

March 30, 1937.

F. A. KORN ET AL

2,075,527

TELEPHONE SYSTEM

Filed March 11, 1936

24 Sheets-Sheet 1

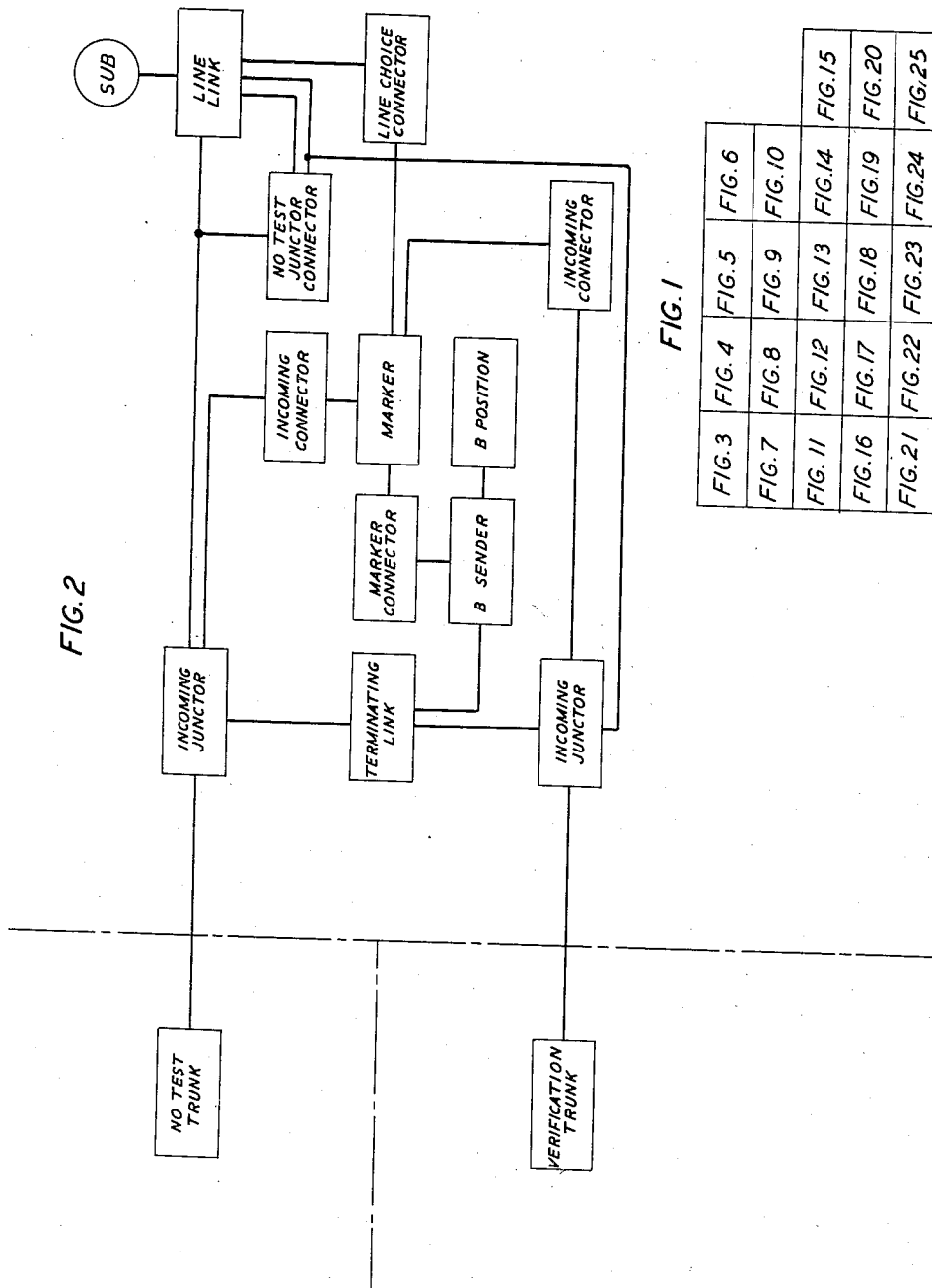


FIG. 2

FIG. 1

|         |         |         |         |         |
|---------|---------|---------|---------|---------|
| FIG. 3  | FIG. 4  | FIG. 5  | FIG. 6  |         |
| FIG. 7  | FIG. 8  | FIG. 9  | FIG. 10 |         |
| FIG. 11 | FIG. 12 | FIG. 13 | FIG. 14 | FIG. 15 |
| FIG. 16 | FIG. 17 | FIG. 18 | FIG. 19 | FIG. 20 |
| FIG. 21 | FIG. 22 | FIG. 23 | FIG. 24 | FIG. 25 |

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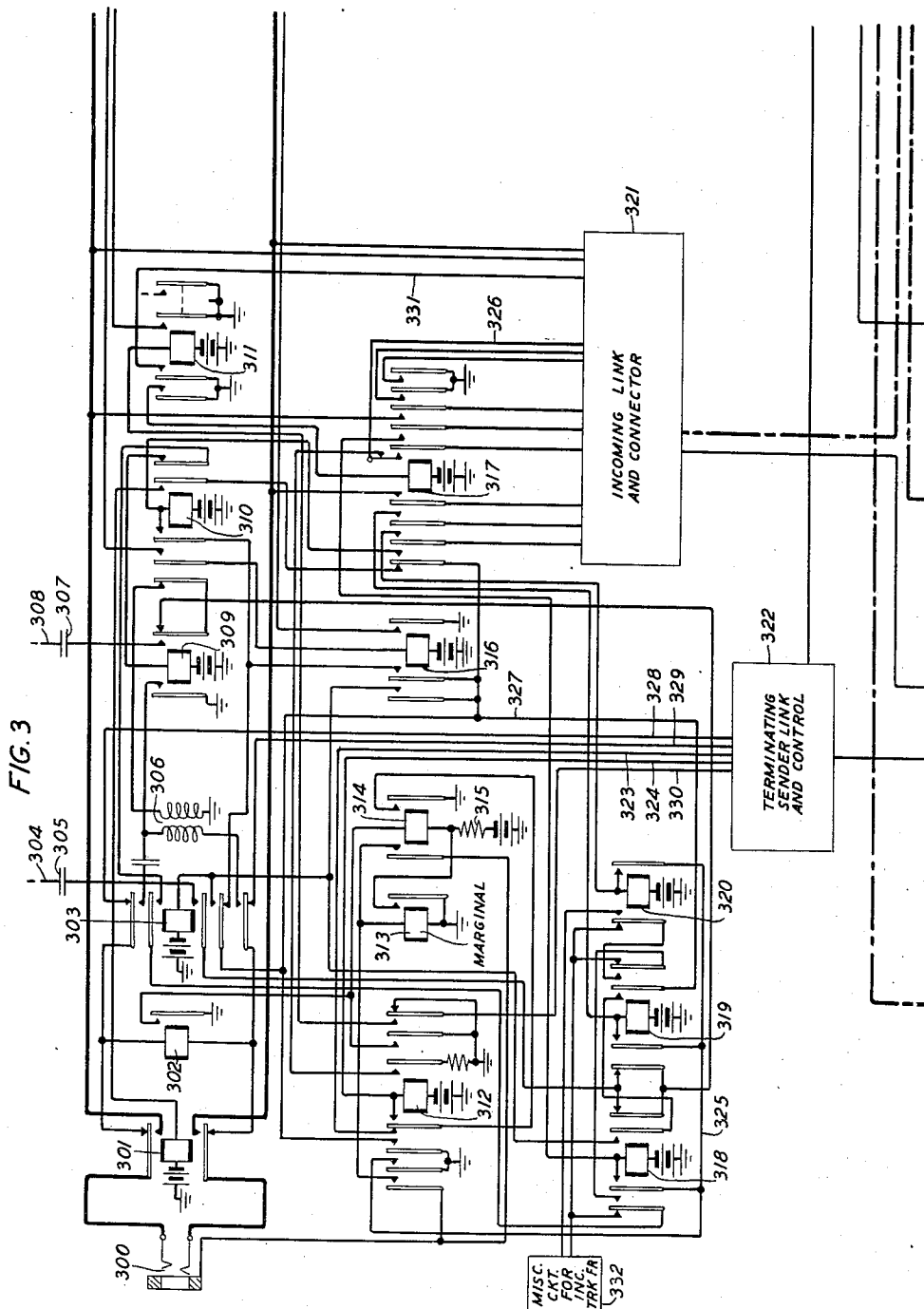
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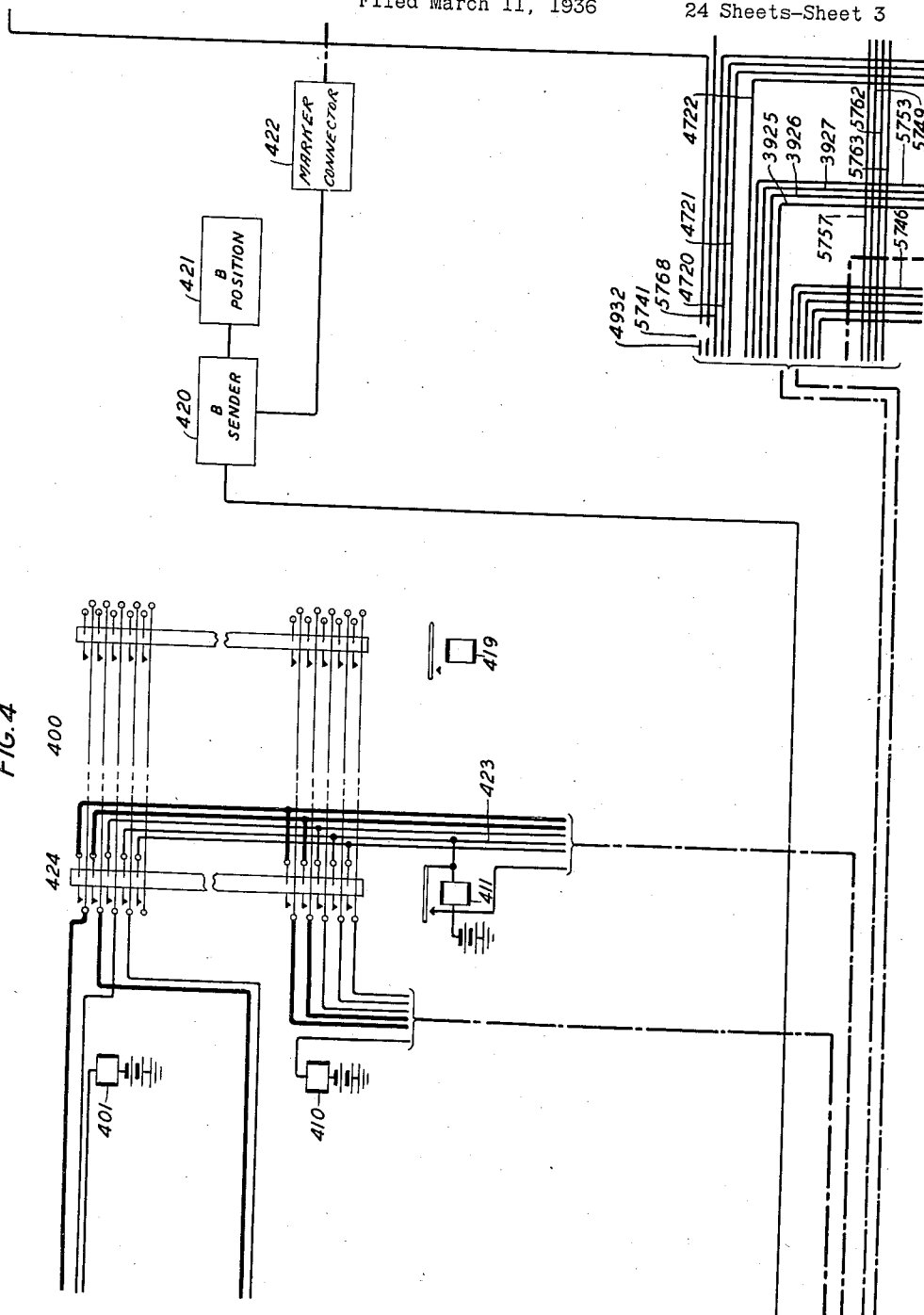
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FIG. 4



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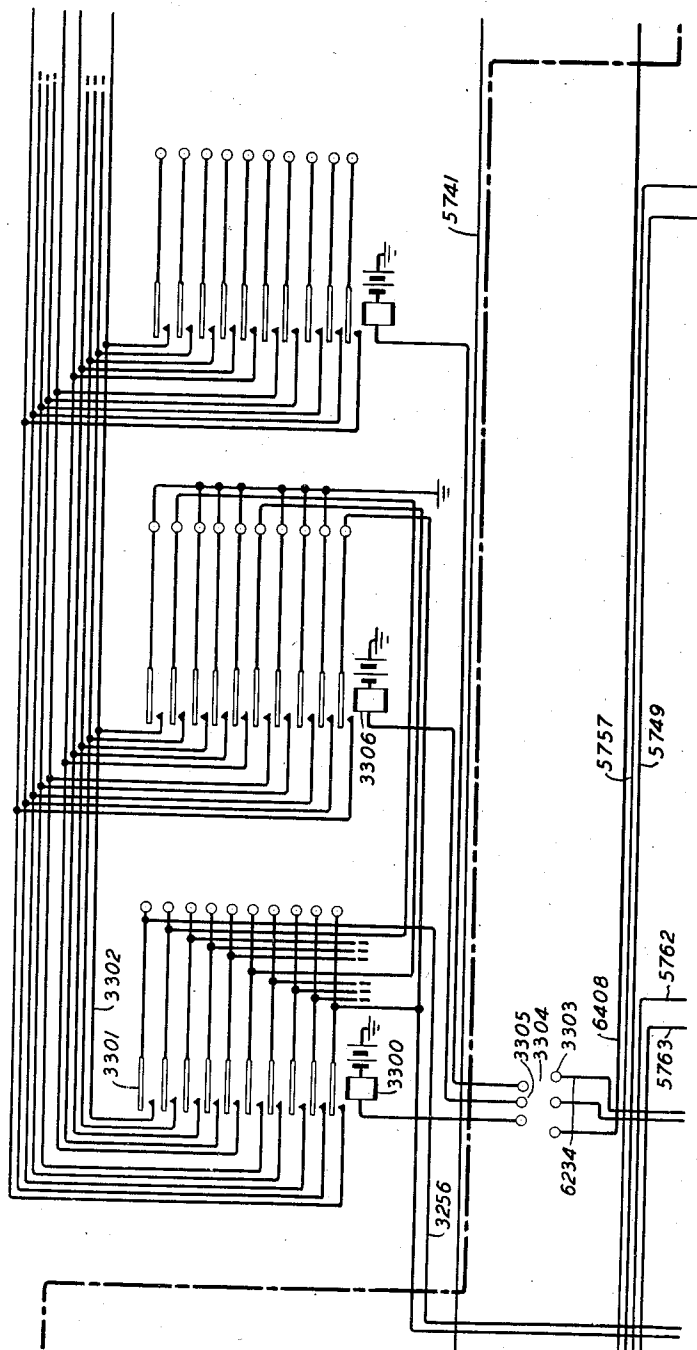
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FIG. 5



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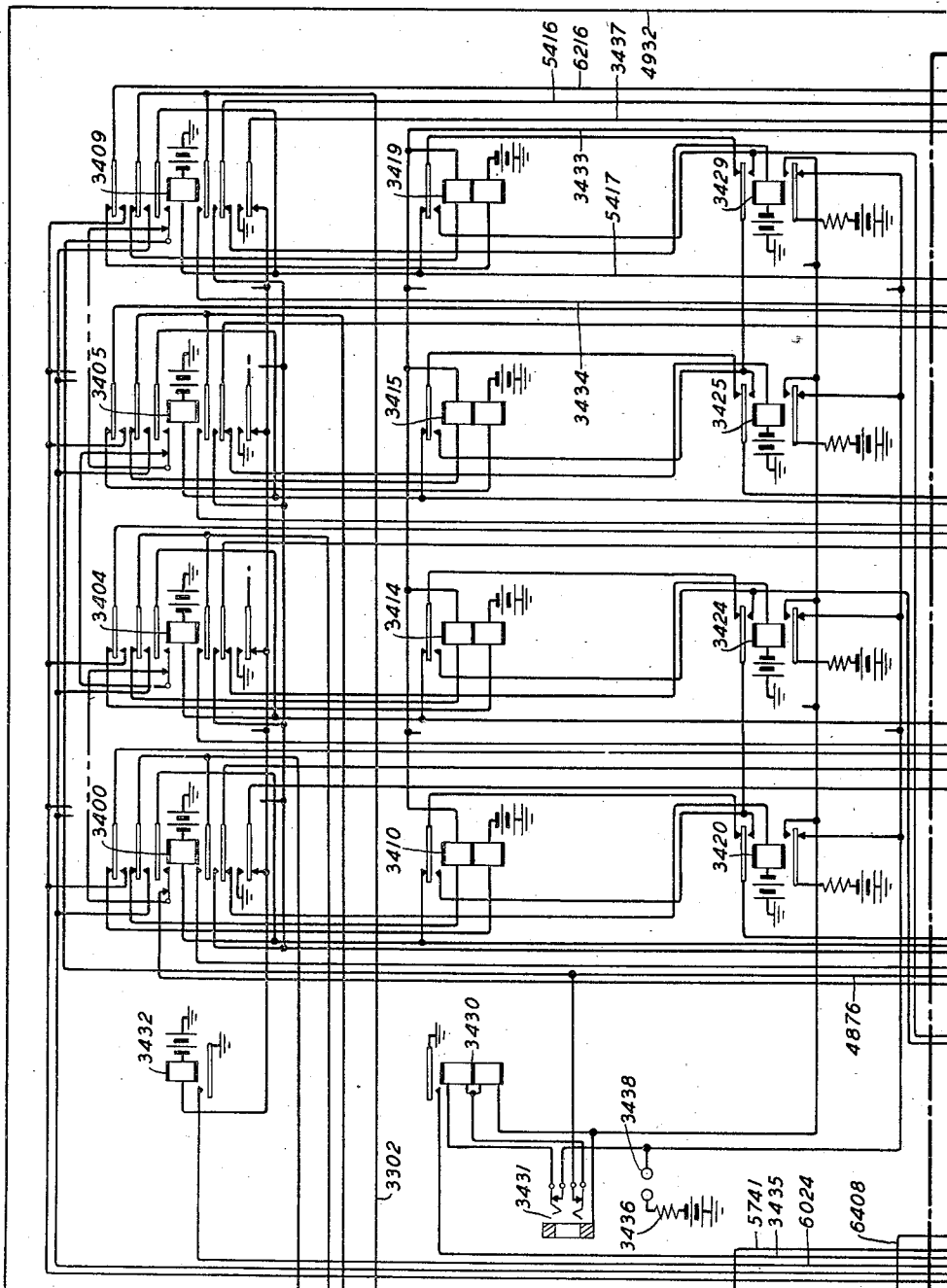
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**FIG. 6**

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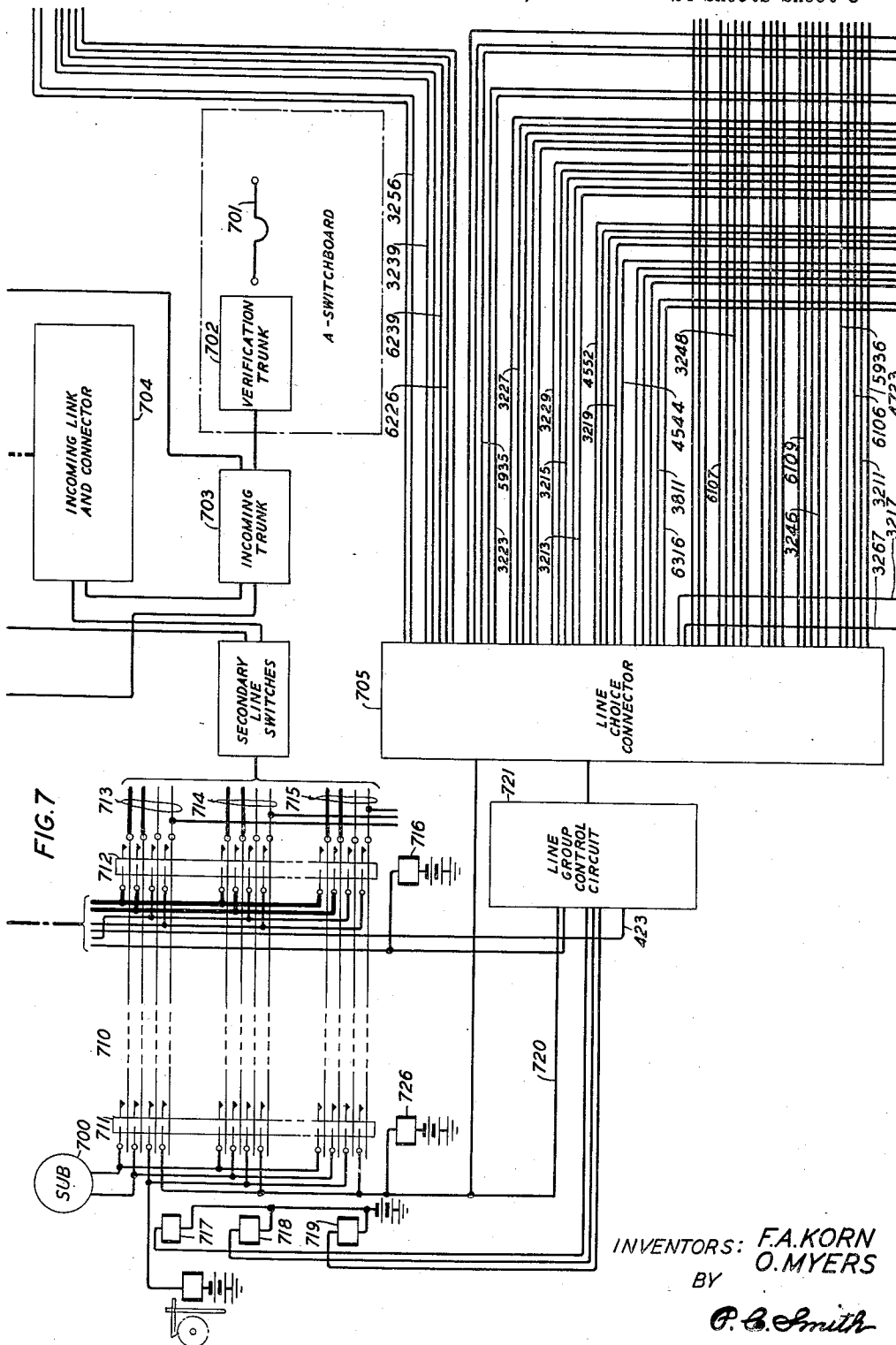
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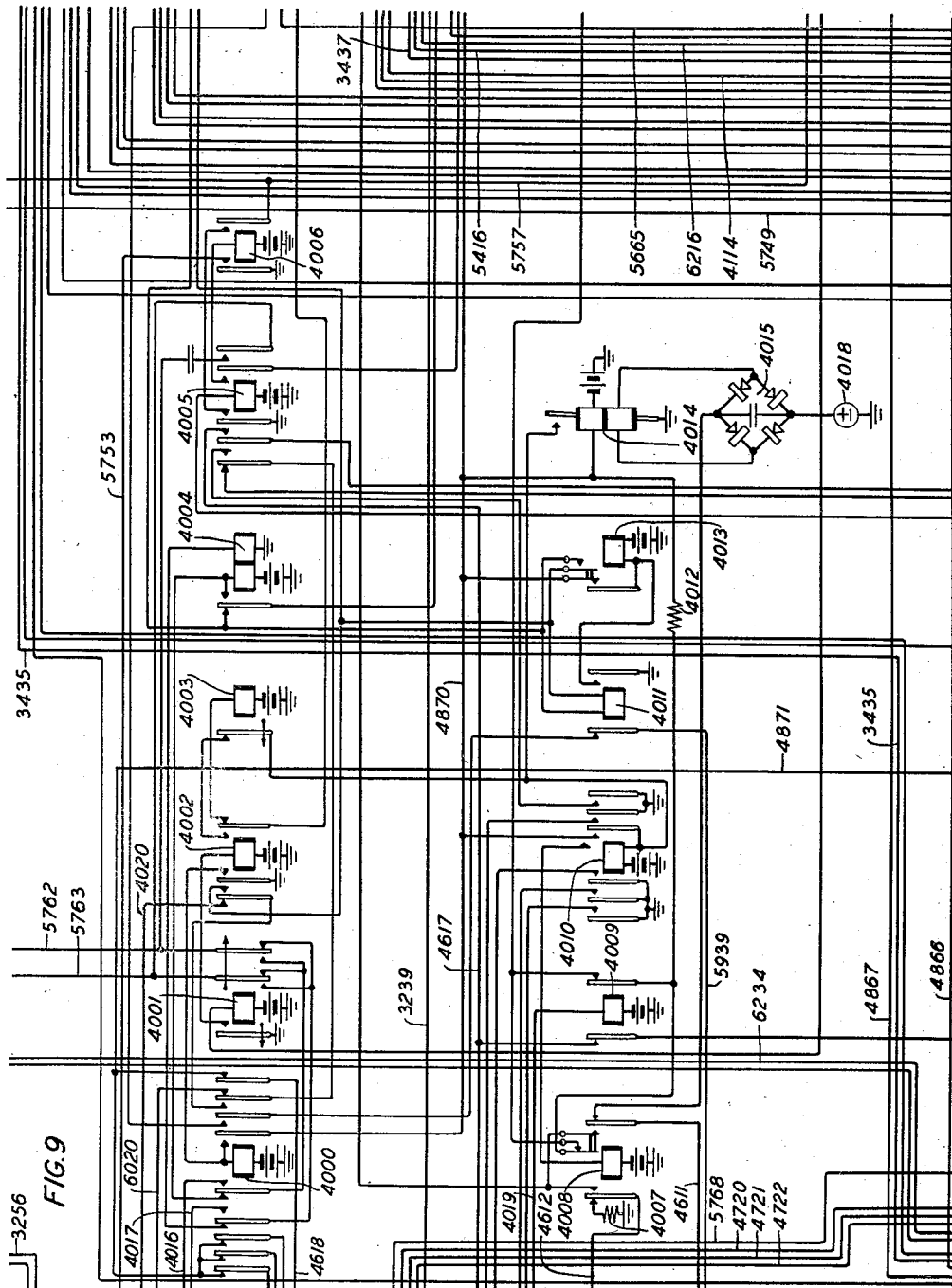


FIG. 9

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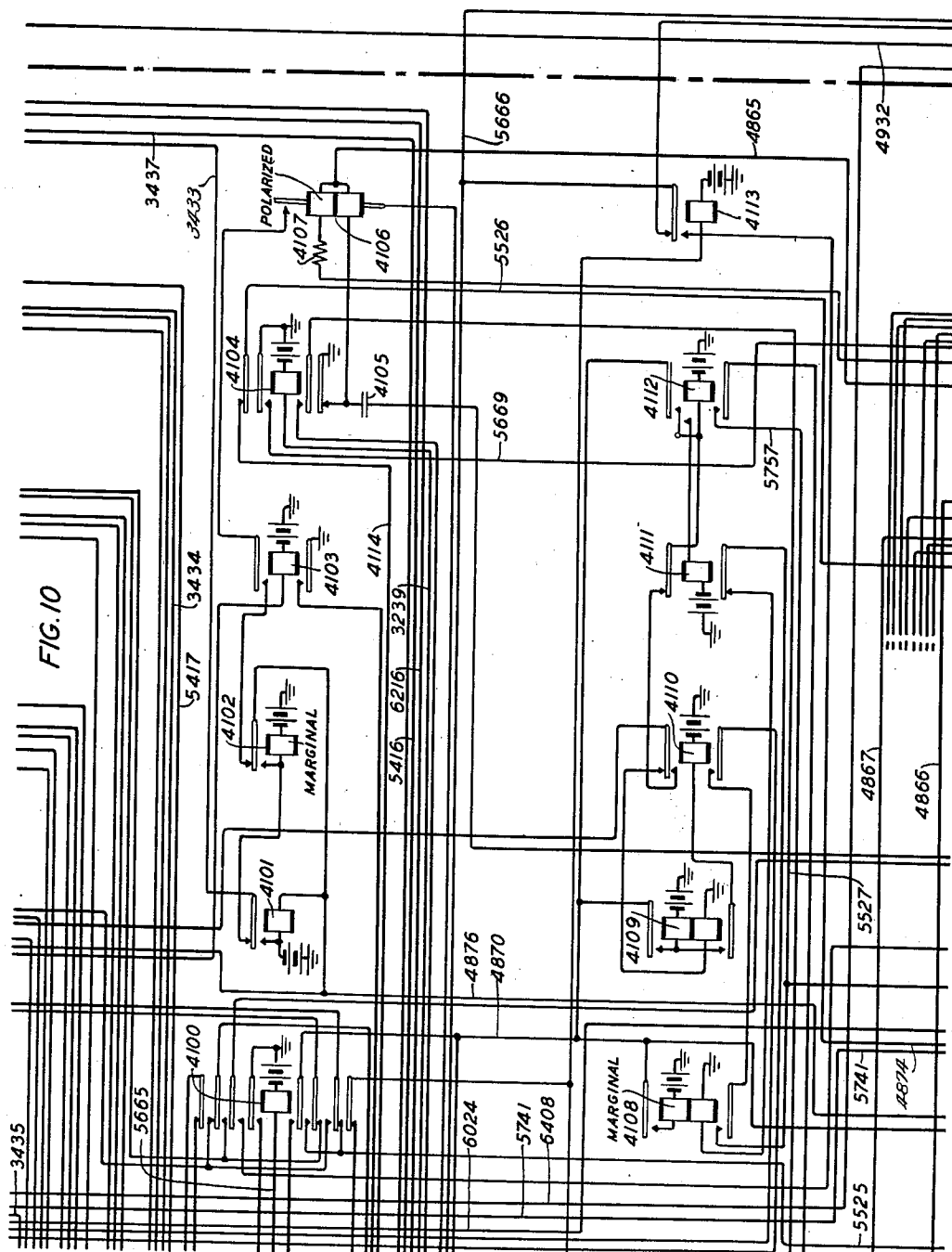
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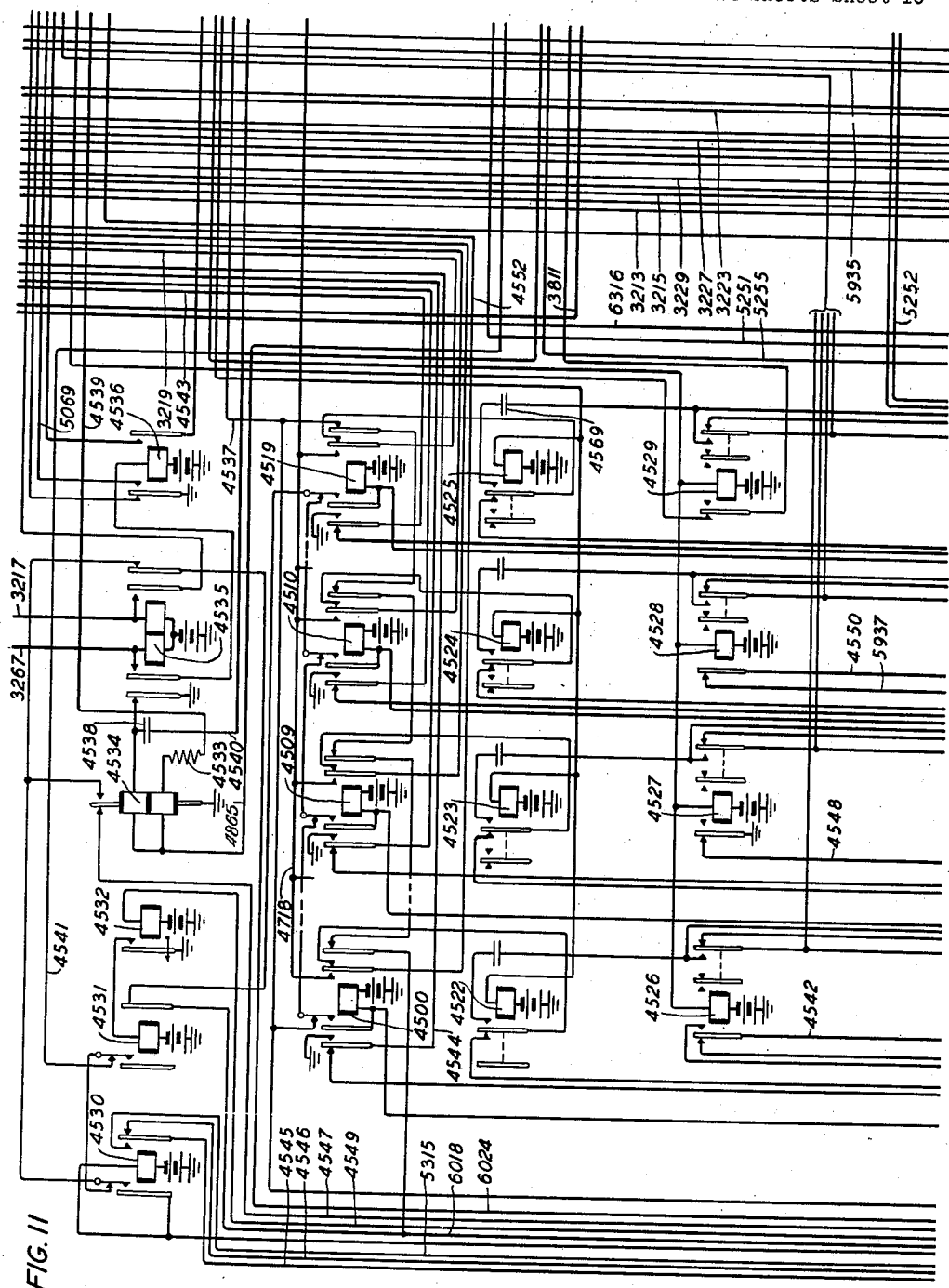
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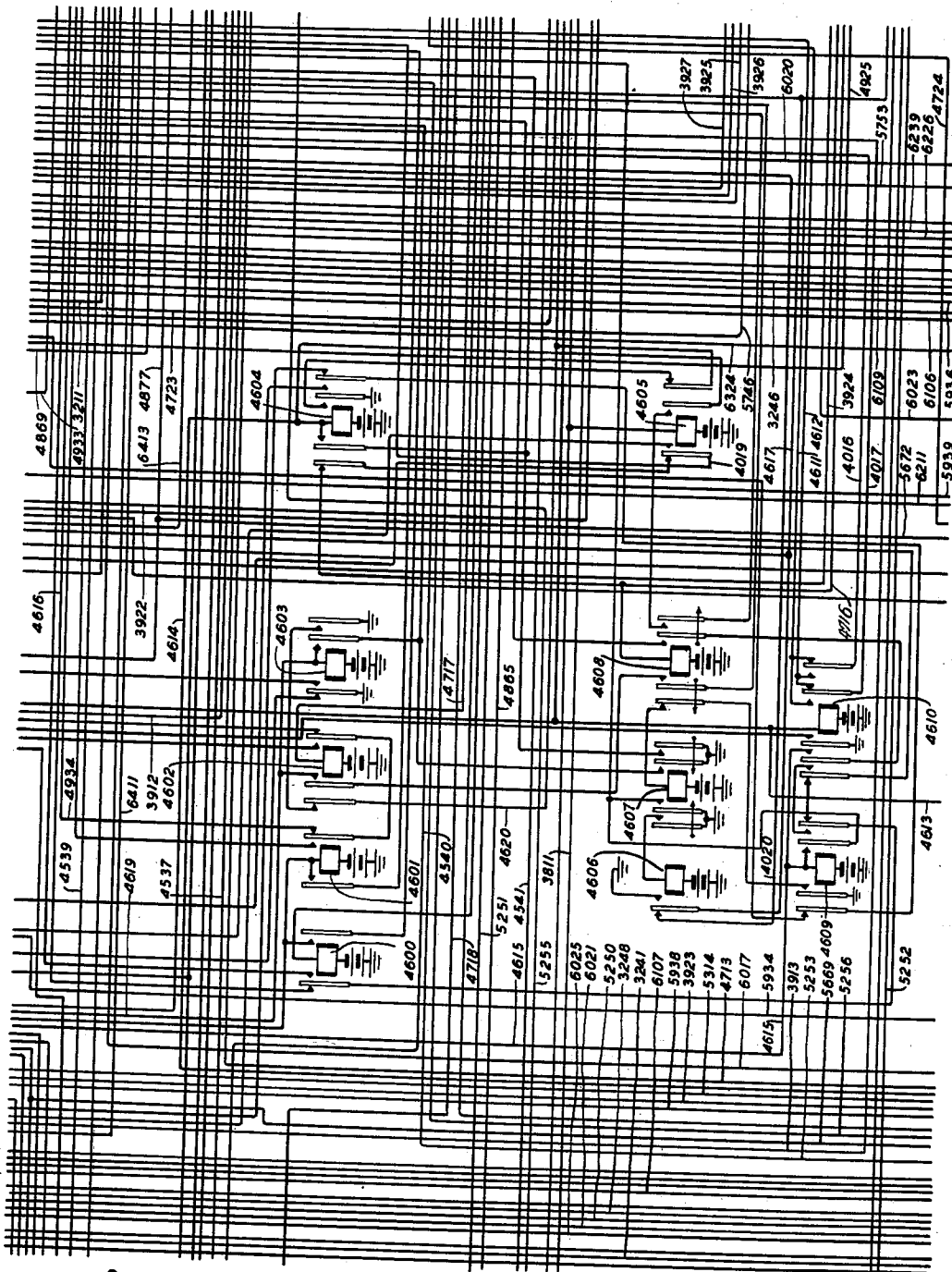
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**FIG. 12**

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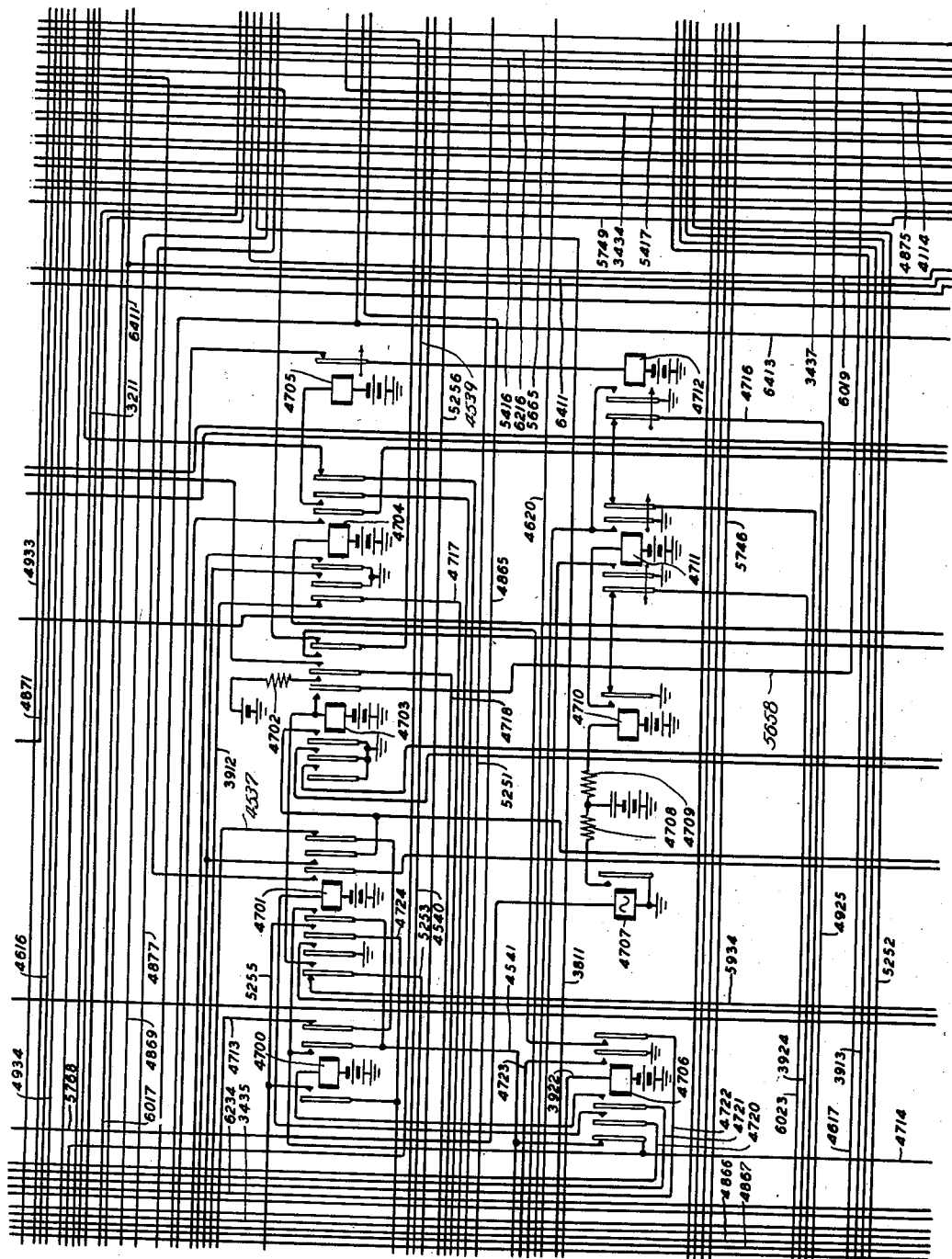


FIG. 13

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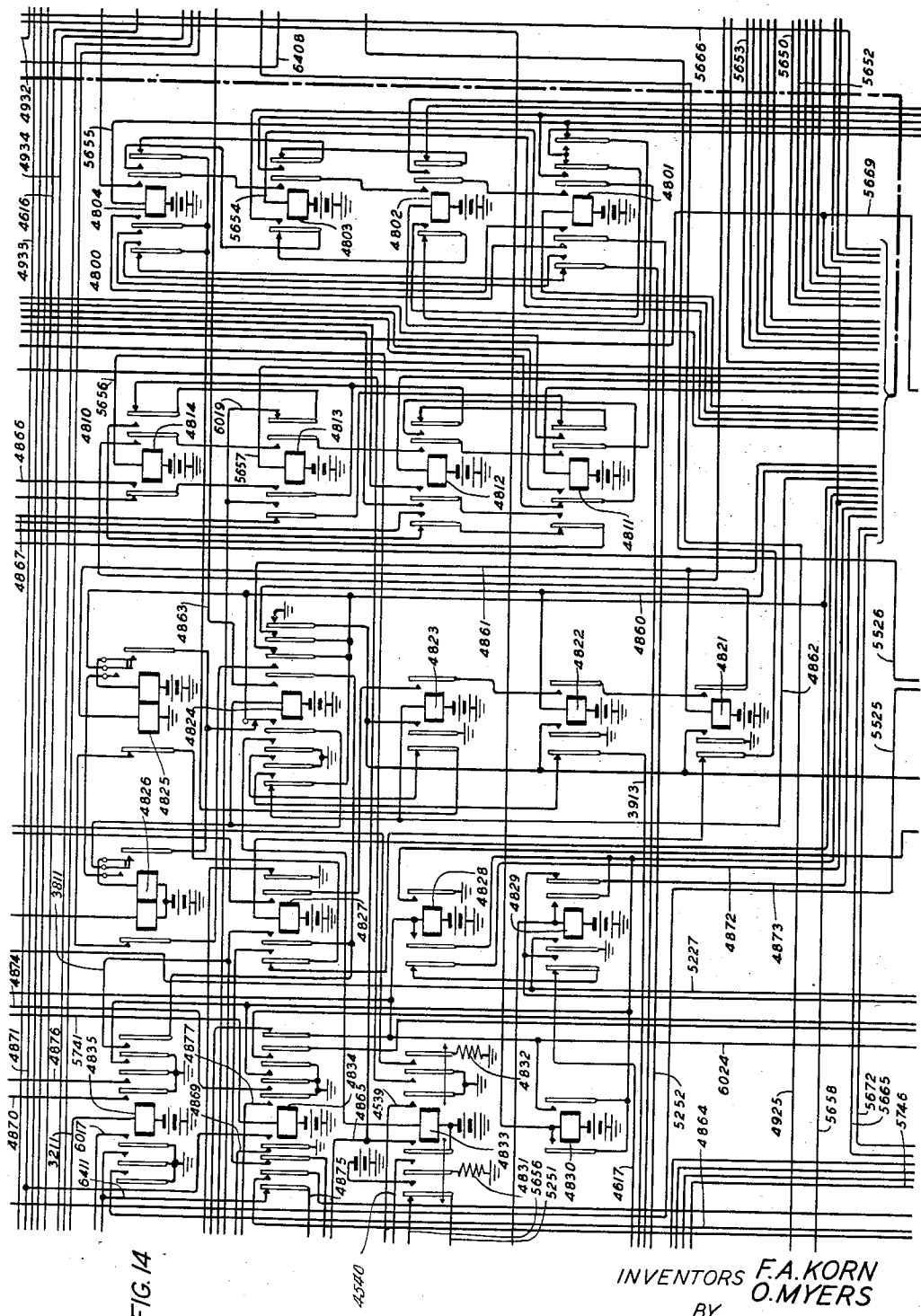


FIG. 14

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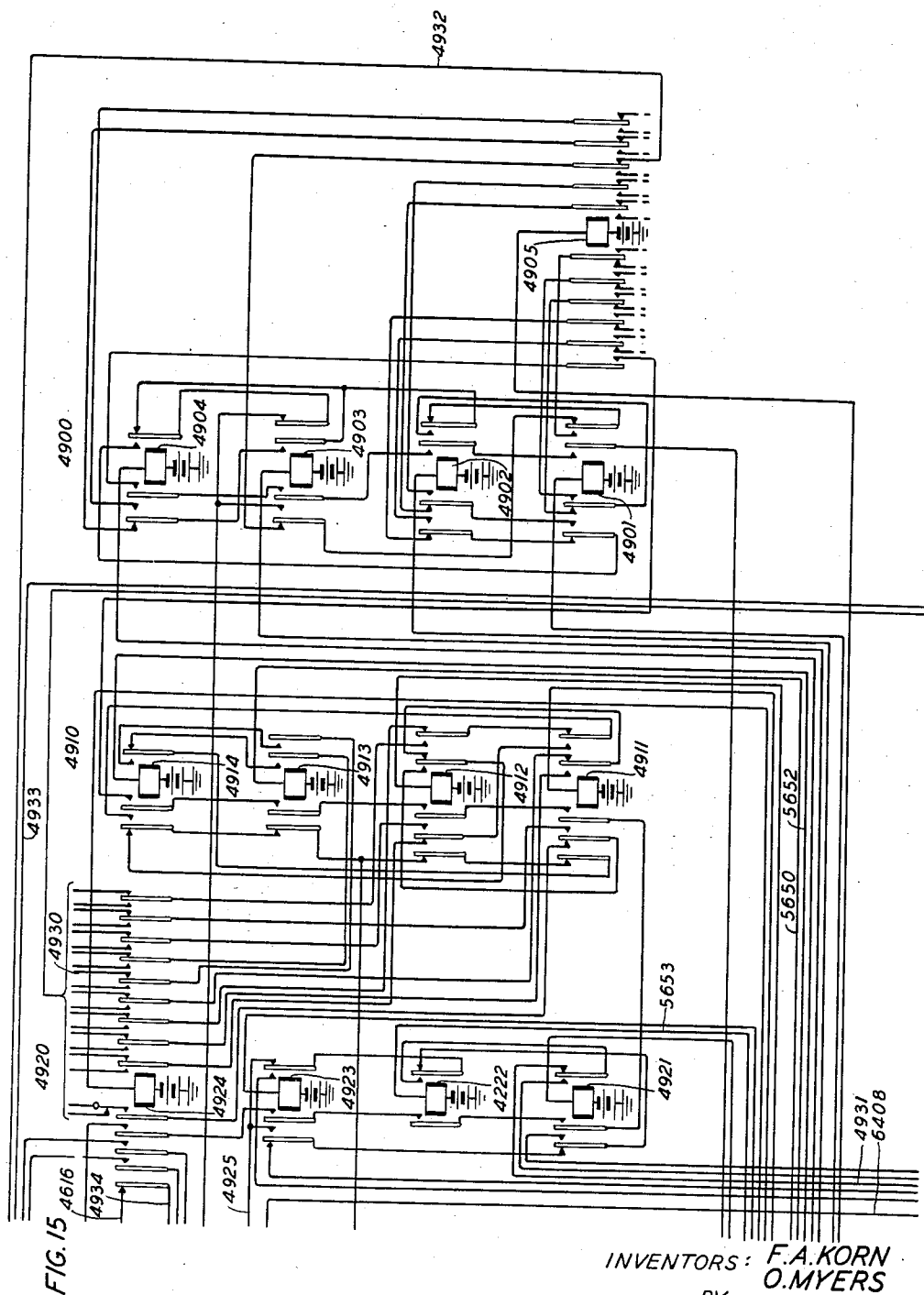
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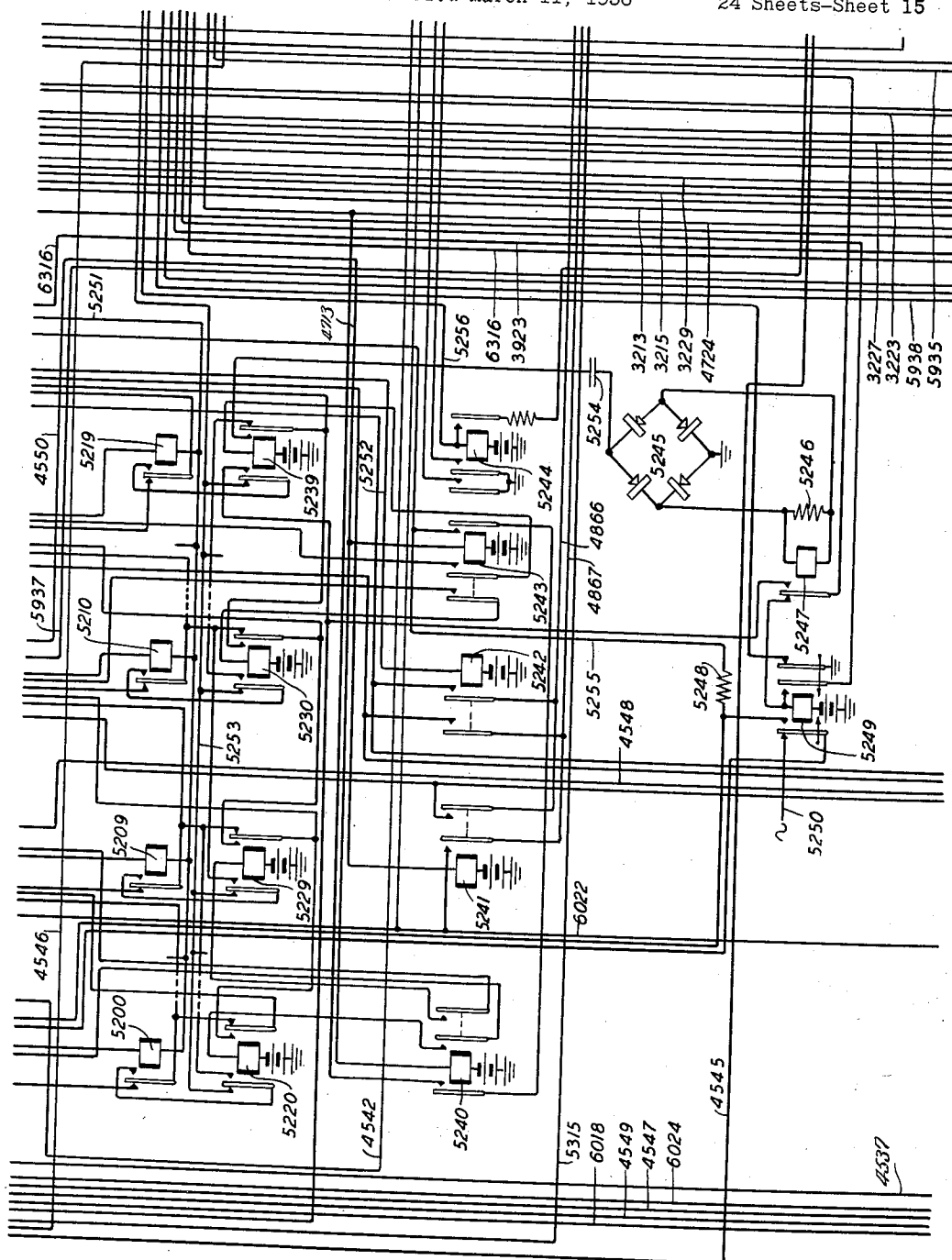
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**FIG. 16**

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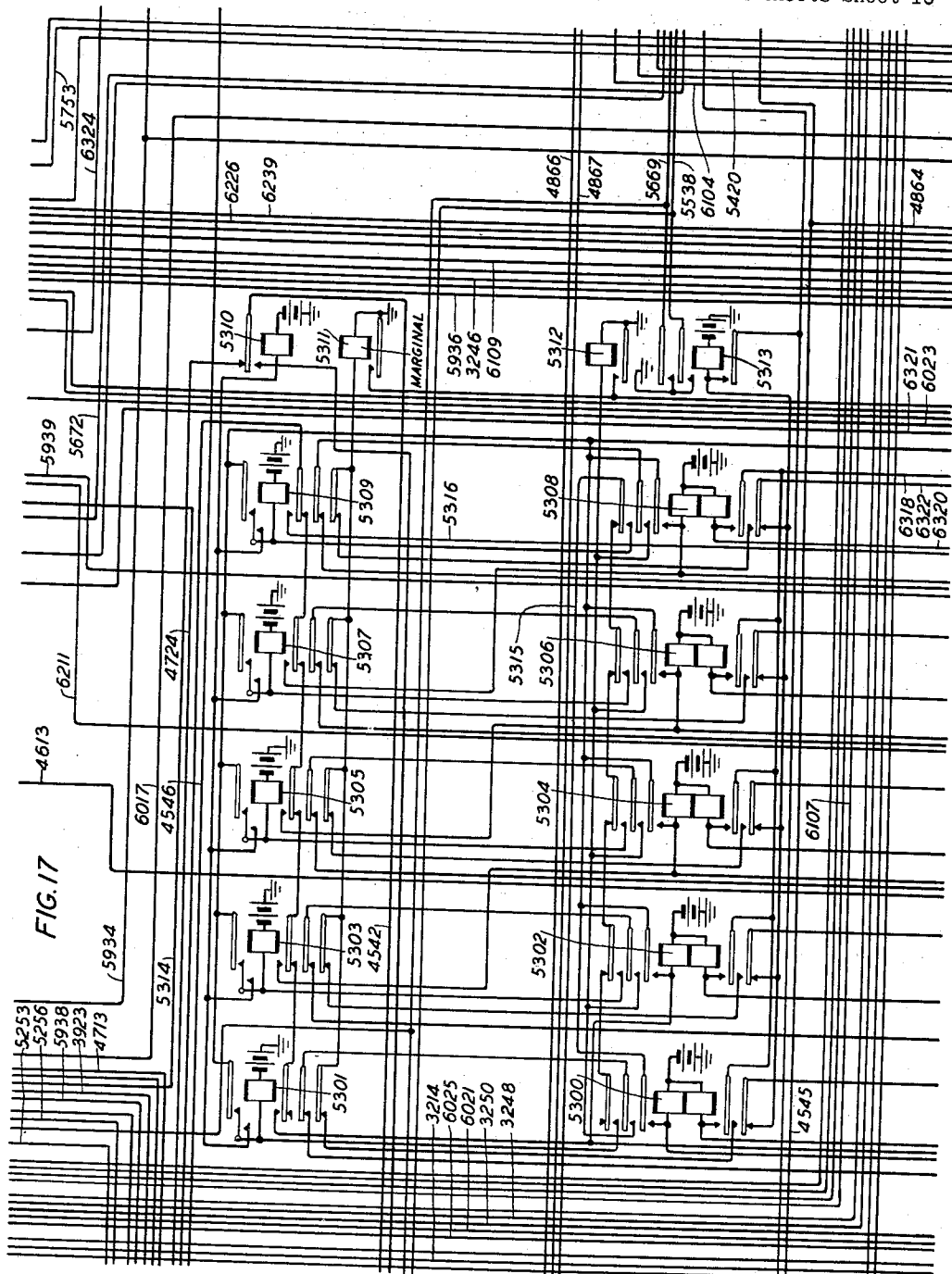
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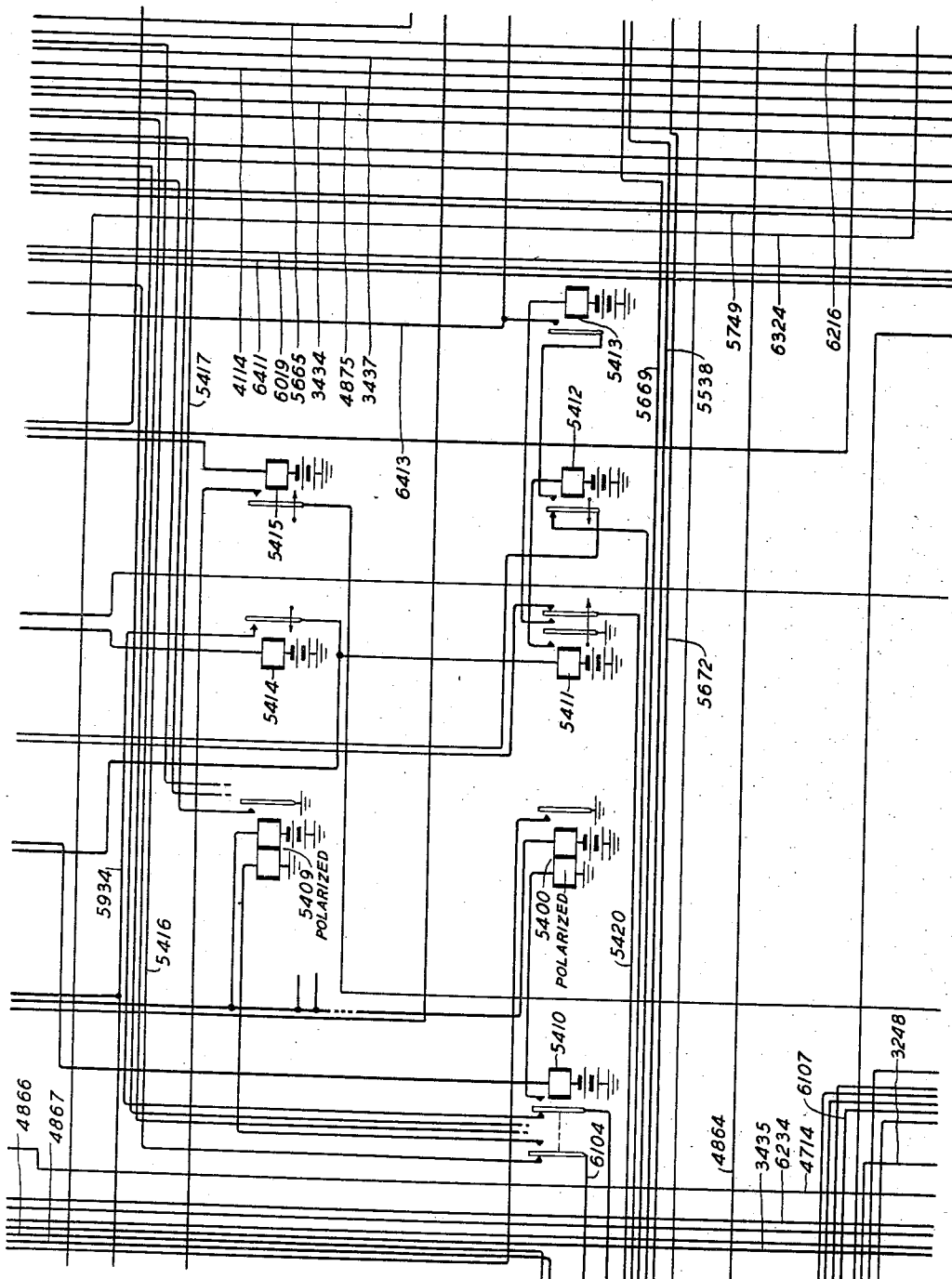
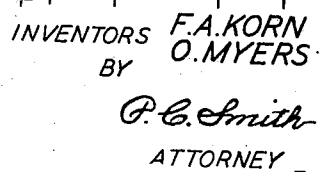


FIG. 18

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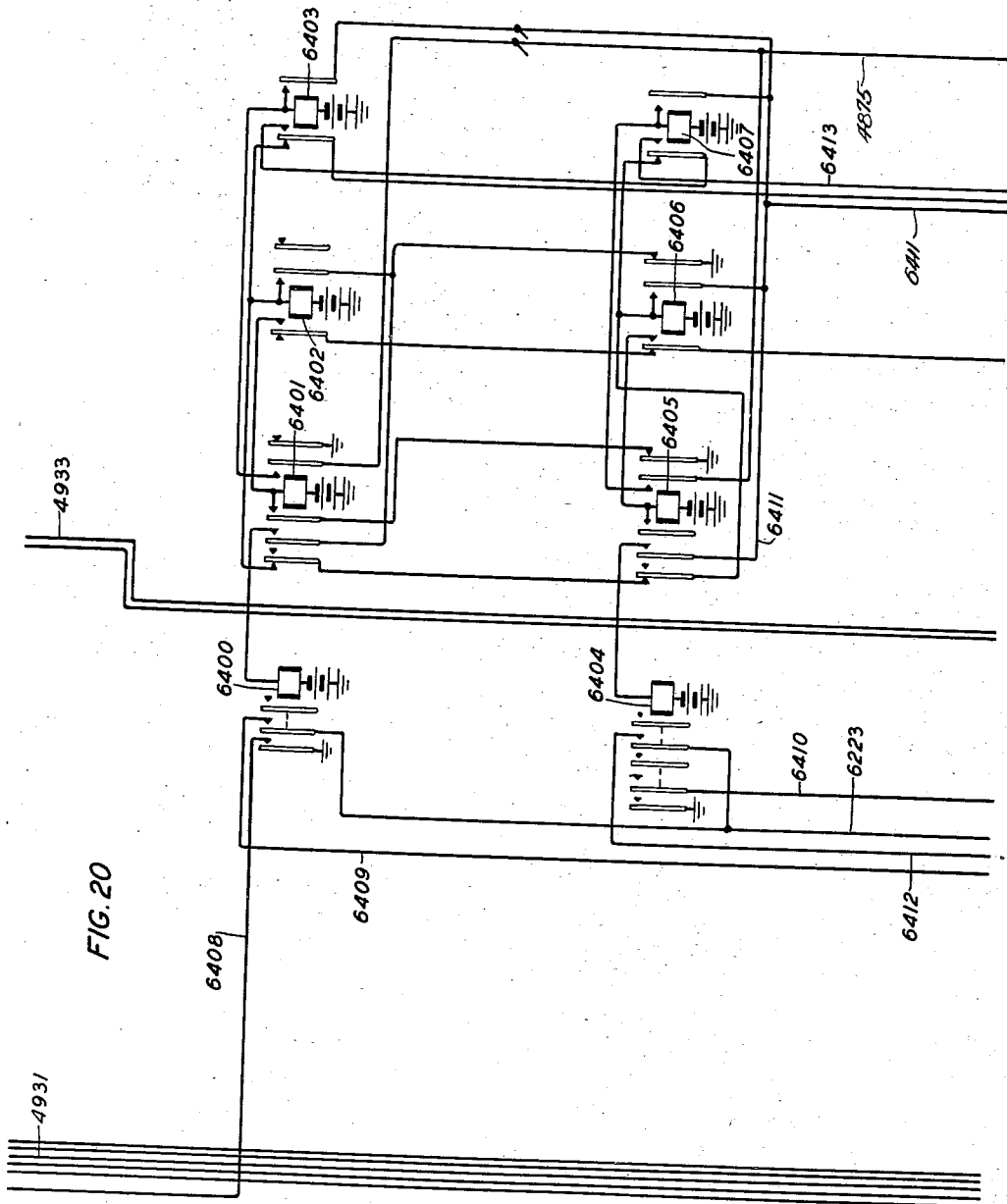
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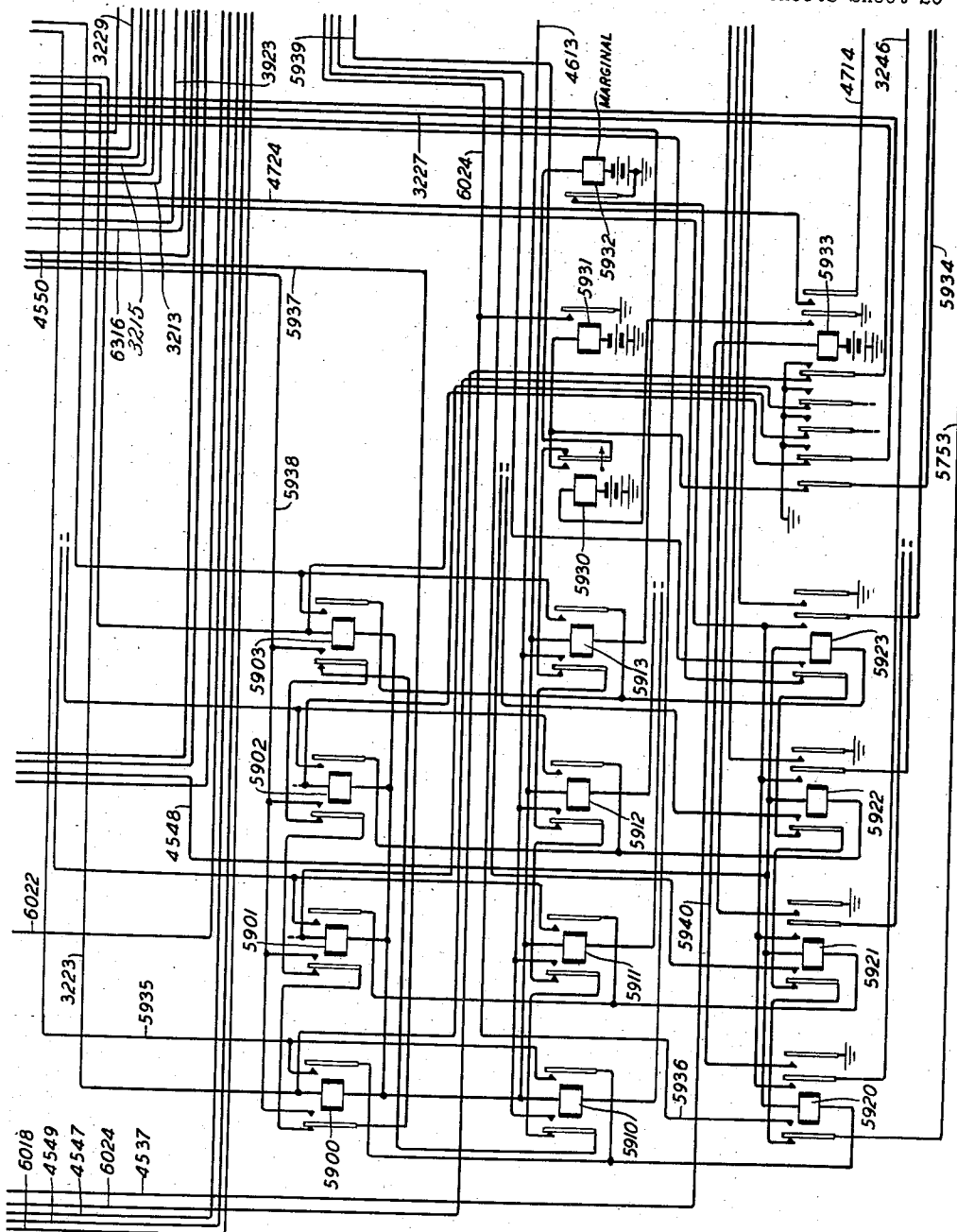


FIG. 21

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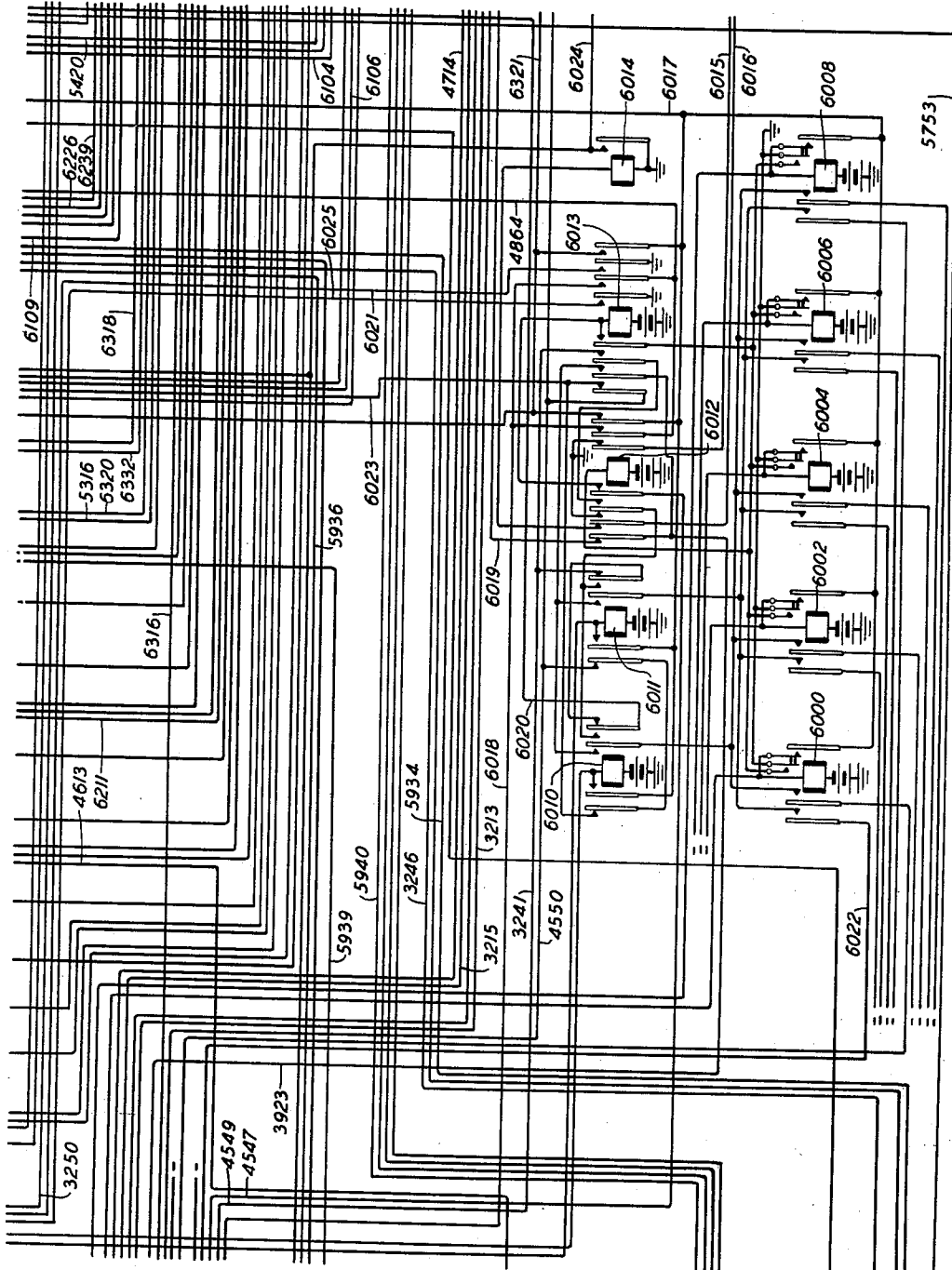


FIG. 22

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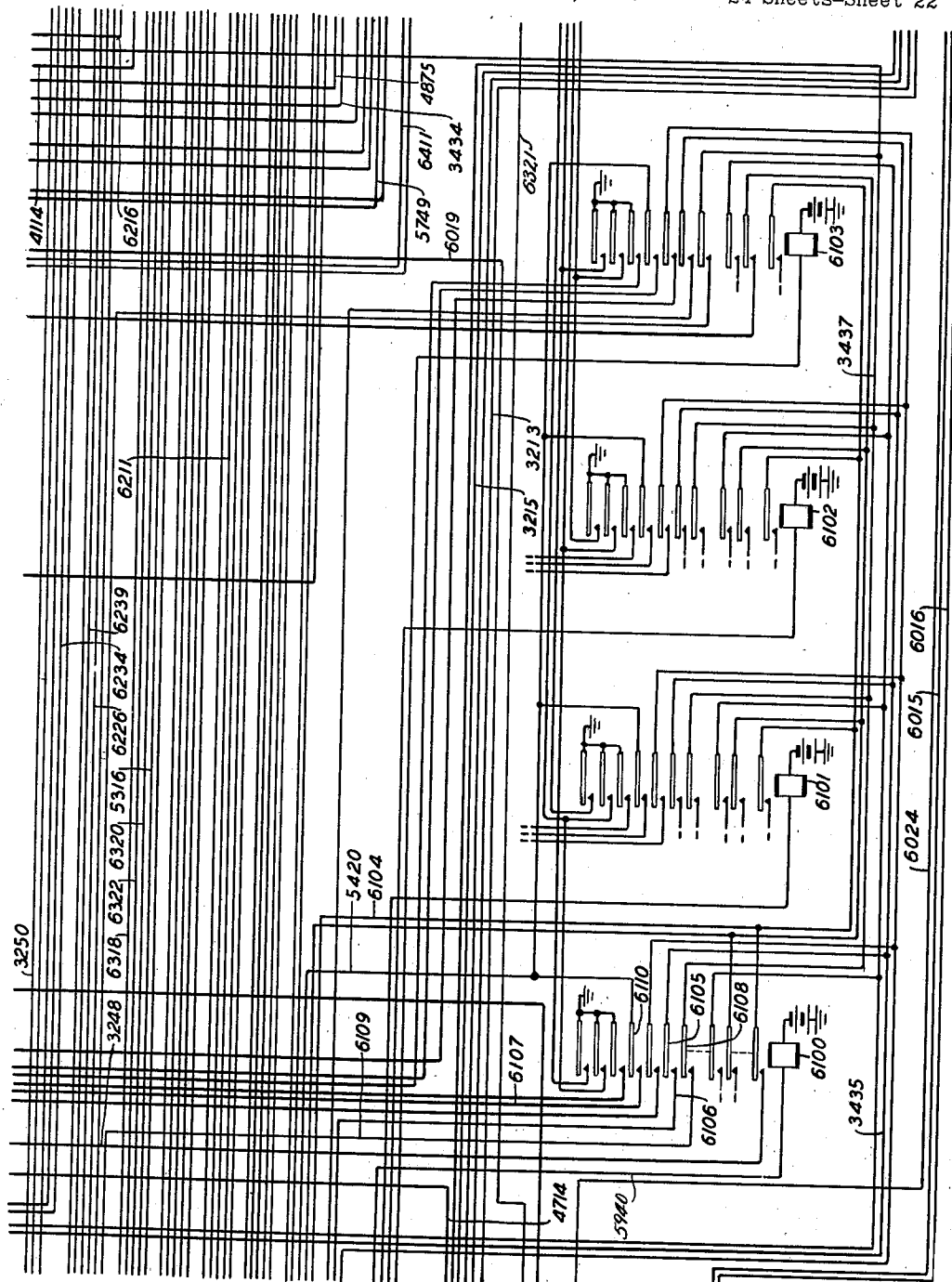


FIG. 23

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**March 30, 1937.**

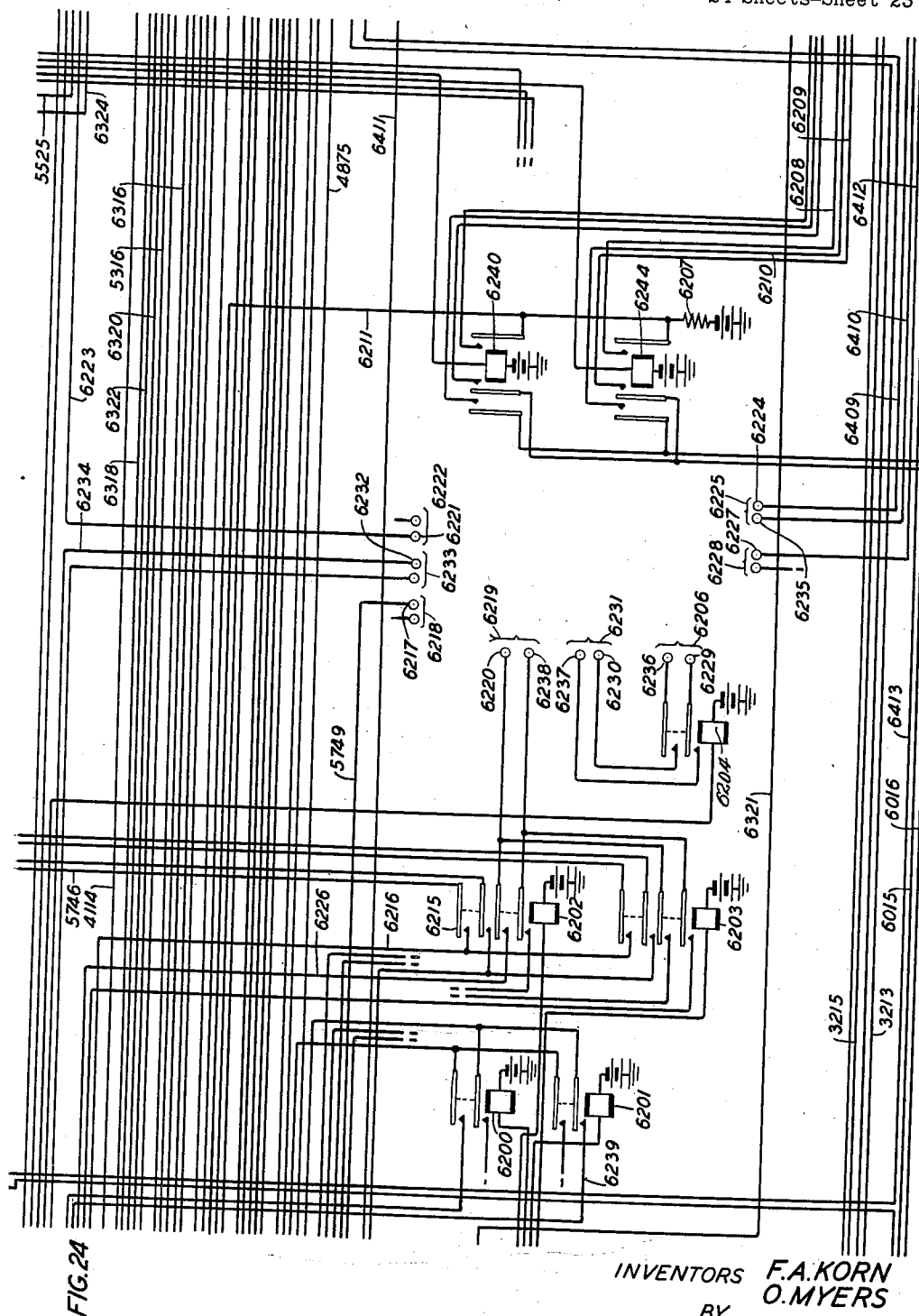
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**March 30, 1937.**

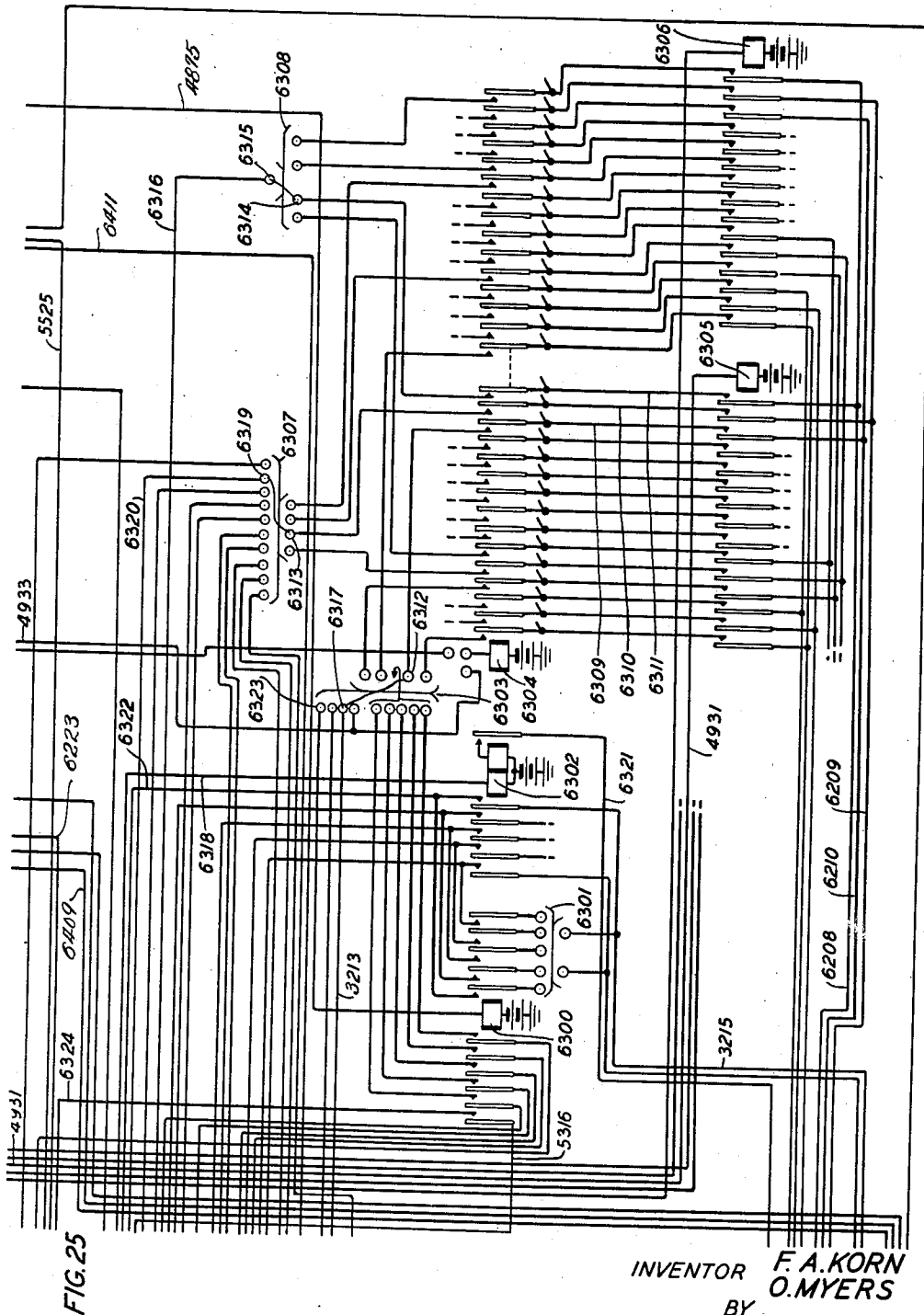
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## UNITED STATES PATENT OFFICE

2,075,527

## TELEPHONE SYSTEM

Franklin A. Korn, Elizabeth, N. J., and Oscar Myers, Brooklyn, N. Y., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application March 11, 1936, Serial No. 68,257

12 Claims. (Cl. 179—175.2)

This invention relates to telephone systems and has for its object to facilitate the completion of no-test connections.

More specifically the invention relates to a telephone system employing cross-bar type switches controlled by markers which test both the line and the links having access thereto and normally direct the completion of the connection only when an idle line and a set of idle links are simultaneously available. In accordance with the present invention, when a connection is desired with a line irrespective of its busy or idle condition, for example for testing purposes, the seizure of the marker over a no-test trunk permits the completion of the connection over the regular equipment if the line tests idle and over special equipment if the line tests busy. The line test is delayed until the marker has connected with the group of lines containing the wanted line and has prepared its switching control connection with the no-test trunk. If the line is busy the locked condition of the hold magnet prevents the operation of any others of the line terminals and therefore the marker connects an identifying potential to the sleeve of the line junctor over the sleeve of the line, tests for this potential with a group of polarized relays and connects with the wanted line by establishing a second connection with the identified line junctor.

These no-test control circuits form a part of the disclosure of the application of W. W. Carpenter, Serial No. 68,262, filed March 11, 1936, to which reference is hereby made for such details of operation as may be omitted from the following description.

The invention will be more clearly understood from a consideration of the following specification in connection with the drawings, in which

Fig. 1 shows the arrangement of Figs. 3 to 25, inclusive;

Fig. 2 shows the schematic arrangement of the circuits necessary for carrying out the invention;

Fig. 3 shows an incoming junctor particularly adapted for use in making no-test connections;

Fig. 4 shows the no-test junctor connector;

Fig. 7 shows the subscriber's line and part of the equipment employed in reaching the line; and

Figs. 5, 6, and 8 to 25, inclusive, show the terminating marker which controls the establishment of the connection.

Figs. 5, 6 and 8 to 25, mentioned above, as showing the terminating marker are substantially copies of a portion of the drawing of the above-identified Carpenter application and correspond

respectively to Figs. 33, 34, 39 to 41, 45 to 49, 52 to 55 and 59 to 64 of that drawing. For convenience in consulting the above application the same reference characters have been used.

Referring to Fig. 2, no-test connections are chiefly made by the test desk to obtain connection with the line for test or repair, or by an "A" operator, in order to verify a busy condition. When the test man seizes a no-test trunk terminating in an incoming junctor or an "A" operator seizes a verification trunk, also terminating in an incoming junctor, the seizure of the junctor signals the terminating link which establishes a connection between the incoming junctor and a "B" operator's sender. The "B" operator's sender hunts for an idle "B" operator's position and signals the "B" operator. The test man or "A" operator then asks the "B" operator for the wanted line and the operator records the line number in the sender. The sender then operates the marker connector, and transmits to the marker connector a signal which it receives from the incoming junctor indicating that a special connection is desired. The marker connector, therefore, seizes a special marker and the registration is transferred. When the registration has been translated, the marker by means of the line choice connector connects with the group of lines in which the wanted line is located and then by means of an incoming connector closes a second path to the incoming junctor. Over this path the incoming junctor transmits a signal to the marker that a no-test connection is desired. The marker tests the line and if the line is idle establishes the connection in the usual manner. If the line is busy the no-test junctor connector is used to connect the incoming junctor with the line link with which the wanted line is connected. The no-test connection is held under the control of either the incoming junctor or the wanted line, the connection being released whenever either end disconnects.

Referring now to the detail circuits, when the test man wishes a connection with a line for test purposes he inserts the plug of his test cord in the jack 300 of a trunk terminating in a no-test incoming junctor. High resistance battery from the cord is connected to the sleeve of the jack, and battery and ground are connected to the tip and ring terminals of the jack. A circuit is therefore closed over the back contacts of relay 301 and through the winding of relay 302 operating relay 302. Relay 302 operates relay 314 which extends the high resistance battery connected to the sleeve of the jack 300 over its left front contact to the

winding of relay 313 and ground. However, relay 313 is marginal and does not operate at this time. Relay 314 connects ground over its right contact and the left back contact of relay 312 to conductor 323 as a start signal to the terminating sender link and control circuit 322. This circuit seizes an idle "B" sender 420 which in turn connects with an idle "B" operator's position 421, whereupon ground is connected by the sender to conductor 324 operating relay 312 which opens the start circuit of the terminating link 322 and locks over its inner left front contact to ground at the right contact of relay 314. Relay 312 grounds conductors 325 and 327 directly, connects ground over the inner right normal contact of relay 317 to conductor 326, closes a holding circuit for relay 314 and closes a substitute connection between the sleeve of the jack 300 and the winding of relay 313. The locking ground from relay 312 extends back to the sender 420 where a circuit is prepared for recognizing a premature disconnection indicated by the removal of this ground.

The tip and ring contacts of the jack 300, and thereby of the cord inserted therein, are connected over the back contacts of relay 301 and the outer back contacts of relay 303 to conductors 328 and 329 which are extended through the link 322 and the sender 420 to position circuit 421 where they are connected to the "B" operator's telephone circuit.

Following the transmission of the usual "zip" tones, the test man may verbally request connection with the desired line and the "B" operator sets up the number on her numerical keys, the record of each digit as written being transmitted immediately to the sender. The operation of the "B" position and the "B" sender is described in the application of F. A. Korn, Serial No. 68,256, filed March 11, 1936.

Prior to the operation of relay 312, ground over its right back contact is connected to conductor 330 as an indication that a special marker will be required. This ground is passed through the terminating link 322 to the "B" sender where a relay is operated to transfer the information to the marker connector 422. The marker connector responds to this signal by selecting a special marker, for example, the one shown in the larger part of the drawings and, when that connection has been established, the ground is passed on to conductor 5672 which is connected over the left back contacts of relays 3901 and 3902, conductor 3922 to the winding of relay 4706 and battery. Relay 4706 immediately opens the line selecting circuit to delay the action of the marker until the precise type of the special call has been determined.

At the same time, the registration set up in the sender is transmitted to the marker and the registration leads are tested. The registration leads representing the required designation are grounded directly by the sender. Ground from the marker connector is extended over conductor 5658, the inner and middle right back contacts of relay 4824, to conductors 4861 and 4860, and over the outer left back contact of relay 4824 to conductor 4862. These conductors extend through the marker connector to the sender where they are further extended over contacts of the sender registers to the unused register conductors and thence to the marker, thereby operating all the register relays together with relays 4827 and 4100. Relays 4821, 4822 and 4823 operate directly over conductors 4861, 4860 and 4862. If all of these relays operate, a circuit is closed from ground

through the left winding of relay 4825, inner right front contacts of relays 4901 and 4902, inner left front contacts of relays 4903 and 4904, outer left front contact of relay 4905, inner left front contacts of relays 4914, 4913, 4912, 4911, 4921, 4922 and 4923, second left contact of relay 4924, inner right front contacts of relays 4804, 4803, 4802, 4801, 4811, 4812, 4813, 4814, 4821, 4822, 4823 and 4827, middle upper front contact of relay 4100, left winding of relay 4826 and battery.

Relays 4826 and 4825 both operate in this circuit, relay 4826 locking over its outer right contact and the left normal contact of relay 4824 to grounded conductor 5658. Relay 4825 also locks over its outer right contact and the left normal contact of relay 4824 to grounded conductor 5658. With relays 4826 and 4825 both operated, a circuit is closed from battery, through the winding of relay 4824, inner right contacts of relays 4826 and 4825, to grounded conductor 5658. Relay 4824 operates, locking over its inner left alternate contact to conductor 5658. The make-before-break character of the inner left contacts of relay 4824 holds relays 4825 and 4826 until the locking circuit of relay 4824 is fully established, after which these relays release. Relay 4824, at its second left front contact operates relay 4833, which prepares the circuits of polarized relays 4534 and 4106.

The operation of relay 4824 disconnects ground from conductors 4860, 4861 and 4862, thereby releasing those register relays operated thereover as well as relays 4821, 4822, 4823, 4827 and 4100. Assuming that the wanted number is 9299, and the calling junctor is located on frame No. 0, relays 4913, 4914, 4922, 4803, 4804, 4813 and 4814 will remain operated.

With relay 4824 operated and relays 4825 and 4826 released, a circuit is closed from grounded conductor 5658 over the outer right front contact of relay 4824, left back contacts of relays 4826 and 4825, left back contact of relay 4827, left back contact of relay 4821, to the contacts of the thousands register 4910. Ground is supplied to the contacts of the hundreds register 4920 over conductor 4925, normal contacts of relays 3904, 3903, 3902 and 3901, conductor 3913, back contact of relay 4822, outer left front contact of relay 4824 and grounded conductor 5658. Ground is also supplied to the contacts of the tens register 4800 from the third left contact of relay 4824 and the back contact of relay 4823.

The lines of an office are arranged in large groups, called for convenience "choices", each choice including four frames on which are mounted ten horizontal groups of switches or levels which may contain from one to seven individual switches each serving ten lines. For selection as called lines, for the purpose of testing their busy or idle condition, the subscribers' lines are arranged in numerical groups of twenty which, being consecutive, all appear within the same hundred group and within a given choice, but which may be moved from choice to choice as desired. In an office of the usual size of 10,000 lines, there will be 500 such groups of lines.

The marker is connected to the lines through a line choice connector, one for each of the line choices. In each choice connector there are a number of hundreds relays, one for each hundred lines in the choice and a number of group relays, one for each group of twenty lines.

A group of twenty lines is identified from the line designation by a translation of the thousands, hundreds and tens digits. These digits as recorded

ed in the marker combine to mark 500 sets of cross-connecting points, a few of which are shown in Fig. 25, by operating one of twenty "five-hundred's" relays such as relay 6304, one of five "hundred's" relays such as relays 6305 and 6306 and one of five "twenty's" relays such as relays 6240 and 6244. These relays with their associated cross-connecting racks form what is known as a "translator". Since thousands register relays 4913 and 4914 were operated and hundreds register relay 4924 was not operated, the ground extended to the thousands register by the operation of relay 4824 extends over the outer left back contacts of relays 4912 and 4911, right front contact of relay 4914, outer right front contact of relay 4913, fifth right back contact of relay 4924 to conductor 4930 which is cross-connected to the winding of relay 6304. Each of the conductors embraced by the bracket including conductor 4930 extends to a separate relay like relay 6304.

The ground supplied to the hundreds register extends over the right back contact of relay 4923, right front contact of relay 4922, right back contact of relay 4921, conductor 4931 to the winding of relay 6305. Ground supplied to the tens register extends over the inner left front contact of relay 4804, inner left back contact of relay 4801, conductor 5252, winding of relay 5242 and battery to indicate that the wanted number lies in an odd ten. This ground also extends over the right front contact of relay 4804, left front contact of relay 4803 to the winding of relay 6244 and battery. The joint operation of relays 6244, 6305 and 6304 identifies the group of twenty lines lying between 9289 and 9299.

With relay 6244 operated, three circuits are prepared, one from battery through resistance 6207 over the right contact of relay 6244, to conductor 6208, a second from ground over the inner right contact of relay 6012, conductor 6015, inner left contact of relay 6244 to conductor 6209 and a third from ground through the winding of relay 6014, middle left back contact of relay 6012, conductor 6016, outer left contact of relay 6244 to conductor 6210. These three conductors are connected in multiple to the armatures of the five "hundreds" relays 6305, 6306, etc., and, since relay 6305 is operated, are extended to conductors 6311, 6310 and 6309, respectively. Conductors 6309, 6310 and 6311 are connected in multiple to armatures of the twenty "five-hundreds" relays 6304, etc. Since relay 6304 is operated, these conductors are extended to cross-connecting racks 6303, 6307 and 6308, respectively, thereby connecting battery to cross-connecting point 6314, ground through relay 6014 to point 6312 and direct ground to point 6313.

These cross-connecting racks are wired in accordance with the location of the lines in the frames and the location of any group of twenty line numbers may be altered by altering the connections at this point.

Each line choice connector has a start lead for each marker and these leads are brought into each marker at cross-connecting rack 6308. Each group of twenty consecutive numbers is a unit and will be referred to hereafter as a twenty-block. Each twenty-block has its own cross-connecting terminal in rack 6308 for the location and seizure of the line choice.

Assuming that terminal 6314 is cross-connected to terminal 6315 and thereover to the start conductor 6316 of the line choice connector 705, a preference circuit is completed for this marker in the line choice 705, and when the line choice

is available, a set of multi-contact relays is operated to connect the marker with the choice.

The operation of these multi-contact relays connects ground to conductor 3211 and the winding of relay 4835 as a signal to the marker that the connector has operated to connect it with the choice. Relay 4835 closes a circuit from battery through the winding of relay 4113, right back contact of relay 4009, resistance 4012, conductor 4870 to ground at the inner right contact of relay 4835. At its outer left contact, relay 4835 grounds conductor 4864, completing a circuit over the middle right contact of relay 6012, conductor 6018, over normal contacts of relays 4531 and 4500 to 4519 to conductor 4537 which extends directly to the winding of relay 5933 and over the back contacts of relays 4701 and 4700 to conductor 4713 and the windings of relays 5240 and 5243.

Relay 4835 also extends battery connected to conductor 3811 by connector 705 over its outer right contact, inner right contact of relay 4824, conductor 4863 to the frame register 4900, and, since none of the frame relays were operated, over the right back contacts of relays 4903, 4904, 4902 and 4901, left back contact of relay 4903, third right back contact of relay 4905, to conductor 4932 and to the incoming link and connector circuit 321. When the incoming connector operates, it connects ground to conductor 5471, winding of relay 4834 and battery to tell the marker that it has been connected with the calling frame. Relay 4834 closes a circuit from battery through the winding of relay 4608, conductor 4716, over the left back contact of relay 4712 and the right back contact of relay 4711, conductor 3924, inner right back contact of relay 3909, inner left back contact of relay 3908, conductor 4877 to ground at the inner right front contact of relay 4834. A parallel branch of this circuit extends from conductor 4716, over the left back contacts of relays 4604 and 4609 to conductor 4877. Relay 4834 also closes a circuit from ground at its second right front contact, conductor 4874, front contact of relay 4113, conductor 5568 through the marker connector 422, sender 420 and terminating link 322 to conductor 330, outer right front contact of relay 312, winding of relay 311 and battery. Relay 311 operates the select magnet 401 in the no-test junctor connector of Fig. 4, as well as corresponding select magnets in other junctor connectors and incoming connectors. It also closes a circuit for relay 317. Relay 317 operates relays in the incoming connector which complete the connection between the marker and the incoming junctor. The operation of these incoming connector relays connects ground from the inner left contact of relay 311, conductor 331, through the incoming connector 321 to conductor 4720, outer left front contact of relay 4706, winding of no-test relay 4701 and battery. Relay 4701 at its third left contact connects ground to the right windings of relays 5400 to 5409 to electrically polarize them in case the no-test link is required and at its inner left front contact closes a shunt around the left back contact of relay 4706, thereby reclosing the line selecting circuit. Relay 4701 also opens the circuit of relays 5240 and 5243, disabling the terminal hunting operation.

When the line choice connector has operated, it completes a circuit from ground through the winding of relay 6014 which is connected as previously described to terminal 6312 of cross-connecting rack 6303 and, assuming a cross-connec-

tion to terminal 6317, over conductor 3213 to the winding of the associated hundred-block relay. This relay represents the group of terminals within which the called line is located and prepares the circuits for five twenty-block relays.

The connection of ground to terminal 6313 in cross-connecting rack 6307 serves to operate one of the relays 5300, 5302, 5304, 5306 or 5308. Assuming that terminals 6313 is connected to terminal 6319, a circuit is closed over conductor 6320 to the lower winding of relay 5308 and battery. Relay 5308 extends its operating ground over its inner lower front contact, conductor 6318 to battery through the left winding of relay 6302. Relay 6302 locks through its right winding and right contact, conductor 6321, outer right back contact of relay 6012, conductor 6017 to ground at the inner left contact of relay 4835.

With relay 6302 operated, the circuits of the five twenty-block relays prepared by the hundred block relay are extended over the left armatures of relay 6302 to the outer lower armatures of relays 5300, 5302, 5304, 5306 and 5308. Since relay 5308 is operated, a circuit is closed from ground through the winding of relay 5311, outer lower back contact of relay 5309, outer lower front contact of relay 5308, conductor 6322, inner left contact of relay 6302, and conductor 3215 to the winding of the desired twenty-block relay. The twenty-block relay, in operating, connects ground over conductor 3267 through the left winding of relay 4535 to battery as a signal to the marker that a block of twenty lines has been selected. Relay 4535 extends its operating ground to the winding of relay 4536 which also operates.

The twenty-block relays also close two cross-connecting points for each of the twenty line circuits. One set of twenty contacts or sleeve contacts are cross-connected to the hold magnets and sleeve terminals of the lines. The other set of twenty contacts or number control contacts are cross-connected to the windings of level relays, which transmit to the marker the location and class of the called line. The relays belonging to one line group have their windings multiplied together and connected to a relay in group 5900 to 5903, to a relay 5910 to 5913 or temporarily to ground according to the class of the called line. The relays of the No. 0 line group lead to relays 5900 and 5910; the relays of the No. 1 line group to relays 5901 and 5911, etc.

Assuming that the wanted number refers to the line shown in Fig. 7 which is an individual line, the operation of the twenty-block relay connects the sleeve terminals of the twenty lines belonging thereto to the windings of twenty test relays 5200 and 5219. The test circuit for line 700, for example, extends from the winding of hold magnet 726 and the sleeve contacts of the cross-points of vertical row 711 in primary line switch 710, over conductor 720, through the line group control circuit 721 and the line choice connector 705 to conductor 3219, inner right back contact of relay 4519, inner left back contact of relay 4525, winding of relay 5219, conductor 5251, outer left front contact of relay 4833, to battery. Similarly, the sleeve contacts of other lines are connected to the windings of relays 5200—5209, 5210, etc. If any of these twenty lines is busy, ground on the sleeve conductor will operate the corresponding test relay.

When relay 4833 operated, as above mentioned, circuits were prepared for polarized relay 4534

from battery over the inner left front contact of relay 4833, conductor 4865 to both windings of relay 4534, extending through the lower winding and resistance 4533, over conductor 4539 to ground at the inner right front contact of relay 4833. A second circuit extends through the upper winding of relay 4534 to ground at the back contact of relay 4535. In parallel to this last ground a circuit extends through condenser 4538, conductor 4540 to ground over the middle left contact of relay 4833 and resistance 4831. The upper winding of relay 4534 holds the relay contact in the position shown, overcoming the effect of the lower winding. Ground on both sides of condenser 4538 holds it discharged.

When the twenty-block relay serving the wanted line has been operated, in turn operating relay 4535, as above described, relay 4535 opens the circuit through the upper winding of relay 4534 allowing the lower winding to become operative and close the right contact of the relay. However, current flows in the circuit through condenser 4538 until that condenser is charged, thus continuing the opposition to the lower winding for a definite time and delaying the closure of the right relay contact. The purpose of this delay is to allow sufficient time for all of the relays of group 5200 to 5219 which have been connected to busy lines to operate fully.

When relay 4534 closes its right contact, it extends ground over that contact, normal contacts of relays 4530 and 4531, conductor 4541, inner left front contact of relay 4701, conductor 4714, outer right front contact of relay 5933, conductor 4724, second left front contact of relay 4701, conductor 5255, resistance 5248, left back contact of relay 4526, conductor 4542, back contact of relay 5310, conductor 5314, left back contact of relay 3900, conductor 3923, outer left back contact of relay 6012, conductor 6019, outer left front contact of relay 4813, right back contacts of relays 4811 and 4812, inner left front contact of relay 4813, left front contact of relay 4814, conductor 4866, inner left front contact of relay 5242, right back contact of relay 4529, to the left armature of relay 5219 connected to the wanted line.

If relay 5219 were operated, during a normal call, the circuit above traced would extend over the front contact of that relay, left back contact of relay 5239, conductor 5253, left back contact of relay 4701, conductor 5934, to the winding of busy back relay 3908 and battery. Relay 3908 functions to return a busy back signal to the calling subscriber. In the case of a call from a no-test junctor, with relay 4701 operated, the circuit would extend over the front contact of relay 5219, left back contact of relay 5239, conductor 5253, outer left front contact of relay 4701, to the winding of relay 4703 and battery. The function of relay 4703 will be described hereinafter.

Assuming that the wanted line is idle and relay 5219 is not operated, the circuit extends over the back contact of relay 5219, to the winding of relay 4519 and battery. Relay 4519 locks over its inner left front contact and the right back contact of relay 4531 to grounded conductor 6018. It also disconnects this ground from the winding of relay 5933, releasing this relay, which in turn opens the operating circuit for relay 4519.

Relay 4519 disconnects relay 5239 from the number control contact of the selected line on the twenty-block relay, and connects ground to that contact. Since it was assumed that line 700 was an individual line, that contact is connected to the corresponding winding of the proper level

relay and thence to conductor 3223, winding of relay 5900, winding of relay 5932 and battery. Relay 5900 prepares for the test and seizure of the proper switches and links for connecting the line with the incoming junctor. The level relay also operates in this circuit.

Before proceeding with the description of the establishment of the connection, the test of other types of lines will be mentioned. If the called number referred to the tip party on a party line, the number control terminal on the twenty-block relay would have been connected to a different winding of the level relay and, therefore, to the winding of relay 5910. Relays 5900 and 5910 differ only in their control of ringing.

If the called number had indicated an intermediate line in a terminal hunting group, the number control terminal belonging thereto would have been connected at one side over the back contact of relay 4519 to the winding of relay 5239 and at the other side through a third winding of the level relay to ground over the front contacts of relay 5933. Since relays 5240 and 5243 were not operated this circuit would be incomplete, relay 5239 unoperated and no terminal hunting performed. When relay 4519 operates and relay 5933 releases, ground is substituted for relay 5239 and battery through the winding of relay 5900 for ground, relay 5900 operating to give the location and class of the line.

#### *Connection to idle line*

Returning to the establishment of the original call the operation of relay 5900 indicates the frame on which the wanted line is located and connects relay 5920 through the line choice connector to the line group control circuit. When the control circuit is free it is seized for use with this call and relay 5920 operates, as well as a relay in the line choice connector, indicating that the line group control circuit is ready. These relays in combination with the level relay prepare the operating circuits of the primary and secondary select magnets of the line link group serving line 700 as well as the test circuits for the line links. Relay 5920 also closes a circuit from ground at its outer right contact, conductor 5940, winding of multi-contact relay 6100 and battery. This relay prepares ten circuits for testing the ten line links of the horizontal group and ten circuits for operating the ten corresponding select magnets of the primary line switch. These circuits extend in multiple to the line group and control circuit where the operation of the horizontal group relay extends them to a particular level.

In addition relays 6100 to 6103 operate one of the relays 6200 and 6201 to indicate whether the frame is an odd or an even frame and one of the relays 6202 and 6203 to indicate whether it is a left or right frame. Relay 6100 operates relays 6201 and 6202 to further identify the line frame. Relay 6201 prepares the operating circuits for ten hold magnets of the secondary line switches serving the wanted line, while relay 6202 prepares the circuits for testing ten incoming links and for operating a line junctor relay in the line choice connector circuit, which in turn closes circuits for testing ten line junctors and further extends the circuits for operating the secondary line switch hold magnets.

Relay 317 in the incoming junctor, operates the select magnet individual to the junctor in the primary incoming selector and causes the operation of the select magnets of the ten secondary

incoming selectors corresponding to the ten incoming links serving the junctor. These selectors and links are included in the incoming link and connector 321. The line group and control circuit operate the ten select magnets of the secondary line switches for the ten line junctors which serve the wanted line.

As set forth in the above-mentioned Carpenter application ten line links serve any one line and twenty incoming links serve any one incoming junctor but only ten may be used in reaching a particular line frame. Two hundred line junctors interconnect the secondary line switches and the secondary incoming switches. Different numbers of line junctors are available according to the number of line choices in incoming frames. Where more than ten line junctors interconnect the same line and incoming frame they are divided into groups.

A channel connecting a line with an incoming junctor includes in combination a particular line link, a line junctor and an incoming link. In order to determine whether an idle channel is available, the ten line links and ten incoming links are tested simultaneously with the line junctors which connect them and, if more than one group of line junctors may be used, the test may be repeated in combination with a second group of line junctors. The group of line junctors to be tested is selected by a line junctor relay in the line choice connector which is operated under the control of relays 6202 and 6203, which corresponds to the incoming switch frame, relay 6204, which is individual to the line choice and the relays of Fig. 20 which indicate whether the first, second or other group of line junctors is to be tested if more than one group is available.

Two relays are provided for testing each channel, one for testing the incoming link and line junctor and the other for testing the line link. These are relays 3410 to 3419 and 3420 to 3429, respectively. The test circuit for the line link 713 extends from the sleeve conductor of that link through the line group and control circuit 721 and the line choice connector to conductor 3248, innermost contact of relay 6100, conductor 6104, outermost left back contact of relay 5410, conductor 5416, inner lower back contact of relay 3409, winding of relay 3429 to battery. Nine similar circuits testing the other nine line links serving the wanted line are extended to the windings of relays 3420 to 3424, 3425, etc. If any of the links are busy, they will be grounded and the test relay will operate.

In preparation for the test for and selection of an idle channel, relay 4835 when operated, closes a circuit from ground at its second right contact over conductor 4876 to battery through the winding of relay 4101 which supplies the upper windings of relays 3410 to 3419 with battery. At the same time ground on conductor 4876 extends over the normal contacts of relays 3409 to 3400, through the winding of relay 4103 and battery.

In addition relay 4833 connects battery over conductor 4865 to the windings of relay 4106. The upper winding of relay 4106 is connected through resistance 4107 to ground at the middle right contact of relay 4833 and the lower winding to ground at the lower back contact of relay 4104 and through condenser 4105 to ground over the outer right contact of relay 4833 and resistance 4832. The lower winding tends to hold the contact of the relay open while the upper winding tends to close it.

The test circuit for the incoming link extends from the sleeve conductor of the link, through the incoming connector 321 to conductor 5746, armature 6215 of relay 6202, conductor 6216, 5 outer upper back contact of relay 3409, lower winding of relay 3419 and battery. In this case, the remaining nine incoming links, as determined by relay 6202, are tested by the lower windings of relays 3410, 3414, 3415, etc., and where a link 10 is marked busy by a grounded sleeve the corresponding relay operates.

Since the precise manner of connecting the group of line junctors for test has been set forth in detail in the above-identified Carpenter application, and since it forms no part of the present 15 invention, it will not be taken up in detail. Assuming a first test, relay 6400 will be operated as described in the Carpenter application, in turn operating the normal pattern relay 3300 over conductor 6408. The normal pattern relay 3300 connects the ten line junctors selected by the line junctor relay through to the ten channel test relays. The circuit for the first line junctor relay extends from ground in the incoming connector 25 321 over conductor 5749, terminal 6217 at cross-connecting rack 6218, cross-connected to terminal 6221 at rack 6222, conductor 6223, front contact of relay 6400, conductor 6409, terminal 6224 at rack 6225, cross-connected to terminal 6220 at 30 rack 6218, upper contact of the inner set of armatures of relay 6202, conductor 6226 to the line choice connector and the winding of the line junctor relay which connects the test leads and the operating circuits for the hold magnets of the 35 selected ten junctors to the armatures of relay 3300.

With the line junctor relay operated, one test circuit extends from the sleeve conductor of the line junctor, over the line junctor relay through 40 the line choice connector to conductor 3256, armature 3301 of normal junctor pattern relay 3300, conductor 3302, middle upper back contact of relay 3409, upper winding of relay 3419, conductor 3433, front contact of relay 4101 and bat- 45 tery.

A circuit has now been prepared for each of the relays 3420 to 3429 and two circuits for each of the relays 3410 to 3419. Relays 3410 and 3420 test 50 parts of the same channel comprising one line link, one incoming link and one line junctor connecting the two links. If any one of the elements of a channel is busy, the channel cannot be used.

When the line junctor relay operated, the marker closed a circuit for relay 4104, which indicates that the incoming trunk and connector 55 are connected with the marker, that the proper line group or frame, horizontal group and line junctor group have all been connected with and that the channel test circuits should be complete.

60 Relay 4106 is a timing relay similar to relay 4534. With relay 4104 released, condenser 4105 is shunted and the current in the lower winding of relay 4106 overcomes that in the upper winding. When relay 4104 operates, it opens the circuit 65 of the lower winding, but condenser 4105 charges through that winding to produce a current flow which delays the closure of the relay contact for a sufficient length of time for the test relays to operate.

70 When relay 4106 closes its contact it prepares a channel selecting circuit which extends from grounded conductor 4876, back contact of relay 4102, upper front contact of relay 4103, contact of relay 4106, outer right back contact of relay 75 4703, inner upper back contact of relay 4100, to

the upper armature of relay 3420. If relay 3420 is operated, the circuit extends to the armature of the next relay of this group over the front contact of relay 3420. If relay 3420 is unoperated 5 the circuit extends over the back contact of relay 3420 to the armature of relay 3410. If relay 3410 is operated, the circuit extends to the armature of the same relay as from the front contact of relay 3420. If relay 3410 is also idle, the circuit extends to the winding of relay 3400. Similar 10 circuits are closed by each of the relays of the two groups. Therefore, if any element of a channel is busy and that channel cannot be used, the selecting circuit is advanced to the next set of channel testing relays. 15

Assuming that the tenth channel is available on the first test, neither relay 3429 nor relay 3419 will be operated and the channel selecting circuit will extend to the winding of relay 3409 and battery. As soon as relay 3409 operates, it locks 20 over its inner upper front contact to grounded conductor 4876, and opens the operating circuit of relay 4103 which in turn opens the operating circuit of relay 3409.

Relay 3409 initiates the establishment and test 25 of the connection. At its outer lower front contact relay 3409 operates the primary select magnet of the corresponding line link. It also transfers the sleeve of the incoming link to the winding of relay 4108 which operates and locks if the condition of that link is satisfactory. The line link is tested by relay 4109, which in turn operates relay 4110. With relay 4110 operated, the line link 30 is transferred to the winding of relay 4112 and battery over the upper back contact of relay 4111. With relays 4109 and 4110 operated, ground is extended to the sleeve conductor of the line junctor and in parallel therewith, through the line choice connector to the winding of the hold magnet of the secondary line switch. 35 This magnet operates, connecting its winding and the sleeve conductor of the line junctor over the sleeve contact of the cross-points to the sleeve conductor of the line link. This conductor being connected to the winding of relay 4112, relay 4112 45 operates if the sleeve cross-point has closed properly. Relay 4112 locks over its outer upper front contact to conductor 4870 and operates relay 4111 over its inner upper front contact. Relay 4111 disconnects relay 4112 from the sleeve conductor. 50

The ground connected to the sleeve conductor of the line junctor also operates the hold magnet belonging to that line junctor in the secondary incoming switch, which magnet extends its operating ground over the sleeve contact of the cross- 55 point to the sleeve conductor of the incoming link and the winding of the primary hold magnet of that link which in turn closes its cross-point extending this ground over the cross-point through the incoming connector to conductor 5757, lower front contact of relay 4112, winding of relay 4001 and battery. The operation of relay 4001, therefore, indicates the satisfactory closure of the cross-points at the secondary line switch and the 60 primary and secondary incoming switches. The line conductors through primary and secondary incoming switches and the secondary line switch are tested for false battery and ground, by connection with relay 4004. 65

Assuming that relay 4004 does not operate, 70 when relay 4001 operates, it closes an obvious circuit for relay 4002, which in turn operates relay 4000, relay 4000 locking to grounded conductor 4870. When relay 4519 operated it connected relay 4532 to the sleeve conductor of the 75

line to test for the subsequent busying of the line. If the line has not become busy, when relay 4000 operates, it connects the line sleeve conductor to grounded conductor 5527 operating the line hold magnet and completing the connection between the line and the incoming junctor.

During the interval between the operation of relay 4001 and the operation of relay 4000, relay 4004 is connected in the reverse direction to the tip and ring conductors through the switches as a test for double connections.

When relay 4000 operates, the line tip conductor is extended through the full wave rectifier 4015, and the lower winding of polarized relay 4014 to the source of ringing current 4018, while the ring conductor is extended to ground through resistance 4007. Relay 4014 has two functions, namely, to inform the marker when the line hold magnet has operated and to check the continuity of the switch cross-points.

Relay 4014 operates through the subset, when the cross-points are properly closed, and closes an obvious circuit for relay 4010, which locks to grounded conductor 4870 and extends this locking ground to the winding of relay 4008. Relay 4008 at its inner right back contact disconnects relay 4113 from ground and at the same time connects it over the back contact of relay 4100 and the right and left front contacts of relay 4008 to the tip and ring conductors of the wanted line as a test for false or fraudulent grounds.

In the meantime, the operation of relay 5900 has transmitted a ringing start signal to the incoming junctor. Relay 4608 is operated when relay 4834 operates, over the back contacts of relays 4604 and 4609 to test the non-operation of these ringing control relays, and over the back contacts of relays 4712, 4711, 3909, and 3908 to check the normal condition of the no test, busy back and overflow relays. Relay 5900, as well as the other relays of that group, closes a circuit from ground at the back contact of relay 4710, left back contact of relay 4711, conductor 6023, left back contacts of relays 6010 and 6011, conductor 4550, left back contact of relay 4528, conductor 5937, left front contact of relay 5900, conductor 5938, outer right back contact of relay 3901, right back contact of relay 3908, left back contact of relay 4529 to the winding of relay 4605 and battery. Relay 4605 closes a circuit from ground at the inner left front contact of relay 4834, conductor 4871, third left back contact of relay 4000, outer right front contact of relay 4608, right front contact of relay 4605, to the winding of relay 4604, which operates and closes a locking circuit over its left front contact to ground at the inner left front contact of relay 4010. Relay 4605 also connects ground as above traced over conductor 4614, through the incoming connector, third left front contact of relay 317 to the winding of relay 320 and battery.

With relays 4605 and 4604 operated, a circuit is closed from battery through the winding of relay 4009, conductor 4019, left front contact of relay 4605, middle left back contact of relay 3908, outer right front contact of relay 4604, back contacts of relays 4610 and 4609, left back contact of relay 4600, conductor 4616, left back contact of relay 4924, conductor 4934, right back contact of relay 4601, right back contact of relay 4602, left back contact of relay 3909, outer left back contact of relay 3908, right back contact of relay 3907, left back contact of relay 4603 and ground.

Relay 4009 in operating opens one point in the circuit of relay 4113 so that when relay 4008 con-

nects relay 4113 to the tip and ring conductors it responds to the condition of the line. If no ground is present in excess of the allowable leak, relay 4113 releases, in turn releasing relay 317.

When relay 320 operated, it locked over its right contact, to ground over the second left front contact of relay 312. Relay 320 in this case merely serves to transmit its locking ground to the marker to hold relay 4604 until the locking circuit of that relay becomes effective.

When relay 317 releases it opens the connection between the tip and ring conductors of the trunk and the marker. It also connects ground from the innermost right front contact of relay 312 through a low resistance and the inner right normal contact of relay 317 to conductor 326 to hold the primary and secondary hold magnets of the incoming and line switches operated.

When relay 317 releases, it releases the incoming connector 321 and also relay 4104. When relay 4104 releases, it disconnects grounded conductor 5527 from the sleeve of the called line, by which the hold magnets have been held. At this time relay 317 should have completed its holding circuit for these magnets. The release of relay 317 also opens the circuit of relay 4001, but relay 4001, being slow to release, remains operated for an interval, holding relay 4002 operated. When relay 4002 releases, the ground supplied by relay 317 to conductor 326 completes a circuit over the sleeve conductors of the incoming link, line junctor and line link, through the line choice connector to conductor 3219, right front contact of relay 4519, conductor 4718, inner right back contact of relay 4703, left back contact of relay 4005, outer right front contact of relay 4609, left back contact of relay 4002, conductor 4020, back contact of relay 4606, conductor 4617, left back contacts of relays 4829 and 4828, conductor 4872, through the marker connector to the release relay of the sender.

This relay releases the marker connector and disconnects the sender from the marker. In addition, it opens the holding circuit for the sender selector hold magnets, thereby releasing the sender from the incoming junctor.

The release of the marker connector releases all of the recording relays of Figs. 14 and 15. It also disconnects ground from conductor 5658, releasing relay 4824. Relay 4824 opens the circuits of the translator relays 6305, 6304 and 6244. The release of these relays opens the circuit of the line choice connector multi-contact relays which in releasing open the circuit of relay 4835, which disconnects ground from conductors 4864, 6411, 6017, 4870, 4876 and 5669, releasing relays 6403, 4519, 6302, 4108, 4109, 4112, 4010, 4008, 4000, 4101 and 3409.

Relay 4824 disconnects battery from the incoming connector circuit which disconnects the connector from the marker, releasing all of the connector relays. Relay 4834 disconnects ground from conductors 4871, 4877, 4874 and 5669, releasing any timing relays which may be operated.

#### *No-test connection to busy line*

As previously mentioned, if the line is found busy on a call from a no-test incoming junctor, relay 4703 is operated. Relay 4703 locks over its inner right front contact to ground at conductor 5658.

When relay 4103 operated as above described, it closed a circuit from ground at its lower front contact over the inner right front contact of relay 4701, winding of relay 5411 to battery. Relay

5411 in turn operates relay 5412 and these two relays render the ground supplied over the middle and outer left contacts of relay 4703 ineffective at that time. Relay 5411 at its outer right contact connects relay 5413 over conductor 5420, armature 6100 of relay 6100, conductor 6107, through the line choice connector and the line group and control circuit to conductor 423 in the no-test junctor connector circuit, maintaining a test of the busy or idle condition of the no-test junctor connector as long as the marker is in use by the no-test junctor. When relay 4703 operates, if the no-test junctor connector is busy, a circuit is closed from ground at the outer left contact of relay 4703, front contact of relay 5412, front contact of relay 5413, conductor 6413, winding of relay 3909 and battery. Relay 3909 transmits an overflow signal in the manner described in the above-identified Carpenter application.

At its innermost left front contact, relay 4703 closes the circuit for relay 5410 which transfers the test leads from the incoming links from the channel test relays of Fig. 6 to the left windings of relays 5400 to 5409. At this same contact, relay 4703 closes a circuit over the outer right front contact of relay 4701 for relays 4522 to 4525. These relays, in operating open the test circuits for the block of twenty lines including the wanted line, thereby releasing relay 5219 and operating relay 4519 which locks as previously described. With relay 4519 operated the sleeve conductor of the wanted line is extended over the inner right front contact of relay 4519, conductor 4718, middle right contact of relay 4703 to positive battery through the resistance 4702, thereby marking the sleeve of the line, and of the line link which is serving the line, with reverse battery. The operation of relay 4519 also connects ground over its outer left front contact to the number control contact of the wanted line on the twenty-block relay in the line choice connector and over that contact through the level relay to the winding of relay 5900 and battery through relay 5932. Relay 5900 in turn operates relay 5920 as soon as the line group control circuit is ready and relay 5920 operates relay 6103 as previously described. The operation of relay 6100 causes the operation of relays 6201 and 6202.

With relay 6100 operated the test circuits for the line links are extended to the windings of relays 5400 to 5409. These relays are polarized to respond to the positive battery supplied to the line link by relay 4703. Assuming that the wanted line is connected to the line link tested by relay 5409, that relay will operate, grounding conductor 5417 and therefore operating relay 3409 which locks to conductor 4876. Relay 3409 closes a circuit from ground over its outer lower front contact, conductor 3437, armature 6103 of relay 6100, conductor 6109, through the line choice connector and line group control circuit to the winding of select magnet 717. Magnet 717 prepares the cross-points of the selected line link.

When relay 3409 operates it opens the circuit of relay 4103 which in turn releases relays 5411 and 5412. Relay 5411 transfers conductor 5420 from the winding of relay 5413 to ground at the middle left contact of relay 4703, thereby operating hold magnet 411 to close cross-point 424 which was prepared by the operation of select magnet 401 and connecting the incoming junctor through to the line link serving the wanted line. The operation of magnet 411 extends its operating ground over its front contact to the winding of the hold magnet 716 of the no-test junctor in

the primary line switch, thereby connecting the line with the no-test incoming junctor in parallel with the previous connection.

If relay 3909 is not operated, the release of relay 5412 closes a circuit from ground at the outer left front contact of relay 4703, back contact of relay 5412, outer right back contact of relay 3909 to conductor 4617, which operates the release relay of the sender and restores it and the other control circuits including the marker to normal. Relays 5411 and 5412 are made slow to release to allow time for the select and hold magnets to energize, close the cross-point and operate the holding relay in the no-test incoming junctor. The release of the marker opens the circuit for relay 311 which in turn releases relay 317.

Ground over the sleeve of the established connection extends back through the cross-point 424, outer left front contact of relay 310 to the winding of relay 316 and battery. Relay 316 closes a holding circuit for magnet 411. Relay 316 also closes a circuit for relay 303 which locks to conductor 327 independent of relay 316. Relay 303 prepares a tone circuit and also opens one holding circuit for relay 310 leaving that relay dependent upon relay 316. The release of relay 317 extends ground over conductor 327 and the outer left back contact of relay 317, right front contact of relay 310 to the winding of relay 301 and battery. Relay 301 extends the tip and ring conductors of jack 300 to the tip and ring contacts of the cross-point 424 and thence to the tip and ring of the line link. This circuit provides a clear metallic path to the calling line.

Relays 319 and 320 operate from the marker in response to the ordinary ringing signals in order to satisfy the marker, but perform no function in that connection, since signaling is under the control of the test man.

When the called line is free, ground is removed from the sleeve conductor and relay 316 releases, in turn releasing the no-test junctor connector and relay 310. The release of relay 310 releases relay 301 and closes a circuit from battery through the winding of relay 309, right back contact of relay 310, inner upper front contact of relay 303, left back contact of relay 318 to an interrupter in circuit 332 causing relay 399 to operate intermittently. With relay 309 normal, the right winding of tone coil 306 is connected over the left back contact of relay 310, back contact of relay 309, back contacts of relays 318 and 319 in parallel, inner lower front contact of relay 303, through condenser 305 to the high tone source 304. With relay 309 operated, the right winding of coil 306 is connected over the back contact of relay 310 and the front contact of relay 309 to conductor 307 and the low tone source 308. Therefore, alternate low and high tone is transmitted to the test set as a signal that the called line has been disconnected. Relay 309 also connects intermittent ground through the left winding of tone call 306 over the lowermost front contact of relay 303 to the ring conductor of the junctor in order to provide a visual signal as well. If the test man wishes to reestablish contact with the line he must now disconnect and originate another call. This time the line will be reached over the regular channels unless the line has been seized meanwhile.

The test man disconnects by operating the disconnect key in the cord circuit, which connects low resistance battery to the sleeve of the jack 300, operating relay 313 which shunts relay 314

releasing it to a turn release relay 312. The release of relay 312 removes the holding ground, thereby restoring the circuit to normal. If the test man releases before the called line, the release of relay 312 releases relay 310 which opens the holding circuit of the no-test junctor connector and releases the junctor from the line.

If the line is busy and the no-test junctor connector is busy so that the connection cannot be established, either directly or through the no-test equipment, the operation of relay 3909 operates relays 4602, 4610 and 4605, in turn operating relays 318, 319 and 320 which lock. With all of these relays operated, relay 303 is operated over the inner right contacts of relays 318 and 319 and grounded conductor 327. Relay 303 opens the locking circuit of relay 310 and since no connection has been established and therefore relay 316 has not operated, relay 310 releases. With relay 310 released, relays 318, 319 and 320 close a circuit from a high speed interrupter in circuit 332, over the left front contact of relay 320, outer right front contact of relay 319, outer left front contact of relay 318, inner upper front contact of relay 303, right back contact of relay 310 to the winding of relay 309, operating that relay intermittently at high speed. As above, relay 309 connects ground to the ring conductor and connects low tone from source 308 over its front contact and the back contact of relay 310 to the right winding of tone coil 306. Source 304 is not connected to the tone coil, the circuit from that source being opened by the contacts of relays 318 and 319.

In some cases, none of the relays 5400 to 5409 will operate. This may be due to a trouble ground, a make busy direct ground or by other special conditions. If none of these relays operates, the operation of relay 4106 after the line group and control circuit has been seized will close a circuit from ground on conductor 4876, back contact of relay 4102, upper front contact of relay 4103, contact of relay 4106, outer right front contact of relay 4702, to the winding of relay 5414 and battery. Relay 5414 closes a circuit from ground at the front contact of relay 4103, inner right contact of relay 4701, front contact of relay 5414, to conductor 5934, winding of relay 3908 and battery. Relay 3908 returns a line busy signal to the incoming junctor by operating relays 4602 and 4610. These relays in turn operate relays 318 and 319 in the incoming junctor. Relay 303 is operated, releasing relay 310 as previously described. Relay 309 is operated over front contacts of relays 318 and 319 and the back contact of relay 320 from the low speed interrupter in the interrupter circuit 332, applying tone from source 308 to the trunk, interrupted at low speed as a busy signal.

What is claimed is:

1. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, and means responsive to the seizure of said control equipment by one of said no-test trunks to render said test means ineffective.

2. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, means responsive to the seizure of said control equipment by one of said no-test trunks to render said test means ineffective, means to establish a second connection between said trunk

and said control equipment, and means responsive to said second connection to again render said test means effective.

3. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, means responsive to the seizure of said control equipment by one of said no-test trunks to render said test means ineffective, means to establish a second connection between said trunk and said control equipment, means responsive to said second connection to again render said test means effective, switches and means controlled by said test means when directed to an idle line to control said switches to establish a connection with said line irrespective of the type of trunk seizing said control equipment.

4. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, means responsive to the seizure of said control equipment by one of said no-test trunks to render said test means ineffective, means to establish a second connection between said trunk and said control equipment, means responsive to said second connection to again render said test means effective, switches, means controlled by said test means when directed to an idle line to control said switches to establish a connection with said line irrespective of the type of trunk seizing said control equipment, auxiliary switches, and means controlled by said test means when directed to a busy line to control one of said auxiliary switches to establish a connection with said line only if said control equipment has been seized by a no-test trunk.

5. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, switches, and means controlled by said test means when directed to an idle line to control said switches to establish a connection with said line irrespective of the type of trunk seizing said control equipment.

6. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, switches, means controlled by said test means when directed to an idle line to control said switches to establish a connection with said line irrespective of the type of trunk seizing said control equipment, auxiliary switches, and means controlled by said test means when directed to a busy line to control one of said auxiliary switches to establish a connection with said line only if said control equipment has been seized by a no-test trunk.

7. In a telephone system, subscribers' lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, switches, means controlled by said test means when directed to an idle line to control said switches to establish a connection with said line irrespective of the type of trunk seizing said control equipment, means normally responsive to said test means when directed to a busy line to prevent the operation of said switches to establish a connection, and means responsive to a busy indication by said test means when said control equipment is seized by a no-test trunk

to disable said test means to give a false idle indication.

8. In a telephone system, subscribers' lines, trunks outgoing from busy lines, service trunks, no-test trunks, control equipment associable with either type of trunk, means in said control equipment to test said subscribers' lines, switches, means responsive to said test means when directed to an idle line to find an idle switch having access to said line, and means effective if said control equipment is seized by a no-test trunk and said test means is directed to a busy line to establish a no-test connection with said line, comprising an auxiliary switch, means for identifying the trunk outgoing from said line and means for connecting said no-test trunk and said outgoing trunk together through said auxiliary switch.

9. In a telephone system, a subscriber's line having a test terminal, a group of trunks outgoing from said line, each having a test conductor, one of said trunks connected with said line, and means for identifying said connected trunk comprising means for connecting a characteristic potential to the sleeve terminal of said line, a group of polarized relays, means for connecting one of said polarized relays to the test conductor of each of said trunks and means responsive to the operation of one of said polarized relays to establish a second connection to the corresponding trunk.

10. In a telephone system, a plurality of subscribers' lines, a cross-bar line switch, a set of contacts for each line in said switch, a plurality of trunks accessible to said lines over said contacts, an auxiliary set of contacts, means for identifying a trunk connected to a particular busy line and means for connecting with said line comprising means for operating the auxiliary contact individual to the identified trunk.

11. In a telephone system, a subscriber's line, a test conductor for said line, a trunk outgoing from said line, means applied over said trunk to simultaneously maintain the connection between said line and said trunk and to mark said test conductor with a busy potential, and means to establish a no-test connection with said line, comprising means for identifying said trunk and means for connecting with said trunk.

12. In a telephone system, a subscriber's line, a test conductor for said line, a trunk outgoing from said line, means applied over said trunk to simultaneously maintain the connection between said line and said trunk and to mark said test conductor with a busy potential, and means to establish a no-test connection with said line, comprising means for identifying said trunk by connecting a characteristic potential to said test conductor, and means for connecting with said trunk.

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