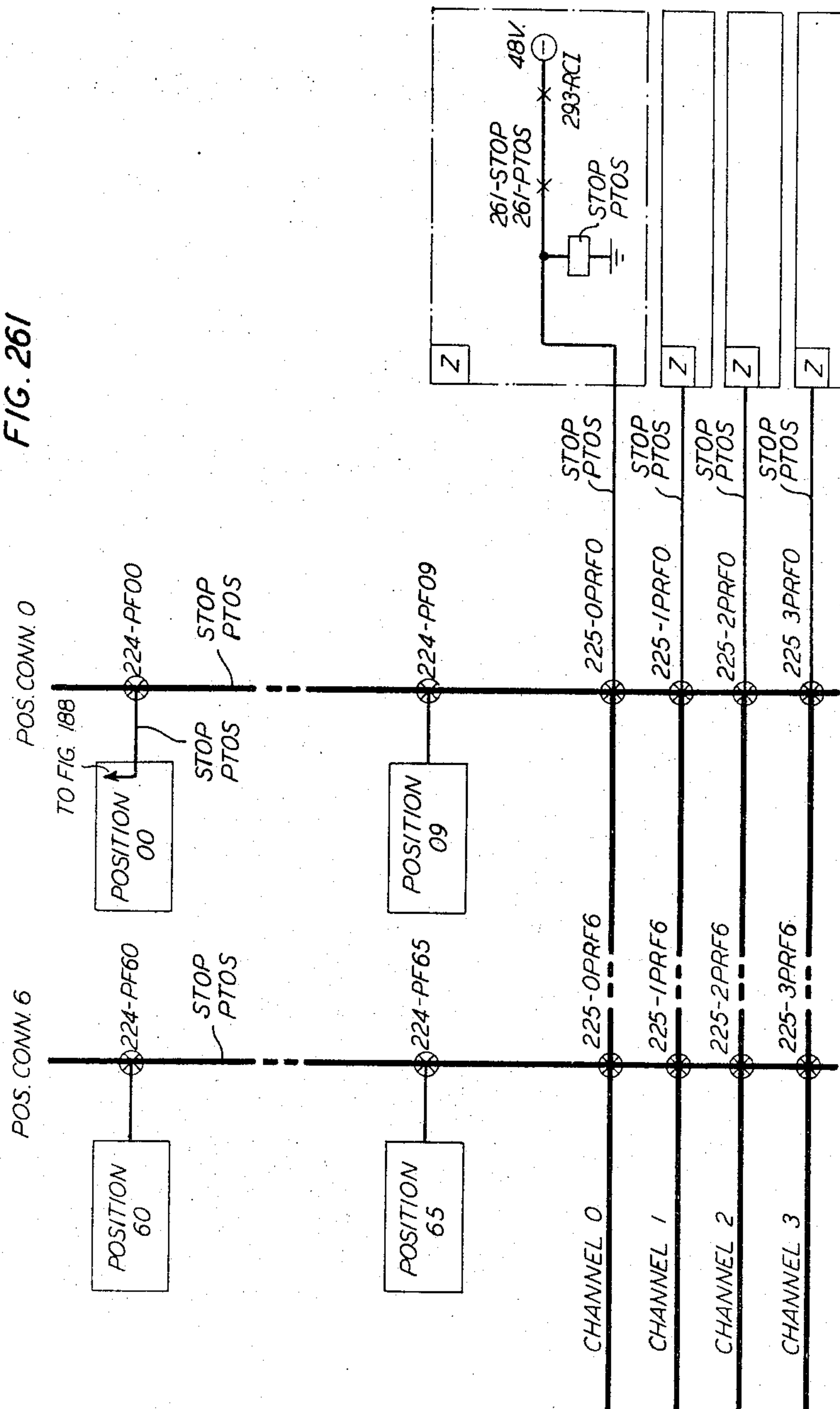
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 334

FIG. 261



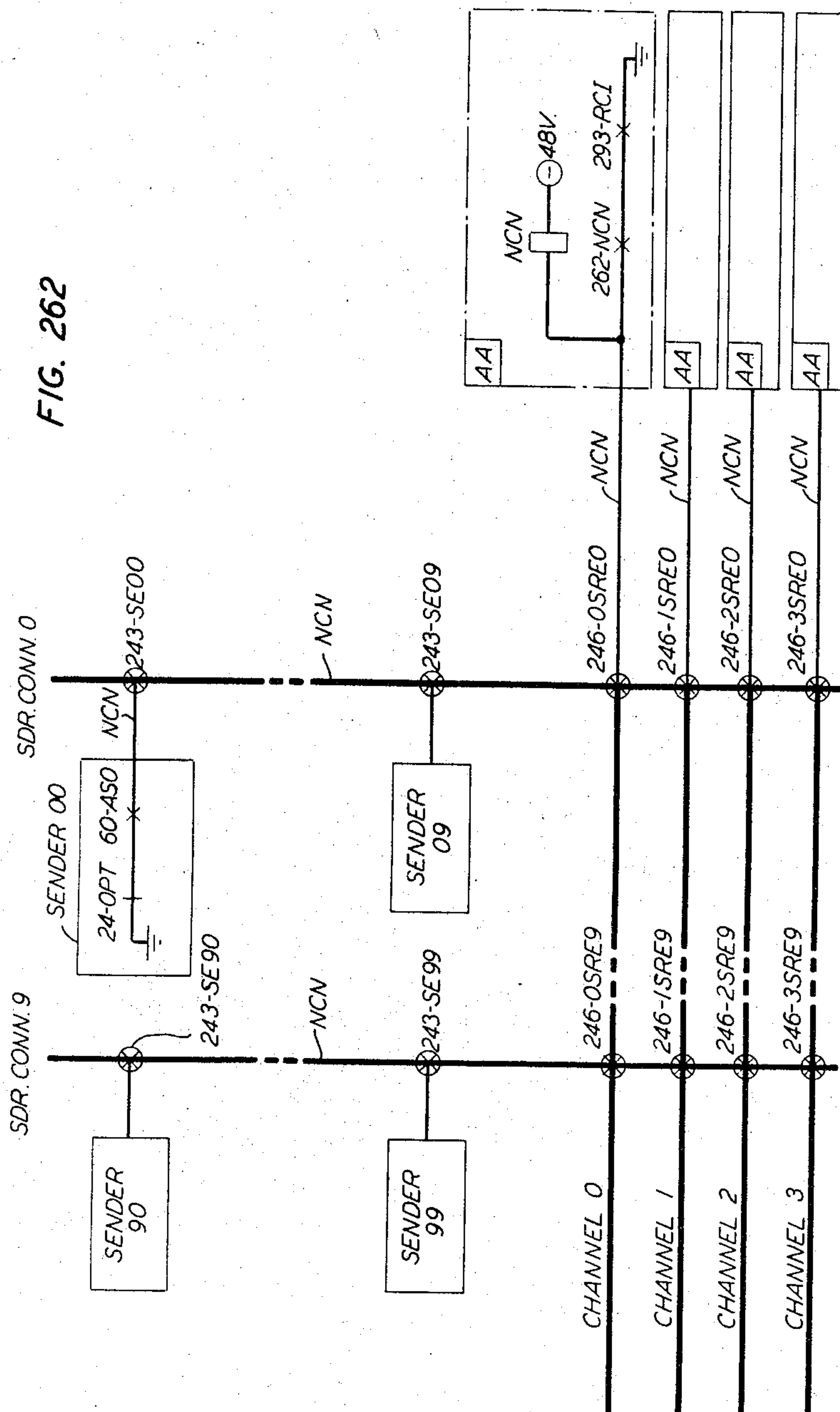
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 335



Sept. 12, 1967

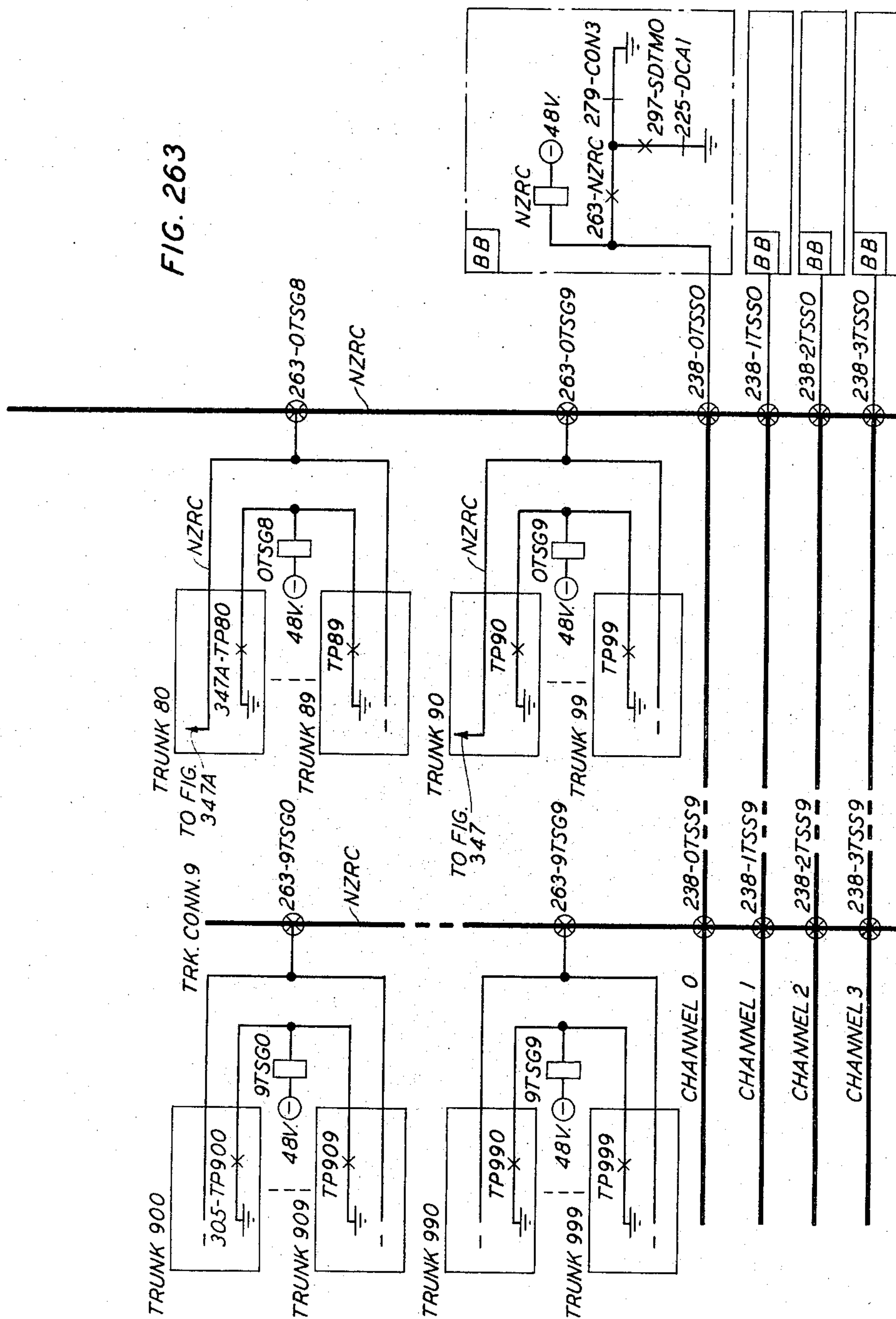
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 336

FIG. 263



Sept. 12, 1967

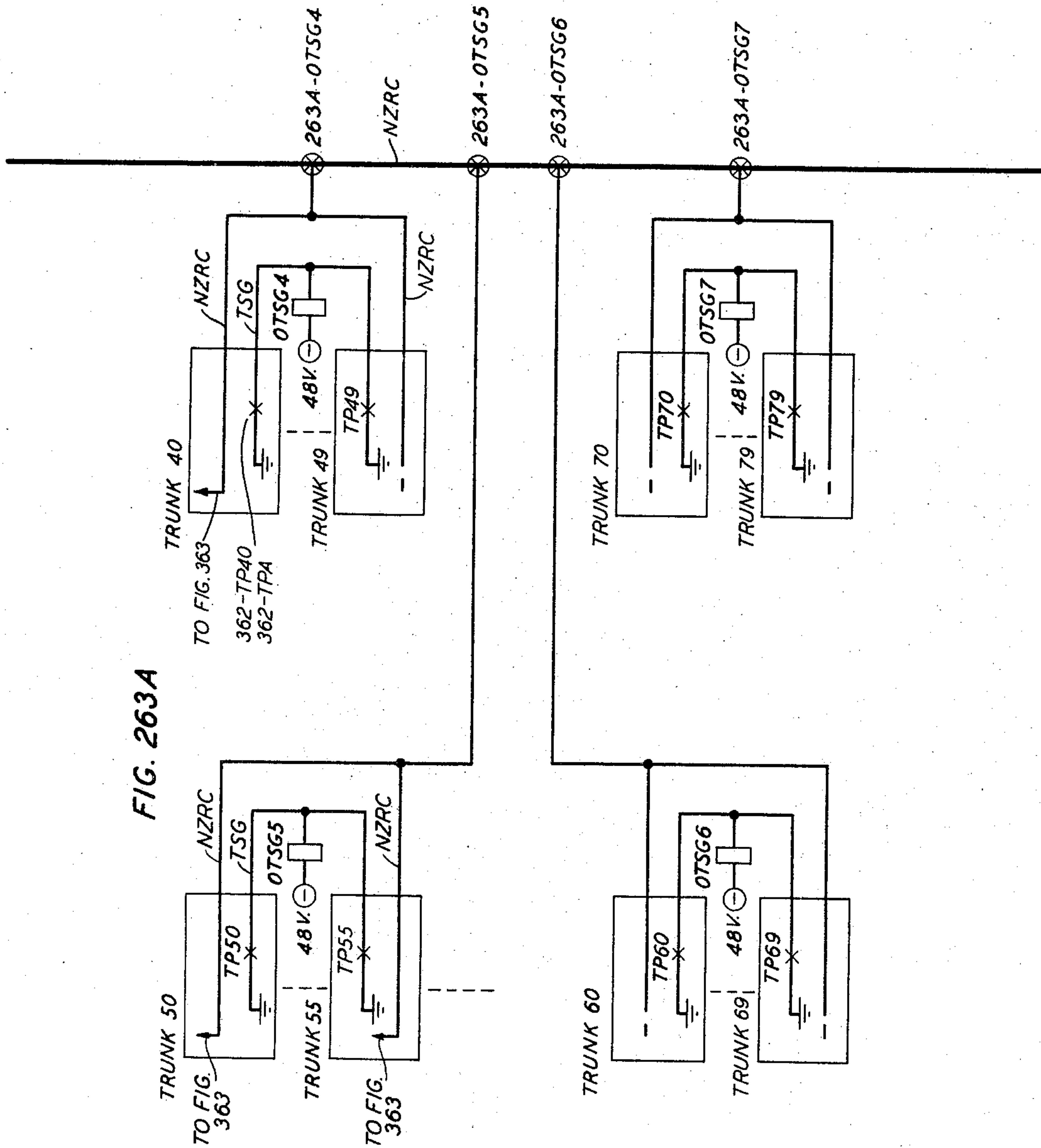
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 337

FIG. 263A



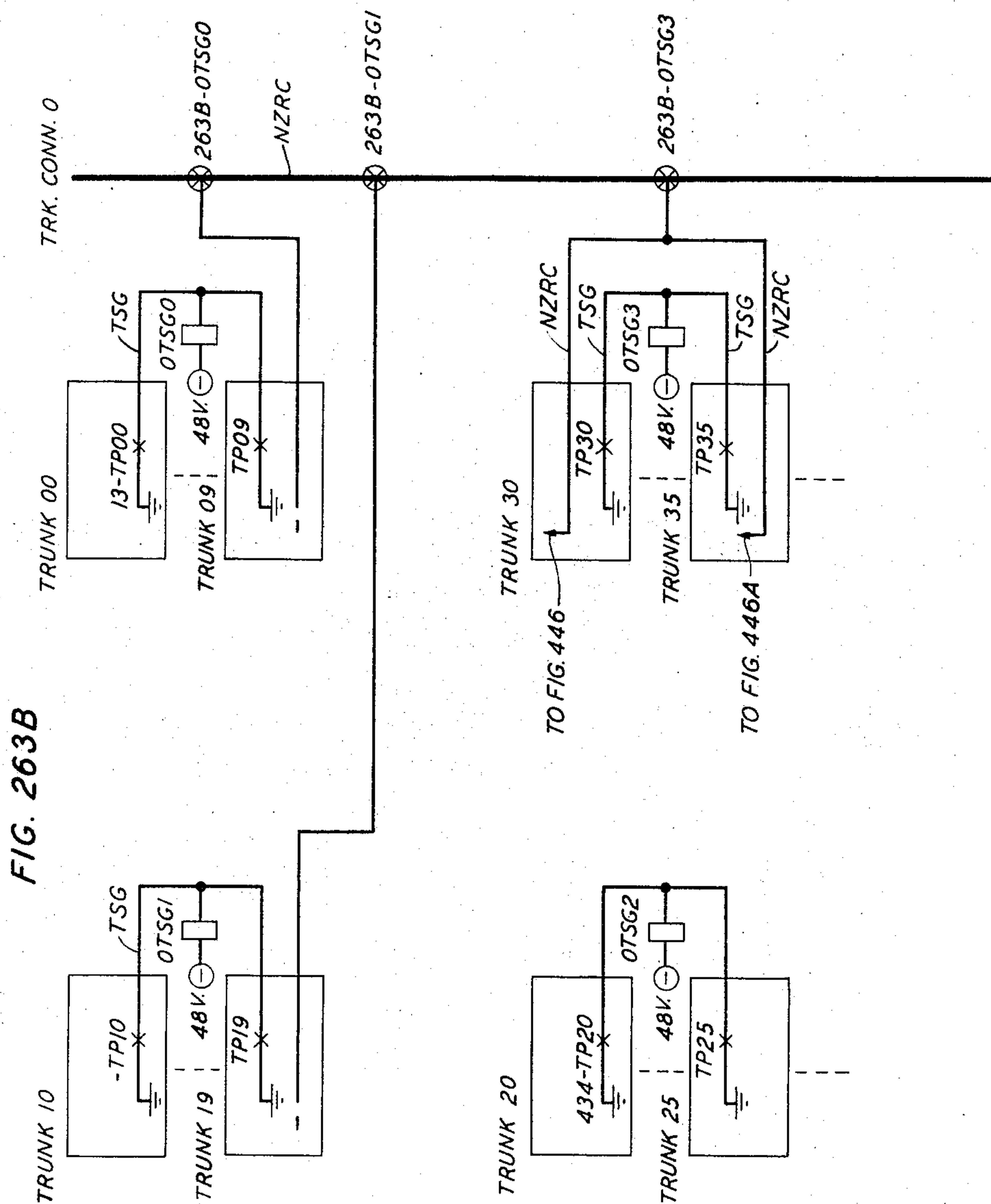
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 338



Sept. 12, 1967

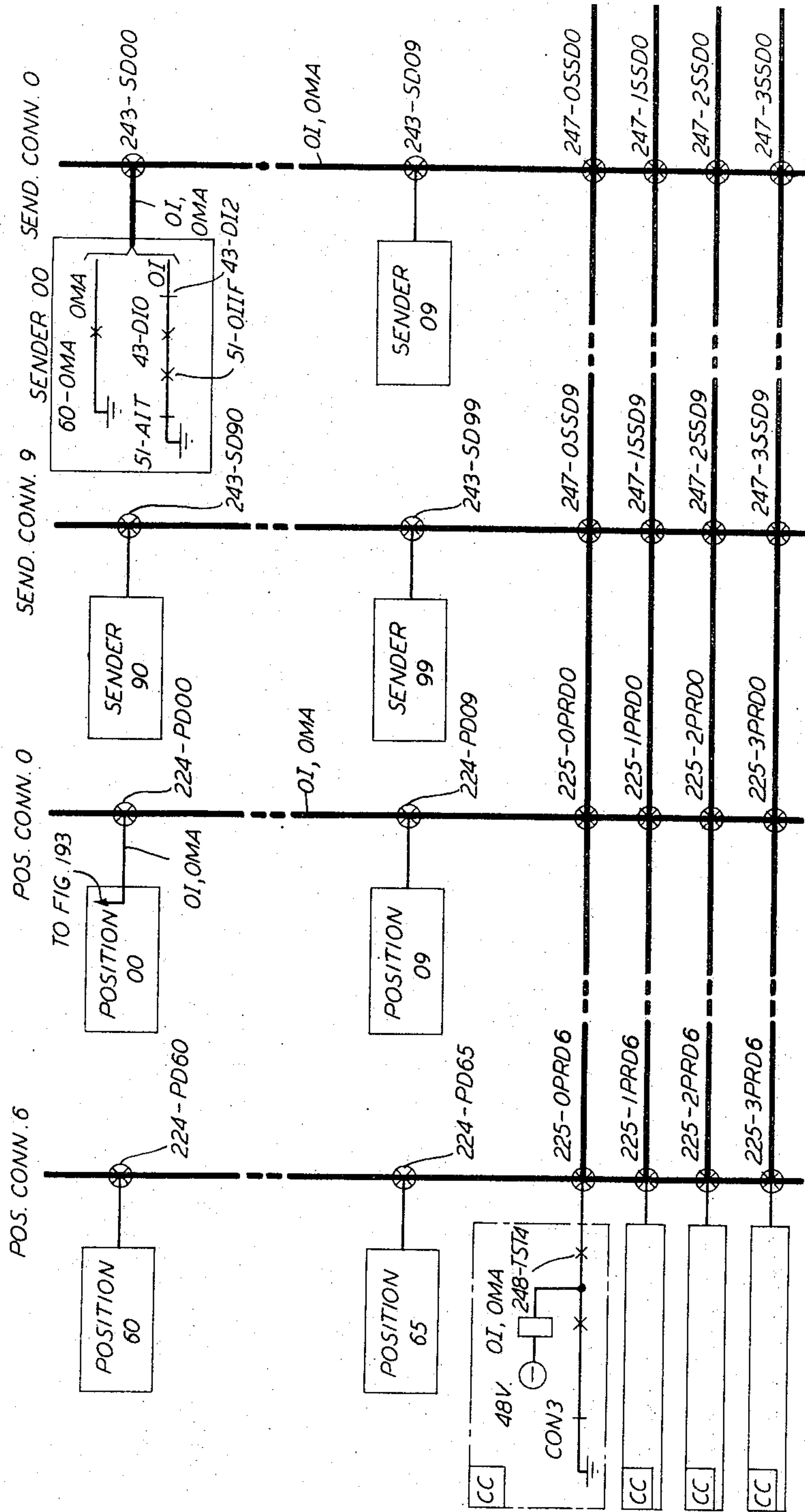
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 339

FIG. 264



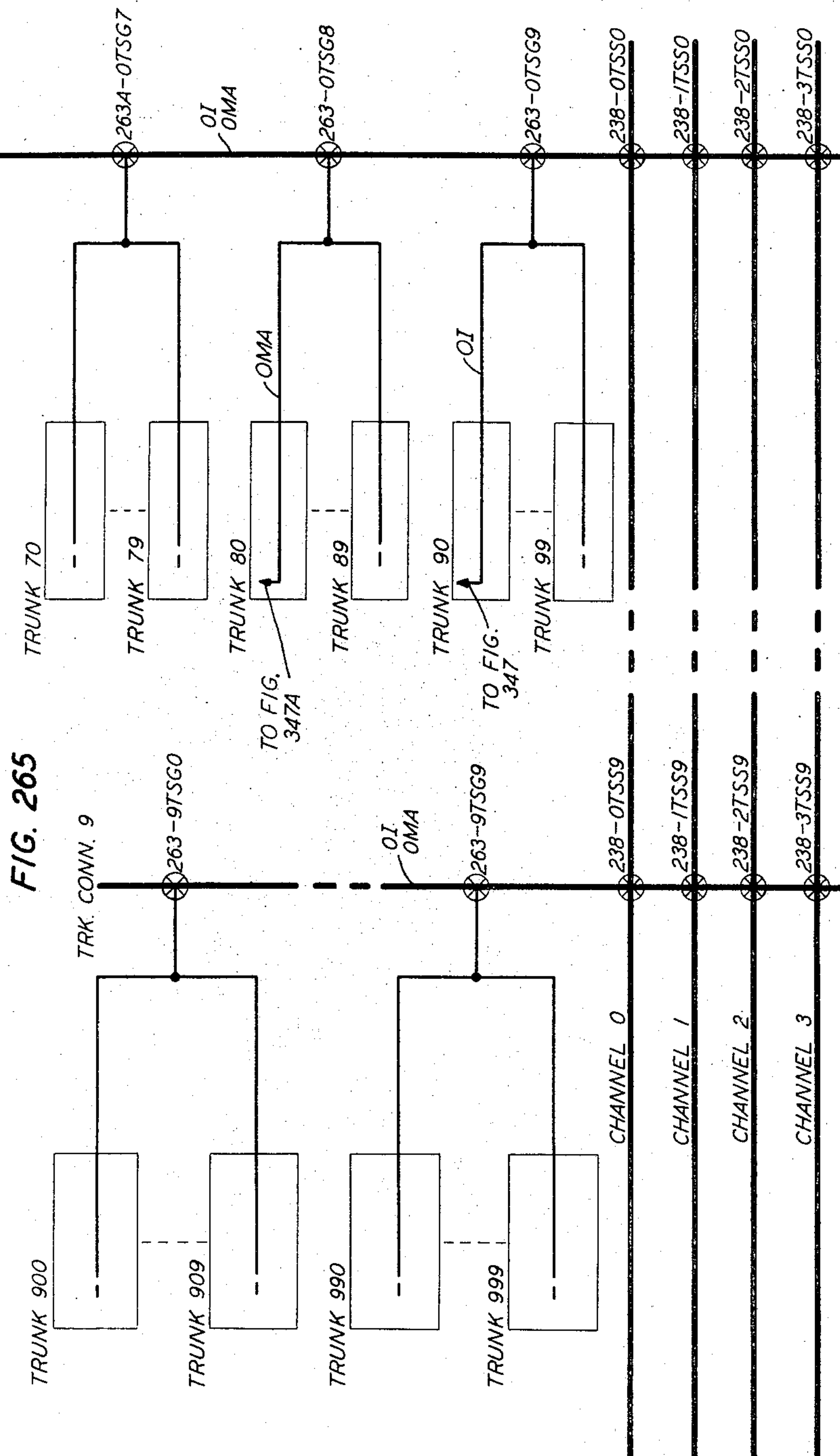
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 340



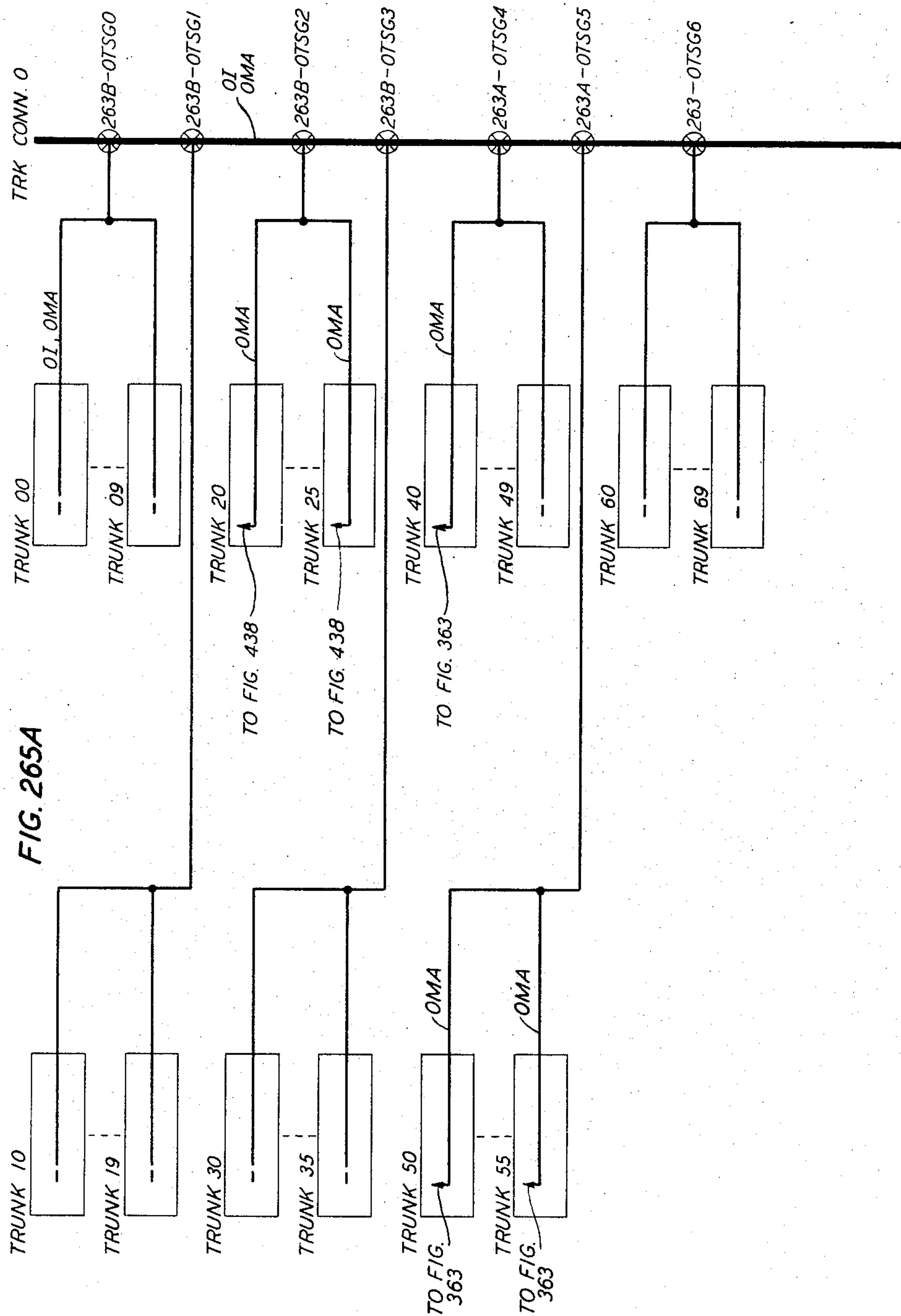
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 341



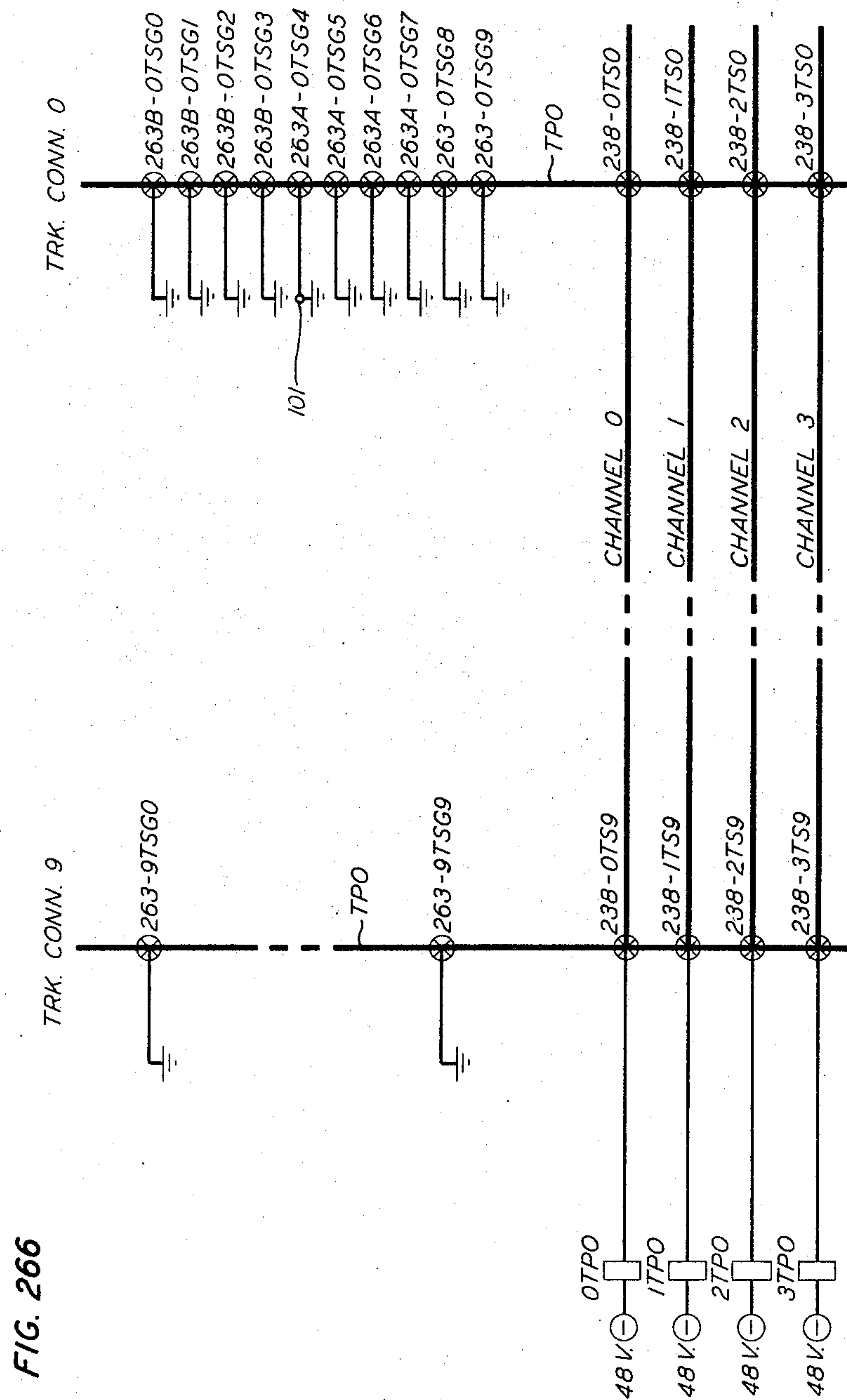
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 342



Sept. 12, 1967

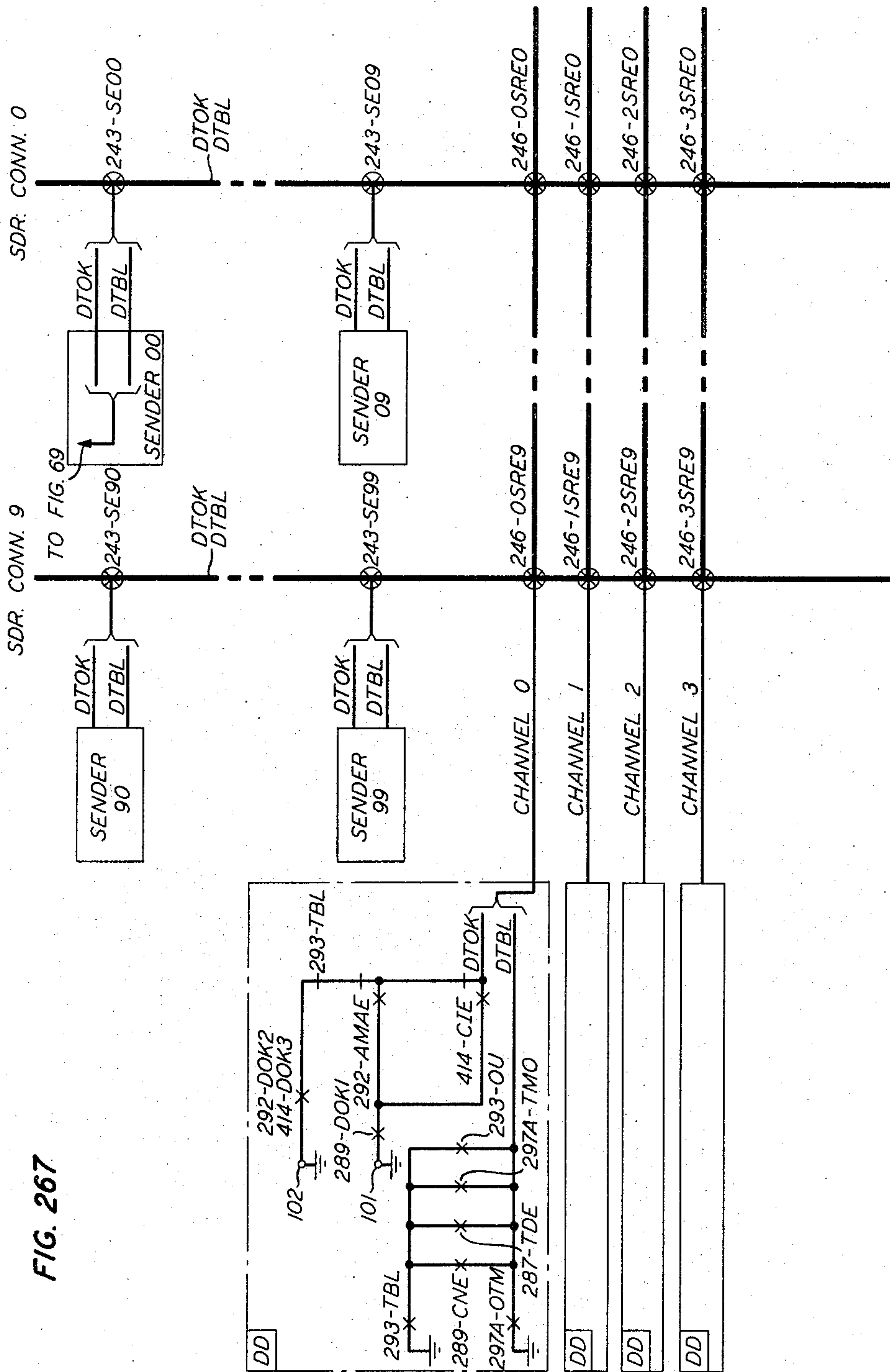
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 343

FIG. 267.



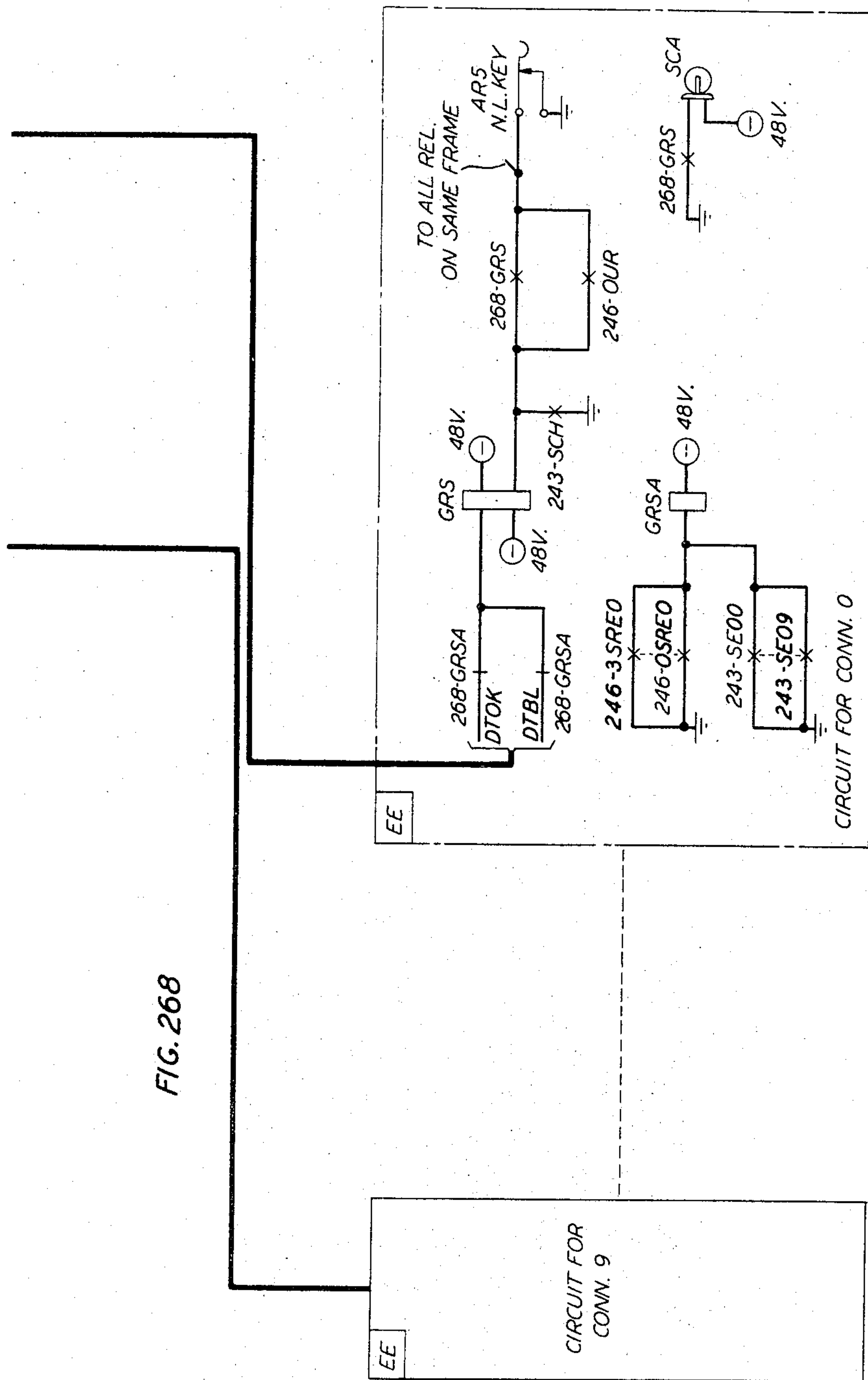
Sept. 12, 1967

L. J. CERNY ET AL.
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER.

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 344



Sept. 12, 1967

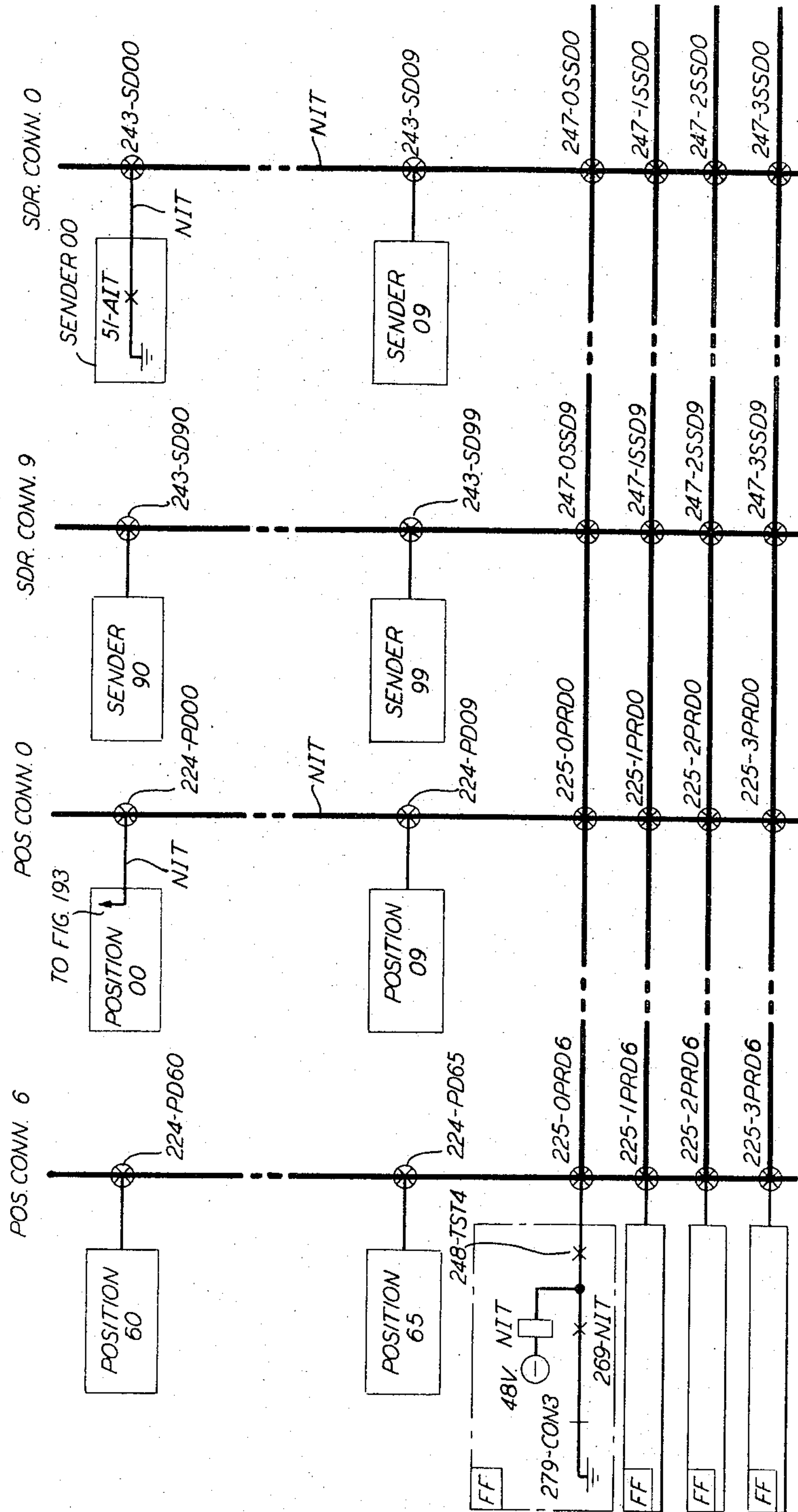
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 345

FIG. 269



Sept. 12, 1967

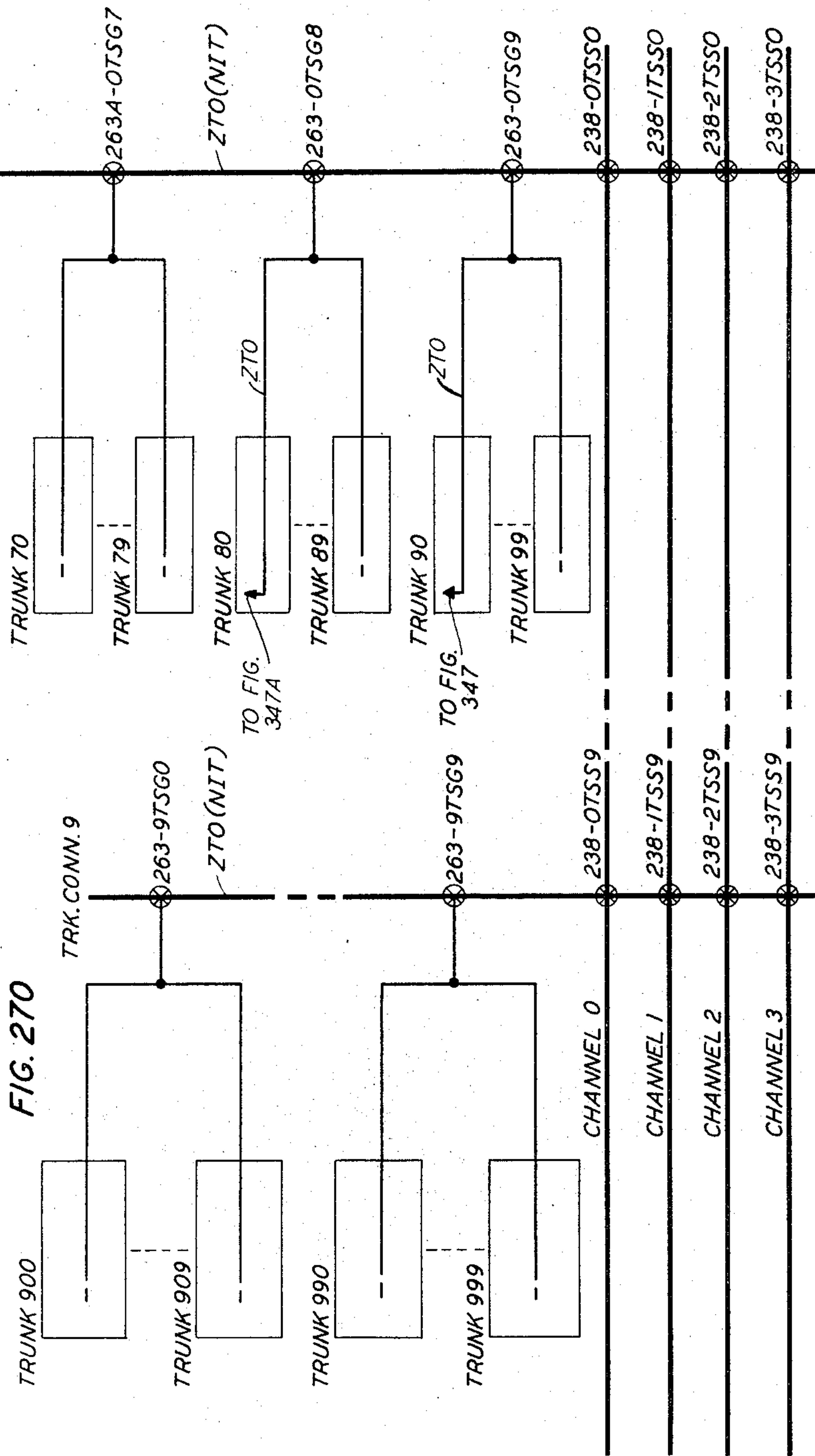
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 346



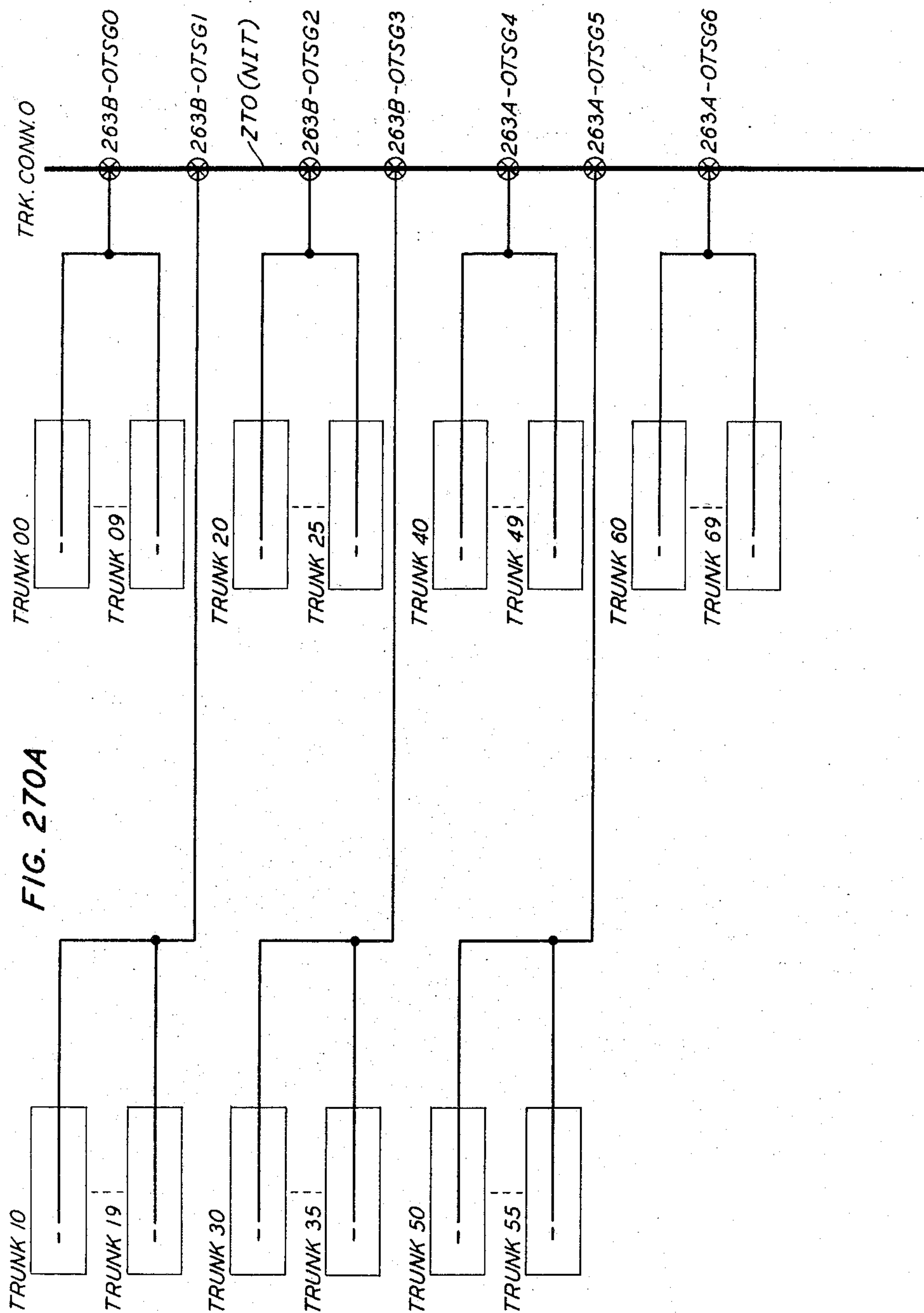
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 347



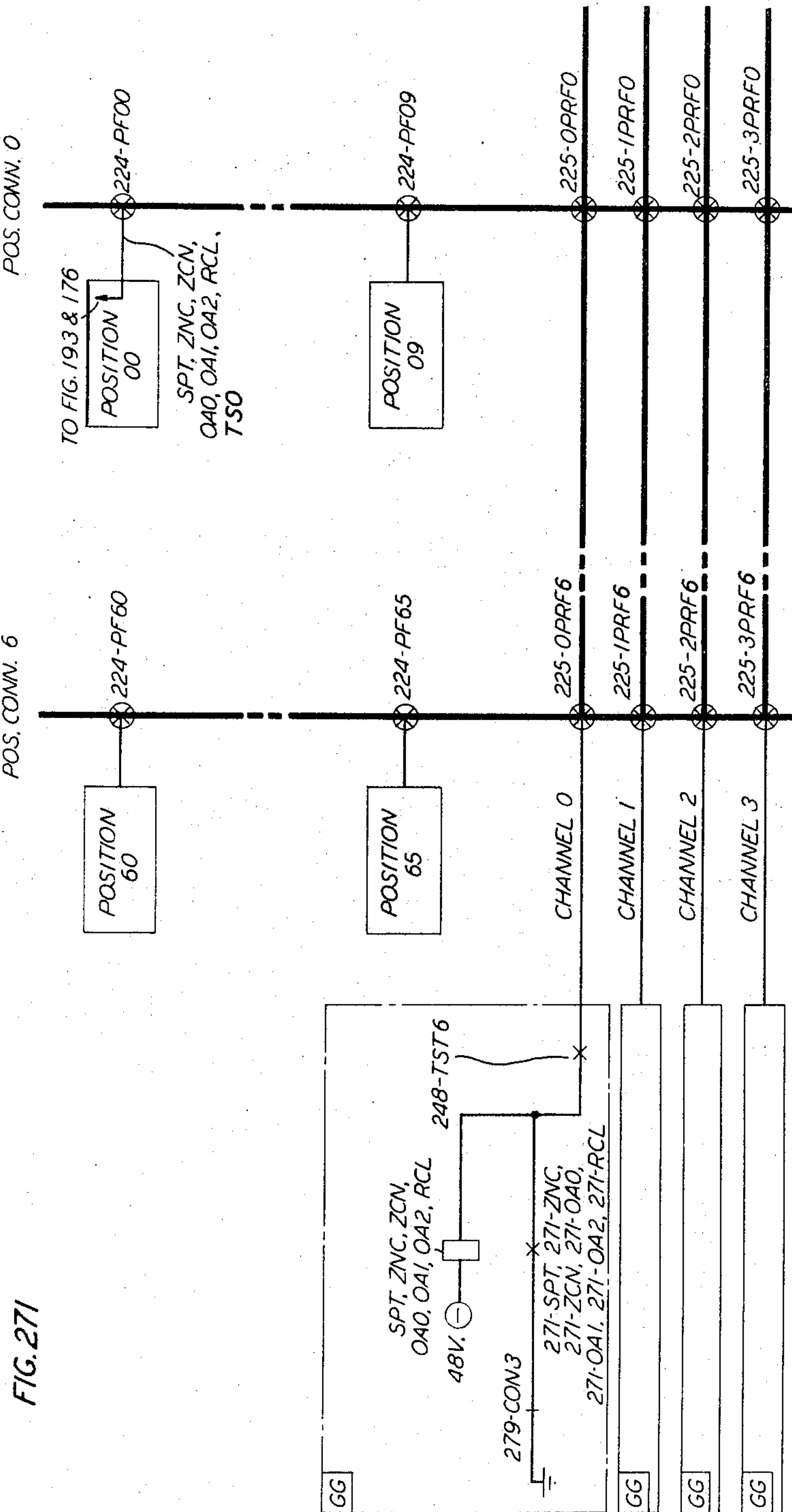
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 348



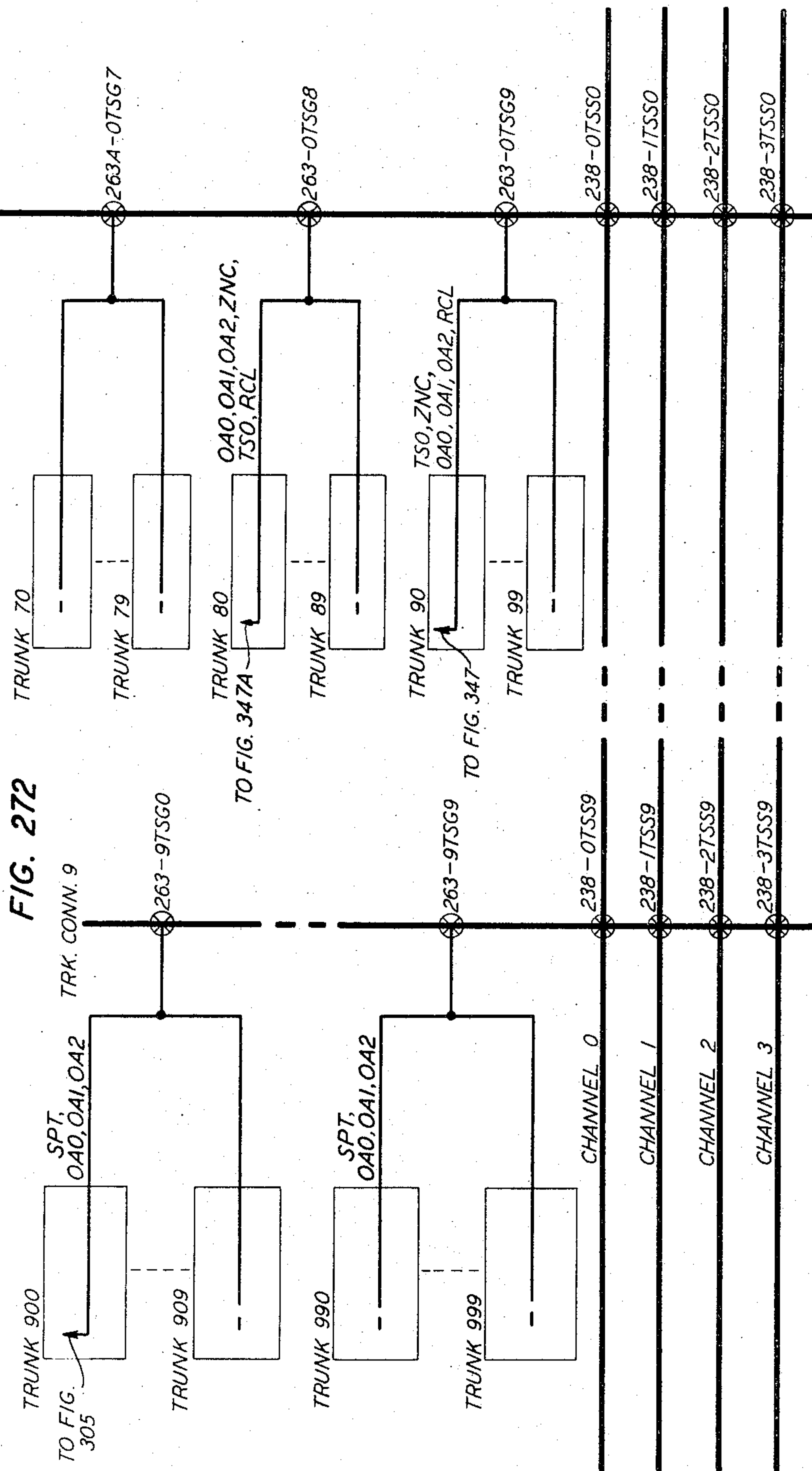
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 349



Sept. 12, 1967

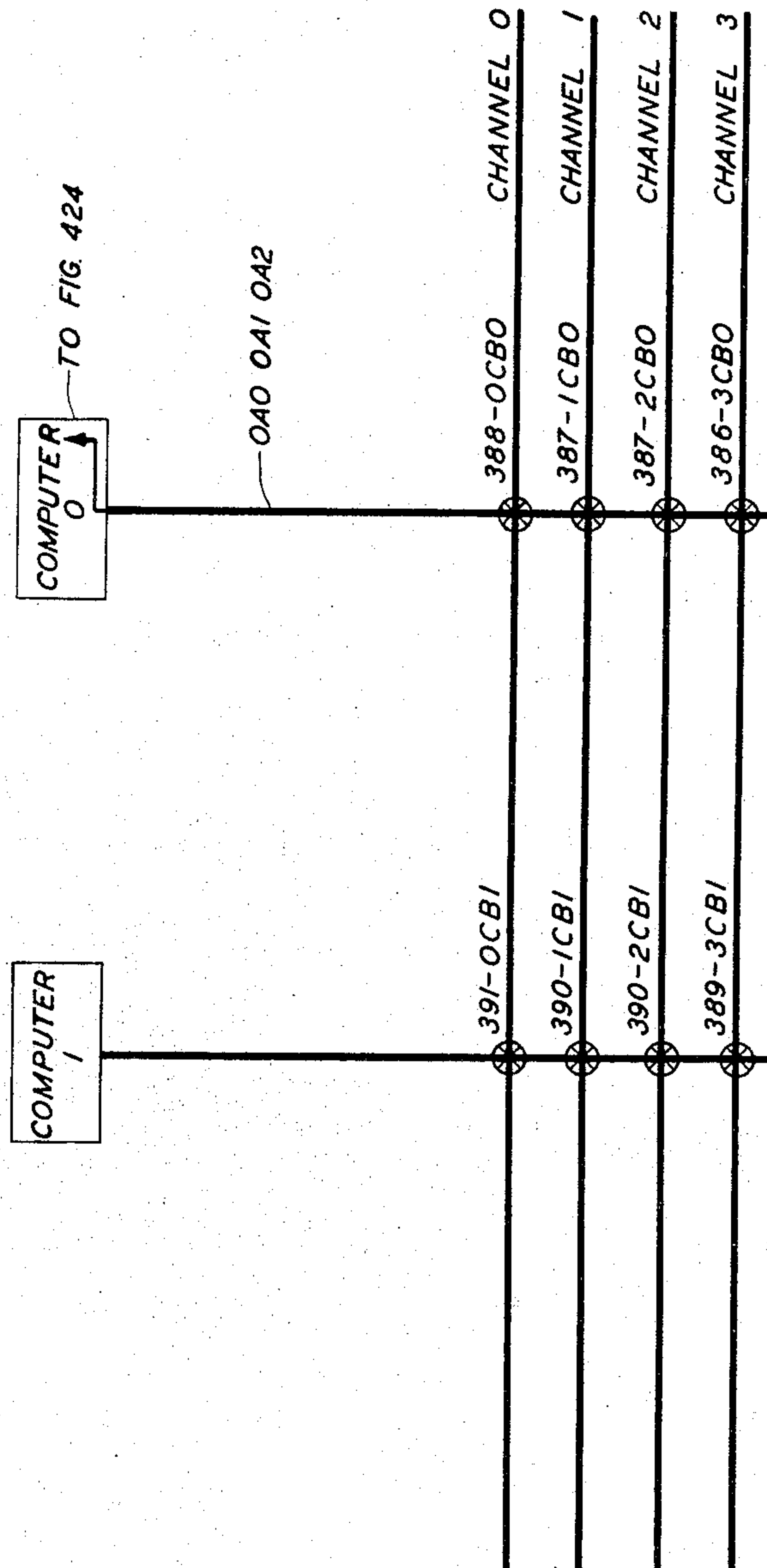
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 350

FIG. 272A



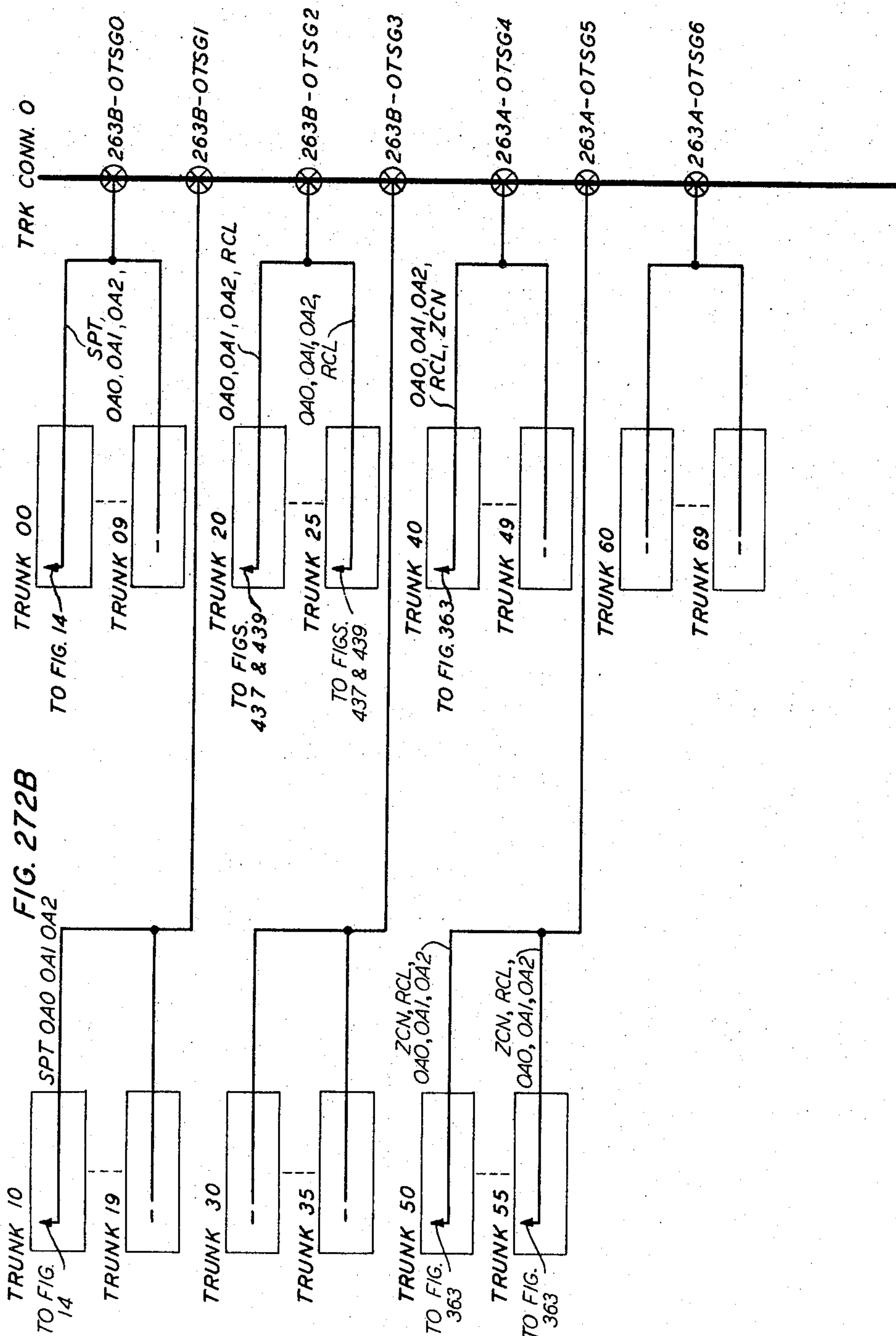
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

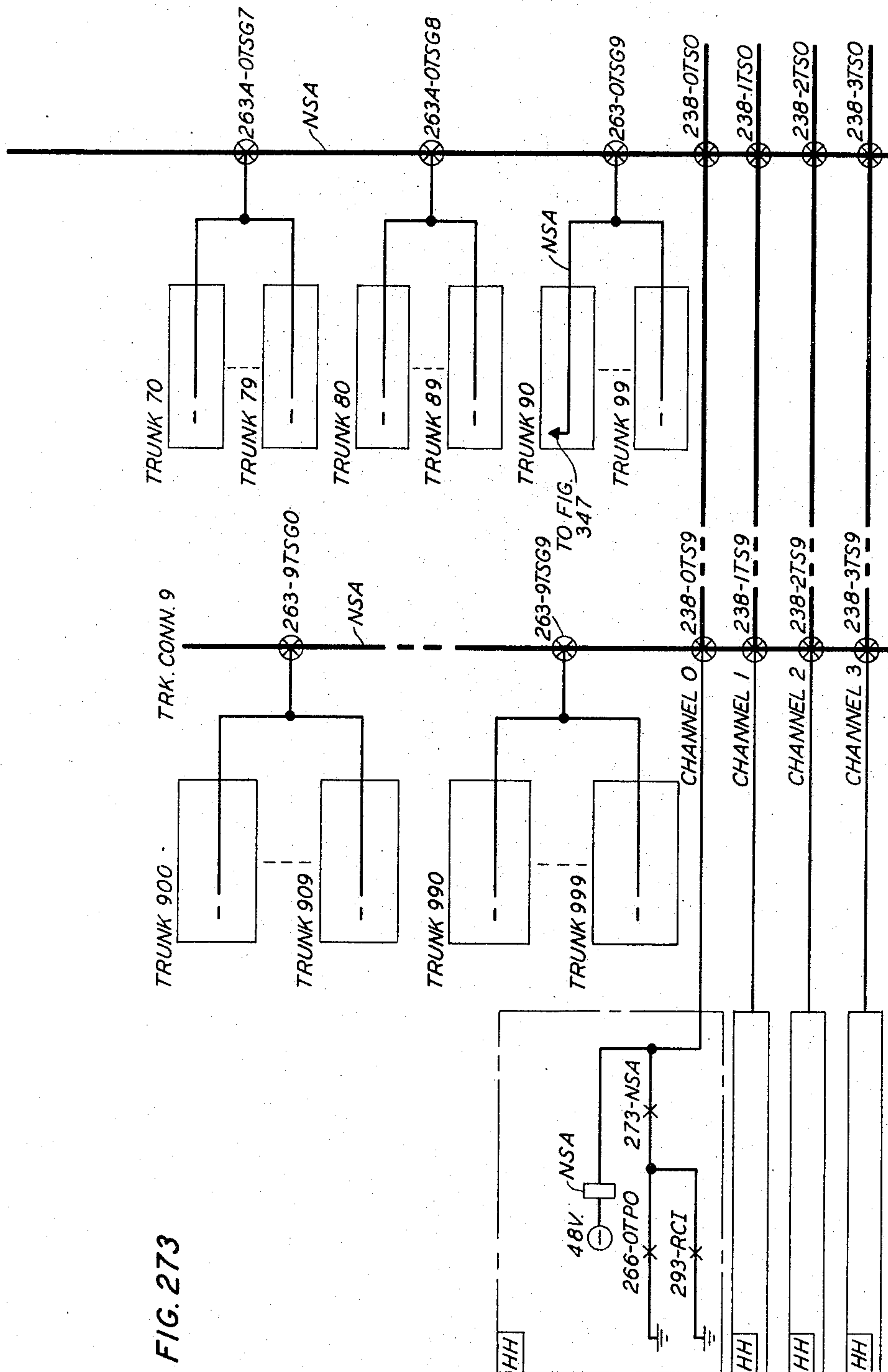
570 Sheets-Sheet 351



L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 352

FIG. 273



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 353

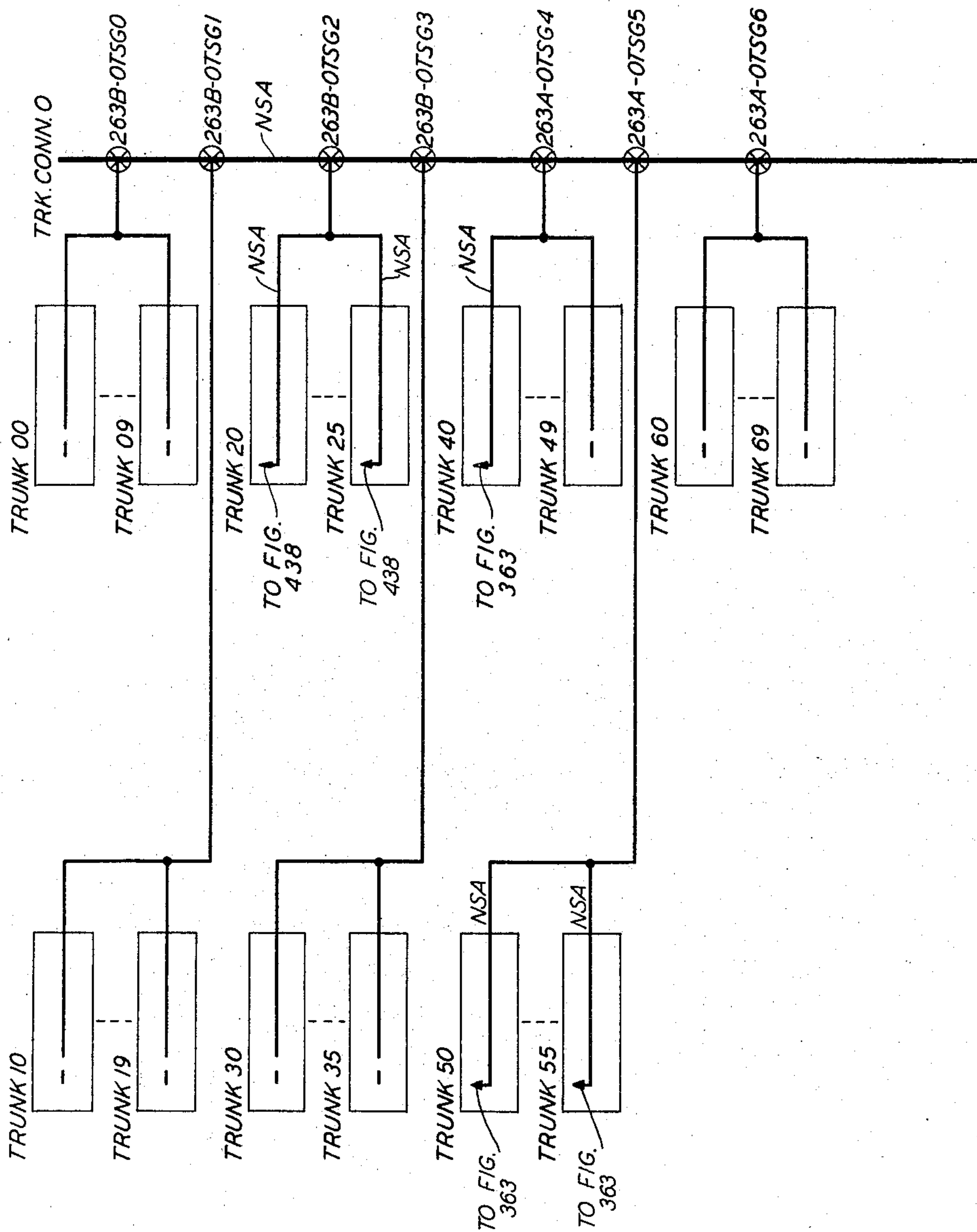


FIG. 273A

Sept. 12, 1967

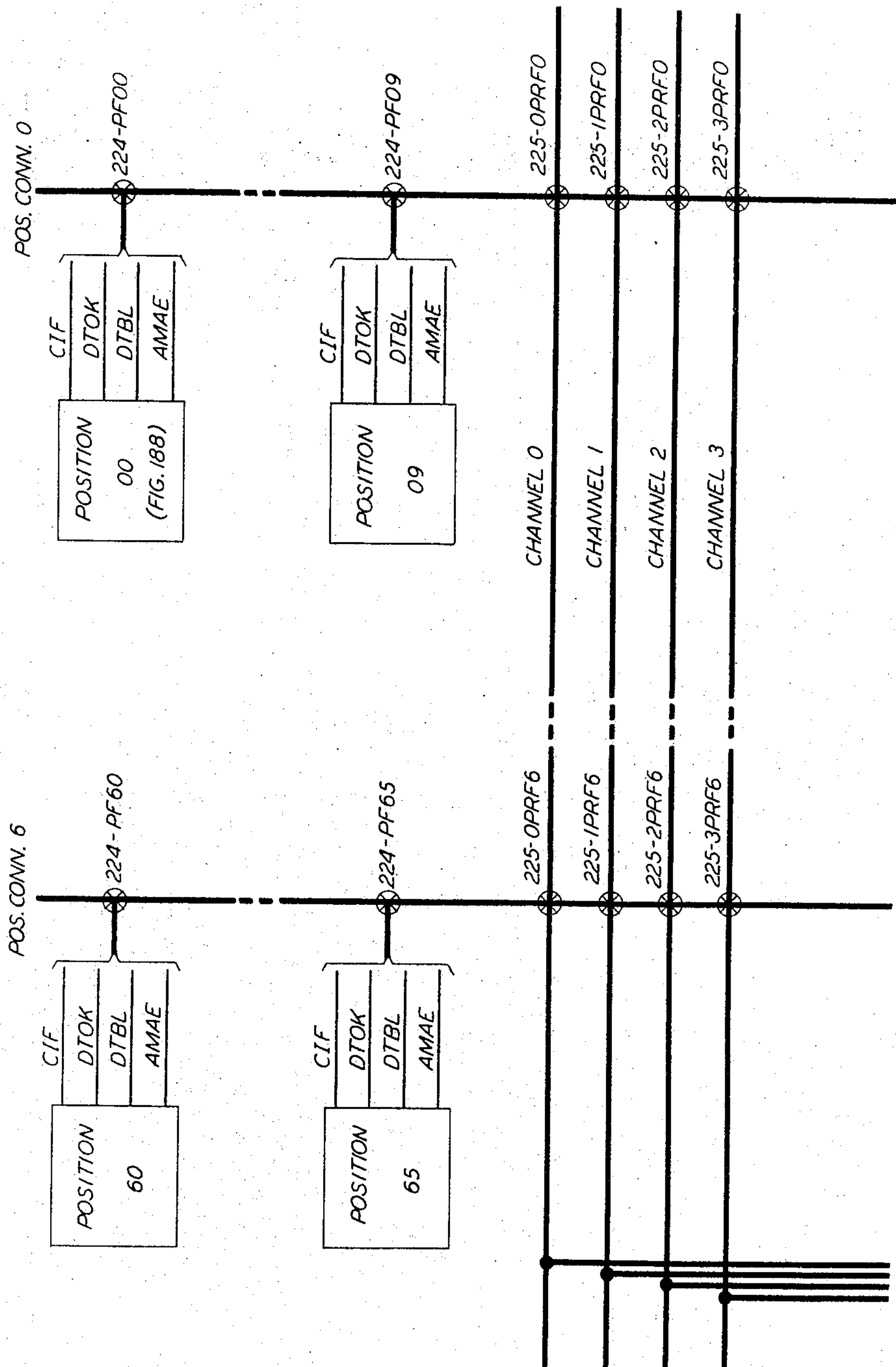
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 354

FIG. 274



Sept. 12, 1967

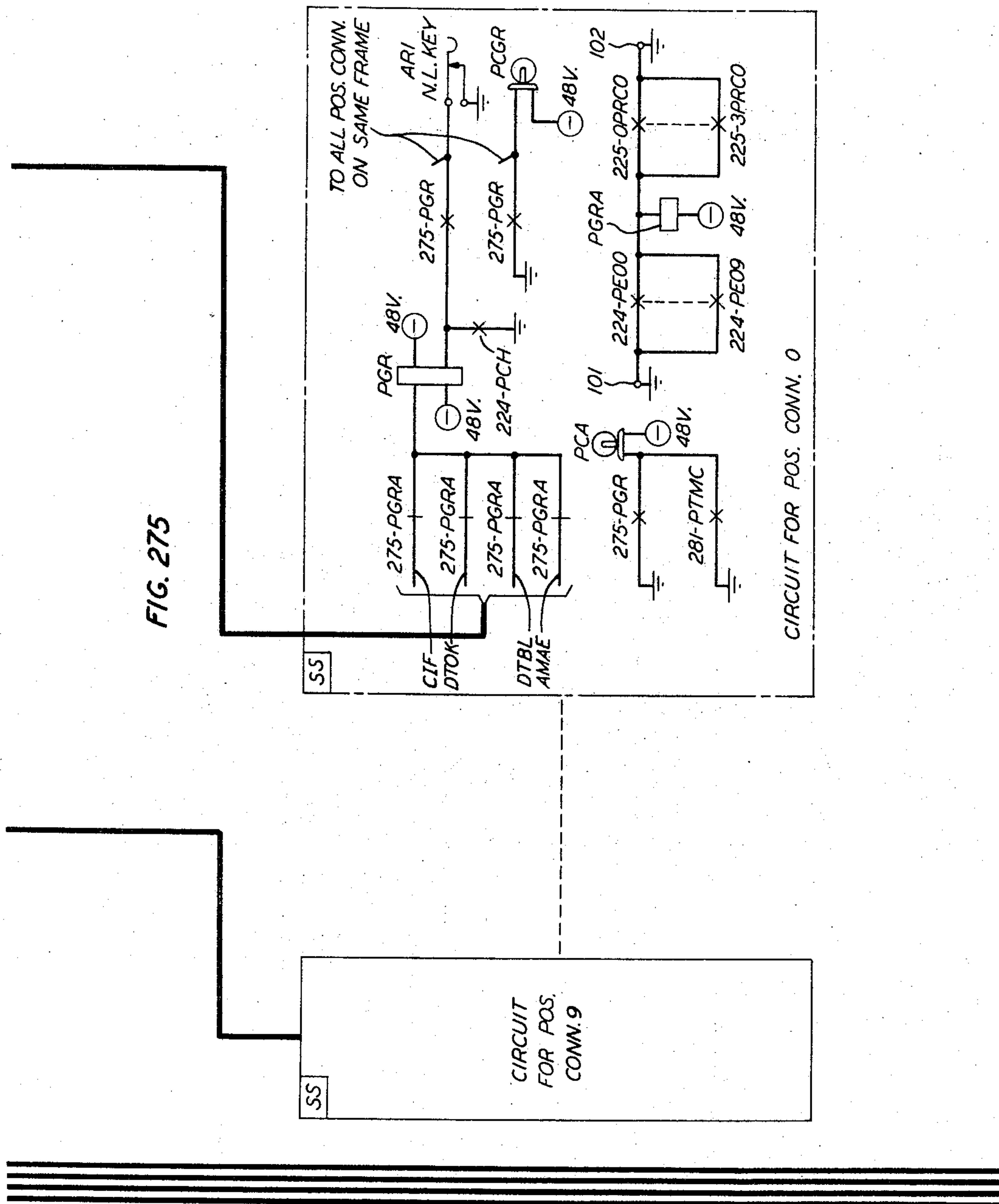
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 355

FIG. 275



Sept. 12, 1967

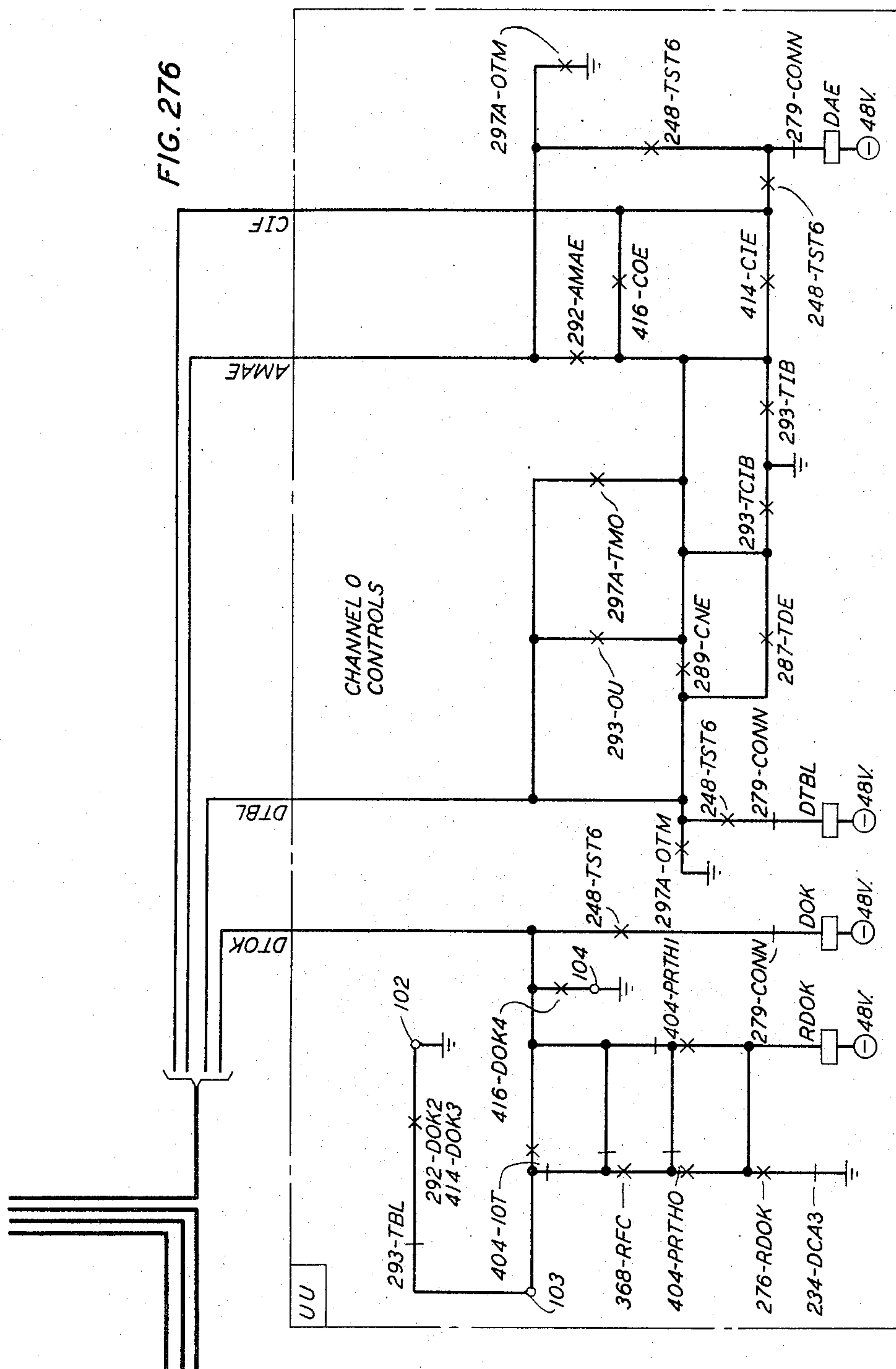
L. J. CERNY ET AL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER.

Filed Nov. 26, 1963

570 Sheets-Sheet 356



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 357

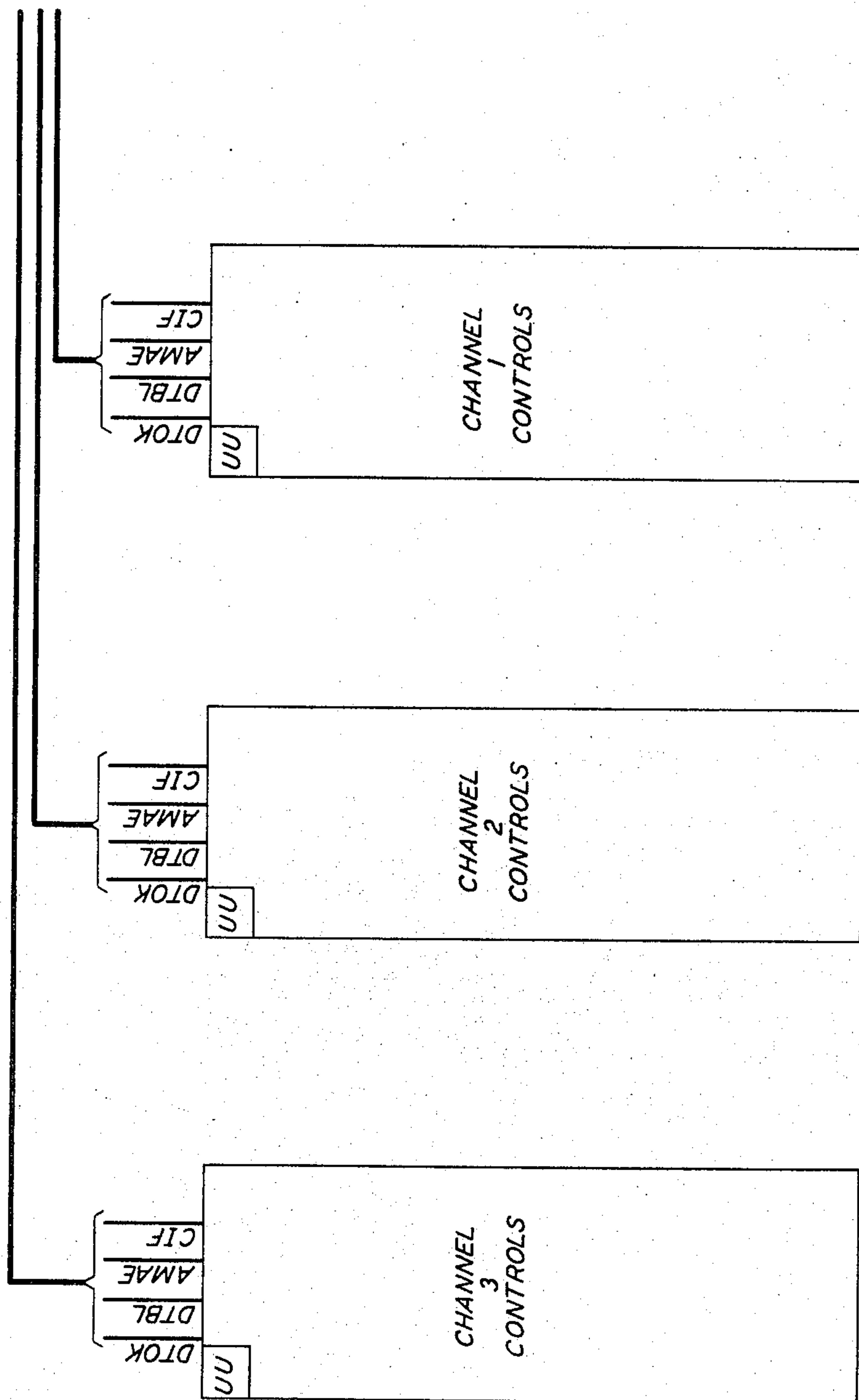


FIG. 276A

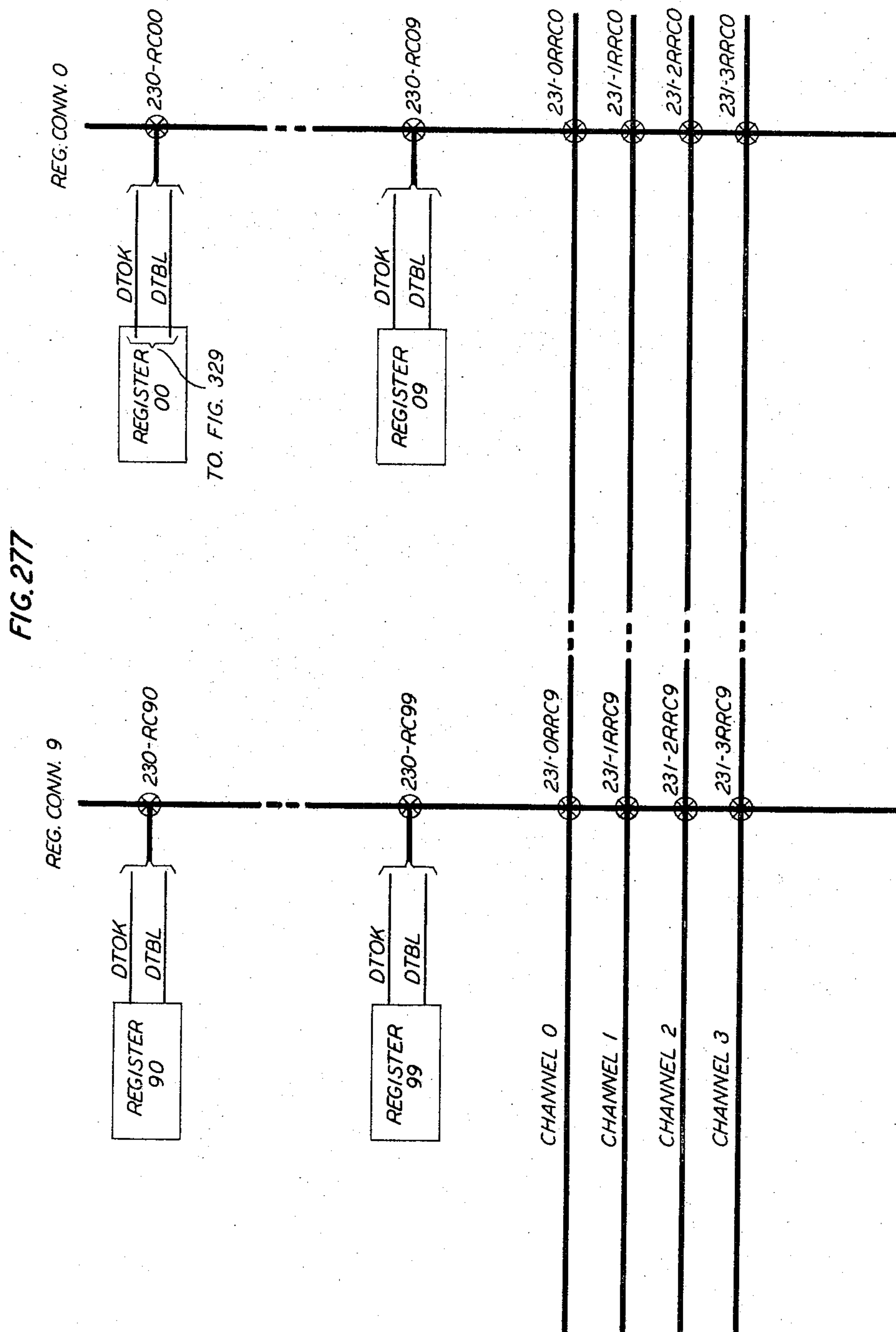
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 358



Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 359

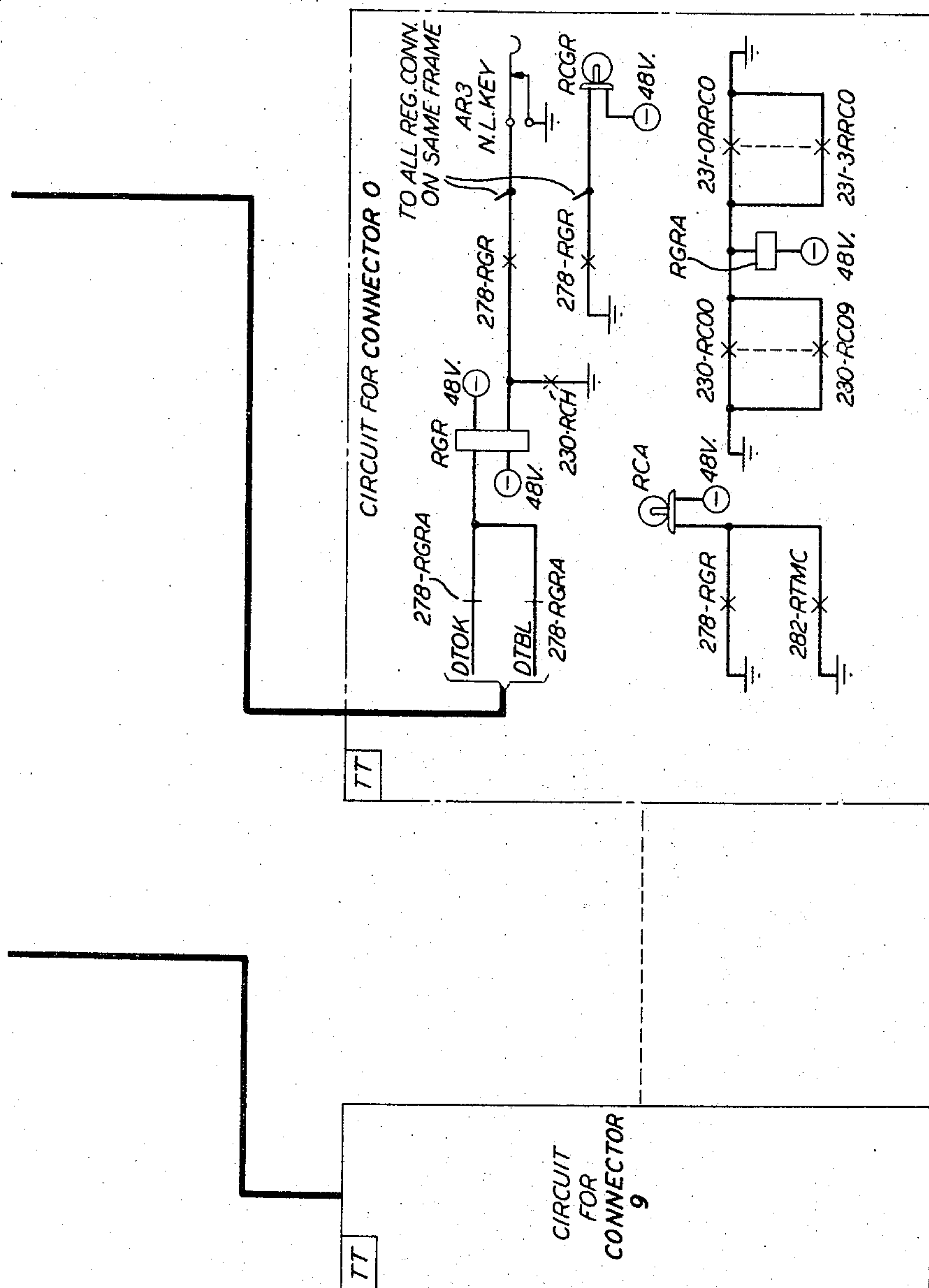


FIG. 278

Sept. 12, 1967

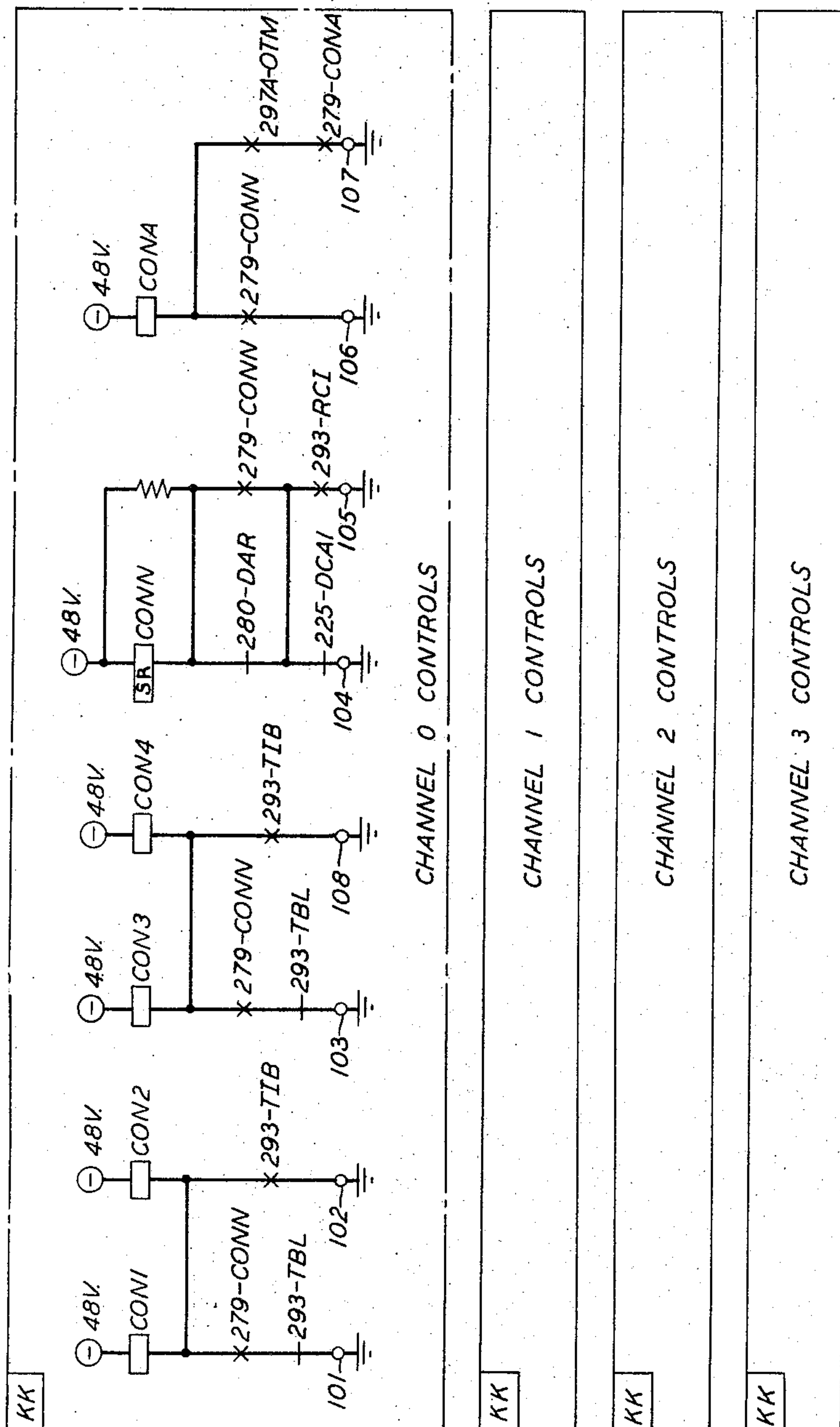
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 360

FIG. 279



Sept. 12, 1967

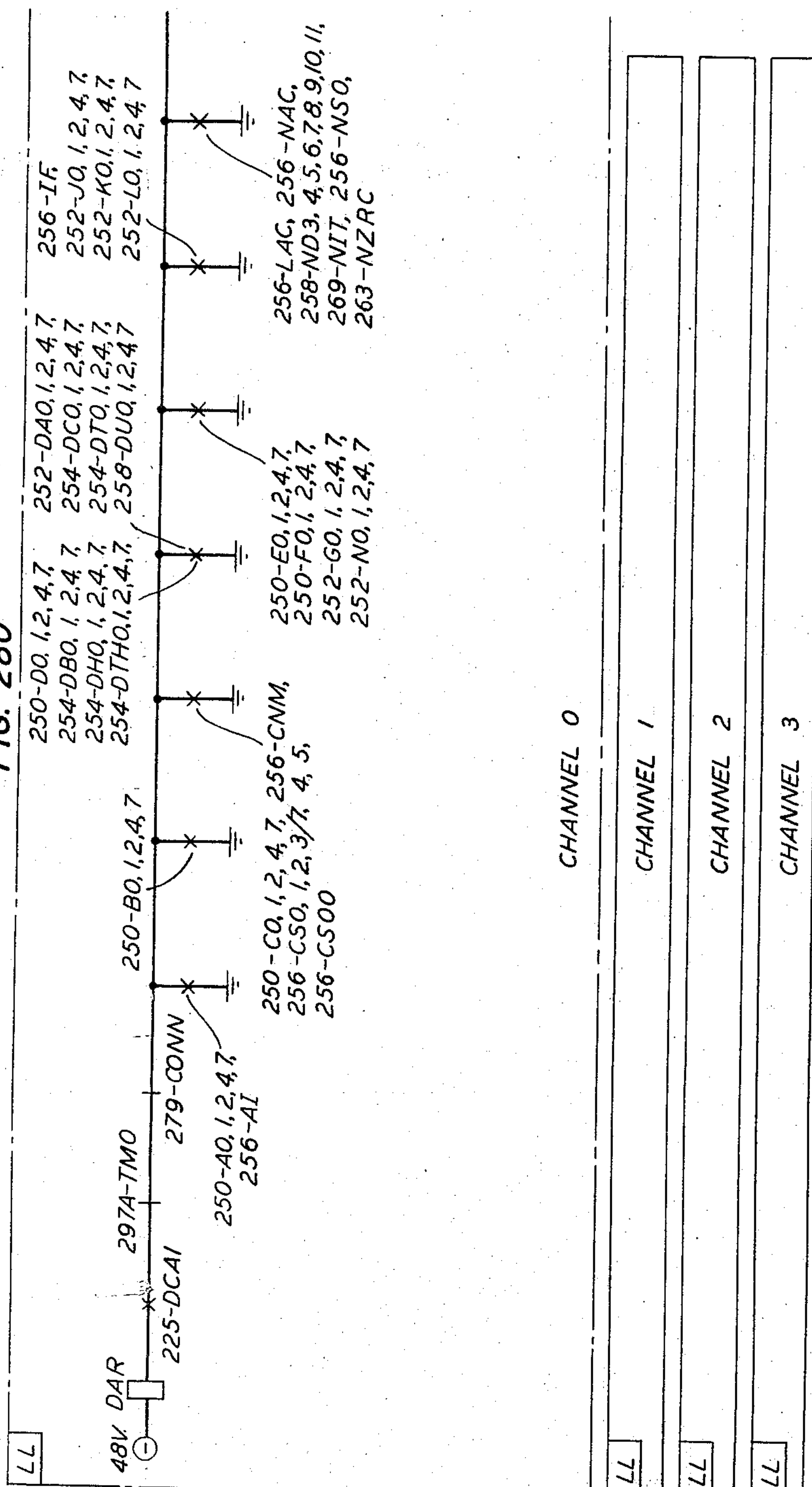
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 361

FIG. 280



Sept. 12, 1967

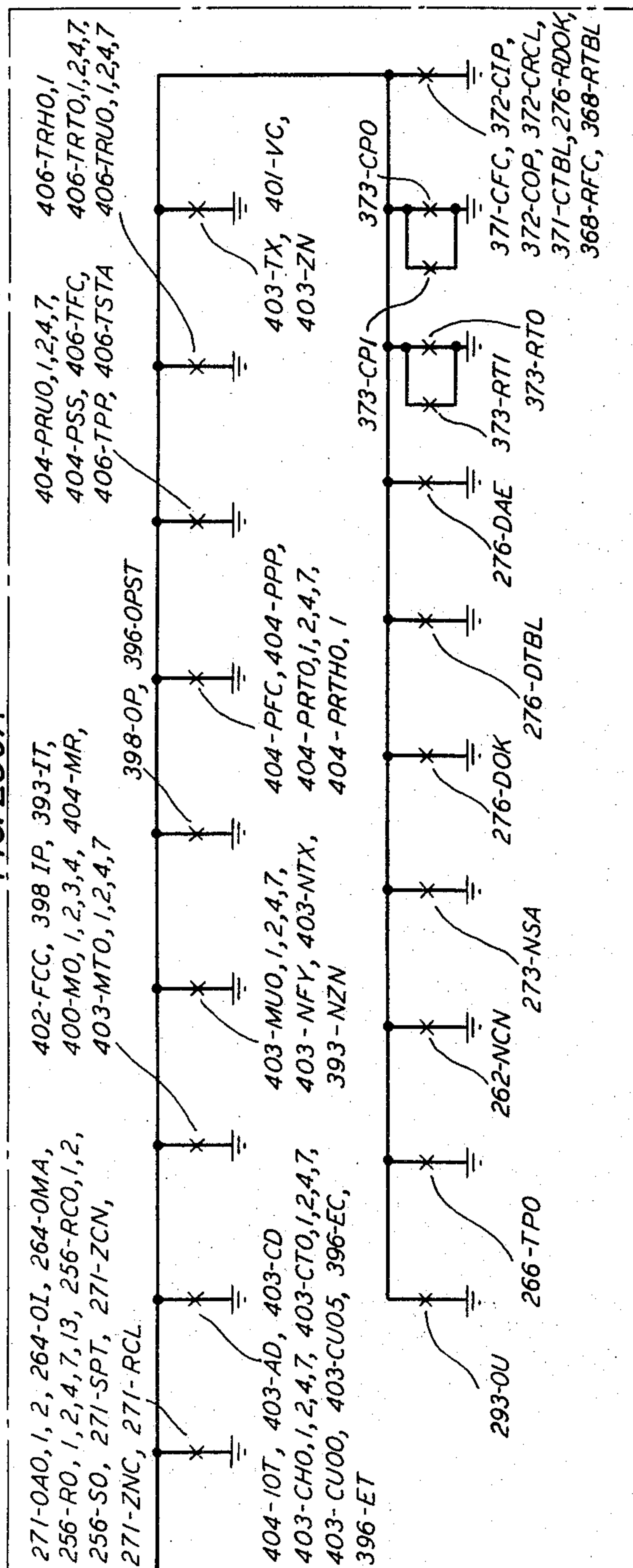
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 362

FIG. 280A



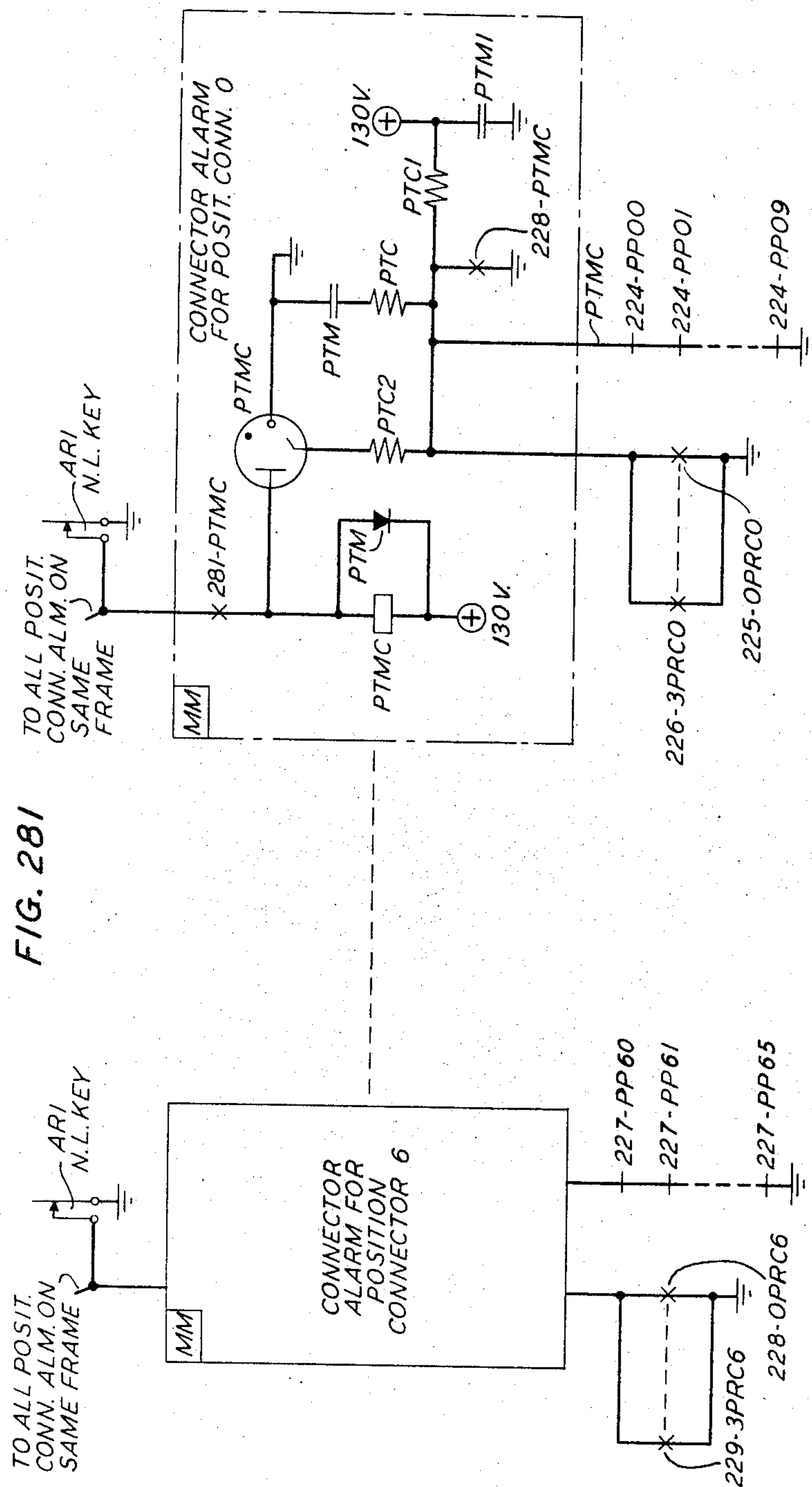
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 363



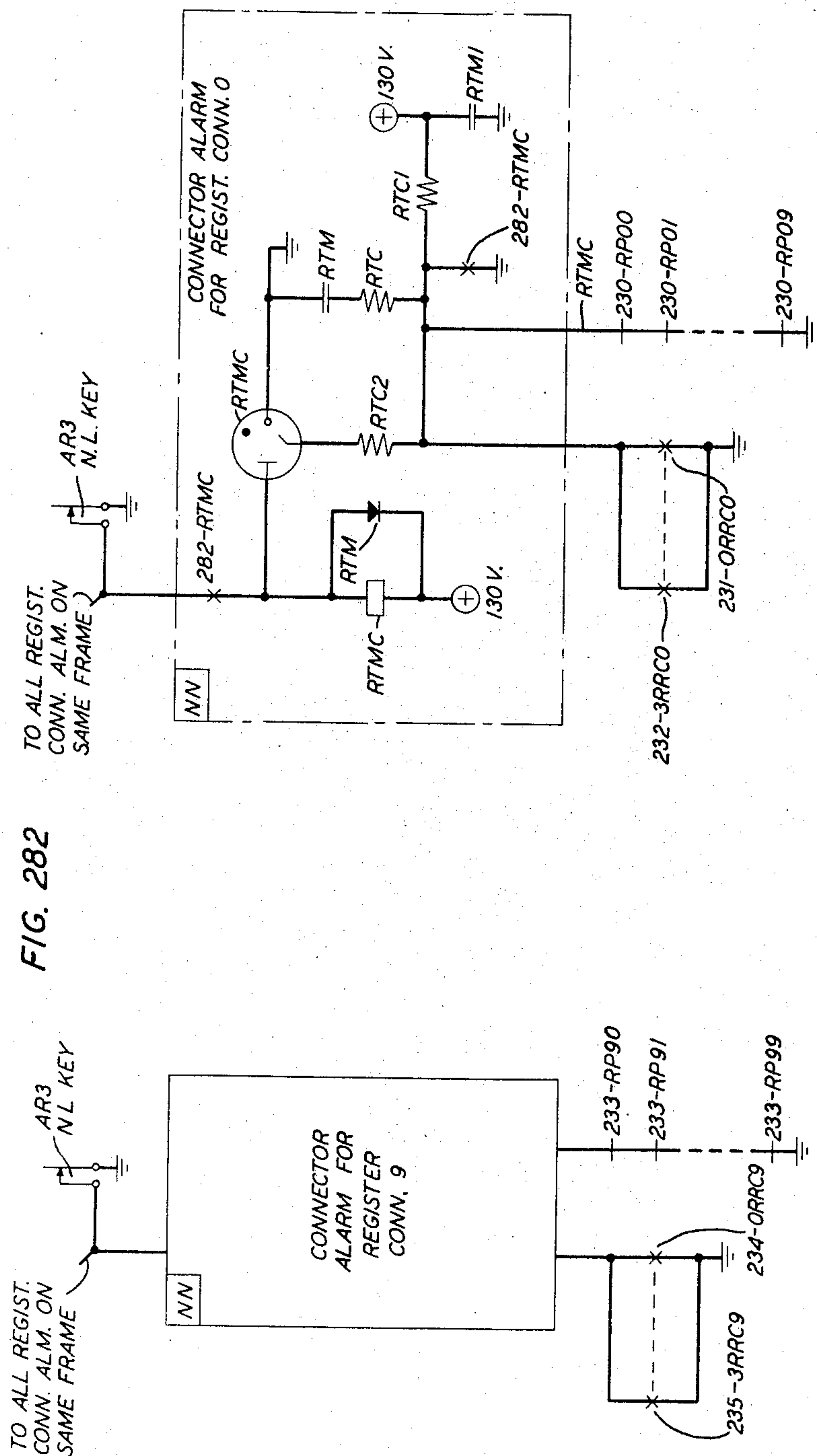
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 364



Sept. 12, 1967

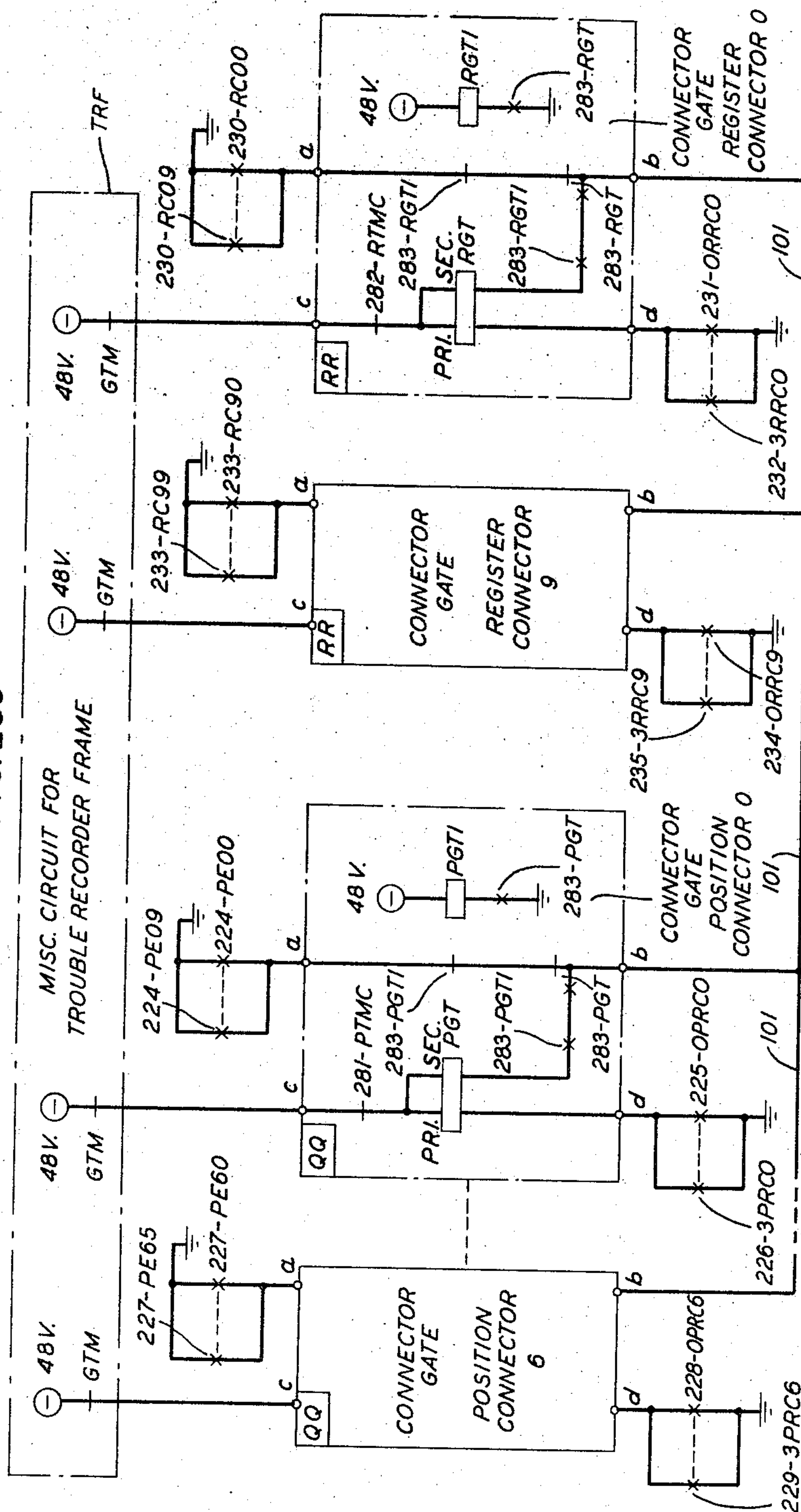
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 365

FIG. 283



Sept. 12, 1967

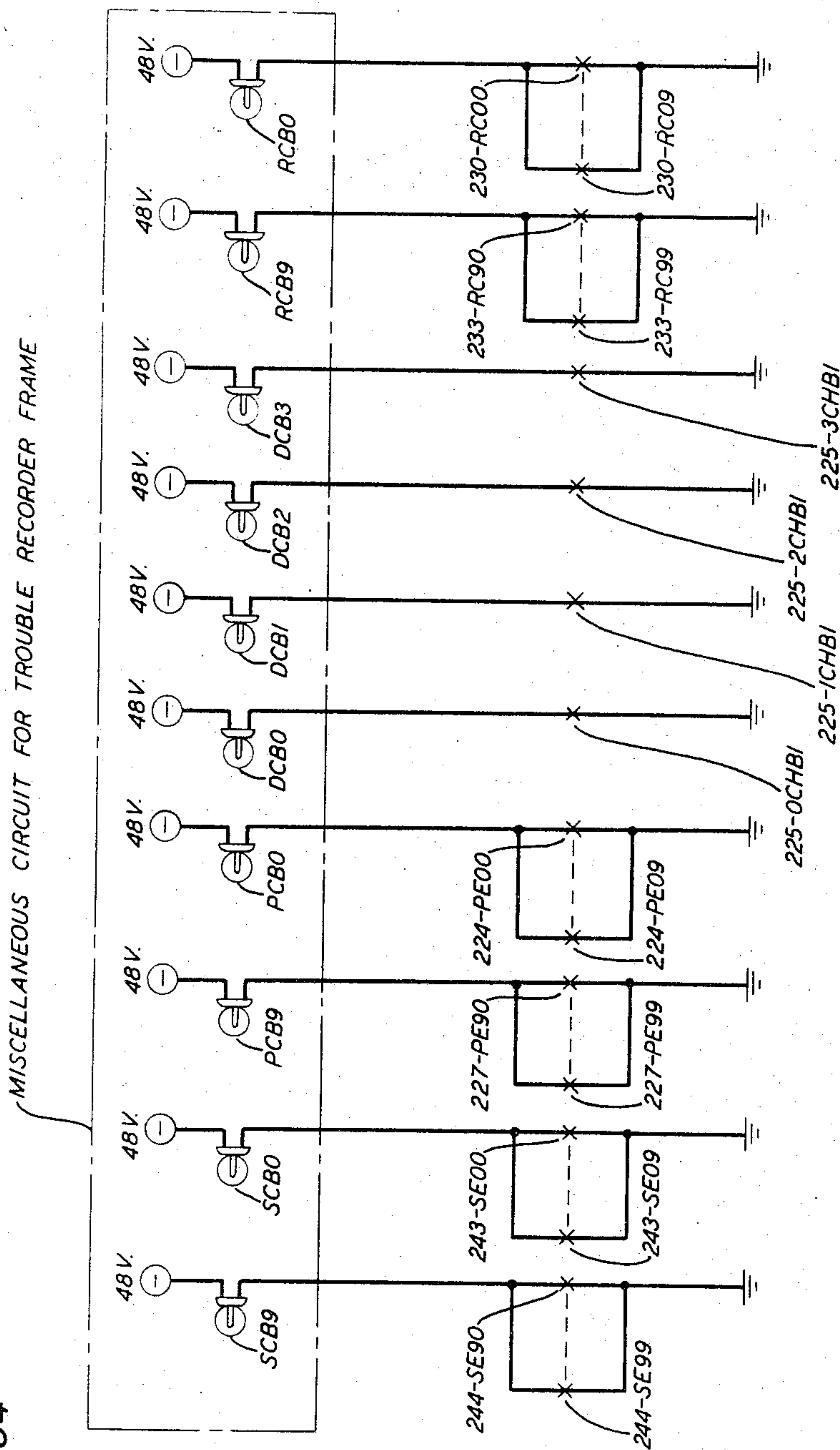
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 366

FIG. 284



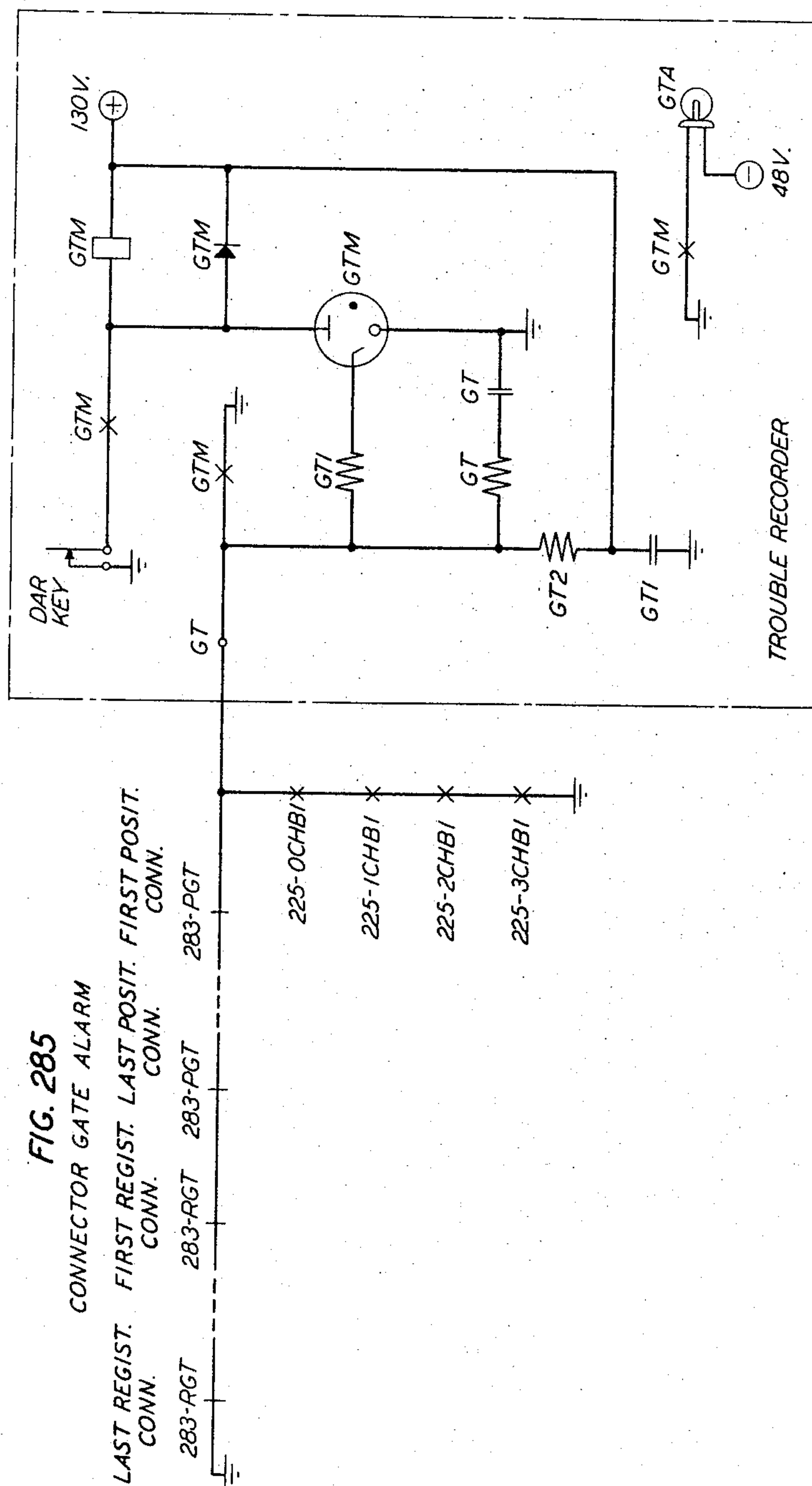
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 367



Sept. 12, 1967

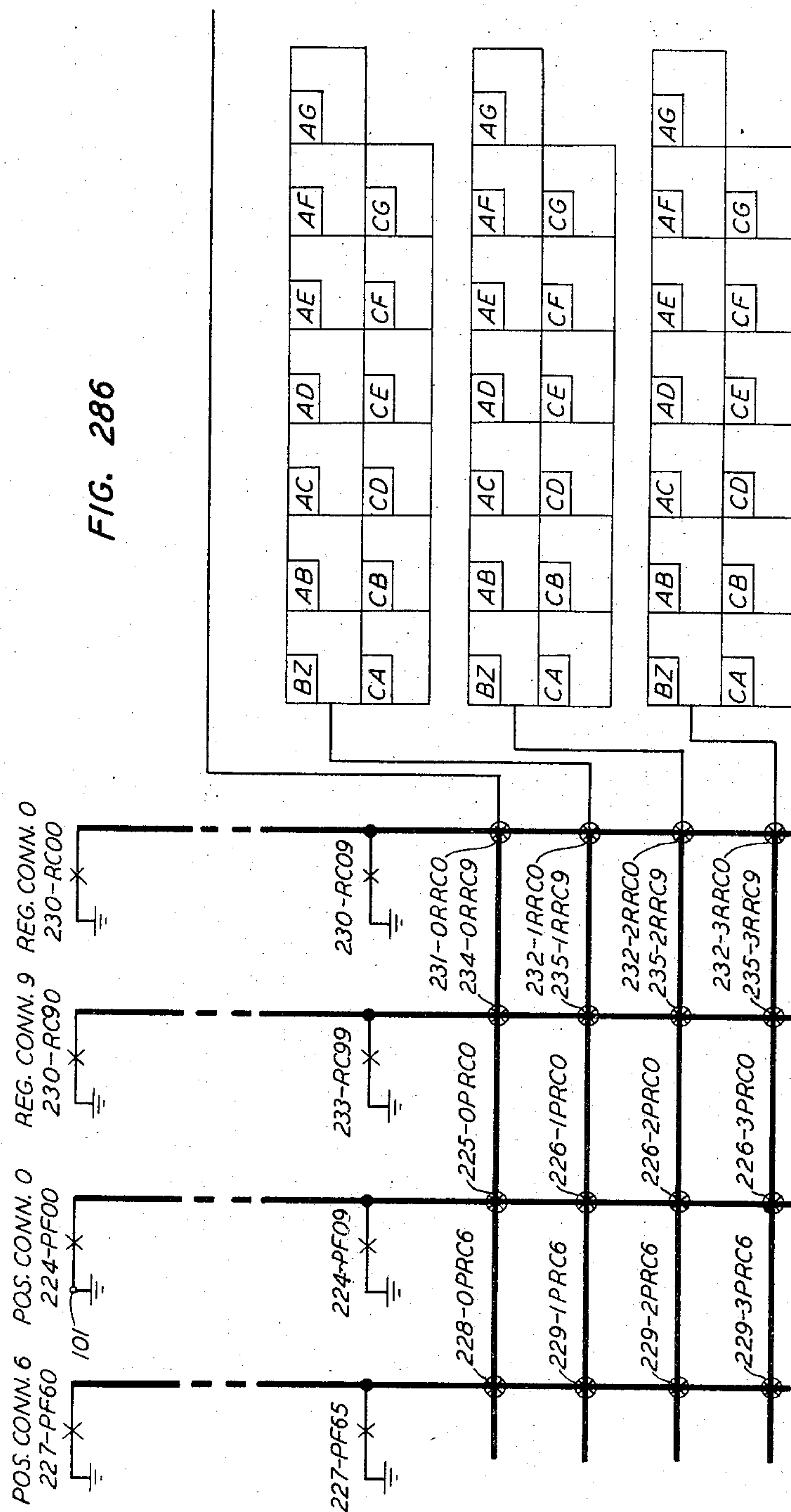
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 363

FIG. 286



Sept. 12, 1967

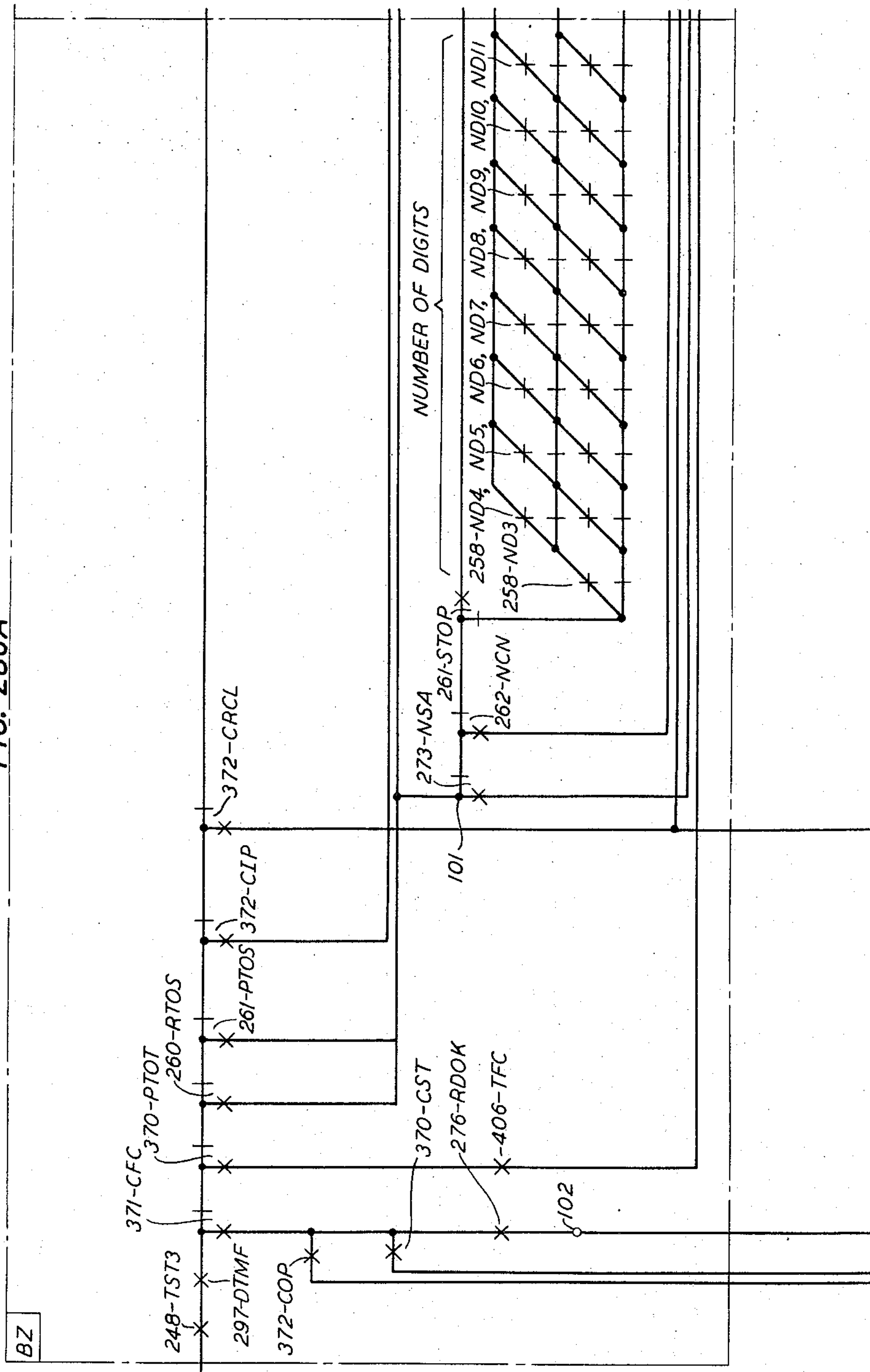
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 360

FIG. 286A



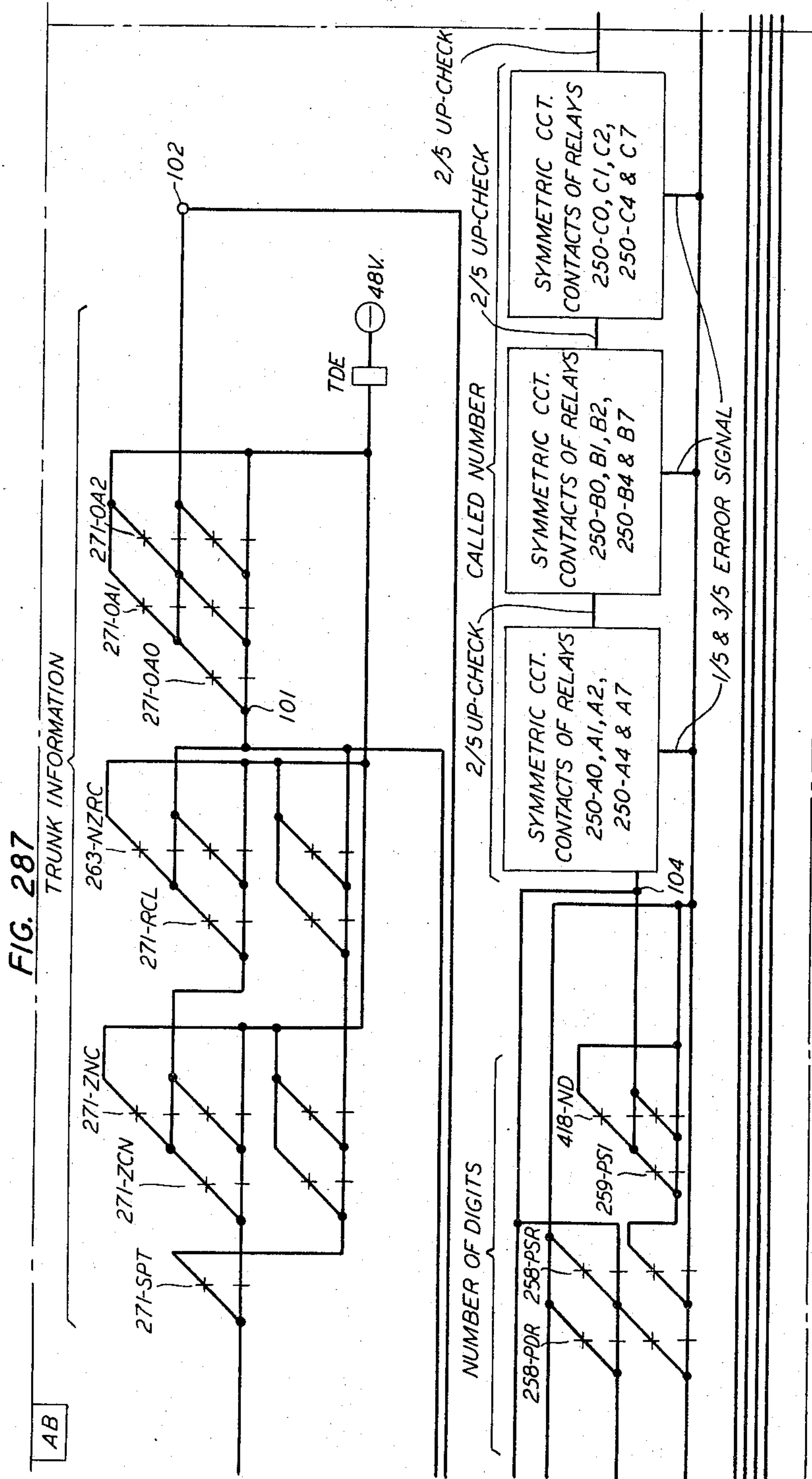
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 370



Sept. 12, 1967

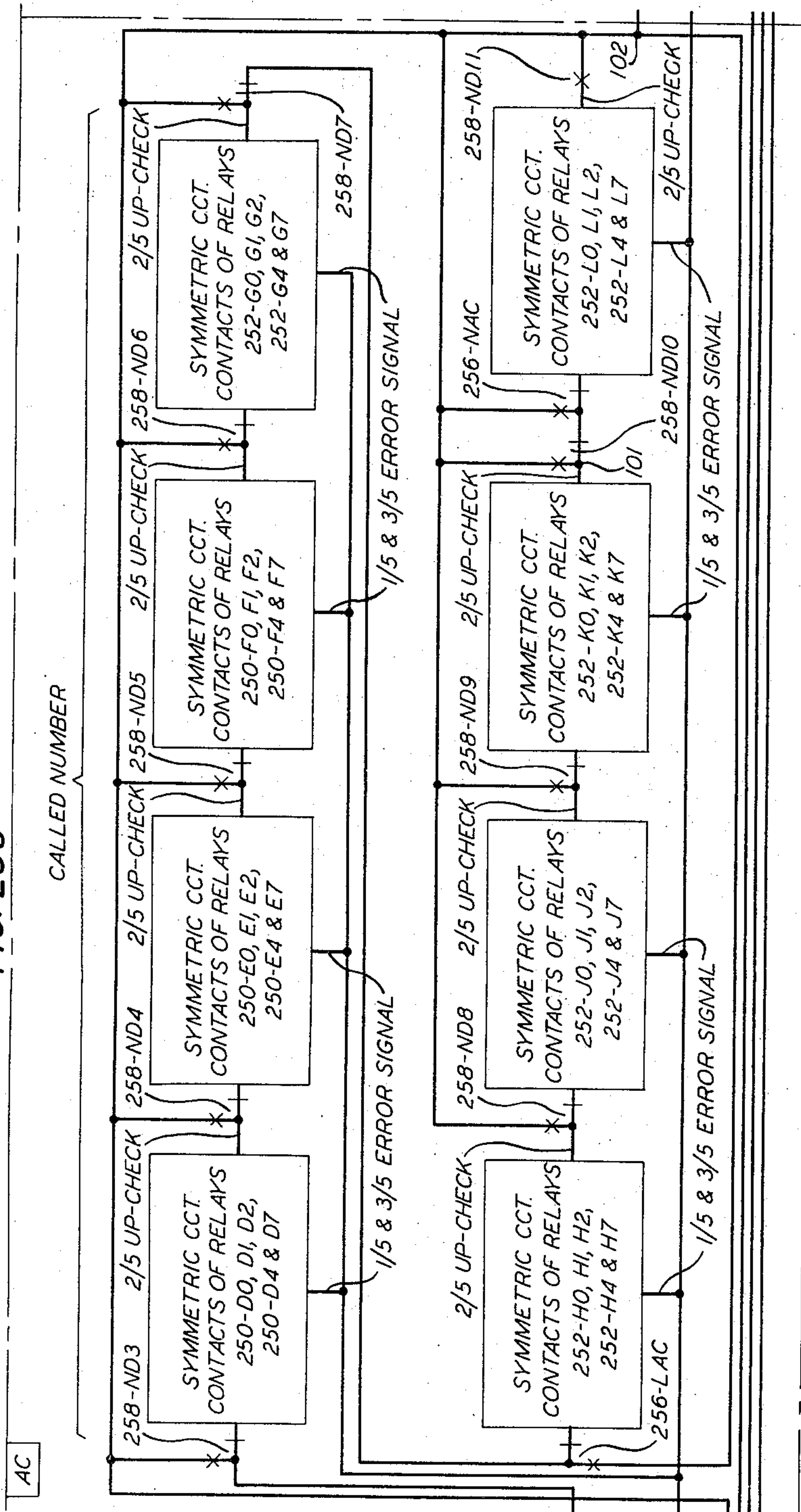
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 371

FIG. 288



Sept. 12, 1967

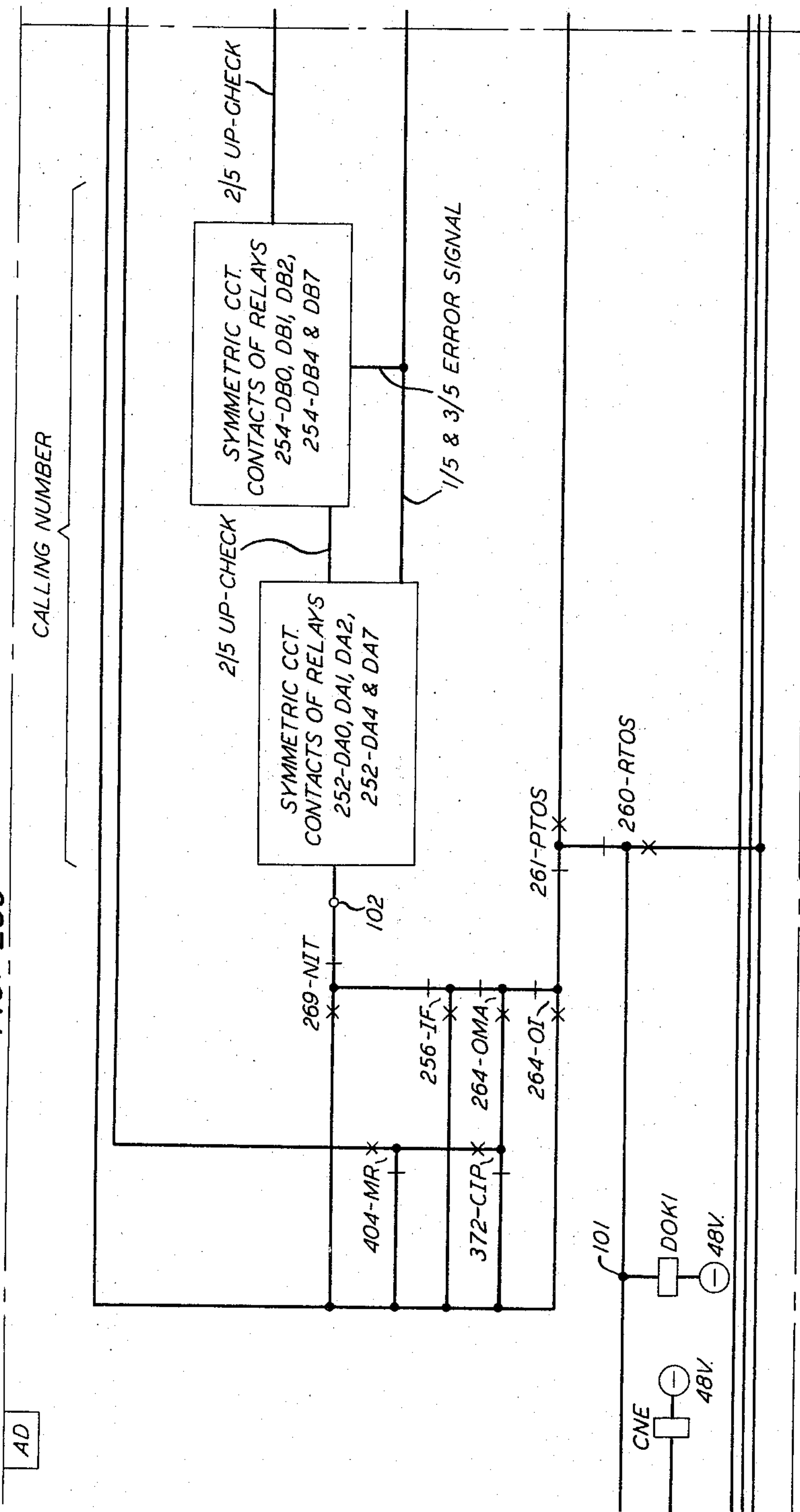
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 372

FIG. 289



Sept. 12, 1967

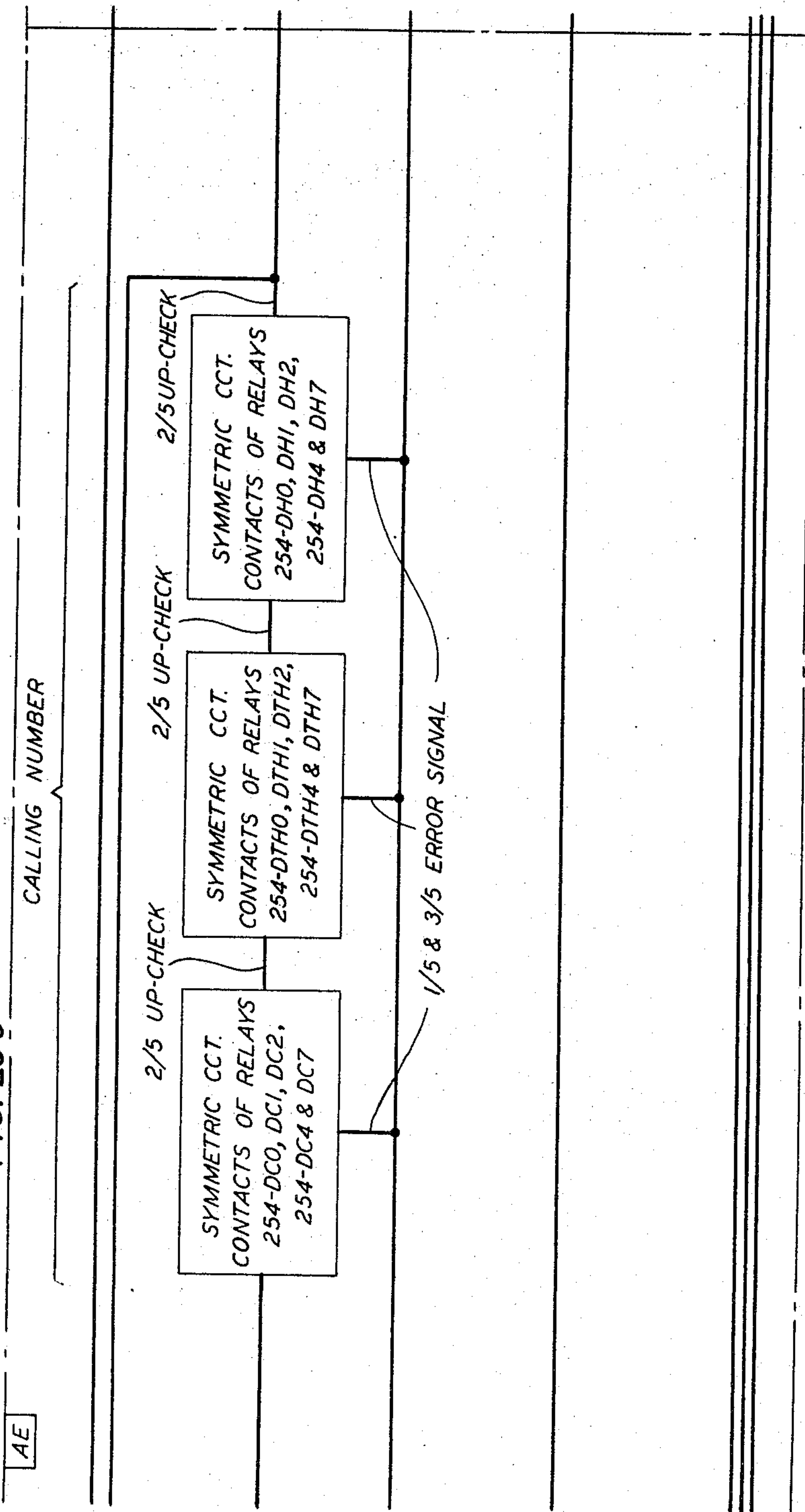
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 373

FIG. 290



Sept. 12, 1967

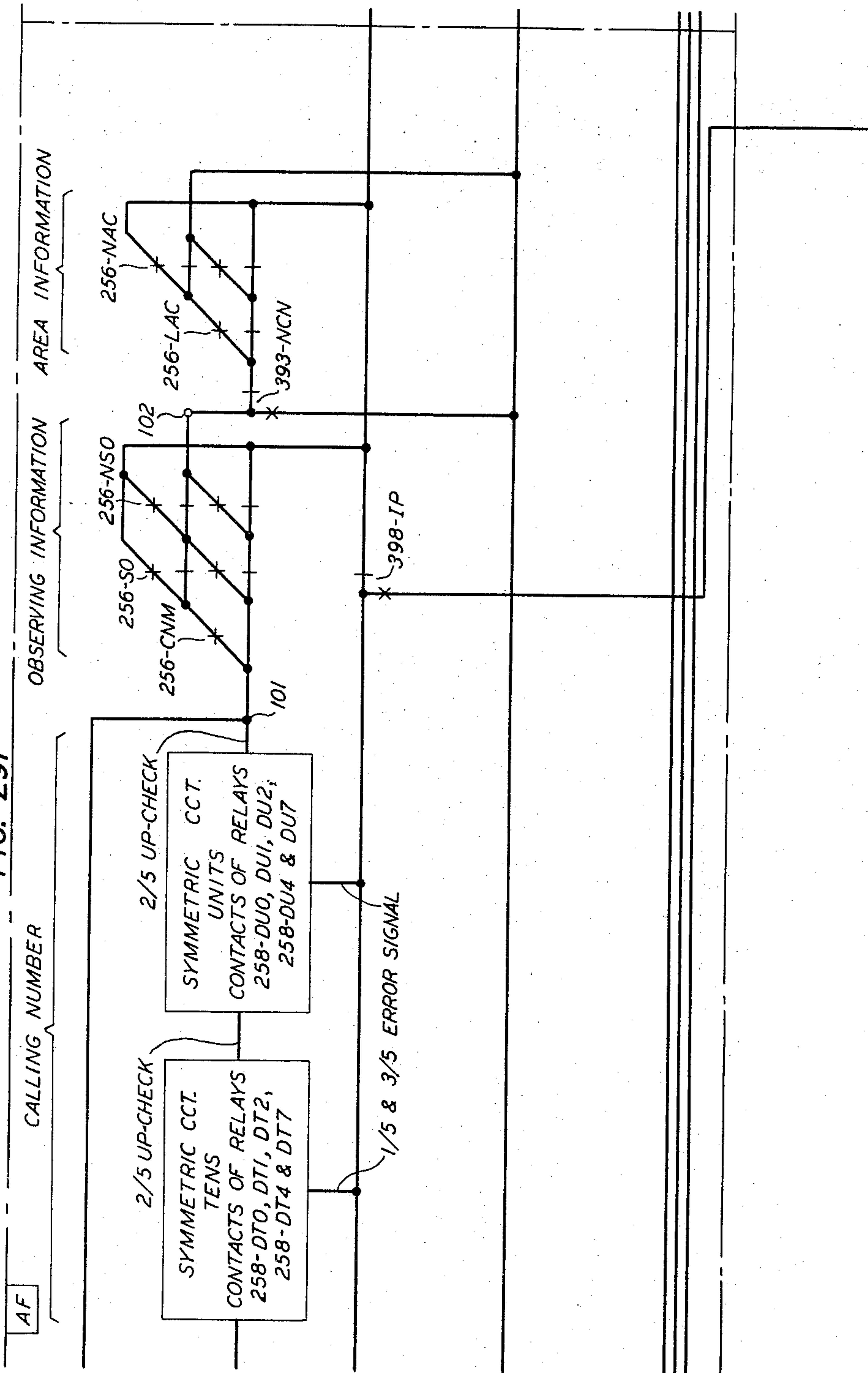
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 374

FIG. 291



Sept. 12, 1967

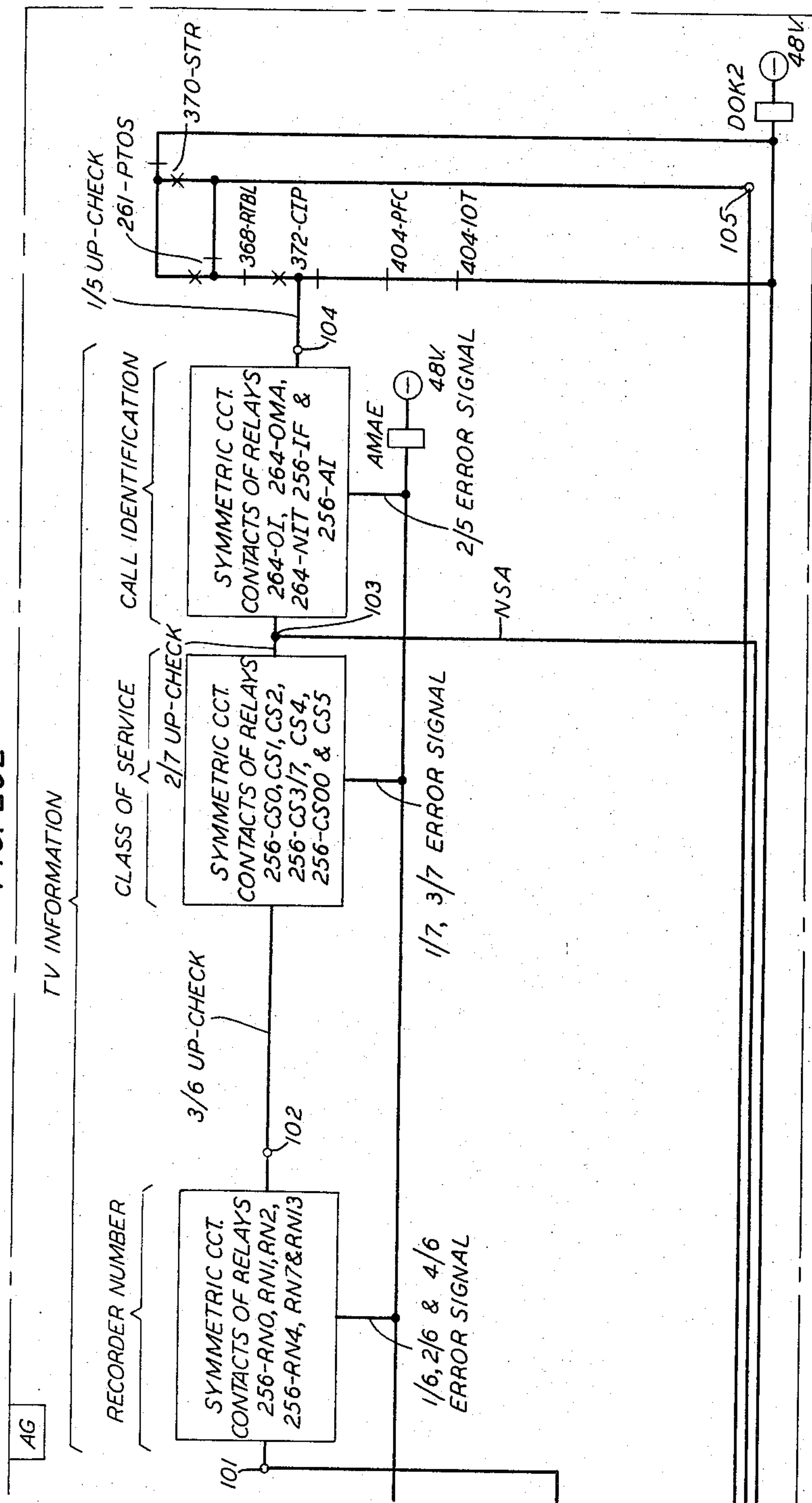
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 375

FIG. 292



Sept. 12, 1967

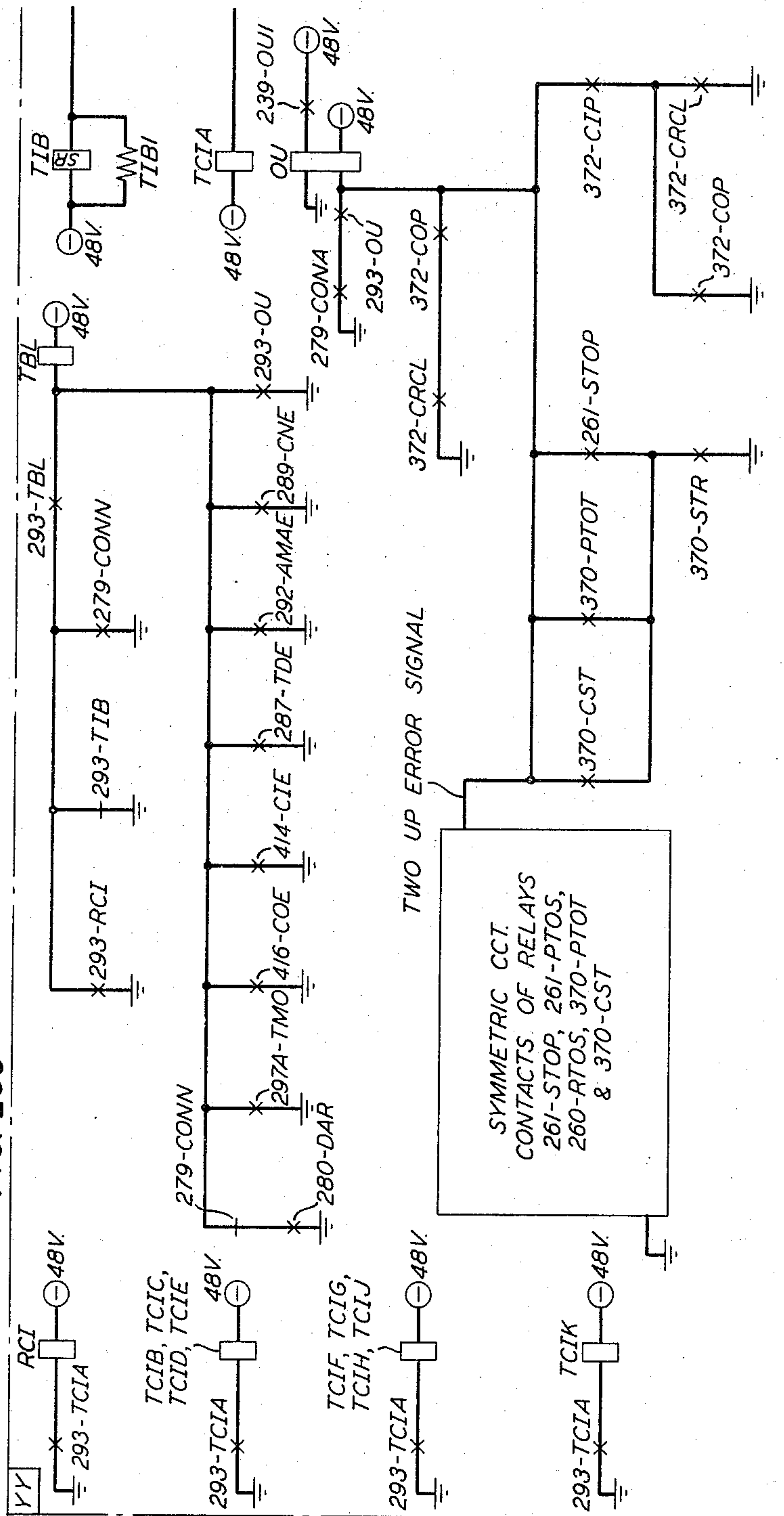
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 376

FIG. 293



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

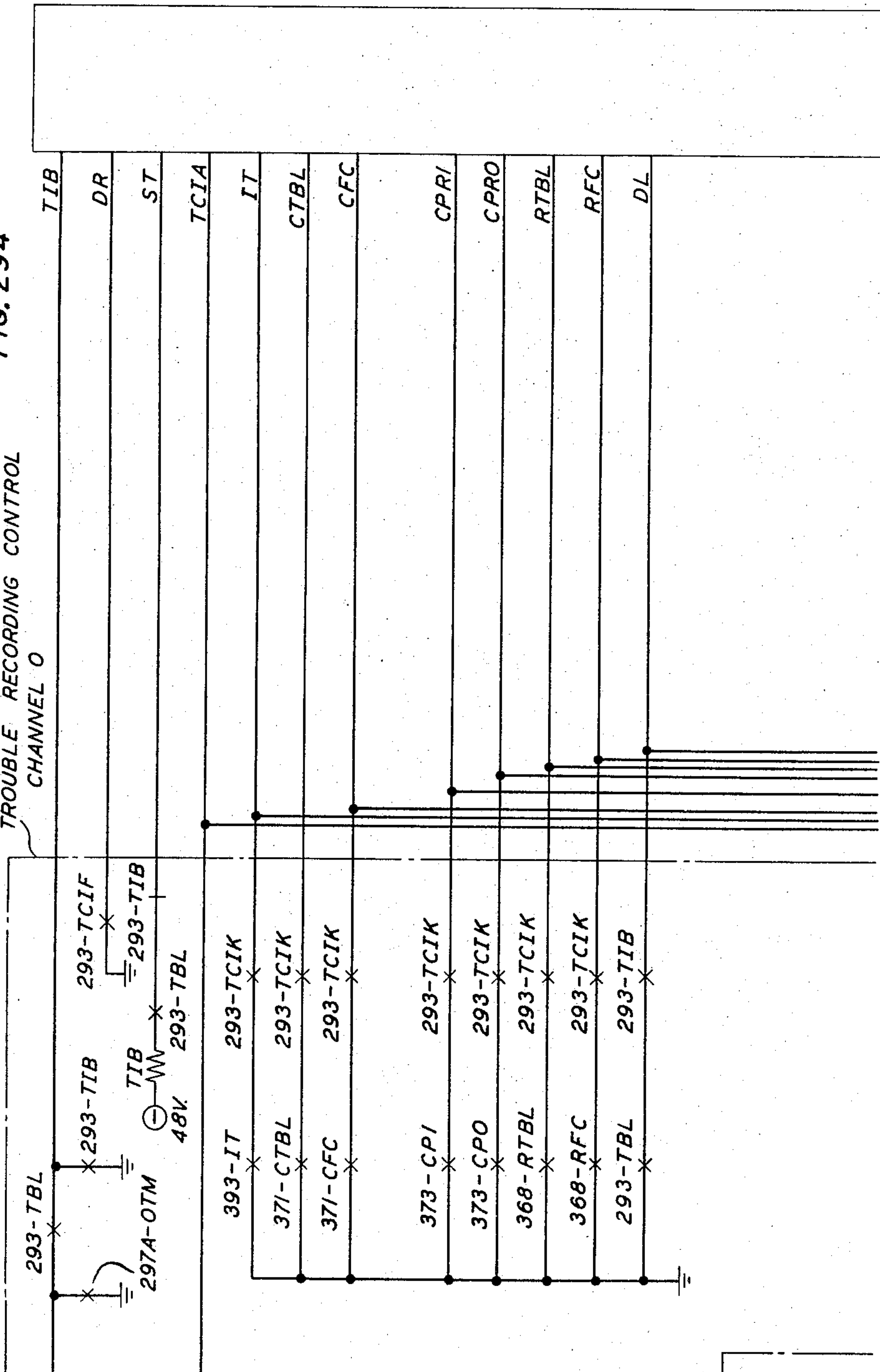
3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 377

FIG. 294

TROUBLE RECORDING CONTROL
CHANNEL 0



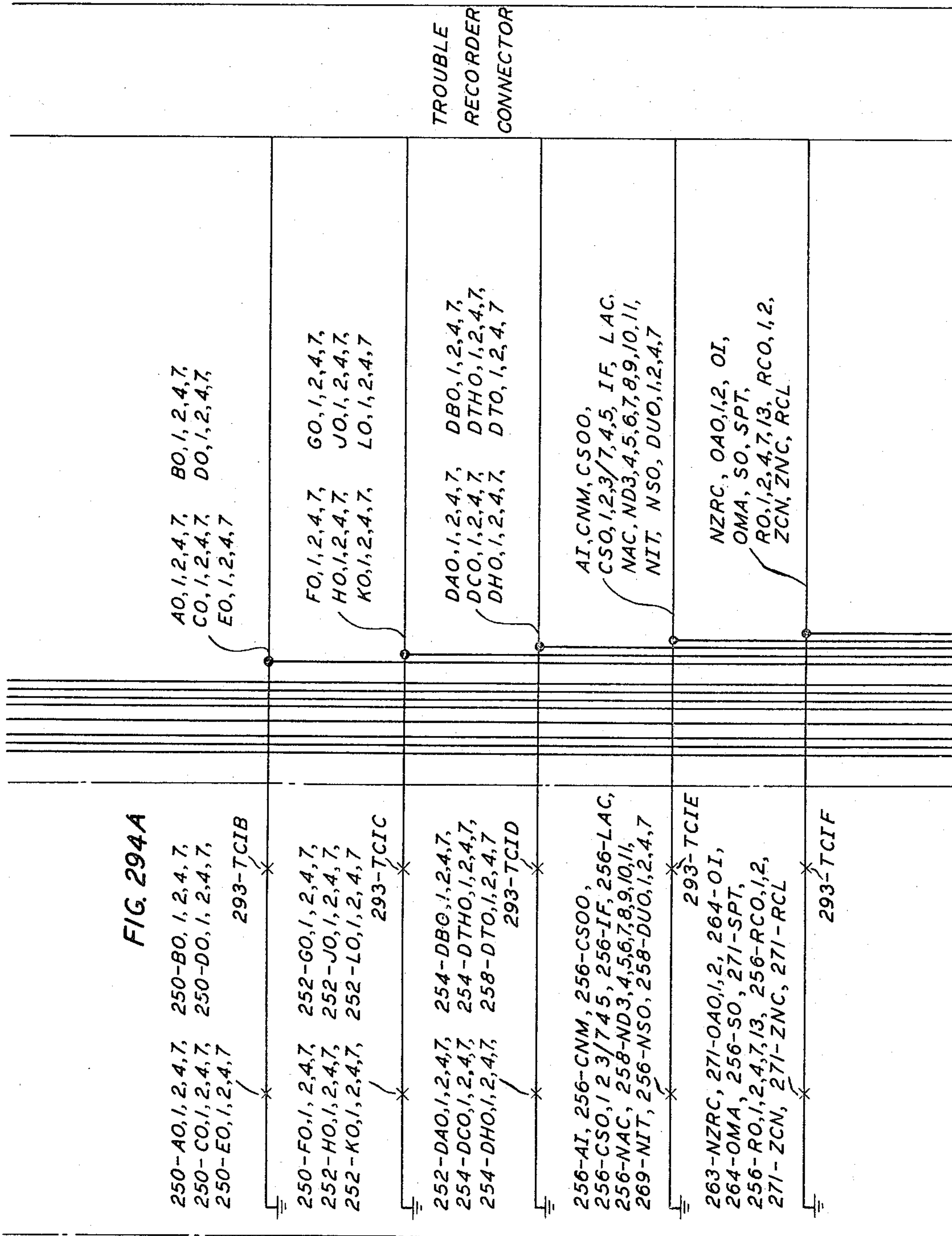
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 378



Sept. 12, 1967

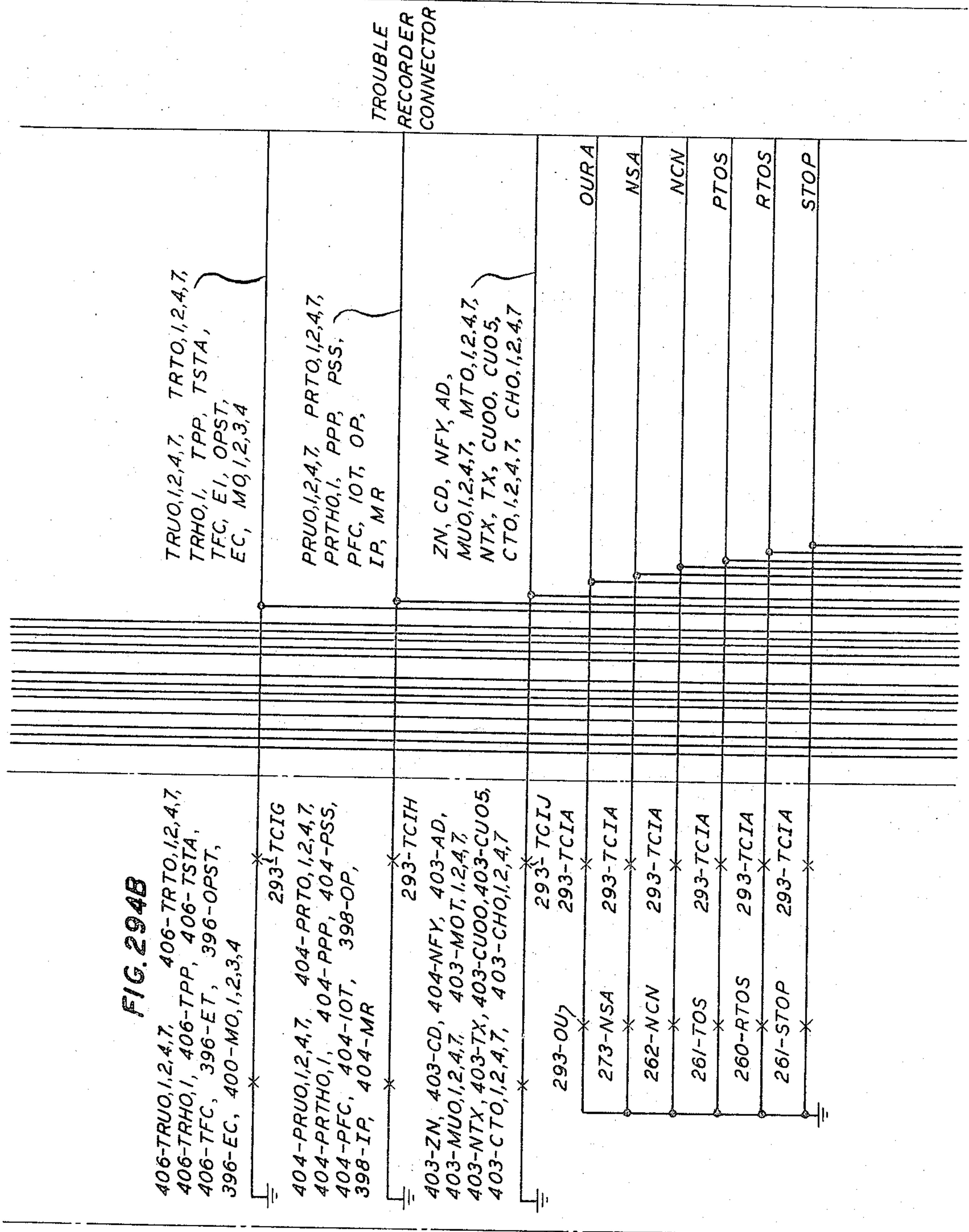
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3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 373



Sept. 12, 1967

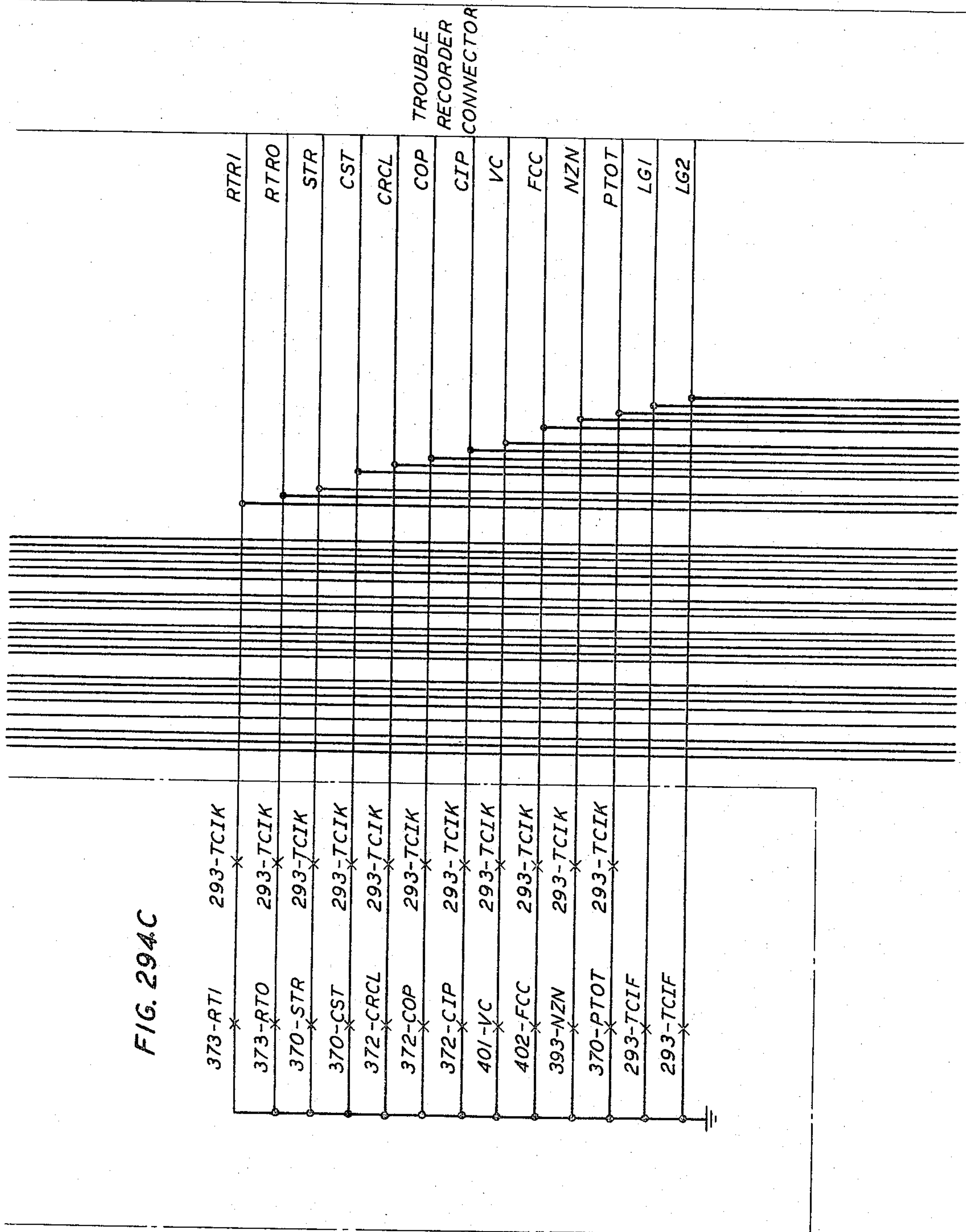
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 380



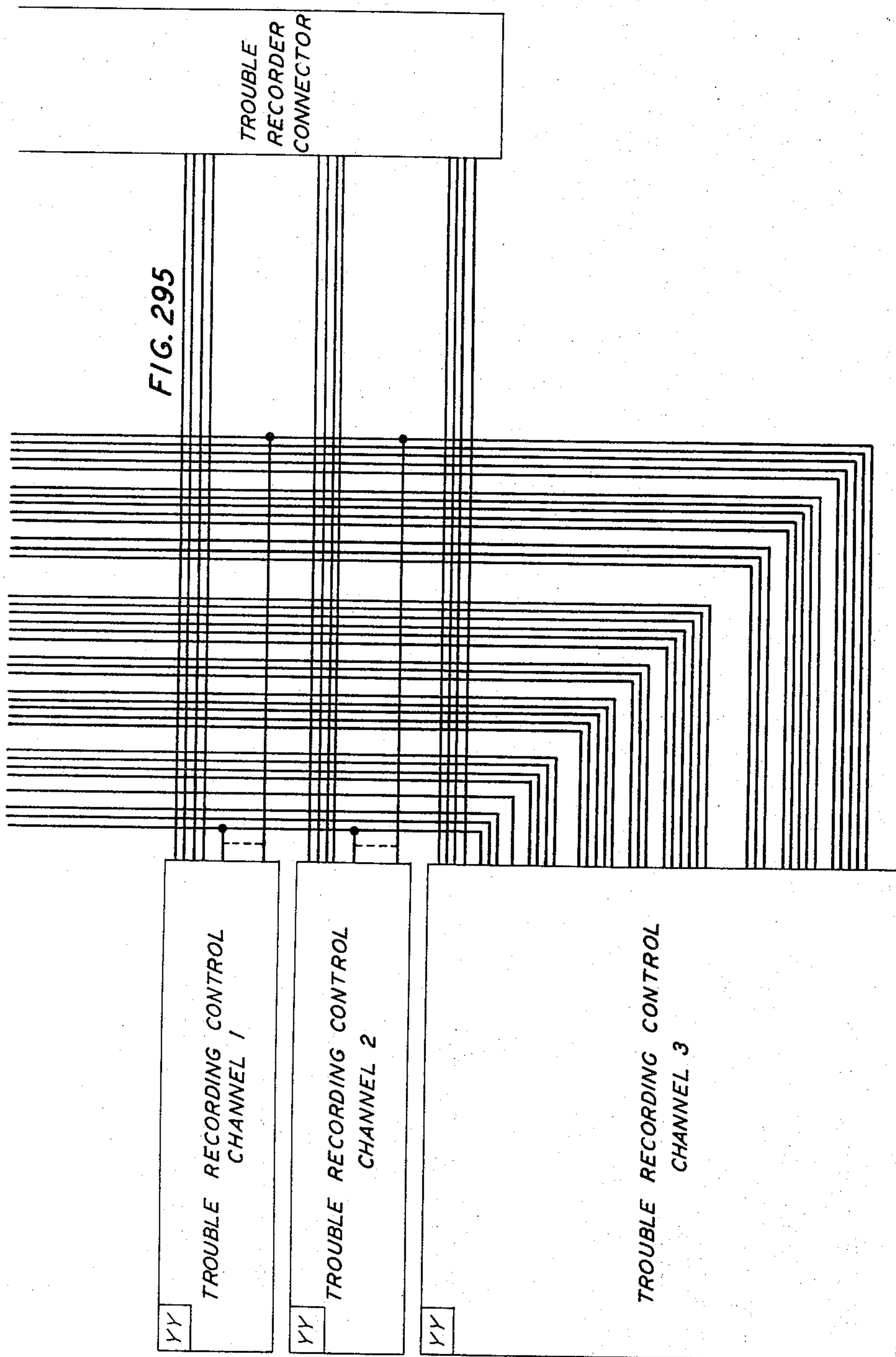
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 381



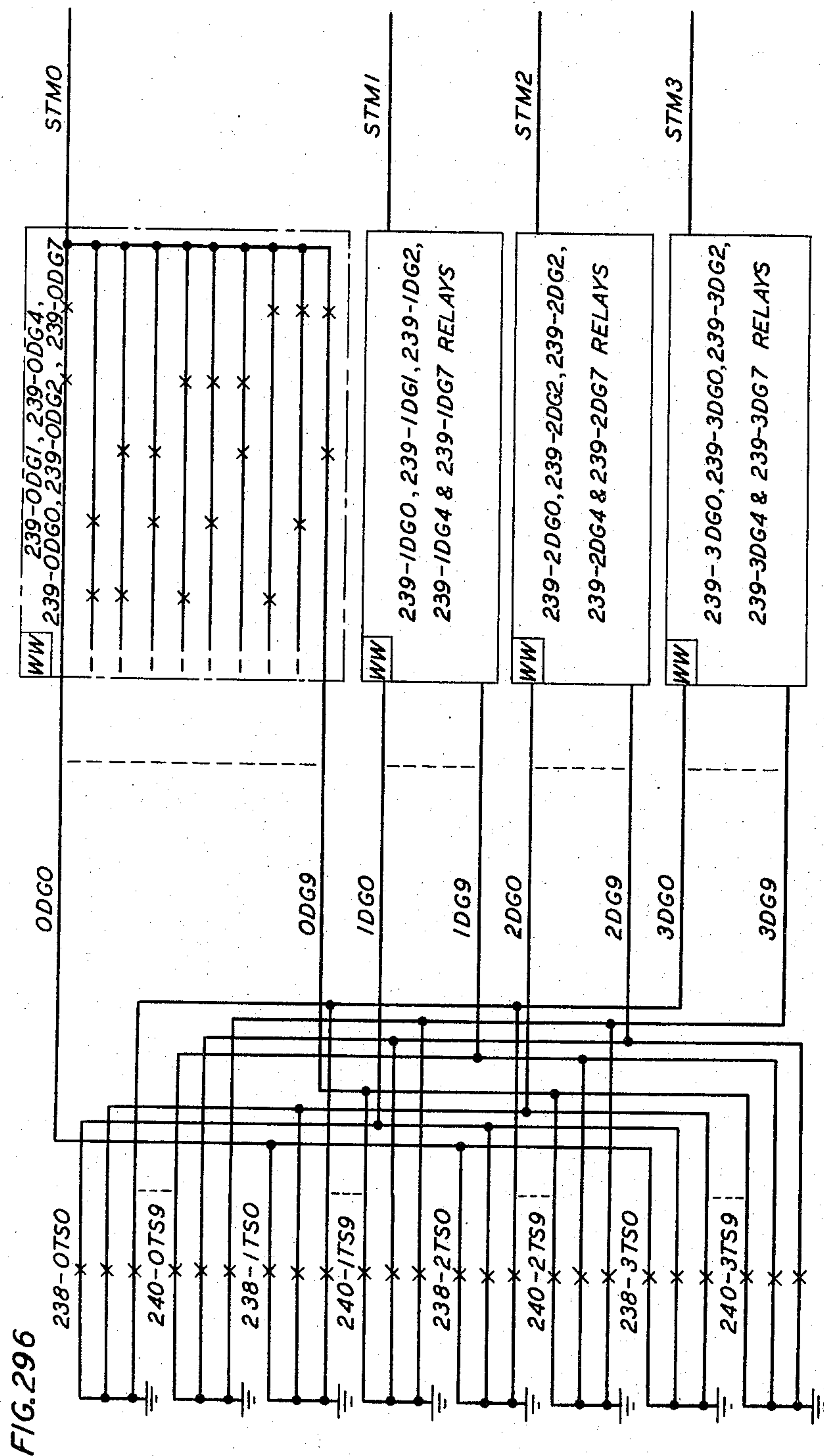
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 382



Sept. 12, 1967

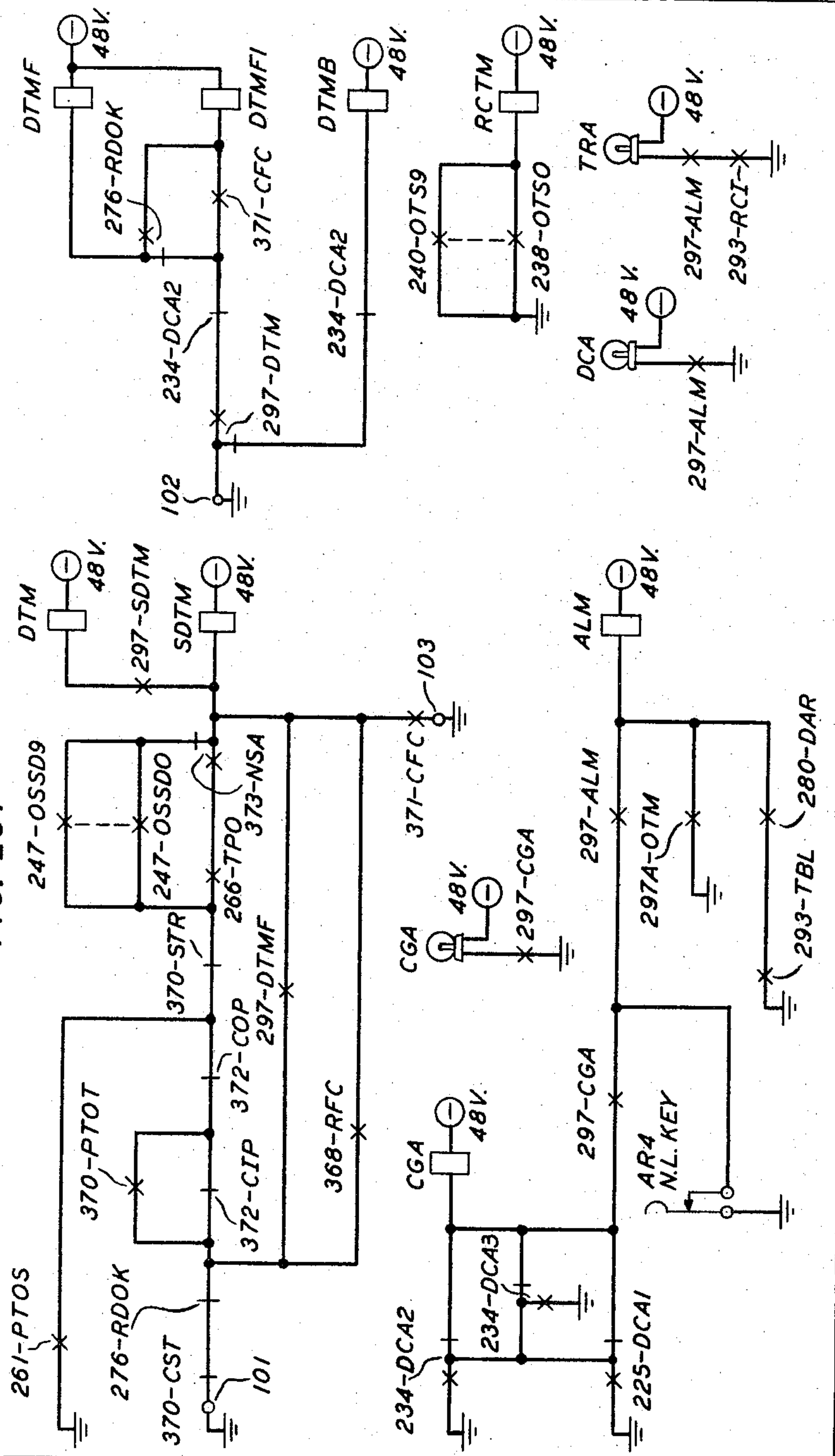
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 383

FIG. 297



Sept. 12, 1967

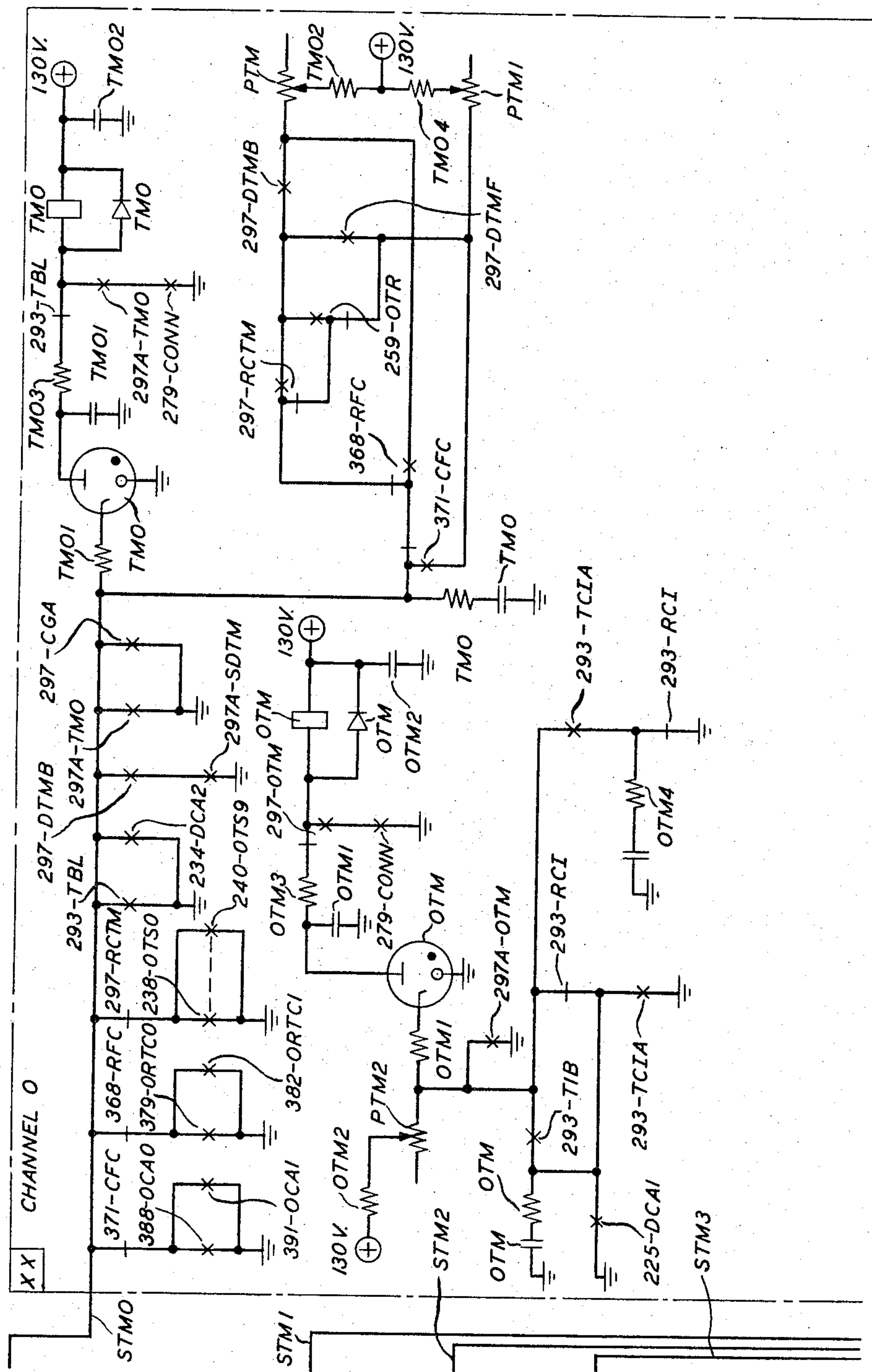
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 384

FIG. 297A



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 385

FIG. 298

CHANNEL 1

CHANNEL 2

CHANNEL 3

XX

XX

XX

Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 386

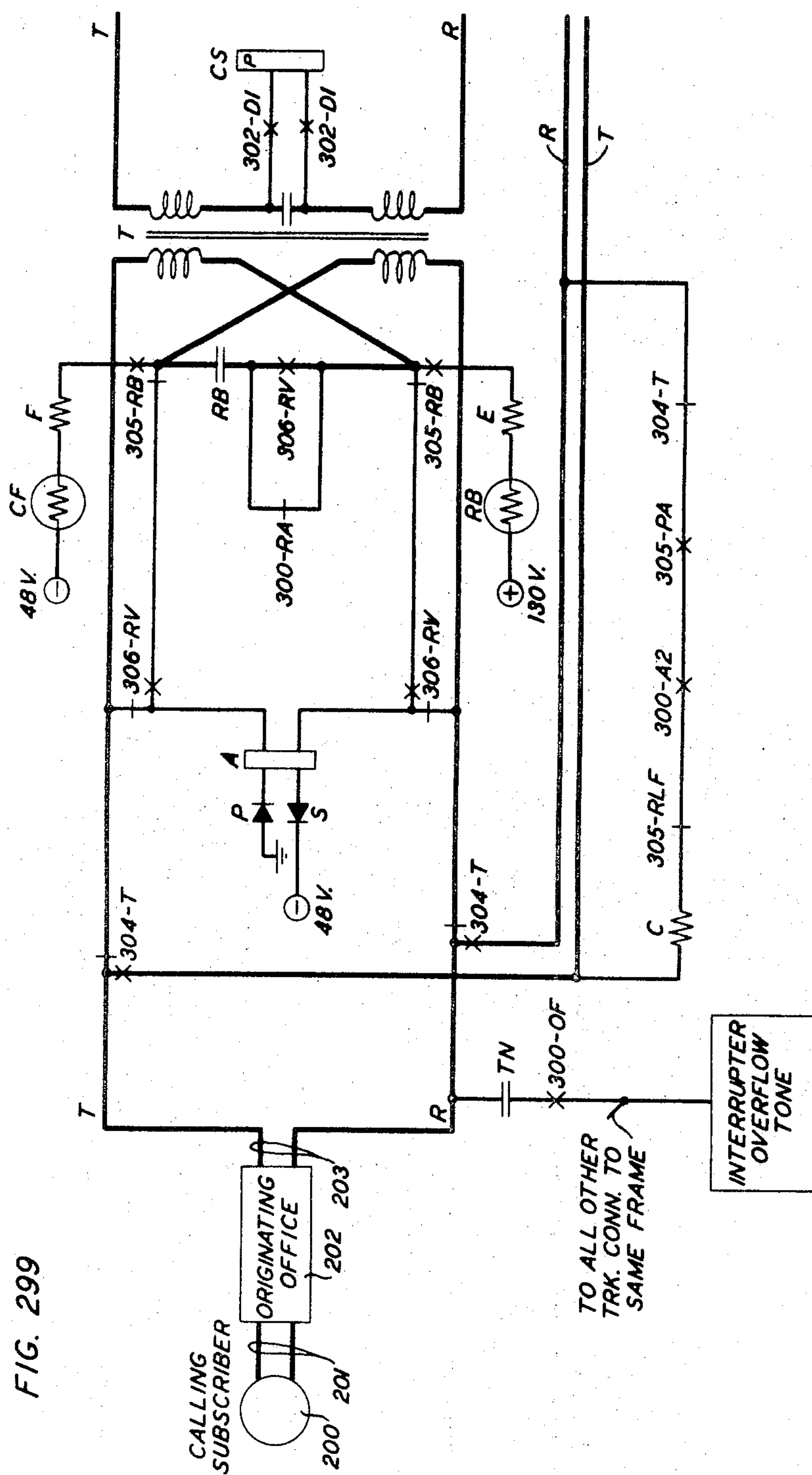


FIG. 299

Sept. 12, 1967

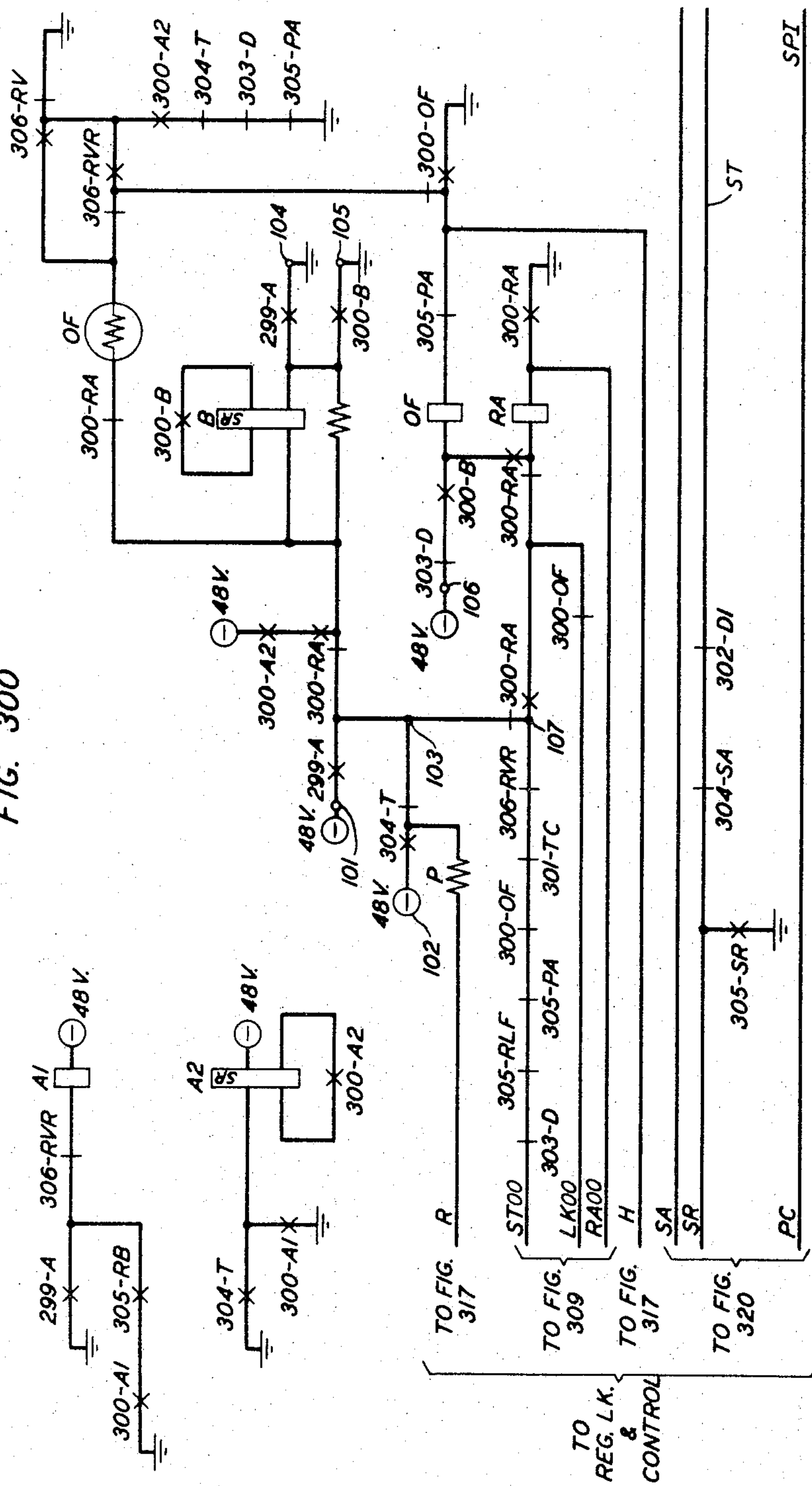
L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 387

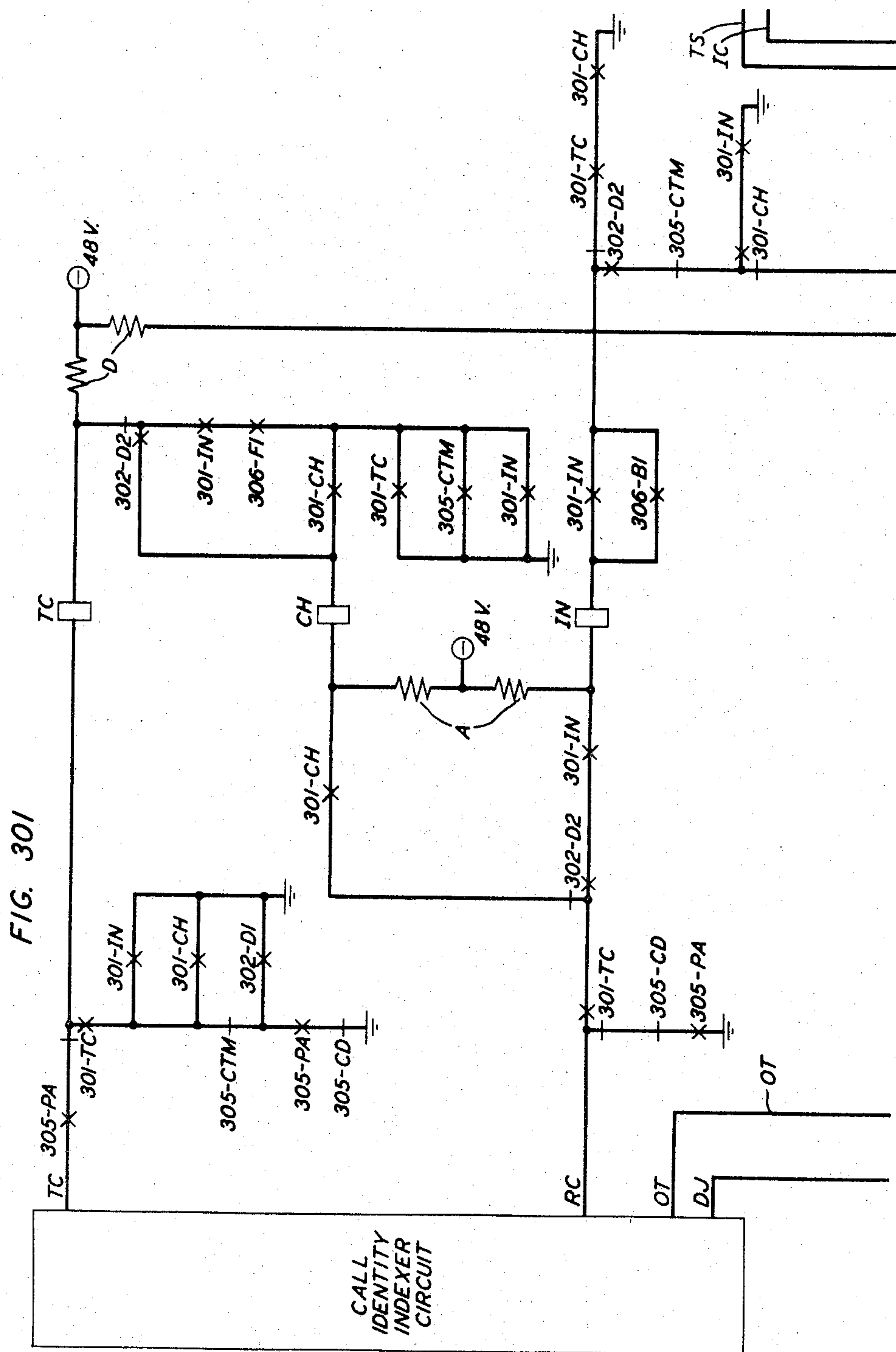
FIG. 300



Filed Nov. 26, 1963

570 Sheets-Sheet 383

3,341,662



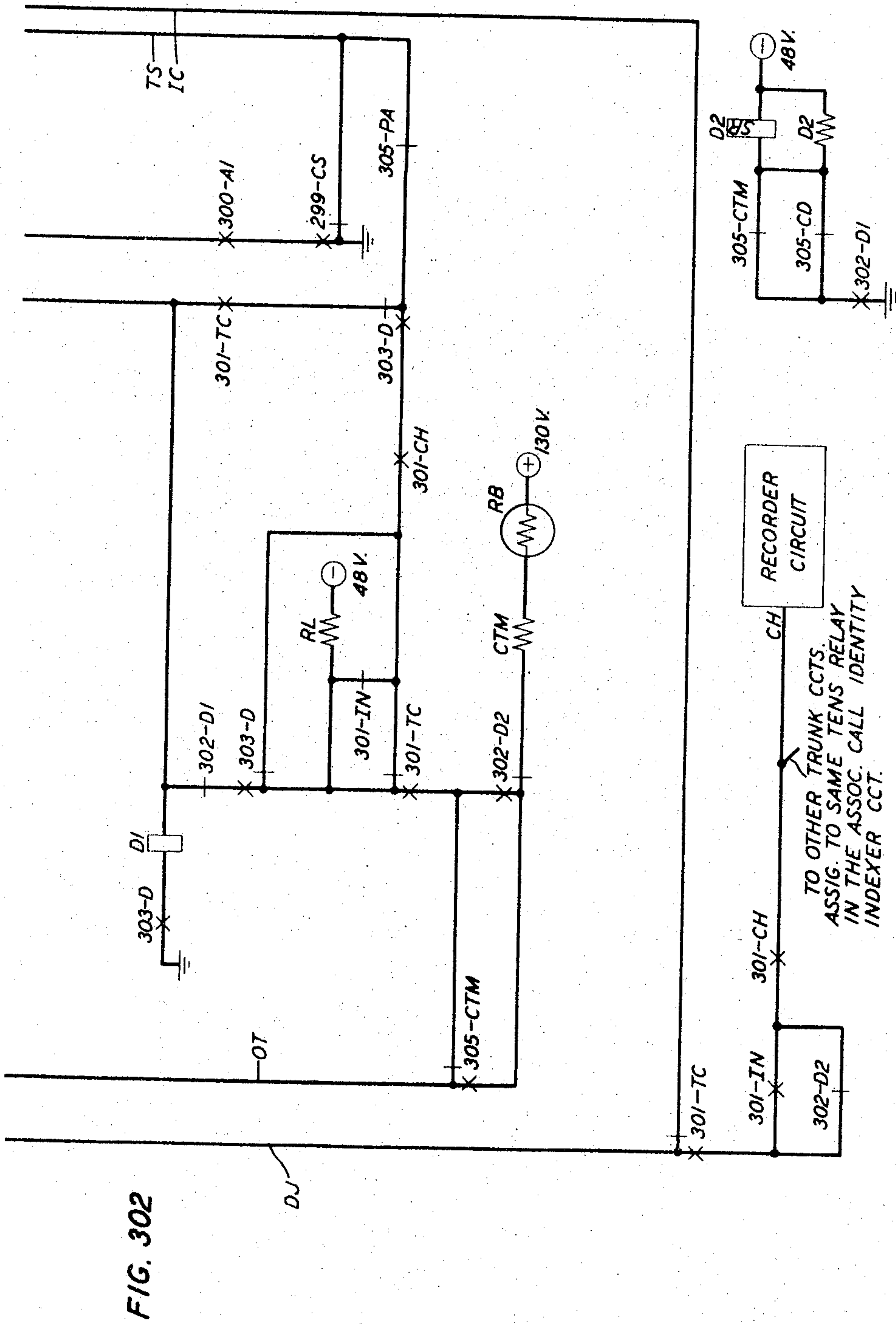
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 389



Sept. 12, 1967

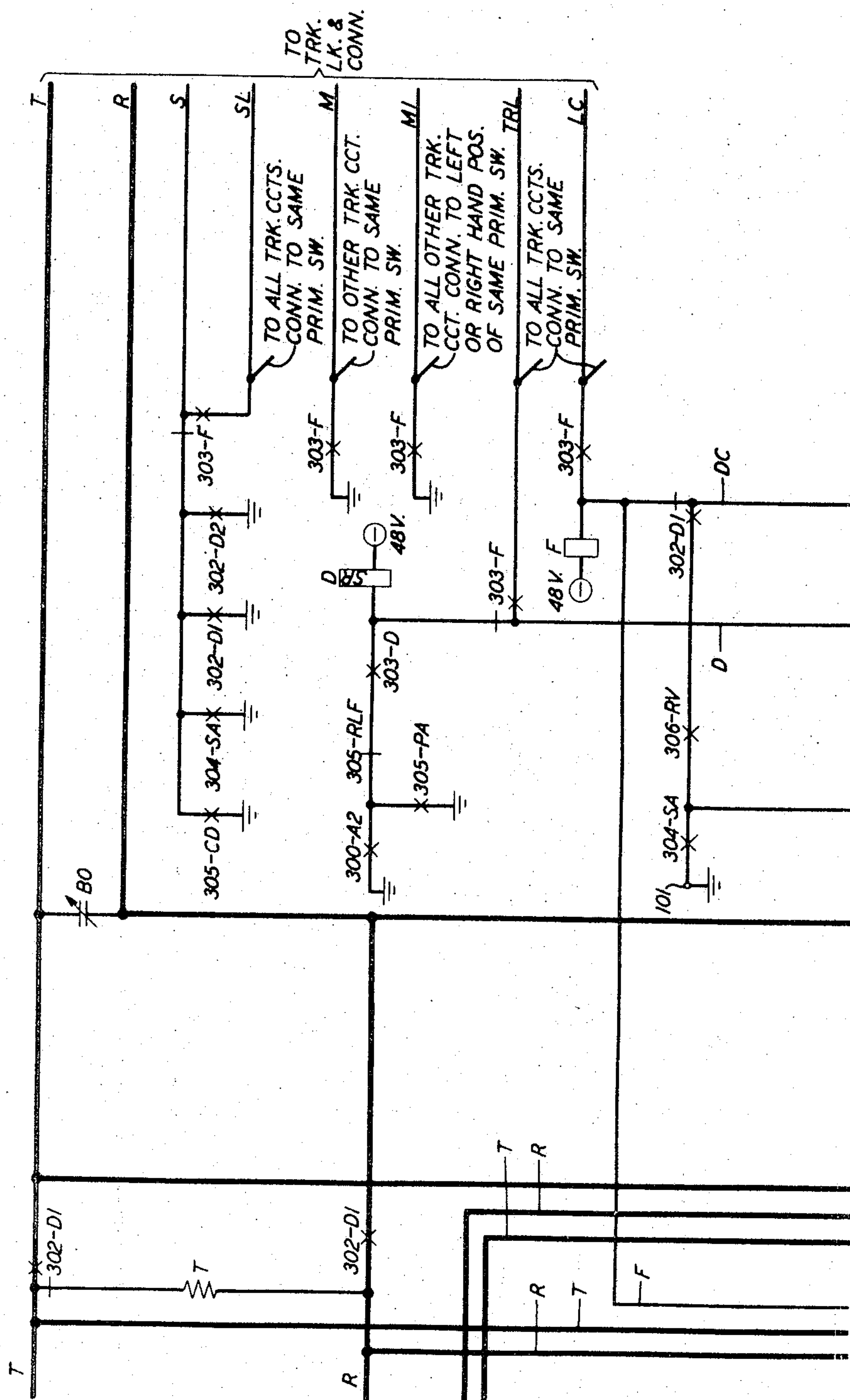
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 390

FIG. 303



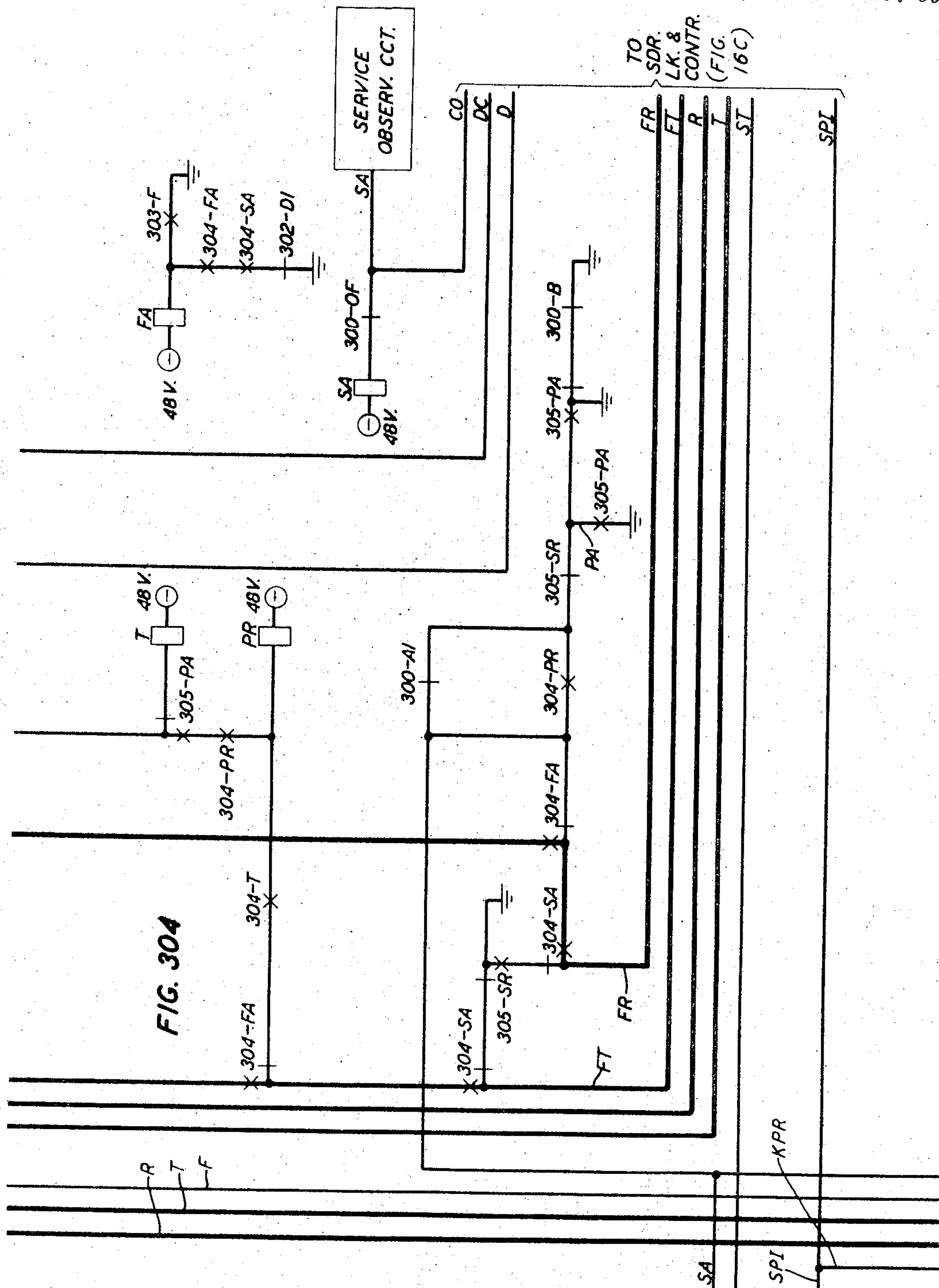
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 391



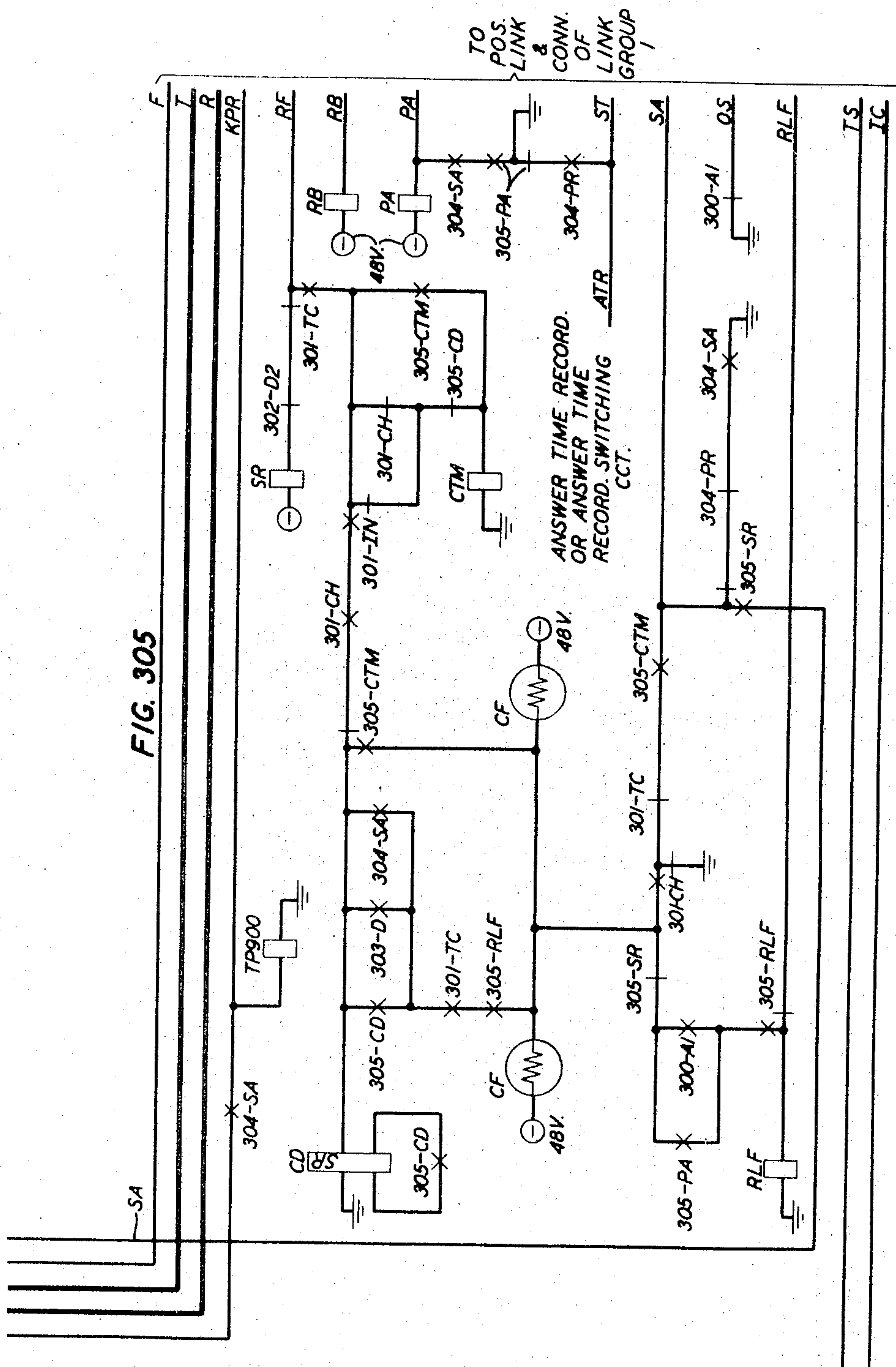
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L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 392



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 393

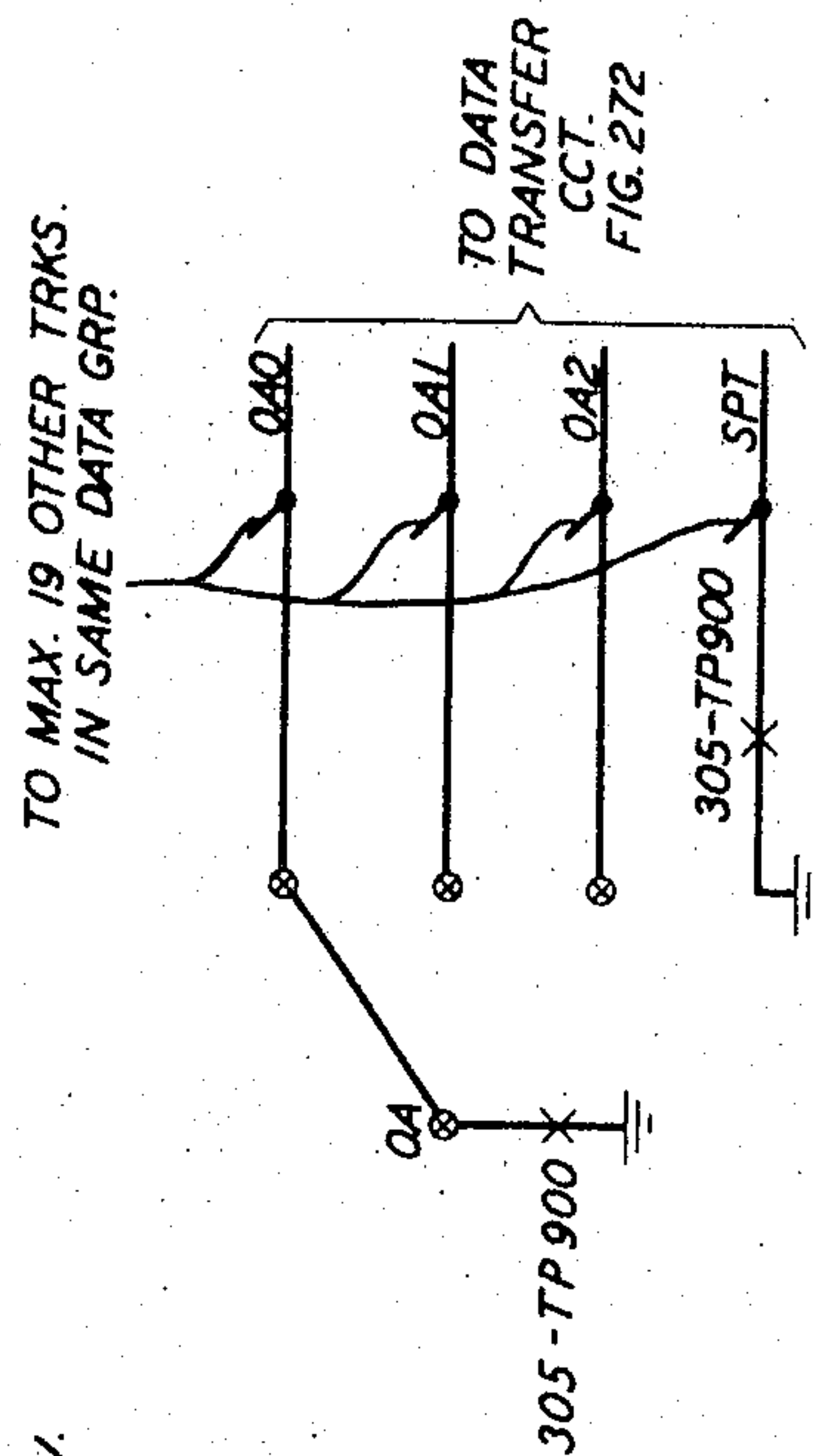
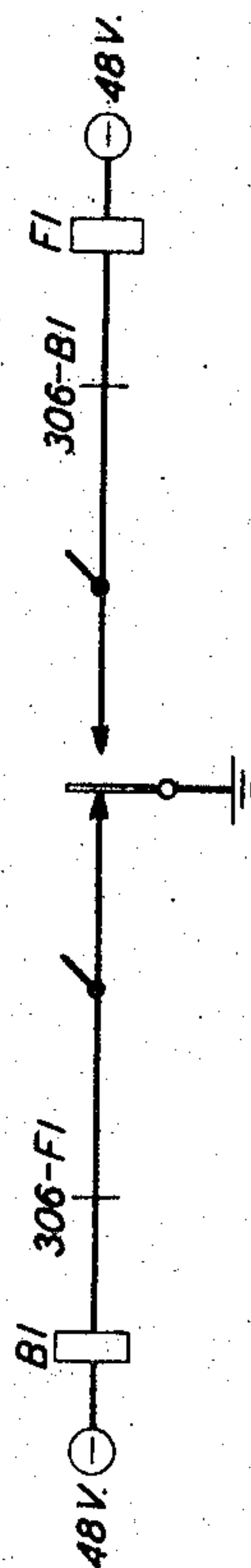


FIG. 306A

FIG. 299	FIG. 303
FIG. 300	FIG. 304
FIG. 301	FIG. 305
FIG. 302	FIG. 306

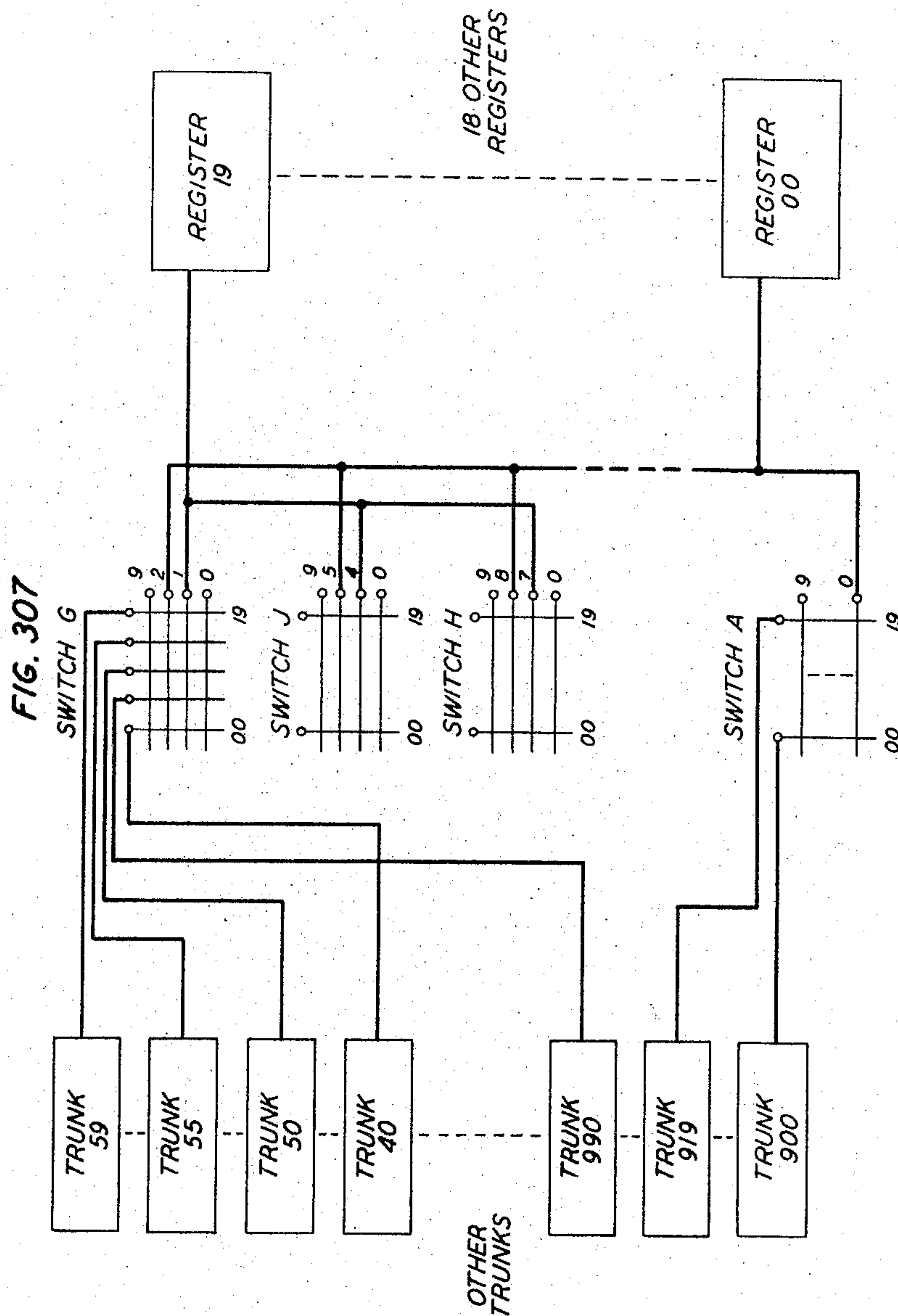
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 394



Sept. 12, 1967

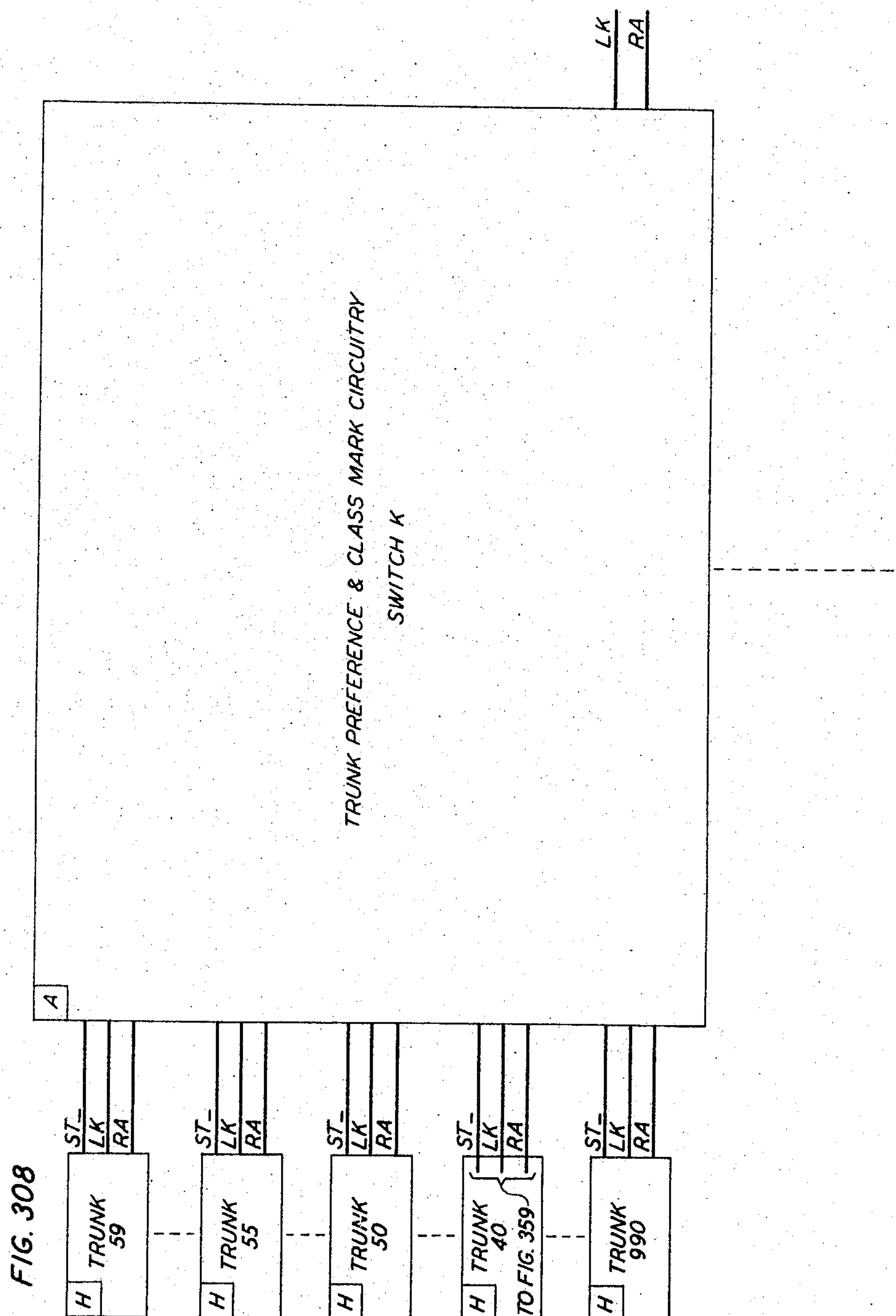
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3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
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Filed Nov. 26, 1963

570 Sheets-Sheet 395



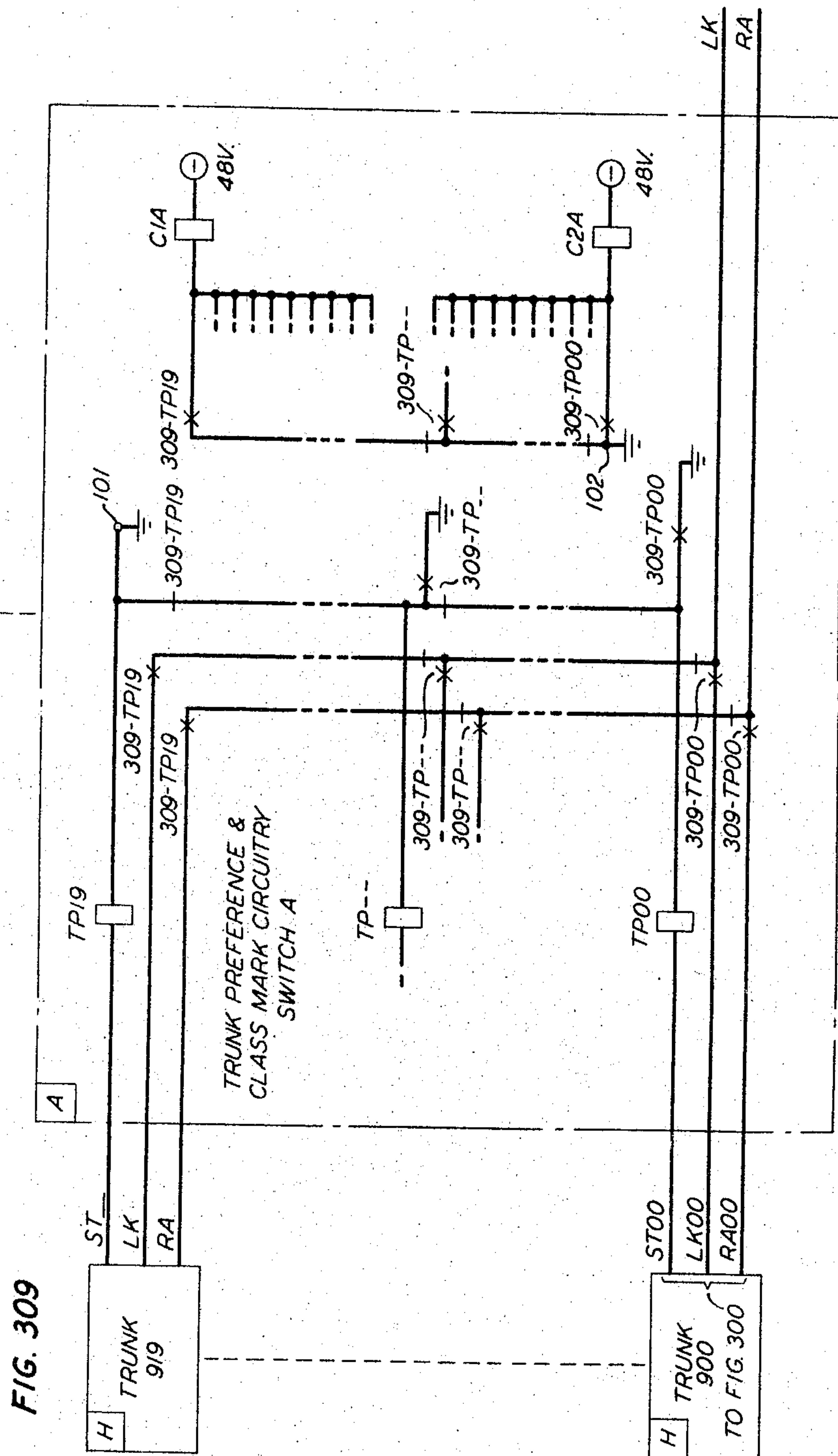
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 396



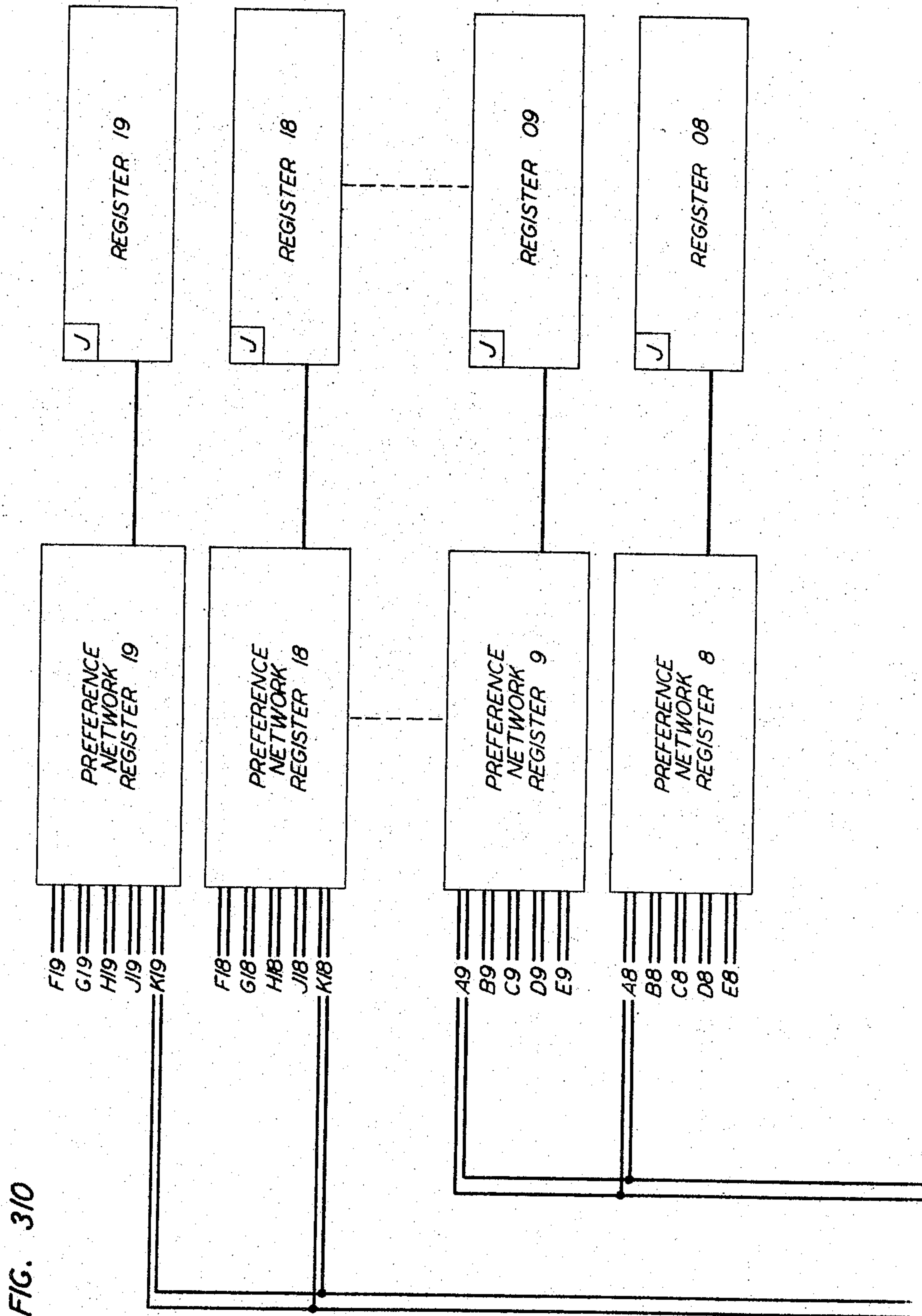
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 397



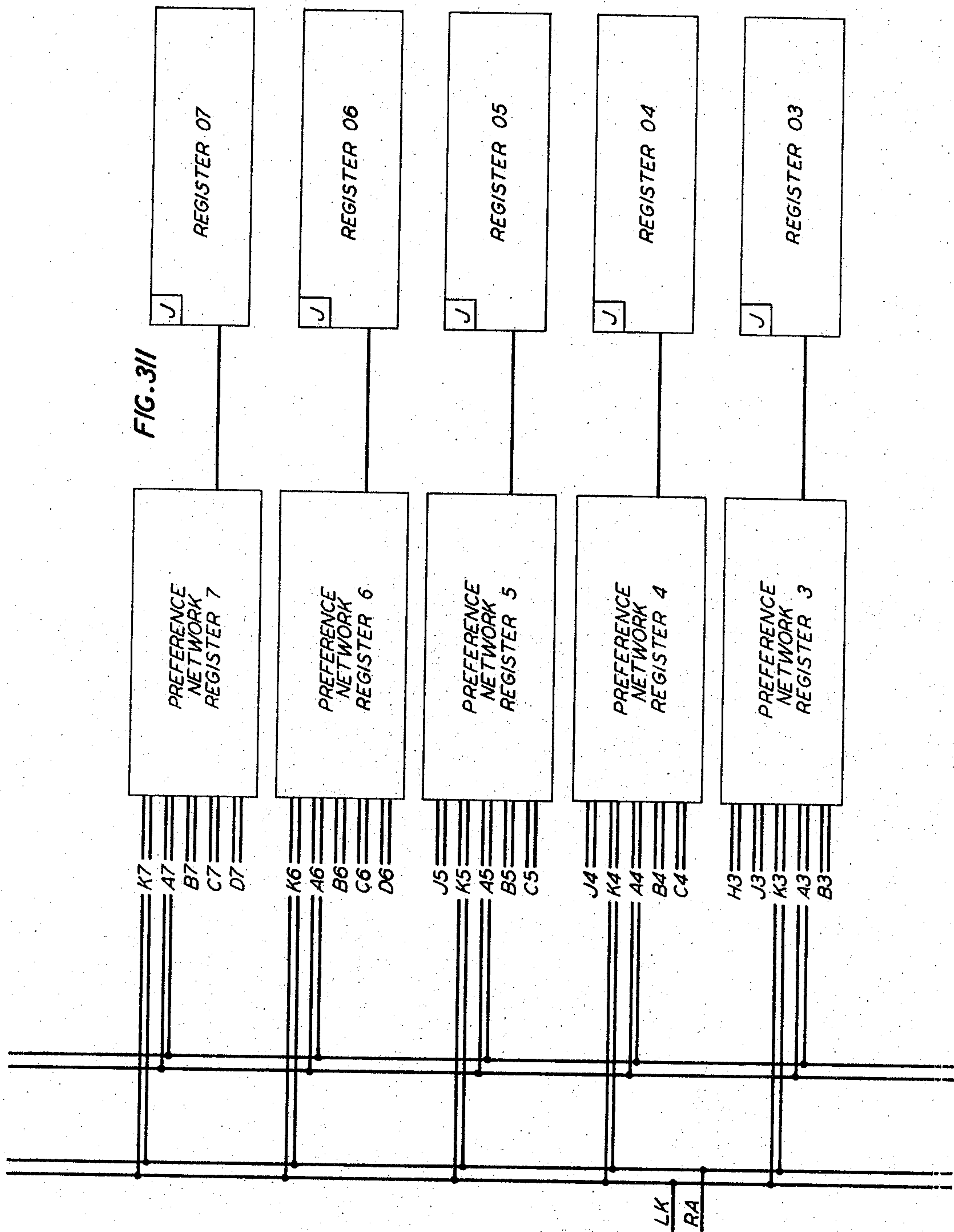
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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 398



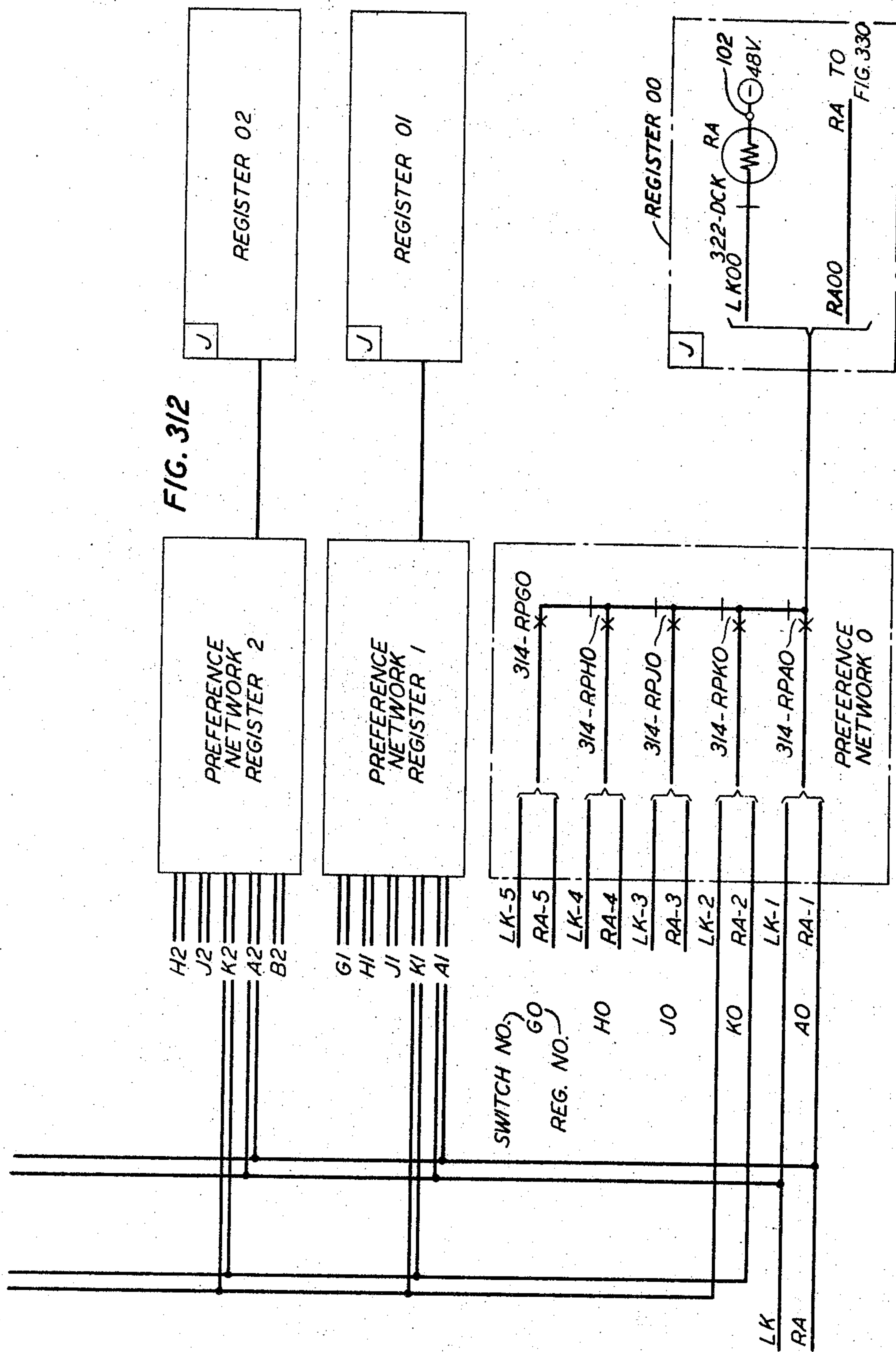
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 399



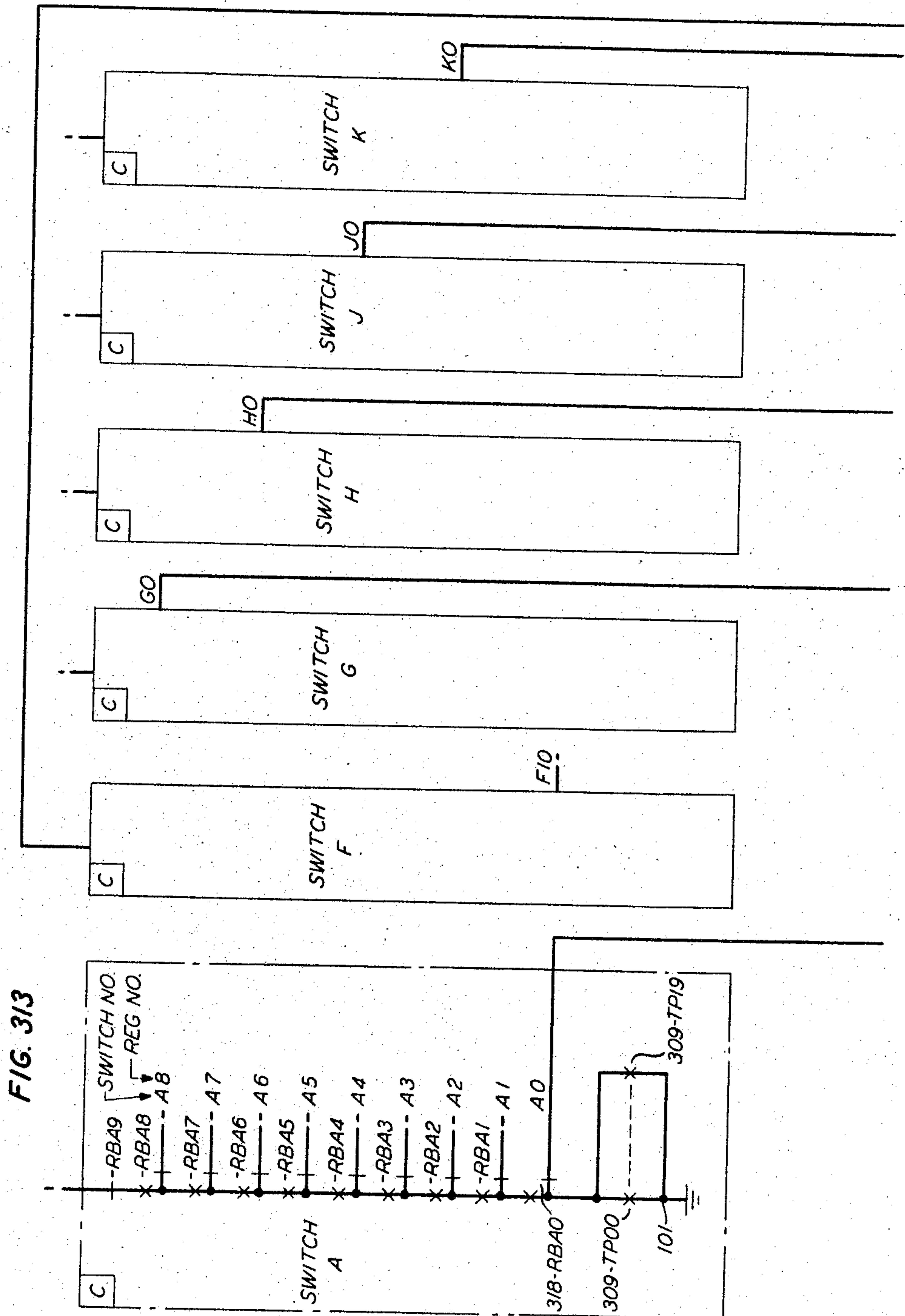
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 400



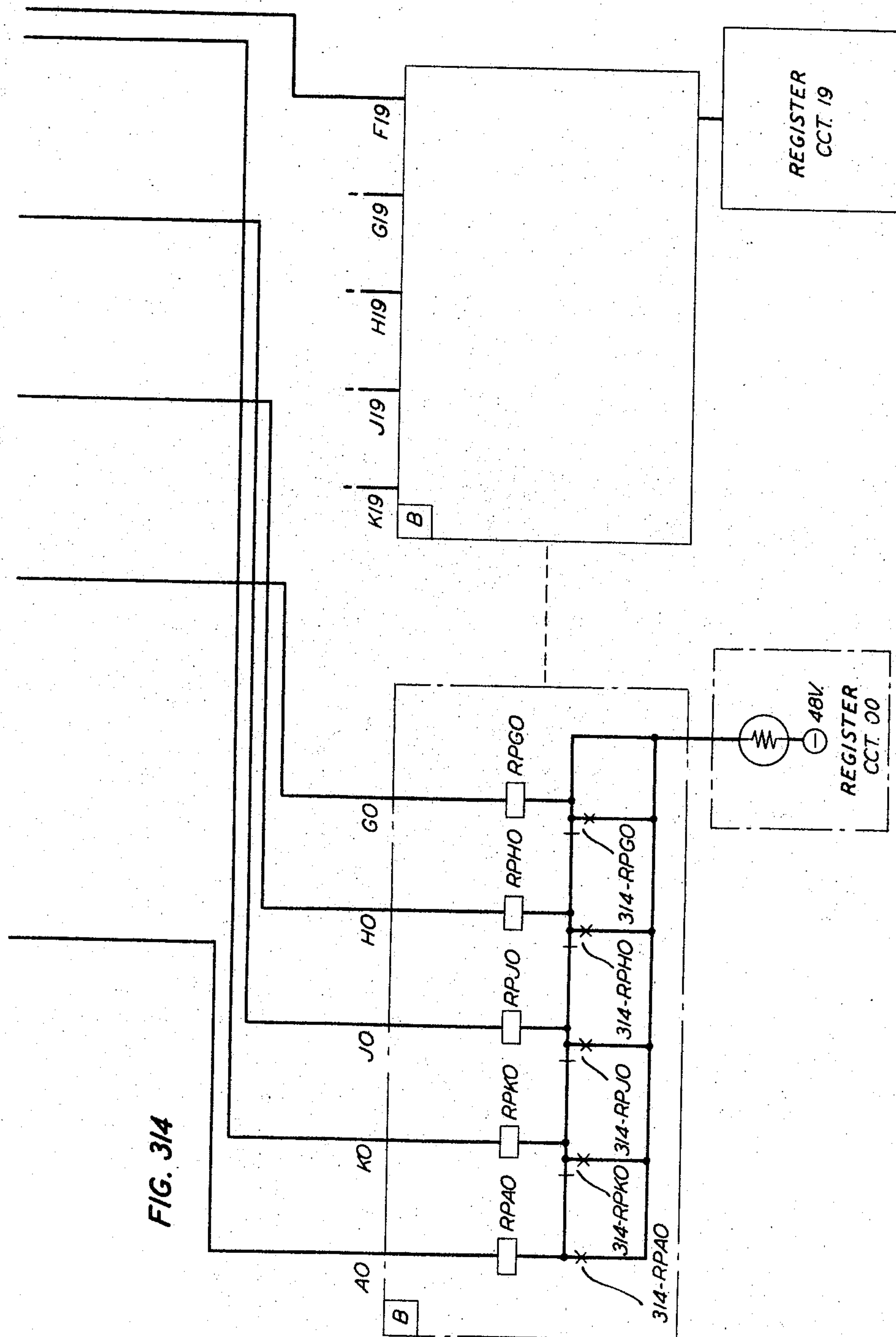
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 401



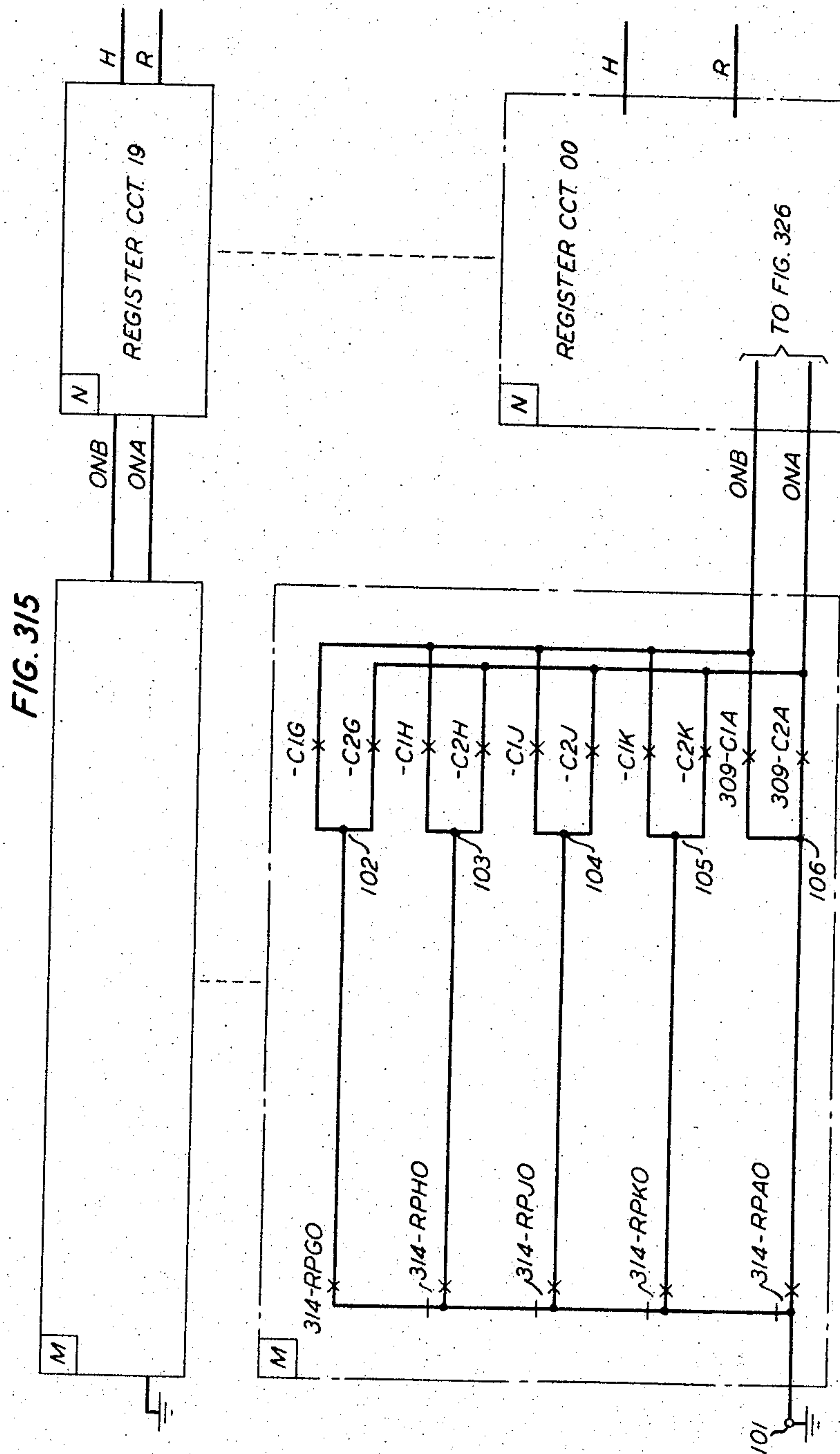
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 402



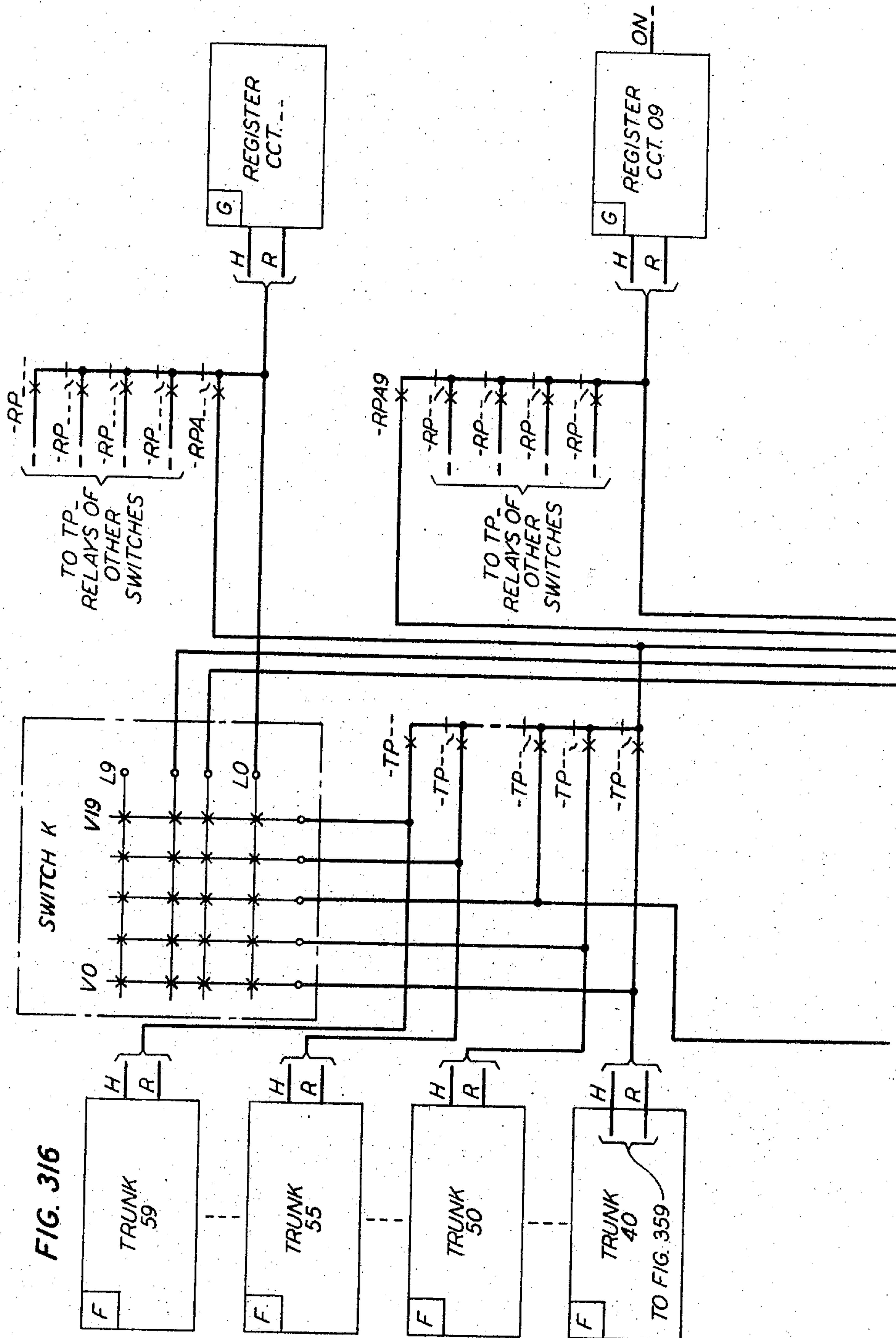
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 403



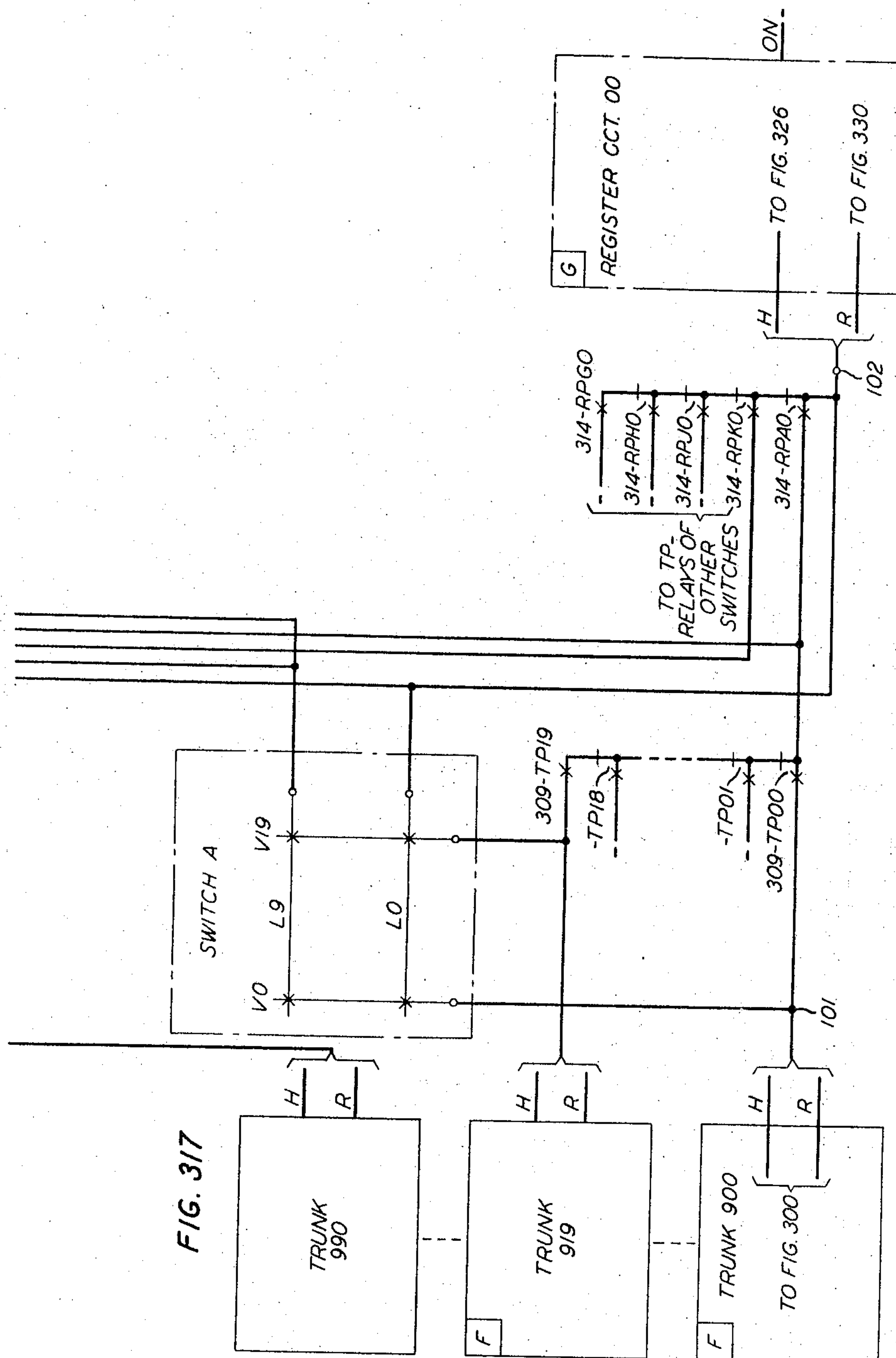
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 404



Sept. 12, 1967

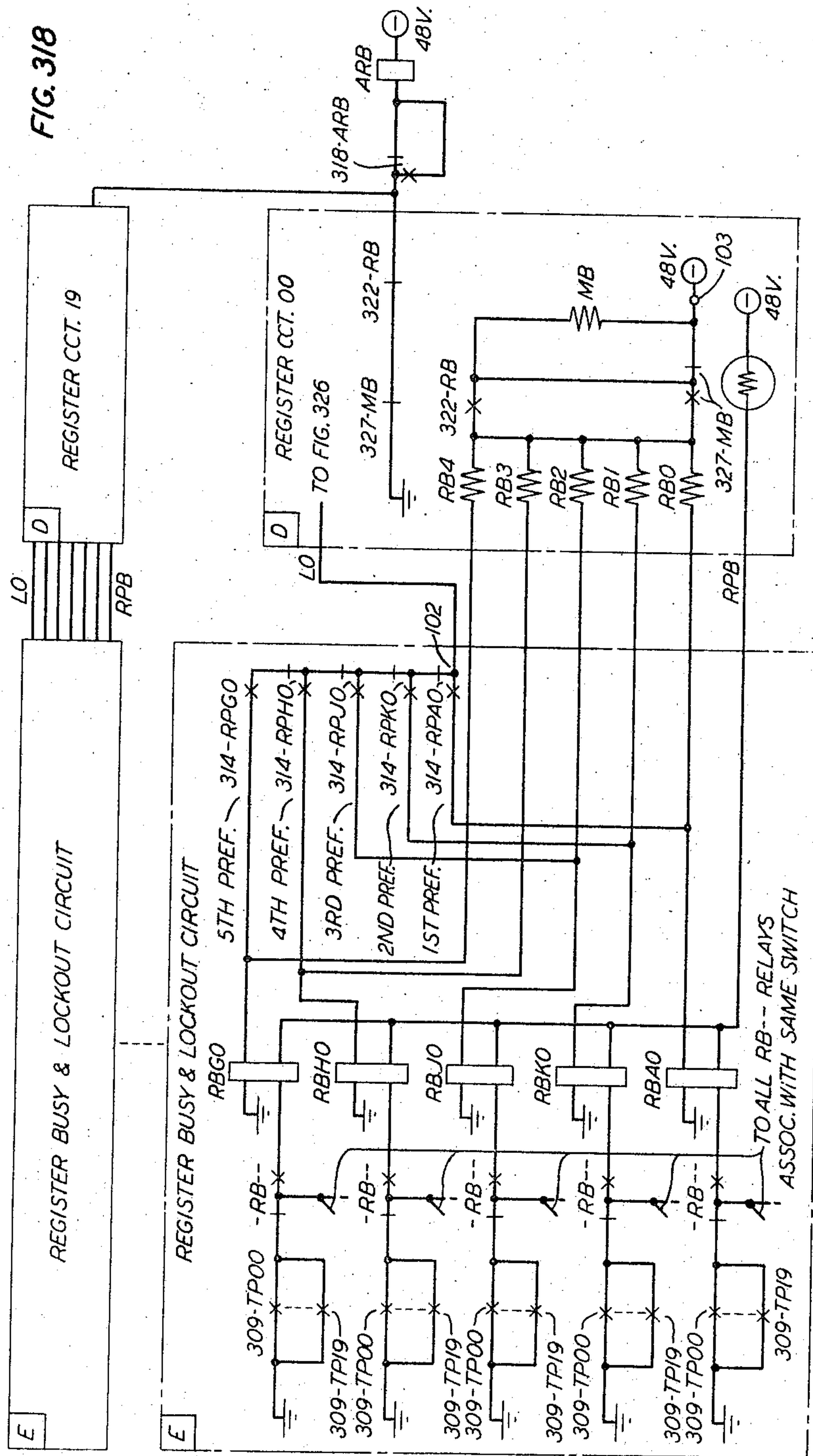
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 405

FIG. 318



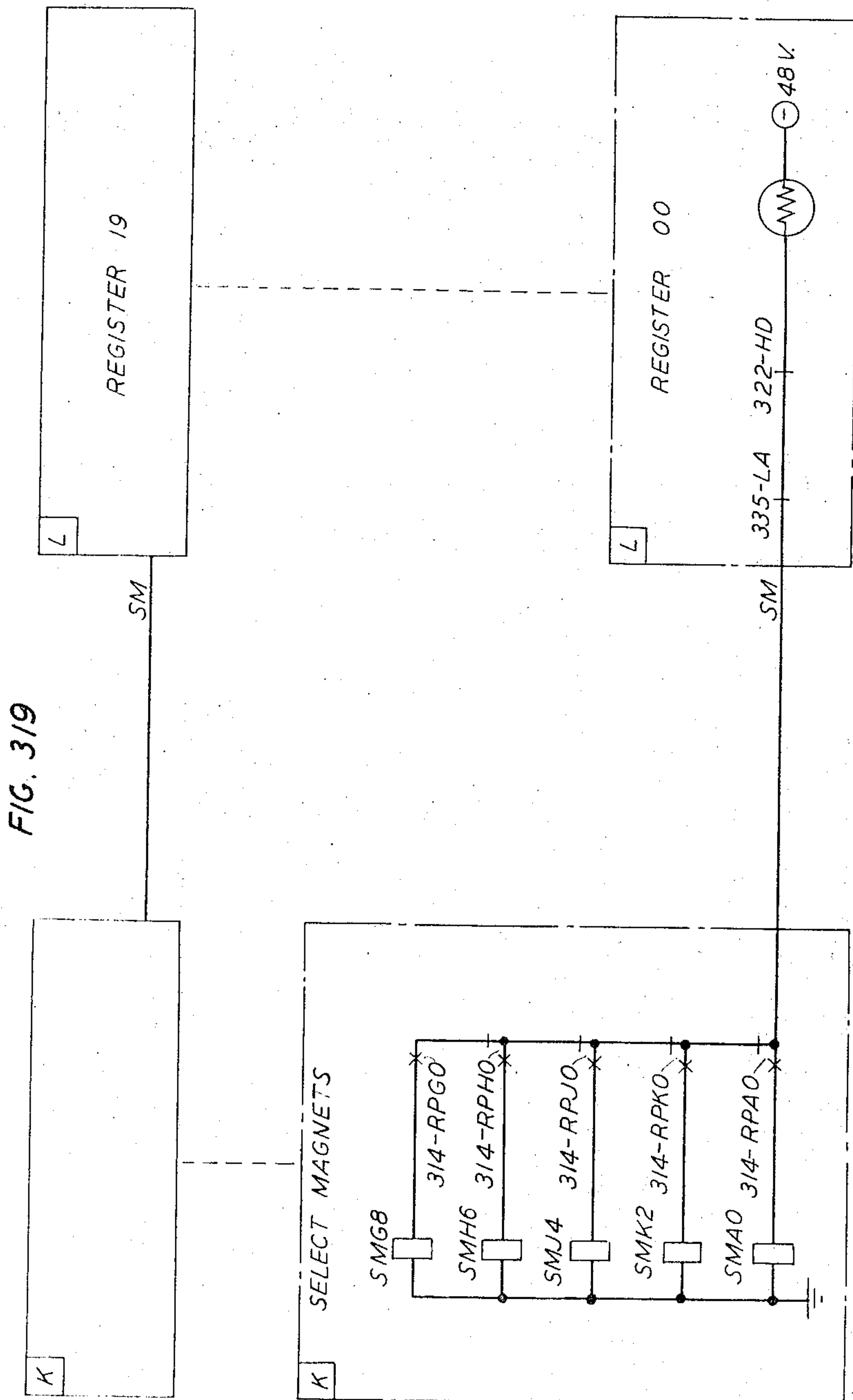
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 406



Sept. 12, 1967

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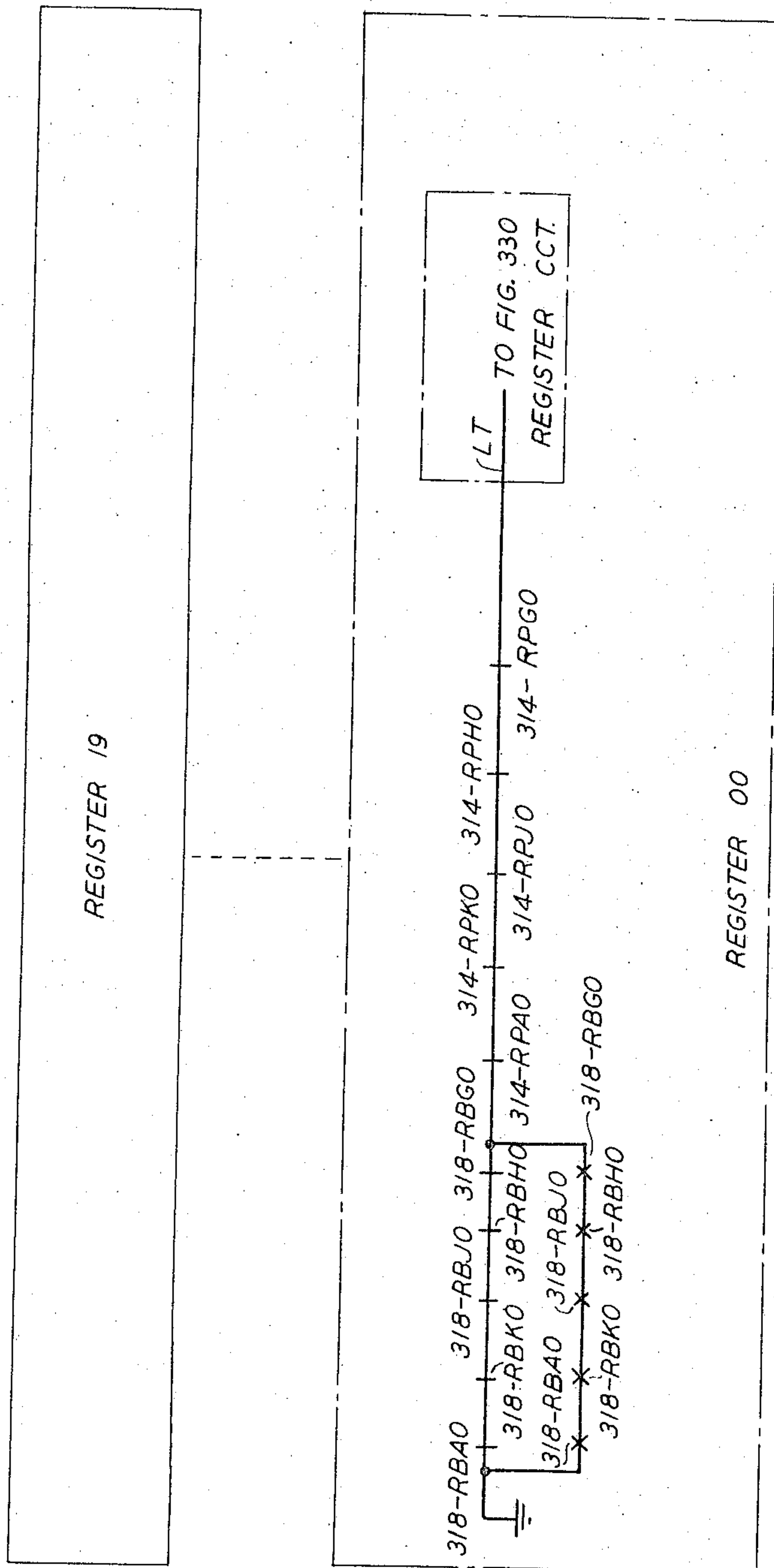
3,341,662

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Filed Nov. 26, 1963

570 Sheets-Sheet 407

FIG. 319A



Sept. 12, 1967

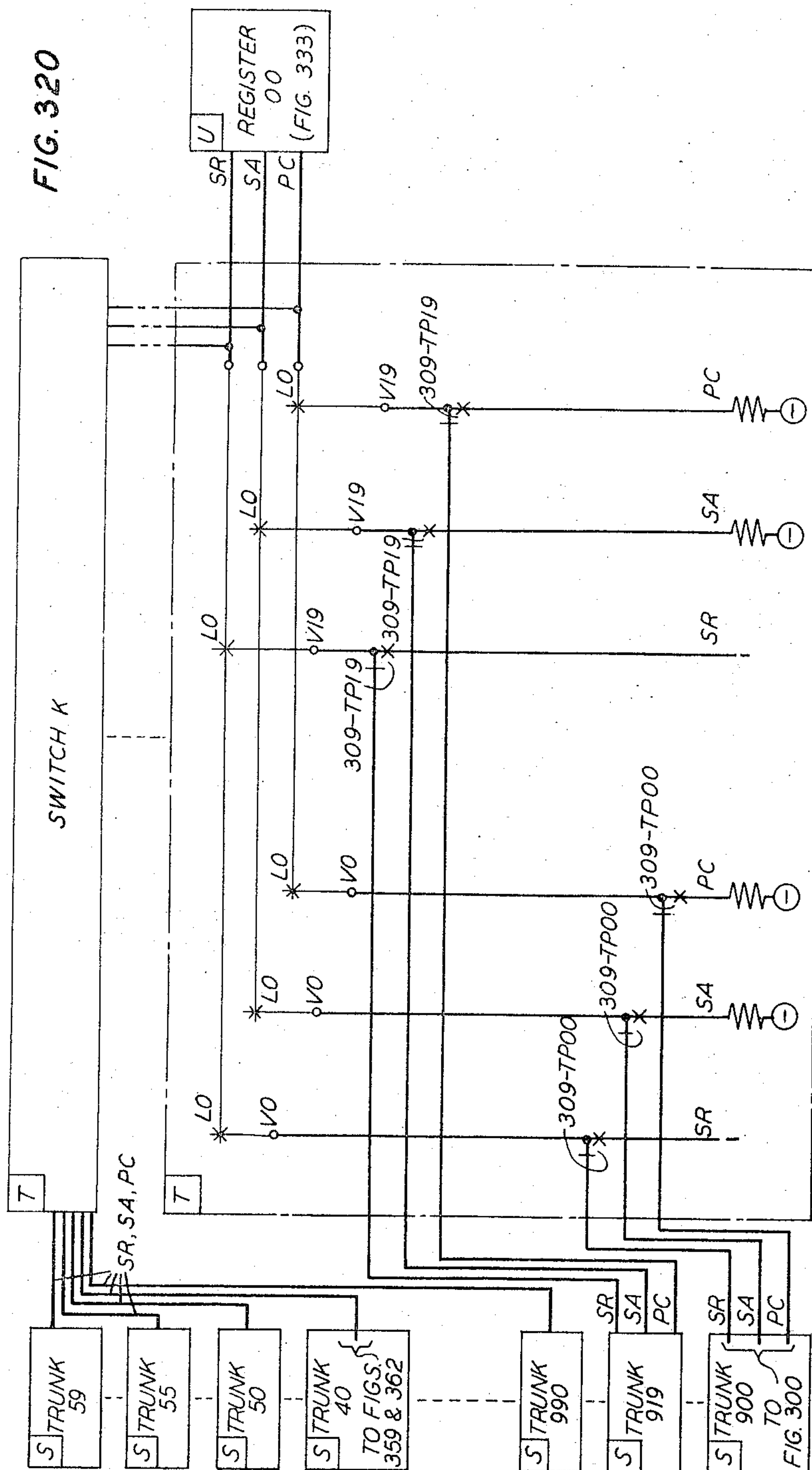
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 408



Sept. 12, 1967

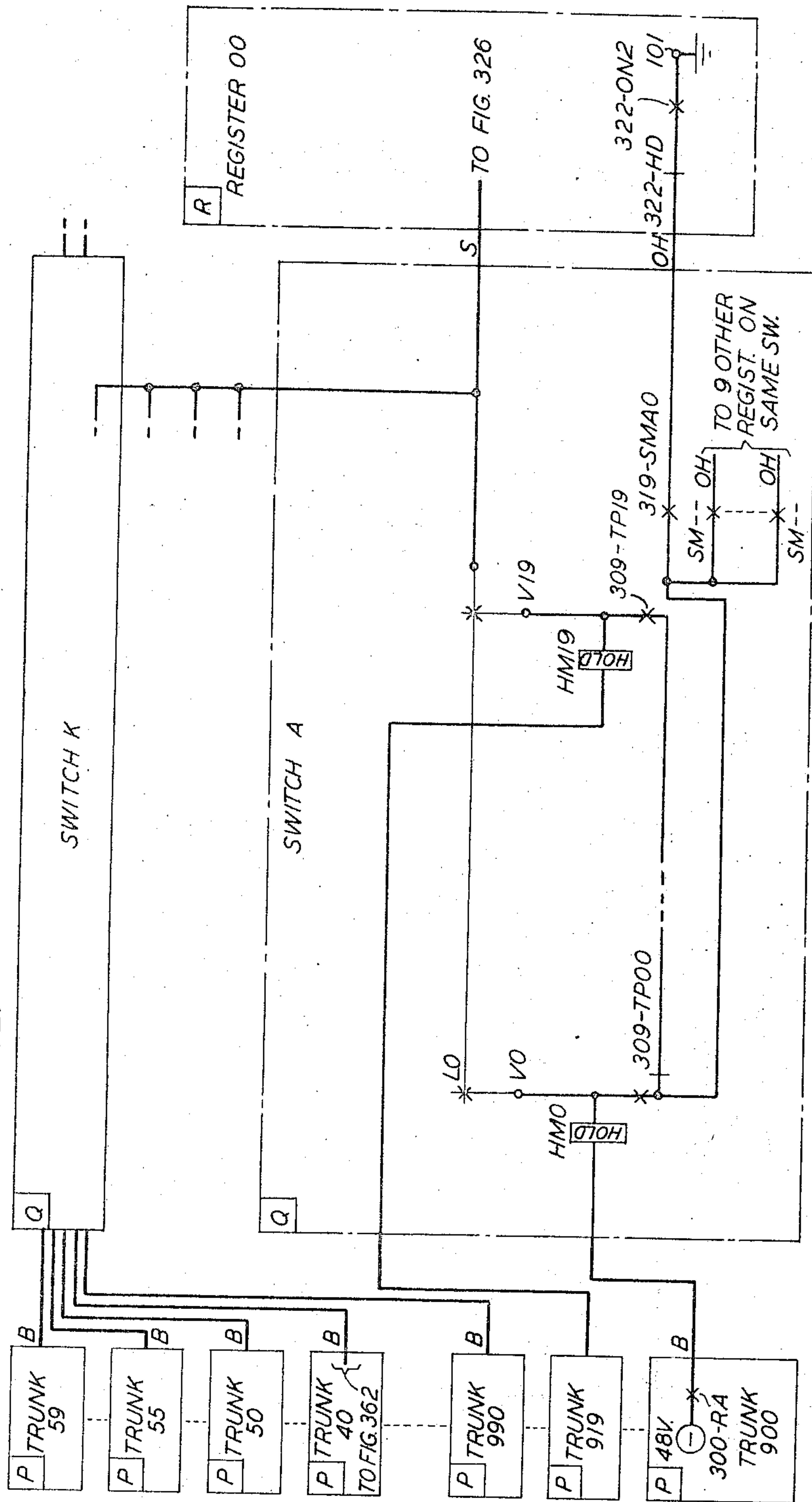
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 409

FIG. 321



Sept. 12, 1967

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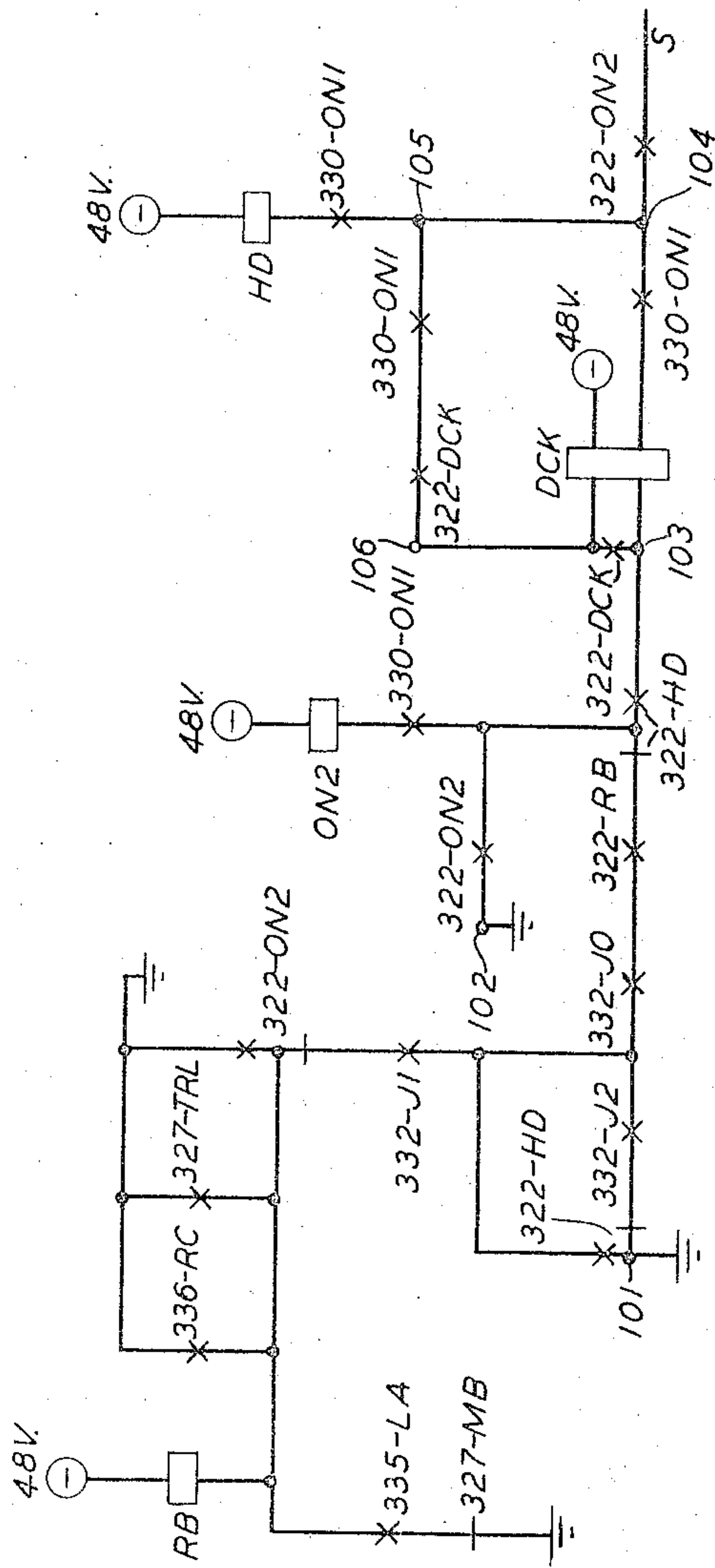
3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 410

FIG. 322



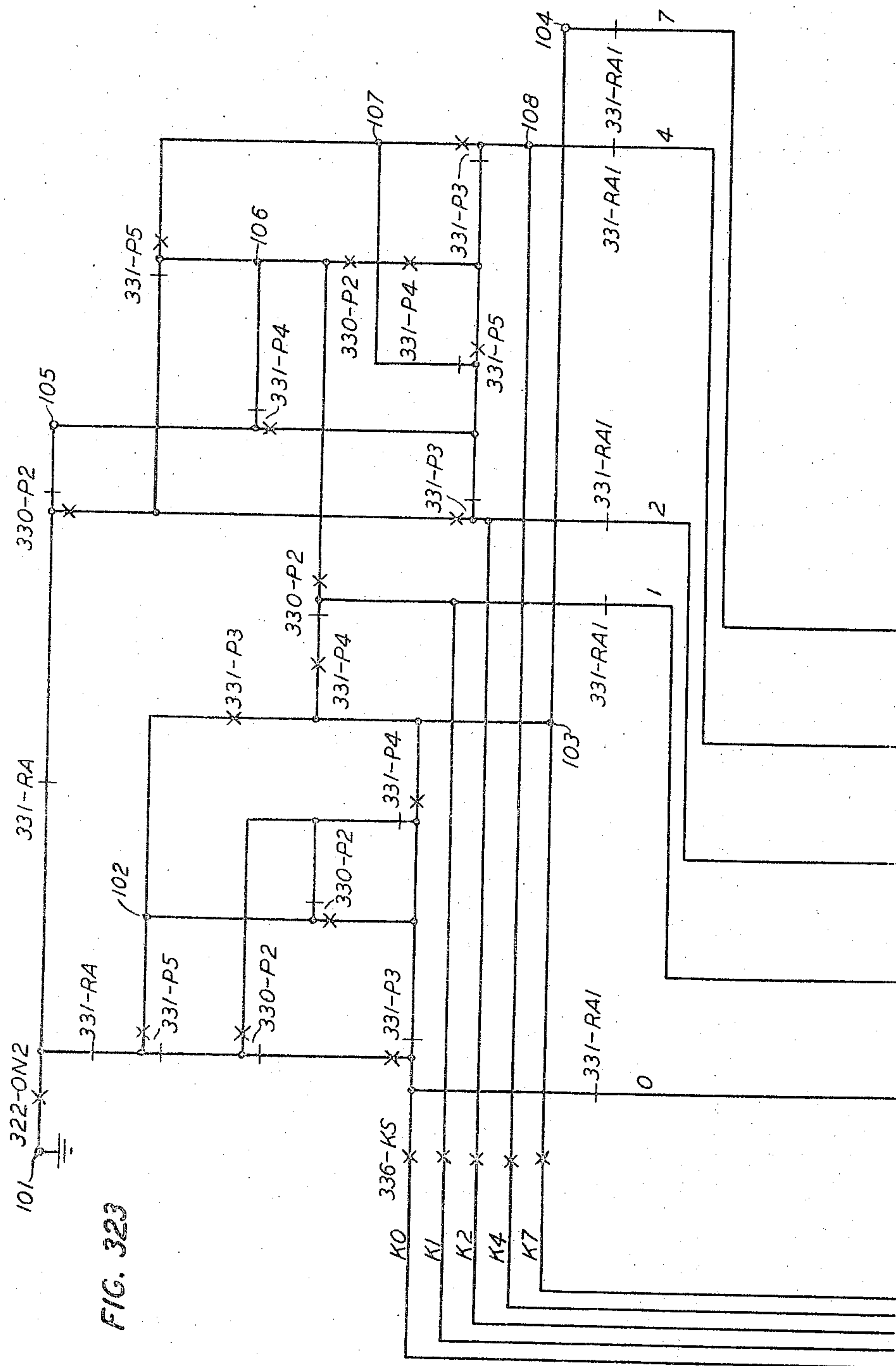
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 411



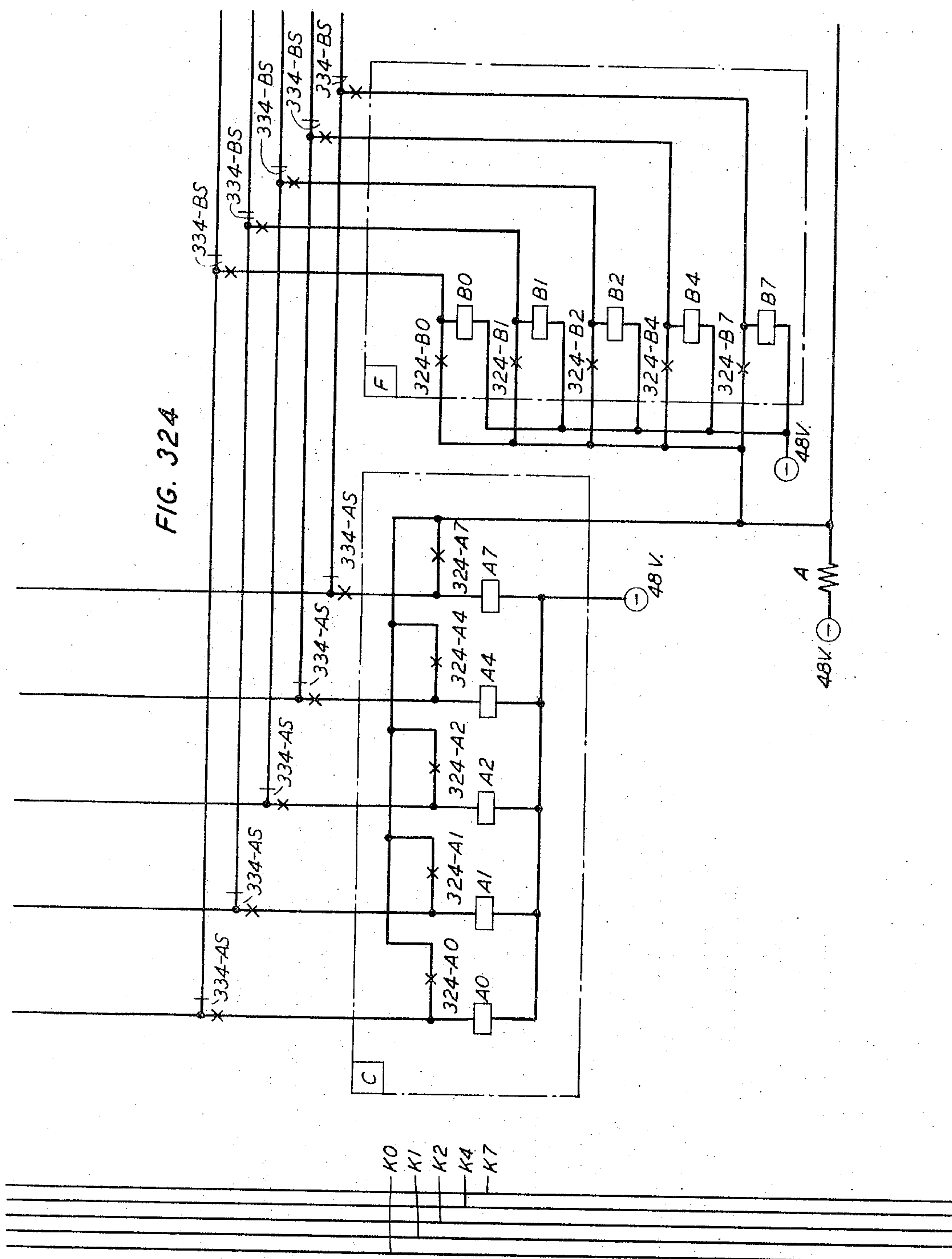
Sept. 12, 1967

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3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 412



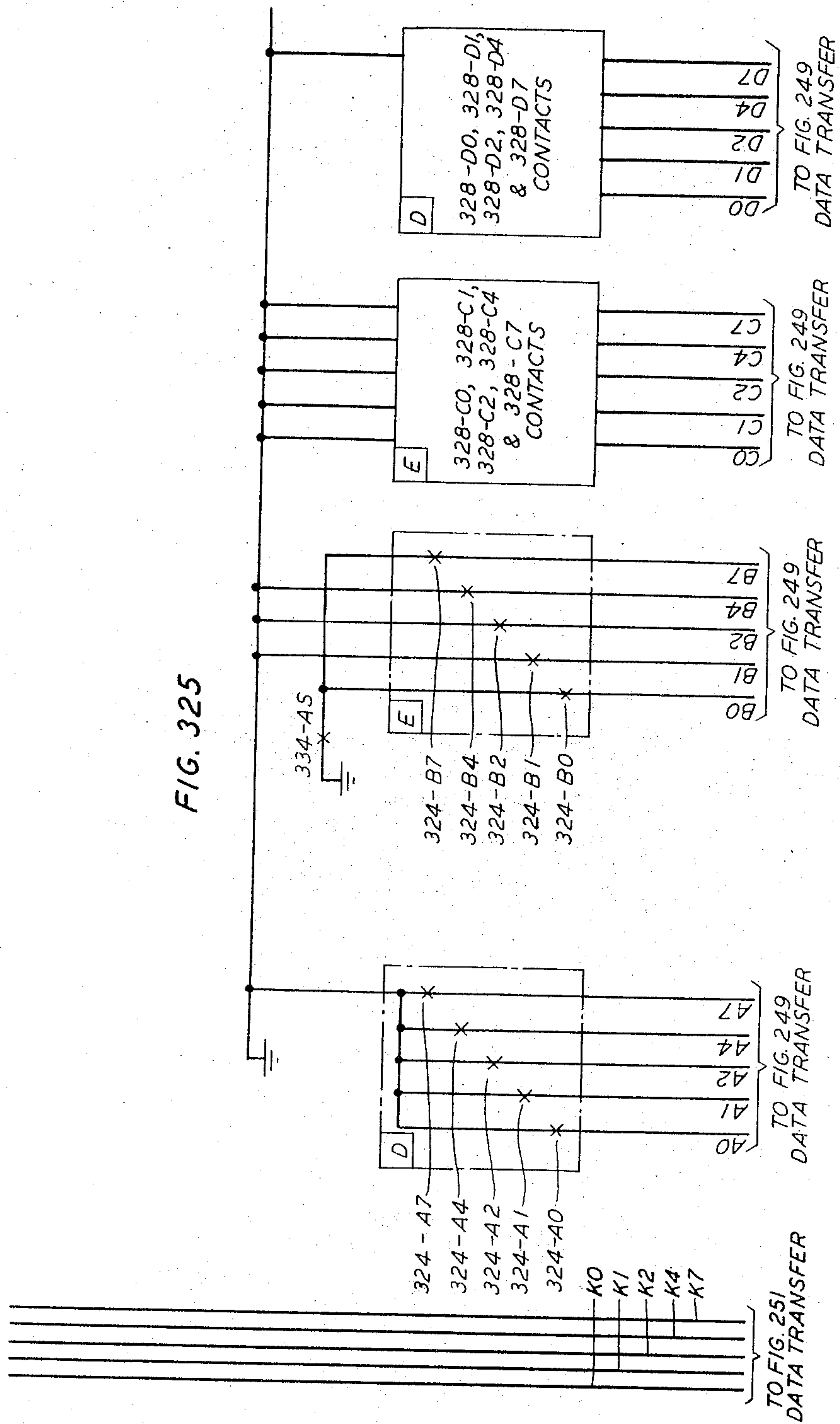
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 415



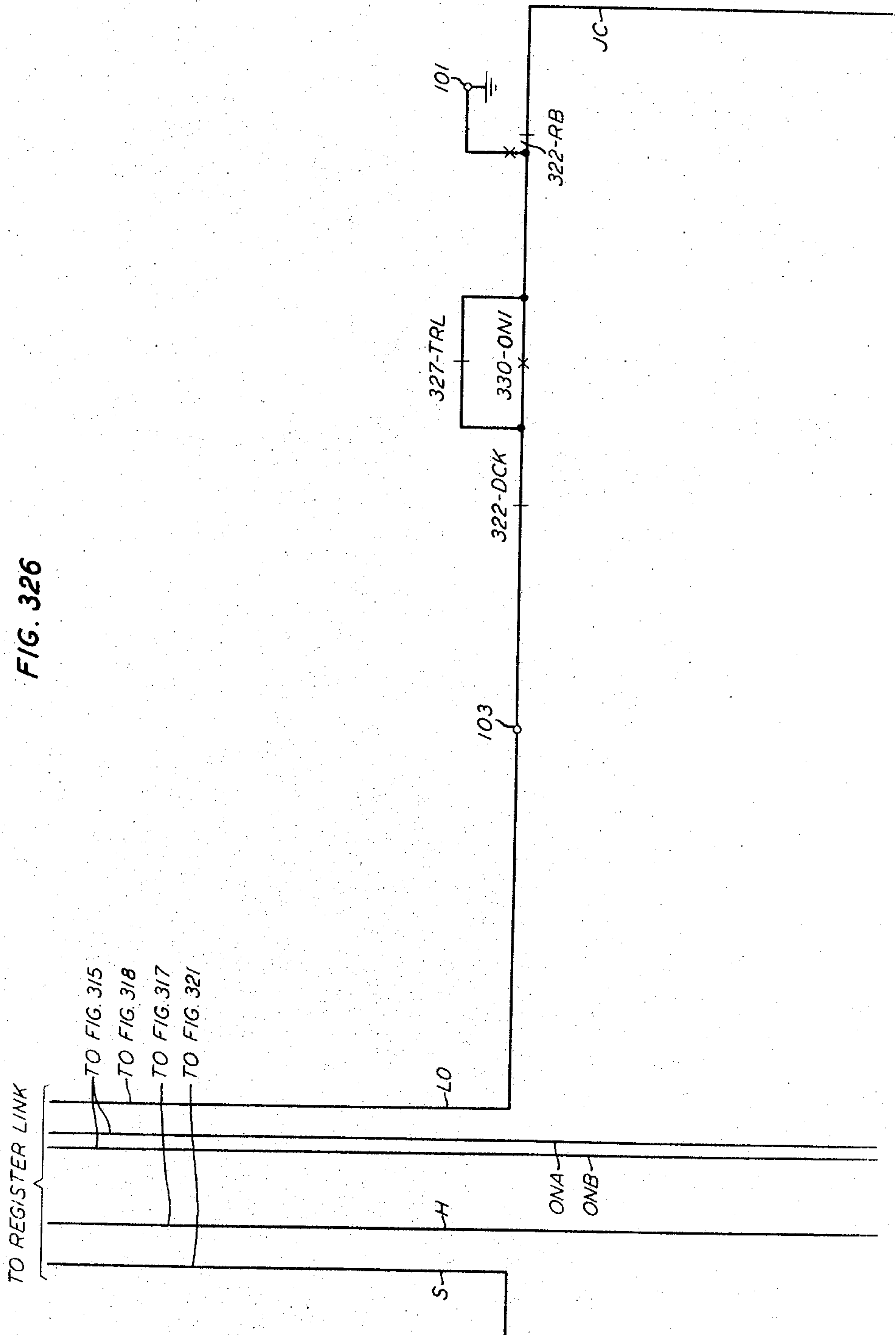
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 414



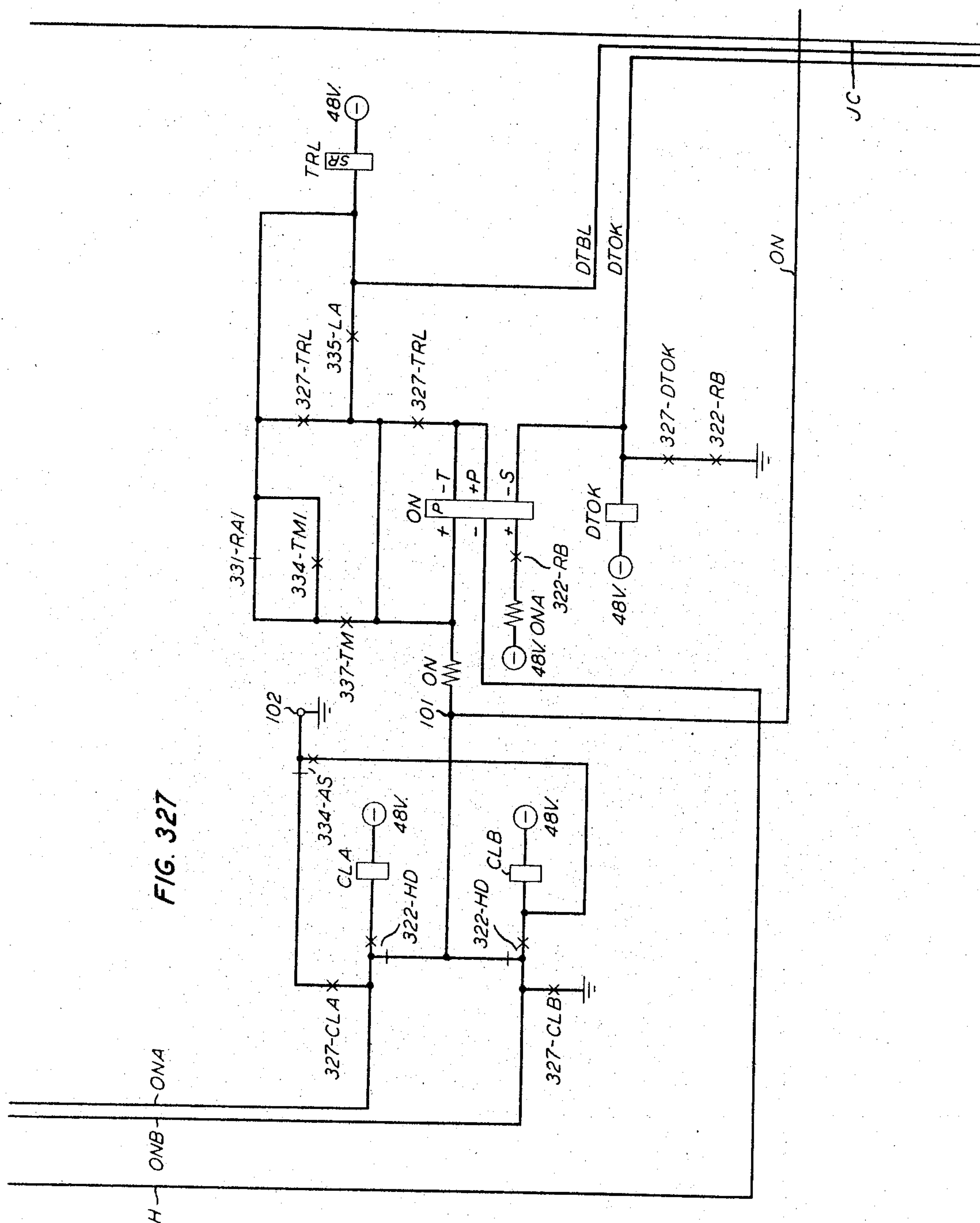
Sept. 12, 1967

Filed Nov. 26, 1963

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INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 415



Sept. 12, 1967

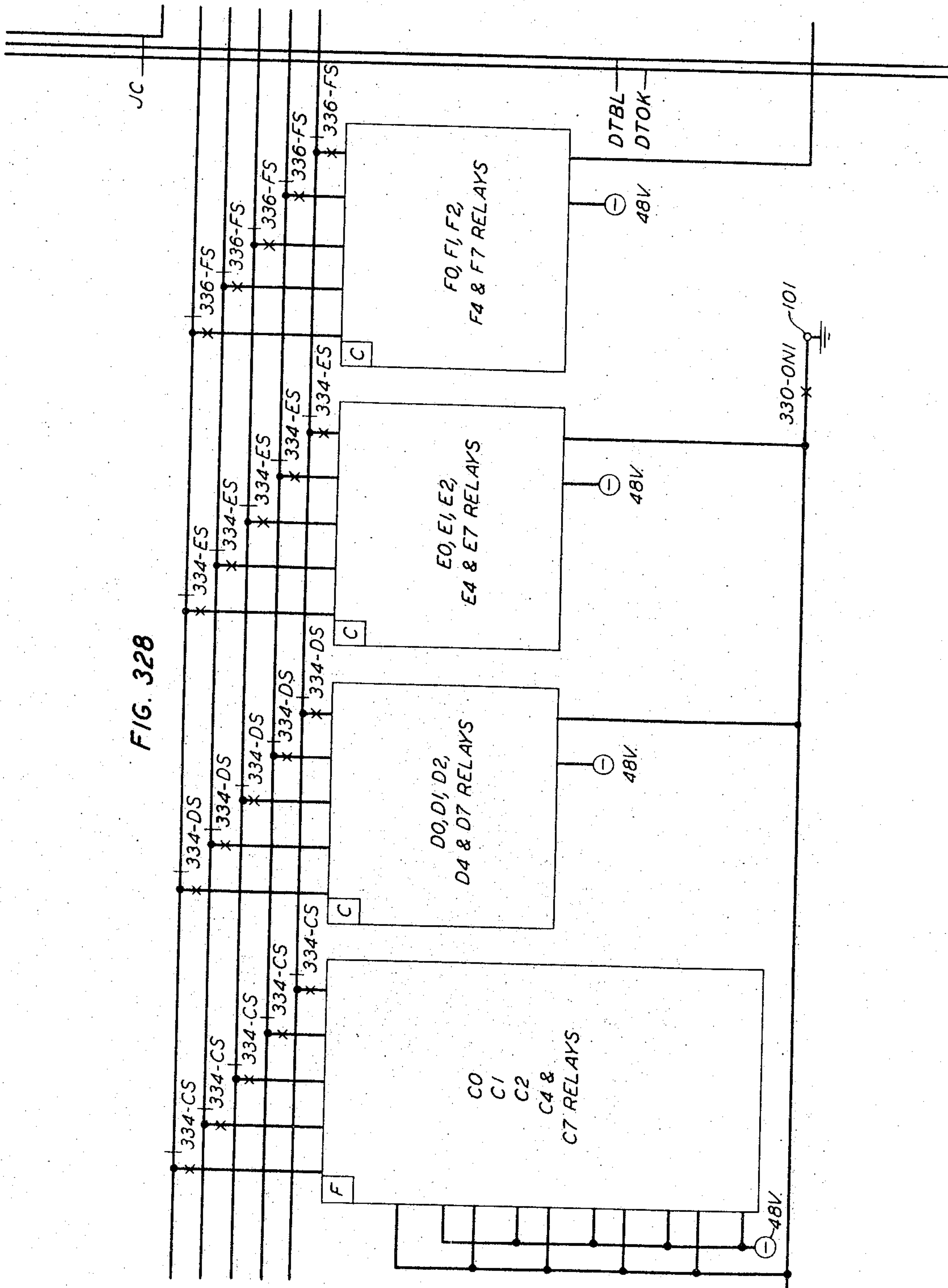
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 416

FIG. 328



Sept. 12, 1967

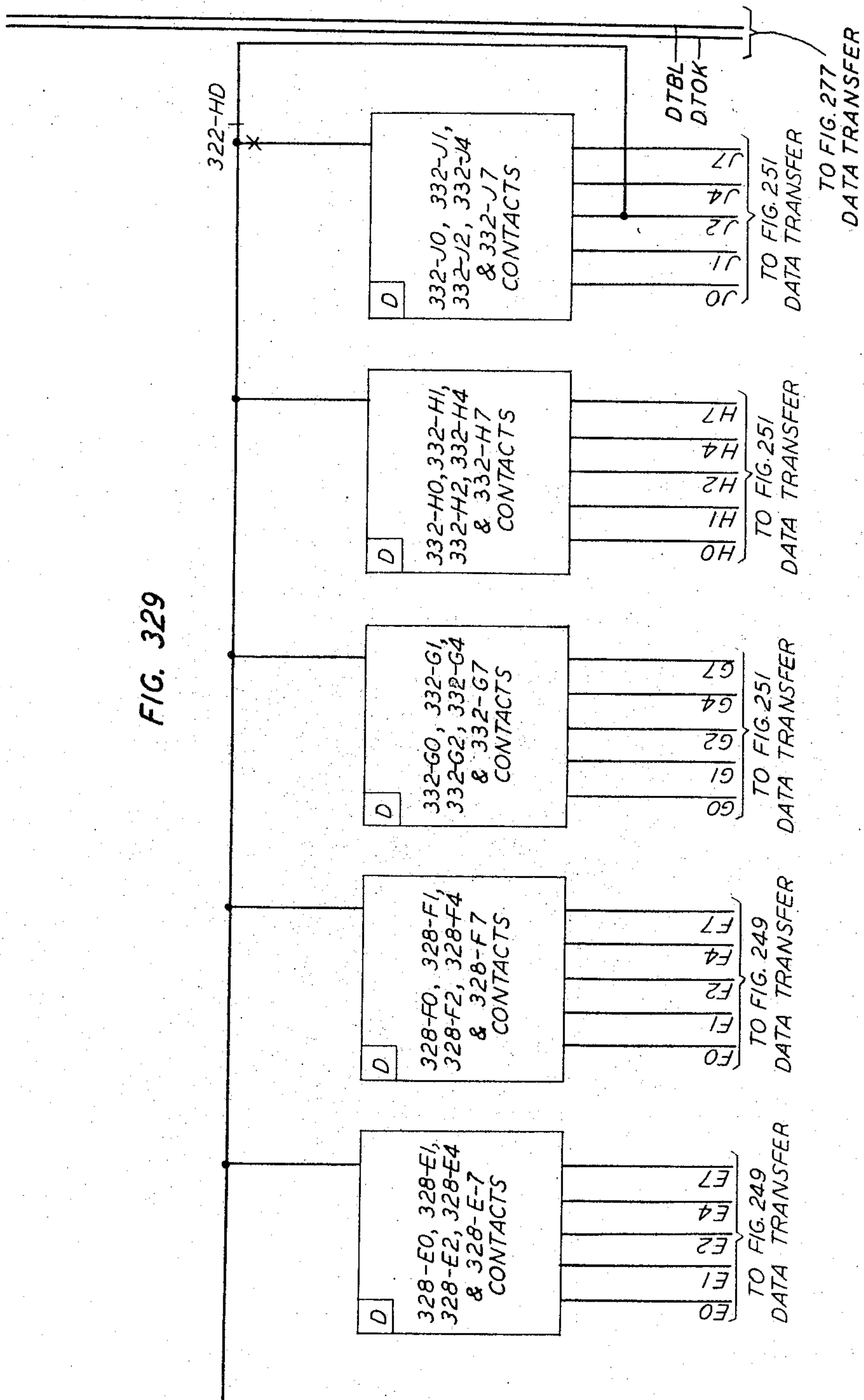
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 417

FIG. 329



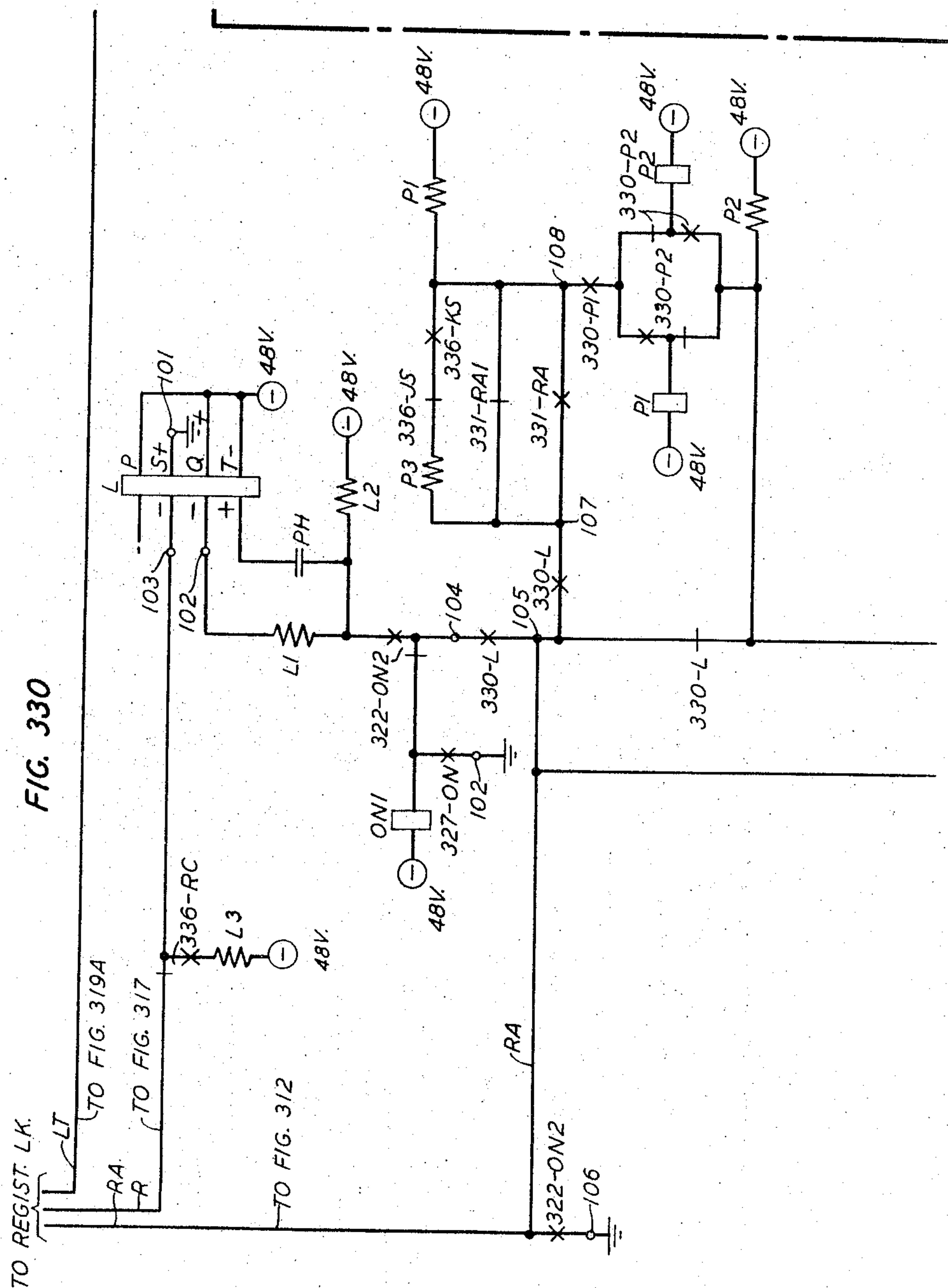
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 418



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 419

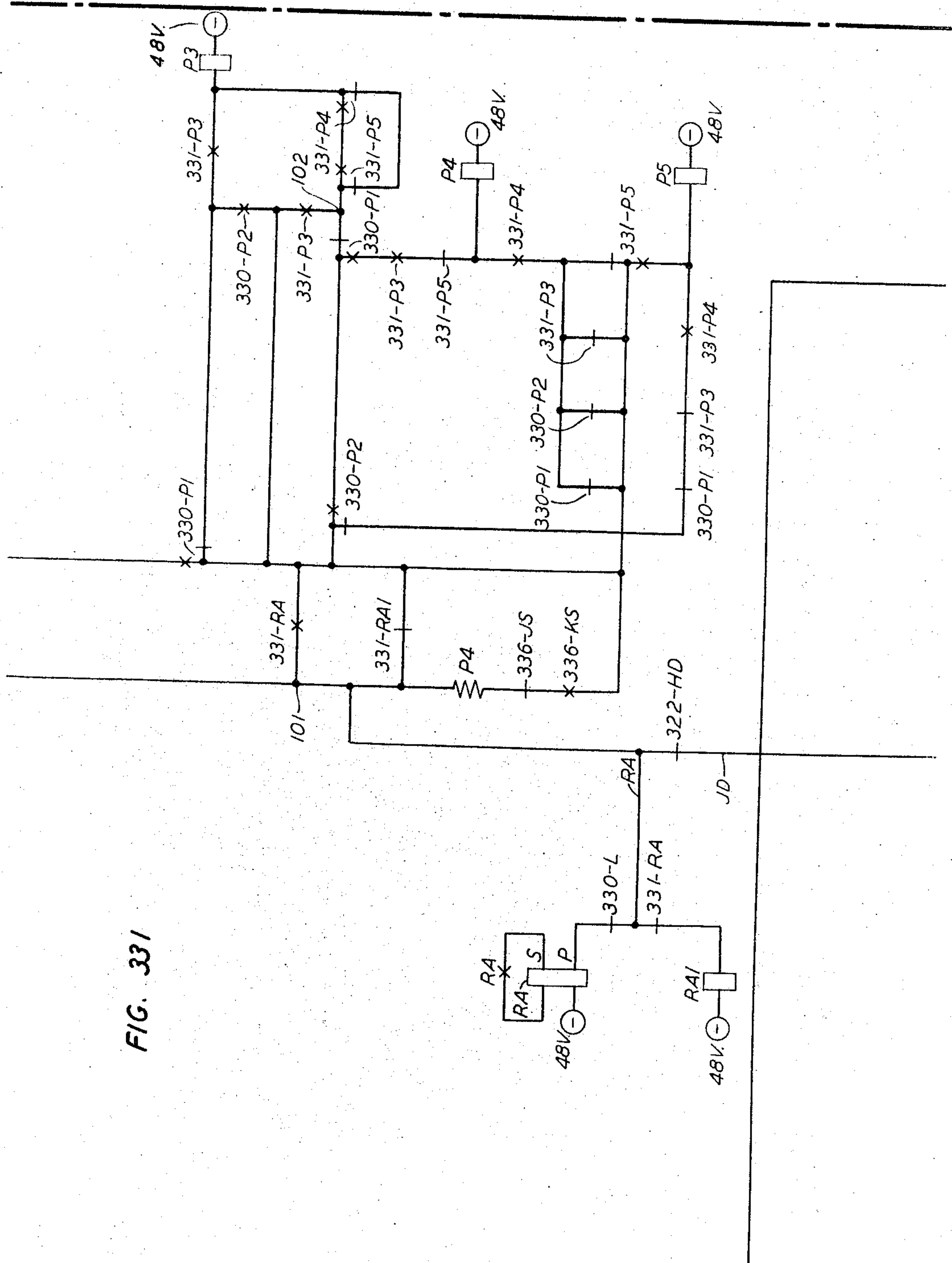


FIG. 331

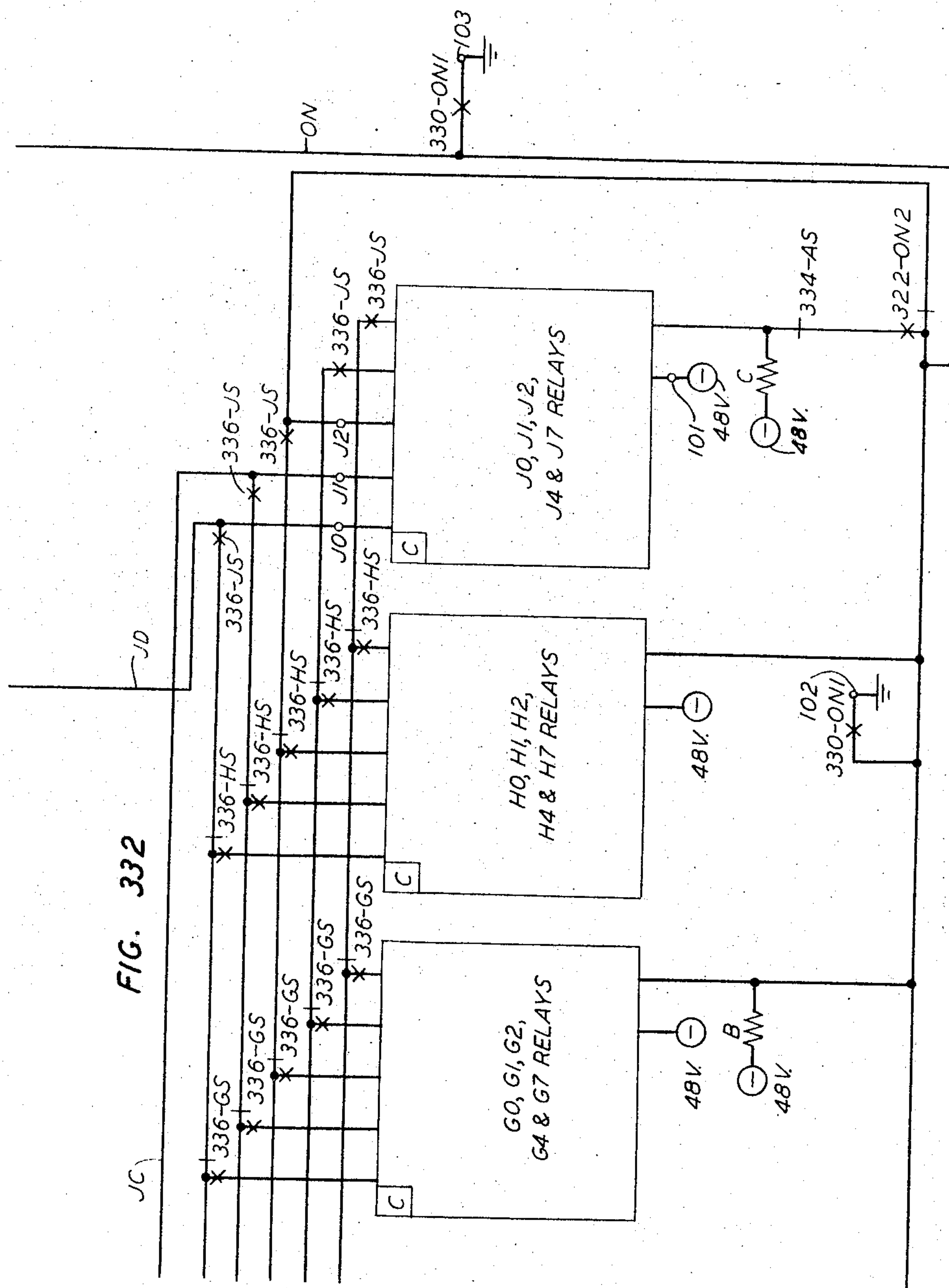
Sept. 12, 1967

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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 420



Sept. 12, 1967

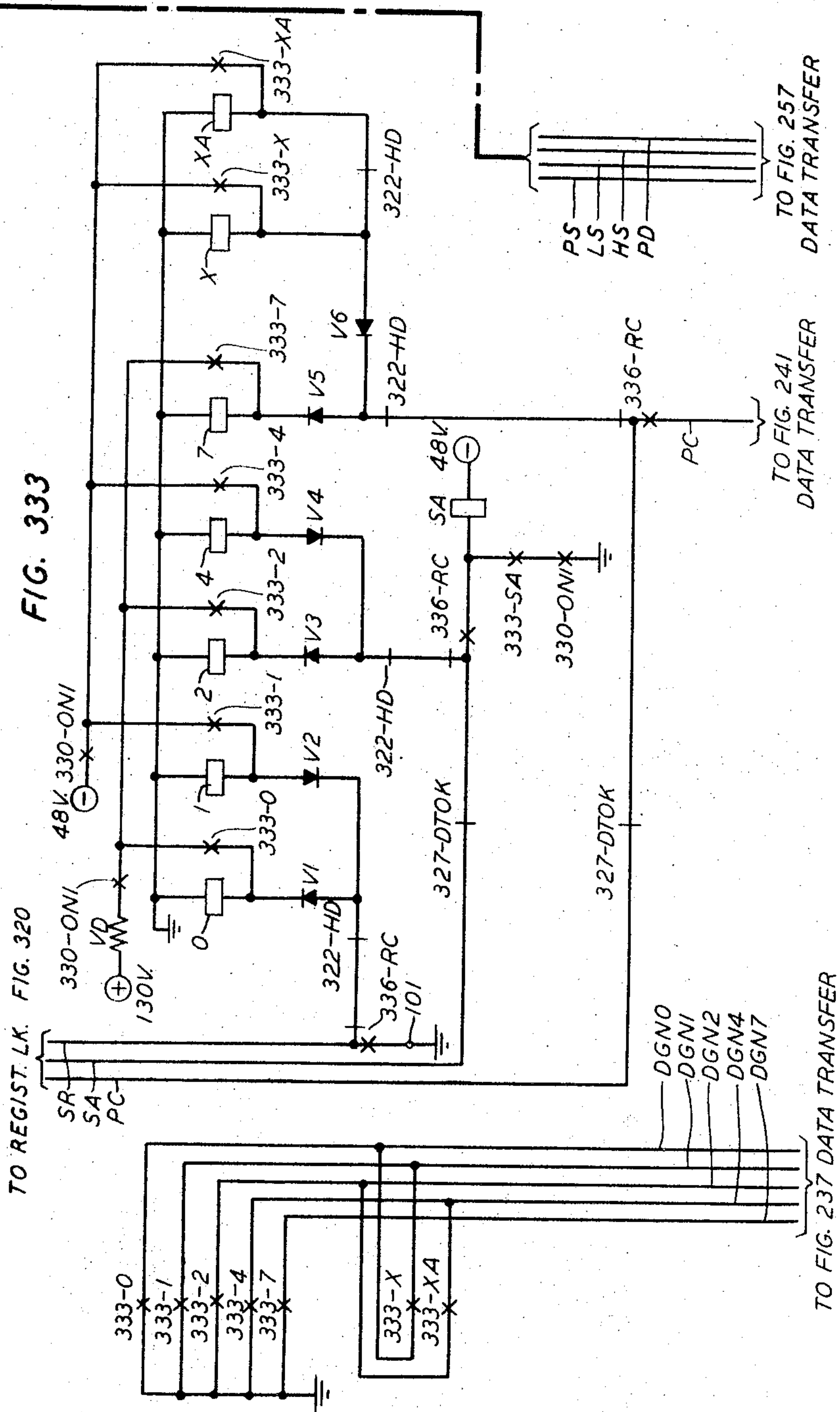
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 421

FIG. 333



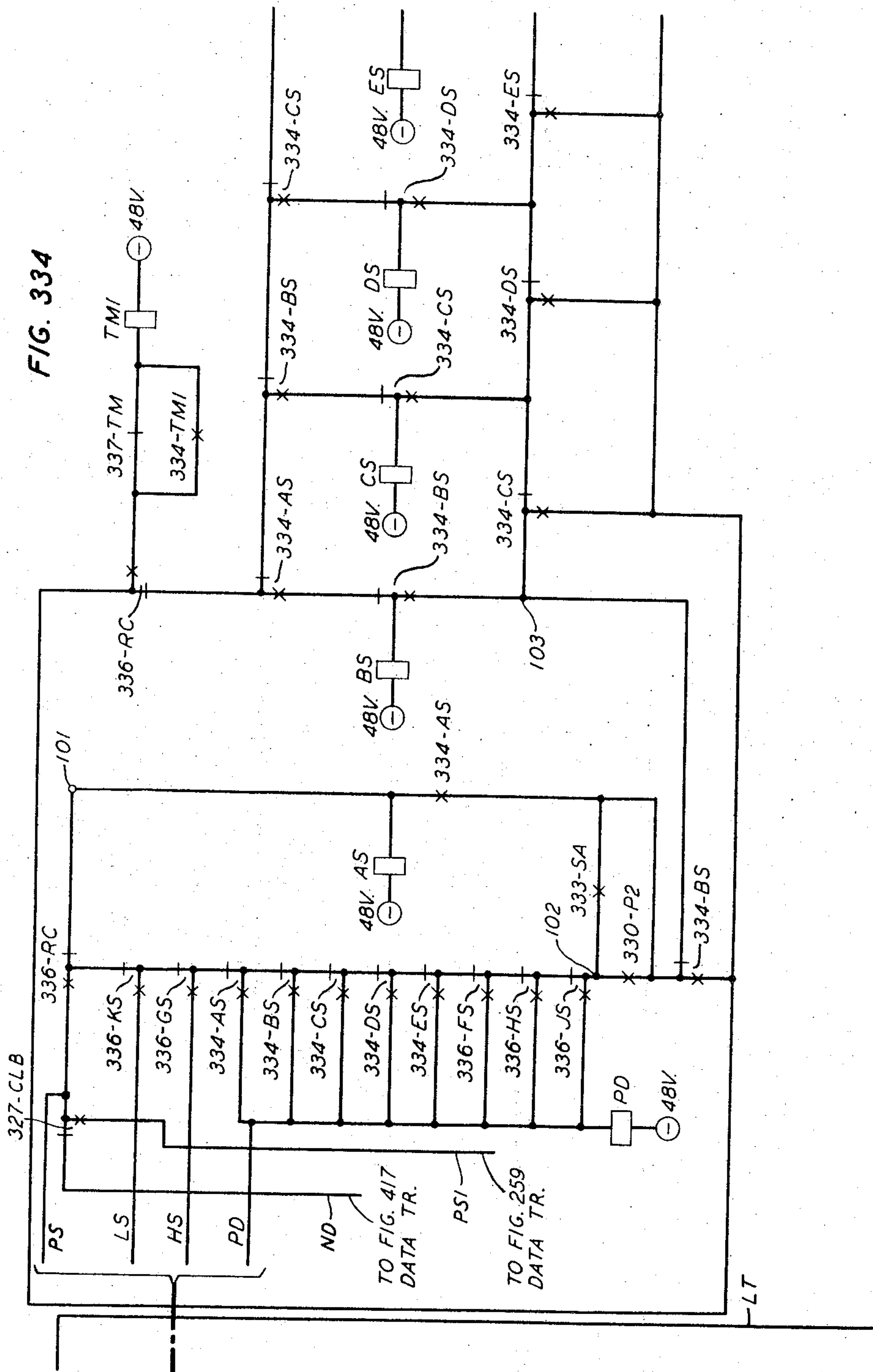
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 422



Sept. 12, 1967

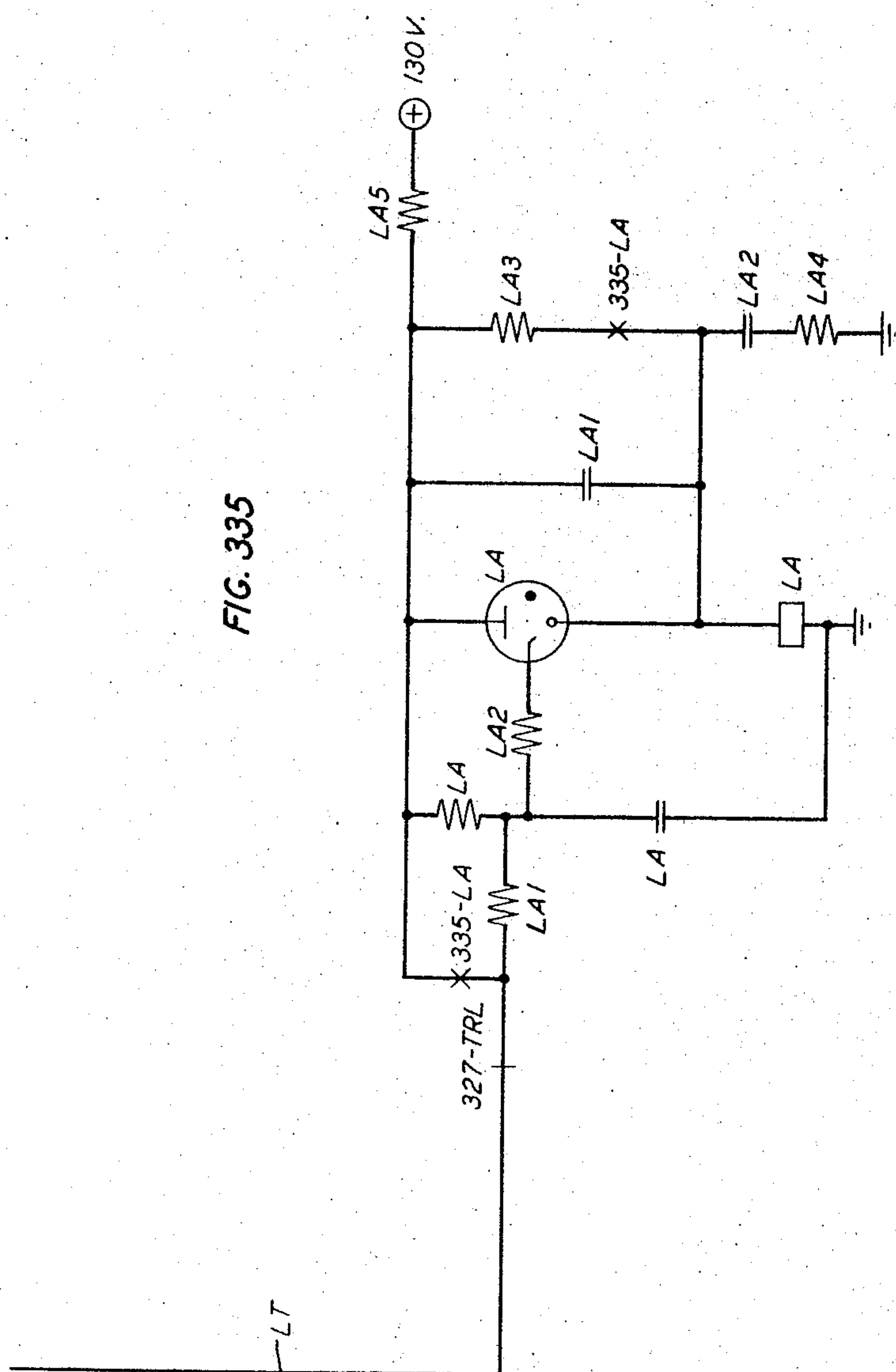
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 423

FIG. 335



Sept. 12, 1967

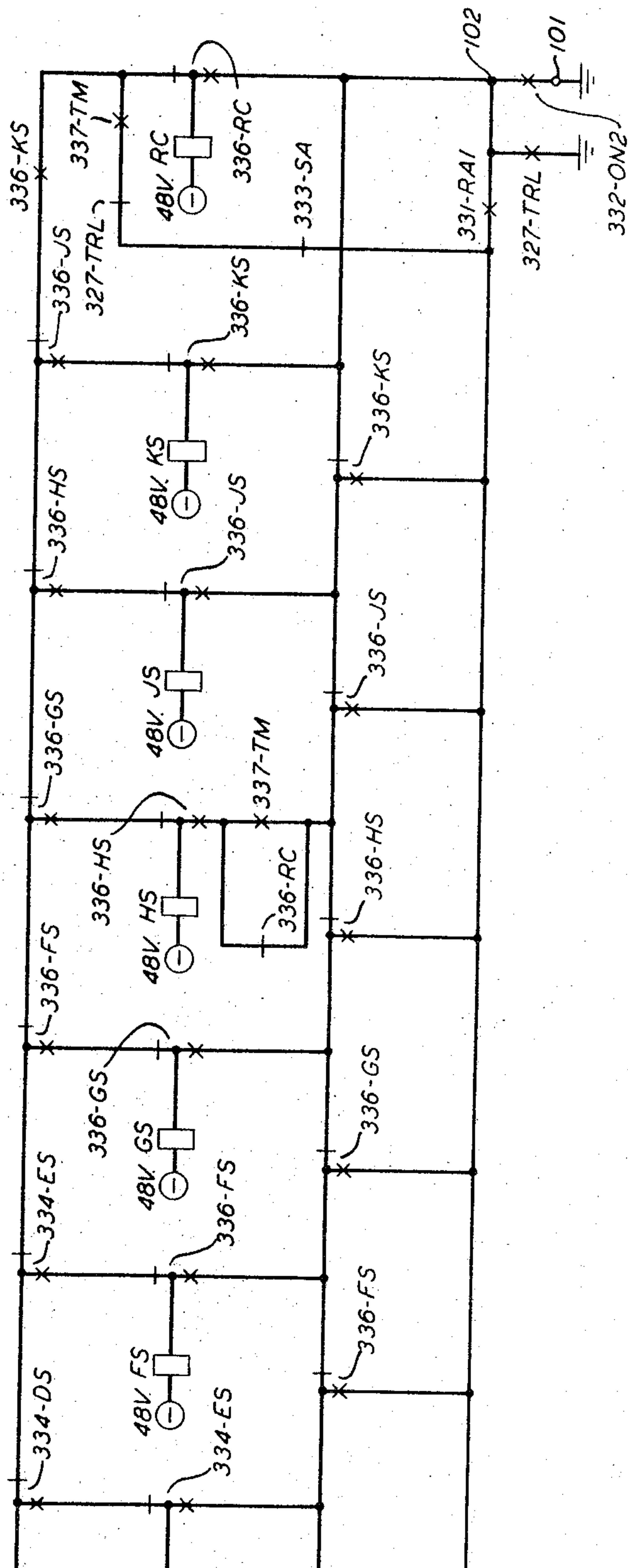
Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 424

FIG. 336



Sept. 12, 1967

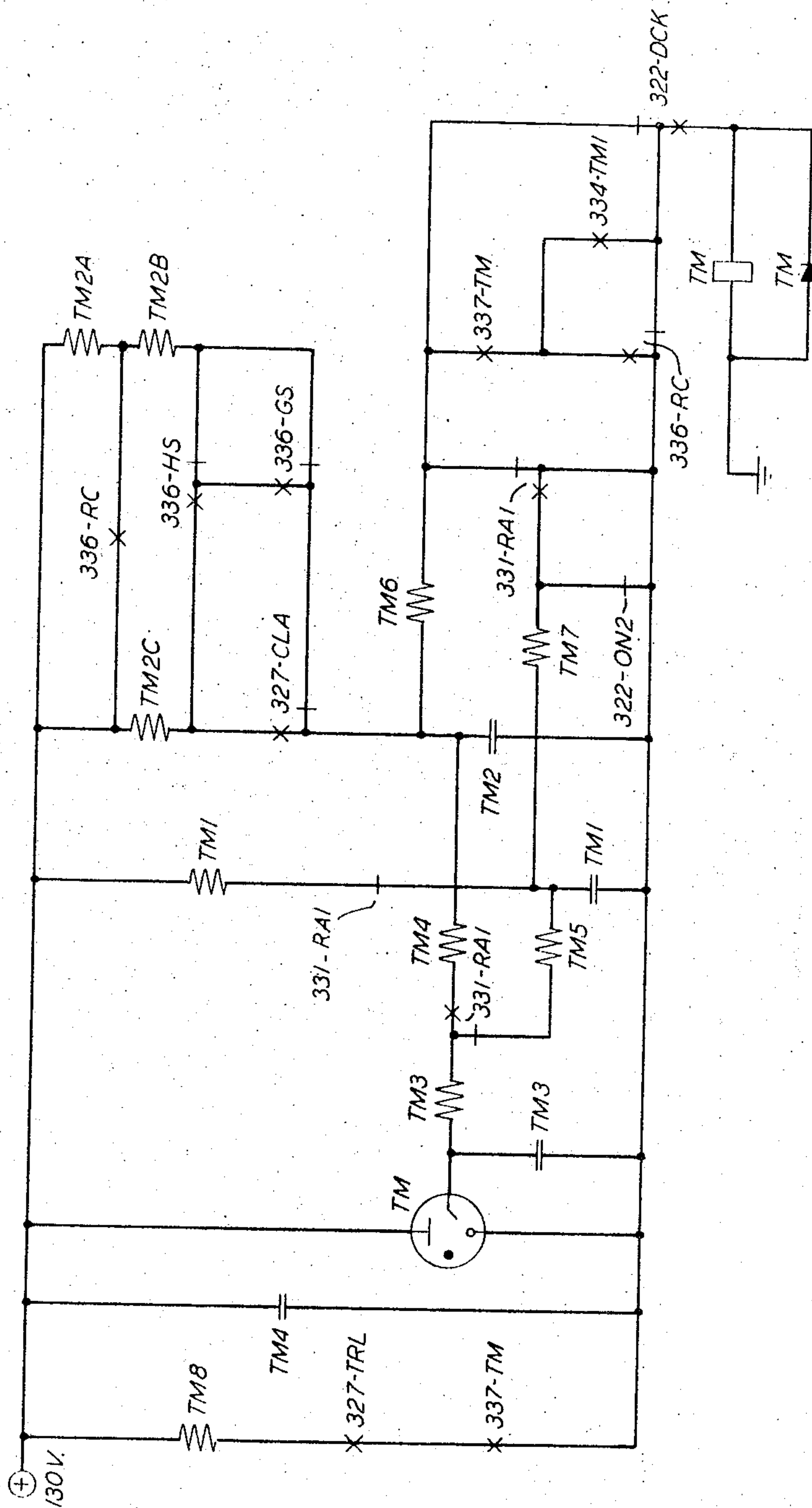
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 425

FIG. 337



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 426

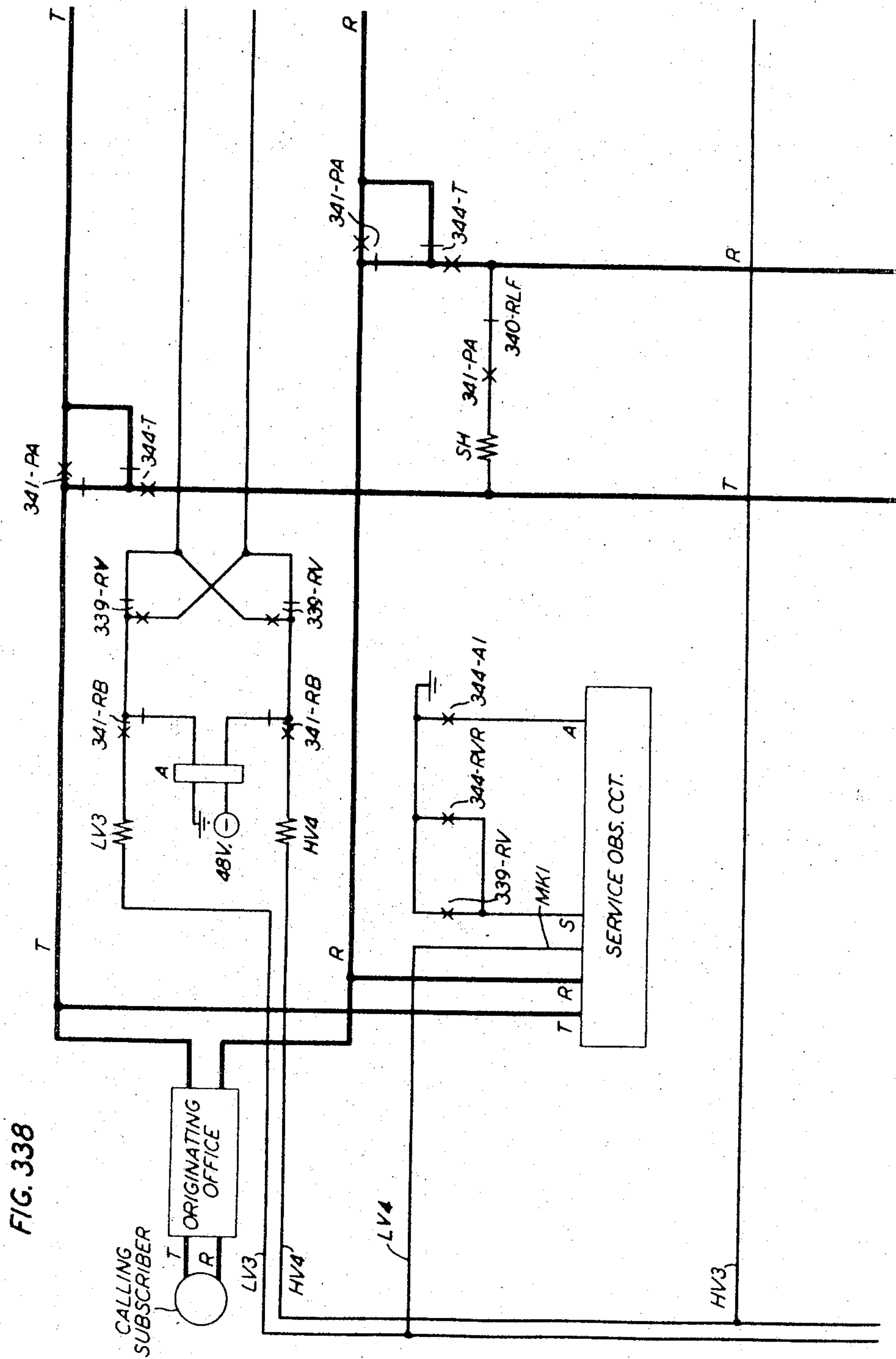
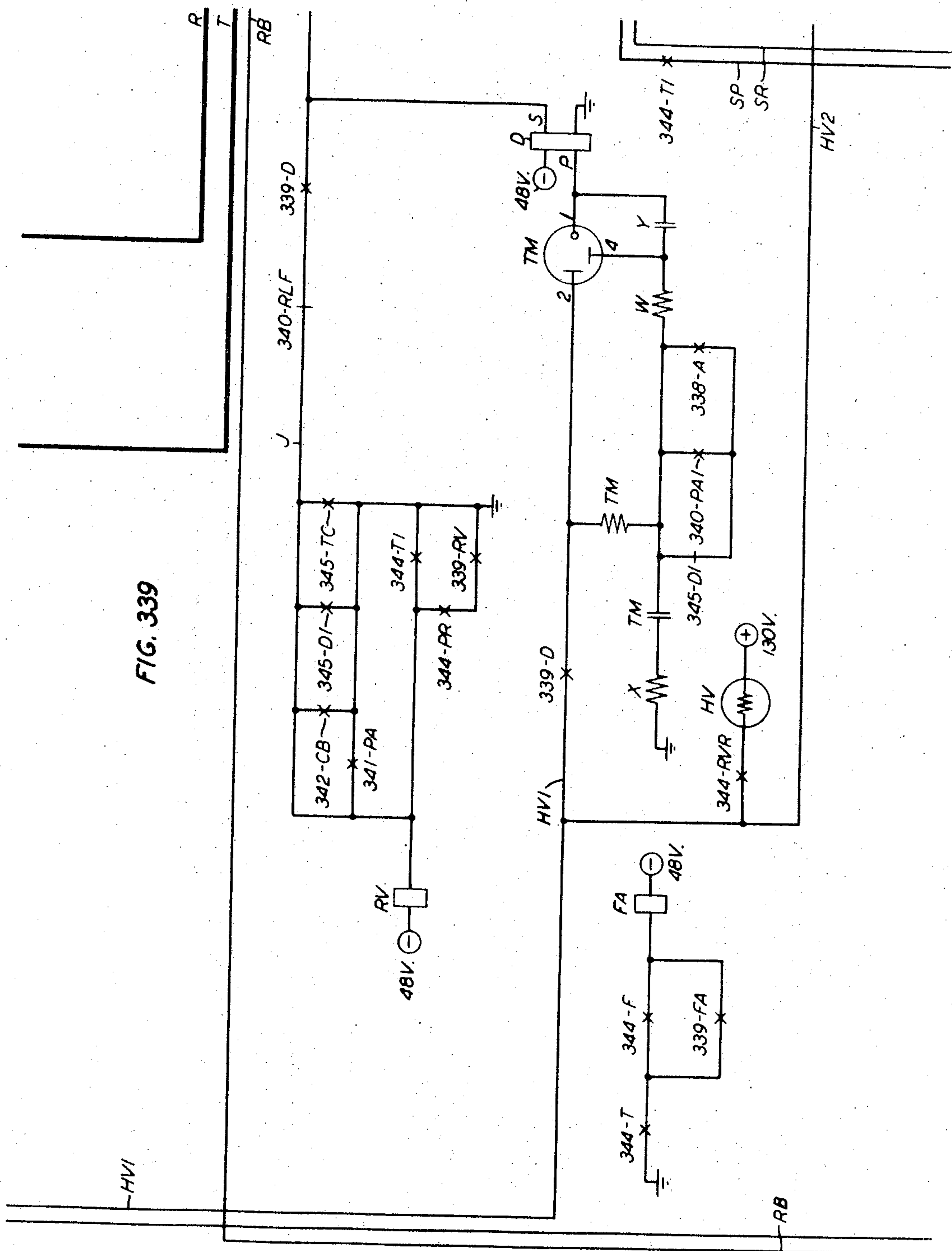


FIG. 338

Filed Nov. 26, 1963

570 Sheets-Sheet 427

570 Sheets-Sheet 427



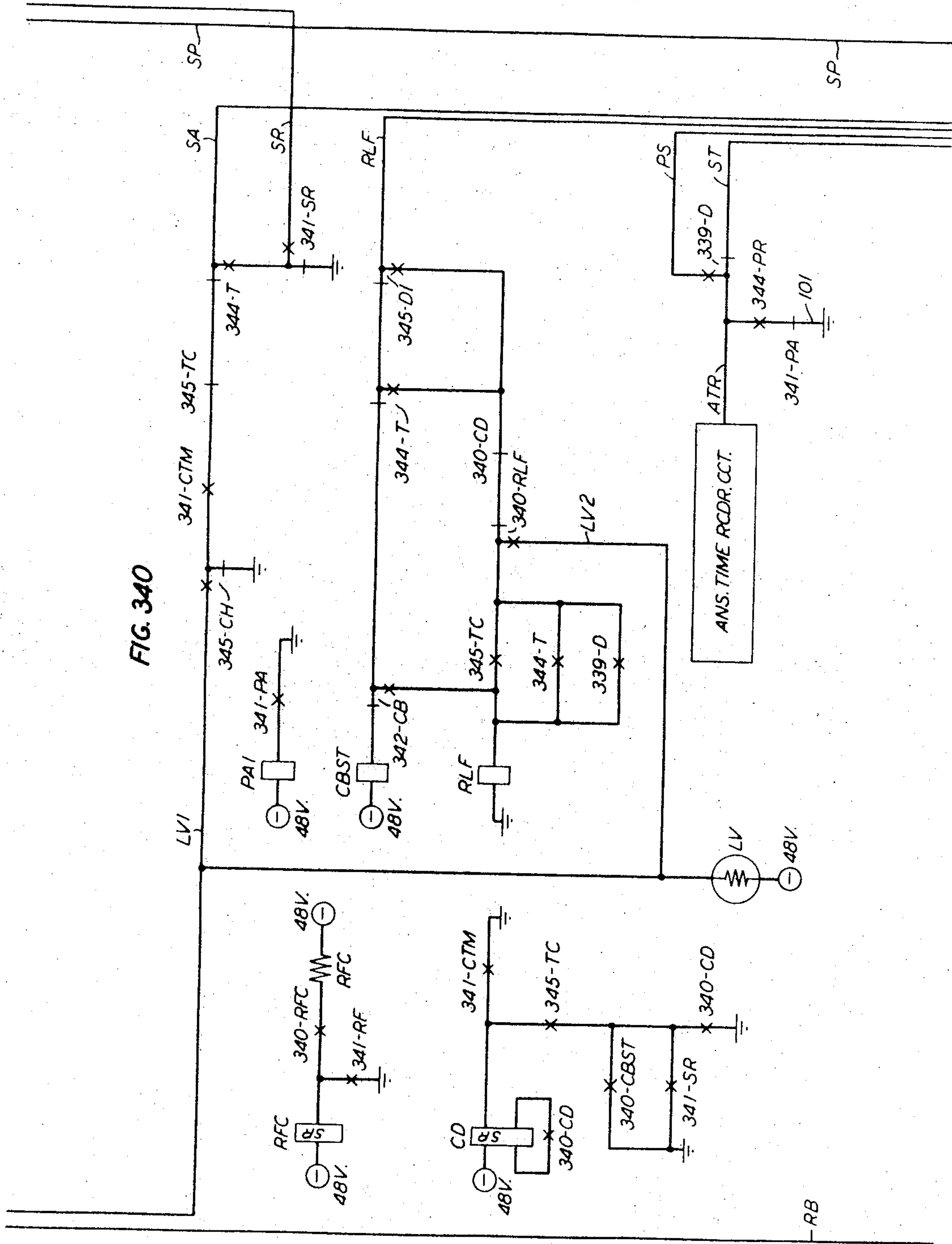
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 428



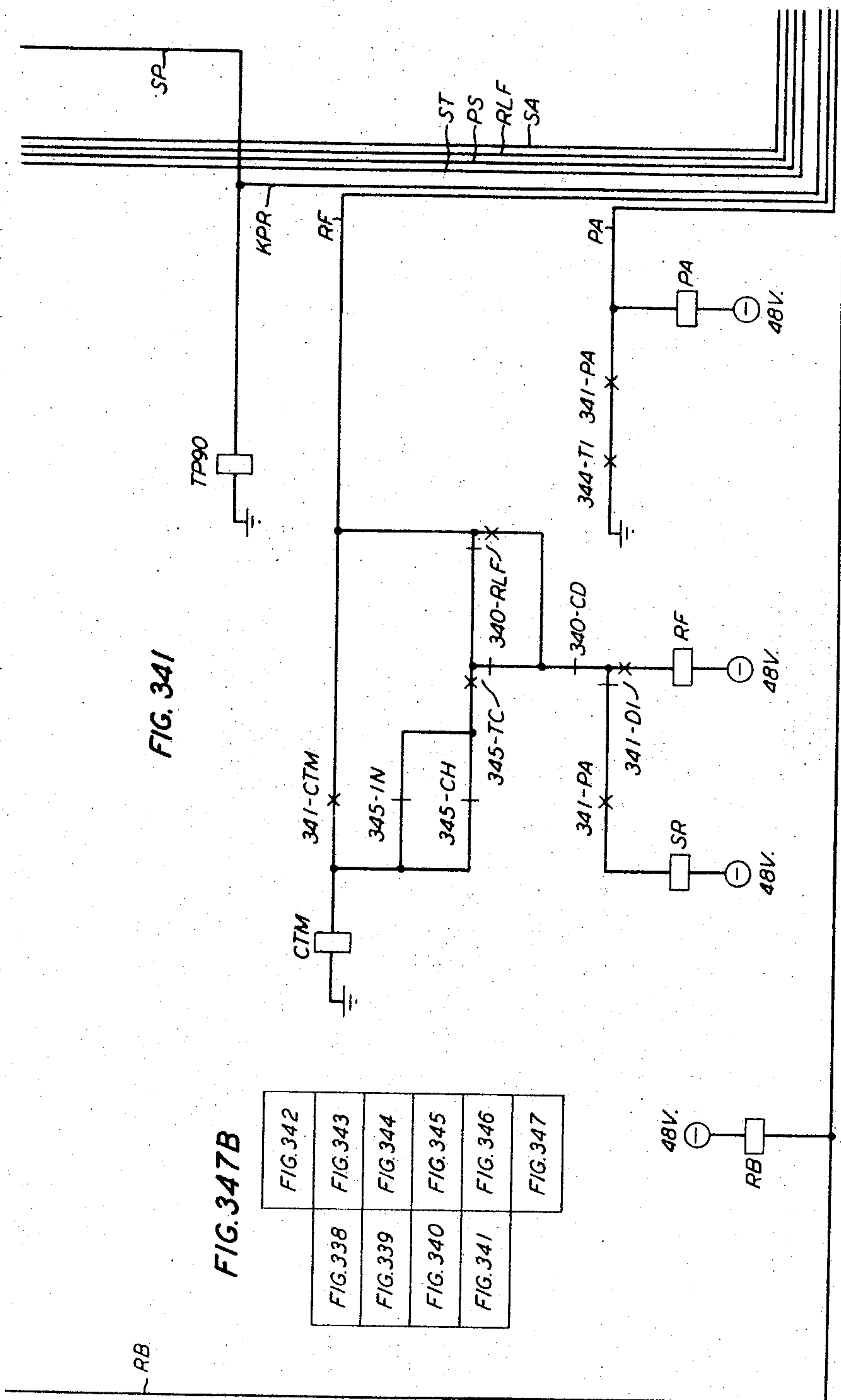
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 429



Sept. 12, 1967

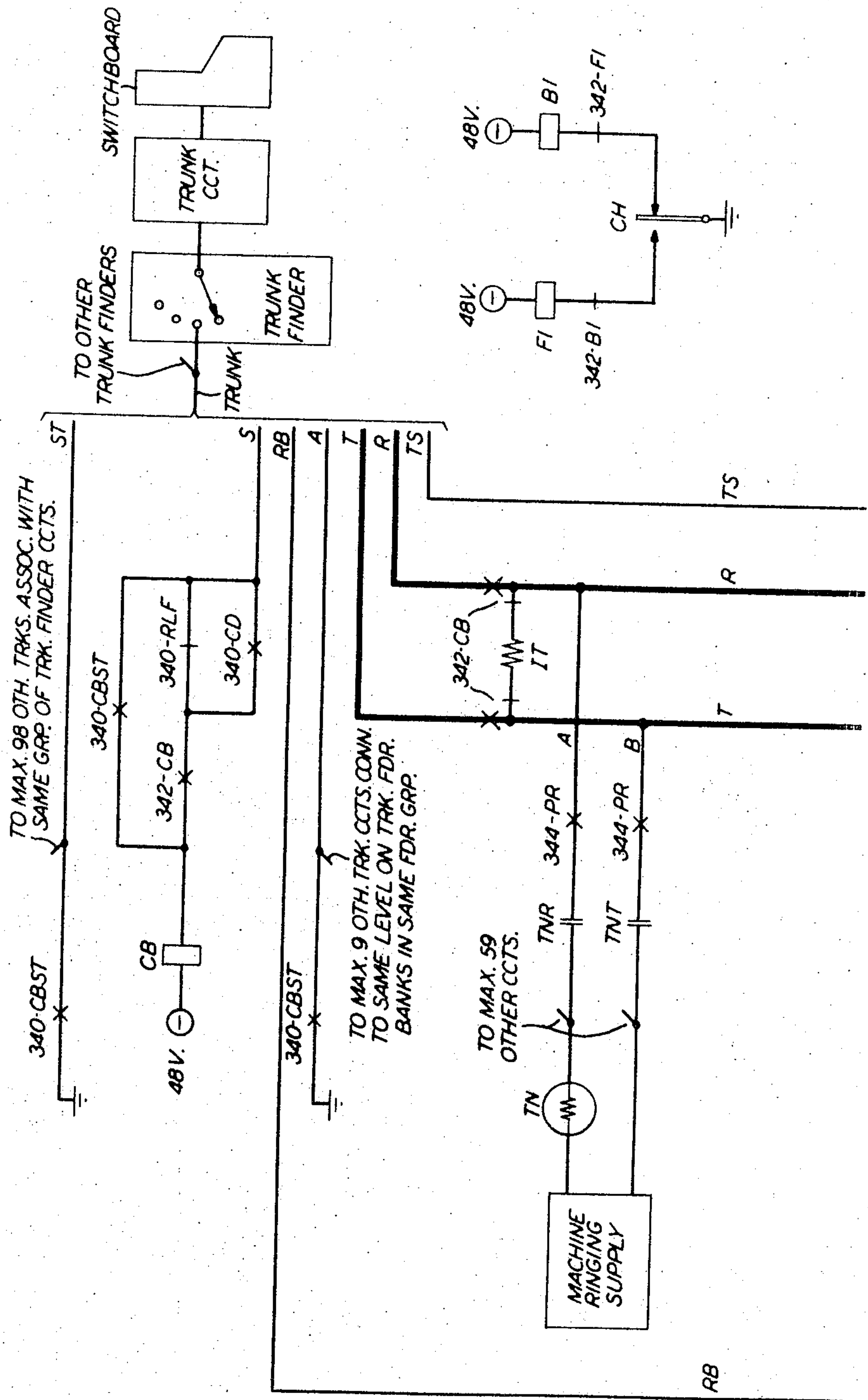
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 430

FIG. 342



Sept. 12, 1967

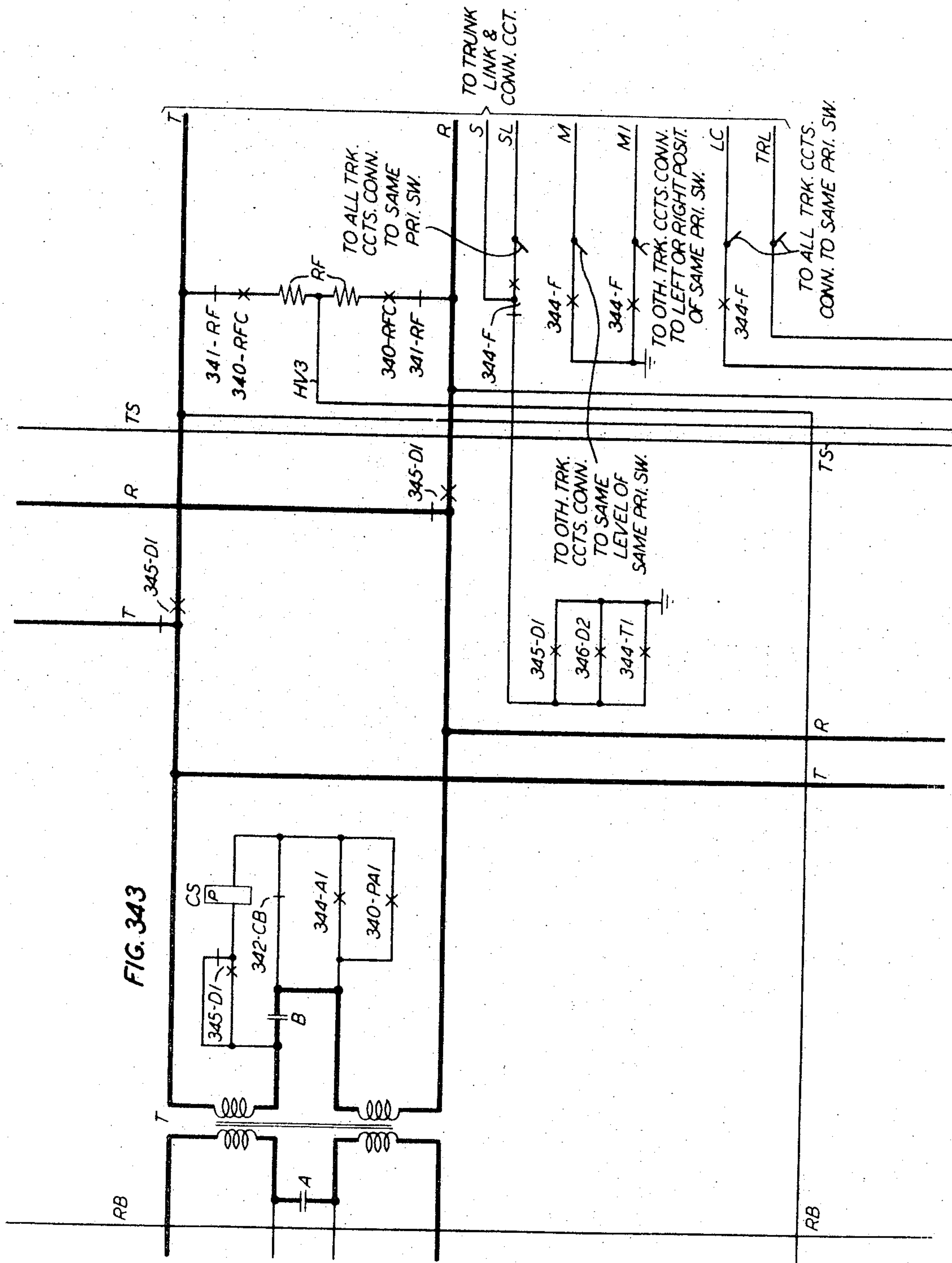
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3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 431



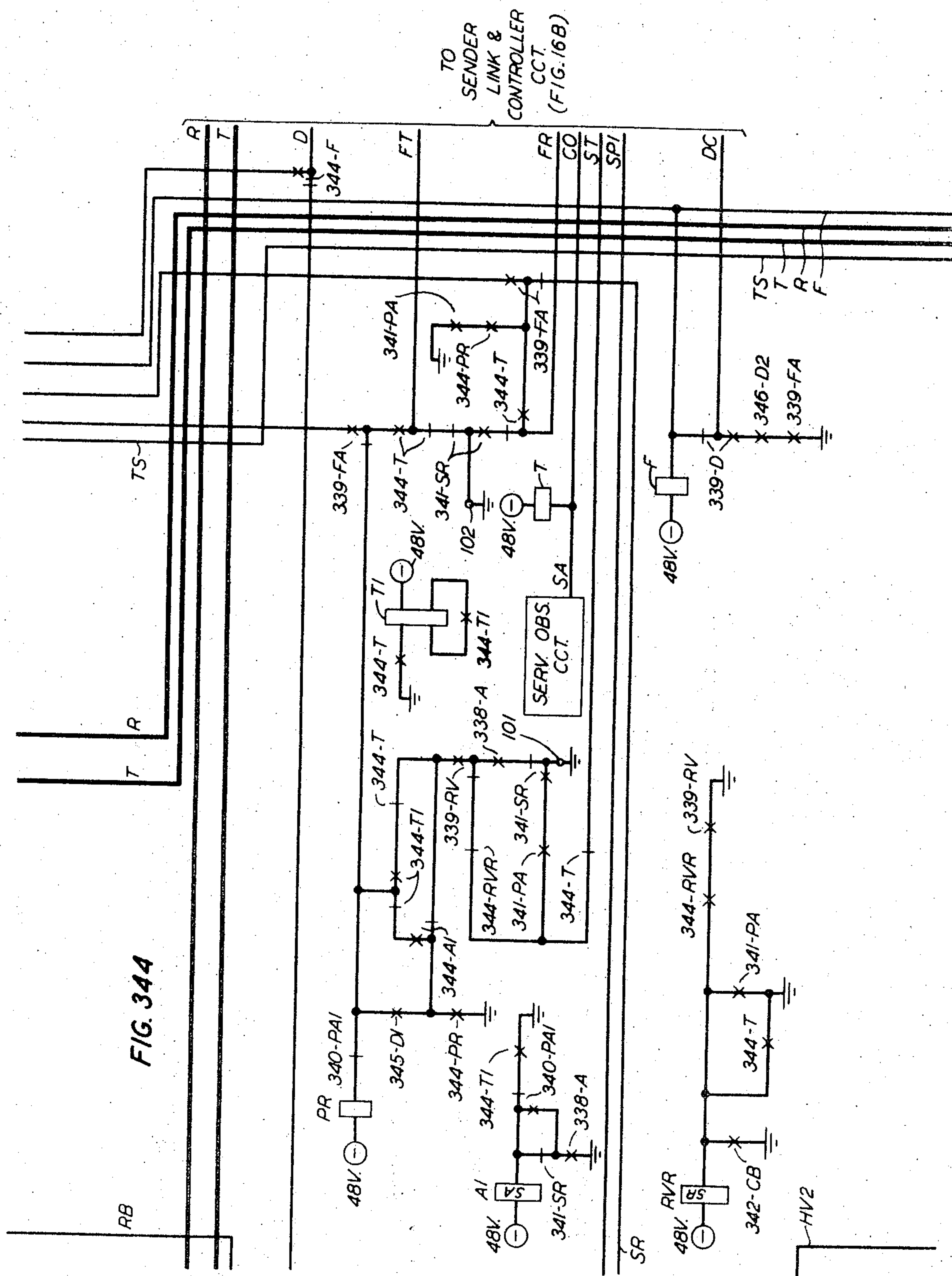
Sept. 12, 1967

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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 432



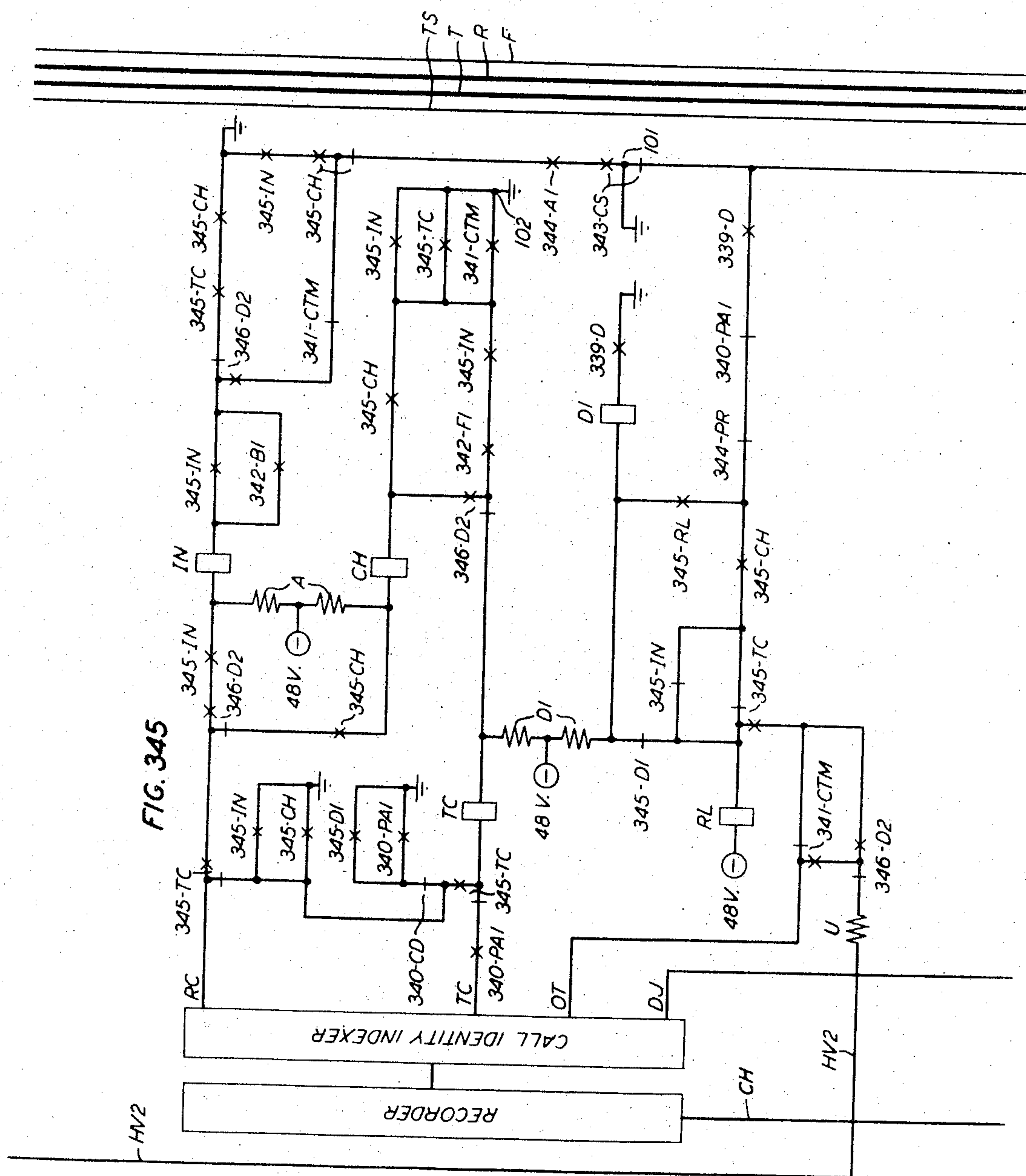
Sept. 12, 1967

L. J. CERNY ETAL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 433



Sept. 12, 1967

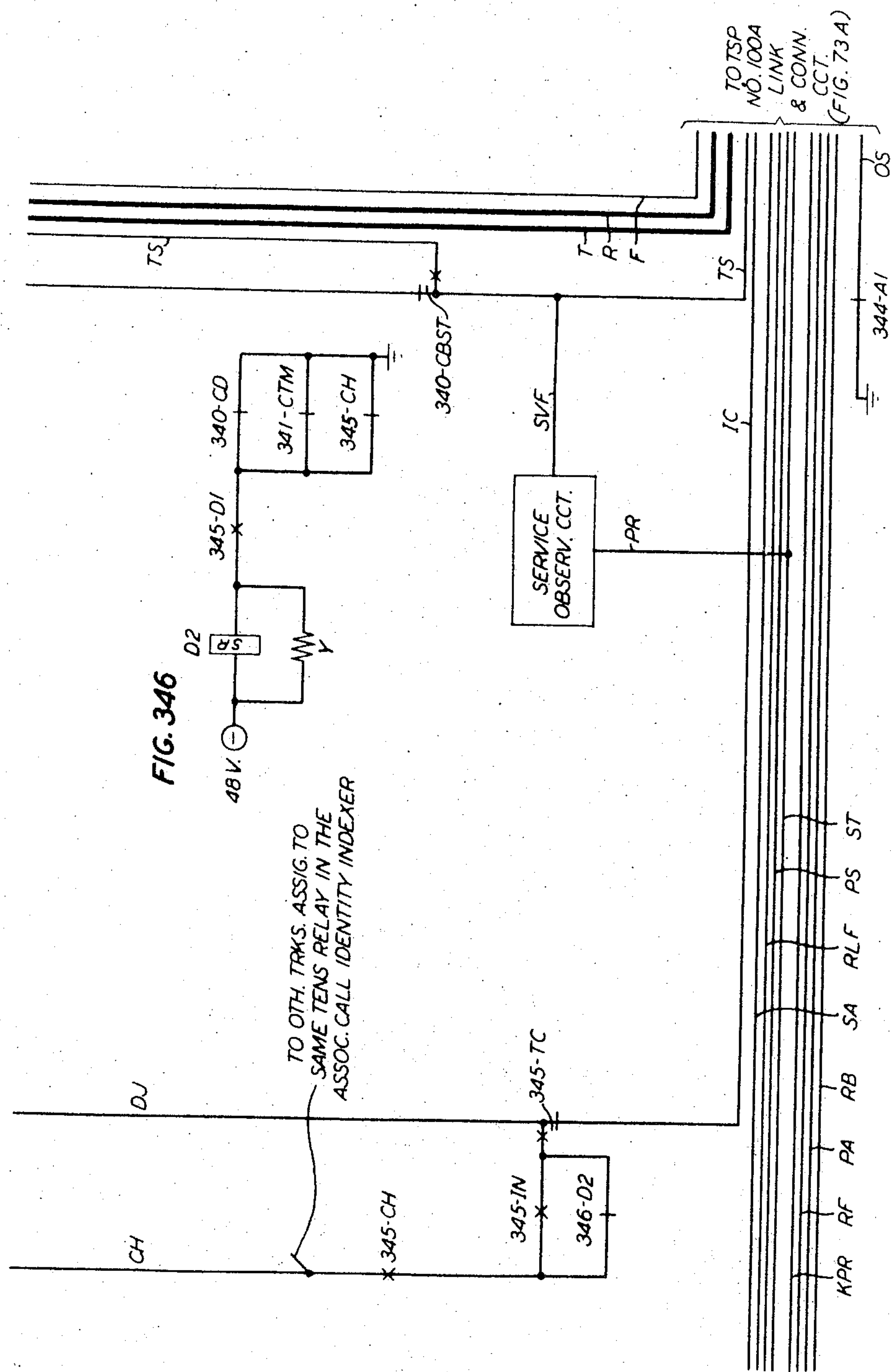
L. J. CERNY ET AL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 434



Sept. 12, 1967

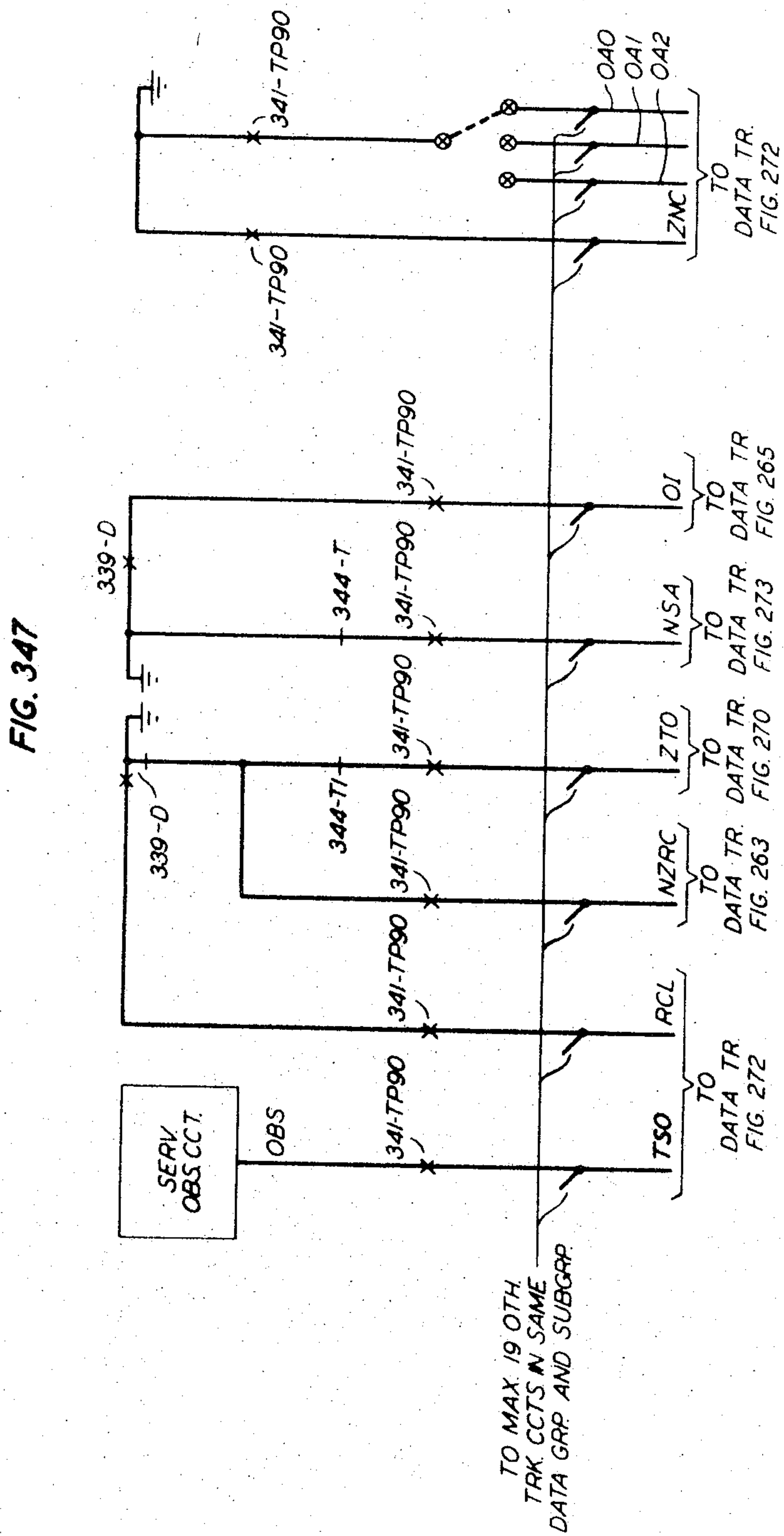
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 435



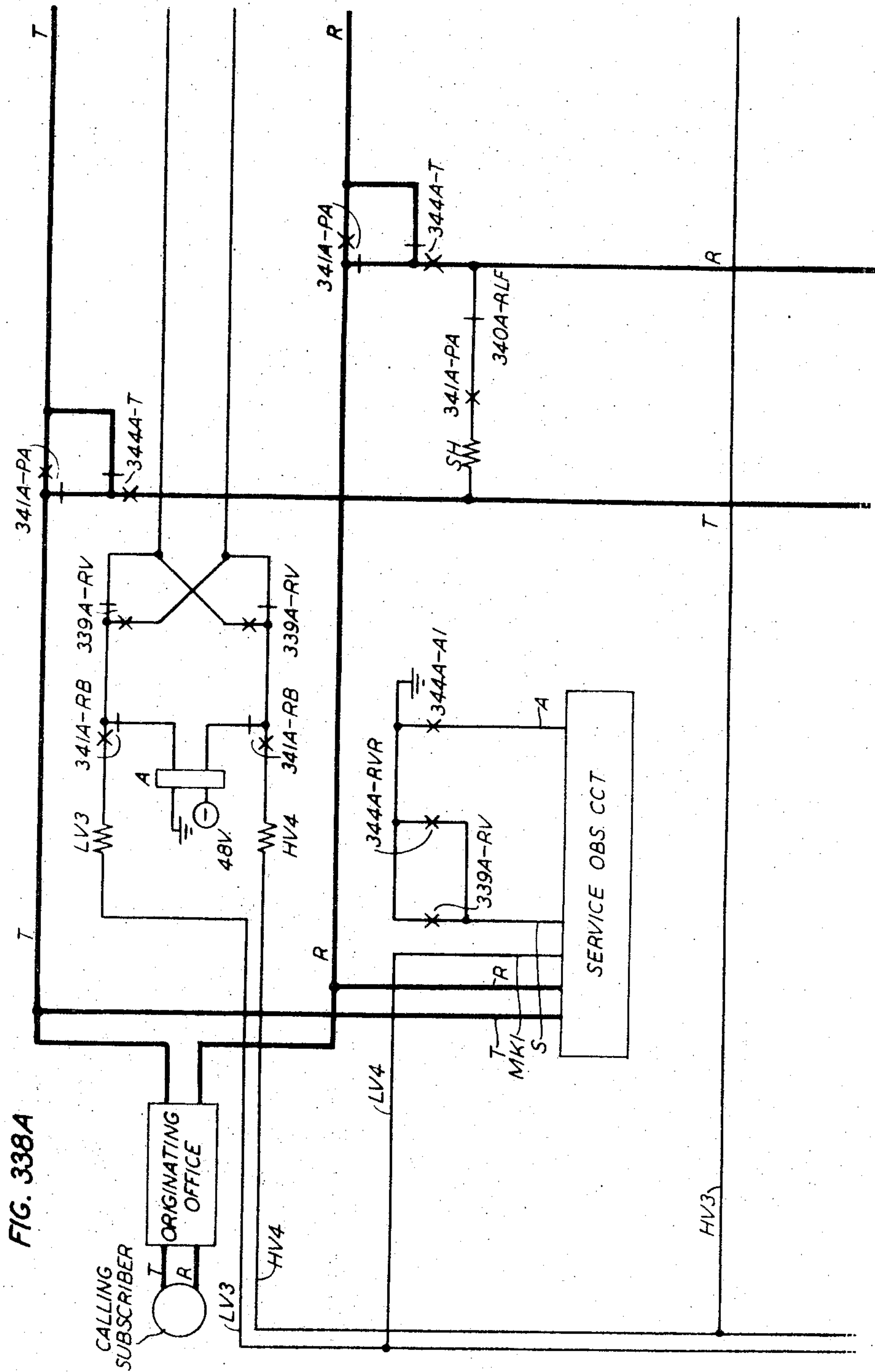
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 436



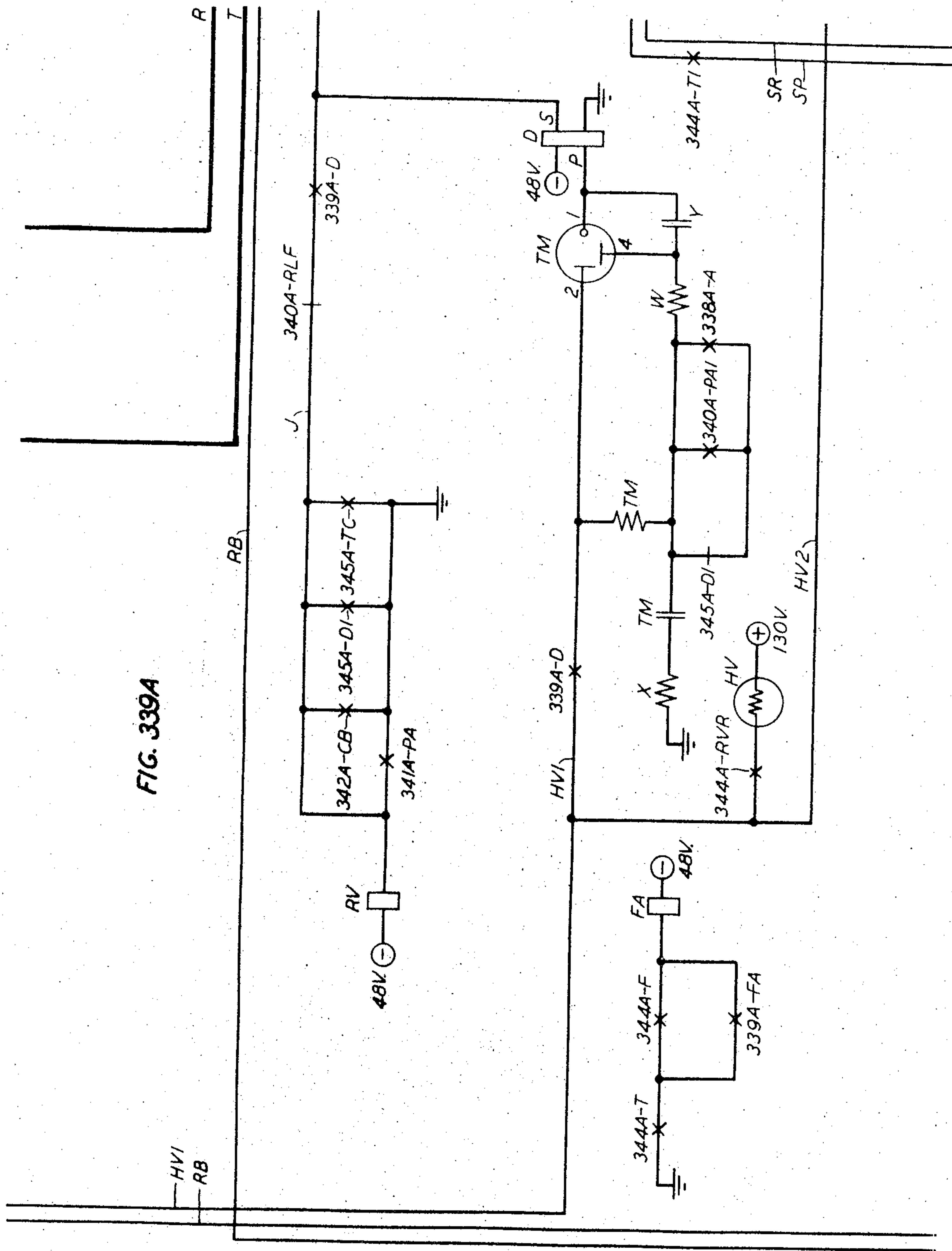
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 437



Sept. 12, 1967

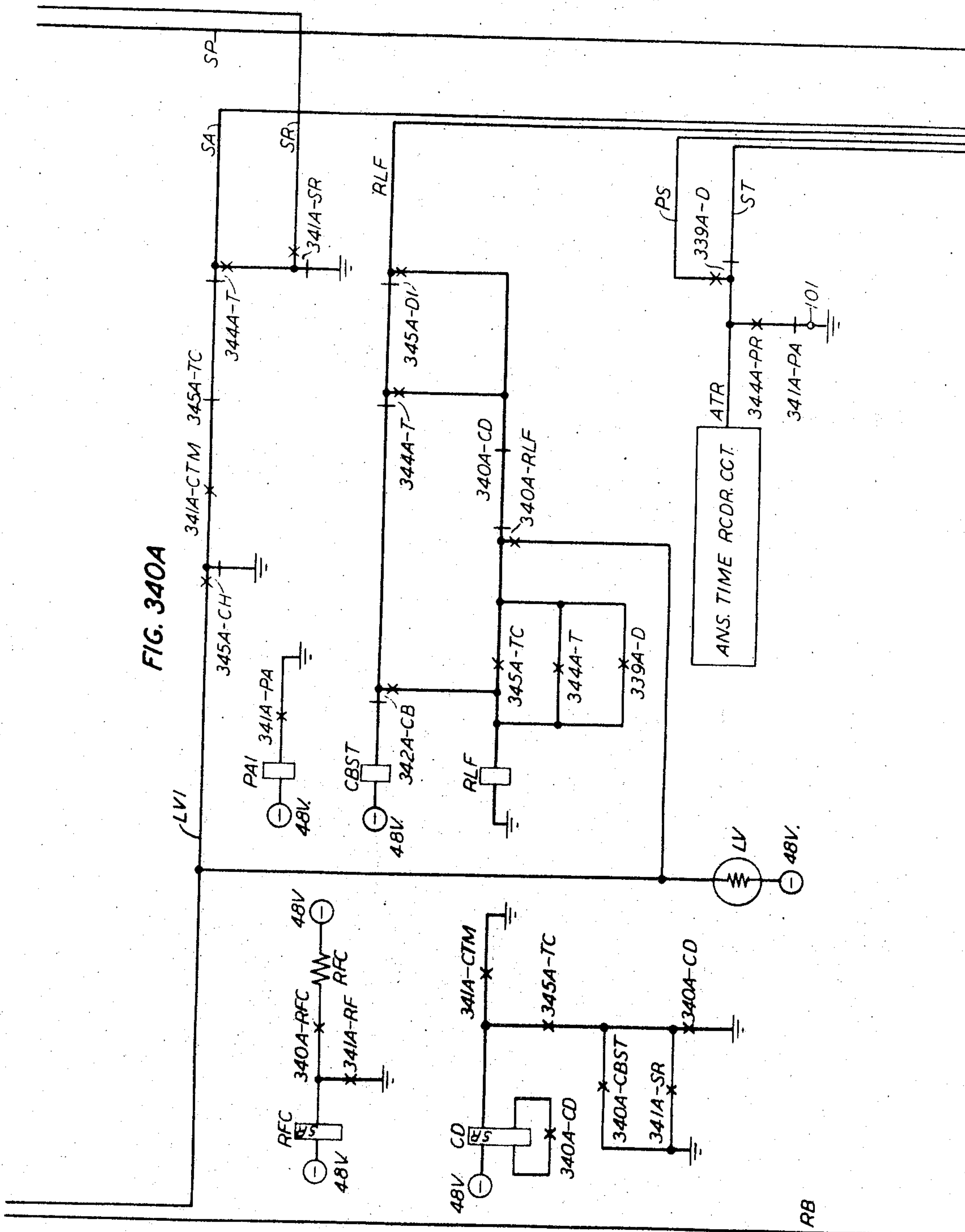
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 438

FIG. 340A



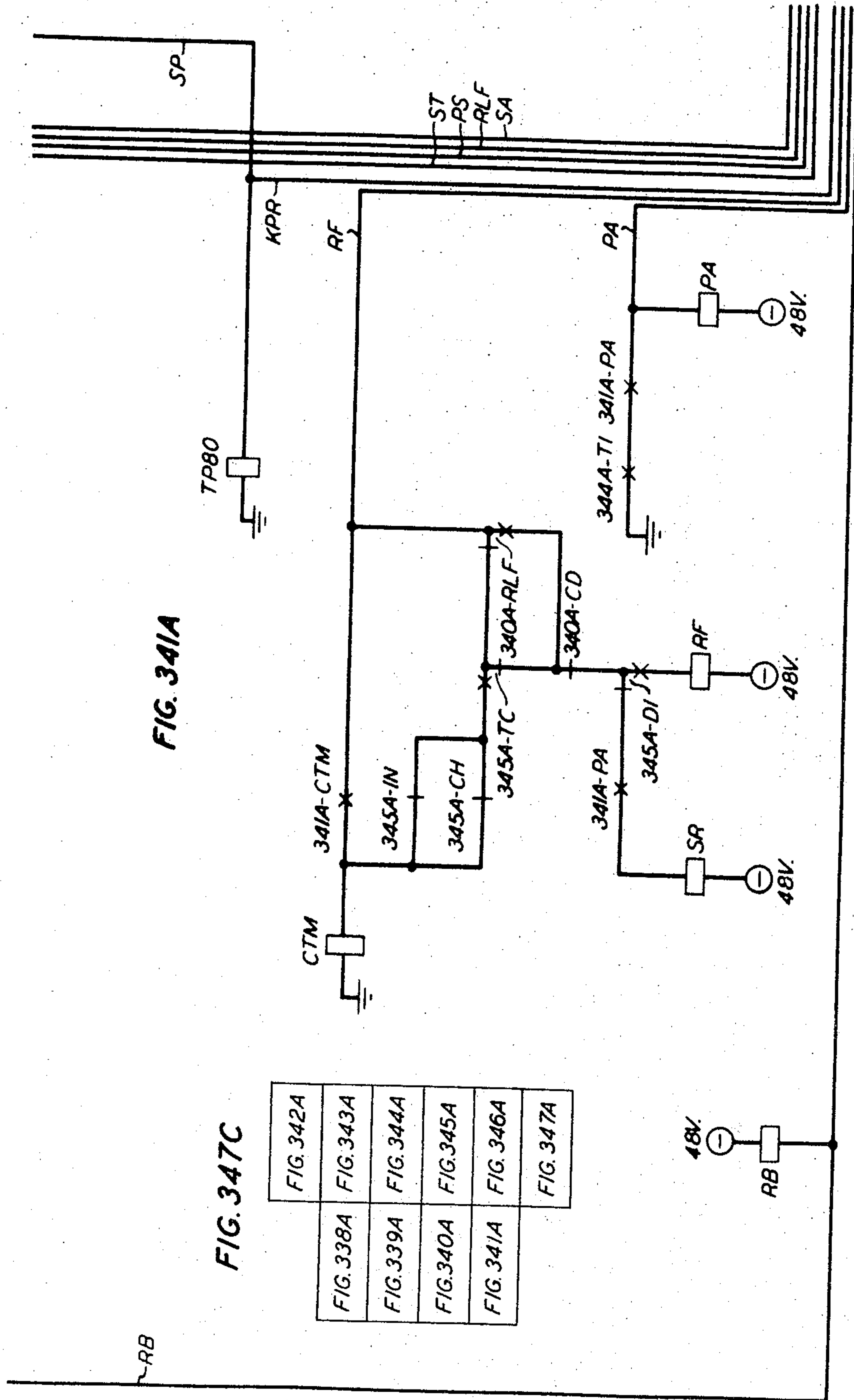
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 439



Sept. 12, 1967

Filed Nov. 26, 1963

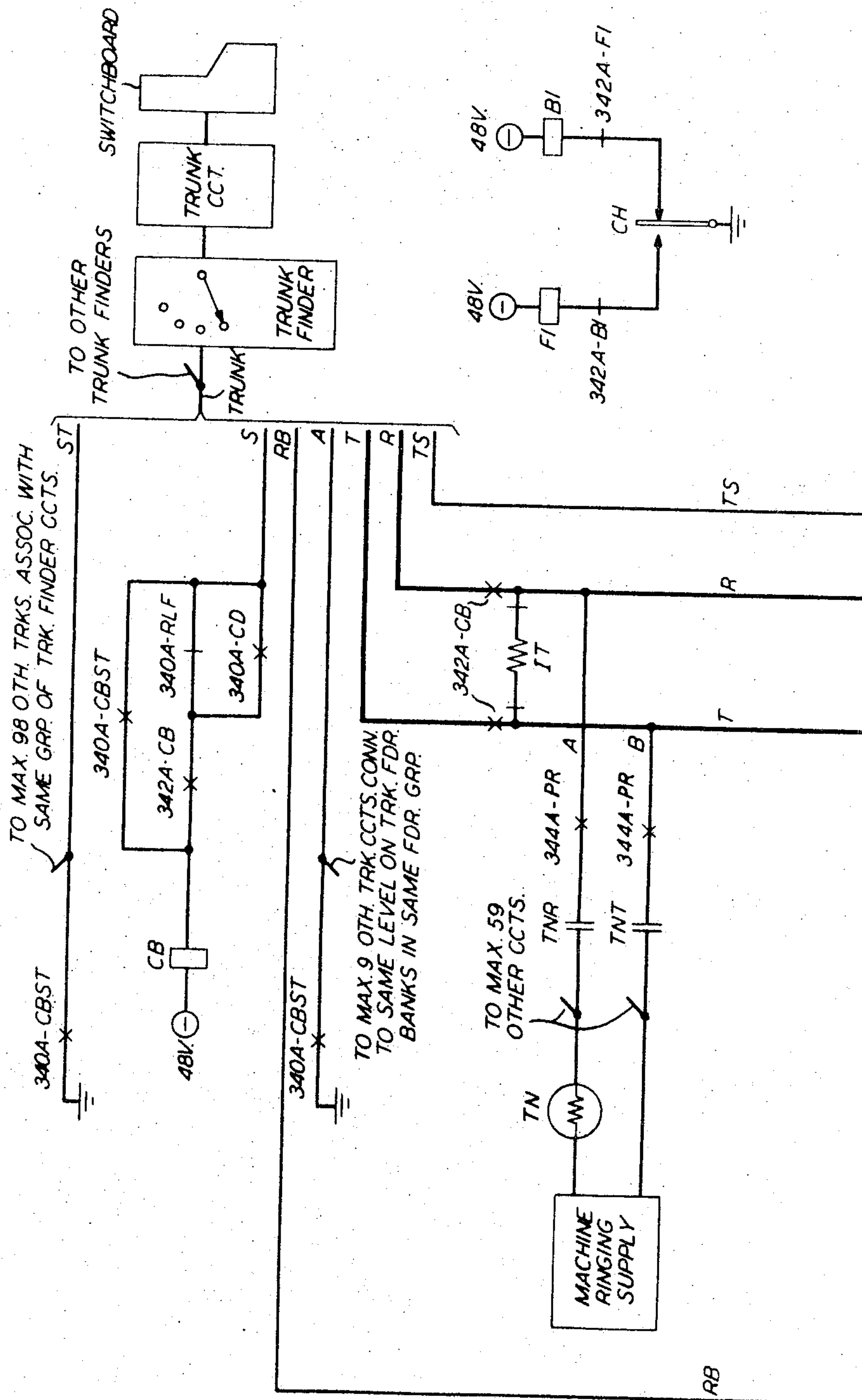
L. J. CERNY ET AL

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 440

FIG. 342A



Sept. 12, 1967

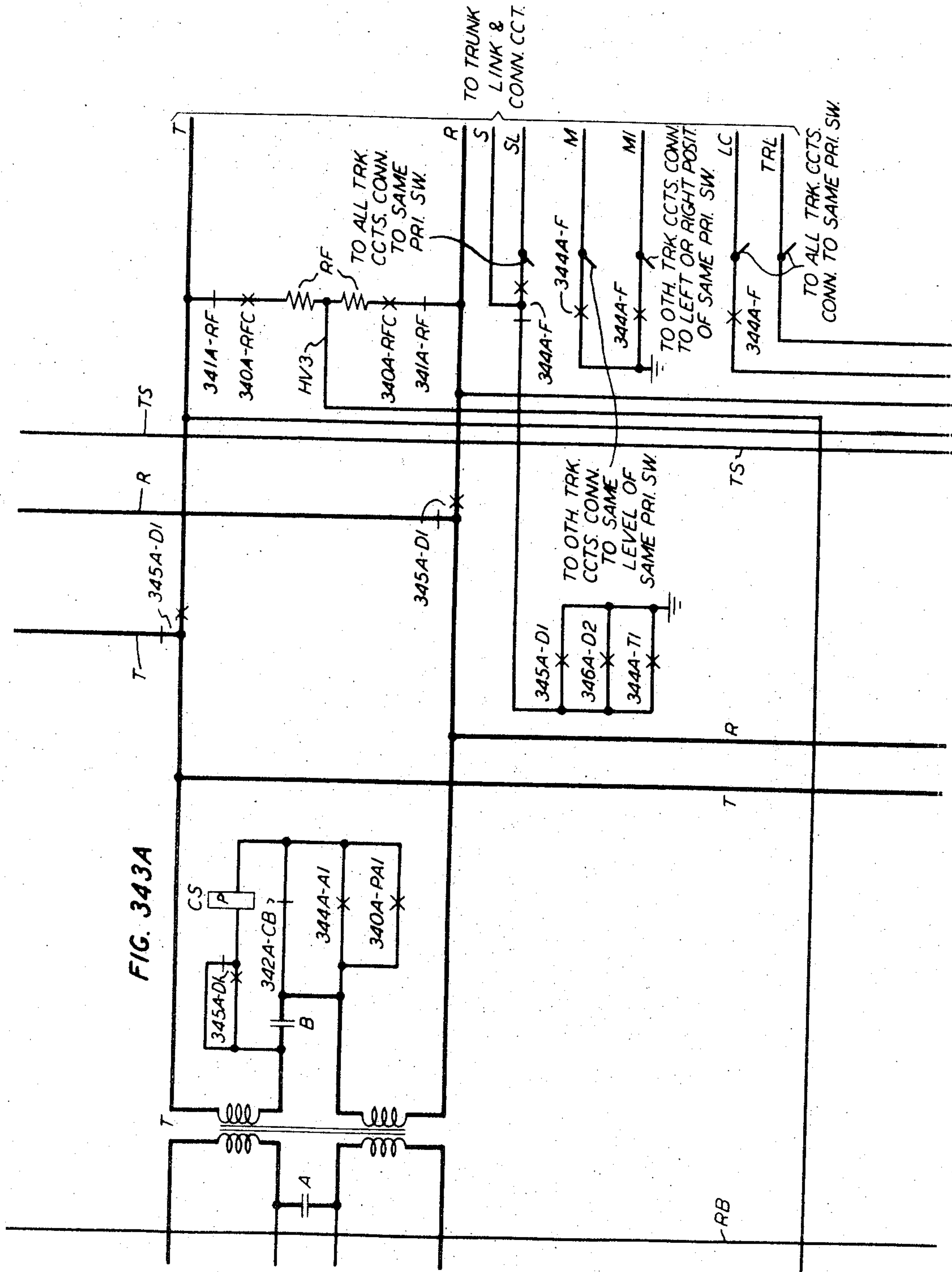
L. J. CERNY ETAL

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 441



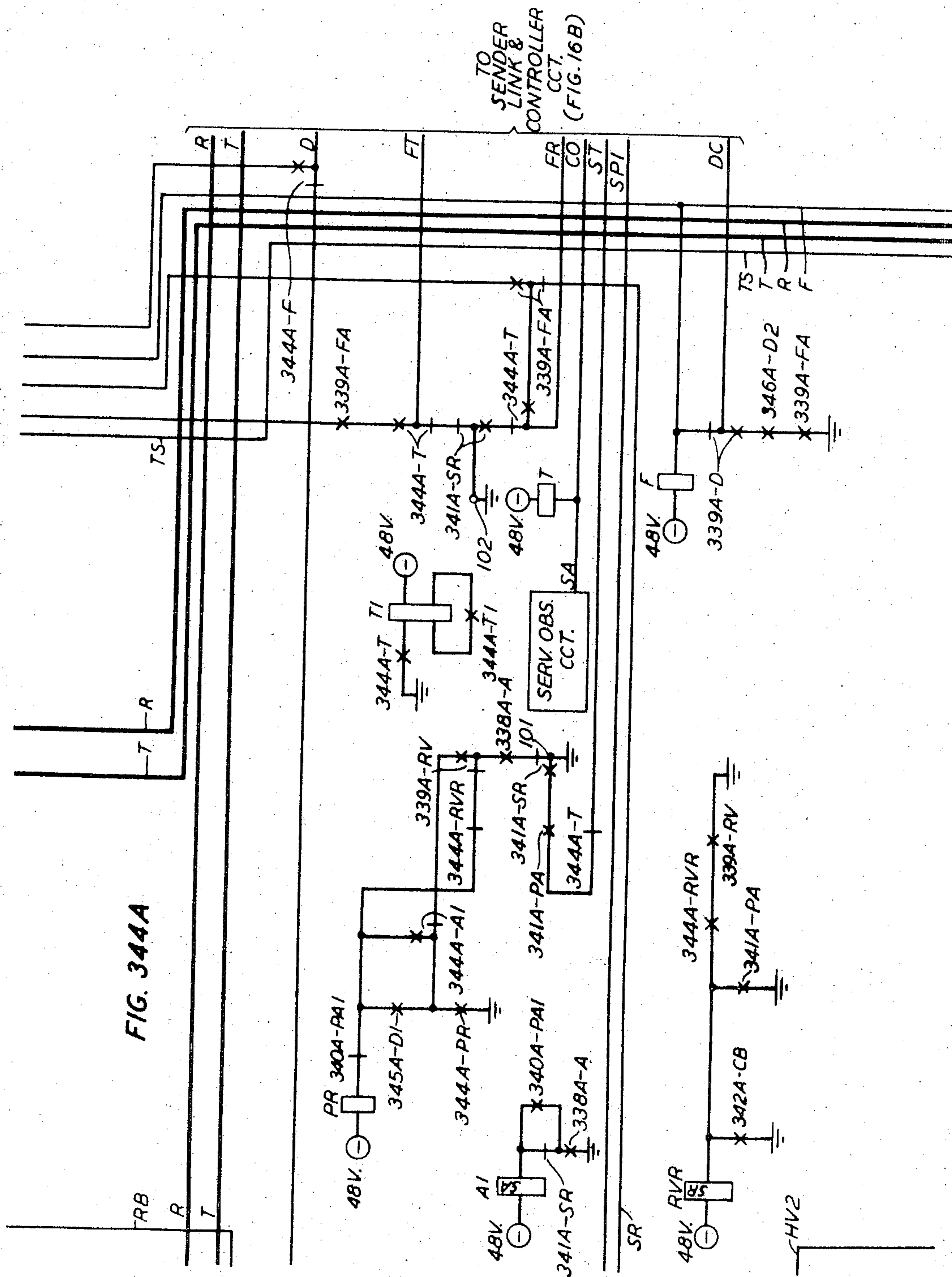
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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 442



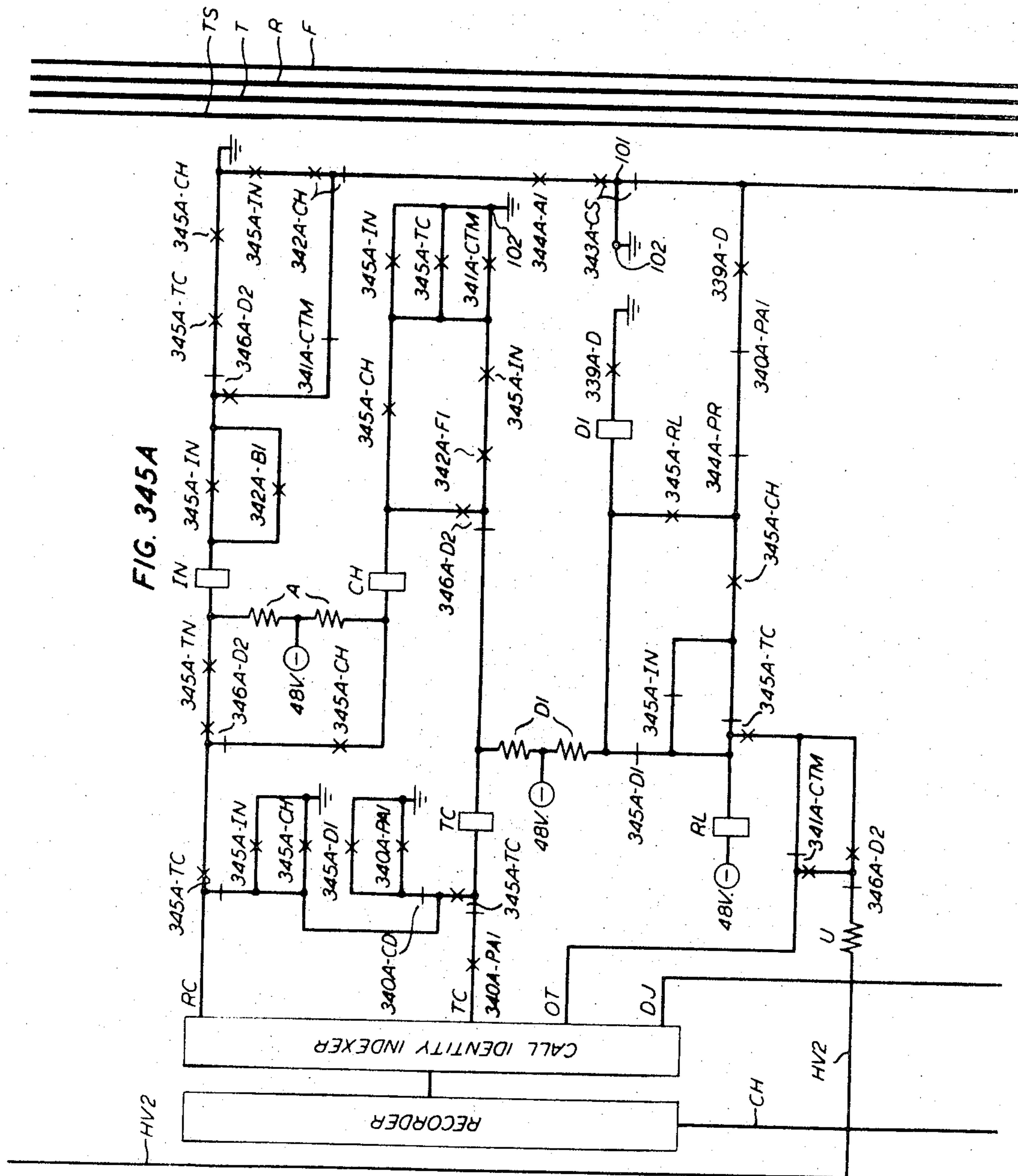
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 443



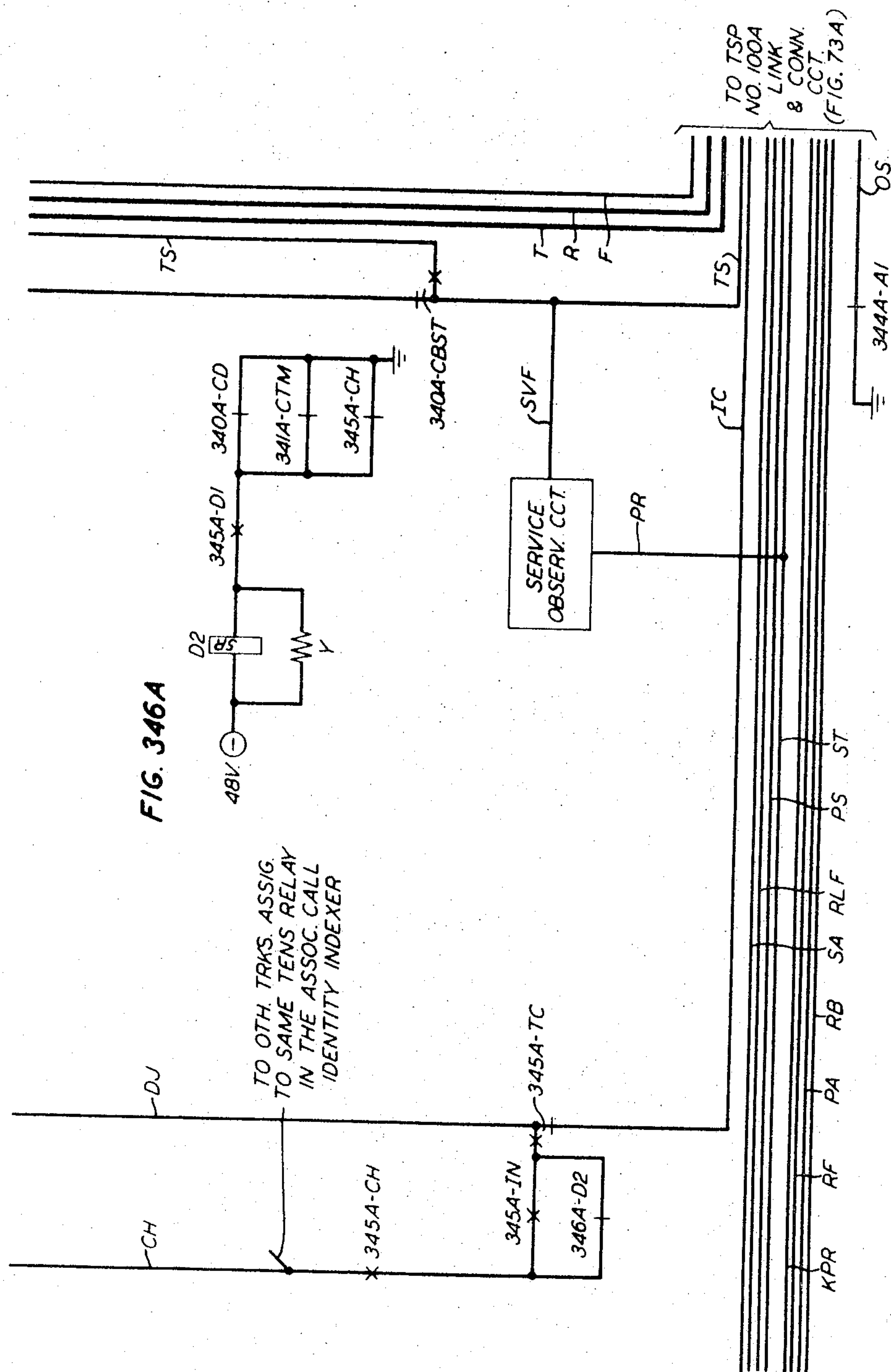
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 444



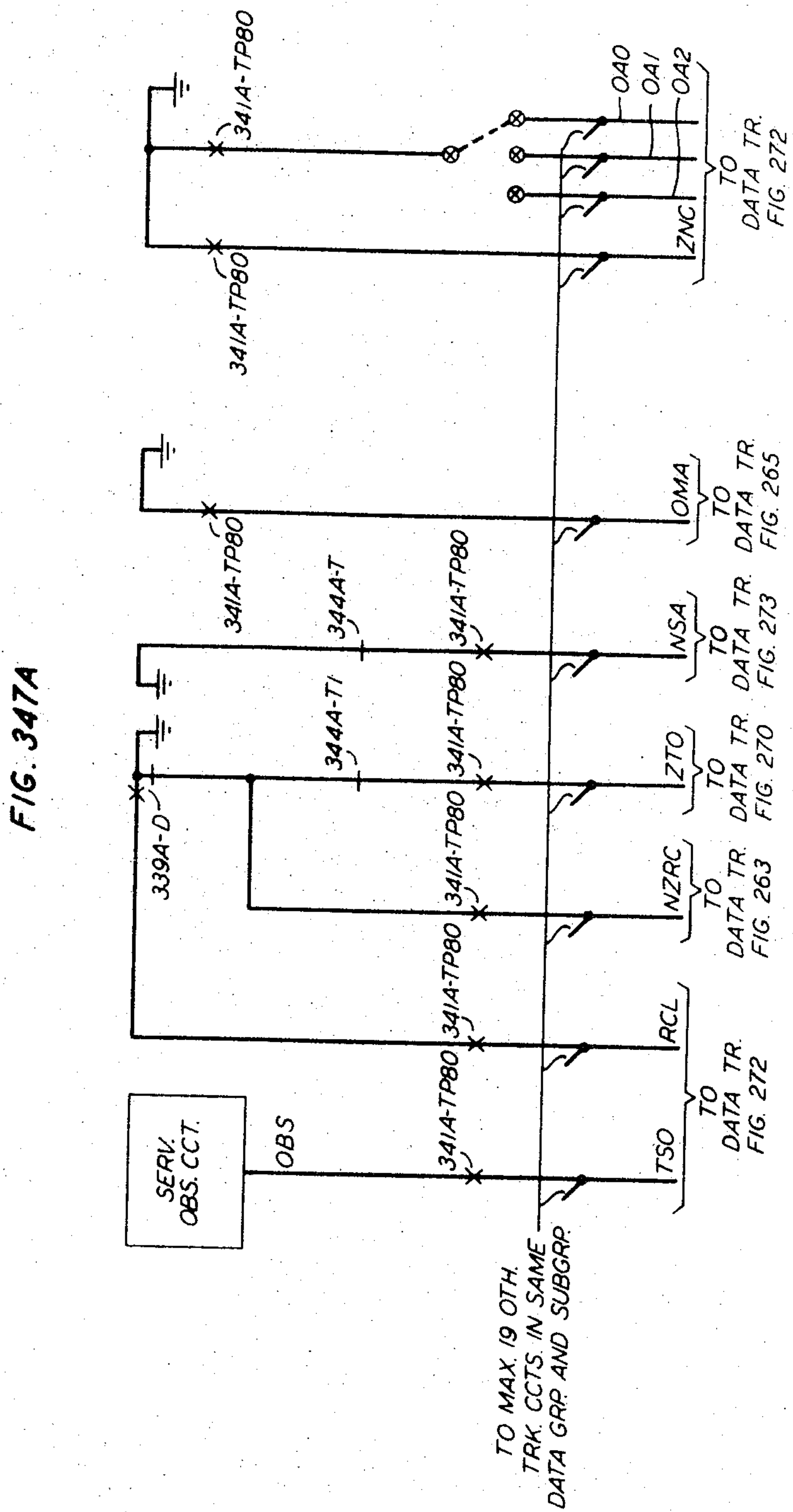
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 445



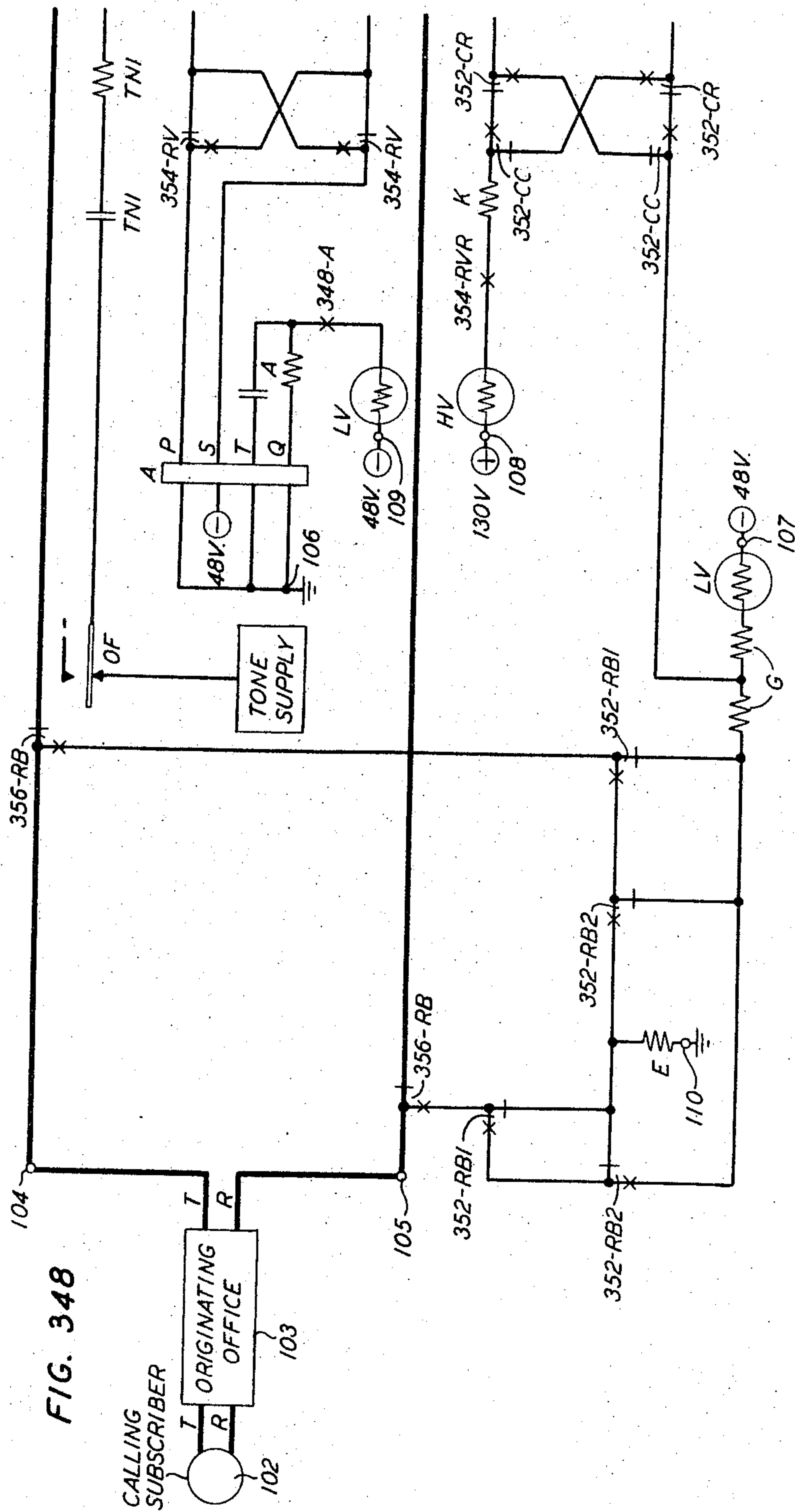
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 446



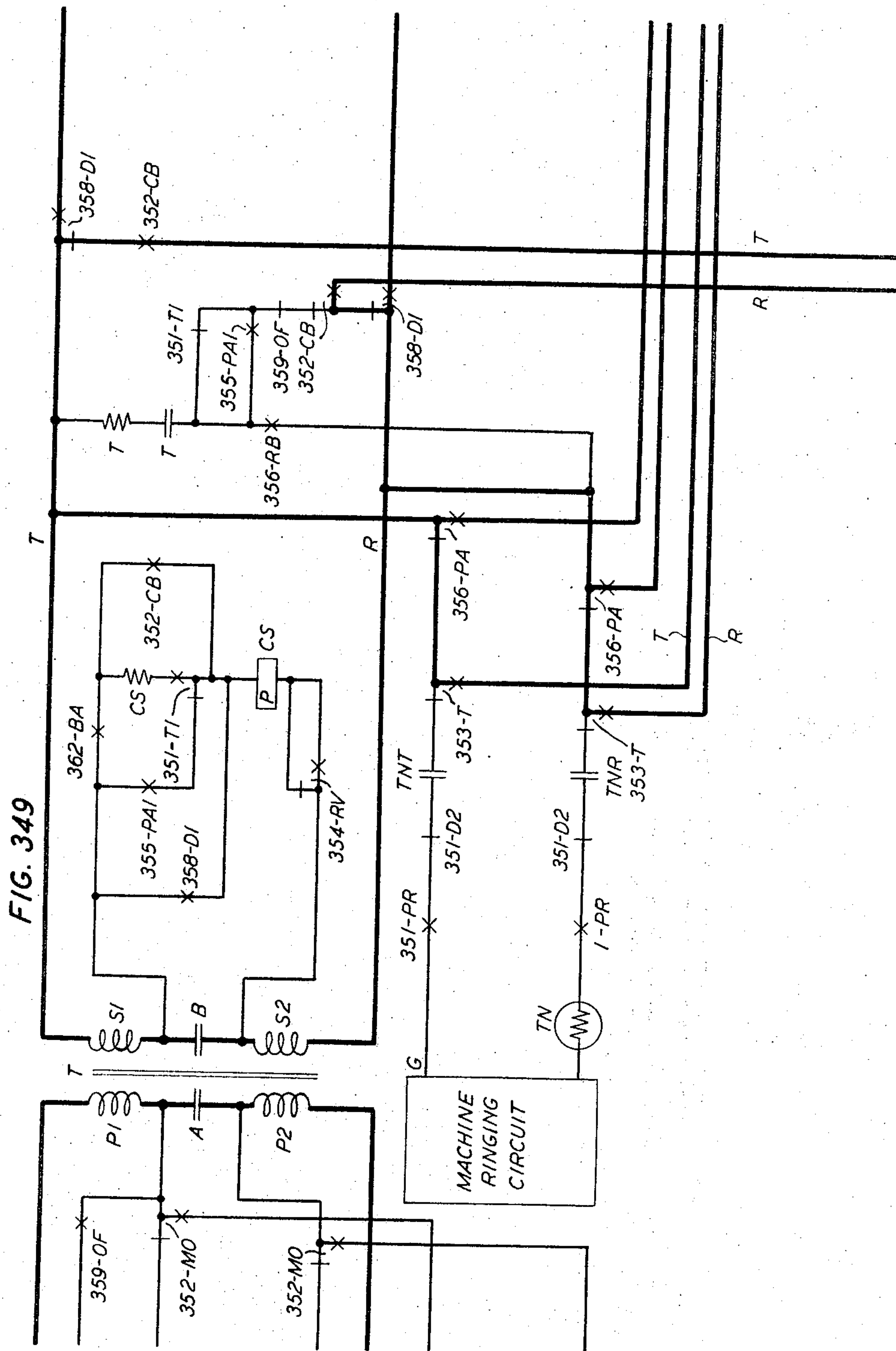
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 447



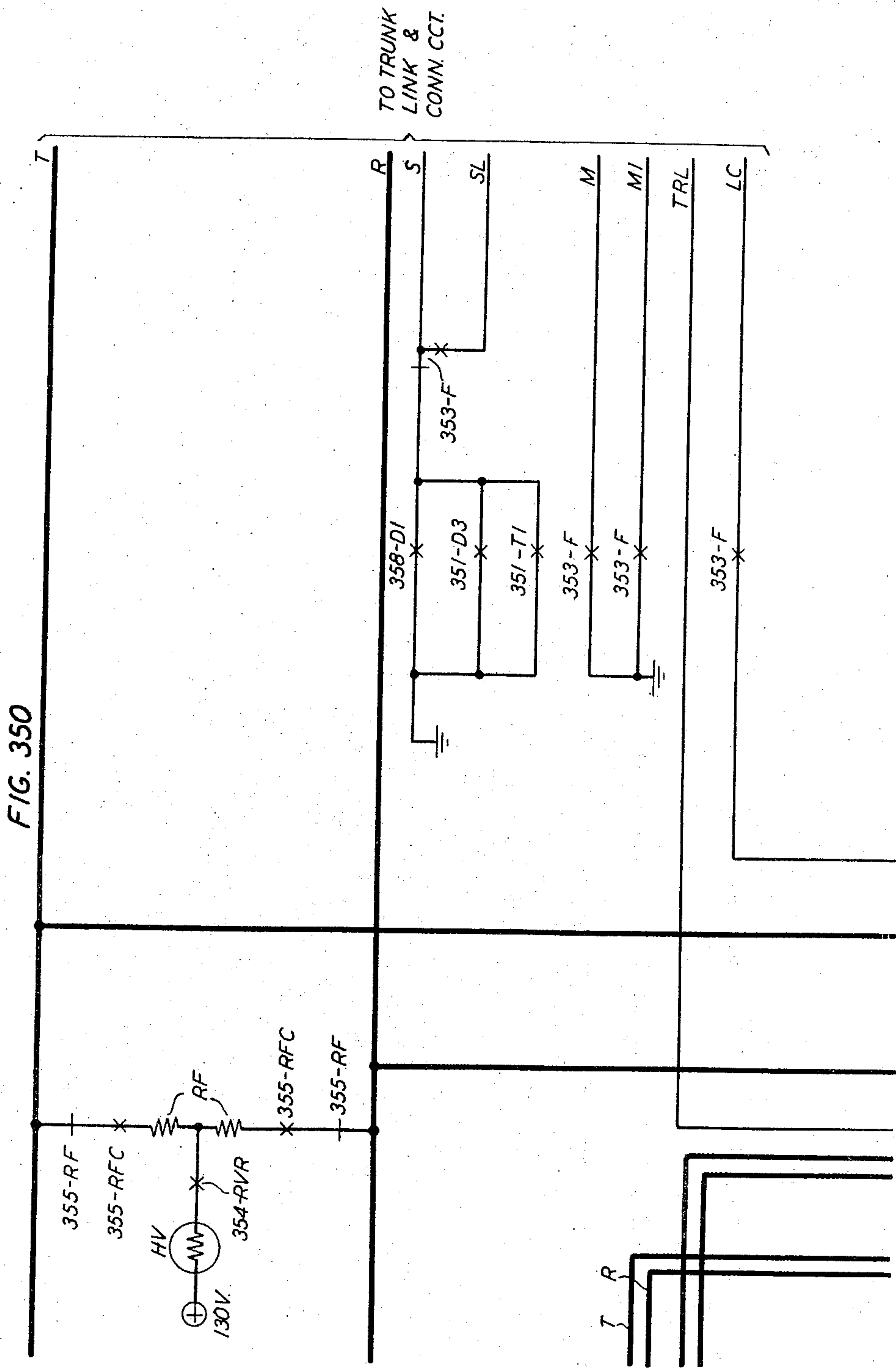
Sept. 12, 1967

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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 448

3,341,662



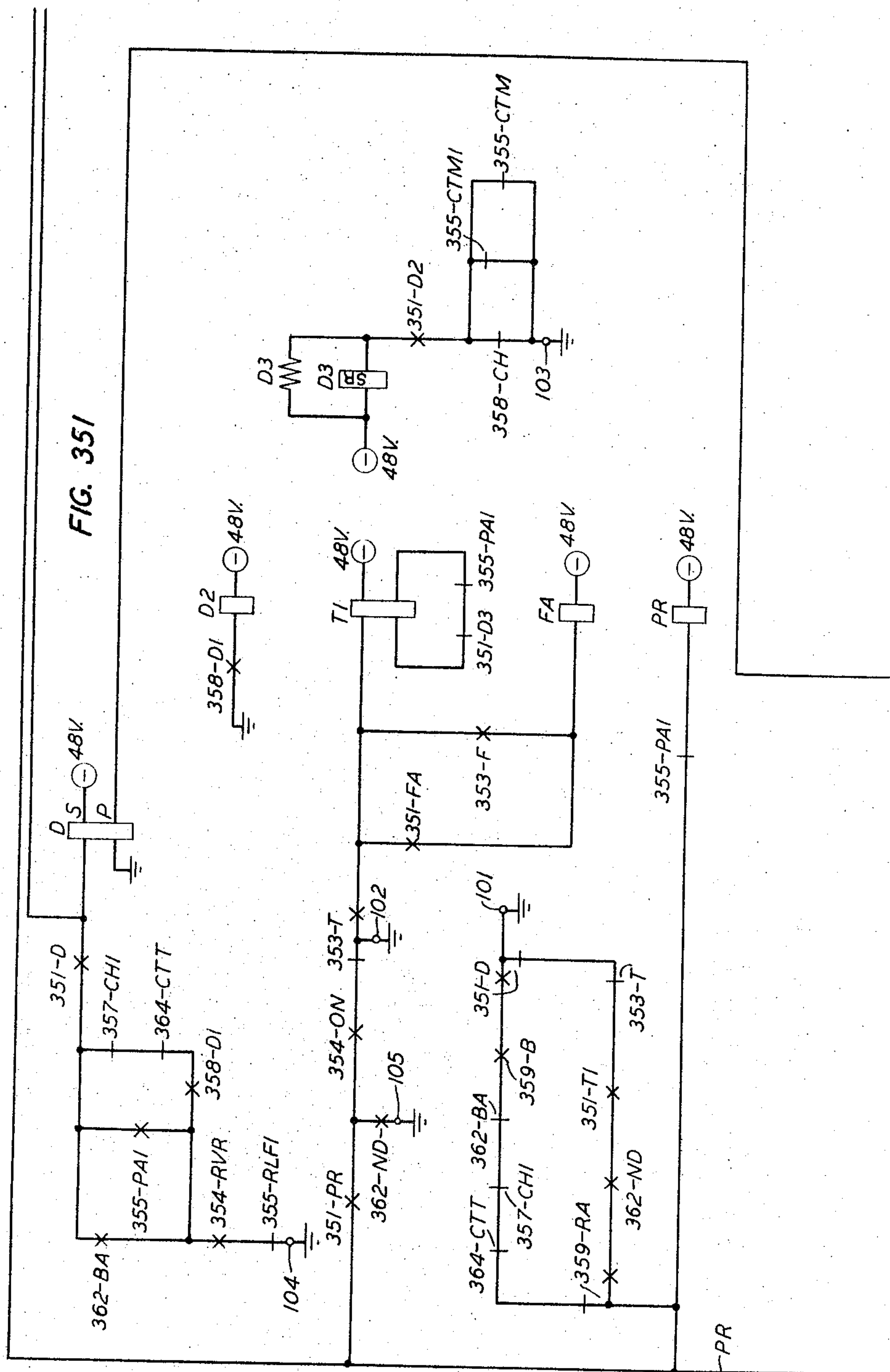
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L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 449



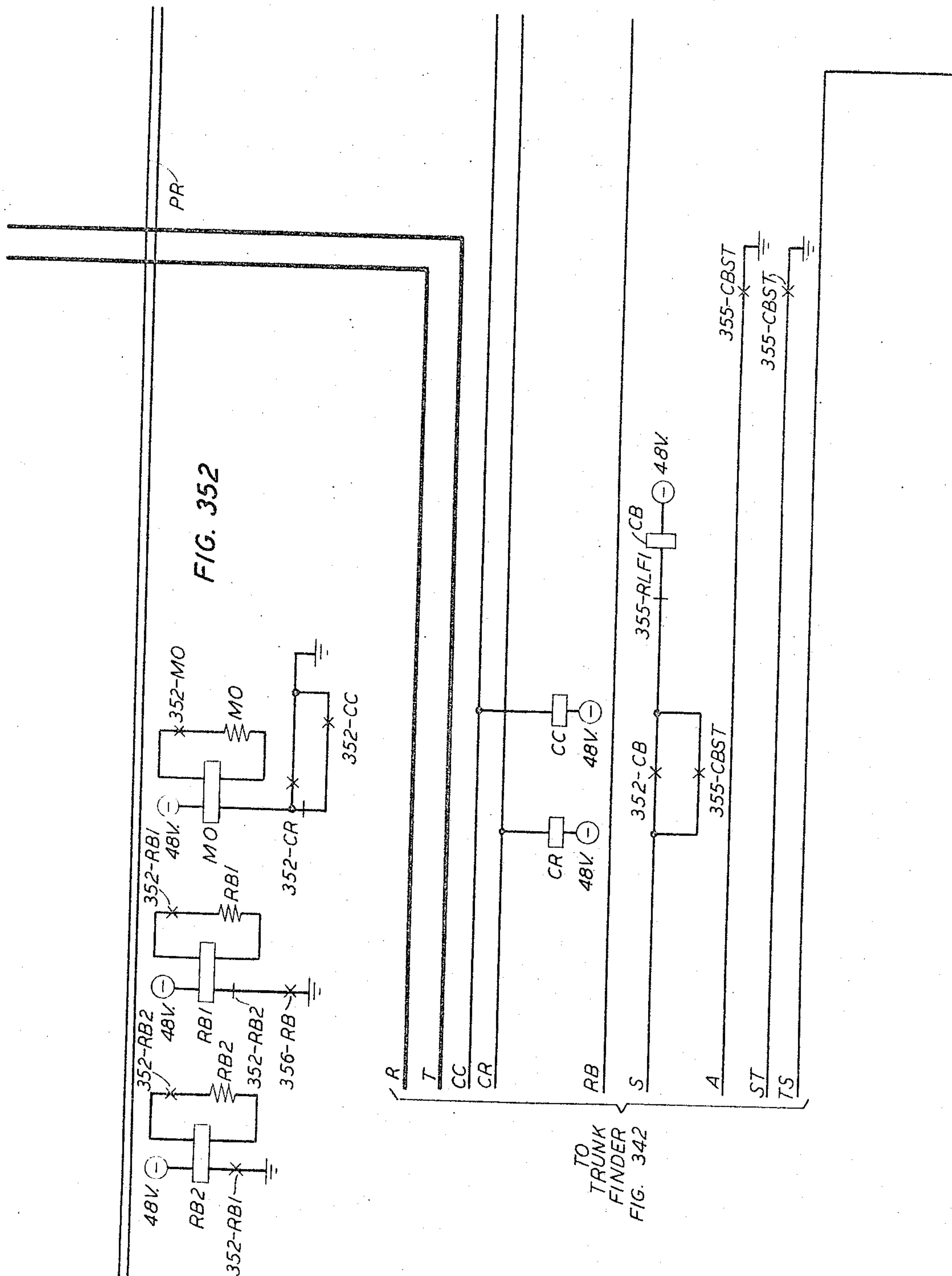
Sept. 12, 1967

Filed Nov. 26, 1963

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 450



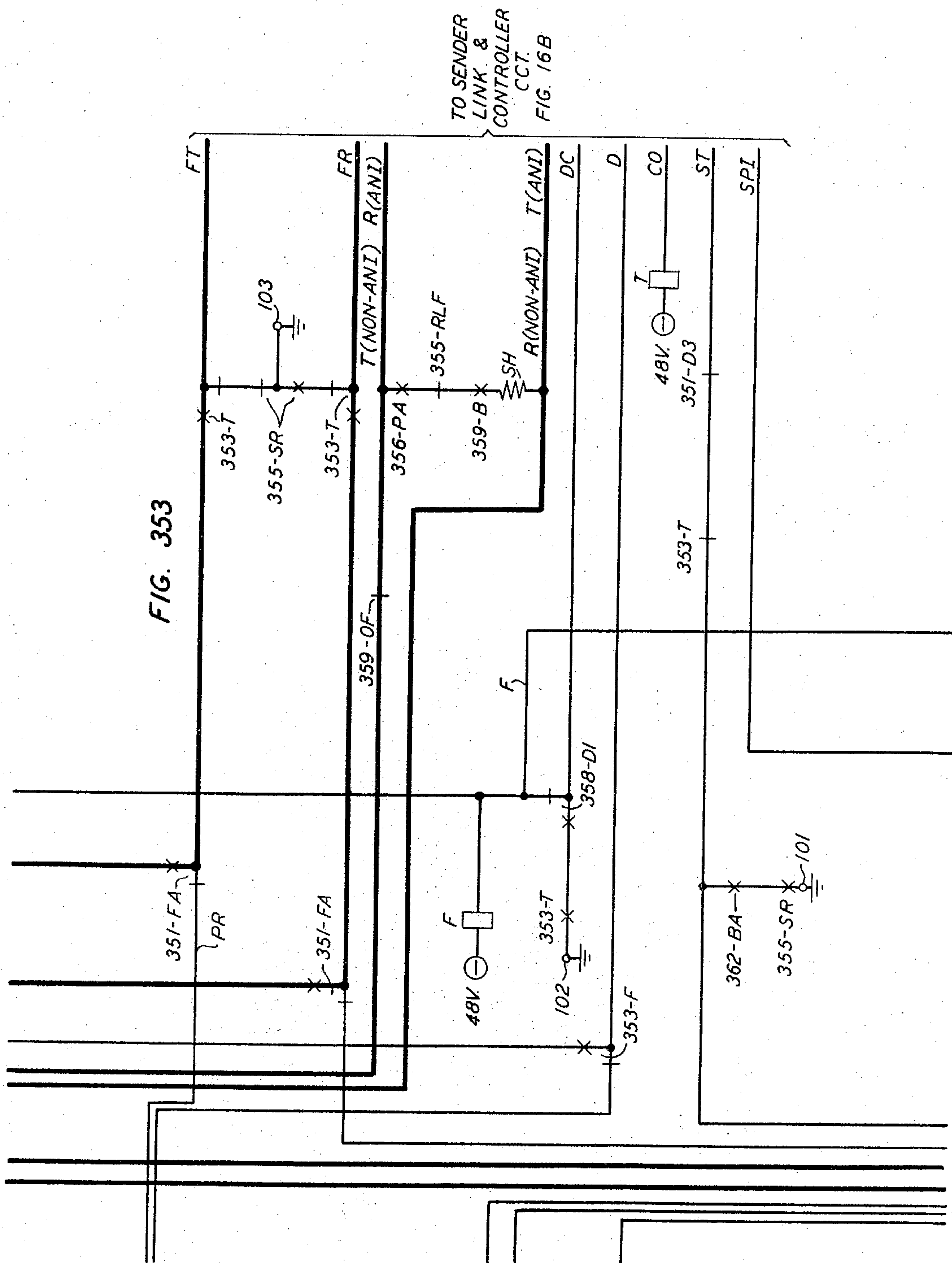
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 451

3,341,662



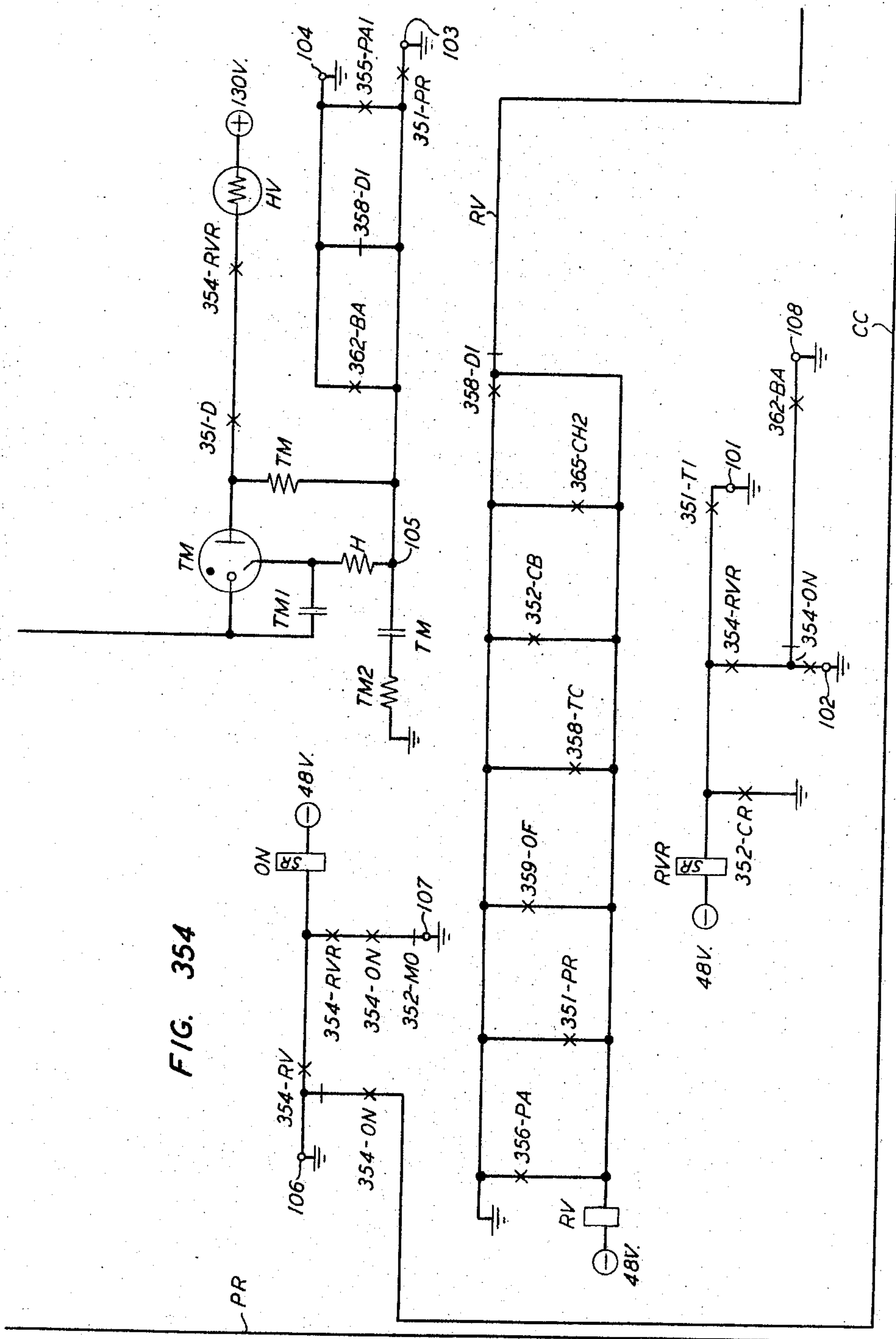
Sept. 12, 1967

Filed Nov. 26, 1963

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 452



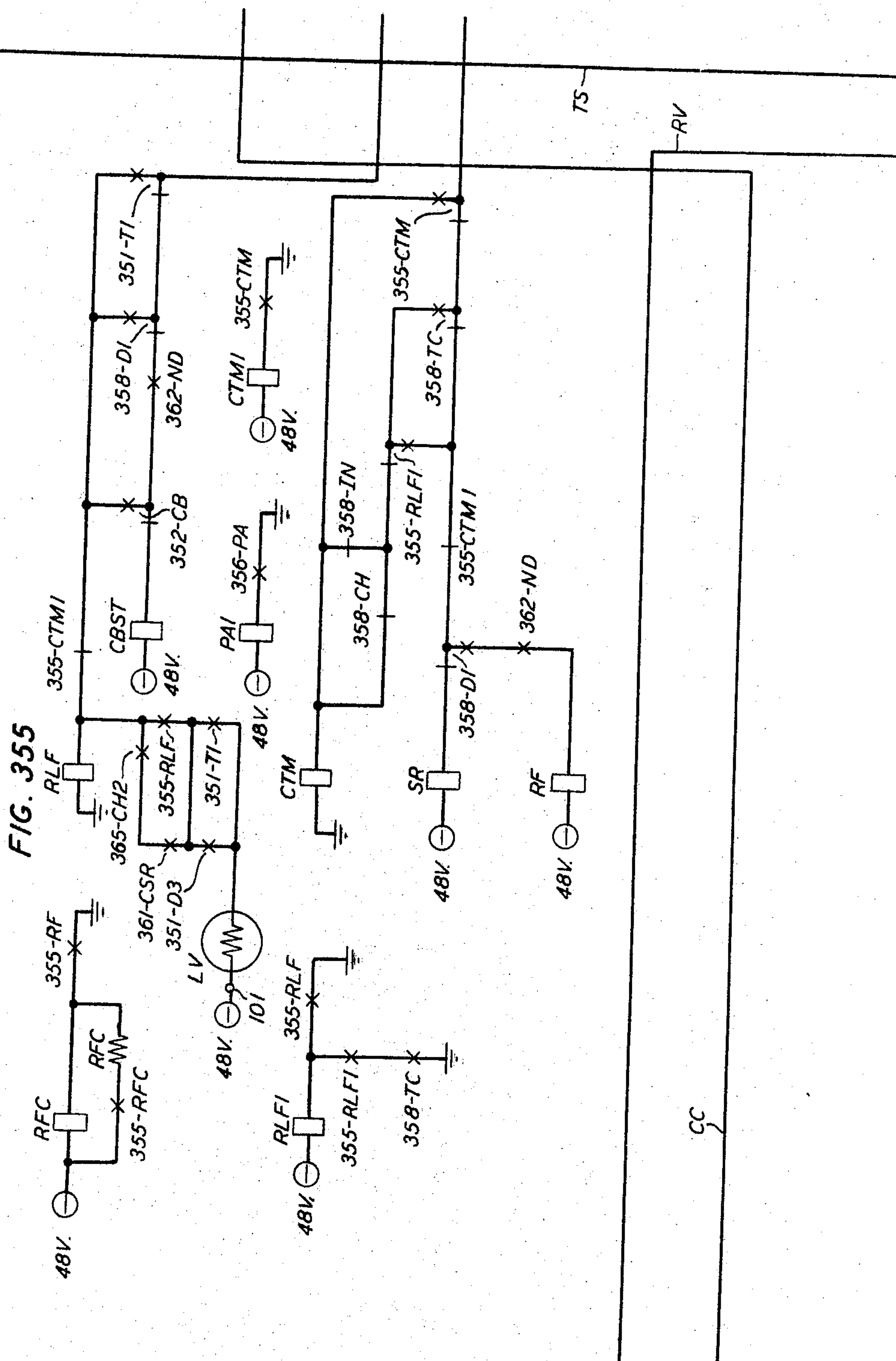
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 453



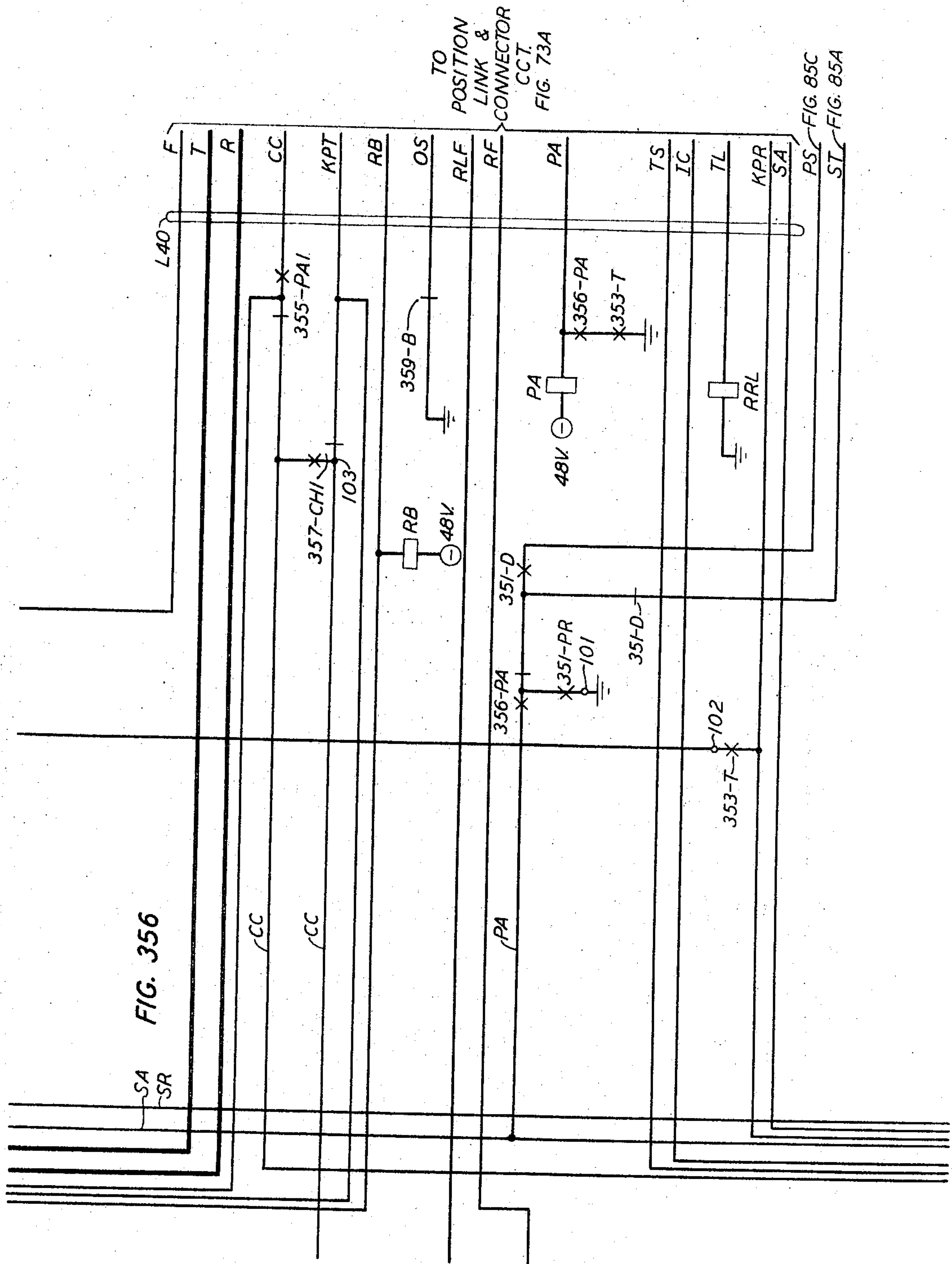
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 454



Sept. 12, 1967

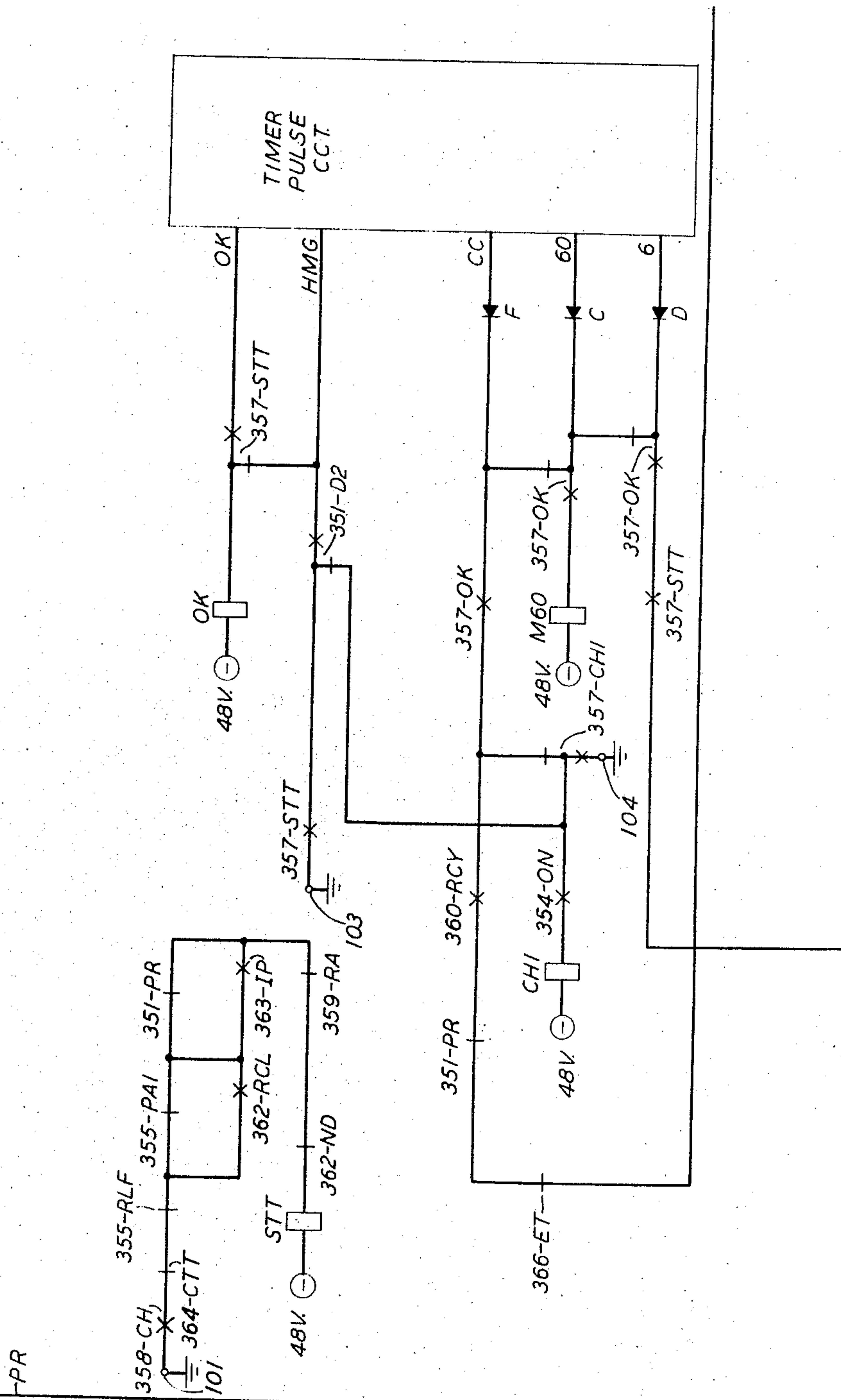
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 455

FIG. 357



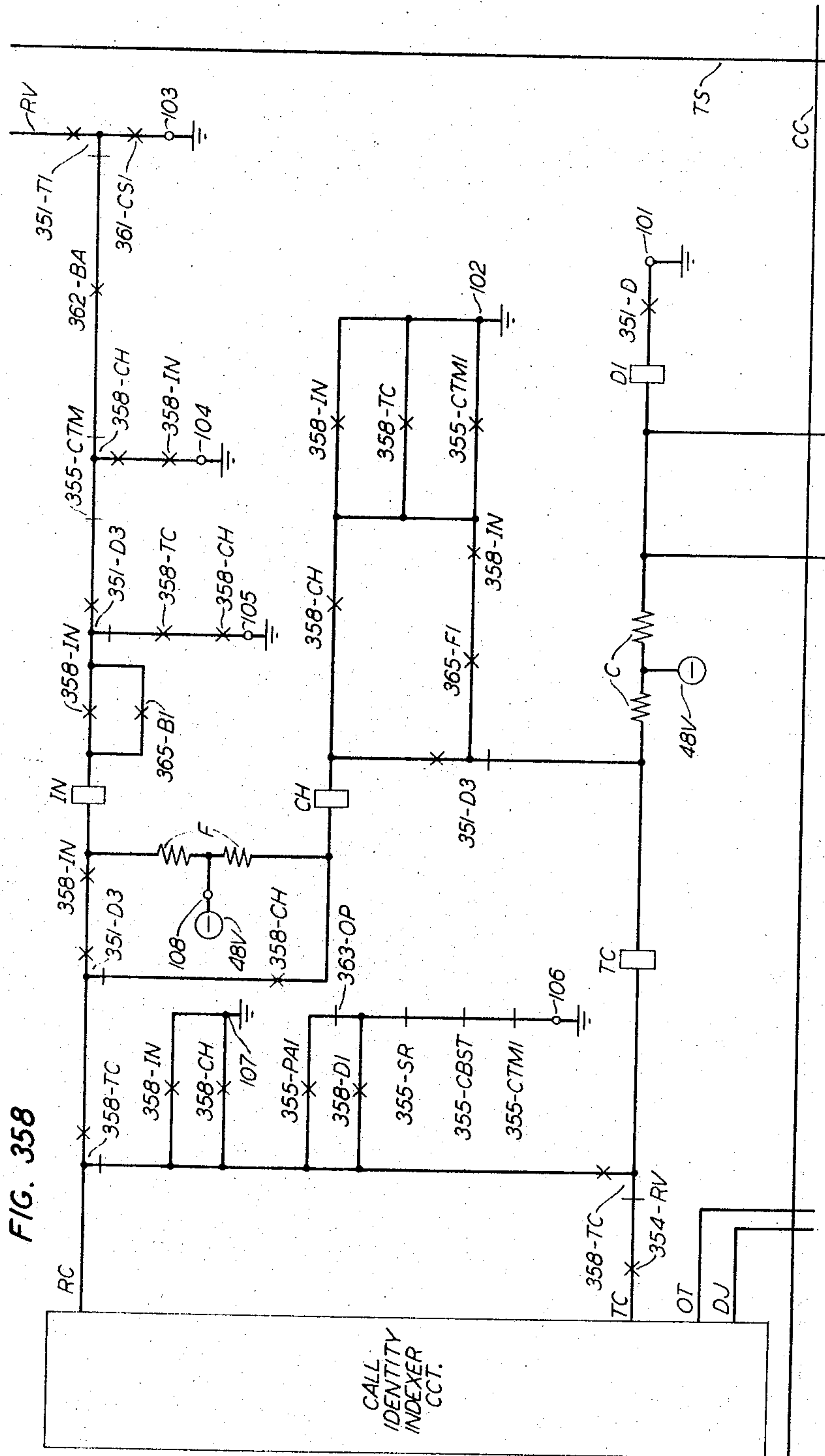
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 456



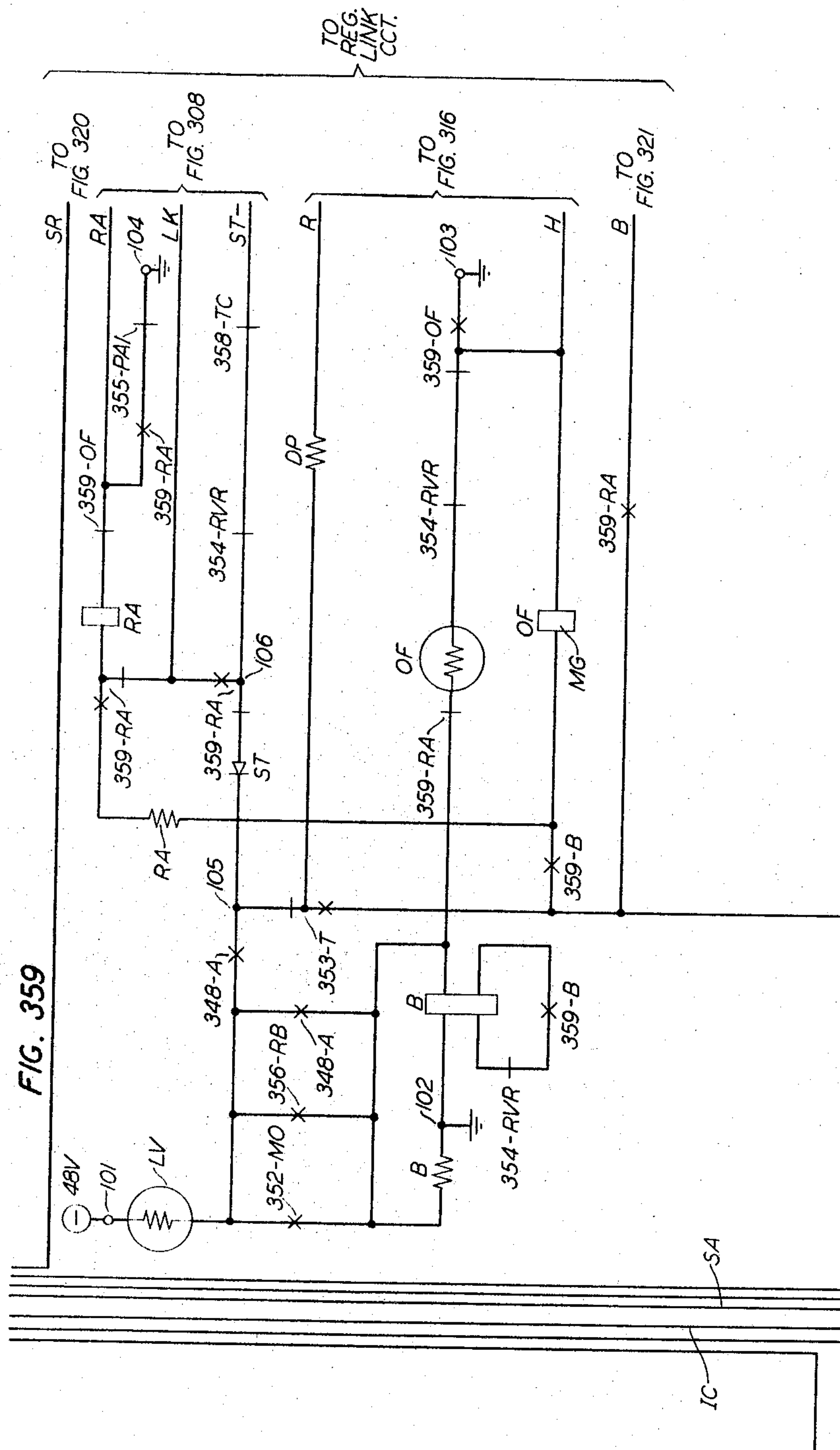
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 457



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 458

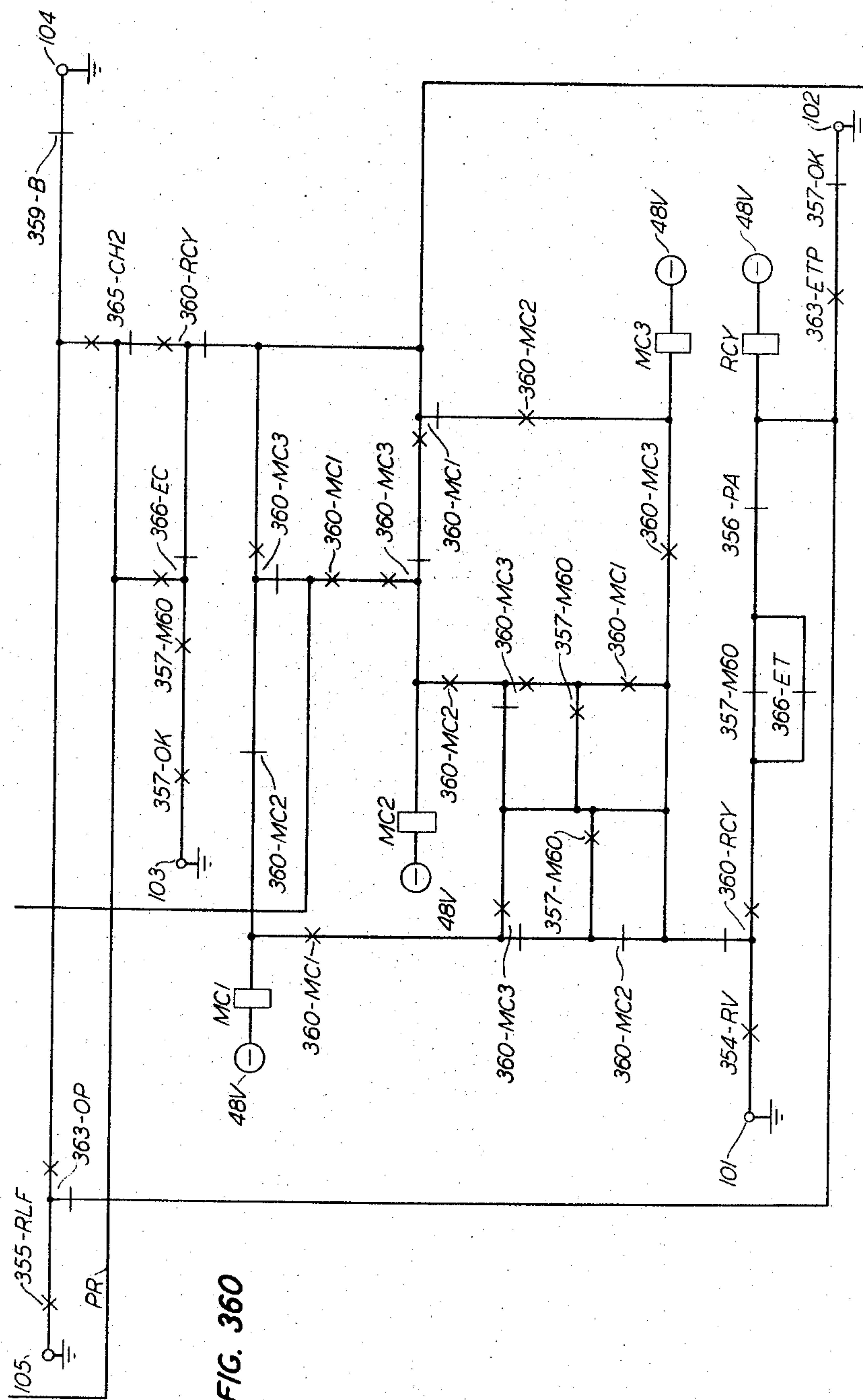


FIG. 360

Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 459

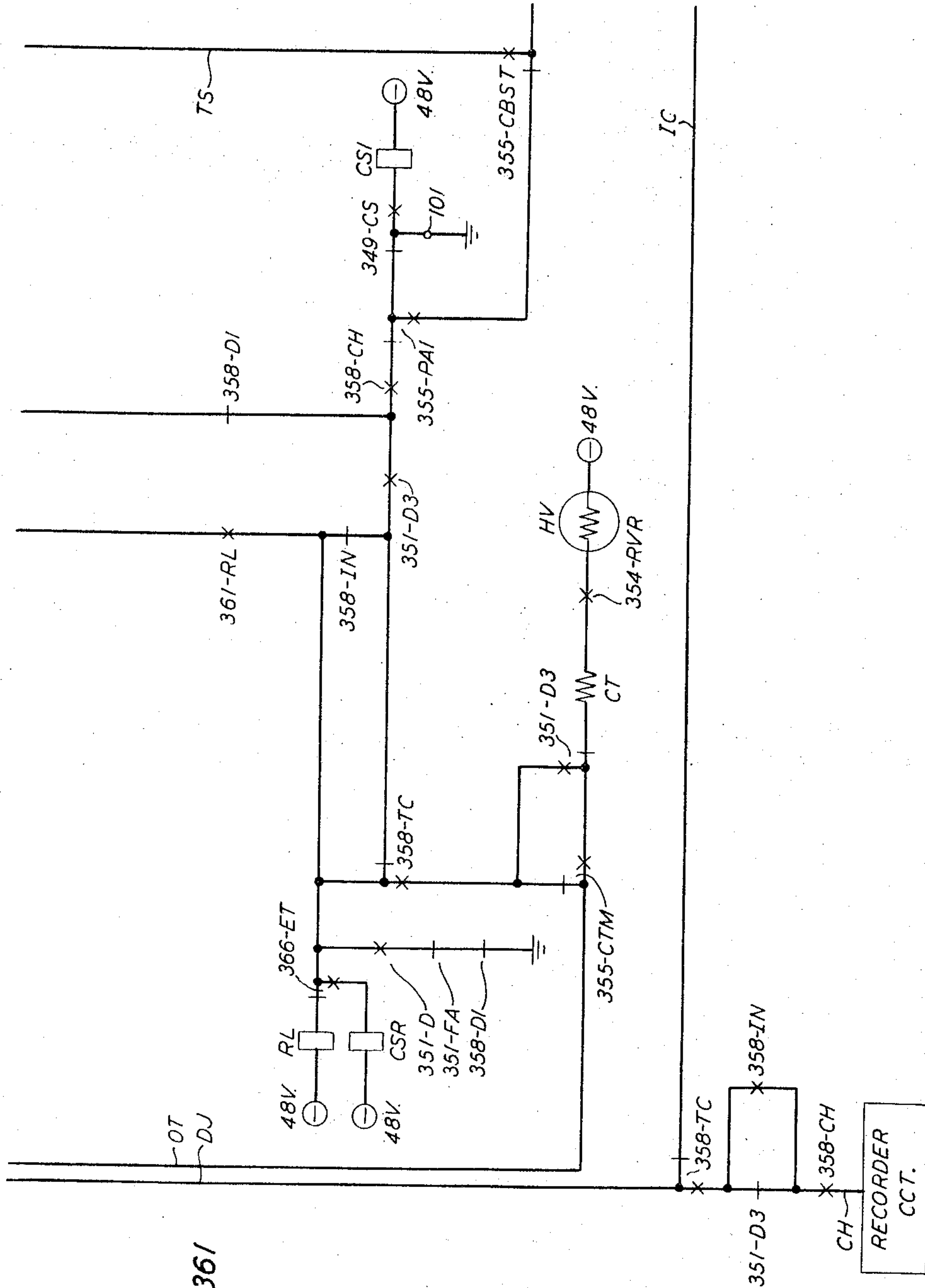


FIG. 361

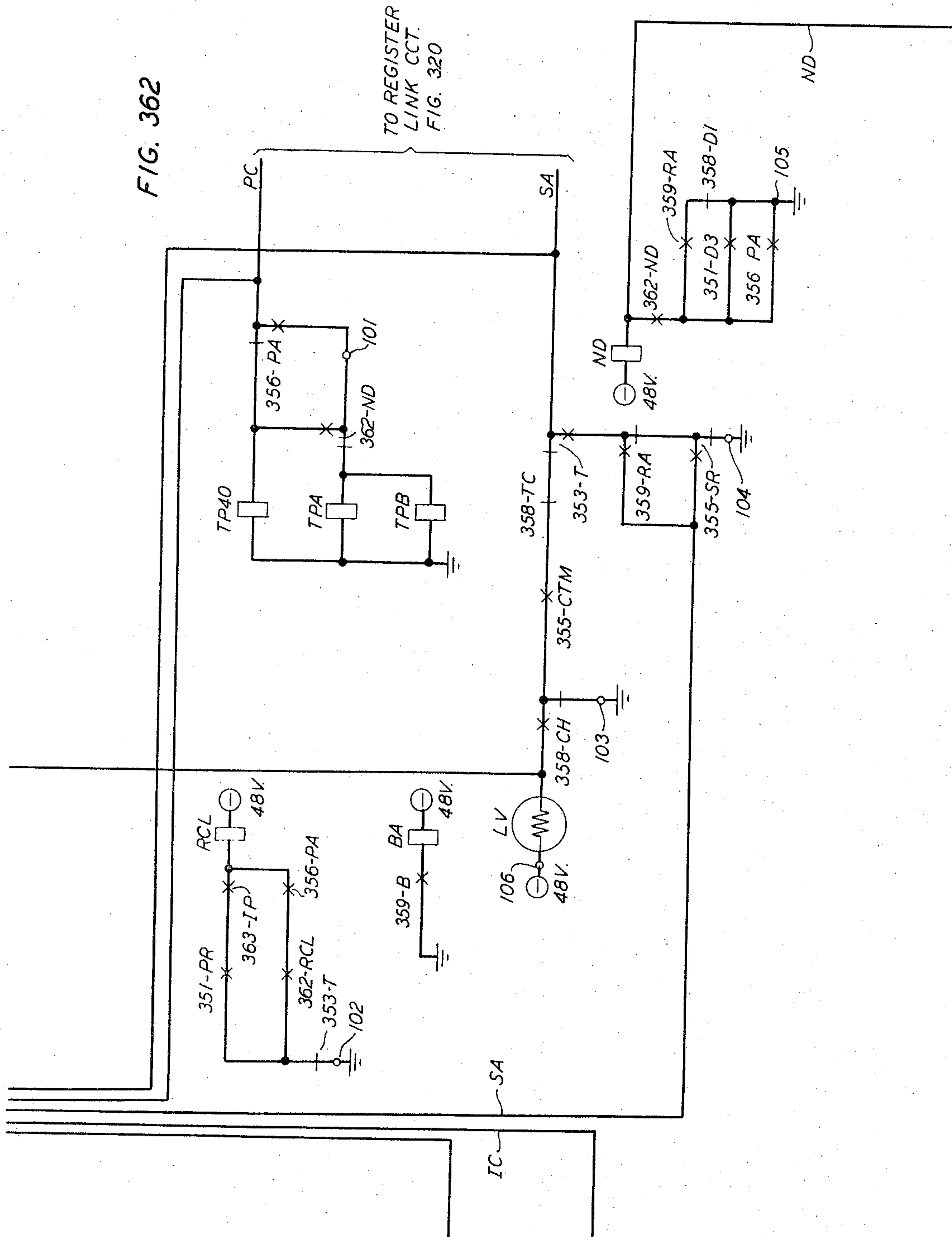
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 460



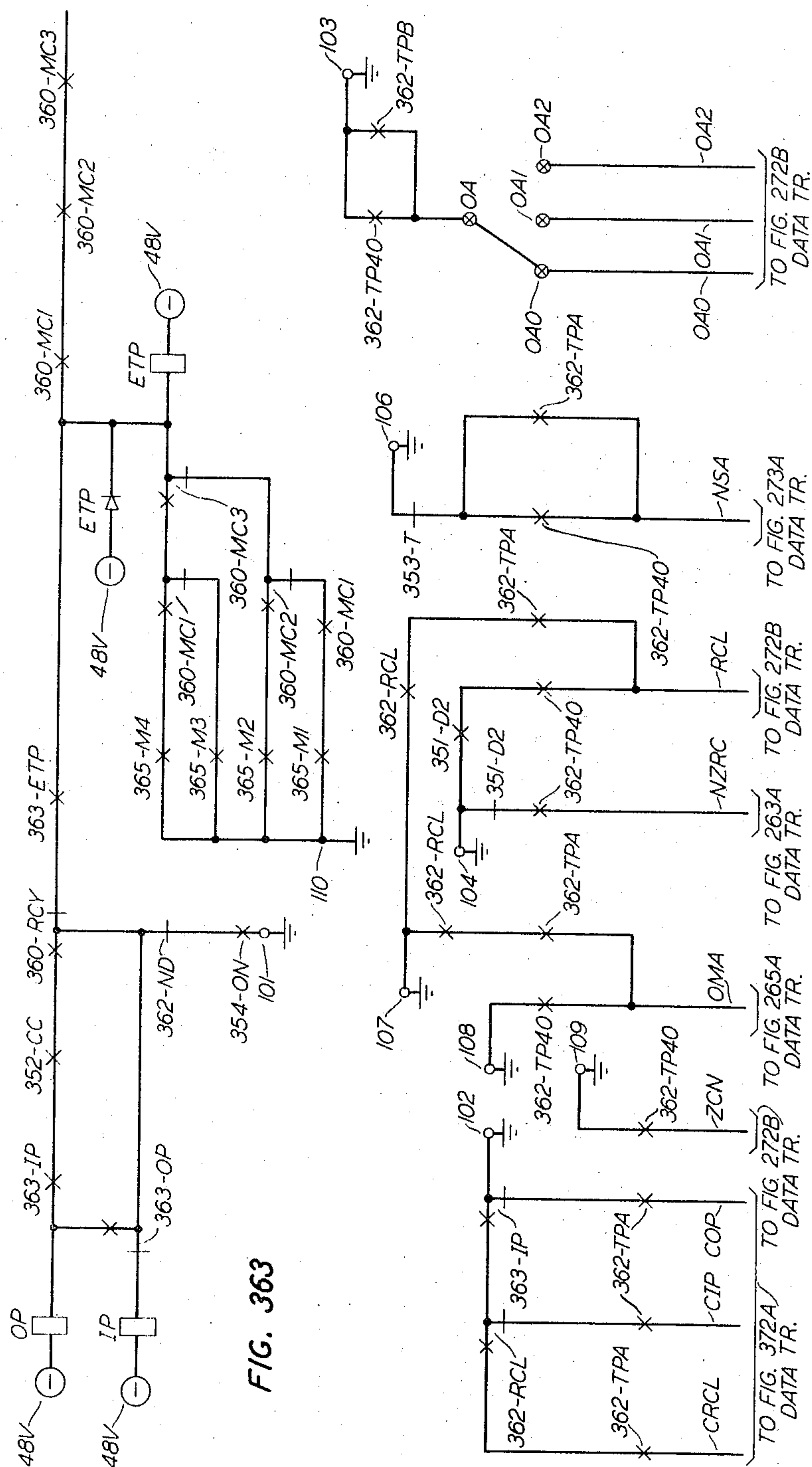
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 461



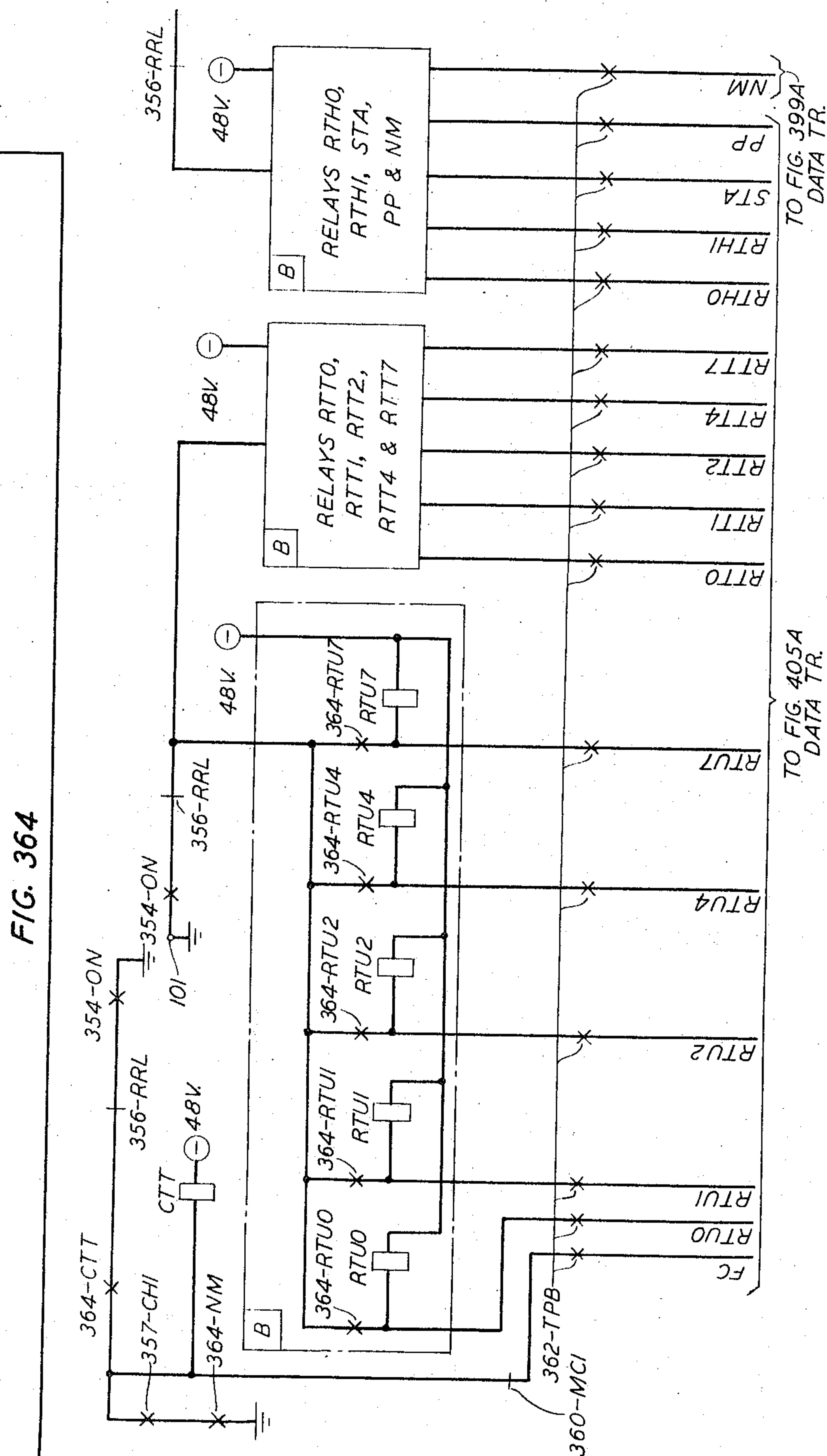
Sept. 12, 1967

Filed Nov. 26, 1963

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 462



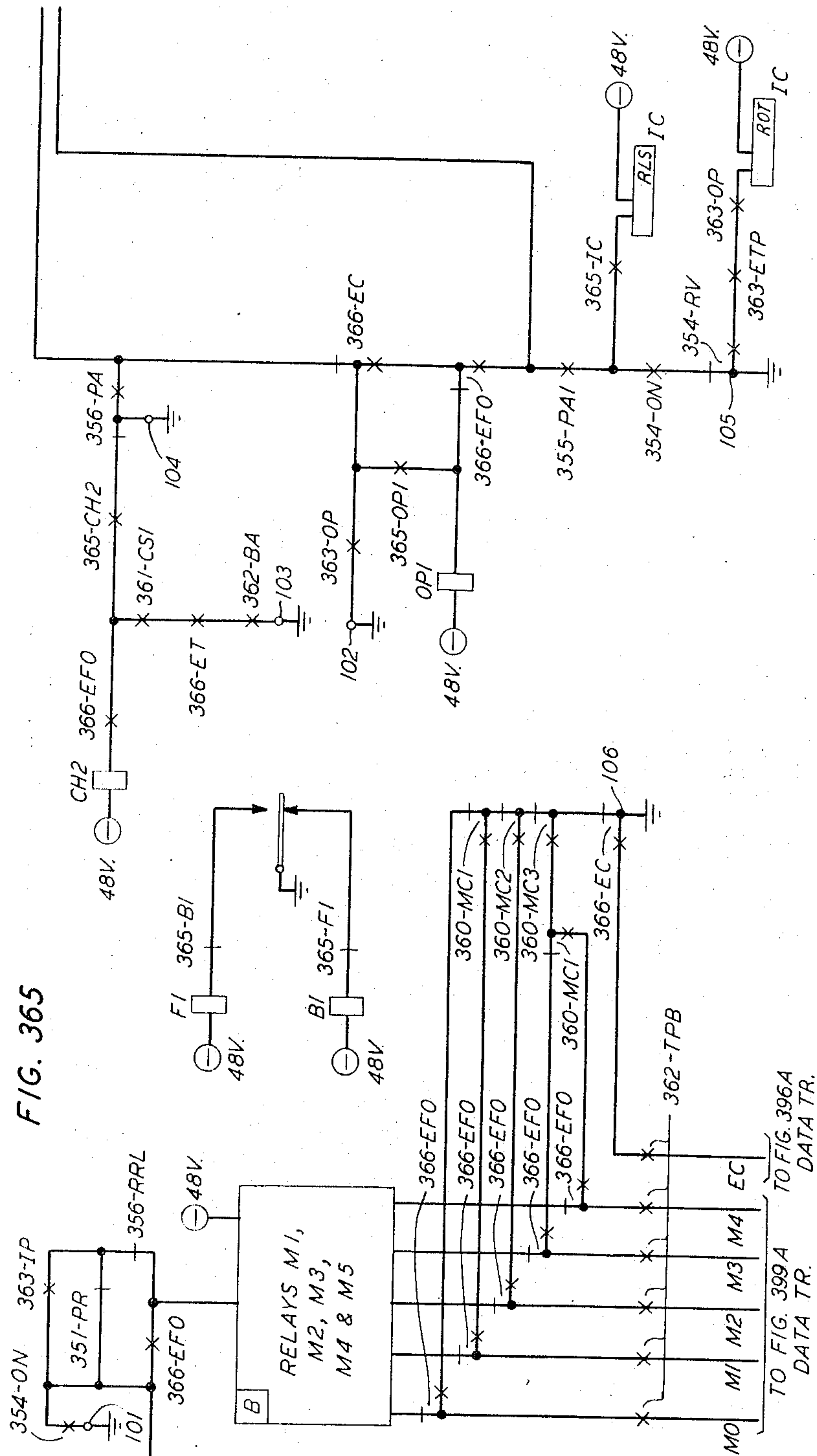
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

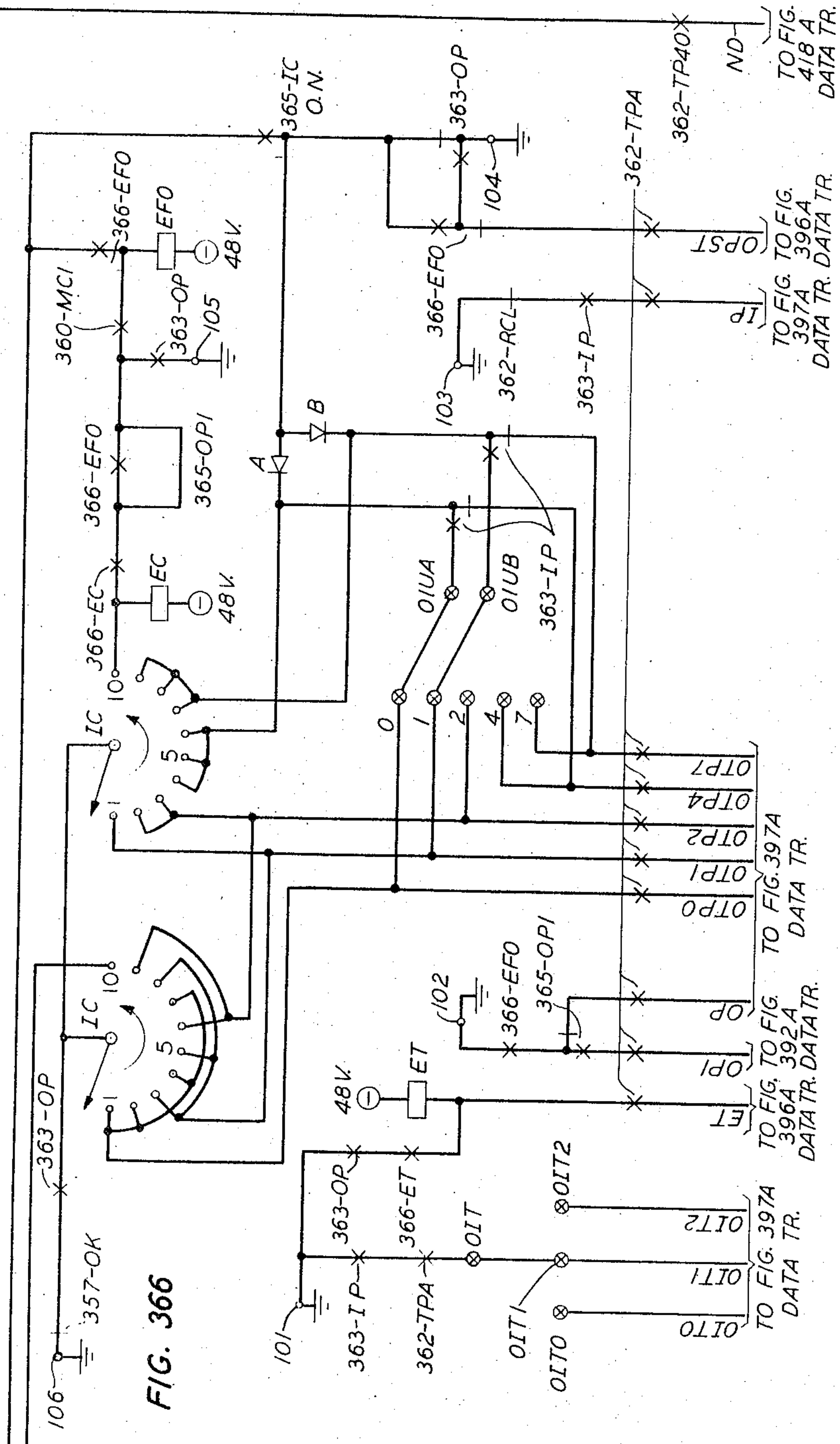
570 Sheets-Sheet 463



Filed Nov. 26, 1963

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 464



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 465

INCOMING COIN TRUNK CCT.

FIG. 348	FIG. 349	FIG. 350
FIG. 351	FIG. 352	FIG. 353
FIG. 354	FIG. 355	FIG. 356
FIG. 357	FIG. 358	FIG. 359
FIG. 360	FIG. 361	FIG. 362
FIG. 364	FIG. 365	FIG. 366
FIG. 363		

FIG. 367

Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

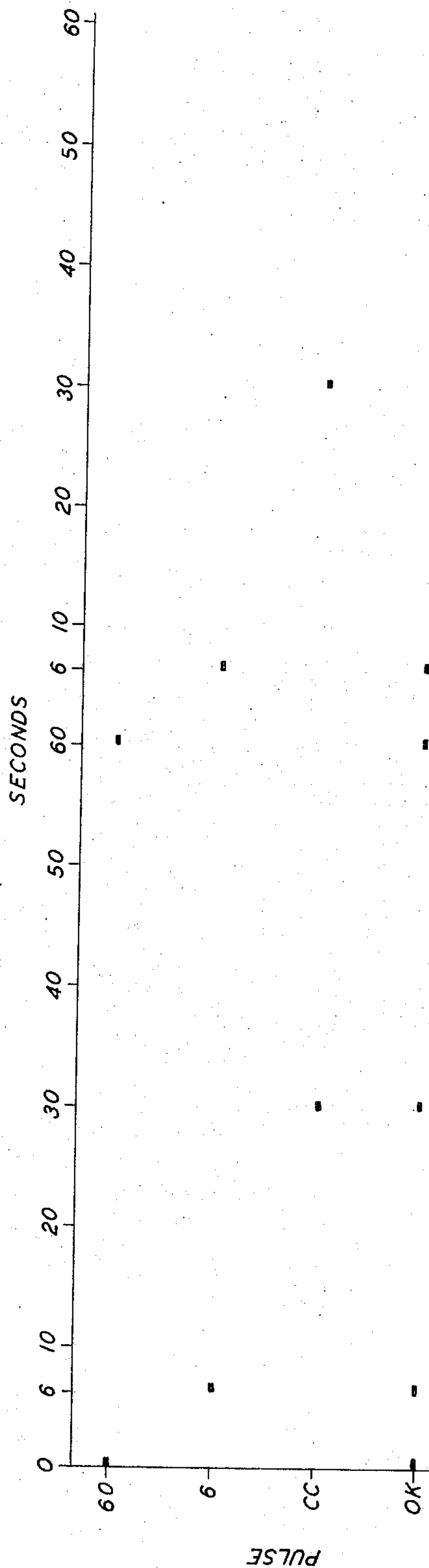
3,341,662

570 Sheets-Sheet 466

FIG. 367A

TIMER PULSE CCT.

PULSE DURATION = .5 SECOND



Sept. 12, 1967

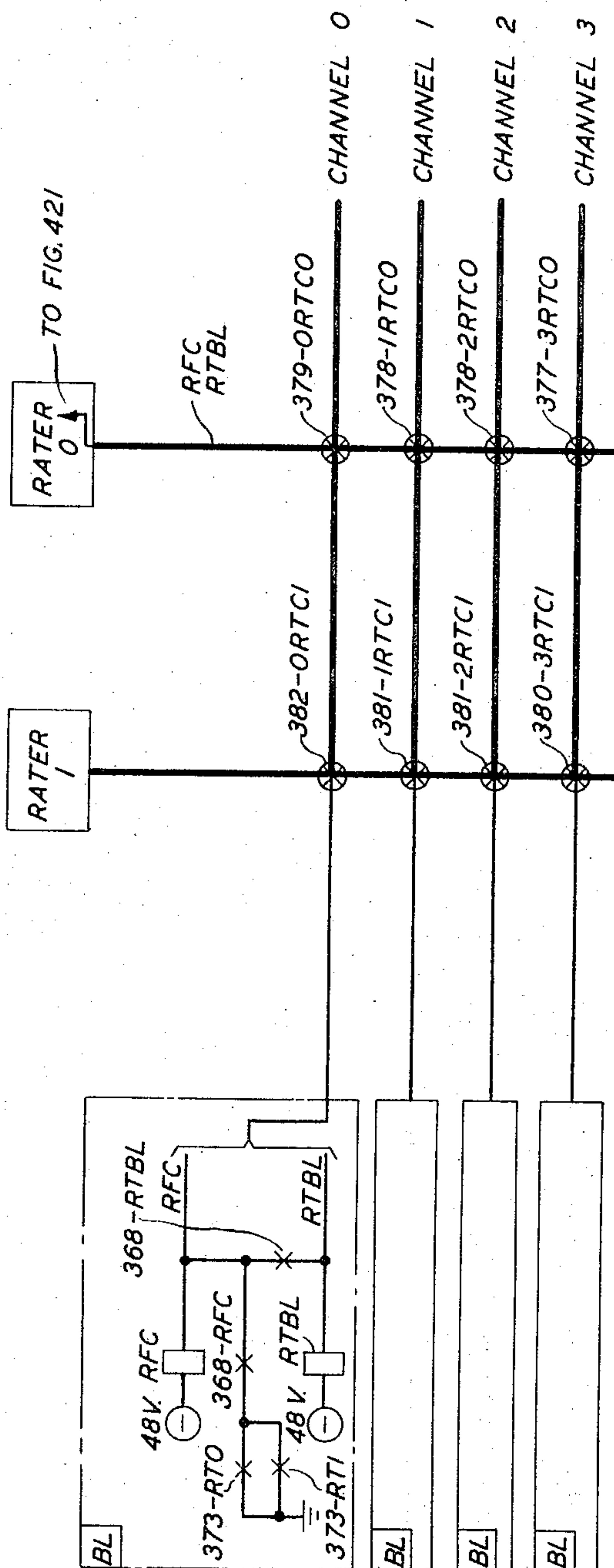
L. J. CERNY ET AL
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INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 467

FIG. 368



Sept. 12, 1967

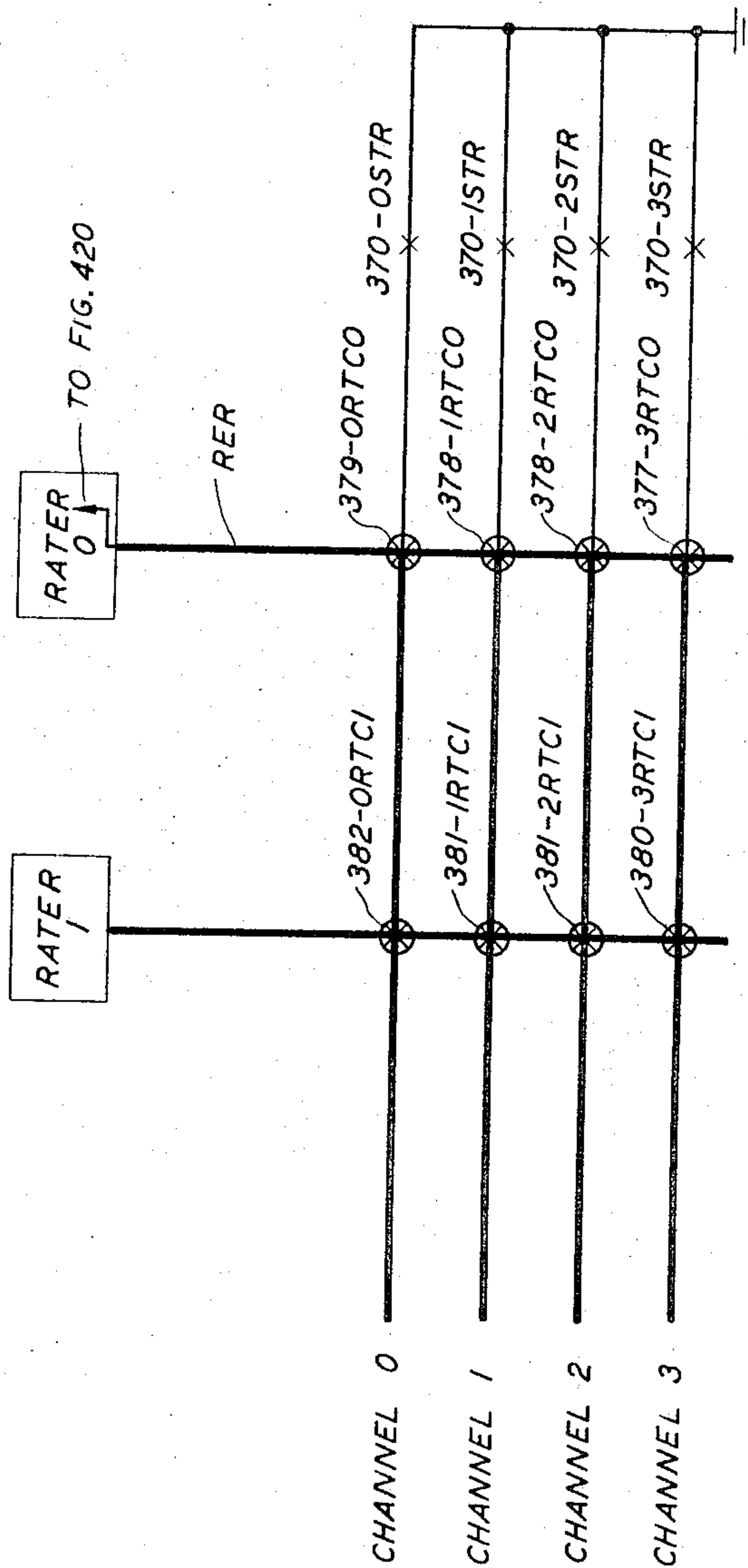
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 468

FIG. 369



Sept. 12, 1967

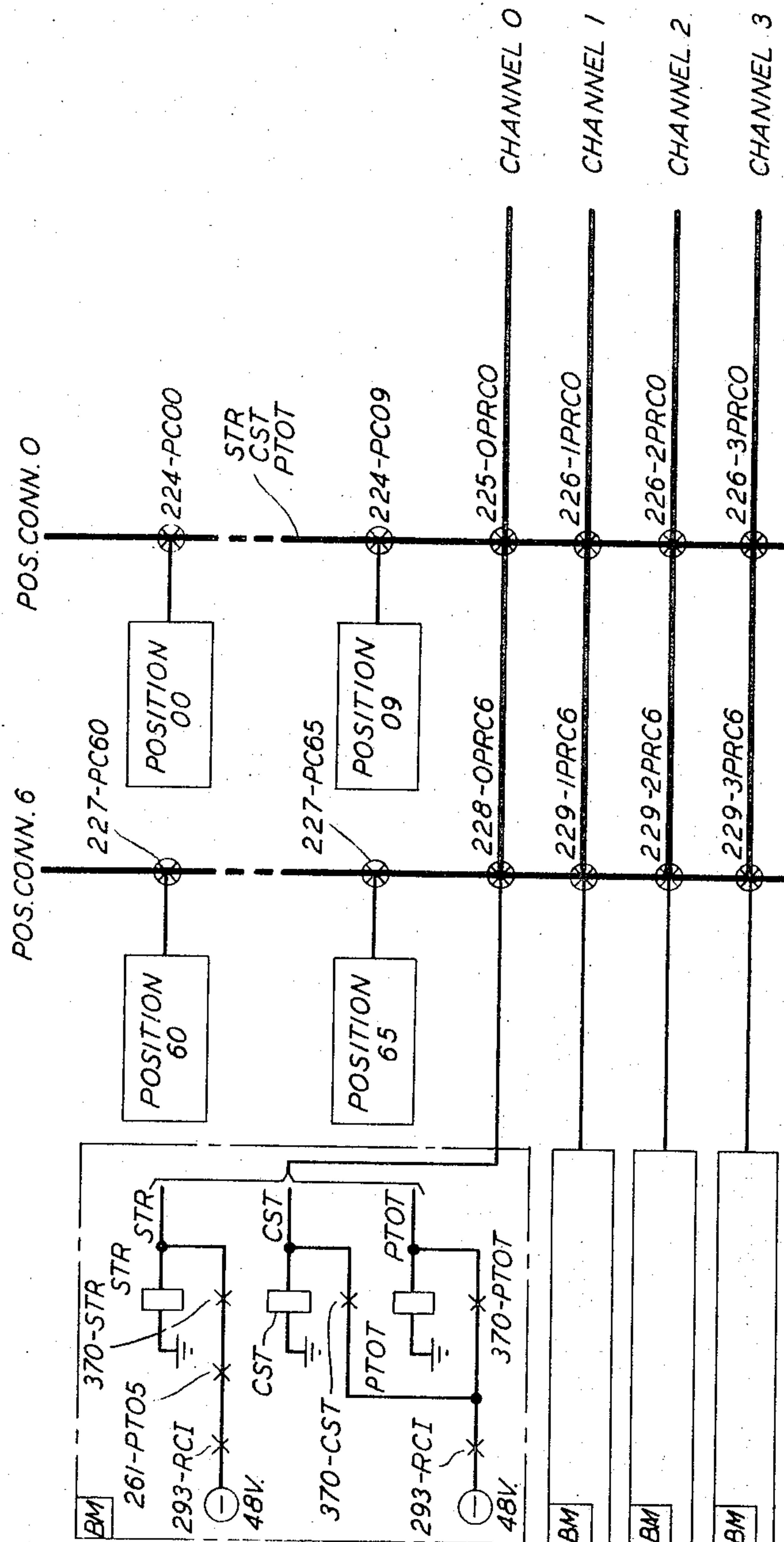
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 469

FIG. 370



Sept. 12, 1967

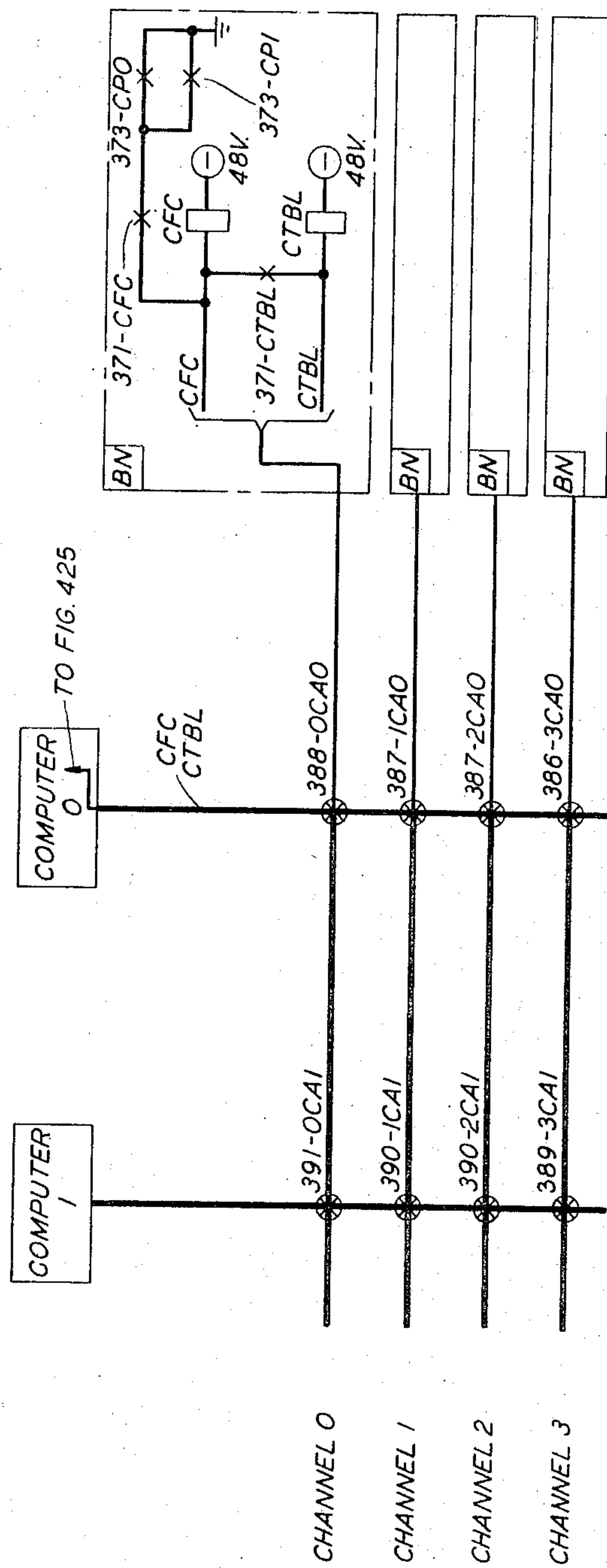
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 470

FIG. 371



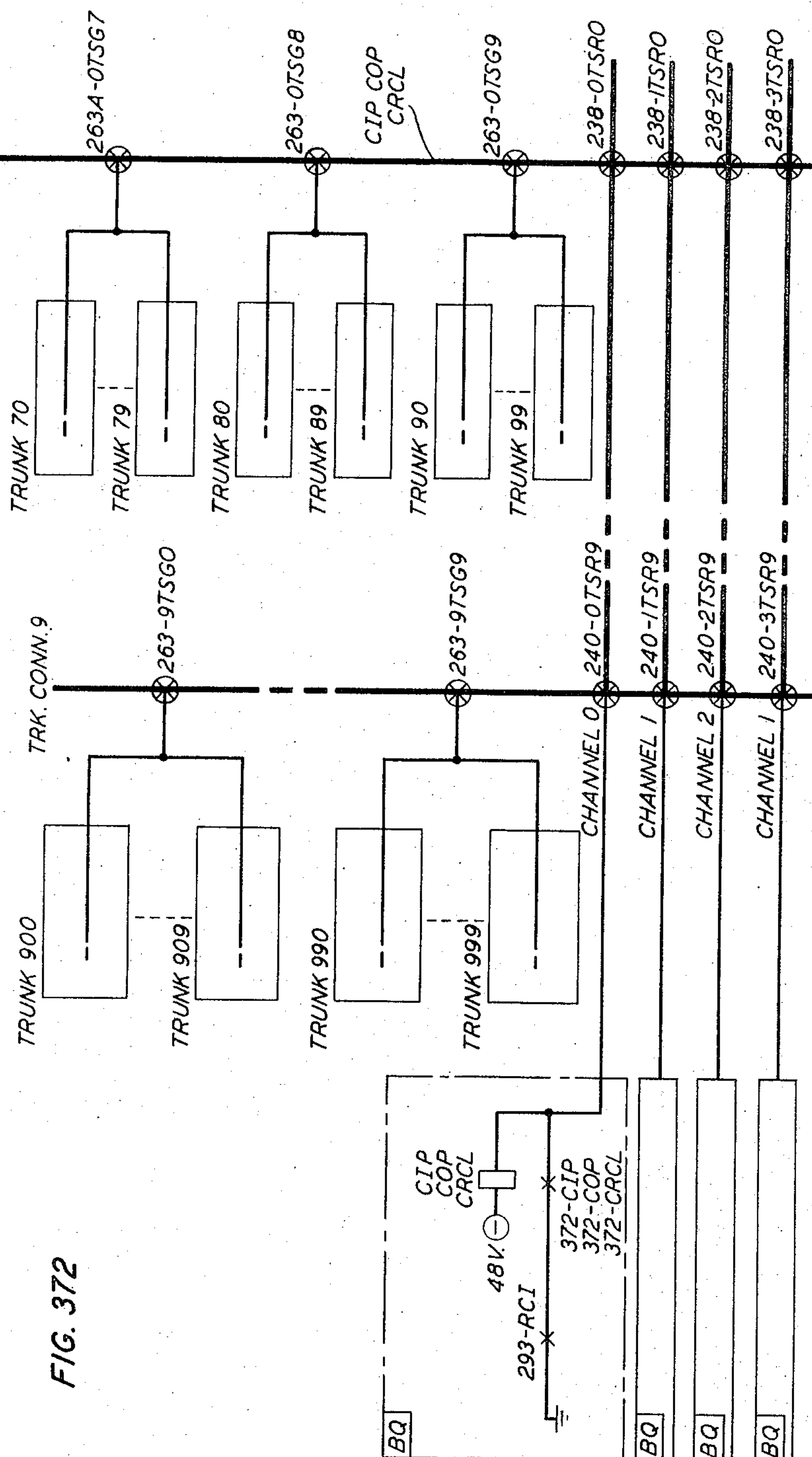
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 471



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 472

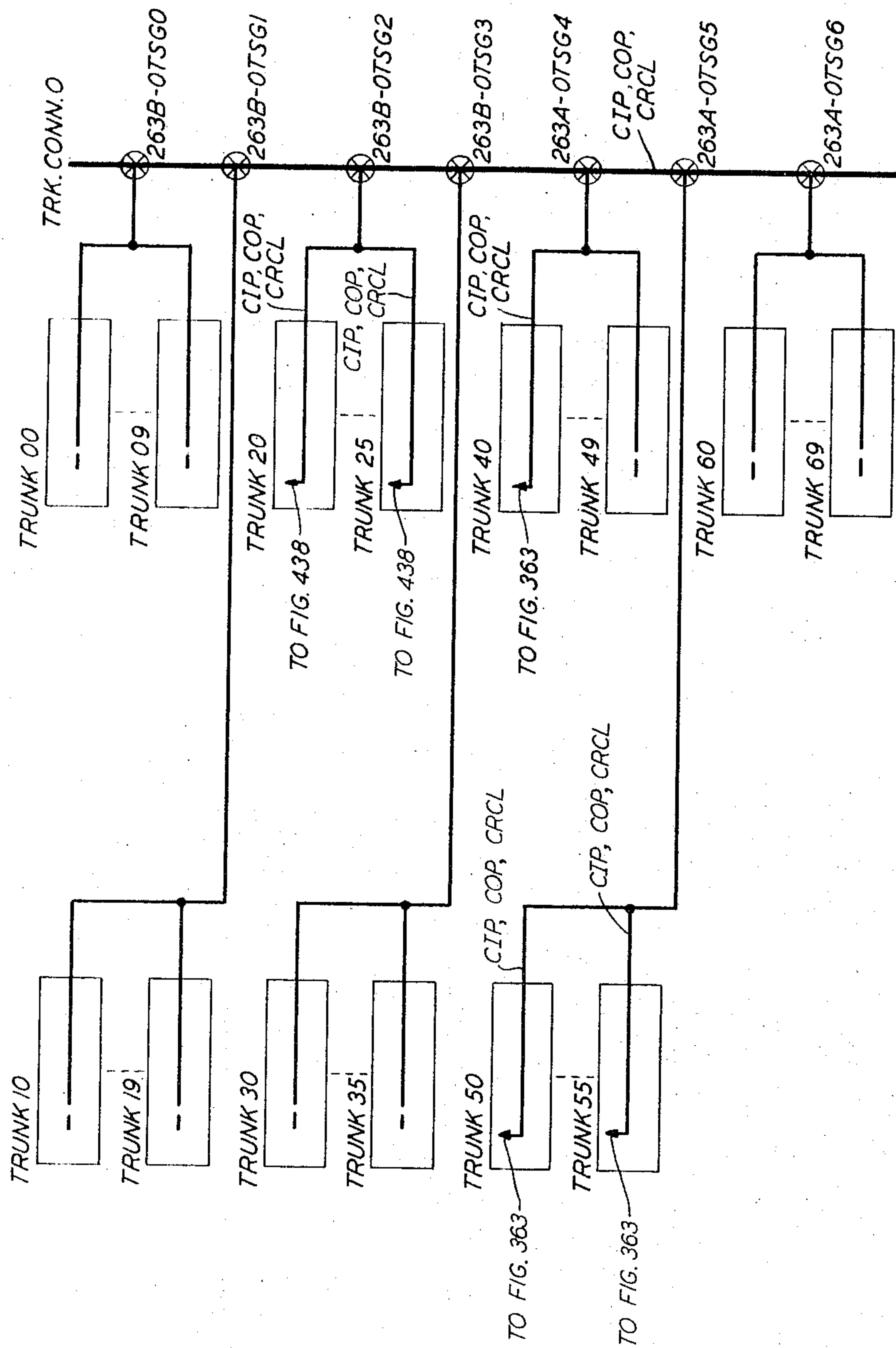


FIG. 372A

Sept. 12, 1967

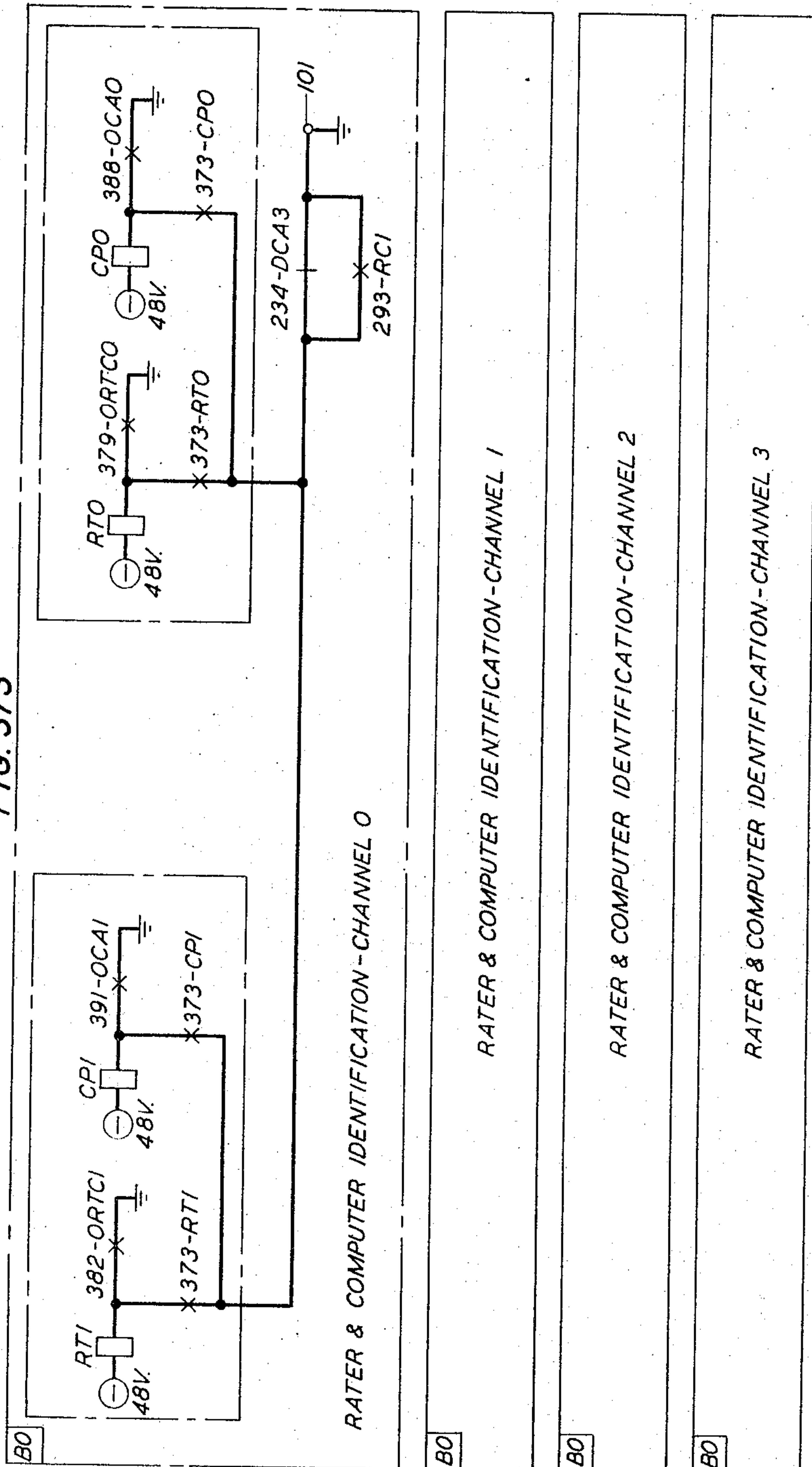
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 473

FIG. 373



Sept. 12, 1967

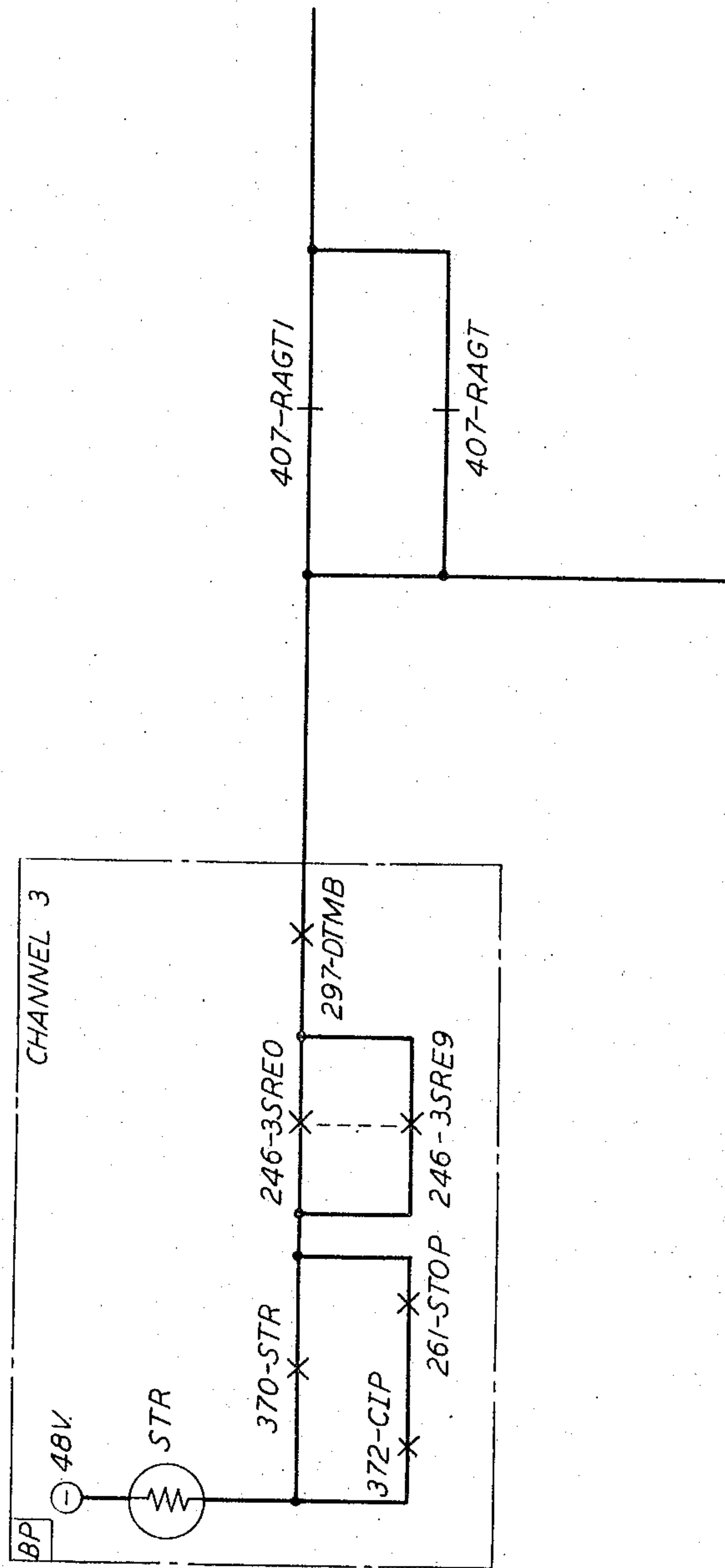
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 474

FIG. 374



Sept. 12, 1967

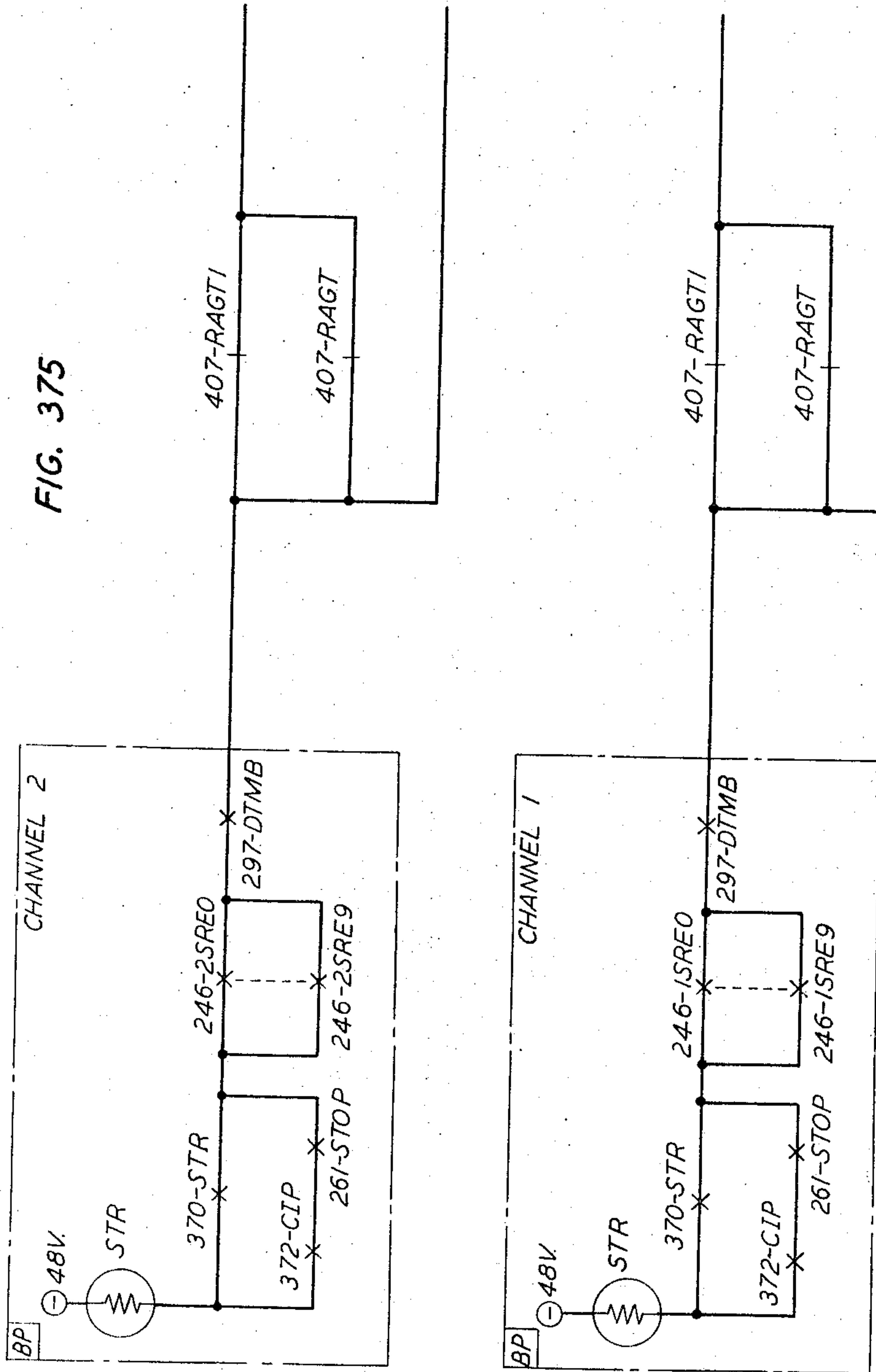
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 475

FIG. 375



Sept. 12, 1967

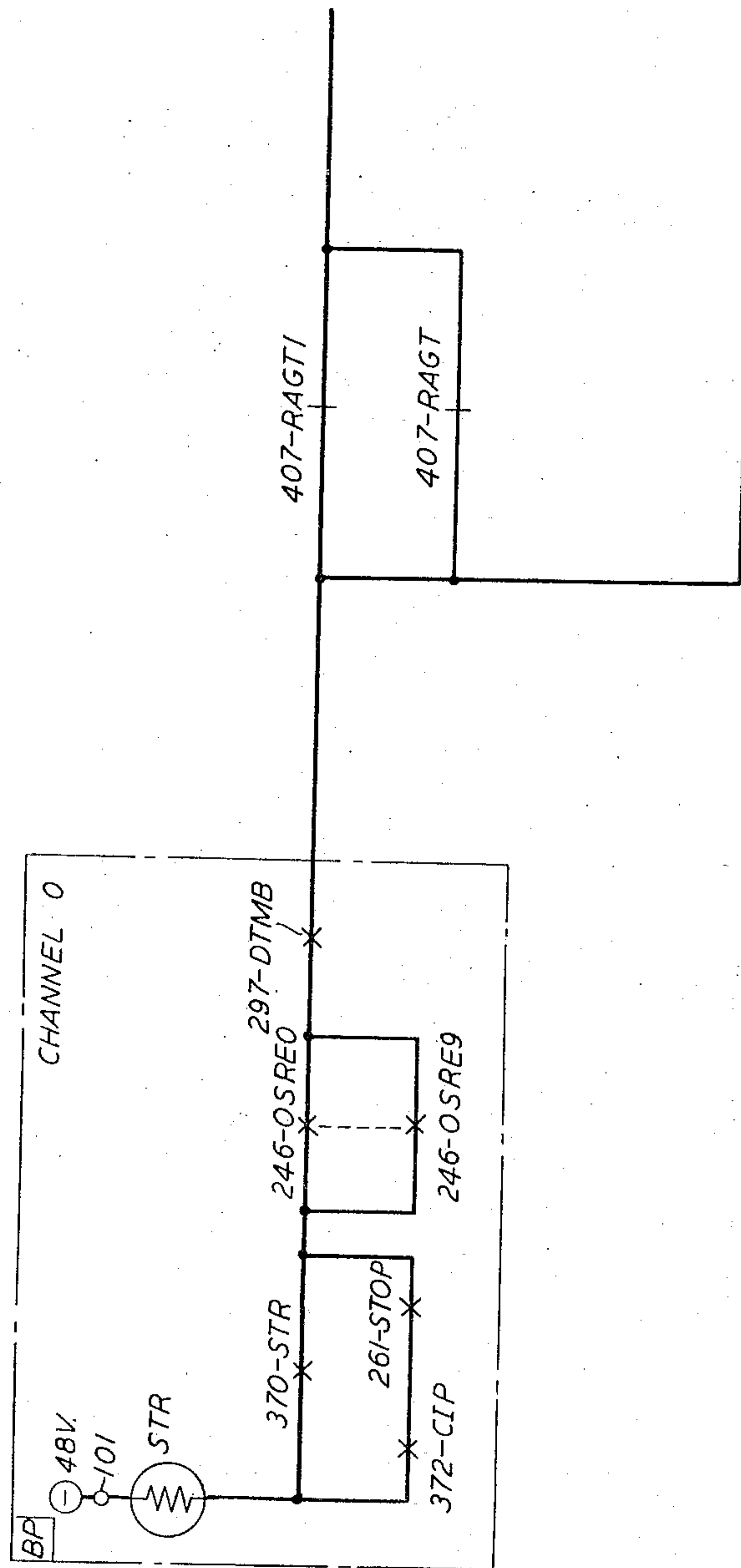
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 476

FIG. 376



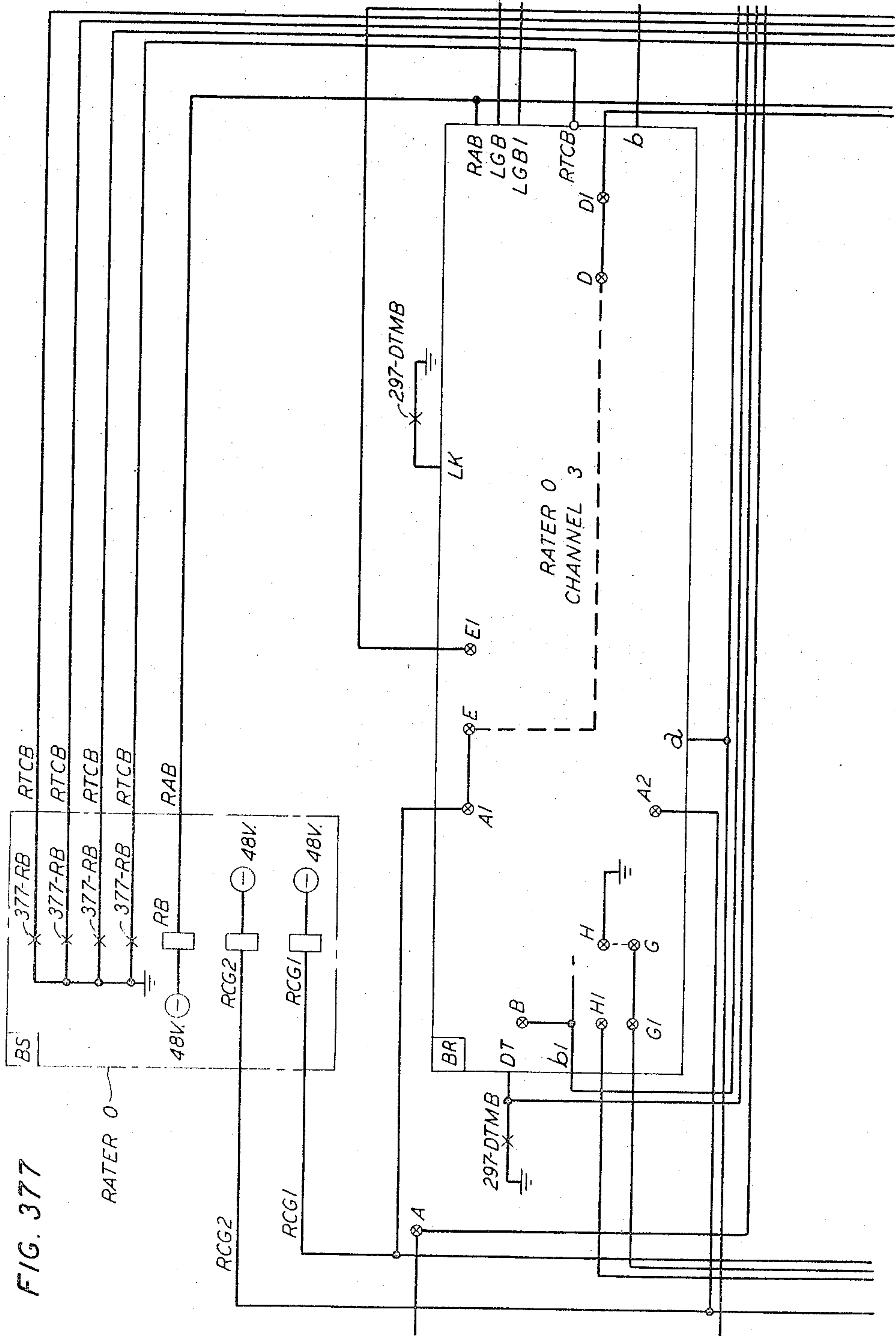
Sept. 12, 1967

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EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 477



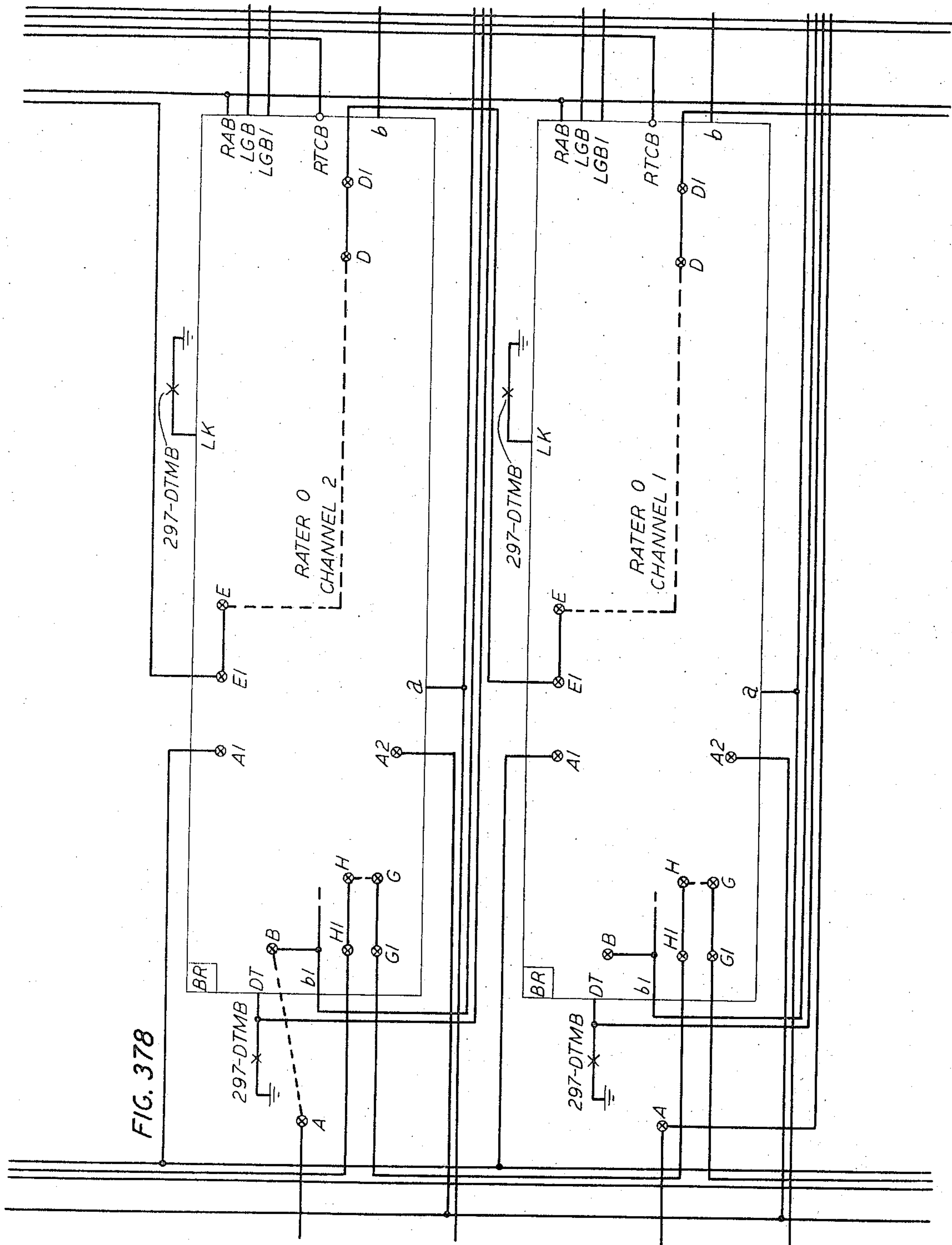
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 478



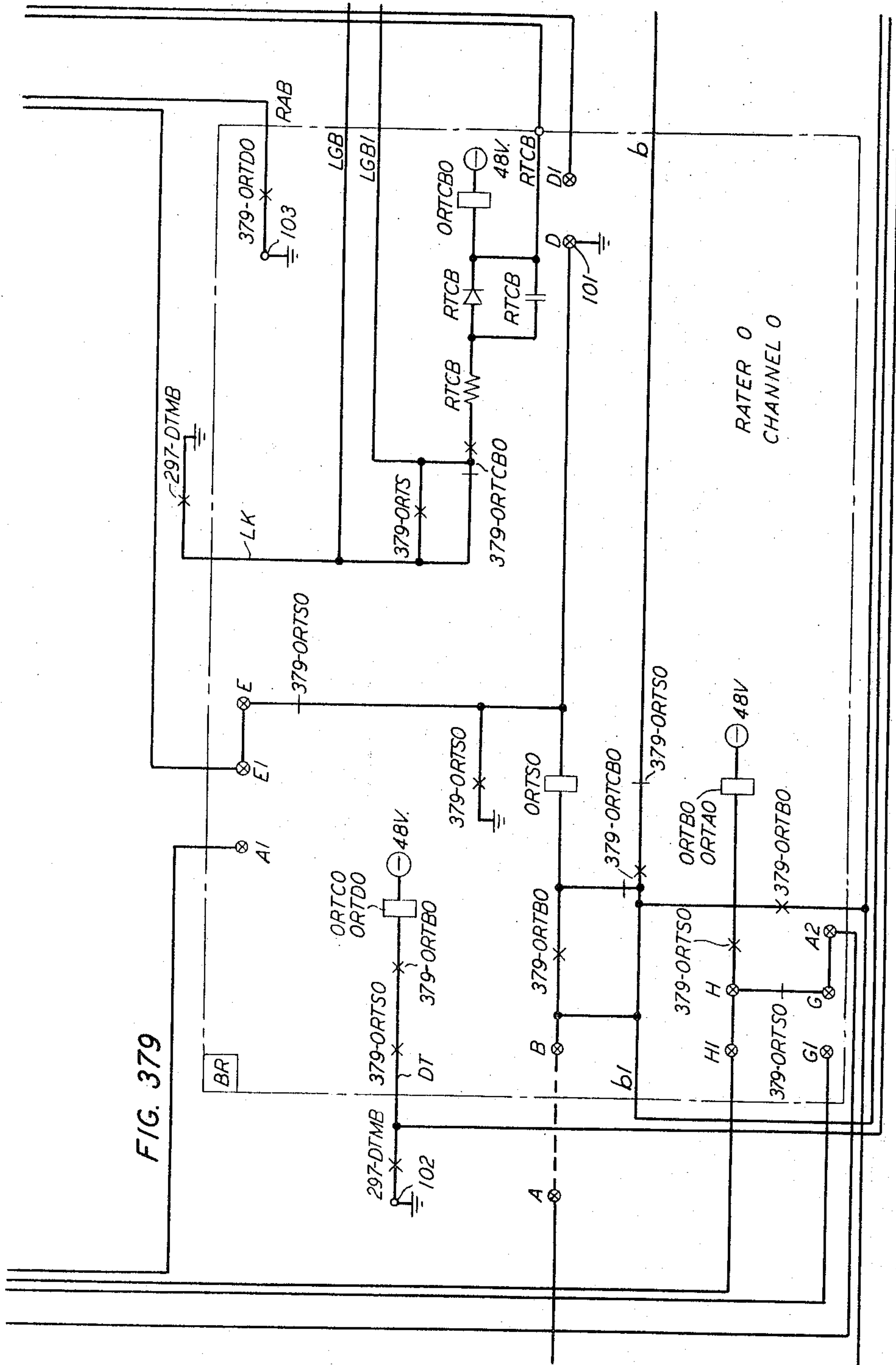
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 479



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 480

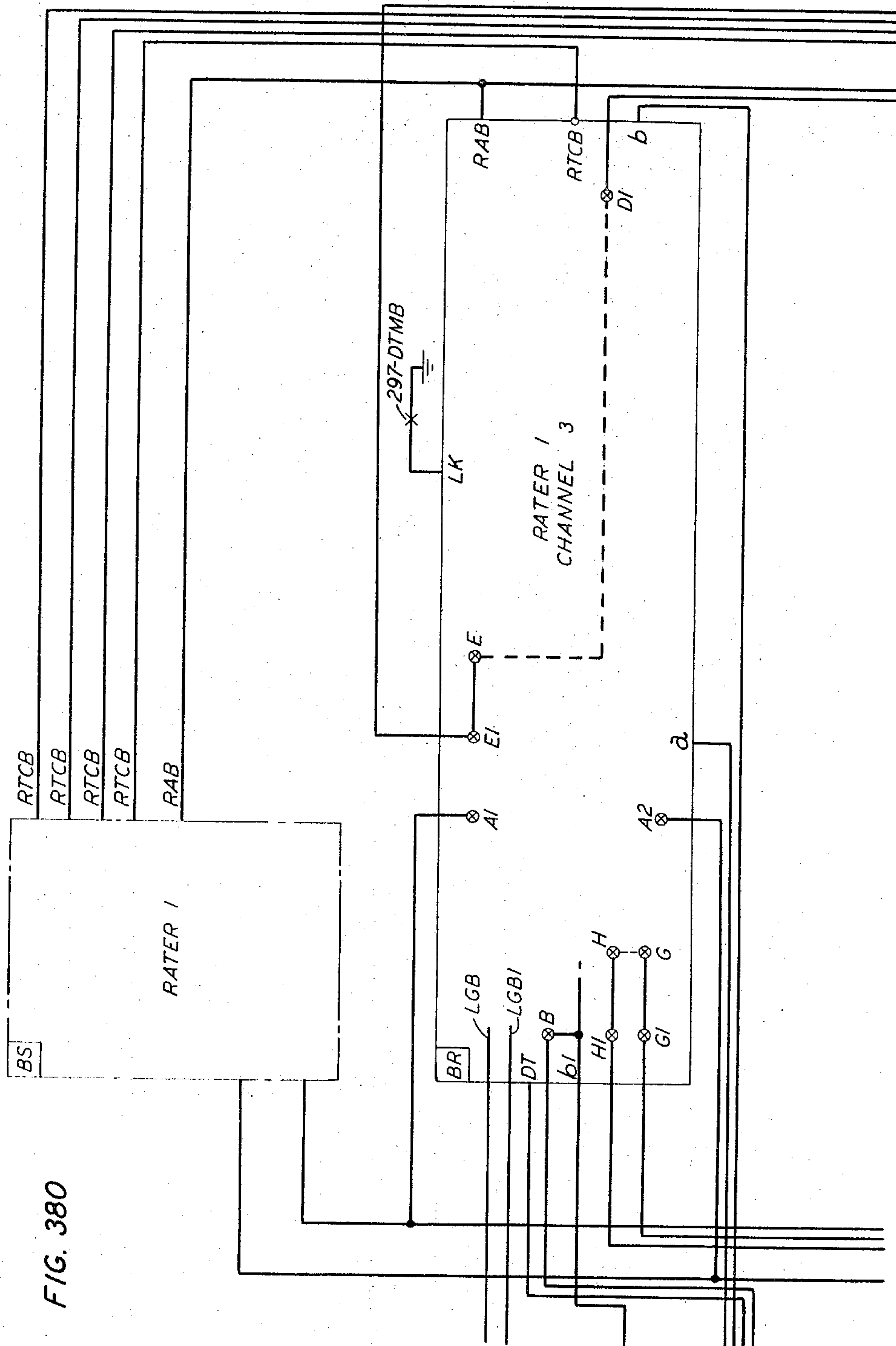


FIG. 380

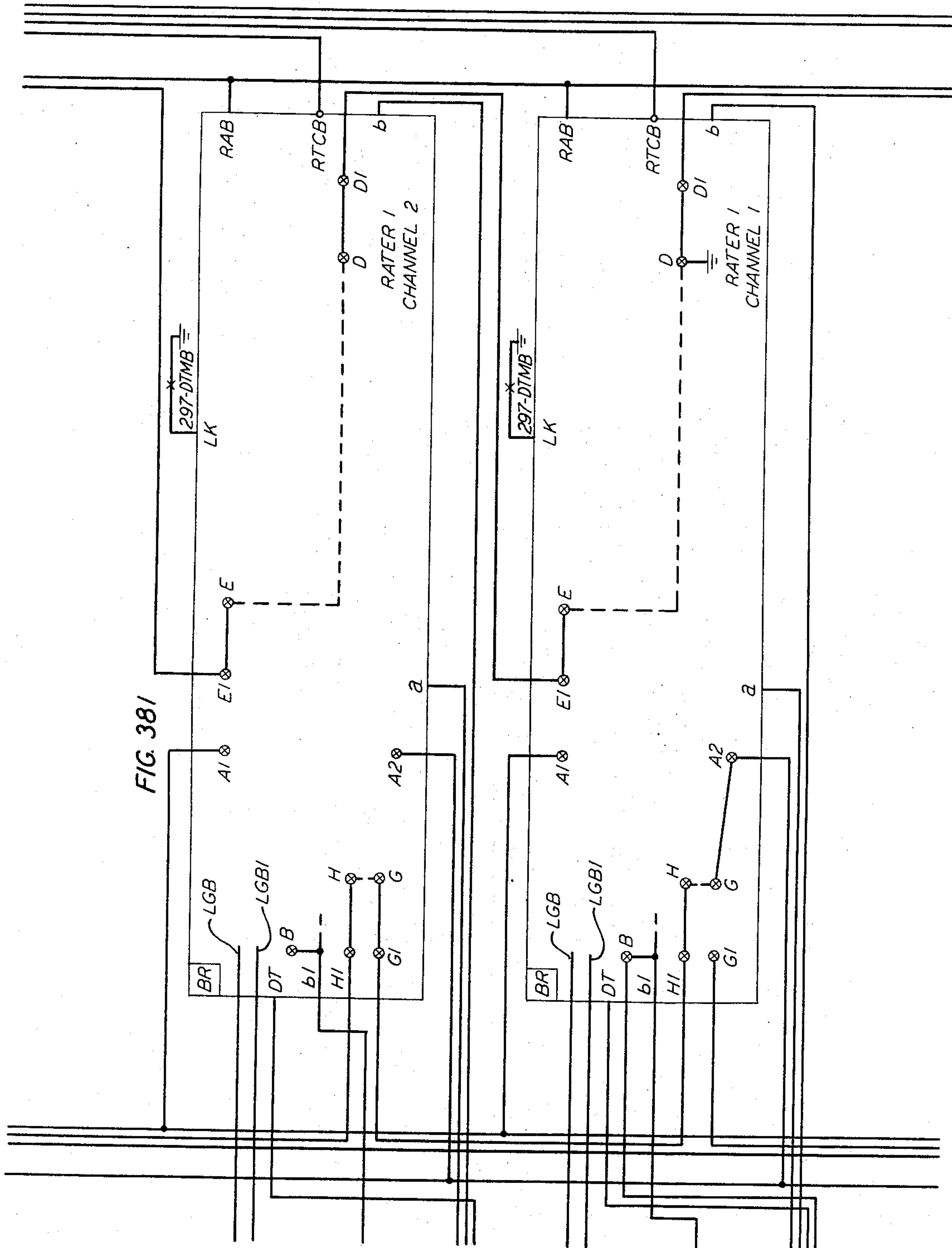
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 481



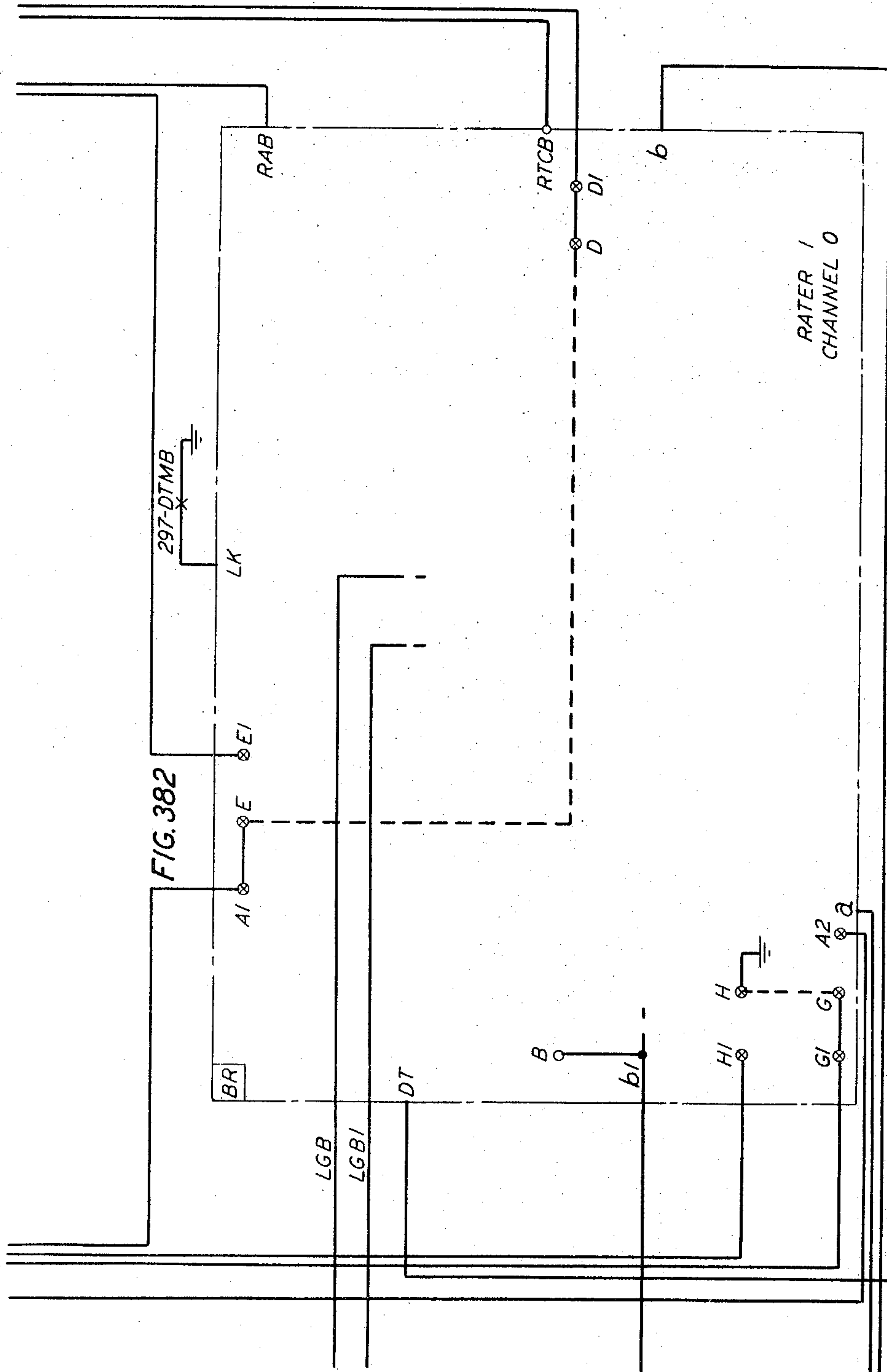
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 482



Sept. 12, 1967

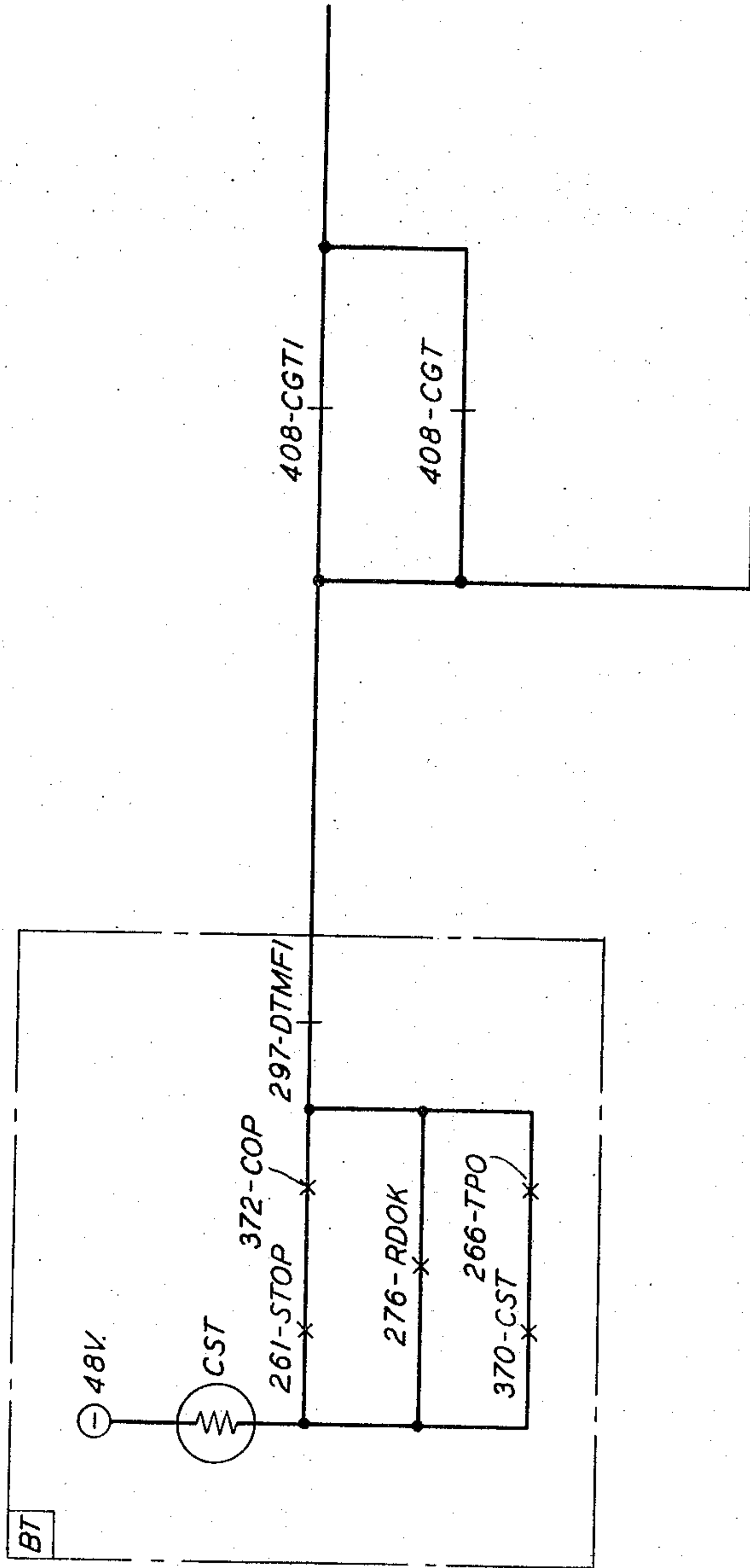
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 483

FIG. 383



Sept. 12, 1967

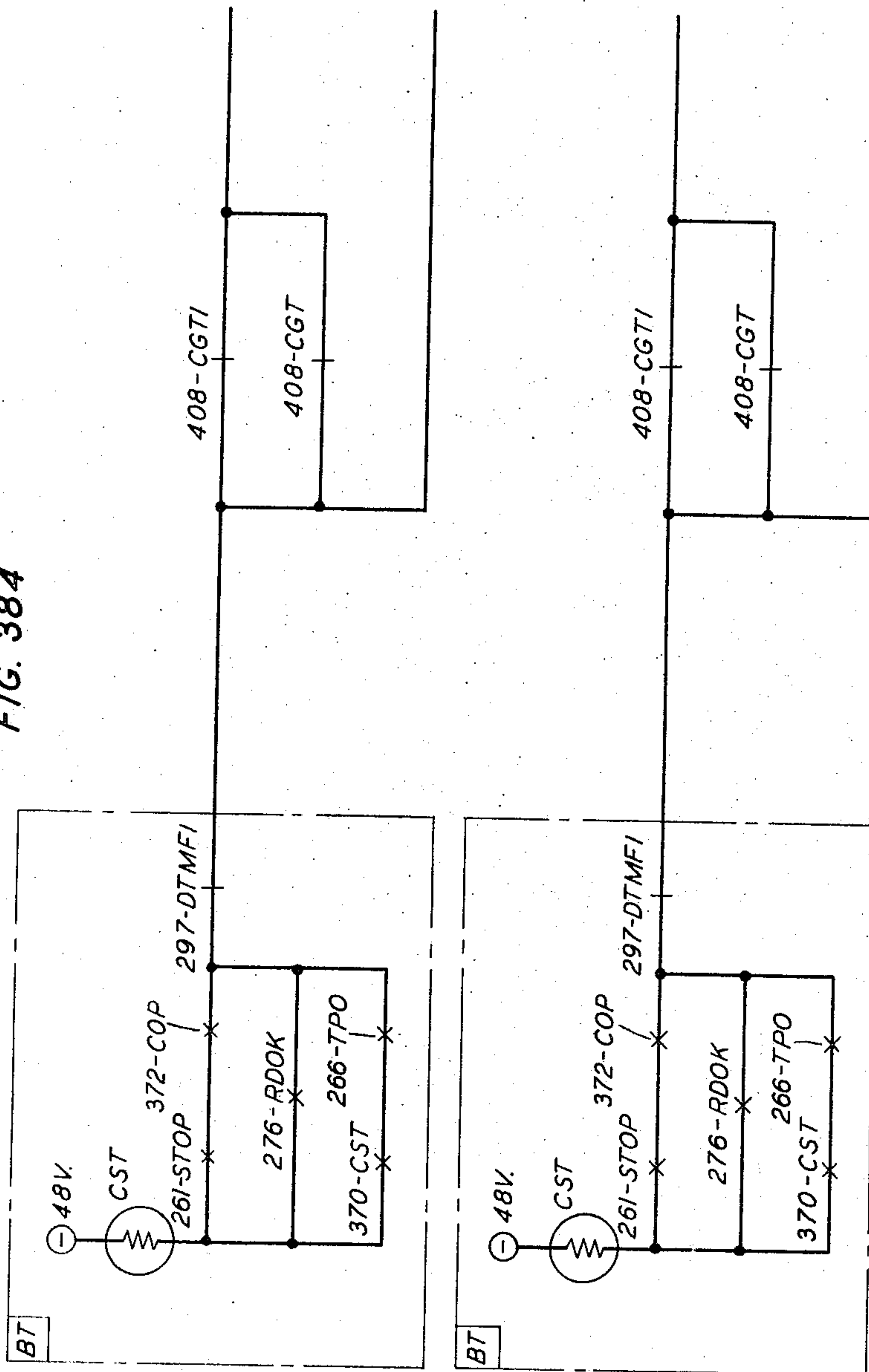
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 484

FIG. 384



Sept. 12, 1967

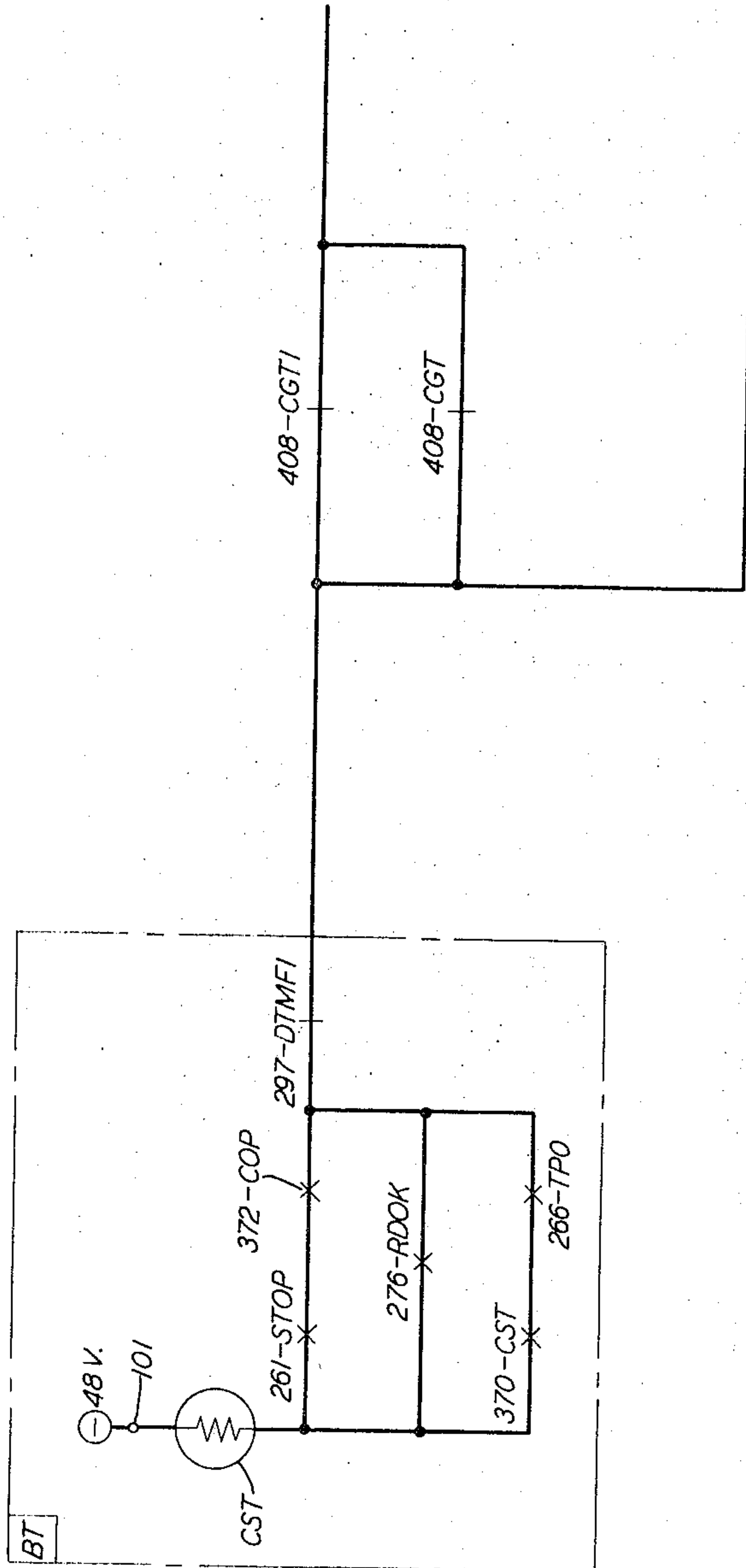
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 485

FIG. 385



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 486

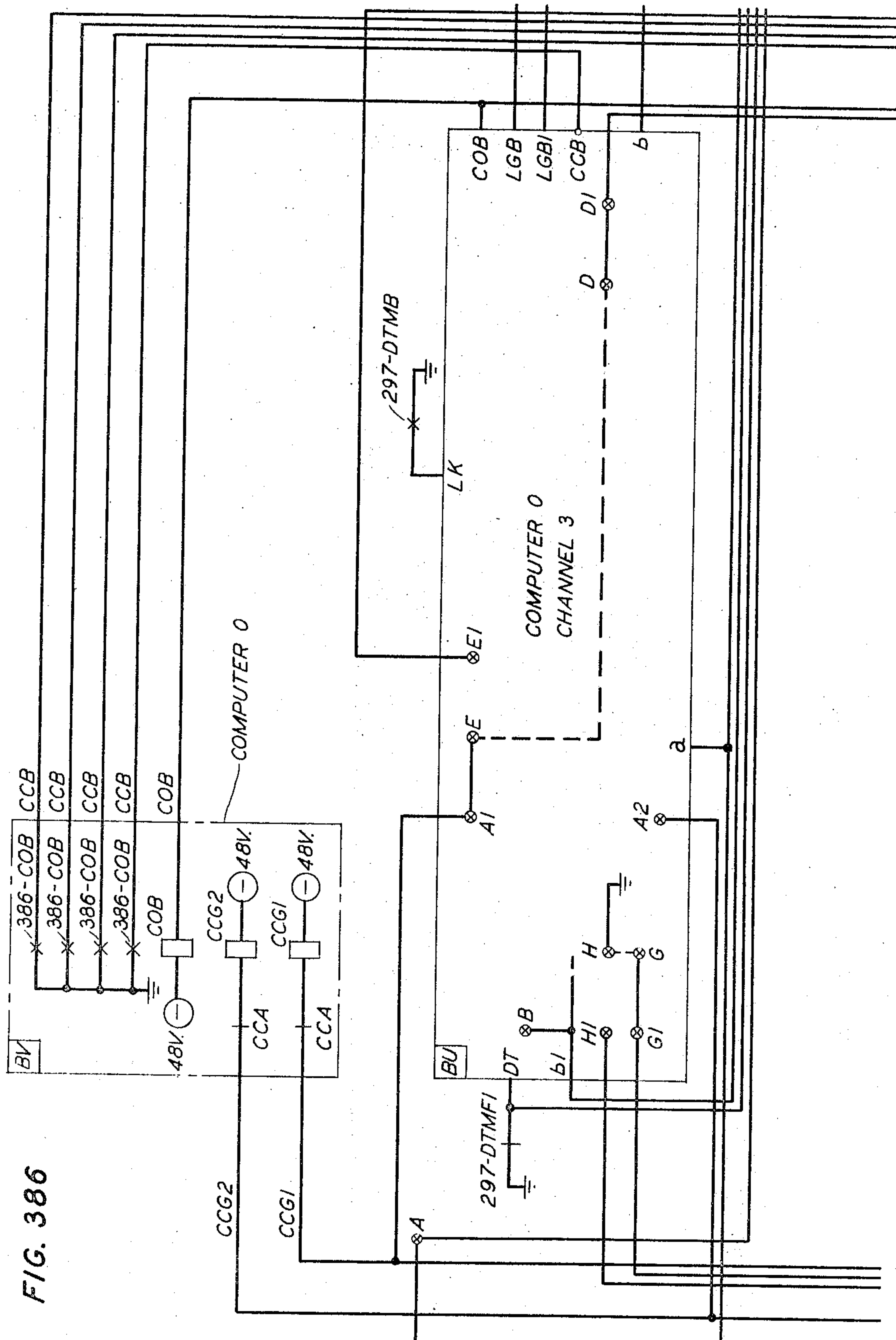


FIG. 386

Sept. 12, 1967

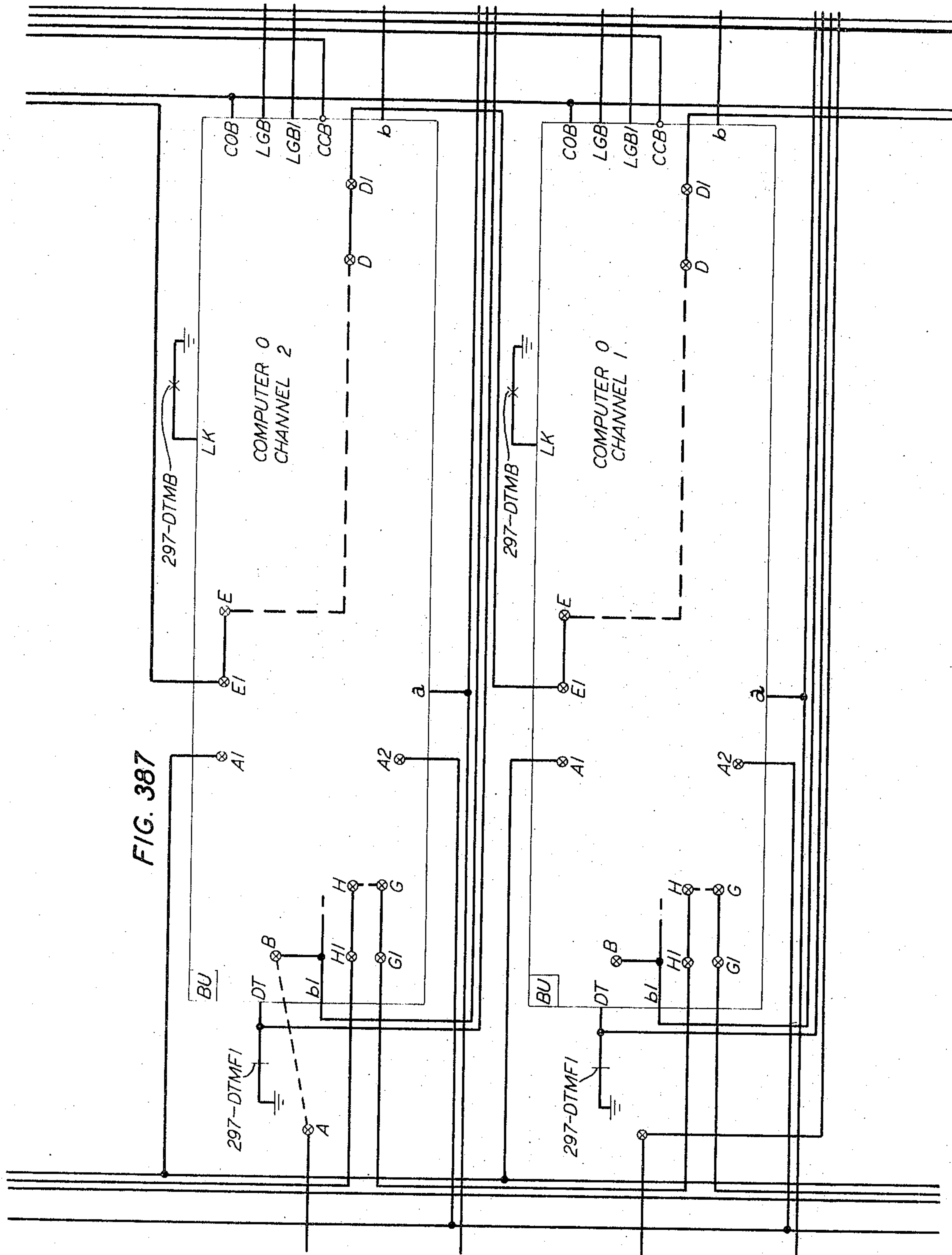
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 487

FIG. 387



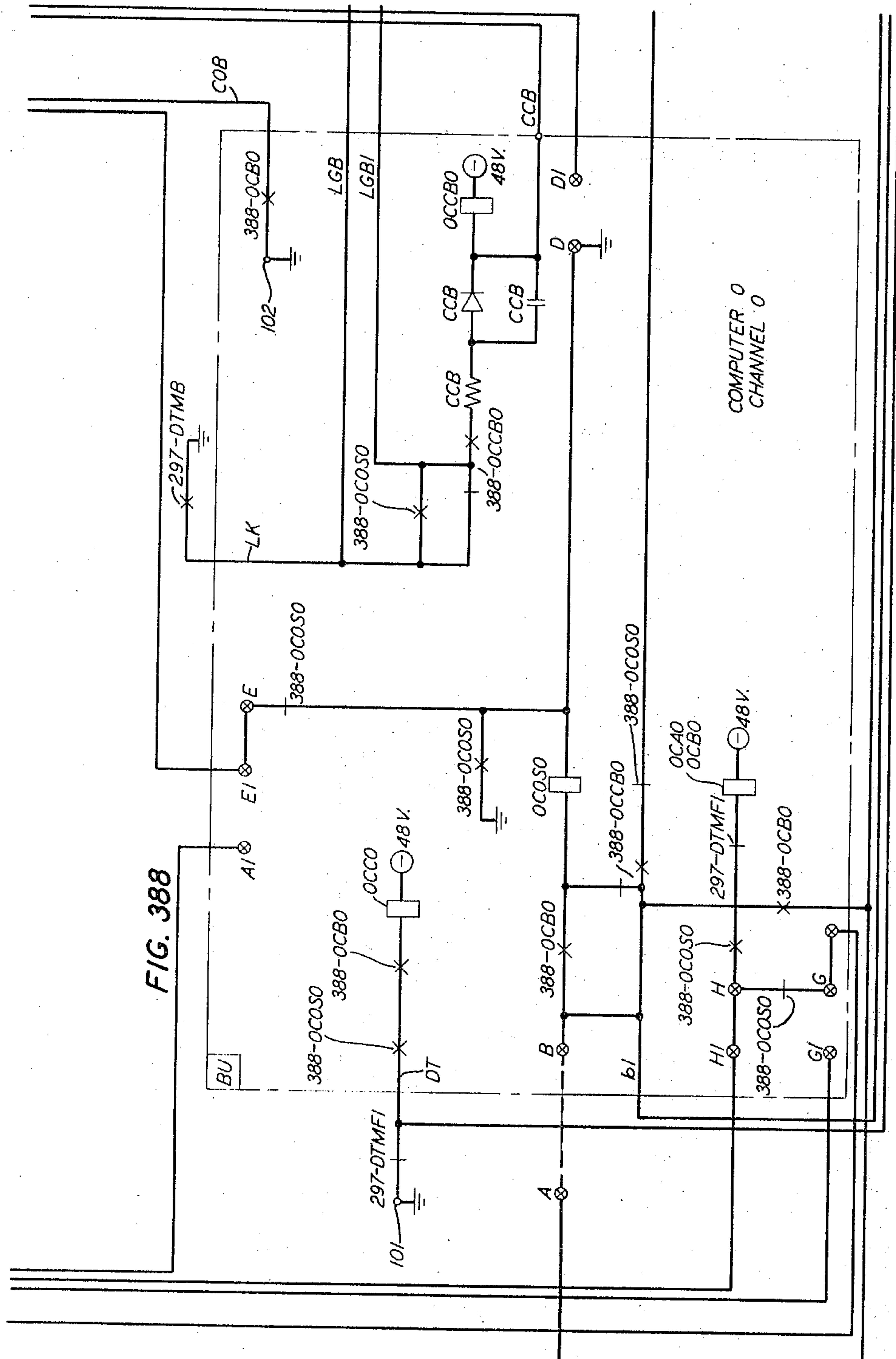
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 488



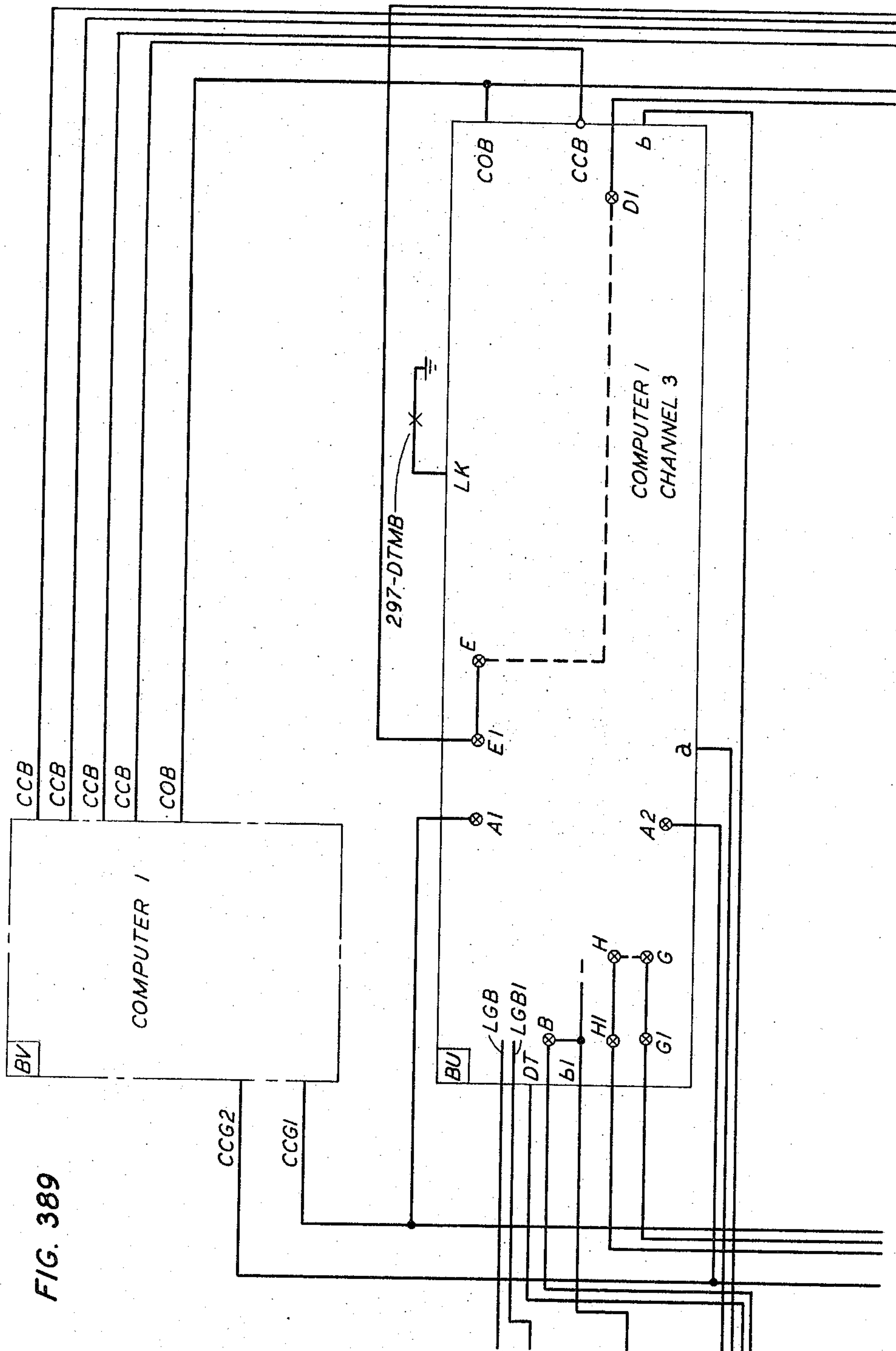
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 489



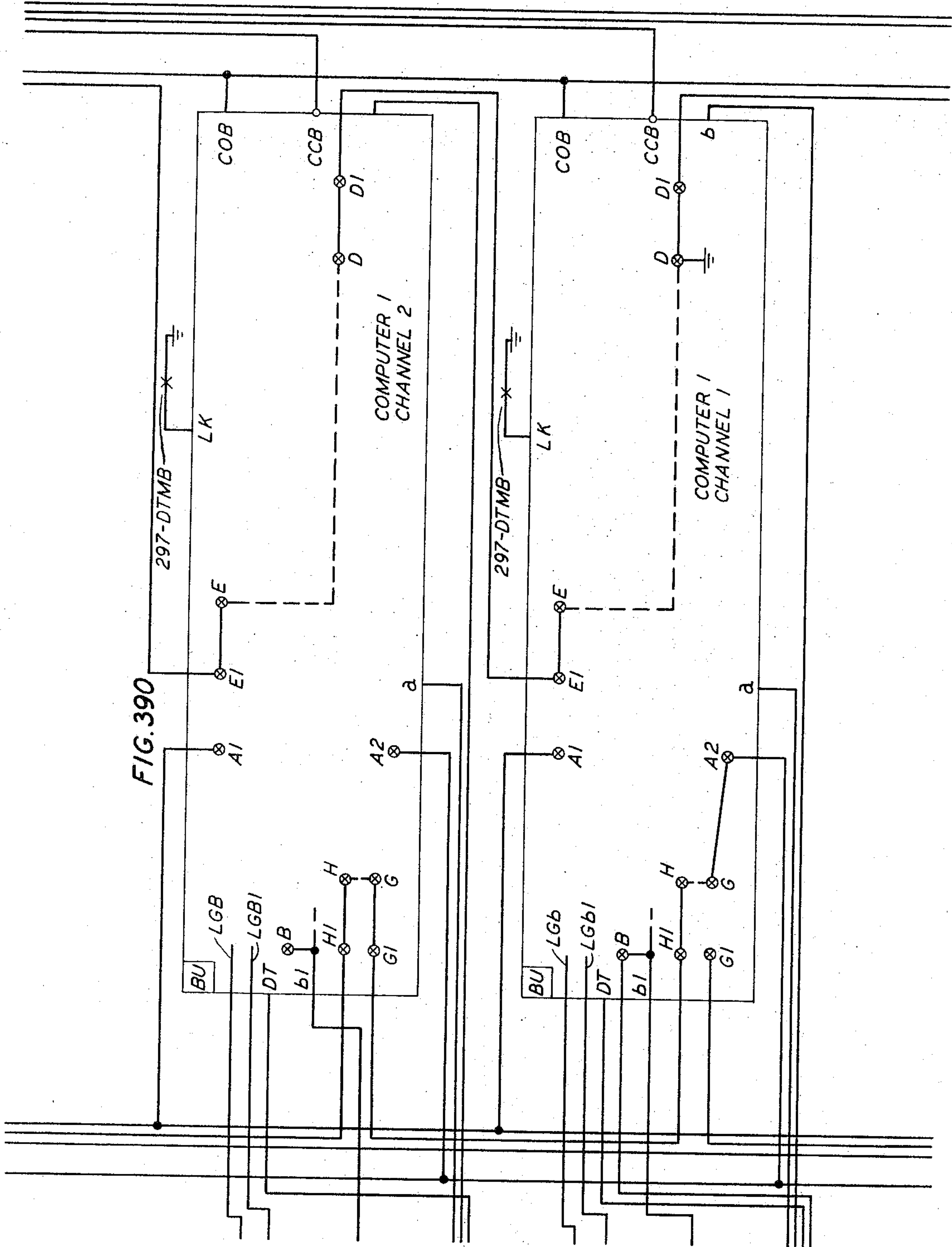
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 490



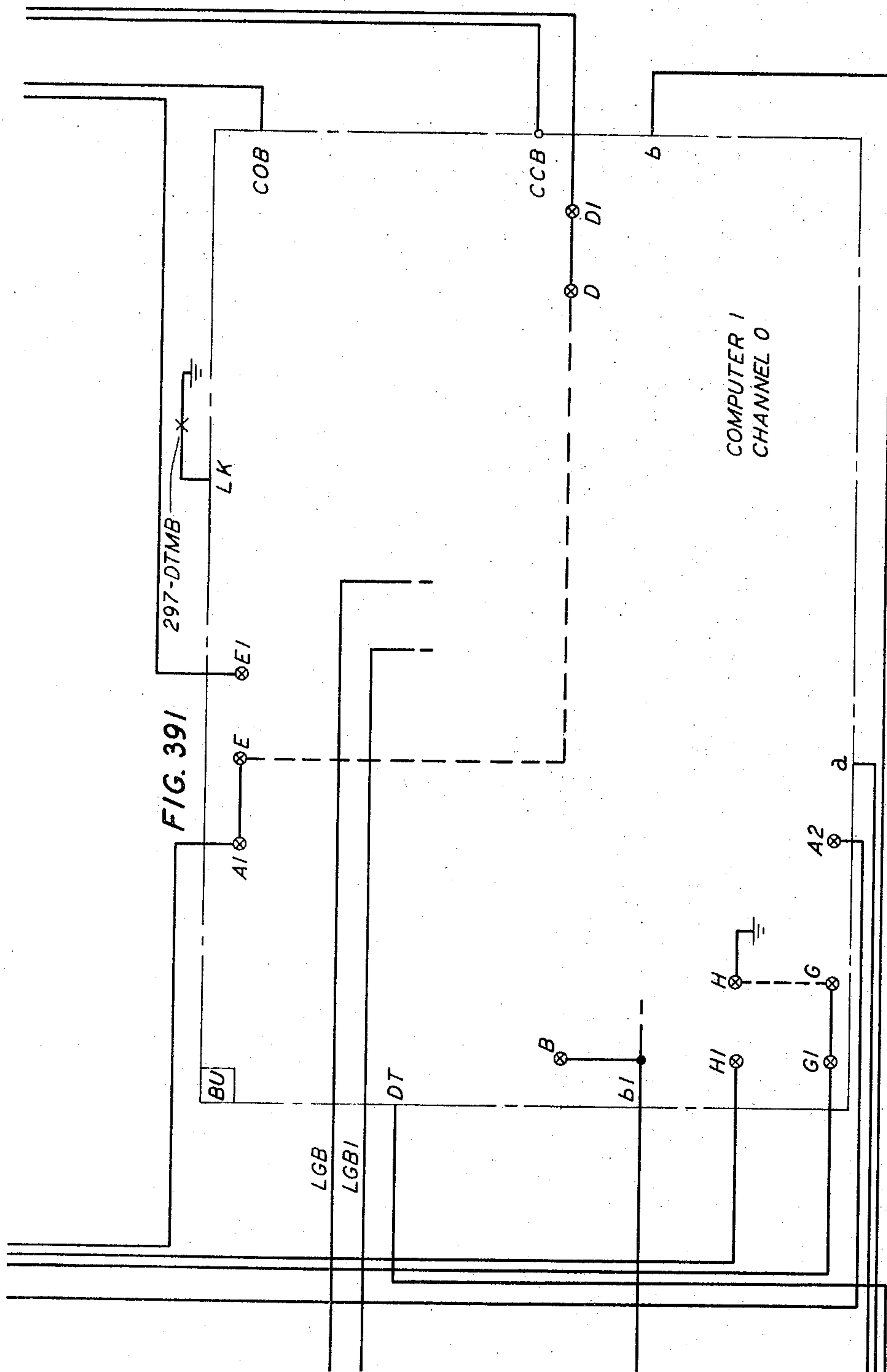
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 491



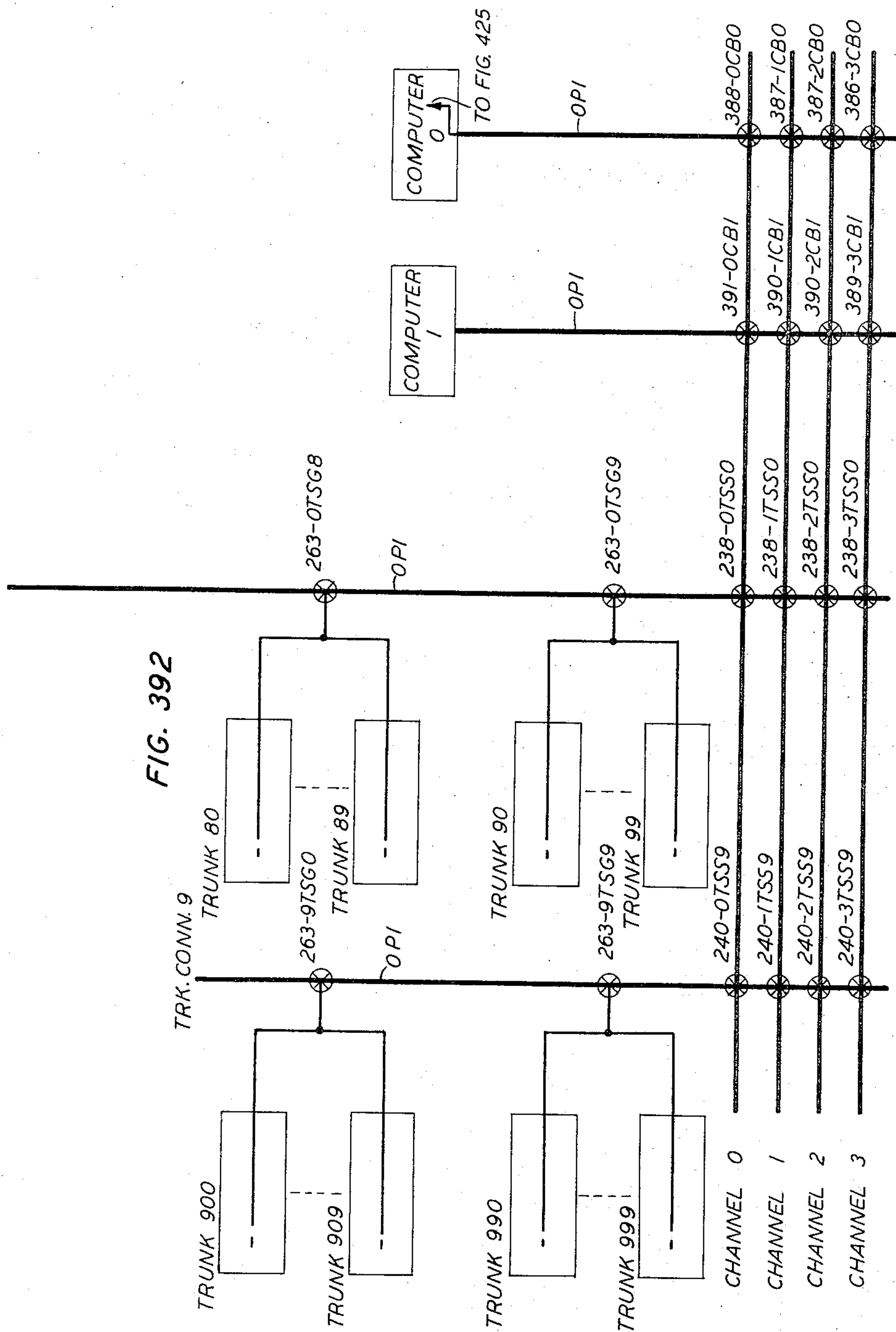
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 492



Sept. 12, 1967

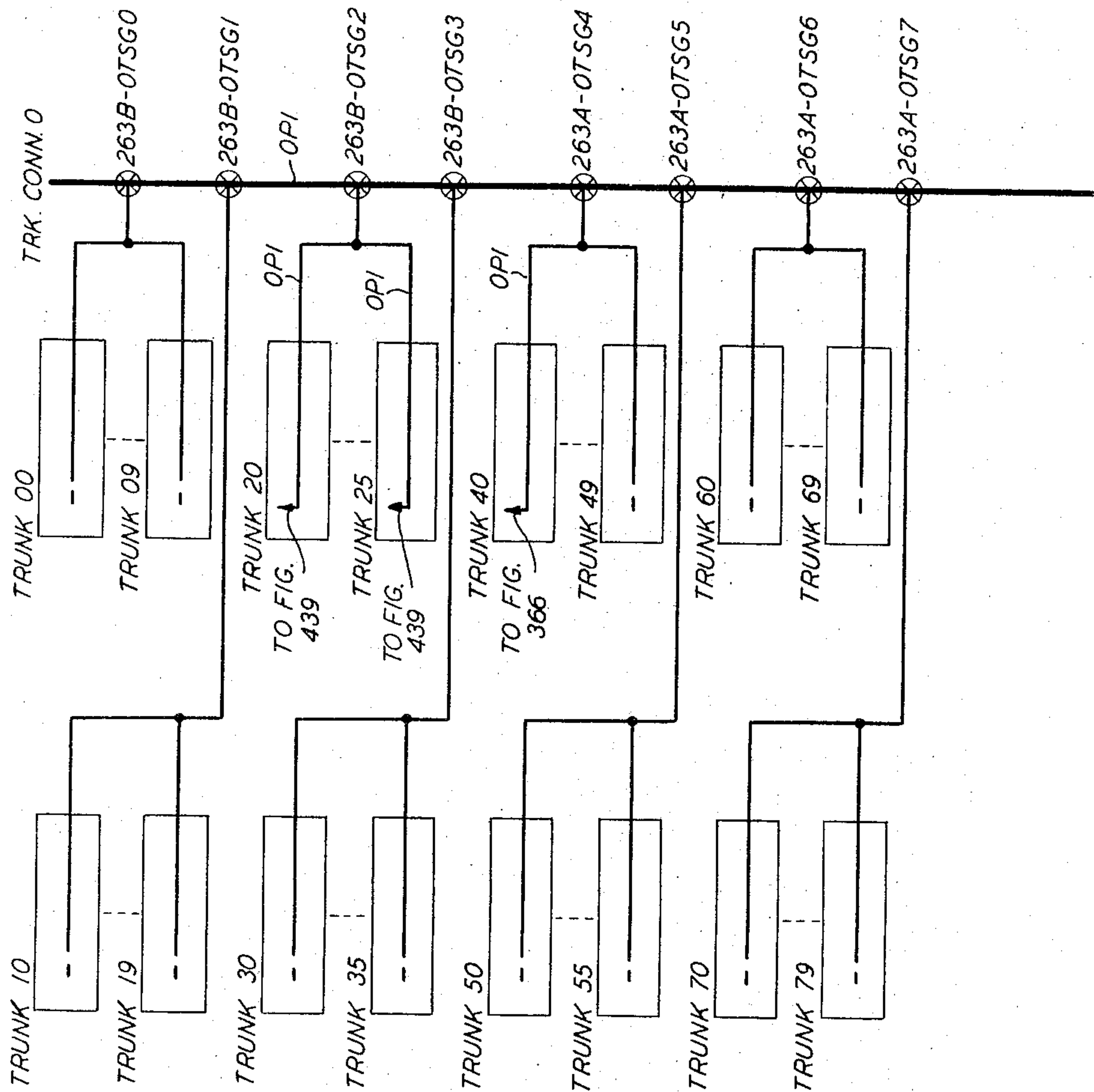
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 493

FIG. 392A



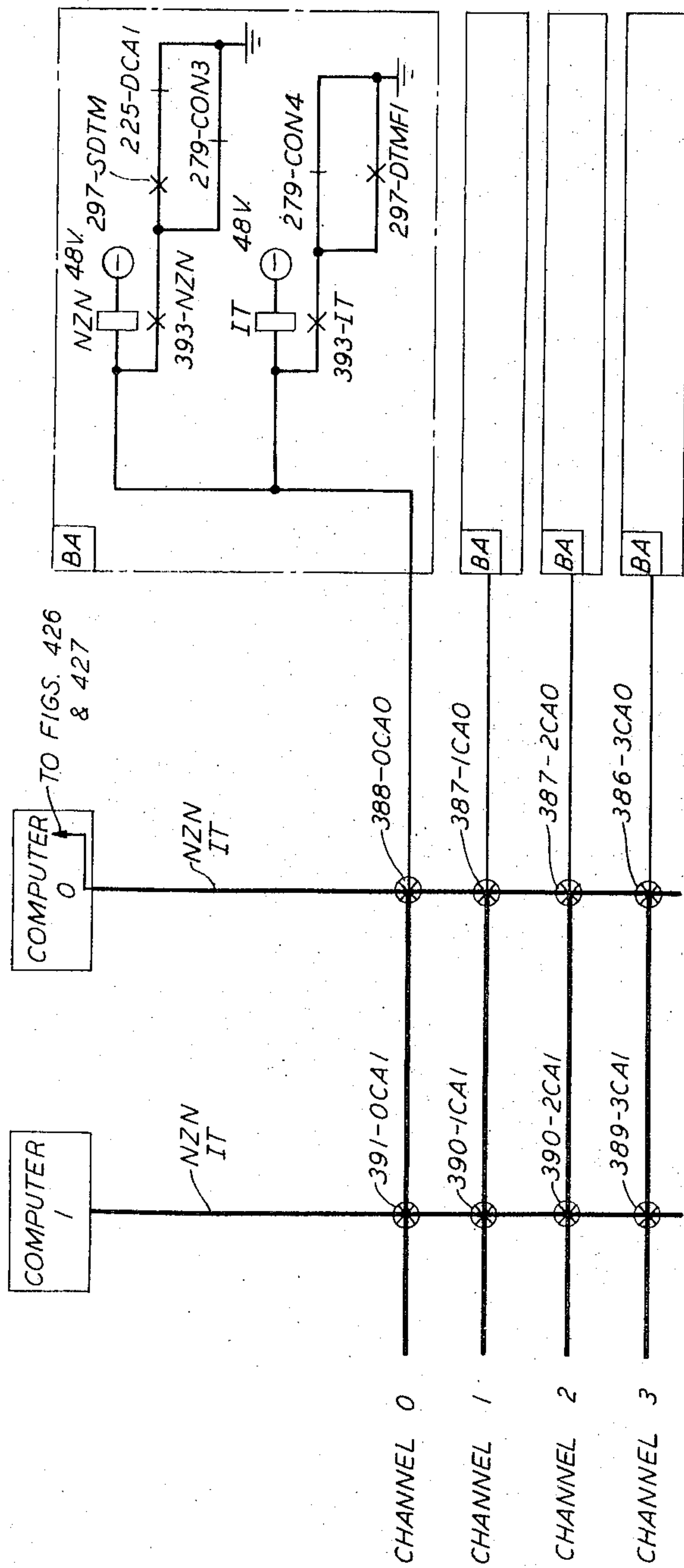
Sept. 12, 1967
EC
Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 494

FIG. 393



Sept. 12, 1967

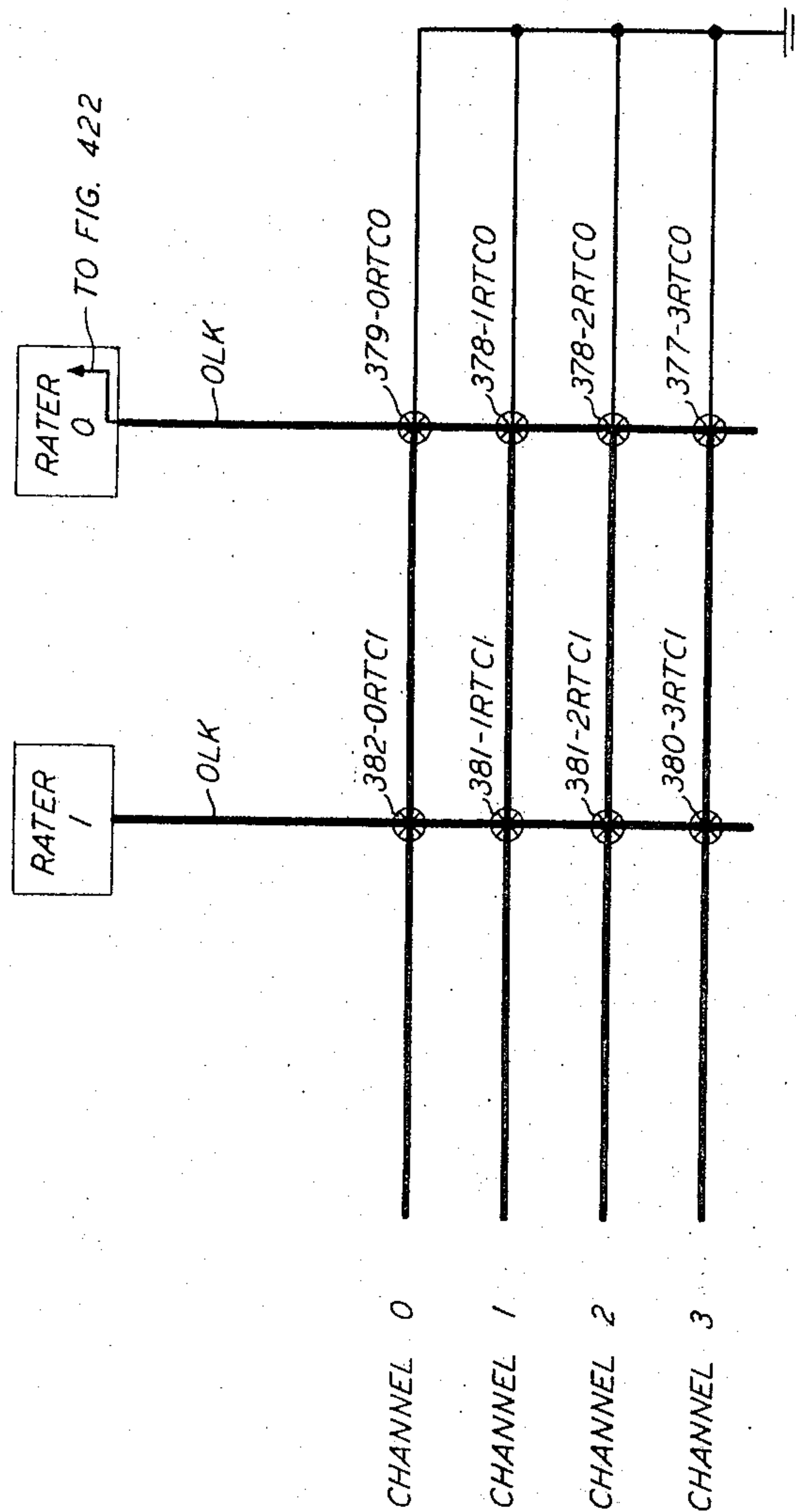
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 495

FIG. 394



Sept. 12, 1967

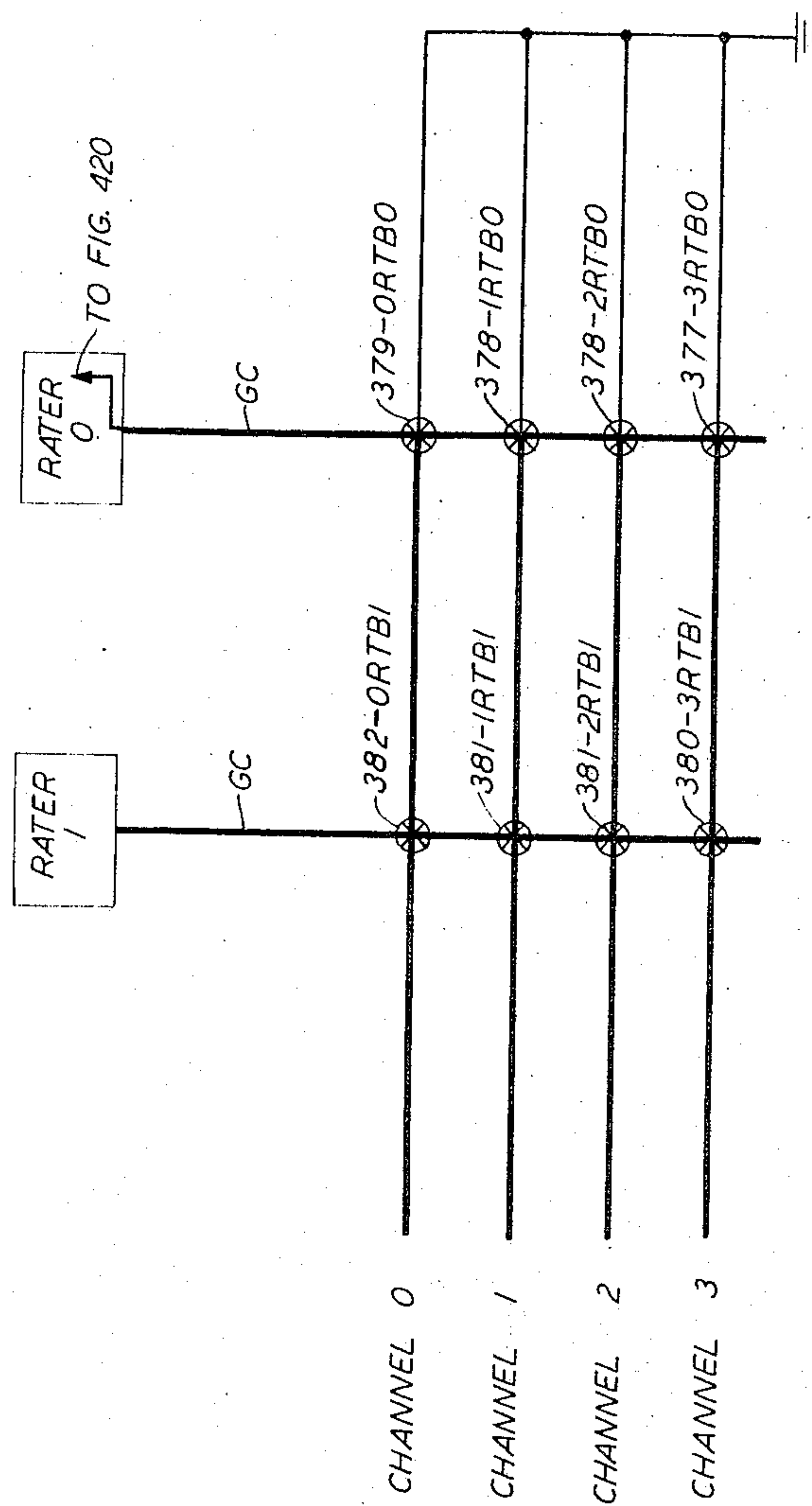
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 496

FIG. 395



Sept. 12, 1967

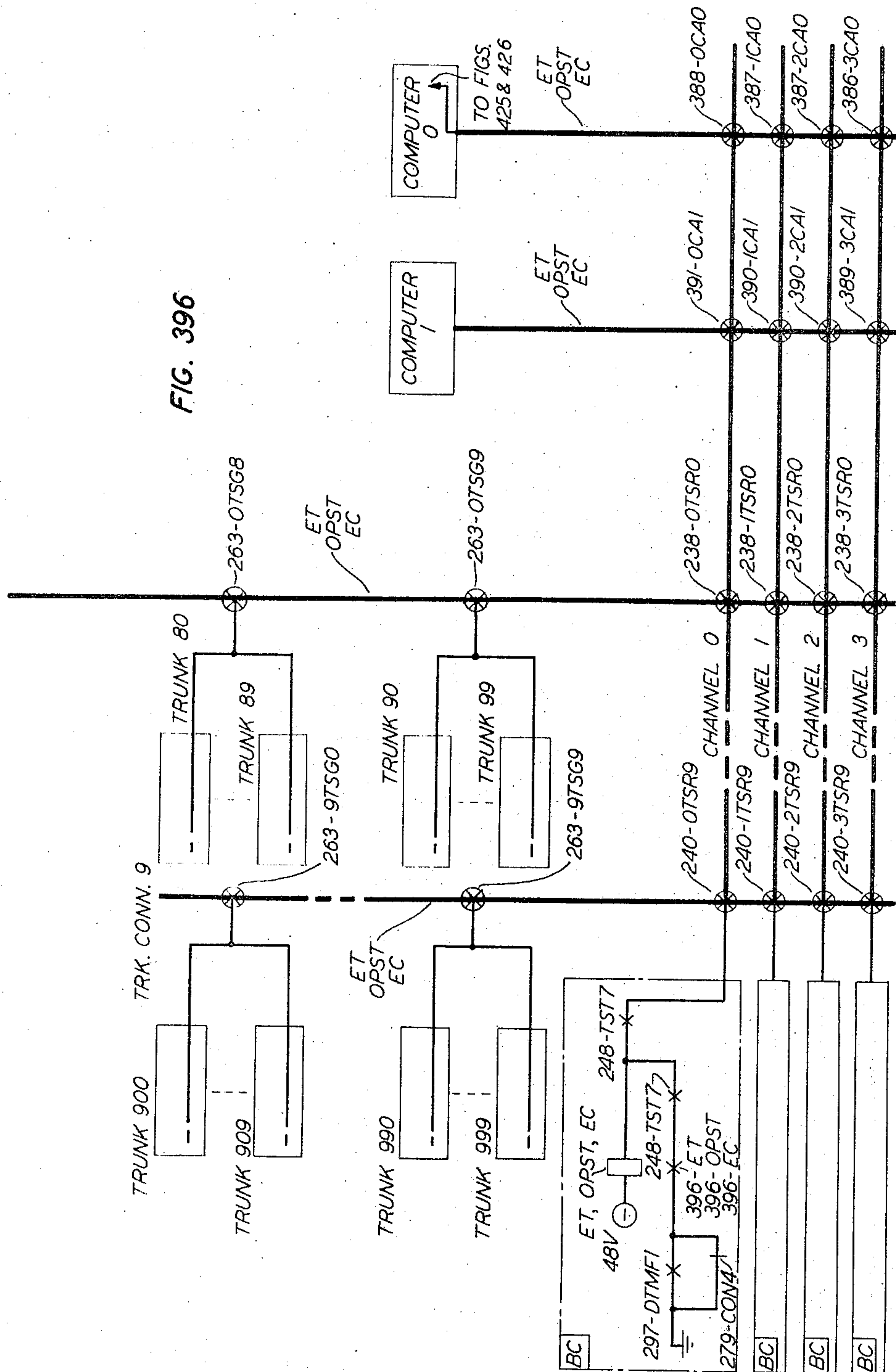
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 497

FIG. 396



Sept. 12, 1967

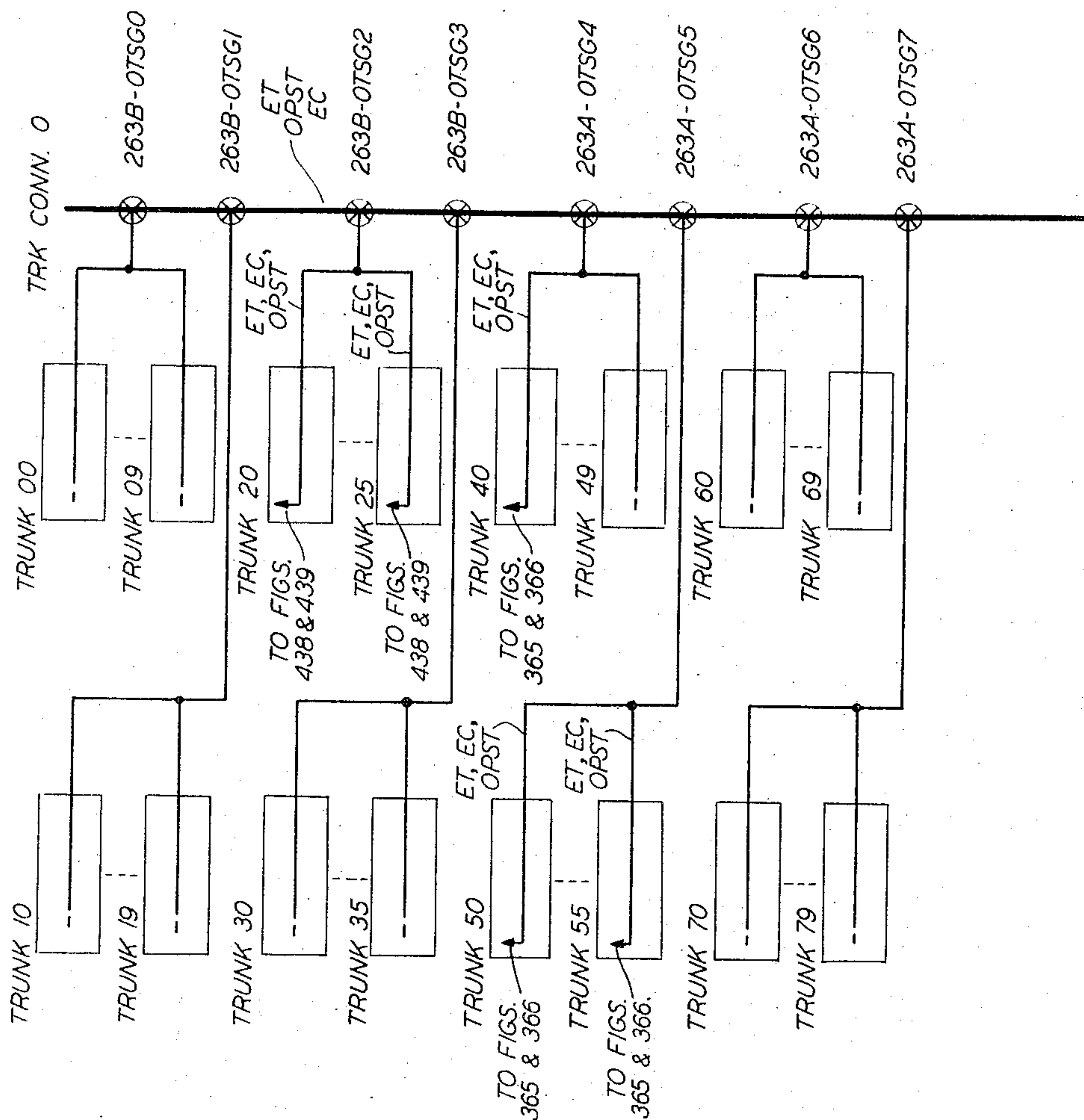
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 498

FIG. 396A



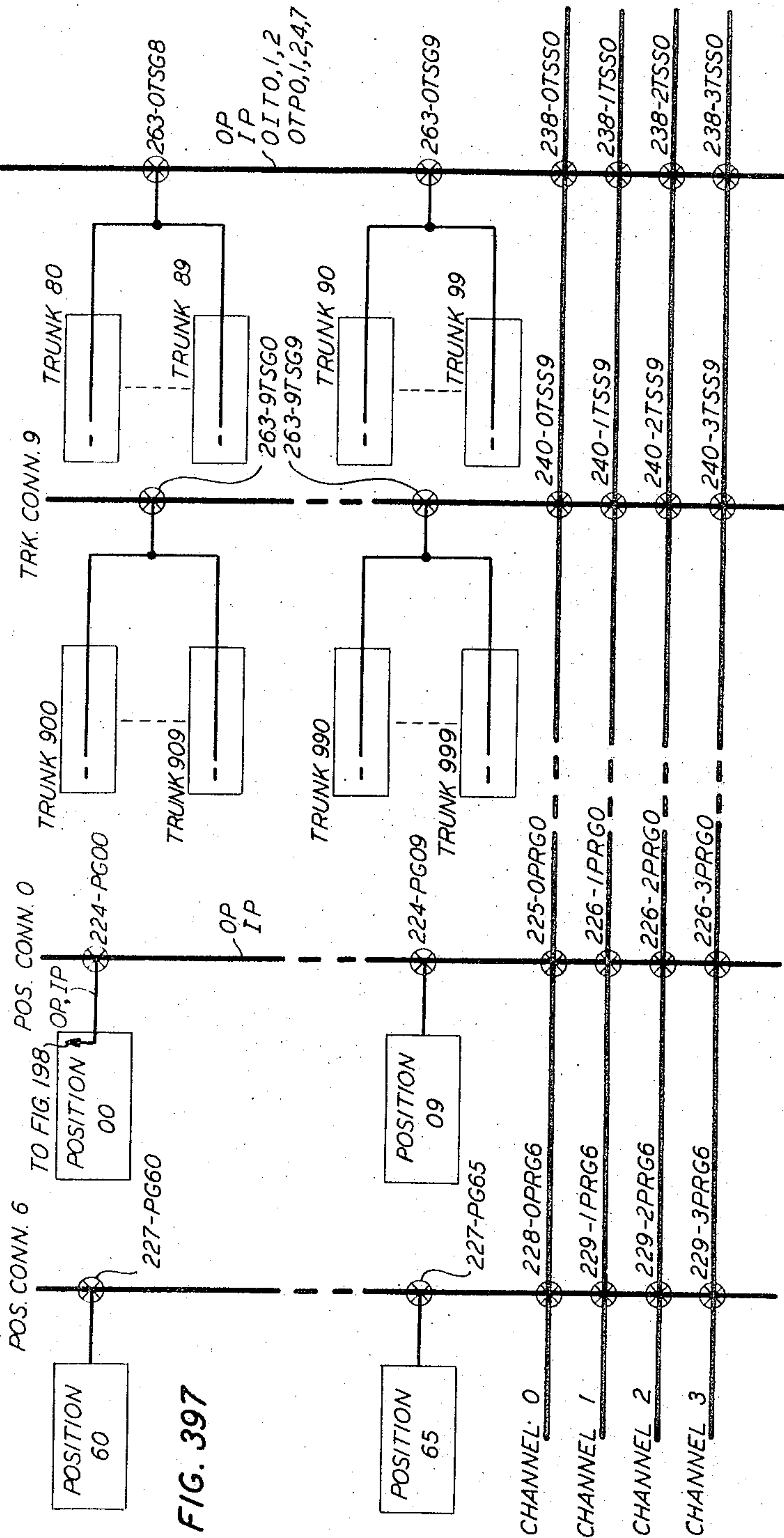
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 499



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 500

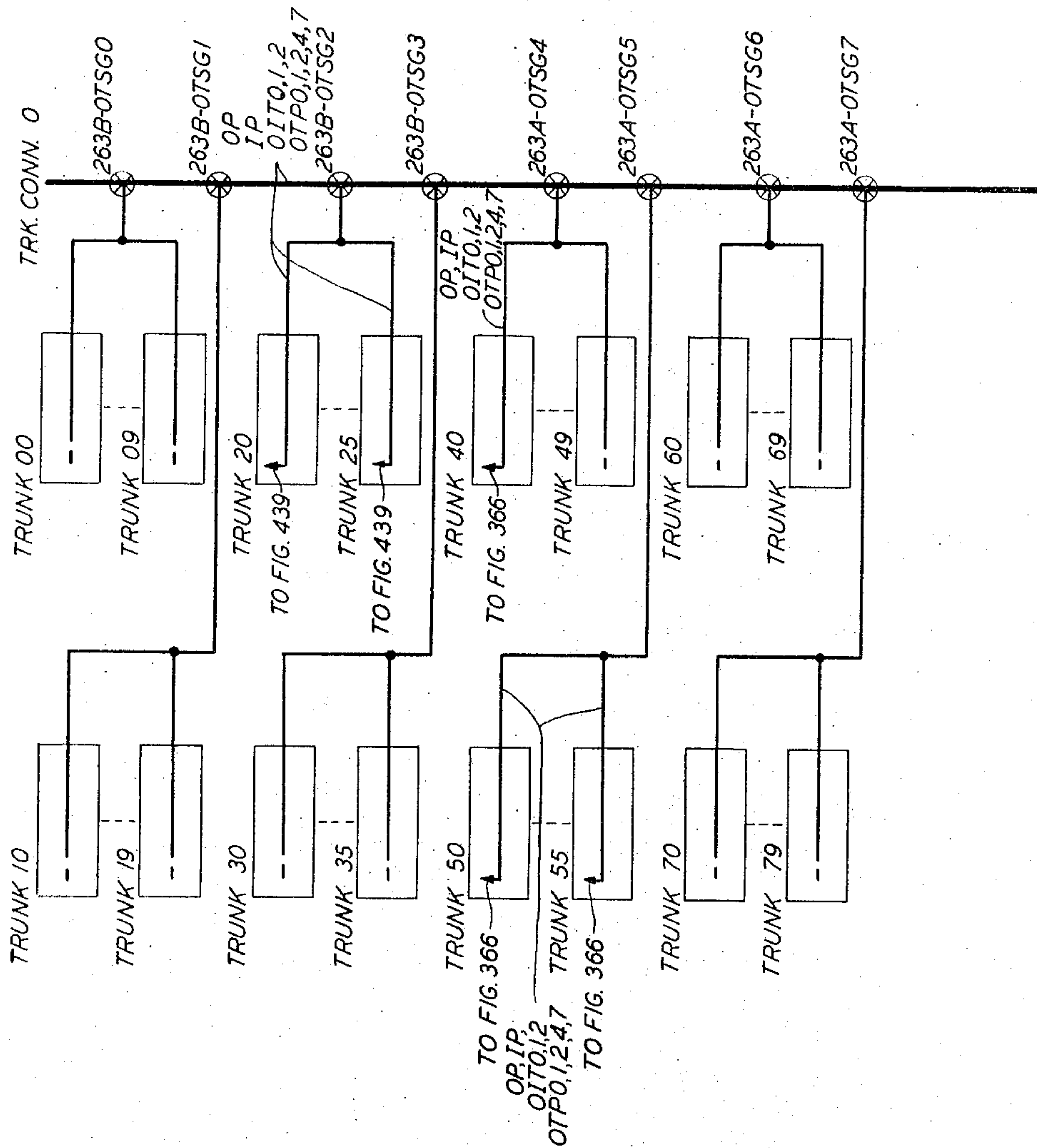


FIG. 397A

Sept. 12, 1967

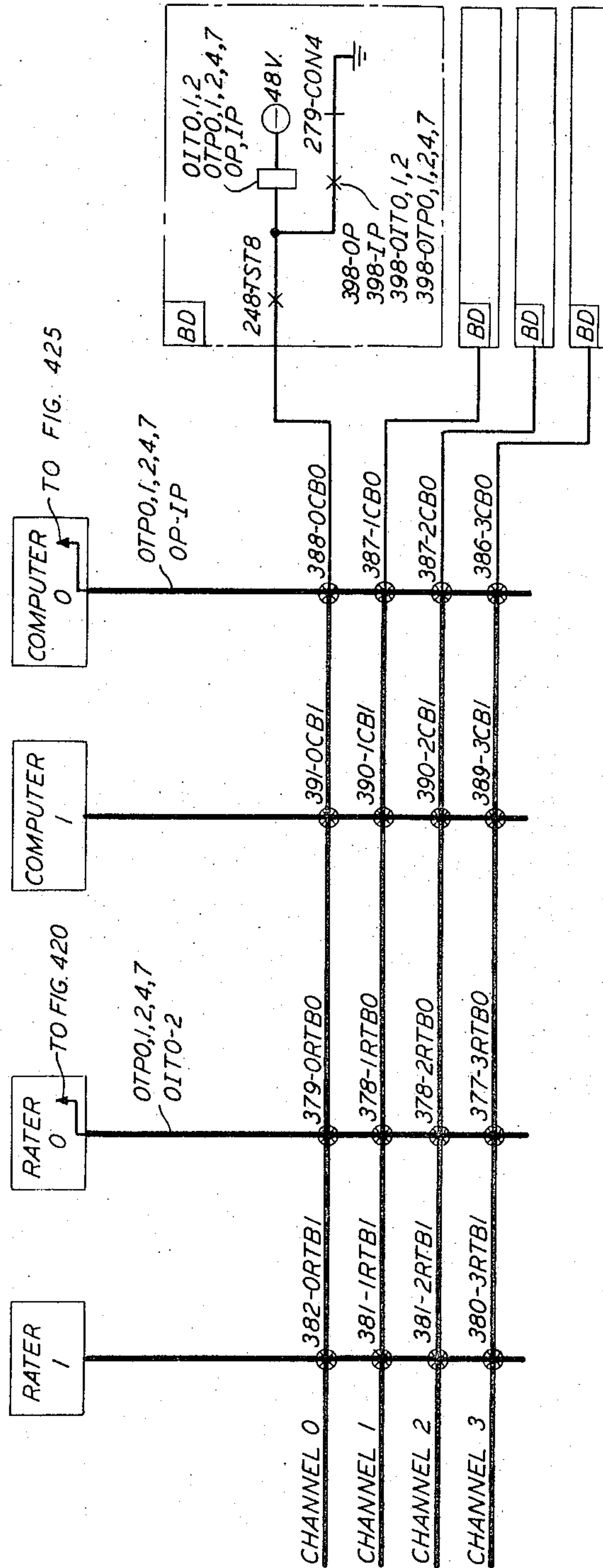
L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 501

FIG. 398



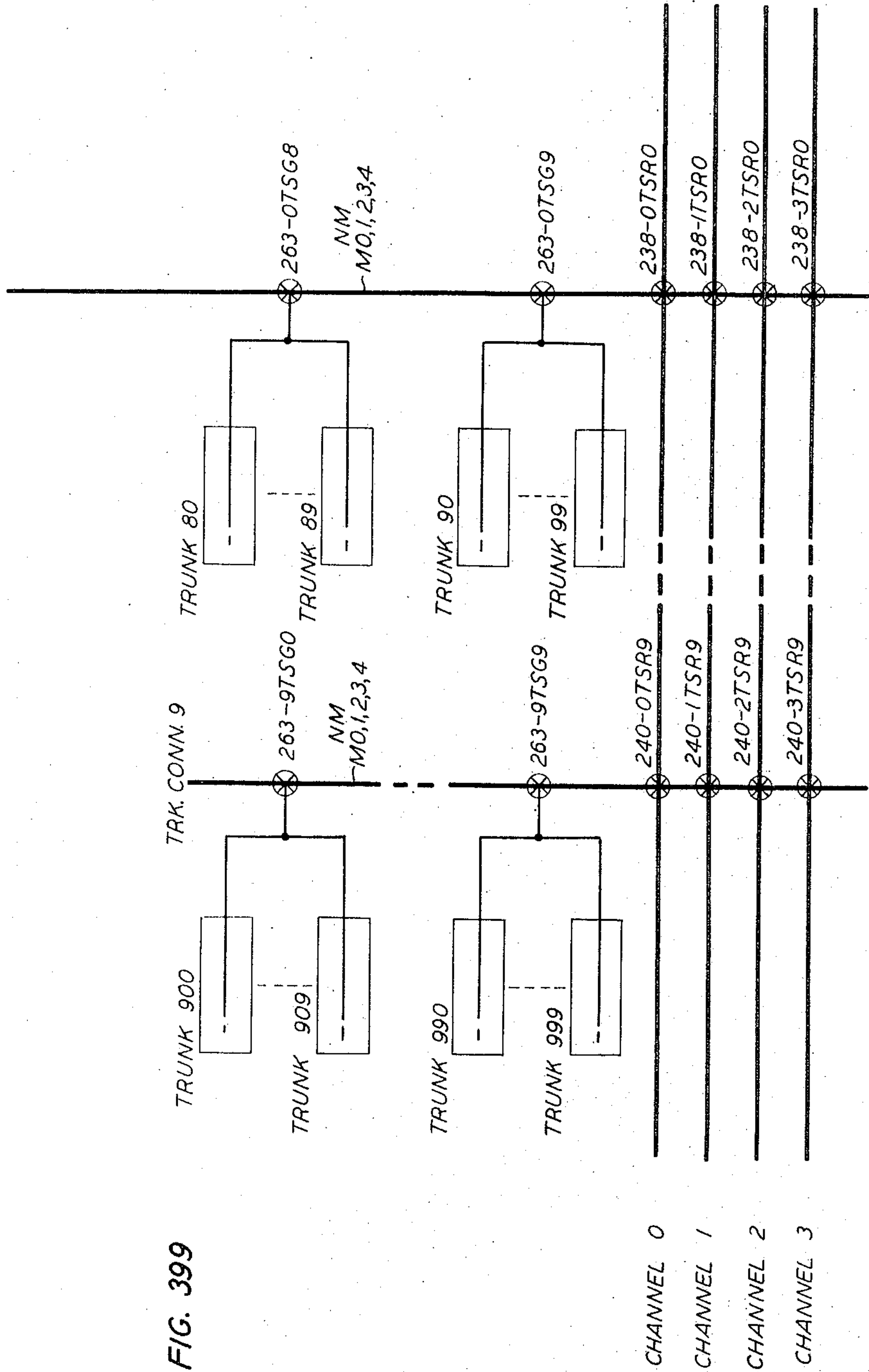
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 502



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 503

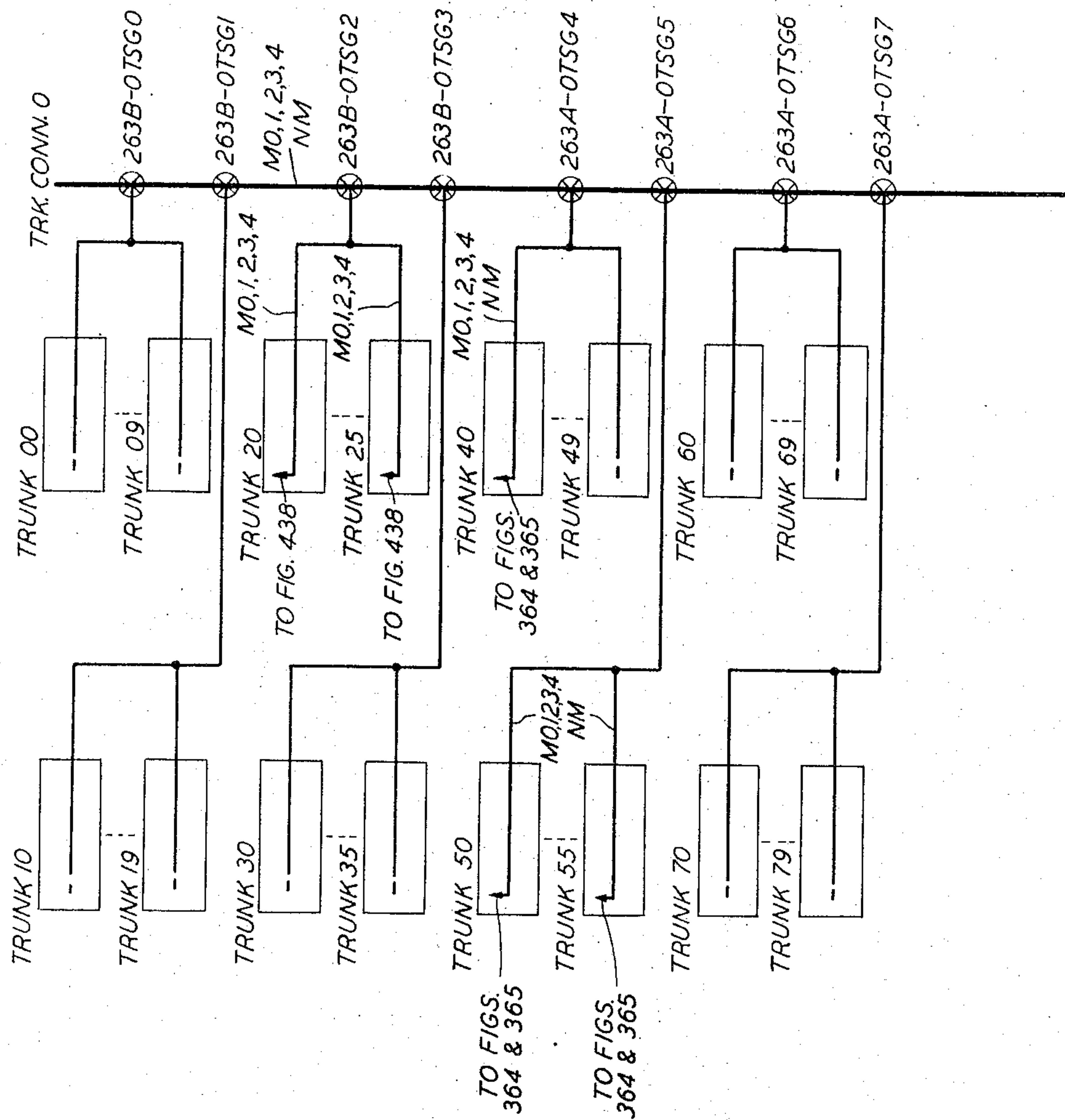


FIG. 399A

Sept. 12, 1967

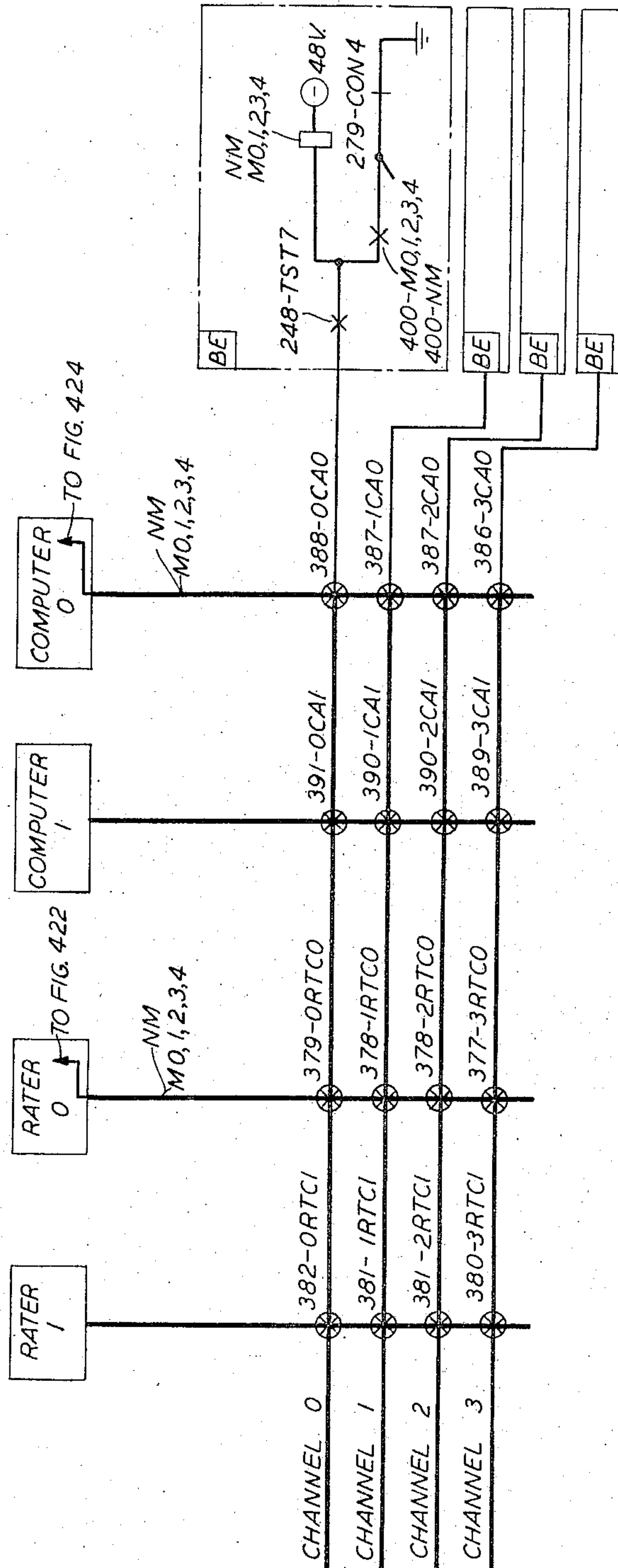
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 504

FIG. 400



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 505

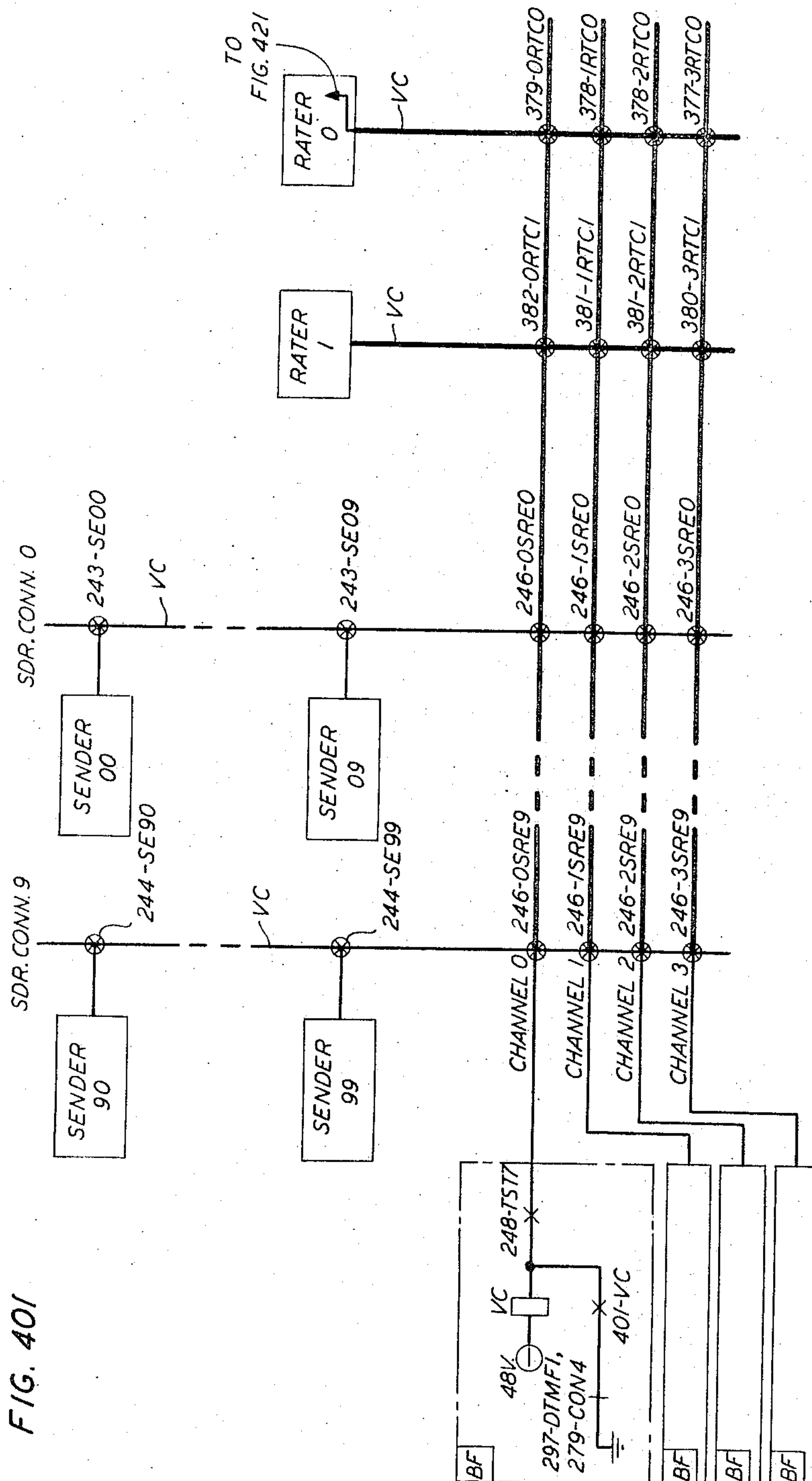


FIG. 401

Sept. 12, 1967

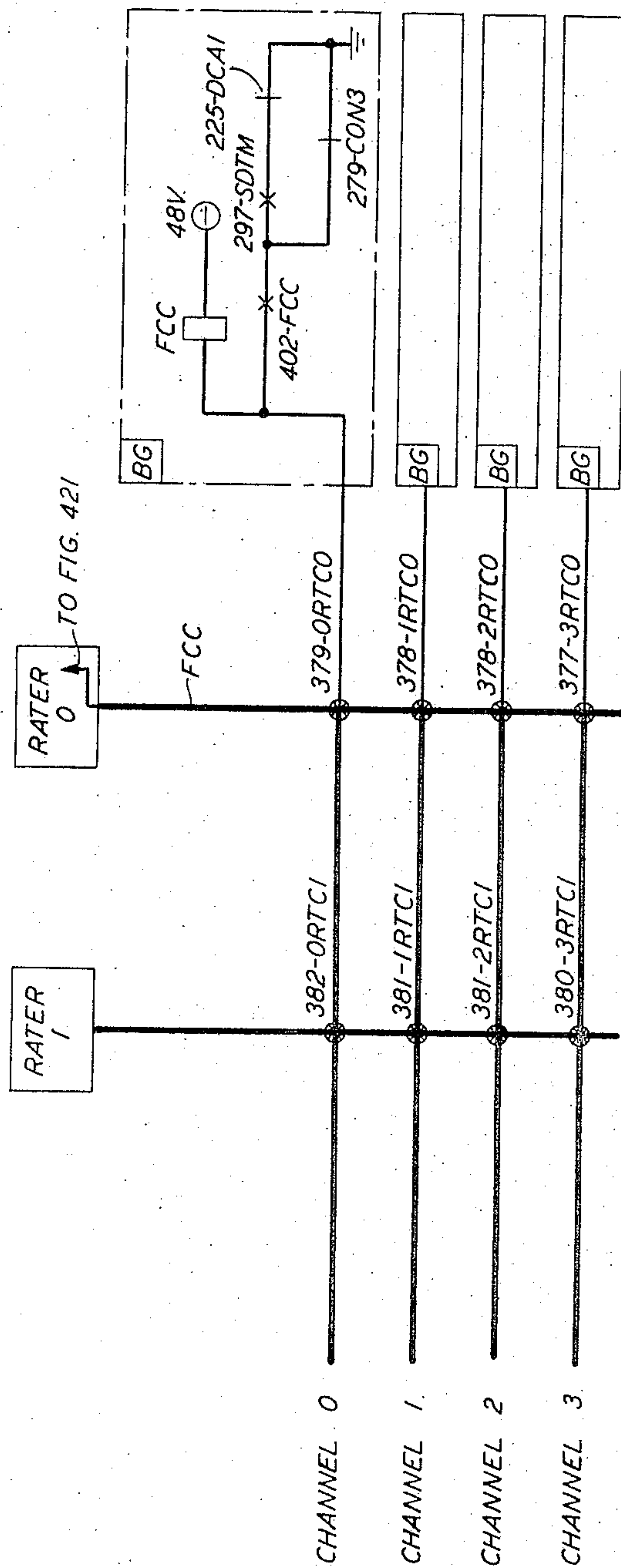
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 506

FIG. 402



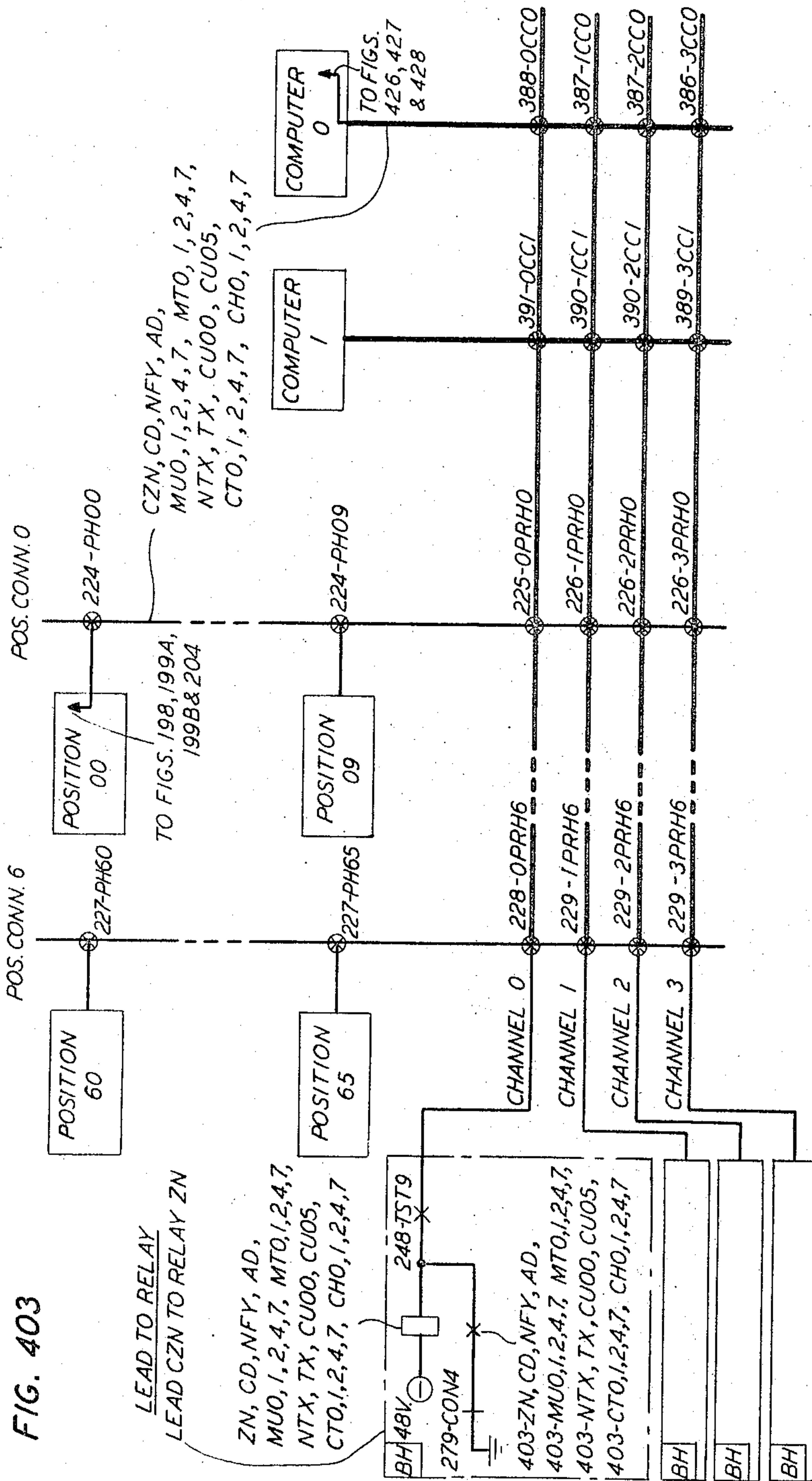
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 507



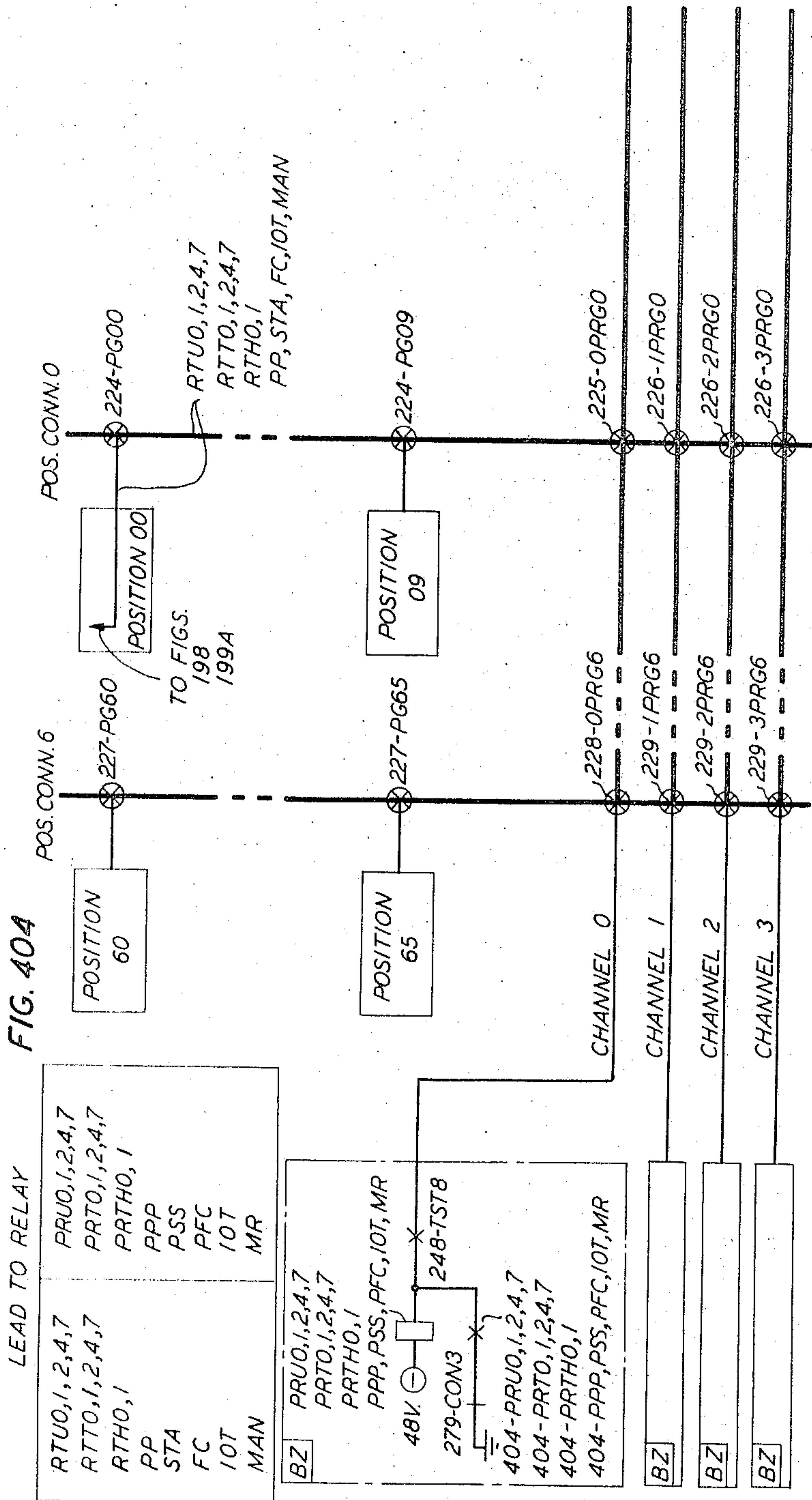
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 508



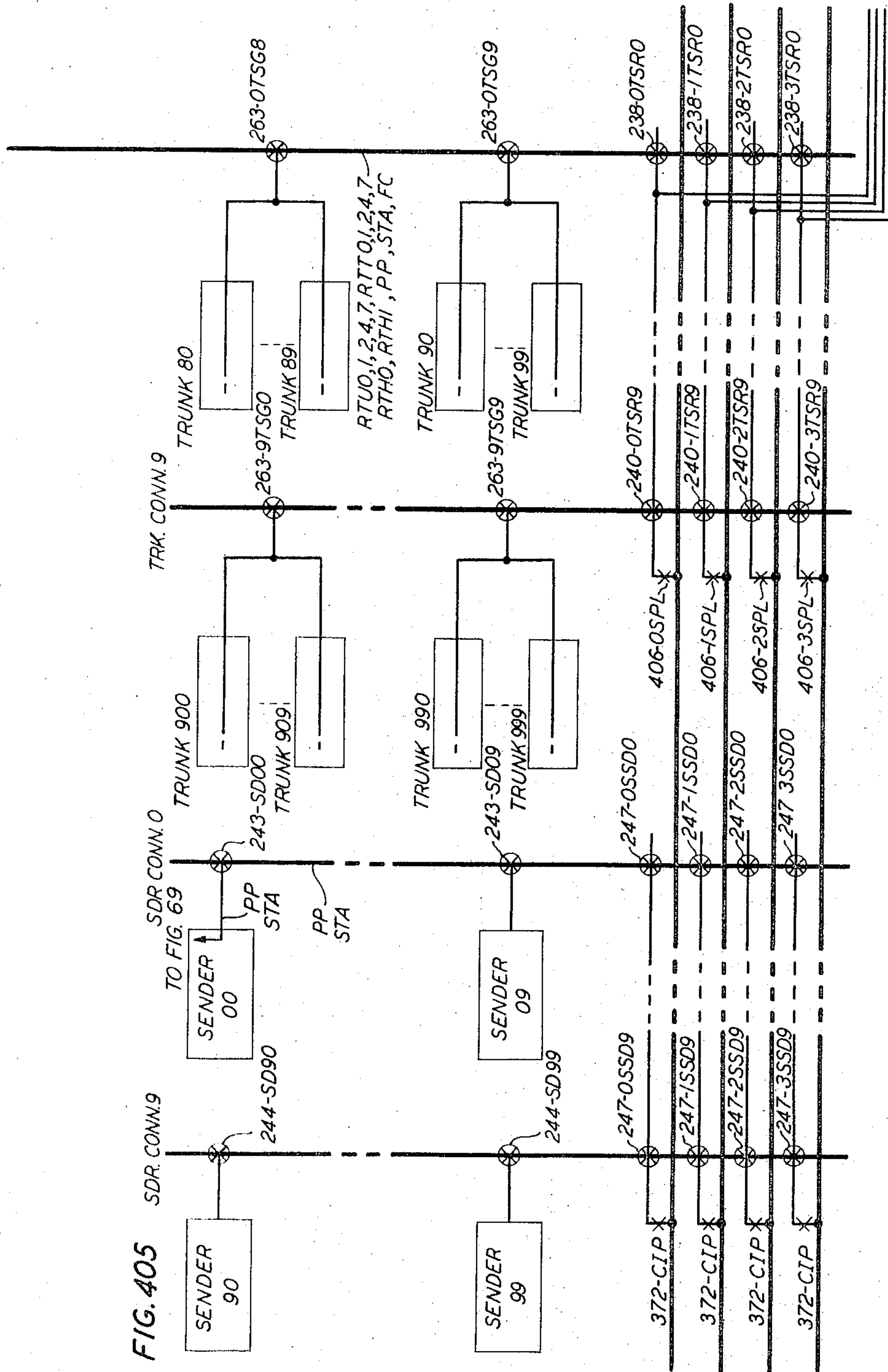
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 509



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 510

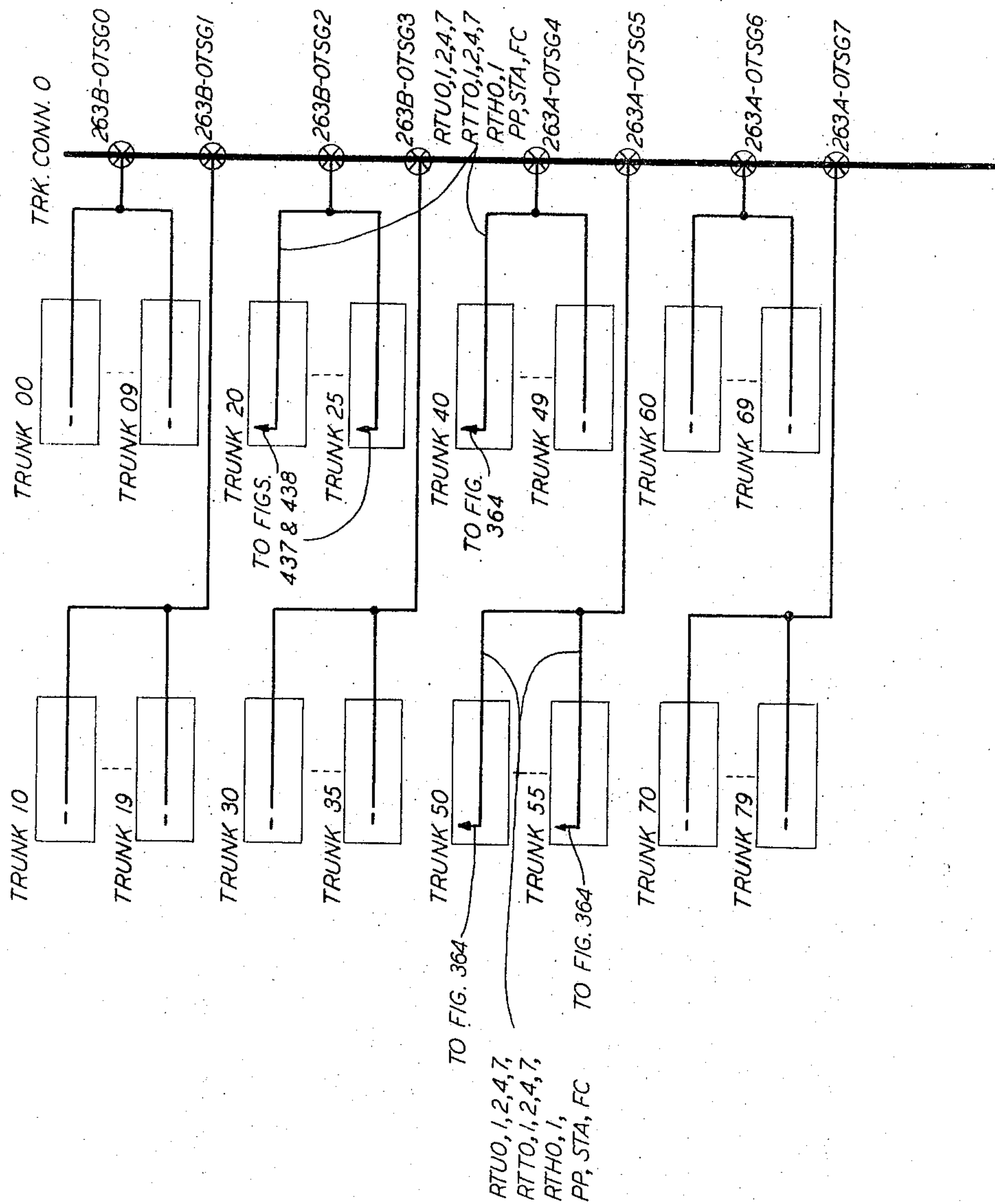


FIG. 405A

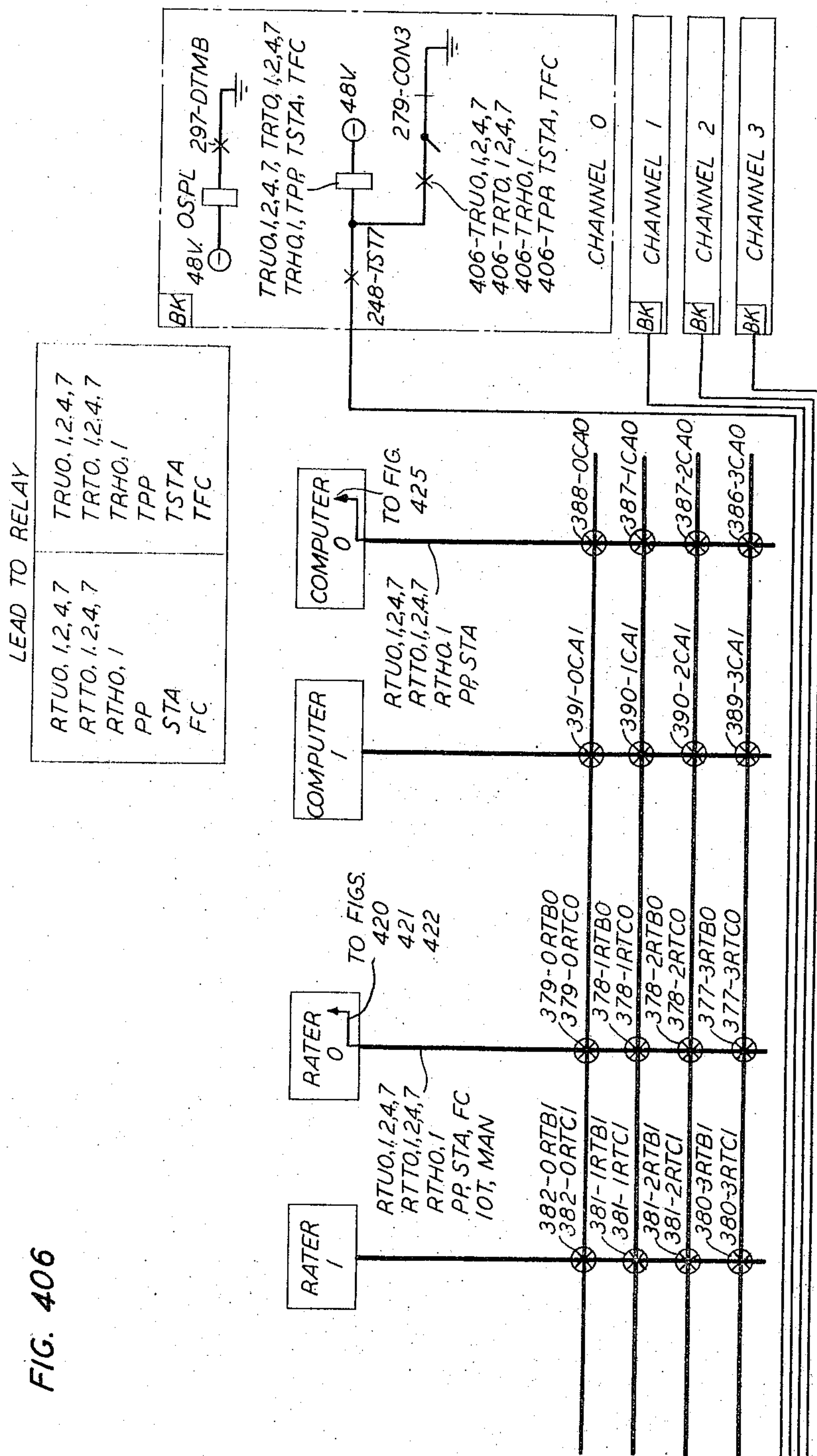
Sept. 12, 1967

L. J. CERNY ET AL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 511



Sept. 12, 1967

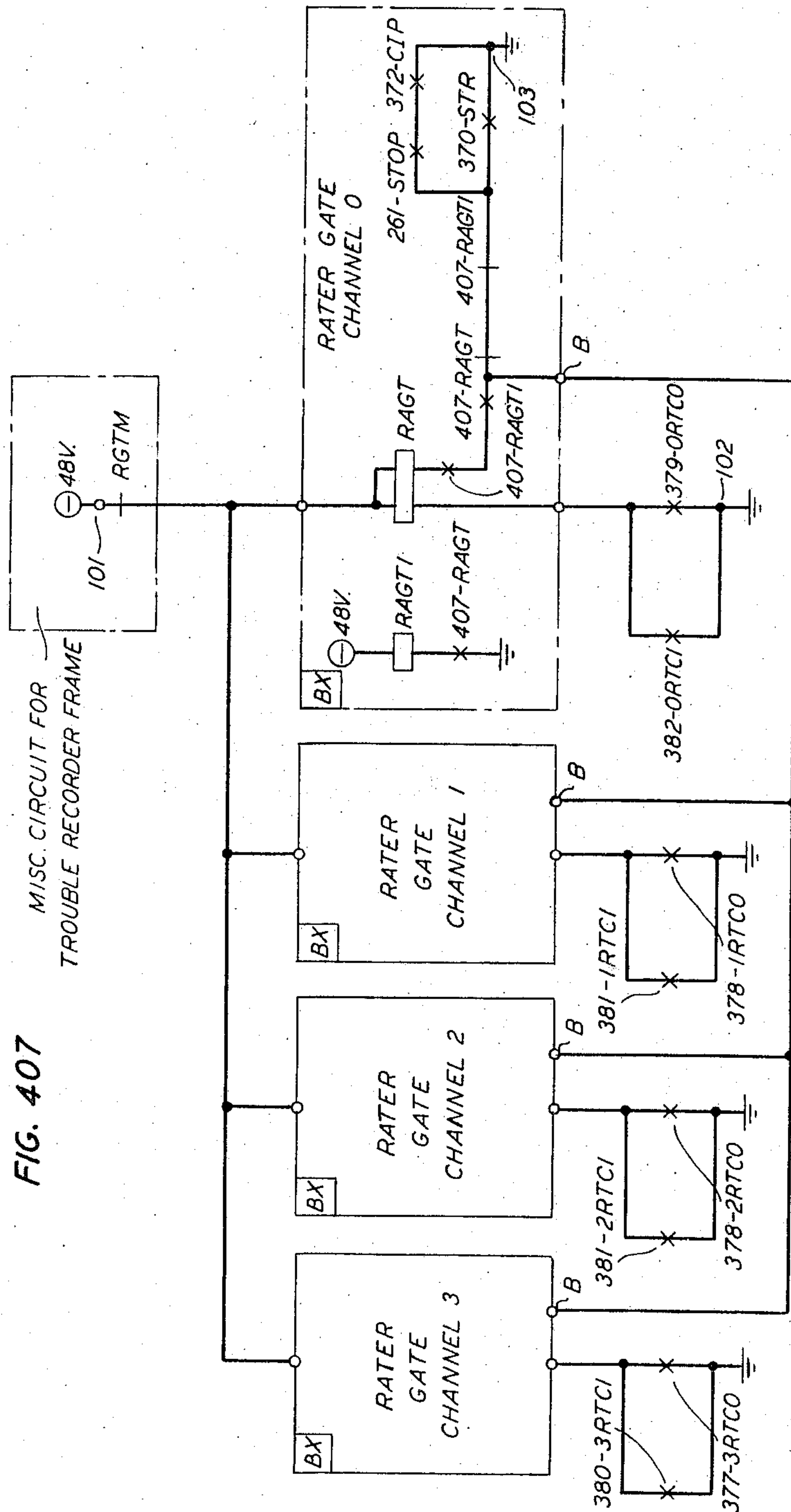
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 512

FIG. 407



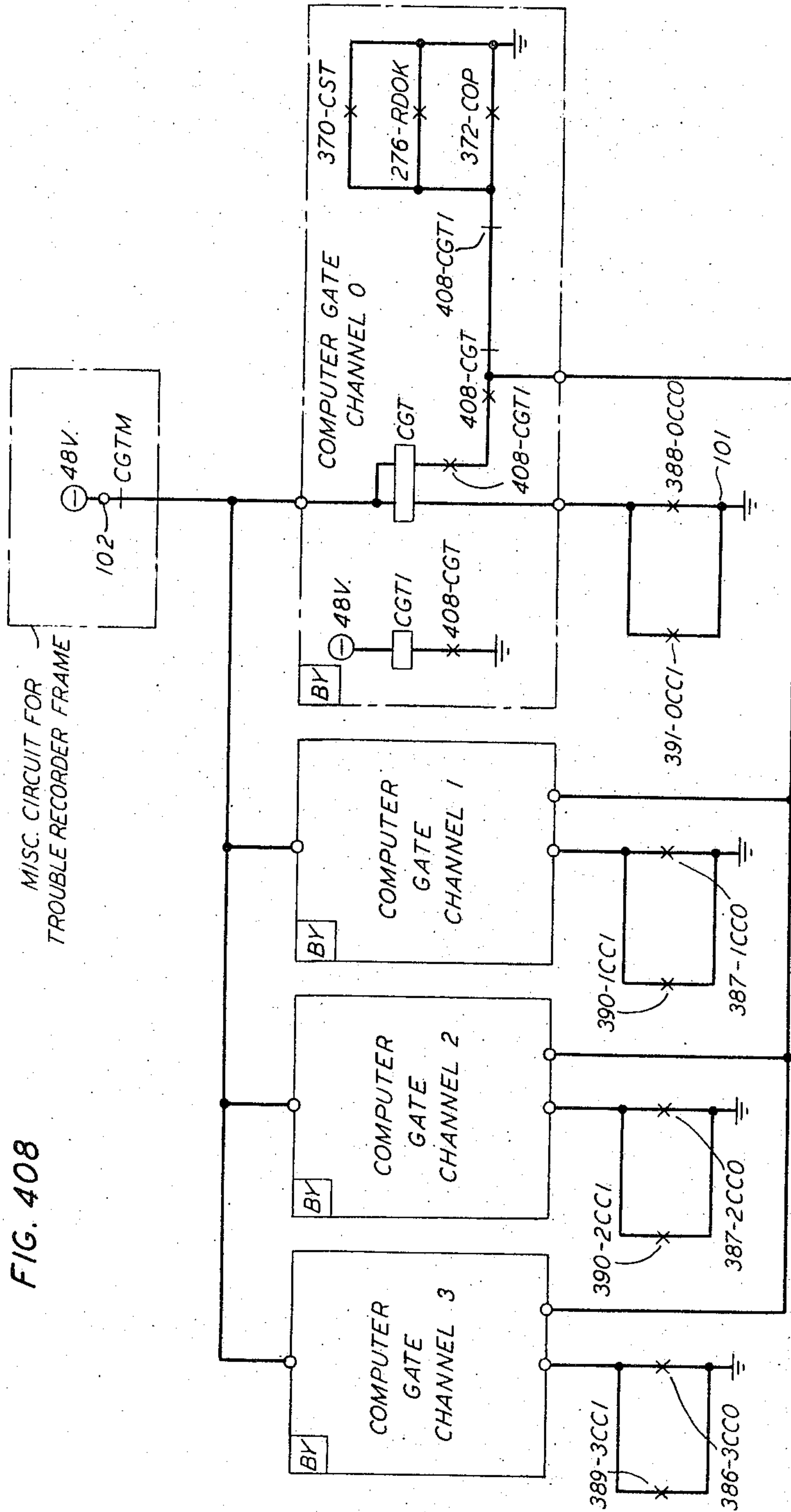
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 513



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 514

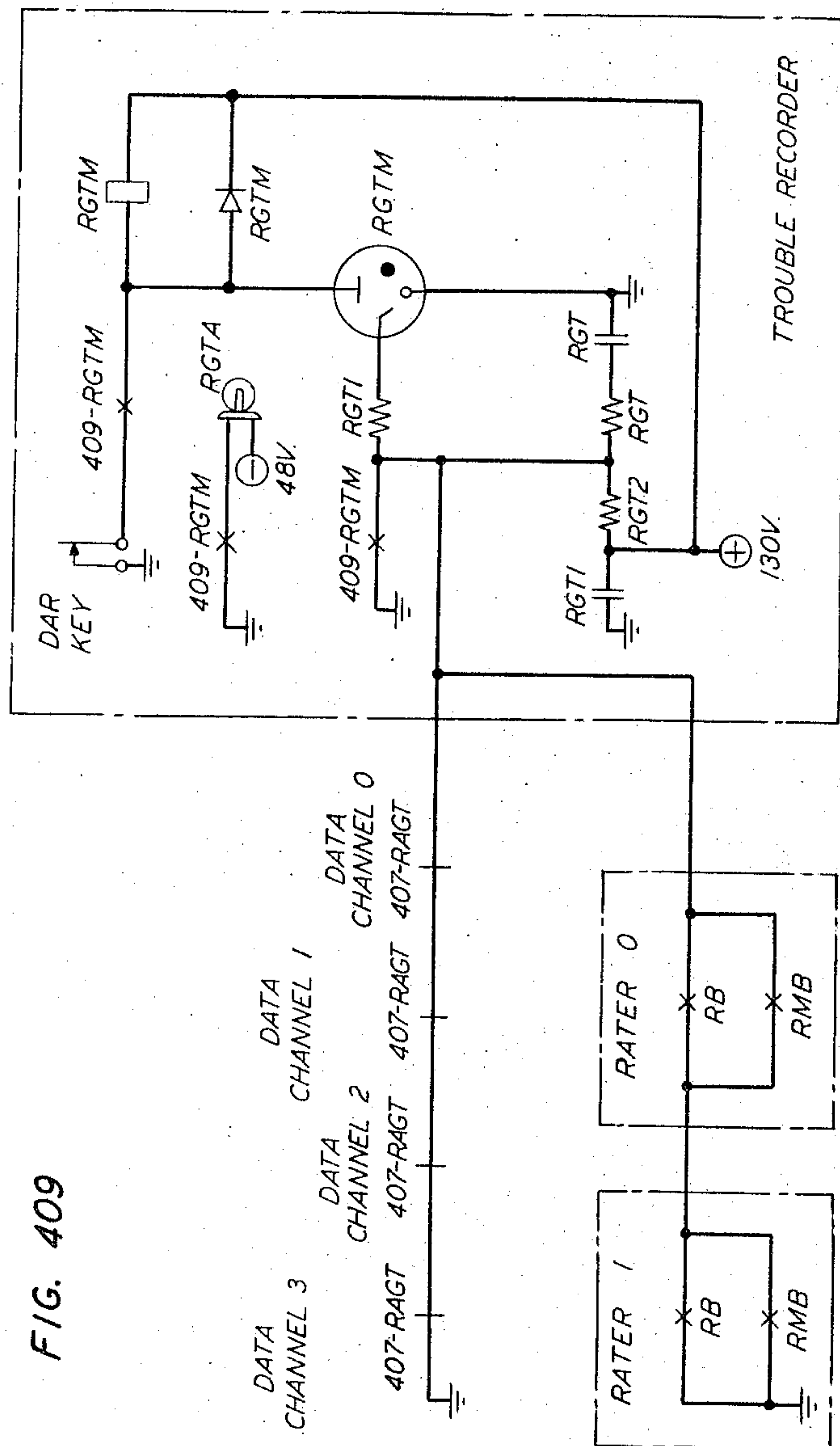


FIG. 409

Sept. 12, 1967

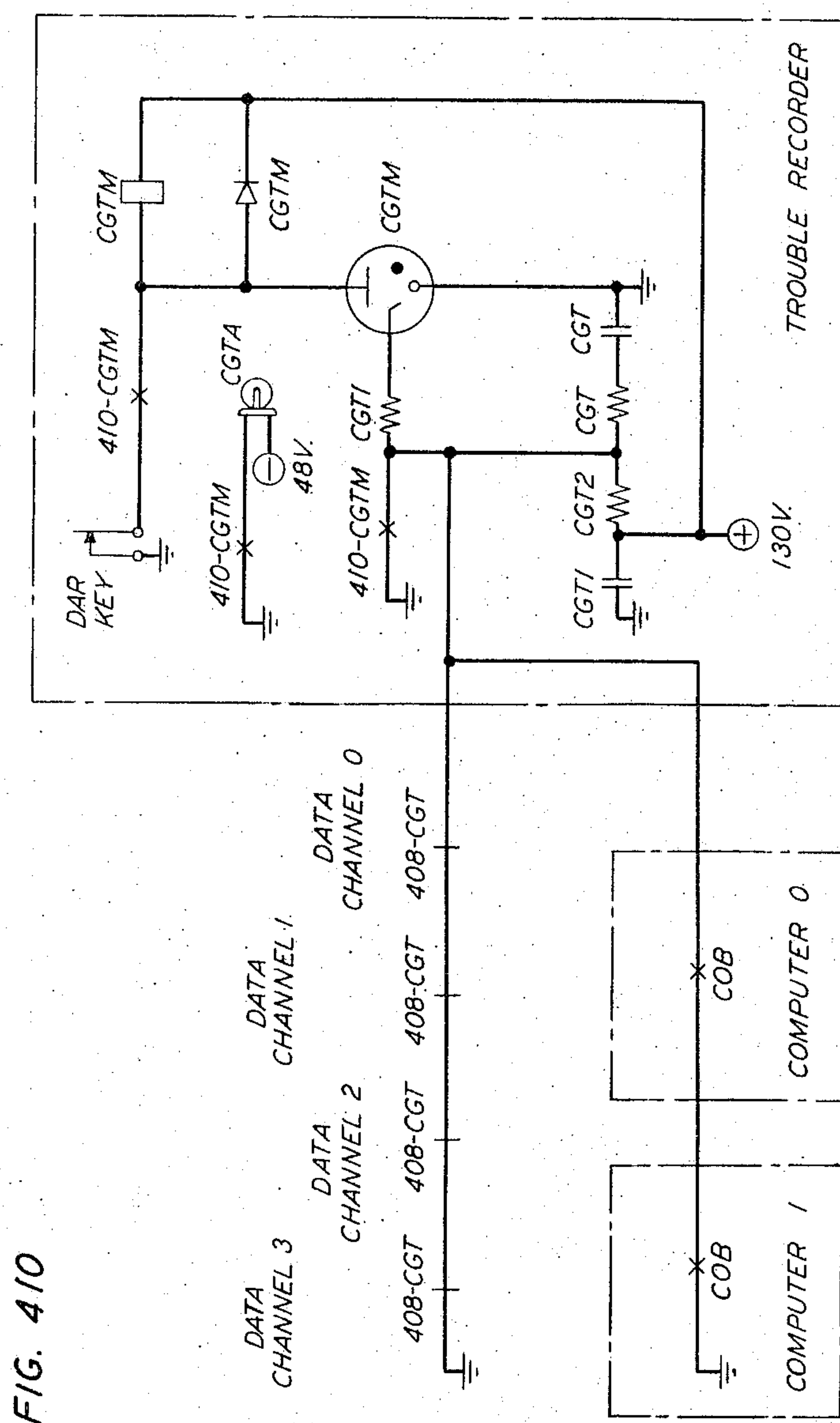
L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 515



Sept. 12, 1967

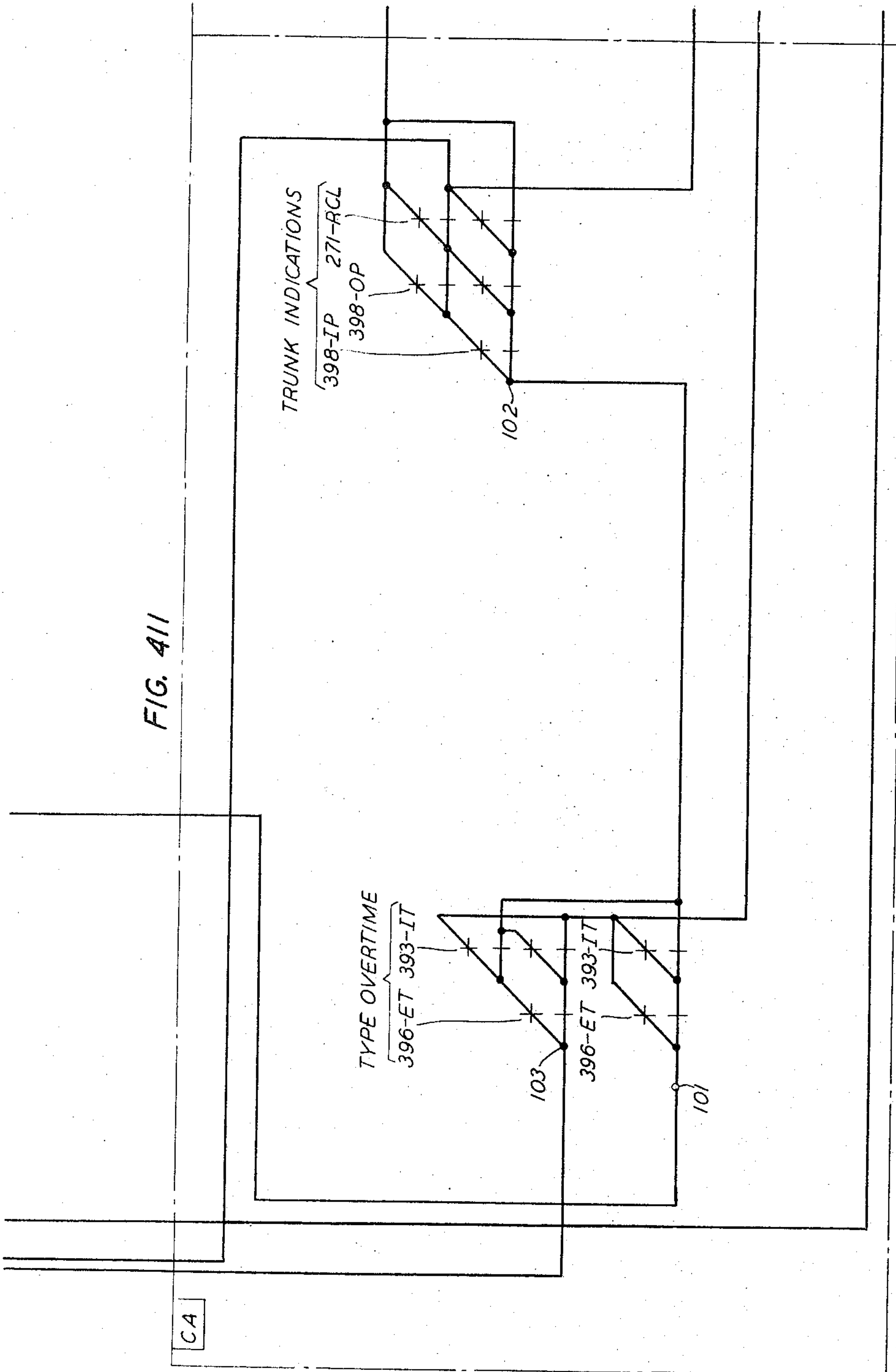
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 516

FIG. 411



Sept. 12, 1967

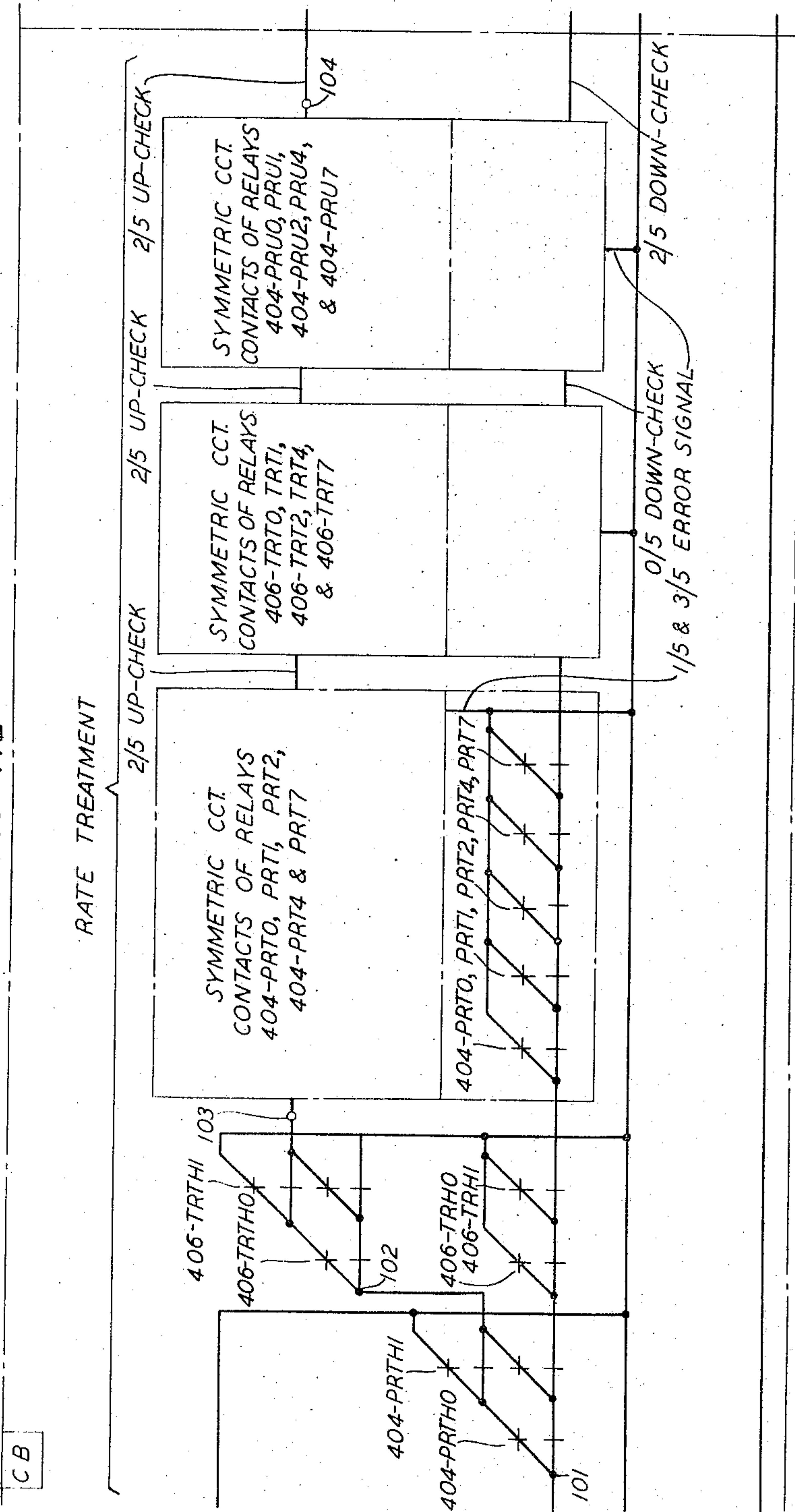
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 517

FIG. 412



Sept. 12, 1967

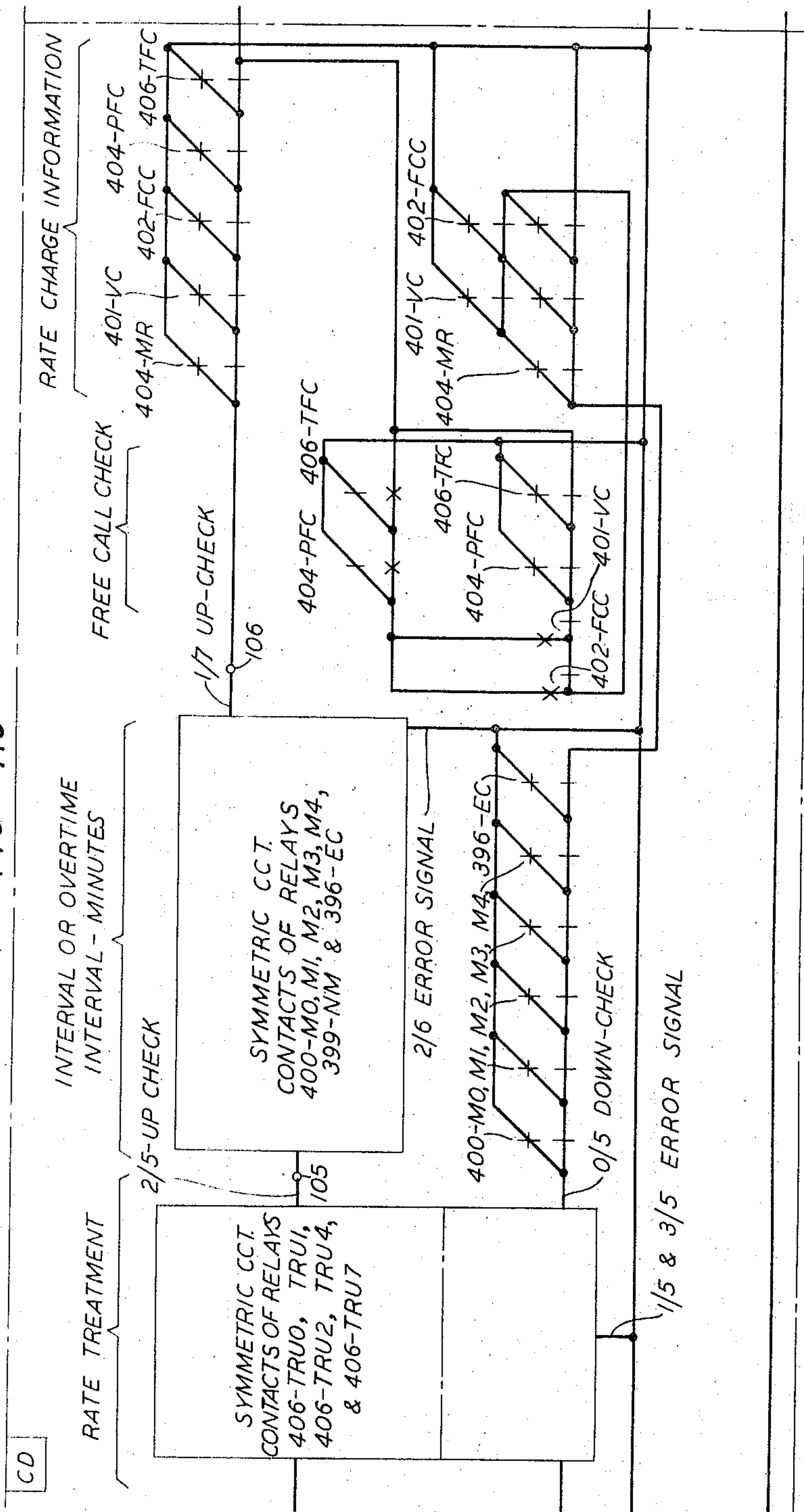
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 518

FIG. 413



Sept. 12, 1967

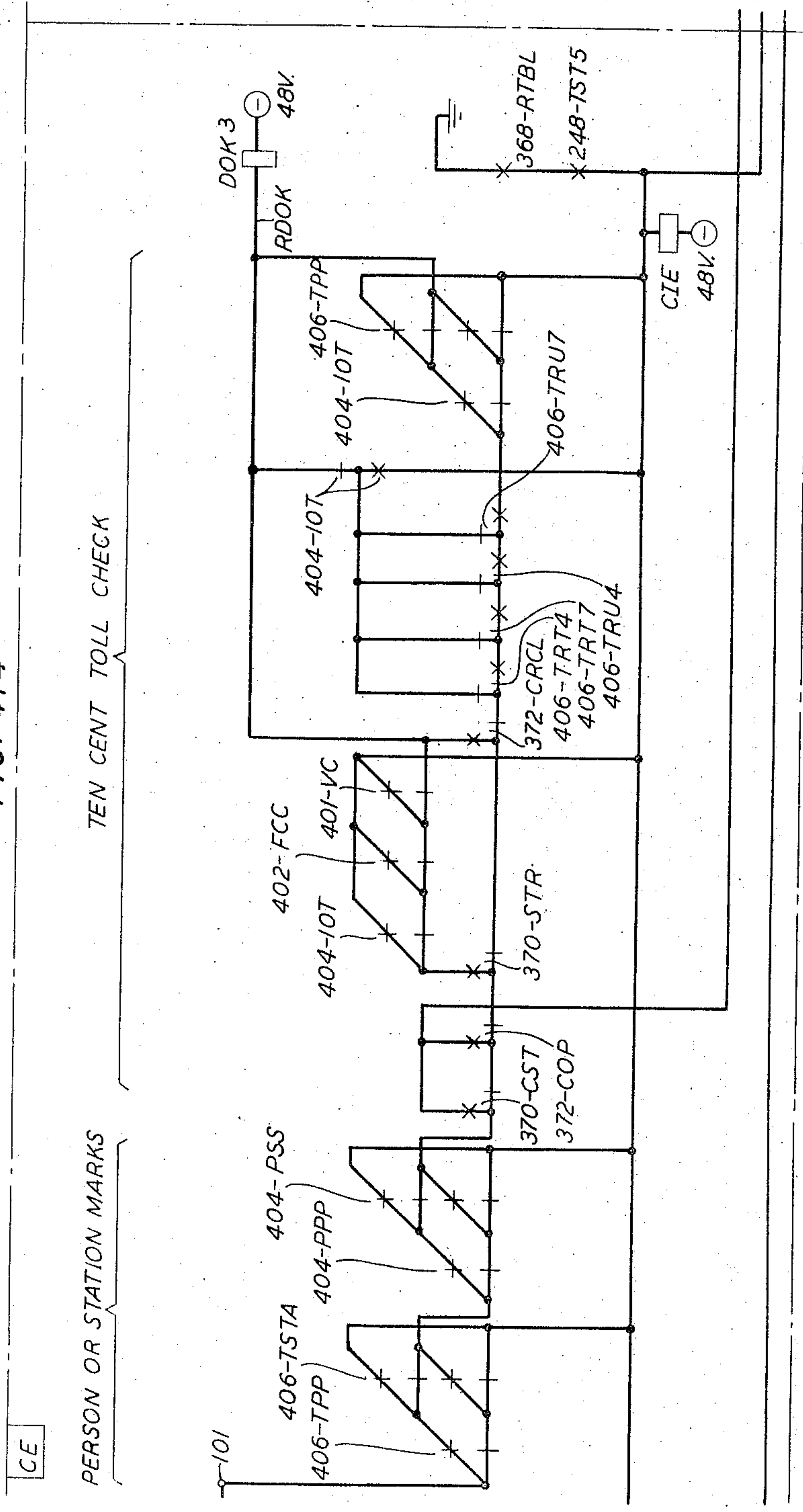
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 519

FIG. 414



Sept. 12, 1967

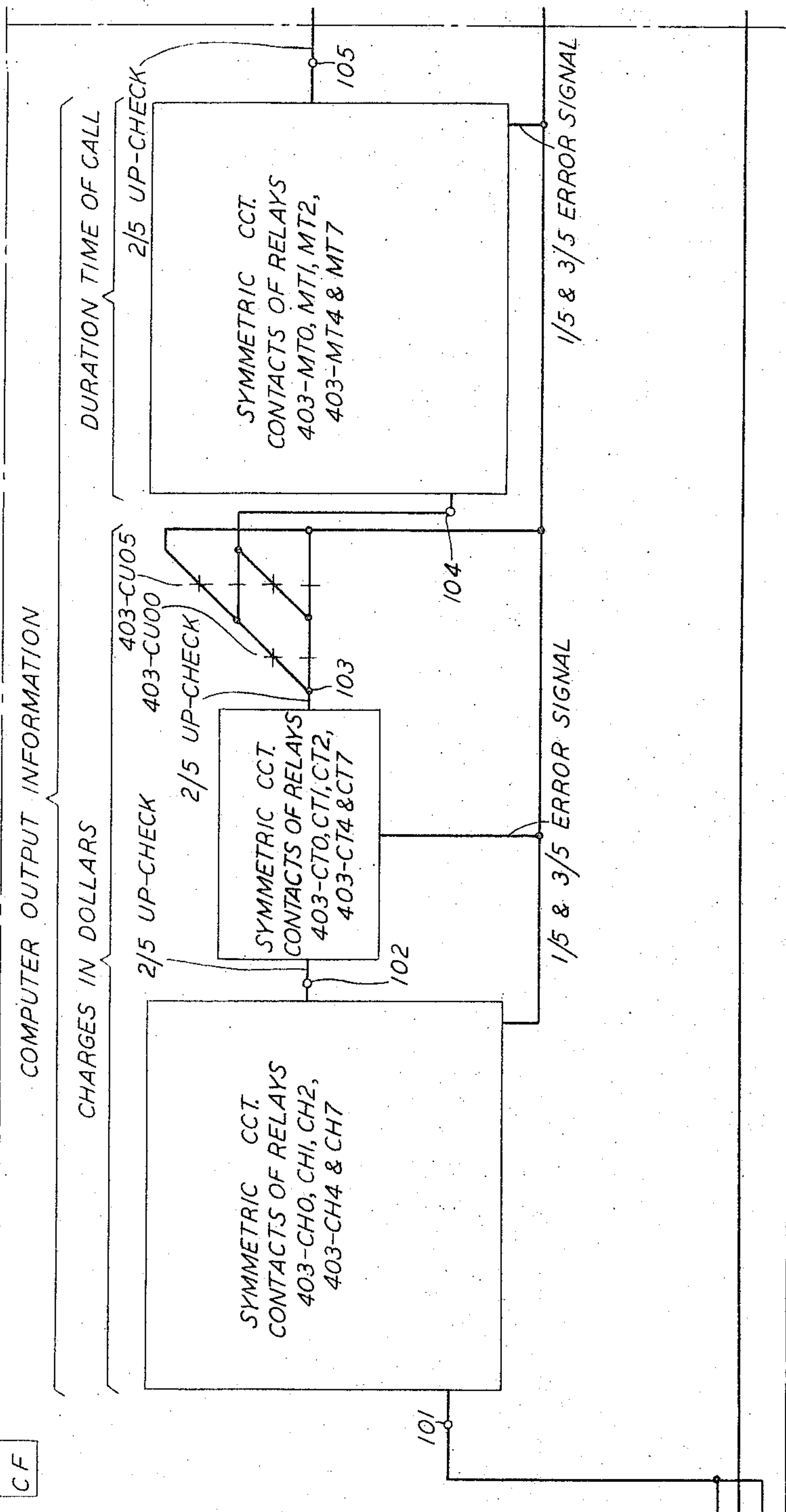
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 520

FIG. 4/5



Sept. 12, 1967

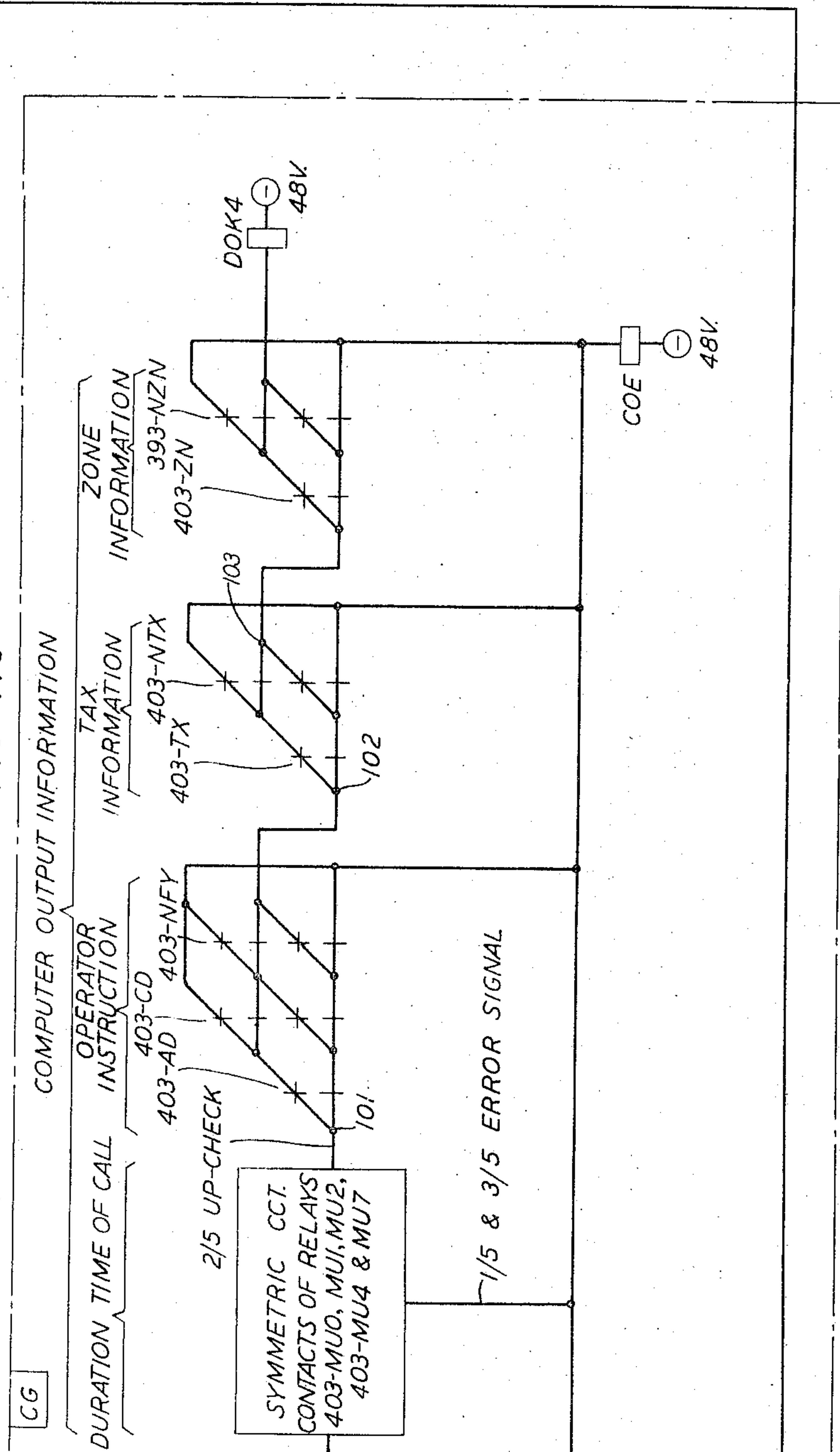
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 521

FIG. 416



Sept. 12, 1967

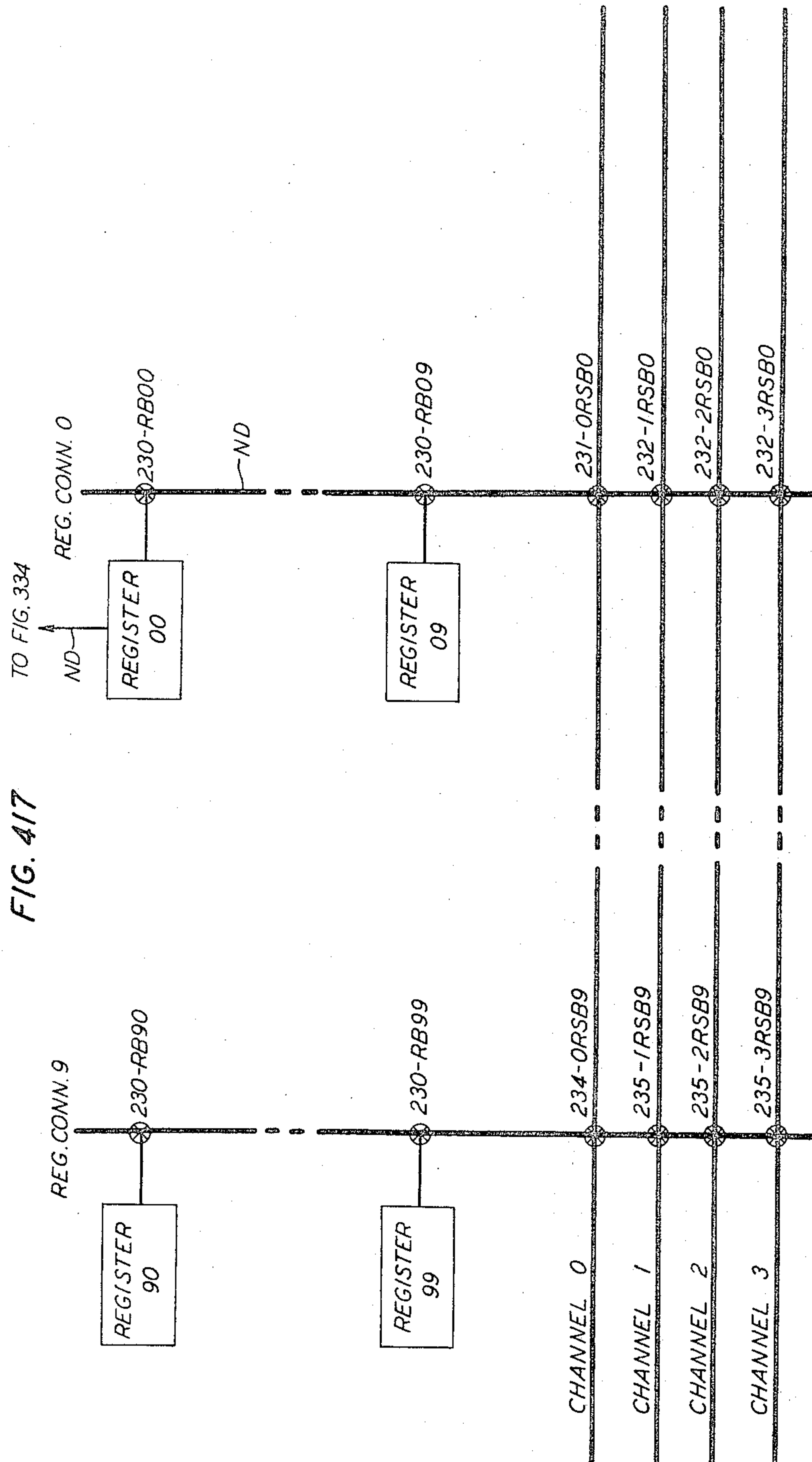
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 522

FIG. 417



Sept. 12, 1967

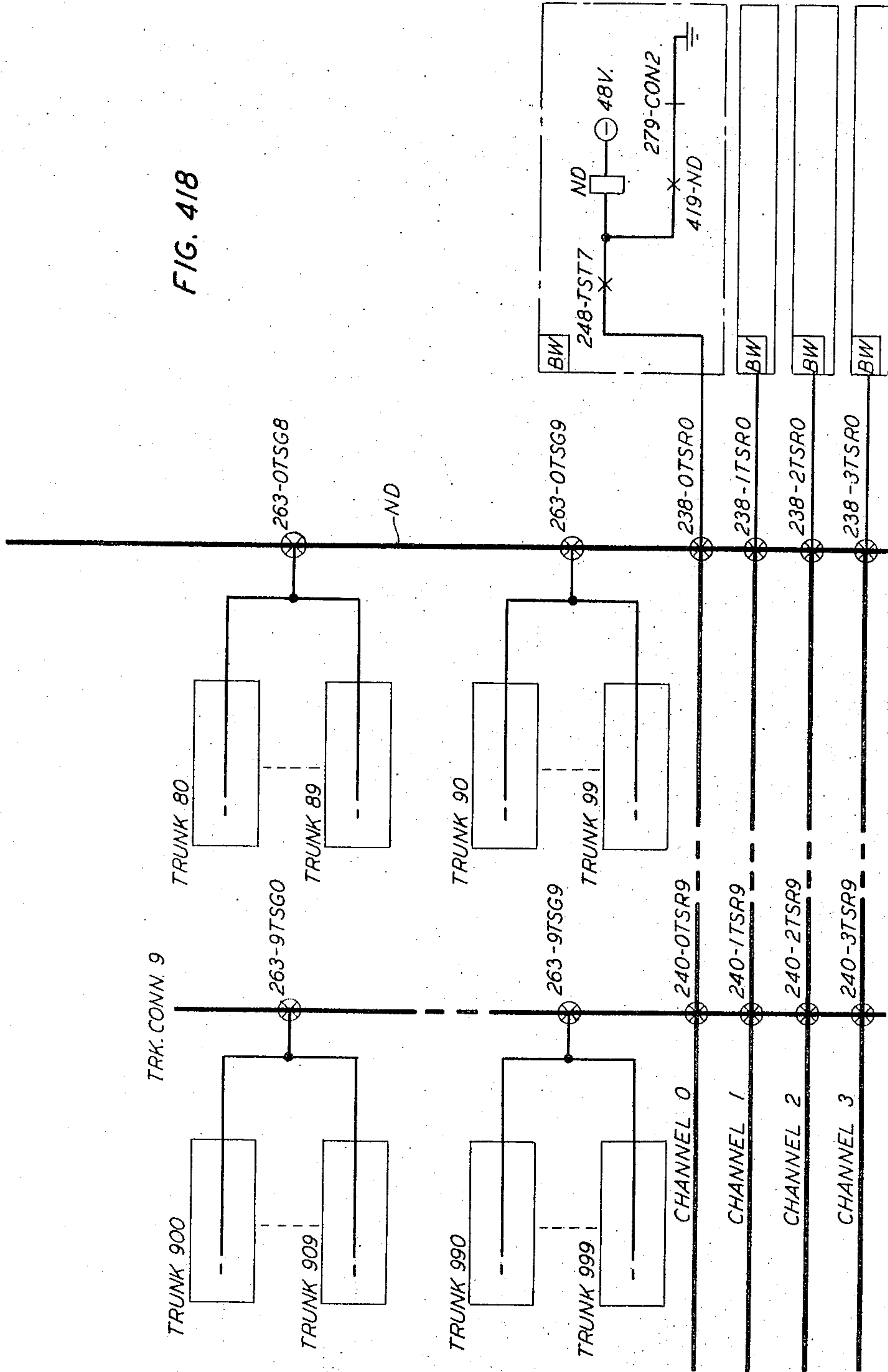
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 523

FIG. 418



Sept. 12, 1967

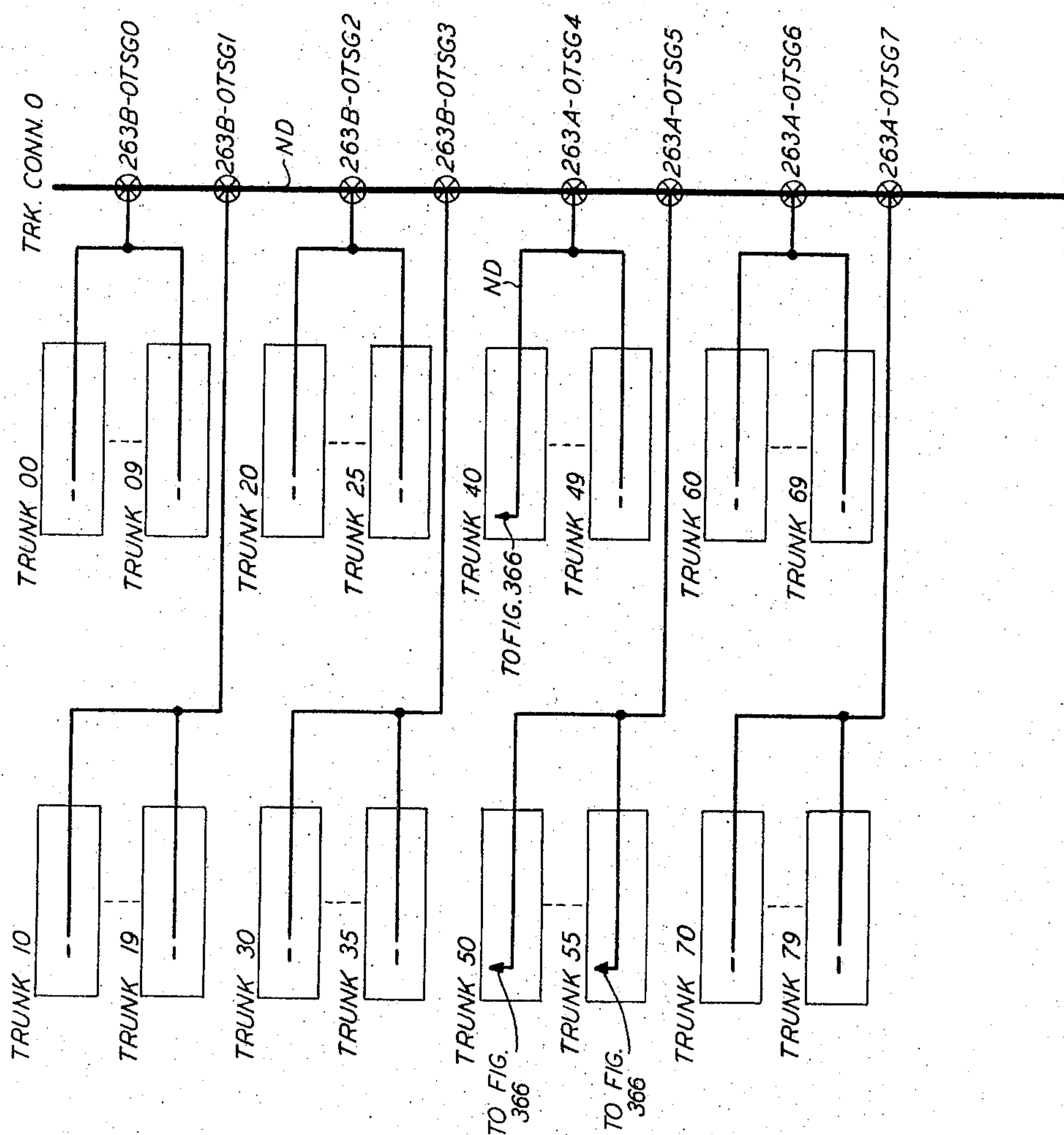
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 524

FIG. 4/8A



Sept. 12, 1967

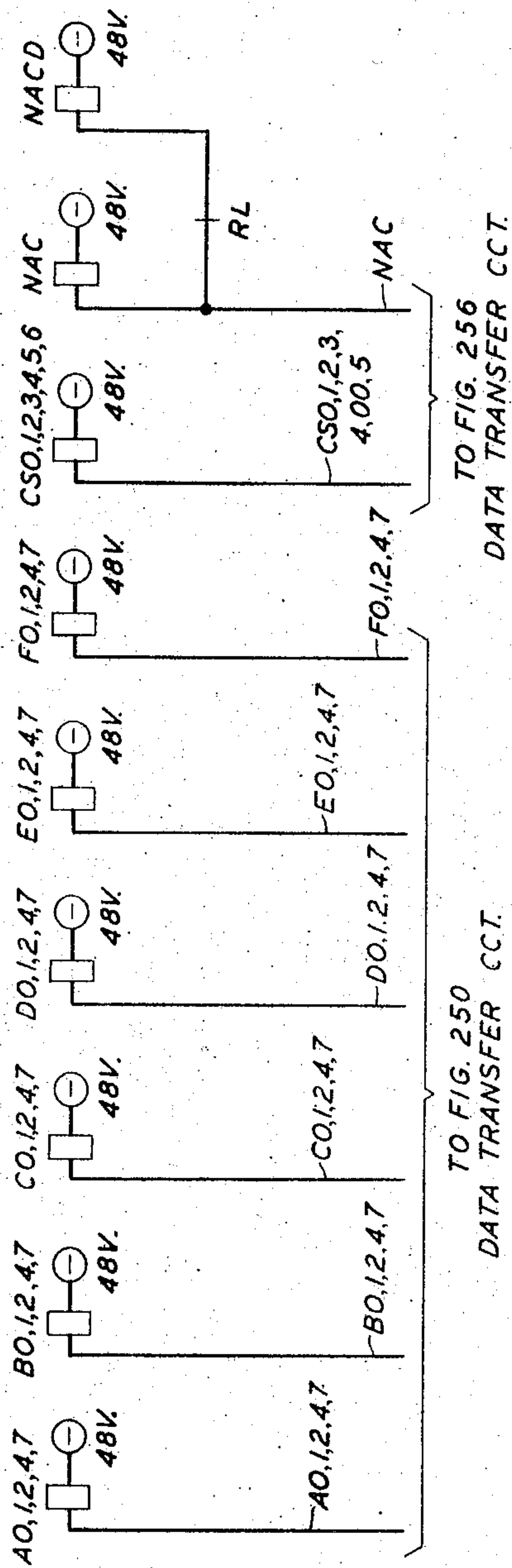
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 525

FIG. 4/9



Sept. 12, 1967

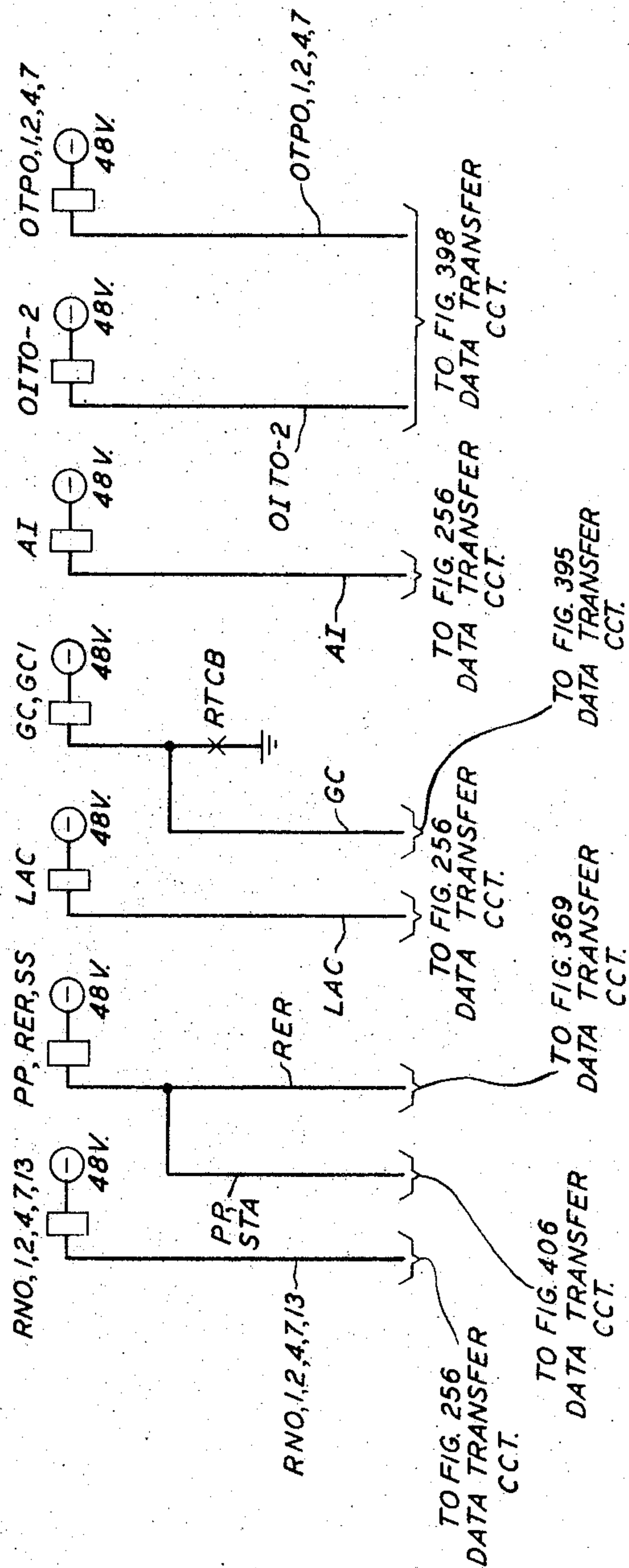
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 526

FIG. 420



Sept. 12, 1967

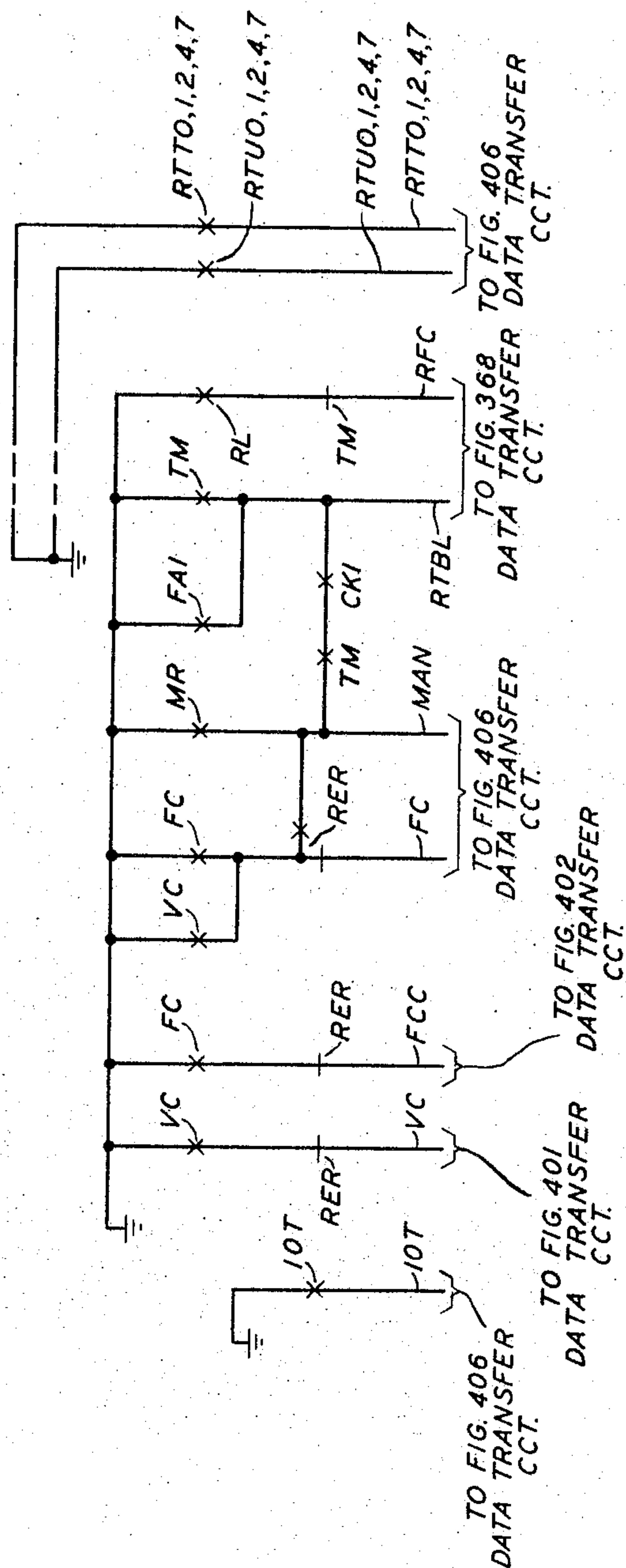
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 527

FIG. 421



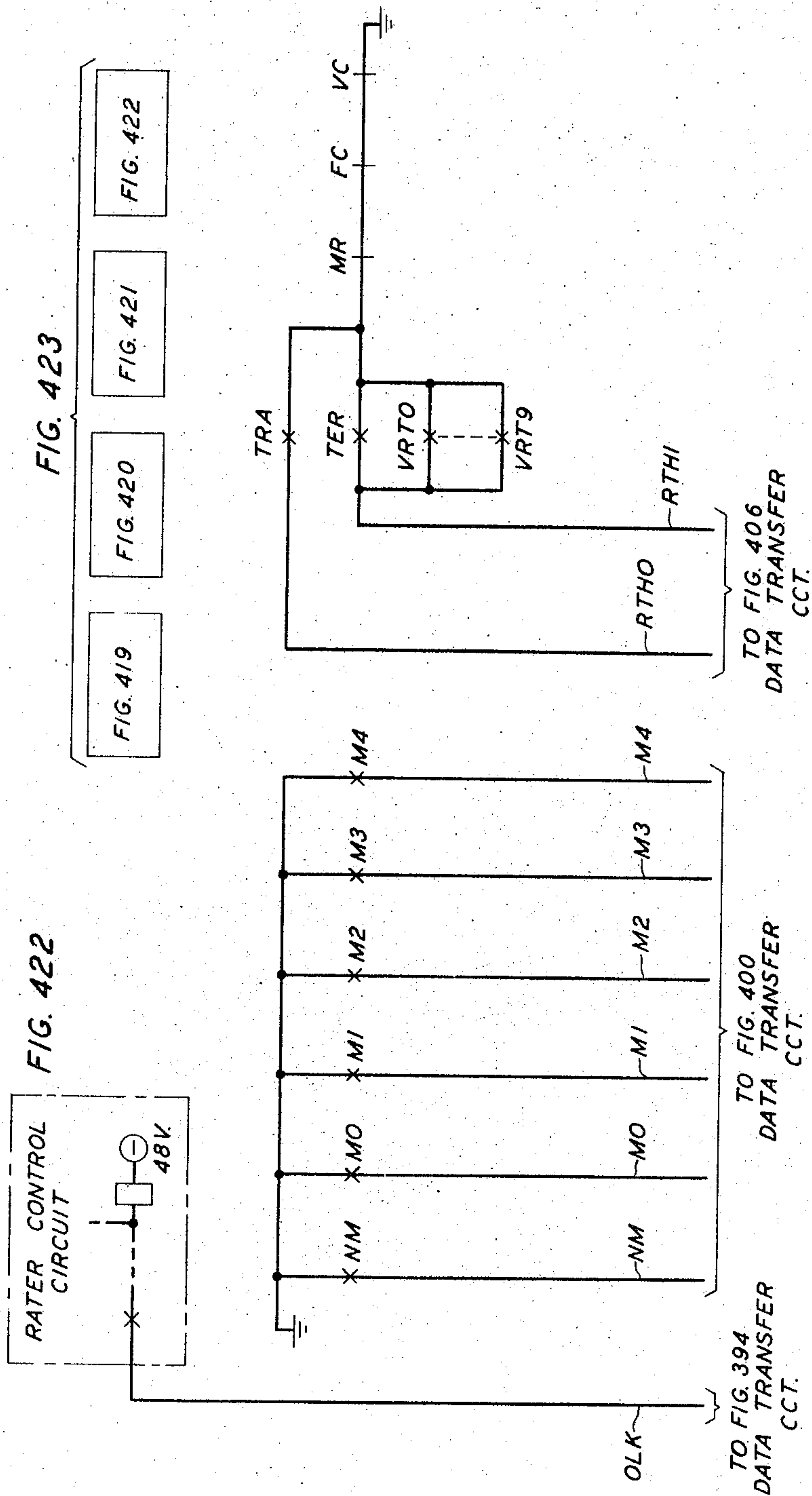
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 528



Sept. 12, 1967

L. J. CERNY ETAL

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

Filed Nov. 26, 1963

570 Sheets-Sheet 529

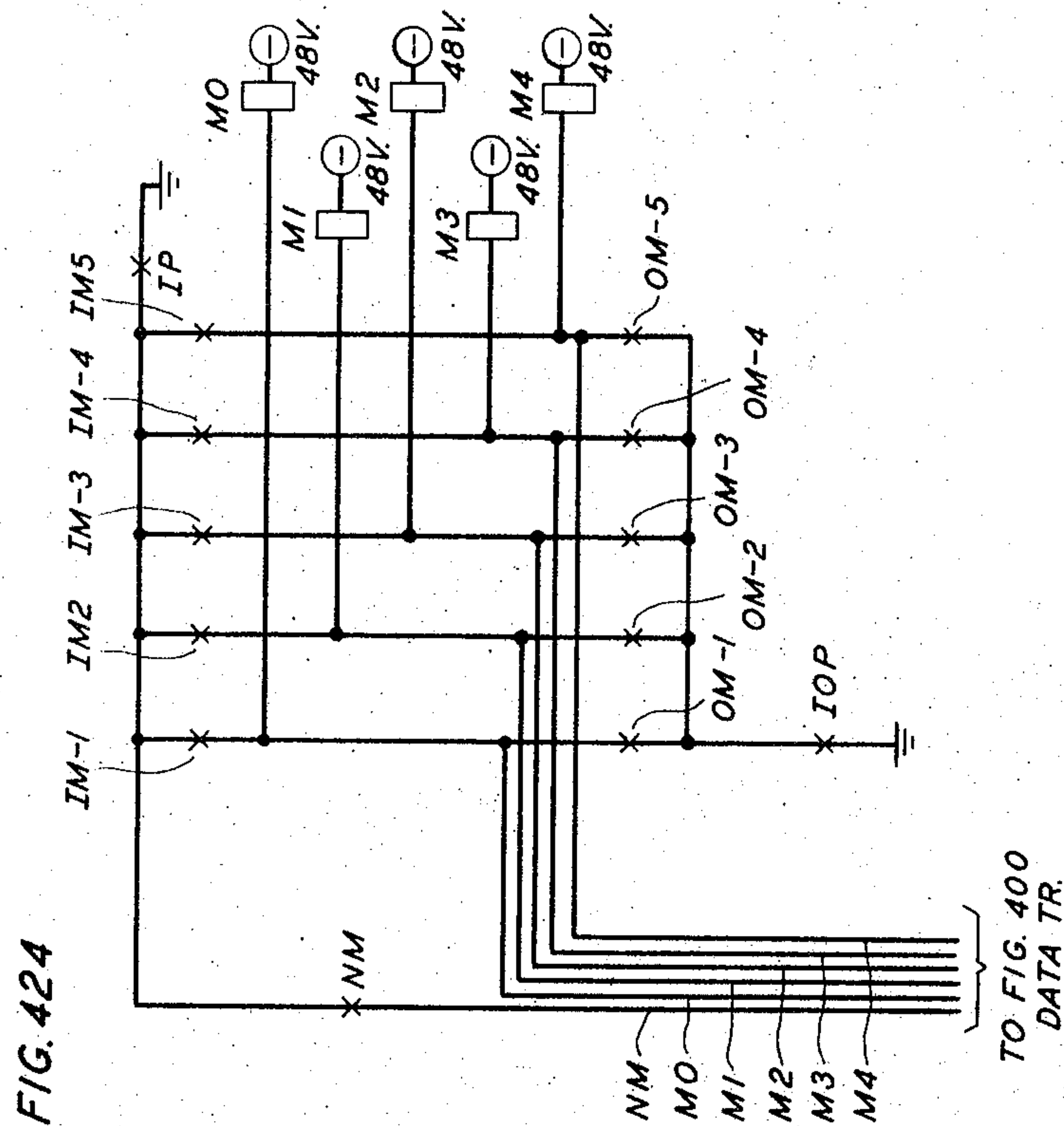
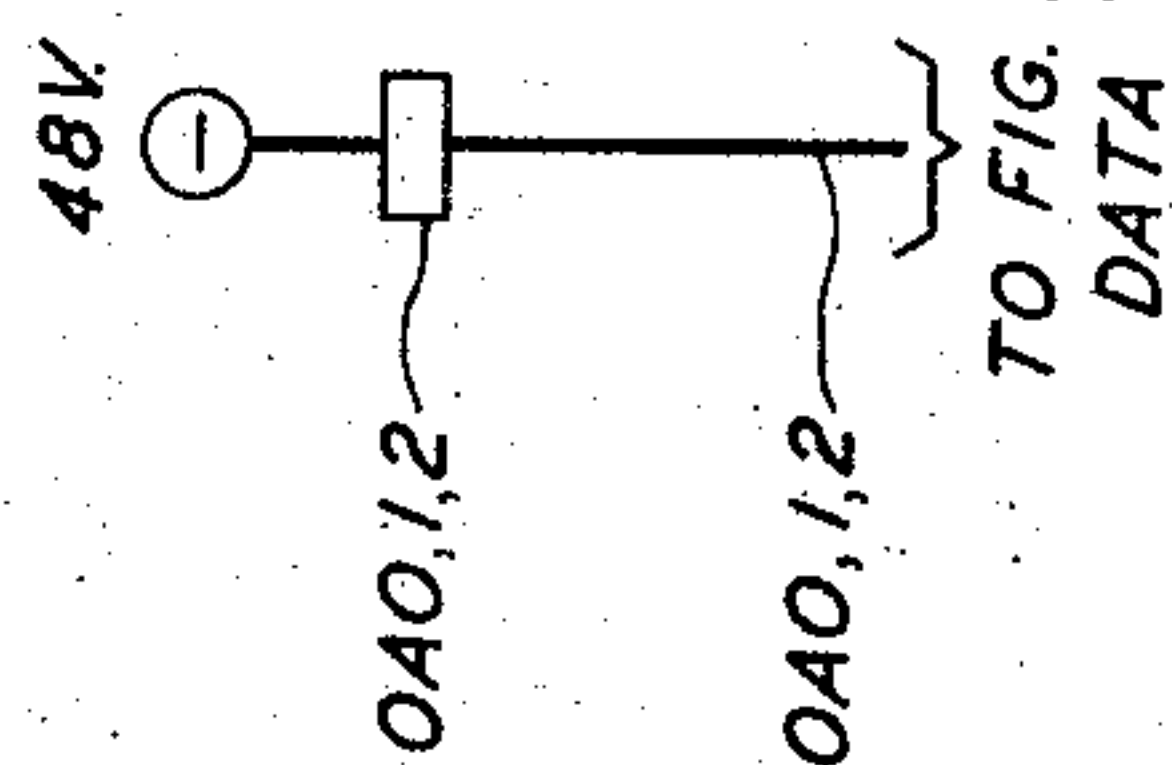
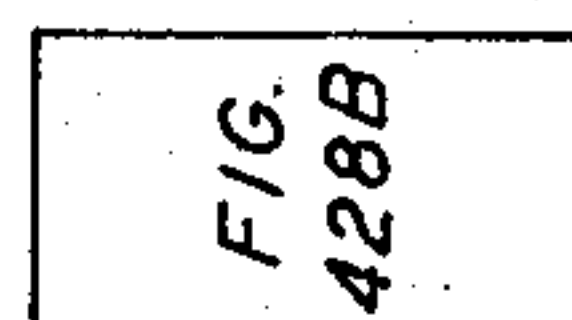
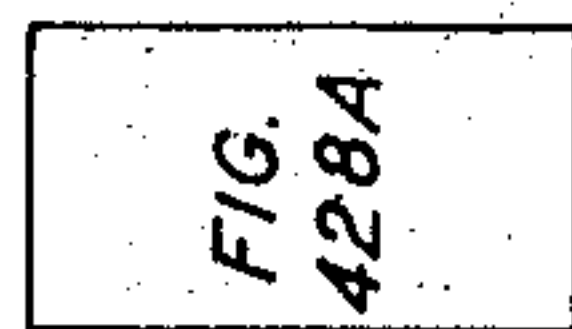
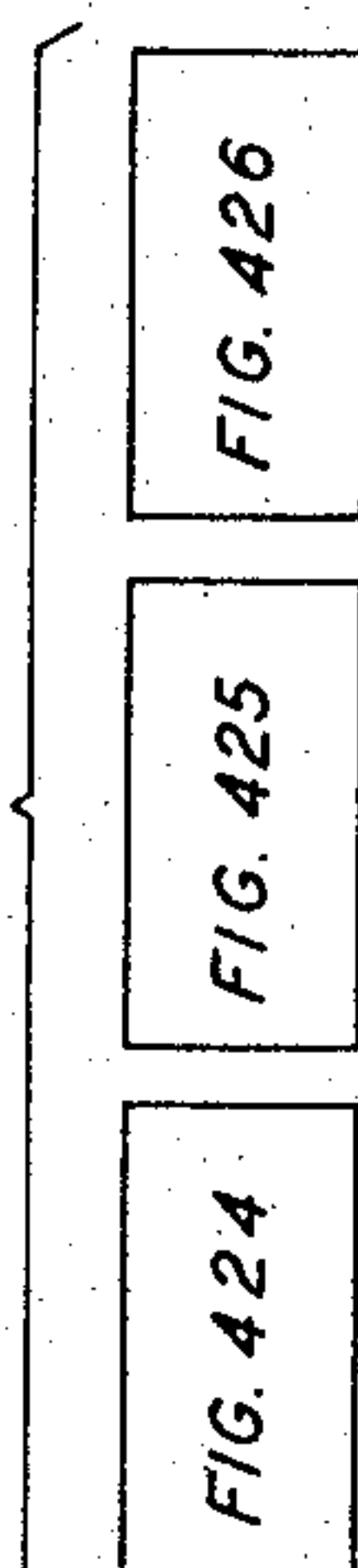


FIG. 428C



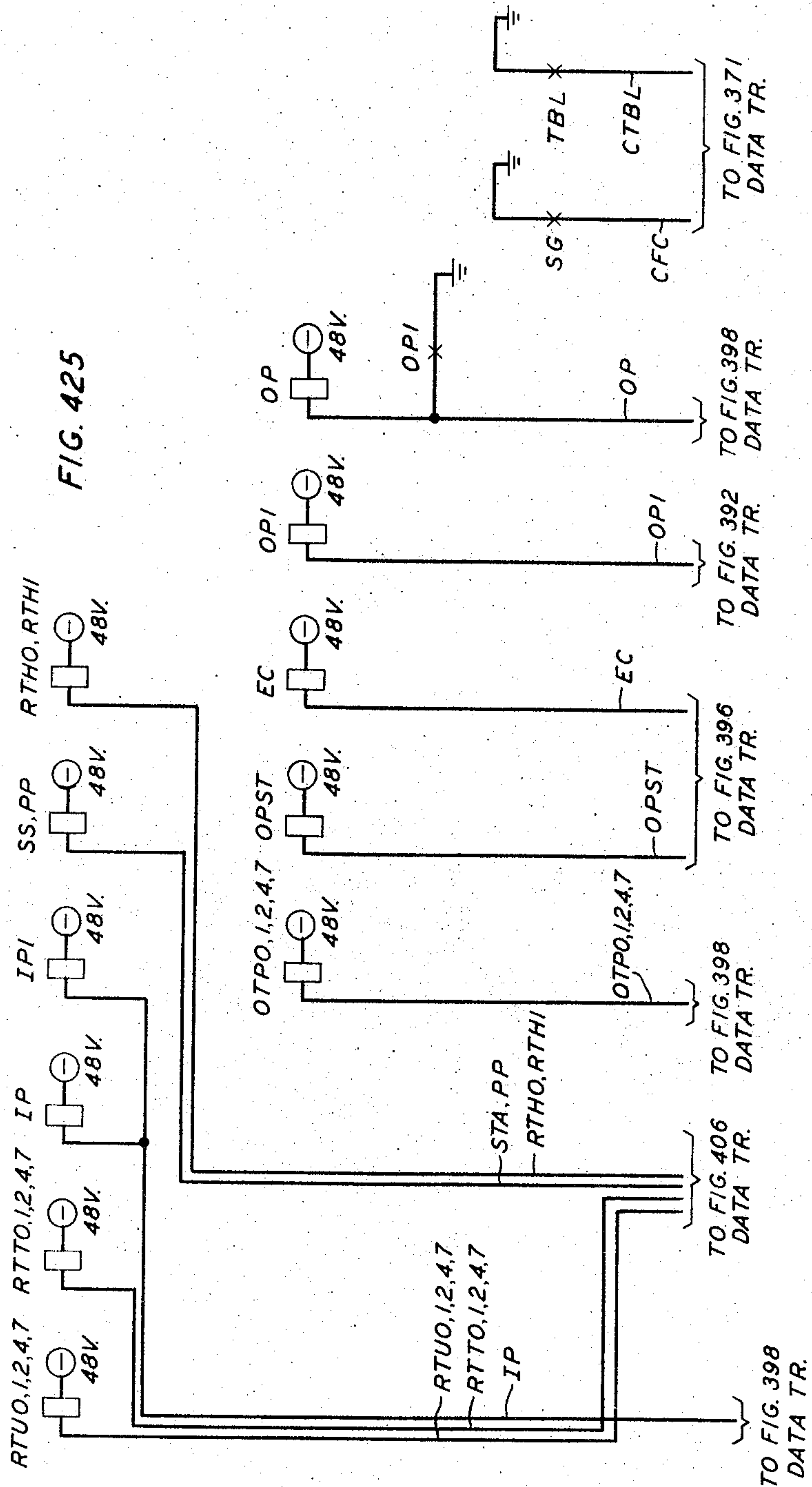
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 530



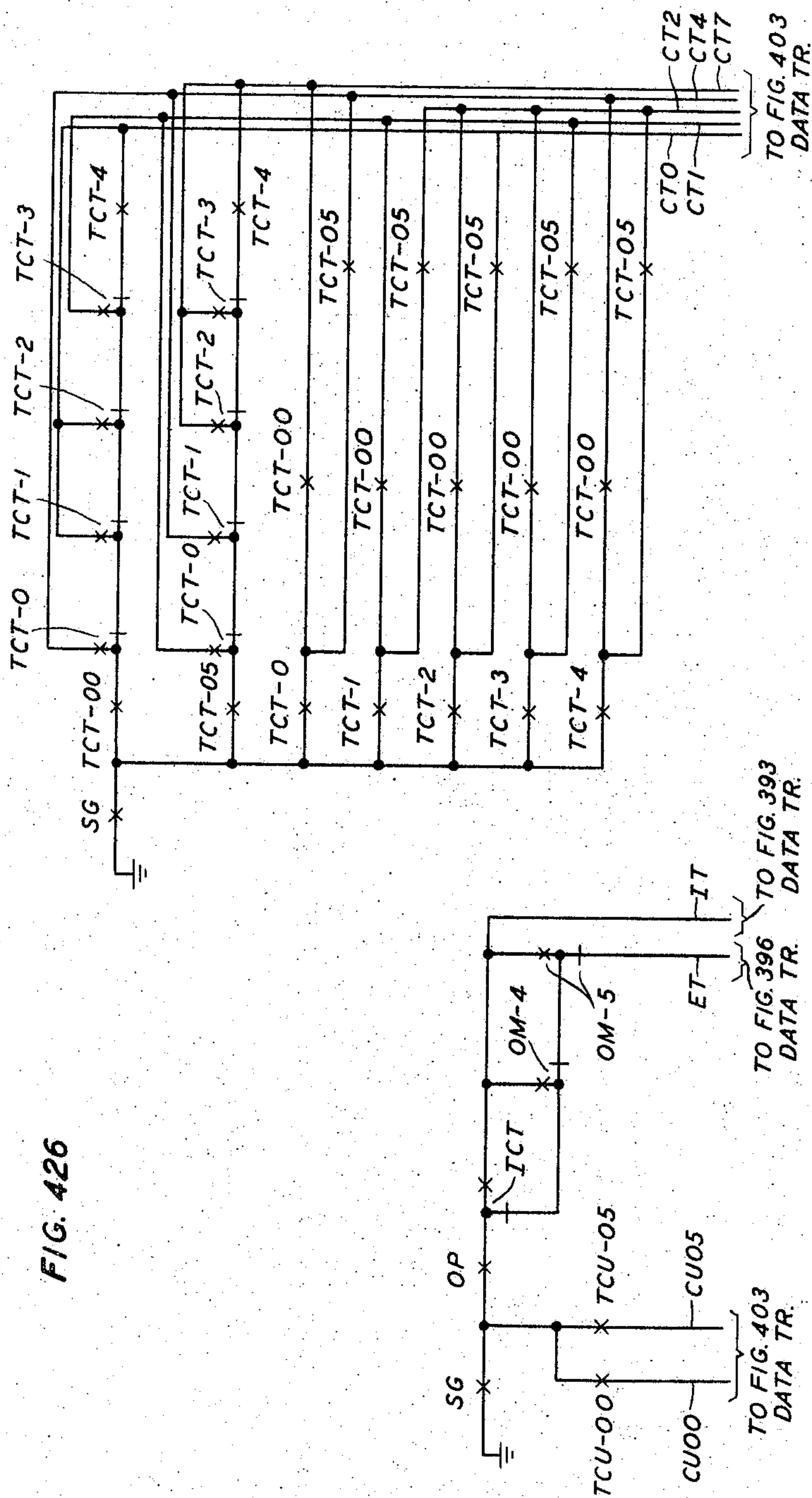
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 531



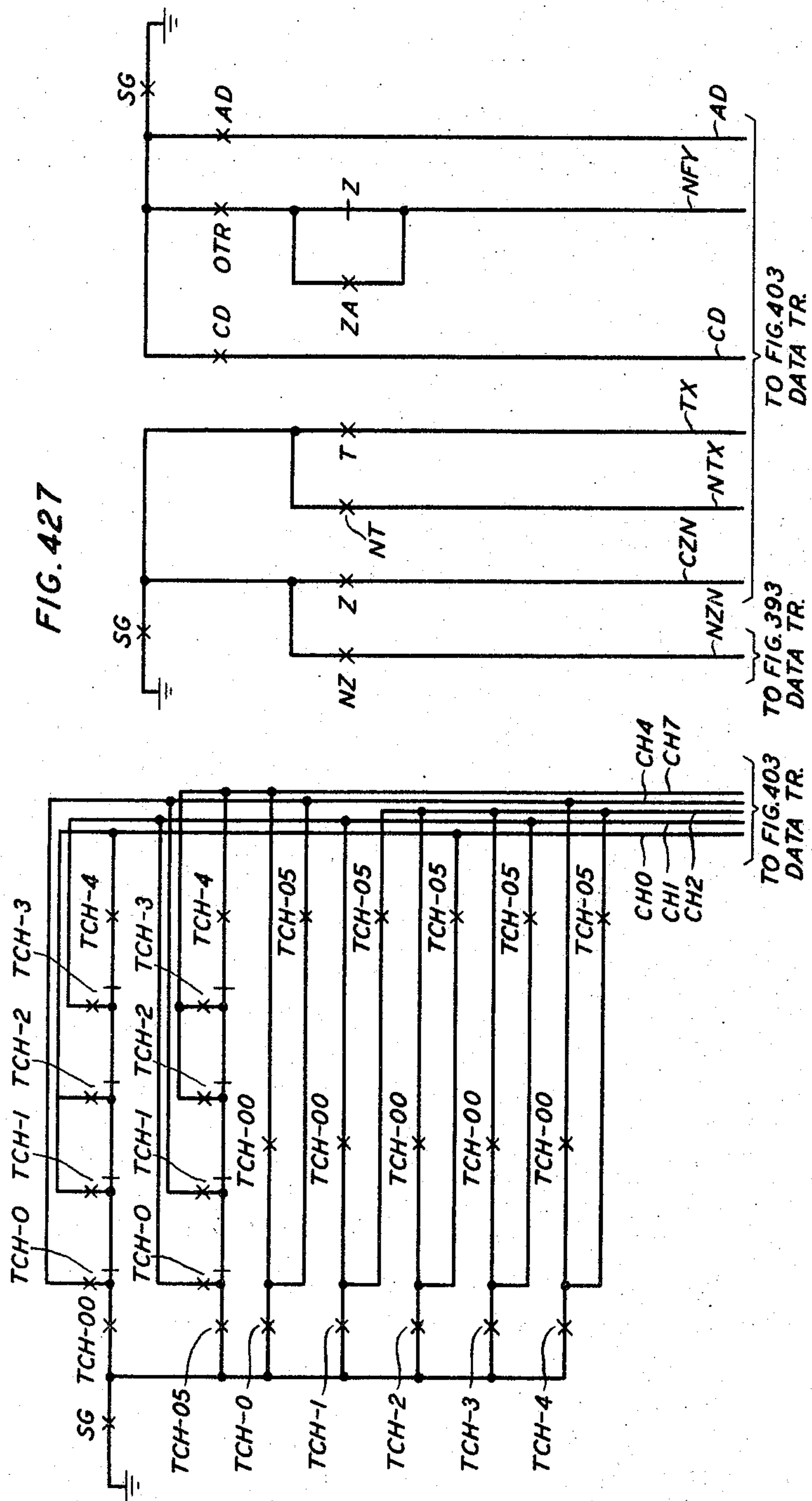
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 532



Sept. 12, 1967

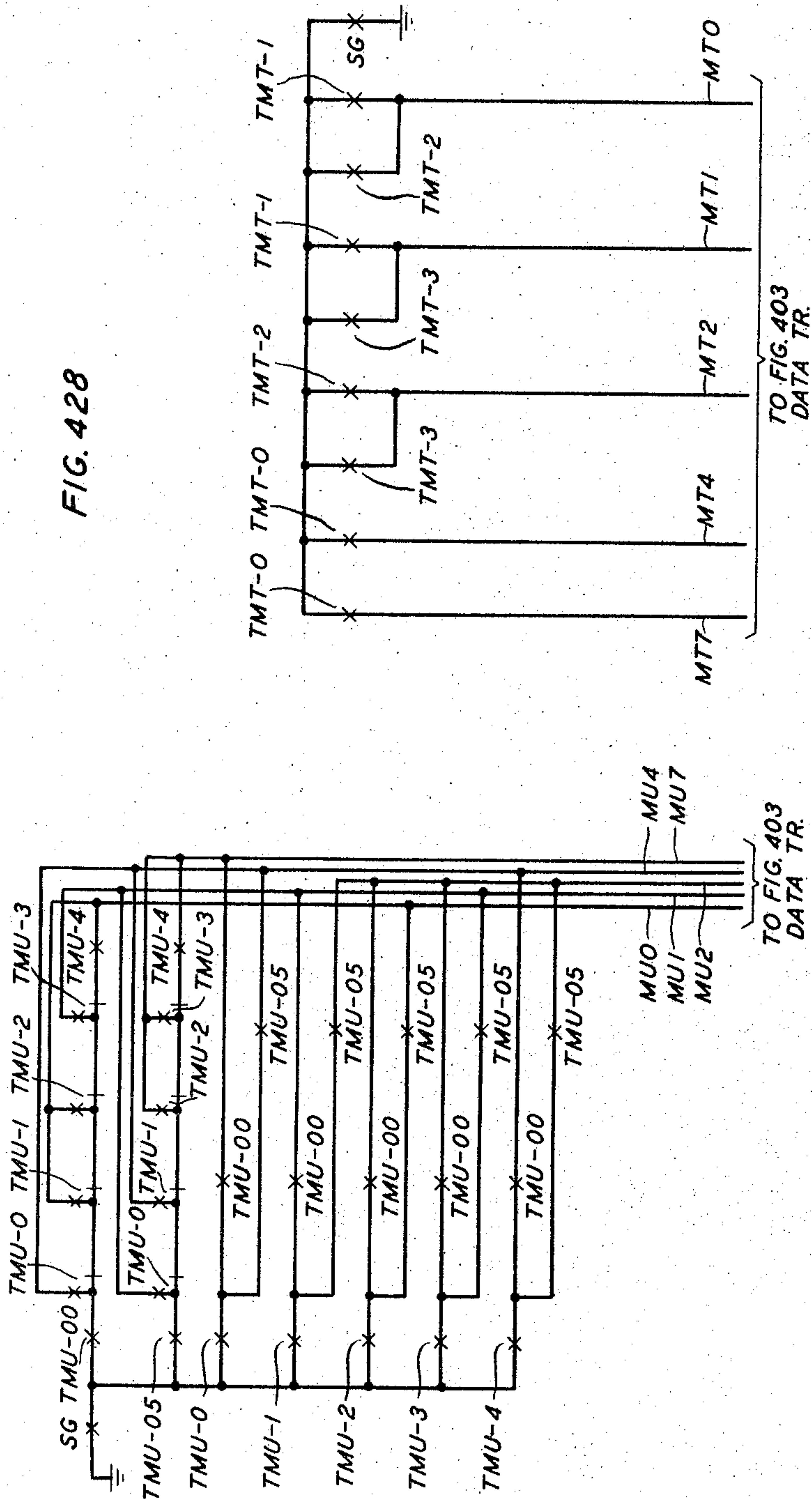
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 533

FIG. 428



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 534

FIG. 428A

TABLE ILLUSTRATING CORRESPONDENCE BETWEEN
COMPUTER RELAYS OF PRESENT SPECIFICATION AND
THAT OF THE J.G. NIGHTINGALE APPLICATION,
SERIAL NO. 275,008, FILED APRIL 23, 1963.

RELAYS

FIGS. 424 TO 428

NIGHTINGALE

EC	EC
IP	IP
IPI	IPI
MO	MLO-0
M1	MLO-1
M2	MLO-2
M3	MLO-3
M4	MLO-4
OP	OP
OPI	OPI
OPST	IOP
OTPO,1,2,4,7	NOP-0,1,2,4,7
PP	PP
RTHO	RCH-0
RTHI	RCH-1
RTTO,1,2,4,7	RCT-0,1,2,4,7
RTUO,1,2,4,7	RCU-0,1,2,4,7
SS	SS

Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 535

FIG. 428B

TABLE ILLUSTRATING CORRESPONDENCE BETWEEN
COMPUTER CONDUCTORS OF PRESENT SPECIFICATION
AND THAT OF THE J. G. NIGHTINGALE APPLICATION,
SERIAL NO. 275,008, FILED APRIL 23, 1963.

CONDUCTORS

FIGS. 424 TO 428	NIGHTINGALE	FIGS. 424 TO 428	NIGHTINGALE
AD	AD	MT0	MT-0
CD	CD	MT1	MT-1
CHO	CH-0	MT2	MT-2
CH1	CH-1	MT4	MT-4
CH2	CH-2	MT7	MT-7
CH4	CH-4	MU0	MU-0
CH7	CH-7	MU1	MU-1
CT0	CT-0	MU2	MU-2
CT1	CT-1	MU4	MU-4
CT2	CT-2	MU7	MU-7
CT4	CT-4	NFY	NFY
CT7	CT-7	NTX	NT
CU00	CU00	NZN	NZ
CU05	CU05	OP	OP
CZN	PC	OPI	OPI
EC	EC	OPST	IOP
ET	ET	OTPO.1,2,4,7	NOP-0.1,2,4,7
IP	IP	PP	PP
IT	ST	RTH0	RCH-0
MO	MLO-0	RTH1	RCH-1
MI	MLO-1	RTTO.1,2,4,7	RCT-0.1,2,4,7
M2	MLO-2	RTUO.1,2,4,7	RCU-0.1,2,4,7
M3	MLO-3	STA	STA
M4	MLO-4	TX	TX

Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 536

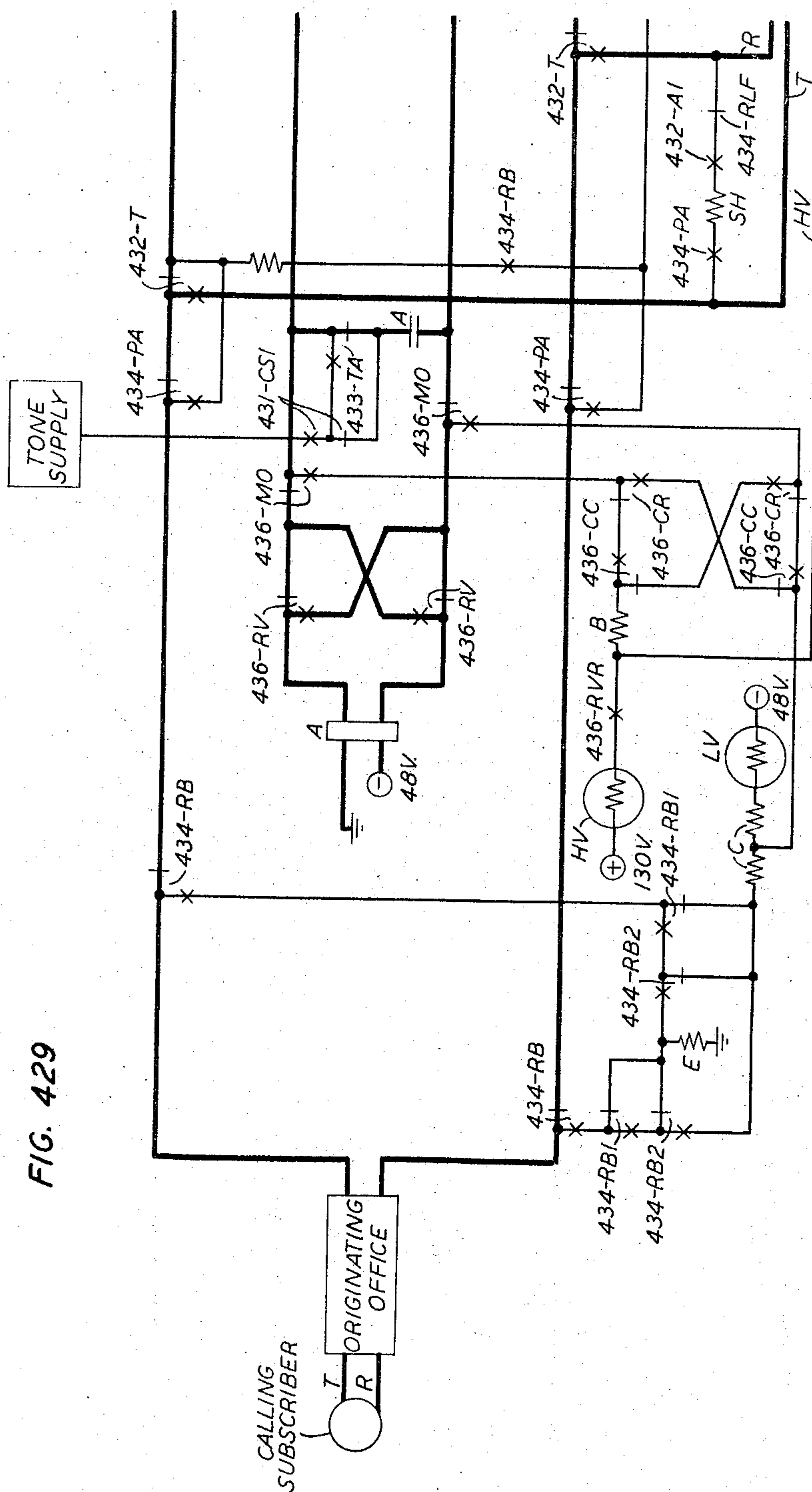


FIG. 429

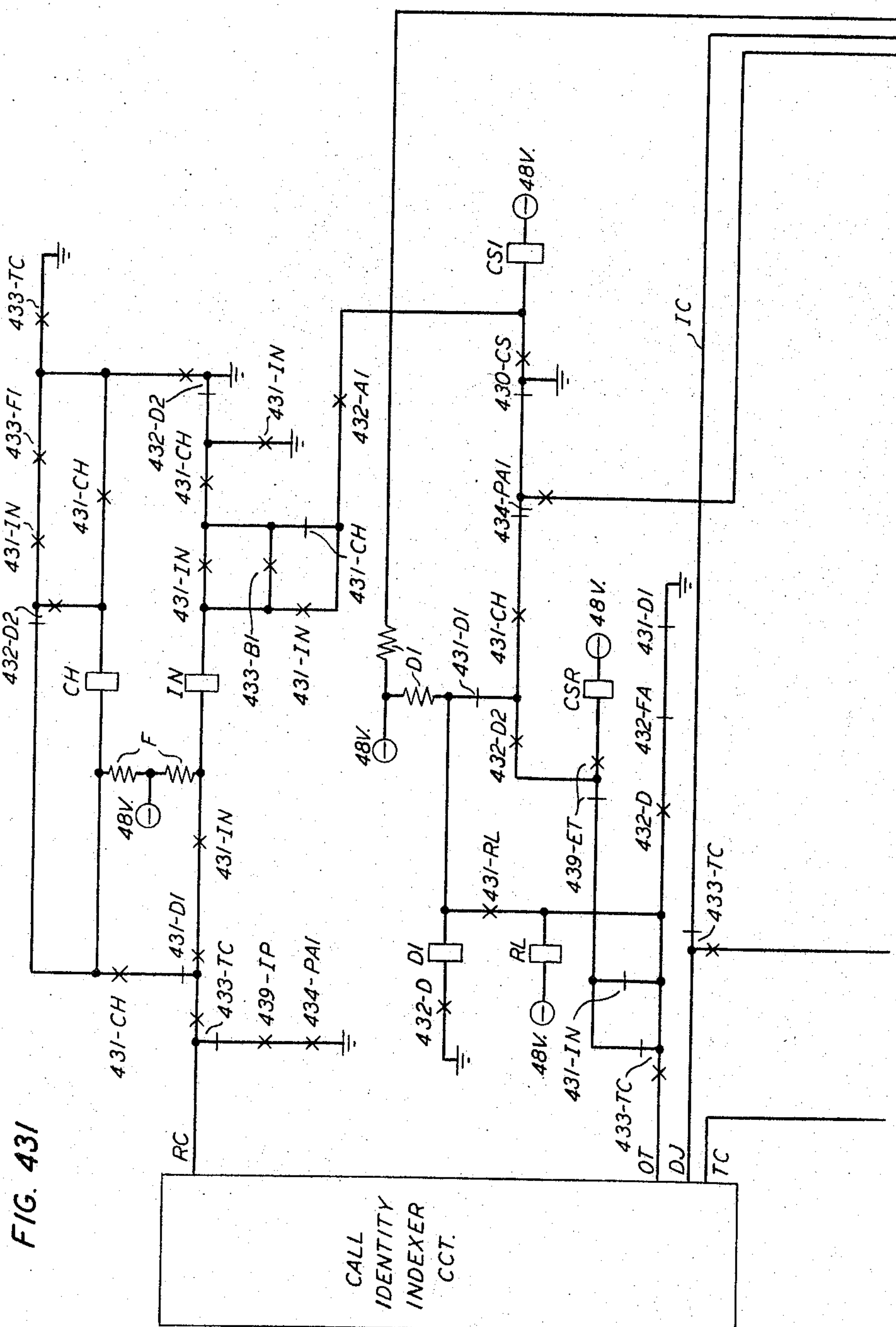
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 538



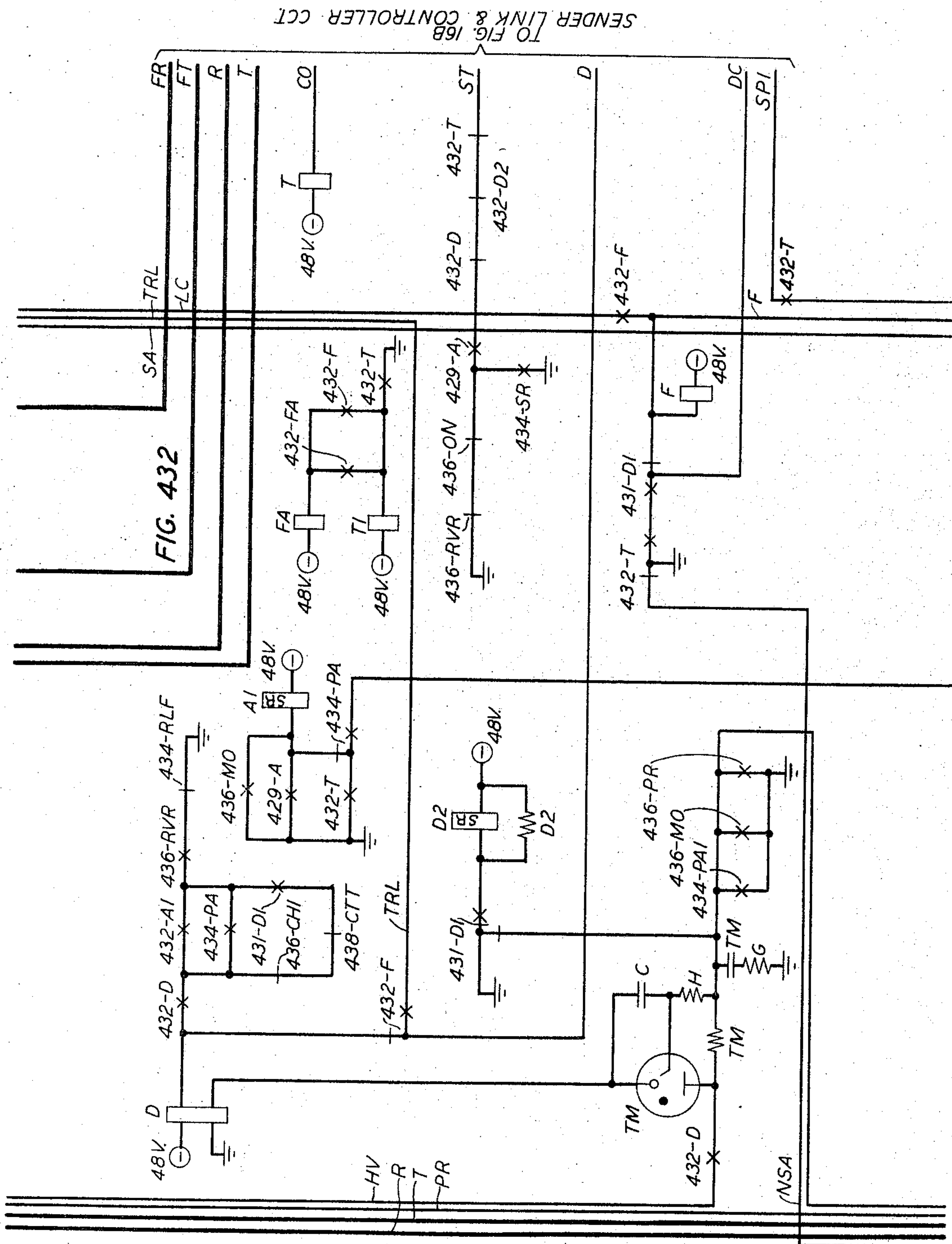
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 539



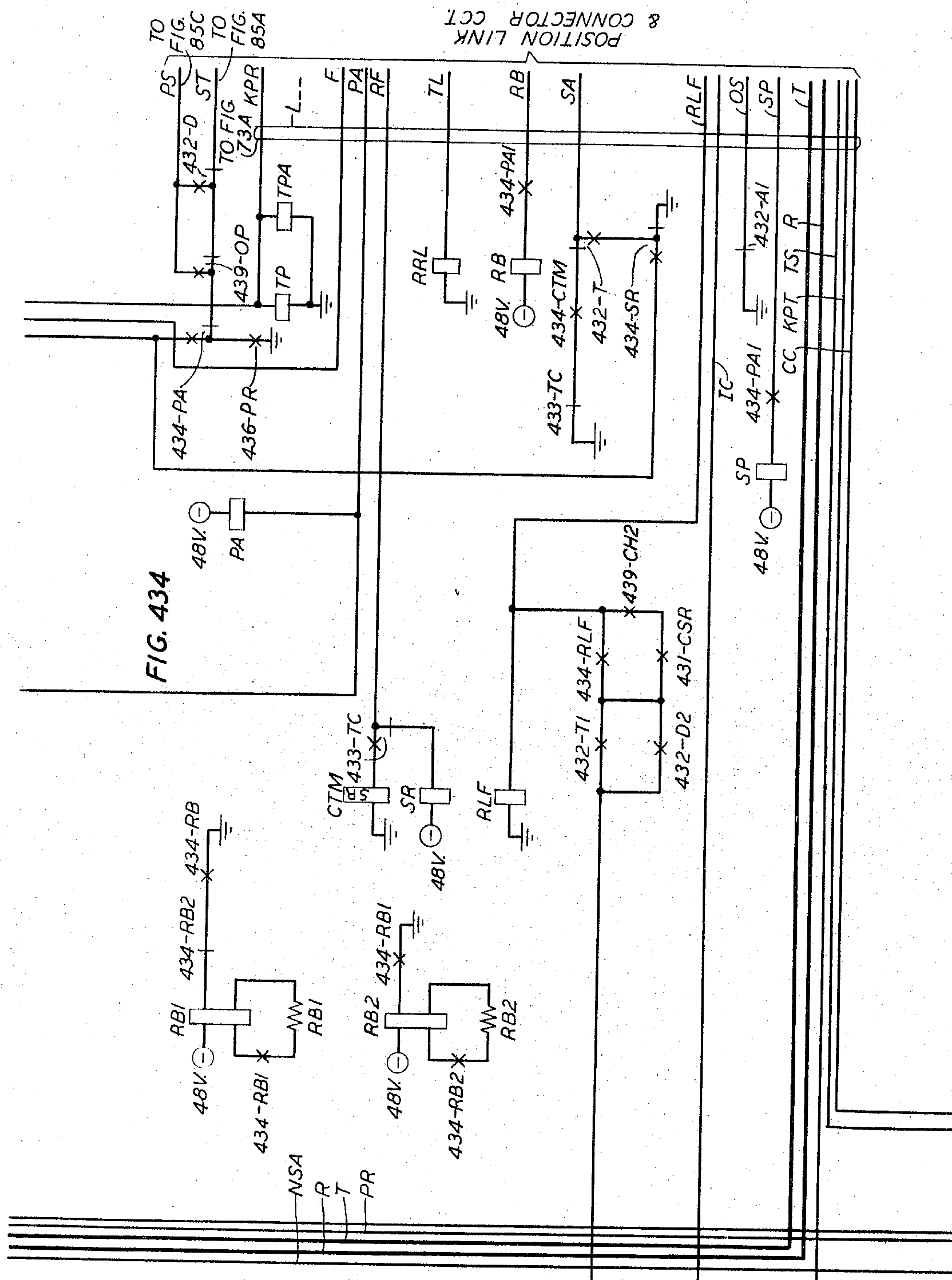
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 541



Sept. 12, 1967

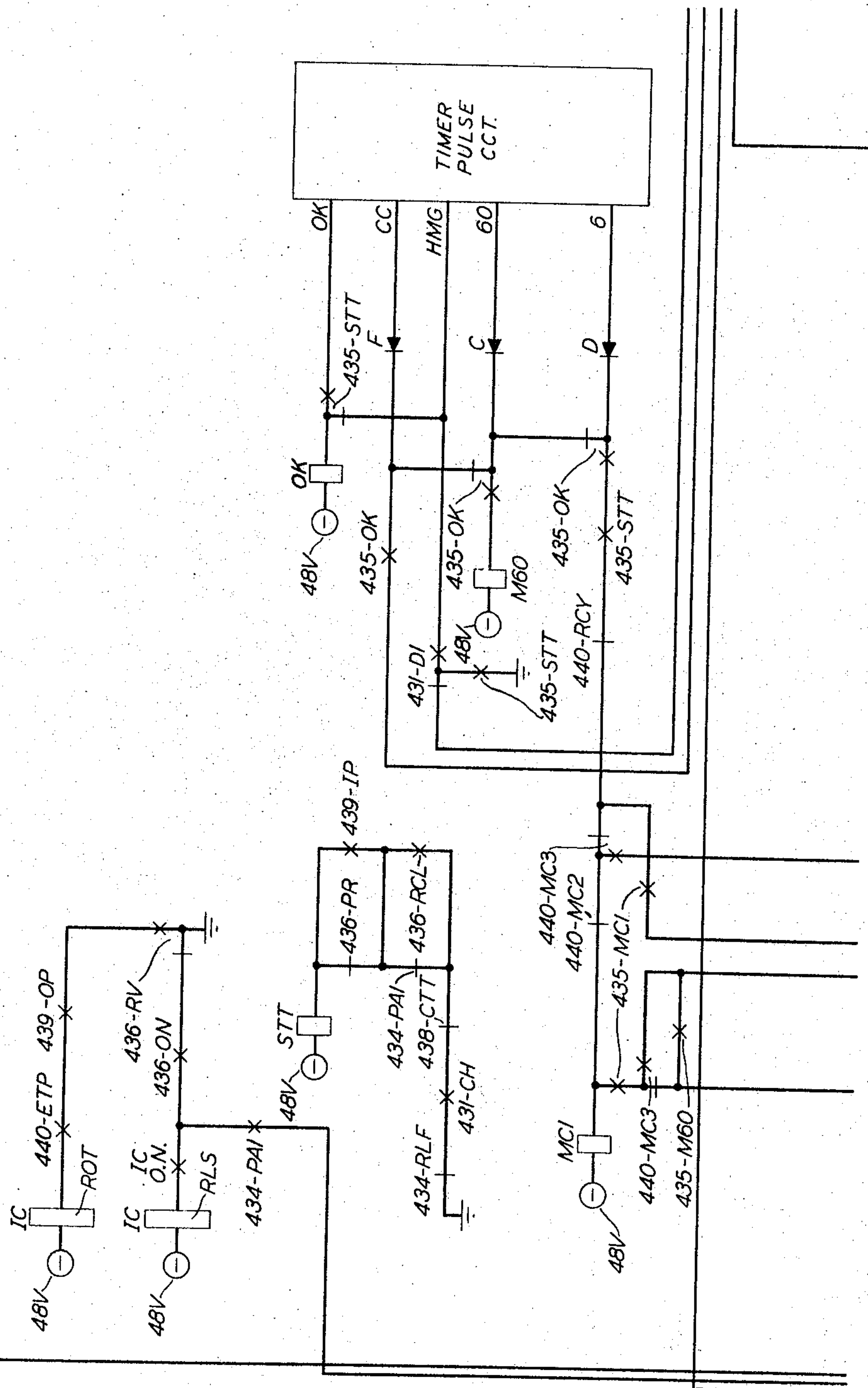
Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 542

FIG. 435



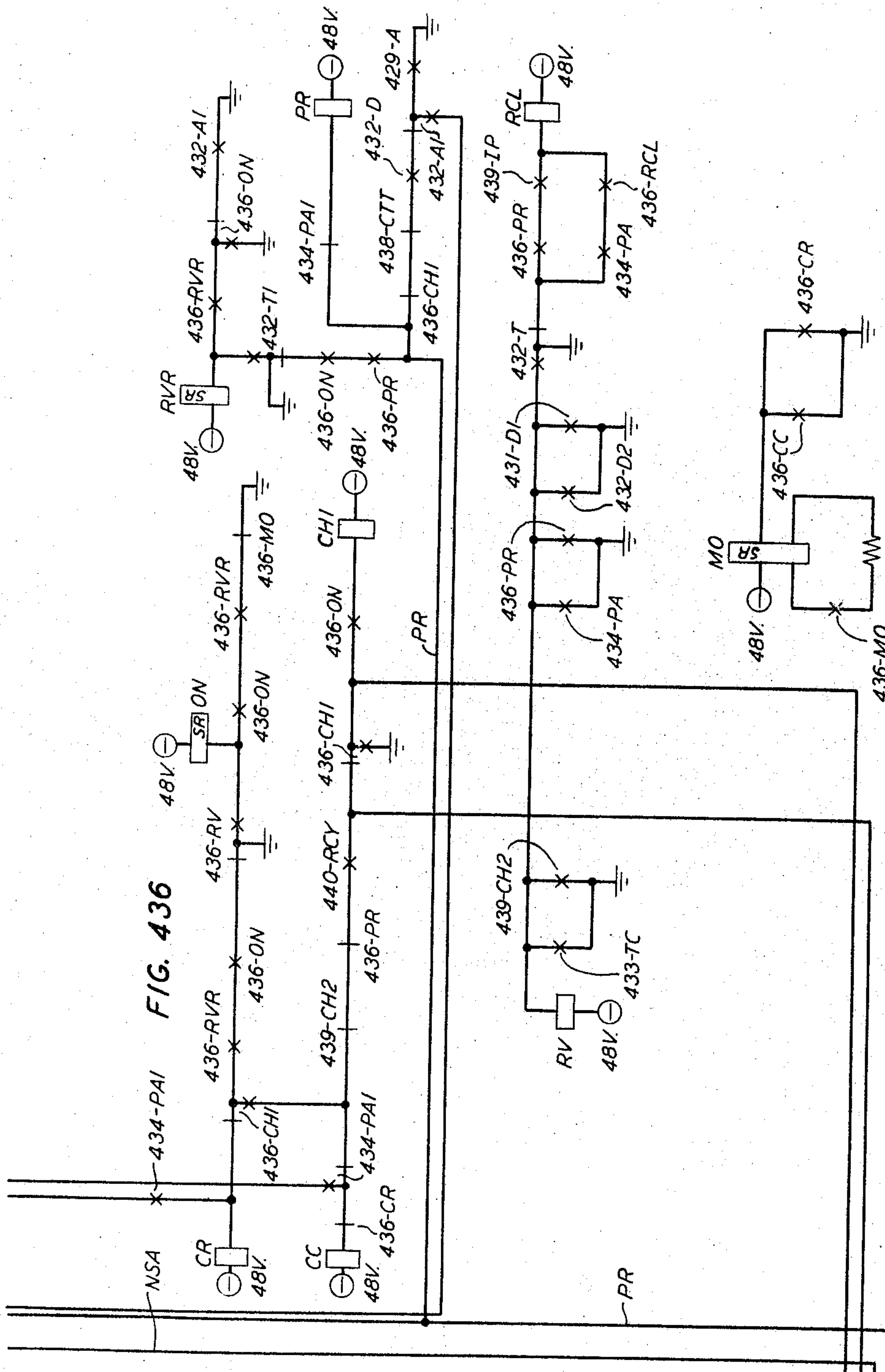
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 543



Sept. 12, 1967

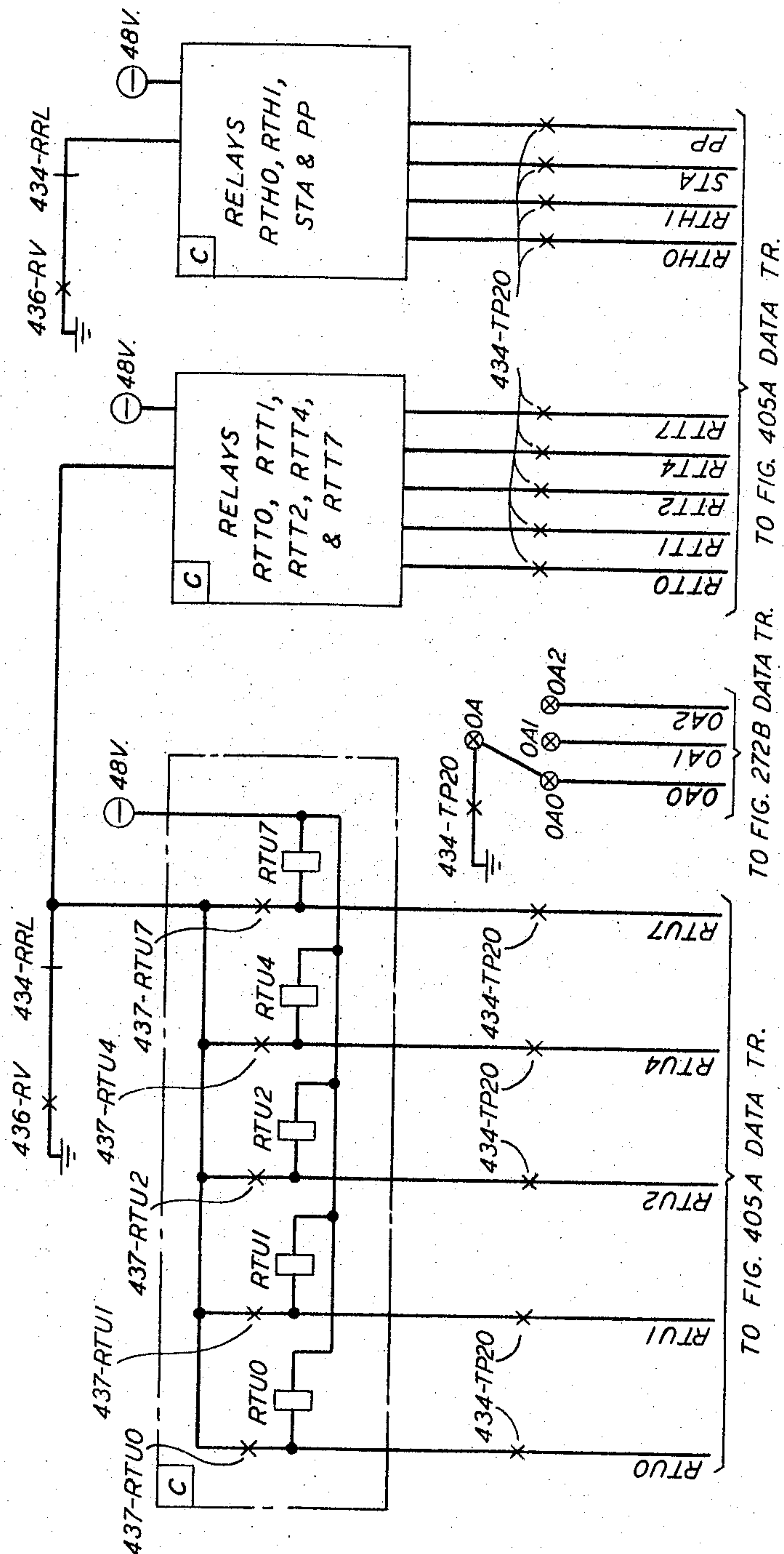
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 544

FIG. 437



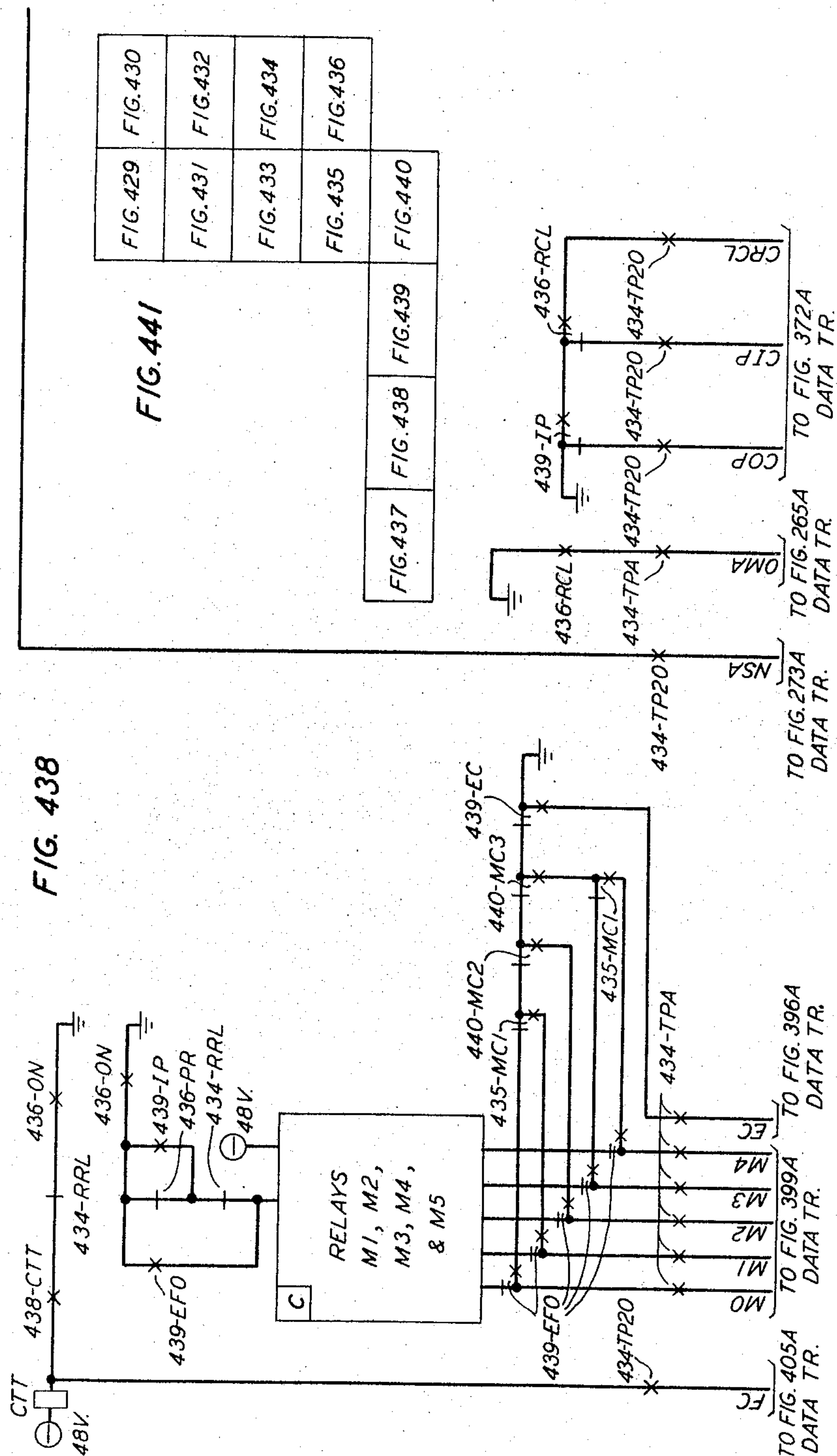
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 545



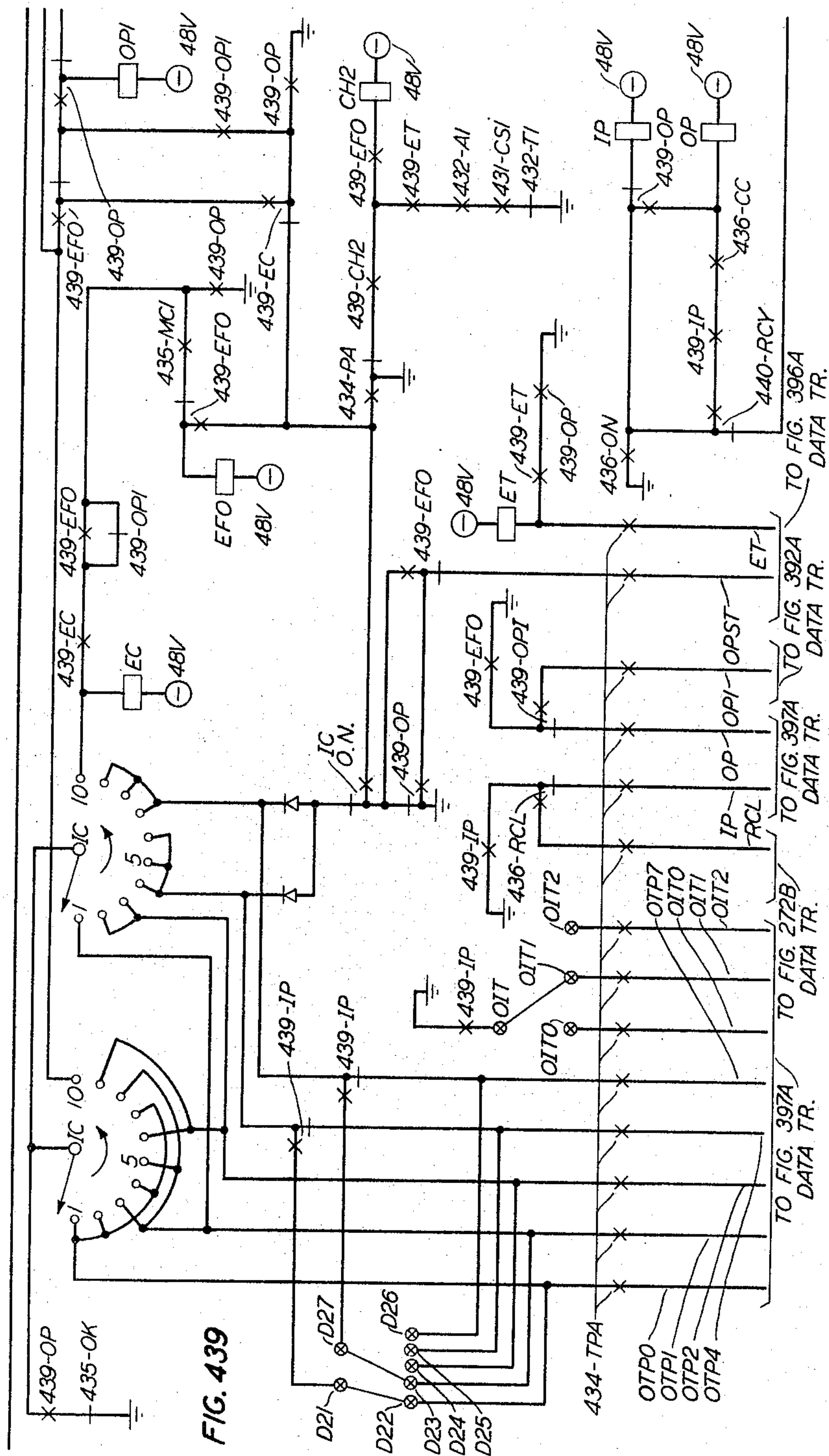
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 546



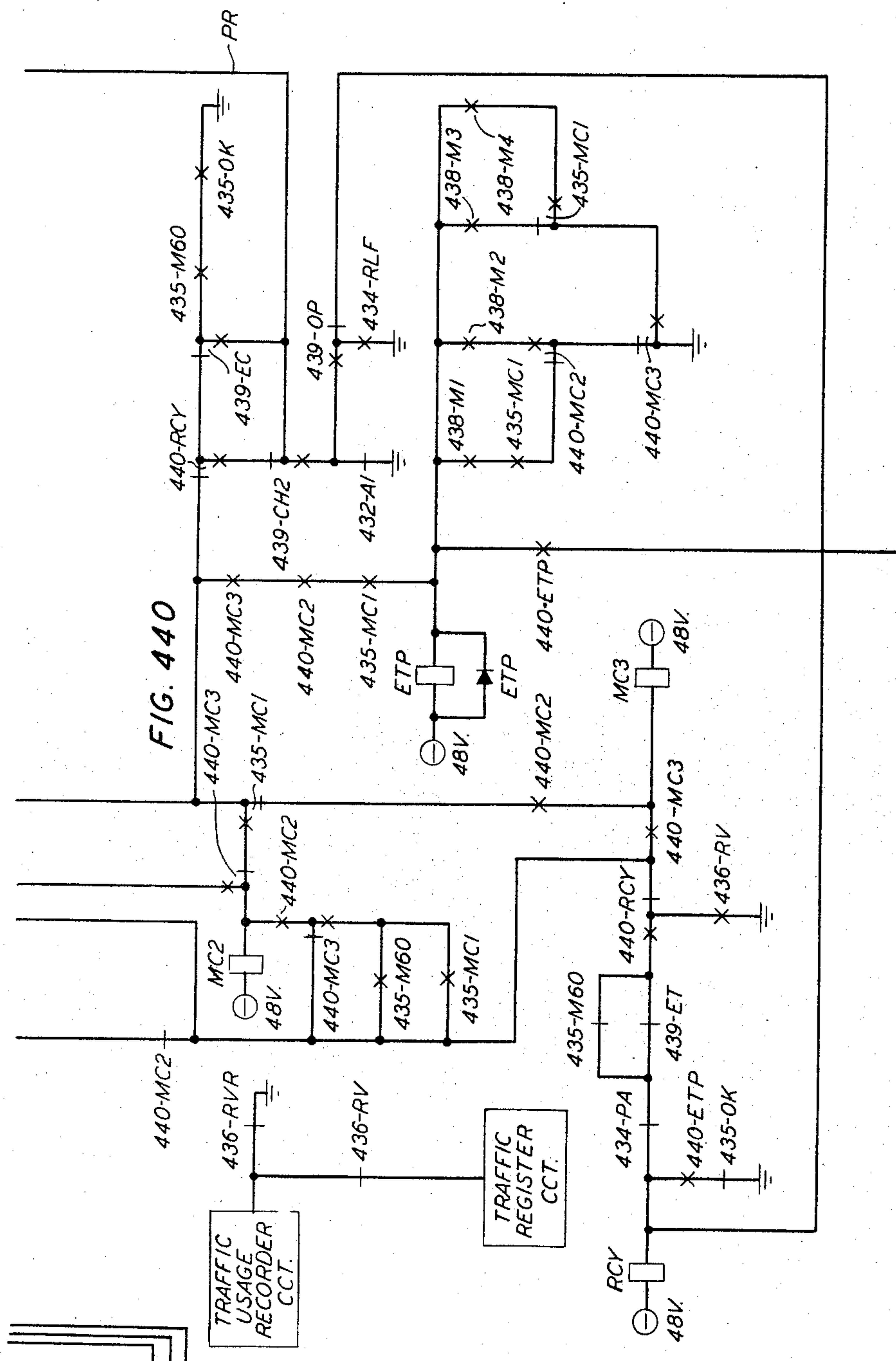
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 547



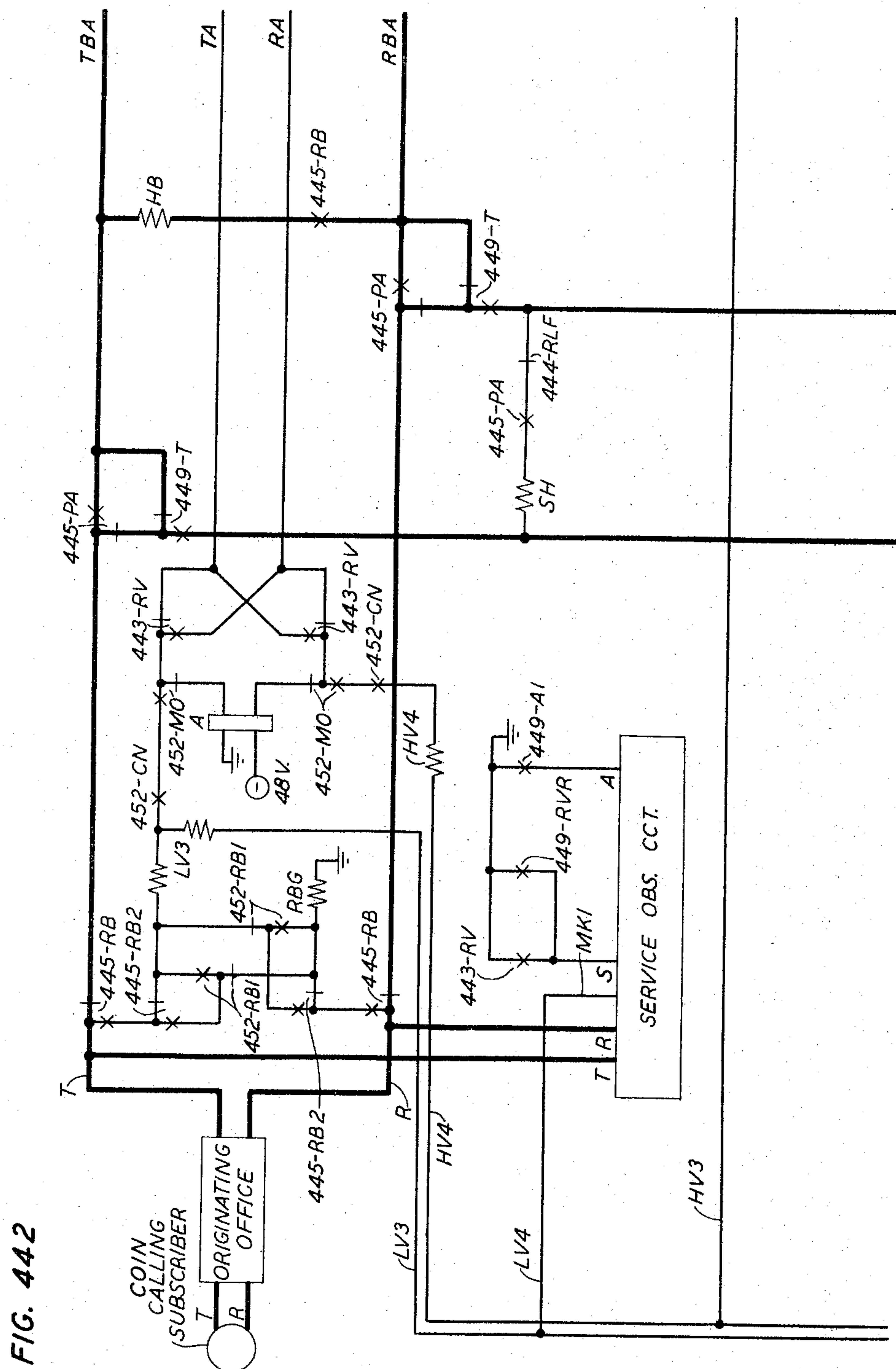
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 548



Sept. 12, 1967

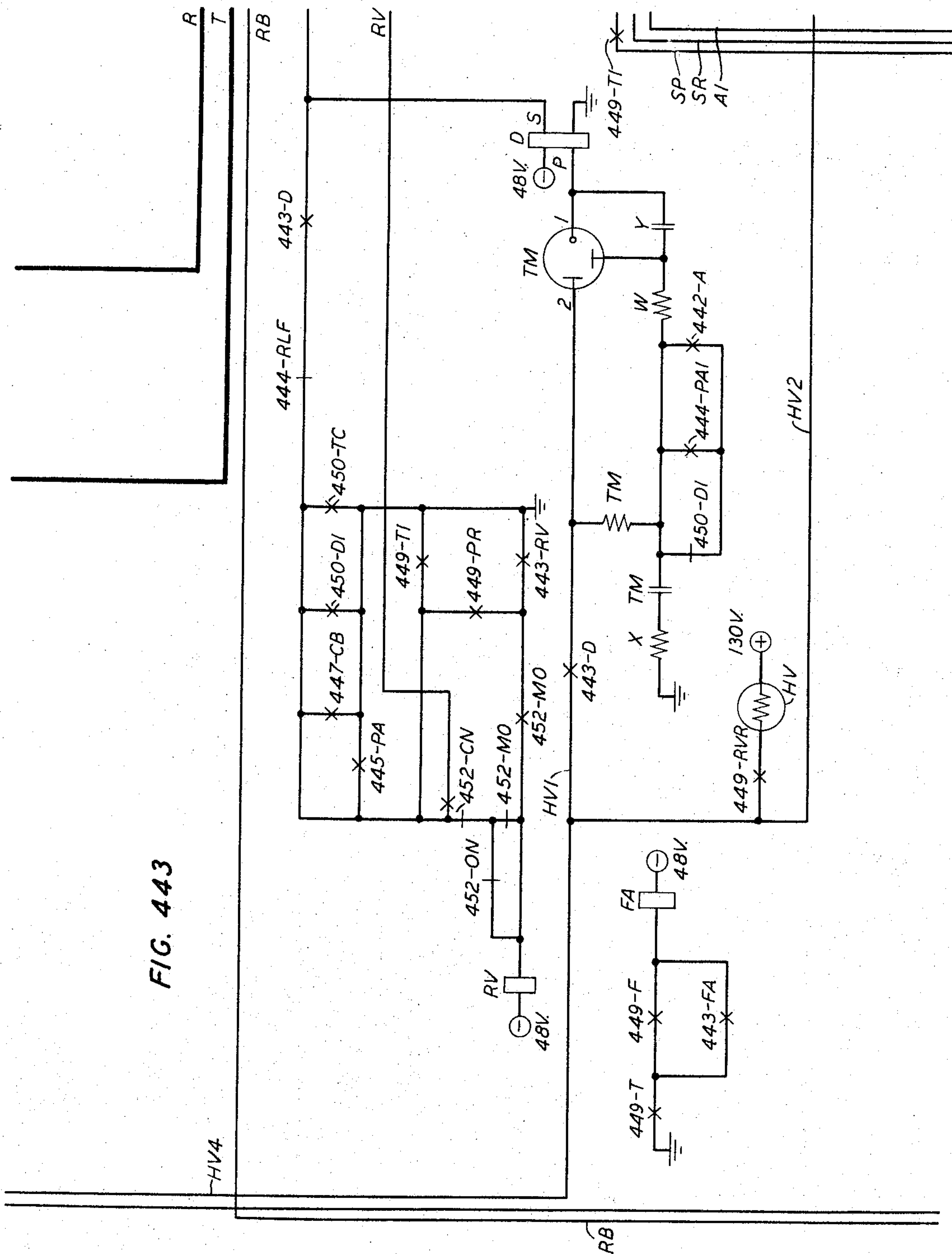
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 549

FIG. 443



Sept. 12, 1967

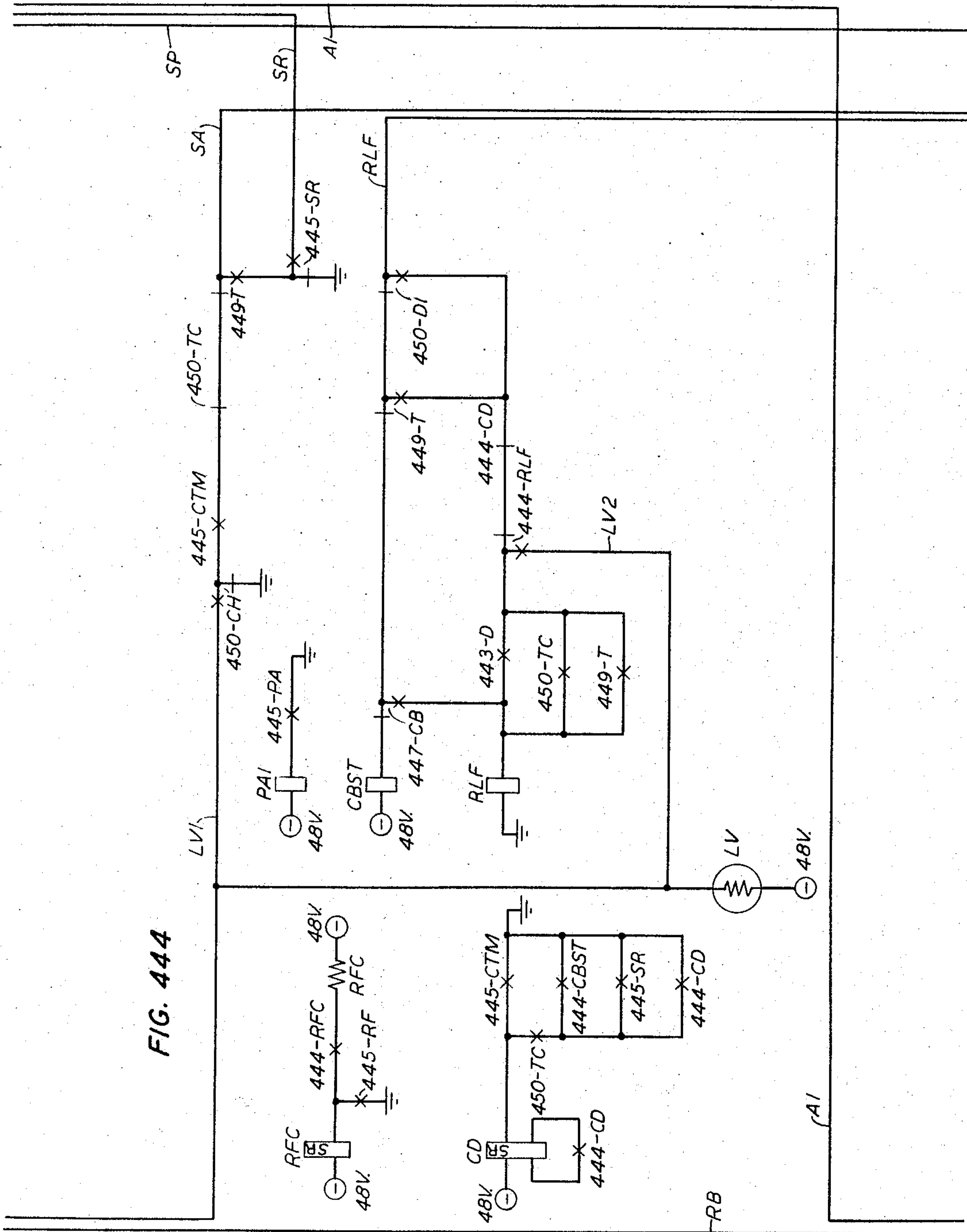
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 550

FIG. 444



Sept. 12, 1967

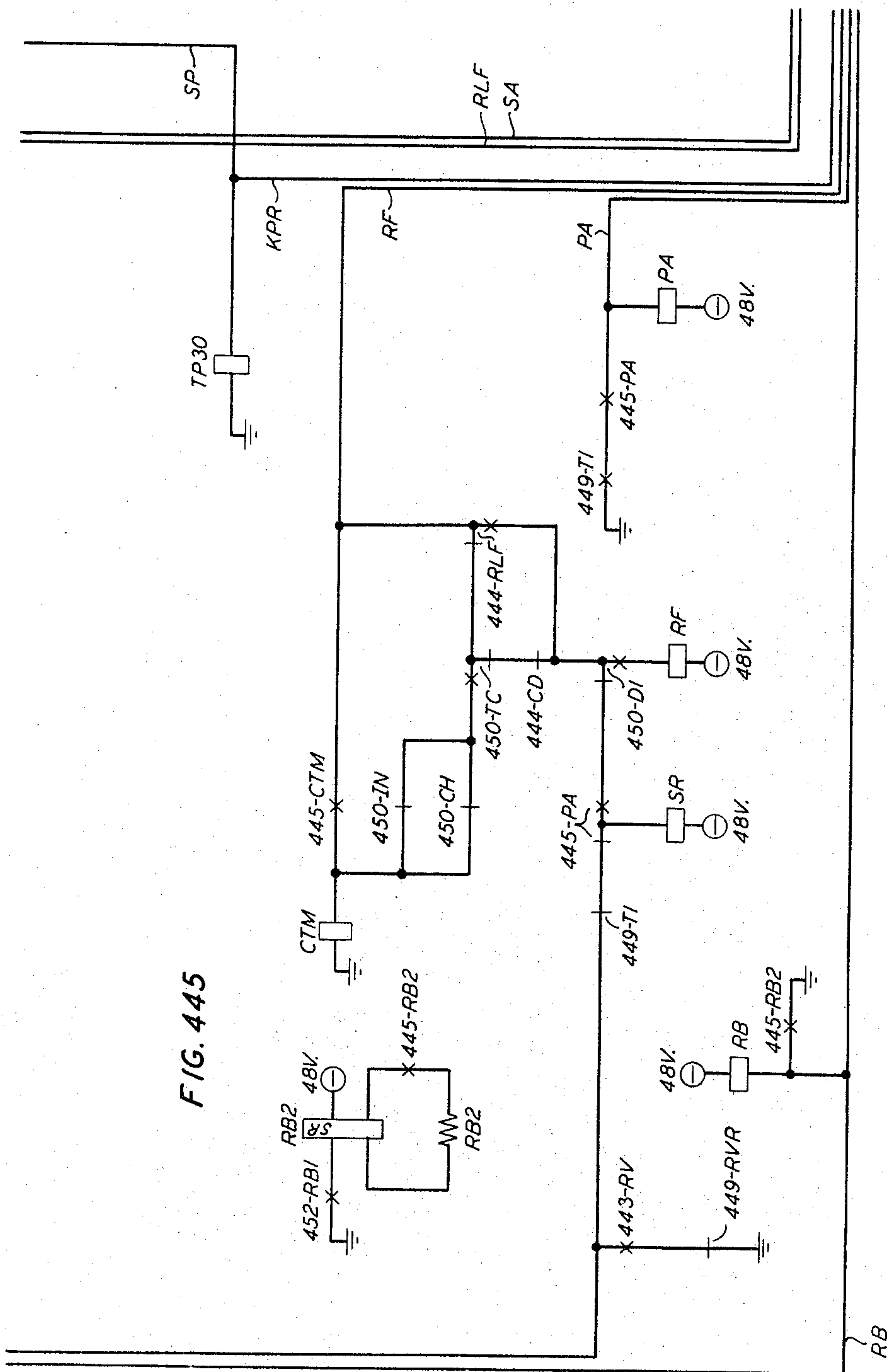
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 551

FIG. 445



Sept. 12, 1967

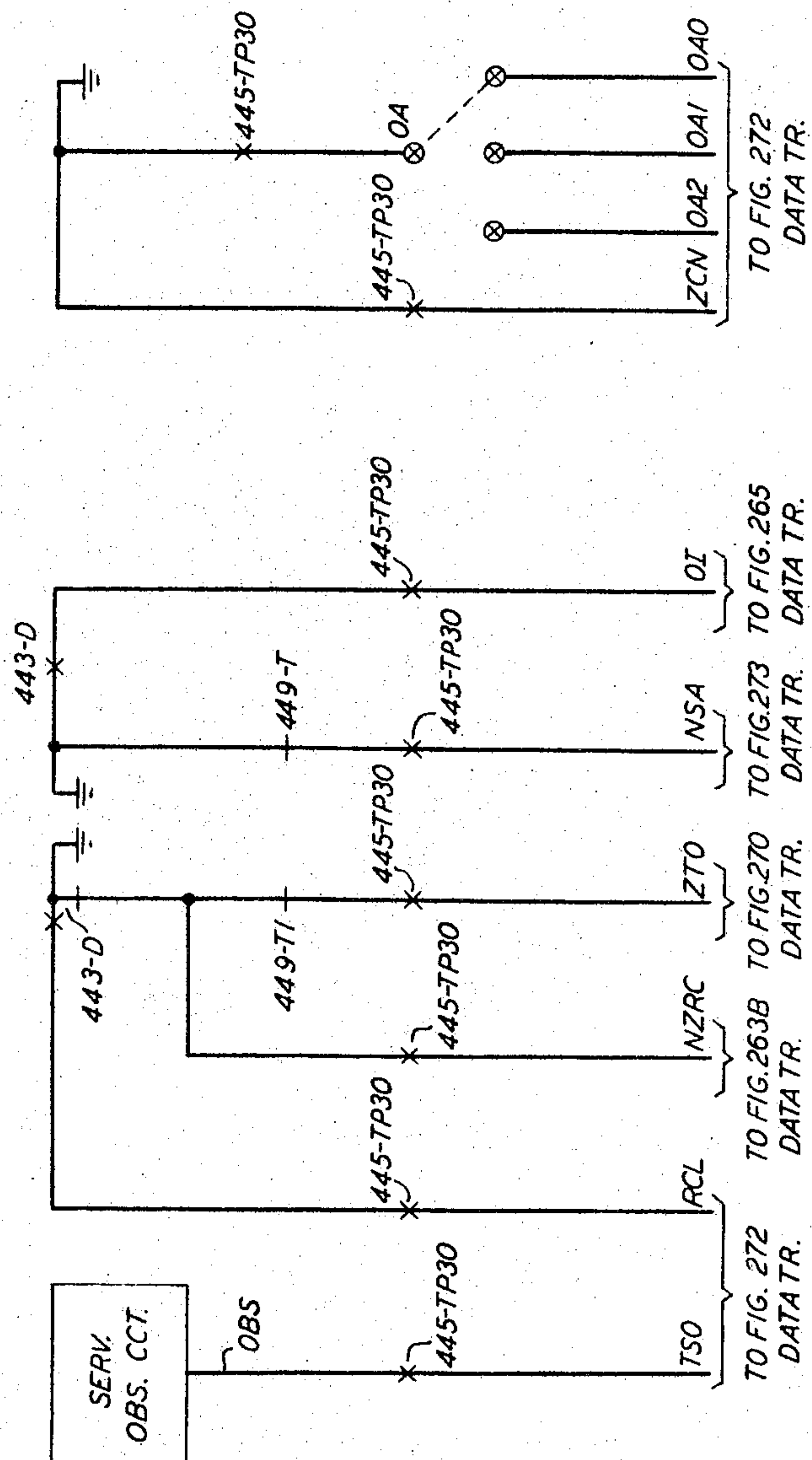
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 552

FIG. 446



Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 553

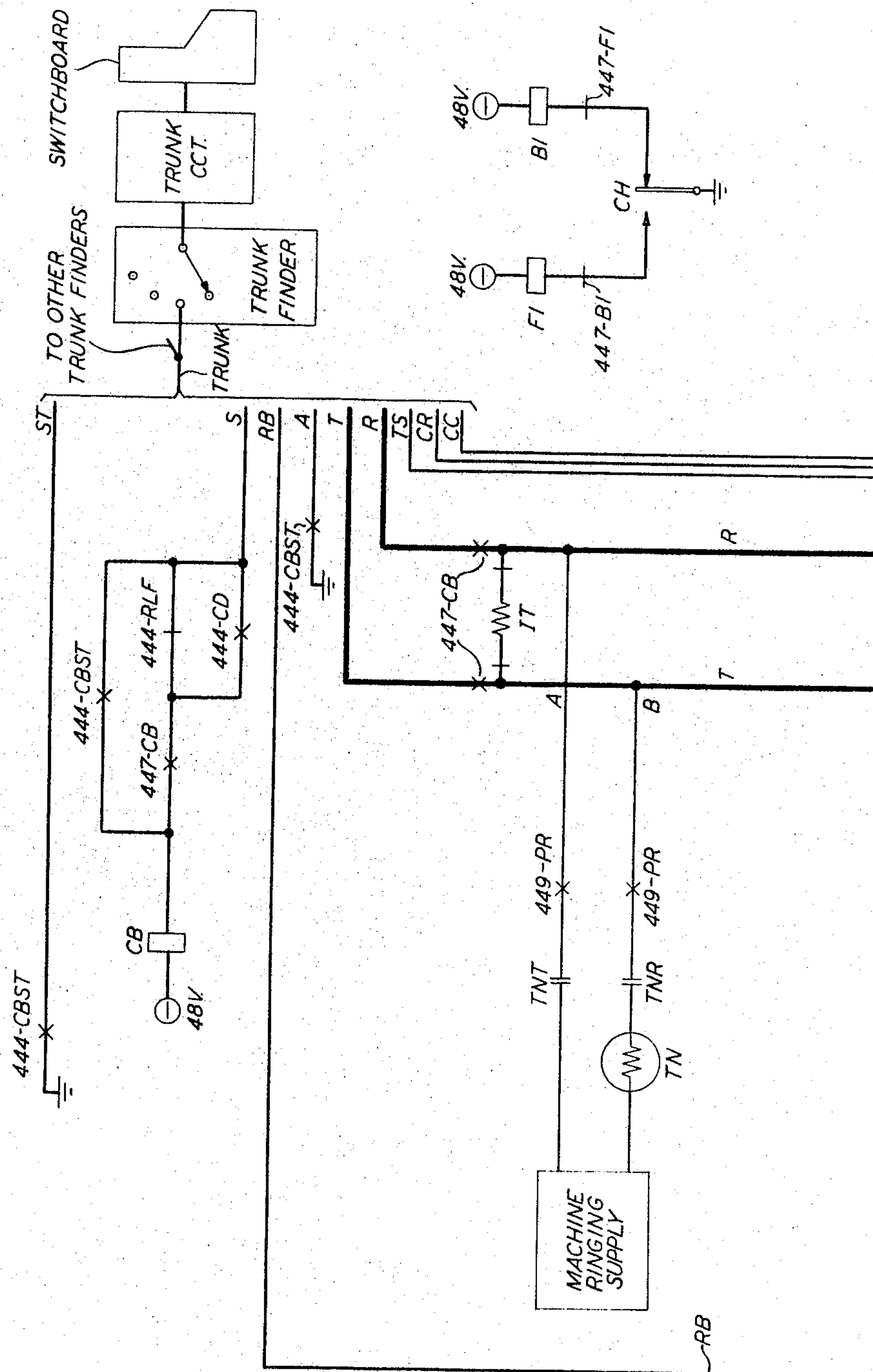


FIG. 447

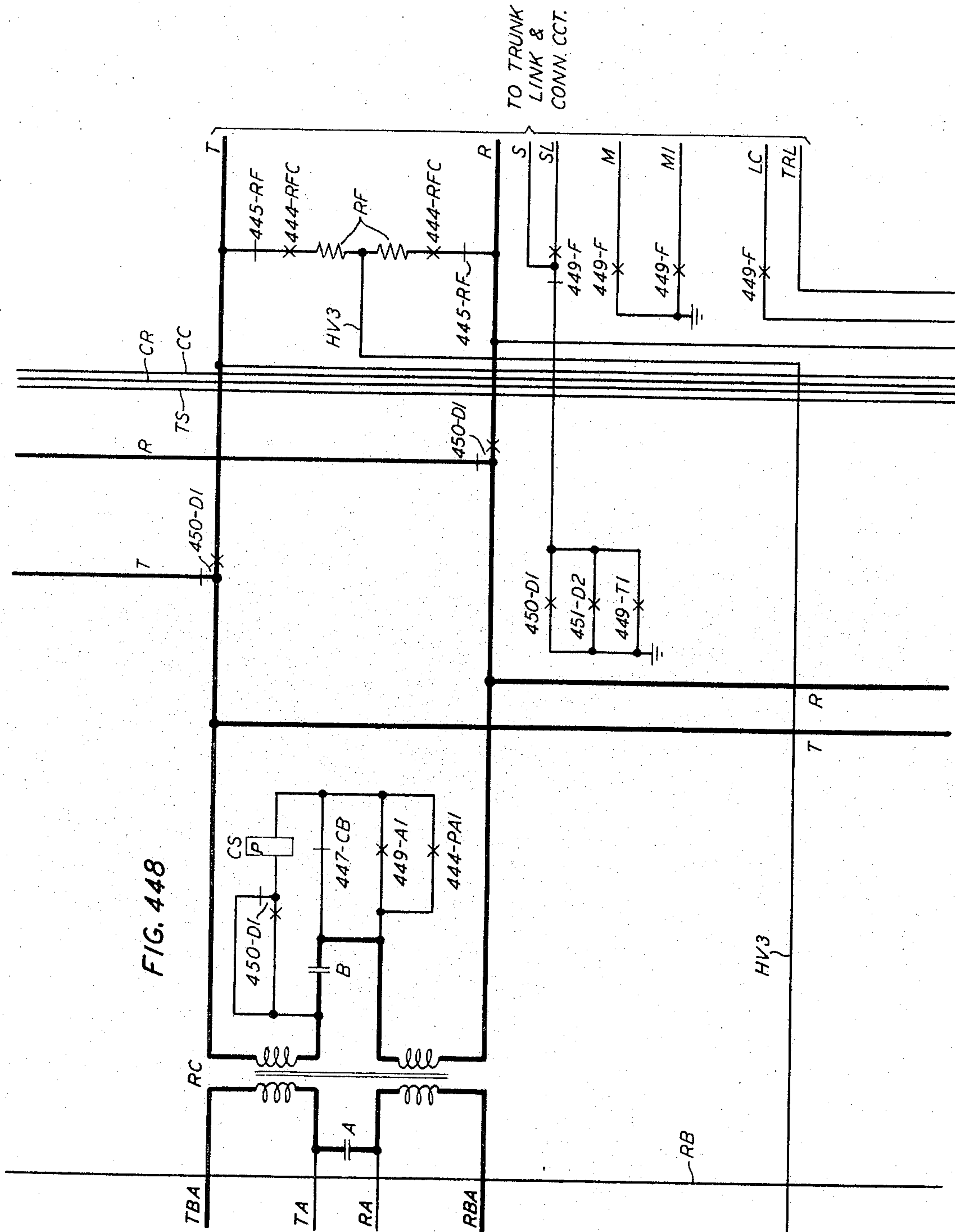
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

570 Sheets-Sheet 554

3,341,662



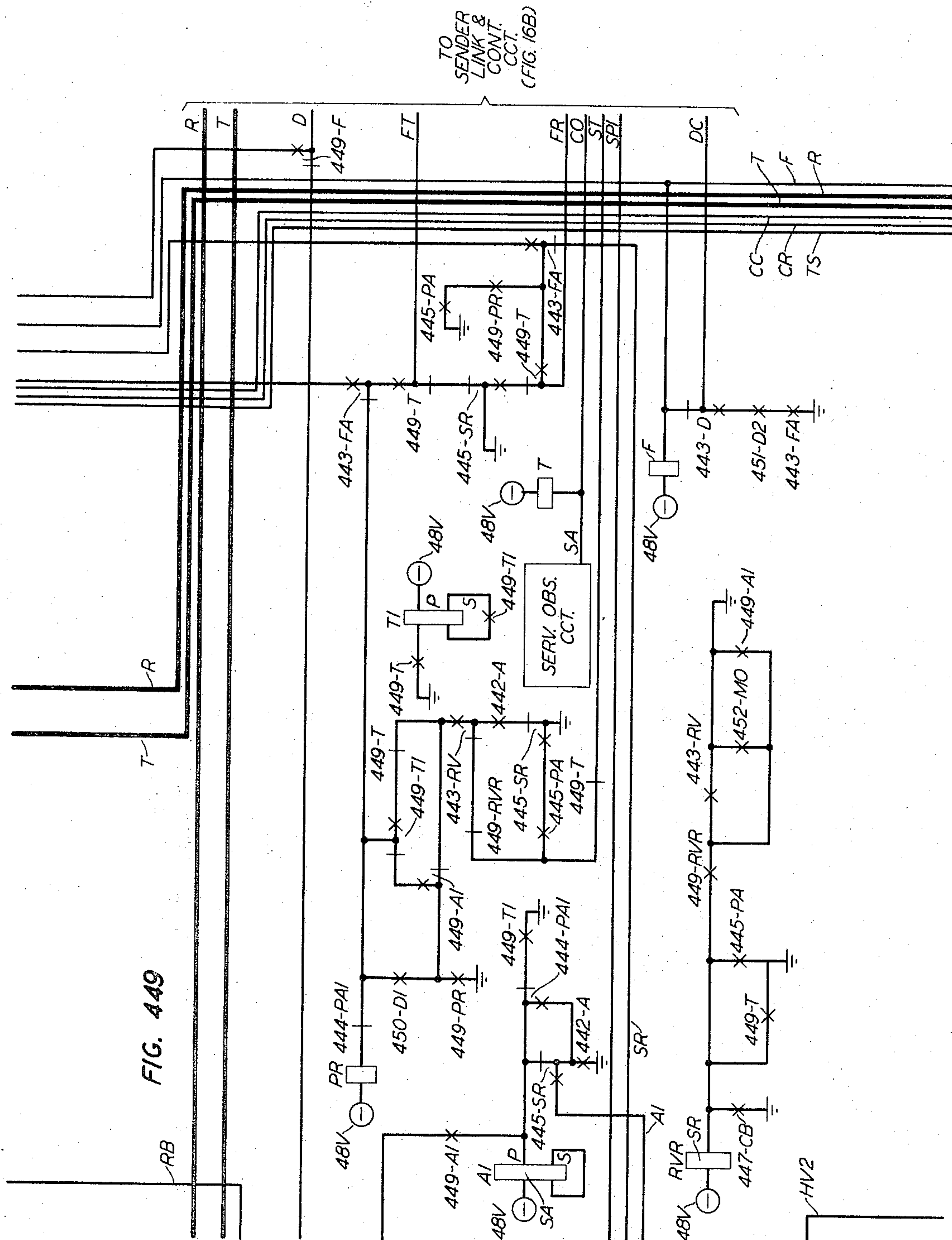
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 555



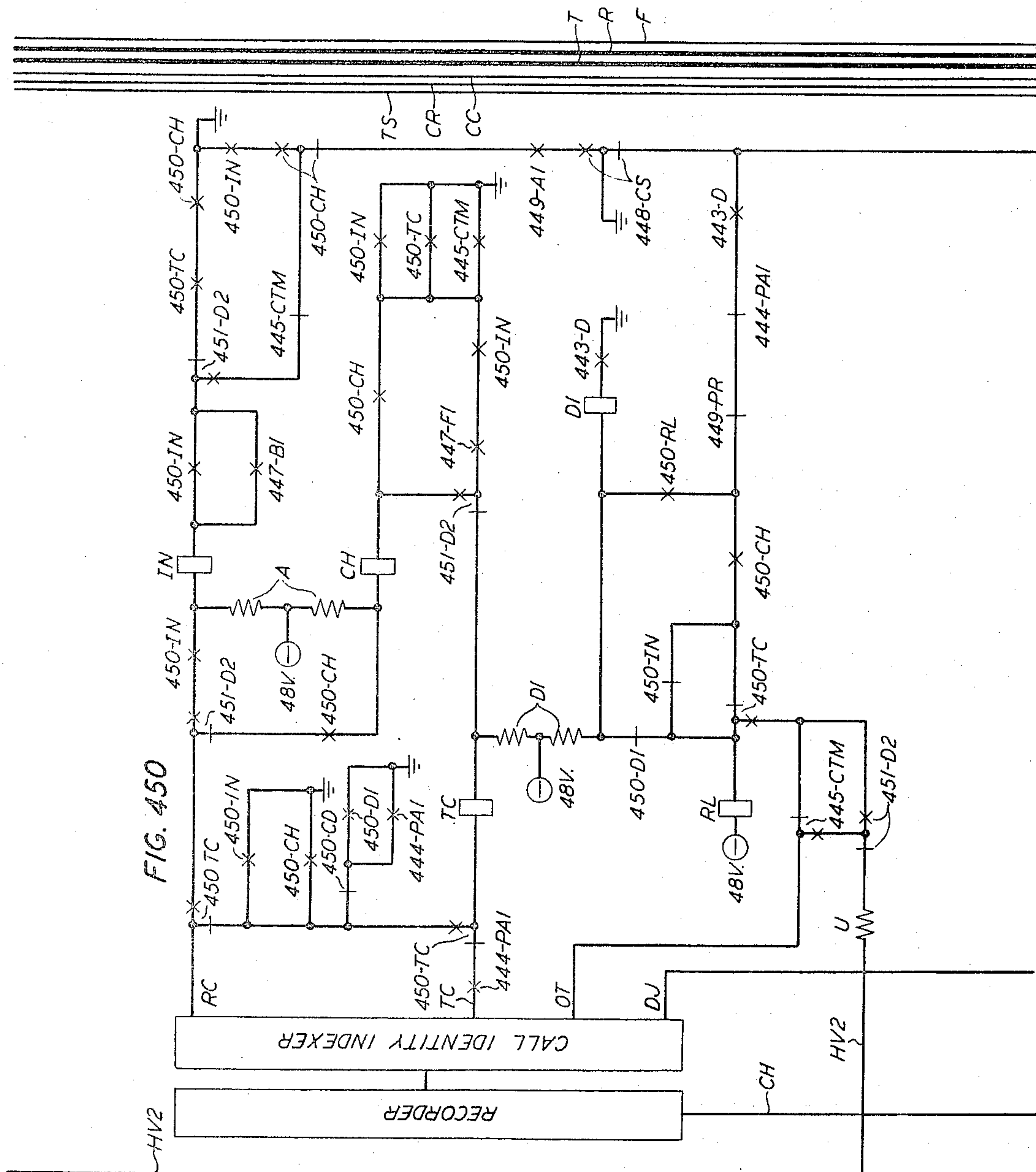
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 556



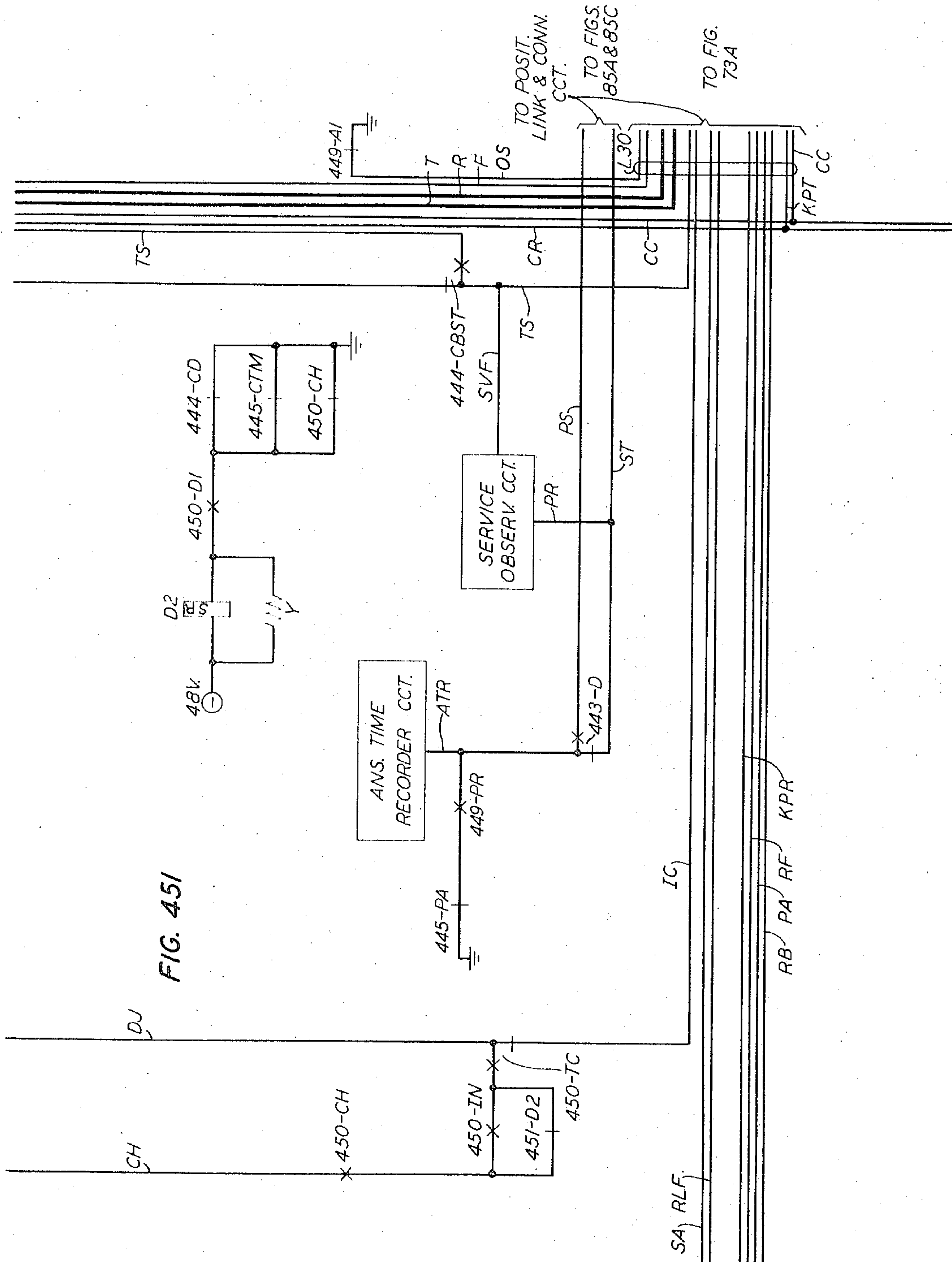
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 557



Sept. 12, 1967

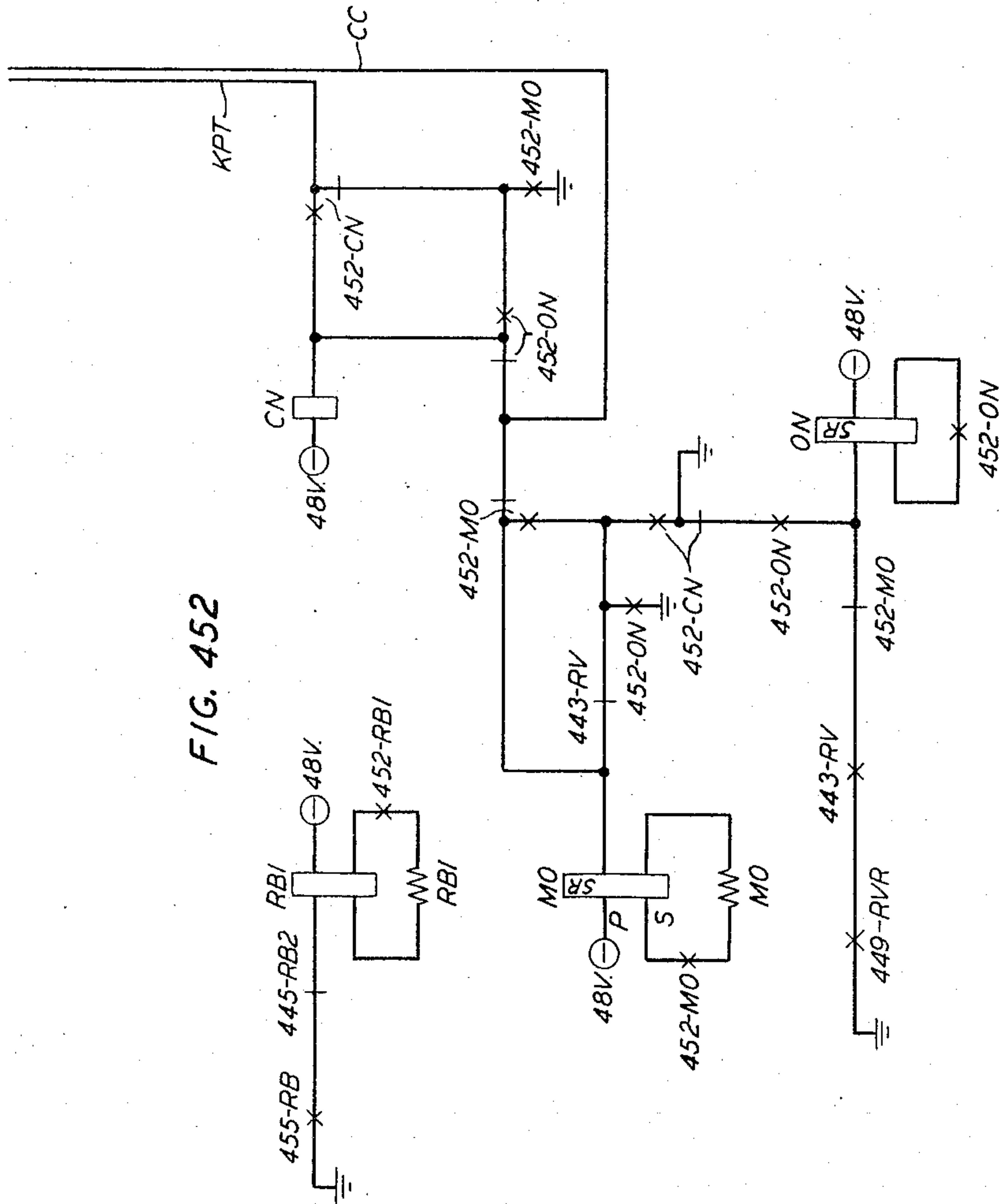
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 558

FIG. 452



Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 559

FIG. 453A

FIG. 447A	FIG. 442A
FIG. 448A	FIG. 443A
FIG. 449A	FIG. 444A
FIG. 450A	FIG. 445A
FIG. 451A	FIG. 446A
FIG. 452A	

FIG. 453

FIG. 447	FIG. 442
FIG. 448	FIG. 443
FIG. 449	FIG. 444
FIG. 450	FIG. 445
FIG. 451	FIG. 446
FIG. 452	

Sept. 12, 1967

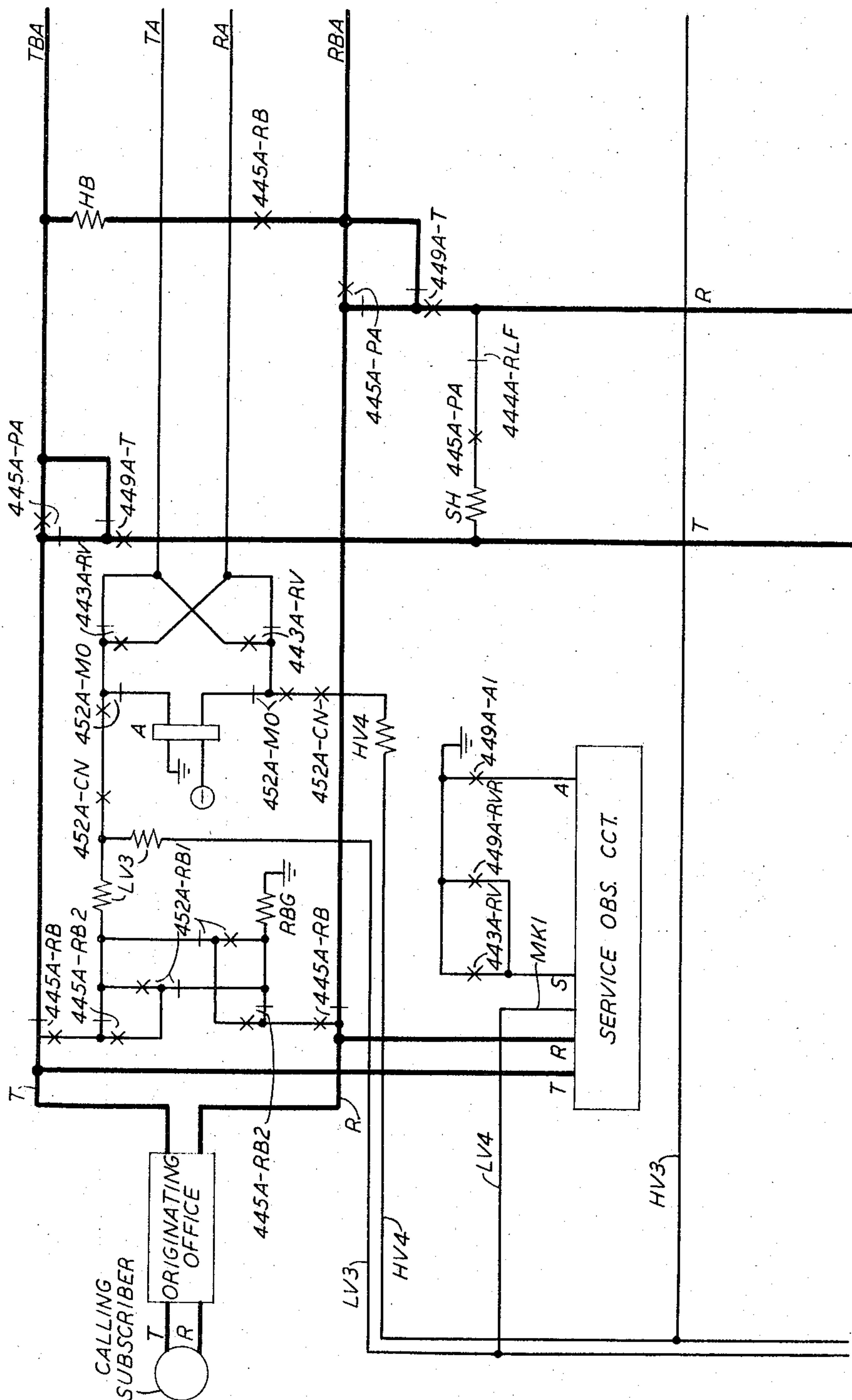
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 560

FIG. 442A



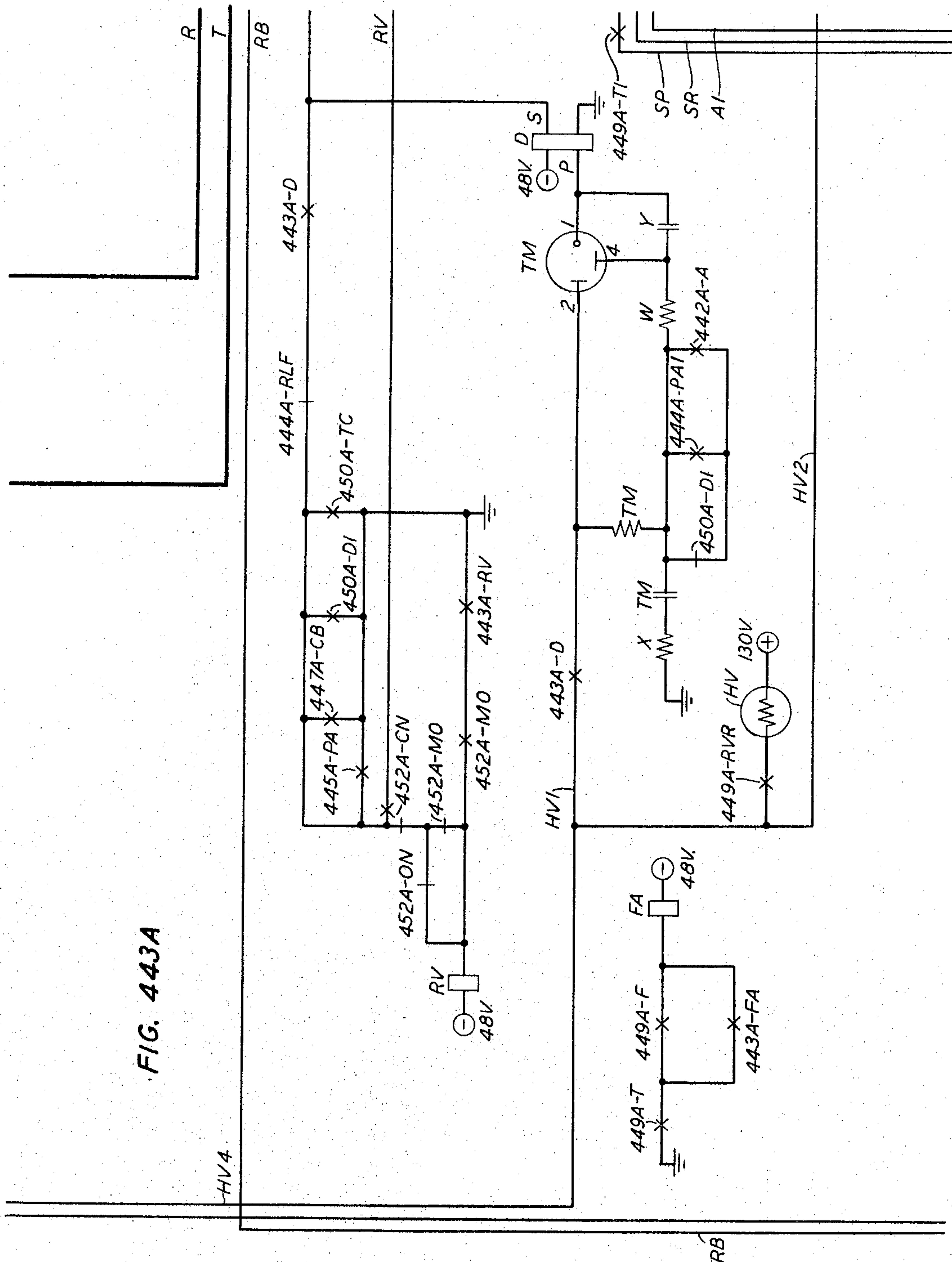
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 561



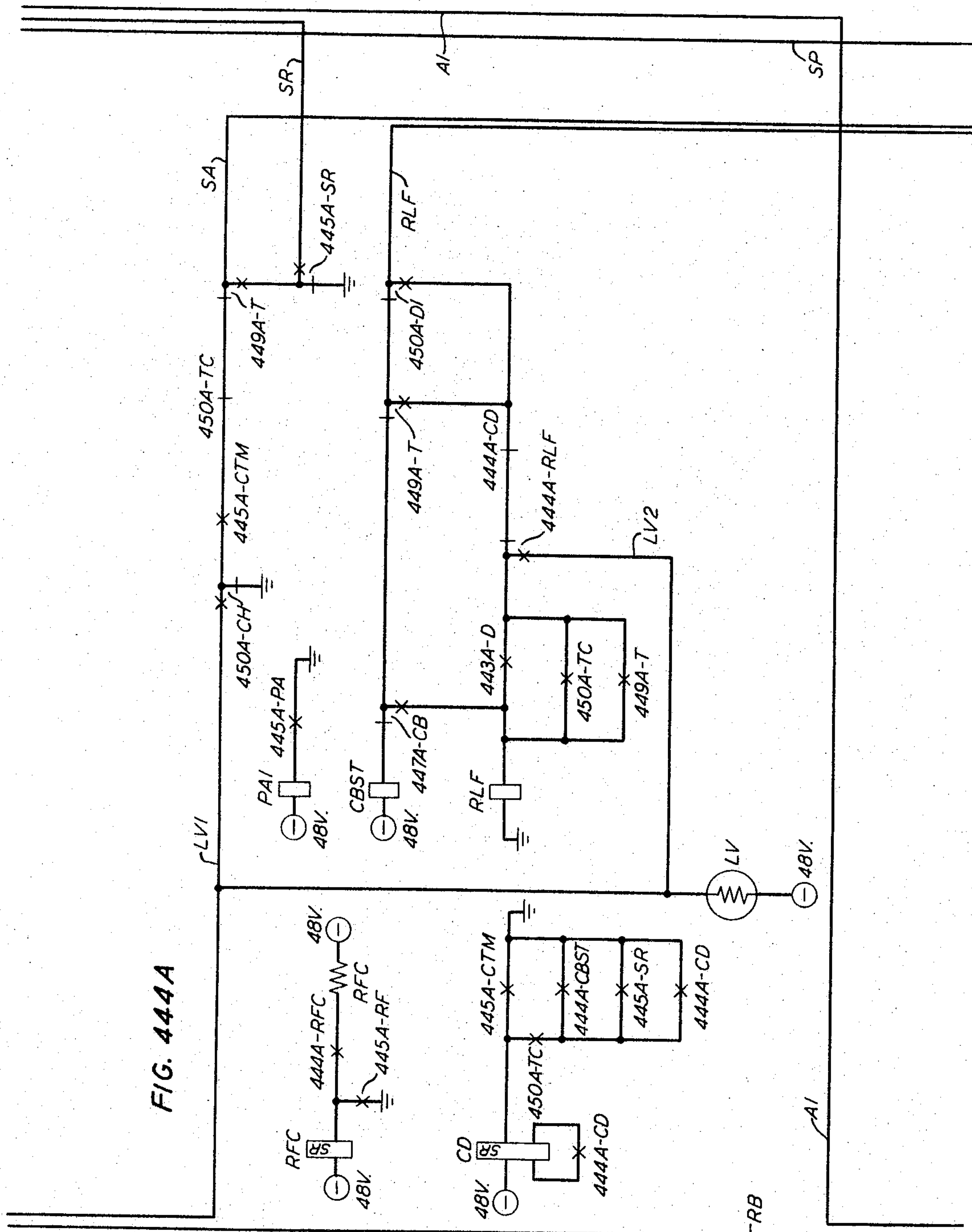
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 562



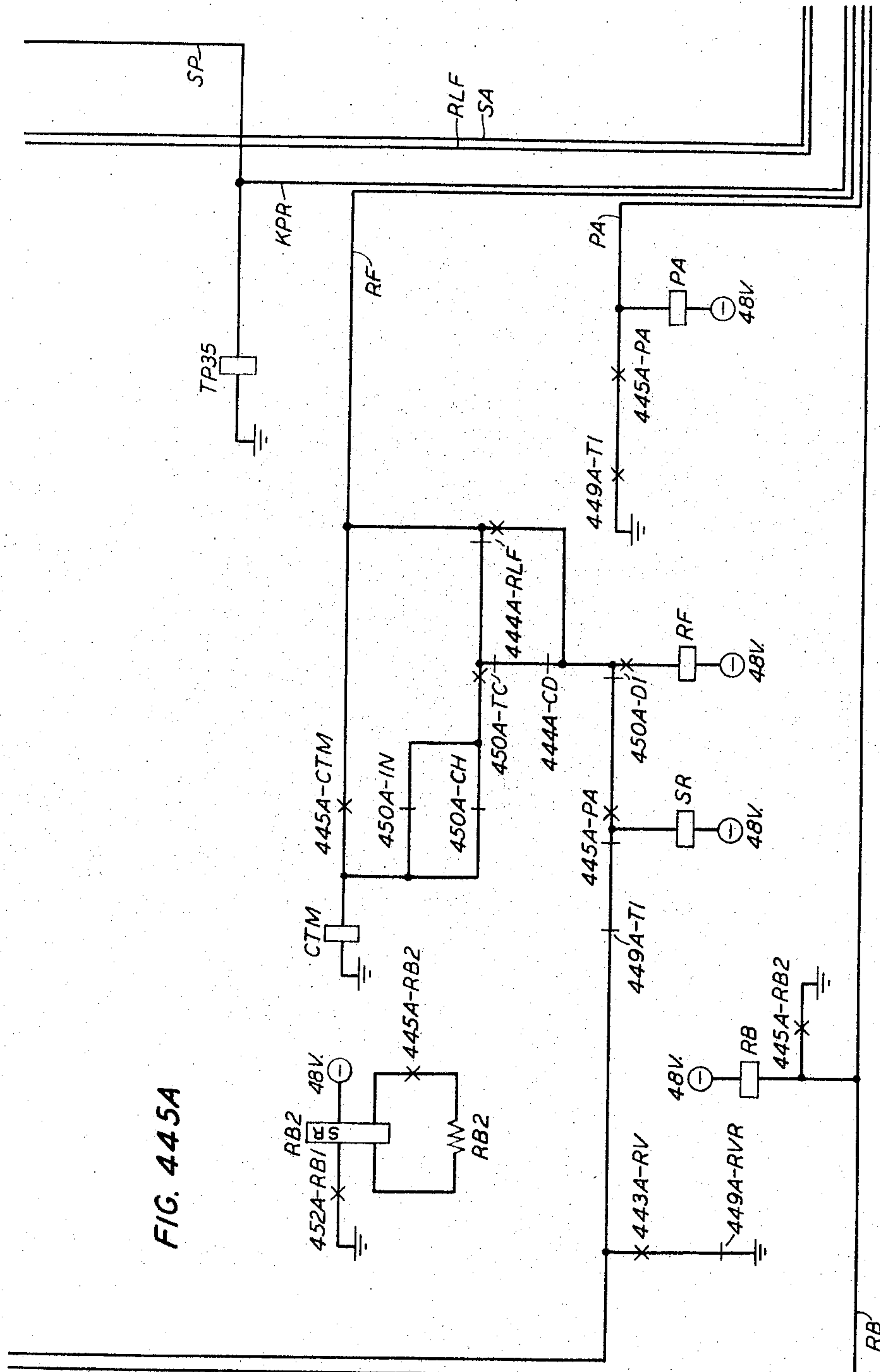
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 563



Sept. 12, 1967

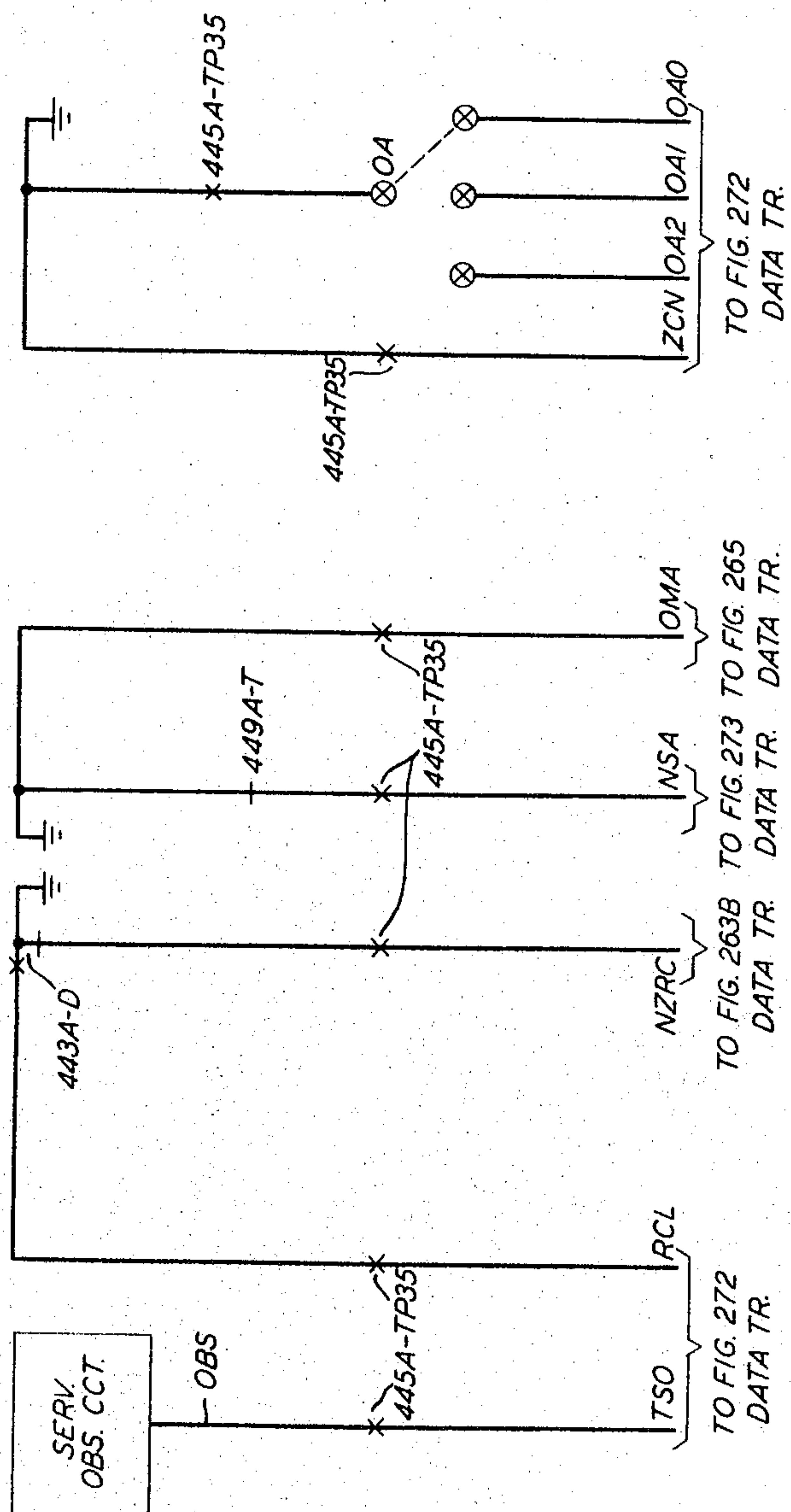
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 564

FIG. 446A



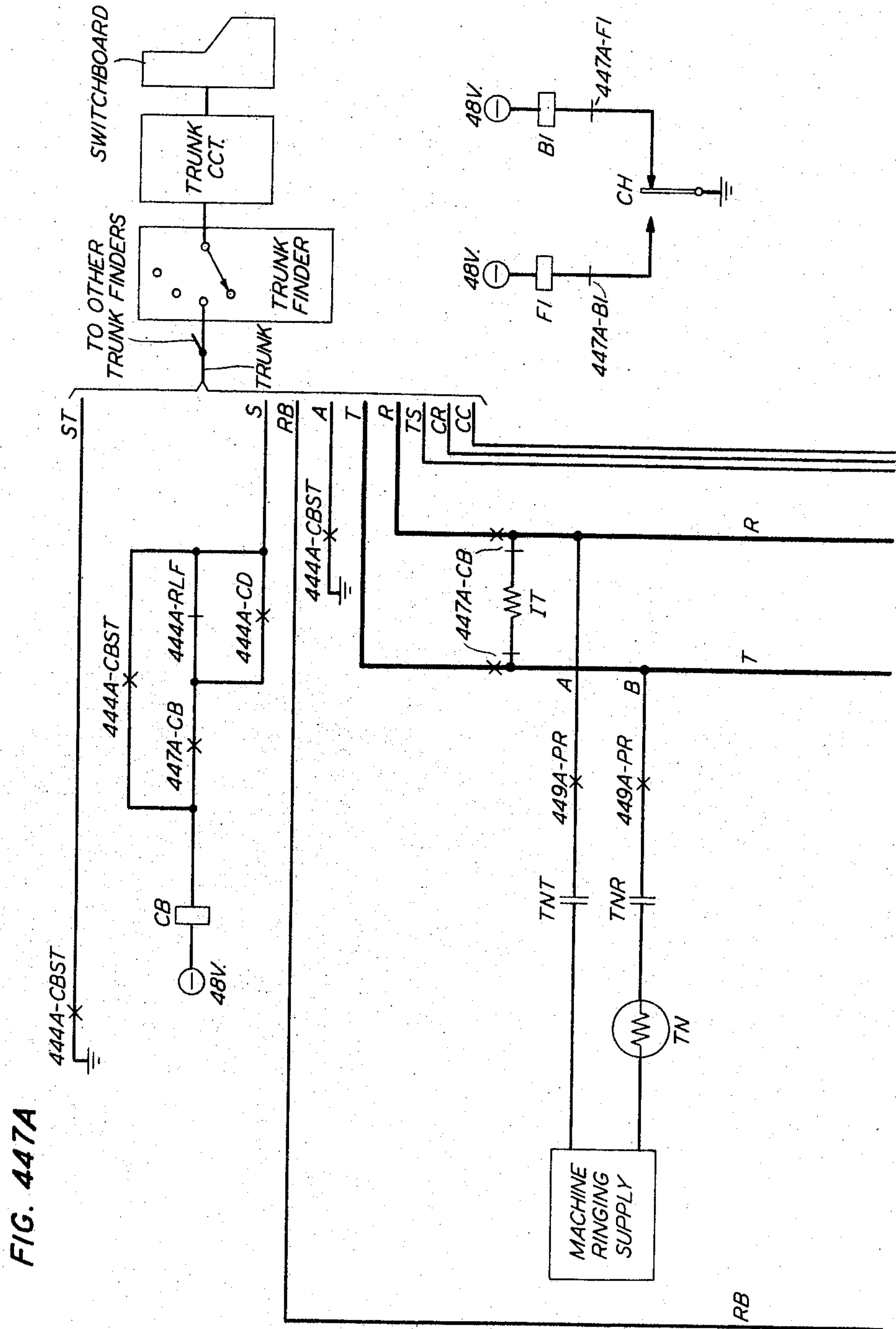
Sept. 12, 1967

Filed Nov. 26, 1963

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

570 Sheets-Sheet 565



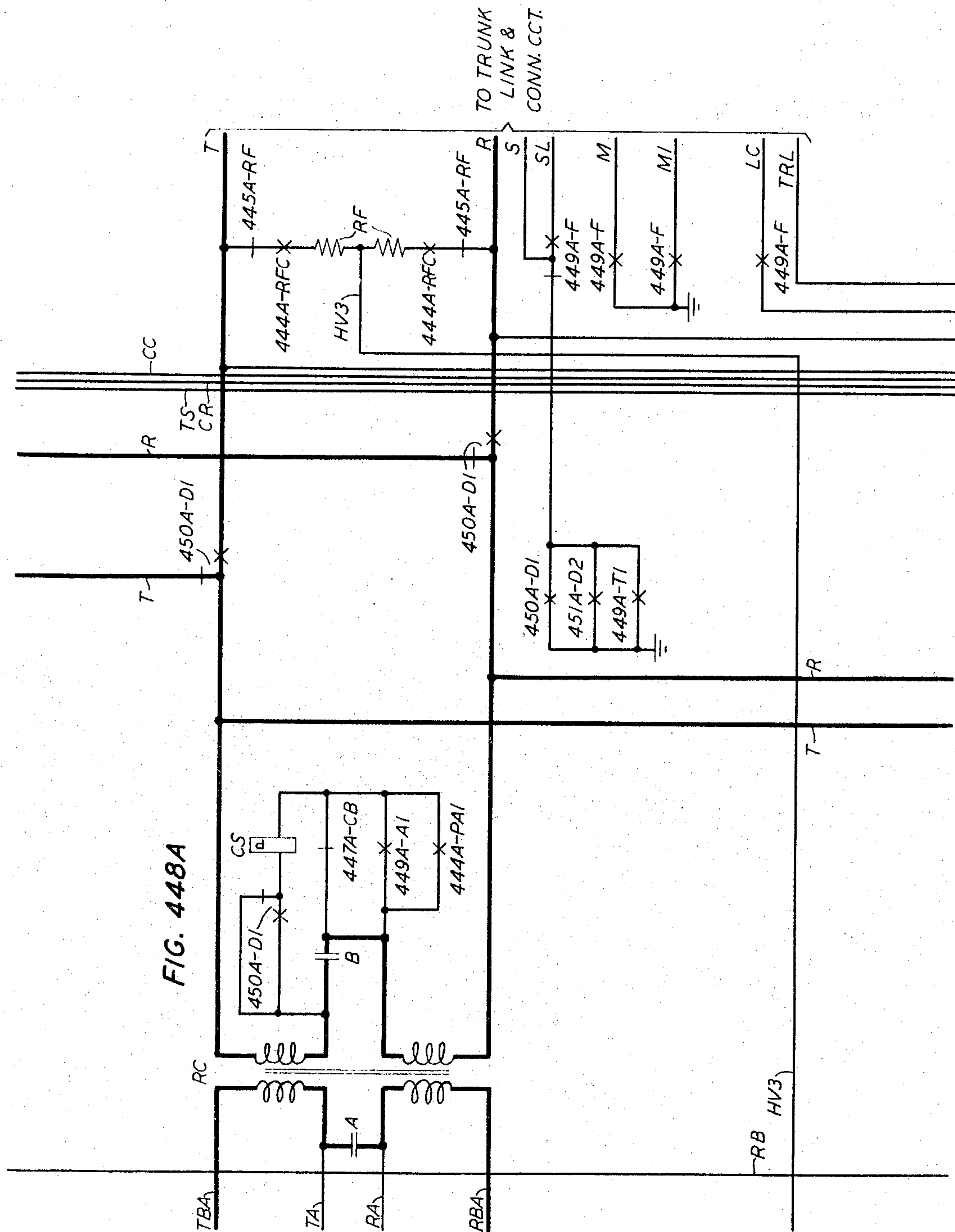
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 566



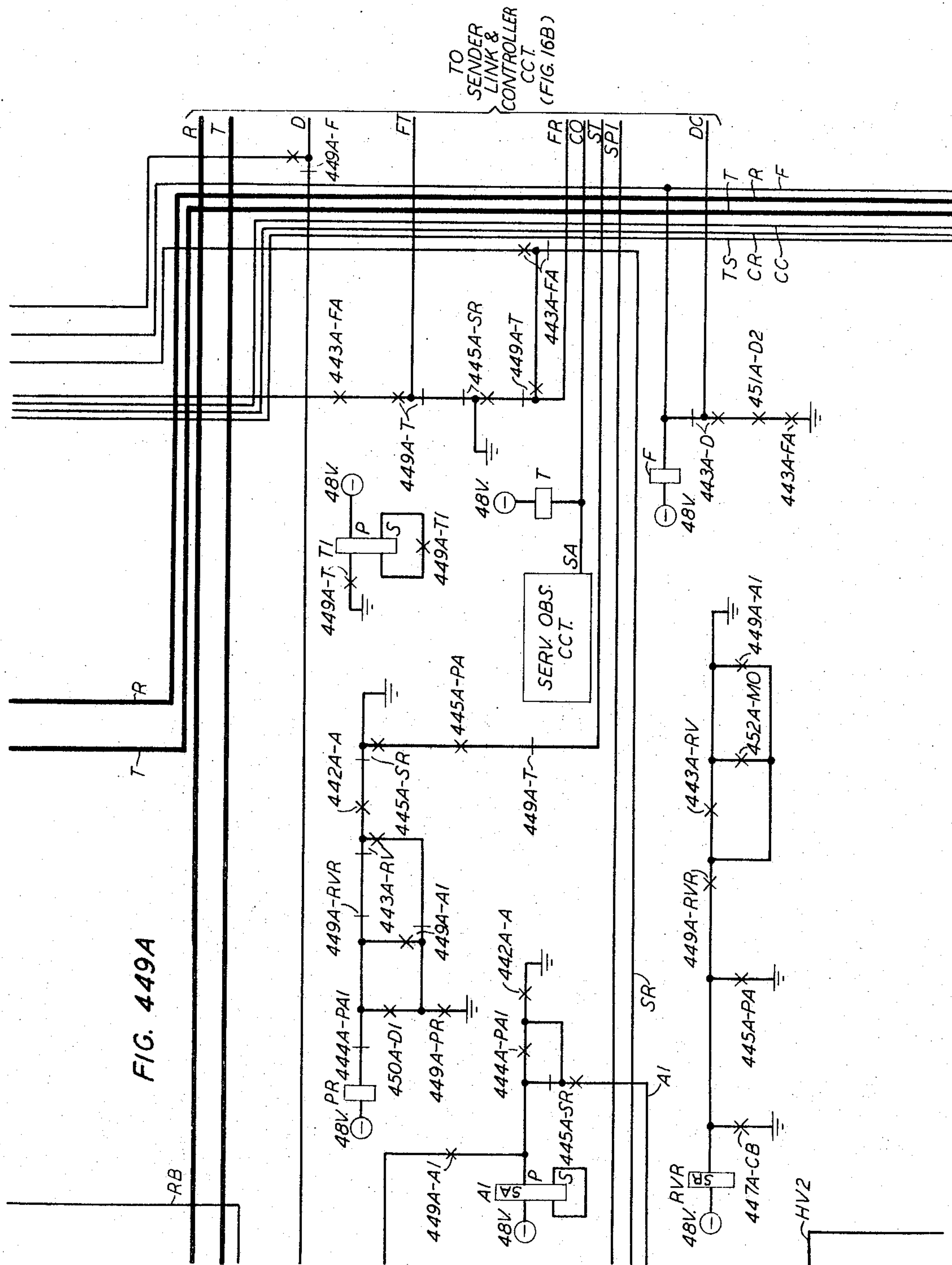
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 567



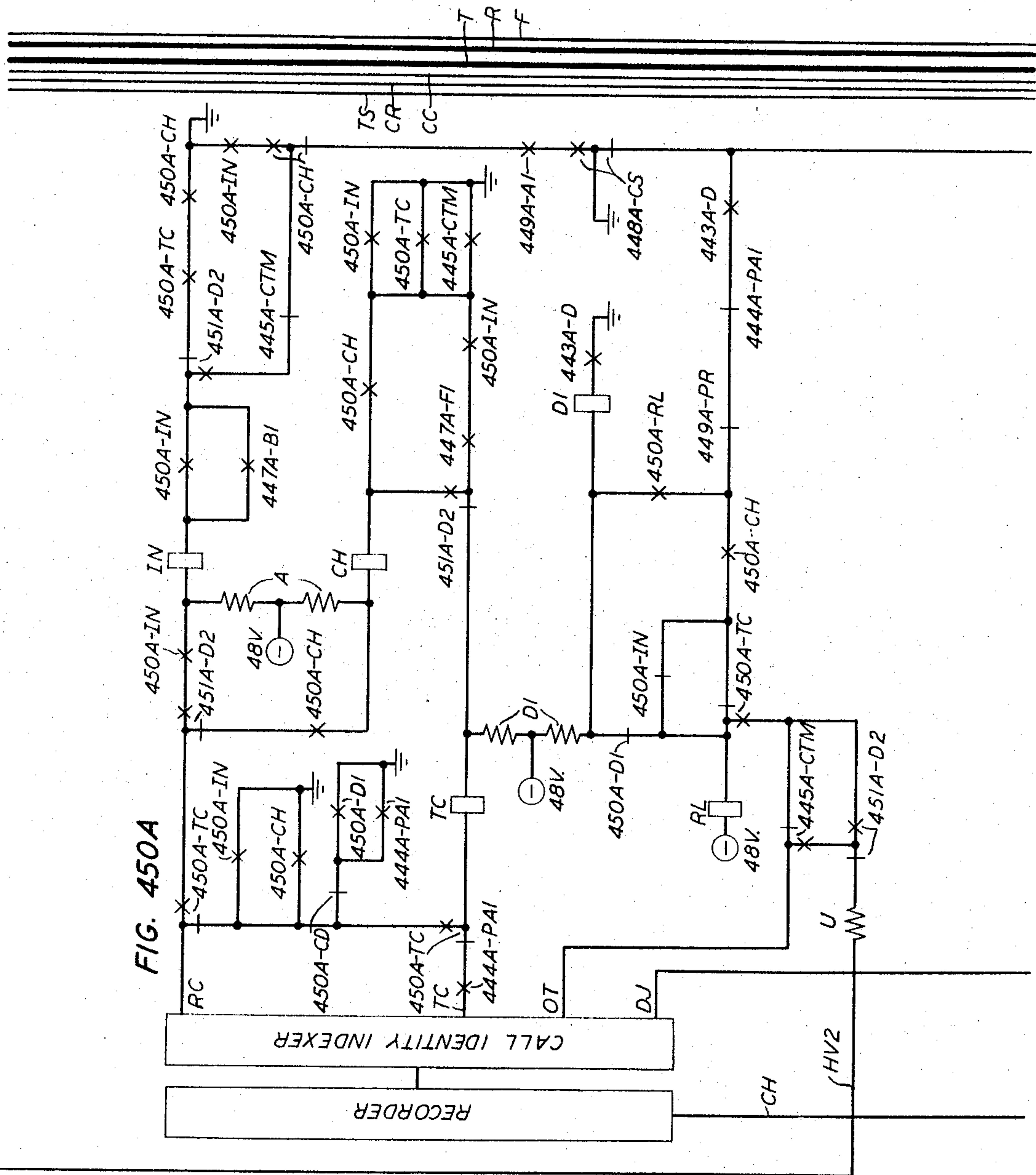
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 568



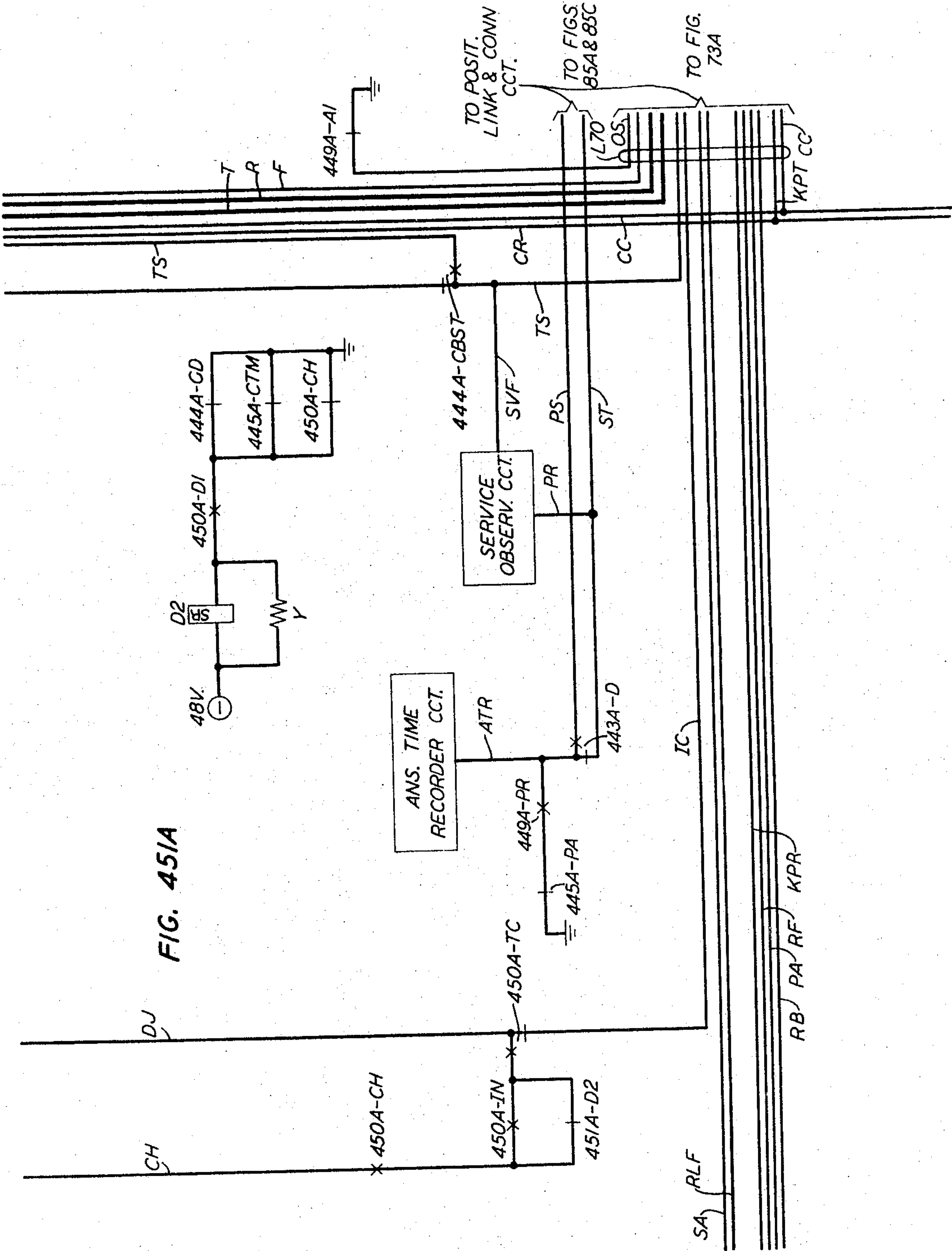
Sept. 12, 1967

L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 569



Sept. 12, 1967

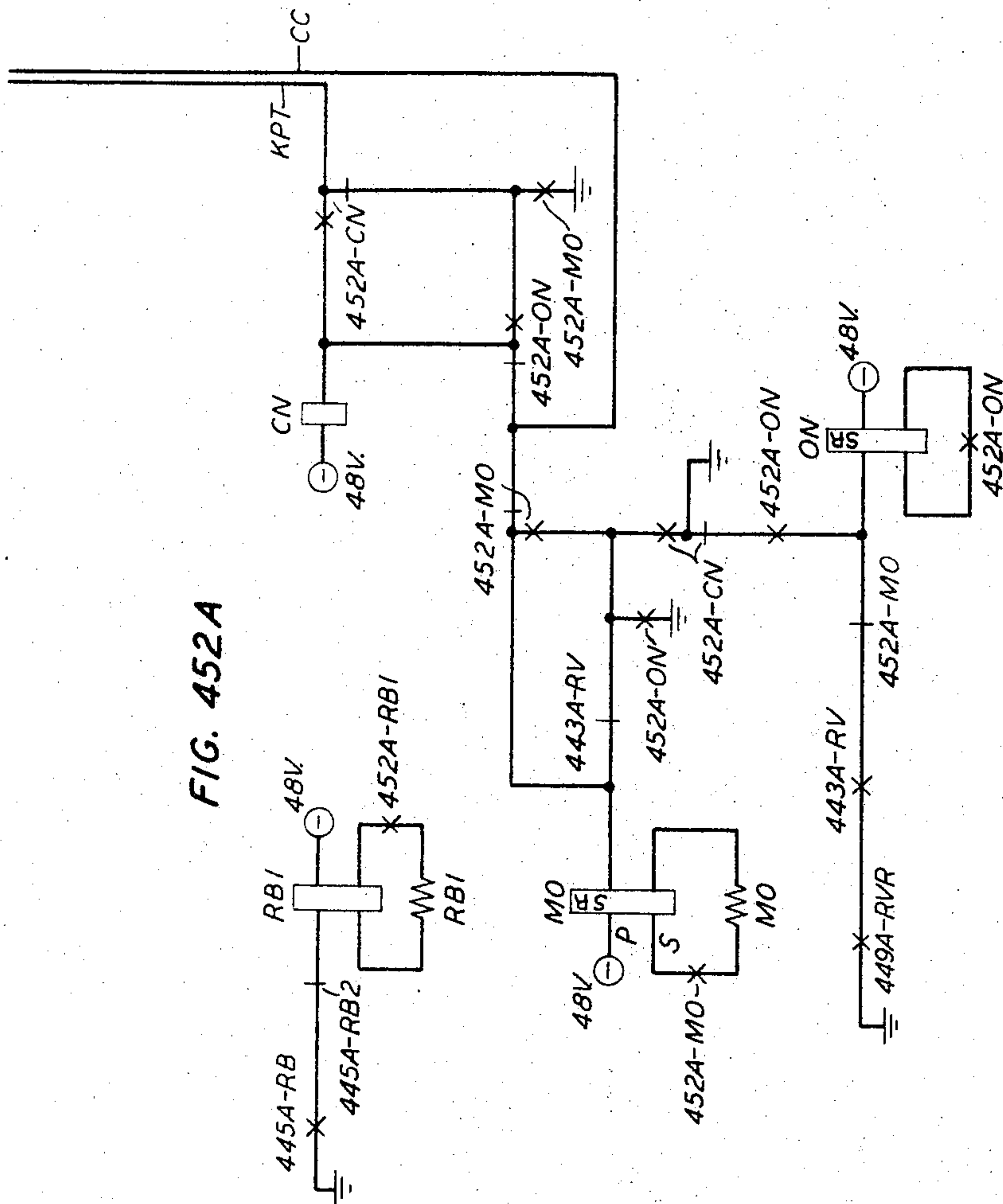
L. J. CERNY ETAL
EQUIPMENT FOR OPERATOR SERVED CALLS AT AN
INTERMEDIATE SWITCHING CENTER

3,341,662

Filed Nov. 26, 1963

570 Sheets-Sheet 570

FIG. 452A



1

3,341,662

EQUIPMENT FOR OPERATOR SERVED CALLS AT AN INTERMEDIATE SWITCHING CENTER

Louis J. Cerny, Long Island City, N.Y., Orfeo Cesareo, Washington Township, Bergen County, N.J., Robert B. Curtis, Columbus, Ohio, John G. Nightingale, Fair Lawn, N.J., and Frederick H. Parkinson, Jr., Columbus, Ohio, assignors to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York
Filed Nov. 26, 1963, Ser. No. 325,842
81 Claims. (Cl. 179-27)

This invention relates to a switching system, and more particularly to a telephone switching system which expedites the serving of calls requiring operator assistance for their completion. The present invention also relates to a switching system which reduces the time required to complete toll calls initiated from coin stations. The invention still further relates to a switching system which enables a calling customer at a coin station to dial the called station number, including the area code, on many types of toll calls requiring operator assistance for their completion. The invention also relates to a switching system which reduces the operator call effort and holding time by automatically timing and computing the charges on customer-dialed coin toll calls.

Recent advances in the telephone switching and call data recording art have mechanized telephone switching networks to the extent that it is now commonplace for noncoin subscribers to dial practically all of their local calls and a substantial portion of their station-to-station toll calls without operator assistance being required either for the extension of a connection to the called station or for the recording of call charge data. This degree of automation has been brought about by the development of suitable local, tandem, and toll switching centers for the serving of customer-dialed calls, together with the development of suitable automatic call charge data recording equipment.

However, these advances have merely reduced, rather than eliminated, the need for operators since a substantial percentage of present-day toll calls still require operator assistance for their completion. The term "toll call" as used in this specification includes long-distance calls, as well as other types of calls for which a charge is assessed, other than those of a strictly local nature. Included among the types of both coin and noncoin toll calls currently requiring operator assistance are: (1) person-to-person, (2) collect, (3) credit card, (4) charge-to-third-party, and (5) a miscellany of other types, such as mobile and marine calls. The calls in categories (1) through (5) are hereinafter referred to as special service calls since the calling party requires some sort of special service by an operator in addition to the extension of a connection to the called station, special service even for the completion of a station-to-station connection, or operator assistance for the extension of a connection to the called station as well as further assistance once the connection is established.

In addition to the above listed types of toll calls requiring operator assistance, operator assistance is also required on many types of coin toll calls, both those in categories (1) through (5) and those of the station-to-station type, in order that the call charges may be collected from the calling party.

2

The copending R. B. Curtis application, Ser. No. 318,275, filed Oct. 23, 1963, hereinafter referred to as the R. B. Curtis disclosure or specification, discloses a switching system having facilities whereby noncoin calls of the types set forth in categories (1) through (5) may be completed with a minimum of operator assistance. Curtis discloses a switching system in which operator and recording equipment are provided at a tandem switching center for serving calls of the types which heretofore have been typically served at tandem, as well as for serving noncoin special service calls originating in local offices served on an originating basis by the tandem switching center.

Calls of the type which have heretofore been typically served on an originating basis by tandem may include calls requiring merely a tandem switching operation, calls requiring a switching operation plus a call charge data recording operation at tandem and for which the calling station information is automatically transmitted to tandem via automatic number identification facilities in the originating office, and calls requiring a switching operation plus a call charge data recording operation at tandem and for which operators stationed at the tandem office are momentarily bridged onto the calling connection in order to obtain from the calling party the calling station number and to key this information into the switching equipment which, in turn controls a charge data recording operation. The noncoin special service calls served by the system comprising the Curtis invention are of the types priorly enumerated in categories (1) through (5).

Each special service call incoming to the tandem office disclosed in the Curtis invention is routed to a tandem operator who: (1) converses with the calling party to ascertain the type of service required, (2) furnishes the requested service, (3) controls the recording of the call charge data required for billing purposes, and (4) depending upon the call type, either releases from the connection immediately after furnishing the requested service, or at the end of the call. The provided equipment at tandem minimizes the operator duties on most special service calls and thereby reduces the operator call holding time. This, in turn, reduces the call completion time. The operator duties are reduced by the provision of switching equipment which enables many types of special service calls to be completed on a customer-dialed basis to any called station to which a station-to-station connection may be established by the same calling party on a direct-dialed basis. The operator duties are also reduced by the provision of automatic call charge data recording equipment which permits the data required for subsequent billing purposes to be recorded automatically for all special service calls except a relatively limited few which still require manual ticketing by the operator.

If a special service call in the Curtis system is of the customer-dialed type, called office information is outputted from the originating office as a consequence of the dialing operation and, in response thereto, the tandem switching equipment proceeds to establish a connection therethrough extending to the called office. At the same time, the call is momentarily routed to a tandem operator only for the furnishing of the call assistance required in addition to the extension of the connection to the called station. If the call is not of the customer-dialed type, it is immediately routed to the tandem operator, who then

must furnish all the assistance normally provided on customer-dialed calls and, additionally, must obtain the called station number from the calling customer and key it into the system.

The centralizing of the operators and of the charge recording equipment at tandem in accordance with the Curtis invention is advantageous in that it dispenses with the need for operators and recording equipment at the local offices. This enables customers in local offices served on an originating basis by the tandem office to be accorded the benefits of reduced operator holding time and direct dialing for many types of noncoin special service calls, even though the volume of special service traffic generated in each local office is insufficient to warrant the installation of special service operators and equipment therein.

The Curtis invention provides a significant advancement in the switching art in that it expedites the serving of, reduces the completion time of, and additionally, for the first time, extends the benefits of subscriber dialing to many types of noncoin special service toll calls. However, the improvements provided by Curtis are not applicable to all types of toll calls since he makes no provisions for serving toll calls originating at coin stations. The Curtis system cannot serve coin calls because it contains no facilities either for computing call charges or for enabling the operator to monitor the collection of such charges. These limitations restrict the percentage of toll calls whose completion can be expedited by Curtis since a substantial portion of the current-day toll traffic is of the coin type.

A majority of coin toll calls are presently served in a manner wherein the calling customer makes an initial deposit, dials the operator, gives the operator the called station number including area code, if any, and then deposits the monetary amount requested by the operator. The operator determines and informs the calling party of the initial period charge, dials the called number, monitors the collection of the initial period charge, times the call for its duration, computes the overtime charge, informs the calling party of the overtime charge, monitors the collection of this charge and, additionally, performs whatever special service, if any, may be required, such as for example, ascertaining that the specified party is available on a person-to-person call.

The operational procedures associated with the serving of coin toll calls are somewhat less than ideal, both for the telephone companies and for their customers. The formidable and time-consuming quantity of operator's duties required for such calls limits the operator call-serving rate. This, in turn, represents a financial and a personnel burden to the telephone companies that is, at times, out of proportion to the revenue derived from such calls. The operational procedures are less than ideal for the customers since the completion of their calls must, of necessity, be delayed by the time required for the operator to perform the many duties required of her. As a result, a customer who is accustomed to completing toll calls on a direct-dialed basis from his home or office phone to certain called stations with practically no delay, may have to wait a considerable period of time when placing a coin call to the same called station. This results mainly from the fact that he cannot perform his own dialing operation on coin toll calls, as well as from the fact that the charges for such calls must be manually determined by the operator, either from records at her position or from a special rate-and-route operator.

It may be seen from the foregoing that an immediate need exists in the switching art for facilities which reduce the operator holding time on, and which otherwise expedite the serving of, coin toll calls.

It is therefore an object of the invention to provide an improved switching system for the serving of coin toll calls.

It is a further object to provide an improved switching system for reducing the completion time of coin toll calls.

It is another further object to provide a switching system which reduces the operator duties and holding time on coin toll calls.

It is a still further object to provide a switching system which permits the customer-dialing of many types of coin toll calls.

The switching system of the present invention attains all of the foregoing objects by providing operators and equipment at a tandem switching center for the serving of all coin toll calls originating in local offices served on an originating basis by the tandem center. Each coin toll call incoming to tandem is routed to an operator who: (1) in the event the call charges are to be paid at the calling station, informs the calling party of the required charges and supervises their collection, (2) furnishes whatever additional call assistance may be required, and (3) depending upon the call type, releases from the connection either immediately after furnishing the requested assistance or at the end of the call.

The equipment provided at tandem in accordance with the present invention enables many coin toll calls to be completed on a customer-dialed basis, with the tandem switching equipment being automatically controlled as a consequence of the dialing operation and with operator assistance being required only for the collection of charges and for the rendering of any assistance requested by the calling party in addition to the extension of a connection to the called station. Each customer-dialed coin toll call incoming to the tandem office and requiring a further deposit by the calling party is routed to an operator who: (1) determines from an automatically controlled display board the amount of the required deposit for the initial period, (2) informs the calling party of this amount, and (3) monitors the collection of this charge, if it is to be paid at the calling station, before releasing from the connection and permitting the calling and called parties to converse.

If the received call is of the person-to-person or collect type, the operator additionally performs the services requested by the calling party in addition to the extension of the connection to the called station before releasing from the connection. Also, if the call charges are to be paid at the calling station, an operator is reconnected to the calling circuit at the end of the initial period in order to inform the calling party that the call is entering overtime, and again at the completion of the call, in order that she may determine the overtime charges from the automatic display board and supervise their deposit by the calling party.

Coin toll calls which are not customer-dialed are routed to a tandem operator who converses with the calling party to ascertain the type of service required, and then furnishes this service, including the dialing of the called station number. If the call charges are to be paid by the calling party, the operator position remains attached to the connection for the entirety of each call in order that the operator may manually time, compute, and collect the charges therefor in the customary manner. If the call is to be charged to the called party, to a credit card, or to a third party, the operator controls the recording of the charge data required for subsequent billing purposes, and then releases from the connection. The timing of the call as well as the charge data recording operation is then performed by automatic message accounting equipment in the same manner as for a comparable type of noncoin call in the Curtis system.

The equipment provided at the tandem office in accordance with the present invention reduces the operator duties on most coin calls and thereby, in turn, reduces the operator holding time per call and, consequently, the call completion time. The operator duties are less-

ened by the provision of the aforementioned switching equipment which enables coin toll calls to be completed on a customer-dialed basis to most called stations to which a station-to-station connection may be established from the same calling locality from a noncoin phone on a subscriber-dialed basis. The operator duties are further lessened by the provision of computing equipment which, for customer-dialed calls, receives call data from various circuits of the tandem office and, in response thereto, automatically determines the monetary amount to be deposited by the calling party for both the initial period charge at the beginning of the call and for the overtime charge at the end of the call. The operator duties are still further lessened on many customer-dialed toll calls by the provision of automatic call timing equipment which receives information from the computing facilities and, in response thereto, times the initial period portion of each such call, controls the connection of an operator to the calling circuit at the end of the initial period in order that she may inform the calling party that the call is about to enter overtime, times the overtime portion of the call, and controls the connection of an operator to the calling circuit at the end of the call for the collection of the charges then due.

The operator duties are also reduced by the provision of automatic call charge data recording equipment which permits the call data required for subsequent billing and accounting purposes to be recorded automatically under control of an operator for those coin calls for which such information is desired. Data pertaining to coin toll calls is recorded whenever the charges are to be reversed and paid by either the called party or by a third party. This data is also sometimes used to facilitate the determination of Federal excise taxes due as well as the division of revenue between phone companies.

The aforementioned automatic charge-computing and call-timing equipment is operative only on customer-dialed calls and comprises the combination of a charge rater, a charge computer, as well as incoming trunk circuits having facilities for timing the calls served thereby as well as for registering certain items of data having charge significance. A new and novel switching circuit, hereinafter referred to as a data transfer circuit, is provided in order to interconnect an incoming trunk, an operator position, a rater, and a charge computer, as well as certain other circuits, on each customer-dialed toll call in order that the interconnected circuits may interchange call data.

The rater receives information identifying the calling and called offices, as well as other information, from various circuits of the tandem office on all calls which are to be automatically timed and for which the charges are to be automatically computed. The rater, in response to the receipt of this information, derives a charge rate for the call as well as information signifying the duration of the initial period. The charge rate does not represent a monetary amount but, instead, represents an arbitrary number indicating the manner in which the call charges are to be computed after its elapsed time is determined. The charge rate and initial period duration information is then transmitted from the rater via the data transfer circuit to the incoming trunk circuit serving the call, as well as to an operator position circuit which has been priorly attached to the calling connection under control of the incoming trunk circuit. This information, along with certain other information having charge significance, is stored in registers of both the trunk and the position circuits. The trunk circuit and the rater then release from the data transfer circuit. The trunk remains connected to the position circuit via a position link, while the position circuit, in turn, remains connected to the data transfer circuit. The rater is free to serve other calls at this time.

The data transfer circuit next interconnects the position circuit with a computer, and charge information, includ-

ing the charge rate, stored in the position circuit is transmitted to the computer which computes the charge for the initial period portion of the call. In so doing, the computer considers the amount initially deposited by the calling party, and then transmits to the operator position information signifying the additional amount that must be deposited by the calling party to cover the cost of the initial period. This information is automatically displayed in front of the operator, who notifies the calling party of the required deposit, monitors the collection of this charge, and then depresses a key to release her position from the connection if no further operator services are required, as would be the case on a station-to-station call. If a charge record is to be made for accounting purposes, the operator also depresses a key to initiate a data recording operation before releasing from the connection. If further operator services are required beyond the mere extension of the connection to the called station, such as for example, on a person-to-person call, the operator also performs these services before releasing from the connection. However, if the calling party at this time informs the operator that the call is to be of the collect, charge-to-third-party, or credit card type, the operator depresses a key to disengage the automatic timing and charge-computing facilities. In this case, the call charges are subsequently determined from information recorded by the automatic message accounting equipment in the same manner as for the customer-dialed noncoin station-to-station calls described in the Curtis specification.

Assuming that the call charges are to be deposited by the calling subscriber and that the automatic timing and charge-computing facilities of the office are required, the timing of the call begins when the operator releases from the connection, or after the called station answers, whichever occurs later. The timing of the call is controlled by the equipment within the incoming trunk circuit which, as already mentioned, has currently stored in its registers information signifying the charge rate for the call as well as the duration in minutes of the initial period. The timing facilities within the trunk include a pulse-actuated time-counting circuit which times the initial period on all calls and which additionally, as subsequently described, times the overtime portions of all calls which extend into overtime.

The timing of the call proceeds up to the point where the trunk timer determines that the call has continued for a period of time which approaches the initial period duration received from the rater and stored in the trunk register. The trunk then, in response to the reception of an end-of-initial period signal from its timer, causes other circuits of the office, including a position link, to attach an operator position to the calling circuit on a priority basis. The position circuit, once it is attached to the calling connection, signals the data transfer circuit to interconnect the calling trunk with the position as well as with a computer. The tandem office includes a plurality of operator positions, and the particular position to which the trunk is connected at this time need not be the same position to which the trunk was connected at the beginning of the call.

The call information currently registered in the trunk circuit, including the charge rate and a person-to-person or a station-to-station indication, is transmitted via the data transfer circuit both to the operator position circuit and to the computer. The computer, in response to the receipt of this information, derives the monetary charge for a single overtime period as well as information signifying the duration of a single overtime period, and then transmits this data to the operator position circuit where it appears on the automatic display board. The overtime period duration information is also transmitted from the computer, via the data transfer circuit, to the trunk circuit at this time for registration therein. The trunk timer, in the meantime, has been reset to zero in order that it may time the overtime portion of the call in the event

that the call should proceed into overtime. The data transfer circuit is then released.

The operator, who is currently connected to the calling connection via the position link, advises the calling party that the call is about to enter overtime. If requested, she also advises him concerning the charge for and duration of a single overtime period. She then releases from the connection and the timing of the call once again proceeds under control of the timer in the trunk. The trunk timer now times the overtime portion of the call by counting the number of overtime periods under control of the overtime period duration information received from the computer and registered in the trunk.

At the end of the call, when either party hangs up or when the calling party flashes his switchhook, the trunk once again causes an operator position to be attached on a priority basis to the calling connection and, additionally, causes the data transfer circuit to interconnect the attached operator position with the trunk as well as with a computer. The trunk may be connected to any available operator position at this time and need not be connected to the position or positions which earlier served the call. The call information now registered in the trunk includes the charge rate, a person-to-person or station-to-station indication, as well as the number of overtime periods counted by the trunk circuit. This information is transmitted via the data transfer circuit to the attached operator position circuit and to the computer.

The computer derives the charges applicable to the overtime portion of the call and transmits this information to the attached operator position. The operator informs the calling party of the overtime charges, monitors the collection of these charges, and releases from the connection. The charge information supplied by the computer at the end of the call includes the charges necessary to cover any required excise taxes. It also includes an adjustment for any tax paid in connection with the initial period deposit in order that the total tax paid by the calling party will not be greater than that required.

Noncustomer-dialed coin calls may arrive at tandem either on trunks which exclusively serve such calls or on trunks which serve a plurality of types, including both customer-dialed and noncustomer-dialed. In either event, the automatic trunk timing as well as the charge computing equipment, including the rater and the computer, are not used on noncustomer-dialed calls. Instead, these calls are manually timed, rated, and the charges therefor computed in the conventional manner by an operator at one of the operator positions. However, even though these operations must be performed manually, the position circuits contain sufficient facilities so that these functions may be performed with a minimum of effort by the operators, as compared with the facilities provided by the systems of the prior art.

The equipment provided in the tandem office includes position link circuits which comprise an interconnecting medium between the incoming trunk circuits and a plurality of operator positions, each of which may have a busy or an idle condition, depending upon whether or not it is currently engaged in the active serving of a call. The position links are utilized one or more times on each call to connect an incoming trunk with an idle operator position. On each request from an incoming trunk for connection to an operator position, a link determines the type of trunk that is initiating the request, determines whether an idle operator position is available to serve the type of trunk requesting service, and if such a position is available, the link then interconnects the bidding trunk with the idle position. The position links also have preference circuitry which ensures that simultaneously bidding trunk circuits are connected to operator positions in approximately the same order in which their bids are received by the links.

All coin trunks which may serve customer-dialed calls that are to be automatically timed and the charges there-

for computed have facilities whereby the trunk may selectively request either a priority or a nonpriority connection via the position link to an operator position. As priorly described, trunks of this type request nonpriority position link service at the beginning of a call and priority service at the end of the initial period and at the end of the call.

The position links have priority seizure circuitry and a nonpriority seizure circuitry which together enable each link to determine the type of service currently being requested by a trunk and, in turn, to connect a bidding trunk to an operator position either on a priority or a nonpriority basis. The position links also have circuitry which ensures that all trunks currently bidding for priority service are connected to idle operator positions as they become available before any nonpriority requesting trunks.

The operator duties are further minimized by the provision of equipment associated with each operator and comprising cordless positions which have facilities enabling the operators to serve, with a minimum of effort, practically all conceivable types of coin and noncoin calls incoming to the tandem office and requiring operator assistance. Accordingly, each operator position includes a plurality of keys, of which there is one for each call function that may be performed by the operator. Included among these is a key for each type of special service call having call billing significance, i.e., collect, person-to-person, charge-to-third-party, and credit card. The depression of one of these keys on a call, together with the depression of a start-timing key, causes the recording equipment to record the data typically recorded on a station-to-station connection, and, in addition, causes it to record information signifying the nature of the special services provided. Also included at each operator position are keys which enable the operator to release the forward portion of an existing connection and to key a new called number into the system in order to control the establishment of a connection to the called station represented by the new number.

Each operator position also has keys and associated circuitry which together enable the operator to change the billing class of the call in the event that such a change is required. For example, a call may arrive at tandem on a customer-dialed station-to-station basis and then, after conversing with the operator, the calling subscriber may request that the call be completed on a person-to-person basis. In this case, the operator first depresses a key which releases certain of the billing information currently registered in her position and then depresses a further key which enters into her position registers the billing data associated for a person-to-person call.

The capacity of the rater is somewhat limited in that it can derive charge rates for about only 95 percent of the customer-dialed calls that can be served by the tandem office. On the remaining 5 percent, the rater, in response to the information fed thereto, instead of deriving a charge rate, derives and transmits to the attached operator position an indication that the call cannot be automatically rated and that the operator should manually determine the charge rate. On these calls, the operator determines the charge rate from information available at her position and then keys the charge rate into her position registers. This information is then subsequently transmitted to the computer, which derives the initial period charges in the same manner as previously described for automatically rated calls. The incoming trunk serving the call subsequently receives the charge rate and the initial period duration from the computer, rather than from the rater.

Each operator position also includes the equipment typically associated with operator positions, such as keys for controlling ring-forward and ring-back operations as well as coin-collect and coin-return keys. Further, each position contains versatile display facilities whereby an operator may selectively cause various items of call data

to be displayed at her position. This arrangement permits information which is useful on some, but not all, calls to be displayed by the operator only when the information is required.

Each operator position includes a plurality of loop circuits, each of which has an active and a held condition. Each loop circuit includes a portion of the speech equipment and control circuitry required for the serving of a call. A loop is in an active condition at the time the operator headset is connected speechwise with the calling circuit to which the loop is connected and at the time the data pertaining to the call served by the loop is displayed on the position display board. A loop may be said to be in a held condition at the time the data for the call currently served thereby is not displayed at the position and at a time the loop is not connected speechwise with the operator headset.

An incoming call may be extended to an operator position by the position link only when one or more of its loops are in an idle condition at the same time that all of its busy loops, if any, are in a held condition. In other words, an incoming call may not be extended to a position circuit when any of its loops are in an active condition, even though one of its loops may currently be in an idle condition.

The extension of a call, via the position link, to an idle loop transfers the position link appearances of all remaining idle loops, as well as the loop to which the call is extended, from an idle to a busy indication. The calling loop remains in its active condition for the duration of time that the operator actively serves the call. Once the call has progressed to the point where the operator need not, for the time being, furnish further service in connection therewith, although she must for one reason or another hold the call at her position, such as for example, if it requires manual timing, she depresses a key at her position which transfers the loop from an active to a held condition. The transfer of the loop from its active to its held condition transfers the position link appearances of the other two loops of the position (assuming they are currently idle) from an apparent busy condition to an idle condition so that the position link may then extend other calls to either of two remaining loops. Once the call connected to the held loop progresses to the point where further service by the operator is required, the operator depresses a key which transfers the held loop back to an active condition, thereby permitting her to furnish whatever additional services may be required at the time.

The provision of facilities whereby the call on each loop may be transferred from an active to a held or from a held to an active condition enables the operator to serve a plurality of calls simultaneously with a lessened effort and yet, at the same time, permits her to keep a constant check on the current status of the call on each loop in order that she may furnish promptly and efficiently any service that may be required. Included in the circuitry associated with each loop is its own calculagraph timer, which enables the operator to individually time the call served by each loop.

The foregoing facilities of the system comprising the present invention require that the various circuits of the tandem office interchange a considerable quantity of call data. The data interchange is facilitated by means of a connector circuit comprising an improved and expanded version of the data transfer circuit disclosed in the aforementioned Curtis specification. It is described in detail by Curtis how his data transfer circuit connects various combinations of circuits at various times in order that the circuits of his system may interchange the data required for the serving of different types of calls. The data transfer circuit of the present invention performs each and every function of the data transfer circuit disclosed in the Curtis specification. In addition, for calls which are to be automatically timed, rated, and the

charges therefor computed, the presently disclosed data transfer circuit interconnects an incoming trunk, a position circuit, a rater, and subsequently a computer, as well as other circuits of the office, in order that the additional data interchange required for the serving of coin calls may be accomplished.

The tandem switching center of the present invention is not limited to the serving of coin calls and, accordingly, it may serve all types of noncoin nonspecial service calls which heretofore have been typically served at tandem as well as the various types of noncoin special service calls described in detail in said Curtis specification. Thus, it may serve noncoin nonspecial service station-to-station calls from local offices having their own call recording facilities, and for which no charge data recording operation need be performed at tandem. The only function of the tandem office on calls of this type is to extend a connection therethrough to the following office in response to the information received from the originating office. It may also serve noncoin nonspecial service station-to-station calls which require a charge data recording operation at tandem since the originating office is not equipped with charge data recording facilities. It may further serve calls of the latter type for which the calling station number is automatically identified by the originating office and transmitted to tandem, as well as those for which the calling station number is not automatically identified and for which an operator at tandem must orally obtain this information and key it into the system. The tandem office may also serve a miscellany of other types of nonspecial service noncoin calls. The noncoin special service calls are served by the system of the present invention in an identical manner to that described in detail by Curtis. All special service calls require operator assistance in addition to that required for the extension of a connection to the called station, operator assistance only for the extension of a connection to the called station, or operator assistance for the extension of a connection to the called station as well as further assistance once the connection is established.

The tandem office of the present invention is provided with different types of incoming trunks which may be classified into groups in accordance with the type of traffic served by each group. Thus, for example, the incoming trunks may be first divided into noncoin nonspecial service trunks, noncoin special service trunks, and coin trunks. The noncoin nonspecial service trunks serve calls of the type which heretofore, before the advent of the Curtis invention, were typically served at tandem. The noncoin special service trunks are of the type disclosed in detail in the Curtis specification, while the coin trunks (those with which the present invention is mainly concerned) serve coin toll traffic originating in the local offices served on an originating basis by the tandem switching center of the present invention.

Both the noncoin special service trunks and the coin trunks may be further subdivided in accordance with the type of called station information outpulsing received thereover. The types of outpulsing discussed in detail in the present specification are MF (for multifrequency outpulsing), DP (for dial pulse outpulsing), and dial 0 (for calls where no called digits are forthcoming from the originating office). Each noncoin special service and each coin trunk may be further classified into an ANI or non-ANI category, depending upon whether or not the originating office served by the incoming trunk is equipped for automatic identification of the calling station number.

The foregoing subdivision of trunks into various groups requires that each local office served on an originating basis by the tandem office route its calls to the proper incoming tandem trunk. This, in turn, among other things, requires that each originating office must determine whether each call is of the noncoin or coin, as well as of the nonspecial or special service, type. The originating offices may determine whether each call is of the coin or

noncoin type in accordance with the usual expedients, such as equipment classification. It is presently contemplated that each originating office will determine whether a call is of the station-to-station or special service type by means of a directing digit dialed by the calling customer. For example, the calling customer may prefix his normal dialing routine with the digit "1" if station-to-station service is desired for both coin and noncoin calls. On the other hand, he may initiate a special service call of either the coin or noncoin type by dialing only the digit "0" to reach a tandem operator, or by dialing the prefix digit "0" followed by a full complement of digits representing a called station. The specific dialing routine for each special service call depends upon a number of factors, including whether or not a station-to-station connection may be completed on a direct-dialed customer basis to the same called station from a noncoin station of the same originating office.

Coin calls for which the prefix "1" is dialed are of the station-to-station type. On these, the originating office responds to the dial digits, establishes a connection to the tandem office, and outpulses the necessary called station information to tandem to enable the switching equipment thereat to establish a connection extending to the called station. Before the call is routed from the tandem office, it is routed to an operator only for a coin collection operation as previously described, and a charge data recording operation. The operator is connected to the calling connection at the beginning of the call, at the end of the initial period, and once again at the end of the call and, in response to the receipt of information from the automatic timing and computing equipment, she monitors, on each seizure, the deposit of the proper charges by the calling customer. These calls are fully timed, rated, and the charges therefor computed as already described.

Coin calls for which only the digit "0" is dialed are hereinafter referred to as dial 0 calls. Such calls may include calls to nondialable destinations, calls originated by handicapped people unable to dial, emergency calls, marine calls, and overseas calls. On calls of this type, the originating office recognizes that no called station digits will be dialed by the calling subscriber, and it then establishes a connection to a tandem trunk which exclusively serves dial 0 calls, or which serves dial 0 calls as well as other types of calls, and which, upon its seizure, informs the tandem office that no called station information will be outpulsed by the originating office. The tandem office, in turn, immediately routes the call to an operator who obtains the called station information from the calling party, performs the dialing operation required to control the establishment of the desired connection by the switching apparatus and, in addition, provides, or assists in providing, whatever other assistance, if any, that may be requested on the call. Also, since the call is assumed to be of the coin type, the operator must manually determine the charge rate and the initial period charge, monitor the deposit of the initial period charges by the calling party, time the call, notify the calling party at the end of the initial period that the call is about to enter overtime, and finally, at the end of the call she must compute the overtime charges and monitor their deposit. If desired, the operator may control the recording of charge data for subsequent billing and accounting purposes.

If a dial 0 call becomes a collect, credit card, or charge-to-third-party call, the call is then not served as just described. Instead, the operator keys the charge data into registers at her position which, in turn, causes the charge data required for billing purposes to be perforated by the automatic message accounting equipment in the same manner as is customary on noncoin station-to-station calls.

Coin special service calls for which the calling party dials a prefix digit of 0 followed by the called station digits may include person-to-person, collect, credit card,

and charge-to-third-party calls. On these, the originating office responds to the dialed digits, establishes a connection to the tandem office, and outpulses the necessary called station information to tandem to enable the switching equipment thereat, as well as that in any succeeding office, to establish a connection to the called station. Before the connection is routed through the tandem office, it is routed to a tandem operator who normally performs no further dialing operation and who is bridged onto the calling connection for furnishing the assistance required in addition to that for a comparable station-to-station connection, as well as for a coin collection operation and for controlling the automatic call charge data recording operation. Person-to-person calls for which the charges are to be collected by means of coin deposits from the calling party are fully timed, rated, and the charges therefor computed as previously described. The operator is also called in at the end of the initial period and at the end of the call to perform the same functions as described for the prefix 1 station-to-station coin call. If a prefix 0 coin call becomes a collect, credit card, or charge-to-third-party call, the automatic timing and charge computation facilities are not utilized and, instead, the charges for the call are subsequently determined from data perforated by the automatic message accounting equipment in the same manner as is customary on noncoin station-to-station calls.

The cost of a call and, in some instances, its call-handling procedure within the tandem office, is dependent upon its person-to-person or station-to-station classification. Therefore, it is necessary that the tandem office determine whether each call was initiated by the dialing of a digit 1 or a digit 0. This information is generated internally by the tandem office for calls on incoming trunks which exclusively serve calls of a single type, such as for example, station-to-station calls or special service calls. On these, the incoming trunk informs the sender concerning the type of traffic served by it and, the sender in turn, subsequently informs the remainder of the interested circuits of the office regarding the type of traffic associated with each call.

However, certain incoming trunk circuits of the system comprising the present invention serve calls for which the calling customer may have dialed a prefix "1" for station-to-station service, calls for which he may have dialed a prefix digit "0" for special service followed by the called station digits, as well as calls for which only an initial digit of "0" may have been dialed. The tandem office cannot by itself identify the type of service desired on each call served by such trunks. Therefore, in accordance with the present invention, the originating office, when extending a call to tandem via an incoming trunk capable of serving a plurality of different call types, ascertains the nature of the prefix digit dialed and transmits this information to tandem at the time it is outpulsing other call information. To elaborate, the originating office determines the nature of the prefix digit dialed and encodes this information into the start pulse for the called number outpulsing operation on calls for which such information is outpulsed in MF form. It encodes this information into the start pulse for the ANI outpulsing operation on DP calls and on dial 0 calls, for which no called number is outpulsed.

More specifically, the start pulse associated with MF outpulsing, whether it be of an ANI or a called number outpulsing operation, has typically comprised a certain combination of frequencies. The purpose of the start pulse has always been, and still is, to notify the MF receiver that the outpulsing operation is terminated and that it may proceed with whatever further circuit operations may be required. In accordance with the present invention, the start pulse is encoded to signify not only a start pulse indication, but also to signify the nature of the prefix digit dialed. The start pulse comprises a first pair of frequencies in the event a prefix digit "1"

was dialed and a second pair of frequencies in the event that a prefix digit "0" was dialed. This encoded start pulse is transmitted to the tandem office at the termination of its associated outpulsing operation in the conventional manner. The MF receiver at tandem, which in this case is situated in the sender circuit, has facilities for detecting and registering both types of start pulses. The reception of either type of start pulse effects the circuit operation typically associated with the reception of a start pulse. In addition, the reception of a start pulse indicating a prefix "1" digit energizes a relay within the sender to signify that the call is of the station-to-station type. The reception of a start pulse representing a prefix "0" digit operates a relay in the sender signifying that the call is of the person-to-person type. This station-to-station or person-to-person mark is then transmitted by the sender to other circuits of the office in order that the proper charges may be assessed on the call.

A feature of the invention is the provision of a tandem switching center having operators for the serving of coin toll calls incoming from local offices served on an originating basis by the tandem switching center.

A further feature is the provision of a tandem switching system which, in response to the reception of an incoming customer-dialed coin toll call, establishes a connection therethrough extending towards a terminating office, and simultaneously bridges an operator onto the incoming tandem connection for providing call assistance including the collection of charges from the calling party.

A further feature is the provision of a tandem switching system which, in response to the reception of calling and called office information on a customer-dialed coin toll call, automatically computes the call charges and transmits them to an operator who supervises their collection from the calling party.

A further feature is the provision of a tandem switching system having facilities for receiving and registering call data for customer-dialed coin toll calls originating in local offices served on an originating basis by the tandem switching center, facilities for computing the call charges in response to the registration of this call data, and facilities for transmitting the call charges to an operator who supervises their collection from the calling subscriber.

A further feature is the provision of a tandem switching system having automatic call time measuring facilities operative upon the reception of each customer-dialed coin toll call for measuring the chargeable conversation time thereof and for transmitting the measured time to an automatic charge computer which then computes the call charges.

A further feature is the provision of a switching system having facilities for registering call data during the serving of incoming customer-dialed coin toll calls, for establishing a connection extending towards the called office in response to the registration of this call data, for simultaneously bridging an operator onto the incoming connection, for automatically computing the initial period duration and the initial period charges under control of the registered data, for enabling the operator to supervise the collection of the initial period charges, for automatically timing the call during its initial period, for recalling an operator to the connection at the termination of the initial period, for automatically computing the duration and charge for a single overtime period and transmitting this information to an operator, for automatically timing the overtime duration of the call, for automatically computing the overtime charges at the termination of the call, and for recalling an operator to the connection at the call termination in order that she may supervise the collection of the overtime charges.

A further feature is the provision of a tandem switching system having operators for serving incoming coin toll calls together with recording facilities operable for recording call charge data.

A further feature is the provision of a tandem switching system which, in response to the reception of an incoming coin toll call from an originating office, bridges a tandem operator onto the incoming connection, in order that she may register called station information, supervise the collection of call charges, and control the recording of call charge data.

A further feature is the provision in a tandem switching center of operators for serving coin toll calls together with incoming coin trunks having circuitry for requesting nonpriority operator connections at the beginning of a call and for requesting priority operator connections subsequently during the serving of the call.

A further feature is the provision of a tandem switching system having operators for serving incoming coin toll calls, incoming coin trunks, together with position links for connecting an incoming coin trunk with an operator on a nonpriority basis at the beginning of a call and for connecting a coin trunk on a priority basis to an operator subsequently during the serving of the call under control of a trunk timer.

A further feature is the provision of a tandem switching system having operators for serving coin toll calls, position links for interconnecting a calling trunk with an operator position on a nonpriority basis at the beginning of a call, trunk facilities for registering the initial period duration of a call currently served thereby, trunk facilities for measuring the elapsed time for each call and for requesting a priority connection to an operator at the termination of the initial period, and facilities including the position link for interconnecting the trunk on a priority basis with an operator.

A further feature is the provision in a tandem switching system of a multifrequency receiver which registers start pulses comprising various combinations of frequencies, which initiates a first circuit operation common to the reception of all start pulses, and which initiates other circuit operations unique to each different combination of frequencies comprising the start pulses.

A further feature is the provision in a tandem switching office of incoming trunk circuits having timing and data registration equipment as well as nonpriority and priority service-requesting facilities which, under control of the timing equipment and the currently registered data, causes the trunk to request nonpriority operator service at the beginning of a call and to request priority operator service at the end of the initial period as well as at the end of the call.

A further feature is the provision of incoming tandem coin trunks having facilities for registering variable time information pertaining to the time durations applicable to different portions of the calls served thereby and for signaling other circuits within the office upon the expiration of each such time duration.

A further feature is the provision in a tandem switching center of incoming coin trunks having timing equipment and time duration registers operable under the control of automatically operable computers to register the time duration applicable to different portions of the various calls served thereby, and for signaling other circuitry within the office on the expiration of each registered time duration.

A further feature is the provision of a tandem switching center having automatically operable rating and computing equipment for deriving the charges for customer-dialed coin toll calls incoming from the originating offices served on an originating basis by the tandem switching center.

A further feature is the provision in a tandem switching center of a charge rater operable in response to the receipt of coin toll call data registered in the tandem office for deriving the charge rate and initial period duration for the call and for transmitting the derived information to both operator positions at the tandem office, as well as to registration facilities within the coin trunk serving the call.

A further feature is the provision of a tandem switching office having a charge rater operable upon receipt of call data from other circuits of the office for deriving output information including the initial period duration pertaining to a call, for transmitting this information to registers within the trunk serving the call which also has timing equipment for timing the initial period duration and for signaling other circuits of the office at the termination of the initial period.

A further feature is the provision in a switching system of a rater for deriving output information for each call including the call charge rate and initial period duration, a computer for deriving the initial period charge from the rater output information, an operator position for displaying the initial period charge and duration information, timing facilities for timing the initial period duration and for signaling the position circuit upon the termination of the initial period, facilities operable at the end of the initial period for transmitting the charge rate to the computer together with an indication signifying that the call is about to enter overtime, facilities for transmitting from the computer to the position information signifying the charge and time duration of a single overtime period, facilities for counting the number of overtime periods on each call, facilities for signaling the operator position upon the termination of each call, facilities for transmitting the charge rate together with the measured number of overtime periods to the computer at the call termination, and facilities for transmitting from the computer to the operator position the total overtime charges.

A further feature is the provision in a tandem office of a rater, a computer, an operator position, and an incoming trunk having timing and data registration facilities whereby the charge rater derives the charge rate and the initial period duration for each call and transmits this information both to the trunk and to the position, facilities whereby the position transmits the charge rate information to the computer, which, in response thereto, derives the initial period charge and transmits this information to the position for display thereat, facilities whereby the timing facilities within the trunk time the call upon the operator's release from the connection, facilities whereby the trunk timing equipment signals the operator position upon the termination of the initial period stored in the trunk registers, facilities whereby the call charge rate is transmitted from the trunk registers to the charge computer, which, in response thereto, derives information signifying the cost and duration of a single overtime period, facilities for transmitting this overtime information to the operator position and for transmitting the overtime period duration to the trunk circuit, facilities within the trunk circuit for timing the call upon the release of the operator from the connection and for counting the number of overtime periods, facilities within the trunk for signaling the operator upon the termination of the call, facilities for transmitting the charge rate and the number of call overtime periods to the operator position and to the computer, which, in response thereto, derives the overtime charges and transmits this information to the operator position for the collection of charges due.

A further feature is the provision of a data transfer circuit for interconnecting on each call various combinations of a trunk, a register, a sender, a position, a rater, and a computer, depending upon the type of each call as well as upon its progress within the tandem office.

A further feature is the provision in a tandem switching system of equipment for detecting the type of start pulse transmitted from the originating office on an MF outpulsing operation and, in response thereto, for deriving an indication as to whether a call is of the person-to-person or station-to-station type.

A further feature is the provision in a tandem switching center of a charge computer, an incoming trunk, an operator position having facilities for registering a manually derived call charge rate which is subsequently transmitted

to the computer, which, in turn, derives the initial period call charge and the initial period duration, with the initial period duration and the charge rate then being transmitted to the trunk circuit from the computer for registration therein.

A further feature is the provision of a tandem switching center for the serving of coin toll calls having operator positions which receives and register data having billing significance for each call extended thereto and which, additionally, have facilities whereby an operator may selectively erase certain of the currently registered billing data and enter new data therein as a consequence of changed call conditions.

A further feature is the provision in a switching system of a coin trunk having equipment for registering call data, for timing the initial period of each call, for signaling an operator position upon the expiration of the initial period, for registering other call data, for counting the number of call overtime periods, and for transmitting the measured number of overtime periods to a computer upon the termination of the call.

These, and other objects and features of the invention, may be more readily understood when taken in connection with the following description and drawings disclosing an exemplary embodiment of the invention, in which:

FIGS. 1A through 1F, when arranged as shown on FIG. 1G, diagrammatically illustrate the relationship between the various units of apparatus comprising the present invention;

FIGS. 2A through 2I, when arranged as shown on FIG. 2J, diagrammatically disclose the data transfer circuit together with the circuits of the office with which it cooperates;

FIGS. 3A through 3W, when arranged as shown on FIG. 3X, diagrammatically disclose in further detail the same circuits and circuit relationships shown in FIGS. 2A through 2I;

FIG. 4 diagrammatically discloses the relationship between the circuit elements comprising a position link frame;

FIG. 5 diagrammatically discloses further details of the primary A and B switches of a position link frame;

FIGS. 6A through 6D, when arranged as shown on FIG. 6E, diagrammatically disclose the link patterns between the primary, secondary, and tertiary switches of a position link frame;

FIG. 7 diagrammatically discloses the interrelationship between the incoming trunks, the position link groups, and the operator positions, as well as the interrelationship between the units of apparatus comprising a position link group;

FIG. 8A discloses the manner in which the drawing figures should be arranged for both the sender link circuit and for trunk circuits 00, 10, and 20;

FIG. 8B discloses the manner in which the drawing figures comprising trunks 30 and 35 should be arranged;

FIG. 8C discloses the manner in which the drawing figures comprising trunks 40 and 80 should be arranged;

FIG. 8D discloses the manner in which the drawing figures comprising trunks 90, 960, and 990 should be arranged;

FIG. 8E discloses the manner in which FIGS. 8A through 8D should be arranged in order to illustrate the relationship between the sender link and the incoming trunks;

FIG. 8F discloses the manner in which the drawing figures comprising the sender, the position link and connector, and the position link controller should be arranged;

FIG. 8G discloses the manner in which the drawing figures comprising the position link and connector, the position link controller, the key-control position-control circuit, the position control circuit, and the position circuit should be arranged;

FIG. 9A discloses the manner in which the drawing figures comprising the sender circuit should be arranged;

FIG. 9B discloses the manner in which the drawing figures comprising the position link and connector should be arranged;

FIG. 9C discloses the manner in which the drawing figures comprising the position link controller and the key-control position-control circuits should be arranged;

FIG. 9D discloses the manner in which the drawing figures comprising the position control circuit and the position circuit should be arranged;

FIGS. 9E through 9H disclose the manner in which the drawing figures comprising the data transfer circuit should be arranged;

FIG. 9I discloses the manner in which the drawing figures comprising the incoming register link circuit and the register circuit should be arranged;

FIGS. 10 through 15 when arranged as shown on FIG. 15A, disclose the circuit details of incoming noncoin MF trunk circuits of both the ANI and non-ANI types;

FIGS. 16A through 16D and 17A through 17E, when arranged as shown on FIG. 17F, disclose the circuit details of the sender link;

FIGS. 18 through 72 disclose the details of the sender circuit;

FIGS. 73A through 111 disclose the details of the position link and connector circuit;

FIGS. 112 through 157 disclose the details of a position link controller circuit;

FIGS. 158 through 161 disclose the details of the key-control position-control circuit;

FIGS. 162 through 204 and 222 disclose the details of the position control circuit;

FIGS. 205 through 221 and 223 disclose the details of an operator position circuit;

FIGS. 224 through 298 and 368 through 418A disclose the details of the data transfer circuit;

FIGS. 299 through 306, when arranged as shown on FIG. 306A, disclose the details of an incoming dial pulse noncoin trunk circuit of both the ANI and non-ANI types;

FIGS. 307 through 321 disclose the details of the incoming register circuit;

FIGS. 322 through 337 disclose the details of the dial pulse register circuit;

FIGS. 338 through 347, when arranged as shown on FIG. 347B, disclose the details of an incoming noncoin dial 0 trunk circuit equipped for ANI operation;

FIGS. 338A through 347A, when arranged as shown on FIG. 347C, together disclose the circuit details of an incoming noncoin dial 0 trunk circuit equipped for non-ANI operation;

FIGS. 348 through 366, when arranged as shown on FIG. 367, disclose the circuit details of a dial pulse coin combined incoming trunk arranged for ANI operation as well as a noncombined trunk arranged for non-ANI operation;

FIG. 367A illustrates the nature of and the relationship between the timing pulses utilized by the trunk circuit;

FIGS. 419 through 422, when arranged as shown on FIG. 423, disclose the details of the rater circuit;

FIGS. 424 through 428B, when arranged as shown on FIG. 428C, disclose the details of the computer circuit;

FIGS. 429 through 440, when arranged as shown on FIG. 441, disclose the details of an incoming MF coin trunk circuit arranged for both ANI and non-ANI operation;

FIGS. 442 through 452, when arranged as shown on FIG. 453, disclose the circuit details of an incoming dial 0 coin ANI trunk circuit; and

FIGS. 442A through 452A, when arranged as shown on FIG. 453A, together disclose the details of an incoming dial 0 coin non-ANI trunk circuit.

	Column
Introduction.....	1
Apparatus Designations.....	20
General Description.....	21
Embodiment of FIGS. 1A, 1B, 1C, 1D, 1E and 1F.....	21
Noncoin Nonspecial Service Calls.....	22
Noncoin Special Service and Coin Trunk Classification.....	23
Noncoin Special Service MF-ANI Calls.....	24
MF-ANI Coin Calls.....	25
MF Coin and Noncoin Non-ANI Calls.....	26
Noncoin Dial 0 ANI Calls.....	26
Noncoin Dial 0 Non-ANI Calls.....	26
Coin Dial 0 ANI and Non-ANI Calls.....	27
Noncoin Dial Pulse ANI Calls.....	27
Noncoin Dial Pulse Non-ANI Calls.....	27
Coin Combined Dial Pulse ANI Trunks.....	28
Coin Noncombined Dial Pulse Trunks.....	28
Miscellaneous Facilities.....	28
Related Patents.....	30
Continuation of General Description.....	32
Basic Layout of Data Transfer Network—Embodiments of FIGS. 2A through 2I.....	32
Data Channels.....	32
Access Capabilities.....	32
Functional Description.....	33
Bidding for a Data Channel.....	33
Bid by Register.....	34
Bid by Position.....	34
Illustration of Data Transfer Circuit Operation on an MF Coin Call.....	35
Bid for an Idle Data Channel.....	35
Ascertain Trunk Identity.....	35
Connect Trunk to Channel.....	35
Connect Sender to Channel.....	35
Overtime Seizure of Data Transfer Circuit.....	37
Seizure of the Data Transfer Circuit at the End of the Call.....	38
Dial 0 Operator Calls.....	38
Coin Combined DP-ANI Calls.....	38
Coin Noncombined DP—Non-ANI Calls.....	39
Noncoin Calls.....	39
Block Diagram—Embodiment of FIGS. 3A through 3X.....	39
Access Capabilities.....	39
Elementary Description of Functional Units and Terms Used.....	40
MF-ANI Coin Call.....	41
Position Connector.....	41
Data Channel Preference and Selection Circuit.....	42
Trunk Connector Identification.....	42
Trunk Connector Preference and Lockout.....	43
Trunk Operation.....	44
Sender Connector Preference and Lockout.....	45
Translating the Trunk Connector Number.....	45
Sender Connector.....	46
Seizure of a Rater.....	46
Overtime Seizure of Data Transfer Circuit.....	47
End of Call Seizure of Data Transfer Circuit.....	48
Coin MF Non-ANI Calls.....	49
Dial 0 Coin ANI Calls.....	49
Coin Dial 0 Calls—Non-ANI Operation.....	49
Coin Combined Calls.....	49
0+ and 1+ Coin Combined Calls.....	50
Coin Noncombined Calls.....	50
Noncoin Calls.....	50
DETAILED DESCRIPTION.....	50
Person-to-Person Coin Call Incoming on a Combined DP-ANI Trunk.....	50
General Comments Regarding the Facilities Utilized on This Call.....	50
Seizure.....	51
ANI Operation.....	52
Non-ANI Operation.....	52
Connection to Operator Position.....	52
Operator Functions—Customer-Dialed Calls.....	52
Operator Functions—Dial 0 Assistance Calls.....	53
Called Party Answers—AMA Answer Entry.....	53
Trunk Timing.....	53
Dial 0 Calls—Timing and Recall.....	54
Disconnect and Disconnect AMA Entry—Dial 0 Calls.....	54
Disconnect and Disconnect AMA Entry—Customer-Dialed Calls.....	54
Other Functions.....	54
Detailed Description of Circuit Operation for a Person-to-Person Coin Call Incoming on a Dial Pulse Trunk.....	55
Incoming Trunk Seizure.....	55
Attachment of Register Circuit Via the Register Link.....	56
Receipt of Dialed Pulses.....	57
Seizure of Sender Link and Connection of Sender.....	58
Seizure of Data Transfer Circuit by Register.....	59
Transfer of Data.....	59
Checking of Data.....	60
ANI Operation.....	60
Reception of MF-ANI Digits.....	61
Prefix—Functions.....	62
Seizure of Position Circuit Via the Position Link.....	63
Initial Period Seizure of the Data Transfer Circuit.....	64
Bid for Idle Data Transfer Channel.....	64
Determine Data Flow Direction.....	65
Registration of Trunk Connector Number.....	65
Customer-Dialed Coin Call.....	66
Initial Period Indication of Coin Toll Call.....	66
Connection of Sender Connector to Data Channel.....	67
Bid for Services of Rater.....	67
Rater Preference Circuitry.....	68
Data Interchange.....	69
Originating Area Code.....	69
Call—Initial Period.....	69
Calling Office Index.....	70
Class-of-Service Information.....	70
Type-of-Call Information.....	70
Calling Number Information.....	71
Called Number Information.....	72

DETAILED DESCRIPTION—Continued

Detailed Description of Circuit Operation for a person-to-person Coin Call Incoming on a Dial Pulse Trunk—Continued	
Rater Operation	73
Timing of Data Exchange Interval	74
Release of Sending Secondary Cut-in Relays	75
Data-Checking Circuitry	75
Release of Sender and Trunk from Data Channel	79
Computer Seizure	80
Receipt of Data by Computer	81
Computer Output Data	81
Release of Computer	83
Check of Data Transmitted from Computer to Position	83
Release of Position from Data Channel	84
Summary of Call Progress	85
Trunk Functions for Other Types of Calls—Dial 0 Calls	85
Continuation of Summary of Progress of Present Call	85
Progress of Special Toll Calls After Release of Data Channel—General	86
Initial Seizure Period When Rater Sends Out Manual Rate, Free Call, Vacant Code, or Ten-Cent Toll Indication with the Associated Rate Treatment	87
Progress of Special Toll Calls After Release of Data Channel—Rated Ten-Cent Station-Paid Toll Call	87
Progress of Special Toll Calls After Release of Data Channel—Rated Single-Charge Untimed Call	88
Progress of Special Toll Calls After Release of Data Channel—Other Rated Calls	89
Features of Position and Position Control Circuits	91
Progress of Special Toll Calls After Release of Data Channel—Manually Rated Calls	92
Progress of Special Toll Calls After Release of Data Channel—Vacant Code and Free Calls	95
Progress of Special Toll Calls After Release of Data Channel—Class Change	96
Initial Period Seizure When Operator Keys Rate Treatment or Changes Class of Call	97
Progress of Special Toll Calls After Release of Data Channel—Dial 0 Calls	97
Marker Functions	99
Perforation of the Initial AMA Entry	101
Called Party Answer and Charge Delay	103
AMA Answer Entry and Start of Trunk Timing	103
Timer Circuit	104
Trunk Timing—Special Toll Calls—Common Features	105
Trunk Timing—Special Toll Call—Initial-Period Timing	108
Data Transfer Seizure at End of Initial Period	109
Data Interchange—Trunk Output Information	110
Data Interchange—Computer Output Information	112
Validity Check of Interchanged Data	113
Release of Data Transfer Circuit	114
Position Circuit Operation	115
Trunk Timing—Special Toll Call—Overtime Timing—General	115
Trunk Timing—Special Toll Call—Overtime Timing—Detailed	118
Data Interchange Upon an End-of-Cycle Seizure	119
Trunk Output Information	119
Computer Output Information	121
Position Circuit Operation	121
Release of Operator Position and Reoperation of Trunk Timing Circuit	121
End of Call and End-of-Call Seizure	122
End-of-Call Data Interchange between Trunk, Computer, and Operator Position Circuit	122
Trunk Output Information at End of Call	122
Computer Output Data to Position Circuit at the End of Call	124
Operation of Position Circuit on an End-of-Call Seizure	126
Recall of Operator When Call is in Progress—General	127
Recall of Operator When Call is in Progress—Recall on Dial 0	127
Recall of Operator When Call is in Progress—Recall on Special Toll Calls	128
Recall of Operator When Call is in Progress—Action of TM Timer in Recall	128
Trunk Timeout on Recall	128
Operation of Position Circuit on a Recall Seizure	129
Data Transfer Circuit Operation on Recall	129
Data Interchange Between Trunk and Position on a Recall Seizure of the Operator—0+ and 1+ Calls	130
Recall Data Interchange—Dial 0 Calls	131
Coin Control—Manual and Automatic Coin Control	132
Disconnect—Calling Party Disconnect	133
Disconnect—Called Party Disconnect	133
AMA Disconnect Entry	134
Trunk Release	134
SPECIAL FEATURES—Locked-Link Connections	135
SPECIAL FEATURES—Releasing Forward	136
SPECIAL FEATURES—Retrial or Reroute by the Operator	136
SPECIAL FEATURES—Ringback	138
SPECIAL FEATURES—Cancel Timing and Cancel AMA Timing Entry	138
SPECIAL FEATURES—Ring Forward on Dial 0 Calls	139
SPECIAL FEATURES—Non-ANI Operation	139
Description of Calls Served by MF Coin Trunks—General	139
Detailed Description of Calls Served by MF Coin Trunks	141
Seizure, Pulsing and Position Request	142
Connection to the Data Transfer Circuit	143
Passing Information from the Trunk to the Rater Over the Data Channel	144
Information from the Rater to the Trunk Circuit	144
Description of Calls Served by Dial 0 Coin Trunk Circuits—General	145
DESCRIPTION OF CALLS SERVED BY DIAL 0 COIN TRUNK CIRCUITS	148
Seizure	148
Sender Attached (ANI)	148
Operator Position Attached	149
Progress of Call Following Connection to Data Channel	150

Each relay shown on the drawings is given a designation comprising one or more letters, or one or more digits, or a combination of letters and digits. In some instances, these designations are purely arbitrary while in others they are related to the circuit functions of the relay. Since the detailed circuit of the present invention is shown on many separate figures, each discussion of a relay in the body of the specification prefixes the normal designation of the relay, as shown on the drawings, with the digits of the drawing figure number on which its controlling winding appears. Thus, for example, relay RA on FIG. 359 is referred to as relay 359-RA in any circuit discussion involving relay RA, and, similarly, relay D on FIG. 351 is referred to as relay 351-D. However, in order to avoid repetition, this identification scheme is used selectively, and if repeated reference is made to a particular relay or a particular group of relays, the figure identifying prefix is utilized only once or twice at the beginning of the discussion and is not repeated each and every time a relay is mentioned. In other words, this identification scheme is used selectively and judiciously in such a manner as to facilitate an identification of the figure on which the controlling winding of each relay is located and, at the same time, to avoid the monotony and repetition that would be the case if each and every occurrence of a relay in the body of the specification were preceded by its figure identifying prefix.

Relay contacts are shown separated from their associated controlling windings on the present drawings. Contacts which are closed when a relay is operated (make contacts) are represented by an X superimposed on the interconnecting conductors. The two portions of a conductor on opposite sides of the superimposed X are not connected with each other until such time as the contacts represented by the X are closed by the controlling relay winding. Contacts which are opened upon the operation of a relay (break contacts) are represented by a short line perpendicular to and intersecting the connecting conductors. The two portions of a conductor on opposite sides of the superimposed break contact symbol are normally connected to each other via the break contacts. The same two conductor portions are disconnected from each other as the break contacts are opened upon the energization of the controlling relay winding.

A considerable portion of the data transfer circuit is disclosed in coordinate or matrix form, in which the conductors representing each data channel are shown as horizontal lines while the conductors representing the various connectors having access to each channel are represented as vertical lines. Thus, for example, referring to FIG. 274, channels 0, 1, 2, and 3 are represented by the four horizontal lines on the bottom of the figure while the conductors comprising position connectors 0 through 6 are represented as vertical lines.

The intersection of each connector conductor with a channel conductor has superimposed thereon an X enclosed within a small circle whose diameter approximates that of the X. Each such symbol represents a make contact which, when closed, interconnects the data channel conductors and the connector conductors common to the encircled X symbol. Thus, for example, on FIG. 274 the encircled X symbol common to data channel 0 and position connector 0 is designated 225-OPRF0. The conductors of channel 0 and position connector 0 are not connected with each other when relay 225-OPRF0 is unoperated. The operation of this relay closes its make contacts common to channel 0 and position connector 0 and thereby interconnects their conductors. The portions of the conductors of channel 0 on each side of make contacts 225-OPRF0 are continuous and are interconnected with each other at all times, regardless of the operated or unoperated condition of the relay contacts. The same is true of the portions of the conductors of position connector 0

shown above and below these contacts. In short, contacts represented by an encircled X may be considered to be analogous to contacts of crossbar switches in that they serve to interconnect, when operated, the vertical conductor and the horizontal conductor common to the contact represented by the encircled X symbol. Similarly, an encircled X symbol is used for the make contacts which may be closed to interconnect the various connectors with the individual circuits served thereby. Thus, contacts 224-PF00 on FIG. 274 may be closed to interconnect the conductors of position connector 0 with those of position circuit 00.

Each relay contact is designated in a manner which indicates the drawing figure on which the controlling relay winding appears as well as the drawing designation of the winding. For example, referring to relay RV on FIG. 354, its operating circuit includes make contacts 356-PA, 351-PR, and 352-CB, as well as others. The controlling windings for these three contacts are shown on FIGS. 356, 351, and 352, respectively, and are respectively designated PA, PR, and CB thereon.

There are a number of instances on the present drawings where groups of relays are disclosed in which each relay in the group has a designation which differs from that of other relays in the group only by a final digit or combination of digits. For example, on FIG. 69 there is a group of relays designated A0, A1, A2, A4, and A7. In the following description, groups of relays such as these are sometimes discussed by identifying the entire group as the 69-A- relays where the final dash may be understood to represent the numerical designation of each relay in the series. This abbreviated form of designation permits the circuit function of the entire relay group to be discussed conveniently without the necessity of enumerating each and every relay therein each time reference is made to the group.

The system comprising the present invention utilizes circuits of considerable size and complexity. Therefore, in order to minimize the number of circuit drawings required, circuits which are composed of a plurality of subcircuits which are identical or similar to each other are illustrated on the present drawings by disclosing only the details of each type of subcircuit once and by disclosing the remaining subcircuits diagrammatically. For example, referring to FIG. 262, the NCN conductor of channel 0 is connected to a relay designated NCN, with the winding of the relay being connectable via make contacts 262-NCN and 293-RCI to ground. These circuit details are shown only for channel 0 and are enclosed within a rectangle designated AA. The remaining data channels are each similarly connected to an equipment rectangle designated AA. However, no circuit details are shown inside of the AA rectangles for these channels and it is to be understood, in instances such as this, that each AA equipment rectangle having no specific circuitry shown there-within actually includes circuitry similar or identical to that of the AA rectangle whose details are shown. This expedient reduces considerably the quantity of drawing figures required. For example, FIGS. 293, 294, 294A, 294B, and 295 disclose a plurality of YY equipment rectangles with the one YY rectangle for channel 0 whose circuit details are shown being disclosed on FIGS. 293, 294, 294A, 294B, and 294C, while the remaining three YY rectangles for the other channels are all disclosed on the single FIG. 295.

GENERAL DESCRIPTION

Embodiment of FIGS. 1A, 1B, 1C, 1D, 1E and 1F

The principal circuits comprising the switching center of the present invention, as well as the interrelationship between these circuits, are diagrammatically shown on FIGS. 1A through 1F. The incoming trunk circuits are shown on FIGS. 1A through 1D; the outgoing portion of the office including the trunk link, the office link, the

marker, the marker connector, and the outgoing trunks extending to terminating offices are shown on FIG. 1E; the register bylink, the register, the position link, the position control circuit, the position circuit, the operator position, the traffic regulator, the key control position control circuit, and the position link controller are shown on FIG. 1D; the sender, the sender link, and the CAMA position link, are shown on FIG. 1F; the AMA recording equipment and the circuitry associated therewith, including the call identity indexer, the master timing circuit, the recorder, the recorder connector, the transverter, the transverter connector, and the billing indexer are also shown on FIG. 1F; the rate calendar circuit, the rater, and the computer are also shown on FIG. 1F; while the data transfer circuit is shown extending across the bottom of FIGS. 1D and 1F.

The incoming trunks are shown to be of three general types; namely, noncoin nonspecial service, noncoin special service, and coin trunks which may serve both special and nonspecial traffic. The present invention does not relate to the manner in which calls incoming on the noncoin nonspecial service trunks are served, and therefore only one trunk of this type is shown. This trunk, which is in the upper left-hand corner of FIG. 1A, may therefore be understood to be representative of all of the many different types of trunks that may extend noncoin nonspecial service calls through the tandem office of the present invention. Also, for the same reason, the circuit details of this trunk are not shown on the present drawings. The noncoin special service trunks, trunks 00, 10, 80, 90, 900, and 990, are identical to those shown and described in the R. B. Curtis disclosure.

NONCOIN NONSPECIAL SERVICE CALLS

A brief review of the operation of the tandem office during the serving of calls incoming on the noncoin nonspecial service trunk shown in the upper left-hand corner of FIG. 1A will subsequently facilitate an understanding of the manner in which the office functions during the serving of coin calls of both the special service and nonspecial service type. A calling noncoin nonspecial service incoming trunk seizes a sender via the sender link and transmits to the sender for registration therein the call information outpulsed from the preceding office. The sender, in response to the registration of this information, calls in a marker via the marker connector and transmits to the marker the information needed by it to set up the call. The marker selects an idle outgoing trunk extending to the called office and then selects and closes via the trunk link and office link frames a connection between the incoming trunk and the selected outgoing trunk. The marker releases once this connection is established, and the sender outpulses forward to the next office, via the sender link, the incoming trunk, the trunk and office links, and the outgoing trunk, the information required by the succeeding office to complete the call. The sender then releases, thereby leaving the connection within the tandem office under control of the incoming trunk.

A noncoin nonspecial service call may originate in different types of local offices, and the remainder of the functions of the tandem office in serving such a call vary in accordance with the manner in which the originating office is equipped. For example, the originating office may be equipped with its own AMA or other charge data recording equipment. If this is the case, all call details necessary for charging purposes are recorded at the local office and no recording operation need be performed by the tandem office; therefore, the functions of the tandem office on such a call are completed once a connection has been established to the terminating office and after the tandem marker and sender have released.

Other types of local offices may not have their own charge data recording equipment, and therefore the extension of a noncoin nonspecial service call from such an

office through tandem requires that charge data be recorded at the tandem office. In this case, the call identity indexer obtains and transmits to the recorder the necessary incoming trunk information, while the transverter obtains from the sender and transmits to the recorder the remainder of the call information necessary for billing purposes, including the calling and called numbers. If the originating office is equipped for automatic number identification (ANI), the calling station number is outputted to the sender along with the called station information, and the charge data recording operation is automatically competed at the tandem office without the necessity of operator intervention. If the originating office is not equipped for automatic number identification, the sender calls in the CAMA (centralized automatic message accounting) position link which interconnects, via the position control and operator position circuit, an operator onto the calling connection who orally obtains the calling station number and keys it into the sender. This information is then transmitted by the sender to the transverter, along with the called station information, thereby enabling the recording equipment to make the necessary call charge records in essentially the same manner as for calls for which the calling and called numbers are received automatically from the originating office.

The tandem office may also serve a miscellany of other types of nonspecial service noncoin calls in addition to the three just described. However, these other types of calls are comparatively infrequent and are of a sufficiently specialized nature so that no further discussion of them is required.

NONCOIN SPECIAL SERVICE AND COIN TRUNK CLASSIFICATION

Noncoin special service calls and all types of coin calls are received on one of the correspondingly designated types of incoming trunks at tandem in accordance with the manner in which the originating office is equipped. These trunks may be generally classified in accordance with two parameters of the associated originating office, namely, the type of outputting (or lack thereof) utilized by the originating office for the called number information, as well as whether or not the originating office is equipped for automatic number identification (ANI). Thus, of the six noncoin special service trunks there are two MF trunks, 00 and 10, two dial 0 trunks, 80 and 90, and two dial pulse trunks, 900 and 990. Also, of the coin trunks there are two dial 0 trunks, 30 and 35, two MF trunks, 20 and 25, and three dial pulse trunks, 40, 50 and 55. Coin dial pulse trunk 40 is of the combined type while the other two are of the noncombined type. A combined trunk as disclosed herein may serve both dial 0 and DP traffic. Excluding the three coin dial pulse trunks, one of the two trunks in each of the other types is associated with an originating office equipped for ANI operation, while the other trunk is associated with an office equipped for non-ANI operation. One of the three coin dial pulse trunks (trunk 40) serves ANI equipped offices, while the other two (trunks 50 and 55) serve non-ANI equipped offices. The reason for this arrangement is discussed hereinafter. The MF trunks serve calls from originating offices which output called number information in multifrequency (MF) form; the dial pulse trunks serve calls from offices which output called number information in dial pulse form or which output no called number, while the dial 0 trunks serve offices for which no called number is outputted by the originating offices. The ANI information is always outputted by the originating office in MF form, regardless of whether the call is of the MF, DP, or of the dial 0 type.

Both of the coin dial 0 trunks exclusively serve special service traffic since the calling subscriber never dials called station digits for calls incoming on this trunk. Thus, the services of an operator at tandem are always required on dial 0 calls to orally obtain this information from the call-

ing party and to key it into the system. The MF coin trunks may serve both special service and nonspecial service traffic. The coin combined dial pulse ANI trunk may serve both special service and nonspecial service traffic. One of the coin noncombined dial pulse non-ANI trunks serves only special service traffic, while the other trunk of the same type serves only nonspecial service coin traffic.

A special service call is initiated by the dialing of a prefix digit of "0," while a nonspecial service call is initiated by the dialing of a prefix digit of "1." The originating office determines on each call whether a prefix "0" or a prefix "1" was dialed and, in the event that the call is to be directed to a tandem incoming trunk of the type that may serve both special and nonspecial traffic, the originating office transmits an indication to the tandem office concerning the identity of the prefix digit. This indication is transmitted by means of a distinctively coded start pulse in connection with the called station outputting operation on MF calls and in connection with the MF-ANI outputting operation on dial 0 and dial pulse ANI traffic. With this arrangement, the start pulse representing a prefix digit "0" is composed of a first combination of frequencies, while the start pulse representing a prefix digit "1" is composed of a different combination of frequencies. The start pulse, in addition to signifying the nature of the prefix digit, also serves the same purpose as do the start pulses utilized heretofore in connection with MF outputting operations.

The coin noncombined dial pulse non-ANI trunks must be divided into two groups as shown. One group serves "0" and "0+" traffic, where a single "0" represents a dial 0 call and where a "0+" represents a call for which the calling party dialed the prefix digit "0" followed by the called station digits including area code, if any. The other coin noncombined dial pulse non-ANI trunk serves "1+" traffic, where the symbol "1+" represents calls for which the calling party dials a prefix "1" followed by the called station digits. Information signifying whether special service or station-to-station service is desired on calls served by the coin noncombined dial pulse non-ANI trunks cannot be transmitted to tandem as part of an ANI outputting operation, since the offices served on an originating basis by these trunks do not have ANI facilities. The originating offices, in routing calls to these noncombined coin trunks, must make their own determination as to the nature of the prefix digit dialed and then route the call to one or the other of these trunks at tandem in accordance with whether a "0" or a "1" prefix was dialed on the call.

NONCOIN SPECIAL SERVICE MF-ANI CALLS

A calling noncoin special service MF-ANI trunk seizes a sender via the sender link and transmits calling and called number information thereto from the originating office. The sender registers this information and transmits a portion of it to the marker, which sets up a connection between the incoming trunk and a selected outgoing trunk, in the same manner as previously described for noncoin nonspecial service calls. The sender simultaneously transmits a signal via the sender link to cause the trunk to seize a position link, which, in turn, interconnects the calling trunk with an operator position via the position control and position circuit. The data transfer circuit is next called in to interconnect the position circuit, the calling trunk circuit, and the sender, in order that the trunk and the position circuit may transmit to the sender the information required by it to complete the call. The sender now outputs via the sender link, the incoming trunk, and the trunk and office links, information forward to the next office to enable that office to either complete or to further extend the connection. The operator is connected at this time to the calling connection via the position link and the incoming trunk, and the operator now conserves with the calling party to ascertain the nature of the special services required on the call. The operator then performs these services and releases from the connection.

The serving of an MF-ANI coin call is similar to the call just described, except that once the incoming trunk seizes a position circuit via the position link, the data transfer circuit is called in to interconnect the incoming trunk, the position circuit, the sender, and a rater circuit which receives information from the trunk and the sender and, in response thereto, derives charge rate information applicable to the call. This derived charge rate information includes a three-digit charge rate and an indication of the initial period duration. The three-digit charge rate comprises a three-digit code which represents the parameters required to derive charge information for the call under all possible conditions. Included among these parameters are the initial period duration, the initial period charge, together with the charge and duration applicable to a single overtime period. Since the three-digit charge rate comprises a three-digit code, the two terms, i.e., charge rate and charge rate code, are used interchangeably throughout the remainder of the specification. This charge rate information is transmitted both to the calling trunk for storage therein, as well as to the position circuit. Next, the data transfer circuit releases itself from the rater, the trunk and the sender, and connects a computer to the position circuit. The position now transmits the charge rate to the computer which then computes the monetary charges, including tax, for the initial period portion of the call. This charge information is transmitted back to the position circuit, after which the data transfer circuit and the computer are released. The position circuit now displays this information to the operator, who informs the calling party concerning the amount that must be deposited and monitors the collection of these charges before releasing from the connection.

Once the connection has been established, or once the calling party has received the services requested on the call, a timer circuit within the incoming coin trunk activates a timer pulse circuit which provides the necessary timing pulses to MF and dial pulse coin trunks to enable timer circuits within these trunks to time the initial and overtime periods on each call. The trunk timers are not activated on station-to-station calls until the connection is established, and are not activated on person-to-person and other special type calls until the operator depresses a START TIMING key after having been assured that the calling party has received the call assistance he has requested. Once the trunk timer is actuated on a call, whether as a consequence of the establishment of the connection or whether as a consequence of an operator having depressed the START TIMING key, the duration of the call is automatically measured by the trunk timer solely under control of timed pulses transmitted thereto by the timer pulse circuit.

A few seconds prior to the end of the initial period, the trunk, under control of its timer, signals the position link to seize an idle operator position on a priority basis. The position, when attached, bids for the services of the data transfer circuit, which, upon its seizure, establishes connections between the incoming trunk, the position, and the charge computer. The trunk passes the rate treatment information and a station-to-station or person-to-person mark, as well as an end-of-initial-period indication, both to the position and the computer. The computer uses this information to reset the trunk timer in order that it may time the overtime portion of the call and to transmit to the trunk an indication of the duration of a single overtime period. The computer also determines and transmits to the position circuit the monetary charge and duration for a single overtime period. The operator at this time notifies the customer that he is entering the overtime portion of the call and requests him to signal when through. The operator may also notify the customer concerning the overtime period charge and duration, in case such information is requested. The operator and the

data transfer circuit then release from the connection, and the overtime portion of the call is then timed by the trunk timer under control of pulses from the timer pulse circuit.

At the end of the conversation, when the calling party either flashes or hangs up, the operator is again called in via the position link by the trunk circuit on a priority basis. The position, in turn, seizes the data transfer circuit which interconnects the incoming trunk, the position circuit and the charge computer. The trunk transmits to the position and the computer the overtime duration of the call, a person-to-person or a station-to-station indication, as well as the applicable charge rate. The computer, in response to the receipt of this information, computes the monetary charges for the overtime and transmits this information to the operator position circuit. This information is displayed to the operator, who notifies the customer concerning the amount to be deposited. The operator then monitors the collection of these charges and releases her position from the connection.

MF COIN AND NONCOIN NON-ANI CALLS

The system operation for MF non-ANI coin and non-coin calls is essentially the same as for MF-ANI calls of both the coin and noncoin types, respectively, except that in this case the calling station number is not received automatically from the originating office and registered in the sender. Instead, the operator receives an indication that it is necessary to orally obtain this information from the calling subscriber and key it into registers at the position.

NONCOIN DIAL 0 ANI CALLS

A calling dial 0 noncoin ANI trunk immediately seizes a sender via the sender link and transmits the calling number to the sender. The sender also receives an indication that no called station information will be automatically forthcoming and it immediately causes the incoming trunk to interconnect itself with an operator position circuit via the position link. The data transfer circuit then interconnects the incoming trunk, the position circuit, and the sender, in order that the trunk and the sender may transmit information to the position circuit, with the information transmitted by the sender including the calling station number. The data transfer circuit releases after this information is received and registered in the position circuit. The sender and the sender link also release at this time.

The operator has by now received a signal indicating that this is a dial 0 call and that, therefore, it will be necessary to obtain the called station number orally from the calling subscriber and to key it into the system. After the operator has received and keyed this information into registers at the position, the operator depresses a key which transmits a signal via the position link to the incoming trunk to cause it to bid for a connection to a sender. Once a sender is attached, the trunk, the position, and the sender are interconnected via the data transfer circuit in order that the information required for the completion of the call by the remainder of the office may be transmitted from the position and trunk to the sender. The data transfer circuit releases after this information is received and registered in the sender. The sender, together with the marker, now establishes the remainder of the connection to the called office in the same manner as previously described. The operator may, after the called station answers, furnish any further assistance required before releasing from the call and causing the recording of the necessary charge information.

NONCOIN DIAL 0 NON-ANI CALLS

The system operation for a dial 0 noncoin non-ANI call is similar to that of a dial 0 noncoin ANI call, except that only one usage of a sender is involved. In this case, the incoming dial 0 non-ANI trunk, immediately upon its seizure, interconnects itself with an operator po-

sition via the position link. The data transfer circuit then interconnects the incoming trunk and the position circuit in order that the trunk may transmit call data to the position. The data transfer circuit then releases. Included in the data received by the sender is an indication that this is a dial 0 non-ANI noncoin call and that, therefore, the operator will have to orally obtain and key into registers at the position both the calling and called station numbers. Once this is done, it causes the incoming trunk to bid for a connection to a sender via the sender link. The data transfer circuit then interconnects the incoming trunk, the position circuit, and the sender in order that the information required by the rest of the office to extend the call may be transmitted from the position circuit and the trunk to the sender. Following this, the connection to the terminating office is established and the necessary call assistance is provided by the operator in the same manner as on noncoin dial 0 ANI calls.

COIN DIAL 0 ANI AND NON-ANI CALLS

The operation of the system for the serving of coin dial 0 ANI and non-ANI calls is the same as their non-coin counterparts except that the operator, in addition to other duties, also manually rates, times, and monitors the collection of the proper charges for the call in the conventional manner. The dial 0 coin trunks do not contain timer circuits, as do the other coin trunks, and since calls served by these trunks are rated and timed manually by the operator, the rater and the computer circuits are also not used on such calls.

NONCOIN DIAL PULSE ANI CALLS

A calling dial pulse noncoin ANI trunk first seizes a register via the register link. The register then registers the called station information received in dial pulse form from the originating office. Following this, the register instructs the trunk to seize a sender via the sender link. The sender then registers the ANI information which is received from the originating office in MF form. At the same time, once the called station information has been received by the register, the data transfer circuit interconnects the incoming trunk, the register, and the sender, in order that the trunk and the register may transmit information to the sender, with a portion of the information transmitted by the register including the called station digits. The data transfer circuit releases following the successful registration of this information in the sender.

The sender by now has registered therein both the calling and called stations numbers, as well as other information pertaining to the call, and it now causes the incoming trunk to seize a position circuit via the position link. Once this connection is established, the data transfer circuit is called in to interconnect the incoming trunk, the position, and the sender, in order that the trunk and the sender may transmit call information to the position circuit. The data transfer circuit releases as soon as this information is successfully registered in the position circuit. The marker and the sender cooperate in the same manner as previously described to set up the connection forward to the called station, following which the operator furnishes the requested assistance on the call before releasing from the connection and initiating the recording of the necessary charge data.

NONCOIN DIAL PULSE NON-ANI CALLS

Dial pulse noncoin non-ANI calls are served in the same manner as dial pulse noncoin ANI calls, with the exception that the calling station information is not automatically received from the originating office and registered in the sender, and therefore it is orally obtained by the operator and keyed into the system in the same manner as for MF non-ANI calls.

COIN COMBINED DIAL PULSE ANI TRUNKS

The operation of the coin combined dial pulse ANI trunk during the serving of "0+" and "1+" traffic, as previously defined, is similar to the operation of the non-coin dial pulse ANI trunk. In addition, the coin combined dial pulse ANI trunk contains timer circuitry which enables it to store charge rate information and time the call, in the same manner as described for the coin MF trunks. Thus, when the operator is brought aboard the calling connection during the establishing of the call, the operator performs the same functions as described for noncoin dial pulse ANI calls and, in addition, receives, via the data transfer circuit, from the rater and the computer the charge rate for the call, as well as the required initial period deposit. At the same time, the rater transmits via the data transfer circuit to the trunk the applicable charge rate together with the initial period duration. Both of these items of information are stored in the timer circuitry of the trunk, which then, once the operator releases from the connection, times the initial period portion of the call. The operator releases from the connection after notifying the calling party concerning the required initial period deposit, and after monitoring the collection of these charges. The operation of the system circuitry for the remainder of the coin dial pulse call is the same as previously described for MF coin calls.

The coin combined dial pulse ANI trunk can serve "0," "0+" and "1+" traffic. It has just been described how the system functions during the serving of "0+" and "1+" traffic by this trunk. The "0" traffic served by this trunk constitutes dial 0 calls, which are served in the same manner as those served by the coin dial 0 ANI trunks as previously described. In other words, for a dial 0 call served by a coin combined dial pulse ANI trunk, the timer portion of the trunk is disabled and the call is rated and timed manually by the operator in identically the same manner as are all coin dial 0 calls.

COIN NONCOMBINED DIAL PULSE TRUNKS

The coin noncombined dial pulse non-ANI trunks are divided into two groups, with one group serving "0" and "0+" traffic, and with the other group serving exclusively "1+" traffic. The dial 0 calls served by the trunk handling "0" and "0+" traffic are handled in essentially the same manner as dial 0 calls on the coin combined dial pulse ANI trunk, except that the calling station information is not automatically received from the originating office and registered in the sender, and therefore, it must be orally obtained by the operator and keyed into the system in the same manner as described for other types of non-ANI calls. The operation of the coin combined dial pulse non-ANI trunks for "0+" and "1+" traffic is the same as the operation of the system for the corresponding type of traffic on the coin combined dial pulse ANI trunks, except that the operator must also on these calls orally obtain and key into the system the calling station information.

MISCELLANEOUS FACILITIES

The facilities provided at the tandem office in accordance with the present invention also enable the operators to serve calls which, due to rater limitations, cannot be automatically rated by the rater circuit. Although these calls constitute a relatively small percentage of the coin traffic, it is necessary that they be manually rated by an operator. During the serving of these calls, the operator receives an indication at the position that it is necessary to manually rate them. The operator then looks up the appropriate rate treatment in a book and keys the appropriate rate treatment into the system. This causes a seizure of the computer and results in an initial period charge and an initial period duration display at the operator position, just as in the case of automatic rating. In this case, however, the computer instead of the rater

sets the trunk timer for the initial period. If the operator is not able to ascertain the rate with the material supplied, the operator communicates with a rate-and-route operator who has more complete rating information and who is able to determine the appropriate rate treatment for any conceivable type of call. The operator then keys in the rate treatment number, as before.

There are also instances where a rate treatment derived by the rater must be changed and a new one entered into the system, due to changing call conditions. For example, the person answering the phone at the called station on a person-to-person call may report that the party specified by the calling subscriber is at a station other than the one initially dialed. In this case, the operator can release the forward connection and key a new called number into the system in hope of locating the specified party. In this case, the rate treatment initially derived by the rater in response to the digits dialed by the calling subscriber is erased from the trunk by the operator, and a new rate treatment is automatically derived by the rater in accordance with the called station digits dialed by the operator.

The charge data recording equipment is under the initial control of the operator, and the operator may initiate the recording of call data for any type of call for which the resulting record would be useful. Records of this type are sometimes used for determining the tax applicable to each coin call. They are also used for division of revenue purposes where the proceeds of coin toll calls are to be shared with other telephone companies. Call records are not normally perforated for station or person paid dial 0 calls since these are handled exclusively on a manual basis, as already described, and therefore a mark sensed record is already available, containing all the call data that may be needed for either tax or division of revenue purposes. On a collect, credit card, or charge-to-third-party coin call, including those of the dial 0 type, the operator mark senses a ticket to indicate the called number, the start of conversation time, and the credit card number, or the number of the telephone to be billed. The operator then cancels the timing operation in the incoming trunk and causes the duration of the call to be recorded on the AMA tape. At the AMA accounting center, the calling number, the called number, and the start-of-conversation time shown on the card made from the AMA tape are matched against similar information shown on the mark sensed records made by the operator.

The operator is not called in on calls for which the deposit initially made by the subscriber preparatory to dialing equals the initial period charge for the call. In this case, unless the operator is required for other purposes, the call continues until the initial period is ended, at which time an operator is called in to advise the calling party concerning the overtime charge per overtime period. The operator is called in at the end of the call in order to collect the overtime charges.

A substantial portion of the novelty of the present invention relates to the interrelationship between the incoming trunks, the position link and link controller, the position control circuit, the position circuit, the operator position, the sender, the register and register link, the rater, the computer, and the data transfer circuit, including the manner in which the data transfer circuit is operable to interconnect various combinations of trunks, registers, positions, raters and computers on different calls. The interrelationship between these circuits is hereinafter discussed generally in connection with FIGS. 2A through 2I, and in further detail in connection with FIGS. 3A through 3X, as well as in complete detail in connection with the detailed drawings. The key control position control circuit and the traffic regulator are disclosed in detail in the specification as well as in the copending applications incorporated by reference. The only thing that need be understood concerning these two circuits at

the present time is that they control the position link and the position control circuits so as to provide equitable service for the different types of incoming calls, as well as an equitable distribution of these incoming calls to the various operator position circuits in accordance with the type of traffic that may be served by each position circuit.

Each operator is associated with an operator position which comprises the physical switchboard at which the operator is stationed, an operator position circuit which includes the electrical components within the switchboard, and a position control circuit which includes the circuitry that cooperates with the data transfer circuit, the link controller, and the key control position control circuit, the transverter connector, the CAMA position link circuit, the rater and computer, for receiving information from and for transmitting information to these various circuits. The position control circuit, the position circuit, and the operator position are shown to comprise three different units of apparatus, rather than one, since each of the three units may be physically separated from the other two by varying distances depending upon the requirements of the office. However, for simplicity in discussion and ease of understanding, these three circuits may be considered as one and may be generically referred to as the operator position circuit. This terminology is used extensively throughout the remainder of the specification, and therefore when a statement is made indicating that a connection is completed to, or that information is transmitted to or from, an operator position circuit, it is to be understood that this of necessity includes the related operator position control circuit and the related operator position apparatus.

RELATED PATENTS

The present invention is not concerned with the details of the circuits comprising the outgoing portion of the office, which circuits extend a connection from the incoming trunk to the terminating office. Further, the invention is not concerned with the circuit details of the circuits involved in the call charge data recording operation, or with the circuit details of the CAMA position link. None of these circuits are shown in the present drawings, except on the block diagram of FIGS. 1A through 1F, since either similar, analogous, or identical circuits are well known in the various tandem switching systems of the prior art. For example, Patent 2,848,543 of Aug. 19, 1958, to R. N. Breed et al., together with the patents referred to therein, discloses a crossbar tandem switching system equipped for CAMA operator identification of the calling station, together with the automatic recording of charge data for the CAMA calls served by the office. Reference is hereby made to the Breed et al patent, together with the patents cited herein, for a detailed description of the marker, the marker connector, the trunk link, the office link, the outgoing trunk, the recorder, the transverter and transverter connector, the billing indexer, the master timing circuit, and the call identity indexer circuit. Another crossbar tandem system of the prior art is shown in Patent 2,559,312 of July 3, 1951, to J. B. Newsom, together with the patents referred to therein.

The system of the present invention transmits call data to recording equipment which, by now, is well known to those skilled in the art as automatic message accounting equipment (AMA), in which three entries, designated as initial entry, an answer entry, and a disconnect entry, are placed on a record chronologically in the order of their production and are interspersed among similar entries for other calls established by other trunks served by the recording equipment. This recording equipment comprises the call identity indexer, the recorder, the master timing circuit, the transverter, and transverter connector, as well as the billing indexer shown on FIG. 1F of the drawings. A similar recording system is described in the aforementioned Breed et al., patent and is further described in detail in Patent 2,688,658 of Sept. 7, 1964, to W. W.

Carpenter et al., as well as in the prior art patents described to therein.

The details of the terminating or succeeding offices to which call information is outputted by the tandem sender are of no consequence to the present invention, and therefore such office or offices may be of any suitable type well known in the art. The same is true of the local offices served on an originating basis by the present invention, and therefore they too may be of any type well known in the art. The operation of the present invention is described in detail for calls incoming from offices utilizing multifrequency and dial pulse outputting of the called number information, as well as from offices which, for some calls at least, output no called number information. All such types of outputting are by now well known in the art, and therefore the present invention is not concerned with the details of how the calls are served in the originating office, nor in the manner in which the outputted information is generated.

The operation of the disclosed system is also described for calls incoming from offices equipped for automatic number identification, as well as from offices which are not equipped with such facilities. The automatic number identification equipment at the local offices may advantageously be of the type shown in Patent 3,071,650 of Jan. 1, 1963, to H. D. Cahill et al., or of the type shown in Patent 2,672,515 of Mar. 16, 1954, to D. S. Barlow. The Cahill et al. patent, together with the patents cited therein, discloses an originating office equipped for automatic calling number identification in which the originating office first extends a connection to a tandem or toll switching center and then identifies and automatically outputs calling station information to the sender in the next office, in response to a polarity reversal of the outgoing trunk by the tandem or toll office when it is ready to receive the calling station information. The tandem sender of the present invention is designed to work with automatic number identification facilities of this type, and it is described in detail in the present invention how the tandem sender reverses the trunk polarity back to the originating office when it is ready to receive calling station identification information, and how this information is subsequently registered in the sender.

The aforementioned R. B. Curtis disclosure describes a tandem switching system having equipment and circuits similar or identical to certain of those utilized by the system of the present invention. As already mentioned, the presently disclosed system serves all of the noncoin nonspecial service and noncoin special service calls described in the Curtis disclosure and, in so doing, it serves them in an identical manner with identical circuitry to that utilized and disclosed by Curtis. The present specification discusses generally, throughout its various portions thereof, the manner in which noncoin calls are served. However, the circuit details relating to the serving of such calls, including a discussion of relay operations and the tracing of circuit paths, is not set forth herein since these details are fully set forth in Curtis.

The J. Baumfalk et al. application, Ser. No. 318,407, filed Oct. 23, 1960, discloses certain details of the operator position and position control circuits above and beyond those described in the present specification. The N. L. Laefer application, Ser. No. 318,355, filed Oct. 23, 1963, and the A. H. Scheinman application, Ser. No. 318,360, filed Oct. 23, 1963, are also related to the present invention in that they are directed to the circuit details concerning the manner in which certain incoming trunks may be selectively connected with operator position circuits on either a priority or nonpriority basis depending upon the call type as well as the call progress.

Reference is also made to the C. E. Germanton application, Ser. No. 318,427, filed Oct. 23, 1963, for further details concerning the manner in which the traffic regulator, the key control position control circuit, the position link and the position link controller together func-

tion to provide equitable service to all incoming trunks on both a priority and a nonpriority basis. Reference is further made to the J. G. Nightingale application, Ser. No. 316,653, filed Oct. 16, 1963, for the details of the computer circuit above and beyond those disclosed in the present specification.

All of the foregoing mentioned patents and applications are hereby incorporated into and made a part of the present specification to the same extent as if fully disclosed herein.

CONTINUATION OF GENERAL DESCRIPTION

Basic layout of data transfer network—embodiments of FIGS. 2A through 2I

FIGS. 2A through 2I diagrammatically disclose the data transfer circuit together with those central office circuits which may be interconnected with one another via the data transfer circuit during the serving of various types of calls. The data transfer circuit may be functionally divided into two parts, namely, control circuitry and interconnecting circuitry. The control circuitry is that which directs and regulates the operation of the entire data transfer circuit. The interconnecting circuitry comprises the circuit paths which may be closed to interconnect the central office circuits served by the data transfer circuit. The data transfer circuit is disclosed on FIGS. 2A through 2I in a manner which highlights its interconnecting functions in order that the over-all system operation may be better understood. A thorough appreciation of such functions is necessary for an understanding of the present invention. The control circuitry portion of the data transfer circuit is hereinafter described in some detail in connection with FIGS. 3—, and is described in complete detail in connection with the drawing figures disclosing the detailed circuits.

Referring to the drawings, it may be seen that the data transfer circuit, per se, is shown on FIGS. 2F, 2G, 2H, and 2I, while the positions and position control circuits, the registers, the senders, the incoming trunk circuits, the raters, and the computers, all of which circuits may be interconnected with each other via the data transfer circuit, are shown on FIGS. 2A, 2C, 2D, 2E, and 2I. FIG. 2B discloses position links, a register link, and a sender link, since some of the functions performed by these circuits are intimately associated with the operation of the data transfer circuit. The other circuits of the office shown on FIGS. 1— are not shown on FIGS. 2A through 2I, since their functions are not directly and intimately related to the data transfer circuit operation.

DATA CHANNELS

The data transfer circuit, for the purpose of disclosing a greatly simplified version thereof, is shown as being basically comprised of four data channels (groups of communication paths) which are represented by the four heavy horizontal lines on the lower portions of FIGS. 2F, 2G, 2H, and 2I. Each channel can, independently of the other three channels, interconnect the combination of central office circuits requiring interconnection on a call, and the provision of four data channels thereby enables the data transfer circuit to serve four different calls simultaneously. Inasmuch as the present drawings are essentially diagrammatic in nature, it is to be understood that each line representing a circuit path may comprise a plurality of conductors and that the specific number of conductors represented by each line is immaterial to the present discussion.

ACCESS CAPABILITIES

The various central office circuits which may be interconnected by the data transfer circuit are functionally divided into groups, and each group, excluding the raters and computers, is connectable to the four data channels via a connector individual to its group. The present disclosure assumes that the data transfer circuit serves 330 operator positions, of which an arrangement of 66 are

shown in detail. The remaining positions are served by other position link groups and are represented by the multiple marks on FIGS. 3A and 3B. The data transfer circuit also serves 100 registers, 100 senders, and 2,500 trunk circuits (of which only 1,000 are shown), two raters, and two computers. The operator positions which are not shown in detail are served by the data transfer circuit in precisely the same manner as are the position circuits whose details are shown. In this connection, all position circuits are distributed over the seven position connectors so that each connector serves its pro rata share of the position circuits. The operator positions are designated 00 through 65 and are divided into seven groups, comprising six groups of ten and one group of six, with each such group being individual to and served by one of the position connectors 0 through 6. The registers and senders, designated 00 through 99, are divided into ten groups of ten circuits each. Each register group is served by one of the ten register connectors 0 through 9, and each sender group is served by one of the ten sender connectors 0 through 9. The 1,000 disclosed trunk circuits, designated 00 through 999, are divided into ten groups of 100 circuits each, and each such group is served by one of the trunk connectors 0 through 9. The remaining trunk circuits whose details are not shown are served in the same manner as the 1,000 disclosed trunk circuits, and, in this connection, all the trunk circuits served by the data transfer circuit are equitably distributed over the ten trunk connectors so that each trunk connector serves 10 percent of the trunks which require the services of the data transfer circuit. The two raters and the two computers are not associated with connectors and, instead, each of these circuits is directly connectable to any one of the four data channels.

FUNCTIONAL DESCRIPTION

A connection may be completed between two or more circuits, via the data transfer circuit, by first closing the contacts common to each circuit to be interconnected and their connectors, except in the case of the raters and the computers which are not served by connectors, and secondly, by closing the contacts common to these connectors and to the data channel that will serve the call. The relays which control the closure of the contacts connecting a connector to one of the circuits served by it are designated "primary relays," while the relays which control the contacts connecting a connector to one of the four data channels are designated "secondary relays."

BIDDING FOR A DATA CHANNEL

Each position circuit and each register circuit can apply a signal to its respective connector requesting an interconnection, via an idle data channel, with other circuits of the office. The remaining circuits, namely, the senders, trunks, raters, and computers, may be connected to a data channel only in response to a request to that effect from either a position circuit or from a register circuit. The function of the data transfer circuit in response to a bid from a register is to interconnect the bidding register with the sender serving the same call in order that information, including the called number, may be transmitted from the register to the sender. The function of the data transfer circuit in response to a bid from a position is to interconnect the bidding position with the calling trunk as well as, additionally, with either the sender, the rater, or the computer, or a combination of these circuits, depending upon both the type of call as well as the progress of the call. Once interconnected, these circuits then interchange the call data required for the successful serving of the call. The precise nature and quantity of the information interchanged, the precise combination of circuits interconnected, as well as the direction of data flow, varies for the different types of calls that may be served by the system.

BID BY REGISTER

If a register is the bidding circuit, the register connector serving the bidding register connects itself to the register and then signals a request for a connection to an idle data channel. The channel control circuitry on FIG. 2F receives this request and connects the bidding register connector to an idle channel in competition with other currently bidding register connectors and position connectors. Once the connection between the bidding register connector and a data channel is completed, the register transmits information to the channel control circuitry, which enables the seized data channel to extend the connection from the bidding register to the sender serving the same call. The connection between the data channel and the sender is established by first closing the necessary sender connector primary relay contacts to interconnect the sender with its sender connector, and then by closing the sender connector secondary relay contacts necessary to interconnect the sender connector with the proper data channel.

The register transmits the called station number and other information to the sender when the connection via the data channel to the sender is completed. After this information is satisfactorily registered in the sender and so checked by the channel control circuitry, the register and the sender are released from the data channel, thereby enabling the register connectors and the sender connectors, as well as the data channel, to release and serve subsequent calls.

BID BY POSITION

If a position is the bidding circuit, the position connector associated with the bidding position receives the bid and interconnects itself with the position by closing the appropriate position connector primary relay contacts. Once this connection is established, the position connector transmits a request for a connection to an idle data channel. The channel control circuitry of FIG. 2F then closes the necessary position connector secondary relay contacts to connect the bidding position connector with an idle data channel. The bidding position next transmits information to the channel control circuitry indicating the identity of the calling trunk being served, as well as to inform it concerning the circuits that are to be interconnected via the data channel at this time. The circuits to be interconnected at this time will always include the bidding position and the calling incoming trunk, as well as, depending upon the type of call and its progress, a sender, a rater, a computer, or various combinations thereof.

Once the data channel has been interconnected with the bidding position, it proceeds to interconnect itself with the calling trunk by first closing the trunk connector secondary relays common to the channel and to the trunk connector associated with the calling trunk. It then causes the trunk connector primary relays and the necessary trunk subgroup primary relays to close and thereby connect the calling trunk to its trunk connector. If a sender is to be connected to the channel at this time, the data channel now transmits a signal via the position connector, the bidding position, the position link, the calling trunk, and the sender link, to the sender. The sender, in response to this signal, controls the establishment of a connection via its sender connector, to the data channel serving the call. If either a rater or a computer is to be brought aboard the connection at this time, the data channel serving the call directly bids for and controls the establishment of a connection between itself and the rater or computer.

Once the appropriate combination of positions, senders, calling trunk circuits, and raters or computers are all connected to the same data channel, the data required for the serving of the call is then interchanged via the data channel between these various circuits. After the transmitted data is satisfactorily registered in the receiver

ing circuits, the position, sender, and trunk connectors, as well as the data channel utilized, are all released, thereby freeing them for the serving of subsequent calls.

ILLUSTRATION OF DATA TRANSFER CIRCUIT OPERATION ON AN MF COIN CALL

In order to illustrate the functions of the data transfer circuit during the serving of specific calls of the most frequently occurring type, let it be assumed that MF-ANI coin trunk No. 20 shown on FIG. 2E is currently serving an incoming call, that it is currently connected to sender 00 (shown on FIG. 2C) via the sender link, and that, in addition, it is currently connected via the position link to position 00 (on FIG. 2A). Trunk 20 does not require the services of a dial pulse register since it is of the MF type. The following paragraphs discuss how, on calls of this type, the data transfer circuit: (1) interconnects position 00 with sender 00 and trunk 20 in response to a bid from the position, (2) seizes a rater and adds it to the connection, (3) transmits rater out information to the trunk and position circuit, (4) checks for the proper registration of this information in the trunk and position circuits, (5) releases the sender, the trunk, and the rater from their connection to the data channel, and (6) seizes a computer and connects it to the data channel in order that the position and the computer may interchange call information.

Once the progress of the call has advanced to the point where position 00 is interconnected with trunk 20 via the position link, the position sends a start signal to position connector 0 requesting a data channel in response to a signal to this effect from sender 00. This signal is transmitted from the sender, via the closed crosspoints of the sender link, through MF-ANI coin trunk circuit 20, through the crosspoints of the position link, to position 00. Upon the reception of this start signal, position 00 transmits a bid for an idle data channel to position connector 0, which serves positions 00 through 09. This position connector, as well as all other position connectors and register connectors, has preference circuitry which ensures that only one of a plurality of the simultaneously bidding circuits served thereby may be successful in obtaining a connection to it. Let it be assumed that position 00 is the only bidding position in its group or that, in the event of simultaneous bids, it is the preferred circuit and is therefore successful in obtaining a connection to its connector. The interconnection of position 00 with connector 0 closes the position connector primary contacts P00 (on FIG. 2F) which are common both to the conductors of position 00 and to those of position connector 0.

Bid for an idle data channel.—Once position 00 is connected to position connector 0, the connector bids for connection to an idle one of the four data channels. Each register and position connector is connectable to the data channels under control of preference circuitry which equitably allocates among the four data channels all requests for service and, additionally, provides for an orderly sequence of operation in the event of simultaneous requests for a connection to the same data channel. Let it be assumed that position connector 0 is successful in obtaining the services of data channel 0, for example. This results in the closure of position connector secondary relay contacts 0PS0 (FIG. 2F) which are common to the conductors of data channel 0 and to those of position connector 0.

Ascertain trunk identity.—The next step in interconnecting position 00, trunk 20 and sender 00, once position 00 has been connected to data channel 0, is for the channel control circuitry on FIG. 2F to ascertain which trunk connector serves trunk 20, and then to close the appropriate trunk connector secondary relay contacts common to data channel 0 and to this trunk connector. It may be seen from a study of FIGS. 2E and 2H that trunk 20 is served by trunk connector 0; thus, trunk connector secondary relay contacts 0TS0 (on FIG. 2H)

are the ones which should be closed at this time to connect data channel 0 to trunk connector 0.

Position 00 receives a plurality of items of information concerning the call, incident to its interconnection with trunk 20 via the position link. Part of this information represents an identification of the trunk connector associated with the calling trunk. This information is transmitted as a two-digit code from the trunk, via the position link, to the position, and it is then subsequently transmitted, via the position, to the channel control circuitry. Thus, for this call, position 00 receives information signifying that trunk connector 0 serves trunk 20. The position, in turn, transmits this trunk connector number to the channel control circuitry of FIG. 2F, which, in response thereto, closes contacts 0TS0 (FIG. 2H) common to channel 0 and to trunk connector 0.

Connect trunk to channel.—The data transfer circuit next transmits a signal from the channel control circuitry (FIG. 2F), via data channel 0, contacts 0PS0, position connector 0, contacts P00, position 00 (FIG. 2A), the closed crosspoints of the position link (FIG. 2B) to trunk circuit 20 on FIG. 2E. The reception of this signal by trunk 20 causes the contacts TP20 on FIG. 2E to close, thereby interconnecting the conductors of this trunk circuit with those extending to make contacts 0TSG2 on FIG. 2H which are still open. The closure of make contacts TP20 causes make contacts 0TSG2 to close, thereby completing the interconnection of trunk 20, via data channel 0, with position 00, since contacts 0TS0 were priorly closed.

Connect sender to channel.—It will be recalled that trunk 20 is currently interconnected with sender 00 via the sender link. The signal transmitted from the data transfer circuit to trunk 20, controlling the operation of contacts TP20, is also transmitted through the sender link circuit to sender 00 on FIG. 2C, where it causes the sender to bid for a connection to its sender connector. This service request is received by sender connector 0, and, assuming that sender 00 is the only sender of its group currently bidding, or that it is the preferred sender in the event of simultaneous bids, primary relay contacts S00 on FIG. 2G, common to the conductors of sender 00 and sender connector 0, are now closed.

The sender now transmits a plurality of items of information to the data transfer circuit incident to its connection to sender connector 0. Included in this information is the number of the trunk connector serving the trunk to which this sender is currently connected via the sender link. Trunk connector 0 serves calling trunk 20, and therefore a trunk connector number of 0 was registered in sender 00 at the time it was interconnected with the calling trunk via the sender link. This trunk connector number is transmitted to the data transfer circuit when sender 00 is connected to sender connector 0 by the closure of the sender primary relay contacts S00. The data transfer circuit has priorly received the same trunk connector number from position 00, incident to establishing a connection between position 00 and trunk 20. Therefore, the reception of a trunk connector number of 0 from sender 00 via its sender connector, in essence, constitutes a request that sender connector 0 be connected to the same data channel that is currently connected to trunk connector 0. This request is received by the data transfer circuit and, by means which are described in greater detail in connection with FIGS. 3-, the data transfer circuit first ascertains which one of its four data channels is currently connected to trunk connector 0, and then closes the proper sender connector secondary relay contacts to connect sender connector 0 to this channel. Specifically, for the present call, the data transfer circuit ascertains that channel 0 is currently connected to trunk connector 0, since contacts 0TS0 on FIG. 2H are now closed. It then closes sender connector secondary relay contacts 0SS0 (FIG. 2G) to interconnect channel 0 with sender 00 via sender connector 0.

Once trunk 20, sender 00, and position 00 are all connected to data channel 0 via their respective connectors, the data channel itself bids for and establishes a connection between itself and an idle rater circuit. Let it be assumed, for example, that it seizes rater 0 and, in so doing, closes make contacts 0RTA0 on FIG. 2I. Once the rater is brought aboard the connection, the sender and the trunk transmit to the position and to the rater the various items of information needed by these circuits for the successful serving of the call. The items of information received by the position are stored in registers of that circuit for subsequent use by the operator. The items of information received by the rater are utilized by it to derive the charge rate applicable to the call. The rater now computes the charge rate and, in so doing, also derives an indication of the initial period duration for the call. Both the charge rate and the initial period duration are then transmitted via data channel 0 to the position and to the trunk circuit.

The data channel now checks to ensure that all items of transmitted data are successfully registered in the receiving circuits, and then releases itself from the trunk, the sender, and the rater. Trunk connector 0 and sender connector 0 both release at this time, along with rater 0, in order that these circuits may serve other calls. However, position 00 remains connected via its position connector to data channel 0. The data channel now receives an instruction from the position 00 instructing it to connect itself to an idle computer. This being the case, data channel 0 now bids for and connects itself to a computer, such as for example, computer 0, and, in so doing, it closes make contacts 0CA0 on FIG. 2I. Position 00 now transmits the information, via data channel 0, to computer 0 that it needs to derive the monetary charges for the initial period portion of the call. The computer derives this charge information and transmits it to the position for registration therein. The data transfer circuit once more checks that all transmitted information has been correctly received and registered in the receiving circuits, and then releases both itself, as well as computer 0 and sender connector 0, in order that these circuits may serve subsequent calls.

The operator now has at the position all the information necessary for the serving of the call, as priorly described in connection with block diagram FIGS. 1-. The position circuit remains connected at this time to the trunk, via the position link, until the operator releases from the connection after having furnished the required call services. For example, on a person-to-person coin call, the operator does not release her connection with the calling trunk via the position connector until she first determines that the called party specified by the calling subscriber is available and, second, supervises the deposit of the initial period charges by the calling party. Having done this, the operator then depresses keys to release the position from the calling connection and to start the timing of the call under control of the trunk timer, as described in connection with FIGS. 1-.

Overtime seizure of data transfer circuit.—Shortly prior to the end of the initial period, the calling trunk, under control of the trunk timer, determines that the initial period is about ended and transmits a signal to the position link, instructing it to interconnect the trunk with an idle operator position on a priority basis. Once this connection is established, the trunk circuit transmits a signal, via the position link, to the position, instructing it to interconnect itself with the calling trunk via an idle data channel. The position receives this signal, seizes the data transfer circuit, and instructs it to interconnect the position with the calling trunk, in the manner just described for the data transfer circuit usage at the beginning of the call except that a sender is not connected to the channel on this usage. Once this connection is established, the data channel is then instructed by the position to connect itself to a computer in order that the

calling trunk, the position, and the computer may now interchange information. When this connection is established, the trunk transmits both to the position and to the computer the charge rate applicable to the call, together with an indication that the call is now going into overtime. The computer receives this information and, in response thereto, derives the monetary charge for a single overtime period and transmits this charge information to the position circuit. The computer at this time also derives information indicating the duration of a single overtime period and transmits it to both the position and the trunk for registration therein. The data transfer circuit releases after having determined that the transmitted information has been successfully received and registered by the receiving circuits. The operator has at the position at this time all the information that is required to notify the calling party that the call is entering overtime, as well as to inform him concerning the charge and duration of a single overtime period. The trunk still has registered therein at this time the charge rate originally transmitted thereto by the rater. However, its trunk timer is reset to zero by the computer and, at the same time, information is registered in the trunk indicating that the call is entering overtime, as well as indicating the length of a single overtime period. The operator releases the position from the calling connection via the position link after having conversed with the calling party and notified him regarding the current status of the call.

Seizure of the data transfer circuit at the end of the call.—The call now continues into overtime, with the overtime being measured by the trunk timer circuitry as described in connection with FIGS. 1-. At the termination of the call when one of the parties hangs up or flashes his switchhook, the trunk signals for a connection, via the position link, to an idle operator position on a priority basis, in order that an operator may be brought aboard the connection to supervise the collection of the charges for the call overtime. The data transfer circuit is once again seized by the position circuit and instructed to interconnect the position with the calling trunk circuit as well as with a computer in the same manner as described for the overtime seizure operation. Once this connection is established, the trunk circuit transmits the charge rate, the measured overtime, as well as an indication that the measured time represents overtime, to both the position and the computer. The computer, in response to the receipt of this information, derives the monetary charges applicable to the overtime portion of the call and transmits this to the position circuit. The data transfer circuit checks to ensure that all transmitted information has been satisfactorily received and registered and then releases itself from the connection. The operator now monitors the collection of the overtime charges from the calling subscriber and releases from the connection.

Coin MF non-ANI calls are served by trunks 25 through 29 on FIG. 2E in essentially the same manner as just described for the coin MF-ANI call except that, in addition, the operator must orally obtain the calling station number from the subscriber and key it into the position registers in the same manner as described in detail in the Curtis specification.

DIAL 0 OPERATOR CALLS

Dial 0 ANI coin calls are served by trunks 30 to 34 (FIG. 2E), and dial 0 non-ANI coin calls are served by trunks 35 to 39 (FIG. 2E). The rater and the computer are not used on these calls since they are manually rated and timed by the operator. Other than this, the calls are served in a manner identical to that described for the corresponding type of noncoin dial 0 calls in the R. B. Curtis specification.

COIN COMBINED DP-ANI CALLS

The calls served by coin combined trunks 40 through 49 may be of either the 1+, 0+, or dial 0 type. The

dial 0 calls served by these trunks are served in an identical manner to that for the calls served by coin dial 0 ANI trunks 30 through 34. The 1+ and 0+ calls are DP coin calls of the station-to-station and person-to-person type, respectively. It is described in the following paragraphs how these 1+ and 0+ DP calls are served.

The data transfer circuit is used on DP coin calls to interconnect various combinations of position circuits, calling trunk circuits, sender circuits, rater circuits, and computer circuits, in the same manner as already described for MF coin calls. Also, the data transfer circuit is used earlier on each DP call to interconnect the incoming DP coin trunk with the register and sender in order that the called station digits, including area code, if any, may be transferred from the register to the sender. The data transfer circuit is first seized on a DP coin call when the register bids for and obtains a connection to an idle data channel after it has received the called station number and area code digits from the DP coin trunk such as, for example, trunk 40 on FIG. 2D. At this time, by expedients similar to those already described, the data transfer circuit extends a connection, via one of its data channels, from the bidding register to the particular sender which, at this time, is connected via the sender link to the trunk associated with the bidding register. The register transmits the called number digits to the sender as soon as this connection is established and then releases itself and the data transfer circuit, thereby freeing both of these circuits to serve other calls. The call then progresses to the point where the position, the sender, the trunk, the rater, and then the computer are interconnected on the initial period seizure, in the manner just described for MF coin calls.

The overtime and end-of-call data transfer circuit usages are identical to those for the priorly described MF coin call.

COIN NONCOMBINED DP—NON-ANI CALLS

The calls served by trunks 50 through 54, which are of the coin noncombined DP—non-ANI type, may be of either the 0 or 0+ variety. 0 calls (dial 0 calls) are served in the same manner as are the coin dial 0 non-ANI calls previously discussed. Insofar as the present discussion is concerned, the 0+ calls are served in the same manner as the DP coin calls previously discussed for trunks 40 to 49 except that the operator must also identify the calling station.

The calls served by trunks 55 through 59 are of the 1+ type and are similar to those previously described for the DP coin calls for trunks 40 to 49.

NONCOIN CALLS

The noncoin calls are served by trunks 00 through 09, 10 through 19, 80 through 89, 90 through 99, and 900 through 999, depending upon whether the call is of the MF, DP, or dial 0 variety, and, also, depending upon whether it serves originating offices equipped for ANI or non-ANI operation. The type of traffic served by each trunk is indicated within the box representing the trunk on one of FIGS. 2C, 2D, and 2E. The manner in which the noncoin calls incoming to these trunks are served is set forth in detail in the aforementioned Curtis specification and need not be discussed herein.

Block diagram—Embodiment of FIGS. 3A through 3X

FIGS. 3A through 3W, when arranged as shown on FIG. 3X, disclose the same basic system relationships as do FIGS. 2A through 2J. In addition, FIGS. 3A through 3W disclose sufficient added detail as to facilitate an understanding of the circuitry utilized to control the interconnecting functions of the data transfer circuit.

ACCESS CAPABILITIES

The embodiment of FIGS. 3A through 3W is similar to that of FIGS. 2A through 2J in that it comprises 66 position circuits (00 through 65) served by seven po-

sition connectors (0 through 6—FIGS. 3A and 3B), 100 register circuits (00 through 99) served by 10 register connectors (0 through 9—FIGS. 3C and 3G), 100 sender circuits (00 through 99) served by 10 sender connectors (0 through 9—FIG. 3J), 1,000 trunk circuits (00 through 999) served by 10 trunk connectors (0 through 9—FIGS. 3L through 3S), two raters (shown on FIG. 3T), and two computers (shown on FIG. 3V).

Each trunk connector includes 10 subgroup relays individual thereto, with the subgroup relays for trunk connector 0 being designated 263B-0TSG0 through 263B-0TSG3, 263A-0TSG4 through 263A-0TSG7, 263-0TSG8, and 263-0TSG9. The trunk subgroup relays for trunk connector 9 are designated 263-9TSG0 through 263-9TSG9. FIGS. 3E and 3F disclose position links, a register link, and a sender link for performing the same interconnecting functions priorly described for FIGS. 2A through 2J. The data transfer circuit, similarly, includes four data channels designated 0 through 3, which are represented by the four groups of conductors extending horizontally between FIGS. 3A and 3V.

ELEMENTARY DESCRIPTION OF FUNCTIONAL UNITS AND TERMS USED

There are a number of distinctions between the showing of FIGS. 2A through 2J and that of FIGS. 3A through 3W which deserve comment at this point. All of these distinctions relate to the manner in which added detail has been incorporated into the showing of FIGS. 3—.

Each data channel is represented by a single line on FIGS. 2—. It was priorly explained in connection therewith that each such line may comprise as many conductors as may be necessary for performing the required interconnecting functions. Each data channel on FIGS. 3— is shown, not as a single line, but instead, as a plurality of lines. On FIGS. 3A, 3B, 3C, and 3G, each channel comprises four such lines; while on FIGS. 3J, 3M, 3S, and 3T each channel comprises three such lines; and on FIG. 3V each channel comprises two lines. Except where indicated to the contrary, it is again to be understood that each line on FIGS. 3— does not comprise a single conductor, but instead, comprises a plurality of conductors, the specific number of which is immaterial to the present discussion. The fact that four lines are associated with each data channel on some figures while a lesser number of conductors is shown as associated with each data channel on other figures, functionally signifies that the quantity of data transmitted over the channels varies in accordance with the type of circuits interconnected by the various portions of the channel.

The expedient of representing a plurality of conductors by a single line has been extensively used on FIGS. 2— and 3— in order to minimize the complexity of the drawings and to facilitate an understanding of the circuit concepts involved. A departure has been made from this expedient in a few instances on FIGS. 3— in order to describe certain aspects of the channel control circuitry. Other than where stated to the contrary, it is to be understood that each line may represent as many conductors as may be necessary to perform the indicated functions of the circuitry represented by the line.

A further distinction between the showing of FIGS. 2— and 3— is that the circuit components, including relays and their contacts, are designated in a simplified manner on FIGS. 2—, but not on FIGS. 3—, as compared with the designation of the corresponding elements on the detailed drawings. This was done for FIGS. 2— in order that an understanding of the over-all function of the circuit would not be impeded by the complexity of the apparatus designations utilized. On the other hand, each element on FIGS. 3— bears the same designation it does on the detailed drawings, in order to facilitate a comparison between the detailed drawings and FIGS. 3—. In order to further facilitate this comparison, many circuit elements, including relay windings, are enclosed within rectangles

having designations indicating the figure number of the detailed drawings on which the element may be found. Also, the functional designation of most relay contacts is preceded by a dash and a figure number, such as for example, 263-0TSG9. The prescribed figure number indicates where the relay winding controlling the operation of the contacts may be found on the detailed drawings. For those relay contacts whose functional designation is preceded merely by a dash, such as for example, -TP999 on FIG. 3M, the absence of a prescribed figure number indicates that the relay does not appear on any figure of the detailed disclosure. The reason for this will be apparent when it is considered that a large number of certain circuits, such as trunk circuits, for example, comprise the present system. In the detailed disclosure, it is neither necessary nor desirable to show all such circuits. A number of incoming trunk circuits are shown in detail. However, in order to explain the operation of the system, certain corresponding relay contacts, e.g., -TP999, of certain other trunks which are not disclosed in detail, are shown on the block diagram even though it is not necessary to show the circuit details of such trunks on the detailed drawing figures. It is considered highly important in connection with the embodiment of FIGS. 3- that the apparatus designations facilitate such a comparison in order that the detailed drawings, together with the accompanying detailed description, may be better understood by reference to the diagrammatic showing of FIGS. 3-.

MF-ANI COIN CALL

Position connector.—The system of FIGS. 3- is initially described in connection with a call that is assumed to be served by coin MF-ANI trunk 20 shown on FIG. 3O (phonetically, "three oh"—not to be confused with figure thirty), operator position 00 shown on FIG. 3B, sender 00 shown on FIG. 3J, rater 0 shown on FIG. 3T, and computer 0 shown on FIG. 3V. As priorly described, trunk 20 is first connected, via the sender link of FIG. 3F, to sender 00, and subsequently is connected, via the position link of FIG. 3E, to position 00 while it remains connected to the sender via the sender link. Once the call has progressed to this point, it is then required that position 00, sender 00, trunk 20, and then rater 0 and computer 0, be connected to the same data channel of the data transfer circuit in order that these circuits may interchange call data. Position 00 receives a signal from sender 00, via the connection established through the sender link and the position link, instructing it to request a connection via its position connector to a data channel. Position 00, in response to this signal, applies a "start" signal over conductor STDT00 extending to the preference and lockout circuitry for position connector 0. This circuitry equitably allocates the services of the position connector to the 10 positions associated therewith, namely, 00 through 09. As part of this function, it provides for an orderly sequence of circuit operations in the event that two or more of its positions simultaneously bid for its services. Each of the remaining position connectors and register connectors also has similar preference and lockout circuitry.

Let it be assumed that position 00 on FIG. 3B is currently the only bidding position for position connector 0, or alternatively, in the event that two or more of the positions 00 through 09 are simultaneously bidding, that position 00 is preferred at this time. This being the case, under either alternative, the signal on conductor STDT00 is now extended to the preference circuit and to the winding of relay 224-PA00 on FIG. 3B to operate it. Each position served by position connector 0 is individually associated with one of a plurality of relays shown within the rectangle designated position connector 0 preference lockout. For example, position 00 is associated with relay 224-PA00, while position 09 is associated with relay 224-PA09. These relays comprise the primary cut-in relays for connector 0, and the operation of any relay connects the conductors of its position to those of its position con-

necter. Thus, for example, the operation of relay 224-PA00 connects the conductors of position 00 to those of position connector 0. The operating circuits of these relays include preference circuitry which permits only one of them to be operated at a time. The remaining positions and position connectors, as well as the registers and register connectors, have similarly arranged primary cut-in relays, each of which is individually associated with one of the positions or registers served by the connector and which, when operated under control of the preference circuit, interconnects the conductors of its associated register or position with those of its connector.

Data channel preference and selection circuit.—Once the preference and lockout circuit for position connector 0 has interconnected position 00 with position connector 0, via make contacts 224-PA00, it transmits a "start" signal over conductor STDT0 from FIG. 3B to FIG. 3D to the data channel preference and selection control circuit shown thereon. This circuit comprises a two-dimensional preference circuit which, first of all, arranges each of the four data channels in a fixed order of preference with respect to each position connector and register connector taken individually, and, secondly, arranges all register connectors and position connectors in a predetermined order of preference with respect to each other for each individual channel, so that an orderly sequence of circuit operations will occur in the event of simultaneous bids for a particular data channel. Thus, the preference circuit controls the order in which each connector attempts to seize the different data channels. For example, position connector 0 may prefer to bid for channel 0, 1, 2, or 3, in that order, while position connector 6 may prefer to bid for channel 3, 2, 1, or 0, in that order. Also, the preference circuitry for each channel ensures that only one out of a plurality of simultaneously bidding connectors will be successful in obtaining the services of an idle channel.

Let it be assumed at this time that position connector 0 prefers data channel 0 and that it is the only bidding connector out of all the position connectors and register connectors, or that it is the preferred and successful bidding connector in the event of simultaneous bids. This being the case, the potential applied by position connector 0 to conductor STDT0 is extended by means of the circuitry of FIG. 3D to operate relay 225-0PRF0. This relay together with the remainder of the relays shown within the left-most rectangle on FIG. 3D comprises the secondary cut-in relays for the position connectors and register connectors. These relays are operated under control of the data channel preference and selection control circuitry which regulates the operation of the position and register secondary cut-in relays. Each connector includes four secondary cut-in relays, one for each of the four data channels, and the closure of any secondary cut-in relay interconnects the multiples of its connector with those of the data channel associated with the relay. The operation of relay 225-0PRF0 on FIG. 3D closes its make contacts shown on FIG. 3B, thereby interconnecting position connector 0 with data channel 0.

Neglecting the figure identification preceding the functional designation of each relay and still referring to FIG. 3D, it may be seen from FIGS. 3A, 3B, 3C, and 3G that all of the relays 0PRF0 through 0PRF6 and 0RRC0 through 0RRC9 are associated with channel 0. Each of the other three channels also has similar relays associated therewith. The initial digit in each relay's functional designation represents the channel with which the relay is associated, while the final digit of the designation represents the connector with which the relay is associated. Thus, relay 3PRF0 serves data channel 3 and position connector 0.

Trunk connector identification.—Position 00 on FIG. 3B is now interconnected with data channel 0, since the position connector primary cut-in relay 224-PA00 and the position connector secondary cut-in relay 225-0PRF0 are

both operated at this time. Position circuit 00 receives a plurality of items of information concerning calling trunk 20 incident to its connection therewith via the position link on FIG. 3E. One such item of information is the number of the trunk connector on FIGS. 3N through 3S serving trunk 20 on FIG. 3O, which connector must be seized in order to interconnect trunk 20 and position 00 via the data transfer circuit. Trunk connector 0 serves trunk 20, and this trunk connector number is registered at this time in 2-out-of-5 code form in the position circuit in the portion thereof designated "TRK. CONN. NO." The closure of the position connector primary relay contacts 224-PA00 and the position connector secondary contacts 225-0PRF0 causes the trunk connector number registered in the position circuit to be transferred from position circuit 00, over conductor DG on FIG. 3B and data channel conductor 0DG, from FIG. 3B to FIG. 3H, to the 2-out-of-5 to 1-out-of-10 translator for data channel 0 on FIG. 3H.

FIG. 3H contains circuitry for registering and translating the trunk connector number for all calls served by the data channels. This equipment includes a translator for each data channel which receives the trunk connector number on each call, in 2-out-of-5 code form. This information is received either from a bidding register or a bidding position circuit, depending upon the type of circuit attempting to seize the data channel. For the present call, the translator for channel 0 receives a trunk connector number of 0 from position circuit 00.

The trunk connector number information received by the translator is converted to a 1-out-of-10 indication, and an output potential is applied to the appropriate one of its 10 output conductors. The 10 output conductors of each translator are connected to 10 trunk connector preference and lockout circuits (also on FIG. 3H) in such manner that the numerical designation of each output conductor corresponds to the numerical designation of the trunk connector number. Thus, the 0 output conductor 0DGN0 of the translator for the 0 channel is connected to the trunk connector preference and lockout circuit for trunk connector 0, while the 9 output conductor, 0DGN9, for the same translator is connected to the trunk connector preference and lockout circuit for trunk connector 9.

Trunk connector preference and lockout.—The trunk connector preference and lockout circuitry on FIG. 3H cooperates with the 2-out-of-5 to 1-out-of-10 translator for each channel to facilitate an identification of the trunk connector which must be seized by the data channel to serve a call. This preference and lockout circuitry also contains the necessary preference circuitry to ensure that only one channel out of a plurality of simultaneously bidding channels can be successful in obtaining a connection to any single trunk connector. To this end, the four input conductors of each trunk connector preference and lockout circuit are respectively connected to the output conductors in each of the four translators in such a manner that the last digit of the conductor designation equals the numerical designation of the trunk connector. Referring to the trunk preference and lockout circuit for trunk connector 9, its four input conductors are respectively connected to the 9 output conductors in each translator.

Each trunk connector preference and lockout circuit includes four relays, each of which is individual to a different channel. The four relays of trunk connector 0 are designated 238-0TS0, 238-1TS0, 238-2TS0, and 238-3TS0. The first digit of the functional designation represents the channel number with which the relay is associated, while the last digit represents the trunk connector number for the relay. Thus, relay 238-0TS0 serves channel 0 and trunk connector 0, while relay 238-3TS0 serves channel 3 and trunk connector 0. In a similar manner, the four relays for trunk connector 9 are designated 240-OTS9, 240-1TS9, 240-2TS9, and 240-3TS9. These latter relays together comprises the secondary cut-in relays for the

four data channels and trunk connector 9. The four secondary cut-in relays of each trunk connector are connected to the trunk connector preference and lockout circuit for the connector in order to ensure that only one channel at a time can be connected to the trunk connector.

Recalling that position 00 on FIG. 3B is now connected to data channel 0, via the closed primary cut-in relay contacts 224-PA00 and the closed secondary cut-in relay contacts 225-0PRF0, a trunk connector number of 0 is now applied over circuit paths DG and 0DG, in 2-out-of-5 code form, to the 2-out-of-5 to 1-out-of-10 translator on FIG. 3H for data channel 0. This information is translated and results in an output signal on conductor 0DGN0 extending to the 0 channel portion of the preference and lockout circuitry for trunk connector 0. The remaining conductors, which could also bid for trunk connectors 0, are 1DGN0, 2DGN0, and 3DGN0. A potential on one or more of these conductors would represent requests by channels 1, 2, and 3, respectively, for the services of trunk connector 0. Assuming conductor 0DGN0 of channel 0 is the only one bidding at this time, or alternatively, assuming that it is the preferred one of a plurality of bidding channels, the potential on this conductor operates relay 238-0TS0, which comprises the secondary cut-in relay common to data channel 0 and trunk connector 0. The operation of this relay closes its contacts on FIG. 3S to interconnect the multiples of data channel 0 with those of trunk connector 0.

Pausing briefly to review the circuit action described so far, it may be seen that in attempting to interconnect itself with trunk 20 on FIG. 3O, position circuit 00 on FIG. 3B has first obtained the services of data channel 0 as a consequence of the closure of contacts 224-PA00 and 225-0PRF0 and, secondly, has seized trunk connector 0 on FIGS. 3N through 3S by operating relay 238-0TS0 on FIG. 3H. It is obvious from an inspection of FIG. 3O that contacts -TP20 and 263B-0TSG2 must yet be closed in order to complete the interconnection of position 00 and trunk 20 via data channel 0.

Trunk operation.—The operation of relay 238-0TS0 on FIG. 3H, as a consequence of the successful seizure of trunk connector 0 by data channel 0, extends, on the bottom of FIG. 3H, a positive 130-volt resistance battery through its make contacts, over the PC conductor for data channel 0, extending from FIG. 3H to FIG. 3B, make contacts 225-0PRF0, conductor PC for position connector 0, make contacts 224-PA00, conductor PC, which extends through position 00, and becomes conductor KPR, and thence via cable P00 extending from FIG. 3B to the position link on FIG. 3E, through the closed crosspoints of the position link, via conductor KPR in cable T20, extending from FIG. 3I to FIG. 3O to operate relay 434-TP20 in trunk 20 on FIG. 3O. The operation of this relay closes its make contacts to complete an obvious circuit below trunk 20 on FIG. 3O to operate relay 263B-0TSG2. The operation of relay 434-TP20 also closes its make contacts immediately to the right of trunk 20 on FIG. 3O, thereby partially preparing a circuit to extend the conductors of trunk 20 to those of trunk connector 0.

Each trunk connector serves 100 trunks, which are, in turn, subdivided into 10 groups of 10 trunks each. In the interest of simplicity, the groups of trunks 60 through 79, and 100 through 899 are not shown on FIGS. 3-, but their inclusion in the system is to be inferred from the broken portion of the horizontal conductors of the data channel on the right-hand side of FIG. 3S, and from the broken portion of the vertical conductors of the trunk connector on the upper right-hand portion of FIG. 3L. Thus, trunk connector 0 serves trunks 00 through 99, with these 100 trunks being divided into subgroups of 10 trunks each, via the make contacts of trunk subgroup relays 263B-0TSG0 on FIG. 3N through 263-0TSG9 on FIG. 3S. It is to be understood,

however, that the number of trunks may be more or less than 1,000, as required; that the numbers assigned to the individual trunks are not equipment numbers but are merely arbitrary identifications to facilitate discussion; and, therefore, that the highest number assigned to an individual trunk may be higher than the total number of the trunks required. The first of these relays 263B-0TSG0, serves trunks 00 through 09. Similarly, relay 263-0TSG9 serves trunks 90 through 99. Each subgroup relay is operated as a consequence of the operation of any of the TP-- relay in the trunk circuits of its subgroup. Thus, subgroup relay 263B-0TSG0 is operated as a consequence of the operation of any of relays 434-TP00 through -TP09. The operation of the TP-- relay individual to a trunk, as well as the operation of the associated subgroup relay, is required in order to connect the multiples of a trunk to those of its trunk connector. The operation of relay 434-TP20 closes its make contacts as described, thereby preparing a path to connect the trunk with its trunk connector. The operation of relay 263B-0TSG2 closes its make contacts to the right of trunk 20 on FIG. 3O, thereby completing the interconnection of trunk 20 with its trunk connector. This operation also completes the interconnection of trunk 20 of FIG. 3O with position 00 of FIG. 3B, since the trunk connector 0 secondary cut-in relay 238-0TSG0 was previously operated.

Sender connector preference and lockout.—Now that trunk 20 on FIG. 3O and position 00 on FIG. 3B are interconnected via data channel 0, it may be appreciated from a study of FIG. 3J that the connection of sender 00 to the same data channel requires the closing of make contacts 243-SE00 and 246-0SRE0 of sender connector 0. It will be recalled at this time that sender 00 is currently connected, via the sender link on FIG. 3F, to trunk 20 by means of cable S00 on the sender side of the link, and by means of cable T20 on the trunk side of the link. Cable S00 extending into the sender includes a conductor SPI which, at this time, is connected to the SPI conductor of trunk 20, since the sender and the trunk are currently connected via the sender link. Therefore, the positive 130-volt potential transmitted from the data transfer circuit over the PC conductor, as already described, is received by sender 00 on its SPI conductor via the sender link. This potential is applied by the sender as a start signal to the sender connector 0 preference lockout circuit on FIG. 3J as a request to connect sender 00 to sender connector 0. The purpose of this preference lockout circuit is to ensure an orderly sequence of circuit operations in the event that two or more of senders 00 through 09 should simultaneously request connection to sender connector 0. Assuming that sender 00 is the only sender currently bidding, or alternatively, assuming that it is the preferred one of a plurality of bidding senders, the potential now on conductor SPI for sender 00 is cut through by the preference and lockout circuitry for sender connector 0, to operate relay 243-SE00 on FIG. 3J.

Sender 00 has previously received a plurality of items of information concerning the call as a consequence of its link connection to the calling trunk. One of these items is the trunk connector number of the calling trunk, which is received and registered, in 2-out-of-5 form, in essentially the same manner as was previously described for position 00.

Translating the trunk connector number.—The operation of relay 243-SE00 closes its make contacts on FIG. 3J, thereby interconnecting the trunk connector number register of sender 00 with conductor DG0 extending to a 2-out-of-5 to 1-out-of-10 translator on FIG. 3K, common to the 10 senders served by sender connector 0. This translator now translates the trunk connector number of 0, registered in sender 0, from a 2-out-of-5 to a 1-out-of-10 indication and applies an output potential to its output conductor 0. The potential on this conductor signifies that sender 00 is currently connected, via the sender link on FIG. 3F, to a trunk served by trunk connector 0. The

over-all object of the circuit of FIG. 3K, for the present call, is to ascertain which of the four data channels is currently connected to trunk connector 0 and, having ascertained this, to connect sender connector 0 to the same data channel.

Referring to FIG. 3S for the moment, it will be recalled that a position or register requiring an interconnection via a data channel, with one of the trunks served by trunk connector 0 operates one of the relays 238-0TSG0 through 238-3TSG0, depending upon the particular data channel serving the call. Thus, if channel 3 had been seized for this call, relay 238-3TSG0 would be operated; for channel 2, relay 238-2TSG0 would be operated; and, similarly, relay 238-1TSG0 or 238-0TSG0 would be operated for channel 1 or 0, respectively.

Sender connector.—Returning now to FIG. 3K, the 0 output conductor of the translator for sender connector 0 is connectable through the make contacts of the four relays 238-0TSG0 through 238-3TSG0 to relays 246-0SRE0 through 246-3SRE0, respectively, depending upon the data channel currently connected to trunk connector 0, as determined by the circuitry of FIG. 3H. In this manner, the circuitry of FIGS. 3H and 3K, together, enable the sender connector to determine which data channel it should seize, by ascertaining which data channel is connected to the same trunk to which the sender is already connected via the sender link.

Recalling that the currently described call is served by data channel 0; the output on conductor 0 of the translator on FIG. 3K for sender connector 0 may be extended through make contacts 238-0TSG0 to operate relay 246-0SRE0 which constitutes the secondary cut-in relay for channel 0 and sender connector 0. The operation of relay 246-0SRE0 closes its make contacts common to the conductors of sender connector 0 and data channel 0 on FIG. 3J, and since make contacts 243-SE00 on FIG. 3J were previously operated, sender 00 is thereby connected to data channel 0. This completes the interconnection of trunk 20, sender 00 and position 00.

Seizure of a rater.—It has been assumed that the presently described call is of the coin type and, further, that it is of the type for which the charge rate applicable to the call can be automatically derived by the rater circuit. This being the case, now that the trunk, the position, and the sender are interconnected via channel 0, data channel 0 now bids for the services of an idle rater by means of the rater bid circuitry on FIG. 3T, and the rater connector preference and lockout circuitry on FIG. 3U. This operation is initiated when data channel 0 applies a potential over its conductor 0STR extending from the data channel on FIG. 3T, and thence to the channel 0 portion of the rater preference and lockout circuitry on FIG. 3U. The circuitry on FIG. 3U comprises a conductor extending from each data channel, such as conductor 0STR for channel 0, a preference and lockout circuit, and a plurality of rater cut-in relays. The preference and lockout circuitry serves all four data channels and, in so doing, arranges the two raters in a stated order of preference, insofar as each data channel is concerned and, further, controls the bids from all data channels so that an orderly sequence of circuit operations will occur in the event of simultaneous bids from more than one data channel for the services of a single rater. The rater cut-in relays include two relays per channel, with one of the two relays being associated with rater 0 and with the other relay being associated with rater 1. Thus, the rater cut-in relays for channel 0 are 379-0RTA0 and 382-0RTA1, the first of the two relays being associated with rater 0, and the second relay being associated with rater 1. Similarly, each of the remaining three channels has associated therewith two relays in a similar manner, so as to give any channel access to either rater.

Let it be assumed that, for the present call, rater 0 is available for service by data channel 0. This being the case, the potential applied by channel 0 to con-

ductor 0STR is extended through the channel 0 portion of the preference and lockout circuitry on FIG. 3U to operate rater cut-in relay 379-0RTA0. It may be seen from an inspection of FIG. 3T that the operation of this relay closes its make contacts to interconnect rater 0 with channel 0. Thus, sender 00, position 00, trunk 20, and rater 0 are all connected to data channel 0 at this time.

These four circuits now interchange data, with the direction of data flow initially being from the trunk and sender to the position and rater circuits. The rater responds to the information transmitted to it and, in response thereto, derives the charge rate applicable to the call, together with an indication of the duration, in minutes, of the initial period. This derived information is, in turn, transmitted via data channel 0 to the trunk and to the position circuit. The data transfer circuit checks that the information transmitted to the trunk and position circuits has been properly registered therein, and then releases the trunk, the sender, and the rater from the connection to data channel 0. Rater 0 is now free to serve other calls. However, the trunk and the sender are still serving the same call, although their connection with the data transfer circuit has been released.

Data channel 0 now bids for the services of an idle computer by placing an appropriate signal on its conductor 0CST extending from FIG. 3V to FIG. 3W. The circuitry of FIG. 3W is similar to that of FIG. 3U except that it, instead, connects a bidding data channel with an idle computer, if available. Let it be assumed that computer 0 is available at this time for connection to data channel 0. This being the case, the potential applied to conductor 0CST is extended through the computer connector preference and lockout circuitry to operate relay 388-0CA0, thereby closing its make contacts on FIG. 3V to interconnect the conductors of computer 0 with those of data channel 0. Once this connection is established, the position circuit transmits the charge rate and other pertinent information to the computer. The computer responds to the receipt of this information and computes the monetary charges for the initial period of the call, and then transmits this information to the position circuit for registration therein. The data transfer circuit checks that this information has been properly registered in the position circuit and then releases the computer, as well as itself, from the connection.

The operator now notifies the calling party of the amount to be deposited, monitors the collection of the charges, performs whatever other duties may be required in connection with the call, and then releases from the connection. The timing of the call now proceeds under control of the trunk timing circuitry previously discussed in connection with the system description on FIGS. 1-.

Overtime seizure of data transfer circuit.—The next usage of the data transfer circuit on a call of the currently described type occurs at the end of the initial period when the calling trunk, a position circuit, and a computer are interconnected, via the data transfer circuit, in order that the computer may receive the charge rate for the call from the trunk circuit, compute the charge and duration for a single overtime period, and then transmit this information to the operator position circuit so that an operator thereat may advise the calling party that the call is now entering overtime and may also advise him of the duration and monetary charge for a single overtime period if such information is requested.

The seizure of the data transfer circuit at the end of the initial period is initiated when the calling trunk, under control of its timer circuitry, signals the position link to bid for an idle operator position on a priority basis. Once a connection to an operator position is estab-

lished, the trunk circuit signals the position circuit via the position link, to bid for a connection to an idle data channel. Let it once again be assumed that position 00 is seized by the position link and is connected thereby to calling trunk 20. The trunk circuit now signals position 00, via the position link, to interconnect itself with an idle data channel. The position circuit proceeds to apply a battery potential to its conductor STDT00 on FIG. 3B, thereby initiating the sequence of circuit operations by means of which, as priorly described, the data transfer circuit establishes an interconnection, via one of its channels, between the bidding position circuit and the calling trunk circuit with which the position circuit is currently interconnected via the position link. The sender is not connected to the data channel on this usage of the data transfer circuit. Thus, assuming that data channel 0 again serves the call, a connection is established, via data channel 0, between position 00 and trunk 20. A computer is brought aboard the connection at this time, in the same manner as priorly described, so that a computer, trunk 20, and position 00 are all connected to data channel 0 at this time.

The trunk circuit now transmits, via data channel 0, to the computer the charge rate applicable to the call, together with an indication that the call is entering overtime. The computer receives this information and, in response thereto, computes the monetary charges for a single overtime period, together with an indication of the duration, in minutes, of a single overtime period. This information is transmitted, via data channel 0, to the position circuit, where the operator thereat advises the calling party that the initial period has ended and that the call is entering overtime. The operator may also, if requested, advise the calling party concerning the charge for, and duration of, a single overtime period. The data transfer circuit releases the computer, the position, and itself from the connection, once it has determined that the information transmitted to the position circuit has been properly registered therein.

The call now continues in its overtime period, under control of the incoming trunk and its timer, as previously described for the system description in connection with FIGS. 1-.

End of call seizure of data transfer circuit.—The data transfer circuit is utilized again at the end of the call, to interconnect an operator position circuit and a computer with the calling trunk, in order that the computer may compute the monetary charges for the overtime portion of the call and transmit this information to the position circuit, whereat an operator will notify the calling party of the charges and will then monitor their collection before releasing from the connection.

The incoming trunk signals the position link to seize an idle position circuit on a priority basis when either party releases from the call or when the calling party flashes his switchhook. Once the position circuit is seized by the position link, the calling trunk signals the position circuit to seize an idle data channel in order that the calling trunk, the position circuit, and a computer may be interconnected via the data channel. This operation is then accomplished in the same manner as previously described for the seizure of the data transfer circuit at the end of the initial period.

Once the position circuit, the trunk circuit, and a computer are all connected to the same data channel, the trunk circuit transmits the charge rate and the elapsed overtime for the call to the computer which, in response thereto, computes the overtime charges and transmits them, via the data channel, to the position circuit. The data transfer circuit releases itself and the computer from the connection as soon as the information transmitted to the position circuit is satisfactorily registered therein. The operator now monitors the collection of the overtime charges and then releases the position from the connection.

COIN MF NON-ANI CALLS

Coin MF non-ANI calls may be served by any of trunks 25 through 29 shown on FIG. 30. Calls of this type are served in the same manner as are the coin MF-ANI calls served by the trunks 20 through 24, except that for non-ANI operation the calling station number is not received automatically from the originating office and registered in the sender. Instead, the operator receives an indication that it is necessary to orally obtain this information from the calling subscriber and key it into registers at her position.

DIAL 0 COIN ANI CALLS

Coin dial 0 ANI calls may be served by one of the trunks 30 through 34, as shown on FIG. 3P. The data transfer circuit is used twice at the very beginning of calls of this type, as described in the said Curtis disclosure. The first usage of the data transfer circuit takes place as soon as the calling number information has been received by the sender from the originating office via an ANI operation. The sender is first called in on the initial seizure of the trunk for the sole purpose of receiving the calling number and, upon registering it, sends a request, via the sender link, the trunk and position link, to the position circuit to request a connection to it, via the data transfer circuit, in order to transfer the calling number to the position. The sender is disconnected from the call as soon as the calling number is registered in the position and the data transfer circuit releases.

The second usage of the data transfer circuit on calls of this type occurs when the operator has secured the called number from information furnished orally by the subscriber and, having registered it in the position control circuit, a request is made by the position control circuit to transfer the called number, via the data transfer circuit, to the sender, which has been called in a second time to set the call up forward to the called subscriber station. The rater and the computer are not used on these calls since they are manually rated and timed by the operator. The operator notifies the calling party of the initial period charges and monitors their collection in the same manner as described for MF coin calls.

No further usage is made of the data transfer circuit on calls of this type, since the calling connection is held on a "locked-loop" basis by the operator in order that the call may be manually timed. The operator connects the headset in the associated transmission circuitry of the position to the loop at the end of the initial period and at the end of the call, to perform the same function described for the corresponding portions of the MF coin calls.

COIN DIAL 0 CALLS—NON-ANI OPERATION

A coin dial 0 non-ANI call may be served by one of the trunks 35 through 39 shown on FIG. 3P. The first usage of the data transfer circuit on calls of this type is different from that of coin dial 0 ANI calls in that no sender operation is involved, and therefore the data transfer circuit on its first usage interconnects only the incoming trunk and the position circuit, in order that the trunk may transmit call setup information to the position. The data transfer circuit releases after performing this function. The operator now orally ascertains and then registers in the position circuit the calling as well as the called number. The remainder of the call is served in the same manner as described for coin dial 0 ANI calls.

COIN COMBINED CALLS

Coin combined calls may be served by any of the coin combined DP-ANI trunks 40 through 49 shown on FIG. 3Q. The calls served by these trunks may be of the 0, 0+, or 1+ type. The 0 calls are dial 0 calls and are served in identically the same manner as previously described for coin dial 0 ANI calls served by any of the trunks 30 through 34. The 0+ and 1+ calls are of the person-to-person and station-to-station DP type, respec-

tively, and are served in the manner described in the following paragraphs.

0+ AND 1+ COIN COMBINED CALLS

The data transfer circuit is used one extra time on DP calls, above and beyond the number of times it is used on comparable MF calls. The first use of the circuit takes place as soon as the called station information is received by the register connected to the DP trunk via the register link, as described in Curtis for DP calls. On this usage, the register requests the data transfer circuit to interconnect it, via one of its data channels, with the sender serving the call, in order that the register may transmit the caller number, via the data channel, to the sender. The manner in which the bidding register and the data transfer circuit cooperate to interconnect the register, via one of the data channels, with the sender is analogous in all respects to the operation just described for a call on which a position is the bidding circuit, and therefore a detailed description of this operation at this point of the specification is not believed necessary.

The second usage of the data transfer circuit on DP coin calls takes place when the position, after having been connected to a calling trunk via the position link, initiates a bid for a data channel and then, having secured the same, proceeds to interconnect itself, via the data channel, with the calling trunk and its associated sender, and then subsequently with the rater, and then with a computer. The circuit operations associated with this usage of the data transfer circuit on DP coin calls are identical to those just described for the first usage of the data transfer circuit in connection with MF coin calls.

The data transfer circuit is also utilized at the end of the initial period and at the end of the call to interconnect the same combination of circuits, and in the same manner as previously described for MF coin calls.

COIN NONCOMBINED CALLS

The coin noncombined non-ANI calls may be served by any of the trunks 50 through 54, or 55 through 59 of FIG. 3R, depending upon the type of traffic. Trunks 50 through 54 serve 0 and 0+ traffic. The 0 traffic served by this trunk comprises dial 0 calls and is served in the same manner as previously described for the coin dial 0 non-ANI traffic served by trunks 35 through 39 of FIG. 3P. The 0+ traffic served by this trunk comprises coin DP non-ANI calls of the person-to-person type, which calls are served in the same manner as for the coin DP-ANI calls described in connection with trunks 40 to 49, except that on the second usage of the data transfer circuit, at the beginning of the initial period, the operator additionally ascertains the calling station number and keys it into the system. The 1+ traffic served by trunks 50 through 59 is of the station-to-station type and is served in precisely the same manner as the 0+ traffic served by trunks 50 through 54 except that, being of the station-to-station type, the operator is called in only in order to monitor the collection of charges by the calling party.

NONCOIN CALLS

The noncoin calls are served by the indicated noncoin trunks in the same manner as previously described in detail in the said R. B. Curtis specification.

DETAILED DESCRIPTION

Person-to-person coin call incoming on a combined DP-ANI trunk

GENERAL COMMENTS REGARDING THE FACILITIES UTILIZED ON THIS CALL

This section of the specification describes in detail a person-to-person call originated by a coin station subscriber incoming to the tandem office on an incoming coin combined DP-ANI trunk. An incoming trunk of this type is shown as trunk 40 on block diagram FIGS. 1B, 2D, and 3Q. The circuit details of such a trunk are shown

on FIGS. 348 through 366 of the drawings, and it is assumed that it is this specific trunk which serves the present call. It is believed that a few general comments concerning the circuits utilized on this call will be helpful before the detailed circuit operations themselves are considered. Therefore, the immediately following paragraphs discuss, in synopsis, the manner in which this incoming trunk circuit, as well as the rest of the office, functions during the serving of calls.

The trunk circuit of FIGS. 348 through 366 serves calls from coin telephones, both when the calls are originated either on a fully customer-dialed basis, as well as when they are originated only by the dialing of a zero by the calling party. The called station information on customer-dialed calls is transmitted to this circuit from the originating office by means of a dial pulse outputting operation. No called station information is received from the originating office on calls for which only a zero is dialed by the calling party. The customer-dialed calls may be either those of the station-to-station type or those of the type requiring the operator assistance, such as for example, person-to-person or collect, etc. The calls for which only an initial digit of 0 is dialed are referred to as dial 0 assistance calls, and are routed to an operator who performs any and all assistance that may be required in connection with their further completion.

In order to utilize the features of this circuit which permit the combining of the dial 0 traffic with the customer-dialed traffic, the local originating office must be equipped for ANI operation in order that the tandem sender may receive information indicating the call type. If the originating office is not equipped for ANI operation, the combined trunk potentialities of this circuit cannot be fully utilized. Instead, the trunks of this type must be split into two groups, one of which groups exclusively serves 0 and 0+ traffic, while the other group serves only 1+ traffic.

Seizure.—The originating office must be arranged so that all subscribers dial their nonlocal calls by prefixing a 0 or 1 to the 7- or 10-digit numbers they normally dial. The prefix 0 or 1 causes the local office to connect the call to an outgoing trunk which is connected to this incoming trunk. A seizure signal is then sent forward by the local office outgoing trunk, which signal is, in turn, recognized by this incoming tandem trunk. The tandem trunk makes an immediate bid for a connection to a 10-digit dial pulse register by means of a register link operating on a bylink principle. The pulses representing the first dialed digit may be transmitted to the register via the bylink facilities. However, the pulses representing the subsequent digits are transmitted to the register over the normal facilities of the register link. In the event that the customer dials only a 0 or a 1 and no other digits, the register will time from three to five seconds while awaiting the receipt of further pulses. After that, it will initiate the special action, as hereinafter described.

When the dialing operation has been completed, or when the register has "timed out" while waiting for further dial pulses, it signals the trunk to interconnect itself with a sender. The trunk then bids for and obtains a connection to a sender by means of the sender link. A sender-attached signal is returned to the register at this time. The register now seizes the data transfer circuit and connects itself to one of the data channels of that circuit. It also passes a signal to the trunk, and through the trunk to the sender, causing them both to connect themselves to the same data channel.

The register passes the called number by way of the data channel to the sender; or if no digits were dialed into the register, a no-digit signal is given to the sender and trunk at this time. This signal is then stored in the trunk for further use. When the transfer of information between the register, the sender, and the trunk has been completed and checked, the data channel and the register

both release. The sender, however, remains attached to the trunk for the time being, via the sender link.

ANI operation.—Simultaneously with the sender-attached signal, the sender transmits a signal, by way of the incoming trunk, to the originating office, requesting the identification of the calling number by means of an ANI operation. Along with the receipt of the ANI information identifying the calling number, the sender also receives information indicating whether the customer has dialed a 0 or 1 prefix digit. The sender now has information which places the call in one of the following categories: (a) a customer-dialed person-to-person call, as indicated by the dialing of a prefix 0 followed by seven or ten digits; (b) a customer-dialed station-to-station call, as indicated by the dialing of a prefix 1 followed by seven or ten digits; (c) a dial 0 assistance call, as indicated by the dialing of only a digit 0; (d) a permanent signal, as indicated by the dialing of the digit 1 followed by no further digits.

In the case of category (a), (b), or (c) above, the sender directs the trunk to establish a connection to an operator position as soon as the ANI signals have been received. In the event that a permanent signal situation is recognized, the sender does not request a connection to an operator, but instead takes action to establish a connection to a suitable tone trunk.

Non-ANI operation.—The combined features of the trunk cannot be used for non-ANI operation, and in that event, only traffic wherein calls are prefixed by either a 0 or a 1, but not both types, can be routed to the trunk. The sender then will signal for connection to an operator without requesting ANI operation from the originating office.

Connection to operator position.—When an operator position is attached to the connection, the action that follows depends upon whether the call is of the customer-dialed or dial 0 type. The position circuit now receives a signal indicating the call type. In either case, the position circuit seizes a data channel and causes the sender and trunk to be attached to the same channel. A coin rater will be attached to the data channel for customer-dialed calls, but not for dial 0 calls. In case of customer-dialed calls, the sender proceeds with the marker functions to establish a connection to an outgoing trunk in the customary manner. The sender is released at this time for dial 0 assistance calls.

Operator functions—customer-dialed calls.—The data channel of the data transfer circuit is used for the exchange of the information necessary for the timing and charging of customer-dialed calls. The trunk receives from the rater and stores information in the form of a rate-treatment-number, an initial-period-duration indication, and a station-to-station or person-to-person class mark, depending upon the call type. The data channel releases its connection to the trunk, the sender, and the rater on the completion of this transfer of information, and calls in a charge computer which computes and then transmits to registers in the position circuit the additional deposit information required for the charges for the initial period portion of the call. Meantime, the sender, on calls of this type, is in the process of setting up a forward connection as the operator is called in. Due to the action of the coin rater and the computer, the operator can obtain a visual display of the time and charges, enabling a request to be made for the initial deposit from the calling subscriber. The operator may remain on the connection as long as is required to monitor the deposit of coins and/or to verify the called party for person-to-person calls.

The operator initiates the perforation of the initial AMA entry when the necessary functions are completed, and then disconnects from the call. In this case, the disconnect of the operator and the position circuit is complete. When the initial entry has been perforated and the operator has disconnected, the trunk registers this

information, and the position control and position link circuits release.

Operator functions—Dial 0 assistance calls.—The data channel of the data transfer circuit is used on dial 0 assistance calls to transfer information from the trunk and sender to the position circuit. The coin rater is not used. The position circuit receives the calling number only if the originating office is equipped for ANI operation. The no-digits mark is retained in the trunk. After the transfer of data has been checked by the data channel, the sender releases and the operator is brought in on the connection. The operator talks to the subscriber to determine the nature of the call he wishes to make.

When the position operator is able to complete the call from the position, as is usually the case, the operator first registers the called number in the position control circuit by using a key set and then causes a sender to be associated with the trunk. A data channel is seized when the sender is attached via the data transfer circuit, and it is used to convey the required information to the sender from the position. The data transfer circuit releases after a satisfactory data transfer has been made, the sender proceeds with the marker functions, and the call is established forward in the customary manner. The operator causes the initial AMA entry to be perforated.

When the call has been properly established and the position operator has completed the required functions, the operator may either retain direct control over the call by placing it on a locked-link connection on one of the loops, or the operator may completely release the operator equipment and the position from the trunk. The locked-link connection frees the operator to serve other calls, but retains a direct connection between the trunk and the position. It is used mainly for prepaid station and person-to-person calls where the operator must time and collect the charges due. A complete release of the operator and position circuit from the trunk can be used where the dial 0 call becomes a collect or special call, because in these cases the AMA record is used for charging the proper subscriber. AMA records may be used, if desired, for all types of assistance calls.

Called party answers—AMA answer entry.—When the called party answers, the trunk inserts a delay of at least two seconds before starting to charge or time the call. If an initial AMA entry has already been made, an answer entry is perforated after a two- to five-second charge delay. If a special toll call is in progress, the trunk will start timing the call at this point by signaling for an attachment to the timer link circuit.

Trunk timing.—Trunk timing is never used on dial 0 calls. For customer-dialed calls, the timer circuitry of the trunk is activated after the called party answers and the operator position has released from the trunk. Eighteen seconds before the end of the initial period, and at the direction of the timer circuit, the trunk sends a coin-collect signal to the originating office. At the end of the initial period, the trunk calls for an idle operator position circuit and disengages its timer circuit. The position circuit, when attached, seizes a data channel and a connection is established between the trunk, the position, and a computer. The trunk transmits the charge rate stored therein to the computer. The computer, in response to the receipt of this information, computes the charges for and duration of a single overtime period and transmits this information to the position circuit. The trunk also receives from the computer, and then registers, the overtime period duration.

When the transfer of information is completed, the data channel and the charge computer circuits release, and the operator is called in to notify the customer that he is starting to talk on an overtime period and, if requested, also advises the customer concerning the charges for an additional overtime period. The operator position disconnects after the necessary functions are completed,

thereby releasing the position and position link circuits. The trunk reactivates its timer, which now times the overtime period portion of the call.

Dial 0 calls—Timing and recall.—Dial 0 calls that become prepaid calls are timed by the position operator on a locked-link basis. Collect and special dial 0 calls need not be timed since the AMA record can be used for customer billing. When calls are on a locked-link basis, either party may recall the operator by flashing his switchhook. Dial 0 calls that are not held on a locked-link basis allow the calling subscriber to recall an operator by flashing the switchhook.

Disconnect and disconnect AMA entry—dial 0 calls.—Dial 0 calls held on a locked-link basis permit the position operator to return to the connection when either party disconnects. The operator releases the connection forward and then releases the position from the trunk. A trunk release operation then follows. Dial 0 calls not held on a locked-link basis will release if the calling party disconnects. If only the called party disconnects, a timed release will occur. If the call was set for AMA recording, a proper disconnect entry will then be made when the connection forward is released.

Disconnect and disconnect AMA entry—Customer-dialed calls.—When a calling station on a customer-dialed call goes "on-hook," the trunk causes a disconnect entry to be made. The trunk releases on completion of the disconnect entry if the initial period portion of the call was still in progress. If the trunk is in the overtime portion of the call, the operator is recalled to collect the overtime charges before the trunk releases. In case the calling party remains "off-hook" when the called party disconnects, a timed-release will occur. A timed disconnect entry is then made and the operator is recalled to the connection, in the same manner as before.

Other functions.—In addition to the foregoing discussed capabilities of the trunk, it contains facilities for the following functions:

(1) The operator may set the rate-treatment-number into a trunk manually on calls that cannot be automatically rated by the coin rater circuit. The operator can also change the rate-treatment-number or the station-to-station and person-to-person class marks priorly set into the trunk, if required.

(2) The trunk is arranged to receive and store a signal which deactivates its timer circuit. This mark is provided by the rater on calls to "free" and vacant codes, or by the position control circuit on collect or special calls which require an AMA record but not trunk timing.

(3) When necessary, an operator may lock the trunk to the position and manually "ticket" any call. Either subscriber may recall the operator in that event. The locked-link connection is always used to complete prepaid dial 0 calls, in which case the operator may also cause an AMA record to be made. The trunk never times the call for a locked-link connection.

(4) The operator may release the forward connection whenever the operator equipment is connected to the trunk.

(5) After releasing forward, the operator can attempt a new outgoing call by signaling the trunk to connect to a sender. When the sender is attached, a data channel connection is established and a transfer of data then takes place from the position circuit to the sender. The call then proceeds with the establishment of a new connection in the customary manner.

(6) On prepaid customer-dialed calls, an interval of 42 seconds is allowed after the initial period timing starts, during which the calling party may recall to the connection. After the end of this interval, no recall is possible. As pointed out previously, recall is allowed at any time during a dial 0 call.

(7) Facilities are provided which allow the operator to ring back the calling subscriber on all calls. In addition, the operator has facilities to ring forward when complet-

ing dial 0 calls in order to start the ringing on certain trunks that may be used in completing such calls.

(8) Facilities are provided to permit the operator to collect or return coins manually and to cancel AMA entries on all types of calls.

(9) Facilities are also provided for completing calls whose initial period is not subject to limitation in time and for which the only charge is the initial charge. These calls are referred to as "untimed" calls since the charge therefor is constant, regardless of the duration of the call.

Detailed description of circuit operation for a person-to-persons coin call incoming on a dial pulse trunk

Many of the circuits comprising the system of the present invention are identical to those shown and described in the aforementioned R. B. Curtis application. The operation of these circuits during the serving of the calls described herein is identical or similar to the described operation of the same circuits in Curtis. Therefore, in order to reduce the size and complexity of the present disclosure, circuit operations described in detail in Curtis are not repeated herein whenever the entirety, or a substantial portion, of such a description would duplicate the Curtis material.

With reference to the foregoing, each circuit comprising the present system is described in one of three possible ways depending upon the extent to which the same circuit is described in Curtis. First, a circuit is described in its entirety if it is not described by Curtis or if its operation in Curtis is sufficiently different from its operation in the present system. Second, a circuit is described solely by a reference to Curtis if its operation is identical in both systems. Third, if a circuit which is described by Curtis operates somewhat differently in the present system, it is initially described herein by a reference to Curtis, and is then additionally described by a discussion pertaining to the details not covered in Curtis.

For example, the operation of the coin trunks is described in detail herein since these circuits are neither shown nor described by Curtis. The operation of the sender link, on the other hand, is covered solely by a reference to Curtis since the sender link operates in an identical manner in both systems. The operation of the position link and the position link controller is also covered solely by a reference to Curtis for the same reason. The sender is initially described with a reference to Curtis. However, the present specification contains a detailed discussion of sender circuitry which either is not discussed in Curtis or which operates in a different manner from its described operation in Curtis.

The following description, insofar as details are concerned, pertains mainly to the operation of the various coin trunk circuits, the position and position control circuits, the data transfer circuit, as well as certain other circuits. However, since the position circuit, the position control circuit, as well as most of the data transfer circuit, are shown and described in Curtis, the present discussion pertaining thereto is, to a large extent, supplementary to the Curtis description of the same circuits. Also, the Curtis specification contains a considerable discussion of over-all system philosophy as well as other information which is applicable to both systems. These discussions are not repeated herein, since to do so would unduly increase the size and complexity of the present specification. Therefore, in view of the foregoing, it is to be emphasized that a thorough understanding of the Curtis system will greatly facilitate an understanding of the present invention, and for that reason the Curtis application has been formally incorporated by reference as a part of the present specification to the same extent as if fully disclosed herein.

INCOMING TRUNK SEIZURE

Referring to FIG. 348, the call is initiated as the calling subscriber 102 lifts his telephone handset and first dials

the prefix digit "0" to indicate a special service call, and then dials the called station digits including the area code, if any. The originating office responds to the dialing operation and establishes a connection therethrough from the calling line to the tip-and-ring conductors connected to terminals 348-104 and 348-105 of the incoming tandem trunk circuit. At the same time, the associated outgoing trunk in the originating office 348-103 closes a circuit to place a low-resistance shunt across the tip-and-ring conductors and terminals 348-104 and 348-105. The closure of this shunt circuit closes the following circuit to operate relay 348-A: ground on terminal 348-106, the P winding of relay A, transfer break contacts 354-RV and 352-M0, winding P1 of transformer 349-T, transfer break contacts 356-RB, terminal 348-104, conductor T extending to the originating office 348-103, the low-resistance shunt in the outgoing trunk circuit of that office, conductor R extending back to the incoming tandem trunk, terminal 348-105, transfer break contacts 356-RB, winding P2 of transformer 349-T, transfer break contacts 352-M0 and 354-RV, and the S winding of relay 348-A to the negative battery potential on the other side of this winding. The current flowing over this circuit now operates relay A. Referring now to FIG. 359, the operation of relay 348-A closes the following circuit to operate relay 359-B: battery on terminal 359-101, the LV resistor, make contacts 348-A, to the upper winding of relay B, the terminal of which winding is grounded at terminal 359-102. The operation of relay B, in turn, closes an obvious circuit to operate relay 362-BA.

ATTACHMENT OF REGISTER CIRCUIT VIA THE REGISTER LINK

Referring now to FIG. 359, the operation of relay 348-A now closes the following circuit to apply a negative battery to conductor ST- extending to FIG. 308 of the register link circuit: battery on terminal 359-101, the LV resistor, make contacts 348-A, terminal 359-105, diode ST, transfer break contacts 359-RA, terminal 359-106, break contacts 354-RVR and 358-TC, to conductor ST-. This conductor, as well as the remaining bracketed conductors on FIG. 359, extend to the register link circuit. Conductors ST-, LK, and RA on FIG. 359 extend to FIG. 308 of the register link circuit. The trunk circuit of which FIG. 359 is a part may be considered to be trunk 40 of the group of trunk circuits 40 through 59 shown diagrammatically on FIG. 307 or FIG. 308. The other conductors on FIG. 359 extend as indicated to other figures of the register link.

The battery applied to conductor ST- of FIG. 359 extending to the register link circuit causes the circuitry of the register link to operate and interconnect the calling trunk with an available register, in the same manner as priorly described in detail in the aforementioned R. B. Curtis application. The register link circuit is shown on FIGS. 307 through 321; while the register circuit is shown on FIGS. 322 through 337. Once the register is attached, it applies battery to conductor LK and applies ground to conductor RA extending to FIG. 359. The circuitry by means of which the register applies battery to conductor LK is shown on FIG. 312; while the circuitry of the register which applies ground to conductor RA is shown on FIG. 330. The battery applied to conductor LK on FIG. 359 is extended through transfer break contacts 359-RA, the winding of relay RA, and through break contacts 359-OF to the ground now applied to conductor RA, thereby operating relay 359-RA. The relay, in operating, closes a locking path for itself via its own make contacts and break contacts of relay 355-PA1 to ground on terminal 104 of FIG. 359, and via its transfer make contacts, resistor RA, make contacts of relay 359-B, and resistor LV to battery on terminal 106 of FIG. 362.

It is described in detail in the R. B. Curtis specification how, on FIG. 309, a set of make contacts of the TP- relay associated with each incoming trunk circuit is con-

nected to one or the other of relays C1A or C2A to operate one of these relays each time the TP-- relay representing a particular incoming trunk is operated as the trunk attempts to obtain a connection via the register link to the register. The A equipment rectangle on FIG. 308 also has similar circuitry to that on FIG. 309, and therefore also has a relay corresponding to C1A and C2A on FIG. 309. It is further described in the R. B. Curtis application how the circuitry within the M equipment rectangles on FIG. 315 is operative on each call to ground either conductor ONB or ONA extending to FIG. 326 of the register. The determination of which conductor is grounded depends upon whether the TP-- relay of the bidding trunk has its contacts on FIG. 309 connected to relay C1A to operate it or to relay C2A to operate it. The same is true of the bidding trunks on the other figures as well as the relays therein corresponding to relays C1A and C2A. The TP-- relay of a trunk is connected to its associated C1- relay, such as for example, C1A on FIG. 309, if it is desired to have the register-link ground conductor ONB, while the TP-- contact is connected to relay C2- if conductor ONA is to be grounded. As explained in detail in the Curtis specification, a ground on conductor ONA causes the register to "time out" within a relatively short period, such as, for example, four seconds, if no digits are registered therein within four seconds after its seizure by the incoming trunk. On the other hand, a ground on conductor ONB causes the register to wait a longer interval, such as, for example, from 20 to 30 seconds after seizure, before it will "time out" if no digits are forthcoming from the originating office. The trunk circuit assumed to be serving the presently described call may serve "0," "0+," and "1+" traffic, with some of the "0" traffic representing calls for a possible emergency nature, such as, for example, calls requesting assistance of the police or fire department, or requesting medical aid. It is desired to have a short register "time out" period for such calls, and it is therefore necessary that all trunks of the type shown on FIGS. 348 through 366 be connected to relays corresponding to C2A on FIG. 309, so that the ONA conductor of the register will be grounded, thereby setting it for the short "time out" period.

RECEIPT OF DIALED PULSES

Now that the trunk is interconnected with a register, the office is in a condition to receive the dial pulses from the preceding office and to apply these pulses, via the incoming trunk, to the register for registration therein. The receipt of the dial pulses opens and closes the shunt across terminals 104 and 105 of FIG. 348 in accordance with the number of pulses in each received pulse group. This, in turn, opens and closes the holding circuit for relay 348-A, thereby causing it to follow the incoming DP signals in the conventional manner. Relay 359-B is of the slow-release type and does not release during the reception of the dial pulses. The operation and release of relay 348-A as it responds to the incoming dial pulses results in battery pulses being applied to conductor R on FIG. 359 over the following circuit: battery on terminal 359-101, resistor LV, make contacts 348-A, terminal 105, transfer break contacts 353-T, and resistor DP, to conductor R. It may be seen from this that a battery potential is applied to conductor R whenever relay 348-A is operated, and that no battery potential is applied to the conductor when relay A is released.

The battery pulses on conductor R are transmitted, via the register link, to FIG. 330 of the register where they operate the called-number register relay of that circuit under control of the battery pulses on conductor R. Relay 330-L of the register follows the pulses on conductor R, as explained in Curtis; and assuming the called area to be 212 and the called number to be 243-1000, the following pairs of register relays on FIGS. 324, 328, and 332 are now operated to store these digits in 2-out-of-5 combination code form: A0 and A2, B0 and B1, C0 and

C2, D0 and D2, E0 and E4, F1 and F2, G0 and G1, H4 and H7, and J4 and J7. The K digit of 0 is stored directly by the P1 through P5 counting relays of FIGS. 330 and 331.

SEIZURE OF SENDER LINK AND CONNECTION OF SENDER

Referring now to FIG. 333, the register places a ground on its conductor SR after it has received a full complement of digits. The ground on this conductor is extended, via FIG. 320 of the register link, to FIG. 359 of the trunk. This ground is now forwarded by the trunk to the sender link over the following circuit: ground applied to conductor SR on FIG. 359 and extending via FIG. 356 to FIG. 353, break contacts 353-T, 351-D3, to conductor ST extending to the sender link and controller circuit. The sender link operates in response to this ground and, as discussed in the R. B. Curtis application, the sender link now proceeds to interconnect the calling trunk circuit with an idle sender.

It is assumed that the presently described call is of the 0+ type, for which the calling party dials the prefix digit "0" followed by the full complement of called station digits including area code, if any. The register, as described, does not instruct the trunk to bid for a sender link until the digit registration operation is completed therein. If, however, the present call were of the dial 0 type, the register would have received no digits after having been seized by the incoming trunk and, as a consequence, after a short interval, such as, for example, five seconds, would have timed out and grounded conductor SR extending from FIG. 333, via FIG. 320 of the register link, to FIG. 359 of the trunk, thereby causing it to immediately bid, via the sender link, for connection to a sender.

Referring now to FIG. 353, the trunk now closes the following circuit to apply ground to conductor FT extending via the sender link to the sender: ground on terminal 353-103, transfer break contacts 355-SR and 353-T, to conductor FT on FIG. 48. This ground operates relay 24-SPL in the sender as an indication that this is a customer, rather than an operator, usage of the sender. The sender at this time grounds conductor C0 extending from FIG. 48 of the sender circuit to FIG. 353 of the trunk circuit, thereby operating relay 353-T as a sender-attached signal. The operation of relay T, in turn, closes an obvious circuit to operate relay 351-T1.

The class information passed to the sender from the sender link on this coin call is similar to the class information that was passed on the MF call described in the R. B. Curtis specification, except that the 54-DPC relay now operates from the sender link, instead of from the 60-MF relay as in the Curtis application. The operate path for the DPC relay is from the sender link through the 42-SC3 make contacts to the winding of the DPC relay.

The operation of relay 353-T extends the battery from terminal 106, through resistor LV on FIG. 362, via its own transfer make contacts and resistor DP to conductor R extending from FIG. 359 of the trunk circuit to the register link circuit. The operation of relay 353-T also opens an obvious circuit to remove battery from conductor ST on FIG. 353 extending to the sender link circuit. The operation of relay 353-T also operates its transfer contacts on FIG. 349 so that the tip-and-ring conductors of the trunk on this figure, through break contacts of relay 356-PA, are connected to the tip-and-ring conductors extending through FIG. 353, via the sender link circuit, to the sender. The operation of relay 353-T also closes an obvious circuit on FIG. 356 to interconnect conductor SP1 on FIG. 353, extending to the sender link, with conductor KPR on FIG. 356 extending to the position link circuit and conductor PC on FIG. 362 extending to the register link circuit. The use of this particular circuit is described in detail hereinafter. The operation of relay 351-T1 closes an obvious circuit on FIG. 350 to ground

conductor S extending to the trunk link and connector circuit. The operation of relay 351-T1 also closes an obvious circuit on FIG. 354 to operate relay 354-RVR. The operation of relay 354-RVR maintains the open start lead (ST-) to the register link circuit. This is to ensure that no false starts to the register occur from the release of the RA relay.

When the sender is prepared to proceed with the call, it sends a ground signal to the trunk via the FR conductor on FIG. 48 which enters the trunk circuit on FIG. 353. The trunk extends the ground on this conductor to conductor SA extending to the register link via the following circuitry: ground on conductor FR on FIG. 353, transfer make contacts 353-T, transfer break contacts 351-FA, transfer make contacts 359-RA on FIG. 362, transfer make contacts 353-T, to conductor SA extending via FIG. 320 of the register link circuit to FIG. 333 of the register.

SEIZURE OF DATA TRANSFER CIRCUIT BY REGISTER

Referring now to FIG. 333, the ground extended via conductor SA operates relay 333-SA in the register, which, in the manner described in the R. B. Curtis specification, causes the register to bid for and obtain the services of an idle channel of the data transfer circuit. In this connection, let it be assumed that the register involved on the present call is register 00. The circuitry of this register associated with the data transfer seizure operation is shown within the F equipment rectangle designated "Register 00" on FIG. 230. The operation of relay 333-SA closes its make contacts shown on FIG. 230 to apply a negative battery potential to both conductors STDT and SDT1. The data transfer circuit now operates to interconnect, via one of its data channels, the calling trunk shown on FIGS. 348 through 366, register 00 currently connected to this trunk via the register link, and the sender currently connected to this trunk via the sender link. The circuit operations describing the manner in which the data transfer circuit performs this function need not be set forth in detail herein since they are identical to the operations described in Curtis and, in particular, in the portion thereof pertaining to a dial pulse call in which the data transfer circuit is operative to interconnect, via one of its data channels, a calling trunk, a sender, and a dial pulse register. As a part of this interconnection operation, FIG. 242 of the data transfer circuit applies a positive 130-volt potential to conductor PC, via FIG. 333 of the register circuit and FIG. 320 of the register link circuit, extending to the trunk circuit on FIG. 362. This causes the operation of relay 362-TP40 over an obvious circuit and, in addition, this potential is extended via transfer make contacts 353-T on FIG. 356 to conductor SPI on FIG. 353 extending, via the sender link, to FIG. 48 of the sender circuit. The operation of relay 362-TP40, together with the positive 130-volt potential on conductor SPI extending to the sender circuit, controls the circuit actions which enable the sender and this trunk circuit both to be connected to the same data transfer circuit channel that has just been seized by the register circuit. This is necessary in order that the register, the trunk, and the sender may all be connected to the same data channel for the interchange of call data therebetween. The data interchanged at this time comprises the transmission of data from the trunk and from the register to the sender, with the information transmitted by the register including the called number digits, if any, or the PS mark, if no digits were dialed, as would be the case for a dial 0 call.

TRANSFER OF DATA

The register now transmits the called number information, including the area code, via the data channel to the sender. The transmitting leads are designated A- through K- and are shown on the bottom of FIGS. 325 and 329 of the register. These various leads extend to FIGS. 249

and 251 of the data transfer circuit. Assuming that channel 0 of the data transfer circuit is the channel which has been seized by the register on the present call, the A- through K- conductors on FIGS. 249 and 251 may now be extended via data channel 0 and FIGS. 250A and 252 to the A- through K- conductors extending to FIG. 69 of the sender circuit 00, assuming that sender 00 is the sender which is currently connected to the calling trunk via the sender link. Each A- through K- conductor of the sender is connected to the similarly designated conductor of the data transfer circuit and is also connected to a similarly designated sender register relay on one of FIGS. 69 and 70. The previously-enumerated operated pairs of register relays A- through K- apply ground to the correspondingly designated conductors of the data channel, and these grounds are extended by the data channel to the correspondingly designated conductors of the sender to operate their associated pairs of relays on FIGS. 69 and 70. This being the case, the following pairs of sender register relays on FIGS. 69 and 70 now operate: A0 and A2, B0 and B1, C0 and C2, D0 and D2, E0 and E4, F1 and F2, G0 and G1, H4 and H7, J4 and J7, and K4 and K7. Each of these relays in operating locks to ground over its own make contacts, in the manner described in detail in the R. B. Curtis 2 application.

The preceding describes the register relays that are operated in the sender by the register, provided it has received a 7- or 10-digit called number. If the register recognizes, after a 3- to 5-second timing interval, that no digits are to be received, it assumes that no called number will be registered in it and instructs the trunk to get a sender as previously described; and during the data transfer connection between the sender and the register, the register will pass a ground over lead PS on FIG. 333, via FIGS. 257 and 258A of the data transfer circuit, to FIG. 64 of the sender, to operate relay 64-PS in the sender, indicating that no called number digits were registered. At the same time, the register grounds lead ND extending from FIG. 334, via FIGS. 417, 418 and 418A of the data transfer circuit, to FIG. 366 of the trunk circuit, which ground causes the operation of relay 362-ND in the trunk, to prime the trunk for dial 0 operation if necessary. The sender at this point is prepared to distinguish between a dial 0 or a 1- call by looking at the start pulse of the ANI digits.

Referring now to FIG. 363, a number of conductors extending from the trunk to the data transfer circuit are now grounded at this time as a consequence of the operation of relay 362-TP40. However, none of these grounded conductors are used at this time.

CHECKING OF DATA

The data transfer circuit now checks for a valid reception by the sender of all the data transmitted to it from the trunk and the register as described in Curtis. Following this, the data transfer circuit and the register circuit both release. The release of the data transfer circuit releases relay 362-TP40. When the data transfer circuit checked the information from the register to the sender, it grounded lead DTOK extending from FIG. 267 to FIG. 69 of the sender which operated relay 64-RCKA. The operation of relay RCKA causes the operation of relay 64-RCK when the data transfer circuit has released. The operation of relay RCK with relay 54-DPC operated causes the operation of relay 60-DP through the following path on FIG. 60: from ground through make contacts 64-RCK, make contact 54-DPC, break contacts 64-PD1, transfer break contacts 64-PS, to the winding of relay 60-DP.

ANI OPERATION

At about the same time that the register is apprised that the sender is attached, by the application of a ground on trunk conductor SA, the sender reverses the polarity of the battery and ground on the T and R leads extending to the trunk, via the sender link, on FIG. 353, thereby

reversing the loop current through the winding polarized relay 349-CS to operate it. This relay is connected to the T and R conductors on FIG. 353 extending, via the sender link, to the sender by means of the break contacts 359-OF, operated transfer make contacts of relay 353-T, the transfer break contacts of relay 356-PA, the secondary windings of transformer 349-T, make contacts 362-BA, resistor CS, transfer make contacts 351-T1, the winding of relay CS, and transfer break contacts 354-RV. The operation of relay 349-CS closes an obvious circuit to operate relay 361-CS1. The operation of relay 361-CS1, in turn, closes the following circuit to operate relay 354-RV: ground on terminal 103 of FIG. 358, make contacts, 361-CS1, 351-T1, conductor RV extending from FIG. 358 to FIG. 354, transfer break contacts 358-D1, to the winding of relay RV to operate it.

Referring to FIG. 348 of the trunk circuit, it may be seen that the transfer contacts of relay 354-RV, intermediate to the windings of relay 348-A and the primary windings of transformer 349-T, control the polarity that is applied to the T and R conductors extending back to the originating office through the windings of relay A. The normal or seizure condition of the circuit is such that ground is applied to conductor T through the P winding of relay A, while battery is applied to conductor R via the S winding of relay A. The operation of relay 354-RV in response to the polarity reversal from the sender, and the resultant operation of relay 349-CS, causes a polarity reversal to be sent back to the originating office as the transfer contacts of relay 354-RV reverse the polarity applied to the T and R conductors through the windings of relay A. This reversal of polarity back to the originating office comprises an "off-hook" signal which instructs the originating office to outpulse the calling station digits via its ANI facilities.

The operation of relay 354-RV closes an obvious path to operate relay 354-ON. The operation of relay ON also closes the following circuit to operate relay 363-IP: ground on terminal 101 of FIG. 363, make contacts 354-ON, break contacts 362-ND, and transfer break contacts 363-OP, to the winding of relay IP to operate it. The operation of relay 363-IP functionally indicates that this is the initial period portion of the call. It also may be seen from the foregoing described operating path of relay IP that if relay 362-ND had been operated, thereby indicating that no digits were received by the register, relay IP would not have operated and, as a consequence, would have prevented a timing operation by the trunk as hereinafter described.

Reception of MF-ANI digits.—The local office now responds to the polarity reversal on the tip-and-ring as a consequence of the operation of relay 354-RV and, in the manner described in detail in said R. B. Curtis application, now transmits in MF code form the digits of the identified calling station. Assuming the calling station to be in area 201 and to have the telephone number 582-9106, the sender register relays would now be operated in pairs in response to the reception of the MF-ANI digits to store the calling number, and are operated in a similar manner to that disclosed in the R. B. Curtis application. The sender relays that are now operated are on FIGS. 43 and 44 and are as follows: DI4 and DI7, DA4 and DA1, DB7 and DB1, DC0 and DC2, DTH7 and DTH2, DH0 and DH1, DT4 and DT7, and DU4 and DU2. The D1- relays register ANI identification information. The calling office at this time also, by means of circuitry internal to it, determines whether the calling subscriber dialed a "0" or a "1" as a prefix digit and then transmits an additional signal to the sender advising it what type of prefix digit was dialed. This prefix digit identification is accomplished by the originating office transmitting a normal start signal at the end of the ANI pulses to indicate the

prefix digit "1," and by transmitting a different type of start signal to the tandem office for a prefix digit of "0." Hereinafter, throughout the entirety of this specification, the normal start pulse representing a prefix digit "1" is identified merely as a start pulse, while the special start pulse representing the prefix digit "0" is identified as a start prime pulse. The sender responds to the operation of either the start or the start prime pulse in the following described manner.

Prefix—Functions.—The start and start prime indications serve two major functions. The first major function is to distinguish between calls that are prefixed by "0" or "1" and are followed by seven or ten digits. These are known as "0+" or "1+" calls. The reception of the regular start pulse causes the operation of the 44-STPL relay which, in turn, operates the 71-STA relay. This subsequently gives an indication to the data transfer circuit, and through the data transfer circuit to the rater and to the position, that this is a station-to-station call. This indication is passed over the STA lead extending from FIG. 69 of the sender to FIG. 405 of the data transfer circuit. The receipt of the start prime pulse causes the operation of the 44-STPL' relay. This relay, in turn, operates the 71-PP relay which gives an indication, over the PP lead extending from FIG. 69 of the sender to FIG. 405 of the data transfer circuit and to the rater and to the operator position, that this is a person-to-person type call. The operation of either the 44-STPL or 44-STPL' relay performs the normal function of a start pulse received at the end of seven ANI digits.

The other major function of the start and start prime pulse is to distinguish between a 0- call and a 1- call. The 0- call is a call for which the customer just dials "0" and is requesting the service of an operator. The 1- call is actually a permanent signal or a customer dialing error, and is to be reordered and not served. The receipt of the signal from the register that the sender will not receive a called number in conjunction with the 44-STPL relay operation, which indicates a "1" prefixed because of the start pulse, causes the sender to reorder the call.

If the sender gets the indication from the register that there is no called number and it receives the start prime pulse which operates the 44-STPL' relay, the sender operates the 60-AS0 relay which indicates that this is a dial 0 call and will handle this call in exactly the same manner as is described in the R. B. Curtis application. The operate path for the STPL' relay starts with ground on FIG. 43 from the box designated MF receiver contacts, through the operated contacts 37-KP1 and "1" thereof, make contacts 38-RA, make contacts 72-RGC1, series-connected transfer break contacts on the DNI, DNA, DNB, DNC, DNTH, DNH, DNT, and DNU, relays of FIGS. 43 and 44, transfer make contacts 54-DPC, make contacts 71-10, to the winding of the 44-STPL' relay. The operate path for the 71-STA relay in this case is from ground, through make contacts 44-STPL and 54-DPC. The parallel path with make contacts 60-AMA and 60-DP is used only in the case where coin traffic from the dial pulse office is being handled from a non-ANI office, as explained.

The operate path for the 71-PP relay is from ground through make contacts 44-STPL' and 54-DPC to the winding of the PP relay. The make contacts 60-AMA, which are in parallel with make contacts 44-STPL', are used as an indication from a step-by-step office that is not equipped with ANI, and is explained later. The function of the make contacts 51-OR, in parallel with make contacts 44-STPL', is to allow the PP relay to operate, when operating with the combined coin trunk, in the case that no start pulse is received from the local step-by-step office. The reason that this is necessary is that there is no guarantee that there will always be a start pulse received on an ANI call under the various conditions. If a start pulse is not received, it must be as-

sumed that the customer requesting service has prefixed a "0," and the call will then be handled either as a "0+" call or as an operator-assistance call. This is due to the fact that this call could have been an emergency dial 0 call.

SEIZURE OF POSITION CIRCUIT VIA THE POSITION LINK

If the sender is advised that a prefix "1" was dialed and has, in addition, received a PS mark from the register indicating that no called station digits were dialed, it assumes that it has been presented with a permanent signal condition. The sender then immediately proceeds with the marker functions without calling in a position operator, and the call is routed to a special tone trunk at tandem. However, if the sender is notified that a prefix "0" was dialed and the PS mark is also received, or if a prefix "0" or "1" is recorded with either seven or ten digits from the register, the sender then immediately proceeds to call in the position operator by placing a ground on the FT lead extending from FIG. 48 of the sender, via the sender link and controller circuit, to FIG. 353 of the trunk to operate relay 351-PR over the circuit including transfer break contacts 351-FA and break contacts 355-PA1. The sender at the same time returns audible ringing tone to the calling subscriber.

Referring now to FIG. 356, the operation of relay 351-PR closes the following circuit to apply ground to conductor ST extending to the position link and connector circuitry: ground on terminal 356-101, make contacts 351-PR, transfer break contacts 356-PA, break contacts 351-D, to conductor ST. The ground on this conductor is extended to FIG. 85A of the position link circuit which, in the manner described in detail in said R. B. Curtis application, now proceeds, with the assistance of the link controller, to select an idle operator position circuit and interconnect it via its linkages to the conductors of the calling trunk circuit extending from FIG. 356 to the position link and connector circuit.

When a connection via the position link circuitry is established to the position control circuit of an idle operator position, the position control circuit forwards ground on the PA lead to the trunk on FIG. 356, thereby operating relay 356-PA over an obvious circuit. The operation of relay 356-PA closes an obvious circuit to operate relay 355-PA1. The operation of relay 355-PA1 opens the operating path of relay 351-PR to release it. The operation of relay PA1 also opens a locking circuit for relay 359-RA, thereby releasing it.

The position control circuit of an idle operator position is now connected to the trunk. However, an operator is not immediately brought in on the connection as described in said R. B. Curtis specification. It has been described how the operation of relay 356-PA effects the release of relay 351-PR. However, relay PR takes a finite period of time to release following the operation of relay PA, and during this time the following circuit is closed to apply a momentary ground to conductor FR extending, via the sender link and controller circuit, to FIG. 48 of the sender from FIG. 353 of the trunk: ground on terminal 101 of FIG. 356, make contacts 351-PR, transfer make contacts 356-PA, transfer break contacts 351-FA on FIG. 353, and transfer make contacts 353-T to conductor FR. This pulse advises the sender that the position circuit is now attached to the trunk. This ground pulse is nothing more than the equivalent of the position-attached signal that is always passed to the sender when an operator is associated with the trunk. In other trunks this indication is left on for a longer period of time and is taken off by the operation of the F relay. This trunk gives a pulse instead of such longer ground period.

The operation of relay PA closes a circuit on FIG. 353 including make contacts 356-PA, break contacts 355-

RLF, make contacts 359-B, and resistor SH, to shunt the T and R conductors to the sender at this time, thereby holding the sender during the time the position is attached to the trunk. The operation of relay 356-PA also operates both sets of transfer contacts of this relay on FIG. 349, thereby disconnecting the T and R leads extending to the sender from the winding of relay 349-CS and its associated circuitry, and transfers this circuitry, including the winding of relay CS and the secondary windings of transformer T, to the T and R leads extending via the position link and connector circuitry to the operator position circuit. Relay 349-CS releases at this time, followed by the release of relay 361-CS1. The foregoing operation, and specifically the operation of relay 356-PA, opens its break contacts on FIG. 356 to remove ground from conductor ST extending to the position control circuit via the position link connector circuit, thereby removing the start signal from the position link. The position link is held at this time by the position control circuit, and the detailed circuit operations associated with the position and position control circuit up to this point in the call are identical to those described in detail in the said Curtis application. The detailed circuit operation associated with the position and position control circuits, up to this point in the call, are identical to those described in detail in the Curtis specification.

INITIAL PERIOD SEIZURE OF THE DATA TRANSFER CIRCUIT

This portion of the description initially describes how, in response to a bid from the position circuit, the data transfer circuit first interconnects the calling trunk, the sender, and the position via one of its data channels. It is then described how the data channel itself bids for and adds a rater to this connection so that the rater, the trunk, the sender, and the position are all connected to the same data channel for the purposes of exchanging call data therebetween. It is further described how, after having checked the transmitted data, the data transfer circuit releases the trunk, the sender, and the rater from the connection and then adds a computer so that the position and the computer may interchange data. Following this, it is described how the data transfer circuit checks for the proper registration of data within the receiving circuits and then releases the computer and itself from the call.

A substantial portion of the data transfer circuit operation, including its cooperation with the sender, the position, and the trunk is similar to that portion of the R. B. Curtis specification wherein it is described in detail how, in response to a bid from a position circuit, the data transfer circuit is activated to interconnect, via one of its data channels, the bidding position, the calling trunk, and the sender. Therefore, in order to minimize the size and complexity of the following description, only the circuit operations which are not set forth in Curtis are described in detail. Operations which are similar, or identical, to operations described in detail in Curtis are merely stated as occurring, without any attempt being made to trace the circuit paths therefor. Reference is made to the Curtis disclosure for such details. However, the following description lists all relay operations in the proper sequence so that a complete understanding may be had of the order in which each relay operates. The circuit path over which a relay operates is described in detail in the present specification, provided a corresponding description is not contained in Curtis. Also, in order to minimize the size and complexity of the specification, a functional description, including the design philosophy of the relationship between various elements of the present circuit, is set forth in detail only if the same is not set forth in Curtis.

Bid for idle data transfer channel.—Relay 181—DTST is operated in the position control circuit for position 00 in response to a signal from the sender. The operation of this relay instructs the position control circuit to bid for the services of an idle channel of the data transfer cir-

cuit. The operation of this relay closes a circuit shown within the C rectangle on FIG. 224 to apply a negative battery potential to conductor STDT, thereby operating relay 224-PP00. The operation of this relay initiates the circuit actions by means of which the position first bids for and obtains the services of its position connector and then, following this, the circuit actions by means of which the position connector (in this case, position connector 0) bids for and obtains the services of an idle data channel. It is described in detail in Curtis how these circuit actions are accomplished and, in this connection in particular, how the following relays operate in the following sequence: 224-PE00, 224-PF00, relay 275-PGRA within the SS equipment rectangle for position connector 0 on FIG. 275, relays 224-PA00, PB00, PC00 and PD00. In addition, relays 224-PG00 and PH00 operate over an obvious circuit shown within the A equipment rectangle on FIG. 224 associated with position 00.

Next, relay 225-0PS0 operates in connection with the bid from position connector 0 for the services of data channel 0. The operation of relay 225-0PS0 operates relay 225-0PRF0. Next, relays 225-DCA1 and 234-DCA2 release as described in Curtis. Also, relay 234-DCA3 releases in parallel with relay 234-DCA2. Relays 248-TST1 through TST6 now release. Relays 248-TST7 through TST9 release over obvious circuits at this time as a consequence of release of relay 234-DCA3. Next, relays 279-CONN, 279-CONA, and 279-CON1 through CON3 operate at this time. Also, relay 279-CON4 operates at this time in parallel with relay 279-CON3.

Determine data flow direction.—The release of relay 234-DCA2 closes an obvious circuit to operate relay 297-DTMB. The operation of relay 297-DTMB for channel 0 closes an obvious circuit to operate relay 406-OSPL in the BK rectangle for channel 0. Next, relays 2250-0PSA0, 0PSB0, 0PSE0, 0PRC0, and 0PRD0 also operate as described in Curtis. In addition, relays 225-0PRG0 and 0PRH0 operate over an obvious path as a consequence of the operation of relay 225-0PRC0. Next, FIG. 188 of position circuit 00 applies a negative battery potential to its conductor "STOP," shown on FIG. 261, thereby extending a circuit to operate relay 261-STOP within the Z rectangle for channel 0. The operation of this relay signifies that the direction of data flow on this usage of the data transfer circuit is primarily from the sender to the position circuit. The operation of relay 225-0PRD0 closes an obvious circuit to operate the channel-busy relays 225-CHB and 225-CHB1 for channel 0. The operation of these relays signifies that channel 0 is now busy. Next, as described in Curtis, the gate timing relays PGT and PGT1, within the QQ rectangle on FIG. 283, for position connector 0 operate.

The operation of relays 225-CHB and CHB1, as a consequence of the seizure of data channel 0, closes their make contacts within all of the G rectangles on FIGS. 225 and 228 and within all of the J rectangles on FIGS. 231 and 234, thereby operating relay 225-0PCB0 and corresponding relays within the other G rectangles, and operating relay 231-0RCB0 and all corresponding relays within the other J equipment rectangles, thereby shifting the preference networks within these rectangles so that subsequent bids from other register and position connectors will be bypassed to others of the data channels which may be idle at the time such subsequent bids are received.

Registration of trunk connector number.—It has been assumed that the presently described call is being served by trunk 40 which, as shown on FIGS. 2D and 2H, and 3Q, is connected to trunk connector 0. Therefore, as described in Curtis, the circuitry shown on FIGS. 236, 237, and 239 now transmits, in 2-out-of-5 code form, a trunk connector number of 0 from the position 00 rectangle on FIG. 236 in the form of ground potentials to operate relays 239-0DG4 and 0DG7, thereby registering a trunk connector number of 0 in these relays. The

operation of these relays now energizes the circuitry shown on FIGS. 238, 239, and 240, which causes data channel 0 to enter a bid for the services of the trunk connector associated with the trunk serving the present call, which trunk connector, in this case, is trunk connector 0. Therefore, the battery potential on terminal 101 within the K rectangle on FIG. 239 is extended to operate relay 238-0DCS0 within the L rectangle on FIG. 238, thereby entering a bid for the services of trunk connector 0. Assuming that trunk connector 0 is idle, the operation of relay 238-0DCS0 operates the secondary cut-in relays 238-0TS0 and 238-0TSS0. Additionally, the operation of relay 238-0DCS0 closes circuitry within the L equipment rectangle on FIG. 238 for trunk connector 0 to operate relay 238-0TSR0 which is also a secondary cut-in relay.

The operation of relay 238-0TS0 closes an obvious circuit to operate relay 297-RCTM which is associated with a timing operation. Next, as described in Curtis, the operation of relay 238-0TS0, as well as the operation of the other priorly described relays, closes a circuit path, beginning on FIG. 242, to extend a positive battery potential from terminal 242-105 over the PC conductor extending, via make contacts 224-PF00 of position connector 0, to FIG. 241. The PC conductor on FIG. 241, extending upwards on the left side thereof to a legend reading "to position control circuit 00 FIG. 185," extends over a complicated circuit disclosed in detail in Curtis and shown in abbreviated form within the rectangle on FIG. 241, whereby the battery potential is extended from the PC conductor through the various circuits shown within the rectangle on FIG. 241 so that the potential finally returns to the data transfer circuit from the sender on the SP conductor shown on the right-hand side of FIG. 241.

Customer-dialed coin call.—The battery potential applied to the PC conductor is extended via the position control circuit and the position link circuit, and enters trunk circuit 40 serving the present call on its KPR conductor on FIG. 356. The potential on this conductor is thence extended to FIG. 362 and through transfer make contacts 356-PA to terminal 362-101. From there the potential may further be extended to relay 362-TP40 if relay 362-ND is operated or, alternatively, may further be extended to relays 362-TPA and TPB if relay 362-ND is normal at this time. At this stage of the call, relay 362-ND would be operated only for a dial 0 call for which the calling subscriber dialed only the prefix digit "0." Relay 362-TP40 if operated would connect the trunk to the data transfer circuit, via the information leads required for dial 0 assistance calls; whereas relays 362-TPA and TPB if operated would close through the information leads needed for a customer-dialed coin call for which the customer dialed the called station digits. The present portion of the specification concerns a customer-dialed coin call, and it is therefore assumed that relay 362-ND is unoperated and that the battery potential on conductor KPR now operates relays 362-TPA and TPB. The potential on conductor KPR of FIG. 356 is also extended at this time, via make contacts 353-T, to conductor SPI on FIG. 353 extending to the sender link and controller circuit. Once the potential on conductor SPI enters the sender, it is further extended therethrough, via the circuitry shown in abbreviated form for sender 00 on FIG. 241, and finally emerges from the sender on conductor SP and terminal 102 on FIG. 241, and returns to the data transfer circuit. The potential on this conductor is now extended to FIG. 243 to operate relay 243-SS00, thereby signifying a bid by sender 00 for the services of its sender connector.

Initial period indication of coin toll call.—The operation of relay 362-TPA closes an obvious circuit on FIG. 263A to operate relay 263-0TSG4, thereby interconnecting the conductors of this trunk with the multiples of trunk connector 0. The operation of relay 0TSG4, in turn, closes a circuit on FIG. 266 to extend ground from ter-

minal 101, via make contacts 263A-OTSG4 and 238-OTS0, to operate relay 266-OTP0 for channel 0. The operation of relay OTSG4 also closes the following circuit to operate relay CIP within the rectangle "BQ" for channel 0 on FIG. 372: ground on terminal 102 of FIG. 363, transfer make contacts 363-IP, transfer break contacts 362-RCL, make contacts 362-TPA, conductor CIP extending from FIG. 363 of the trunk circuit to FIG. 372A of the data transfer circuit and to the rectangle thereon for trunk 40, make contacts 263A-OTSG4, 238-OTSR0, to the winding of relay 372-CIP for channel 0 to operate it. This relay, in operating, closes a holding circuit for itself to ground over its own make contacts and those of relay 293-RCI. The operation of relay CIP indicates that this is the initial period of a coin toll call.

The priorly described operation of relay 243-SS00 closed a circuit, described in Curtis, to operate relay 243-SE00, assuming that sending connector 0 is available for connection to sender 00 which is now bidding for its services. The operation of relay 243-SE00 now closes an obvious path to operate relays 243-SA00, SB00, SC00, and SD00. All of relays SA00 through SE00 are primary cut-in relays for sender 00 and sender connector 0.

Connection of sender connector to data channel.—Recalling that the trunk connector number for the presently described calling trunk is a zero, sender 00 closes a circuit on FIG. 245 to transmit a trunk connector number of 0 to the Q rectangle for sender connector 0 on FIG. 245, thereby operating relays 245DGN4 and DGN7. The operation of these relays energizes the circuitry within the R equipment rectangle on FIG. 246 for sender connector 0, as described in Curtis, to operate relay 246-OSRE0, thereby operating the secondary cut-in relay for sender connector 0 corresponding to the channel to which the trunk connector serving the present call is also connected. In other words, the operation of this relay connects sender connector 0 to data channel 0 since the circuitry of FIG. 246 enables the data channel to determine that the particular trunk connector serving this present call is also connected to channel 0 at this time. The auxiliary secondary relays 247-OSSA0, OSSB0, OSSC0, and OSSD0 also operate at this time.

Bid for services of rater.—Reviewing the circuit operations described so far, it may be seen that trunk 40, sender 00, and position 00, all of which are involved on the present call, are all connected to data channel 0 of the data transfer circuit. Now that this connection has been accomplished, the data transfer circuit proceeds to bid for the services of one of the raters in an attempt to connect a rater to the same data channel in order that the rater and the other circuits connected to the channel at this time may interchange call data. The function of the rater is to derive a charge rate and an initial period duration, as well as other call data, in response to the receipt of certain information on each call. The rater may be of the type disclosed in detail in Patent 2,965,718 to R. C. Avery of Dec. 20, 1960, as well as in the application to R. C. Avery et al. Ser. No. 46,945, filed Aug. 2, 1960.

The circuitry by means of which the data channels bid for the services of a rater is shown on FIGS. 374 through 382. This circuitry is analogous, although not identical, to that shown on FIGS. 224 through 235, which controls the manner in which the various position and register connectors bid for the services of a data channel. However, the circuitry of FIGS. 374 through 382 is different from that of FIGS. 224 through 235 in that the channels are the bidding circuits and the raters are the circuits whose services are bid for. This being the case, the circuitry within each data channel which bids for one of the raters is shown within the rectangles BP on FIGS. 374, 375, and 376; while the preference and control circuitry which determines the order in which a given channel bids for the services of the two raters, as well as the order in which each rater gives priority to bid from the various data channels, is shown within the rectangles BR and BS on

FIGS. 377 through 382. The preference and control circuitry common to rater 0 and channel 0 is shown in detail on FIG. 379, while that for the other channels, as well as for all channels for rater 1, is shown in abbreviated form.

Recalling the operation of the priorly described relays, the following circuit on FIGS. 376 and 379 is now closed to operate relay 379-ORTS0: battery on terminal 101 of FIG. 376, resistor STR, make contacts 372-CIP, 261-ST0P, 246-OSRE0, 297-DTMB, break contacts 407-RAGT1, terminal A on FIG. 379, via the strap to terminal B on the same figure, transfer break contacts 379-ORTCB0, through the winding of relay ORST0 to ground on terminal 101, also designated D, on the same figure. The operation of relay ORTS0 represents a bid by channel 0 for the services of rater 0. It is assumed at this time that rater 0 is idle and is available for connection to data channel 0. This being the case, the following path is now closed to operate relays 379-ORTB0 and ORTA0: ground on terminal H on FIG. 377 within the rectangle BR for the control circuitry representing rater 0 and channel 3, via the strap to terminal G, and then via a strap to terminal G1 of the same rectangle, over a conductor extending to FIG. 378 and to terminal H1 for the rectangle BR common to rater 0 and channel 2, via the straps and terminals H, G, and G1 of this rectangle, over the conductor extending to the H1 terminal of the rectangle BR for rater 0 and channel 1, over the straps and H and G terminals to the G1 terminal of the same rectangle over the conductor to the H1 terminal of the rectangle BR on FIG. 379 for rater 0 and channel 0, via the strap to the H terminal, and make contacts 379-ORTS0, to the windings of relays ORTA0 and ORTB0, to operate them. The operation of the relays ORTS0 and ORTB0 closes the following path on FIG. 379 to operate relays ORTC0 and ORTD0 on the same figure: ground on terminal 102 of FIG. 379, make contacts 297-DTMB, 379-ORTS0, 379-ORTB0, to the windings of relays ORTC0 and ORTD0, to operate them. All of relays ORTA0 through ORTD0 are cut-in relays, and their operation at this time interconnects data channel 0 with rater 0.

Rater preference circuitry.—The operation of relay 379-ORTD0 closes the following path to operate relay 377-RB in rater 0; ground on terminal 103 of FIG. 379, make contacts 379-ORTD0, over conductor RAB extending to FIG. 377, to the winding of relay RB in rectangle BS on the same figure, to operate it. This relay, in operating, by means of its make contacts, grounds the RTCB leads shown on FIG. 377 which respectively extend to the RTCB terminal of each such BR rectangle on FIGS. 377 through 379. The ground on this terminal operates relay 379-ORTCB0 as well as the corresponding relay in each of the other BR rectangles for rater 0. The operation of this relay shifts the preference circuit for channels 1, 2, and 3 so that any subsequent bids by these channels will be extended to rater 1, since rater 0 is now in use. All the guard and preference circuit features priorly described for FIGS. 224 through 235 are also included in the circuitry of FIGS. 374 through 382, so that once a bidding channel is connected to a nonpreferred rater, it will not be subsequently disconnected and connected to a preferred rater in the event that the preferred rater should become available at a subsequent time.

The operation of relay 379-ORTC0 closes an obvious circuit on FIG. 373 to operate relay 373-RT0. The operation of this relay indicates that rater 0 has been selected by channel 0. This relay is also used for "trouble-shooting" purposes. The rater gate circuitry is shown on FIG. 407. The function of this circuit is similar to that of the register connector and position connector gate circuit shown on FIG. 283 and priorly described in detail in Curtis. The following circuit is now closed to operate relay 407-RAGT: ground on terminal 102 of FIG. 407, make contacts 379-ORTC0, the left-hand winding of relay 407-RAGT, break contacts RGTM within the trouble recorder circuit, to battery on terminal 101 thereof. The operation

of relay 407-RAGT closes an obvious path of the same figure to operate relay RAGT1. The operation of relay RAGT also closes a holding circuit for itself through its right-hand winding, over make contacts 407-RAGT1 and transfer make contacts 407-RAGT, to terminal B of the same rectangle, and thence over the conductors extending to the corresponding terminal of each of the corresponding rectangles for the other channels. Assuming that one or more of these other gate circuits are idle, the ground on its terminal B may be extended through the circuitry thereof corresponding, as follows, to the circuitry for the gate circuit for channel 0: its terminal B, transfer break contacts 407-RAGT (since the RAGT relay of the other channel gate will be idle), break contacts 407-RAGT1, make contacts 261-STOP, and 372-CIP (or make contacts 370-STR for a different type of call) to ground on terminal 103. This circuitry prevents a data channel from obtaining successive connections to a rater while other data channels wait unserved for a connection to a rater.

The rater is now connected to data channel 0, and is therefore connected to trunk 40, sender 00, and position 00, all of which circuits have been priorly connected to data channel 0. These four circuits now interchange the data required for the successful serving of this call.

DATA INTERCHANGE

The following paragraphs describe the manner in which information is interchanged between the trunk 40 (FIGS. 348-366), sender 00, position 00, and rater 0, all of which are currently connected to channel 0 of the data transfer circuit.

Originating area code.—The trunk now sends information to the position circuit regarding the originating area of the calling office. Each trunk circuit serves only a single calling office, and the originating area identity of this calling office is obtained by means of strapped cross connections, shown on FIG. 363, to one of terminals 0A0, 0A1, or 0A2. The strapping on FIG. 363 shows this particular incoming trunk to serve a calling office located in originating area 0. This being the case, a path is now closed on FIG. 363 to extend ground from its terminal 103 through make contacts 362-TP40, terminal 0A, via the strapping to terminal 0A0, and thence to conductor 0A0 extending to FIG. 272B of the data transfer circuit. The ground on conductor 0A0 for trunk 40 on FIG. 272B of the data transfer circuit may be further extended through make contacts 263A-OTSG4, 238-OTSS0, 225-OPRF0 on FIG. 271, and 224-PF00 to conductor 0A0 extending to FIG. 193 of the control circuitry for position 00. The ground on conductor 0A0 on FIG. 193 may further be extended to operate and lock register relay 193-0A0.

Call—Initial period.—The trunk circuit also extends ground on its terminal 103 on FIG. 366, through break contacts 362-RCL, make contacts 363-IP, make contacts 362-TPA, to its conductor IP extending to FIG. 397A of the data transfer circuit. From there, the ground on conductor IP may be further extended through make contacts 263A-OTSG4, 238-OTSS0 on FIG. 397, via the conductors of data channel 0, through make contacts 225-OPRG0 and 224-PG00 on FIG. 397, to FIG. 198 of the control circuitry for position 0, to operate relay 198-CIP therein. The operation of this relay functionally indicates that this is the initial period portion of the call being served.

The trunk now closes a circuit on FIG. 363 to extend ground from terminal 102 on the same figure through transfer make contacts 363-IP, transfer break contacts 362-RCL, make contacts 362-TPA, to its conductor CIP extending to FIG. 372A of the data transfer circuit. The ground on this conductor may then be further extended through make contacts 263A-OTSG4, make contacts 238-OTSR0, the conductors of channel 0, to relay 372-CIP within the BQ equipment rectangle for channel 0, to op-

erate it. The operation of this relay closes a holding path for itself over its own make contacts and those of relay 293-RCI to ground. The operation of relay CIP functionally indicates to the data transfer circuit that this is the coin initial-period portion of the call.

Calling office index.—The circuitry on FIG. 366 of the trunk circuit transmits grounds over the appropriate ones of conductors 0IT0 through 0IT2, and 0TP01, -2, -4, and -7 to signify the office index digits assigned to the calling office for the present call. Let it be assumed, for example, that the office index digits are 11. A circuit is now closed on FIG. 366 to extend ground from terminal 101, through make contacts 363-IP and 362-TPA, terminal 0IT, via the strap to terminal 0IT1, to conductor 0IT1 extending to FIG. 397A of the data transfer circuit. The ground on this conductor represents a "1" for the tens digit of the office index. A circuit is also closed on FIG. 366 from ground on terminal 104, through transfer break contacts 363-0P and 365-IC, diodes A and B, two sets of transfer make contacts of relay 363-IP to terminals 0IUA and 0IUB, via straps to terminals 0 and 1, respectively, two sets of make contacts of relay 362-TPA to conductors 0TP0 and 0TP1, respectively, which together represent a digit "1" in 2-out-of-5 code. These conductors also extend to FIG. 397A of the data transfer circuit. The ground on conductors 0IT1, 0TP0, and 0TP1 on FIG. 397A may be further extended through make contacts 263A-OTSG4 and make contacts 238-OTSS0 on FIG. 397 to the conductors of channel 0. From there, the potentials may further be extended through make contacts 379-0RTB0 on FIG. 398 to FIG. 420 of the rater, to operate relays 420-0IT1, 0TP0, and 0TP1. The operation of these relays in the rater circuit registers the office index 11 therein.

Class-of-service information.—The sender now closes a circuit on FIG. 39 to transmit the class-of-service information to the position and to the rater. Assuming that the class of service for the present call is a zero, as indicated by the operation of relays 60-CS0 and 60-CS5, conductors CS0 and CS00, respectively, extending from FIG. 39 of the sender circuit to FIG. 45 and thence to FIG. 255 of the data transfer circuit will thereby be grounded. On FIG. 255 the grounds on these two conductors may further be extended through make contacts 243-SD00 and 247-0SSD0, via channel 0, to the correspondingly designated conductors on FIG. 419 of rater 0, via make contacts 379-0RTB0 on FIG. 256, and to the correspondingly designated conductors on FIG. 193 of the position control circuit for position 00, via make contacts 225-OPRD0 and 224-PD00 on FIG. 255. The grounds extended via these conductors to the rater operate relays CS0, and CS5 on FIG. 419. The grounds extended via these conductors also operate relays CS0 and CS00 on FIG. 193 of the position control circuit.

The sender also transmits the recorder number information at this time to both the position circuit and the rater. Assuming a recorder number of zero, the sender circuit on FIG. 39 closes make contacts of relays 60-RN0, 60-RN7, and 60-RN13 to ground the correspondingly designated conductors extending via FIG. 45 of the sender to data transfer circuit FIG. 255. The grounds on these conductors on FIG. 255 may further be extended through make contacts 243-SD00 and 247-0SSD0 to the conductors of data channel 0. From there, they may further be extended to FIG. 420 of rater 0, via make contacts 379-0RTC0 on FIG. 256, and to the correspondingly designated conductors of FIG. 193 of the position circuit 00, via make contacts 225-OPRD0 and 224-PD00 on FIG. 255. The grounds on these conductors of the rater operate the correspondingly designated relays on FIG. 420, while the grounds on these conductors of the position circuit operate relays R0, R7, and R13 on FIG. 193 thereof.

Type-of-call information.—The sender circuit on FIG. 45 also grounds its conductor NAC via break contacts 24-0PT, transfer break contacts 60-AS0, and transfer

make contacts 28-AC, to conductor NAC extending to FIG. 255 of the data transfer circuit. The ground on this conductor on FIG. 255 may be further extended through make contacts 243-SD00 and 247-OSSD0 to data channel 0. It may then be further extended to rater 0 via make contacts 379-ORTB0 on FIG. 256, and to the position circuit 00, via make contacts 225-OPRD0 on FIG. 255, and make contacts 224-PD00 to FIG. 204 of the position circuit. The ground on this conductor in the rater operates the relay 419-NAC and the ground on this conductor in the position circuit operates relay 204-NAC. The operation of these relays in the rater and in the position circuit indicates that this is a 10-digit national area code type of call.

The sender circuit on FIG. 45 now grounds its conductor CNM extending to the position as a cancel-number-match indication to the operator. The following circuit is now closed to ground this conductor on FIG. 45: ground on terminal 101 thereof, break contacts 24-0PT, 27-0EZ, transfer break contacts 51-AIT, transfer make contacts 51-AI and 43-DI7, to conductor CNM extending to FIG. 255 of the data transfer circuit. The ground on this conductor on FIG. 255 may be further extended through make contacts 243-SD00 and 247-OSSD0 to data channel 0. The conductor may then further be extended through make contacts 225-OPRD0 and 224-PD00 to conductor CNM extending to FIG. 193 of the position circuit. The ground on this conductor operates the correspondingly designated relay on FIG. 193.

Calling number information.—The sender also closes circuits at this time to transmit the calling number information, which was received via ANI from the originating office, to the position circuit. The sending contacts within the sender circuit which transmit this information are shown on the data transfer circuit drawings since they involve only make contacts. The A digit of the calling number is transmitted by the DA- contacts on FIG. 252 within the rectangle representing sender 00, while the B, the C, the thousands, and the hundreds digits of the calling number are transmitted by the contacts on FIG. 253 within the rectangle representing sender 00. The tens and units digits of this number are transmitted by the DT- and DU- sender contacts shown on FIG. 258A for sender 00.

Assuming a calling number of 582-9106 in area 201, make contacts 43-DA1 and DA4 are now operated on FIG. 252 to ground the correspondingly designated conductors. The grounds on these conductors may then further be extended through make contacts 243-SB00 and 247-OSSB0 to data channel 0. From there, these conductors run to position 00, via make contacts 225-OPSB0 and 224-PB00, to FIG. 200 of the position circuit to operate relays 194-DA1 and DA4 on FIG. 194. Referring to rectangles for sender 00 on FIG. 253 and recalling the calling number of 582-9106, make contacts 43-DB7 and DB1, 44-DC0 and DC2, 44-DTH7 and DTH2, 44-DH0 and DH1 are now operated to ground the correspondingly designated conductors. These grounds may be further extended through make contacts 243-SC00 and 247-OSSC0 to data channel 0. From there, the grounds may further be extended through make contacts 225-OPRC0 and 224-PC00 to FIG. 200 of the position circuit to operate relays 194-DB7 and DB1, DC0 and DC2, DTH7 and DTH2, and DH0 and DH1 on FIG. 194. Finally, the tens and units digits of the calling number are a zero and six, respectively, and therefore on FIG. 258A, make contacts 44-DT4 and DT7, along with make contacts 44-DU2 and DU4, are operated to ground the correspondingly designated conductors. These grounds may further be extended through make contacts 243-SE00 and 247-OSSC0 to the conductors of data channel 0. These grounds may then be further extended through make contacts 225-OPSE0 and 224-PE00 to the correspondingly designated conductors extending to FIG. 200

of the position circuit. The grounds on these conductors of the position circuit on FIG. 200 may then be further extended to FIG. 194 to operate relays 194-DT4 and DT7, and DU2 and DU4.

Called number information.—The called station number, including the area code, is registered in 2-out-of-5 code form in the relays designated A- through H- and J- and K- on FIGS. 69 and 70 of the sender circuit. The operated pairs of these relays ground the correspondingly designated conductors extending from FIG. 69 to FIGS. 250A and 252 of the data transfer circuit. The A- through F- conductors are shown on FIG. 250A extending from the sender 00 rectangle, through make contacts 243-SA00 and 247-OSSA0, to the conductors of data channel 0. From there, the grounds on these conductors may be extended to FIG. 419 of the rater circuit 0 via make contacts 379-ORTA0 on FIG. 250. The grounds on these data channel conductors may also be extended via make contacts 225-OPSA0 on FIG. 249 and 224-PA00 to the rectangle representing position 00, and thence to FIG. 202 of the position circuit. The G- and H- and J- through L- conductors shown on FIG. 252 within the rectangle representing sender 00 may be extended through make contacts 243-SB00 and 247-OSSB0 to the conductors of data channel 0. The grounds on these conductors may then further be extended to FIG. 251, and via make contacts 225-OPSB0 and 224-PB00 to the correspondingly designated conductors of position 00 extending to FIG. 202 of the position circuit.

The grounds on the grounded pairs of conductors A- through F- operate the correspondingly designated relays on FIG. 419 of the rater circuit, while the grounds on the A- through H- and J- through K- conductors enter the position circuit on FIG. 202, whence they may be further extended to the correspondingly designated relays on FIGS. 199 and 200 to operate them. Thus, assuming a called number of 212-243-1000, the following pairs of relays on FIGS. 199 and 200 of the position are now operated: 199-A0 and A2, B0 and B1, C0 and C2, D0 and D2, E0 and E4, F1 and F2, 200-G0 and G1, H7 and H4, J7 and J4, and K7 and K4.

It has priorly been described how relay 71-PP of the sender is operated to indicate a person-to-person call. This being the case, conductor PP extending from sender FIG. 69 to data transfer circuit FIG. 405 is now grounded on FIG. 71 by the circuit holding relay PP operated. The ground on this conductor is shown as entering the sender 00 on FIG. 405 within the rectangle for sender 00, and thence it may be further extended through make contacts 243-SD00, 247-OSSD0, and 372-CIP, to the conductors of data channel 0. From there, the path may be further extended on FIG. 404 through make contacts 225-OPRG0 and 224-PG00 to FIG. 198 of position 00 to operate relay 198-CSP. This circuit may also be extended, via data channel 0 on FIG. 406, through make contacts 379-ORTC0 to conductor PP of FIG. 420 of rater 0 to operate relay 420-PP.

If the call had been a station-to-station call, relay 71-STA would have been operated in the sender instead of relay 71-PP. In that event, conductor STA extending from sender FIG. 69 to data transfer circuit FIG. 405 would be grounded on FIG. 71 by the circuit path holding relay STA operated. The ground on this conductor is shown as entering the sender 00 on FIG. 405 within the rectangle of sender 00, and thence it may be further extended through make contacts 243-SD00, 247-OSSD0, and 372-CIP to the conductors of data channel 0. From there, the path may be further extended on FIG. 404 through make contacts 225-OPRG0 and 224-PG00 to FIG. 198 of position 00 to operate relay 198-CNS. This circuit may also be extended, via data channel 0 on FIG. 406, through make contacts 379-ORTC0 to conductor STA of FIG. 420 of rater 0, to operate relay 420-SS.

The sender at this time also transmits an AI mark to the rater and to the position, via the data transfer circuit,

to inform the operator, and subsequently the transverter, that the calling number has been automatically identified. The circuit over which this information is transmitted begins with ground on FIG. 39 of the sender via transfer break contacts 51-AIT, and make contacts 51-AI to the AI conductor of the sender extending via FIG. 45 to data transfer circuit FIG. 255 and, in particular, to the rectangle representing sender 00 on this figure, through make contacts 243-SD00, 247-OSSD0, to the AI conductor of channel 0. From there, the ground on this conductor may be extended through make contacts 379-ORTC0 on FIG. 256 to FIG. 420 of the rater to operate relay 420-AI. The ground on this channel conductor may also be extended through make contacts 225-OPRD0 and 224-PD00 on FIG. 255 to FIG. 193 of the position control circuit to operate relay 193-SAI.

RATER OPERATION

The rater at this time has all the information required by it to derive a rate treatment for the present call. The rate treatment comprises a 3-digit number having a possible zero or one in the hundreds digit and having any value from zero to nine for the tens and units digits. The tens and units digit information is transmitted in a 2-out-of-5 code, while the hundreds digit is transmitted simply as a zero or a one indication. Let it be assumed, for example, that the rate treatment for the present call is 011. This being the case, the rater closes circuits shown on its FIGS. 421 and 422 to ground conductors RTH0, RTT0, RTT1, RTU0, and RTU1 extending from FIGS. 421 and 422 to FIG. 406 of the data transfer circuit. The grounds on these conductors may be further extended through make contacts 379-ORTC0 to the conductors of data channel 0. The grounds on these conductors are further extended to trunk 40, via make contacts 406-OSPL on FIG. 405 and make contacts 238-OTSR0 and 263A-OTSG4 on FIG. 405A, to FIG. 364 of the trunk circuit.

The grounds on these conductors on FIG. 364 operate relays 364-RTH0, RTT0 and RTT1, and RTU0 and RTU1, through make contacts of relay 362-TPB, thereby registering a rate treatment of 011 in the trunk circuit. The grounds on these conductors of data channel 0 are also extended, via make contacts 225-OPRG0 and 224-PG00 on FIG. 404, to FIG. 199A of the position circuit to operate relays 199A-RH7 (which registers a 0), RT0 and RT1, and RU0 and RU1 on FIG. 199A, thereby registering the same rate treatment digits in the position circuit.

As part of the output information of the rater, at the same time that it transmits the applicable charge rate for the call to the trunk and position control circuit, it also derives and transmits to the trunk an indication of the duration of the initial period in minutes. Let it be assumed, for example, that the duration of the initial period for the present call is four minutes. This being the case, a circuit is closed on FIG. 422 of the rater to apply ground over conductor M3, which represents a four-minute initial period, to FIG. 400, make contacts 379-ORTC0 on FIG. 400, to the conductors of data channel 0. From there, the ground may be further extended to FIG. 399 and make contacts 238-OTSR0, and make contacts 263A-OTSG4 on FIG. 399A, to the correspondingly designated conductor of trunk 40 extending to FIG. 365 of the trunk circuit to conductor M3 thereon, through make contacts 362-TPB and break contacts 366-EF0 to the winding of relay 365-M4, to operate it and thereby inform the trunk circuit that the initial period is to be of four minutes duration.

This completes the interchange of data between the trunk, the position and the rater at this time and, as a consequence, rater 0 completes a circuit via conductor RFC shown on FIG. 421, to operate relay 368-RFC on FIG. 368 for channel 0, via make contacts 379-ORTC0 shown on FIG. 368. The operation of this relay indicates to the data transfer circuit that the rater function is com-

plete. Really RFC in operating closes an obvious locking path for itself.

If this were a dial 0 call, relay 362-ND would have been operated during the earlier interchange of data between the register, the trunk, and the sender. If operated, relay 362-ND remained locked through make contacts of relay 359-RA and break contacts of relay 351-D1 to ground on terminal 105 of FIG. 362. As a result of relay 362-ND being operated, relay TP40 of FIG. 362 would have operated instead of relays 362-TPA and TPB. This being the case, the data transfer information just previously described would be modified to provide the data exchange needed for a dial 0 call. The trunk provides information to the position circuit regarding the originating area of the calling office in a manner similar to that previously described, except that on FIG. 363 the path for ground from terminal 103 is by way of make contacts of relay 362-TP40. The trunk would also extend ground from terminal 104 of its FIG. 363 through break contacts 351-D2, make contacts 362-TP40 to conductor NZRC extending to FIG. 263A of the data transfer circuit. The ground on this conductor to FIG. 263A would then be further extended through make contacts 263-OTSG4 and 238-OTSS0 to the winding of relay NZRC within the BB equipment rectangle of FIG. 263 for channel 0 to operate it. The operation of this relay would then close a holding path for itself over its own make contacts and break contacts 279-CON3 to ground. The ground on this conductor and the operation of this relay would functionally indicate to the data transfer circuit that this is an initial dial 0 bid and not a recall bid for an operator on a dial 0 call. The trunk will also extend ground from terminal 109 of its FIG. 363 through make contacts 362-TP40 to conductor ZCN, which extends to FIG. 272B of the data transfer circuit. Ground on this conductor is used by the data transfer circuit and extended to the position control circuit as previously described in the Curtis specification. Also, this ground and the associated operated relays provide a signal to the operator identifying a dial 0 call from a coin trunk. Since information regarding a called number is not available to the sender at this time for a dial 0 call, the sender cannot provide data information regarding the called number. Otherwise, the sender functions with the data transfer circuit in the same manner as previously described for a customer-dialed coin call and in the same manner as described in Curtis relating to a dial 0 coin call.

TIMING OF DATA EXCHANGE INTERVAL

The following description relates to the manner in which the data transfer circuit times the interval permitted for the receiving circuits to register and receive the data transmitted thereto. Referring now to FIG. 297, the following circuit is now closed to operate relay 297-SDTM: ground on terminal 297-101, break contacts 370-CST and 276-RDOK, and make contacts 368-RFC, to the winding of relay SDTM to operate it. This relay in operating extends its operating ground over its own make contacts to operate relay 297-DTM. The operation of relay DTM closes the following path to operate relay 297-DTMF: ground on terminal 297-102, transfer make contacts 297-DTM, break contacts 234-DCA2, and transfer break contacts 276-RDOK, to the winding of relay DTMF to operate it. The following circuit is now opened as a consequence of the operation of relay 217-DTM to release relay 297-DTMB: ground on terminal 102 of FIG. 297, the open transfer break contacts 297-DTM (which remove the ground formerly supplied via break contacts 234-DCA2), to the winding of relay DTMB, to release it at this time. The time interval measured from the beginning of the operation of relay 368-RFC and ending with the release of relay 297-DTMB provides a sufficient time for all the register relays in the receiving circuits which are to be operated at this time to operate as a consequence of the data interchange between the circuits connected to chan-

nel 0 at his time. The locking of all these operated relays is also ensured by the time interval thus provided.

RELEASE OF SENDING SECONDARY CUT-IN RELAYS

The following describes the manner in which the sending secondary cut-in relays of the sender, the trunk, and the rater are released, thereby leaving only the receiving secondary cut-in relays of these circuits operated in order that the test relays may then be applied to the data conductors in order to ascertain whether or not the relays which are required to be operated at this time actually are operated.

The release of relay 297-DTMB opens its make contacts on FIG. 379 to release relays 379-ORTC0 and 0RTD0. The release of relay 297-DTMB also opens its make contacts on FIG. 376 within the circuitry for channel 0 which bids for the raters, thereby disconnecting relay 379-ORTS0 from the battery potential on terminal 101 of FIG. 376 and releasing the relay. This relay in releasing, in turn, opens an obvious circuit to release relays 379-ORTA0 and 0RTB0. The release of all the priorly mentioned relays releases rater 0 from data channel 0.

The release of relay 297-DTMB for channel 0 also opens its make contacts on FIG. 247, thereby releasing relays 247-0SSA0, 0SSB0, 0SSC0, and 0SSD0. The release of these relays constitutes a release, or opening of the circuit, by means of which the sender transmits information to the other circuits. The release of relay 297-DTMB opens its make contacts on FIG. 238 to release relay 238-0TSS0. The release of this relay disconnects the leads of the trunk circuit from the data channel by means of which the trunk circuit transmits information to other circuits. The release of relay 297-DTMB also opens an obvious circuit on FIG. 406 to release relay 406-0SPL for channel 0.

DATA-CHECKING CIRCUITRY

Both the position and the trunk circuits have received certain common information at this time from other circuits, and therefore the data channel circuitry must check to make sure that the locking grounds of the associated register relays in both the trunk and position circuits are operated and are applying ground back to the conductors of the data channel by means of which the relays were initially operated. Since both of these circuits are connected to the same data channel (in this case, channel 0), facilities must be provided whereby the common conductors of the data channel between the position and the trunk must be split into two portions in order that separate and independent checks can be made for the grounds which are supposed to be applied by the position and trunk circuits to these data conductors at this time. This is accomplished by means of the release of relay 406-0SPL as already described. Referring to FIGS. 404, 405, and 406, it may be seen that the operation of relay 406-0SPL closes its make contacts on FIG. 405, thereby interconnecting the conductors of data channel 0 with the trunk connectors. The release of relay 0SPL, on the other hand, disconnects the trunk portion of the data channel conductors from that portion of the data channel conductors connected to the positions and the senders, and formerly connected to the raters. In other words, once relay 406-0SPL is released, the conductors of trunk connector 0 are interconnected by means of make contacts 238-0TSR0 with the various test relays shown in rectangle BK on the right-hand side of FIG. 406 for channel 0, while the conductors of the other portion of data channel 0 are connected to the test relays shown within the rectangle BZ for channel 0 on the left-hand side of FIG. 404.

Referring to FIG. 407, the release of relay 379-ORTC0 releases relay 407-RAGT and, in turn, releases relay RAGT1 for channel 0. Referring to FIG. 379, the release of relay 379-0RTD0 removes the operating ground, extended from terminal 103 and via conductor RAB of

FIG. 379, from the winding of relay 377-RB within rater 0 in rectangle BS on FIG. 377, thereby releasing relay RB. The release of this relay, in turn, releases relay 379-0RTCB0 as well as the corresponding relays in the other BR rectangles associated with rater 0 on FIGS. 377 and 378. The release of these relays completely releases the rater, thereby freeing it for the serving of other calls. Referring now to FIG. 348, the operation of relay 297-DTMF closes an obvious circuit on FIG. 248 to operate all of the relays 248-TST1 through TST9. The operation of these relays now closes subsequently described circuitry by means of which the data transfer circuit ensures that the proper relays within the receiving circuits, and, in this case, within the trunk and position circuits, have operated and locked and are applying grounds back to the associated data conductors.

Each of the data receiving relays in a circuit which receives data from other circuits, via data channel 0 at this time supplies a locking ground for itself. This locking ground is also extended back to the data conductor which operated the receiving relay, thereby permitting the data transfer circuit to make a check on the correctness of the registered data, as is described in subsequent paragraphs. Also, the sending relays of the circuits which transmit data have been released at this time, as priorly described, so that the operating grounds formerly supplied by them are no longer applied to the data channel conductors. In other words, a data channel conductor is initially grounded within a sending circuit, and the ground on the data conductor is extended to operate a corresponding relay in a receiving circuit. Following this, the operating ground in the sending circuit is disconnected from the data channel conductor and, if the associated register relay in the receiving circuit has operated and locked, a locking ground is supplied to the same conductor at this time from the circuitry of the receiving circuit.

By means of subsequently explained circuitry, the operation of relays 248-TST1 through TST9 connects each data channel conductor to a correspondingly designated test relay, so that each channel conductor having a receiving circuit locking ground on it at this time operates its associated test relay. The contacts of these test relays are arranged into symmetric check circuits shown on FIGS. 286 through 292, and 411 through 416. These check circuits are used to check for the correctness of the registered data under all types of possible calls and call conditions.

The following describes the manner in which the circuitry on FIGS. 286 through 292, and 411 through 416, check for the correctness of the data registered in the receiving relays of the trunk and position circuits. Essentially, the circuitry shown on these figures comprises a plurality of symmetric circuits, with each symmetric circuit by itself checking the correctness of certain items of information. The output of one symmetric circuit is connected to the input of the next by means of contacts of control relays, so that the various symmetric circuits are interconnected on each call in such a manner as to check for the proper registration by the receiving circuits of the data transmitted thereto from other circuits via the data transfer circuit. The operation of the check circuitry shown on FIGS. 286 through 292 has been priorly described for various calls in the aforementioned R. B. Curtis specification, and therefore the present description concerns itself mainly with details above and beyond those described in Curtis. In this connection, the circuits of FIGS. 411 through 416 exclusively check information pertaining to coin calls, and this operation is described in detail herein since the Curtis application is not concerned with the serving of coin calls. However, the symmetric circuits on FIGS. 411 through 416 are of essentially the same type as those on FIGS. 286 through 292, and therefore a thorough understanding of the check circuitry of Curtis will facilitate an understanding of the check circuitry of FIGS. 411 through 416.

The checking operation begins with the circuitry shown on FIG. 286, with ground on terminal 286-101, extended through make contacts 224-PF00 and 225-OPRC0, over the channel 0 conductor to FIG. 286A, through make contacts 248-TST3 and 297-DTMF, transfer break contacts 371-CFC, 370-PTOT, 260-RTOS and 261-PTOS, transfer make contacts 372-CIP (since this is a coin-initial-period portion of the coin call), over the conductor to terminal 101 of FIG. 287. This terminal comprises the input of a symmetric check circuit composed of the contacts of the relays 271-0A0, 0A1, and 0A2, which are connected to the data channel conductors over which the originating area information was priorly transmitted from the trunk to the position circuit. It has been described how, for this call, the trunk transmitted an originating area indication of zero over conductor 0A0 on FIG. 363. This being the case, and referring to FIG. 271, the operation of relay 248-TST6 connects relay 271-0A0 to the 0A0 conductor of data channel 0, which at this time has a ground supplied thereto, via the locking circuit of the 0A0 relay on FIG. 193 of the position circuit and make contacts 224-PF00 and 225-OPRF0, causing relay 271-0A0 to operate.

Returning now to FIG. 287, the ground on terminal 101 may be extended through make contacts 271-0A0 and through the break contacts of the remaining relays in the symmetric check circuit to terminal 102, and thence to terminal 101 on FIG. 286A. The ground on terminal 286A-101 may now be extended through transfer break contacts 273-NSA and 262-NCN, transfer make contacts 261-STOP, to terminal 104 on FIG. 287. This terminal comprises the input of a symmetric circuit which checks for the correctness of the registered "A" digit of the called number in the position circuit. The output of this symmetric circuit is connected to the input of the following symmetric circuit which checks the registered "B" digit of the called number, and the output of this symmetric circuit is connected to the input of a following symmetric circuit which checks the next digit of the called number. In a similar manner, the remaining symmetric circuits on FIG. 288, identified by a bracket on top designated "called number," provide for a check of the correctness of the registered called number stored in the position circuit registers at this time.

The winding of the relays whose contacts comprise these "called number" symmetric check circuits are connected at this time by various ones of relays 248-TST1 through TST9 to the data channel conductors on the fingers indicated, by means of which the called number information was transmitted from the sender to the position circuit. For example, referring now to FIG. 250, relays A0, A1, A2, A4, and A7, in rectangle S, are connected to the correspondingly designated data channel conductors over which the "A" digit of the called number was transmitted to the position circuit. The same relationship holds true between the windings of the relays comprising each remaining symmetric circuit on the figures of the checking circuitry and the data channel conductors over which the correspondingly indicated information was transmitted to the circuit receiving this information.

Recalling the immediately preceding discussion, and referring again to FIG. 287, the ground on terminal 104 may now be extended through the "A" digit symmetric circuit for the called number to its 2-out-of-5 output, and from there to the input of the "B" digit symmetric circuit. In a similar manner, the 2-out-of-5 output of the "B" digit symmetric circuit is connected to the input of the "C" digit symmetric circuit, etc., so that for a 10-digit call (assuming the position receives and registers correctly the information transmitted thereto), the check ground may now be extended through the "D," "E," "F," "G," "H," "J," and "K" digit symmetric circuits to terminal 101 on FIG. 288, which is the 2-out-of-5 upcheck output terminal of the "K" digit symmetric circuit. From

there, the ground may be extended through transfer break contacts 258-ND10, transfer make contacts 256-NAC, terminal 102 on FIG. 288, to terminal 101 and the winding of relay 289-DOK1 on FIG. 289, to operate it.

The ground on terminal 101 of FIG. 289 may also be extended through transfer break contacts 260-RTOS, 261-PTOS, 264-0I, 264-0MA, 256-IF, and 269-NIT, to terminal 102 on FIG. 289. This terminal comprises the input of a symmetric circuit which checks the "A" digit of the calling number. In a similar manner, the 2-out-of-5 output of this symmetric circuit is connected to the input of a symmetric circuit which checks the next digit of the calling number, etc., so that the DA-, DB-, DC-, DTH-, DH-, DT-, and DU- symmetric circuits on FIGS. 289, 290, and 291 together check for the correctness of the registered calling number information. Assuming a correct registration, the ground on terminal 102 of FIG. 289 may be extended from the input of each "calling number" symmetric circuit to the 2-out-of-5 output thereof and through the following symmetric circuits in series to terminal 101 on FIG. 291.

The ground on terminal 291-101 is now extended through make contacts 256-CNM in the "observing information" symmetric circuit to its 1-out-of-3 output on terminal 291-102. This terminal is then interconnected via transfer break contacts 393-NCN to the input of an area information symmetric circuit. This ground may be further extended through break contacts 256-LAC and make contacts 256-NAC to terminal 101 on FIG. 292. The ground on this terminal is then extended through the "recorder number" symmetric circuit on a 3-out-of-6 upcheck basis to terminal 292-102, which constitutes the input of the "class-of-service" symmetric circuit. The ground on this terminal may then be further extended through this symmetric circuit on a 2-out-of-7 upcheck basis to terminal 292-103, which is the input of the "call identification" symmetric circuit. Only relay 256-AI is operated, and therefore the ground on terminal 292-103 may be extended through the call identification symmetric circuit on a 1-out-of-5 upcheck basis to terminal 292-104. The ground on this terminal may now be extended through transfer make contacts 372-CIP, break contacts 368-RTBL, transfer break contacts 261-PTOS, terminal 292-105, and thence, extending over the attached conductor leftwards, to terminal 101 on FIG. 411, which constitutes the input of the "type overtime" symmetric circuit. This call is not currently in its overtime portion, and therefore the ground on this terminal may be extended through break contacts 396-ET and 393-IT to terminal 411-102, which is the input of the "trunk indications" symmetric circuit. Relay 398-IP of this symmetric circuit is operated, and therefore the ground on terminal 411-102 may now be extended through make contacts 398-IP, break contacts 398-OP and 271-RCL, to terminal 101 on FIG. 412, which is the input of a series of symmetric circuits which together check the rate treatment information currently registered in the position circuit as well as in the trunk circuit.

Referring to FIGS. 404 through 406, it should be observed that the channel 0 conductors currently connected, via position connector 0, to the register relays of position 0, are connected to the test relays in the BZ equipment rectangle shown on the left-hand side of FIG. 404, while the portion of the channel 0 conductors currently connected to the conductors of trunk connector 0 and the register relays of trunk 40 are connected to the test relays shown in the BK equipment rectangle on the right-hand side of FIG. 406. Relay 406-OSPL is released at this time, and thereby its make contacts on FIG. 405 separate the trunk conductors and the test relays on FIG. 406 from the remainder of the data channel 0 conductors and the test relays on FIG. 404. By this means, the test relays on FIG. 404 can test for the proper combinations of grounds from the register relays of position 00, while the test relays on FIG. 406 can test for

he proper combination of register relay grounds supplied by trunk 40.

Recalling the immediately prior discussion, terminal 101 on FIG. 412 constitutes the input of a series of symmetric circuits which check for the registration of the rate treatment information in both the position and the trunk circuit. Recalling that the rate treatment for the present call is 011, the ground on terminal 101 of FIG. 412 may now be extended through make contacts 404-PRTH0 and break contacts 404-PRTH1, to terminal 412-102, which constitutes the input of the symmetric circuit which checks the rate treatment hundreds digit in the trunk. The ground on this terminal may now be extended through make contacts 406-TRH0 and break contacts 406-TRH1, to terminal 412-103, which is the input of a symmetric circuit for checking the rate treatment tens digit information stored in the position circuit. The output of this symmetric circuit is connected to a following symmetric circuit input, whose output, in turn, is connected to another symmetric circuit input which together check the remainder of the rate treatment information. Assuming a proper registration in all circuitry, the ground on terminal 412-103 may now be extended through the following three symmetric circuits, to terminal 104 on FIG. 412, on a 2-out-of-5 upcheck basis. The ground on terminal 412-104 is then extended through one more rate treatment symmetric circuit on FIG. 413, to terminal 105 on FIG. 413.

Terminal 413-105 constitutes the input of a symmetric circuit which checks for the proper registration of the interval in minutes of the initial period. It also includes relays 396-EC and 399-NM. Only relay 400-M3 is operated at this time, since it is connected to the conductor which transmits an indication representing a four-minute initial period from the rater to the trunk. This being the case, the ground on terminal 413-105 is extended through the symmetric circuit on a 1-out-of-7 upcheck basis to terminal 413-106, which extends to the input of a symmetric circuit which checks the rate charge information. All of the relays of this symmetric circuit are unoperated at this time, and therefore the circuit may be further extended through the series-connected break contacts thereof to terminal 101 of FIG. 414.

The ground on terminal 101 of FIG. 414 may now be extended through make contacts 406-TPP, break contacts 406-TSTA, make contacts 404-PPP, break contacts 404-PSS, break contacts 370-CST and 372-C0P, make contacts 370-STR, break contacts 404-10T, 402-FCC and 401-VC, to the winding of relay 414-DOK3, to operate it as an indication that all the information transmitted to the position and the trunk circuits has been properly registered therein. Referring now to FIG. 276, the operation of relay 414-DOK3 now closes the following circuit to operate relay 276-RDOK: ground on terminal 276-102, make contacts 414-DOK3, break contacts 293-TBL, terminal 276-103, transfer break contacts 404-10T, transfer make contacts 368-RFC and 404-PRTH0, to the winding of relay 276-RDOK to operate it. The operation of this relay constitutes the end of the data check operation at this time and signifies that the rater data has been transmitted to the trunk and position circuits and registered properly therein.

RELEASE OF SENDER AND TRUNK FROM DATA CHANNEL

Referring now to FIG. 239, the operation of relay 276-RDOK opens its break contacts within the K equipment rectangle, thereby removing the operating battery on the DGN0 lead for the trunk connector circuitry shown on FIG. 238. This causes relays 238-0TS0 and 0DCS0 to release. This, in turn, releases relay 238-0TSR0. The release of relay 238-0TS0 opens its make contacts on FIG. 242, thereby removing the positive 130-volt potential from the PC conductor extending, via the position control and position link circuit, and via lead KPR, to the trunk cir-

cuit, as shown schematically on FIG. 241. This, in turn, releases relays 362-TPA and TPB in the trunk circuit. The removal of battery from this conductor also removes the operating potential from conductor SP extending from the sender to relay 243-SS00, thereby releasing it. The release of relay 238-0TS0 also releases relay 246-0SRE0. The release of this relay also releases relay 297-RCTM.

The release of relay 243-SS00, as described, opens obvious circuits to release relays 243-SA00, SB00, SC00, SD00, and SE00. The release of relay 243-SE00 releases relays 245-DGN4 and DGN7 within the Q equipment rectangle for sender connector 0 on FIG. 245.

The release of relays 362-TPA and TPB releases relay 372-CIP for channel 0. The release of relays 362-TPA and TPB also opens an obvious circuit on FIG. 263A to release relay 0TSG4 on that figure. This, in turn, releases relay 266-0TP0. The foregoing described operations have by now released the trunk and the sender from data channel 0.

The operation of relay 276-RDOK also releases relay 297-SDTM as well as 297-DTM and DTMF. The release of relay 297-DTMF releases relays 248-TST1 through TST9. The release of these test relays, in turn, disconnects all the test relays from the data channel conductors, thereby releasing the operated ones of these relays. The release of relay 297-DTM operates relay 297-DTMB which, in turn, reoperates relay 406-0SPL. The release of the sender from the data transfer circuit enables the sender to proceed with the marker functions as described in the Curtis specification and described elsewhere in the present specification in some further detail.

COMPUTER SEIZURE

The operation of relay 276-RDOK closes circuitry shown on FIGS. 385 and 388, by means of which data channel 0 bids for the services of an idle computer, which may be of the type disclosed in the aforementioned J. G. Nightingale application. The circuitry shown on FIGS. 383 through 391 is similar to that previously discussed and by means of which data channel 0 seizes an available rater. Let it be assumed, in this case, that computer 0 is idle and that it is seized by channel 0. This being the case, the following circuit is now closed to operate relay 388-0C0S0: battery on terminal 101 of FIG. 385, resistor CST, make contacts 276-RDOK, break contacts 297-DTMF1, break contacts 408-CGT and CGT1 in parallel, terminal A on FIG. 388, via the strap to terminal B, transfer break contacts 388-0CCB0, to the winding of relay 388-0C0S0, through the winding of this relay, to ground on terminal D on FIG. 388. The operation of this relay, in turn, closes the following path to operate relays 0CA0 and 0CB0 on the same figure: ground on terminal H within the BU rectangle of FIG. 386, through the straps and the G and G1 terminals, through the H1, H, G, and G1 terminals and the straps of the BU rectangles on FIG. 387, and to the H1 terminal on FIG. 388, via the strap to the H terminal, make contacts 388-0C0S0, and break contacts 297-DTMF1, to the windings of relays 388-0CA0 and 0CB0 to operate them.

The following circuit is now closed at this time to operate relay 388-0CC0: ground on terminal 388-101, break contacts 297-DTMF1, make contacts 388-0C0S0 and 388-0CB0, to the winding of relay 0CC0 to operate it. Referring now to FIG. 373, the operation of relay 388-0CA0 closes an obvious circuit to operate relay 373-CP0. Reverting to FIG. 388, the following circuit is now closed to operate relay 386-C0B: ground on terminal 388-102, make contacts 288-0CB0, conductor C0B extending to the winding of relay 386-C0B within rectangle BV on FIG. 386, to operate it. The make contacts of this relay now close and ground the various conductors CCB, respectively, extending to the various BU rectangles on FIGS. 386, 387, and 388, thereby operating relay 388-0CCB0 and the corresponding relays in each of the other BU rectangles associated with computer 0.

Referring now to FIG. 408, the following circuit is now closed to operate relay 408-CGT: ground on terminal 408-101, make contacts 388-0CC0, through the left-hand winding of relay CGT, break contacts CGTM, to negative battery on terminal 408-102. The current over this path operates relay CGT which, in turn, operates relay 408-CGT1. The foregoing operations have, by now, connected the data channel 0 to computer 0.

Receipt of data by computer.—Both the computer 0 and position 00 are connected to data channel 0 at this time by means of the previously-described circuitry. The position circuit transmits the rate treatment stored therein to the computer at this time, along with an indication signifying that this is a person-to-person call and that this is the initial-period portion of the call. The person-to-person indication is transmitted by the circuitry shown on FIGS. 404 to 406 of the data transfer circuit. Specifically, the circuit begins with ground on conductor PP on FIG. 198 of the position circuit, to FIG. 404 of the data transfer circuit, to the rectangle representing position 00 thereon, make contacts 224-PG00, 225-OPRG0, to the conductors of data channel 0, over these conductors to FIG. 406, make contacts 388-0CA0, to the rectangle representing computer 0, to conductor PP extending to FIG. 425 of the computer circuit, to operate relay 425-PP thereon.

If this were a station-to-station call, then the station-to-station indication would be transferred by the circuitry shown on FIGS. 404 to 406 of the data transfer circuit. Specifically, the circuit begins with ground on conductor STA on FIG. 198 of the position circuit, to FIG. 404 of the data transfer circuit, to the rectangle representing position 00 thereon, make contacts 224-PG00, 225-OPRG0, to the conductors of the data channel 0, over these conductors to FIG. 406, make contacts 388-0CA0, to conductor STA extending to the rectangle representing computer 0, to FIG. 425 of the computer circuit to operate relay 425-STA thereon. The computer uses the STA or the PP indication in conjunction with the rate treatment to derive the proper charge for either a person-to-person or a station-to-station call.

The initial-period indication is transmitted to the computer by means of a circuit beginning with ground on conductor IP on FIG. 198 of the position circuit, to FIG. 397 of the data transfer circuit, make contacts 224-PG00, 225-OPRG0, to data channel 0, thence to FIG. 398, make contacts 388-0CB0, to the rectangle representing computer 0, conductor IP extending to FIG. 425 of the computer circuit, to operate relay 425-IP thereon.

The rate treatment for the present call is assumed to be 011. This being the case, relays RH7, RT0, RT1, RU0, and RU1 on FIG. 199A have been operated at this time by the rater as priorly described, and are being held over their locking paths. The operation of this specific combination of relays signifies the rate treatment 011, with relay RH7 representing the hundreds digit of 0, with relays RT0, RT1, and RU0 and RU1 together representing tens and units digits of 1. This specific combination of relays operated also applies grounds to conductors RTH0, RTT0, RTT1, RTU0, and RTU1 on FIG. 199A. These grounds extend to the position 00 rectangle on FIG. 404. From there, they extend to the computer circuit, via the circuitry of FIGS. 404 through 406, in a manner identical to that previously described for the PP indication. These grounds extend from FIG. 406 of the data transfer circuit to FIG. 425 of the computer circuit, where they operate the relays whose designations correspond to the grounded leads. Thus, at this time, the following relays on FIG. 425 are operated in the computer to register the rate-treatment number 011: relays 425-RTH0, RTT0 and RTT1, and RTU0 and RTU1.

Computer output data.—The computer operates in response to the reception of the foregoing described input information and, in the manner described in detail in said J. G. Nightingale application, Ser. No. 316,653, filed Oct. 16, 1963, derives a number of items of output data con-

cerning the call which are transmitted to the position circuit as described in the following paragraphs.

The first item derived is the charge information (in dollars and cents) which comprises the initial period charge for the call. This information is derived in the form of a charge-hundreds digit representing the dollar information, a charge-tens digit representing the tens or dimes information, and a charge units digit representing either a zero or a nickel for the units digit of the charge. The charge-hundreds information is derived by the circuitry shown on FIG. 427. The charge-tens and units information is derived by the circuit on FIG. 426. Assuming the initial-period charge to be \$1.25, the computer now grounds conductors CH0 and CH1 on FIG. 427, and conductors CT0, CT2 and CU05 on FIG. 426. The grounds on all these conductors are extended to FIG. 403 of the data transfer circuit, to the rectangle representing computer 0, where they may be further extended through make contacts 388-0CC0 to data channel 0, make contacts 225-OPRH0, 224-PH00, to the rectangle representing position 0, to FIGS. 199A and 199B of the position circuit, to operate relays CH0, CH1, CT0, CT2 on FIG. 199B and relay 199A-CU05.

The initial-period duration information is derived in the form of a two-digit code, the first digit of which represents the tens digit of the initial period, while the second digit represents the units digit. This information is derived by the circuit of FIG. 428 of the computer. It has been priorly discussed how the initial-period duration for the present call is assumed to be five minutes. This being the case, the circuitry on FIG. 428 grounds conductors MT4 and MT7 for a zero tens digit and MU1 and MU4 for a units digit of five. The grounds on these conductors are extended to FIG. 403 of the data transfer circuit, to the rectangle representing computer 0, to the correspondingly designated conductors thereon. The grounds may be further extended through make contacts 388-0CC0 to data channel 0, make contacts 225-OPRH0 and 224-PH00, to the rectangle representing position 00, to FIG. 199B of the position circuit to operate the correspondingly designated relays thereon.

The circuitry on FIG. 427 of the computer grounds conductors TX or NTX on every call to indicate whether or not the charge display now in front of the operator includes tax. Assuming that conductor TX is grounded, this ground is extended to data transfer circuit FIG. 403, to the rectangle representing computer 0, where, in a manner previously described for the initial-period duration information, it is transmitted via the data transfer circuit to FIG. 204 of the position circuit to operate the correspondingly designated relay therein.

Since this is a toll call, and not a coin zone call, the computer circuit on FIG. 427 grounds conductor NZN. The ground on this conductor is extended to FIG. 393 of the data transfer circuit, to the rectangle representing computer 0, and thence through make contacts 388-0CA0 to data channel 0 to operate relay 393-NZN for channel 0.

The computer on each call grounds one of the leads AD, NPY, or CD on FIG. 427, depending upon whether initial-period seizure, notify seizure, or a coin collection seizure, respectively, is to be made. Since this in an initial-period usage of the computer, the computer grounds conductor AD which extends, via the circuitry of FIG. 403 of the data transfer circuit, in the manner previously described, to FIG. 204 of the position circuit to operate relay 204-AD.

The computer on each call also grounds one of conductors M0 through M4 on FIG. 424. These grounds serve no useful function at this stage of the call, other than to satisfy a data transfer check circuit requirement. However, on calls for which the rater is not used and for which the operator must manually determine the rates and key them into the computer, the computer then derives the initial-period duration on these conductors and

transmits this information to the trunk circuit via the data transfer circuit by means of the one grounded conductor. It has been assumed that the initial-period duration for the present call is four minutes, and therefore the computer is currently grounding conductor M3, which represents a four-minute period, and which ground is transmitted to FIG. 400 of the data transfer circuit, to the rectangle representing computer 0, but is not transmitted to the trunk circuit on the present call since the trunk circuit has priorly released. However, it does operate the test relay 400-M3 of data channel zero via make contacts 388-OCA0 and 248-TST7 of data channel 0.

Release of computer.—The computer functions are now complete. This condition is signified to the rest of the system by the computer circuit on FIG. 425 which grounds conductor CFC. This conductor, in turn, extends to FIG. 371 of the data transfer circuit, where it may be further extended through make contacts 388-OCA0 to the winding of relay 371-CFC for channel 0, to operate it. The relay in operating closes an obvious locking path for itself over its own make contacts and those of relay 373-CP0 to ground. The following circuit is now closed to operate relay SDTM on FIG. 297: ground on terminal 103, make contacts 371-CFC, to the winding of relay 297-SDTM to operate it. The operation of this relay, in turn, operates relay 297-DTM. The operation of DTM releases relay 297-DTMB and closes a path to operate relay 297-DTMF1 and DTMF. The release of relay 297-DTMB releases relay 406-OSPL.

The operation of relay 297-DTMF1 releases relays 0CA0, 0CB0, and 0CC0 on FIG. 388. Also, the operation of relay 297-DTMF1 opens its make contacts within the BT equipment rectangle on FIG. 385, thereby releasing relay 388-0C0S0. The release of relay 388-0CC0 releases relay 408-CGT which, in turn, releases relay 408-CGT1. The release of relay 388-0CB0 releases relay 386-C0B within the BV equipment rectangle on FIG. 386 for computer 0. The release of relay 386-C0B in the computer removes ground from conductors CCB, respectively, extending to the various BU equipment rectangles on FIGS. 386 through 388, thereby releasing relay 388-0CCB0 together with the corresponding relays in the other BU equipment rectangles of FIGS. 386 and 387. The operation of relay 297-DTMF operates relays TST1 through TST9 on FIG. 248, thereby connecting the various channel test relays to their correspondingly designated channel conductors. The release of relays 388-OCA0, 0CB0, and 0CC0 effectively disconnects the conductors of the computer from the data channel conductors.

CHECK OF DATA TRANSMITTED FROM COMPUTER TO POSITION

The data transferred from the computer to the position is now checked by the circuitry shown on FIGS. 286 through 292 and 411 through 416, in a manner similar to that previously described. Once again, the circuit begins with ground on terminal 101 of FIG. 286, which ground can be extended through make contacts 224-PF00, 225-OPRC0, make contacts 248-TST3 on FIG. 286A, make contacts 297-DTMF, transfer make contacts 371-CFC (since the computer functions are now complete), make contacts 276-RDOK, to terminal 102 on FIG. 286A. The ground on this terminal is then extended over the conductor attached thereto to terminal 101 on FIG. 415, which constitutes the input of a symmetric circuit which checks the charge-hundreds digit information on a 2-out-of-5 code basis and, assuming a proper registration in the position circuit, extends the ground from terminal 415-101 through the symmetric circuit on a 2-out-of-5 code basis to terminal 415-102. The ground on terminal 102 is then extended on a 2-out-of-5 code basis through the charge-tens information symmetric circuit to terminal 415-103, and thence through the charge-unit information symmetric circuit on a 1-out-of-2 code basis to terminal

415-104 to the input of the minutes-tens symmetric circuit. The ground on terminal 104 is then extended on a 2-out-of-5 code basis through the symmetric circuit to its output terminal 105. The ground on this terminal is then further extended through the minutes-units symmetric circuit on FIG. 416 to terminal 416-101. The ground on this terminal may be extended through make contacts 403-AD, break contacts 403-CD, and 403-NFY, to terminal 416-102. The ground on terminal 102 of FIG. 416 is then extended through make contacts 403-TX, break contacts 403-NTX, break contacts 403-ZN, and make contacts 403-NZN, to the winding of relay 416-DOK4 to operate it. The operation of this relay at this time signifies that the data transmitted to the position circuit by the computer has been properly registered and checked.

RELEASE OF POSITION FROM DATA CHANNEL

The operation of relay 416-DOK4 closes the following circuit to operate relay DTOK on FIG. 182 of the position circuit: ground on terminal 104 of FIG. 276, make contacts 416-DOK4, conductor DTOK extending from FIG. 276 to FIG. 274, the conductors of channel 0, make contacts 225-OPRF0 on FIG. 274, make contacts 224-PF00, to conductor DTOK extending to FIG. 188 of the position circuit to operate relay 182-DTOK of that circuit. The operation of relay 182-DTOK opens its break contacts within the C equipment rectangle for position 00 on FIG. 224. This removes the battery potential from conductor STDT extending to relay 224-PP00 and thereby causes it to release. The removal of this battery potential also releases relay 225-OPS0. Relays 224-PE00, PF00, PA00, PB00, PC00, PD00, PG00, and PH00 also release at this time.

The release of relay 224-PF00 releases relays 0DG4 and 0DG7 on FIG. 239. The release of relay 224-PF00 also releases relay 261-ST0P for channel 0.

The release of relay 225-OPS0 releases relays 225-OPRC0, OPRD0, and OPRF0. It further releases relays 225-OPSA0, OPSB0, and OPSE0. The release of relay 225-OPRC0 releases relays 225-OPRG0 and OPRH0. The release of relay 225-OPS0 closes a check circuit, priorly described, to operate relay 225-DCA1 as well as relays 234-DCA2 and DCA3. The operation of these three relays checks and signifies that data channel 0 is now idle. The operation of relay 234-DCA2 now opens its break contacts to release relay 297-DTMF1. Relay 297-DTMF also releases at the same time. The operation of relay 234-DCA3 opens its make contacts on FIG. 373 to release relay 373-CP0. The release of this relay, in turn, opens a locking path for relay 371-CFC for channel 0, to release it.

The release of relay 297-DTMF opens one path holding relay 248-TST1 through TST9 operated. The release of relay 371-CFC releases relays 297-SDTM and DTM. The release of relay 297-DTMF is also required for the release of relays 297-DTM and SDTM, since both of these relays can be held over the make contacts of either relays 297-DTMF or 371-CFC. The operation of relay 234-DCA3 also releases relay 373-RT0. The release of this relay, in turn, releases relay 368-RFC for channel 0. The operation of relay 225-DCA1 releases relay 279-CONN for channel 0. The release of this relay, in turn, releases relays 279-CON1 through CON4. It also releases relay 279-CONA. The release of relay 279-CONA reoperates relays 248-TST1 through TST9. The release of relays 297-SDTM and 225-OPRD0 releases relays 225-CHB and CHB1. The release of relay 225-CHB, in turn, releases relay 225-OPCB0 as well as the corresponding relays on the other G equipment rectangles, and releases relay 231-ORCB0 as well as the corresponding relays on the other J equipment rectangles. The foregoing operations have completely released the data channel from this call, and it is in idle condition and is available for the serving of subsequent calls. Also, the entire data

transfer circuit, including the position connector, is released at this time and is available for seizure by the other position circuits serving calls.

SUMMARY OF CALL PROGRESS

The description of the present call has progressed to the point where the trunk received from the rater, via the data transfer circuit, all the information needed by it during the initial-period portion of the call; and where the position received from the trunk, the rater, and the computer, all the information needed by the operator to serve the call at this point of its progress, which is the operator position seizure at the beginning of the initial period. Among the operator duties at this time are to notify the calling party of the initial-period charges and to then monitor their collection. Also, since the present call is assumed to be of the person-to-person type, the operator must ascertain the name of the individual at the called station with whom the calling party desires to converse and then, once the called station answers, to determine whether the individual specified by the calling party is available for conversation.

TRUNK FUNCTIONS FOR OTHER TYPES OF CALLS—DIAL 0 CALLS

It has priorly been described how the calling trunk, by means of the circuits on FIGS. 364 through 366, transmitted information via the data transfer circuit to the position and to the rater, and subsequently, how it received information back from the rater with the received information including the charge rate and the duration of the initial period in minutes. If the call had been of the dial 0 type, relay 362-TP40, rather than 262-TPA and 362-TPB, would have been operated and would have grounded conductor NZRC on FIG. 363 extending to FIG. 263A of the data transfer circuit. It also would have grounded conductor ZCN on FIG. 363 extending to FIG. 272B of the data transfer circuit. The ground on conductor NZRC comprises an initial request for an operator position, rather than a recall request for an operator position, while the ground on conductor ZCN signifies a dial 0 coin call. The ground on conductor ZCN is transmitted, via the circuitry of FIGS. 272B, 272, and 271 to FIG. 193 of the position circuit to operate relay 193-ZCN. Thus, the data channel and the position control circuits are notified that this is the initial request for the services of an operator from a coin subscriber on a dial 0 call. For this type of call, the sender releases when a satisfactory data transfer of the calling number information has been completed from the sender to the position circuit. The data channel checks the registered data and releases from the trunk, the sender, and the position control circuits. Relay 362-TP40 then releases.

CONTINUATION OF SUMMARY OF PROGRESS OF PRESENT CALL

It has been described how, on person-to-person calls and other similar type special toll calls, relays 362-TPA and 362-TPB operate and ground the following trunk conductors to the data channel: IP, CIP, 0IT0, 0IT1, and 0IT2, on a 1-out-of-3 basis, and two out of five of conductors 0TP0, 0TP1, 0TP2, 0TP4, and 0TP7. Conductor IP is on FIG. 366 and extends to FIG. 397A of the data transfer circuit. The grounding of this conductor indicates that this is the first request for the services of an operator. The grounding of conductor CIP on FIG. 363 extending to FIG. 372A of the data transfer circuit causes the data transfer circuit to associate the data channel with a rater, and subsequently with a coin computer after the rater has been released. The grounding of one of conductors 0IT0, 0IT1, or 0IT2 on FIG. 366, extending to FIG. 397A of the data transfer circuit, signifies the office index tens digit to the rater. The grounding of two out of five of the 0TP- leads on FIG. 366 extending to FIG. 397A of the data transfer circuit signifies the office index units digits to the rater. The office index is a two-

digit number, having possible values from 00 to 29, and is fixed for a particular trunk by means of cross connections. It serves to identify the originating office. These cross connections are shown on FIG. 366 and provide an office index tens digit of "1" and an office index units digit of "1" in the 2-out-of-5 code by grounding conductors 0IT1, 0TP0, and 0TP1.

Using the foregoing information and the called office code as received from the sender, the rater produced a rate treatment number which consists of three digits, ranging in value from 000 to 199. The rate treatment was derived by the rater, passed to the trunk over the data channel, and was stored in the trunk on relays 364-RTU- on a 2-out-of-5 basis for the units digit, 364-RTT- on a 2-out-of-5 basis for the tens digit, and 364-RTH0 or RTH1 for a hundreds digit of "0" or "1," respectively. The rate treatment number was also passed to and stored in the position control circuit in the manner described.

It has also been described how the rater provided information indicating the time duration of the initial period. This information was passed over the data channel to the position control circuit and to the trunk. In the trunk the initial-period duration is stored in the 365-M- relays on a 1-out-of-5 basis. There is a variation of one in the designation of a 365-M- delay with the correspondingly designated M- conductor. Thus for example, conductor M0 on FIG. 365 is connected to relay 365-M1 while conductor M4 is connected to relay 365-M5.

Also, the trunk has received by now, via conductors PP and STA extended through the data channel, an indication from the sender indicating whether a person-to-person or station-to-station call was dialed, by means of the operation of one of relays 364-PP or 364-STA. The present call is assumed to be of the person-to-person type, and therefore relay 364-PP was operated and locked. The sender produced the station or person indication from the prefix dialed. The prefix "0" indicates a person call and a prefix "1" indicates a station call. This information is also registered, via conductors PP and STA in the position control circuit, on relays 198-CSP and CNS, respectively, in the manner described. The data channel then releases its connection to the trunk, the sender, and the rater after the information transmitted to the trunk and the position has been checked by the data channel. Relays 362-TPA and TPB released as the potential was removed from conductor KPR on FIG. 356 by the data transfer circuit through the intermediary of the position control circuit.

It was then described how, since the present call requires charging information for the operator's use, a charge computer was called in by the data channel. Using the rate treatment number and the station-to-station or person-to-person mark stored in the position, the computer derived the data as to the amount of money required for the initial deposit and transmitted this information, via the data transfer circuit, to the position control circuit. After a subsequent data-check of the registration of this information in the position circuit, the data channel released itself from connection with the computer and the position control circuit and returned itself to normal, along with its associated connector circuits. At this stage of the call, the sender, the trunk, and the position control circuits remain interconnected only by means of the link circuitry.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—GENERAL

The position control circuit now uses the information it has received via the data transfer circuit to decide whether or not an operator should be called in on the connection. Special toll calls may be of different types, with an operator being required on certain, but not all, of the types. The types are as follows: (1) a rated 10-cent station-paid toll call, (2) a rated single-charge untimed call, (3) other rated calls, (4) a manually rated call, (5) free calls, and (6) vacant code calls.

INITIAL SEIZURE PERIOD WHEN RATER SENDS OUT MANUAL RATE, FREE CALL, VACANT CODE, OR TEN-CENT TOLL INDICATION WITH THE ASSOCIATED RATE TREATMENT

The priorly described initial period data transfer seizure covered conditions wherein the rater indicated that the services of a computer were required to determine the monetary charges for the initial period. However, when the rater indicates that a call is to be manually rated, is a free charge call, a vacant code call, or a flat 10-cent toll call, the services of a computer are not required. In such cases the initial period operations progress as priorly described up to the point where the rater data output has been transmitted to the position and trunk circuit, and a check is made that this information was properly registered therein, thereby operating relay 414-DOK3. The operation of relay 414-DOK3 with, for instance, the 404-10T relay operated as a result of the rater indicating that this is a flat 10-cent toll call, closes the following circuit to operate 182-DTOK of the position circuit: ground on terminal 102 of FIG. 276, make contacts 414-DOK3, break contacts 293-TBL, make contacts 404-10T, conductor DTOK extending from FIG. 276 to 274, conductors of channel 0, make contacts 225-OPRF0 on FIG. 274, make contacts 224-PF00, to conductor DTOK extending to FIG. 188 of the position circuit to operate relay 182-DTOK. This results in the release of the data transfer connection as priorly described for the initial period of a coin toll call once the 182-DTOK relay operates, except that, in addition, the relays associated with the sender and trunk are also released at this time, while in the previous description they had been released at the time the RDOK relay had operated.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—RATED TEN-CENT STATION-PAID TOLL CALL

For this type of call, the customer has dialed a station-to-station toll call to a point for which the initial-period charge is ten cents, and the calling number was received automatically from the local office. If the calling number were not received automatically, the rater would not manufacture a 10T mark and this special handling for this type of call would not result. In the case where the calling number was not automatically received, even though the initial-period charge is ten cents, the call would be handled in a normal toll call manner which would enable the operator to manually obtain the calling number so that it may be recorded on the AMA tape entry. The rater now transmits a 10T indication, via conductor 10T from FIG. 421, and via the data transfer circuit, to the position control circuit to operate relay 198-10T. The operation of this relay and the operation of relay 182-DTOK, in response to the receipt of the DTOK signal from the data transfer, as elsewhere described, closes a path to operate relay 172-STM. The operation of this relay, in turn, initiates a seizure of the transverter connector and transverter for the purpose of making an initial AMA entry, as previously described.

The operation of relay 198-10T and 182-DTOK also completes an obvious path to operate relay 170-PR. This relay, in turn, operates relay 176-PDA. The operation of relay PDA prepares a path to operate relay 170-PDB. The operating path of the PDB relay is subsequently completed either upon the receipt of a TVR signal from the transverter, indicating that a satisfactory AMA record has been made (operation of relay 172-TVR), or upon receipt of either an R0P or R0R signal from the transverter, indicating that a satisfactory AMA initial entry could not be made (operation of relays 172-R0P or 172-R0R), or upon release of the 181-TTMG relay, which indicates that the position control circuit had timed out while waiting for connections of a transverter. In the event that the initial entry cannot be made, or in the event that the position times out while waiting for a transverter, the call goes

on to completion without waiting for an AMA entry to be made.

No additional monetary deposit is required on these calls, and therefore there is no need to attach an operator to the calling connection. The rate treatment number for this type of call is always 000 or 100. The initial period can be from one to five minutes duration. Since charge information is not needed, the data channel would not have called in a computer. Upon release of the data channel, the position control circuit does not call in the operator but, instead, proceeds at once to perforate an AMA entry as elsewhere described.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—RATED SINGLE-CHARGE UN-TIMED CALL

In this type of call, the customer dials a station-to-station call, for which he is allowed a connection for an unlimited time period for the initial charge. This type of call is identified during the data transfer circuit functions by the rater. The trunk is accordingly advised by the operation of relay 364-NM. None of relays 365-M1 through M5 are operated on a call of this type. Upon the release of the data channel, the position control circuit attaches an operator, who then requests the deposit of the amount of money displayed on the position for the initial-period charge. At the end of the alerting tone interval transmitted to the operator, the TE relay in FIG. 169 operated. Operation of the TE relay will complete a path from ground through the make contacts of the TE relay, through the make contacts of the PRA relay, to operate the LL relay in FIG. 181 of the position control circuit. Operation of the LL relay in the position control circuit completes the paths for the various lamp indications transmitted to the operator at this time. If the particular coin call connected to the position at this time is a special toll class, the CSP relay will have been operated when the data transfer circuit transmitted information between the various connected circuits. Operation of the LL relay in FIG. 181 connects ground from terminal 101 through make contacts of 181-LL relay, break contacts of the 195-0VLP relay, through break contacts of the 198-NFY relay, through the break contacts of the 193-RCL relay, to the make contacts of the 198-CSP relay, to operate the special toll lamp in the position circuit over the CSP lead. If the call connected to the position was of the coin station class, the CNS relay shown in FIG. 198 would have been operated during the period of information transfer while connected to the data transfer circuit. In this case, when the LL relay operated, ground is connected from terminal 101 in FIG. 219 through the make contacts of the 181-LL relay, through the break contacts of the 195-0VLP relay, through the break contacts of the 198-NFY relay, through the break contacts of the 193-RCL relay, through the break contacts of the 178-CTT relay, through the make contacts of the 198-CNS relay, to light the coin station lamp in the position circuit shown in FIG. 219 over the CNS lead. Also, when the LL relay operates, ground through the normal contacts of the display called number, display calling number, and display rate keys, shown in FIG. 223 of the position circuit, is extended over the DMC lead to FIG. 186 of the position control circuit. This ground is then connected through the make contacts of the 181-LL relay, break contacts of the 178-CTT relay, the break contacts of the 198-MAN relay, break contacts of the 198-NFY relay, make contacts of 186-CRON relay, to operate the MCR relay in FIG. 186. Operation of the MCR relay connects the minutes-and-charge relays indicated in FIGS. 199A and 199B of the position control circuit to the translator relays shown in FIGS. 199 and 200 in the position control circuit. With the minutes-and-charge relays connected to the translator relays, the stored information in the minutes-and-charge registers operates the appropriate translator relays in FIGS. 199 and 200. Operation of the translator relays in FIGS. 199 and 200 of the position control circuit

completes a path from battery through the operated 2-out-of-5 translator relay contacts shown in FIGS. 210 and 211 of the position circuit to operate the appropriate indicator tubes shown in FIGS. 207 and 208 of the position circuit. The operator then requests the calling subscriber to deposit the amount displayed for the indicated initial period. After securing this deposit, the operator causes the initial entry to be perforated and releases from the call. The trunk then proceeds to the called party answer condition as subsequently described, and no further charges are required on such calls.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—OTHER RATED CALLS

These calls comprise the bulk of the special toll coin traffic served by this trunk. The presently described call is of this type. These calls may be either station-to-station or person-to-person calls and require timing and charging for the initial period as well as for the overtime intervals. Overtime is collected on a post-pay basis, either at the end of the call or at the end of 10 overtime periods. During the data transfer circuit operation, information is given to the trunk and to the position control circuit to provide for the proper timing and charging, as already described. The operator is connected after the data channel releases, as already described. The operator then secures the proper deposit for station calls, initiates an initial AMA entry, and then releases from the connection. For person-to-person calls, the operator additionally monitors the connection until the correct part is on the connection and then obtains the initial deposit, initiates the AMA entry, and releases from the connection.

When the subscriber advises the operator that the call which he has dialed is to be treated as a collect call or a special call, such as a charge-to-third-party, it is necessary for the operator to change the class of the call. The operator does this by a key operation at her position. Since the trunk has been primed with information for a prepaid type of call, it is necessary to release the data stored in the trunk and provide the trunk with new data peculiar to the new class of call. When the operator changes the call class, the trunk data is erased, as described hereinafter.

The operation of any of the billing class keys shown in FIG. 218 of the position circuit, other than the station-paid or person-paid key (or the no-charge key), results in the operation of relay 178-CTT of the position control circuit. The operation of this relay opens a path for relay 186-MCR, thereby releasing it. The release of this last relay extinguishes the minutes-and-charge display on the indicator tubes on FIGS. 207 and 208 of the position circuit. The minutes-and-charge display is extinguished at this time because there is no further need for it and since the information displayed thereby may not be appropriate for the new call class. The release of the 186-MCR relay is effective in extinguishing this display since it opens its make contacts on FIG. 200, thereby disconnecting the minutes register relays of FIG. 199B from the A- through K- translator relays on FIGS. 199 and 200, which, in turn, control the display of the indicator tubes on the position circuit.

After ascertaining that a proper connection has been established between the calling and called parties, the position operator operates the start-timing key (FIG. 213) at the position. The operation of this key extends a ground from the position over the STM lead through break contacts on relay 173-HPR, break contacts on relay 172-STMF, break contacts on relays 183-NCH, 172-TCMB, 181-TIFM, 198-COP, 204-LAC, make contacts on relays 204-NAC, 183-CLKA, 204-TRON, 192-ORON, break contacts on relay 172-STMA, make contacts on relay 183-SS, make contacts on relay 178-CTT, to operate relay 172-CTTA, which, in turn, causes the operation of relay 187-RRL. The operation of this latter relay, in turn, extends a signal over the TL- lead (FIG. 185), via the

position link and connector, to the trunk, to operate relay 356-RRL in the trunk circuit.

When relay 356-RRL of the trunk operates, it removes the locking ground for all the data information relays previously locked operated in the trunk. Referring to FIGS. 364 and 365 and recalling what has been previously described, it may be assumed that the following information relays were locked operated in the trunk: 364-RTH0, 364-RTT0, 364-RRT1, 364-RTU0, 364-RTU1, 364-PP, and 365-M4. Ground from terminal 101 in FIG. 365 through make contacts of relays 354-ON and 363-IP is removed by the break contact of relay 356-RRL to release relay M4. Ground from terminal 101 on FIG. 365 through the make contact of relay 354-ON is removed by the break contact of relay 356-RRL on FIG. 364 to release relays PP and RTH0. Ground from terminal 101 on FIG. 364 through the make contact of relay 354-ON is removed by the break contact of relay 356-RRL to release relays RTT0 and RTT1 and relays RTU0 and RTU1. Thus, data information previously stored in the trunk is now erased in preparation for a new data transfer connection. The release of relay 187-RRL removes the signal from the TL- lead to the trunk and releases relay 356-RRL in the trunk circuit.

The operation of the 187-RRL relay also causes relay 172-CTTB to operate. This relay, in operating, opens the operate path for the 187-RRL relay, thereby causing it to release. The shorted secondary winding of the 187-RRL relay delays its release momentarily. When the relay is fully released, a path is completed to operate relay 181-DTST. The path to operate this relay begins with ground on terminal 102 of FIG. 182, extends through make contacts 169-T, break contacts 191-OG, transfer break contacts 163-PLCA, transfer make contacts 169-TE, make contacts 172-CTTB and 172-CTTA, break contacts 170-PR, and then through the obvious path to the winding of relay 181-DTST, to operate it.

The operation of relay 181-DTST initiates a position-to-trunk seizure of the data transfer circuit, as elsewhere described. The operated 172-CTTB relay extends a ground over the FC lead of FIG. 198 to the trunk, via FIGS. 404, 405 and 405A of the data transfer circuit, to operate relay 364-CTT in the trunk, thereby canceling trunk timing. The trunk timing is canceled on collect or charge-to-third-party calls since the billing for such calls is handled in the conventional manner by the AMA equipment of the office.

Relay 181-DTST subsequently releases upon receipt of the DTOK signal from the data transfer circuit, as elsewhere described. The release of this relay, in turn, releases the start signal to the data transfer circuit, thereby releasing it. Also, upon receipt of the DTOK signal, a path is completed to operate relay 172-STM. This path begins with ground on terminal 110 of FIG. 172, break contacts 172-TCMB, make contacts 172-CTTB, 182-DTOK, and then through an obvious path to the winding of relay STM to operate it. The operation of this relay then initiates a seizure of the transverter connector and the transverter circuits to initiate the initial AMA entry. Upon receipt of a TVR signal from the transverter, the call then proceeds in a normal manner, as described in the following paragraphs.

The priorly described operation of relay 356-RRL of the trunk circuit releases the trunk register relays on FIGS. 364 and 365, thereby erasing the information currently registered in these relays. The subsequent release of trunk relay 356-RRL, and the subsequent data transfer circuit seizure, enters new trunk information into the trunk registers, in a manner similar to that previously described. However, it should be mentioned that the timer of the trunk is now disabled, in a manner which will be subsequently described, as a consequence of the operation of trunk relay 364-CTT over the FC lead from the position control circuit via the data transfer circuit. The trunk timing is canceled since the billing functions are either performed by the AMA equipment in the conventional

manner or by the operator, depending upon the specific nature of the call.

FEATURES OF POSITION AND POSITION CONTROL CIRCUITS

This section discusses the details of the position and position control circuits, above and beyond those discussed in the R. B. Curtis specification.

Referring to FIG. 219, the coin station lamp is illuminated whenever a coin-station-class call is connected to the position. A coin-station-class call is one in which a calling coin subscriber prefixes the dialing of his call with a "1" in order to indicate that station-to-station service is desired. FIG. 219 also includes a coin special toll lamp, which is colored red on the position in order to distinguish it from the noncoin special toll lamp also on FIG. 219. The coin special toll lamp is illuminated whenever a person-to-person class coin call is served to the position. A call of this type is initiated as a coin subscriber prefixes his normal dialing routine with a zero. FIG. 219 also includes an NFY lamp, which corresponds to a "notify" seizure of a coin call to the position. On a notify seizure of the position, the NFY relay shown in FIG. 198 of the position control circuit is operated during the data transfer interchange of information between the interconnected circuits. The NFY relay locks up through its own make contact, through the break contact of the 186-DRT relay, through the break contacts of the 186-RLMC relay, through the make contacts of the 181-PRA1 relay to ground. The NFY relay then completes a path from ground through the make contact of the 198-NFY relay to operate the NFYA relay in FIG. 198. The NFYA relay locks up through its own make contacts to ground through the make contacts of the 181-PRA relay. Upon operation of the LL relay in FIG. 181 as previously described, ground is extended from terminal 101 through the make contacts of the 181-LL relay, through the break contacts 195-0VLP, through the make contacts of the 198-NFY relay, to light the NFY lamp in FIG. 219 of the position circuit over the NFY lead. This lamp is lighted whenever a coin call is connected to the position at the end of the initial period. The operator's function on this type of seizure is to notify the customer that the initial period has ended and that he should signal when the call is ended.

The next lamp on this figure is the charges-due lamp, which is lighted under either of two conditions. A coin call is connected to the position on a charges-due seizure either when the call is terminated by the calling subscriber or when a maximum of ten overtime intervals have elapsed. On a charges-due seizure the CGD relay shown in FIG. 204 of the position control circuit is operated during the data transfer information interchange over the CD lead from the data transfer circuit. The 204-CGD relay locks up through its own make contact to the ground through the make contacts of the 181-PRA relay. Upon operation of the LL relay in FIG. 181 as previously described, ground is extended from terminal 101 in FIG. 219 of the position circuit, through the make contacts of the 181-LL relay, the break contacts of the 195-0VLP relay, to the make contacts of the 204-CGD relay, to light the charges-due lamp in the position circuit over the CGD lead. The lighting of the charges-due lamp on the position indicates to the operator that this is a charges-due seizure and it is necessary for the operator to supervise the collection of charges at this time.

The tax or no-tax lamp on FIG. 223 is lighted, respectively, to indicate either that a tax or no-tax increment is included in the charge display illuminated at the position at this time. The advance deposit lamp on FIG. 223 is lighted when the coin call is connected to the position on a seizure for which the operator must collect the charges in advance before releasing from the connection and allowing the parties to converse.

The coin-collect coin-return keys on FIG. 213 are used to send a coin-collect or coin-return signal to the coin trunk. Operation of the coin-collector, coin-return keys in FIG. 213 will extend ground over the CC or CR lead, respectively, to the position control circuit in FIG. 186. The CC lead is then extended to FIG. 185 through make contacts on the 169-T0 to 2A relays, and is then extended over the CC lead to the trunk circuit, via the position link and connector circuit, as indicated in FIG. 165. The CR lead is extended from FIG. 186 to FIG. 185 through break contacts on relay 191-0G, and through make contacts on the 169-T0 to 2A, and is then extended over the KPT lead through the position link and connector to the associated trunk circuit. The ground signal on either the CC lead or the KPT lead to the trunk will operate either the CC or CR relay, respectively, in the trunk circuit. Operation of either the CC or CR relay in the trunk will result in the collection or return of the deposited coins at the calling station.

If the operator desires to display the stored rate treatment information on the indicator tubes, operation of the display rate key shown in FIG. 223 of the position circuit will extend a ground over the DRT lead to FIG. 186 of the position control circuit through make contacts of the 186-RRON relay to operate the 186-DRT relay. The DRT relay in operating completes a path to operate the 186-RTR relay over the obvious path. Operation of the 186-RTR relay closes through the rate treatment registers in FIG. 199A to the translator relays in FIG. 200. When the display rate key in FIG. 223 was operated as previously described, ground is removed from the DMC lead, which in turn causes the release of the MCR relay in FIG. 186. Release of the 186-MCR relay removed the minutes-and-charge register shown in FIGS. 199B and 199A from the translator relays of FIGS. 199 and 200 in the position control circuit. Removal of the minutes-and-charge register relays from the translator relays, in turn, causes the extinguishing of the minutes-and-charge display information on the indicator tubes shown in FIGS. 207 and 208 of the position circuit. Upon connection of the rate treatment registers through the 186-RTR relay contacts to the translator relays in FIG. 200, the corresponding translator relays 200-H0, 1, 2, 4, and 7, 200-J0, 1, 2, 4, and 7, and 200-K0, 1, 2, 4, and 7, will operate on a 2-out-of-5 basis corresponding to the stored information in the rate treatment registers. Operation of the H, J and K translator relays on a 2-out-of-5 basis will complete a path from battery through the operated contacts of the translator relays to operate the appropriate indicator elements on the H, J, and K indicators, respectively, in FIG. 208 of the position circuit. The rate treatment is displayed as long as the position operator holds the display rate key in FIG. 223 operated. Upon release of the display rate key, the ground will be removed from the DRT lead, in turn, resulting in the release of the DRT relay in FIG. 186 of the position control circuit. Release of the 186-DRT relay in turn releases the 186-RTR relay, which then in turn causes the removal of the rate treatment registers from the translator relays in FIG. 200. At the same time, upon release of the display rate key, ground is again extended over the DMC lead in FIG. 186 to the 186-MCR relay to operate the 186-MCR relay over the path previously described. Operation of the 186-MCR relay again connects the minutes-and-charge registers in FIGS. 199A and 199B to the translator relays in FIGS. 199 and 200, resulting in the display of the minutes-and-charge information on the indicator tubes shown in FIGS. 207 and 208 of the position control circuit.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—MANUALLY RATED CALLS

There are a number of calls for which the rater cannot provide a rate treatment number in response to the information received. Upon release of the data channel,

the operator is connected on such calls and receives an indication that the call must be manually rated. The rater now grounds the MAN lead on FIG. 421 extending to FIG. 406 of the data transfer circuit, to the rectangle representing rater 0, and via FIGS. 405 and 404 to the rectangle representing position 00, to operate relay 198-MAN in the position control circuit. The operation of this relay connects interrupted ground through make contacts of relay 181-INT, make contacts of relay 198-MAN, break contacts of relay 178-OTT, and make contacts of relay 181-LL, to the RTL lead on FIG. 218 of the position circuit to flash the "rate" lamp on that figure, thereby indicating to the operator that it is necessary to manually rate the call.

The operator, having been apprised that the call requires manual rating, determines the rate treatment number from available information manuals, and keys this rate treatment number into the position control circuit, as described in the following paragraphs.

The KP rate key shown on FIG. 220 and the associated KP rate lamp on FIG. 223 are utilized by the operator to key-pulse the derived rate treatment into the position control circuit. Operation of the KP rate key shown in FIG. 220 of the position circuit extends ground over the RS lead and KPRT leads to the position control circuit in FIG. 184. Ground on the RS lead operates the RS relay over the obvious path. The 184-RS relay locks up to make contacts of the 184-RS relay, through the break contacts of the RLTR-204, through break contacts of the 192-RLOR, through break contacts of the 186-RLRR, through the make contacts of the 181-PRA1 relay to ground. Ground on the KPRT lead operates the KPR relay over the obvious path. The KPR relay in FIG. 184 locks up through the break contacts of the 184-ST relay, break contacts 187-STMR relay, through make contacts 184-KPR relay, through break contacts of the 184-KPB relay, through break contacts of the 175-TRW relay, through break contacts of the 191-OG relay, through break contacts of the 184-HPR1 relay, through make contacts of the 181-PRA1 relay to ground. Operation of the RS relay opens the locking path for the steering relays AS through MS shown in FIG. 174 of the position control circuit to release any steering relay that is operated. With all the steering relays released, a path is completed from ground on terminal 101 in FIG. 174, through make contacts of the 184-RS relay, through break contacts of the 174-RS1 relay, through break contacts on the 174-AS, through 174-MS steering relays, to operate the 174-RS1 relay. The RS1 relay in operating locks up through its own make contacts, through the make contacts of the 184-RS relay to the ground on terminal 101. Operation of the RS1 relay completes a path from ground through break contacts of the 172-TBA relay, through make contacts of the 174-RS1 relay, through break contacts of the 184-KPB relay, through break contacts of the 184-KBF relay, through make contacts of the 184-KPR relay, to operate the KPI relay in FIG. 177. The KPI relay locks up through an obvious path to ground through its own make contacts. The KPI relay in operating extends ground through make contacts on the 177-KPI, through make contacts of the 174-KPR, to operate relays KPR1 and KPR2 in FIG. 177. Operation of the 177-KPR1 relay completes a path to operate the JS steering relay in FIG. 174 of the position control circuit. The path is as follows: from ground through make contacts of the 174-RS1 relay, through break contacts of the 169-T5 relay, through make contacts of the 177-KPR1 relay, through break contacts of the 174-JS relay, to operate the 174-JS relay. The 174-JS relay locks up through its own make contact, through the chain circuit of break contacts of the succeeding normal steering relays 174-KS through 174-MS, respectively, through the make contacts of the 174-RS1 relay, through the make contacts of the 167-P0A relay to ground. Operation of the 177-KPI relay also completes

a path to operate the RLRR relay in FIG. 186. The path is as follows: from ground through the make contacts of the 177-KPI relay, through the make contacts of 184-RS relay, through the make contact of the 184-KPI relay, to the winding of RLRR relay. Operation of the 186-RLRR relay opens the locking path for the rate treatment register shown in FIG. 199A of the position control circuit. This causes any operated relays in the rate treatment registers RH0, 4, 1, and 7, the RT0, 1, 2, 4, and 7, and the RU0, 1, 2, 4, and 7 relays in FIG. 199A to be released. This ensures that no false information is stored in the rate treatment register prior to the operator keying. Release of any operated rate treatment register relays, in turn, ensures the release of the RRON relay shown in FIG. 186 of the position control circuit since none of the 199A-RU0, 1, 2, 4, 7 relays will be operated. With the 186-RLRR relay operated and the 186-RRON relay released and the 174-JS steering relay operated, the lock path for the RS relay in FIG. 184 is removed, therefore causing the release of the 184-RS relay. Release of the 184-RS relay in turn removes the locking path for the 174-RS1 relay, causing it to release. However, the locking path for the operated 174-JS steering relay is maintained over the break contacts of the 184-RS relay and the make contacts of the 181-PRA1 through the make contacts of the 167-P0A relay to ground, ensuring the holding of the 174-JS steering relay during this releasing sequence. Release of the 184-RS relay also causes the release of the 186-RLRR relay by opening the make contacts of the 184-RS relay. Upon release of the 184-RS relay, a path is completed from ground in FIG. 222 of the position control circuit, through the break contacts of the 174-BE relay, the break contacts of the 184-RS relay, through the make contacts of the 184-KPR relay, over the KPRL lead to light the KP rate lamp in the position circuit shown in FIG. 223. Lighting of the KP rate lamp indicates to the operator that the position control register circuitry is prepared for the reception of the three-digit rate treatment code. The operator may then proceed to key in the three-digit rate code. The digit information for a particular rate treatment digit will be extended from ground at FIG. 217 through an operated 2-out-of-5 combination of the 217-R0, 1, 2, 4, 7 relays over the 0, 1, 2, 4, 7 leads to FIG. 175 in the position control circuit. These leads are then extended as the PR' lead through FIGS. 181, 187, 188, 189, and 195, to FIG. 201. The leads are then extended through the make contacts of the 174-JS steering relay, through the make contacts of the 177-KRP1 relay, to the rate hundreds, tens, and units registers shown in FIG. 199A. The first digit keyed by the operator can only be a zero or a one and is stored in the rate hundreds register, composed of the RH0, RH4, RH1, and RH7 relays, respectively. If the operator keys, for example, a zero as the first digit, the 4 and 7 leads will be grounded from the position circuit FIG. 217. The 7 lead will be extended from FIG. 201 to FIG. 199A as the RTH0 lead to operate the 199A-RH7 register relay, which in turn locks up through the obvious path. Operation of the 199A-RH7 relay completes a path to operate the 199A-RH4 relay over the obvious path. The 199A-RH4 relay in turn locks up to the obvious lock path. Upon keying by the operator, the steering circuit shown in FIG. 174 is advanced in the conventional manner so that the circuitry is prepared for the reception of the second, and eventually the third, rate treatment code digit. Upon storage of the three-digit rate treatment in the position control circuit registers, as shown on FIG. 199A, the operator operates the start-timing key shown on FIG. 213. The operation of the start key, in the manner hereinabove described, sends a start signal to the position control circuit to operate relay 187-RRL. The operation of this relay, as hereinabove described, sends a rate-release signal over the TL- lead to the trunk to operate relay 356-RRL, via the position link circuitry interconnecting the trunk and the position.

The operation of relay 356-RRL causes the release of data information currently stored in the trunk, in the manner previously described.

Relay 187-STMR also operates at this time. The operation of this relay, in turn, operates relay 186-RLMC. The operation of this latter relay results in the release of any information that might have been stored in the minutes-and-charge register on FIG. 199B of the position control circuit. The 187-STMR relay, in operating, causes the release of relay 184-KPR. The release of the KPR relay removes the operating path for the 187-RRL relay, which then slow-releases in about 150 milliseconds. With the RRL relay fully released, a path is then completed to operate relay 181-DTST. The operation of this relay, in turn, initiates a seizure of the data transfer circuit for the interconnection of the position control circuit and the computer, which then determines the appropriate time and monetary charges for the new rate treatment keyed in by the operator.

Upon receipt of this new time and charge information from the computer, a DTOK signal is received from the data transfer circuit as previously described. The receipt of this signal causes the position control circuit to remove its start signal to the data transfer circuit, thereby releasing that circuit in turn. The time-and-charge information received during this seizure of the data transfer circuit is stored in the minutes-and-charge registers on FIG. 199B. This new information is also automatically displayed on the indicator tubes of the position circuit on FIGS. 207 and 208.

The operator now proceeds to serve the call in the normal manner, as elsewhere described. The minutes-and-charge lamps on FIG. 218 are now energized to indicate that the information currently displayed by the indicator tubes comprises minutes-and-charge information. The rate lamp on FIG. 218 is used for two purposes. First of all, it indicates that the information currently displayed by the indicator tubes is the rate treatment requested by the operator under control of the display rate key on FIG. 223. Secondly, the rate lamp may be flashed whenever the rater determines that this is a manual rate call, and it is the operator's function to determine the rate treatment and key the rate treatment into the position as just described.

Whenever the operator wishes to display the rate treatment on the indicator tubes, the operation of the display rate treatment key on FIG. 223 causes the 186-DRT relay to operate. The operation of this relay, in turn, causes the operation of relay 186-RTR. The RTR relay, in operating, cuts through the leads from the rate treatment register relays on FIG. 199A to the translator relays on FIGS. 199 and 200. The corresponding translator relays operate in accordance with the stored information in the rate treatment register relays, thereby causing the lighting of the appropriate indicator tubes on FIGS. 207 and 208.

Whenever a coin DDD class call is connected to the position, and no other information is being requested by the position operator, ground through the break contact of the display rate key on FIG. 223 of the position circuit, over the DMC lead, operates the 186-MCR relay. This relay, when operated, cuts through the information stored in the minutes-and-charge registers on FIG. 199B to the display translator relays on FIGS. 199 and 200 to operate the corresponding translator relays on these figures. This results in the minutes-and-charge information being displayed on the appropriate indicator tubes of FIGS. 207 and 208.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—VACANT CODE AND FREE CALLS

For either of these calls, only the 364-CTT relay and one of relays 364-PP or STA will be operated during the data transfer circuit operation. An operator is not

called in on either of these calls by the position control circuit.

When the call is initially connected to the position circuit and either a free call mark or a 10T mark is received from the rater through the data transfer circuit, the corresponding FC or 10T relay on FIG. 198 is operated. The FC relay, in operating, completes a path to operate relay 170-PR. The PR relay, in turn, operates relay 176-PDA. A path is now closed to operate relay 170-PDB. The operation of this relay then causes the position to be released from the connection, as previously described.

The operated relay 364-CTT eliminates the trunk timing of the call in a manner to be described later. When the data transfer circuit performs a data check, the data channel releases and the sender is allowed to proceed with its marker functions as subsequently described. In the case of a vacant code call, the data transfer circuit has passed a vacant code mark from the rater to the sender. When the sender proceeds with its marker functions in this case, it will indicate to the marker that this was a vacant code for routing to a special announcement trunk.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—CLASS CHANGE

When either a coin station or a coin special toll call is connected to the position, as indicated by either the operation of relay 198-CNS or 198-CSP, the associated coin station or special toll lamp on FIG. 219 of the position circuit is lighted. Assuming that the call connected to the position is a coin special toll class call, the coin special toll lamp will be lighted on the position. If when the operator requests information from the customer, the customer decides that he prefers to make this call on a station-paid basis, the operator will then operate the station-paid key on the position. Operation of the station-paid key on FIG. 218 of the position results in the operation of the 183-SP relay of the position control circuit. The SP relay operating completes a path to operate relay 198-CNS. With both the CNS and the CSP relay operated, a path is completed to operate relay 187-RRL. The operation of the RRL relay, as hereinabove described, sends a rate-release signal to the trunk circuit over the TL- lead, via the position link, thereby causing relay 356-RRL to operate. The operation of relay 187-RRL operates relay 186-RLMC. The operation of this relay causes the release of the information stored in the minutes-and-charge registers of FIG. 199B and thus causes the display on the indicator tubes of the position circuit to be extinguished. Upon release of the stored minutes-and-charge information, as indicated by the release of relay 186-CRON, a path is completed to operate relay 187-SCC. This relay, in operating, causes relay 198-CSP to release. The release of this relay results in the removal of the operating path for relay 187-RRL, thereby enabling it to slow-release. When the relay is fully released, a path is completed to operate relay 181-DTST. The operation of this relay initiates a seizure of the data transfer circuit for the attachment of the computer in order to determine the time and charges for the new class of the call. The newly received time-and-charge information is stored in the appropriate register relays on FIG. 199B. This new information is also displayed on the indicator tubes of FIGS. 207 and 208. The remaining portion of the call proceeds in the conventional manner, as elsewhere described.

On the other hand, if the call connected to the position was of the coin station class, the coin station lamp would be lighted on the position when the call has been connected to the position. Under this condition, if the customer then decides to make the call a person-paid class, when the operator depresses the person-paid key shown on FIG. 218 of the position circuit, the ground

will be extended over the PP lead to operate relay PP in

FIG. 183 of the position control circuit. Operation of the PP relay will, in turn, cause the operation of relay CSP shown on FIG. 198 of the position control circuit. Again, with both the CNS and the CSP relays operated, a path will be completed to operate the RRL relay shown on FIG. 187 of the position control circuit. The remaining sequence of operation of the circuit is as previously described. On completion of the data transfer seizure, the coin special toll lamp will be lighted on the position circuit, and corresponding time and charge information for a person class call will be displayed on the appropriate indicator tubes shown on FIGS. 207 and 208 of the position circuit. The remaining portion of the call proceeds in the conventional manner, as elsewhere described.

INITIAL PERIOD SEIZURE WHEN OPERATOR KEYS RATE TREATMENT OR CHANGES CLASS OF CALL

The priorly described data transfer circuit initial period seizure covered conditions wherein the services of a rater were required prior to calling in a computer to determine and furnish the monetary charges, or the services of a computer were not required, as is the case on flat 10-cent toll charge calls, free calls, etc. However, there are cases wherein the operator, after having received the monetary charges, is required to cancel these charges as registered in the position and request the services of a computer to recalculate the charges based on changed conditions of the call. That is, the class of call indication may have to be changed by the operator upon instruction from the subscriber, in which case the operator cancels the registered class of call and keys in a new class. Also, the operator may be required to manually rate the call upon instructions from the rater, in which case the operator keys in the required rate treatment in the position.

In either event, the position initiates a new request for the services of a computer, via the data transfer circuit, so that new monetary charges based on the new conditions may be posted in the position and the new conditions be indicated and registered in the trunk.

The process of these calls through the data transfer circuit is the same as for the initial period seizure of a regular coin toll call, as priorly described, up to the point where the trunk connector is attached, thereby operating the 266-TP0 relay. No sender is attached to this call, so no attempt is made to connect to one by the data transfer circuit, it having received an NSA mark (no sender attached) from the position over the NSA lead. In addition, the 370-CST relay is operated from a negative battery potential received from the position over the CST lead through make contacts of the 224-OPC0 relay, make contacts of the 225-OPRC0 relay, to the winding of the 370-CST relay to operate it.

The operation of the 370-CST and 266-TP0 relays constitutes an instruction to the data channel to request the services of a computer, as priorly described. The action of the data transfer circuit from here on in is the same as priorly described for the regular initial data transfer circuit seizure, with the computer transmitting the required monetary charge data to the position register and the position circuit transmitting any revised data to the trunk, after which the data transfer circuit is disconnected from the call in a similar manner as priorly described.

PROGRESS OF SPECIAL TOLL CALLS AFTER RELEASE OF DATA CHANNEL—DIAL 0 CALLS

Dial 0 calls result from the subscriber dialing the digit 0 and no other digits from a coin telephone, usually in a step-by-step office as previously described. Also, as previously described, the DP register recognizes that no digits are being dialed by the calling party and "times out." After time-out, it seizes the data transfer circuit for connection to a sender and informs the sender that no digits were dialed by the calling party. The sender by now has recognized, by means of the ANI information

received, that a directing digit of "0" was dialed by the calling party. From this, as well as from the no-digits indication received from the register, the sender now knows that this is a dial 0 call. Therefore, immediately after the receipt of the calling station number, via the ANI operation, the sender transmits a position-request signal to the trunk. When the position control circuit is attached by means of the position link, a data transfer seizure is made and the positive 130-volt potential is passed to the trunk over its KPR lead and on to the sender over the SPI lead, all as previously described. At this time, relay 362-ND is operated in the trunk and the 362-TP40 relay is operated for a connection to a data channel. The operation of relay TP40 connects the necessary trunk information leads to the data transfer circuit to apply output information pertaining to a dial 0 call to the data transfer circuit. The data transfer circuit at this time interconnects the trunk, a sender, and a position control circuit, and the dial 0 information from the trunk circuit is transmitted to the position control circuit. After the completion of a satisfactory data transfer, the data channel releases and an operator is brought in on the connection to assist in the completion of the call.

When the dial 0 call is connected to the position via the position link, the 193-ZCN relay is operated. The operation of this relay extends a ground to the position circuit to light the dial 0 coin lamp on FIG. 219. The lighting of this lamp indicates to the operator that a dial 0 coin class call has been connected to the position.

After talking to the subscriber, the operator either completes the call forward from the position or transfers the call to a cord board switchboard, as described in the aforementioned R. B. Curtis specification. If the dial 0 call is to be completed from the operator position, the call will then be treated as a station-to-station or a person-to-person call and may be further classified as prepaid, collect, or special. Since the 362-ND relay has been operated and locked for a dial 0 call, the trunk cannot time the call. Therefore, it becomes necessary for the operator to manually time all dial 0 calls that are prepaid calls. This the operator will do by retaining control of the connection by means of a locked-link arrangement, as described in the Curtis specification.

When the operator has obtained the called number, the operator sets it into the position control circuit with the key set. The operation of the start-timing key at the position sends a ground to the trunk over the RF lead via the position link, thereby operating trunk relay 355-SR. This relay, in operating, causes a "start" signal to be given to the sender link, and a new sender is connected in the conventional manner. However, the SR relay, operated, causes a ground from terminal 103 on FIG. 362 to be passed to the sender on the FR lead of FIG. 353 as a signal that the called number will be forwarded from an operator position and not from the originating office. The sender grounds conductor CO extending to FIG. 353 of the trunk, thereby operating relay 353-T as a sender-attached signal. Relay 353-T, operated, in turn, operates relay 351-T1. The operation of the T relay removes the ground from conductor FR and, at the same time, prepares a path for the sender to send a signal that it is ready when it sends a ground to the trunk on the FR lead. This signal from the sender is then forwarded to the position control circuit as a sender-attached signal. The path of this sender-attached signal may be traced as follows: ground from the sender to lead FR of FIG. 353, through transfer make contacts of relay 353-T, transfer break contacts of relay 351-FA, through FIGS. 356 and 359, through transfer make contacts of relay 355-SR, transfer break contacts of relay 359-RA, and transfer make contacts of relay 353-T, through FIG. 359, to FIG. 356 on the SA lead, and via the position link and connector circuit to the operator position.

The position control circuit now bids for a data channel and causes the trunk and the sender to attach them-

selves to the selected channel in the usual manner. The called number is passed to the sender over the data channel. After a satisfactory data transfer operation, the data channel releases from the trunk, the sender, and the position control circuit. The sender now proceeds with the marker functions as described in the Curtis specification, and as described elsewhere in the present specification in some further detail.

The operator now monitors the call to determine that a proper connection is made, such as for example, on a person-to-person call. The operator then requests and supervises the initial deposit, initiates the perforation of the initial AMA entry, and, for prepaid calls, places the connection on a locked-link basis. Collect and special calls may be released from the operator position if an AMA charge entry has been made. In either case, the 362-ND relay of the trunk remains operated and the timing functions of the trunk are disabled.

MARKER FUNCTIONS

The marker functions described in the following paragraphs supplement those described in complete detail in the aforementioned R. B. Curtis specification. Reference is therefore made to that specification for marker operations affecting the sender and which are not described in detail herein.

When the sender proceeds with marker functions, it seizes an idle marker and passes to it the information necessary to establish linkage to the proper outgoing trunk. When the marker has been seized, the sender grounds lead DC on FIG. 353 to the trunk, thereby operating relay 353-F and, in turn, operating relay 351-FA from ground on terminal 102 of FIG. 351. Leads M and M1 on FIG. 350 are grounded by the trunk, and the ground received on lead DC on FIG. 353 from the sender is connected to the LC lead of the trunk circuit, extending to the trunk link and connector, to assist the trunk link connector in identifying the incoming calling trunk. Leads S and SL on FIG. 350 are connected together by the trunk for use by the marker. The FT and FR leads on FIG. 353 are cut through to the sender at this time for use in outpulsing.

The marker sets up the linkages forward and releases relay 353-F of the trunk by causing the sender to remove the ground extended to the trunk on conductor DC to FIG. 353, as described in Curtis.

The sender outpulses the called number and then grounds the D lead on FIG. 353, thereby causing the operation of relay 351-D which, in turn, operates relays 351-D2 and 358-D1; and relay 358-D2, in turn, operates relay 351-D3. The 351-D relay locks under control of operated relay 354-RVR from ground on terminal 104 of FIG. 351 as well as under control of several other operated relays, as subsequently explained, and as is obvious from an inspection of FIG. 351.

When the 358-D1 relay operates, the DC conductor on FIG. 353 extending to the sender, via the sender link, is grounded from ground on terminal 102 of FIG. 353 as a signal that the D- relays have operated. The sender removes ground from the CO lead, thereby releasing relays 353-T, 351-T1, and 351-FA. Ground is then removed from the DC lead on FIG. 353 by the release of relay 353-T, and the sender then releases as described in Curtis.

The unoperated 349-CS relay is now closed through towards the distant office by the operated 358-D1 relay. The CS resistor is shunted out of the CS path at this time. The trunk now awaits an answer by the called party.

When relay 351-D operated, it locked to ground under control of break contacts of relay 355-RLF1, through make contacts 354-RVR and 362-BA. As soon as relay 358-D1 operated, an additional holding path was provided through the make contacts of the D1 relay and break contacts 357-CH1 and 364-CTT. Thus, the D relay is locked operated, but not under direct control of the calling subscriber (if relay 364-CTT is not operated). When relay

357-CH1 operates, under control of ground via lead CC from the timer, as will be hereinafter described, direct control of the 351-D relay reverts to the calling subscriber. The function of relay 355-RLF1 is explained subsequently in connection with the release forward and timed release operation.

The arrangement just referred to for locking the 351-D relay is involved in the following functions of the trunk: subscriber's recall, cancel trunk timing, operator position attached, releasing forward, and normal trunk release. In general, it is required that the connection be held by the calling subscriber through control of the release of the 351-D relay. There are two exceptions to this generalization. These are the conditions which exist when an operator position is attached, and the condition under which the subscriber is permitted a recall privilege. With reference to FIG. 351, it may be seen that the operation of relay 355-PA1 closes a locking path for relay 351-D which is independent of the state of relay 362-BA. Thus, the calling subscriber cannot control the release of the trunk if an operator is attached. Also, with reference to FIG. 351, it can be seen that a third locking path for relay 351-D is provided through break contacts of 357-CH1, 364-CTT, and make contacts of 358-D1. This path also provides a separate lock of the 351-D relay which is independent of the calling subscriber control. As will be explained later, the operation of relay 357-CH1 indicates the termination of a period during which the calling subscriber is allowed to recall an operator to the connection. Since this recall function results from a flashing on-hook signal by the calling subscriber, it is necessary that relay 351-D be locked independently of the make contacts of 362-BA for such a duration of time in which the recall privilege is to be allowed. Also, with reference to FIG. 351, it may be seen that the operation of relay 364-CTT places the control of the 351-D relay under control of the calling subscriber, and also eliminates the recall privilege. This is the condition that prevails in the case of free calls or calls to vacant code. In the peculiar case of the un-timed call, relay CTT is only operated after a certain passage of time, as is hereinafter described. Again, with reference to FIG. 351, it may be seen that the break contact of 355-RLF1 causes the release of relay 351-D under all conditions. Relay 355-RLF1 is under direct control of the operator and is caused to operate at such time as the operator wishes to cause a release of the connection forward. The make contact of relay RVR provides a portion of the locking path for relay 351-D until such time as a normal release of the trunk is required.

In establishing a dial 0 call, the functions of the sender, the marker, and the trunk are essentially the same as just described. The 362-ND relay is operated by the register on any call for which no digits are outpulsed to the tandem office. This relay, when operated, remains locked under control of relay 359-RA, operated, and 358-D1, normal, to ground on terminal 362-105. If a call for which no digits are received by the tandem office was preceded by the dialing of the prefix 0, the sender will be advised of this fact by the originating office, via the ANI start signal, and will signal for the attachment of an operator position. The ND relay remains locked under control of the operated 356-PA relay during the interval between the operation of the 358-D1 and 351-D3 being finally locked to 351-D3. In this case the relay 359-RA is released by the operation of relay 355-PA1.

The operated 362-ND relay performs certain functions for the dial 0 call which should be noted here. It provides for the operation of relay 362-TP40, instead of relays 362-TPA and TPB, as previously described. It prepares operating paths for relay 355-RF in response to a signal applied to conductor RF extending from the position link circuit to FIG. 356, and for relay 355-CBST in response to a signal applied to lead RLF extending from the position link circuit to FIG. 356, by way of its make contacts. These relays respond to signals on their respective leads

for the purpose of establishing ring-forward signals or transferring to cord board, respectively, under operator control. The operation of relay 362-ND, by means of its break contacts, opens the operate path of relay 363-IP since a dial 0 call does not require an initial-period mark. The operation of relay 357-STT is also prevented by the opening of break contacts of the 362-ND relay since trunk timing is not required for this class of call.

A path is also provided to hold operated relay 351-PR if the sender times out and releases before the position is attached. This path is found on FIG. 351, as follows: ground from terminal 105, through make contacts 362-ND and 351-PR, break contacts 355-PA1 to winding of the PR relay. There is also a path to force the operation of relay 351-PR if the sender releases without requesting a position while the 362-ND relay is operated. This path is also found in FIG. 351. It consists of ground from terminal 101 through transfer break contacts 351-D, break contacts 353-T, make contacts 351-T1, 362-ND, 359-RA, and break contacts of 355-PA1 to the winding of relay PR. The latter two functions of the ND relay are provided to give a maximum assurance that an operator will be attached to a call resulting from a dial 0 signal in the event that difficulty is encountered in the sender or in the sender's action in securing a position attachment.

An examination of the locking path of relay ND on FIG. 362 shows that it is dependent upon the overlapping of operated relays 359-RA, 356-PA, and 351-D3. In the normal progress of a dial 0 call, such an overlap exists, insofar as relay 356-PA will operate before relay 355-PA1, which causes the release of relay 359-RA, thus transferring the locking path of relay 362-ND to relay 356-PA. Subsequently, relay 351-D3 should normally operate before the release of relay 356-PA. In this manner, relay ND remains locked for the duration of the call. If, however, the sender detects the presence of a call prefixed by the digit 1 with no digits dialed, commonly referred to as a 1-call, the sender will not provide the position-request signal to operate relay 351-PR of this trunk, followed by the operation of relay 356-PA as previously described. Instead, the sender will proceed with an arrangement to route the call to a tone trunk, causing the operation of relays 351-D, 358-D1, 351-D2, and 351-D3, in that order. As a result, there will be an interval during the time following the operation of relay D1 and the subsequent operation of relay D3, during which the locking ground for relay 362-ND will be removed and that relay will release. This arrangement is provided since this call, which is being routed to a tone trunk, does not require certain features provided by the operation of relay 362-ND.

PERFORATION OF THE INITIAL AMA ENTRY

This trunk can make an AMA record for all chargeable calls whether they are customer-dialed or dial 0 calls, except for those calls which are transferred to a cord board operator. The perforation of the initial AMA entry is controlled by the operator on all calls, except in the case of 10-cent station-paid ANI toll calls which are not routed to an operator, as previously discussed. The functions usually performed by the sender in making initial entries are now performed by the position control circuit under the direction of the operator. The position control circuit performs these functions without the aid of an operator only for the aforementioned 10-cent station-paid toll calls.

Seizure of the transverter connector and subsequent transverter circuits by the position control circuit for purposes of making the initial AMA entry are initiated by the operator on operation of the start-timing key shown on FIG. 213 of the position circuit. Operation of the start-timing key will extend the ground over the STM lead, as described in the Curtis specification, to operate the STM relay shown on FIG. 172 of the position control circuit. In the network for operating the STM relay on FIG. 172,

there are various check circuits which have to be satisfied before the relay will be operated by the start-timing key. The checks involved are as follows: an originating number must be registered in the position control circuit registers; a terminating, or called, number must also be registered in the position control circuit registers; the operator must have operated one of the billing class keys indicated by the operation of the CLKA relay shown on FIG. 183 of the position control circuit; either an LAC or an NAC mark must be stored in the position control circuit; and on other than station special, station paid, or station enterprise billing classes, it also must be ensured that the terminating subscriber has been reached, as indicated by the 176-TS00 to 176-TS02 relays being released. If all of these check conditions are satisfied, the 172-STM relay will then operate. If any of the required check information is missing, rather than operating the STM relay upon operation of the start-timing key, a path will be completed to operate the STMF relay shown on FIG. 172 of the position circuit. Operation of the STMF relay will indicate a "start-timing failure" condition which will result in the start-timing lamp shown on FIG. 213 of the position circuit being flashed at 120 i.p.m. This flashing lamp signal will be an indication to the operator that the proper information required for the initial AMA entry is not registered in the position control circuit. The operator will then proceed to provide any information that may be missing, and then start the AMA entry by reoperating the start-timing key. The 172-STM relay will then operate as previously described. Operation of the STM relay will, in turn, operate the STMA relay which, in turn, will operate the STMB relay shown on FIG. 172 of the position control circuit. The STMA relay, in operating, will provide a start signal over the STV and CBS leads on FIG. 172 to the transverter connector to obtain connection to an idle transverter. When the transverter has been seized by the connector, a TVA signal will be extended to the position control circuit over the TVA lead on FIG. 172 to operate the 172-TVA relay in the position control circuit. Prior to the operation of the TVA relay, the STM relay completed a path to start the timing function of the TM tube timer, shown on FIG. 171, to time the interval required for the attachment of a transverter. Upon receipt of the transverter-attach signal, indicated by operation of the TVA relay, the timing features of the TM tube timer are canceled. Referring to FIG. 213, operation of the 172-TVA relay will also extend the ground over the KGR lead to operate the 213-KGR relay of the position circuit. Operation of the KGR relay will remove ground from various keys in the position circuit to prevent the operator from either changing or mutilating stored information in the position control circuit registers while it is attached to the transverter for purposes of making the initial AMA entry.

The calling number is registered in the sender by means of the ANI information from the originating office and then transferred via the data transfer circuit to the position registers on most calls. However, the operator has the ability to set this number into the position registers when ANI is not used or in the event of an ANI failure. The operator starts the initial AMA entry with a key operation at the position, as described in detail in the Curtis invention. The position control circuit seizes an idle transverter and passes to it the information needed by the transverter to control the perforation of the initial entry. When the AMA equipment is ready for the trunk identification operation, it sends ground to the trunk on the IC lead on FIG. 356, via the position control circuit and the position link. The trunk forwards this ground through transfer break contacts 358-TC, and via its DJ lead, to the call identity indexer, as shown on FIG. 358, where the call identity indexer is shown diagrammatically. When the AMA entry has been successfully completed, the 358-TC relay of the trunk is operated over the TC lead from the call identity indexer circuit. The TC relay then locks to the operated

351-D or 355-PA1 relay and the normal 355-SR, 355-DBST, and 355-CTM1 relays to ground on terminal 106 of FIG. 358. It should be noted that the 351-D relay need not be operated (which signifies an established forward connection) for relay TC to lock. Thus, it is possible for an initial entry to be made before the connection forward has been completed. Relay TC remains operated for the duration of the call.

CALLED PARTY ANSWER AND CHARGE DELAY

The operation of relay 358-CH, as subsequently described, signifies a charge condition. Conversely, a charge condition of the call cannot exist until relay CH operates. Relay 349-CS is normally unoperated when it is connected to the trunk loop. Battery and ground from the outgoing trunk are present on the tip and ring of this loop in such a polarity that the CS relay remains unoperated. When the called party answers, this polarity is reversed and relay CS operates. A charge delay of two to five seconds is then introduced. The CS relay must remain operated for at least two seconds before relay 358-CH can be operated. This prevents false charges due to flashing signals, etc. Relay 349-CS, in operating, closes an obvious path to operate relay 361-CS1.

Relay 365-B1 operates from 0 to 2.6 seconds after relay 361-CS1. The operation of relay 365-B1 closes a circuit on FIG. 358, to operate relay IN from the ground supplied from terminal 103 and the battery supplied through the F resistor. On FIG. 365, after relay B1 releases, there is an interval of two seconds before relay F1 operates due to the action of the interrupter. The interrupter referred to herein is a mechanical device activated by an electrical motor and gear train so designed as to maintain the aforementioned time intervals within reasonable tolerance. Interrupters of this type are presently in common usage. Relay 358-CH then operates over a path which checks that the 358-TC, 351-D3, 365-F1 and 358-IN relays are all operated. If the 358-IN relay should release due to a momentary release of either relay 361-CS1 or relay 362-BA before relay 358-CH operates, the timing cycle must be restarted. Thus, both the 362-BA and the 361-CS1 relays must remain concurrently operated for at least two seconds before the CH relay can operate and establish a charge condition. It should be noted that the foregoing sequence of operating relays 358-IN and 358-CH, which comprises a charge condition, takes place on all calls, whether chargeable or not. A further sequence will be required in order to determine whether a call will be charged and/or timed. The operation of relay 358-CH closes its make contacts on FIG. 357 to operate 357-SST from ground on terminal 101 of the same figure.

It should be noted that there are other requirements for the operation of relay 357-SST (start trunk timing) other than the operation of relay 358-CH. These requirements are that relay 364-CTT is not operated, indicating that a cancel-trunk-timing situation is not in effect; that relay 355-PA1 is released, indicating that an operator position is not attached; that relay 362-ND is not operated, indicating that a dial 0 call is not in progress; and that relay 359-RA is released indicating that a 1-condition has not been recognized, as previously described. For the present call, it may be assumed that the cancel-trunk-timing dial 0 and 1- situations are not pertinent; consequently, the operation of relay 357-SST is dependent only upon the release of the operator position and the operation of relay 358-CH. When both of these conditions have been met, the SST relay will operate, and a trunk timing condition will be started.

AMA ANSWER ENTRY AND START OF TRUNK TIMING

If an initial AMA entry has been made, then the operation of relays IN and CH on FIG. 358, as described, causes the perforation of the AMA answer entry by connecting the CH lead of the recorder on FIG. 361 to the DJ lead of the call identity indexer on FIG. 358. It should

be noted that the answer entry can be made while the operator is still attached to the connection.

When the answer entry has been completed, the call identity indexer circuit grounds the RC lead to the trunk, thereby causing the release of the 358-IN relay by shunting its battery supply through resistor F on FIG. 358. Relay 358-CH remains operated for the duration of the call.

If the call is one that requires coin timing, such as for example, a special toll prepaid call, the operation of relay 358-CH provides a ground to operate relay 357-SST. However, the 357-SST relay cannot operate until the operator releases from the call and releases the 355-PA1 relay. The break contacts of relays 362-ND, 359-RA, and 364-CTT are also included in the operate path of relay 357-SST. This is done to prevent trunk timing for dial 0 calls for which relay 362-ND is operated, permanent signal conditions as indicated by the operation of relay 359-RA, and collect or special calls as indicated by the operation of relay 364-CTT.

TIMER CIRCUIT

Relay 357-SST is operated for those calls which require timing following the operation of relay 358-CH. For calls on which timing is not required, the 364-CTT relay operates as previously described and prevents the operation of relay SST at this time. The operation of the 357-SST relay is also prevented by the operated 362-ND relay for dial 0 calls. For those calls on which trunk timing is required, and when the operator releases with the 358-CH relay operated, the 357-SST relay operates and extends a ground from terminal 357-103 of the HMG lead on FIG. 357 to the timer circuit.

The timer pulse circuit on FIG. 357 generates pulses of the types shown on FIG. 367A and described in the subsequent paragraphs in order to enable the trunk to time the initial-period duration on all calls served by this trunk which are automatically timed and, additionally, enables the trunk to time the overtime portion of automatically timed calls which extend into overtime. FIG. 357 discloses the relationship between the trunk and the timer circuitry on the basis that there is a timer circuit individual to each trunk circuit. The trunk is shown related to the timer circuitry in this manner in order to simplify the description. However, there need not be a timer circuit individual to each trunk circuit but instead, if desired, a centrally located source of pulses could be provided which, in turn, may be interconnected with any calling trunk in response to a request to this effect from the trunk. An arrangement such as this is shown in Patent 2,362,425 to F. M. Wiese of Nov. 7, 1944. The pulse generator of the Wiese patent does not provide the specific pulses required by the trunk circuits of the present invention. However, if desired, the teachings of the Wiese patent could be utilized with a commercial embodiment of the system comprising the present invention in order that a timer single pulse generator and suitable interconnecting circuitry could be provided in order to transmit timing pulses to all the trunk circuits of the office having facilities for automatically timing the call served thereby.

The ground applied via the HMG lead of FIG. 357 causes the timer circuit to apply timing pulses to the trunk over the 6, 60, and CC leads, as subsequently explained. All pulses generated by this circuit are of approximately 500 milliseconds duration. The pulse on the 60 lead is the first one to be received by the trunk, and it is received and repeated once every minute. The pulse on the 6 lead follows the pulse on the 60 lead separated by an interval of six seconds. The CC pulse follows the 60 pulse, separated by an interval of 42 seconds. This sequence of pulses is repeated once every minute as long as the trunk is connected to the timer pulse circuit.

An additional pulse is received by the trunk from the timer over the OK lead to operate the 357-OK relay of

the trunk once every six seconds. The OK pulse is synchronized by the timer circuit in such a manner that it is received coincidentally with each of the 6, 60, and CC pulses. The operation of the 357-OK relay as a consequence of the reception of the OK pulse from the timer is required in order to close through the 60, CC, and 6 leads between the timer circuit and the trunk. This provides a means for enabling the timer to check the integrity of these leads between itself and the trunk. In the event that trouble in the form of false crosses or grounds is discovered, the timer will take action to terminate the transmission of any further pulses, thereby preventing a false charge condition that might occur within the trunk.

The timing of a call starts when ground is supplied to the OK and 60 leads, thereby operating relay 357-OK followed by the operation of relay 357-M60. The M60 relay remains operated until the removal of the OK pulse, at which time the OK relay releases itself and, in turn, releases the M60 relay. Pulses on the 6 and CC leads, together with coincidental pulses on the OK lead, follow in the previously-described sequence.

TRUNK TIMING—SPECIAL TOLL CALLS—
COMMON FEATURES

The minutes counter of the trunk is shown on FIG. 360. It is used to time prepaid special toll calls only, and generally functions in the same manner whether an initial period or an overtime call is being timed. The following is a description of these common features. The minute counting relays 360-MC1, MC2 and MC3 are arranged to count from one to five minutes of time under control of the time-storage relays M1 through M5 on FIG. 365. The time-storage relays store the duration of the initial period in minutes for the initial-period por-

the first (or left-hand) column, entitled "Comments," states, for each line of the table, which pulse is either ending or beginning at the instant of time associated with the line. The second column, entitled "Start of Timed Minute No." and subtitled "Minutes and Seconds," indicates the specific instant of time represented by the line. The third column, entitled "Pulses Received" and subtitled OK, 60, 6, indicates in each line thereunder, by a + or -, whether each of the OK, 60, or 6 pulses received is starting or ending at the instant of time represented by the line. The fourth (or last) column, entitled "Relays Operated or Released," and subtitled "OK M60, MC1, MC2, and MC3," indicates in each line thereunder, by either a + or a -, whether the relay represented by the column operates or releases at the instant of time associated with the line. For example, column 1, line 1, of the table states that the start of the 60 pulse occurs at the time represented by the line 1. Column 2, line 1, indicates that this action occurs on the first minute and zero seconds of the timing operation. Column 3 indicates that the OK and 60 pulses are received at this time, while the 6 pulse is not received. Column 4 indicates that relays OK and M60 operate at this time. Similarly, for example, the fourth line of the table indicates in column 1 that the 6 pulse terminates at this time; in column 2, that this action occurs during the first minute and 6.5 seconds subsequent to the initiation of timing; column 3 indicates that pulses OK and 6 terminate at this time; while column 4 indicates that relay OK now releases while relay MC1 remains operated. Neither the initiation nor the termination of the OK pulse is mentioned in column 1 of the table since this pulse is received coincidentally with the beginning and the end of each of the other three pulses, namely, the 60, the 6, and the CC pulses.

TABLE I

	Start of Timed Minute No.		Pulses Received			Relays Operated or Released				
	Minutes	Seconds	OK	60	6	OK	M60	MC1	MC2	MC3
Start of 60 pulse.....	1	0	+	+	-----	+	+	-----	-----	-----
End of 60 pulse.....	1	.5	-	-	-----	-	-	-----	-----	-----
Start of 6 pulse.....	1	6	+	-----	+	+	-----	+	-----	-----
End of 6 pulse.....	1	6.5	-	-----	-	-	-----	-	-----	-----
Start of 60 pulse.....	2	0	+	+	-----	+	+	-----	-----	-----
End of 60 pulse.....	2	.5	-	-	-----	-	-	-----	+	-----
Start of 6 pulse.....	2	6	+	-----	+	+	-----	-----	+	-----
End of 6 pulse.....	2	6.5	-	-----	-	-	-----	-----	-	-----
Start of 60 pulse.....	3	0	+	+	-----	+	+	-----	+	-----
End of 60 pulse.....	3	.5	-	-	-----	-	-	-----	-	-----
Start of 6 pulse.....	3	6	+	-----	+	+	-----	-----	-----	+
End of 6 pulse.....	3	6.5	-	-----	-	-	-----	-----	-----	+
Start of 60 pulse.....	4	0	+	+	-----	+	+	-----	-----	+
End of 60 pulse.....	4	.5	-	-	-----	-	-	-----	-----	+
Start of 6 pulse.....	4	6	+	-----	+	+	-----	+	-----	+
End of 6 pulse.....	4	6.5	-	-----	-	-	-----	+	+	+

tion of the call and store the duration of a single overtime period in minutes for the overtime portion of a call. When timing a particular call, one of the five time-storage relays is operated to limit the minutes count to some interval of time of from one to five minutes. This information is received from the rater on the initial-period portion of the call, and from the computer on the overtime portion of the call. The minute-counting relays operate in sequence, in response to pulses on the 6, CC, or 60 leads. As mentioned in the previous paragraphs, the first timer pulse received from the timer pulse frame, coincident with the reception of the OK pulse, is on the 60 lead, thereby operating relay 357-M60. However, no action is taken in the trunk at this time. Six seconds later, when a pulse is received on the 6 lead, relay 360-MC1 operates and locks. The circuit for operating this relay includes ground on the 6 lead, diode D, make contacts 357-OK and 357-STT, transfer break contacts 360-MC3, and break contacts 360-MC2, to the winding of MC1 to operate it. The operation of relays MC1, MC2 and MC3 occur in sequence as shown in the following table. In this table,

Referring to column 4 of the preceding table, the particular MC- relay operated, or the combination of MC-relays which are operated at any instant of time, indicate how many minutes have elapsed since the beginning of the timing interval. The particular minute being counted, with the exception of the fifth minute, may be determined from the sum of the numerical designations of the MC-relays that are currently operated at the end of the applied pulse. The exception to this occurs in the last two lines of the table, where the start of minute 5 is signified by the operation of relays MC1, MC2, and MC3.

It should be noted that the operation of relays MC1, MC2, and MC3, either singly or in combination, serves to "mark" the start of a particular minute of the time count. It should be further noted that minute 1 is "marked" six seconds after time 0; minute 2 is marked at the end of one minute; and likewise, minutes 3 and 4 are marked at the end of minutes 2 and 3, respectively. However, minute 5 is marked six seconds after the beginning of minute 4. The significance of this arrangement is explained in the following paragraphs.

Each M- relay on FIG. 365, such as for example, relay M1, represents the time the customer is permitted to talk on that portion of the call before an additional charge is made. The MC- relays on FIG. 360, when operated either singly or in combination, as previously described, indicate the chargeable time currently elapsed from the initiation of the timing interval currently being measured by the trunk. The M- relays on FIG. 365 and the MC- relays on FIG. 360 together are effective to operate relay 363-ETP precisely one minute before the end of the time allotted to that portion of the call. In other words, if an initial period is being timed, whose duration is four minutes, as indicated by the operation of relay 365-M4, relay 363-ETP is operated one minute prior to the end of the fourth minute or, in other words, at the beginning of the fourth minute. This is accomplished by the closure of make contacts 360-MC1, 360-MC3, and 365-M4, which together extend ground from terminal 110 on FIG. 363 to the winding of relay ETP to operate it. Relay ETP, in operating, closes an obvious circuit on FIG. 360 to operate relay RCY a half-second later when relay 357-OK releases at the end of the OK pulse. Relay RCY, in operating, closes a locking path for itself to ground on terminal 101 in FIG. 360. No further action occurs until the beginning of the next (the fifth) minute, at which time the appearance of the 60 pulse operates relay 357-M60 which closes the following circuit to operate relay 351-PR; ground on terminal 103 of FIG. 360, make contacts 357-OK and 357-M60, transfer break contacts 366-EC, transfer make contacts 360-RCY, transfer break contacts 365-CH2, over conductor PR extending to FIG. 351, break contacts 355-PA1 to the winding of relay PR, to operate it. The operation of this relay causes the trunk circuit to bid for a connection to an operator position on a priority basis, as is subsequently described.

The circuitry associated with the counting of a five-minute period is somewhat different and slightly more complicated. It should be noted that in the case of time periods lasting one, two, three, or four minutes, the operation of the MC1, MC2, or MC3 relays, or combinations thereof, corresponding to the time duration allowed, causes the immediate operation of relay 363-ETP. For the five-minute interval, this is not the case. Relay 365-M5 is operated to indicate a five-minute period. A combination of relays MC1, MC2, and MC3 is required, together with the operated 365-M5 relay, to provide a path to operate relay ETP. However, in this case, the mere operation of relays MC1, MC2, and MC3 does not provide an immediate operate path for ETP. It will be noted that this combination of operated MC- relays occurs six seconds after the start of the fourth minute, in response to a pulse on the 60 lead. It should also be noted that the operation of relays 357-OK and 357-M60 is now required to operate relay ETP. This path may be traced from ground on terminal 103 of FIG. 360 through make contacts 357-OK and 357-M60, transfer break contacts 366-EC and 360-RCY, to FIG. 363, through make contacts 360-MC3, 360-MC2, and 360-MC1, to the winding of relay ETP. Since the combination of operated MC- relays to provide this path occurred six seconds after the start of the fourth minute, the required operation of relays 357-M60 and 357-OK, in response to the 60 pulse, to operate relay ETP does not occur until the start of minute 5.

Relay 363-ETP, operated, in turn operates relay 360-RCY, which locks as priorly described. Then, 60 seconds later, relay M60 again operates at the end of the fifth minute (or at the beginning of the sixth minute) and closes the priorly-described path to operate relay 351-PR, thereby initiating a bid for an operative position. It should be noted that relay 360-RCY does not operate immediately upon the reception of the 60 pulse. Instead, it waits until the 60 pulse has terminated, as well as the OK pulse, thereby releasing relay 357-OK and closing the circuit to operate relay RCY. This relay then locks

and remains operated for one minute more and then, at the beginning of the next minute, operates relay 351-PR.

In partial summary, a combination of the operated MC- relay or relays on FIG. 360 and one operated M- relay on FIG. 365 causes relay 363-ETP to operate, as above described, and mark the start of the last minute of time which is to be allowed for a particular call interval. In other words, a customer is allowed one minute of conversation following the operation of relay 363-ETP. In the case of a five-minute interval, the combination required to operate relay ETP changes slightly and becomes relays MC1, MC2, MC3, and M60 operated. Thus, for a five-minute interval of time, the ETP relay operates at the start of minute 5 and not at four minutes, six seconds. The following table shows the time at which relay ETP operates for various combinations of the timing relays. Only one such combination is used to time any particular portion of a given call, such as for example, the initial period. In this table, T0 represents the moment at which the call timing starts.

TABLE II

Time T0 Plus		Relay Combinations Operated		363-ETP Operates
Min.	Secs.	Control Relay	Counting Relay(s)	
0	6	(M1)	(MC1)	Yes.
1	0	(M2)	(MC2)	Yes.
2	0	(M3)	(MC3)	Yes.
3	0	(M4)	(MC3) and (MC1)	Yes.
3	6	(M5)	(MC3), (MC1) and (MC2)	No.
4	0	(M5)	(M60), (MC3), (MC1) and (MC2)	Yes.

With relay 363-ETP operated and relay 357-OK released, the 360-RCY relay operates, as above described. Relay ETP remains locked operated to ground on terminal 101 of FIG. 363 until relay 360-RCY operates. Relay RCY locks operated to ground on terminal 360-101, through the make contacts of the operated 354-RV relay under control of relay 356-PA, 357-M60, and 366-ET, normal. When relay RCY operates, in addition to releasing relay 363-ETP, it also releases any of the operated MC- relays on FIG. 360 which may be operated, and thus recycles the minutes counter circuit. As long as relay RCY remains operated, further minute counting by the trunk is prevented, since the locking path of the MC- relays remains open.

One minute after relays 363-ETP and 360-RCY operate, the OK and M60 relays on FIG. 357 once again operate. The action of the trunk circuit at this point depends upon what portion of the call is being timed. This is explained in the following paragraphs for various call conditions.

TRUNK TIMING—SPECIAL TOLL CALL—INITIAL-PERIOD TIMING

When timing the initial-period portion of a call, relay 363-IP is operated and relay 363-OP is released. One of the 365-M1 through M5 relays on FIG. 365 is operated. Trunk timing begins, as described in the preceding section, as pulses are received on the OK and 60 leads. Forty-two seconds after timing has started, a pulse is received on the CC lead which operates relay 357-CH1. This relay locks operated and marks the end of the recall-period, as is elsewhere described. Relay CH1 also sets the trunk for collection of the initial deposit at the termination of the call. The timing now continues for the duration of the initial period, as previously explained, up to the point where relay 360-RCY operates, which is the start of the last minute of the initial period. Forty-two seconds after the operation of relay RCY, a pulse is received on the CC lead from the timer, which pulse is able to operate the 353-CC relay through a circuit including contacts of relays 357-OK and 360-RCY, operated. The operation of the CC relay causes the collec-

tion of the initial deposit, and also operates relay 363-OP and releases relay 363-IP. The operation of the CC relay on FIG. 353 accomplishes these functions by momentarily operating relay 352-M0 which, essentially, is a slave of the CC relay. The transfer contacts of the 352-M0 relay on FIG. 349 disconnect the tip and ring conductors from the ground and negative 48-volt potentials normally supplied thereto through the primary and secondary windings, respectively, of the 348-A relay and transfers them to the potentials on terminals 108 and 107, respectively, of FIG. 348, which potentials are, respectively, positive 130 volts and negative 48 volts. The path to connect the potentials from terminals 107 and 108 through the winding of transformer T in FIG. 349 includes transfer contacts of relay 352-CC.

At the end of the last minute, relay 357-M60 again operates in response to the 60 pulse and causes the operation of relay 351-PR to establish a connection to an idle operator position. Relay 351-PR, operated, extends ground from terminal 101 on FIG. 356, through make contacts 351-PR, transfer break contacts 356-PA, and make contacts 351-D to conductor PS extending to the position link connector circuit. The ground on this conductor signifies a priority-start and causes the position link connector, under control of the position controller, to interconnect this trunk with an idle operator position on a priority basis.

When relay 351-PR operates at this time, it causes relay 357-STT to release, thereby removing ground from the HMG timer lead on FIG. 357. All timing signals to the trunk are now stopped. The locked-in one of relays M1 through M5 on FIG. 365 is also released at this time by removing ground from terminal 101 of FIG. 365 through break contacts of 351-PR operated, so that a new one of these relays may presently be operated for use during the overtime portion of the call in the event that the call should continue into overtime. Relay 360-RCY is also released through break contacts of 356-PA (which operates when the position is attached), and the minutes counter circuit is restored to normal.

DATA TRANSFER SEIZURE AT END OF INITIAL PERIOD

The position link now proceeds to bid for and attach itself to an operator position on a priority basis. Once the operator position is attached to the trunk, the position bids for the services of an idle channel of the data transfer circuit. The function of the data transfer circuit on this usage is to interconnect the trunk, the position, and a computer in order that the trunk may transmit information to the computer including: the charge rate for the call, a station-to-station or person-to-person indication, as well as information indicating that the call is at the end of the initial period and is about to enter the overtime period. The computer receives this information and, in response thereto, derives output information indicating the cost and duration of a single overtime period. This information is then transmitted to the position circuit in order that the operator thereat may advise the calling party that the call is about to enter overtime and, if requested by the calling party, also inform him concerning the cost and duration of a single overtime period. The computer also sends information, via the data transfer circuit, to the trunk indicating the duration of a single overtime period.

The details of the circuit operations associated with the seizure of a data channel by the position, and the connection of the trunk to the seized data channel, are similar to those already described in detail in connection with the prior seizure of the data transfer circuit by the position circuit at the beginning of the initial period. Therefore, the description of the circuit operations associated with such details is not repeated, and instead the relays which operate at this time are enumerated in the sequence in which they operate, without any discussion of the specific paths over which each relay operates.

Assuming that position 00 serves the present call, the position bids for a data channel by closing its make contacts 181-DTST shown within the C equipment rectangle on FIG. 224, thereby initiating the operation of relays PP00, PE00, and PF00 on FIG. 224. Relay 275-PGRA also operates at this time. Also, relays PA00 through PD00 on FIG. 224 operate at this time, as well as relays PG00 and PH00 on FIG. 224. Relays OPS0 and OPRF0 followed by OPRC0, OPRD0, OPRG0, and OPRH0, on FIG. 225 now operate.

The operation of the foregoing relays releases relays 225-DCA1, 234-DCA2, and 234-DCA3. Relays TST1 through TST9 on FIG. 248 now release. Relays CONN, CONA, CON1 through CON4, on FIG. 279 now operate. Next, relays 297-DTMB and 406-OSPL operate as previously described. The following relays on FIG. 225 now operate: OPSA0, OPSB0, and OPSE0.

The operation of the foregoing relays has, among other functions, connected bidding position 00 to data channel 0. The following relays next operate: 261-ST0P, 225-CHB, 225-CHB1, 283-PGT, 283-PGT1, 225-0PCB0, 231-0RCB0, and the associated relays in the remaining connectors for data channel 0.

Relays 239-0DG4 and 0DG7 now operate to register the trunk connector number of 0. Relay 238-0DCS0 operates to signify a bid for the services of this trunk connector. Relays 238-0TS0 and 0TSS0 also operate at this time, in response to the bid for the services of this trunk connector. The operation of relay 238-0DSC0 operates relay 238-0TSR0. Relay 238-0TS0 operates relay 297-RCTM for data channel 0.

Next, the data transfer circuit, on FIG. 242, applies positive 130 volts to the PC conductor extending over the circuit shown on FIGS. 241 and 242 to operate relays 362-TPA and TPB in the trunk circuit, in the manner priorly described. The operation of these relays closes an obvious path, as shown on FIG. 263A, to operate relay 263A-0TSG4, which is a trunk subgroup relay serving calling trunk 40. The following circuit is now closed to operate relay NSA on FIG. 273 for channel 0: ground on terminal 106 of FIG. 363 of the trunk circuit, break contacts 353-T, make contacts 362-TPA, conductor NSA extending to FIG. 273A of the data transfer circuit, make contacts 263A-0TSG4 and 238-0TS0, to the winding of relay 273-NSA, to operate it. The relay, in operating, closes a locking path for itself over its own make contacts, as well as those of relay 266-0TP0, which is operated at this time in a manner similar to that previously described. The operation of relay NSA apprises the data transfer circuit that no sender is attached to the connection at this time.

The following circuit is now closed to operate relay COP for channel 0 on FIG. 372: ground on terminal 102 of FIG. 363, transfer break contacts 363-IP, make contacts 362-TPA, conductor COP extending to FIG. 372A of the data transfer circuit, make contacts 263A-0TSG4 and 238-0TSR0, to the winding of relay 372-COP, to operate it. The operation of this relay notifies the data transfer circuit that this is a coin call and that it is entering its overtime period.

The data transfer circuit now proceeds to bid for the services of a computer. Let it be assumed that computer 0 is idle and is to be connected to data channel 0 at this time. Referring now to FIG. 385, the circuitry, including break contacts 297-DTMF1, make contacts 372-COP and 261-ST0P, within the BT rectangle now extends a negative battery to FIG. 388 to operate relay 0C0S0 thereon. As a result of the operation of this relay, the following relays now operate in the manner previously described: 0CA0, 0CB0, and 0CC0 on FIG. 388, relays 373-CP0, 386-C0B, 388-0CCB0, 408-CGT and 408-CGT1, as well as the corresponding relays in the other channels for computer 0. The operation of the foregoing relays has connected the computer 0 to data channel 0.

75 Data interchange—Trunk output information.—As a

result of this connection, the trunk now transmits a number of items of information to the computer circuit and the position control circuit. It also transmits a "COP" and an "NSA" indication to the data transfer circuit as above described.

Relay 364-PP of the trunk circuit is operated and locked at this time, as hereinbefore described, since this is a person-to-person call. This being the case, the locking circuit of the relay maintains a ground on the PP lead extending through make contacts 362-TPB to FIG. 405A of the data transfer circuit, where the ground may be further extended through make contacts 263A-OTSG4, 238-OTSR0, and 406-OSPL to the PP conductor of channel 0. From there, the ground may be further extended through make contacts 388-0CA0 on FIG. 406, to FIG. 425 of the computer, to operate relay 425-PP, hereby informing the computer that this is a person-to-person type of call. The ground on the PP conductor of data channel 0 may also be further extended to FIG. 404, and through make contacts 225-OPRG0 and 224-PG00 to FIG. 198 of the position circuit, to operate relay 198-CSP, thereby informing the position circuit that this is a person-to-person type of call.

The trunk circuit, on FIG. 366, now closes a circuit to extend ground from terminal 104, through transfer make contacts 363-OP, transfer break contacts 366-EF0, and make contacts 362-TPA, to conductor 0PST, extending to FIG. 396A of the data transfer circuit. The ground on this conductor may be further extended through make contacts 263A-OTSG4, and 238-OTSR0 to the 0PST conductor of channel 0. From there, the ground on this conductor may be further extended through make contacts 388-0CA0, to FIG. 425 of the computer, to the winding of relay 425-0PST to operate and lock it, thereby informing the computer that this is the overtime-period-start portion of the call.

The trunk also closes a circuit on FIG. 363 at this time to extend ground from terminal 103, through make contacts 362-TPB, the 0A terminal, across the strapping to the 0A0 terminal, and thence to conductor 0A0 extending to FIG. 272B of the data transfer circuit. The ground on this conductor may be further extended through make contacts 263A-OTSG4 and 238-OTSS0 to the 0A0 conductor of channel 0. From there, the ground may be further extended through make contacts 388-0CB0 on FIG. 272A, to FIG. 424 of the computer, to the winding of relay 424-0A0 to operate and lock it, thereby informing the computer that the originating office is in Area 0. The ground on conductor 0A0 of channel 0 on FIG. 272 is also extended through make contacts 225-OPRF0 on FIG. 271 and make contacts 224-PF00 to FIG. 193 of the position control circuit to operate relay 193-0A0, thereby informing this circuit that the originating office is in Area 0.

The rate treatment for the present call is 011, and therefore relays RTH0, RTT0 and RTT1, and RTU0 and RTU1 on FIG. 364 of the trunk circuit are locked operated at this time to register this rate treatment. The locking circuits of these relays extend grounds through make contacts 362-TPB on FIG. 364 to the correspondingly designated conductors which, in turn, extend to FIG. 405A of the data transfer circuit. The grounds on these conductors may then be further extended through the same circuitry of the data transfer circuit as was described in connection with the transmission of the person-to-person indication, to correspondingly designated relays in both the computer and position control circuits, to register the rate treatment therein. These relays, for the computer circuit, are on FIG. 425 and are designated identically to those of the trunk circuit. The rate treatment register relays for the position control circuit are on FIG. 199A and, at this time, relay 199A-RH7 is operated to register a rate treatment hundreds digit of 0, while relays 199A-RT0 and RT1, and RU0 and

RU1 register the tens and units rate treatment digits of 1.

Data interchange—Computer output information.—The computer, in response to the receipt of the foregoing information, proceeds to derive certain output information, including the cost and duration of a single overtime period. The following information is now transmitted by the computer to the position and trunk circuits.

The computer now grounds its conductor CFC on FIG. 425, extending to FIG. 321 of the data transfer circuit. This ground is then further extended through make contacts 388-0CA0 to the winding of relay 371-CFC for channel 0, to operate it. This relay, in operating, closes a locking circuit for itself over its own make contacts and those of relay 373-CP0. The operation of relay CFC functionally indicates to the data transfer circuit that the computer functions are now complete.

Let it be assumed that the charge for a single overtime period for the present call is 25 cents. This being the case, the computer now grounds conductors CH4 and CH7 for a hundreds digit of 0. These conductors are on FIG. 427. The computer also, at the same time, grounds conductors CT0 and CT2 on FIG. 426 for a charge tens digit of 2, and on the same figure grounds conductor CU05 for a charge units digit of five cents. All of the aforementioned charge conductors extend from the computer circuit to FIG. 403 of the data transfer circuit. From there, the grounds on these conductors may be further extended through make contacts 388-0CCC0, 225-OPRH0 and 224-PH00, to FIGS. 199A and 199B of the position control circuit, to operate the correspondingly designated charge relays thereon. The charge hundreds and charge tens relays are on FIG. 199B, while the charge units relay, which in this case is designated CU5, is situated on FIG. 199A. These relays, in operating, together inform the position circuit that the charge for a single overtime period for the present call is 25 cents.

Assuming that the duration, in minutes, of a single overtime period for the present call is one minute, the computer now grounds, on FIG. 428, conductors MT4 and MT7 for a tens digit of 0, and MU0 and MU1 for a tens digit of 1. These grounds are extended to FIG. 403 of the data transfer circuit, and thence, over the same circuitry as just described for the charge information, to FIG. 199B of the position control circuit to operate the correspondingly designated relays thereon. The operation of these relays informs the position control circuit that the duration of a single overtime period for the present call is one minute.

The computer now grounds its conductor ET on FIG. 426, which extends from FIG. 426 of the computer circuit to FIG. 396 of the data transfer circuit. This ground is then further extended through make contacts 388-0CA0, 238-OTSR0 and 263A-OTSG4 on FIG. 396A, to the rectangle representing trunk circuit 40. From there, the ground may be further extended, via conductor ET, to FIG. 366 of trunk circuit 40, make contacts 362-TPA, to the winding of relay 366-ET, which now operates and locks over a holding circuit through its own make contacts.

The computer now grounds its conductor M0 on FIG. 424, which signifies a one-minute overtime period duration. The ground on this conductor is extended to data transfer circuit FIG. 400, whence it may be further extended through make contacts 388-0CA0, 238-OTSR0, on FIG. 399, and 263A-OTSG4 on FIG. 399A, to the rectangle representing trunk circuit 40, via conductor M0 to FIG. 365, make contacts 362-TPB, and break contacts 366-EF0, to the winding of relay 365-M1, to operate it. The operation of this relay informs the trunk circuit that the overtime period duration is one minute.

The computer at this time grounds its conductors NFY and NTX on FIG. 427. The grounds on these conductors

are extended to FIG. 403 of the data transfer circuit, whence they may be further extended through make contacts 388-0CC0, 225-0PRH0 and 224-PH00, to position circuit 00. The ground on conductor NFY is extended to FIG. 198, to the winding of relay 198-NFY, to operate it; while the ground on conductor NTX is extended to FIG. 204, the winding of relay 204-NTX, to operate it. Both of these relays, in operating, close locking paths for themselves. Relay NFY, operated, informs the position circuit that the operator must notify the calling party that the call is about to enter overtime. The operation of relay NTX signifies that the monetary amount registered in the position circuit at this time does not include any tax.

The computer grounds its conductor NZN on FIG. 427, which extends to FIG. 393 of the data transfer circuit. The ground on this conductor further extends through make contacts 388-0CA0 to the winding of relay 393-NZN to operate it, thereby informing the data transfer circuit that this is not a "zone" call. Relay NZN, in operating, closes a locking path for itself. The computer, at this time, also grounds its conductor 0P on FIG. 425, which extends to FIG. 398 of the data transfer circuit. From there, the ground on conductor 0P may be further extended through make contacts 388-0CB0, the correspondingly designated conductor of channel 0 extending to FIG. 397, make contacts 225-0PRG0 and 224-PG00, to the rectangle representing position 00, to FIG. 198 of the position control circuit, to operate relay 198-C0P.

Once the computer has completed its functions, it operates relay 371-CFC for channel 0, as previously described. The operation of relay 371-CFC operates relay 297-SDTM, as previously described. Relay 297-DTM also operates at this time, as well as relays 297-DTMF and 297-DTMF1.

The operation of relay 297-DTMF1 releases relays 0CA0, 0CB0, and 0CC0 on FIG. 388, as previously described. Relay 388-0COS0 also releases at this time. Relay 386-COB now releases. The release of this relay releases relay 388-0CCB0, as well as the corresponding relays in the other channels for computer 0. Relays 408-CGT and CGT1 now release, as previously described. Relay 297-DTMB releases as a consequence of the operation of relay 297-DTM. The release of relay 297-DTMB releases relay 406-0SPL for channel 0, on FIG. 406. The release of relay 297-DTMB also releases relay 0TSS0 on FIG. 238. The sending relays of the trunk circuit and the 406-0SPL relay have by now been released. The operation of relay 297-DTMF operates relays TST1 through TST9 on FIG. 248.

Validity check of interchanged data.—The data transfer circuit now checks for the correctness of the information received and stored in the receiving registers of the position and trunk circuits. This information is checked by the check circuitry shown on FIGS. 286 through 292, and 411 through 416 of the data transfer circuit. The checking operation begins with ground on terminal 101 of FIG. 286 and extends through make contacts 224-PF00 and 225-0PRC0 to FIG. 286A, through make contacts 248-TST3 and 297-DTMF, transfer make contacts 371-CFC and make contacts 372-C0P to terminal 103 on FIG. 411, through make contacts 396-ET, break contacts 393-IT, to terminal 102 on the same figure, through break contacts 398-IP, make contacts 398-0P and break contacts 271-RCL, to terminal 101 of FIG. 412, through make contacts 404-PRTH0 and break contacts 404-PRTH1, to terminal 412-102, through make contacts 406-TRH0 and break contacts 406-TRH1, to terminal 412-103, through the next symmetric circuit, to check on a 2-out-of-5 code basis the tens digit of the rate in the position circuit, through the next symmetric circuit, to check on a 2-out-of-5 code basis the tens digit of the rate in the trunk, through the following symmetric circuit on a 2-out-of-5 code basis, to check the units digit of the rate information in the position circuit, to terminal 104 on FIG. 412, to the next symmetric circuit on FIG.

413, to check on a 2-out-of-5 code basis the units digit of the rate information in the trunk, to terminal 413-105, through the next symmetric circuit on a 1-out-of-7 code basis (with relay 400-M0 being operated), to terminal 413-106, through the break contacts of the following symmetric circuit to terminal 101 on FIG. 414, through make contacts 406-TPP, break contacts 406-TSTA, make contacts 404-PPP, break contacts 404-PSS, break contacts 370-CST, make contacts 372-C0P, to terminal 101 on FIG. 415, through the next symmetric circuit on a 2-out-of-5 code basis (with relays 403-CH4 and CH7 operated), to terminal 415-102, through the next symmetric circuit on a 2-out-of-5 code basis (with relays 403-CT0 and CT2 operated), to terminal 415-103, through break contacts 403-CU00 and make contacts 403-CU05, to terminal 415-104, through the next symmetric circuit on a 2-out-of-5 code basis (with relays 403-MT4 and MT7 operated), to terminal 415-105, to FIG. 416, through the next symmetric circuit on a 2-out-of-5 code basis (with relays 403-MU0 and MU1 operated), to terminal 416-101, through break contacts 403-AD and 403-CD, and make contacts 403-NFY, to terminal 416-102, through break contacts 403-TX and make contacts 403-NTX, to terminal 103, break contacts 403-ZN, make contacts 393-NZN, to the winding of relay 416-DOK4, to operate it.

Release of data transfer circuit.—Upon the successful completion of the checking operation, the data transfer circuit transmits a ground from terminal 104 on FIG. 276, through make contacts 416-DOK4 on FIG. 276 to the DTOK conductor extending to FIG. 274, and via make contacts 225-0PRF0 and 224-PF00 to conductor DTOK extending to FIG. 188 of the position control circuit, to operate relay 182-DTOK. The operation of this relay opens its break contacts on the C rectangle of FIG. 224 to release relays PP00, PE00, PF00, and PA00 through PD00, PG00 and PH00, all on FIG. 224. The opening of the contacts of the 182-DTOK relay also releases relay 225-0PS0, as priorly described. The release of relay 224-PF00 removes battery from conductor PC on FIGS. 241 and 242, thereby releasing relays 362-TPA and TPB in the trunk circuit. The release of these relays releases relay 263A-0TSG4. The release of this relay releases relay 266-0TP0. The release of relays 362-TPA and TPB also releases relay 273-NSA for channel 0. Relay 372-CIP for channel 0 also releases at this time for the same reason. The release of relay 224-PF00 causes relays 0DG4 and 0DG7 on FIG. 239 to release. This, in turn, releases relays 0TS0 and 0DCS0 on FIG. 238. Relay 238-0TSR0 also releases at this time. The release of relay 238-0TS0 releases relay 297-RCTM.

The release of relay 225-0PS0 releases relays 0PSA0, 0PSB0, 0PSE0, 0PRC0, 0PRD0 and 0PRF0, all in FIG. 225. The release of relay 225-0PRC0 releases relays 0PRG0 and 0PRH0 on FIG. 225. Relays 225-DCA1 and 234-DCA2 and DCA3 now reoperate at this time, as priorly described. The operation of relay 234-DCA2 releases relays 297-DTMF and DTMF1. The release of relay 297-DTMF releases relays TST1 through TST9 on FIG. 248. Relay 373-CP0 releases as a consequence of the operation of relay 234-DCA3. The release of relay 373-CP0 releases relay 371-CFC for channel 0. The release of this relay, in turn, releases relays 297-DTM and 297-SDTM. The release of these relays, in turn, releases relays CHB and CHB1 on FIG. 225. The release of these relays, in turn, releases relay 225-0PCB0, as well as the corresponding relays in the other position connectors, together with relay 231-0RCB0 and the corresponding relays in the other register connectors for channel 0.

The operation of relay 225-DCA1 releases relay 279-CONN. The release of this relay, in turn, releases relays CONA, CON1, CON2, CON3, and CON4 on FIG. 279. The release of relay 279-CONA reoperates relays TST1 through TST9 on FIG. 248. The data transfer circuit, together with its connectors utilized on this portion of

the call, is now completely released insofar as this call is concerned, and is available to serve subsequent calls.

POSITION CIRCUIT OPERATION

On a "notify" seizure at the end of the initial period, the seizure of the position control circuit is the same as on an "initial" seizure, as previously described. However, on this (notify) seizure, the position control circuit receives a ground, signifying an NFY mark from the computer. The NFY mark causes the 198-NFY relay to operate. The NFY relay then operates the 198-NFYA relay. The NFYA relay, operated, completes a path over the NFY lead to the position circuit to light the NFY (notify) lamp on FIG. 219. The lighting of the NFY lamp indicates to the operator that the coin call connected to the position has just ended its initial-interval. The operator's function on this call is to notify the customer that the initial-interval has ended and that the customer should signal when the entire call is completed. If the customer does not request what the overtime charges will be, the position operator then releases the position from the connection by operating the position release key, as elsewhere described. If, however, the customer requests what the overtime charges will be, the operator operates the display rate key shown on FIG. 223 of the position circuit. Operation of the display rate key causes the 186-DRT relay in the position control circuit to operate. The DRT relay, in operating, releases the 198-NFY relay. The DRT relay, in operating, also operates the 186-RTR relay to connect the rate treatment register to the translator relays to display the rate treatment on the appropriate indicator tubes of the position circuit. The operator is not at this time concerned with the display of the rate treatment, but upon release of the display rate key, the 198-NFY relay, released, then enables a path to be completed to operate the 186-MCR relay. The operate path for the 186-MCR relay is from ground on FIG. 223 through break contacts of the display called number key, break contacts of the display calling number key, break contacts of the display rate key, to lead DMC of the position circuit through FIG. 186 of the position control circuit, through make contacts of relay 181-LL, break contacts of relay 178-CTT, break contacts of relay 198-MAN, break contacts of relay 198-NFY, make contacts of relay 186-CRON, to the winding of the MCR relay. Operation of the MCR relay at this time connects the minutes-and-charge register shown on FIG. 199B of the position control circuit to the translator relays on FIGS. 199 and 200 of the position control circuit, to light the appropriate minutes-and-charge indicator tubes on the position. The operator then quotes the displayed minutes-and-charge information to the customer and then proceeds to release the call from the position, as elsewhere described.

TRUNK TIMING—SPECIAL TOLL CALL—OVERTIME TIMING—GENERAL

It has been described how the operator was connected to the call at the end of the initial period, and how at that time the operator advised the customer that the initial period had ended and that the call was about to enter overtime. The operator then released the position from the connection, as priorly described, after requesting the calling subscriber to notify the operator at the termination of the call. The trunk "times" the overtime portion of the call after the operator releases from the connection. The release of the position from the connection releases relay 356-PA which, in turn, releases relay 355-PA1. The release of relay PA1 closes a circuit to reoperate relay 357-STT which, in turn, supplies ground to conductor HMG of the timer pulse circuit on FIG. 357, thereby reactivating the timer and causing it to apply timing pulses to the trunk in the manner priorly described in connection with the initial-period timing operation.

In timing the overtime portion of a coin call, either of two methods is used. These are "interval" timing and

"elapsed time" timing. An overtime period may have a time duration of one to five minutes. "Interval" timed calls are charged on a prepaid basis, whereas "elapsed time" calls are charged on a postpaid basis. When a call is served on an "interval" timed basis, the customer is required to deposit the amount charged for the time he is about to use; i.e., one to five minutes in advance. Upon the expiration of this interval, the operator is recalled and requests a deposit to prepay the next overtime interval (one to five minutes). In this manner, the call may continue indefinitely, with the recall of the operator being repeated at the end of each interval, to request prepayment for the next interval. Should the customer disconnect prior to the expiration of the interval for which he has prepaid, the operator is not recalled.

When "elapsed time" timing is used, prepayment of overtime is not required. The customer is notified that he is on an overtime basis and the operator releases from the trunk. The overtime interval, or period, may still be one to five minutes, as described for "interval" timing. However, the operator is not recalled upon the expiration of each interval. Instead, a count of the intervals elapsed for the entirety of the overtime is recorded by advancing the IC selector, on FIG. 366, one step for each interval. One step of the IC selector may represent one to five minutes, depending upon the duration of a single overtime period. The duration of the overtime thus recorded is limited by the structural capacity of the IC selector, which is 10 steps. The total maximum capacity for overtime recording, therefore, is 10, 20, 30, 40, or 50 minutes, depending upon whether the duration of a single overtime period is one, two, three, four or five minutes. If a customer on "elapsed time" overtime remains on the call until this capacity has been reached, a condition known as "end-of-cycle," or EC is reached, whereupon the operator is recalled and requests payment for the time already used. After securing payment, the operator releases from the trunk and another series of overtime intervals can ensue.

The timing of overtime intervals, whether for "interval" timing or "elapsed time" timing, uses the same minute-counting arrangement and time-limiting arrangement as is used for initial-period timing. That is, the length of the interval to be timed is determined by the particular 365-M- relay that is operated by the computer, via the data transfer, at the end of the initial period. The passage of time is recorded by the operation of the 360-MC1, MC2, or MC3 relay under control of pulses from the timer pulse source on FIG. 357. When "interval" timing is used, the operator is called back to the trunk in the same way as for initial-period timing; that is to say, relay 360-RCY, operates and locks, and thus causes the operation of relay 351-PR upon receipt of the next following minute mark, i.e., pulse 60.

When "elapsed time" timing is used, relay 360-RCY operates, as before, and causes release of any operated 360-MC- relays, as before. However, relay 366-EF0 operates at the start of the first overtime interval with the operation of relay 360-MC1. The path to operate relay 366-EF0 may be seen on FIG. 366, starting with ground from terminal 105 of that figure, through make contacts of 363-OP and 360-MC1, and transfer break contacts EF0, to the winding of relay EF0, thereby operating the relay. Relay EF0 operates its own make contacts to provide a locking path which holds it operated. The locking path for 366-EF0 may be traced from ground on terminal 102 of FIG. 365, through make contacts 363-OP, transfer break contacts 366-EC, to FIG. 366, through transfer make contacts 366-EF0, to the winding of that relay to hold it operated. In addition, relay 365-CH2 operates immediately after the operation of relay 366-EF0. The path to operate this relay may be traced on FIG. 365 as follows: ground from terminal 103 of that figure, through make contacts 362-BA, make contacts 366-ET, 361-CS1, and 366-EF0, to the winding of

relay CH2, causing it to operate. Notice, also, that relay 365-CH2 closes its own make contacts, which, in addition to the make contacts of relay 366-EF0, provide a locking path through transfer break contacts 356-PA to ground on terminal 104 of FIG. 365. As a result of relay 365-CH2 being locked operated, the path through which the operated relay 360-RCY would normally operate relay 351-PR, upon receipt of the next following 60 pulse, is opened through transfer break contacts 365-CH2, which may be seen on FIG. 360. When relay 360-RCY operates, it locks through a path previously described and which includes break contacts 357-M60, which may be seen on FIG. 360. As a result, relay RCY remains operated until the next following 60 pulse is received, operating the relay 357-M60. The operation of this relay causes the release of relay RCY, but because of the action of the break contact of relay 365-CH2, previously described, the 351-PR relay is not operated to cause an operator recall. Instead, relay 360-MC1 subsequently reoperates in the usual manner, and the recording of a second or subsequent overtime interval proceeds, operating, if required, relays 360-MC2 and MC3 at the proper time. It should be noted that relay 365-CH2 operates only for "elapsed time" timing. With relay CH2 operated, there is a path to operate relay 351-PR any time the calling subscriber disconnects (indicated by relay 359-B released). Likewise, the operation of relay 366-EC can cause the operation of relay 351-PR. The operation of relay 366-EC signifies that 10 overtime periods have elapsed. This may represent either 10, 20, 30, 40 or 50 minutes, depending upon whether each overtime period is of one, two, three, four, or five minutes duration, respectively.

The IC selector on FIGS. 365 and 366 is advanced one step each time relay 363-ETP operates during overtime timing, whether the overtime is charged on an "interval" basis or on an "elapsed time" basis. In so doing, the selector records the number of overtime intervals that have been used for elapsed time calls. The operator is called in to request the overtime payment when the calling subscriber has disconnected or has operated his switchhook as a signal that the call is completed. Usually this signal occurs before the completion of a cycle of 10 overtime intervals. In order for the charge computer to produce the correct time and charges for this condition, it is necessary to know exactly how many intervals and partial intervals in the form of minutes have elapsed during the overtime period. The IC selector makes this information available to the data transfer circuit on a 2-out-of-5 code basis, over the leads OTP0, OTP1, OTP2, OTP4, and OTP7 on FIG. 366. In addition, the number of minutes that have elapsed in the current interval are made available on the M1 to M5 leads on FIG. 365 by the contacts of the 360-MC1, MC2 and MC3 relays. Since the IC selector is advanced by the energization of the rotary magnet IC, on FIG. 365, which causes the operation of the 363-ETP relay, its position is actually one step ahead of the true position in time. This arrangement is translated to the proper amount of the elapsed time by the charge computer.

Although prepayment is used for "interval" timed calls, it is still necessary for the charge computer to know for which of the several intervals prepayment is being requested at a given time. This is required since there is a problem involving the collection of tax, which is not necessarily collected for each interval. Therefore, the IC selector is also used on "interval" timed calls to advise the charge computer, by way of the data transfer circuit, which of the overtime intervals is involved in a particular prepayment collection.

Referring to FIG. 366, lead 0P1, extending to FIG. 392A of the data transfer circuit, is grounded when relay 365-0P1 is operated subsequent to the first operation of relay 366-EC. Ground on lead 0P1 is further extended

through make contacts 263A-0TSG4, 238-0TSS0, and 388-0CB0 to FIG. 425 of the computer circuit, to operate relay 425-0P1. Ground on lead 0P1 is thus a signal unique to the overtime intervals subsequent to intervals 1 to 10. It provides the means for the computer to distinguish them from intervals 11, 21, 31, etc. This signal is of value in areas where tariffs impose a different rate for the first overtime period as against subsequent overtime periods.

10 TRUNK TIMING—SPECIAL TOLL CALL—OVERTIME TIMING—DETAILED

It is assumed that for the currently described call the overtime is to be computed and collected on an "elapsed time" basis. It was priorly described how relay 357-STT released as a consequence of the operation of relay 351-PR, as the trunk bid for the services of an operator position. The release of the STT relay removed the operating ground from the conductor HMG extending to the timer pulse circuit, thereby terminating the receipt of time pulses by the trunk circuit. The operation of relay 351-PR also released any one of the operated M1 through M5 relays on FIG. 365. The attachment of the position to the trunk via the position link, in turn, grounded conductor PA on FIG. 356, thereby operating relay 356-PA. The operation of this relay, in turn, operated relay 355-PA1 and released relay 360-RCY. Relays 362-TPA and TPB operated when the data transfer circuit applied a positive 130-volt potential, via the position link, to the KPR lead of the trunk on FIG. 356. The operation of the TPA and TPB relays interconnected the data leads of the trunk with the data transfer circuit, thereby permitting the trunk to exchange information with the position circuit and with the computer, as already described. As part of this operation, relay 366-ET was operated from information received by the computer, thereby instructing the trunk that the overtime is to be computed on an "elapsed time" basis. Also, relay 365-M1 was operated from information received from the computer, thereby instructing the trunk that the duration of a single overtime period is to be one minute. Relays 362-TPA and TPB released when the data transfer circuit released from the connection. Relay 356-PA then released when the operator released the position from the connection. This, in turn, released relay 355-PA1. The release of this latter relay reclosed a circuit for relay 357-STT, thereby causing it to reoperate. The reoperation of the STT relay reclosed a ground to conductor HMG, thereby re-energizing the timer circuit which, in turn, now proceeds to transmit pulses to the trunk, as priorly described.

Prior to releasing from the connection, the operator advised the calling subscriber that the call is about to enter overtime and, additionally, if requested, advised him of the cost and duration of a single overtime period.

Relay 360-MC1 operates from the 60 pulse six seconds after the timing of the overtime begins. The operation of this relay, in turn, closes a path to extend ground from terminal 105 on FIG. 366 to operate relay 366-EF0. Also, recalling that relay 366-ET is operated at this time, relay 365-CH2 operates and locks under control of the 356-PA relay break contacts to ground on terminal 365-104. If the customer should disconnect and terminate the call before the operation of relay CH2, the operator is not recalled to the connection to request the payment of the overtime charges. However, once relay CH2 is operated and locked, the operator is recalled immediately upon a subscriber disconnect.

The minutes-counting circuit proceeds as described in connection with the initial-period timing operation. The duration of the overtime interval is fixed by the particular one of the 365-M1 through M5 relays that may be operated. Relay 365-M1 is operated for the present call. Relay 363-ETP operates, as before, when the particular MC- relay on FIG. 360 is operated, which matches the time indicated by the operated M- relay on FIG. 365.

In this case relay 365-M1 is operated, and when relay MC1 operates, an obvious path is closed on FIG. 363 to extend ground from terminal 110 through the make contacts of the 365-M1 and 360-MC1 relays and the transfer break contacts of the 360-MC2 and MC3 relays, to the winding of the 363-ETP relay, to operate it. The operation of the 363-ETP relay closes an obvious path on FIG. 365 to energize the rotary magnet of the IC selector, thereby advancing the wipers of this selector one step. The operation of relay 363-ETP operates relay 360-RCY, as before. However, the operation of relay RCY immediately releases the operated 360-MC1 relay which opens its make contacts on FIG. 363, thereby releasing the 363-ETP relay. The subsequent operation of relay 357-M60 releases relay 360-RCY, since relay 366-ET is operated for this portion of the call. The operated 365-CH2 relay prevents the operation of relay 360-RCY from extending the ground on terminal 103 of FIG. 360 to operate relay 351-PR as a position request signal.

The completion of one interval of overtime has now been recorded on the 365-IC selector, and the minutes-counting circuit next proceeds to "time" and "count" the second overtime interval. In this manner, the subscriber can be permitted to continue talking on overtime up to the completion of 10 overtime intervals, at which time the IC selector moves to its position 10. The IC selector moves to position 10 when the 363-ETP relay operates incident to the start of the last minute of the 10th interval. Relay 366-EC operates through an obvious path shown on FIG. 366, as an end-of-cycle indication, as the IC selector steps to its position 10 at this time. With the 357-OK and the 357-M60 relays operated at the end of the last minute of the 10th interval, the 351-PR relay is operated through the closed transfer make contacts on FIG. 360 of the 366-EC relay. The operation of the PR relay releases relay 357-STT which, in turn, removes ground from conductor HMG to the timer pulse circuit, thereby removing the timing pulses from the trunk.

The operation of relay 351-PR completes a path, on FIG. 356, from ground on terminal 101 to apply ground to conductor PS extending to the position link circuit, thereby instructing this circuit to interconnect the trunk with an operator on a priority basis, as described in detail in the Curtis disclosure. The attachment of the operator position to the trunk circuit by means of the position link operates relay 356-PA which, in turn, operates relay 355-PA1. The operation of relay 355-PA1 releases the 351-PR relay, and also closes a ground from terminal 102 on FIG. 365 to operate the release magnet of the IC selector, thereby restoring it to its "home" or normal position.

DATA INTERCHANGE UPON AN END-OF-CYCLE SEIZURE

Next, the operator position circuit, once it is attached, proceeds to bid for a connection to the data transfer circuit which, in turn, interconnects the trunk, the position, and a computer, as priorly described in connection with the data transfer operation at the end of the initial period. The trunk now transmits information to the position and the computer and, in response to the receipt of this information, the computer transmits information back to the trunk and the position circuit. Following is a discussion of the data interchanged at this point.

Trunk output information.—The trunk now grounds its conductor C0P on FIG. 363 which, in turn, extends to FIG. 372A of the data transfer circuit, to the rectangle representing trunk 40 thereon. The ground on this conductor may then be further extended through make contacts 263A-0TSG4 and 238-0TSR0, and through the winding of relay 372-C0P for channel 0, to operate it. This operation instructs the data transfer circuit that this is a coin-overtime-period seizure. The trunk circuit also grounds at this time its conductor EC on FIG. 365

which, in turn, extends to FIG. 396A, to the rectangle representing trunk 40 thereon. The ground on this conductor may be further extended through make contacts 263A-0TSG4, 238-0TSR0 on FIG. 396, and 391-0CA0, assuming that computer 0 is now attached to the connection, to conductor EC extending to FIG. 425 of the computer circuit, to operate relay 425-EC. The operation of this relay instructs the computer that the call has lasted for 10 overtime periods and that the overtime charges are to be computed on that basis. The trunk also grounds its conductor ET on FIG. 366 at this time, since relay 366-ET is operated. The ground on this conductor may be extended to FIG. 396A of the data transfer circuit, to the rectangle representing trunk 40 thereon. This ground is then further extended to the computer 0 over the same circuitry as described for the EC lead. However, the reception of the ET conductor ground by the computer performs no useful function at this time.

The trunk also grounds its conductor NSA on FIG. 363 at this time, which extends to FIG. 273A of the data transfer circuit to the rectangle representing trunk 40 thereon. This ground may then be further extended through make contacts 263A-0TSG4 and contacts 238-0TS0 on FIG. 273, to the winding of relay 273-NSA for channel 0, to operate it as an indication to the data transfer circuit that no sender is currently attached to the connection. The trunk also grounds its conductor 0A0 on FIG. 363 extending to FIG. 272B of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through make contacts 263A-0TSGA4, 238-0TSS0 on FIG. 272, and make contacts 388-0CB0 to FIG. 424 of the computer, to operate relay 424-0A0 thereon. The ground on conductor 0A0 of channel 0 on FIG. 272 may also be extended to FIG. 271, through make contacts 225-0PRF0 and 224-PF00, to FIG. 193 of the data transfer circuit, to operate relay 193-0A0 as an indication of the originating area for the call.

The trunk circuit grounds its conductor 0P on FIG. 366 which extends to FIG. 397A of the data transfer circuit. This ground may then be further extended through the rectangle representing trunk 40, make contacts 263A-0TSG4, 238-0TSS0, and 388-0CB0, to FIG. 425 of the computer, to operate relay 425-0P. The operation of this relay informs the computer that this is the 10th overtime period for the call, rather than the 20th, the 30th, the 40th, etc.

The trunk at this time also grounds its conductor PP on FIG. 364 extending to FIG. 405A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may be further extended through make contacts 263A-0TSG4, 238-0TSR0 on FIG. 405, 406-0SPL, and 388-0CA0 on FIG. 406, to FIG. 425 of the computer, to operate relay 425-PP thereon as an indication that this is a person-to-person call. The ground on conductor PP of channel 0 on FIG. 405 may also be extended to FIG. 404, through make contacts 225-0PRG0 and 224-PG00, to FIG. 198 of the position control circuit, to operate relay 198-CSP as an indication that this is a person-to-person call.

Referring now to FIG. 364, the rate treatment 011 is currently registered in the trunk by the operation of relays 364-RTH0, RTT0 and RTT1, and RTU0 and RTU1. The trunk now grounds, by means of the locking circuits of these relays the correspondingly designated conductors extending to FIG. 405A of the data transfer circuit, to the rectangle representing trunk 40 thereon. The grounds on these conductors may then be further extended, through the same circuitry just described for the person-to-person indication, to the correspondingly designated conductors of the computer on FIG. 425, to operate the correspondingly designated relays thereon, thereby registering the rate treatment of 011 in the computer. The rate treatment of 011 is also registered in the position control circuit at this time by means of the same data trans-

fer circuitry utilized for the transmission of the person-to-person mark. The rate treatment is registered in the position control circuit by means of the circuitry shown on its FIG. 199A. The ground on the RTH0 lead for the hundreds digit of 0 operates relay 199A-RH7, while the grounds on the RTT0 and RTT1, and the RTU0 and RTU1 conductors, operate the correspondingly designated 199A-RT- and RU- relays.

Computer output information.—The computer operates in response to the data received from the trunk, as just described, and derives charge information which is transmitted to the operator position and position control circuit. The specific items of information derived at this time, and the circuit paths by means of which they are transmitted to the operator position, are similar to those described in detail subsequently for an end-of-call seizure, during which a trunk, a computer, and an operator position circuit are once again interconnected by the data transfer circuit.

POSITION CIRCUIT OPERATION

Following the receipt of information from the computer and the trunk circuit via the data transfer circuit during this overtime seizure, and upon receipt of a DTOK signal from the data transfer circuit, the DTST relay in the position control circuit releases, which, in turn, causes the release of the data transfer circuit. The position operator is connected at this time, with the 204-CGD relay operated in the position control circuit. A ground is extended over the CGD lead to light the charge due lamp on FIG. 219. The charge due lamp, lighted, on the position, in addition to the coin special toll lamp or coin station lamp, lighted, indicates to the operator that the call connected to the position at this time is connected for the purpose of collecting overtime charges. The information stored in the minutes-and-charge registers in the position control circuit, shown on FIG. 199B, is automatically displayed on the indicator tubes shown on FIGS. 207 and 208 of the position circuit. The position operator then quotes the displayed time-and-charge information to the calling subscriber and monitors the resulting coin deposit. It has been priorly assumed that a charge for a single overtime period of one minute duration for the present call is 25 cents. Therefore, at this stage of the call, 10 overtime periods have elapsed and the charges now due as derived by the computer and currently displayed at the operator position are \$2.50. Upon satisfactory monitoring of the requested coin deposit, the position operator may then proceed to release the position from the connection as previously described.

RELEASE OF OPERATOR POSITION AND REOPERATION OF TRUNK TIMING CIRCUIT

Relays 356-PA and 355-PA1 of the trunk circuit release when the operator releases from the connection. The release of relay PA now releases the 366-EF0 relay which in releasing, cause the operation of relay 365-OP1 and the release of the operated 366-EC relay. Relay OP1 locks to relay 363-OP, operated. The release of relay 366-EF0 also releases relay 365-CH2. All of the timing circuits have now returned to normal. The 357-TT relay reoperates, and the timer pulse circuit again supplies pulses to the trunk for timing additional overtime intervals. However, at this time, relay 365-OP1, in its operated condition, is an indication that a count is now being made of the 11th to 20th overtime periods. The OP1 lead of FIG. 366 is subsequently used in connection with the operated or released 365-OP1 relay in order to indicate to the data transfer circuit whether or not the "elapsed time" overtime has continued beyond the first 10 overtime intervals. This is necessary since, in some areas, operating companies provide different charge rates for the first and for subsequent overtime intervals.

The trunk now commences timing, as before, and in the event that the customer continues the call for another

10 overtime periods, relay 366-EC will operate as the IC selector steps to its 10th position and will initiate a position seizure which, in turn, causes the data transfer circuit to interconnect the position, the trunk, and a computer, in a similar manner to that hereinbefore described, in order that these three circuits may interchange call information.

If the call should end any time before the end of a full cycle of 10 overtime periods, a position request is initiated in the manner subsequently described and, in turn, a data transfer circuit seizure is made to once again connect the trunk, the position, and a computer in order that the computer may then determine the charges due for the indicated amount of overtime.

END OF CALL AND END-OF-CALL SEIZURE

If the calling subscriber should terminate the call by hanging up, relay 348-A releases which, in turn, releases relay 359-B. Relay 365-CH2 is in an operated condition at this time and, therefore, the ground on terminal 104 of FIG. 360 may be extended over break contacts 359-B, and transfer make contacts 365-CH2 to the winding of relay 351-PR, to operate it and, in turn, initiate a request for attachment of an operator position on a priority basis, as priorly described. If relay CH2 had not been operated, there would be no charge for this portion of the overtime period and the trunk would have initiated a normal disconnect operation, as elsewhere described, with no connection being required to either the operator or a computer, and a normal AMA disconnect entry would then be made without any further charges being required.

If the called subscriber hangs up first, relay 349-CS releases. The release of this relay extends a ground from terminal 101 on FIG. 361 through transfer break contacts 349-CS and 355-PA1, make contacts 358-CH and 351-D3, break contacts 358-IN, and transfer make contacts 366-ET, to the winding of relay 361-CSR, to operate it. The operation of relay CSR closes its make contacts on FIG. 355 to extend battery from terminal 355-101, through the resistance lamp LV, make contacts 351-D3, 361-CSR, and 365-CH2, to the winding of relay 355-RLF, to operate it. The operation of this relay extends ground on terminal 105 of FIG. 360, through make contacts 355-RLF, transfer make contacts 363-OP and 365-CH2, and thence, over the PR conductor, through the winding of relay 351-PR, to operate it. The operation of this relay, as before, initiates a seizure of an operator position circuit, on a priority basis, by the position link which, in turn, causes the data transfer circuit to interconnect the trunk, the position, and a computer, in order that the computer may determine the charges now due from the calling party.

Assuming that computer 0 is seized by the data transfer circuit at this time, the following information, as described in the subsequent paragraph, is now interchanged between circuits. Before this, however, it should be noted that if the calling party should flash his switchhook rather than merely hang up at the end of a call, the circuit operation will be the same and the position-request and data-transfer operation will also be initiated in the same manner.

END OF CALL DATA INTERCHANGE BETWEEN TRUNK, COMPUTER, AND OPERATOR POSITION CIRCUIT

Trunk output information at end of call.—The trunk now grounds its COP conductor on FIG. 363 which extends to FIG. 372A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through make contacts 263A-OTSG4, and 238-OTSR0 on FIG. 372, to the winding of relay 372-COP for channel 0, to operate it. The trunk also grounds its conductor ET on FIG. 366, which extends to FIG. 396A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through make

contacts 263A-0TSG4, 238-0TSR0 on FIG. 396, and 388-0CA0, to FIG. 426 of the computer circuit, where the appearance of this ground currently performs no useful function.

The trunk at this time also provides an indication over its M0 through M4 leads, on FIG. 365, concerning the number of minutes elapsed and extending into the next overtime period beyond that indicated by the IC selector. It has been assumed for the present call that an overtime period is of one minute duration and therefore, since time is not divided into time intervals having durations of less than one minute by the present circuit, the trunk circuit for the present call never provides a minutes indication in addition to a number-of-overtime-periods indication. However, if the duration of a single overtime period were two or three minutes, the trunk would then, at the end of a call which had extended into overtime, provide an indication of the number of overtime periods (via the IC selector) together with an indication of the number of minutes the call had progressed towards the next overtime period. This number-of-minutes indication, as before stated, is provided by conductors M0 through M4 in FIG. 365.

For the present call, the number of minutes the call has extended into the next overtime period is, of necessity, "0" since an overtime period is stated to be of one minute duration. Therefore, a ground is now extended on FIG. 365 from terminal 106, through the transfer break contacts of relays 366-EC, and 360-MC3, MC2, MC1, and transfer make contacts 366-EF0, and make contacts 362-TPB, to conductor M0 on FIG. 365 which extends to FIG. 399A of the data transfer circuit, to the rectangle representing trunk 40 thereon. The ground on this conductor may then be further extended through make contacts 263A-0TSG4, to 238-0TSR0 on FIG. 399, 388-0CA0 on FIG. 400, to conductor M0 of the computer, extending to computer FIG. 424, to operate relay 424-M0, thereby informing the computer that no (zero) minutes of the next overtime period have elapsed.

The trunk also grounds at this time its conductor NSA on FIG. 363 which extends to FIG. 273A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through contacts 263A-0TSG4, to 238-0TS0 on FIG. 273, to the winding of relay 273-NSA for channel 0, to operate it. The trunk also grounds its conductor 0A0 on FIG. 363 which extends to FIG. 272B of the data transfer circuit, to the rectangle representing trunk 40 thereon. The ground on this conductor may then be further extended through make contacts 263A-0TSG4, to 238-0TSS0 on FIG. 272, to the 0A0 conductor of channel 0. The ground on this conductor may then be first extended through make contacts 388-0CB0 on FIG. 272A to the 0A0 conductor of the computer to operate relay 424-0A0. The ground on this conductor of channel 0 may also be extended through make contacts 225-0PRF0 on FIG. 271, and make contacts 224-PF00, to FIG. 192 of the position control circuit, to operate relay 193-0A0.

The trunk at this time grounds either its 0P or its 0P1 conductor on FIG. 366, depending upon whether or not the call has progressed beyond 10 overtime periods. The trunk grounds conductor 0P if less than 11 overtime periods have elapsed, and it grounds conductor 0P1 if the call has extended into or beyond the 11th overtime period. Since the circuitry for the grounding of conductor 0P for the 10th overtime period has been priorly described, it is, therefore, assumed that this time the call has extended into or beyond the 11th overtime period and that therefore conductor 0P1 is now grounded. This being the case, the ground on conductor 0P1 is extended to FIG. 392A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may be further extended through make contacts 263A-0TSG4, 238-0TSS0 on FIG. 392, and 388-0CB0, to the 0P1

conductor of the computer circuit, to operate relay 425-0P1.

The trunk at this time grounds its conductors 0TP0, 0TP1, 0TP2, 0TP4, and 0TP7, on FIG. 366, on a 2-out-of-5 code basis, as an indication of the number of overtime periods elapsing either from the end of the initial period or from the end of the last overtime cycle, where an overtime cycle is defined as comprising 10 overtime periods. The circuit operations, including the data interchanged at the end of the 10th overtime cycle, have been priorly described, and therefore the number-of-overtime-period information provided by the trunk at this time pertains to the number of overtime periods elapsing since the end of the last overtime cycle. Let it be assumed at this time that three such overtime periods have elapsed. The IC selector on FIGS. 365 and 366 is advanced one position for each elapsed overtime period as priorly described, and, therefore, assuming that three such overtime periods have elapsed, the IC selector is now in its position 3. This being the case, it grounds its 0TP- conductors on a 2-out-of-5 code basis to transmit the digit 3 to the data transfer circuit, and thence to the computer. The following circuit is now closed on FIG. 366 to ground conductors 0TP1 and 0TP2, which together represent the digit 3: ground on terminal 106 of FIG. 366, break contacts 357-OK, make contacts 363-OP, through the wiper of the left-hand bank of the rotary selector to conductor 0TP1, and through the wiper of the right-hand bank of the rotary selector to conductor 0TP2. The grounds on these conductors are extended to FIG. 397A of the data transfer circuit, to the rectangle representing trunk 40. The grounds on these conductors may then be further extended through make contacts 263A-0TSG4, 238-0TSS0 on FIG. 397, to conductors 0TP1 and 0TP2 of channel 0, through make contacts 388-0CB0 on FIG. 398, to the correspondingly designated conductors of the computer circuit, to operate relays 0TP1 and 0TP2 on FIG. 425.

The trunk grounds its conductor PP on FIG. 364 as a person-to-person indication at this time. The ground on this conductor may be extended to data transfer circuit FIG. 405A to the rectangle representing trunk 40. This ground may be further extended through make contacts 263A-0TSG4, and 238-0TSR0 and 406-0SPL on FIG. 405, to the PP conductor of channel 0. From there, this ground may be first extended through make contacts 388-0CA0 to FIG. 425 of the computer circuit, to operate relay 425-PP. The ground on this channel conductor may also be extended to FIG. 198 of the position control circuit, via make contacts 225-0PRG0 on FIG. 404 and make contacts 224-PG00, to operate relay 198-CSP.

The trunk now transmits the rate treatment information to both the computer and to the position control circuits. It is then assumed that the rate treatment number for the present call is 011 and that it is stored in the registers on FIG. 364 of the trunk circuit by the operation of relays 364-RTH0, RTT0, and RTT1, and RTU0 and RTU1. These relays are currently locked operated and their respective locking grounds are extended to the correspondingly designated conductors extending to FIG. 405A of the data transfer circuit, to the rectangle representing trunk 40. The grounds on these conductors may then be extended to the computer and to the position control circuits by means of circuitry identical to that just described for the transmission of the person-to-person mark, to operate the correspondingly designated relays on FIG. 425 of the computer and to operate the following relays on FIG. 199A: RH7, RT0 and RT1, and RU0 and RU1 of the position control circuit.

Computer output data to position circuit at the end of call.—The computer now grounds its CH- leads on a 2-out-of-5 code basis on FIG. 427, its CT- leads on a 2-out-of-5 code basis on FIG. 426, and its CU00 or its CU05 lead on a 1-out-of-2 code basis on the same figure in order to transmit to the position circuit the "hundreds,"

"tens," and "units" digit of the charges now due. It has been priorly assumed that the cost of a single overtime period is 25 cents, and it has been further assumed that the present call has gone three additional overtime periods since charges were last collected at the expiration of 10 overtime periods. This being the case, 75 cents is now due from the calling customer, and the computer grounds its CH4 and CH7 conductors on FIG. 427 for a hundreds digit of zero, its CT0 and CT7 conductors on FIG. 426 for a tens digit of 7, and its CU05 conductor on FIG. 426 for a units digit of 5 cents. The grounds on these conductors are extended to FIG. 403 of the data transfer circuit, to the rectangle representing computer 0, and thence are further extended through make contacts 388-0CC0, 225-OPRH0, and 224-PH00, to FIGS. 199A and 199B of the position control circuit. The grounds on these conductors then operate relays CH4 and CH7 on FIG. 199B for a hundreds digit of zero, relays CT0 and CT7 on FIG. 199B for a tens digit of 7, and relay CU5 on FIG. 199A for a units digit of 5 cents.

The computer also grounds, on FIG. 428, its conductors MT0, MT1, MT2, MT4, and MT7, and MU0, MU1, MU2, MU4, and MU7 on a 2-out-of-5 code basis in order to indicate the tens and units digits, respectively, of the elapsed minutes of overtime since money was last collected. The elapsed overtime for the overtime portion of the present call for which charges are currently being assessed is three minutes and, therefore, conductors MT4 and MT7 of the computer are grounded for a tens digit of zero, while conductors MU1 and MU2 on FIG. 428 are grounded for a units digit of 3. The grounds on these conductors are extended to data transfer circuit, FIG. 403, and thence are extended over identical circuitry to that just described for the charge information to position control circuit 00. These grounds enter the position control circuit on FIG. 199B, where they operate the correspondingly designated relays.

The computer now grounds its CD conductor, on FIG. 427, as a charge-due indication. This ground is extended to the data transfer circuit, FIG. 403, and thence, over circuitry similar to that just described, to FIG. 204 of the position control circuit, to operate relay 204-CGD. The operation of this relay lights a charge due lamp to notify the operator that it is necessary to supervise the collection of charges at this time.

The computer at this time also grounds one of its conductors NTX or TX, on FIG. 427, depending on whether or not the presently calculated charges include taxes. The ground on one of the other of these conductors is then extended to data transfer circuit, FIG. 403, and thence, by means of circuitry similar to that just described for the charge information, to FIG. 204 of the position control circuit, to operate relay 204-TX or 204-NTX, depending on which one of the conductors is presently grounded. The operation of one or the other of these relays controls the illumination of the respectively appropriate lamp, to enable the operator to inform the calling party whether or not the charges now due include taxes.

The computer at this time, on FIG. 427, either grounds its conductor NZN if the call is not of the zone type, or grounds its conductor CZN if the call is of the zone type. A ground on conductor NZN is extended to FIG. 393 of the data transfer circuit, whence it may be further extended from the rectangle representing computer 00, through make contacts 388-0CA0, to the winding of relay 393-NZN for channel 0, to operate it. If the computer grounds its conductor CZN, this ground is extended to FIG. 403 of the data transfer circuit, and thence, by means of the priorly described circuitry, to FIG. 198 of the position control circuit, to operate relay 198-CZN.

This concludes the transmission of output data from the computer to the position control circuit on an end-of-the-call seizure. Similar data would be transmitted from the computer to the position on an EC, i.e., an end-of-cycle seizure, except that in this case the "minutes" and

"charge" information would be different and would depend upon the cost and duration of a single overtime period. An EC seizure pertains to 10 overtime periods and therefore, using the data assumed for the present call, wherein the charge for a single overtime period is 25 cents and wherein the duration of a single overtime period is one minute, the "charge" would then be \$2.50 and the "minutes" would be 10. Other than this, the identical information would be transmitted from the computer to the position, as was just discussed in detail for an end-of-the-call seizure.

The data transfer circuit releases after checking that the data transferred from the computer to the position circuit has been properly registered therein. The data check path on FIGS. 286 through 292, and 411 through 416, is similar to that described for the data transfer circuit seizure at the end of the initial period.

OPERATION OF POSITION CIRCUIT ON AN END-OF-CALL SEIZURE

The "overtime" seizure of the position circuit is similar to the initial-period seizure, as described previously, except that instead of receiving a CIP indication from the trunk circuit, a ground signifying an 0P mark is received from FIG. 425 of the computer, via FIG. 398 of the data transfer circuit. The 0P mark causes the operation of the 198-C0P relay shown on FIG. 198 of the position control circuit. In addition to the 0P mark, a CD mark is also received from FIG. 427 of the computer, via FIG. 403 of the data transfer circuit, resulting in the operation of the 204-CGD relay shown on FIG. 204 of the position control circuit. Operation of the CGD relay causes the charge due lamp shown on FIG. 219 of the position circuit to be lighted. When the computer was connected during this data transfer seizure, the minutes-and-charge information for the accrued overtime interval is stored in the minutes-and-charge register shown on FIG. 199B of the position control circuit. This information was then, in turn, translated by the translator relays shown on FIGS. 199 and 200 of the position control circuit to display the stored information on the appropriate indicator tubes of the position circuit.

Depending upon whether the calling party is in the on-hook or off-hook condition, the position operator's action varies slightly. In the case where the calling subscriber is in the on-hook condition, the position operator must operate the ringback key shown on FIG. 213. Operation of the ringback key causes a ringback signal to be extended from terminal 101 on FIG. 213, through break contacts of relay 213-KGR, make contacts 216-T0, break contacts of the coin collect key, break contacts of the coin return key, break contacts of the ring forward key, make contacts of the ringback key, to lead RB of the position circuit, extending from FIG. 213 through FIGS. 186 and 185 to FIG. 179 of the position control circuit, through make contacts of the 169-T0A relay, and via the position link and connector circuit, to the trunk, to operate the 350-RB relay in the trunk circuit. Operation of the RB relay in the trunk circuit causes a ringback signal to be sent to the originating office, to cause ringing potential to be applied to the calling subscriber line. When the calling subscriber answers, the calling supervisory lamp (CLG0 on FIG. 216) is extinguished, indicating that the customer has answered.

If, when the call is connected to the position, the calling end is in the off-hook condition, the position operator need not ring the originating end back. When the originating subscriber is connected to the position, the operator quotes the displayed overtime charges and monitors the coin deposit. The operator then operates the coin-collect key to extend a ground signal to the trunk, to operate the 352-CC relay. Operation of the CC relay causes the collection of the deposited coins at the originating coin box. Upon collection of the deposited coins,

the operator may then proceed to release the call from the position, as previously described.

RECALL OF OPERATOR WHEN CALL IS IN PROGRESS—GENERAL

Under certain conditions, the originating subscriber can recall the operator to the connection on this trunk. The originating subscriber on a 0+ or 1+ call that is being automatically timed and rated may recall at any time before 42 seconds of the initial period have elapsed. A dial 0 subscriber can recall at any time; while a 0+ or 1+ call for which the charges have been reversed, charged to a third party, or charged to a credit card, cannot recall at any time. Recall by the called subscriber is not permitted. The recall referred to here is due to flashing by the originating subscriber. The operator may also be recalled to the connection by other action on the part of the trunk, such as end-of-overtime period, etc. These are discussed in other sections.

Since recall by the originating subscriber results from a momentary on-hook condition, it is necessary for the trunk to be able to distinguish between a "flash" and a "disconnect" condition. If the on-hook condition lasts for approximately 500 to 750 milliseconds followed by an off-hook signal, the signal is interpreted by the trunk as a recall. Any on-hook signals that are longer than 750 milliseconds are interpreted by the trunk as a disconnect and result in releasing the entire connection. A circuit is provided using the 354-TM cold cathode tube and its associated apparatus, which times the length of the subscriber's on-hook, to differentiate between a flash and a complete disconnect. The recall action differs somewhat for dial 0 calls versus special toll calls, and these calls are described in the following sections.

Recall of operator when call is in progress—Recall on dial 0.—When a dial 0 call is in progress, the customer is allowed to recall the operator at any time during the call. Prepaid dial 0 calls are always completed on a locked-link basis, as elsewhere described. In this type of connection, the trunk is not completely released from the operator position, and a direct signaling path between the calling subscriber and the operator remains. The on-hook condition from the calling subscriber is repeated to the operator position by the release of the 359-B relay grounding the 0S lead on FIG. 356 to the position link, to operate the 185-0S0 relay. The 0S0 relay causes the supervisory lamp to flash at the operator position and call the operator's attention to the customer's flash. Relay 356-PA remains operated for the duration of time that the trunk remains connected to the position on dial 0 calls. This being the case, relay 355-PA1 remains operated as a slave of the PA relay. The continued operation of relay 355-PA1 for the duration of the call prevents the 351-D relay from releasing as a consequence of the subscriber's flashing, and also prevents the 354-TM timer from being activated.

When dial 0 calls become "collect" or "special" calls the operator releases the position completely from the trunk after the initial-period seizure, and a subsequent recall is accomplished in a somewhat different manner. The originating subscriber's switchhook flash causes a momentary release of the 348-A, the 359-B, and the 362-BA relays, followed by their reoperation in sequence. However, the BA relay is somewhat slow to operate and insufficient time is provided for the operation of relay 351-PR between the time that the B relay operates and the BA relay operates. Relay PR is fast to operate. Relay 351-PR operates at this time over the following path on FIG. 351: ground on terminal 101, makes contacts 351-D, 359-B, break contacts 355-PA1, to the winding of relay 351-PR, to operate it. The operation of the PR relay, as before described, causes the trunk to be interconnected with an operator position on a priority basis and, in turn, causes the data transfer circuit to interconnect the trunk with operator position.

Recall of operator when call is in progress—Recall on special toll calls.—On special toll calls, the originating subscriber is permitted to recall the operator to the connection by flashing up until the time the 357-CH1 relay operates, which is 42 seconds after the start of timing. The recall results from the operation of the 351-PR relay, as previously described. In other words, relay PR operates during the operate time of relay 362-BA, following the operation of relay 359-B. With the 357-CH1 and 364-CTT relays normal, the 351-D relay is locked around the released 362-BA relay. Therefore, a customer, flashing an on-hook condition which results in the release of relay 362-BA, does not immediately release relay 351-D and, instead, the release of the D relay does not occur until subsequently, when the TM timer fires and releases the D relay. However, once the CH1 or CTT relay operates, the release of the BA relay permits D relay to release immediately and thereby to terminate the call, as elsewhere described. The TM timer is activated by the release of the BA relay and, on momentary on-hooks of greater duration than 750 milliseconds, results in a complete disconnect of the call instead of a recall. Once the CH1 relay has operated, any on-hook signal from the originating subscriber results in the release of the 351-D relay and the release of the connection forward. When special toll calls are completed as "collect" or "special" calls, the 364-CTT relay is operated to prevent trunk timing. The operation of this relay also cancels the recall feature. Consequently, an on-hook signal from the originating subscriber results in the complete release of the connection forward if relay 364-CTT is operated.

Recall of operator when call is in progress—Action of TM timer in recall.—The TM timer on FIG. 354 consists of the TM cold cathode tube, the 351-D relay, and associated capacitors, resistors, etc. The timer has only one function, and that is to distinguish between "recall" flashes and "disconnect" signals from the originating subscriber. Its function in this connection is to cause the release of the 351-D relay when the on-hook signals from the originating end last longer than 500 to 750 milliseconds. When a connection has been established, as indicated by the 351-D relay operated, there will be +130 volts on the anode of the TM tube. Normally, the control anode will be held at ground potential by the operated 362-BA, 355-PA1, or 351-PR relays. Under these conditions, the tube will not conduit. Also, under these conditions the TM capacitor is completely discharged. The removal of the ground from the TM capacitor causes it to start charging to the positive 130-volt potential through the TM resistor. The potential on the control anode starts to rise. In approximately 500 to 750 milliseconds, the potential on the control anode will be sufficiently high to cause the gas within the tube to ionize, and conduction from the cathode to the anode takes place. The path of the cathode current is from ground through the primary winding of the operated 351-D relay, through the TM tube, to positive 130 volts. This current flowing in the primary winding of the D relay is in such a direction as to cause the fast release of that relay, followed by the release of relays D1, D2, and D3 on FIGS. 351 and 358. This causes a complete release of the connection forward. The action of the TM timer starts with the release of relay 362-BA as long as the position operator is not connected to the trunk.

TRUNK TIMEOUT ON RECALL

The trunk circuit times out in the normal manner if the recall flashes of the calling customer are too slow. Upon the first flash, relays 348-A, 359-B, and 362-BA release. The release of the BA relay removes the ground on terminal 104 from terminal 105, thereby permitting the TM capacitor to charge and fire the TM tube, thereby, in turn, causing the primary winding of the 351-D relay to release it and, in turn, releasing relays 358-D1, 351-D2, and 351-D3. This action results in the normal disconnect

operation of the trunk and the perforation of an AMA disconnect entry, as elsewhere described.

OPERATION OF POSITION CIRCUIT ON A RECALL SEIZURE

Upon seizure of the position control circuit by the trunk circuit via the position link, a seizure of the data transfer circuit is initiated by the position control, similar to the initial seizure, as previously described. The trunk then transmits the subsequently enumerated data, via the data transfer circuit, to the position control circuit. The trunk grounds its RCL lead on FIG. 363, thereby transmitting an RCL mark to the position. The RCL mark ground is extended to FIG. 272B of the data transfer circuit, to the rectangle representing trunk 40, through make contacts 263A-0TSG4, make contacts 238-0TSS0 on FIG. 272, make contacts 225-0PRF0 and 224-PF00 on FIG. 271, and to FIG. 193 of the position control circuit, thereby causing the operation of the 193-RCL relay. With the RCL relay operated, the stored class information, as evidenced, for example, by the CSP relay being operated, the special toll (coin) lamp on the position, instead of lighting from a steady ground, is lighted from a 120 i.p.m. interrupted ground from terminal 101 of FIG. 219, through make contacts of the 181-LL relay, break contacts 195-0VLP and 198-NFY, transfer make contacts 193-RCL, and make contacts 181-INT and 198-CSP to the special toll (coin) lamp on FIG. 219. The flashing special toll (coin) lamp on the position indicates to the operator that this is a recall seizure of a special toll call. The operator proceeds to ascertain what the customer wants and then proceeds to handle the call in a similar manner as for the initial seizure call, as described previously. Examples of action that might be taken at this time by the operator are to establish a new connection to the called station in the event of transmission trouble, or to establish a connection to a new called station upon the customer's request.

DATA TRANSFER CIRCUIT OPERATION ON RECALL

This description covers the condition, for all calls other than those served on a locked loop basis, wherein the subscriber who originated the call requests the services of an operator, at any time for dial 0 calls, and within 42 seconds of the start of the initial period for station-paid calls, by flashing his switchhook after the call has been established and the operator has released her position from the trunk. The trunk, on receiving the flashing switchhook signal, initiates a request for connection to an operator, in the manner priorly described, and is connected thereto. Since the operator has no prior knowledge of the condition of the call, a connection is required between the position trunk circuit, via the data transfer circuit, to furnish the operator with the information as to the condition of the call as registered in the trunk. The position control circuit, after it is connected with the trunk via the position link, requests the services of the data transfer circuit and, upon being connected thereto, as priorly described for an initial-period call, requests connection to the trunk circuit. The data channel receives a "STOP" mark from the position and an NSA mark from the trunk. The position is thereupon connected to the trunk via the data transfer circuit, as priorly described for the coin toll-initial-period seizure up to the point wherein the 263A-0TSG4 and 266-TP0 relays operated. The progress from there on in is as follows: The operation of the 263A-0TSG4 relay connects the trunk to the data channel and to the position, allowing relays 266-0TP0, 273-NSA, and 372-CRCL to operate. The operation of relays 266-TP0 and 273-NSA operate relay 297-SDTM which, in turn, operates relay 297-DTM. This, in turn, releases relay 297-DTMB which, in turn, releases relays 238-0TSS0 and 406-0SPL. Relay 297-DTMF also operates, following the operation of relay 297-DTM. The operation of relay 297-DTMF operates relays 248-TST1

through TST9, whereupon the check relays involved in the transfer of information between the trunk and position operate in the manner priorly described. Upon closure of a satisfactory check path, as described below, the 413-DOK3 relay operates, operating, in turn, the 182-DTOK relay in the position; and the data transfer circuit is released from the call, as priorly described.

The check path for operating the 414-DOK3 relay may be traced as follows: ground from terminal 101 of FIG. 286, make contacts 224-PF00, make contacts 225-0PRC0, make contacts 248-TST3, make contacts 297-DTMF, transfer break contacts 371-CFC, 370-PT0T, 260-RT0S, 261-PT0S and 372-CIP, and transfer make contacts 372-CRCL, to terminal 101 of FIG. 411, thence through break contacts 396-ET and 343-IT, to terminal 102 of FIG. 411, thence through break contacts 398-IP and 398-OP, make contacts 271-RCL, to terminal 101 of FIG. 412, thence (assuming the same rate treatment priorly described for the regular call of 011), through the symmetric circuits for the rate treatment, to terminal 105 of FIG. 413, thence through "interval" or "overtime" minutes, symmetric circuit to terminal 106 of FIG. 413, thence through the break contacts of all the "free call" and "rate charge information" test relays, to terminal 101 of FIG. 414, thence through the "person or station marks" symmetric circuit, break contacts 370-CST, 372-COP and 370-STR, and make contacts 372-CRCL, to the winding of relay 414-DOK3, operating it.

Data interchange between trunk and position on a recall seizure of the operator—0+ and 1+ calls.—The following paragraphs discuss the data interchanged between the trunk circuit and the position circuit upon a "recall" seizure of the operator position circuit on a 0+ or 1+ call. This type of seizure can only occur within the first 42 seconds of the initial period. Once 42 seconds have elapsed, an attempted recall operation by the calling subscriber will completely release the connection if made during the remainder of the initial period and, if made during an overtime period, will bring in the operator, together with a computer, as an end-of-call indication. The trunk now grounds its conductor CRCL on FIG. 363 which, in turn, extends to FIG. 372A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through make contacts 263A-0TSG4 and 238-0TSR0, to the winding of relay 372-CRCL for channel 0, to operate it. The operation of this relay informs the data transfer circuit that the current seizure is for a "recall" connection for a coin call.

It was assumed for the present call that the duration of the initial period is five minutes and that relay 365-M5 was operated as a consequence of a ground having been extended to conductor M4 on FIG. 365. This being the case, the locking circuit for the M5 relay now applies ground to conductor M4, which locking ground is extended to the rectangle representing trunk 40 on FIG. 399A. This ground may then be further extended through make contacts 263A-0TSG4 and 238-0TSR0 to the similarly designated conductor of channel 0. The reception of the ground on this conductor performs no useful circuit function on this seizure of the data transfer circuit. The trunk also grounds conductor NSA on FIG. 363. This ground is extended to the rectangle representing trunk 40 on FIG. 273A, and thence is further extended through make contacts 263A-0TSG4 and 238-0TS0, to the winding of relay 273-NSA for channel 0, to operate it. The operation of this relay instructs the data transfer circuit that no sender is attached to the connection at this time. The trunk also grounds its conductor 0A0 on FIG. 363 which, in turn, extends to FIG. 272B of the data transfer circuit, to the rectangle representing trunk 40. This ground may further be extended through make contacts 263-0TSG4, 238-0TSS0 on FIG. 272, 225-0PRF0 and 224-PF00 on FIG. 271, to FIG. 193 of the position control

circuit, to operate relay 0A0 thereon as an indication to the position circuit of the originating area of the call.

The trunk also grounds, on FIG. 366, its conductors 0IT1, 0TP0 and 0TP1 as a tens and units office-index indication. The grounds on these conductors are extended to FIG. 397A of the data transfer circuit, to the rectangle representing trunk 40. These conductors may then be further extended through make contacts 263A-0TSG4 and 238-0TSS0 to the correspondingly designated conductors of channel 0. These grounds in the data transfer circuit at this time perform no useful function other than facilitating a subsequently required data check operation.

The trunk circuit at this time grounds conductor 0MA on FIG. 363, extending to FIG. 265A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor is then further extended through make contacts 263A-0TSG4, 238-0TSS0 on FIG. 265, 225-0PRD0 and 224-PD00 on FIG. 264, to FIG. 193 of the position control circuit, to operate relay 193-S0MA thereon as an indication that the operator must identify the calling station at this time. The trunk also grounds its conductor PP on FIG. 364 which, in turn, extends to FIG. 405A of the data transfer circuit, to the rectangle representing trunk 40. The ground on this conductor may then be further extended through make contacts 263A-0TSG4, 238-0TSR0 and 406-0SPL on FIG. 405, to the PP conductor of data channel 0. The ground on the PP conductor of channel 0 may be further extended through make contacts 225-0PRG0 and make contacts 224-PG00 of FIG. 404, to FIG. 198 of the position control circuit, to operate relay 198-CSP as an indication that this is a person-to-person type call. The trunk at this time also grounds its conductor RCL on FIG. 363, which extends to FIG. 272B of the data transfer circuit, to the rectangle representing trunk 40 thereon. The ground on this conductor may then be further extended through make contacts 263A-0TSG4, 238-0TSS0 on FIG. 272, 225-0PRF0 and 224-PF00 on FIG. 271, to FIG. 193 of the position control circuit, to operate relay 193-RCL as an indication to the operator that this is a recall situation.

Recalling that the rate treatment for the present call is 011, the following relays on FIG. 364 of the trunk circuit are currently operated: RTH0, RTT0 and RTT1, and RTU0 and RTU1. These relays have been locked operated and their respective locking paths extend grounds to the correspondingly designated conductors which, in turn, extend to FIG. 405A of the data transfer circuit, to the rectangle representing trunk 40. The grounds on these conductors may then be further extended, over the same circuitry previously described for the person-to-person indication, to FIG. 199A of the position control circuit, to ground the correspondingly designated leads thereon. The grounding of these leads on this figure of the position control circuit operates the following relays on FIG. 199A: RH7 for a hundreds digit indication of 0, RT0 and RT1 for a tens digit indication of 1, and RU0 and RU1 for a units digit indication of 1.

Recall data interchange—Dial 0 calls.—The following information is transmitted from the trunk to the operator position via the data transfer circuit on dial 0 calls:

Dial 0 Call

ZCN
ZNC
RCL
0A0
0MA

The circuitry by means of which the above-identified marks are transmitted from the trunk to the position circuit is identical, or similar, to the circuitry already described for other data transfer operations, and therefore the details thereof are not repeated at this time.

Whenever the operator is connected to the trunk through the position link, the operator may, by a key operation, send ground to the trunk over the CC or KPT leads extending to the trunk on FIG. 356, thereby operating, respectively, the 352-CC or 352-CR relays in the trunk, resulting, respectively, in a coin-collect or coin-return signal to the originating office. Automatic arrangements for coin disposal are also provided. A ground pulse on the CC lead of the timer, after relay 360-RCY has operated prior to the end of the initial period, causes the operation of the CC relay to cause a coin-collect signal to be sent to the originating office. This signal occurs 18 seconds before the end of the initial period and causes the collection of the customer's initial deposit.

When the trunk releases at the end of the call, the release of relay 354-RV, with relay 354-ON still operated, causes a ground signal to be transmitted to either the coin-collect or coin-return relay to make a final disposition of any coins which still may remain in the coin telephone. The decision as to whether a coin-collect or a coin-return signal should be sent at this point is controlled by relay 357-CH1. The path which operates either the CC or CR relay on FIG. 352 is as follows: ground on terminal 106 on FIG. 354, transfer break contacts 354-RV, make contacts 354-ON, over the CC conductor extending to terminal 103 on FIG. 356. From there, the relay that is operated is determined by the current condition of relay 357-CH1. If the relay CH1 is operated, the ground on terminal 103 may further be extended through the transfer make contacts of the CH1 relay, through the transfer break contacts of the 355-PA1 relay, to the winding of the CC relay, to operate it. If relay 357-CH1 is normal, the ground on terminal 103 may then be extended through its transfer break contacts directly to the winding of the CR relay, to operate it. Relay CH1 operates for prepaid calls, but does not operate for credit cards or "collect" calls since the charging operation is handled by the AMA equipment for such calls. In this case, the nonoperation of the CH1 relay ensures that the customer's initial deposit is always returned at the end of the call in case the operator should forget to do this when connected to the calling circuit.

The coin signal for the trunk consists of the simultaneous application of +130 and -48 volts to the tip and ring conductors, respectively, towards the originating office. The collect signal occurs when positive 130 volts is applied to the tip and -48 volts to the ring. The coin-return signal occurs when -48 volts is applied to the tip and +130 volts to the ring. The polarity of the applied potential is determined by the operation of either the CC or the CR relay on FIG. 352. The operation of relay 352-M0 applies these potentials to the trunk conductors. Relay M0 is somewhat slow to release, following the release of relay CC or CR. Thus, a momentary open period is provided on the tip and ring towards the distant office following the removal of the coin signal. This is done to allow for the release of certain relays in the outgoing trunk at the originating office before the tandem trunk reapplies battery and ground to the tip and ring conductors. During the time that the M0 relay is operated, the 348-A relay releases. However, the operated M0 relay provides an additional holding path for the 359-B relay to prevent the release of the tandem trunk circuit.

When this coin signal is being produced by the release of the 354-RV relay during trunk release, the 354-ON relay starts to release, following the operation of relay M0. The ON relay is made slow to release to provide a minimum application time for the coin signal. The operated CC or CR relay releases, following the release of relay ON, and the release of relay M0 then follows.

When the coin signal results from the ground pulse on the CC lead from the timer circuit, the duration of the

coin signal is determined by the length of the CC pulse, which is approximately one-half second. The duration of manually-produced coin signals is determined by the action of the operator.

DISCONNECT—CALLING PARTY DISCONNECT

Normally, the calling and called parties will go on-hook at approximately the same time, in which case the calling party controls the disconnect of the trunk. The 348-A, 359-B, and 362-BA relays of the trunk release in response to the calling party on-hook signal. The release of relay 359-B causes the recall of the operator to the connection if an elapsed-time overtime call is in progress when the disconnect occurs, as previously discussed. For calls that disconnect during the initial period of a special toll call, the 351-D relay releases directly through the release of the 362-BA relay, or indirectly through the action of the TM timer, as determined by the state of relay 357-CH1. Dial 0 calls that are not being held on locked-link disconnect by releasing the D relay through the action of the TM timer. For calls that are held on locked-link, the D relay does not release until the operator releases the 355-PA1 relay by disconnecting the position, or by operating the 355-RLF1 relay, as described in connection with the release forward operation.

The release of the 351-D relay is followed by the release of the 358-D1, 351-D2, and 351-D3 relays, and the forward connection through the tandem office is then released. The trunk-disconnect operation now begins, unless the 354-RV relay is held operated because an operator is attached or because an AMA entry is in progress. On normal calls, the 354-RV relay releases upon the release of relay 358-TC as a consequence of the perforation of the disconnect entry.

DISCONNECT—CALLED PARTY DISCONNECT

When the calling party remains off-hook after the called party has disconnected, a timed disconnect operation takes place. The circuit is released by the operation of either of the two thermal relays 361-CSR or 361-RL. Relay RL is the slower to operate, requiring about 30 second, whereas relay CSR operates in about five seconds. The particular one of these two relays that is operated at any time is determined by the current operated or nonoperated condition of the 366-ET relay. The CSR relay is used for "elapsed-time" overtime calls, whereas the RL relay is used with the initial-period calls when a timed disconnect is required. When the called subscriber disconnects, the 349-CS and 361-CS1 relays release. The release of the CS relay provides ground to operate the 361-RL or the 361-CSR relay. When relay RL operates, it closes through a ground to shunt the 348-D1 relay, which releases and, in turn, releases relays D2 and D3 on FIG. 351. The 351-D relay remains operated, however. The linkage through the tandem office is now released. The release of relays 358-D1 and 351-D3 removes ground from the S conductor on FIG. 350 to the trunk link and connector circuit, which will allow the connection between the trunk link and office link frames to be released.

An AMA disconnect entry is started by the release of relay 351-D3 connecting the CH conductor from the recorder circuit in FIG. 361 to the DJ lead of the call-identity-indexer circuit in FIG. 358. The release of 358-D1 relay, through its break contacts on FIG. 361, grounds the OT lead to the call-identity-indexer on FIG. 358, which serves as an indication that a timed-disconnect entry should be made. Following the completion of the AMA entry, relay 358-TC is released, causing the 354-RV relay to release and trunk disconnect to begin. It should be noticed that the position operator is not recalled to the connection at this time.

If the 361-CSR relay is operated, instead of the 361-RL relay, a different sequence of operations takes place. Relay CSR, operated, causes the operation of the RLF and

RLF1 relays on FIG. 355, thereby initiating a release-forward sequence. The RLF1 relay, in operating, causes the release of the 351-D relay, followed by the release of relays 358-D1, 351-D2, and 351-D3, thereby breaking down the forward connection through tandem and, if required, initiating an AMA disconnect entry. In this case, a normal disconnect entry is made. The operation of relay 355-RLF releases the 357-STT relay, and on FIG. 360 passes ground through the operated transfer make contacts 363-OP and 365-CH2, and on FIG. 351 through break contacts 355-PA1, to operate the 351-PR relay and cause a priority connection of an operator to the trunk for the purpose of collecting for the elapsed overtime due. When AMA functions are completed and the operator releases the connection from the trunk, the trunk-release-forward operation begins the release of relay 354-RV.

AMA DISCONNECT ENTRY

An AMA disconnect entry is made when relay 351-D3 releases, with relays 358-CH and 358-TC operated. The DJ lead of the call-identity-indexer circuit is then closed through to the CH lead of the recorder circuit to initiate the entry, as previously described. Ground on the OT lead can alter this entry to become a timed-disconnect entry. Upon completion of the AMA disconnect entry, ground is returned to the trunk from the call-identity-indexer circuit on the RC lead of FIG. 358. This ground serves to shunt the battery supplied to the CH relay and causes the 358-CH relay to release. The 358-TC relay now releases. In the event that trouble was encountered in perforating the AMA disconnect entry, a circuit is provided through the operated make contacts of the CH and TC relays and the transfer break contacts of relay D3 to re-operate the IN relay of FIG. 358 through the operated make contacts of the 365-B1 interrupter relay. Relay 358-IN should operate in about 0 to 2.5 seconds after relay 351-TC releases. Two seconds later, the operation of relay 365-F1 closes ground, through the transfer break contacts of the D3 relay to shunt the battery supply to the winding of the TC relay of FIG. 358 and thereby release it. This withdraws the request for the AMA entry. Relay IN then releases, followed by relay CH. The trunk may now proceed with a normal-release operation.

TRUNK RELEASE

The trunk release begins with the release of the 354-RV relay. This relay releases as a consequence of the occurrence of a number of conditions which vary in accordance with a number of factors, such as whether the calling or the called station has gone on-hook to initiate the release of the trunk. Accordingly, the following relays must be released before relay 354-RV can release: 356-PA, 351-PR, 358-TC, 352-CB, 365-CH2, 358-D1, and 359-OF. The release of all these relays indicates that there is no further reason for the trunk to be held off normal.

The release of the 354-RV relay releases relay 360-RCY, if operated, as well as any of the operated MC-counting relays on FIG. 360. The release of the RCY and MC-relays restores the minutes-counting circuit of the trunk to normal. The release of the 354-RV relay also extends the ground on terminal 105 of FIG. 365, through the transfer break contacts of the RV relay and the "off-normal" make contacts of the 365-IC selector, to the winding of its release magnet, to energize it and thereby return the wipers of the selector on FIG. 366 to their normal or home position.

The release of the 354-RV relay also operates either the 352-CR or the 352-CC relay, depending upon the current state of relay 357-CH1, as priorly described. The operated CR or CC relay then initiates an automatic coin-return or coin-collect function, respectively, as priorly described. The release of the RV relay also opens its transfer make contacts intermediate the windings of the A relay on FIG. 348 and the primary windings of the

T transformer on FIG. 349. This reverses the polarity applied to the tip and ring conductors from the A relay windings and causes an on-hook signal to be transmitted back to the originating office. However, the operated CR or CC relay, as the case may be, operates the 352-M0 relay sufficiently fast that its transfer make contacts connected to the inner terminals of the primary windings of the T transformer on FIG. 349 are able to apply a coin-return or coin-collect signal to the originating office. The operation of relay 352-M0 closes its make contacts on FIG. 359 to extend the negative battery from terminal 101 to the upper winding of the B relay on the same figure, thereby reoperating it in the event that it has released, as would be the case if the release of the trunk had been initiated by an on-hook condition of the calling station. The reoperation of relay 359-B, in turn, reoperates relays 362-BA.

The operation of relay 352-M0 opens its break contacts on FIG. 354, thereby removing ground on terminal 107 from the winding of relay ON to initiate its release on a slow release basis. The slow release on the ON relay, in turn, causes the release of various information relays which have been previously operated. The relays which may now release as a consequence of the release of relay ON include 357-CH1, 363-OP, 364-CTT if operated, the operated coin-collect-coin-return relays CC and CR on 352 as a consequence of the opening of the make contacts of relay ON on FIG. 354, extending via the break contacts of RV to ground on terminal 106 of the same figure, relay 365-M1 as a consequence of its disconnection from ground on terminal 101 of the same figure by the opening of the make contacts of the ON relay, relays 364-PP, 364-RTH0, 364-RTT0 and RTT1, and 364-RTU0 and RTU1, by opening of the make contact of ON in FIG. 364.

Relay 352-M0 releases as a consequence of the release of the operated one of either the CR or the CC relays on the same figure and connects the 348-A relay to the tip and ring conductors from the originating office. The originating office momentarily maintains a low resistance bridge on the tip and ring to reoperate and hold the A relay until the "coin" functions within the originating office are completed. After this, the originating office removes the tip and ring shunt, thereby permitting the A relay to release. The release of relay 348-A causes slow release relay 359-B to release which, in turn, releases relay 359-B to release which, in turn, releases relay 362-BA. The release of relay BA, in turn, causes slow release relay 354-RVR to release as a consequence of its disconnection from ground on terminal 108 of FIG. 354, thereby restoring the entire trunk to its normal condition, in which it may serve subsequent calls.

SPECIAL FEATURES—LOCKED-LINK CONNECTIONS

Under certain conditions, the operator is required to retain control over calls on the trunk of FIGS. 348 through 356; for example, on prepaid dial 0 calls. The arrangement which provides such direct control over the trunk is known as a locked-link connection. Although the trunk is directly connected to the operator's position at such times, the arrangement for locked link is such that the operator is able to handle other traffic while retaining supervision over the held call.

The operator establishes a locked-link connection by placing a particular call in the "hold" condition, and then releases herself from the talking connection to the trunk but retains supervisory control. The 356-PA and 355-PA1 relays of the trunk remain operated during such times and trunk timing cannot take place. Linkage is maintained between the position control circuit through the position link to the trunk. Leads OS and TS on FIG. 356 from the trunk extend calling party and called party supervision to the operator's position. In this case, either party can recall the operator to the connection. A locked-link connection remains established until released by the

operator. The details of the position and position control circuit operation in connection with a locked-link connection are described elsewhere in the specification, as well as in the Curtis specification.

SPECIAL FEATURES—RELEASING FORWARD

If the operator is connected to the trunk of FIGS. 348 through 366 and the connection has been established in the forward direction, she is able to release this connection by sending battery to the trunk on the RLF lead on FIG. 356 to operate relay 355-RLF. In order to operate relay RLF, the trunk requires that either the 351-T1 or the 358-D1 relays be operated or that a combination of the 362-ND and 352-CB relays operated occur. Thus, a release forward can take place with a sender attached, a link forward attached, or with a cordboard attachment. Operation of relay 355-RLF causes the operation of relay 355-RLF1. The action which follows depends to some extent on the progress of the call at the point when the release forward action is taken.

If the release forward occurs during the initial period of a special toll call following a recall by the subscriber, the trunk timing will be stopped by the release of the 357-STT relay. The 360-RCY relay will be operated to recycle the minute counter. Operation of the 355-RLF1 relay releases the 351-D relay, followed by relays 358-D1, 351-D2 and 351-D3. If the release forward occurs while a sender is attached and working with the trunk, then immediate notification of the release is given to the sender by opening the holding bridge across the tip and ring to the sender via the sender link circuit. If the sender is in a position to immediately recognize the abandonment, it releases the 353-T relay and releases itself from the connection. However, the sender may not be able to recognize the abandonment at this point, in which case it advances to the operation of the 351-D relay in the trunk and then releases itself from the connection. The D relay then immediately releases upon the release of the sender. In any case the release of the D relay breaks down the connection that may have been established in the forward direction. Notice that the 355-RLF relay remains locked to the operated 351-T1 or 351-D3 relay, thus assuring that the release forward condition is maintained until an actual release has occurred.

If the call has already received AMA treatment, the release of relay 351-D3 calls for the perforation of a disconnect entry. Relay 358-TC will not release with 351-IN and 351-CH relays normal, but remains operated over a path which can be traced in FIG. 358 from ground on terminal 106 through break contacts of 355-CTM1, 355-CBST, 355-SR, 363-OP, and the make contacts of 355-PA1 and 358-TC, to the winding of relay 358-TC, to battery through the C resistor. The relay 355-RLF1 remains locked to the operated 358-TC relay. Should the operator decide to set up a new connection forward at this point, there is a path to operate the 355-SR relay of the trunk. The path to operate relay 355-SA may be traced on FIG. 355 from battery through the winding of the 355-SR relay, through the break contacts of 358-T1 and 355-CTM1 and the make contact of 355-RLF1 and 358-TC, and through the break contact of 355-CTM to the RF lead of FIG. 356 where it will continue to the position link circuit. In order to start a new call, the operator requests the trunk to connect to a sender by connecting battery to this RF lead from her position, by way of the position link circuit, to operate the 355-SR relay and cause the connection of a sender. The operation of relay SR in this case releases the 358-TC relay, followed by the release of the 355-RLF1 relay. Relay 355-SR holds to ground on the RF lead through the transfer contacts of the 358-TC relay.

SPECIAL FEATURES—RETRIAL OR REROUTE BY THE OPERATOR

Retrial may be used by the operator when the call fails to complete in a forward direction in a satisfactory man-

ner. For example, a call may terminate in an overflow or a busyback condition or may possibly result in a stuck sender. In making a retrial, the operator reuses the information already stored in the trunk and position control circuits for the new attempt. She first performs a release forward function as just described, to clear the connection forward, and releases any sender that may be attached. Then she operates the start key at her position, which causes a request for a new sender to be made by transmitting a ground on the RF lead to the trunk, via the position link and connector circuit, to operate relay 355-SR of the trunk. Operation of relay 355-SR places ground on the start lead to the sender link and controller circuit, by way of an obvious path on FIG. 353, and causes that circuit to bring about the connection of a new sender. When the sender is attached, it finds ground on the FR lead of the trunk on FIG. 353 as an indication that the seizure is being made by an operator and that pulsing should not be expected from the originating end. This is known as "an OPT mark." The sender operates the 353-T and 351-T1 relays. Relay T removes ground from the FR lead and cuts the FT and FR leads of the trunk through to the sender. The sender then places ground on the FR lead to the trunk, which is extended by the trunk over the SA lead to the operator position as an indication that a sender has been attached. The path for this signal may be traced, starting with the FR lead from the sender link controller circuit on FIG. 353, by way of the make contact of 353-T, break contact 351-FA, over the SA lead to FIG. 362 through the make contact of 355-SR, break of 359-RA, and the make of 353-T to the SA lead to FIG. 356, where it extends to the position link and connector circuit and on to the operator's position.

The position control circuit releases the 355-SR relay and initiates a data transfer seizure. A +130 volt signal is sent to the trunk and then via the trunk to the sender on the lead KPR of FIG. 356 and the SPI lead on FIG. 353. The 362-TP40 or TPA/TPB relays of the trunk operate. The trunk and sender are associated with a data channel along with the position control circuit. The position control circuit uses the data channel to furnish the sender with the called number. After the data channel checks the information exchanged, it releases. The TP40 or TPA/TPB relays of the trunk then release and the sender proceeds with marker function. The circuit operations associated with the interconnection of the sender, the trunk, and the position via the data transfer circuit have been described in detail elsewhere in this specification.

Reroute occurs when it becomes necessary for the operator to set up a new connection to a destination which is different from one which has already been reached. Such a condition may happen, for example, in the completion of a person-to-person call when the operator is informed by the first called party reached that the person to whom the call should be completed may be reached at a different number. To accomplish the reroute, the operator first releases the forward connection already established by performing the release forward function as already described. She will then operate the KPF key at her position and manually set the information for the new called number into the position control circuit. Following this, she operates the start key at the position. The position control circuit now sends battery to the trunk via the position link and connector circuit over the TL lead of FIG. 356 to operate relay 356-RRL. The operation of this relay causes the release of all information already stored in the trunk, such as the rate treatment number, the station or person mark, the NM mark and the M1/5 time storage relays. The position control circuit then grounds the RF lead to the trunk to operate relay 358-SR and cause the seizure of a new sender in the same manner as described under retrial.

When advised that the sender is attached, the position control circuit initiates a data transfer seizure operating the connector relays in the trunk and sender as previously

described. A data transfer now occurs between the sender, position and trunk. If the call is a prepaid special toll call, that is, the coins are going to be deposited for the initial period, a coin rater and computer are also associated with the data channel to provide new information for storage in the trunk and position control circuit, that is the rate treatment number, the station or person mark, the NM mark, the M1/5 time storage mark as required. Upon an OK check of the data transfer, the data channel is released. The connector relays in the trunk and sender are released and the sender proceeds with marker functions.

SPECIAL FEATURES—RINGBACK

Whenever the operator is connected to a trunk, she has the ability to "ring back" the calling subscriber. To activate the ringback function, the operator causes ground to be sent to the trunk over the 356-RB lead from the position link and connector circuit operating relay 356-RB in the trunk. The operation of relay RB transfers the incoming tip and ring conductors from the windings of the A relay to the ringback circuit, made up of relays 352-RB1 and 352-RB2 and their associated resistors. At the same time, the 356-RB relay provides a holding ground for the 359-B relay and in addition operates relay 352-RB1. Relay RB1 operates RB2. The latter two relays are both slow in releasing and are arranged in a circuit such that they will alternately operate and release as long as the RB relay remains operated. With relays RB1 and RB2 both operated, resistance battery and ground is transmitted to the originating office over the tip and ring in the direction of on-hook polarity. When RB1 releases, the resistance battery and ground is connected to the tip and ring and the direction of off-hook polarity. Thus, as long as relays RB1 and RB2 continue to operate and release, alternate on-hook and off-hook polarity signals are transmitted to the originating office. The duration of these on- and off-hook signals is approximately 50 to 100 milliseconds. The originating office trunk is arranged to recognize this type of signal as a request for ringback and does, in fact, upon receipt of such signals, apply ringing current to the calling subscriber's telephone.

SPECIAL FEATURES—CANCEL TIMING AND CANCEL AMA TIMING ENTRY

When the operator is connected to a trunk on which there is a call for which initial and answer AMA entries have been made, she has the ability to cause the trunk to place a "cancel AMA timing" entry on the AMA tape. The cancel timing entry is a signal to the AMA accounting center that the preceding answer and initial entries should be ignored. To initiate a cancel timing entry, the operator sends battery to the trunk on the RF lead via the position link and connector circuit. This battery signal operates the 355-CTM relay if the 358-TC relay is operated and either the 358-IN or 358-CH relays are normal. Upon operating, the 355-CTM relay locks directly to the RF lead. Break contacts of the IN and CH relays are used in this path to prevent interference with AMA operation of the cancel timing signal should be transmitted while an answer entry is already in progress. The slow release 355-CTM relay operates the 355-CTM1 relay, which is also slow to release. The action which follows depends upon whether an answer entry has been started, completed, or is actually in progress.

If the answer entry has not yet started, the operation of relay 355-CTM1 causes the immediate release of relay 358-TC. No entry is made on the AMA tape.

If the answer entry is in progress of being perforated, both the IN and CH relays on FIG. 358 will be operated and relay CTM would not immediately operate. The position control circuit will maintain the signal for cancel timing on the RF lead until the IN relay has been released in the process of making the answer entry. With IN released, the 355-CTM relay may operate. The action then proceeds as for answer entry completed.

If the AMA answer entry has been completed, the signal on the RF lead operates the 355-CTM relay at once followed by relay 355-CTM1. With both of these relays operated, the 351-D3 relay releases. The DJ and CH leads of FIGS. 358 and 361 are closed together as a signal that the AMA entry should be perforated. With relay D3 released and relay 355-CTM operated, a +130 volt potential is closed to the 0T lead of FIG. 358 toward the call identity indexer circuit. This signal causes the perforation of a cancel timing entry.

SPECIAL FEATURES—RING FORWARD ON DIAL 0 CALLS

On certain types of connection, for example, those to inward operators, it is necessary for the operator to transmit a ringing signal forward in order to signal the called end. For this purpose, the trunk of FIGS. 348 through 366 is equipped with a ring forward feature. However, this feature is available only when dial 0 type calls are being handled. The feature is activated by the operation of the 355-RF relay in response to a ground signal from the position circuit over the RF lead to the trunk. In order to operate the RF relay, the 358-D1 and 362-ND relays must be operated. When the RF relay operates, it operates relay 355-RFC. The latter is made slow to release by way of a resistance shunt across its winding. Upon removal of the RF ground from the position, the 355-RF relay releases. However, the slow release 355-RFC relay does not immediately follow in releasing. As a result, +130 volts on FIG. 350 is connected in a simplex arrangement through the RF resistors to the tip and ring of the circuit in the forward direction. This +130 volts is then removed by the release of relay RFC. Thus, a short pulse of positive potential is transmitted in a simplex manner over the tip and ring to the called end. This pulse of voltage is recognized by the incoming circuit at the distant office as a request for service.

SPECIAL FEATURES—NON-ANI OPERATION

This trunk may be used to handle traffic on a non-ANI basis. Under these conditions, the trunks must be divided into two groups, one group of which will serve calls preceded by the prefix digit "0" while the others serve calls preceded by the prefix digit "1." The prefix "0" digit calls comprise either dial 0 or person-to-person calls, while the prefix digit "1" calls are of the station-to-station type. The ten digit dial pulse register is attached to the trunk upon seizure in the same manner as for an ANI call. The dial pulse register accepts dialing from the step-by-step subscriber, or times out, to indicate a dial 0 call in the same manner as previously described. The call proceeds in the same manner as for an ANI call; however, when the operator is attached, she receives a signal which indicates that she should obtain the calling number from the originating subscriber. The sender is allowed to proceed with marker functions and outpulse in the usual manner for special toll calls. In the case of assistance calls, the sender releases itself from the connection as soon as the operator has been attached.

DESCRIPTION OF CALLS SERVED BY MF COIN TRUNKS—GENERAL

Turning now to another aspect of the present invention, a description is presented of the manner in which station-to-station and person-to-person coin calls are served by the MF coin ANI and non-ANI trunk circuits 20 and 25 of FIGS. 1A and 1B on coin-paid, collect and special coin calls bases. Initially, a general description is presented of the manner in which these calls are served, and then a detailed description is presented of the circuit operations. Most of the circuit operations associated with the serving of this call are similar or identical to those already described for trunk 40. Therefore, to the extent that is practicable, this description discusses only circuit operations that are unique to the serving of calls on MF trunks.

This MF coin trunk is designed to serve coin call traffic, for which the calling customer prefixes a "0" or a "1" and follows it by 7 or 10 digits of a called number. The prefix digit "0" or "1" dialed by the customer is utilized by the system to derive the difference between the person-to-person charge and the station-to-station charge.

When a calling customer at a coin station originates a prepaid coin call which is to be completed through the tandem office, the originating office seizes an outgoing trunk to the tandem office. The seizure is recognized by an associated MF coin trunk circuit in the tandem office, which immediately bids for and is connected to a sender through a sender link. Thereafter, the connected sender requests and registers the called number received from the originating office. The originating office also informs the tandem office as to which prefix the calling customer dialed by sending a unique start pulse for the dialed "0" or a "1" at the end of the called number.

If the originating office is equipped with ANI, the tandem sender signals that office to forward the calling number identity by means of ANI (automatic number identification) pulses immediately after the called number has been registered. After registering the calling number, the sender signals the trunk circuit to request connections to an idle one of the operator positions through the position link and connector on a nonpriority basis, and then it returns audible ringing tone via the tandem trunk to the originating office.

In the event that the originating office is not equipped for ANI, the MF sender signals the MF trunk circuit to request nonpriority connections to an idle operator position immediately after the registration of the called number.

When the position has been attached to the trunk circuit, a data transfer channel is seized and the transmission of audible ringing tone to the originating office is interrupted. The data channel establishes connections among the MF coin trunk, sender, position, and rater circuits for facilitating the exchange of information necessary for timing and charging for the coin call. The trunk circuit receives and stores the information in the form of rate treatment, initial period duration, and either a station-to-station or a person-to-person class mark. After this information has been stored by the trunk circuit, the data channel releases its connection to the trunk, sender, and rater circuits and bids for connections to a charge computer to set the time and charges in the position circuit.

While the foregoing circuit actions are in progress, the MF sender cooperates with a marker to control the establishment of connections with the MF coin trunk circuit, via a terminating office, to the called station in the conventional manner.

After the time and charges have been set in the position control circuit, the data channel and charge computer circuits release and the operator is alerted to the presence of a call requiring her service. In providing the service, the operator requests and monitors the initial coin deposit on all of the coin calls and further, on the person-to-person calls, she verifies that the desired called party has been reached. Following the completion of her functions, the operator initiates circuit actions which result in the perforation of the initial entry on the AMA tape. When the initial entry has been perforated, the MF coin trunk circuit registers this information and releases the operator position and position link and connector circuits.

The trunk circuit recognizes when the called party answers and immediately bids for a recorder to perforate the AMA answer entry. At the same time, the trunk circuit initiates the timing of the initial period. Before the actual initiation of timing and charging, a charge delay interval is provided to guarantee that the called party has actually answered.

Several seconds prior to the end of the initial period, the trunk circuit sends a coin-collect signal to the originating office for causing the deposited coins to be collected.

lected. If the call continues after the expiration of the initial period, the trunk circuit bids for and is connected to an idle operator position on a priority basis. Thereafter, the operator position seizes a data channel, and connections are established between the trunk, position, and charge computer circuits for facilitating the exchange of overtime charge information. The trunk circuit receives and stores the overtime period duration in minutes. For calls that extend into an overtime period, the operator is recalled by either the calling customer at the end of the call or automatically at the end of the ten overtime periods, for collection of the overtime charges.

After the trunk has stored the overtime period duration and the mark indication, the data channel and charge computer circuits release and the operator is alerted to the call requiring her services. The operator then proceeds to inform the customer that this is the end of the initial period and, if he wishes to continue the call, to flash his telephone switchhook when finished. The operator then proceeds to effect the disconnection of her position and the position link and connector. Timing of the overtime period is then resumed by the MF coin trunk circuit.

When the calling party disconnects at the end of the call, the trunk circuit releases the connection forward to the terminating office and bids for a recorder to perforate the AMA disconnect entry. For overtime calls, an operator is recalled for requesting the calling party to deposit the overtime coin charges after the disconnect entry has been perforated. After the operator has performed these functions, the position is released, and the trunk circuit sends a coin-collect or return signal to the originating office and then restores to its idle condition.

In the exemplary embodiment, an MF coin trunk circuit includes additional facilities for enabling an operator manually to set the rate treatment in the trunk circuit for a coin call that cannot be automatically rated by the rater circuit. These facilities also enable the operator to change both the rate treatment and the station-to-station and person-to-person class marks set in the trunk circuit.

In addition, the trunk circuit comprises apparatus for serving calls whose initial-period-time duration is not limited. For these calls, the initial deposit will be collected at the end of the call.

The trunk circuit is further arranged to receive and store a mark for canceling the timing of a call. This mark is provided by either the rater circuit on calls to free codes or by an operator on collect or special service coin calls requiring an AMA tape record but no trunk timing.

When necessary, the operator may lock the MF coin trunk circuit to her position via the position link and connector for manually ticketing a coin call. No AMA entry will be made on such calls.

The trunk circuit also includes apparatus for enabling an operator to release connections forward to a terminating office. After releasing the forward connections, an operator may initiate a new outgoing call by signaling the trunk circuit to connect to an idle sender. When the sender is attached, a data channel is established for transferring information among the trunk, sender, position, and rater circuits, and then for effecting the establishment of connections to the called station.

On prepaid coin calls encountering transmission or other service difficulties, the calling party may recall an operator during the first portion of the initial period. The recalling is effected when a switchhook signal is sent by the calling customer to the MF coin trunk circuit. Upon receiving this signal, the trunk circuit requests connections to an idle operator position on a priority basis. After these connections are established, the operator can initiate a new outgoing call for the customer as described in the immediately preceding paragraph.

Detailed description of calls served by MF coin trunks

Referring now to FIGS. 429-440, a detailed description is presented of the manner in which an MF coin trunk

circuit serves the various station-to-station and person-to-person coin calls. It is noted that the mode of operation and circuitry of both the MF coin ANI and non-ANI trunk circuits are the same. Accordingly, only the schematic drawing of the trunk circuit 20 is shown.

SEIZURE, PULSING AND POSITION REQUEST

Referring to FIG. 429, when the originating office receives a coin call which is to be extended to the tandem office, it seizes the trunk circuit 20 by changing the bridge across the tandem trunk from a high to a low resistance and accordingly completes a path for operating the relay 429-A. This path is from the low resistance supplied in the originating office, the trunk conductors, break contacts 434-RB, 434-PA and 432-T, windings of repeating coil T, break contacts 436-M0 and 436-RV, and the windings of relay A to ground and -48 volts, respectively. Upon operating, relay A operates relay 432-A1 over the obvious path.

In operating, relay A also grounds the ST lead of FIG. 432 to the sender link and controller circuit as a request for connections to an MF sender. This ground is applied to lead ST via break contacts 432-T, 432-D2 and 432-D, make contact 429-A and break contacts 436-ON and 436-RVR. Ground is also placed on the FT lead of FIG. 432 via the break contacts 432-T and 434-SR to notify the MF sender that this is a customer usage of this trunk circuit.

When the sender is attached, ground is returned on the CO lead of FIG. 432 to operate relay T which, in turn, operates relay 432-T1 over the obvious path. Upon operating, relay T closes its make contacts 432-T for cutting through the tip and ring conductors of the incoming tandem trunk to the MF sender. At the same time, operated relay T completes a supplementary operating path for relay 432-A1. Relay T also opens the ST lead to the sender. Operated relay T also completes the obvious operate paths for the relays RV and RVR of FIG. 436. In turn, relay RV operates relay 436-ON over the obvious operate path. In operating, relay ON locks to ground via contacts 436-ON, 436-RVR and 436-M0. Operated relay ON also operates the initial period relay 439-IP over the path from the -48 volts through the IP relay winding, break contact 439-0P and make contact 436-ON to ground.

When relay 432-T1 operated, as explained, it grounds the S lead of FIG. 430 toward the trunk link and connector circuit through contacts 432-T1 and 432-F for controlling the establishment of interconnections through the trunk link and connector, as hereinafter explained.

The sender thereafter signals the originating office to transmit the called number by reversing the polarities applied to the tip and ring conductors of the tandem trunk to "on-hook." The sender will receive the called number from the originating office as described in the Curtis specification. At the end of the called number, the originating office will send a start or a start-prime pulse, indicating the completion of the called number. This start, or start-prime, pulse also indicates to the sender which prefix the customer dialed. If the customer has prefixed the seven or ten digits with a zero, the originating office sends a start-prime pulse. If the customer has prefixed the seven or ten digits with a zero, originating office sends a start-prime pulse. If the customer has prefixed the seven or ten digits with a "1," the originating office sends a start pulse. The MF receiving circuit, recognizing a start pulse, passes ground from terminal 101 in FIG. 71 through make contacts of relay 37-KP1 and make contacts of relay 37-10, to operate the 71-10 relay in the MF sender. This ground is also being extended from the make contacts of 37-KP1 through make contacts of relay 37-7, through make contacts of relay 38-RA, break contacts of relay 72-RGC1, make contacts of relay 71-10, break contacts of relay 60-DP, to the winding of the 71-STA relay, thereupon operating the 71-STA relay. If the MF

receiving circuit recognizes a start-prime pulse, the circuit operates the 71-10 relay in the sender, as previously described, and also extends ground from the make contacts of the 37-KP1 through make contacts of relay 37-1, make contacts of relay 38-RA, break contacts of relay 72-RGC1, make contacts of relay 71-10, to the winding of the 71-PP relay, thereby operating the 71-PP relay in the sender. The receipt of the prefixing information by the sender on this call is recognized in the start pulse of the called number rather than in the start pulse of the calling number, as was previously described for trunk 40. If the trunk circuit is being used for ANI calls, the sender also signals the originating office to outpulse the calling number after the called number has been registered by subsequently changing the polarity on the tip and ring conductors T and R of the tandem trunk to the "off-hook" polarity. When either the calling number has been registered in the sender or a signal is received indicating that operator identification is required, the sender requests that an operator position be connected to the trunk circuit, and also returns audible ringing tone to the calling party over the T and R leads circuit.

If the originating office is not arranged for ANI, the sender immediately requests that an operator position be connected to the trunk circuit as soon as the called number has been registered.

The sender signals the trunk circuit to request connection to an operator position by applying ground to the lead FT of FIG. 432 for completing a circuit for operating the position request relay 436-PR. The latter circuit extends from the -48 volts in FIG. 436 through the PR relay winding break contact 434-PA1, lead PR through FIGS. 434 and 432 into FIG. 430, break contact 432-FA, make contact 432-T, to the ground on lead FT. In operating, relay PR grounds the nonpriority start ST lead of FIG. 434 via the contacts 436-PR and the break contacts 434-PA, 439-OP and 432-D, extending to the position link and connector, which then is activated to connect an idle operator position with the trunk circuit on a nonpriority basis.

After the position and position control circuits have been connected to the trunk circuit, ground is returned on lead PA of FIG. 434 for operating relay PA of the same figure. Operated relay PA completes the obvious circuit for operating relay 434-PA1. The operation of relay PA1 effects the release of relay 436-PR by opening the break contact 434-PA1, and thereby removes the position request signal from lead ST of FIG. 434. The operate-release sequence of the PA and PR relays sends a ground pulse to the sender from FIG. 434 over the SA lead through FIG. 432 into FIG. 430, break contact 432-FA, make contact 432-T and leads FR. The operation of relay PA restores the "off-hook" potentials to the tip and ring conductors of the incoming tandem trunk over the path extending from the ground and negative 48 volts, respectively, through the upper and lower windings of relay 429-A, the make contacts of relay 436-RV, break contacts 436-M0, the windings of the repeating coil T, make contacts 434-PA and break contacts 434-RB. At the same time, relay PA connects the resistor SH of FIG. 429 across the tip and ring leads to the sender, via the make contacts 434-PA and 432-A1 and the break contact 434-RLF, to prevent the sender from releasing at this time.

CONNECTION TO THE DATA TRANSFER CIRCUIT

The data transfer circuit serves as "a common connector" for the exchange of information among trunks, senders, operator positions, computers and raters. In the illustrative embodiment, the data transfer circuit has a maximum of four separate channels. An MF coin trunk is connected to the data transfer circuit at least once on every call. The trunk circuit is directed to connect itself to one of the data channels by means of the selected position circuit when it receives +130 volts on the KPR lead

of FIG. 434. The presence of the +130 volts on lead KPR completes the obvious circuit for operating the relays TP20 and TPA of FIG. 434. The voltage on lead KPR is also passed to the sender, via the make contact 432-T and lead SP1 of FIG. 432, via the sender link, as a signal for the sender to attach itself to the same data channel. The operation of the relays TP20 and TPA connect approximately 48 leads between the trunk circuit and the selected data channel.

Trunk circuits connected to the data transfer circuit are assigned to one of 10 trunk connectors, and each such trunk connector may serve a maximum of 200 trunks, which are divided into trunk connector subgroups each of which may comprise a maximum of 20 trunk circuits.

On an initial period call seizure, a rater is also connected to the selected data channel in a manner similar to that previously described for other trunk circuits. Also, on an initial period seizure, the data transfer circuit causes a rater to be connected to the same data channel in a manner similar to that already described for other trunk circuits.

PASSING INFORMATION FROM THE TRUNK TO THE RATER OVER THE DATA CHANNEL

An office index number from 00-29 is preassigned to each originating office. This number is fixed in the trunk circuit by means of cross connections between the terminal 0IT and 0IT0-0IT2 of FIG. 439. By means of these cross connections, the trunk circuit applies ground on the 0IT0-0IT2 lead extending through the selected data channel to pass the office index number to the associated rater. Also by way of the data channel, the sender informs the rater of the called office code and the NPA code, if used. The sender also signals the rater over the STA or PP lead of FIG. 437 whether a station-to-station or person-to-person call is being served.

INFORMATION FROM THE RATER TO THE TRUNK CIRCUIT

As previously described, the rater utilizes the received called and calling office identifications to establish a rate treatment and time interval for the initial period of the call. The trunk circuit is arranged to record and store any one of a total of 200 different rate numbers 000-199 received over the selected data channel from the rater on the rate treatment relays of FIG. 437; hundredths RTH0, RTH1; tens RTT0, RTT1, RTT2, RTT4 and RTT7; and units RTU0, RTU1, RTT7, RTU2, RTU4 and RTU7. The trunk circuit can also record and store the amount of time to be allowed in minutes for the initial period on one of the five relays M1-M5. One of the latter relays is operated over the selected data channel under control of the rater. In addition, the trunk circuit includes a station-to-station rate relay STA and a person-to-person rate relay PP of FIG. 437, one of which is operated by the sender over the selected data channel to signify the appropriate charge rate for the call presently in progress on the trunk circuit.

While the foregoing action is taking place in the trunk circuit, the same information is being passed to and recorded in the selected operator position. When all of this information has been checked as properly recorded in the trunk circuit and the position, the data transfer circuit causes the release of the trunk circuit, sender and rater from the selected data channel. At the same time, the +130 volts are disconnected from lead KPR of FIG. 434 to effect the release of relays TP20 and TPA.

When the trunk circuit is connected to the selected data channel on the initial seizure, the following leads are also grounded:

TSG (FIG. 263B)—The grounding of this lead operates the cut-in relays of the data transfer trunk connector frame.

CIP (FIG. 438)—This lead is grounded via the make contact 439-IP, break contact 436-RCL and make

contact 434-TP20 for causing the selected data channel to seize a rater and may also cause the subsequent seizure of a charge computer.

IP (FIG. 439)—This lead is grounded via the make contact 439-IP, break contact 436-RCL and the make contact 434-TPA to inform the selected operator position that the call is about to start on the initial period.

0A0-0A2 (FIG. 437)—This lead is grounded to inform the selected operator position which originating NPA area is being served. This assignment is fixed in the trunk circuit by means of a cross connection in FIG. 437 between terminal OA and one of the terminals 0A0-0A2, and in the selected arrangement this cross connection is between terminal OA and 0A0.

After the data transfer circuit has received and checked the foregoing information, it releases the rater, trunk, and sender circuits and requests connection to a charge computer as previously described. The progress of the call and the various operator functions necessitated by the customer request are essentially the same as disclosed in the description of the combined dial pulse trunk 40. Accordingly, it is not necessary to further describe the operation of this trunk circuit since all of its functions may be obtained from the foregoing description of trunk circuit 40 for 0+ and 1+ call traffic.

Before concluding the remarks with regard to the MF trunk circuit, it is advisable to point out that the call served by that circuit can be described as one of five different types, as follows:

Type call:	Operator required
Rated call—ten cents station paid toll.....	No
Other rated calls.....	Yes
Manual rate.....	Yes
Free call.....	No
Vacant code call.....	No
Untimed call.....	Yes

All of these various call conditions have been previously described in detail for trunk 40.

Description of calls served by dial 0 coin trunk circuits—General

This section describes the manner in which dial 0 coin calls are served by the dial 0 ANI and non-ANI trunk circuits 30 and 35 of FIG. 1B. These circuits are fundamentally the same in regard to the apparatus employed and in their respective modes of operation. However, the circuits differ with respect to operations with the sender and sender link of the tandem office. In order to emphasize these similarities and differences, the features and operations of the two circuits are described concurrently and the distinctions between the two circuits are expressed where appropriate in the following description. Many of the circuit operations previously described for trunk 40 are applicable to the serving of calls by trunks 30 and 35. Therefore, to the extent practicable, the following paragraphs discuss only circuit operations unique to the serving of dial 0 calls on trunks 30 and 35.

When a customer dials an operator code, such as the single digit 0, an outgoing trunk circuit is seized in the originating office to extend the call to the tandem office. The call is received by a dial 0 trunk circuit at the tandem office, and, if the originating office is equipped with ANI (Automatic Number Identification), the trunk circuit bids for and is connected to an MF sender. The sender then signals the originating office to forward the ANI record of the calling number and, after this number has been forwarded thereto and registered, the sender signals the dial 0 trunk circuit to request connections to an idle operator position on a nonpriority basis. On the other hand, if the originating office is not equipped with ANI, the dial 0 trunk circuit requests the nonpriority connections to an idle operator position immediately upon receiving the incoming call.

In response to the position request signal from the trunk circuit, the position link and connector locates an idle operator position and interconnects it with the requesting trunk circuit. The operator position, in turn, activates the data transfer circuit to establish a data channel among the dial 0 trunk circuit, sender, and the position for transferring the class-of-call (coin) and calling number, if the latter is available, to the operator position. After receiving these call details, the connection between the trunk, sender, and position via the data channel is released. The sender releases and a communication path is maintained between the call customer and the operator via the position link.

The calling customer then informs the operator of the called number and whether the call is a person-to-person, station-to-station, station-paid, collect, or a special service call, and the operator then keys this information into a position register. When the operator is prepared to complete the call, she signals the dial 0 trunk circuit to request connections to an MF sender. The position waits for a "sender-attached" signal from the trunk and then associates itself with a data channel of the data transfer circuit and signals the trunk and sender to attach themselves to the same data channel. The called number stored in the position register is thereafter passed over the channel and is recorded in the sender. Under the receipt of this information, the data channel is released and the sender bids for a marker, which then establishes a communication channel between the dial 0 trunk circuit and an outgoing trunk via the trunk link and office link frames. After the marker has completed its functions, it is released. The dial 0 trunk circuit thereafter maintains holding control over the channel through the trunk link and office link frames. Following the completion of these functions, the sender outpulses the information required for completing the call to the desired station. When this outpulsing has been completed, the sender activates the dial 0 trunk circuit to establish a transmission path between the calling and called stations and then releases. At this time, the operator position is bridged onto the established connections for supervising the call.

A timing circuit in the dial 0 trunk circuit is arranged to guarantee that answer supervision exists for approximately two seconds before marking a true called party answering condition. Only when a true answer is encountered will the trunk circuit prepare itself for perforating an AMA charge entry, and such an entry will not be made until an initial entry has been concluded.

The operator controls the perforation of the initial entry. For station-to-station, paid, or special service coin calls, she effects the making of the entry before the called party answers. For all other chargeable coin calls requiring an AMA record, however, verification must be made with the called party, either that the proper person has been reached or that the charges have been accepted. On the latter type of calls, the perforation of the initial entry follows after the called party answers. On noncharge calls, no initial entry is made. For coin-prepaid calls, the operator is required to remain bridged to the established connections since coin control features are not an automatic feature of this trunk.

When the initial entry has been completed, the dial 0 trunk circuit is notified to connect to an AMA recorder for recording the answer entry and starting the charge timing. Meanwhile, the operator may release her position from the call connections and transfer supervision over the call to the dial 0 trunk circuit.

Subsequently, when the calling party disconnects, the trunk circuit releases the outgoing tandem trunk and seizes the recorder to perforate the disconnect entry. The trunk circuit is signaled to release the outgoing local office trunk when the disconnect entry has been completed and then to restore itself to normal.

This description, thus far, has covered the operations involved on a normal call. In addition, there are a num-

ber of irregular and special conditions which may occur during a call. These are:

(1) Operator recall—After the call connections have been established between the calling and called stations, the operator position, on some calls, is released. In the instant embodiment, the calling party may recall an operator for additional service by simply flashing the telephone switchhook. Upon receiving such a signal, the dial 0 trunk circuit functions to effect the reconnection of an operator position to the call connections through a position link and connector, on a priority basis, and indicates to the operator that this is a recall seizure.

(2) Cord switchboard transfer—There are certain types of calls which an operator position will not be able to complete. These are overseas calls, marine operator calls, conference calls, mobile telephone calls, and certain sequence calls. In these cases, the operator will institute a transfer of the call to a cord switchboard. The dial 0 trunk circuit will start a conventional trunk finder which will cause a switchboard operator to receive and serve the call. The switchboard operator will orally receive the call details from the operator transferring the call connection. Thereafter the transferring operator will cause her position to be disconnected from the call connections and to transfer supervision over these connections to the cord switchboard operator.

(3) Abandoned calls—A subscriber may abandon a call at any time prior to the called party answering and no timing entries will be made. If the call is abandoned before an operator position has been attached to the dial 0 trunk circuit, the trunk circuit cancels the position request and restores to its idle condition. When the abandonment occurs after an operator position has been attached, the operator receives a disconnect signal to inform her to release her position. The trunk circuit thereafter is restored to its idle condition.

(4) Operator coin control—When an operator desires to collect or return coins, the appropriate signal is sent to the trunk circuit from her position. The trunk circuit in turn signals the originating office trunk circuit, which then applies the appropriate coin potential toward the calling station.

(5) Automatic coin return—If the calling party disconnects after the operator position has been attached to the trunk circuit, this trunk circuit sends a coin return signal to the originating office trunk circuit before signaling the position to disconnect. This mode of operation is employed when the trunk circuit is used for non-ANI operation and is used for ANI operation only on the initial sender seizure.

(6) Ringback—When an operator wishes to ring the calling station, a signal is sent from the position to the dial 0 trunk circuit, which in turn signals the originating office outgoing trunk circuit to apply a ringing signal to the calling line.

(7) Ring forward—If the operator desires to recall an inward operator for any reason, she signals the dial 0 trunk circuit to ring forward in the customary manner. The trunk circuit then signals the outgoing tandem trunk to recall the inward operator.

(8) Release forward—If upon completing a call the operator determines that the desired called station has not been reached, she may release the connection. To do so, a release forward signal is sent from the operator position to the dial 0 trunk circuit, which will then release the outgoing tandem trunk, which in turn releases the terminating connection extending therefrom. Thereafter, the operator may initiate the completion of the call to another called station.

(9) Cancel timing—If the operator decides that the initial entry contained the wrong information or that it was made too soon, she can control the perforation of a cancel timing entry. Following this entry, the trunk circuit restores its charging features to their idle condition. The operator may thereafter make the appropriate AMA

entries. Accordingly, the accounting center will disregard the information perforated for the call prior to the cancel timing entry.

DESCRIPTION OF CALLS SERVED BY DIAL 0 COIN TRUNK CIRCUITS

As mentioned previously, the apparatus and operations of the dial 0 ANI and non-ANI trunk circuits 30 and 35 are essentially the same. For this reason, the following description is presented principally with respect to the dial 0 ANI trunk circuit shown in the schematic drawing of FIGS. 442-452. Where, in the course of the description, the trunk circuit 30 operations differ from the operations of the dial 0 non-ANI trunk circuit 35, reference is made to the appropriate schematic drawing of the circuit 35 shown in FIGS. 442A-452A.

SEIZURE

Referring to FIG. 442, when a coin calling customer originates a dial 0 call, the originating office places a low resistance across the T and R leads of the incoming tandem trunk to seize the associated coin dial 0 ANI trunk circuit 30 and thereby completing a path for operating relay 442-A. This path is from the negative 48 volts and ground, respectively, through the windings of relay A, break contacts 452-M0 and 443-RV, leads TA and RA, windings of repeat coil RC, leads TBA and RBA, break contacts 449-T, 445-PA and 445-RB, to the low resistance across the T and R leads of the incoming tandem trunk. In operating, relay A operates relay 449-A1 over the path through the break contact 445-SR and make contact 442-A to ground.

Since this trunk circuit is serving an originating office equipped for ANI operation, the operation of relay A grounds the ST lead of FIG. 449 via the break contacts 449-T, 449-RVR and 443-RV, make contact 442-A, and break contact 445-SR, which then causes the trunk circuit to be associated with an idle sender via the sender link.

SENDER ATTACHED (ANI)

When a sender has been attached, the trunk circuit grounds the FT lead of FIG. 449 via the break contacts 449-T and 445-SR to inform the sender that it is to be used for receiving the calling station number from the originating office. Shortly afterwards, the sender grounds the C0 lead of FIG. 449 via the sender link for causing the operation of relay T over the obvious path. The operation of relay T removes ground from the FT lead and connects the T and R leads of FIG. 449 to the T and R leads of the incoming tandem trunk via the make contacts 449-T and break contacts 445-PA and 445-RB. The sender applies off-hook potentials to these T and R leads for holding the call connections in the originating office. The operated relay T also opens the previously described operate path for relay 442-A at the break contacts 449-T and, at the same time, provides a holding path for relay 449-A1 via make contact 449-T1 and break contact 444-PA1. Operated relay T also removes the ground from the ST lead to the sender link at break contact 449-T of FIG. 449. Relay T also operates relay 449-T1 over the obvious path and relay T1, in turn, operates relay 443-RV over the path through break contacts 452-ON and 452-CN and make contact 449-T1 to ground. The operation of relay T also operates relay 449-RVR over the path through contact 449-T to ground. In operating, relay RVR completes a path for operating relay 452-ON through break contact 452-M0 and make contacts 443-RV and 449-RVR.

When the sender is prepared for receiving the calling station number, it reverses the aforementioned tip and ring potentials on the incoming tandem trunk as a signal to the originating office to start outputting that number. After it has received and registered the calling number, the sender signals the trunk circuit to connect with an idle operator position by grounding the FT lead of FIG.

449, which completes a circuit through make contact 449-T and break contacts 443-FA and 444-PA1 to the winding of relay 449-PR for operating relay PR. The operation of relay PR grounds the ST lead of FIG. 451 toward the position link and connector via break contact 443-D, make contact 449-PR, and break contact 445-PA, as a position request signal. At approximately the same time that these operations are in progress, the sender sends ringing tone over the T and R leads to the originating office to notify the calling party that the call is being served.

Turning now to a discussion of the circuit operations involved for non-ANI, it may be noted that when relay 442A-A in the coin dial 0 non-ANI trunk circuit is operated, as previously indicated, it immediately operates the position request relay 449A-PR without first establishing a connection between the trunk circuit and a sender. Relay 449A-PR operates over the path through the break contacts 444A-PA1, 449A-RVR and 443A-RV, make contact 442A-A and break contact 445A-SR. Audible ringing is then supplied to the calling station from the machine ringing supply of FIG. 447A via the resistance lamp TNA, capacitors TNTA and TNRA, make contacts 449A-PR and break contacts 450A-D1, instead of from the sender as in ANI operation.

OPERATOR POSITION ATTACHED

Returning the description again to the ANI operation, it is noted that upon the connection of an operator position to the dial 0 trunk circuit, a ground is supplied via the position link and connector to the PA lead of FIG. 451 for operating relay 445-PA over the obvious path. On ANI operation, the relay PA connects resistor SH of FIG. 442 across the tip and ring circuit to the T and R leads of the sender to prevent the sender release. (On non-ANI operation, the sender is not attached at this time.) The operation of relay PA disconnects ground from the ST lead to the position link and connector circuit, reconnects relay 442-A to the T and R leads of the incoming tandem trunk, connects ground to the sender lead FR of FIG. 449 as a position attached signal, and operates relay 444-PA1 over the obvious path. Upon operating, relay PA1 effects the release of relay 449-PR by opening contact 444-PA1. At the time that the dial 0 trunk circuit is connected to the operator position, the selected position control circuit connects to an idle data channel of a data transfer circuit in a manner as explained in previous sections. The selected position also connects +130 volts to the KPR lead of FIG. 451 via the position link and connector to operate relay 445-TP30. The same +130 volts is extended from lead KPR in FIG. 445 to the sender via lead SP1 of FIG. 449, make contact 449-T1, and lead SP of FIG. 444, to cause the sender to be connected to the same data channel for registering call data including the calling number in the operator position. The operation of relay TP30 closes the various leads of FIG. 446 from the trunk circuit to the selected data channel for transferring trunk class information to the selected position.

After the call information has been transferred to the position and has been checked, the sender releases from the data channel and the data channel is released from the trunk and position control circuit. Relay 445-TP30 is released. The operator is then given a signal to inform her that she is connected to a dial 0 call. The sender, in releasing, removes ground from the lead C0 of FIG. 449 for effecting the release of relay T. In releasing, relay T opens the T and R leads between the sender and the incoming tandem trunk. In addition, release relay T effects the release of relay 449-T1. The talking and supervisory leads are then closed through from the trunk circuit to the operator position.

Turning again to the discussion of the circuit actions involved for the non-ANI operation, it is noted that upon the connection of an operator position to the dial 0

trunk circuit, the position control circuit operates the 445A-PA relay by applying ground via the position link and connector to lead PA of FIG. 451A to the PA relay. The operation of relay PA, in turn, disconnects ground from the ST lead of FIG. 451A to the position link and connector to remove the position request signal. The operation of relay PA also operates relays 444A-PA1 and 449A-RVR over the obvious paths and relay 443A-RV over the path through break contacts 452A-ON and 452A-CN, and make contact 445A-PA to ground. Upon operating, the relay 449A-RVR operates relay 452A-ON over the path through break contact 452A-M0 and the make contacts 443A-RV and 449A-RVR to ground. When the relay PA1 operates, it opens the operate path for relay 449A-PR and relay PR releases. The operation of relay RV sends an off-hook signal to the originating office over the incoming tandem trunk by reversing the potential supplied to the leads T and R under control of the transfer contacts 443-RV of FIG. 442A for enabling the originating office to establish the connections between the calling station and the incoming tandem trunk.

Thereafter, the position control circuit is connected to a data channel of the data transfer circuit in a manner as described with respect to ANI operation. The selected position also connects positive 130 volts to the lead KPR of FIG. 451A for operating the 445A-TP35 relay. In operating, relay TP35 closes the various leads of FIG. 446A to the selected data channel for transferring trunk class information to the position. The remainder of the trunk circuit and data transfer circuit operation for the non-ANI call are essentially the same as for the previously described dial 0 ANI call up to the point where the talking and supervisory means between the operator position and the tandem trunk are interconnected, except that a sender is not involved and the calling number is not registered automatically in the position register.

On-hook and flashing recall signals from the calling and called parties are repeated to the operated by grounds on the 0S and TS leads of FIGS. 451 and 451A under the control of the relays 442-A1, 442A-A1, 448-CS and 448A-CS.

PROGRESS OF CALL FOLLOWING CONNECTION TO DATA CHANNEL

When the trunk circuit, sender, or position has been connected to the data channel on ANI operation, or only the trunk circuit and position have been so connected for the non-ANI operation, the subsequent operation of the data transfer circuit and the interchange of data is similar to that described for trunk 40 for the dial 0 calls. Accordingly, further reference can be made to the description provided for trunk 40 for such functions as perforation of initial entry, position release, perforation of answer entry, coin collection or return and calling party disconnection as therein related to the dial 0 type of call, for the purpose of applying those descriptions to the present trunk. It will be found that such similarity in circuitry exists as to permit the use of those descriptions to apply to the present trunk.

It should also be noted that certain special functions of this trunk circuit, namely, holding to a locked link, canceling AMA timing, releasing forward, establishing a new connection forward, ringback, ringforward, cord-board transfer, and operator recall have been described in full detail, either in the aforementioned description of trunk circuit 40 under the dial 0 call or in the Curtis specification, to the extent that reference may be made to that description for an understanding of the corresponding circuit operations of this dial 0 coin trunk circuit.

Certain irregular conditions which have been priorly described either in the Curtis or the present specification may also be applied to the present trunk, again due to the similarity in operation and function. These conditions are abandoned calls, sender time-out before position

attachment, and timed release on failure of calling party to disconnect.

It is to be understood that the above-described arrangements are but 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 a switching system for establishing connections from originating circuits to other circuits, means in each of said originating circuits responsive to the receipt of a service request thereon for initially requesting a nonpriority connection to one of said other circuits, switching means responsive to said connection request for establishing said connection on a nonpriority basis, means subsequently operative for releasing said connection, means in each of said originating circuits operative subsequently for requesting a priority connection to one of said other circuits, and means including said switching means effective for establishing said last-mentioned connection on a priority basis.

2. In a telephone switching system for establishing connections from incoming calling trunk circuits to outgoing circuits extending to called offices, call service circuits, means in each of said trunk circuits responsive to the receipt of a call thereon for requesting a nonpriority connection to one of said call service circuits, switching means responsive to said connection request for establishing said connection on a nonpriority basis, means subsequently operative for releasing said connection, means in each of said trunk circuits subsequently operative for requesting a priority connection to one of said call service circuits, and means including said switching means effective for establishing said last-mentioned connection on a priority basis.

3. The invention of claim 2 wherein said means in each of said trunk circuits subsequently operative during the serving of a call thereby for requesting a priority connection to one of said call service circuits includes a trunk timer together with means subsequently operative under control of said timer for requesting said priority connection.

4. In a telephone switching system for establishing connections from incoming calling trunk circuits to outgoing trunk circuits extending to called offices, call service circuits, means in each of said trunk circuits responsive to the receipt of a call thereon for requesting a nonpriority connection to one of said call service circuits, switching means responsive to said request for establishing said connection on a nonpriority basis, means subsequently operative for releasing said connection, a timer, means responsive to the receipt of said call for controlling said timer to measure a predetermined interval, means in each of said trunk circuits subsequently operative during the serving of a call thereby for requesting a priority connection to said call service circuit under control of said timer at the conclusion of said predetermined interval, and means including said switching means responsive to said request for establishing said connection on a priority basis.

5. The invention recited in claim 4 in combination with means subsequently operative for releasing said connection, and means in said trunk circuit operative at the end of each call served thereby for requesting a priority connection to said call service circuit.

6. In a telephone switching system for establishing connections from incoming calling trunk circuits to outgoing trunks extending to called offices, call service circuits, means in each of said trunk circuits responsive to the receipt of a call thereon for initially requesting a connection to any one of said call service circuits, switching means responsive to said request for establishing said connection, means subsequently operative for releasing said connection, a timer, means responsive to the receipt of said call for controlling said timer to measure a predetermined interval, means in each of said trunk circuits subsequently

operative during the serving of each call thereby for requesting a connection to any one of said call service circuits under control of said timer at the conclusion of said predetermined interval, said switching means being responsive to said request for establishing said connection, and means in each of said trunk circuits operative at the end of each call served thereby for requesting another connection to any one of said call service circuits.

7. The invention of claim 5 in combination with means in each of said trunk circuits subsequently operative during the serving of each call thereby for requesting a priority connection to any one of said call service circuits under control of said timer at the termination of a second predetermined interval prior to the end of said call, said switching network being responsive to said request to effect the requested connection.

8. In a telephone switching system, incoming trunk circuits, means responsive to a call on one of said incoming trunk circuits for completing a connection through said system to a circuit extending to a called office, operator positions, means additionally responsive to the receipt of a call on said one trunk circuit for effecting a nonpriority connection from said trunk circuit to any one of said operator positions, means subsequently operative for releasing said nonpriority connection, a timer, and means including means in said trunk circuit operative under control of said timer during the serving of said call for subsequently effecting a priority connection from said trunk circuit to any one of said operator positions.

9. The invention recited in claim 8 in combination with means in each of said trunk circuits operative at the conclusion of each call served thereby for initiating a priority connection to any one of said operator positions.

10. In a telephone switching system, incoming trunk circuits, means responsive to a call on any one of said incoming trunk circuits for establishing a path through said system to a circuit extending to a called office, operator positions, switching means effective upon request for providing nonpriority and priority connections from a calling trunk circuit to any one of said operator positions, means additionally responsive to the receipt of a call on one of said trunk circuits for requesting a nonpriority connection from said one trunk circuit via said switching means to any one of said operator positions, means subsequently operative for releasing said connection, a timer in each of said trunk circuits operative for measuring different time intervals, means responsive to the receipt by a trunk circuit of a call for controlling its timer to measure a predetermined interval, and means subsequently operative during the serving of each call for requesting a priority connection from the trunk circuit serving said call to any one of said operator positions under control of the timer in said trunk circuit at the conclusion of said interval.

11. The invention recited in claim 10 in combination with means subsequently operative for releasing said connection, and means in each of said trunk circuits operative at the conclusion of each call served thereby for requesting a priority connection to any one of said operator positions.

12. In a telephone switching system, incoming trunk circuits, means responsive to a call on any one of said incoming trunk circuits for completing a path through said system to a circuit extending to a called office, operator positions, switching means, means effective upon request for providing nonpriority and priority connections from any calling trunk circuit to any one of said operator positions, means in each of said trunk circuits responsive to the receipt of a call thereon for requesting a nonpriority connection via said switching means to any one of said operator positions, means subsequently operative for releasing said connection, a timer in each trunk circuit operative for measuring different time intervals, means responsive to the receipt by a trunk circuit of a call for controlling its timer to measure predetermined in-

tervals, means in each of said trunk circuits subsequently operative during the serving of each call thereby for requesting a priority connection to any one of said operator positions under control of its timer at the end of said first predetermined interval, means subsequently operative for releasing said connection, and means in each of said trunk circuits subsequently operative during the serving of each call thereby for requesting a priority connection to any one of said operator positions under control of its timer at the termination of a second predetermined interval.

13. In a telephone switching system, an incoming trunk circuit, means responsive to a call on said incoming trunk circuit for completing a connection through said system to a circuit extending to a called office, operator positions, means effective upon request for providing non-priority and priority connections from said trunk circuit to any one of said operator positions, means in said trunk circuit responsive to the receipt of a call thereon for requesting a nonpriority connection to any one of said operator positions, means subsequently operative for releasing said connection, a timer in said trunk circuit operative for measuring initial periods of varying durations, means additionally responsive to the receipt by said trunk circuit of a call for controlling its timer to measure an initial period having a predetermined duration, means in said trunk circuit subsequently operative under control of said timer at the end of the initial period of the call being served for requesting a priority connection to any one of said operator positions, means subsequently operative for releasing said connection, and means including said trunk circuit operative at the conclusion of each call served thereby for requesting a priority connection to any one of said operator positions.

14. The invention of claim 13 in combination with means in said trunk circuit operative under control of its timer subsequent to the end of the initial period of said call and prior to the end of said call for requesting a priority connection to any one of said operator positions upon the conclusion of a predetermined call interval measured by said timer.

15. The invention of claim 4 wherein said means responsive to the receipt of said call for controlling said timer to measure a predetermined interval comprises, means for registering call data received via the trunk circuit serving a call, and means responsive to said registration for programming said timer to measure a call interval whose duration is controlled by said registered call data.

16. In a telephone switching system, an incoming trunk circuit, means responsive to the receipt of a call by said incoming trunk circuit for completing a path through said system to a circuit extending to a called office, operator positions, switching means effective upon request for providing nonpriority and priority connections from said trunk circuit to any one of said operator positions, a trunk timer, means in said trunk circuit additionally responsive to the receipt of a call thereby for requesting a nonpriority connection to any one of said operator positions, means subsequently operative for releasing said connection, means responsive to call data received over said incoming trunk circuit for controlling said timer during the serving of said call to measure the duration of the initial period portion of said call, and means including said trunk circuit subsequently operative under control of said timer during the serving of said call for requesting a priority connection to any one of said operator positions at the conclusion of said initial period.

17. In a telephone switching system, an incoming trunk circuit, means responsive to the receipt of a call by said incoming trunk circuit for completing a path through said system to a circuit extending to a called office, operator positions, switching means effective upon request for establishing a connection from said trunk circuit to any one of said operator positions, a trunk timer operative

for measuring different time intervals, means in said trunk circuit additionally responsive to the receipt of a call thereby for requesting an initial connection to any one of said operator positions, means subsequently operative for releasing said connection, means responsive to call data received over said incoming trunk during the serving of said call for programming said timer to measure an initial period whose duration is controlled by said call data, means including said trunk circuit subsequently operative under control of said timer during the serving of each call for requesting a subsequent connection to any one of said operator positions at the end of said initial period, means subsequently operative for releasing said trunk circuit from said position, and means in said trunk circuit subsequently operative for requesting another connection to one of said operator positions at the conclusion of said call.

18. In a telephone switching system, an incoming trunk circuit, means responsive to the receipt of a call by said incoming trunk circuit for completing a connection through said system to a circuit extending to a called office, operator positions, switching means effective upon request for establishing nonpriority and priority connections from said trunk circuit to any one of said operator positions, a trunk timer, means in said trunk circuit additionally responsive to the receipt of a call thereby for requesting a nonpriority connection to any one of said operator positions, means subsequently operative for releasing said connection, means operative in response to the receipt of call data by said trunk circuit on each call served thereby for programming said timer to measure an initial period duration, means in said trunk circuit subsequently operative under control of said timer during the serving of each call for requesting a priority connection to one of said operator positions at the conclusion of the initial period portion of the call being served, and means operative subsequent to said initial period in response to the reception of said call data to program said timer to measure the overtime duration each call persists.

19. The invention recited in claim 18 wherein said last named means includes means operative subsequent to said initial period to program said timer to record the number of overtime periods said call persists where the duration of a single overtime period is specified by said received call data, and means in said trunk circuit for requesting a priority connection to one of said operator positions at the conclusion of said call.

20. The invention recited in claim 18 in combination with means including said timer operative upon the conclusion of said call for transmitting information signifying the number of call overtime periods to said one operator position.

21. The invention recited in claim 20 in combination with means in said trunk circuit operative prior to the end of said call under control of said timer for requesting a priority connection to one of said operator positions upon the conclusion of a predetermined number of call overtime periods.

22. In a switching system, trunk circuits for serving incoming calls, other circuits, means responsive to the receipt of each incoming call for registering call data pertaining thereto under control of said other circuits, said call data including a call charge rate and an initial period duration, a call timer, means responsive to the receipt of each call for timing its initial period portion under the coadjuvant control of said call timer and said registered initial period duration information, and means responsive to the conclusion of the initial period of each call for transmitting said registered call data including the call charge rate to said other circuits.

23. The invention recited in claim 22 in combination with means subsequently operative during the serving of each received call for registering additional call data pertaining thereto under control of said other circuits with said additional data including an overtime period

duration, means for counting the number of overtime periods comprising the overtime portion of each call under the coadjutant control of said call timer and said registered overtime period duration information, and means operative upon conclusion of each call for transmitting call data including the call charge rate and the number of elapsed overtime periods to said other circuits.

24. The invention of claim 23 in which said means for registering comprises, means in each of said trunk circuits for registering said call data for the calls served thereby and wherein said call timer comprises a timer in each of said trunk circuits operable on only the calls served thereby.

25. The invention recited in claim 24 in combination with means in each of said trunk circuits operative upon the expiration of a predetermined number of overtime periods for each call served thereby for transmitting call data including the charge rate and the number of elapsed overtime periods to said other circuits.

26. The invention recited in claim 24 in combination with means in each of said trunk circuits additionally responsive to the conclusion of the initial period of each call served thereby for resetting its timer to a zero time condition.

27. The invention recited in claim 26 in which said means for resetting in each of said trunk circuits is operative upon the expiration of said predetermined number of overtime periods for each call served thereby for resetting its timer to a zero time condition.

28. In a switching system, a trunk circuit for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from the calling one of said trunk circuits to an outgoing circuit extending to a called office, a rater and a computer means, means responsive to the receipt of an incoming call for transmitting call information to said rater and computer means, means including said rater and computer means responsive to the receipt of said call information for transmitting call data from said rater and computer means to said calling trunk circuit for registration therein, and means for transmitting call data from said trunk circuit to said rater and computer means upon the conclusion of said call, said rater and computer means being effective for deriving the call charges in response to the reception of said call data from said trunk circuit.

29. The invention of claim 28 in combination with means for timing the duration of said call, and means controlled by said timing means for including the call duration in the call data transmitted from said trunk circuit to said rater and computer means upon the conclusion of said call.

30. In a switching system, a trunk circuit for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from said trunk circuit to an outgoing circuit extending to a called office, a rater and computer means, other circuits, means responsive to the receipt of an incoming call for transmitting call information to said rater and computer means, means including said rater and computer means responsive to the receipt of said call information for transmitting call data to said trunk circuit for registration therein, means for timing an initial period portion of said call, means for transmitting call data from said trunk circuit to said rater and computer means upon the conclusion of said initial period, said rater and computer means being effective for deriving additional call data, means for transmitting said additional call data to said trunk circuit for registration therein, means for measuring the overtime duration said call persists under control of said timing means, means effective upon the conclusion of said call for transmitting call data including said additional data and the measured overtime to said rater and computer means, said rater and computer means being effective for deriving call overtime charges, and means for transmitting call data including said overtime charges to said other circuits.

31. In a switching system, trunk circuits for serving incoming calls, means responsive to the receipt of each incoming call for extending a connection from the calling trunk circuit serving said call to an outgoing circuit extending to a called office, a rater, a computer, other circuits, means additionally responsive to the receipt of an incoming call for transmitting call information to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate, means for transmitting said call data from said rater to said calling trunk circuit for registration therein, means effective upon the conclusion of said call for transmitting call charge data including the call charge rate from said calling trunk circuit to said computer, means responsive to the reception of said call data by said computer for deriving call charges, and means for transmitting said charges from said computer to said other circuits.

32. In a switching system, trunk circuits for serving incoming calls, means responsive to the receipt of each incoming call for extending a connection from the calling trunk circuit serving said call to an outgoing circuit extending to a called office, a rater, a computer, other circuits, means additionally responsive to the receipt of an incoming call for transmitting call information to said rater, said rater being responsive to the reception of said information for deriving call data including a call charge rate, means for transmitting said call data from said rater to said computer, means responsive to the reception of said information by said computer for deriving an initial period charge, and means for transmitting said initial period charge from said computer to said other circuits.

33. The invention of claim 32 in combination with means for transmitting said call data from said rater to said calling trunk circuit for registration therein, means for timing the initial period portion of the call, means for transmitting said call data registered in said calling trunk circuit to said computer upon conclusion of the initial period, means responsive to the reception of said call data by said computer from said calling trunk circuit for deriving additional call data including an overtime period duration and an overtime period charge, means for transmitting said overtime period duration from said computer to said calling trunk circuit for registration therein, means for transmitting said overtime period charge and duration to said other circuits, means for counting the number of overtime periods said call persists, means effective upon the conclusion of said call for transmitting call charge data including the call charge rate and the number of elapsed overtime periods from said calling trunk circuit to said computer, means responsive to the reception of said call data by said computer for deriving the call overtime charges, and means for transmitting said overtime charges from said computer to said other circuits.

34. The invention of claim 29 in combination with operator position circuits, means for transmitting call data including said charges to one of said operator position circuits, and means at said one position circuit for controlling the collection of said call charges at the calling station.

35. The invention of claim 32 wherein said other circuits include operator position circuits and wherein said means for transmitting said charges from said computer to said other circuits includes means for transmitting said initial period charge from said computer to one of said operator position circuits, said invention further comprising means at said position circuit for controlling the collection of the charge at the calling station.

36. In a switching system, trunk circuits for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from the calling trunk circuit serving said call to an outgoing circuit extending to a called office, a rater, a computer, an operator position circuit, other circuits, means additionally respon-

sive to the receipt of a call for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate, means for transmitting said call data from said rater to said calling trunk circuit, means for timing said call, means effective upon the conclusion of said call for transmitting call charge data including the call charge rate and the chargeable time from said calling trunk circuit to said computer, means responsive to the reception of said call information by said computer for deriving the call charges, means for transmitting said charges from said computer to said operator position circuit, and means at said position circuit for controlling the collection of said charges at the calling station.

37. The invention of claim 33 wherein said other circuits include operator position circuits and wherein said means for transmitting charges to said other circuits includes means for transmitting said overtime charges from said computer to one of said operator position circuits, said invention further comprising means at said one position circuit for controlling the collection of the call charges at the calling station.

38. The invention recited in claim 37 in combination with means in each trunk circuit operative upon the conclusion of the initial period of each call served thereby, for resetting its timer to a zero time condition.

39. In a switching system, trunks for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from the trunk circuits serving said call to an outgoing circuit extending to a called office, a rater, a computer, an operator position circuit, other circuits, means additionally responsive to the receipt of a call by a calling one of said trunk circuits for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate and an initial period duration, means for transmitting said call data from said rater to said calling trunk circuit for registration therein, means in said calling trunk circuit for timing the initial period portion of said call, means for transmitting call data including said charge rate from said calling trunk circuit to said computer upon conclusion of the initial period of said call, means responsive to the reception of said call data by said computer from said calling trunk circuit for deriving additional call data including an overtime period duration, means for transmitting said overtime period duration from said computer to said calling trunk circuit for registration therein, means including said timing means in said calling trunk circuit for counting the number of overtime periods said call persists, means effective upon the conclusion of said call for transmitting call charge data including the call charge rate and the number of elapsed overtime periods from said calling trunk circuit to said computer, means responsive to the reception of said call data by said computer for deriving call overtime charges, means for transmitting said overtime charges from said computer to said operator position circuit, and means at said position circuit for controlling the collection of the call charges at the calling station.

40. In a switching system, trunk circuits for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from the trunk circuit serving said call to an outgoing circuit extending to a called office, a rater, a computer, an operator position circuit, other circuits, means additionally responsive to the receipt of a call by a calling one of said trunk circuits for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate and an initial period duration, means for transmitting said call data to said calling trunk circuit for registration therein, means for transmitting said charge

rate to said computer for registration therein, means responsive to the reception of said data by said computer for deriving an initial period charge, means for transmitting said initial period charge to said operator position circuit, means in said calling trunk circuit for timing the initial period portion of said call, means for transmitting said charge rate registered in said calling trunk circuit to said computer upon conclusion of the initial period portion of said call, means responsive to the reception of said call data by said computer from said calling trunk circuit for deriving additional call data including an overtime period duration and an overtime period charge, means for transmitting said overtime period duration to said calling trunk circuit for registration therein, means for transmitting said overtime period charge and duration to said operator position circuit, means in said calling trunk circuit for counting the number of overtime periods said call persists, means effective upon the conclusion of a predetermined number of overtime periods for transmitting call charge data including the call charge rate and the number of elapsed overtime periods from said calling trunk circuit to said computer, means responsive to the reception of said call data by said computer for deriving the charge for said predetermined number of overtime periods, means for transmitting said charges from said computer to said operator position circuit, means at said position circuit for controlling the collection of said charges at the calling station, means effective upon the conclusion of the call for transmitting call charge data including the call charge rate and the number of chargeable overtime periods from said calling trunk circuit to said computer, means responsive to the reception of said call data by said computer for deriving overtime charges due, means for transmitting said overtime charges due from said computer to said operator position circuit, and said controlling means at said position circuit being effective for controlling the collection of said charges at the calling station.

41. In a switching system for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from an incoming circuit to an outgoing circuit extending to a called office, operator position circuits, means additionally responsive to the receipt of each incoming call for deriving and registering call data including a call charge rate and an initial period duration and an initial period charge, means for transmitting said initial period charge information to any one of said operator position circuits, means responsive to the conclusion of the initial period of each call for deriving additional call data, means for registering said additional call data, means operative upon the conclusion of each call for deriving its overtime charge under control of said registered additional data, and means for transmitting said overtime charge to any one of said operator position circuits.

42. In a switching system for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from an incoming circuit to an outgoing circuit extending to a called office, operator position circuits, means additionally responsive to the receipt of each incoming call for deriving and registering call data including a call charge rate and an initial period duration and an initial period charge, means for transmitting said initial period charge to any one of said operator position circuits, means at each position circuit for monitoring the collection of call charges at the calling station, a call timer, means responsive to the serving of a call for timing its initial period under the coadjutant control of said call timer and said registered initial period duration, means responsive to the conclusion of the initial period of each call for deriving additional call data, means for registering said additional data, means for timing the overtime portion of each call, means operative upon conclusion of each call for deriving its overtime charge

under control of said registered data including its charge rate and the overtime counted by said timer, means for transmitting said overtime charge data to any one of said operator positions, and means at each position for controlling the collection of charges at the calling station.

43. In a tandem switching system for serving incoming calls, means responsive to the receipt of an incoming call or extending a connection from an incoming circuit to an outgoing circuit extending towards a called station, a rater, a computer, an operator position circuit, other circuits, means responsive to the receipt of an incoming call for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate, means for transmitting said call data including said charge rate to said other circuits from said rater, means effective upon the conclusion of said call for transmitting call charge data including the call charge rate to said computer, means responsive to the reception of said call data by said computer for deriving call charges, means for transmitting said charges from said computer to said operator position circuit, and means at said position circuit for controlling the collection of charges at the calling station.

44. In a switching system for serving incoming calls, means responsive to the receipt of an incoming call for extending a connection from an incoming circuit to an outgoing circuit, a rater, a computer, operator position circuits, other circuits, means additionally responsive to the receipt of an incoming call for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate and an initial period charge, means for transmitting said call data including said charge rate to said other circuits from said rater, means for transmitting said initial period charge to any one of said operator position circuits, means at each position circuit for monitoring the deposit at the calling station of the initial period charges, a call timer, means for timing the initial period and overtime duration of said call under control of said timer and said call data registered in said other circuits, means effective upon the conclusion of the call for transmitting call charge data including the call charge rate and the call overtime duration measured by said timer to said computer, means responsive to the reception of said call information by said computer for deriving overtime charges, means for transmitting said overtime charges from said computer to any one of said operator position circuits, and means at said position circuits for controlling the collection of said overtime charges at the calling station.

45. In a switching system for serving incoming calls, a rater, a computer, operator position circuits, other circuits, means responsive to the receipt of an incoming call for transmitting call information from said other circuits to said rater, said rater being responsive to the reception of said call information for deriving call data including a call charge rate and an initial period duration, means for transmitting said call data including said charge rate and initial period duration to said other circuits from said rater, means for transmitting said call data from said rater to said computer, means responsive to the reception of said data by said computer for deriving an initial period charge, means for transmitting said initial period charge from said computer to any one of said operator position circuits, means for timing the initial period portion of the call under control of said initial period duration information, means for transmitting call data from said other circuits to said computer upon conclusion of the initial period, means responsive to the reception of said call data by said computer for deriving additional call data including an overtime period duration and an overtime period charge, means for transmitting said overtime period charge and duration to any one of said operator position circuits, means for transmitting

said overtime period duration to said other circuits, means for counting the number of overtime periods the call persists under control of said registered overtime period duration data, means effective upon the conclusion of the call for transmitting call charge data including the call charge rate and the number of elapsed overtime periods to said computer, means responsive to the reception of said call data by said computer for deriving the call overtime charges, means for transmitting said overtime charges from said computer to any one of said operator position circuits, and means at each of said position circuits for controlling the collection of call charges at the calling station.

46. In a switching system having a plurality of incoming trunk circuits and a first and a second group of circuits wherein a trunk circuit serving an incoming call is interconnected via a first switching arrangement with one circuit in each of said groups, the system further comprising a second switching arrangement associable with any trunk circuit and with any circuit in said first and second groups for connecting a calling trunk circuit to the one circuit in each of said groups with which said calling trunk circuit is currently interconnected via said first switching arrangement, characterized in that the system further comprises a timer and charge rate register in each trunk circuit, other circuits interconnectable with a calling trunk circuit via said second switching arrangement at the beginning of each call served by said calling trunk circuit to register a call charge rate therein, each timer being effective for measuring the chargeable time for each call served by its trunk circuit, and means effective upon the conclusion of each call wherein the chargeable time and the charge rate registered in the calling trunk circuit is transmitted via said second switching arrangement to said other circuits which, in response thereto, compute the call charges.

47. The invention recited in claim 46 in combination with operator position circuits, and means for transmitting said call charge information via said second switching means to any one of said position circuits.

48. A switching system having a plurality of incoming trunk circuits and a first and a second group of circuits wherein a trunk circuit serving an incoming call is interconnected via a first switching arrangement with one circuit in each of said groups, means responsive to said interconnection for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a called office, the system further comprising a second switching arrangement associable with any trunk circuit and with any circuit in said first and second groups for connecting a calling trunk circuit to the one circuit in each of said groups with which said calling trunk circuit is currently interconnected via said first switching arrangement, characterized in that the system further comprises a timer and call data registers in each trunk circuit, other circuits interconnectable with said calling trunk circuit via said second switching arrangement at the beginning of each call served by said calling trunk circuit to register a call charge rate and an initial period duration therein, each trunk circuit being effective for measuring the initial period portion of each call served thereby under the co-adjutant control of its timer and the registered initial period duration information, and means effective upon the conclusion of the initial period portion of each call wherein the charge rate registered in the calling trunk circuit is transmitted via said second switching arrangement to said other circuits.

49. The invention recited in claim 48 in combination with means subsequently operative during the serving of each call for entering by means of said second switching arrangement additional call data including an overtime period duration into the data registers of the trunk circuit serving the call, means in the trunk circuit serving the call for counting the number of overtime periods comprising the overtime portion of each call served there-

by under the coadjutant control of its timer and the overtime period duration information registered therein, means operative upon the conclusion of each call for transmitting call data including the call charge rate and the number of overtime periods from the trunk circuit serving the call via said second switching arrangement to said other circuits, operator positions, means including said other circuits responsive to the receipt of call charge data from a calling trunk circuit for deriving overtime charges for the call served by said trunk circuit, means for transmitting said overtime charges via said switching arrangement to any one of operator positions, and means at each operator position for monitoring the deposit of call charges at the calling station.

50. In a switching system, a sender, operator positions, incoming trunk circuits, means responsive to the receipt of a call by one of said trunk circuits for interconnecting said calling trunk circuit with said sender, switching equipment operative under control of said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, further means responsive to the receipt of a call by said one trunk circuit for interconnecting said calling trunk circuit and any one of said positions, means including a data transfer circuit responsive to said interconnection of said one position and said calling trunk circuit for establishing a data channel interconnecting said one position with said sender and with said calling trunk circuit, a rater and computer means, further means responsive to the establishment of said data channel for connecting said data channel to said rater and computer means, means responsive to the connection of said data channel to said rater and computer means for transmitting call information to said rater and computer means, said rater and computer means being responsive to the reception of said call information for transmitting call data to said calling trunk circuit via said data transfer circuit, means in each trunk circuit for registering call data, means for subsequently releasing said one position from the call, means for transmitting call data from a calling trunk circuit to said rater and computer means upon the conclusion of the call via said data transfer circuit, means responsive to the receipt of said call data by said rater and computer means for transmitting call charges to a second one of said operator positions via said data transfer circuit, and means at said second position for monitoring the collection of said charges at the calling station.

51. In a switching system, a sender, operator position circuits, incoming trunk circuits, means responsive to the receipt of a call by one of said trunk circuits for interconnecting said one calling trunk circuit with said sender, means in said sender for registering call information received over said calling trunk circuit, switching equipment responsive to said registration in said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, further means responsive to a call on a calling trunk circuit for interconnecting said calling trunk circuit and any one of said position circuits, means including a data transfer circuit responsive to said interconnection of said position and said calling trunk circuit for establishing a data channel interconnecting said one position circuit with said sender and with said calling trunk circuit, means responsive to the establishment of said data channel whereby said sender and said trunk circuit transmit over said channel to said one position circuit information pertaining to the call currently served by said trunk circuit, a rater and a computer, further means responsive to the establishment of said data channel for connecting said data channel to said rater and to said computer, means responsive to the connection of said data channel to said rater for transmitting call information to said rater, said rater being responsive to the reception of said call information for transmitting call data

including a call charge rate and an initial period duration to said calling trunk circuit via said data transfer circuit, means in each trunk circuit for registering said call data, means for transmitting said charge rate via said data transfer circuit to said computer, means responsive to the reception of said charge rate by said computer for transmitting an initial period charge to said one operator position, and means at said one position for monitoring the deposit of the initial period charge at the calling station.

52. The invention recited in claim 51 in combination with timing means in each trunk circuit for timing the initial period duration of each call served thereby, means for transmitting call data including the charge rate via said data transfer circuit from a calling trunk circuit to said computer upon the conclusion of the initial period of a call served by said calling trunk circuit, means responsive to the receipt of said call data by said computer for transmitting additional call data including an overtime period duration to said calling trunk circuit via said data transfer circuit, means operative under control of said trunk circuit timing means for counting the number of overtime periods said call persists, means effective upon the conclusion of the call for transmitting call data including the charge rate and the number of overtime periods from said calling trunk circuit via said data transfer circuit to said computer, means responsive to the receipt of said call data by said computer for transmitting overtime charge data from said computer to any one of said operator position circuits via said data transfer circuit, and means at said position circuits for controlling the collection of the overtime charges at the calling station.

53. The invention of claim 52 in combination with means effective upon the conclusion of a predetermined number of overtime periods for transmitting call data including the charge rate and the number of chargeable overtime periods from said calling trunk circuit via said data transfer circuit to said computer, means responsive to the receipt of said call data by said computer for transmitting the charge for said predetermined number of overtime periods from said computer to said operator position circuit via said data transfer circuit, said controlling means at said position circuit being effective for controlling the collection of said charges at the calling station.

54. In a tandem switching system, incoming trunk circuits for serving noncoin calls, incoming trunk circuits for serving coin calls, means responsive to the reception by said trunk circuits of noncoin and coin calls for extending connections through said system to outgoing circuits extending to called offices, means for receiving calling and called office information from a preceding switching center over said incoming trunk circuits during the serving of coin calls, means responsive upon the reception of said calling and called office information for coin calls for automatically deriving charge information therefor, an operator position, means for transmitting said charge information to said operator position, and means at said operator position for controlling the collection of said charges.

55. In a tandem switching system, incoming trunk circuits for serving noncoin calls, incoming trunk circuits for serving coin calls, means responsive to the reception of noncoin and coin calls by said trunk circuits for extending connections through said system to outgoing circuits extending to called offices, means for receiving call information over said trunk circuits from a preceding office, means responsive upon the reception by said trunk circuits of calling and called office information for a coin call for automatically determining its initial period charge, operator positions, means for transmitting said initial period charge to a first one of said operator positions, means at said operator position for monitoring the collection of said initial period charge at the calling station, means for releasing said first operator position from said

all, means for subsequently connecting a second one of said operator positions to a calling coin trunk in response to the conclusion of a call served thereby, means responsive to the conclusion of each coin call for deriving the overtime charges due, means for transmitting said overtime charges to said second operator position, and means at said second position for facilitating the collection of said overtime charges at the calling station.

56. In a tandem switching system, incoming trunk circuits for serving noncoin calls, incoming trunk circuits for serving coin calls, means responsive to the reception of noncoin and coin calls by said trunk circuits for extending connections through said system to outgoing circuits extending to called offices, means for receiving call information from a preceding office, means responsive upon the reception of said call information for each coin call for automatically determining its initial period charge, operator positions, means for transmitting said initial period charge to a first one of said operator positions, means at said first operator position for monitoring the collection of said initial period charges, means for subsequently releasing said first operator position from a coin call, a timer in each coin trunk circuit, means including the timer in each of said coin trunk circuits for timing the initial period portion of coin calls served thereby, means for connecting a second one of said operator positions to a calling coin trunk circuit at the termination of the initial period for each call served thereby under control of its trunk circuit timer, means for subsequently releasing said second position, means in each coin trunk circuit for measuring the overtime portion of each call served thereby under control of its timer, means responsive to the conclusion of a coin call for deriving the overtime charges due under control of the overtime measured by the trunk circuit serving the call, means for transmitting said overtime charges to a third one of said operator positions, and means at said third position for facilitating the collection of said overtime charges.

57. In a tandem switching center for serving non-coin nonspecial service calls, noncoin special service calls, and coin calls; noncoin nonspecial service incoming trunk circuits, noncoin special service incoming trunks circuits, and coin incoming trunk circuits; means responsive to receipt of a call on any one of said trunk circuits for extending a connection through said tandem office to an outgoing circuit extending to a terminating office; an operator position; means simultaneously operable upon the receipt of a call on one of said noncoin special service trunk circuits for extending a connection therefrom to one of said operator positions; means in said operator position for providing call assistance; means additionally operative in response to the receipt of a call on one of said coin trunk circuits for transmitting charge information to one of said operator positions; and means at said operator position for monitoring the collection of call charges from the calling customer.

58. In a tandem switching center for serving noncoin nonspecial service calls, noncoin special service calls, and coin calls; noncoin nonspecial service incoming trunk circuits, noncoin special service incoming trunk circuits and coin incoming trunk circuits; means responsive to receipt of a call on any one of said trunk circuits for extending a connection through said tandem office to an outgoing circuit extending to a terminating office; operator positions; means simultaneously operable upon the receipt of a call on one of said noncoin special service trunk circuits for extending a connection therefrom to any one of said operator positions, means in each of said operator positions for providing call assistance for each call connection extended thereto; means simultaneously operable upon the receipt of a call on a calling one of said coin trunk circuits for extending a connection therefrom to any one of said operator positions; a computer; a timer in each coin trunk circuit; means including said computer operative in response to the receipt of a call on said call-

ing coin trunk circuit for transmitting charge information including an initial period charge to the operator position to which said call is first connected; means at each of said operator positions to which a coin call is first connected for monitoring the collection of the initial period charge from the calling customer; means for releasing said connected operator position from said calling coin trunk circuit; means subsequently operative under the control of the timer in said calling coin trunk circuit for connecting any one of said operator positions to said calling trunk circuit at the end of the initial period of a coin call served thereby; means for subsequently releasing the last-established connection to said operator position; means including said timer for timing the overtime portion of a coin call served by said calling coin trunk circuit; means subsequently operative upon the conclusion of a coin call for connecting any one of said operator positions to said calling coin trunk circuit; means effective upon the conclusion of a coin call for transmitting the measured overtime from said calling coin trunk circuit to said computer; means in said computer for deriving and transmitting the overtime period charges to said last-connected position; and means at each of said positions for controlling the collection of the overtime charges from the calling customer for a coin call connection extended thereto.

59. In a switching system, a sender, incoming trunk circuits, means responsive to a call on one of said trunk circuits for interconnecting said calling trunk circuit with said sender, means in said sender for registering call information received over said calling trunk circuit, an operator's position, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, a position link, further means including said position link responsive to said registration in said sender for interconnecting said calling trunk circuit and said position, means including a data transfer circuit responsive to said interconnection of said position and said calling trunk circuit for establishing a data channel interconnecting said position with said sender and with said calling trunk circuit means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position information pertaining to the call currently served by said trunk circuit, a rater and computer means, further means responsive to the establishment of said data channel for connecting said data channel to said rater and computer means, means responsive to the connection of said data channel to said rater and computer means for transmitting call information to said rater and computer means, said rater and computer means being responsive to the reception of said call information for transmitting call data including the call charges to said position, and means at said position for monitoring the deposit of said charges at the calling station.

60. The invention recited in claim 59 in combination with means at said position for registering calling station information under control of an operator, and means at said position for controlling the recording of calling and called station information.

61. In a switching system, a sender, incoming trunk circuits, means responsive to a call on one of said trunk circuits for interconnecting said calling trunk circuit with said sender, means in said sender for registering originating and terminating office information received over said calling trunk circuit, operator's positions, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, means in said sender responsive to the establishment of said connection for transmitting called station information to said terminating office, a position link, further means including said position link responsive

to said registration in said sender for interconnecting said calling trunk circuit and any one of said positions, means including a data transfer circuit responsive to said interconnection of said one position and said calling trunk circuit for establishing a data channel interconnecting said position with said sender and with said calling trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position information pertaining to the call currently served by said trunk circuit, means effective when said position is interconnected with said calling trunk circuit for establishing a speech circuit between said position and the calling and called stations for said call, a rater, a computer, further means responsive to the establishment of said data channel for connecting said data channel to said rater, means responsive to the connection of said data channel to said rater for transmitting call information from said sender and from said trunk circuit to said rater, said rater being responsive to the reception of said call information for transmitting call data including a charge rate to said position and to said trunk circuit and as well as an initial period duration to said trunk circuit, means responsive to the reception of said call data by said position and said trunk circuit for releasing said rater from said data channel, means subsequently operative for connecting said computer to said data channel, means responsive to the connection of said computer to said data channel for transmitting call information including said charge rate from said position to said computer, means in said computer responsive to the receipt of said call information for transmitting call data including an initial period charge to said position circuit, means at said position for monitoring the deposit of the initial period charge by the calling party, means at said position operable under control of an operator thereat for recording call data, means subsequently operative for releasing said position and said data channel, a timer in each trunk circuit, means operative for timing the initial period of said call under the coadjutant control of the timer in said calling trunk circuit and said initial period duration data currently registered in said trunk circuit, means operative at the conclusion of the initial period under control of the timer in said calling trunk circuit for connecting said calling trunk circuit with any one of said operator positions via said position link on a priority basis, means responsive to said connection of said trunk circuit and position whereby said data transfer circuit interconnects said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer whereby said trunk circuit transmits call information including the charge rate and the initial period duration to said computer, means in said computer responsive to the receipt of said call information from said trunk circuit for transmitting overtime period charge and duration information to said position and for transmitting call data including an overtime period duration to said trunk circuit for registration therein, means subsequently operative for releasing said position and said computer and said data transfer circuit, means in said trunk circuit subsequently operative for timing the overtime portion of the call, means effective upon the conclusion of the call for interconnecting said calling trunk circuit and any one of said positions via said position link on a priority basis, means responsive to said last-named interconnection of said trunk circuit with said position whereby said data transfer circuit interconnects said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer whereby said calling trunk circuit transmits call data to said computer with said data including the overtime duration and the call charge rate, said computer being effective for deriving call data including the overtime charges, means for transmitting call data including said overtime charges to said posi-

tion, and means at said position for controlling the collection of said overtime charges.

62. In a switching system, a sender, incoming trunks means responsive to a call on one of said trunk circuits for interconnecting said calling trunk circuit with said sender, means in said sender for registering call information received over said calling trunk circuit, operator's positions, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, a position link, further means including said position link responsive to said registration in said sender for interconnecting said calling trunk circuit and any idle one of said positions, means including a data transfer circuit responsive to said interconnection of said position and said calling trunk circuit for establishing a data channel interconnecting said position with said sender and with said calling trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position information pertaining to the call currently served by said trunk circuit, a rater, a computer, further means responsive to the establishment of said data channel for connecting said data channel to said rater, means responsive to the connection of said data channel to said rater for transmitting call information from said sender and from said trunk circuit to said rater, said rater being responsive to the reception of said call information for transmitting call data including a charge rate to said position and to said trunk circuit as well as an initial period duration to said trunk circuit, means responsive to the reception of said call data by said position and said trunk circuit for releasing said rater from said data channel, means subsequently operative for connecting said computer to said data channel, means responsive to the connection of said computer to said data channel for transmitting call information including said charge rate from said position to said computer, means in said computer responsive to the receipt of said call information for transmitting call data including an initial period charge to said position, means for releasing said computer, means at said position for monitoring the deposit of the initial period charges by the calling party, means subsequently operative for releasing said position and said data channel, a timer in each trunk circuit, means operative for timing the initial period of said call under the coadjutant control of the timer in said calling trunk circuit and said initial period duration data currently registered in said trunk circuit means operative at the conclusion of the initial period for connecting said calling trunk circuit with any one of said operator positions via said position link, means responsive to said connection of said trunk circuit and said last-named position whereby said data transfer circuit interconnects said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer for causing said trunk circuit to transmit call information including the charge rate and the initial period duration to said computer, means in said computer responsive to the receipt of said call information from said trunk circuit for transmitting overtime period charge and duration information to said position and for transmitting call data including an overtime period duration to said trunk circuit for registration therein, means subsequently operative for releasing said position and said data transfer circuit, means in said trunk circuit subsequently operative for timing the overtime portion of the call, means effective upon the conclusion of the call for interconnecting said calling trunk circuit and any one of said positions via said position link, means responsive to said last-named interconnection of said trunk circuit with said position whereby said data transfer circuit interconnects said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit said position and said computer whereby said calling trunk circuit transmits call

data to said computer with said data including the overtime duration and the call charge rate, said computer being effective in response thereto for deriving call data including the overtime charges, means for transmitting call data including said overtime charges to said position, and means at said position for controlling the collection of said overtime charges.

63. In a switching system, a sender, incoming trunk circuits, means responsive to a call on one of said trunk circuits for interconnecting said calling trunk circuit with said sender, means in said sender for registering terminating office information received over said calling trunk circuit, an operator position, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said calling trunk circuit to an outgoing circuit extending to a terminating office, means in said sender responsive to the establishment of said connection for outpulsing called station information to said terminating office, a position link, further means including said position link responsive to said registration in said sender for interconnecting said calling trunk circuit and said position, means including a data transfer circuit responsive to said interconnection of said position and said calling trunk circuit for establishing a data channel interconnecting said position with said sender and with said calling trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position information pertaining to the call currently served by said trunk circuit, means effective when said position is interconnected with said calling trunk circuit for establishing a speech circuit between said position and the calling and called stations for said call, means at said position for registering calling station information under control of an operator, a rater, a computer, further means responsive to the establishment of said data channel for connecting said data channel to said rater, means responsive to the connection of said data channel to said rater for transmitting call information from said sender and from said trunk circuit to said rater, said rater being responsive to the reception of said call information for transmitting call data including a charge rate to said position and to said trunk circuit and further including an initial period duration to said trunk circuit, means responsive to the reception of said call data by said position and said trunk circuit for releasing said rater from said data channel, means subsequently operative for connecting said computer to said data channel, means responsive to the connection of said computer to said data channel for transmitting call information including said charge rate from said position to said computer, means in said computer responsive to the receipt of said call information for transmitting call data including an initial period charge to said position circuit, means at said position for monitoring the deposit of the initial period charge by the calling party, means at said position operable under control of an operator thereat for recording call data, means subsequently operative for releasing said position and said data channel, a timer in each trunk circuit, means operative for timing the initial period of said call under the coadjutant control of the timer in said calling trunk circuit and said initial period duration data currently registered in said trunk circuit, means operative at the conclusion of the initial period under control of the timer in said calling trunk circuit for connecting said calling trunk circuit with an operator position via said position link on a priority basis, means responsive to said connection of said trunk circuit and position for causing said data transfer circuit to interconnect said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer whereby said trunk circuit transmits call information including the charge rate and the initial period duration to said computer, means in said computer

responsive to the receipt of said call information from said trunk circuit for transmitting overtime period charge and duration information to said position and for transmitting call data including an overtime period duration to said trunk circuit for registration therein, means subsequently operative for releasing said position and said computer and said data transfer circuit, means in said trunk circuit subsequently operative for timing the overtime portion of the call, means effective upon the conclusion of the call for interconnecting said calling trunk circuit and a position via said position link on a priority basis, means responsive to said last-named interconnection of said trunk circuit with said position whereby said data transfer circuit interconnects said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit with said position and with said computer whereby said calling trunk circuit transmits call data to said computer with said data including the overtime duration and the call charge rate, said computer being effective for deriving call data including the overtime charges, means for transmitting call data including said overtime charges to said position, and means at said position for controlling the collection of said overtime charges.

64. In a switching center for interconnecting an incoming calling trunk circuit from an originating office with an outgoing circuit extending to a terminating office, a register, an incoming trunk circuit responsive to the receipt of a call thereon for seizing said register, means in said register for registering called station information received over said calling trunk circuit, a sender, means in said register responsive to the registration of said called station information for controlling said calling trunk circuit to seize said sender, a data transfer circuit, means in said register responsive to the registration of said called station information for causing said data transfer circuit to interconnect said register with said sender, means in said register for transmitting said called station information over said data transfer circuit to said sender for registration therein, means responsive to said registration for releasing said register and said data transfer circuit, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said incoming trunk circuit to said outgoing circuit extending to said terminating office, an operator position circuit, means including a position link responsive to the conclusion of registration of call information by said sender for interconnecting said incoming trunk circuit and said position circuit, means including said data transfer circuit responsive to said interconnection of said position and said trunk circuit for establishing a data channel interconnecting said position circuit with said sender and with said trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position circuit information pertaining to the call currently served by said incoming trunk circuit, a rater and computer means, further means responsive to the establishment of said data channel for connecting said data channel to said rater and computer means, means responsive to the connection of said data channel to said rater and computer means for transmitting call information to said rater and computer means, said rater and computer means being responsive to the reception of said call information for transmitting call data including the call charges to said position, and means at said position for monitoring the deposit of said charges at the calling station.

65. The invention recited in claim 64 in combination with means in said sender for registering calling station information received over said incoming trunk circuit, and means at said position operable under the control of an operator thereat for controlling the recording of call data.

66. The invention recited in claim 64 in combination with means at said position circuit operable under control of an operator thereat for registering calling station in-

formation, and further means at said position operable under control of an operator thereat for controlling the recording of call data.

67. In a switching center for interconnecting an incoming calling trunk circuit from an originating office with an outgoing circuit extending to a terminating office, a register, an incoming trunk circuit responsive to the receipt of a call thereon for seizing said register, means in said register for registering called station information received over said calling trunk circuit, a sender, means in said register responsive to the registration of said called station information for controlling said calling trunk circuit to seize said sender, a data transfer circuit, means in said register responsive to the registration of said called station information for causing said data transfer circuit to interconnect said register with said sender, means in said register for transmitting said called station information over said data transfer circuit to said sender for registration therein, means responsive to said registration for releasing said register and said data transfer circuit, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said incoming trunk circuit to said outgoing circuit extending to said terminating office, means in said sender responsive to the establishment of said connection for outputting called station information to said terminating office, means in said sender for recording calling station information received over said incoming trunk circuit an operator position circuit, means including a position link responsive to the conclusion of registration of said calling and called station information by said sender for interconnecting said incoming trunk circuit and said position circuit, means including said data transfer circuit responsive to said interconnection of said position and said trunk circuit for establishing a data channel interconnecting said position circuit with said sender and with said trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position information pertaining to the call currently served by said incoming trunk circuit, means effective when said position is interconnected with said calling trunk circuit for establishing a speech circuit between said position and the calling and called stations for said call; a rater, a computer, further means responsive to the establishment of said data channel for connecting said data channel to said rater, means responsive to the connection of said data channel to said rater for transmitting call information from said sender and from said trunk circuit to said rater, said rater being responsive to the reception of said call information for transmitting call data including a charge rate to said position and to said trunk circuit and further including an initial period duration to said trunk circuit, means responsive to the reception of said call data by said position and said trunk circuit for releasing said rater and said trunk circuit from said data channel, means subsequently operative for connecting said computer to said data channel, means responsive to the connection of said computer to said data channel for transmitting call information including said charge rate from said position to said computer, means in said computer responsive to the receipt of said call information for transmitting call data including an initial period charge to said position circuit, means at said position for monitoring the deposit of the initial period charge by the calling party, means subsequently operative for releasing said position and said computer and said data channel, means at said position operable under control of an operator thereat for recording call data, a timer in each trunk circuit means operative for timing the initial period of said call under the coadjutant control of the timer in said calling trunk circuit and said initial period duration data currently registered in said trunk circuit, means operative at the termination of the initial period under control of the timer in said calling trunk circuit for connecting said calling trunk

circuit with an operator position via said position link on a priority basis, means responsive to said connection of said trunk circuit and position for causing said data transfer circuit to interconnect said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer for causing said trunk circuit to transmit call information including the charge rate and the initial period duration to said computer, means in said computer responsive to the receipt of said call information from said trunk circuit for transmitting overtime period charge and duration information to said position and for transmitting call data including an overtime period duration to said trunk circuit for registration therein, means subsequently operative for releasing said position and said computer and said data transfer circuit, means in said trunk circuit subsequently operative for timing the overtime portion of the call, means effective upon the conclusion of the call for interconnecting said calling trunk circuit and a position via said position link on a priority basis, means responsive to said last-named interconnection of said trunk circuit with said position for causing said data transfer circuit to interconnect said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer for causing said calling trunk circuit to transmit call data to said computer with said data including the overtime duration and the call charge rate, said computer being effective for deriving call data including the overtime charges, means for transmitting call data including said overtime charges to said position, and means at said position for controlling the collection of said overtime charges.

68. In a switching center for interconnecting an incoming calling trunk circuit from an originating office with an outgoing circuit extending to a terminating office, a register, an incoming trunk circuit responsive to the receipt of a call thereon for seizing said register, means in said register for registering called station information received over said calling trunk circuit, a sender, means in said register responsive to the registration of said called station information for controlling said calling trunk circuit to seize said sender, a data transfer circuit, means in said register responsive to the registration of said called station information for causing said data transfer circuit to interconnect said register with said sender, means in said register for transmitting said called station information over said data transfer circuit to said sender for registration therein, means responsive to said registration for releasing said register and said data transfer circuit, switching equipment responsive to said conclusion of said registration in said sender for establishing a connection from said incoming trunk circuit to said outgoing circuit extending to said terminating office, means in said sender responsive to the establishment of said connection for transmitting called station information to said terminating office, an operator's position circuit, means including a position link responsive to the conclusion of registration of said called station information by said sender for interconnecting said incoming trunk circuit and said position circuit, means including said data transfer circuit responsive to said interconnection of said position and said trunk circuit for establishing a data channel interconnecting said position circuit with said sender and with said trunk circuit, means responsive to the establishment of said data channel for causing said sender and said trunk circuit to transmit over said channel to said position circuit information pertaining to the call currently served by said incoming trunk circuit, means effective when said position is interconnected with said calling trunk circuit for establishing a speech circuit between said position circuit and the calling and called stations for said call, means at said position circuit operable under control of an operator thereat for registering calling station information, a rater, a computer, further means responsive to the establishment

of said data channel for connecting said data channel to said rater, means responsive to the connection of said data channel to said rater for transmitting call information from said sender and from said trunk circuit to said rater, said rater being responsive to the reception of said call information for transmitting call data including a charge rate to said position and to said trunk circuit and further including an initial period duration to said trunk circuit, means responsive to the reception of said call data by said position and said trunk circuit for releasing said rater from said data channel, means subsequently operative for connecting said computer to said data channel, means responsive to the connection of said computer to said data channel for transmitting call information including said charge rate from said position to said computer, means in said computer responsive to the receipt of said call information for transmitting call data including an initial period charge to said position circuit, means at said position for monitoring the deposit of the initial period charge by the calling party, means subsequently operative for releasing said position and said computer from said data channel, means at said position operable under control of an operator thereat for recording call data, a timer in each trunk circuit, means operative for timing the initial period of said call under the coadjutant control of the timer in said calling trunk circuit and said initial period duration data currently registered in said trunk circuit, means operative at the conclusion of the initial period under control of the timer in said calling trunk circuit for connecting said calling trunk circuit with an operator position via said position link on a priority basis, means responsive to said connection of said trunk circuit and position for causing said data transfer circuit to interconnect said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit, said position and said computer for causing said trunk circuit to transmit call information including the charge rate and the initial period duration to said computer, means in said computer responsive to the receipt of said call information from said trunk circuit for transmitting overtime period charge and duration information to said position and for transmitting call data including an overtime period duration to said trunk circuit for registration therein, means subsequently operative for releasing said position and said data transfer circuit, means in said trunk circuit subsequently operative for timing the overtime portion of the call, means effective upon the termination of the call for interconnecting said calling trunk circuit and a position via said position link on a priority basis, means responsive to said last-named interconnection of said trunk circuit with said position for causing said data transfer circuit to interconnect said trunk circuit with said position and with said computer, means responsive to said connection of said trunk circuit with said position and with said computer for causing said calling trunk circuit to transmit call data to said computer with said data including the overtime duration and the call charge rate, said computer being effective for deriving call data including the overtime charges, means for transmitting call data including said overtime charges to said position, and means at said position for controlling the collection of said overtime charges.

69. In a switching system, incoming coin trunk circuits, a plurality of operator positions, switching means responsive to receipt of a call by one of said trunk circuits from a preceding office for extending a connection to an outgoing circuit and for connecting to said one trunk circuit a first idle one of said operator positions, means additionally responsive to receipt of said call on said one trunk circuit for transmitting to said first operator position charge information including an initial period charge, means for subsequently releasing said first operator position from said one trunk circuit said switching means being effective subsequent to the initial period portion of said call for connecting a second idle one of said operator positions

to said one trunk circuit, and means responsive to said last connection for transmitting to said second operator position call information including call overtime charges.

70. In a switching system, incoming coin trunk circuits, a plurality of operator positions, switching means responsive to receipt of a call on one of said trunk circuits for extending a connection to an outgoing circuit and for connecting to said one trunk circuit any idle one of said operator positions, means additionally responsive to receipt of said call on said one trunk circuit for both transmitting to said operator position charge information including an initial period charge and for transmitting call data to said one trunk circuit for registration therein, said switching means being subsequently effective for releasing said operator position from said one trunk circuit, means effective upon the conclusion of said call for causing said switching means to connect any idle one of said operator positions to said one trunk circuit, means for deriving call overtime charge under control of said call data registered in said trunk circuit, and means responsive thereto for transmitting to said last-named operator position call information including said call overtime charges due.

71. In a switching system, incoming coin trunk circuits each including a timer, a plurality of operator positions, means for determining charge information relative to coin calls, means for connecting any idle one of said positions to a calling coin trunk circuit, means responsive thereto for transmitting initial period charge information to said position from said determining means, means for releasing said first position from said calling trunk circuit, means operative at the end of said call for connecting any idle one of said positions to said calling trunk circuit, and means operative under control of said timer for transmitting overtime charge information to said last-named position from said determining means.

72. In a switching system, the combination in accordance with claim 71 further comprising means in said calling trunk circuit for effecting the first connection to any one of said positions on a nonpriority basis and for subsequently effecting the second connection to any one of said positions on a priority basis.

73. In a switching system, the combination in accordance with claim 71 further comprising means for controlling said coin trunk circuit timer by said determining means.

74. In a switching system, incoming coin trunk circuits, a plurality of operator positions, means for computing call charges and call period durations, means for connecting a calling trunk circuit with an operator position, means at said position for registering call information received over said calling trunk circuit, means at said position for manually registering in said computing means a call charge rate code based on said registered call information, and means responsive to said manual registering for both transmitting back to said position call initial period charge information and transmitting to said trunk circuit said charge rate code and call initial period duration information.

75. In a switching system, incoming coin trunk circuits each having a timer therein, a plurality of operator positions, means for computing call charges and call period durations, means for connecting a calling trunk circuit with an operator position on a nonpriority basis, means at said position for registering call information received over said calling trunk circuit, means at said position for manually registering in said computing means a call charge rate code based on said registered call information, means responsive to said manual registering for both transmitting back to said position call initial period charge information and transmitting to said trunk circuit said charge rate code and call initial period duration information, means for timing the initial period of said call under the coadjutant control of said timer and said registered initial period duration information, means responsive to the termination of said initial period for connecting said calling

trunk circuit on a priority basis with a second one of said operator positions, means responsive to said last-named connection for transmitting call data from said calling trunk circuit to both said second position and to said computing means, said computer being responsive thereto for deriving call overtime charge data, and means for transmitting said overtime charge data to both said trunk circuit and said second position, said computer being effective upon the termination of the call for computing the overtime charges under control of call data registered in said calling trunk circuit.

76. In a switching system, trunk circuits for serving incoming calls, means responsive to a call on one of said trunk circuits for extending a connection through said system to an outgoing circuit extending to a called office, operator positions, means additionally responsive to said call for connecting said calling trunk circuit and one of said positions, call data determining means, means additionally responsive to said call for registering call data in said calling trunk circuit and in said one position under control of said determining means, means at said position operable under control of an operator thereat for releasing said connection to said called office and for releasing the call data registers in said calling trunk circuit, means at said position operable under control of an operator thereat for registering new call data in said position, means responsive to said registration of said new data for extending a connection through said system to an outgoing circuit extending to a called office, means additionally responsive to said registration of said new data for transmitting call data from said determining means to said calling trunk circuit for registration therein.

77. In a switching system, trunk circuits for serving incoming calls, means responsive to a call on one of said trunk circuits for extending a connection through said system to an outgoing circuit extending to a called office, operator positions, means additionally responsive to said call for connecting said calling trunk circuit and one of said positions, a rater, a computer, means additionally responsive to said call for registering call data in said calling trunk circuit and in said one position under control of said rater and said computer, means at said position operable under control of an operator thereat for releasing said connection to said called office and for releasing the call data registers in said calling trunk circuit, means at said position operable under control of an operator thereat for registering new call data in said position, means responsive to said registration of said new data for extending a connection through said system to an outgoing circuit extending to a called office, means additionally responsive to said registration of said new data for transmitting said new data to said rater, said rater being effective for deriving additional call data, means for transmitting said additional call data to said position and to said trunk circuit for registration therein, means for transmitting said additional call data to said computer, means in said computer for deriving call charge information, and means for transmitting said call charge information to said position.

78. In a switching system, trunk circuits for serving incoming calls, means responsive to a call on one of said trunk circuits for extending a connection through said

system to an outgoing circuit extending to a called office operator positions, means additionally responsive to said call for connecting said calling trunk circuit and one of said positions, a computer, means additionally responsive to said call for registering call data in said calling trunk circuit and in said one position, means at said position operable under control of an operator thereat for releasing said connection to said called office and for releasing the call data registers in said calling trunk circuit, means at said position operable under control of an operator thereat for registering new call data in said position means responsive to said registration of said new data for extending a connection through said system to an outgoing circuit extending to a called office, manually operable means at said position for transmitting a call charge rate code to said computer, means for transmitting said charge rate code data to said computer, means for transmitting said new call data to said trunk circuit for registration therein, means in said computer for deriving call charge information, and means for transmitting said call charge information to said position.

79. In a switching system, incoming coin trunk circuits each having a timer therein, means for determining coin call charges and coin call durations, a plurality of operator positions, means responsive to a call on one of said coin trunk circuits for establishing a connection to an idle one of said positions, and means for transmitting from said determining means call charge information to said one position and call duration information to said timer circuit.

80. In a switching system in accordance with claim 79, the combination further comprising means controlled by said timer circuit for establishing a connection to any idle one of said operator positions after the passage of the particular time duration transmitted to said timer circuit from said determining means.

81. A switching system having a plurality of trunk circuits together with equipment operable for extending a connection from a calling one of said trunk circuits to an outgoing circuit extending to a called office, a call timer and a charge rate code register for each of said trunk circuits, charge determining means operable upon the receipt of a call on one of said trunk circuits for deriving a charge rate code for said call, means for registering said charge rate code in the register for said calling trunk circuit, and means effective upon the conclusion of said call for transmitting said charge rate code and the call duration measured by said call timer to said charge determining means, said charge determining means being operable to derive the charges applicable to said call.

References Cited

UNITED STATES PATENTS

2,357,756	9/1944	Brooks et al.	179—6.31
3,019,294	1/1962	Esperseth et al.	179—6.31
3,133,153	5/1964	Bonanno	179—7.1
3,218,392	11/1965	Blashfield	179—7.1

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,341,662

September 12, 1967

Louis J. Cerny et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 156, line 55, for the claim reference numeral "29"
read -- 28 --.

Signed and sealed this 2nd day of January 1968.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents