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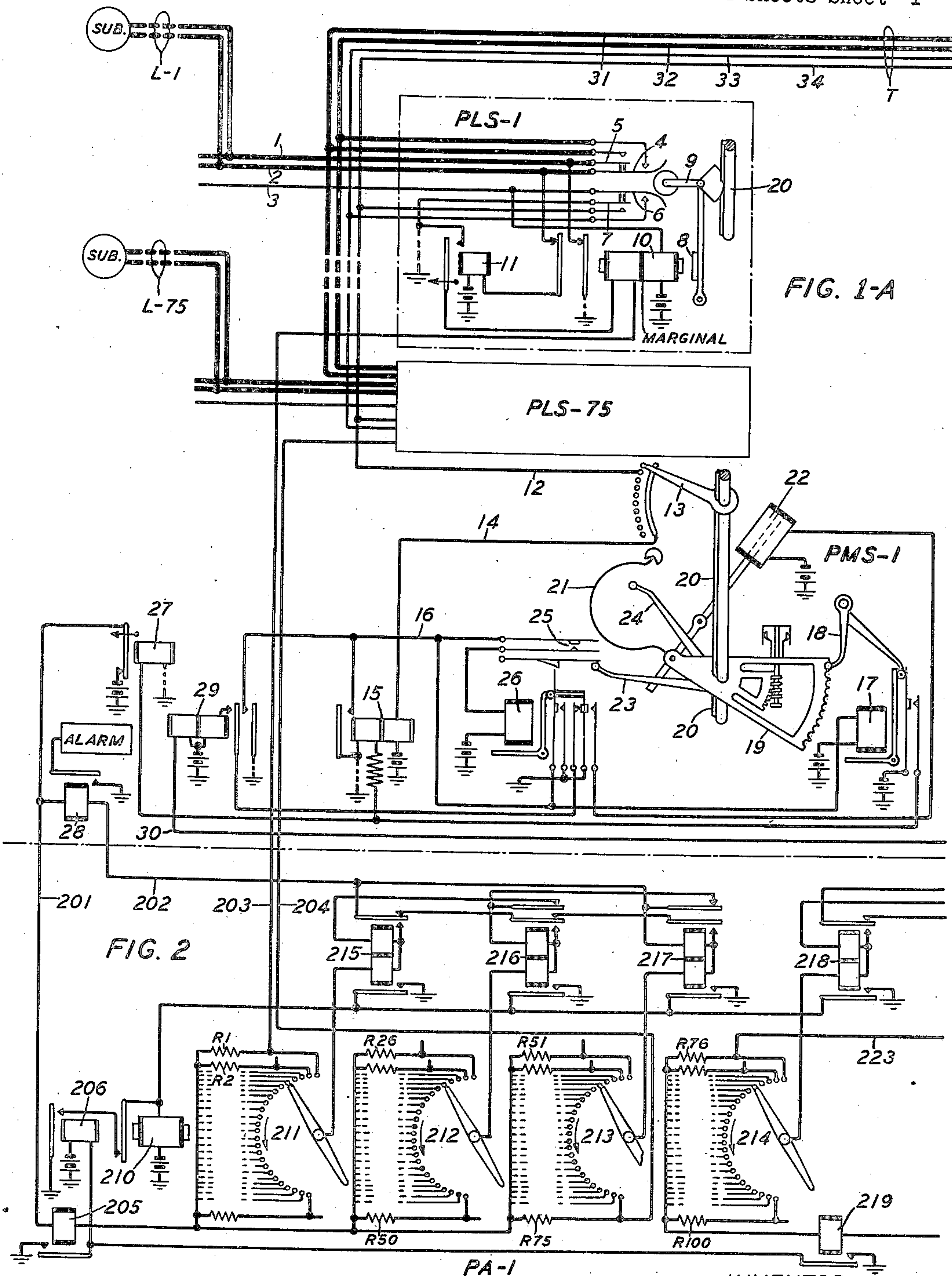
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2,027,465

TELEPHONE SYSTEM

Filed Feb. 7, 1933

4 Sheets-Sheet 1



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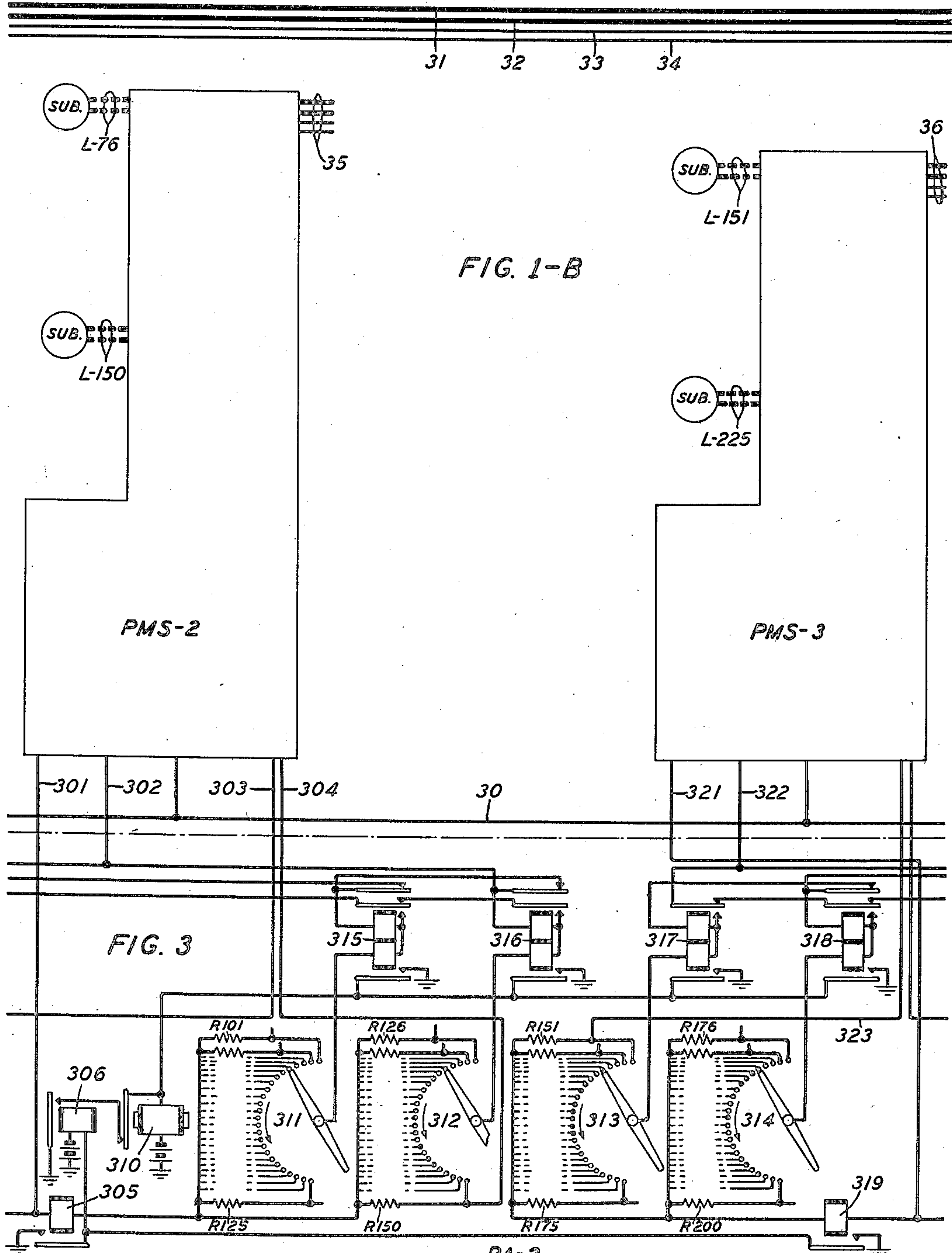
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TELEPHONE SYSTEM

Filed Feb. 7, 1933

4 Sheets-Sheet 2



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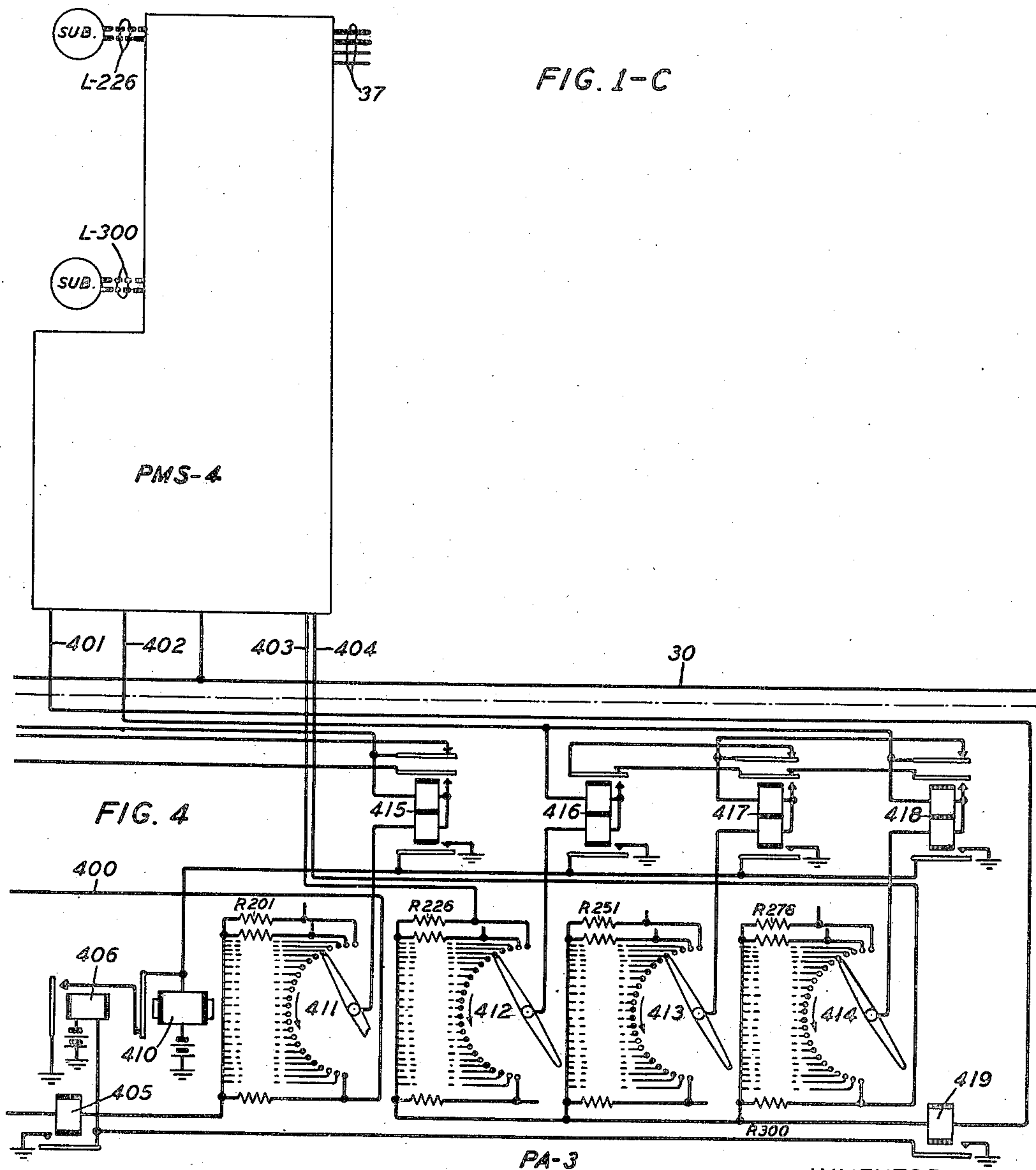
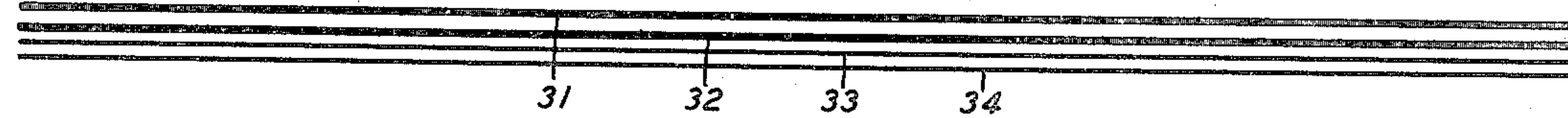
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TELEPHONE SYSTEM

Filed Feb. 7, 1933

4 Sheets-Sheet 3



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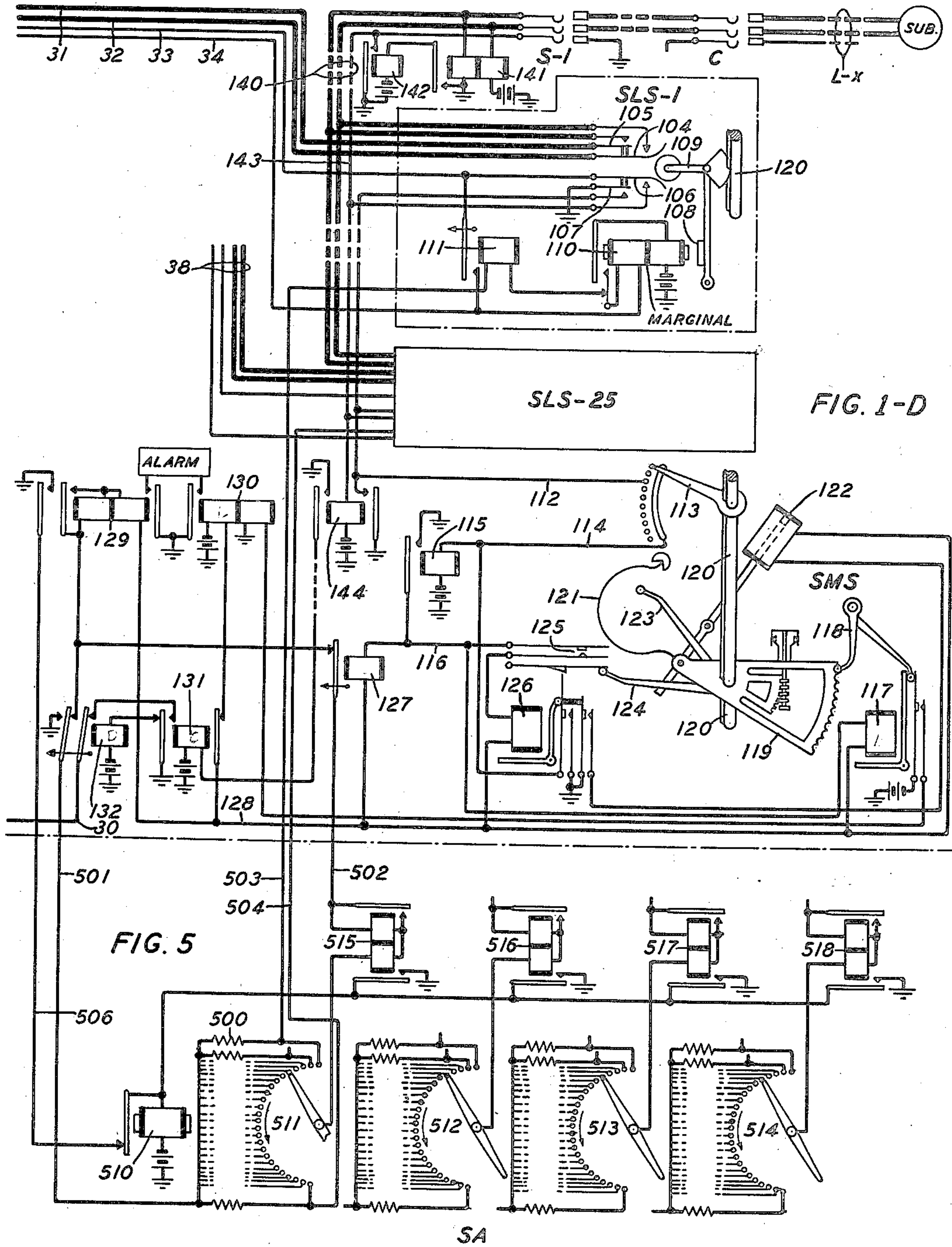
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TELEPHONE SYSTEM

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,027,465

TELEPHONE SYSTEM

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Application February 7, 1933, Serial No. 655,670

20 Claims. (Cl. 179—18)

This invention relates to telephone systems and more particularly to systems employing plunger-type line-switches.

The object of this invention is to improve the operation of plunger-type line-switches and to render their operation more reliable by eliminating the possibility of double connections.

The construction, operation and utility of plunger-type line-switches are too well-known to require a detailed description here. It is also well-known that systems employing these switches are subject to trouble from double connections caused by two or more switches being operated simultaneously. Such seizure of one trunk by more than one line-switch occurs when a plurality of calls are simultaneously initiated on lines associated with the same master-switch. Since the battery is disconnected from the pull-down windings of the magnets of all line-switches of a group during the time that the master switch is in motion, the line-switches are prevented from operating to extend calls which are originated during this time, with the result that double connections may also occur in case two or more calls are waiting when the operation of the master-switch ceases and battery is again connected to the pull-down windings of the magnets of the associated line-switches.

The present invention provides an allotter equipment, whereby the plunger of but one line-switch in a group may be operated at a time. According to one feature of the invention, a rotary allotter having four banks of 25 terminals each is provided for supplying the battery connections for the pull-down windings of the magnets of a line switchboard of 100 line-switches, so that only one pull-down winding is operatively connected to battery at one time. A further feature is the provision of a preference circuit for controlling the order of operation of the four line-switches represented by terminals in corresponding positions of the four banks of the selector. A further feature of the invention is an arrangement in which a plurality of allotter-switches are provided for supplying the battery connections for the plunger magnets of a plurality of groups of line-switches, the number of line-switches in a group not corresponding to the number of line switches associated with each allotter-switch.

The telephone system illustrated in the drawings, which forms a part of this specification, is one in which the subscribers' station equipments include a dial or other impulse sending device, in which selector and connector switches of the

well-known two-motion step-by-step (Strowger) type are employed in establishing connections and in which both primary and secondary line-switches of the plunger (Keith) type are provided for extending calling lines to idle first selectors. Sheets 1, 2, 3 and 4 of the drawings are to be placed adjacent each other in a horizontal line in the order named. Referring to the drawings:

Figure 1—A shows, schematically, a first group of subscribers' lines and primary line-switches and the associated primary master-switch PMS—1.

Fig. 1—B shows, schematically, a second and a third group of subscribers' lines and primary line-switches and the associated primary master-switches PMS—2 and PMS—3.

Fig. 1—C shows, schematically, a fourth group of subscribers' lines and primary line switches and the associated primary master-switch PMS—4.

Fig. 1—D shows, schematically, a group of secondary line-switches and the associated secondary master-switch SMS. Fig. 1—D also shows, schematically, a first selector switch S—1, a connector switch C and a called subscriber's line L—x.

Figs. 2, 3 and 4 show, schematically, three primary allotter-switches PA—1, PA—2 and PA—3 for controlling the operation of the four groups of primary line-switches shown in Figs. 1—A, 1—B and 1—C.

Fig. 5 shows, schematically, a secondary allotter-switch SA for controlling the operation of the group of secondary line-switches shown in Fig. 1—D.

Although the primary groups of such a system may comprise any number of switches, groups of 25, 50, 75 or 100 lines are most commonly used. In the drawings, there are 75 lines and primary line-switches in the group associated with the master-switch PMS—1; 75 lines and primary line-switches in the group associated with the master-switch PMS—2; 75 lines and primary line-switches in the group associated with the master-switch PMS—3; and 75 lines and primary line-switches in the group associated with the master-switch PMS—4. Each group of primary line-switches has access to a group of ten trunks, each trunk leading to a secondary line-switch in a different secondary group. Although the secondary groups may also comprise any number of switches, according to traffic requirements, there are 25 secondary switches in the group associated with the master-switch SMS; each secondary

switch has access to a group of ten trunks, each trunk leading to a first selector. Each of the groups of primary lines shown in Figs. 1—A, 1—B and 1—C are represented by the first and last lines in the group. The primary line-switch PLS—1 associated with the first line in the first group is shown in detail as is also the associated master-switch PMS—1. The group of secondary line-switches associated with the secondary master-switch SMS is also represented by the first and last switch in the group, the first switch SLS—1 and the master-switch SMS being shown in detail. The invention is, of course, not limited in its application to the particular primary and secondary trunking arrangement illustrated in the drawings nor is it limited in its application to a system employing both primary and secondary line-switches.

For a more detailed description of the primary-secondary trunking scheme, reference may be had to the patent to Keith No. 1,101,854, granted June 30, 1914. For a description of the construction and operation of switches of the Keith type and the associated master-switches, reference may be had to pages 43 to 50, inclusive, and pages 83 to 89, inclusive, of the second edition of "Automatic Telephony" by Smith and Campbell published in 1921. The selector S—1 and connector C of Fig. 5 may be of the two-motion step-by-step (Strowger) type and reference may be had to pages 53 to 65, inclusive, of the aforementioned second edition of "Automatic Telephony" for a description of the construction and operation of these switches.

The allotter-switches PA—1, PA—2, PA—3, and SA are of the single-motion rotary step-by-step type, each switch comprising a stepping magnet, a shaft and set of four double-ended brushes mounted thereon, and four corresponding banks each comprising 25 terminals. Obviously, switches of any convenient capacity may be used. The allotter-switches have no normal position and the position in which the brushes of these switches are shown represents any position. The brushes are advanced one step each time the stepping magnet releases. For further description of the construction and operation of switches of this type, reference may be had to the patent to Forsberg et al. No. 1,472,465, granted October 30, 1923.

Since there are only three primary allotter switches for the four groups of primary line-switches, the first allotter PA—1 is operatively associated with the 75 switches of the first primary group and the first 25 switches of the second primary group; the second primary allotter PA—2 is operatively associated with the remaining 50 switches of the second primary group and the first 50 switches of the third primary group, and the third primary allotter PA—3 is operatively associated with the remaining 25 switches of the third primary group and the 75 switches of the fourth primary group. The 25 secondary line-switches controlled by the master-switch SMS are associated with the first bank of the secondary allotter SA, each bank of this allotter-switch being associated with a separate group of secondary line-switches.

In addition to the rotary switch, each primary-allotter unit includes a resistance associated with each bank terminal and a control relay for each bank. The plunger or pull-down winding of each line-switch magnet is connected directly to a terminal in one of the banks of an allotter-switch so that the plunger can not be operated until

the corresponding brush of the allotter is in engagement with this terminal. The pull-down winding of each line-switch is also connected through the aforementioned individual resistance to the open-main battery supply lead of the associated master-switch.

In the case of primary allotter units, a start relay is connected in series with the open-main battery supply lead connecting to all of the aforementioned resistances which are associated with a single master-switch. Ordinarily start relays are not provided in the secondary allotter units since a secondary master-switch includes a relay which operates when an associated secondary line-switch is seized; this relay performs the function of an allotter start relay. If the magnets of a part of the lines in a primary group connect to one or more banks of one allotter-switch and the magnets of the remaining lines connect to one or more banks of another allotter-switch, the open-main battery supply lead from the associated primary master-switch connects to a start relay in each of the associated allotter-switches. The origination of a call by one or more of the lines in a primary group or the seizure of one or more trunks leading from primary line-switches to the same secondary group causes operation of the associated start relay in a primary allotter, or the relay in a secondary master-switch which performs this function to initiate the advance of the controlling allotter-switch, the resistances through which the open-main battery supply lead is connected to each pull-down winding being high enough to prevent the operation of the plungers of the seized or calling switches. An allotter-switch thus started continues to advance until one or more of its brushes encounters a terminal connected to the pull-down winding of a switch associated with a calling primary line in the case of a primary allotter-switch or associated with a seized secondary switch in the case of a secondary-allotter switch. When one of the brushes encounters a marked terminal (that is, a terminal associated with a seized or calling switch), a control relay in series with the brush in question is operated to stop further advance of the allotter-switch until the corresponding line-switch has been fully operated. The control relays have a high and a low resistance winding normally in series, the current through both windings in series being sufficient to operate the control relay but insufficient to operate the line-switch which is awaiting operation. The high resistance winding becomes short-circuited when the relay operates and thereby reduces the resistance in the circuit to cause the operation of the line-switch, the control relay being held operated by the current through its low resistance winding. When the primary master-switch associated with an operated line-switch advances the engaged line-switch plungers, the opening of the open-main battery supply causes the release of the control relay of the allotter, the line-switch magnet being thereafter held by the energization of its holding winding in the well known manner. If the plunger of the calling line-switch is disengaged from the master switch shaft, the master-switch is not operated and the control relay remains operated until the line-relay releases. In the case of secondary line-switches, the control relay is released due to the operation of the line-switch, the line-switch magnet being held by its windings in series. In order to prevent the simultaneous operation of two or more line-switches in the same group and connected

to corresponding positions of two or more banks of the associated allotter-switch (or allotter-switches), the control relays for the various banks associated with a single line-switch group are arranged so that but one of them can be operated at a time. It is, of course, understood that if the allotter is already standing with one of its brushes in engagement with the terminal which is connected to the pull-down winding of a calling line-switch, that the control relay operates immediately without advance of the allotter-switch.

To further explain the function and utility of the invention, the operation of the apparatus involved will be described in detail. Assume a call originating at the station of line L—1. Removal of the receiver at this station closes a circuit from battery through the winding of line relay 11, the outer back contact of magnet 10 of line-switch PLS—1, over line conductor 2 and through the station apparatus, back over line conductor 1 to ground at the inner back contact of magnet 10. The line relay 11 operates thereby closing a connection from ground through its front contact, left (pull-down) winding of line-switch magnet 10, over conductor 203 to the first terminal of the bank associated with the brush 211 of primary allotter PA—1; this ground connection is further extended through the resistance R1 which is individual to the line L—1, through the winding of start relay 205, over conductor 201, through the back contact of relay 27 of the primary master-switch to battery. Relay 205 operates but the energization of the left winding of magnet 10 in series with resistance R1 is insufficient to operate its armatures. Relay 205 closes a circuit for operating relay 206. Relay 206 closes a self-stepping circuit for the magnet 210 of switch PA—1, causing magnet 210 to alternately operate and release as long as relays 205 and 206 remain operated. Each release of magnet 210 advances the brushes 211, 212, 213 and 214 one step. When one of the brushes engages a terminal associated with a calling line, the corresponding one of relays 215, 216, 217 or 218 is operated. Having assumed the line L—1 to be the calling line, relay 215 operates when brush 211 makes contact with the terminal to which conductor 203 is connected; the circuit for operating relay 215 is traced from battery through the back contact of relay 27 of primary master-switch PMS—1, winding of relay 28, over conductor 202, outer back contacts of relays 217 and 216, windings of relay 215, brush 211 and terminal associated with line L—1 over conductor 203, through the left winding of magnet 10, to ground at the front contact of relay 11. The current in this circuit, while sufficient to cause the operation of relay 215, is insufficient to cause the operation of the armatures of line-switch magnet 10. Relay 28 of the master-switch also operates to connect ground to an alarm equipment which is effective to give an alarm in case relay 28 remains operated for a period longer than that required for operation of the magnet 10 and release of relay 11. If the stepping-magnet 210 is fast, this magnet may reoperate before relay 215 is completely operated and to prevent the advance of the allotter beyond the terminal corresponding to the calling line, the operation of relay 215 is effective to close a circuit for holding the stepping-magnet operated until the control relay has released on account of either the operation of the master-switch or the release of the line relay. With relay 215 operated, the

high resistance upper winding is short-circuited by its upper front contact, the current through the left winding of magnet 10 being increased sufficiently to cause the operation of armature 8 and plunger 9. The line conductors 1 and 2 are thereby extended through contacts 4 and 5 to the line conductors of the trunk opposite which the plunger 9 is stationed at that particular time. Assuming the trunk T to be the one thus seized, the line L—1 is extended through contacts 4 and 5 over conductors 31 and 32 of trunk T to an associated secondary line-switch which we will assume to be the switch SLS—1 in the group of 25 secondary switches controlled by the secondary master-switch SMS. The operation of the line-switch magnet 10 also closes a circuit for operating the line relay 111 of the secondary switch SLS—1, this circuit being traced from ground through contact 7 of line switch PLS—1, over conductor 34 of trunk T, through the left winding and back contact of secondary line-switch magnet 110, winding of the line relay 111 of the secondary line-switch, over conductor 503 to secondary allotter-switch SA, through resistance 500 (individual to line-switch SLS—1), over conductor 501, through normally closed outer front contact of relay 132 of secondary master-switch SMS, windings of relay 129 of secondary master-switch SMS, right back contact of relay 131, and through the left winding of relay 130 to battery. The line relay 111 of secondary switch SLS—1 and relay 129 of master-switch SMS both operate; but the current in this circuit is insufficient to operate the line-switch magnet 110. The operation of line relay 111 connects holding conductor 34 of trunk T to sleeve conductor 33 thereby establishing, through contact 6 of line-switch PLS—1 and the right winding of magnet 10, a temporary holding circuit for the magnet 10.

The aforementioned operation of magnet 10 of line-switch PLS—1 also causes the release of line relay 11, thereby opening the circuit over conductor 203 to release relays 205, 206 and 215 of the allotter PA—1, if not already released by the operation of the master-switch as hereinafter described, and to release relay 28 of the primary master-switch PMS—1. The ground connected to conductor 34 of trunk T is also extended over conductor 12 to the master-switch PMS—1 and through brush 13 and right winding of starting relay 15 to battery thus causing the operation of relay 15. Relay 15 connects ground to conductor 16 causing the operation of lock-magnet 17. Magnet 17 pulls locking-lever 18 out of engagement with the notched portion of sector 19, the spring 21 being thereupon effective to rotate the shaft 20, brush 13, and all of the line-switch plungers engaged by shaft 20 into a position corresponding to the next idle trunk in the group. Magnet 17 also closes a circuit for operating relay 27 thereby disconnecting battery from the pull-down windings of all line-switches in the group. Magnet 17 also closes a circuit through the left winding of starting relay 15, the current in this circuit being in such a direction and magnitude as to weaken the magnetic flux through the core of this relay and thus make the relay fast in releasing as soon as brush 13 encounters an ungrounded terminal. The energization of the left winding of relay 15 does not hold this relay operated after the circuit through its right winding is opened. The release of relay 15, when the engaged plunger arms have been positioned opposite an idle trunk, causes the release of magnet 17 and the locking-lever 18 re-engages the

sector 19 to prevent further rotation of the shaft. No idle trunk having been encountered before the sector 19 reaches the limit of its counter-clockwise rotation, trip relay 26 is operated due to the actuation of springs 25 by the arm 24 attached to sector 19. Relay 26 closes a circuit for energizing the solenoid 22. The operation of solenoid 22 rotates the sector 19 in a clockwise direction, all disengaged plungers of idle line-switches being picked up in the usual manner. As soon as the sector 19 moves away from the limit of its counter-clockwise rotation, springs 25 are opened; but the springs operated by trip relay 26 are held in their operated position by the latch associated with these springs until the sector 19 reaches the limit of its clockwise rotation; whereupon the arm 23 engages the latch and the springs of relay 26 are released. The solenoid 22 releases and magnet 17 also releases unless relay 15 is operated in which case the counter-clockwise rotation of the shaft 20 and sector 19 is resumed and continues until an idle trunk is encountered. The relay 29 is the pick-up relay which is operated in case there are no idle trunks outgoing from one or more of the secondary groups to which this primary group of line-switches has access. Relay 29 closes a circuit for operating the lock-magnet 17. Relay 29 locks through its right-hand winding and inner front contact until the operation of trip relay 26 insures the sweeping of the master-switch shaft 20 to redistribute the idle line-switches of the group with respect to the secondary groups in the well-known manner.

Returning now to the secondary line-switch SLS—1, the operation of relay 129 of secondary master-switch SMS closes a circuit from ground through its outer front contact, over conductor 506 through the self-interrupting contacts and winding of stepping-magnet 510 of allotter switch SA to battery. The brushes of allotter SA are thus advanced until one of them makes contact with the terminal corresponding to the seized secondary switch. The switch SLS—1 being the one in question, relay 515 is operated when brush 511 makes contact with the terminal to which conductor 503 is connected, the circuit for operating relay 515 being traced from battery through the left winding of relay 130 of the master-switch SMS, right back contact of relay 131, right winding and inner front contact of relay 129, back contact of relay 127, over conductor 502, windings of relay 515, brush 511 and terminal to which conductor 503 is connected, over conductor 503, winding of line relay 111, back contact and left (pull-down) winding of magnet 110, over conductor 34 to ground at spring 7 of primary line-switch PLS—1. The current in this circuit, while sufficient to cause the operation of relay 515, is insufficient to cause the operation of magnet 110. With relay 515 operated, the high resistance upper winding is short-circuited by its upper front contact, the current through the left winding of magnet 110 being thereby increased sufficiently to cause operation of the armature 108 and plunger 109. The line conductors 31 and 32 of trunk T are extended through contacts 104 and 105 to the line conductors of the trunk opposite which the plunger 109 is stationed at the particular time in question. Assuming the trunk 140 to be the one thus seized, the connection from line L—1 is thus extended through contacts 104 and 105 over trunk 140 and through the windings of line relay 141 of the associated first selector S—1 to battery

and ground. The operation of magnet 110 opens the circuit through line relay 111 and over conductor 503 thereby causing the release of relays 111, 129 and 515. Magnet 110 is held operated by its windings in series over conductor 34 of trunk T to ground through contact 7 of the primary line switch PLS—1.

Upon extension of the line L—1 to the line relay 141 of selector S—1, as above described, relay 141 operates causing the operation of the release relay 142 which connects ground to the sleeve conductor of trunk 140 and thence through contact 106 of line-switch SLS—1 to sleeve conductor 33 of trunk T soon enough after the release of relay 111 to maintain the energization of the right winding of the primary line-switch magnet 10. The selector S—1 and succeeding switches including the connector C operate in response to dial impulses created by operation of the dial at the calling station to extend the connection from line L—1 to the called line L—x in the well known manner.

The operation of line-switch magnet 110 also connects ground through its contact 107, over conductor 112, through the associated terminal and brush 113 of the master-switch SMS, conductor 114, and through the winding of start relay 115 to battery. Relay 115 operates thus closing a circuit from battery through the left winding of relay 130, right back contact of relay 131 over conductor 128, through the windings of lock-magnet 117 and relay 127 in parallel and over conductor 116 to ground at the front contact of relay 115. The lock-magnet 117 and relay 127 both operate; the magnet 117 withdraws the lock-lever 118 from engagement with the sector 119 and the relay 127 disconnects the open-main battery supply from conductor 502. When released, the sector 119 and shaft 120 together with all engaged line-switch plungers are rotated in a counter-clockwise direction. As long as brush 113 encounters a ground potential, relay 115 is held operated causing further movement of the master-switch. When an idle trunk is encountered, relay 115 releases followed by the release of relay 127 and magnet 117, thus locking the shaft and engaged plungers in position opposite the idle trunk. The return of the master-switch from the limit of the counter-clockwise motion is effected by relay 126 and solenoid 122 in the usual manner.

The busy and holding ground connected to the sleeve conductor 143 of trunk 140 is also effective to operate relay 144 which is individual to this trunk, a similar relay being associated with each of the other nine trunks outgoing from this group of secondary switches. With all ten trunks busy, a chain circuit is closed from ground at the front contact of relay 144, and through the front contacts of the other nine relays to operate relay 131. The operation of relay 131 causes the release of the normally operated relay 132, thereby opening the connection from battery to the secondary line-switches. Since relay 132 is slow in releasing, ground is temporarily connected through the front contact of relay 131 and the inner front contact of relay 132 to the pick-up conductor 30 thus operating the pick-up relays of the primary master-switches to secure a redistribution of the primary line-switches of the various groups to different secondary groups in the usual manner. Ground is also connected through the outer back contact of relay 132 and through resistance 500 and all similar resistances which are associated with idle secondary switches

in the group, and through the windings of the line relays and left winding of the magnets of these idle secondary switches to the conductors corresponding to conductor 34 to prevent seizure of these idle secondary line-switches as long as there are no idle trunks outgoing from this secondary group in the usual manner.

The connection from the subscriber of line L—1 to the subscriber of line L—x is maintained under control of supervisory relays in the connector C in the usual manner, the holding ground for the various switching units including the magnet 10 of the primary line-switch PLS—1 being supplied from the front contact of release relay 142 over the sleeve conductor of the connector. When the connection is released, this holding ground is disconnected causing the release of magnet 10 and the return to normal of the various switches involved in the connection. The release of the primary line-switch causes the release of the secondary line-switch.

Let us assume next that in addition to the line L—1 being a calling line, the lines (not shown) with which resistances R26 and R51 of allotter PA—1 are associated are also calling lines so that the first terminal in each of the banks 211, 212 and 213 are connected to ground by the operation of the line relay 11 of line L—1 and the line relays (not shown) of the other two calling lines. In this case, upon the allotter brushes coming into engagement with these terminals, a circuit is closed from open-main battery at the back contact of relay 27, through the winding of relay 28, over conductor 202 through the windings of relay 217, brush 213 and first terminal of the associated bank, over the conductor corresponding to conductor 203 and through the left winding of the magnet corresponding to magnet 10, and through the front contact of the associated line relay to ground; a circuit is also closed from open-main battery over conductor 202, through the upper back contact of relay 217, through the windings of relay 216 and through brush 212 and the first terminal of the associated bank to ground at the front contact of the line relay of the associated line switch; and a circuit is also closed as hereinbefore described through the windings of relay 215 and brush 211 to the ground at relay 11. All three relays 215, 216, and 217 begin to be energized simultaneously. Should relay 217 be the first to open its back contact, the operation of relays 215 and 216 is prevented; when relay 217 closes its upper front contact, its upper winding is short-circuited thereby causing operation of the line-switch with which the resistance R51 is associated. When relay 217 releases the allotter is again advanced until one or more of its brushes encounters a terminal associated with a calling line. Should relay 216 open its back contact before relay 215 closes its upper front contact and if relay 216 also closes its upper front contact before relay 217 opens its upper back contact, then relay 216 is the first to short-circuit its upper winding and cause operation of the line-switch with which the resistance R26 is associated. In this case relay 215 can not operate, but relay 217 operates, and if the plunger of the line-switch associated with resistance R26 was not engaged by the master-switch shaft, the stepping magnet 210 of the allotter switch is held operated by relay 217; upon release of relay 216, the upper winding of relay 217 is short-circuited and the line-switch with which the resistance R51 is associated immediately operates without further advance of

the allotter-switch. Upon release of relay 217 the allotter is advanced, the switch PLS—1 being the last to be operated. Should relay 215 close its upper front contact before its operating circuit is opened by either of relays 216 or 217, the upper winding of relay 215 is the first to be short-circuited and the switch PLS—1 is the first to be operated; in which case relay 217 operates but the short circuit around its upper winding is held open by relay 215 and the operating circuit for relay 216 is held open by relay 217. If the plunger of switch PLS—1 was not in engagement with the shaft of the master-switch, the allotter-switch does not advance when relay 215 releases, and the line-switch with which the resistance R51 is associated is the next to be operated.

If the plunger arm of one of the line-switches associated with the aforementioned three simultaneously calling lines should be disengaged from the shaft of the master-switch, the release of the corresponding one of control relays 215, 216 or 217 depends upon and awaits the release of the line relay of that switch, since, on the extension of that particular line, the master-switch does not advance.

If a call is originated over a line controlled by primary master-switch PMS—2 and the corresponding allotter terminal is located in bank 214 of allotter PA—1, the start relay 219 operates to initiate the operation of the allotter-switch. If the start relay 219 is operated at the same time as the start relay 205 and the pull-down windings of the line-switches of the simultaneously calling lines are connected to corresponding positions of bank 214 and any one of the banks 211, 212 or 213, it is understood that both calls are extended simultaneously since the control relay 218 operates independently of control relays 215, 216 and 217.

What is claimed is:

1. In combination, a plurality of automatic switches, a distributor switch comprising a stepping magnet and a plurality of banks of terminals, normally open circuits one for each of the operating magnets of said automatic switches, each of said circuits including a different one of said terminals, and means comprising a relay individual to each of said banks for operatively completing said circuits one at a time.

2. In combination, a plurality of automatic switches, a distributor switch comprising a stepping magnet and a plurality of banks of terminals, the number of terminals in each bank being less than the number of automatic switches, normally open circuits one for each of the operating magnets of said automatic switches each of said circuits including a different one of said terminals, and means for operatively completing said circuits one at a time.

3. In combination, a plurality of automatic switches, an operating magnet for each switch, an allotter switch operable under control of any one of said automatic switches, said allotter switch comprising a plurality of banks of terminals and a brush for each bank, a circuit for each operating magnet including a different one of said terminals, and means responsive to any one of said automatic switches being taken into use for operating said allotter switch to close the circuit for the operating magnet of the switch taken into use.

4. In combination, a plurality of plunger type line-switches, each having a line relay and an operating magnet, a group of trunk lines accessible to said switches, a master-switch for position-

ing said line-switches in operative relation to an idle one of said trunk-lines, an allotter switch comprising a plurality of banks of terminals and a brush for each tank, and a circuit for the magnet of each line-switch jointly controlled by the

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5. In a telephone system, a plurality of non-numerical switches, a plurality of trunk-lines accessible to each of said non-numerical switches, a master-switch for controlling the seizure of said trunk-lines, a distributor switch having access to said non-numerical switches and comprising a plurality of banks of terminals and a brush for each bank, means for seizing said non-numerical switches, means responsive to the seizure of one of said non-numerical switches for operating said distributor switch to hunt for and connect with the seized non-numerical switch, and means controlled by said distributor for operating the seized switch to connect with an idle one of said trunk-lines.

6. In a telephone system, a plurality of non-numerical switches, a plurality of trunk-lines accessible to each of said non-numerical switches, a master-switch for controlling the seizure of said trunk-lines, means for seizing said non-numerical switches, an allotter-switch for controlling the operation of said non-numerical switches, said allotter switch comprising a plurality of banks of terminals and a brush for each bank, and means responsive to a plurality of said non-numerical switches being seized for causing said allotter switch to operate the seized switches one at a time whereby each switch connects with a different one of said trunk-lines.

7. In a telephone system, a subscriber's line and a non-numerical line-switch for said line, a line relay and an operating magnet for said line-switch, said line relay being operatively responsive to the initiation of a call over said line, a finder switch having access to said line-switch and comprising a plurality of banks of terminals and a brush for each bank, means controlled by said relay for marking said line-switch in one of the banks of the finder switch, means for operating the finder-switch to hunt for and connect with the marked line-switch, and means controlled by the finder switch for operating the magnet of the marked line-switch.

8. In a telephone system, a group of automatic switches having common access to a plurality of trunk-lines, a magnet for each switch for effecting a connection with any one of said trunk-lines, a relay for each switch operated responsive to the switch being taken into use for partially closing a circuit for the associated magnet, and a distributor switch comprising a plurality of banks of terminals for completing the partially closed circuits successively, whereby each of the automatic switches connects with a different trunk-line.

9. The combination comprising a plurality of automatic switches, each having access to a group of trunk-lines, a common control switch for positioning said switches in selective relation with an idle one of said trunk-lines, and a second common control switch comprising a plurality of banks of terminals for completing the operating circuits for said automatic switches successively.

10. The combination comprising a plurality of plunger-type line-switches having common access to a group of trunk-lines, a master-switch for positioning said line-switches before an idle one of said trunk-lines, a line relay for each line-switch operated responsive to the switch being

taken into use, a magnet for each line-switch for effecting a connection with any one of said trunk-lines, a single-motion control switch common to said line-switches and having a plurality of banks of terminals, and an operating circuit for the magnet of each line-switch controlled jointly by the associated line relay, said master-switch and said control switch.

11. In a telephone system, a group of non-numerical switches, an operating magnet for each switch, a control switch including a plurality of wipers, each wiper adapted to engage terminals individual to said non-numerical switches, a circuit completed responsive to any one of said non-numerical switches being taken into use for operating said control switch to advance said wipers over said terminals, and means responsive to any one of said wipers engaging the terminal which is associated with the non-numerical switch taken into use for operating the magnet of that switch.

12. In a telephone system, a plurality of automatic switches, an operating magnet for each of said switches, individual means for taking each of said switches into use, a control switch comprising a plurality of wipers and a bank of terminals for each wiper, means responsive to the taking of one of said automatic switches into use for marking a corresponding terminal in one of said banks and for causing the advance of said wipers, and individual means for each wiper effective when the associated wiper engages a marked terminal for stopping the movement of said wipers and for causing the operation of the magnet of said one of the automatic switches.

13. In a telephone system, a plurality of automatic switches, an operating magnet for each of said switches, individual means for taking each of said switches into use, a control switch comprising a plurality of wipers and banks of terminals, the operating magnet of each of said automatic switches being connected to a different one of said terminals, means responsive to the taking of any of said switches into use for marking the corresponding terminals of the control switch and for causing the advance of said wipers, individual means for each wiper effective when the associated wiper engages a marked terminal for stopping the movement of said wipers and for causing the operation of the operating magnet connected to said engaged marked terminal.

14. In combination, a plurality of automatic switches each including a relay and an operating magnet, a control switch comprising a plurality of wipers and banks of terminals, the winding of the operating magnet of each of said automatic switches being connected to a different terminal of said control switch, individual means for operating the relays of said automatic switches, means responsive to the operation of any one of said relays for causing the advance of said wipers, control relays one for each of said wipers, means including one of said control relays and effective upon one of said wipers engaging a terminal corresponding to an automatic switch, the relay of which is operated, for stopping said wipers, and a circuit rendered effective by said one of the control relays for operating the magnet of said automatic switch.

15. In combination, a plurality of automatic switches each including a relay and an operating magnet, a control switch comprising a plurality of wipers and banks of terminals, the winding of the operating magnet of each of said automatic switches being connected to a different terminal

of said control switch, individual means for operating the relays of said switches, means responsive to the operation of any one of said relays for causing the advance of said wipers, control
 5 relays one for each of said wipers, means including said control relays for stopping the advance of said wipers as soon as one of said wipers engages a terminal connecting to the magnet of an
 10 automatic switch the relay of which is operated, and circuits for operating the magnets connected to corresponding positions in the various banks of said control switch, said control relays being adapted to permit the operation of only one of said magnets at a time.

15 16. In a telephone system, groups of subscribers' lines, corresponding groups of individual line-switches, allotter-switches each comprising a plurality of wipers and banks of terminals, the number of terminals in each bank being less
 20 than the number of line-switches in a group, operating magnets one for each of said line-switches and each connected to a different terminal of one of said allotter-switches, means responsive to the initiation of a call over a line for
 25 causing the advance of the wipers of the allotter switch to which the corresponding line-switch magnet is connected, means responsive to the engagement of one of the wipers of the allotter switch with the terminal to which said line-switch magnet is connected for stopping the advance of said wipers, and means thereupon effective to operate said line-switch magnet.

30 17. In a telephone system, subscribers' lines, line-switches one for each of said lines, a line relay and an operating magnet for each line switch, the line relay of each switch being operatively responsive to the initiation of a call over the associated line, a finder-switch comprising a wiper and a bank of terminals, a start relay for
 40 causing the advance of said finder switch, resistances, one for each line switch, one end of each resistance connected to said start relay and the other end of each resistance connected to the operating magnet of the associated line-switch and to
 45 a different terminal of the bank of said finder switch, a circuit closed by the operation of one of said line relays through the winding of the associated magnet through the associated resistance and through the winding of the start relay, said
 50 circuit being effective to operate said start relay and cause the advance of the finder-switch but ineffective to operate said magnet, a control relay connected to the wiper of said finder switch and having a high resistance winding and a low
 55 resistance winding, a circuit through the winding of said magnet, the associated terminal and wiper of the finder switch and through both windings of the control relay effective to operate said control relay but ineffective to operate said magnet, and
 60 means for short-circuiting the high resistance winding of said control relay to cause the operation of said magnet.

65 18. In a telephone system, a first group of subscribers' lines and individual line-switches, a second group of subscribers' lines and individual line-switches, each of said line-switches comprising a line relay and an operating magnet, a
 70 finder switch comprising a plurality of banks of terminals and wipers, the operating magnets of the line-switches of said first group each being connected to a different terminal of certain banks of said finder switch and the operating magnets of the line-switches of said second group each being connected to a different terminal of other

banks of said finder-switch, a start relay common to the line-switches of said first group and a start relay common to the line-switches of said second group, the operation of either one of said start relays being effective to cause the advance of the
 5 wipers of said finder-switch, means responsive to the origination of a call over a line in either of said groups for operating the associated line relay, means responsive to the operation of any one of said line relays for operating the associated
 10 start relay, and means for stopping the advance of said finder-switch wipers as soon as one of said wipers engages a terminal associated with a calling line and for causing the operation of the associated line-switch magnet.

15 19. In a telephone system, a first group of subscribers' lines and individual line-switches, a second group of subscribers' lines and individual line-switches, each of said line-switches comprising a line relay and an operating magnet, a finder
 20 switch comprising a plurality of banks of terminals and wipers, the operating magnets of the line-switches of said first group each being connected to a different terminal of certain banks of said finder switch and the operating magnets of
 25 the line-switches of said second group each being connected to a different terminal of other banks of said finder-switch, a start relay common to the line-switches of said first group and a start relay common to the line-switches of said second
 30 group, the operation of either one of said start relays being effective to cause the advance of the wipers of said finder-switch, means responsive to the origination of calls over said lines for operating the associated line relays, means responsive
 35 to the operation of any one of said line relays for operating the associated start relay, means for stopping the advance of said finder switch wipers as soon as one of said wipers engages a terminal associated with a calling line, and means
 40 for causing the operation of only one of the line-switch magnets associated with simultaneously calling lines in the same group.

45 20. In a telephone system, a first group of subscribers' lines and individual line-switches, a second group of subscribers' lines and individual line-switches, each of said line-switches comprising a line relay and an operating magnet, a finder
 50 switch comprising a plurality of banks of terminals and wipers, the operating magnets of the line-switches of said first group each being connected to a different terminal of certain banks of said finder switch and the operating magnets of the line-switches of said second group each being
 55 connected to a different terminal of other banks of said finder-switch, a start relay common to the line-switches of said first group and a start relay common to the line-switches of said second group, the operation of either one of said start relays being effective to cause the advance of
 60 the wipers of said finder-switch, means responsive to the origination of calls over said lines for operating the associated line relays, means responsive to the operation of any one of said line relays for operating the associated start relay, means for
 65 stopping the advance of said finder switch wipers as soon as one of said wipers engages a terminal associated with a calling line, and means effective if said wipers engage at one time terminals associated with calling lines in both groups for causing
 70 the operation of only one of the line-switch magnets in each group.

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