

Dec. 13, 1955

H. D. CAHILL

2,727,092

TRANSVERTER (RECORDER-CONTROLLER)

Filed Nov. 21, 1952

12 Sheets-Sheet 1

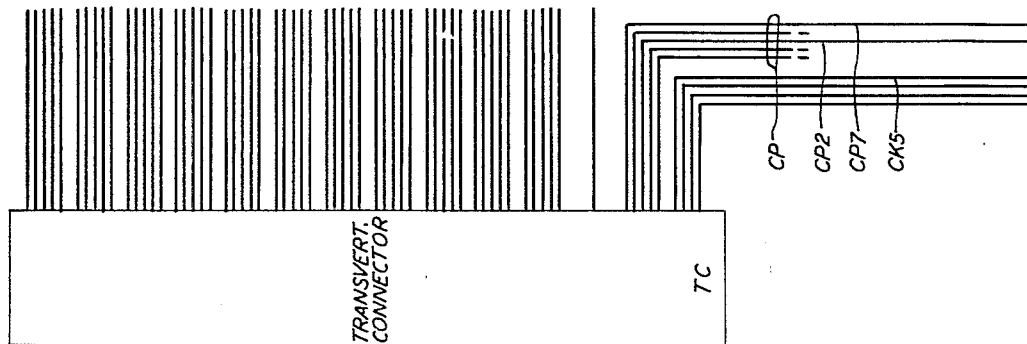


FIG. 1

FIG. 12

FIG. 1	FIG. 2	FIG. 3	FIG. 4
FIG. 5	FIG. 6	FIG. 7	FIG. 8
FIG. 9	FIG. 10	FIG. 11	

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12 Sheets-Sheet 2

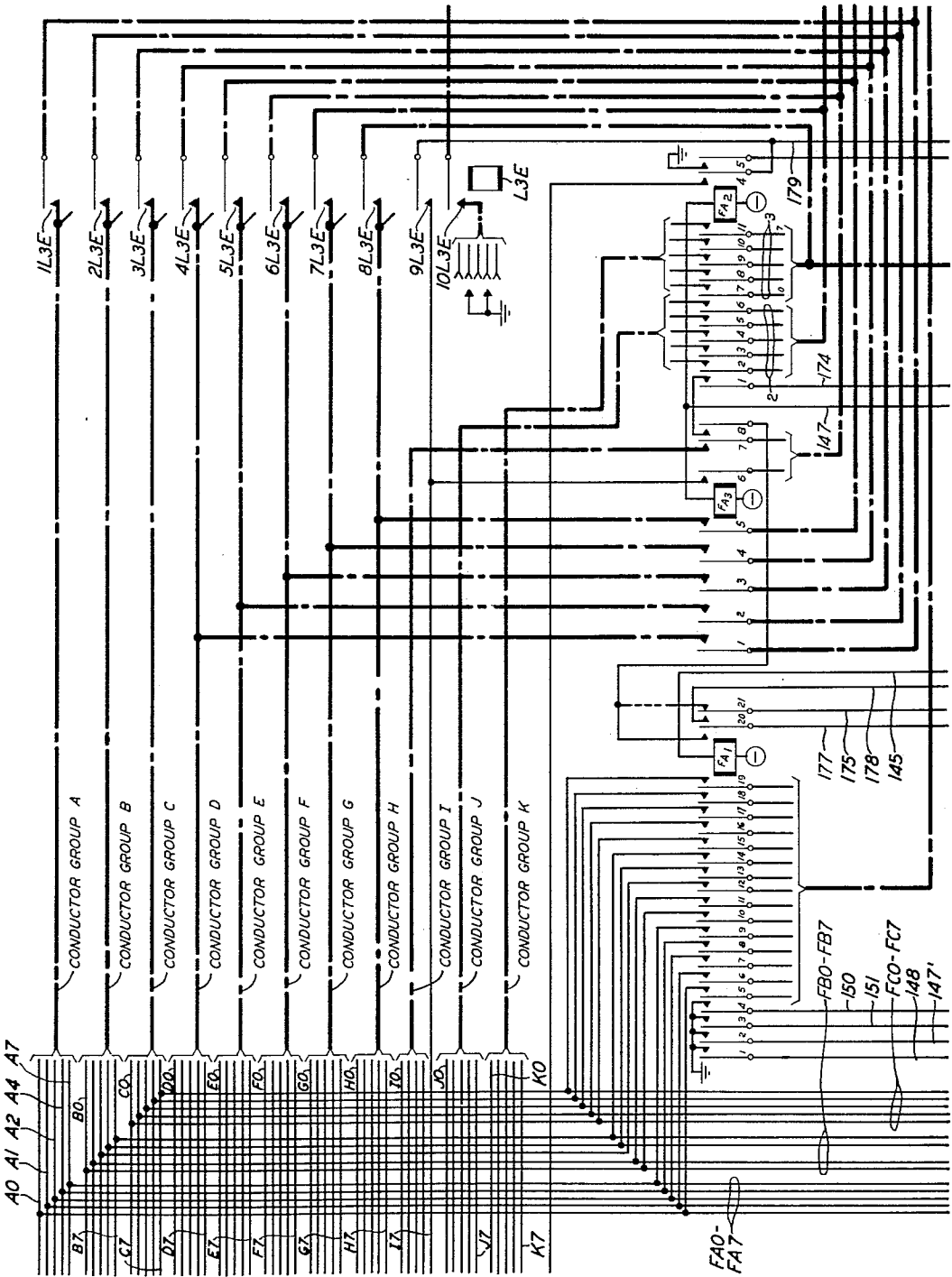


FIG. 2

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12 Sheets-Sheet 3

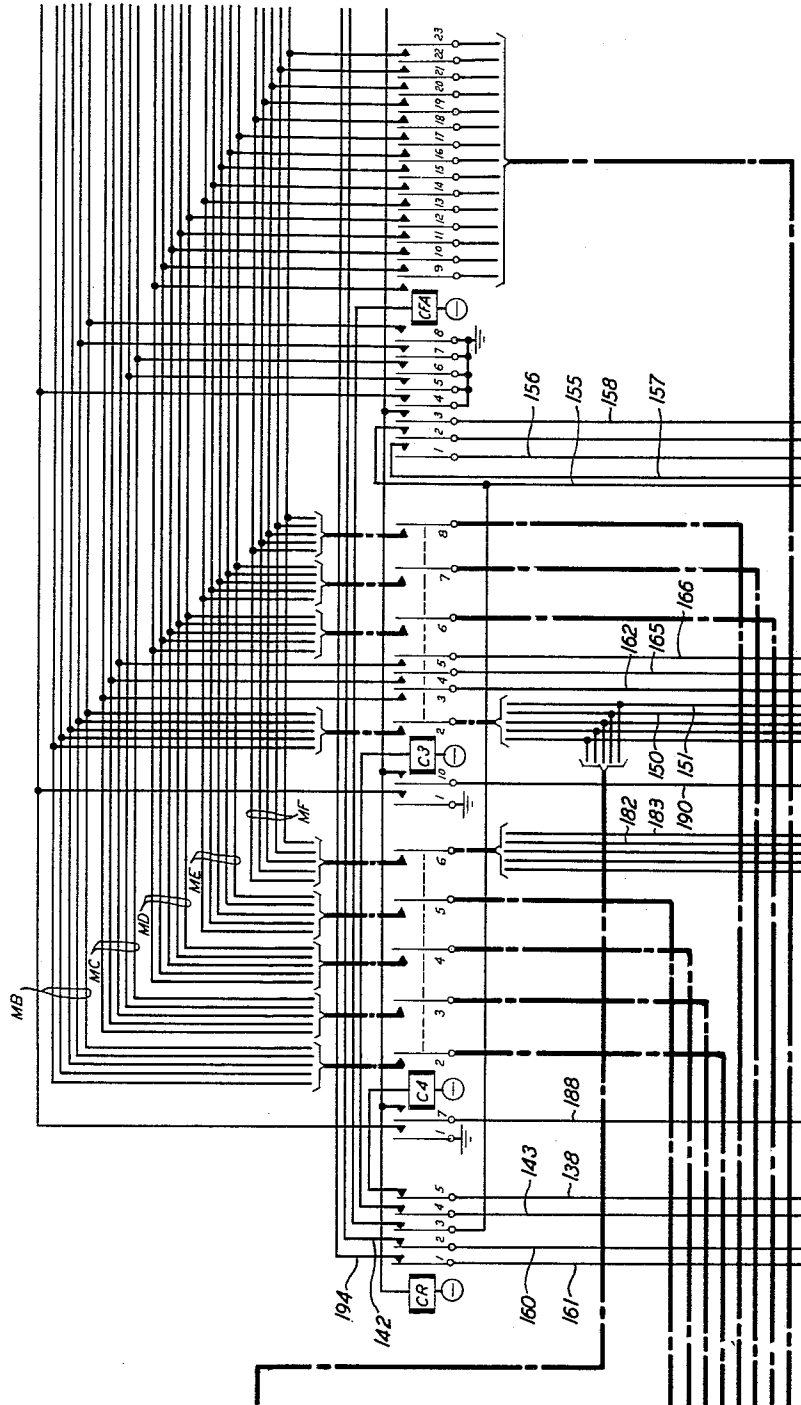


FIG. 3

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12 Sheets-Sheet 4

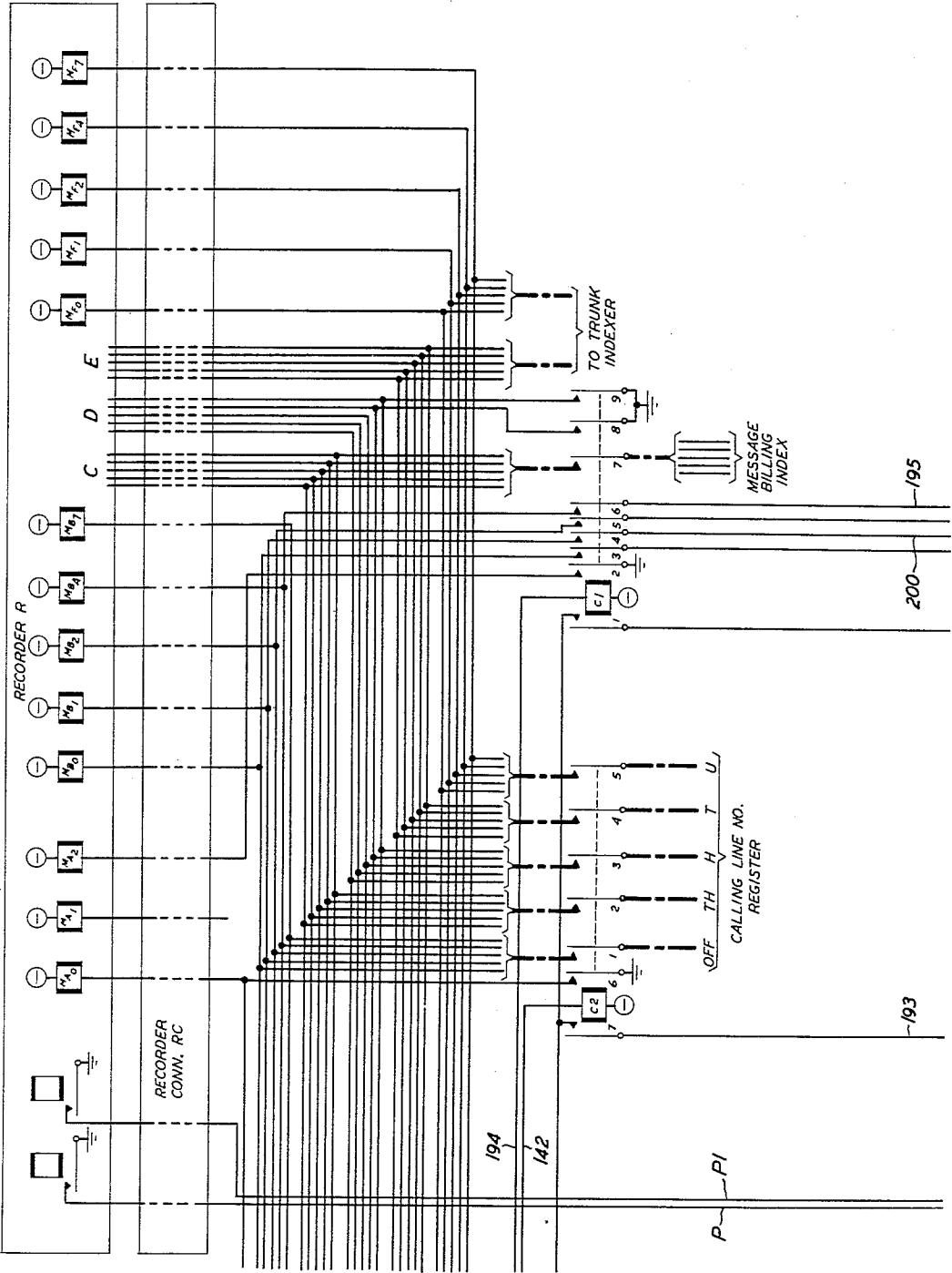


FIG. 4

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12 Sheets-Sheet 5

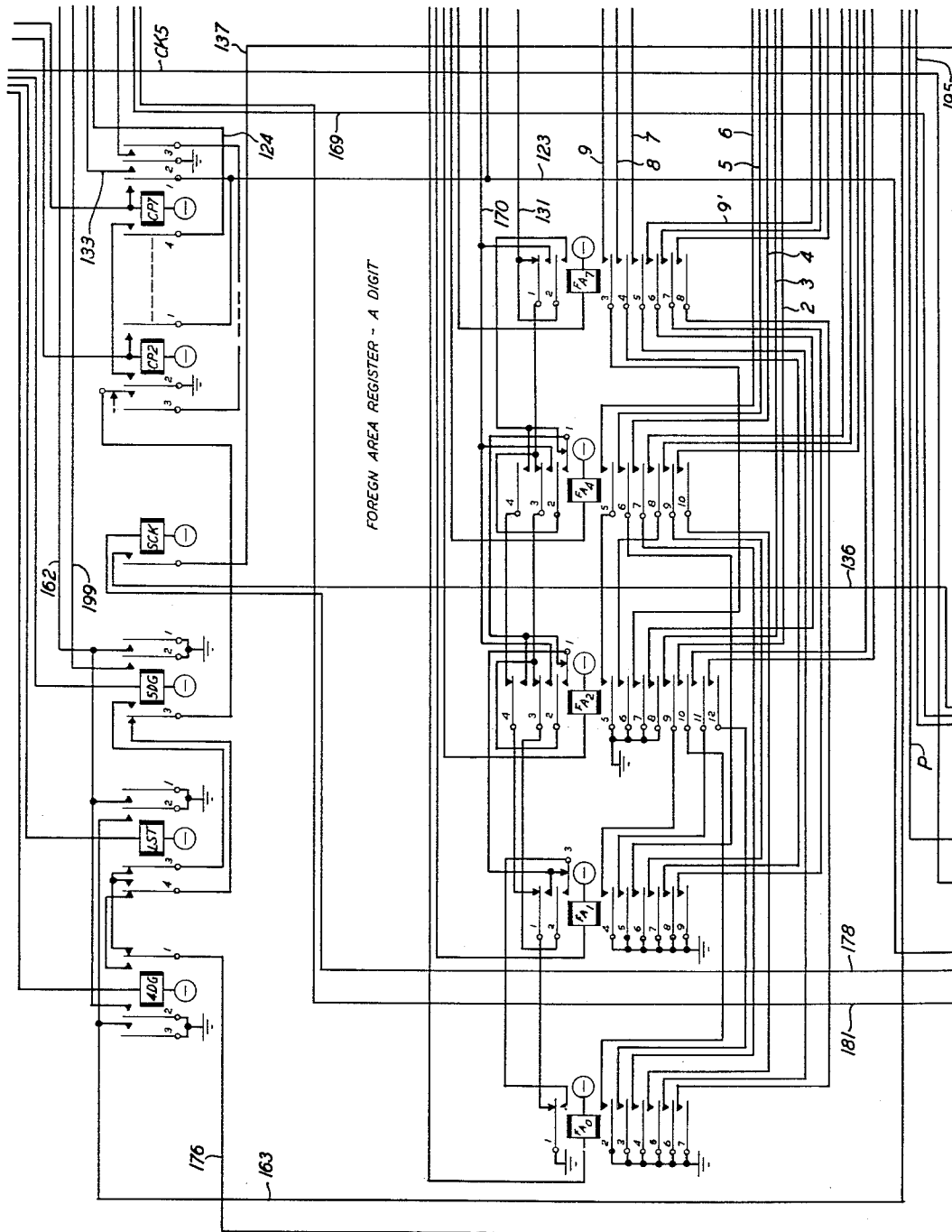


FIG. 5

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12 Sheets-Sheet 6

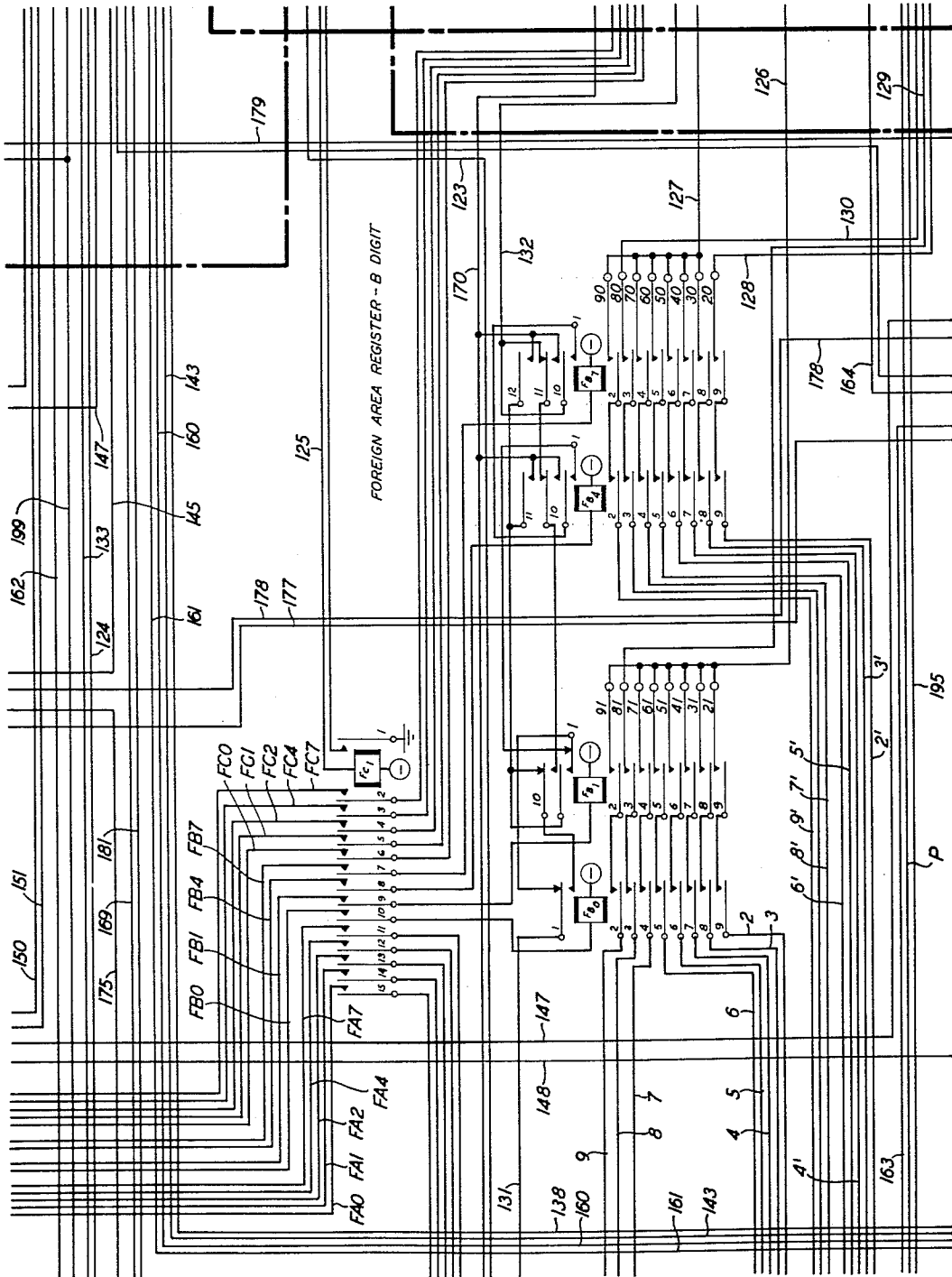


FIG. 6

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12 Sheets-Sheet 7

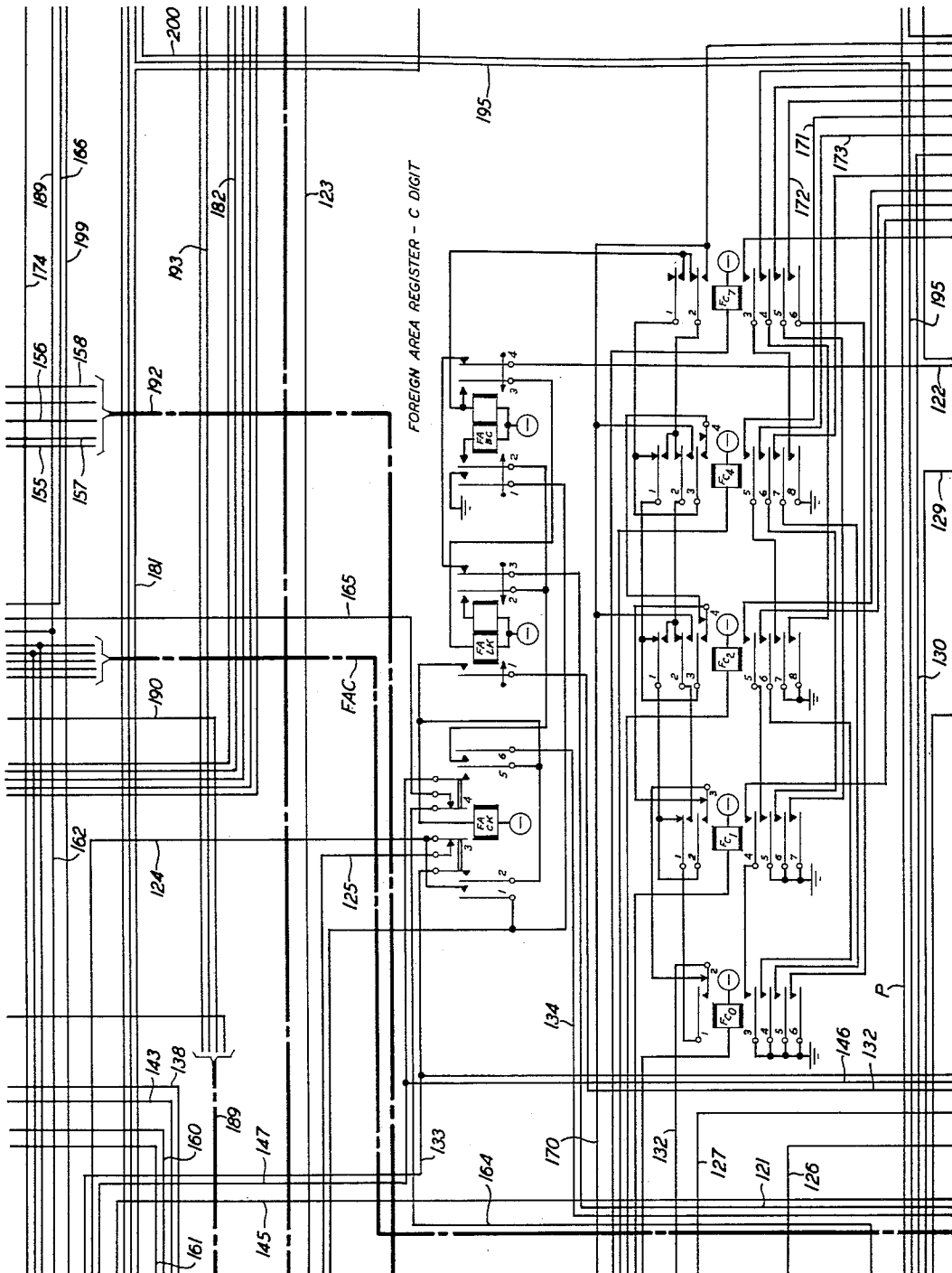


FIG. 7

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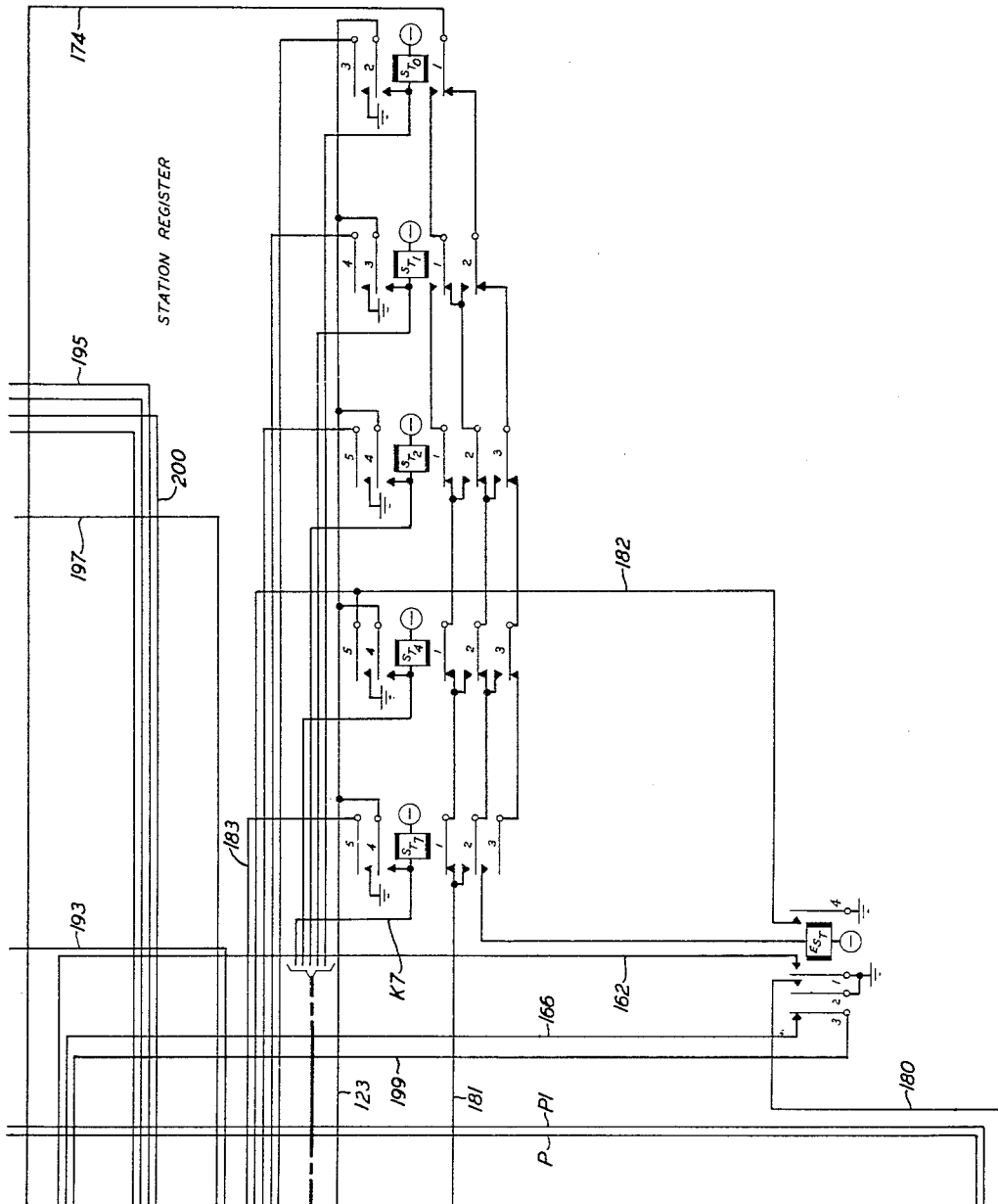
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12 Sheets-Sheet 8



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12 Sheets-Sheet 9

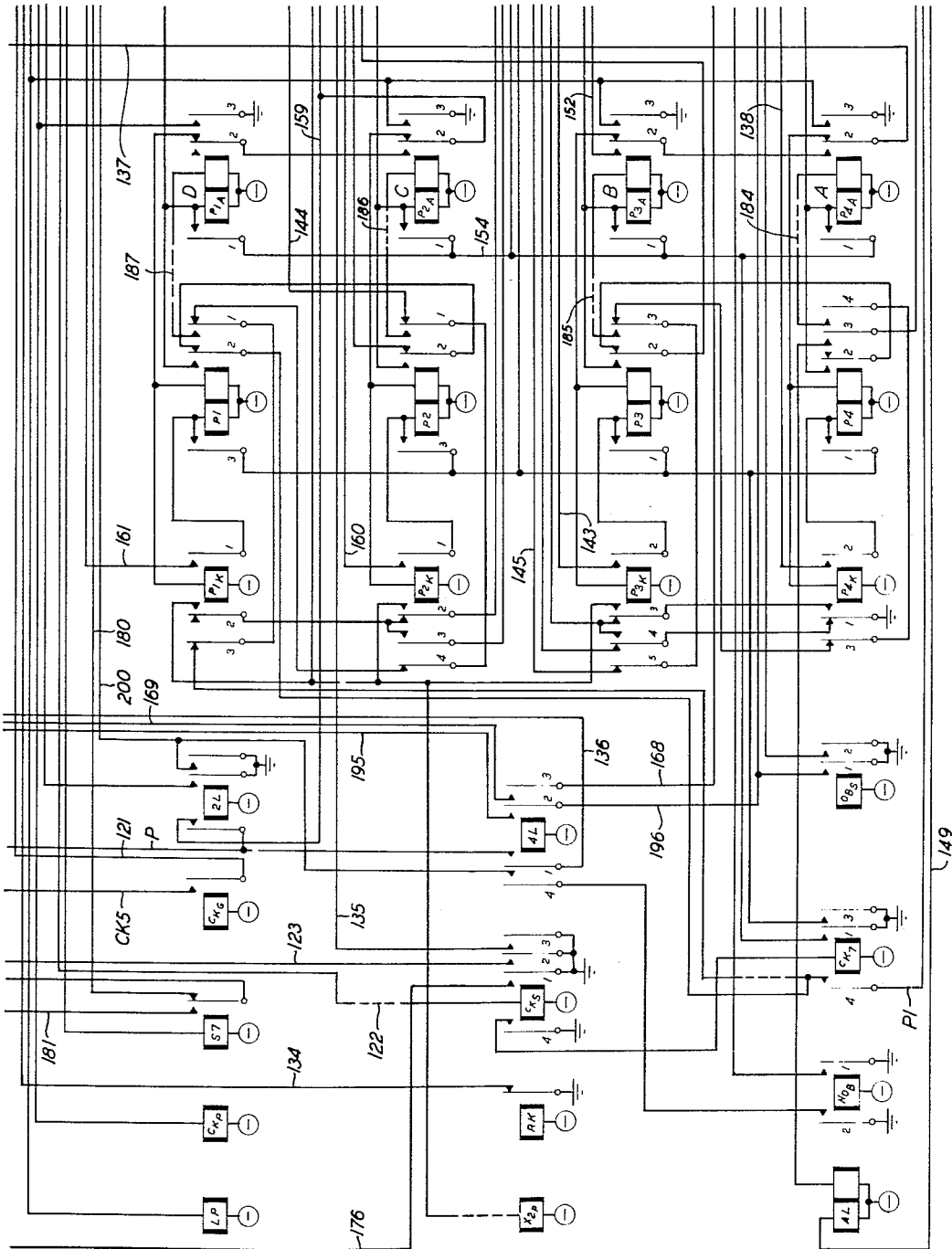


FIG. 9

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12 Sheets-Sheet 10

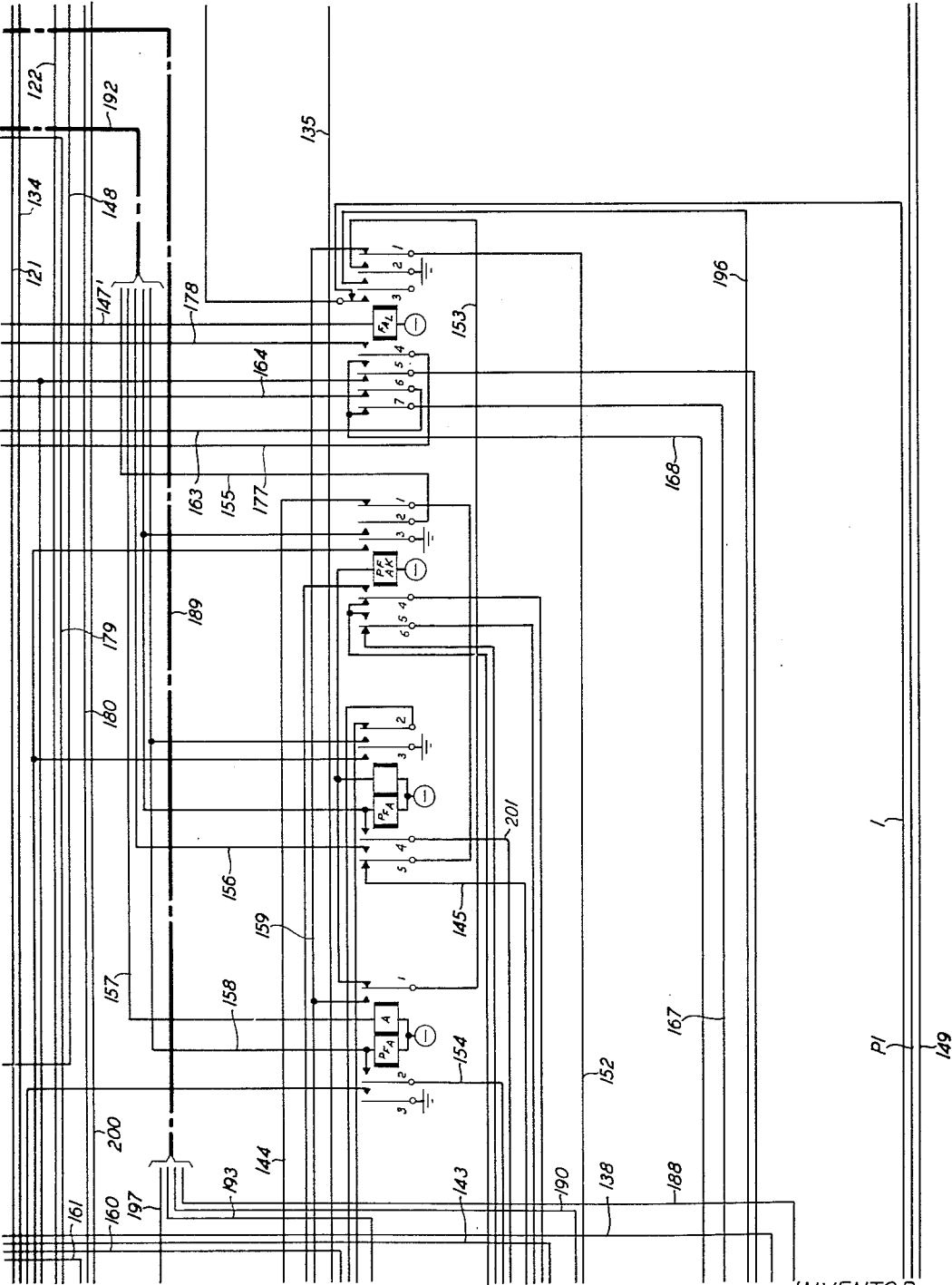


FIG. 10

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12 Sheets-Sheet 11

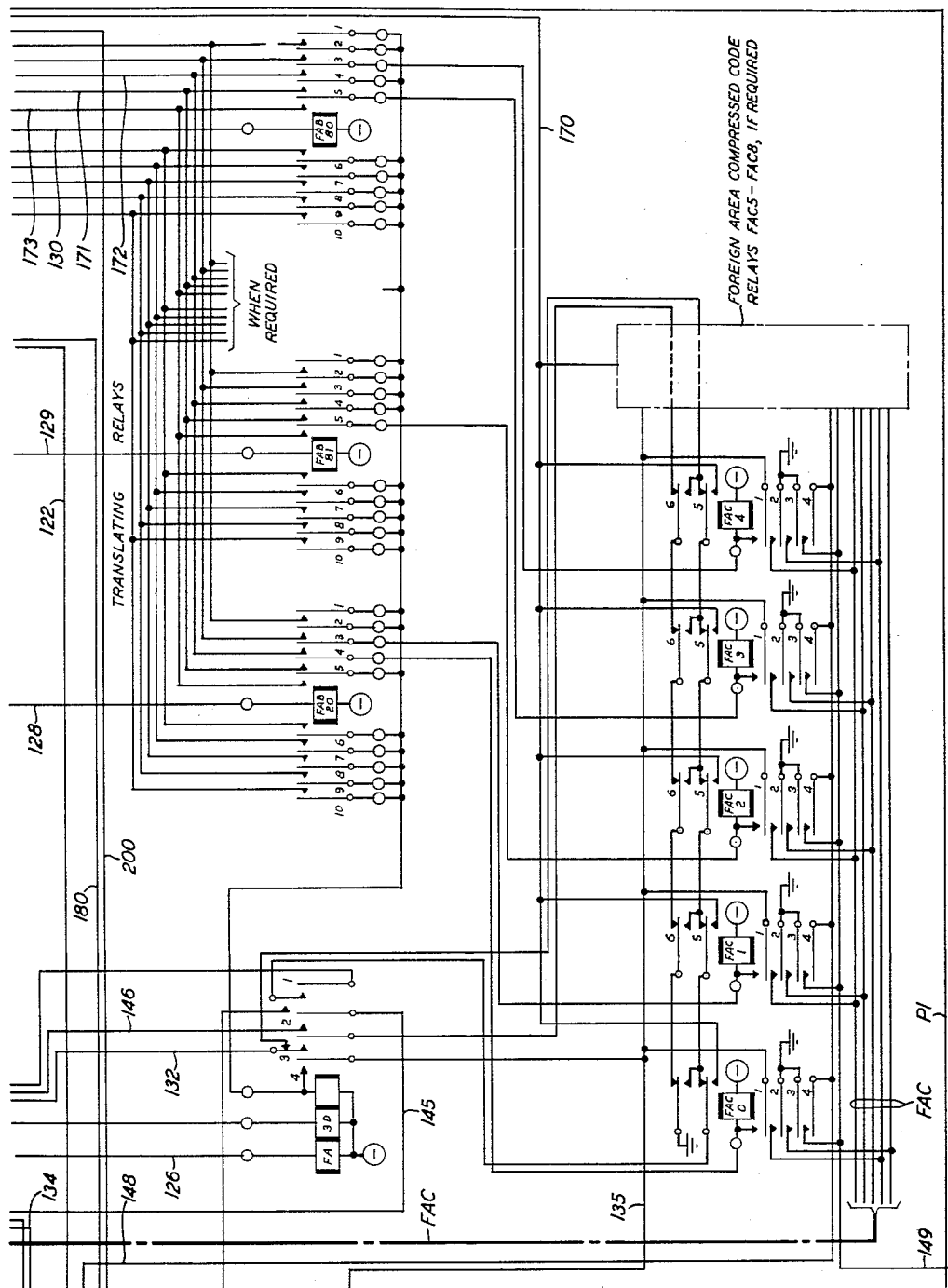


FIG. 11

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FIG. 13A

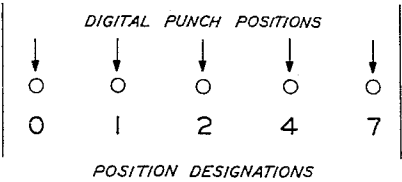


FIG. 13B

	A	B	C	D	E	F						
INITIAL ENTRY DETAIL BILLED 4 LINES	ENTRY INDEX	TH		H		T		U		STATION		
	0	000000		000000		000000		000000		000000		1
	ENTRY INDEX	NO. AREA CODE		CALLED NO. STRUCTURE		CALLED OFFICE CODE						
	0	0-9		0-2		A		B		C		2
	000000	000000		000000		000000		000000		000000		
	ENTRY INDEX	LOCAL AREA		CALLING		NUMBER						
	0	OFFICE		TH		H		T		U		3
	000000	000000		000000		000000		000000		000000		
	ENTRY INDEX	MESSAGE INDEX		CALL IDENTITY INDEX								
	2	3		9		0		T		U		4
000000	000000		000000		000000		000000		000000			

FIG. 13C

	A	B	C	D	E	F						
INITIAL ENTRY DETAIL BILLED 5 LINES	ENTRY INDEX	TH		H		T		U		STATION		
	0	000000		000000		000000		000000		000000		1
	ENTRY INDEX	NO. AREA CODE		CALLED NO. STRUCTURE		CALLED OFFICE CODE						
	0	0		0-2		A		B		C		2
	000000	000000		000000		000000		000000		000000		
	ENTRY INDEX	FOREIGN AREA CODE		CALLING NUMBER								
	A	B	C	A	B	C						
	0	0	0	000000	000000	000000	3					
	0	OFFICE	TH	H	T	U						
	000000	000000	000000	000000	000000	000000	4					
ENTRY INDEX	MESSAGE INDEX		CALL IDENTITY INDEX									
2	5		9		0		T		U		5	
000000	000000		000000		000000		000000		000000			

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2,727,092

TRANVERTER (RECORDER-CONTROLLER)

Harold D. Cahill, Scarsdale, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 21, 1952, Serial No. 321,786

15 Claims. (Cl. 179-7)

This invention relates to recorder controllers, and more particularly to certain novel improvements in the recorder controller disclosed in Patent No. 2,599,358 granted June 3, 1952, to H. D. Cahill et al., and commonly referred to therein as the "transverter."

When used in telephone systems which are adapted to automatically record on a plurality of lines across a continuous recording tape, or medium, items of billable information pertaining to telephone connections, the transverter provides a number of electrical paths between the registers that are operated to express the information to be recorded and the recording magnets which are to record the information, and to so control the switching of the conductors constituting said paths that each item of information is correctly routed thereover from a given register to the appropriate group of magnets which are to record the item in the right line of the recording medium and in the right position on the line predetermined for the item.

In common control automatic telephone systems of the cross-bar type exemplified, for example, by the one shown in Patent No. 2,585,904, granted February 19, 1952, to A. J. Busch, and for which the transverter and associated equipment disclosed in the above-mentioned patent to Cahill et al. furnishes, in part, the recording facilities to record the details of connections established through the office, there are, in general, three record entries made on the recording tape for each call; an original entry, an answer time entry, and a disconnect time entry. The first entry, generally referred to as the "initial" entry, consists of two lines if the call is to be "bulk billed," and four lines if it is to be individually billed, that is, if a detailed statement of the call is to be furnished the subscriber from whose station the call was placed, or if, for any other reason, the operating company desires a detailed statement of the call. When such a statement is to be furnished for the call, the initial entry will consist of four lines, the first line of which contains the called number, the second line the called office code and two items of miscellaneous information, the third line the calling number, and the fourth line the trunk identity and message index.

This "four-line" initial entry is schematically indicated in Fig. 13B, and it is there to be observed that the width of the recording tape is such as to provide space for recording six digits A . . . F thereacross. Five punch positions are provided for each of the five digits B . . . F, while three punch positions are provided for the digit A. As shown in Fig. 13A, the five punch positions for each of the digits B . . . F are given the designations 0, 1, 2, 4, 7 for convenience, and the value of each digit is preferably recorded by the selective punching of two holes out of five in the well-known two-out-of-five code given below:

2

Two-out-of-five code

Digit:	Code holes punched
0	7, 4
1	0, 1
2	0, 2
3	1, 2
4	0, 4
5	1, 4
6	2, 4
7	7, 0
8	7, 1
9	7, 2

It will be noted that for each digit except 0, the sum of the designations of the two punched holes equals the value of the digit represented by the holes.

The A digit never exceeds the value 2, and each of the three punch positions reserved for the digit are given the designations 0, 1 and 2, a hole punched in any one indicating the digit designated by the hole.

For the purpose of nationwide dialing, it has been found desirable to divide the national area and certain contiguous areas into a number of zones, or so-called "foreign areas," and to assign to each of such areas a code X0X or X1X which identifies the area. When a subscriber in one area seeks to establish a connection to a subscriber in an office located in another area, he first dials the three digits of the called foreign area, and then follows it with the letters and/or digits of the called office therein and the digits that constitute the directory number of the called subscriber.

Calls to "foreign areas" obviously come in the category of detailed billed calls, and it is necessary as part of the details of a call to be so billed to include the code of the foreign area, it being possible to have similarly designated offices in different foreign areas, in which case the billed subscriber could only identify the office he called if informed of the foreign area in which it is located. In view of the fact that no provision is made at the present time for recording foreign area codes as parts of initial entries, it becomes necessary in automatic exchanges adapted for nationwide dialing and having call recording equipment, to provide the necessary facilities with which to record the foreign area code as a constituent part of the initial entry. Since the initial entry made by the recorder under control of the transverter now consists of four lines, as above noted, it is desirable to expand such entry by one line, thus making the initial entry a five-line entry instead of a four-line entry.

Accordingly, one of the features of the present invention is a novel circuit arrangement in the transverter by means of which, on foreign area calls, the transverter, in response to the registration of a foreign area code, will control the operation of the recording mechanism to record said foreign code in certain digital positions in an additional line of the "four-line" entry, and thus make said entry a five-line entry.

At the present time and in certain areas in which the telephone exchange facilities have been adapted for automatic call recording, said areas have each been given a single identifying digit, and the automatic accounting devices which process the record tapes containing said digits severally as part of different four-line entries, recognize the digit and accord it the required treatment. With the advent of nationwide dialing, however, such single digit area indications have each been superseded by three-digit foreign area codes, to conform to similar codes assigned to other areas. Since the existing automatic accounting

devices in the areas previously designated by single digits are not adapted to recognize three-digit foreign area codes, it is desirable in areas which are served by such accounting devices to "compress" the new three-digit foreign area codes into the single digit codes previously assigned to such areas, and to record such single digit for a call in the B digit location of the second line of the involved four-line initial entry.

Accordingly, another feature of the present invention is the provision in the transverter of certain novel circuit arrangements by which a foreign area code which is not to be recorded as dialed, on the tape in an additional line of the initial entry (five-line initial entry) is compressed into a single digit and recorded in an appropriate digital location in one of the lines of the regular four-line initial entry, which would be the kind of an entry produced for a foreign area call in which the foreign area code is compressed.

Yet another feature of the invention is a novel form of register in the transverter by which the above-mentioned code-compression operations are effected, in that those compression codes which have identical first and second digits operate a relay common to such codes, through whose contacts are then severally controlled the circuits of the relays individual to each of the codes.

The above and other features of the invention will be more clearly understood from the following description and appended claims, taken in connection with the attached drawing in which:

Fig. 1 schematically represents the originating register, marker and outgoing register extending through suitable connectors to the transverter connector;

Figs. 2 through 11 include those portions of the transverter disclosed in the above-mentioned Cahill et al. patent which appertain to the present invention; Figs. 2 and 3 showing the arrangement by which the various conductor groups incoming from the sender are selectively switched to different groups of recording magnets of the recorder; Fig. 4 schematically indicating the recorder; Figs. 5, 6 and 7 showing the foreign area digit registers; Fig. 8 showing the stations register; Figs. 9 and 10 showing the progress circuit; while Fig. 11 shows the code compression circuit;

Fig. 12 shows how Figs. 1 to 11, inclusive, should be arranged to completely disclose the invention, while

Figs. 13A, 13B and 13C show, respectively, the five digital punch positions for each of the five digits B . . . F recorded across the tape; a four-line initial entry, and a five-line initial entry in accordance with one feature of the present invention.

Before describing the operation of the invention, a brief review of the general operation of the transverter, unmodified by the present invention, will be given with respect to the production of four-line initial entries.

The originating sender R, indicated in Fig. 1, if not arranged for nationwide dialing, is provided with eight numerical registers A . . . H which are settable in response to dial impulses from the calling station to register the called office code and the called subscriber's number, the registers being utilized in the following order for the purpose:

Register	Information Registered
A	First digit of the called code digit.
B	Second digit of the called code digit.
C	Third digit of the called code digit.
D	Thousands digit of called subscriber's number.
E	Hundreds digit of called subscriber's number.
F	Tens digit of called subscriber's number.
G	Units digit of called subscriber's number.
H	Stations digit of called subscriber's number.

When all of the registers have been operated, connection is effected with the marker M, and the called office

code contained in the A, B, and C registers is transmitted thereto for translation into routing, class of call, and other items necessary for the establishment of the connection. The result of this translation is the selection, in the marker M, of a route relay individual to the code, which relay supplies, besides the above, also information which is useful to the transverter. Thus it determines whether the call is to be bulk-billed or individually billed, and in so determining determines whether the initial entry to be recorded for the call is to be a two-line initial entry in the event that the call is to be bulk-billed, or a four-line initial entry in the event that the call is to be separately billed; and it determines whether the called office code is a single digit code, a two-digit code or a three-digit code (in the former two cases the codes would, of course, be registered in the A digit register and in the A and B digit registers, respectively). All of this information the transverter must have in order to insure that the digits which comprise the numerical portion of the called number, including the station digit if dialed, will always appear on the record in the proper places allocated therefor. For, as previously stated, the number of digits in the called office code may vary from one to three digits on interoffice calls, and the outgoing register R attaches the numerical registers to the calling line in the sequence above given. A three-digit office code call, for example, would come in as A, B, C, TH, H, T, U and Station, if dialed, whereas a two-digit office code call would come in as A, B, TH, H, U and Station, the thousands digit being registered in the C register, the hundreds digit in the D register, etc. In the latter case, and because the digital positions on the entry spaces of the tape are invariably allocated to specific digits, it is necessary for the transverter to rearrange these digits so that they will appear on the tape in the order A, 0, B, TH, H, T, U and Station. The second digit of the office code is improvised, as would also be the station digit if no station digit is dialed, since each of the digital spaces in the record entry must either contain a significant digit or a zero.

All of the above information is, as has been stated, obtained from the appropriate route relay in the marker M, which operates in response to the translation of the office code digits transmitted to the marker from the originating register R. The marker M, on an interoffice connection, thereafter obtains access to outgoing sender S through a suitable connector, and to storage registers in the sender the information made available to the marker, and other information contained in the originating register R, including the numerical digits of the called number, are forwarded from the originating register R to the outgoing sender S.

The sender S, among its other functions, obtains access to a transverter through the medium of a transverter connector TC, and over two of the five conductors in the conductor group CP selectively operates in the transverter from the route relay-operated registers in the sender two relays of the five "code pattern" relays designated CP0, CP1, CP2, CP4 and CP7 (of which only relays CP2 and CP7 are shown) in the two-out-of-five code to indicate the number of digits in the called office code, whether the call is locally terminated, or interoffice, or extended (suburban), etc. In accordance with which two of the relays CP0 . . . CP7 are operated codewise, a circuit is completed by said relays to operate a switching relay individual to the code pattern indicated by the number of digits in the code (there being one such relay for each code pattern) and through the contacts of this operated switching relay, conductor groups incoming from the storage registers of the sender are extended in appropriate order to the magnets of the recorder shown in Fig. 4. For a local three-digit interoffice call for which a four-line initial entry is to be made, the two operated relays in the group of relays CP0 . . . CP7 indicating such a call complete the circuit (not shown) of a switch-

ing relay designated L3E, the contacts of which, in groups, are schematically shown in Fig. 2, and indicated therein by the designations 1L3E . . . 10L3E, each such contact except contact 9L3E representing a group of five contacts. The incoming conductor groups A . . . H which extend to different contact groups in all switching relays severally operated by the code pattern relays CP0 . . . CP7 in accordance with the type of call, are further extended through the contacts of certain relays to be mentioned later, and through the recorder connector RC (Fig. 4) to the appropriate punch magnet groups MB0, MB1, MB2, MB4, MB7 . . . MF0, MF1, MF2, MF7. Since the conductor groups A . . . H are selectively grounded by the storage register in the sender S in the two-out-of-five code to express the values of the digits stored in said storage registers, circuits are completed over said conductors to the involved recorder magnets in the above-mentioned magnet group, thereby to cause the operation of said magnets and punch holes in the record medium, or tape, to record the digits in the various digital positions in the two-out-of-five code.

Thus, for example, and referring to the portion of the circuit and equipment shown in Figs. 1, 2, 3, 4 and 5, and to the four-line initial entry illustrated in Fig. 13B, it may be assumed that relays CP0 . . . CP7 are selectively operated in the two-out-of-five code to indicate a three-digit interoffice call involving the production of a four-line initial entry, all in consequence of the selective operation of said relays, relay L3E individual to this type of call is operated, closing contacts 1L3E . . . 10L3E. When the transverter becomes connected to the recorder R by the operation of the recorder connector RC in the manner described in the above-mentioned Cahill et al. patent, with relay L3E operated, and when the recorder is ready to punch the called line number in the first line of the entry (as evidenced by the operation of relay C4 in the manner hereinafter to be described), conductor D having two conductors grounded therein to express the thousands digit of the called number is extended over contacts 4L3E and the contacts of relay C4, to the windings of recording magnets MB0 . . . MB7, which are then selectively operated in the two-out-of-five code by the ground on the two conductors in conductor group D to record the thousands digit of the called line number in the B digit space of the first line of the entry on the tape, as indicated in Fig. 13B.

Conductor group E, selectively grounded by the sender in the two-out-of-five code to express the hundreds digit of the called line number, is extended over contacts 5L3E and over the contacts of relay C4, to the windings of recording magnets MC0 . . . MC7 which are then selectively operated in the two-out-of-five code by the two grounded conductors in said conductor group E to record the hundreds digit of the called line number in the C digit space of the first line, as indicated in Fig. 13B.

Conductor group F, selectively grounded in the sender in the two-out-of-five code to express the tens digit of the called line number, is extended over contacts 6L3E, and over the contacts of relay C4, to the windings of magnets MD0 . . . MD7 (not shown), which are then selectively operated in the two-out-of-five group by the two grounded conductors in said conductor group F to record the tens digit of the called line number in the D digit space in the first line of the entry, as indicated in Fig. 13B.

Conductor group G, selectively grounded in the sender in the two-out-of-five code to express the units digit of the called line number, is extended over contacts 7L3E, and over the contacts of relay C4 to the windings of recording magnets ME0 . . . ME7 (not shown), which are then selectively operated in the two-out-of-five code by the two grounded conductors in said group G to record the units digit in the E digit space of the first line of the entry, as indicated in Fig. 13B.

In connection with the stations digit, and for certain functions of the transverter which are not pertinent to an understanding of the present invention, the circuit is so arranged that the stations digit registered in storage register H of the sender is transferred to a stations register of the transverter, which register is shown in Fig. 8, and this transfer takes place over conductor group H, contacts 8L3E, to the windings of relays ST0 . . . ST7 in the stations register, which relays are selectively operated in the two-out-of-five code to express the value of the stations digit. If no station digit constitutes a part of the called number the sender grounds the one conductor in conductor group H which extends to the winding of relay ST7 which, in operating, completes the circuit of relay EST. If the relays ST0 . . . ST7 have been operated in the two-out-of-five code to register the value of the stations digit recording magnets MF0 . . . MF7 are then similarly operated in the two-out-of-five code from grounds supplied by the two operated relays of the stations register to record the stations digit in the F digit space of the first line of the entry, as indicated in Fig. 13B. If no digit is registered in the stations register, but relay EST is operated instead, then said relay and relay ST7 will ground the two conductors which extend to the windings of recording magnets MF4 and MF7, causing said magnets to operate and record the digit 0 in said F digit space.

When the first line of the entry is punched, relay C4 is released, and when the recorder R is ready to punch the second line of the entry, evidenced by the operation of relay C3 as more particularly pointed out hereinafter, conductor groups A, B and C incoming, respectively, from registers A, B and C in the sender S, are extended, respectively, over contact groups 1L3E, 2L3E, 3L3E, over the contacts of relay C3, to the recorder magnet groups MD0 . . . MD7, ME0 . . . ME7, and MF0 . . . MF7. Said magnets are then selectively operated in the two-out-of-five code by the grounds applied in the sender to two conductors in each of said conductor groups to record the three digits of the office code in the D, E and F digit spaces in the second line of the entry, as indicated in Fig. 13B. The magnet group MB0 . . . MB7 is closed through contacts in relay C3 to the contact group 10L3E over which they extend a separate circuit (not shown) on which is registered a digit indicating the number of the calling area. Ground is selectively applied in the two-out-of-five code to two conductors of said group to operate two of the magnets MB0 . . . MB7 and record in the B digit space in the second line of the entry the digit indicating the area, as indicated in Fig. 13B.

Magnet group MC0 . . . MC7 is operated to record the called number structure in the C digit space; that is, whether the numerical portion of said number consists of four digits, five digits, etc. If the number consists of four digits, relay 4DG is operated from the sender, and when relay C3 operates for the recording of the second line of the entry, a circuit is completed from ground on the No. 2 contacts of relay 4DG, conductor 162, No. 3 contacts of relay C3, to magnet MC0 (not shown) to battery. Another circuit is completed from ground on the No. 3 contacts of relay 4DG, conductor 163, No. 6 contacts of relay FAL, conductor 164, No. 4 contacts of relay FACK, conductor 165, No. 4 contacts of relay CK, winding of magnet MC1 (not shown) to battery. These two magnets operate and record the digit "1" in the C digit space in the second line of the entry as an arbitrary indication that the numerical portion of the called number consists of four digits. In the same manner, if the number consists of five digits, relay 5DG will be operated from the sender, in which event ground applied to conductor 162 will complete the previously described circuit for magnet MC0, while ground applied to conductor 165 over the No. 2 contacts of relay 5DG completes the circuit of MC2 via conductor 165, No. 3 contacts of relay EST, conductor 166, No. 5 contacts of relay C3, winding of magnet MC2 (not shown) to battery. The operation of magnets MC0

and MC2 causes the digit "2" to be punched in the C digit space as an arbitrary indication that the numerical portion of the called number consists of five digits.

When the recorder has punched the second line of the entry, relay C3 is released, and when it is ready to punch the third line relay C2 is operated (as will be described hereinafter), whereupon the recorder magnet groups MC0 . . . MC7 . . . MF0 . . . MF7 are connected through to a calling line number register, not shown but indicated in Fig. 4, having therein the registration of the calling line directory number, as set forth in the above-mentioned Cahill et al. patent, whereupon said magnet groups are selectively operated in the two-out-of-five code by said registers to record said directory number in the four digit spaces C . . . F in the third line of the entry. Also at the same time, recorder magnet group MB0 . . . MB7 is extended to another register (not shown but indicated in Fig. 4) which contains the registration of a single digit denoting the identity of the calling office, and this digit is caused to be registered in the two-out-of-five code in the B digit space on the second line of the entry, all as indicated in Fig. 13B.

When the recorder has punched the third line of the entry, relay C2 is released, and when said recorder is ready to punch the fourth and last line of the entry, relay C1 is operated in the manner to be hereinafter described. The latter relay, over its No. 2 contacts, completes the circuit of recorder magnet MA2, which operates to record the digit "2" in the A digit position, which digit indicates that the line is the last line of the entry though since the record is analyzed in reverse, said last line is usually referred to as the first. Over its Nos. 3, 4, 5 and 6 contacts, circuits are completed for magnet MB0, MB1, MB2 and MB4 in accordance with the character of the entry. If the entry is a four-line initial entry not involving foreign area dialing, relays 4L and NOB are operated from the sender over circuits, not shown, whereupon a circuit is completed from ground on the No. 2 contacts of relay NOB, No. 4 contacts of relay 4L, conductor 166, No. 4 contacts of relay C1, winding of recording magnet MB1 to battery. Another circuit is completed from ground on the No. 1 contacts of relay NOB, conductor 167, No. 7 contacts of relay FAL, conductor 168, No. 3 contacts of relay 4L, conductor 169, No. 5 contacts of relay C1, winding of magnet MB2, to battery. Magnets MB1 and MB2 operate to record the digit "3," indicating a four-line initial entry, as shown in Fig. 13B.

Relay C1 also connects a magnet group MC0 . . . MC7 to a message billing index register in the transverter (not shown but indicated in Fig. 4) which is operated from the sender to register the billing index, and which is instrumental in operating said magnet group in the two-out-of-five code to record said index to the C digit space of the line. Two conductors connecting with the magnets MD7 and MD4 are grounded by the operation of relay C1 to record the improved digit "0" in the D digit space. The two digital spaces E and F in the fourth line of the entry are not utilized by the transverter but by another circuit called the "trunk indexer" which has registered therein the numerical identity of the trunk over which the connection takes place. The indexer operates the magnets directly from its own setting but, of course, through a connector since said indexer is common to a plurality of trunks.

When the telephone system disclosed in the above-mentioned Busch patent is adapted for nationwide dialing, the original register R is provided with three additional dial registers I, J and K. Remembering that in dialing foreign area calls the three digits of the foreign area code X0X or XIX are dialed ahead of the called office code and the numerical portion of the called subscriber's directory number, all of the dial registers, including the three additional registers I, J and K are utilized as follows and in the indicated order to register all of the dial digits.

Registers	Information Registered
A-----	First Digit of the Foreign Area Code.
B-----	Second Digit of the Foreign Area Code.
C-----	Third Digit of the Foreign Area Code.
D-----	First Digit of the Office Code.
E-----	Second Digit of the Office Code.
F-----	Third Digit of the Office Code.
G-----	Thousands Digit.
H-----	Hundreds Digit.
I-----	Tens Digit.
J-----	Units Digit.
K-----	Stations Digit.

The sender S, of course, must be similarly equipped with three additional storage registers which are operated responsive to the setting of the three additional dial registers in the originating register R. In the case of foreign area dialing, however, the foreign area code (registered in registers A, B and C of the originating register R) is transferred to the marker, and causes therein by suitable translation the operation of a route relay individual to the foreign area code, and this relay, as in the case of a route relay operated for a non-foreign area call, supplies the transverter with the required information as to the character of the initial entry, code pattern, etc.

Since the present invention pertains to a novel modification of the transverter for the production of initial entries involving as part of said entries the recording of foreign area codes as dialed or as compressed, there is shown in Fig. 1 incoming from the sender S and through the transverter TC eleven conductor groups A . . . K, each group pertaining to one of the digits of the maximum of eleven that may be dialed for a foreign area call. Since all conductor groups are uniformly used in the two-out-of-five code to express the numerical value of digits according to the code, each conductor group is identified by a capital letter designating the storage register in the sender S whence said conductor group originates, and each conductor in the group is further designated by a numeral of the five expressing the two-out-of-five code. Thus the five conductors A0, A1, A2, A4 and A7 constitute the conductor group extending to the A storage register in the sender, which register, it will be recalled, stores the first of the three digits of the foreign area code when a foreign area call is dialed. The conductors are then selectively grounded in the two-out-of-five code by said register to indicate the value of the A digit stored therein. In the same manner, conductor groups B0 . . . B7 . . . K0 . . . K7, respectively, extend to those registers in the sender which are designated by the letters of the groups, the conductors in each of said groups being similarly and respectively grounded in the two-out-of-five code by said registers to express the values of the B . . . K digits, respectively, stored therein.

Having described the general operation of the transverter in respect to its control of the recorder for the production of four-line initial entries pertaining to calls which are to be separately billed, I will now describe its modification and operation in accordance with the present invention, to enable it to control the recorder R for the production of five-line initial entries and four-line initial entries pertaining to foreign area calls in which, in the case of five-line initial entries, the foreign area code is recorded in the third line of the entry, by way of example, exactly as dialed, and which in the case of four-line initial entries, the three digits of the foreign area code are "compressed" into a single digit and recorded (again by way of example) in the B digit space of the second line of the entry.

When the transverter is seized and connected to the originating register R, the marker M and the outgoing sender S by way of the several connectors, including the transverter connector TC, relays CKG, 4L and NOB are operated over circuits (not shown) completed in the sender S. Further, ground is supplied on conductor CK5, whereupon a circuit is completed for relay CK5,

said circuit being traced from ground on said conductor CK5, contacts of relay CKG, conductor 121, No. 3 contacts of relay FALK, No. 4 contacts of relay FABC, conductor 122, certain other control contacts on relays (not shown) of the transverter, winding of relay CK5, to ground. Relay CK5 operates to supply ground to certain off-normal control conductors, and operates relay CK7 over an obvious circuit, which latter relay, in operating, also supplies ground to certain other off-normal conductors.

By the operation of the transverter connector TC, the transverter is connected to the outgoing sender S which, in turn, is connected to the marker, and the marker to the originating register, all over appropriate connectors, as indicated in Fig. 1. As previously stated, the marker, in response to the translation of the three digits of the foreign area code received from the originating register R, operates a route relay individual to that particular code. Among its other functions, the operated route relay causes conductors CP2 and CP7 to be grounded and thereby complete the circuits of the code pattern relays CP2 and CP7. These relays operate and then lock over their respective No. 1 contacts, conductor 123, No. 2 contacts of relay CK5, to ground. The operation of relays CP2 and CP7 register the digit 9 in the two-out-of-five code, which digit indicates to the transverter that the call being established is a foreign area call, the foreign code X0X or X1X of which will either have to be recorded as dialed or "compressed." Consequently when relays CP2 and CP7 have operated, a circuit is completed for relay FC1, said circuit extending from ground, serially through the No. 2 contacts of relays CP2 and CP7, conductor 124, No. 3 contacts of relay FACK, conductor 125, winding of relay FCI, to battery. The latter relay operates and extends the conductors in the three conductor groups FA0 . . . FA7, FB0 . . . FB7 and FC0 . . . FC7 to the windings of the relays of foreign area digit registers A, B and C, respectively. Said conductors FA0, FA1, FA2, FA4 and FA7 are connected, respectively, to conductors A0, A1, A2, A4 and A7 of conductor group A, which extend to the outgoing sender S, and are therein selectively grounded in the two-out-of-five code in accordance with the dialed value of the first, or A digit, of the foreign area code X0X or X1X, in which the first X represents the A digit, 0 or 1 represents the B digit, and the second X represents the C digit; that the four conductors FB0, FB1, FB4 and FB7 are connected, respectively, to conductors B0, B1, B4 and B7 of conductor group B, which extends to the outgoing sender S and are there selectively grounded in the two-out-of-five code in accordance with whether the dialed value of the second, or B digit, of the foreign area code is 0 or 1, leads B0, B1 being grounded if the B digit has the value "1," and leads B4 and B7 being grounded if the B digit has the value "0"; and that the five conductors FC0, FC1, FC2, FC4 and FC7 are connected respectively to conductors C0, C1, C4 and C7 of conductor group C, which extend to the outgoing sender S and are therein selectively grounded in the two-out-of-five code in accordance with the dialed value of the third, or C digit, of the foreign area code. Each of said leads FA0 . . . FC7 connects with the winding of a relay having a similar designation in the appropriate foreign area digit register; for example, conductor FA0 extends to the winding of relay FA0 in the A digit register; conductor FB0 extends to the winding of relay FB0 in the B digit register; conductor FC0 extends to the winding of relay FC0 in the C digit register, etc.

Consequently, when the conductor groups A, B and C have been selectively grounded in the sender to express the three digits A, B and C of the foreign area code, and because relay FCI has been operated, these three digits will become respectively registered in the foreign area registers A, B and C.

Thus, for example, if the dialed foreign area code is

"203," conductors A0 and A2 will be grounded in the A conductor group, conductors B4 and B7 will be grounded in the B conductor group, and conductors C1 and C2 will be grounded in the C conductor group. Since relay FCI is operated, ground on conductor A0 will cause relay FA0 in digit register A to be operated over a circuit which extends from ground on said conductor A0, conductor FA0, No. 15 contacts on relay FCI, winding of relay FA0, to battery; ground on conductor A2 will cause relay FA2 in digit register A to be operated over a circuit which extends from ground on said conductor A2, conductor FA2, No. 13 contacts of relay FCI, winding of relay FA2, to battery; ground on conductor B4 will cause relay FB4 in digit register B to be operated over a circuit extending from ground on said conductor B4, conductor FB4, No. 8 contacts of relay FCI, winding of relay FB4, to battery; ground on conductor B7 will cause relay FB7 in digit register B to be operated over a circuit extending from ground on said conductor B7, conductor FB7, No. 7 contacts on relay FCI, winding of relay FB7 to battery; ground on conductor C1 will cause relay FC1 in digit register C to be operated over a circuit extending from ground on said conductor C1, conductor FC1, No. 5 contacts on relay FCI, winding of relay FC1, to battery; ground on conductor C2 will cause relay FC2 in digit register C to be operated over a circuit extending from ground on said conductor C2, conductor FC2, No. 4 contacts on relay FCI, winding of relay FC2, to battery. The operation of relays FA0 and FA2 registers the digit "2" in digit register A; the operation of relays FB4 and FB7 register the digit "0" in digit register B, while the operation of relays FC1 and FC2 registers the digit "3" in digit register C. In the same manner, every one of the ten digits 1 . . . 9 will be registered in the given two-out-of-five code in digit registers A and C, the digits registered in register B being limited to "0" and "1," since said last two digits, and said last two digits only, indicate a foreign area call. In the event, however, that the "B" digit for a foreign area call should, by error, become registered as any other digit, the subsequent check of the setting of the three registers will reveal the error and block further operations, as will be described.

When the registers A, B and C have been operated, a check is made to insure that two relays, and only two, have been operated in each of registers A and C, and relays FB0 and FB1, or FB4 and FB7 have been operated in register B. This check involves relay FABC, which operates under the conditions assumed to have occurred. Thus if the foreign code is "203," relays FA0 and FA2 should have been operated in register A, relays FB4 and FB7 in register B, and relays FC1 and FC2 in register C, as before described. Consequently a circuit is then completed extending from ground on the No. 1 front contacts of relay FA0, No. 3 contacts of relay FA1, No. 2 contacts of relay FA2, No. 3 back contacts of relay FA4, No. 1 back contacts of relay FA7, conductor 131, No. 1 back contacts of relay FB0, No. 1 contacts of relay FB1, No. 1 contacts of relay FB4, No. 1 contacts of relay FB7, conductor 132, No. 2 contacts of relay FC0, No. 2 contacts of relay FC1, No. 1 front contacts of relay FC2, No. 2 back contacts of relay FC4, No. 2 back contacts of relay FC7, right winding of relay FABC, to battery. Relay FABC operates and over its No. 3 contacts applies its own operating ground to the left winding of relay FALK which also operates.

In the event that less than two relays operate in the registers A, B and C, the check lead will not be closed through and relay FABC will not operate. All subsequent operations of the transverter are then suspended, whereupon, after a short time interval measured by a master time-alarm circuit not shown in the present disclosure but shown and described in the above-mentioned H. D. Cahill et al. application, an alarm is sounded and the transverter disabled. Should three relays operate in reg-

isters A or C, or should the relays of register B operate in a combination other than relays FB0 and FB1 for the digit 1, and relays FB7 and FB4 for the digit 0, then a special alarm will be given. Thus, for example, if relays FB0 and FB4 operate in register B, the ground previously traced to conductor 131 may further be traced over the front contacts of relay FB0, No. 10 back contacts of relay FB1, No. 11 contacts of relay FB4, conductor 170, through other controlling paths (not shown), winding of relay ALP, to ground. Relay ALP operates and completes the circuit of a suitable alarm. It will be evident from an inspection of the circuit that if three relays operate in register A or three relays operate in register C, the above-traced ground will be similarly applied to conductor 170 and thereby complete the circuit of alarm relay ALP. Operations of the transverter following the operation of relay FABC upon successful check of the registers will be described later.

As previously stated, foreign area codes are characterized by the fact that the B digit therefor is either 1 or 0, the first and third digits of each of the codes being any assignable value from 0 to 9, inclusive. However, since some of the foreign area codes are to be fully recorded as dialed in the third line of a five-line initial entry, while nine of these codes are each to be "compressed" into a single digit 0 . . . 8 and recorded in the B digit space of the second line of a four-line initial entry, it becomes necessary to prearrange the digit registers to distinguish between those codes which are to be recorded in the entry as dialed and those nine (9) codes which are to be compressed into a single digit.

This distinction between the two groups of codes is accomplished by arranging for suitable cross-connections between conductors 21, 31, 41, 51, 61, 71, 81 and 91 (representing the partial code X1) at the stationary contacts of relay FB1 and one of the windings of relay FA3D (the left winding, for example); and between conductors 20, 30, 40, 50, 60, 70, 80 and 90 (representing the partial code X0) at the stationary contacts of relay FB7 and another winding of relay FA3D (the middle winding, by way of illustration). In this connection, it should be noted that the five relays FA0 . . . FA7 of the digit register A, when operated in the two-out-of-five code to express each of the digits 2, 3, 4, 5, 6, 7, 8 and 9, selectively ground two conductors in the group of conductors 2 . . . 9 extending to the armatures 2 . . . 9 of relay FB0, and two conductors in the group of conductors 2' . . . 9' extending to the armatures 2 . . . 9 of relay FB4. The stationary contacts which make with the armatures 2 . . . 9 of relay FB0 are severally and respectively connected to correspondingly numbered armatures on relay FB1, while the stationary contacts making with the latter armatures and expressing the first two digits X1 of foreign area codes which are to be recorded as registered (that is, as dialed) are commoned and connected to the left winding of relay FA3D over conductor 126. On the other hand, each stationary contact on relay FB1 which expresses the first two digits X1 of a foreign area code which is to be compressed, is individually connected to the winding of one of the translating relays FAB— in Fig. 11, as, for instance, contact 81 which, by means of conductor 129, is connected to the winding of relay FAB81.

In the same manner, the conductors 20, 30, 40, 50, 60, 70, 80 and 90 connected to the stationary contacts of relay FB7 and expressing the first two digits X0 of foreign area codes which are to be recorded as dialed, are commoned and connected over conductor 127 to the middle winding of relay FA3D, while those contacts which express the first two digits X0 of foreign area codes which are to be "compressed" into a single digit, are extended to the windings of translating relays as, for instance, the conductor 20 which is connected to the winding of relay FAB20 over conductor 128.

Since relays FB0 and FB1 operate when the B digit of the foreign area code is 1, it follows that when the foreign area code comprises any digit 2 . . . 9 for the A digit and digit 1 for the B digit, a circuit path is completed for relay FA3D for each code which is to be recorded as dialed, that is, for each code indicated by a contact on relay FB1 that has been extended to the left winding of relay FA3D. Thus, for example, if the A and B digits of a foreign area code are "21," the A digit 2 will result in the operation of relays FA0 and FA2, and the B digit 1 in the operation of relays FB0 and FB1, all as above described. Since the No. 9 contacts of relay FB1 are connected to conductor 126, and the latter is connected to the left winding of relay FA3D, then upon the operation of relays FA0, FA2, FB0 and FB1, a circuit is completed which extends from ground on the No. 2 contacts of relay FA0, No. 10 contacts of relay FA2, conductor 2, No. 9 contacts of relay FB0, No. 9 contacts of relay FB1, conductor 126, left winding of relay FA3D, to battery. In the same manner with the other value of the A digit (except 1 or 0 which are not used), the fact that the B digit is 1 and results in the operation of relays FB0 and FB1 will cause the completion of a circuit path to the left winding of relay FA3D over appropriate contacts of the two operated relays of the register A and the contacts of the two operated relays FB0 and FB1 of the digit register B.

Similarly for those partial codes recorded as dialed and whose first two digits are X0. Remembering that for such two digits relays FB4 and FB7 are operated for the B digit 0, a circuit path will be completed for relay FA3D over the middle winding thereof. Thus, for example, if the first two digits of the code are 90, resulting in the operation of relays FA2 and FA7 in register A and relays FB4 and FB7 in register B, a circuit is completed for relay FA3D which extends from ground on the No. 8 contacts of relay FA2, No. 6 contacts of relay FA7, conductor 9', No. 2 contacts of relay FB4, No. 2 contacts of relay FB7, conductor 127, middle winding of relay FA3D, to battery.

The right winding of relay FA3D is cross-connected to all stationary contacts of translating relays FAB20, FAB81 and FAB80. As will be shown, the operation of relay FA3D results in those operations of the transverter by which the three digits of a foreign area code which is to be recorded as dialed will be recorded in the D, E and F digit spaces in the third line of a five-line entry, as indicated in Fig. 13C.

As previously stated, not all foreign area codes are to be recorded as dialed. Certain of these codes, depending upon the number for which provision is made in the circuit, may be "compressed" into single digits and recorded as such in an available digit space in a four-line initial entry, for example the B digit space in the second line of such entry. In the present embodiment of the invention, and only by way of example, provision is made for compressing a maximum of nine foreign area codes, each of which, when so compressed represents the area in which the call terminates.

A relay FAC— is provided for each one of the nine foreign area codes to be compressed into a single digit, these relays being designated FAC0 . . . FAC8, and of which relays FAC0 . . . FAC5 only are shown in Fig. 11. The Nos. 2 and 3 contacts of each of these relays are selectively connected in accordance with the two-out-of-five code to two of the five conductors in the cable FAC to express the particular digit to which the code assigned to the relay is to be compressed. Thus relay FAC0 indicates the digit "0," relay FAC1 indicates the digit "1," etc. with relay FAC8 (not shown) indicating the digit "8." The five conductors in the cable FAC extend to five armatures (consolidated as armature group 1) of relay C3, while the stationary contacts engaging said armatures are respectively connected to conductors that extend to the windings of recording magnets in the B magnet group

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of the recorder R. As previously stated, relay C3 operates for the second line of recording. If the foreign area code is to be compressed into one of the digits 0 . . . 8, then the appropriate one of the relays FAC0 . . . FAC8 will be operated, as will be described, in consequence of which the ground selectively applied to the two conductors in the cable FAC by the Nos. 2 and 3 contacts of said operated relay will complete the circuits of the two recording magnets in the B magnet group, operating said magnets and causing the digit represented by the operated relay FAC— to be punched in the B digit space of the second line in the two-out-of-five code. There are as many translating relays FAB— provided as there are codes whose first two numerals are unlike.

As previously explained, those terminals 21 . . . 91 associated with relay FB1 and those terminals 20 . . . 90 associated with relay FB7, which are expressive of foreign area codes that are to be recorded as dialed, are respectively commoned and connected by conductors 126 and 127 to the left and middle windings, respectively, of relay FA3D. Those terminals in the groups 21 . . . 91 and 20 . . . 90 which are not commoned represent foreign area codes that are to be compressed, and such terminals are respectively extended to the windings of translating relays FAB—. The above, however, should not be understood to mean that one relay FAB— is provided for each code to be compressed. The circuit is so arranged that one relay FAB— is provided for each compressed code whose first two numerals are unlike those of other codes to be compressed. For example, if the number of codes to be compressed is five, and these codes are 206, 207, 815, 805 and 807, only three relays FAB— would be provided. Codes 206 and 207, having like first and second digits, will require but one relay FAB20 for both codes, said relay FAB20 being connected to the terminal 20 by conductor 128. Codes 805 and 807 having also like first and second digits will require but one relay FAB80, which is connected by conductor 130 to terminal 80. On the other hand, code 815 having its first two digits unlike any other compressible code will require a relay by itself, namely, relay FAB81, which is connected by conductor 129 to terminal 81. If nine separate codes are to be compressed all having unlike first two digits, a relay FAB— would be provided for each such code.

The windings of the compression code relays FAC0 . . . FAC8 of which, as said before, one is provided for each code to be compressed, are severally extended over armatures of the involved translating relays FAB— to the relays FC0 . . . FC7 of the digit register C. Depending upon which translating relay FAB— is operated in response to the partial code X0 or X1, a circuit is then completed over the relays of register C for the one compressed code relay FAC— which expresses the one digit into which the code is to be compressed. Thus, if it is assumed that the foreign area code "206" is to be compressed into the digit 0, then since relay FAC0 is assigned to said latter digit, or code, the winding of said relay would be extended over a set of contacts on translating relay FAB20 (representing the partial code 20) to a contact on one of the relays in register C, such that when said relay is operated as part of the two-out-of-five code combination of relays for the digit "6," the circuit of the code compression relay FAC will be completed. Remembering that the first digit "2" results in the operation of relays FA0 and FA2 in register A, that the second digit "0" results in the operation of relays FB4 and FB7 in register B, and that the third digit "6" results in the operation of relays FC2 and FC4 in register C, a circuit will be completed for relay FAB20 in consequence of the operation of relays FA0 and FA2 in register A for the digit "2" and relays FB4 and FB7 for the digit "0," and a circuit will be completed for relay FAC0 in consequence of the operation of relays FC4 and FC2 in register C, which latter circuit extends from battery, through the

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winding of said relay FAC0, No. 4 contacts of relay FAB20, conductor 171, No. 5 contacts of relay FC4, No. 7 contacts of relay FC2, to ground.

Thus by the operation of relay FAC0, the code "206" will have been compressed into the digit "0," the latter digit being expressed by the grounding of the two conductors in the cable FAC that will result in the operation of punch magnets MB4 and MB7 in magnet group B of the recorder.

For the code "207" which, it may be assumed, is to be compressed into the digit "1," relay FAC1 would be assigned therefor. The circuit of this relay would be completed over the No. 3 contacts of relay FA20 (the same translating relay being utilized for the code "207" as was utilized for the code "206" because the first two digits of both codes are alike), conductor 172, No. 6 contacts of relay FC7, No. 6 contacts of relay FC0, to ground, said latter two relays operating in register C for the digit 7. On operating, relay FAC1 will cause the code "207" to be expressed by the digit "1" since its No. 2 and No. 3 contacts apply ground to the two conductors in the cable FAC which complete the circuit of punch magnets MB1 and MB0 in magnet group B of the recorder.

The codes 815, 805 and 807, represented in this example by relays FAC2, FAC3 and FAC4 for compression into the digits "2," "3" and "4," respectively, are operated in the same manner from the setting of register C. However, since the code 815 causes the operation of relay FAB81 by virtue of its first two digits causing the operation of relays FA1, FA7 in register A and relays FB0, FB1 in register B, respectively, the circuit of relay FAC2, representing the code 815 to be compressed to the digit 2, is completed from battery through the winding of said relay, No. 5 contacts of relay FAB81, conductor 173, No. 6 contacts of relay FC4, No. 6 contacts of relay FC1, to ground, said two relays in register C having been operated to register the third digit 5 of the code. On the other hand, codes 805 and 807 will both cause the operation of relay FAB80 since the second digit 0 will cause the operation of relays FB4 and FB7 in register B. Consequently, the circuit of relay FAC3, representing the code 805, and the circuit of relay FAC4 representing the code 807 will be closed through the contacts of relay FAB80 to easily traceable grounds on the contacts of relays FC1 and FC0 in register C.

Relays FABC, FALK AND FACK serve as check relays. Relay FABC, as already noted, operates to determine that the relays in registers A and C have operated according to the two-out-of-five code in registering the first and third digits, respectively, of the foreign area code, and that the relays in register B have operated in the designated pair for digit 1 (relays FB0 and FB1) and in the designated pair (relays FB4 and FB7) to register the second digit of the code. Relay FABC is made slow in operating to allow time for the slowest FA—, FB—, or FC— relay in the registers A, B and C, respectively, to operate if its circuit is closed. When operated, relay FABC, at its No. 3 contacts, closes a circuit for slow-operate relay FALK, which operates and closes a point in the circuit of relay FACK at its No. 1 contacts.

Relay FACK checks to insure either that relay FA3D is operated if the foreign area code is to be recorded as dialed, or that one, and only one, of the code compression relays FAC0 . . . FAC4 is operated. If relay FA3D is not operated, thereby indicating a compression of the foreign area code registered in registers A, B and C, and a compression code relay FAC— is operated, thereby indicating that the code is to be compressed (assume that relay FAC4 is operated for the compression of the code 807 to the single digit 4) then relay FACK is energized over a path extending from battery through its winding, No. 1 contacts of relay FALK, conductor 132, No. 3 normally made contacts of relay FA3D, the No. 6 front contacts of relay FAC4, serially through the No. 6 back contacts of relay FAC3 . . . FAC0, to

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ground. The operation of relay FACK checks that one, and only one, of the code compression relays has been operated, since it is obvious that if two or more of said relays are operated, the above circuit cannot be completed.

If relay FA3D is operated, thereby indicating that the foreign area code registered in registers A, B and C is to be recorded as dialed (five-line initial entry), and none of the relays FAC0 . . . FAC4 is operated, then upon the operation of relay FALK, an alternate circuit is completed for relay FACK, said alternate circuit extending from battery through the winding of said relay, No. 1 contacts of relay FALK, conductor 132, No. 3 operated contacts of relay FA3D, serially through the No. 6 back contacts of relays FAC1 . . . FAC4, to ground. It should be noted that if one of the relays FAC0 . . . FAC4 is operated at the same time that relay FA3D is operated, the circuit of relay FACK will not be closed.

Upon operating, relay FACK locks over its upper No. 2 contacts, conductor 133, to ground on the No. 2 contacts of relay CP7, further extends ground from the contacts of relay RK, conductor 134, its own No. 6 contacts, No. 2 contacts of relay FALK to the right winding thereof, the No. 2 contacts of relay FABC to the left winding thereof, thus locking said latter relays. At its No. 3 contacts, relay FACK opens the circuit of relay FC1 which, upon releasing, opens the connection between the conductor groups A, B and C and the relays of registers A, B and C, respectively, thereby to cause the relays operated in said registers to release. It should be noted, however, that the grounds selectively applied to said conductor groups in the sender to express the three digits of the foreign area code, remain so applied. The operated relay FAC— which represents the foreign area code to be compressed, if the code is to be compressed (relay FAC4, in the given example), or operated relay FA3D if the code is to be recorded as dialed, remains locked to off-normal ground, the former relay over its No. 1 contacts, conductor 135, No. 3 contacts of relay CK5, to ground; the latter relay over its right winding and No. 3 contacts, conductor 133 to the same ground. As will be shortly described, relay FAC— (relay FAC4 in the given example) in the case of code compression, needs to remain operated to cause the compressed code to be recorded as a single digit in the B digit position of the second line of a four-line initial entry, while relay FA3D, in case the three digits of the foreign area code are to be recorded as dialed, needs to remain operated to cause said three digits to be recorded in the D, E and F digit spaces of the third line of a five-line initial entry.

Having described the particulars of the apparatus and circuit arrangement which have been provided in the transverter to compress certain foreign area codes into single digits and to record certain others as dialed, I will now describe the operation of the transverter as modified by my invention. Those operations of the transverter which have already been completely described in the above-mentioned Cahill et al. application will be sketched in briefly wherever necessary to provide enough operational background for a complete understanding of the operation of the invention. Reference, therefore, is made to the above-mentioned application for such operations of the transverter as are not completely described herein.

When the transverter becomes connected to the outgoing sender S, the latter transmits to the transverter certain items of information which the transverter needs for directly guiding the items of record to the appropriate lines and digit positions of the record including the stations digit, which is registered on the stations register shown in Fig. 8. Among such items of information is whether the initial entry to be recorded is a four-line initial entry, in which case relay 4L is operated, or a two-line initial entry in which case relay 2L is operated, whether the called number is four digits, resulting in the

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operation of relay 4DG, or five digits resulting in the operation of relay 5DG.

In the present embodiment of the invention the initial entry is either a four-line initial entry or a five-line initial entry. But in either case, relay 4L is always operated. The sender also selectively grounds two of the five conductors in each of the conductor groups A . . . K in accordance with the digit which each of said groups is to express for recording, and it has already been shown that the grounding of conductor groups A, B and C according to the three digits of the foreign area code results in the operation of relay FA3D if such code is to be recorded as dialed, and in the operation of one of the compression code relays FAC0 . . . FAC4 if the indicated code is to be compressed into a single digit. It will further be recalled that the operation of relay FA3D or the operation of one of the relays FAC0 . . . FAC4 (relay FAC4, for example) effects the operation of relay FACK. When the latter operates, a circuit is closed for relay FA1, which circuit extends from battery through the winding of said relay, conductor 145, No. 2 contacts of relay FA3D (if said relay is operated), conductor 146, No. 5 contacts of relay FACK, No. 1 contacts of relay FALK, conductor 132, No. 3 front contacts of relay FA3D, serially through the No. 6 back contacts of relays FAC4 . . . FAC0, to ground. If relay FA3D is not operated, relay FA1 also will not be operated. But whether relay FA3D is operated because the code is to be recorded as dialed, or whether one of the relays FAC4 . . . FAC0 is operated because the code is to be compressed, relays FA2 and FA3 will operate over the following two alternate paths. If relay FA3D is operated, the circuit of relays FA2 and FA3 extends from battery through their respective windings, conductor 147, No. 5 contacts of relay FACK, No. 1 contacts of relay FALK, conductor 132, No. 3 front contacts of relay FA3D, serially through the No. 6 back contacts of relays FAC4 . . . FAC0, to ground. If relay FA3D is not operated, the circuit extends as traced to conductor 132, but because said relay is normal, the path continues over its normal No. 3 contacts, No. 6 front contacts of relay FAC4 (assumed to be operated) and thence as traced to ground.

When relay FA2 operates, the five conductors in conductor group K, selectively grounded in the sender to express the value of the stations digit, are extended to the windings of the relays ST0 . . . ST7 of the stations register. If the numerical portion of the called subscriber's number consists of four digits, relay 4DG will be operated, and the sender further grounds lead K7 (in said conductor group K) over which, through the No. 11 contacts of relay FA2, relay ST7 is operated. Said relay locks over its No. 4 contacts to ground on conductor 123, and completes the circuit of relay EST from battery through its winding, No. 3 contacts of relay ST7, No. 3 back contacts of relay ST4, No. 3 back contacts of relay ST2, No. 2 back contacts of relay ST1, No. 1 back contacts of relay ST0, conductor 174, No. 1 contacts of relay FA2, No. 8 contacts of relay FA3, through certain other control equipment (not shown) if the foreign area code is not to be recorded as dialed, conductor 175, No. 3 contacts of relay CP7, No. 3 contacts of relay CP2, No. 3 back contacts of relay 5DG, No. 4 back contacts of relay LST, No. 1 front contacts of relay 4DG, conductor 176, No. 1 contacts of relay CK5, to ground. In the event that the foreign area code is to be recorded as dialed (five-line initial entry) then relay FA1 will be operated, as already explained, relay FAL will be operated, as will be explained, and the above path traced to the No. 8 contacts of relay FA3 will extend over the No. 20 contacts of relay FA1, conductor 177, No. 4 contacts of relay FAL conductor 178, No. 21 contacts of relay FA1, and thence as traced to ground on the No. 1 contacts of relay CK5. Relay EST operates to perform a function to be described herein-

after. If a station digit is dialed, the conductors in conductor group K are selectively grounded in the two-out-of-five code to express the digit, which is registered in the usual manner on the relays ST0 . . . ST7 in said two-out-of-five code, and relay EST will not be operated. If the subscriber's number is a four-digit number with no station digit, relay EST is operated as above described and a circuit is completed for relay SCK, which circuit extends from battery through the winding of said relay, conductor 178, back contacts of relay S7 conductor 180, No. 2 contacts of relay EST, to ground. If the subscriber's number includes a stations digit, the sender will cause relay S7 to be operated over the No. 12 contacts of relay FA2 (or contacts 9L3E of relay L3E in the event that the call is not a foreign area call), and conductor 179. In this event, the circuit of relay SCK is completed over the front contacts of relay S7, conductor 181, through two operated front contacts and three back contacts on relay ST0 . . . ST7 selectively operated in the two-out-of-five code to register the stations digit, conductor 174, to ground previously traced thereto.

Subsequent to the operation of relay SCK, circuit operations described in the above-mentioned Cahill et al. patent are initiated by which a recorder R is connected to the transverter via a recorder connector RC. When such a connection is effected, the recorder closes a circuit (not shown) for operating relay RK which, upon operating, releases relays FALK and FABC. The operation of relay RK is an indication that the recorder R is attached to the transverter, whereupon a relay is operated in the recorder that grounds conductor P, in consequence of which a circuit is thereby completed for relays P4 and P4K in multiple, said circuit being traced from ground on said conductor P, No. 1 contacts of relay 4L, conductor 136, contacts of relay SCK, conductor 137, No. 2 back contacts of relay P4A, windings of relays P4 and P4K in multiple to battery. Both relays operate, relay P4 locking over its left winding and No. 1 contacts to ground on the No. 3 contacts of relay CK7. If the locking circuit for relay P4 is continuous, insuring that said relay will not release when ground is later removed from conductor P, said locking ground is then applied over the No. 1 contacts of relay P4, No. 2 contacts of relay P4K, conductor 138, No. 5 contacts of relay CR, winding of relay C4, to battery. Relay C4 operates. Through contact group 1 it extends the five conductors of the recorder magnet group MB0 . . . MB7 to the contact group 4 of relay FA3, the latter contact group connecting with the five conductors of conductor group G, selectively grounded in the sender to express the thousands digit of the called number. By said grounds, two circuits are completed to the two appropriate recorder magnets in the magnet group MB0 . . . MB7, which cause said two magnets to operate and record in the B digit space of the first line of the entry the thousands digit of the called number in the two-out-of-five code, as indicated in Fig. 13B or Fig. 13C. Through contact group 3 relay C4 extends the five conductors of the magnet group MC0 . . . MC7 to the contact group 5 of relay FA3, the latter connecting with the five conductors of conductor group H, selectively grounded in the sender to express the hundreds digit of the called number. By said grounds two circuits are completed to the two appropriate recorder magnets in the magnet group MC0 . . . MC7, which cause said two magnets to operate and record in the C digit space of the first line of the entry the hundreds digit of the called number in the two-out-of-five code, as indicated in Fig. 13B or Fig. 13C. Through contact group 4, relay C4 extends the five conductors of the magnet group MD0 . . . MD7 to the contact group 7 of relay FA3, the latter connecting with the five conductors of conductor group I, selectively grounded in the sender to express the tens digit of the called number. By said grounds two circuits are completed to the two appropriate recorder magnets in the magnet group MD0 . . . MD7, which cause

said two magnets to operate and record in the D digit space of the first line of the entry the tens digit of the called number in the two-out-of-five code, as indicated in Fig. 13B or Fig. 13C. Through contact group 5, relay C4 extends the five conductors of the magnet group ME0 . . . ME7 to the contact group 2 of relay FA2, the latter connecting with the five conductors of conductor group J, selectively grounded in the sender to express the units digit of the called number. By said grounds two circuits are completed to the two appropriate recorder magnets in the magnet group ME0 . . . ME7, which cause said two magnets to operate and record in the E digit space of the first line of the entry the units digit of the called number in the two-out-of-five code, as indicated in Fig. 13B or Fig. 13C. Through contact group 6, relay C4 extends the five conductors of the magnet group MF0 . . . MF7 to the upper contacts of relays ST0 . . . ST7 of the stations register in Fig. 8. If a stations digit is registered therein, two of said conductors are grounded by the two operated relays to express the stations digit, thereby to cause the two appropriate magnets in magnet group MF0 . . . MF7 to operate and record in the F digit space of the first line of the entry the stations digit of the called number. If a stations digit is not registered, then relays EST and ST7 will be operated as before described, in which event relay EST will apply ground over its No. 4 contacts, conductor 182 to the conductor extending to recorder magnet MF4, while relay ST7 will apply ground over its No. 5 contacts, conductor 183 to the conductors extending to magnet MF7. Both of these magnets operate to record in the two-out-of-five code the improvised digit 0 in the F digit space of the first line of the entry. Over its No. 1 contacts, relay C4 grounds the conductor extending to recorder magnet MA0, causing said magnet to operate and record the digit 0 by punching the first of the three punch positions in the A digit space in the first line of the entry, thereby to indicate that said line is not the last line of the entry, or "first" line as considered from the subsequent "reverse" analysis of the record.

When the recording magnets MA0 . . . MF7 have operated, as above described, to perforate the first line of the entry, a signal is provided to this effect in the recorder, in consequence of which ground is removed from conductor P and applied to conductor P1. The removal of ground from conductor P causes relay P4K to release. Ground on conductor P1 then completes the circuit of relay P4A over a path which may be traced from ground on said conductor P1, No. 4 contacts of relay CK7, through contacts of certain other relays (not shown) which play no part in the operation of this invention other than to close the path here being traced, No. 3 contacts of relay P1K, No. 1 back contacts of relay P1, No. 4 contacts of relay P2K, No. 1 back contacts of relay P2, conductor 144, No. 1 contacts of relay PFAK, No. 5 back contacts of relay PFA, conductor 145, No. 5 contacts of relay P3K, No. 3 back contacts of relay P3, No. 3 contacts of relay P4K, No. 4 contacts of relay P4, a pair of closed contacts on relay C4 (not shown but indicated by the broken conductor 184), right winding of relay P4A to battery. Relay P4A operates and locks over its left winding and No. 1 contacts to ground on the No. 1 contacts of relay CK7. This locking ground is then applied over conductor 188 within bracket 189. No. 2 contacts on C4 relay, winding of relay CR, to battery. Relay CR operates and opens the circuit of relay C4 causing it to release and disconnect the recording magnets MA0 . . . MF7 from the called line number conductor groups. The release of relay C4 then releases relay CR.

When the record tape (not shown in Fig. 4) has been advanced to the next line and the recorder is ready to record the second line of the initial entry, ground is re-applied to conductor P, and a circuit is thereby com-

pleted for relays P3K and P3 in multiple, said circuit tracing from ground on conductor P as previously traced to conductor 137, No. 2 front contacts of relay P4A, No. 2 back contacts of relay P3A, windings of relays P3K and P3 in multiple, to battery. These two relays operate, relay P3 locking over its left windings and No. 1 contacts to aforetraced ground on the No. 3 contacts of relay CK7. A circuit is now completed for relay C3, said circuit being traced from ground on the No. 1 locking contacts of relay P3, No. 2 contacts of relay P3K, conductor 143, No. 4 contacts of relay CR, winding of relay C3, to battery. Relay C3 operates. Its No. 1 contacts apply ground to the conductor of recorder magnet MA0, thereby operating this magnet to record the digit 0 in the A digit space of the second line, thus indicating that the line is a line of the entry but not the last. If the foreign area code is to be recorded as dialed, the digit 0 is improvised for the B digit space, in which event, and because relay FA1 is operated, the latter applies ground to conductors 150 and 151 over its No. 4 and No. 3 contacts, respectively. Conductor 150 connects with the conductor which, over a set of contacts in contact group 1 of relay C3, extends to the winding of recorder magnet MB4, while conductor 151, over another set of contacts in said contact group, extends to the winding of recorder magnet MB7. Both magnets then operate to record the digit 0 in the B digit space in the second line of the entry.

If the foreign area code is to be compressed into a single digit, then the appropriate one of the relays FAC0 . . . FAC4 will be operated, relay FA1 will be normal, and the two conductors of the five conductors in the cable FAC connecting with the contacts of contact group 1 on relay C3 will be grounded by the operated relay FAC—in accordance with the digit represented by said relay. For example, if relay FAC4, representing the foreign area code 807 to be compressed into the single digit 4, is operated, said relay grounds the two conductors which, over two sets of contacts in contact group 1 relay C3, connect with recorder magnets MB0 and MB4, causing said magnets to operate and record the compressed code digit in the B digit space in the second line of the entry.

Through its Nos. 3, 4 and 5 contacts relay C3 connects recording magnets MC0, MC1 and MC2 to certain leads, two of which are grounded to indicate the number of digits that constitute the numerical portion of the called subscriber's number. If the number consists of four digits and no station digit, relays 4DG and EST will be operated. In this event, relay EST, over its No. 1 contacts, applies ground to conductor 162 which, over the No. 3 contacts of relay C3, connects with the conductor extending to the winding of magnet MC0. Previously traced ground on conductor 165 from the No. 3 contacts of relay 4DG (relay FACK having been released) is extended over the No. 4 contacts of relay C3 to the conductor connecting with magnet MC1. Both magnets operate to record the digit 1 in the C digit space of the second line of the entry as an indication that the numerical portion of the called subscriber's number consists of four digits with no station digit.

If the number consists of five digits, relay 5DG will have been operated from the sender, which relay, over its No. 1 contacts, applies ground to conductor 162 to operate magnet MC0. Relay 5DG also applies ground to conductor 165. Since relay EST is normal for a five-digit number, the latter conductor is joined to conductor 166 over the No. 3 contacts of relay EST. Over the No. 5 contacts of relay C3, conductor 165 is joined to the conductor extending to the winding of recorder magnet MC2. Both magnets MC0 and MC2 operate to record the digit 2 in the C digit space of the second line of the entry as an indication that the numerical portion of the subscriber's number consists of five digits.

It will be remembered that for a foreign area call the

three digits of the called office code are registered in registers D, E and F of the sender and expressed in the two-out-of-five code by the selective ground therein of conductor D, E and F. Since relay FA3 is operated, the five conductors of conductor group D are extended by way of the contact group 1 of said relay to the contact group 6 of relay C3, over which said conductors are extended to the conductors connecting with the five magnets of the MD0 . . . MW7 magnet group; the five conductors of conductor group E are extended by way of contact group 2 of relay FA3, to contact group 7 of relay C3, over which they are extended to the conductors connecting with the five magnets of the ME0 . . . ME7 magnet group; while the five conductors of conductor group F are extended by way of contact group 3 of relay FA3 to contact group 8 of relay C3, over which said conductors are extended to the conductors connecting with the five magnets of the MF0 . . . MF7 magnet group. Two magnets in each of said magnet groups are operated by the two grounded conductors in each conductor group D, E and F, thereby to record in the two-out-of-five code the three digits of the called office code in the D, E and F digit spaces of the second line of the entry.

After the second line of the record has been punched, ground is removed from conductor P, to release relay P3K and reapplied to conductor P1, whereupon a circuit is completed for relay P3A, said circuit tracing from ground on conductor P1 as previously traced to conductor 145, No. 5 contacts of relay P3K, No. 3 front contacts of relay P3, a set of contacts on relay C3 (not shown, but indicated by the broken conductor 185), right winding of relay P3A to battery. Relay P3A operates, locks over its left winding and No. 1 contacts to aforetraced ground on the No. 1 contacts of relay CK7, and applies said locking ground to conductor 190 in bracket 189, No. 10 contacts of relay C3, to complete the circuit of relay CR, which relay operates to release relay C3, the latter in turn, and upon releasing, opening the circuit of relay CR which then also releases. The release of relay C3 disconnects the called office conductor groups D, E and F from the conductors connecting with the magnet groups MD0 . . . MD7, ME0 . . . ME7 and MF0 . . . MF7, and also opens the circuit path of magnets MA0, MA1 and MA2, causing whichever combination of said magnets that were operated to release. Relay C3 also disconnects the compressed code conductors in the cable FAC from the magnet group MB0 . . . MB7. The transverter then proceeds in the manner hereinafter to be described to operate the recorder to record either the next two lines of the four-line initial entry or the next three lines of the five-line initial entry depending, respectively, upon whether the foreign area code is to be compressed or recorded as dialed. In the latter event relay FA3D will have been operated as already described, and no compression code relay FAC— will have been operated. It will also be recalled that upon the operation of relay FA3D, relays FALK, FABC, FACK, FA1, FA2 and FA3 were also operated.

When relay FA1 operates, it applies ground over its No. 2 contacts to conductor 147', thereby completing the circuit of relay FAL and causing said relay to operate. Over its No. 1 contacts, relay FA1 applies ground to conductor 148, which extends to the armatures of the No. 4 contacts of the code compression relays FAC0 . . . FAC4. Should any of these latter relays be operated at this time (and none should be since this is not a code compression call but a five-line initial entry call for which the foreign area code is to be recorded) then ground on conductor 148 will be applied over the No. 4 contacts of whichever code compression relay FAC— happens to be operated, conductor 149, left winding of alarm relay AL, to battery. The operation of this relay operates any suitable means (not shown) to sound an alarm and stop further operations. Relay FA1 also applies ground to

conductors 150 and 151 which, over contact group 1 of relay C3 when operated for the recording of the second line of the entry, cause the operation of magnets MB4 and MB7 to record the improvised digit 0 in the second line of the entry for a five-line initial entry, as shown in Fig. 13C. It should be noted that if the entry is a four-line entry, with the foreign area code compressed, the magnets MB0 . . . MB7 are selectively operated under the control of the operated compressed code relay FAC—, thereby to cause the recording of the single digit in the B digit space in the second line of the entry, which expresses the three digits of the foreign area code in the compressed form of a single digit. This has already been described.

When relay FAL operates, and remembering that relays P3A and P4A have been operated in consequence of recording the first two lines of the entry, the application of ground on conductor P by the recorder when the latter is ready to record the third line of the five-line initial entry, completes the circuit of relays PFA and PFAK, said circuit tracing from ground on said conductor P as previously traced to the No. 2 front contacts of relay P3A, conductor 152, No. 1 front contacts of relay FAL, conductor 153, No. 1 back contacts of relay PFAA, windings of relays PFA and PFAK in multiple, to battery. These two relays operate, relay PFA locking over its No. 4 contacts, to ground on the No. 1 contacts of relay CK7, and completing the circuit of relay CFA, said latter circuit extending from ground over the No. 4 locking contacts of relay PFA, No. 3 contacts of relay PFAK, conductor 155 in the bracket 192, No. 3 contacts of relay CR, winding of relay CFA, to battery. The latter relay operates. Over its Nos. 9 . . . 22 contacts, it extends conductor groups A, B and C, selectively grounded by the sender to express the three digits of the foreign area code, from the Nos. 5 . . . 19 contacts of relay FA1 to magnet groups MD0 . . . MD7, ME0 . . . ME7, and MF0 . . . MF7, two magnets in each group then being operated in the two-out-of-five code in accordance with the selective grounding of the two conductors in each of said conductor groups to express a digit of the foreign area code, the first digit being recorded by magnet group MD0 . . . MD7 in the D digit space of the "third" line of the entry, the second digit by the magnet group ME0 . . . ME7 in the E digit space, and the third digit by the magnet group MF0 . . . MF7 in the F digit space, as shown in Fig. 13C.

Over its No. 4 contacts, relay CFA grounds the conductor extending to magnet MA0, causing this magnet to operate and record the digit 0 in the A digit space of the third line to indicate that said line is a line of the entry but not the "first" line. Over its Nos. 7 and 8 contacts, said relay grounds the two conductors which extend to magnets MB4 and MB7, while over its Nos. 5 and 6 contacts it grounds the two conductors which extend to magnets MC4 and MC7. Said four magnets operate, the former two to record the improvised digit 0 in the B digit space of the third line, the latter two to record the improvised digit 0 in the C digit space of said third line. Thus the third line of the five-line initial entry has zeros recorded in the A, B and C digit spaces thereof, and the three digits of the foreign area code as dialed in the D, E and F digit spaces thereof.

Where the entry being recorded is a four-line initial entry with or without code compression, if the call is other than a foreign area call, or a five-line initial entry in which the foreign area code is recorded as dialed, the recording of the remaining two lines of the entry, or the recording of the third line, if the entry is a four-line initial entry, is substantially similar to that described in the above-mentioned patent for the third and fourth lines of a four-line initial entry. Assuming, therefore, that the entry being recorded is a five-line initial entry, then when the third line of such entry has been recorded as above-described, the removal of ground from conductor

P will cause the release of relay PFAK, while the subsequent application of ground on conductor PI completes the circuit of relay PFAA, said circuit tracing from ground on said conductor PI as previously traced to the No. 1 back contacts of relay P2, conductor 144, No. 1 contacts of relay PFAK, No. 5 front contacts of relay PFA, conductor 157 within bracket 192, right winding of relay PFAA, to battery. This relay operates, locks over its left winding and No. 2 contacts to aforetraced ground on the No. 1 contacts of CK7, and applies said locking ground over its No. 2 contacts and conductor 158 within bracket 192, No. 3 contacts of relay CFA, winding of relay CR, to battery. Relay CR operates and opens the circuit of relay CFA which releases and disconnects the A, B and C conductor groups from the recording magnets, and further removes ground from the conductors which extend to the windings of the magnets MA0, MB4, MB7, MC4 and MC7. Relay CR releases upon the release of relay CFA.

When the recorder is ready to record the fourth line of the entry ground is again applied to conductor P, whereupon a circuit is completed for relays P2K and P2, said circuit extending from ground on said conductor P as previously traced to conductor 153, No. 1 front contacts of relay PFAA, conductor 159, No. 2 back contacts of relay P2A, windings of relays P2 and P2K in multiple, to battery. Had the entry been a four-line entry, the relays in Fig. 10 including relay FAL, all would have been normal and the above circuit would then have traced from conductor 152, No. 1 back contacts of relay FAL, conductor 159 and thence as traced to the windings of relays P2K and P2 in multiple. The latter relays operate, relay P2 over its No. 2 contacts to ground on the No. 1 contacts of relay CK7. A path is now closed for relay C2, which extends from said locking ground, the No. 3 contacts of relay P2, No. 1 contacts of relay P2K, conductor 160, No. 2 contacts of relay CR, conductor 142, winding of relay C2 to battery. Relay C2 operates and connects the five conductor groups extending from the calling line register (not shown but indicated in Fig. 4) to the recording magnet groups MB0 . . . MB7 . . . MF0 . . . MF7, thereby to operate said magnets selectively in the two-out-of-five code from said register to record the calling office digit in the B digit space of the line and the four digits of the calling line number in the C . . . F digit spaces of said line, as shown in Figs. 13B and 13C and as described in the above-mentioned Cahill et al. patent. Relay C2 also completes an obvious circuit for recording magnet MA0 over its No. 6 contacts, thereby causing said magnet to operate and record the digit 0 in the A digit space of said line to indicate that said line is a part of the entry but not the first line.

When the recorder has completed recording the line, ground is removed from conductor P, thereby to cause the release of relay P2K, and applied it to conductor P1, whereupon a circuit is completed for relay P2A, said circuit extending from ground on said conductor P1 as previously traced to the No. 4 contacts of relay P2K, No. 1 front contacts of relay P2, a pair of contacts on relay C2 (not shown but indicated by the broken conductor 186), right winding of relay P2A to battery. Said relay operates, locks over its No. 1 contacts and left winding, and applies said locking ground to conductor 193 in bracket 189, No. 7 contacts of relay C2, conductor 142, winding of relay C2, to battery. Said relay operates and releases relay C2 which thereupon disconnects the conductor extending to magnet MA0, and the five conductor groups of the calling line register from the five recorder magnet groups MB0 . . . MB7 . . . MF0 . . . MF7. The release of relay C2 also causes the release of relay CR.

When the recorder is ready to record the last line of the entry, whether it be the fourth (first) line of a four-line initial entry or the fifth (first) line of a five-line initial entry, ground is applied to conductor P, whereupon a

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circuit is completed for relays P1K and P1, said circuit tracing from ground on conductor P as previously traced to conductor 159, No. 2 front contacts of relay P2A, No. 2 contacts of relay P1A, windings of relays P1K and P1 in multiple, to battery. Both of these relays operate, relay P1 locking over its No. 3 contacts to aforetraced ground on the No. 3 contacts of relay CK7, and further completing the circuit of relay C1 from said locking ground on its No. 3 contacts, No. 1 contacts of relay P1K, conductor 161, No. 1 contacts of relay CR, conductor 194, winding of relay C1, to battery. Relay C1 operates. Over its No. 2 contacts it completes the circuit of magnet MA2, causing said magnet to operate and record the digit 2 in the A digit space of the line of the entry to indicate that said line is the "first" line of said entry; over its No. 6 contacts it establishes a circuit path for magnet MB4 extending from battery through the winding of said magnet, through the recorder connector C, No. 6 contacts of relay C1, conductor 195, No. 2 contacts of relay 4L, conductor 196, No. 2 front contacts of relay FAL, to ground. Ground previously traced to conductor 166 completes the circuit of recorder magnet MB1 over the No. 4 contacts of relay C1. Both of said magnets operate and record the digit 5 in the B digit space of the last (first) line of the entry as an indication that the entry is a five-line initial entry.

In the manner previously described, relay C1, by closing through its contact group 7, connects magnet group MC0 . . . MC7 to the message billing index circuit (not shown but indicated in Fig. 4) to cause the billing index to be recorded in the C digit space; and by closing contacts Nos. 8 and 9 it grounds the conductors extending to magnets MD4 and MD7, thereby causing these magnets to operate and record the improvised digit 0 in the D digit space.

The magnet groups ME0 . . . ME7 and MD0 . . . MD7 are separately controlled over another piece of equipment known as the "trunk indexer" which determines the trunk number over which the connection is being established and causes the identification thereof to be recorded as a two-digit number in the E and F digit spaces of the last (first) line.

When recording operations for the fifth (or fourth) line are completed, ground is removed from conductor P, thereby to cause the release of relay P1K. Ground is then applied to conductor P1 thereby to cause the operation of relay P1A over a circuit which extends from ground on said conductor P1 as previously traced to the No. 3 contacts of relay P1K, No. 1 front contacts of relay P1, a pair of contacts on relay C1 (not shown but indicated by the broken conductor 187), right winding of relay P1A, to battery. Said relay P1A operates, locks over its left winding and No. 1 contacts to ground on No. 1 contacts of relay CK7, and completes the circuit of relay CR from said locking ground, conductor 197 within bracket 189, contacts of relay C1, winding of relay CR, to battery. Relay CR operates, releases relay C1, thereby to disconnect the last-mentioned conductor groups from the magnets of the recorder. Relay CR releases upon the release of relay C1.

The release of the transverter is then accomplished by way of the transverter connector, as shown and described in said above-mentioned Cahill et al. patent, resulting in the release of relays CK5 and CK7, and the consequent release of all relays held to the grounds at the contacts thereof.

The invention has been described above with reference to a particular embodiment thereof and as applied to a particular recorder controller. It will be evident, however, to one skilled in the art that it is not limited to the particular embodiment disclosed nor to the particular recorder controller shown in connection therewith, but that various applications, modifications and arrangements other than those disclosed herein are within the scope of the invention.

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The terms and expressions employed herein in reference to the invention are used as terms of description and not of limitation. I have no intention by use of such terms and expressions of excluding thereby equivalents of the features disclosed but, on the contrary, intend to include therein any and all equivalents and modifications which may be employed without departing from the spirit of the invention.

What is claimed is:

1. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data to be variously recorded as expressed or in modified form, means responsive to certain of said conductors when electrically conditioned to express certain indices of said data, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in modified form.

2. A recorder controller comprising a plurality of conductors selectively conditionable electrically to express indices of variable data to be variously recorded as expressed or in modified form, means responsive to certain of said conductors when selectively conditioned electrically to express certain of said indices, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in modified form.

3. A recorder controller comprising a plurality of groups of conductors selectively conditioned electrically to express indices of variable data to be variously recorded as expressed or in modified form, means responsive to certain of said groups of conductors when selectively conditioned electrically to express certain of said indices, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in modified form.

4. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data to be variously recorded as expressed or in compressed form, means responsive to certain of said conductors when electrically conditioned to express certain of said indices, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in compressed form.

5. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data to be variously recorded as expressed or in compressed form, means responsive to certain of said conductors when electrically conditioned to express certain of said indices, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in compressed form.

6. A recorder controller comprising a plurality of conductors selectively conditionable electrically to express indices of variable data to be variously recorded as expressed or in compressed form, means responsive to certain of said conductors when selectively conditionable electrically to express certain of said indices, and means responsive to the operation of said last-mentioned means for determining whether said certain indices are to be recorded as expressed or in compressed form.

7. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data to be variously recorded as expressed or in modified form, a register settable in response to certain of said conductors when electrically conditioned to express certain indices of said data, a first means operable to signify that said certain indices are to be recorded as expressed, a second means operable to signify that said certain indices are to be recorded in modified form, and cross-connecting facilities to connect said register and said first and second means for operating said first means

from said register for any setting thereof expressing indices that are to be recorded as expressed by the electrical conditioning of said certain conductors, and for operating said second means from said register for any setting thereof expressing indices that are to be recorded in modified form.

8. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data to be variously recorded as expressed or in compressed form, a register settable in response to certain of said conductors when electrically conditioned to express certain indices of said data, a first means operable to signify that said indices are to be recorded as expressed, a second means operable to signify that said certain indices are to be recorded in compressed form, and cross-connection facilities to connect said register and said first and second means for operating said first means from said register for any setting thereof expressing indices that are to be recorded as expressed by the electrical conditioning of said certain conductors, and for operating said second means from said register for any setting thereof expressing indices that are to be recorded in compressed form.

9. A recorder controller as set forth in claim 8 in which said first means comprises a relay for all settings of said register expressing indices which are to be recorded as expressed, and said second means comprises a relay for each setting of said register expressing indices which are to be recorded in compressed form.

10. A recorder controller as set forth in claim 8 in which the operation of said first and second means from said register is reciprocally controlled by the normal condition of said second means and the normal condition of said first means, respectively.

11. A recorder controller comprising a plurality of conductors electrically conditionable to express indices of variable data of which three indices are to be recorded either as expressed or as a single index, a register settable in response to certain of said conductors when electrically conditioned to express three indices of said data, a first means operable to signify that said three indices are to be recorded as expressed, a second means operable to signify that said three indices are to be recorded as a single index, and cross-connection facilities to connect said register and said first and said second means, thereby to operate said first means from said register when set for three indices which are to be recorded as expressed by the electrical conditioning of certain of said conductors, and to operate said second means from said register when set for said three indices when they are to be recorded as a single index.

12. A recorder controller as set forth in claim 11 in which said first means comprises one relay for all settings of said register indicative of the three indices to be recorded as expressed, and said second means comprises one relay for each setting of said register indicative of the three indices to be recorded as a single index.

13. A recorder controller comprising a plurality of incoming conductors electrically conditionable to express indices of data to be variously recorded as expressed or

in modified form, a plurality of output conductors, a first means responsive to certain of said incoming conductors when electrically conditioned to express certain indices of said data, a second means responsive to said first means when operated for indices to be recorded in modified form, and means controlled by said operated second means for electrically conditioning certain of said output conductors to express said certain indices in modified form.

14. A recorder controller comprising a plurality of groups of incoming conductors selectively and electrically conditionable in accordance with a code to express indices of data, of which indices some are to be recorded as expressed and others to be recorded as a single index, a plurality of groups of outgoing conductors selectively and electrically conditionable in accordance with said code to express said indices, a register settable in response to three of said groups of incoming conductors when electrically conditioned to express three indices A0C or A1C which are to be recorded as a single index, a first means operable to signify that said three indices are to be recorded as expressed, a second means operable to signify that said three indices are to be recorded as a single index, cross-connection facilities between said register and said first and second means for operating each from said register when set for the three indices to be recorded as expressed or when set for the three indices to be recorded as a single index, means for extending those groups of incoming conductors expressing other indices which are to be recorded as expressed to corresponding groups of outgoing conductors, means controlled by said operated first means for extending to other groups of outgoing conductors those groups of incoming conductors to which said register is responsive, thereby to condition said other groups of outgoing conductors to express in said code the three indices as expressed by the said groups of incoming conductors extended thereto, and means controlled by said operated second means for electrically conditioning one group of outgoing conductors to express in said code the single index for the three indices A0C or A1C indicated by that setting of said register to which said second means is operatively responsive.

15. A recorder controller according to claim 14 in which for all three indices A0C or A1C each to be recorded as a single index, said second means comprises a translator responsive to the operation of said register, including a relay responsive to the operation of said register for all index groups having identical first and second indices, a relay for each index group, and means controlled by the one operated index group relay which is common to all index groups having identical first and second indices with those of the index group individual to said relay for operating said relay.

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