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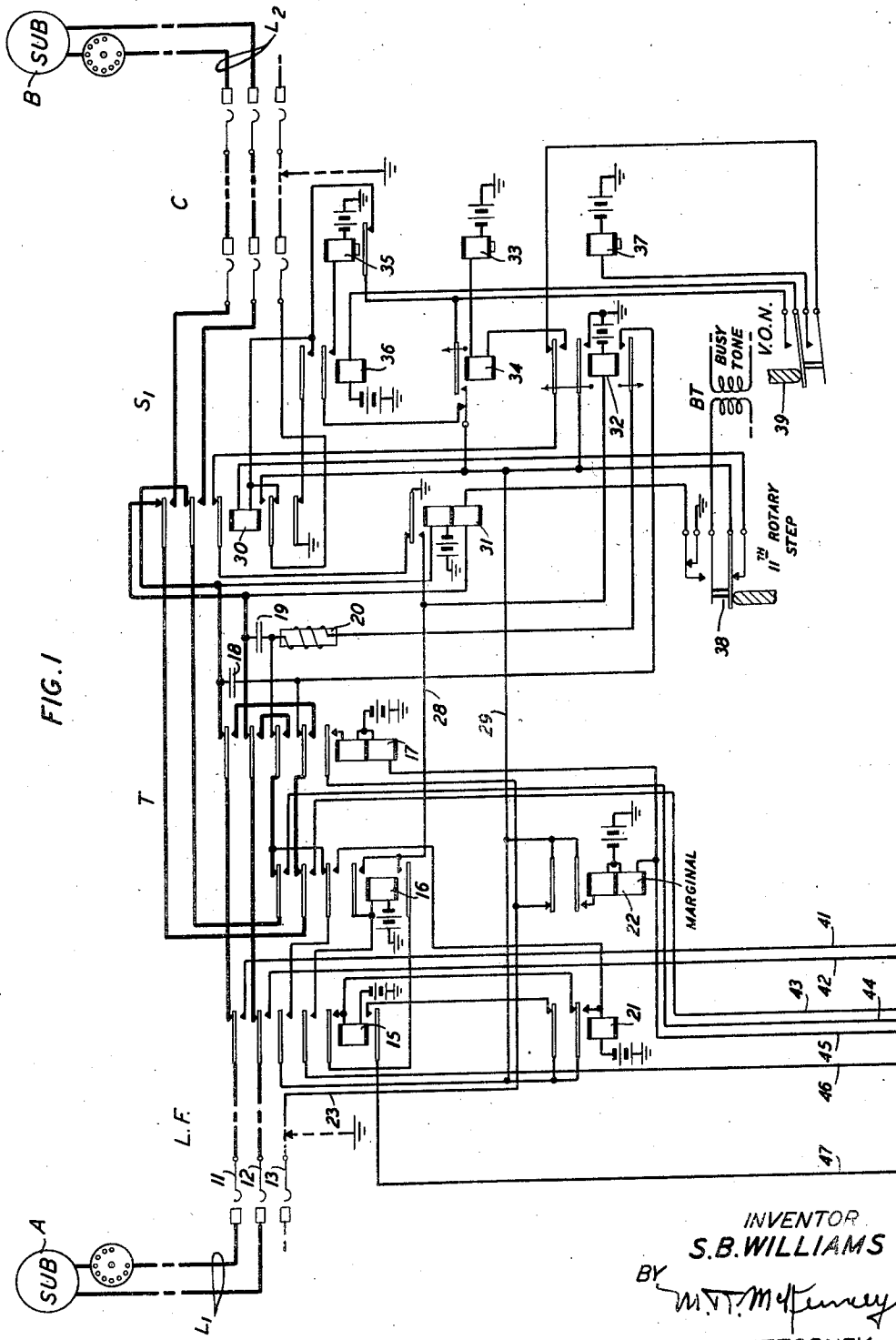
S. B. WILLIAMS

2,248,146

TELEPHONE SYSTEM

Filed July 2, 1938

3 Sheets-Sheet 1



July 8, 1941.

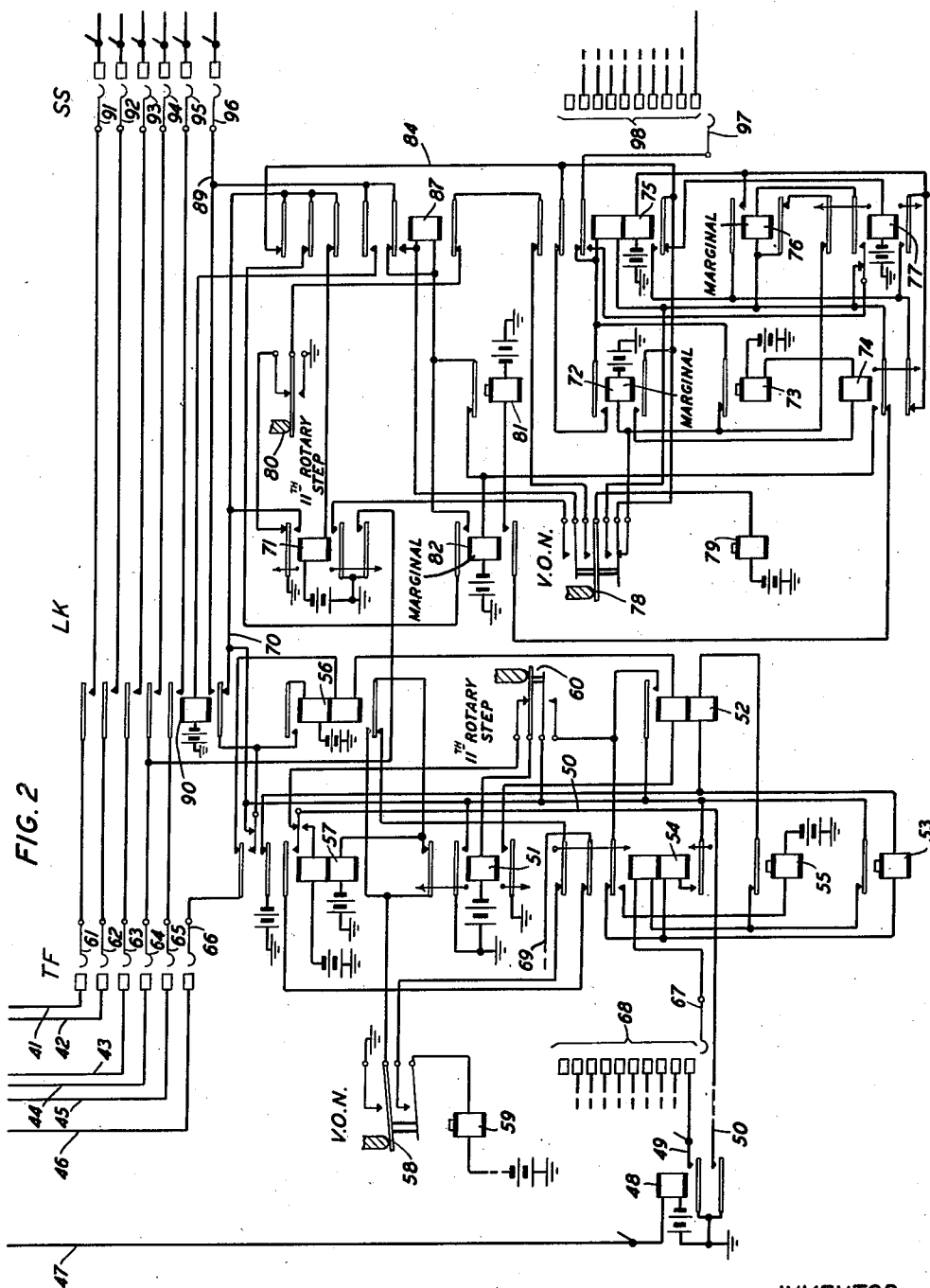
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3 Sheets-Sheet 2



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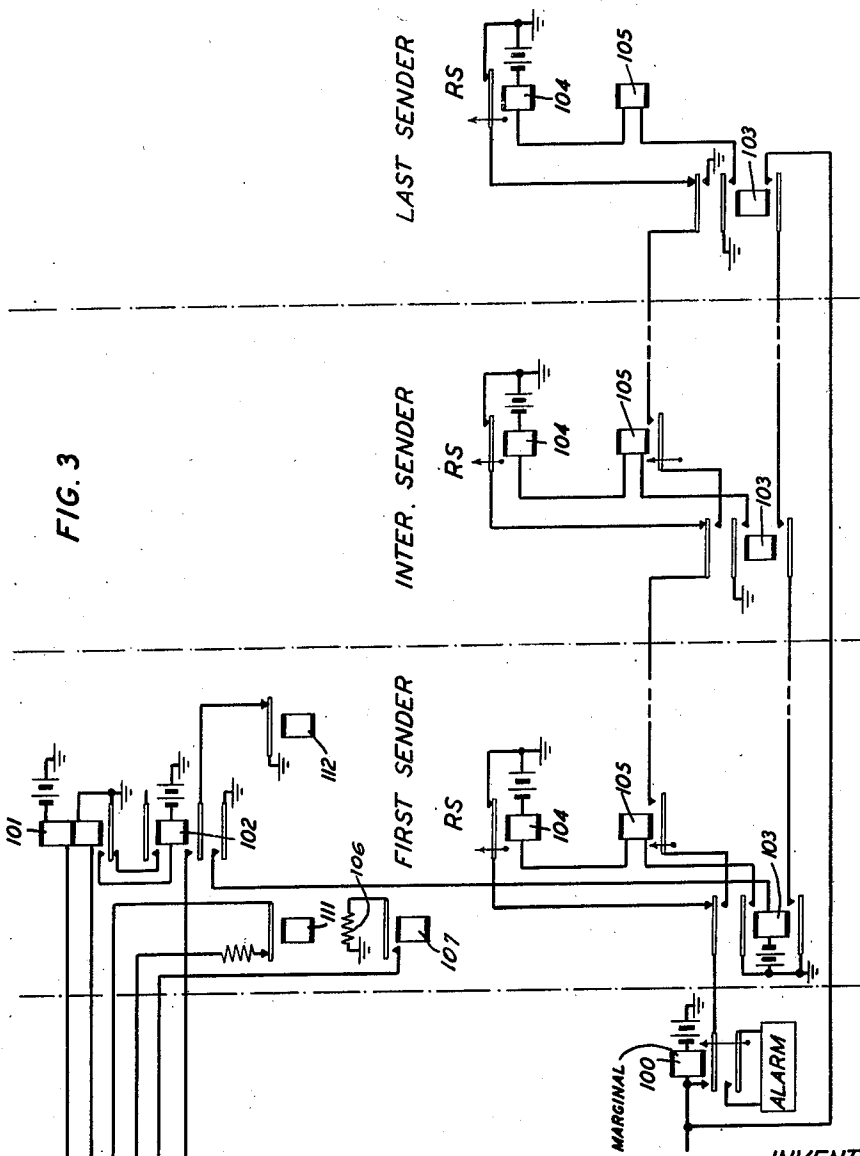
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TELEPHONE SYSTEM

Filed July 2, 1938

3 Sheets-Sheet 3



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TELEPHONE SYSTEM

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Application July 2, 1938, Serial No. 217,176

7 Claims. (Cl. 179—18)

This invention relates to telephone systems and particularly to systems comprising automatic switches.

Objects of the invention are a more efficient use of lines, trunks, or other circuits, reduction in the number of circuits required in groups terminating in the banks of automatic switches, and the more efficient operation of such switches.

This invention is a switching system comprising automatic switches and a plurality of circuits multiplied to the terminals in the banks of these switches, each switch being arranged to hunt for and select a group of terminals having at least one idle circuit therein and to hunt for an idle circuit in the selected group of terminals, the selection of any group of terminals by any one of the switches being effective to guard the corresponding groups of terminals in the banks of the other switches until the one switch finds and seizes an idle set of terminals or until a set of terminals already tested by the one switch becomes idle after the one switch has advanced beyond this set of terminals.

The invention will be better understood by considering a switching system in which the invention is embodied, one such system being shown schematically in the drawings which form a part of this specification. The invention is, however, not limited in its application to the particular embodiment herein disclosed but is, in general, applicable to any automatic switch arranged to hunt for an idle set of terminals in a plurality of groups of terminals.

Referring to the drawings:

Fig. 1 shows a subscriber's line L1, a line-finder switch LF, a selector switch S1, a trunk T permanently associating the switch LF with the switch S1, a connector switch C and another subscriber's line L2;

Fig. 2 shows a link LK comprising a trunk-finder switch TF and a sender selector switch SS; and

Fig. 3 shows portions of the first, an intermediate and the last register sender of a group accessible to the sender selector switch SS of Fig. 2.

The subscriber's stations A and B may be of any known type comprising an impulse sender for use in controlling the establishment of desired connections. The line-finder switch LF, selector switch S1 and connector switch C may be of the well known two-motion step-by-step type. For a description of the structure and the operation of such switches when used as selectors and connectors, reference may be had to pages

53 to 65, inclusive, of the second edition of "Automatic Telephony" by Smith and Campbell. For a complete disclosure of line and line-finder circuits and a description of the operation of a step-by-step line-finder switch, reference may be had to Patent 1,799,654 granted to R. L. Stokely April 7, 1931. Each of the switches LF, S1 and C are represented by a set of brushes and a single set of terminals. The relays and other circuit elements associated with the switches LF and C have been omitted but the selector S1 is shown in detail.

The switches TF and SS, which are also of the well-known two-motion step-by-step type, are each represented by a set of six brushes and a single set of terminals. In addition to the brushes and terminal banks, the trunk-finder switch TF also comprises a vertical commutator 68 and brush 67, a vertical stepping magnet 53, a rotary stepping magnet 55, a release magnet 59, a set of vertical off-normal springs 58 and a set of "11th rotary step" springs 60. In addition to the brushes and terminal banks, the sender selector SS also comprises a vertical commutator 98 and brush 97, a vertical stepping magnet 73, a rotary stepping magnet 81, a release magnet 79, a set of vertical off-normal springs 78, and a set of "11th rotary step" springs 80. One hundred senders may be multiplied to the one hundred sets of terminals in the banks of the sender selectors SS of all of the links LK. Assuming that there are the same number of links as there are senders, the links will be divided into groups, the trunk finders of each group having access to one hundred trunks T between line finders and selectors. Thus ten line finders will be connected to the ten sets of terminals in each level of the trunk-finder switch TF and ten senders will be connected to the ten sets of terminals in each level of the sender selector switch SS.

The register senders may be similar to that disclosed in the patent to R. G. Richardson et al. No. 1,691,410 granted November 13, 1928. The sender connected to the first set of terminals in the first level of switch SS is represented by an impulse receiving relay 101, a release relay 102, an off-normal or busy relay 103 and two associated control relays 104 and 105, an impulse sending relay 111 and a control relay 112. The intermediate sender is represented by its busy relay 103 and associated control relays 104 and 105; and the last sender is represented in like manner.

Further explanation of the invention as disclosed in the drawings will be facilitated by describing the operations involved in establishing a connection from a calling station A to a called station B. Upon removal of the receiver at station A to originate the call, the line-finder switch LF is operated to extend the calling line L1 to the trunk T, for instance as described in the aforementioned Stokely Patent No. 1,799,654. As soon as the line finder LF begins to hunt for the calling line, ground is connected to sleeve conductor 23 of trunk T, thence through the back contact of relay 22, conductor 29, and the inner back contact of relay 21, to the winding of relay 15 to cause the operation of relay 15. Relay 15 closes a connection from battery through the winding of relay 16, an upper front contact of relay 15, and conductor 46 to mark the test terminal of trunk T in the bank of the finder switch TF and other trunk finders in the group. Relay 15 also closes a connection from grounded conductor 23, through back contacts of relays 22 and 21, lower front contact of relay 15, and conductor 47 to operate group relay 48 which is common to a group of trunk circuits T. Relay 15 also closes a circuit for operating relay 31 of selector S1; this circuit is traced from the ground on conductor 23, back contact of relay 22, conductor 29, front contact of relay 15, back contacts of relays 16 and 30 and through the upper winding of relay 31 to battery. Relay 31 closes a circuit for operating slow-to-release relay 32. Relay 32 connects ground to conductor 29 and closes a circuit from battery through the upper winding of relay 31, back contacts of relays 30, 16 and 17, retard coil 20, lower front contact of relay 32, back contacts of relays 17, 16 and 30, lower winding of relay 31, to ground at the normally closed contact of the "11th rotary step" springs 38. The lower winding of relay 31 is short-circuited until relay 16 operates as hereinafter described. Relay 48 connects ground to a terminal of commutator 68 of trunk-finder switch TF to mark the level of the terminal bank in which are located the terminals to which the trunk T is connected. Relay 48 also connects ground through the start conductor 50, through preceding busy finders, if any, in the group, through normally closed contacts of relay 57 and the "11th rotary step" springs 60, and through the winding of relay 51 to battery. Relay 51 operates, connecting ground through its inner front contact to conductor 70, thence through a back contact of relay 87 of sender selector switch SS to operate relay 71; and relay 71 connects ground to conductor 70 and is held operated until relay 87 operates as hereinafter described. Relay 51 also closes a circuit from ground at its inner front contact, through the back contacts of the vertical and rotary stepping magnets 53 and 55, lower winding of stepping relay 52, to battery at a back contact of relay 57. The stepping relay 52 operates, closing a circuit, which includes a back contact of relay 54, for operating the vertical stepping magnet 53. The operation of magnet 53 raises the brushes 61 and 66 and commutator brush 67 to the first level. The vertical off-normal springs 58 are actuated as soon as the shaft moves out of normal position. The operation of magnet 53 opens the circuit through the lower winding of relay 52, and relay 52 releases unless the calling trunk is connected to terminals in the first level of the finder switch; in which case, relay 52 is held operated in a circuit traced from ground at the inner front contact of the

group relay 48, through conductor 49, the first terminal of commutator 68 and brush 67, upper winding of relay 54, back contact of the rotary stepping magnet 55, lower winding of relays 52, to battery at a back contact of relay 57. Relay 54 is operatively energized by its upper winding in this circuit but is slow in operating. Relay 52 prevents further vertical stepping. When relay 54 closes its lower front contact, a circuit is completed from battery at the middle upper back contact of relay 57 through the winding of magnet 53, lower winding and front contact of relay 54, to ground at relay 51. The vertical stepping magnet is not operatively energized in this circuit but relay 54 is held operated independent of the commutator brush 67. If the trunk T is connected to terminals in a level other than the first, relay 52 releases when magnet 53 operates; the release of relay 52 causes the release of magnet 53; the release of magnet 53 causes the reoperation of relay 52; and the vertical stepping magnet 53 is thereupon operated to step the brushes of the trunk-finder switch to the second level. This cycle of operations is repeated to advance the brushes step-by-step until the calling level is found, at which time relay 52 is held operated and relay 54 is operated as above described. The complete operation of the relay 54 closes a circuit, which includes the contacts of the stepping relay 52, for operating the rotary stepping magnet 55. The operation of magnet 55 rotates the brushes 61 to 66 into engagement with the first set of terminals in the level, the brush 67 being moved out of engagement with the commutator terminal. The operation of magnet 55 also causes the release of the stepping relay 52. If the trunk T is connected to the first set of terminals in the level, relay 52 is held operated and relay 56 is operated when brush 66 encounters the test terminal of trunk T; but if the trunk for which the brushes are hunting is not connected to the first set of terminals in the level, relay 52 releases causing the release of magnet 55; whereupon relay 52 reoperates and magnet 55 is reoperated to step the brushes to the next set of terminals. This cycle of operations is repeated until brush 66 encounters the test terminal of trunk T, at which time a circuit is closed from battery through the winding of relay 16 of trunk T, a front contact of relay 15, conductor 46, terminal and brush 66 of trunk finder TF, uppermost back contact of relay 57, lower winding of relay 56, upper winding of relay 52, to ground at relay 51. Relays 16 and 56 are operated and relay 52 is held operated in this circuit. Relay 52 holds magnet 55 to prevent further advance of the brushes. Relay 56 closes a circuit from battery through the lower winding of relay 57, lower front contact of relay 56, to ground at the upper contact of VON springs 58. The operation of relay 57 causes the release of relays 51, 52 and 54, and the release of magnet 55. Relay 57 also extends the starting conductor 50 to conductor 69 leading to the next finder in the group. If the sender selector SS has not yet found an idle register sender, as hereinafter described, relay 56 is held in a circuit through its locking winding and upper front contact, lower back contact of relay 90, and through conductor 70, to ground at a front contact of relay 71. If an idle register sender has been seized and relay 90 operated as hereinafter described, relay 56 is held, through the lower front contact of relay 90 and brush 96, to ground in the sender.

The aforementioned operation of relay 16, when the trunk finder TF connects with the trunk T, closes a circuit through front contacts of relays 16 and 15 and conductor 29 for operating relay 21. Relay 21 disconnects ground from conductor 47 to release group relay 48. Relay 16 also connects the windings of line relay 31 of selector S1 over conductors 43 and 44 to the brushes 63 and 64 of trunk finder TF. If at this time the sender selector SS has not yet completed selection of an idle register sender, relay 90 is normal and relay 31 is held operated by its upper winding through conductor 44 and brush 64, to ground at the lower front contact of relay 71. Relay 16 locks to ground at the front contact of relay 31 and closes a locking circuit for relay 15 to the same ground; and this ground is further extended over conductor 46, through brush 66 and the front contact of relay 57 and through the back contact of relay 90 to conductor 70, if an idle sender has not yet been seized, or through the front contact of relay 90 to conductor 89, if an idle sender has been seized as hereinafter described.

When relay 51 operates as hereinbefore described to start the operation of the trunk finder TF, it also connects ground through its inner front contact to conductor 70 to cause the operation of relays 71, 72 and 77 of the sender selector SS. The connection between conductor 70 and the winding of relay 71 includes a back contact of relay 87; the connection between conductor 70 and the winding of relay 72 includes a back contact of relay 87, conductor 84, and normally closed contacts of the vertical off-normal springs 78; and the connection between conductor 70 and the winding of relay 77 includes conductor 84 and the lower back contact of relay 75. The operation of relay 71 connects ground to conductor 70 so as to hold relays 55 and 71 operated until relay 87 operates as hereinafter described. If the trunk finder TF finds trunk T before an idle sender is selected, the ground thus connected to conductor 70 also extends through the back contact of relay 90, front contact of relay 57, and brush 66 to conductor 46 to hold relays 15 and 16 operated; and ground at the outer lower front contact of relay 71 is connected through brush 64, conductor 44, a front contact of relay 16, and a back contact of relay 30 to the upper winding of relay 31 so as to hold relays 31 and 32 operated. Relay 72 locks under control of the vertical stepping magnet 73 and closes a circuit from battery through the winding of vertical stepping magnet 73, winding of slow-to-release relay 74, lower front contact of relay 72, conductor 84, back contact of relay 87, conductor 70 to ground at relay 71. Relay 74 and the magnet 73 operate. Magnet 73 steps the brushes 91 to 96 and commutator brush 97 up to the first level and also causes the release of relay 72. Relay 74 is slow in releasing and remains operated until vertical stepping is completed. The vertical off-normal springs 78 are operated when the shaft of switch SS moves out of normal position, closing a circuit for operating relay 82; and relay 82 locks through back contacts of rotary stepping magnet 81 and relay 87. If upon engagement of commutator brush 97 with any level terminal, the engaged terminal is guarded against selection by a ground potential connected thereto, relay 72 is reoperated, when magnet 73 releases, by the current in a circuit which includes the inner upper back contact of relay 75, brush 97 and the guarded terminal. The re-

operation of relay 72 causes the reoperation of magnet 73 and the brushes are thereby advanced to the next level. Relay 72 and magnet 73 continue to reoperate and advance the brushes step-by-step until brush 97 engages an unguarded level terminal at which time a circuit is closed for operating relay 75 from battery through relay 100 or corresponding relay of another level, brush 97, back contact and upper winding of relay 75, lower front contact of the VON springs 78, conductor 84 and back contact of relay 87 to ground on conductor 70. Relay 100 is marginal and does not operate at this time.

Before describing the further operation of the sender selector SS, the various conditions which exist when a level is guarded against selection will be described. First, all of the senders in the level may be busy, in which case the level relay 100 is being held operated in a chain circuit through a front contact of the busy relay 103 in each of the senders in that level. Second, there may already be a sender selector hunting in the level; in which case, ground is connected through the back contacts of relays 104 and 105 in the first idle sender in the level and through the front contacts of the corresponding relays in preceding busy senders in the level to hold relay 100 and to guard the commutator terminal against seizure. If, however, a sender, which a hunting sender selector has already tested and found busy, becomes idle before this selector has found an idle sender in the level, the release of its relay 103 causes the release of relays 104 and 105 and disconnects the guarding ground potential from the locking contact of relay 100 and from the level terminal. Since relay 104 is slow in releasing, relay 100 releases before the armature of relay 104 engages its back contact. The disconnection of the guarding ground potential from the level terminal allows another sender selector to start hunting in this level, although the first selector hunting therein has not yet found and seized an idle sender.

When an unguarded level is reached and magnet 73 has released, relay 72 is connected in series with the upper winding of relay 75 to grounded conductor 70. The current in this circuit holds relay 75 but does not reoperate marginal relay 72. Relay 75 opens the circuit through the winding of relay 77 and connects the winding of relay 76 in series with brush 97 and relay 100. Relay 77 is slow in releasing and, if the commutator brushes 97 of two sender selectors should be testing any level at the same time, relays 76 of these sender selectors will fail to operate on account of the increased drop in potential in the winding of relay 100; and, in this case when relay 77 releases, relay 72 is reoperated through the uppermost back contact of relay 77, the back contact of relay 76, the lower front contact of springs 78 and conductor 84 to cause the reoperation of magnet 73 and continued energization of relay 74. When brush 97 engages the terminal of a level in which there is an idle sender, in which no other sender selector is hunting and at a time when no other sender selector is testing this level, relay 76 operates prior to the release of relay 77, preventing the reoperation of relay 72; and in this case, the release of relay 77 closes a holding circuit for relay 75 from battery through the upper winding of relay 75, front contact of relay 76, lower front contact of relay 75, and conductor 84 to ground at relay 71. The release of relay 77 causes the release of relay 76 and the operation of level relay 100; the circuit for

operating relay 100 is traced through brush 97, the inner upper front contact of relay 75, inner back contact of relay 77, lower front contact of the VON springs 78, conductor 84, and through a back contact of relay 87 and conductor 70 to ground. Relay 100 locks through front contacts of relays 103 and 105 of busy senders and the back contacts of relays 103 and 104 of the first idle sender in the level. Relay 75 is held by its upper winding in series with the winding of marginal relay 72 until seizure of an idle sender is completed.

When vertical stepping is completed and relay 74 releases, the rotary stepping magnet 81 is operated by the current in a circuit which includes the lower front contact of relay 82, inner back contact of relay 74, lower front contact of VON springs 78 and conductors 84 and 70. The operation of magnet 81 rotates the brushes 91 to 96 into engagement with the first set of terminals in the selected level and causes the release of relay 82. The release of relay 82 causes the release of magnet 81. The commutator brush is rotated out of engagement with its bank when magnet 81 operates so that the holding of level relay 100 is controlled solely by the busy relays of the senders in the level. If the sender connected to the first set of terminals is idle, relay 82 does not reoperate and relay 87 operates; but if this sender is busy, there is a guarding ground potential connected to the terminal engaged by brush 96 which short-circuits the winding of relay 87 and effects the reoperation of relay 82. If relay 82 reoperates, it causes the reoperation of magnet 81 and the advance of the brushes to the next set of terminals. When an idle sender is reached, relay 87 is operated by the current in a circuit from battery through the winding of relay 82, back contact of magnet 81, winding of relay 87, upper contact of VON springs 78, to ground at a front contact of relay 71. Being marginal, relay 82 does not reoperate in series with relay 87. Relay 87 connects the operating ground through its inner upper front contact to conductor 89 and brush 96 to temporarily guard the sender against seizure by another sender selector; and connects this ground to the winding of relay 90. Relay 87 also opens the circuit through the winding of the slow-to-release relay 71. The operation of relay 90 connects brushes 61 to 66 of finder TF to brushes 91 to 96 of sender selector SS. If at this time the trunk finder TF has found the trunk T and the line finder LF has found the calling line, the impulse relay 101 of the selected sender is operated in a circuit which includes brushes 91 and 92 of sender selector SS, front contacts of relay 90, brushes 61 and 62 of trunk finder TF, conductors 41 and 42, front contacts of relay 15 of trunk T, brushes 11 and 12 of line finder LF and the calling subscriber's line loop. Relay 101 causes the operation of relay 102 and relay 102 connects a busy and holding ground potential to the terminal engaged by brush 96 to hold relays 56, 87 and 90 of the link LK and relays 15 and 16 of trunk T. Since relay 71 is slow in releasing, relay 102 connects ground to conductor 89 before relay 71 releases. If, however, the trunk finder has not yet found the calling trunk when an idle sender is seized and relay 90 operates, relays 101 and 102 do not operate and relays 87 and 90 are held, after relay 71 releases, over conductor 89 through the lower front contact of relay 90 and a back contact of relay 57 to ground at the front contact of relay 51. As soon as the trunk finder TF finds the trunk T and relay 57 operates, con-

ductor 89 is connected with conductor 46 so that ground from the front contact of relay 31 holds relays 56, 87 and 90 operated until relays 101 and 102 are operated over the calling subscriber's loop.

With relay 16 operated, due to the connection of the brushes of trunk finder TF to trunk T, and relay 90 operated, due to the connection of the brushes of sender selector SS to an idle sender, the windings of relay 31 are connected through front contacts of relay 16, conductors 43 and 44, brushes 63 and 64, front contacts of relay 90, brushes 93 and 94, to the closed contacts of the impulse sending relay 111 in the selected sender RS.

When the calling line has been found by the line finder LF and extended through the contacts of relay 15, the trunk finder TF and the sender selector SS to relay 101 of the sender, dial tone is transmitted to the calling subscriber in usual manner. When the called number is dialed, relay 101 responds to each impulse and the called number is registered. Relay 102 is slow-to-release and remains operated during response of relay 101 to dial impulses. The impulse sending relay 111 is thereupon operated to control the selective operations of selector S1, intermediate selectors, if any, and connector C. Since the operation of two-motion step-by-step selectors is well known the operation of selector S1 will be only briefly described. Relay 31 responds to the first train of impulses transmitted by relay 111 of the sender, each closure of the back contact of relay 31 being effective to operate the vertical stepping magnet 33 and thereby raise the brushes up to the desired level. Relay 34 operates in series with magnet 33 and being slow in releasing remains operated until vertical stepping has been completed. Relay 32 is slow-to-release and remains operated while impulses are being received. The operation of the vertical off-normal springs 39 closes a circuit for operating relay 35 and relay 36 locks under control of rotary stepping magnet 35. When relay 34 releases, magnet 35 operates, releasing relay 36 and advancing the brushes into engagement with the first set of terminals in the selected level. After magnet 35 releases, relay 36 reoperates if the test terminal of the first set is connected to ground; and in this case magnet 35 reoperates, stepping the brushes to the next set of terminals. When an unguarded set of terminals is encountered, relay 30 operates in series with relay 36 but relay 36 is marginal and does not reoperate. Relay 30 connects ground from the front contact of relay 32 to the test brush to mark the selected trunk as busy and extends the impulse circuit through the brushes of selector S1 to the line relay (not shown) of the seized selector or connector. The operation of relay 30 causes the release of relay 31 but relays 32, 15 and 16 hold over conductors 28, 46, and 89 to ground at the front contact of relay 102.

The sender thereupon transmits the trains of impulses required for selectively operating any intermediate selectors and the connector C to establish connection with the called line L2. When all impulses have been transmitted, relay 112 is operated, disconnecting the holding ground from conductors 89 and 46 causing the release of relays 15, 16, 56, 87 and 90. The release of relay 15 disconnects the calling line from conductors 41 and 42 and connects the line to the windings of line relay 31 of selector S1. Relay 31 reoperates, holding relay 32 operated and re-

lay 32 maintains the connection of the busy ground to the test brush of the selector S1 until the connection is released by the calling subscriber. A supervisory bridge is closed by the release of relay 16 through the lower front contact of relay 32 and the retard coil 20 for holding the line relay (not shown) of the connector C.

When relay 15 releases, relays 101 and 102 of the register sender release and the register sender is thereupon restored to normal. When ground is disconnected from conductor 89, due to release of relay 102 of the sender, relays 56, 87 and 90 release. The release of relay 87 closes a circuit for operating the release magnet 79 of the sender selector SS and the release of relay 56 closes a circuit for operating the release magnet 59 of the trunk finder TF. When these switches reach normal, the return of the .VON springs 58 and 78 to normal opens the circuits of the release magnets. Relay 57 of the trunk finder TF releases when this switch reaches normal unless the group relay 48 is being held by another call.

If all senders are busy, the brushes of the sender selector are raised to the tenth level and rotated therein to the eleventh rotary position in which the "11th rotary step" springs are operated. Relays 75 and 87 not having been operated, the release magnet 79 is energized and the sender selector is restored to normal. On reaching normal, the hunting operation of the switch is resumed.

When the calling subscriber replaces the receiver, relays 31 and 32 release, thereby causing the release of cut-through relay 30 of selector S1, the release of the cut-through relays of intermediate selectors, if any, the release of the cut-through relay 30 of trunk T and the release of the cut-through relay, not shown, of the line finder LF. The release of relay 30 closes the circuit for operating release magnet 37, restoring the brushes of selector S1 to normal. The connector and line-finder switches are restored to normal in usual and well-known manner.

If the call is one which the sender routes to an operator, the relay 107 in the sender is operated in a circuit local to the sender as soon as the switch S1 selects a set of terminals which are connected to a trunk to an operator. The circuit for operating relay 17 is traced from ground through resistor 106, front contact of relay 107, terminal and brush 95 of switch SS, front contact of relay 90, brush 65 and terminal of switch TF, conductor 45, through the lower windings of relays 22 and 17 in parallel to battery. Relay 22 is marginal and does not operate. Relay 17 locks through its upper winding and inner upper front contact, back contact of relay 22, conductor 29, lower front contact of relay 30, test brush of selector S1 to a holding ground in the trunk to the operator, which trunk is not shown in the drawings. Relay 17 disconnects relay 31 and connects the calling line to and through front contacts of relay 30 and the upper brushes of switch S1, to the talking conductors of the trunk. Relays 31 and 32 release but relay 30 is held through the test brush to the holding ground in the trunk to the operator. When the connection is released, the disconnection of the holding ground causes the release of relays 17 and 30 and the return of switches LF and S1 to normal.

While the invention is herein applied to a sender selector switch, it is, of course, applicable to any circuit hunting switch which automatically operates to select an idle set of terminals in any one of a plurality of groups.

What is claimed is:

1. A switching system comprising a plurality of lines divided into groups, selectors, each selector arranged to select a group having one or more idle lines therein and to hunt for an idle line in a selected group, and means including a group terminal for marking a group busy upon selection of the group by any one of said selectors and for maintaining said marking until an idle line has been selected by the selector in question.

2. In a switching system according to claim 1, means for terminating the marking of a group as busy while a selector is hunting for an idle line therein when and if a line already tested and passed becomes idle.

3. In combination, selectors, each selector comprising a set of brushes and a bank of terminals, the terminals of said bank being divided into groups, a primary magnet for advancing the brushes to select a group of terminals, a group testing brush, a group test terminal for each of said groups of terminals, a secondary magnet for advancing the brushes to select an idle set of terminals in a selected group, and means for starting the operation of the selector, groups of lines, each group being connected to the terminals of a different one of said groups of terminals in the bank of each of said selectors, group relays, one for each of said groups of lines, each group relay being connected to the associated one of the group test terminals of each of said selectors, busy relays for each of said lines, means comprising busy relays of all lines in a group for connecting a guarding potential to the associated group test terminals to prevent selection of the group, means comprising the group relay of a group of lines for connecting the guarding potential to the associated group test terminals to prevent selection of the group, and a circuit closed upon selection of a group of terminals by one of said selectors to operate the group relay to guard said group against selection by another of said selectors.

4. In a combination according to claim 3, means for disconnecting the guarding potential from the group test terminals of a group while one of said selectors is hunting therein if and when one of the lines already tested and passed by becomes idle, said disconnecting means comprising a relay individual to said one of the lines.

5. In combination, selectors, each selector comprising a set of brushes and a bank of terminals, the terminals of said bank being divided into groups, a primary magnet for advancing the brushes to select a group of terminals, a group testing brush, a group test terminal for each of said groups of terminals, a secondary magnet for advancing the brushes to select an idle set of terminals in a selected group, and means for starting the operation of the selector, groups of lines, each group being connected to the terminals of a different one of said groups of terminals in the bank of each of said selectors, group relays, one for each of said groups of lines, each group relay being connected to the associated one of the group test terminals of each of said selectors, a circuit closed upon selection of a group of terminals by one of said selectors for operating the associated group relay, and a circuit closed by said group relay for connecting a guarding potential to the associated group test terminals of the other selectors to prevent selection of the group by another selector.

6. In a combination according to claim 5, means for disconnecting the guarding potential from the group test terminals of a group while one of said selectors is hunting therein if and when one of the lines already tested and passed by becomes idle, said disconnecting means comprising a relay individual to said one of the lines.

7. In combination, selectors, each selector comprising a set of brushes and a bank of terminals, the terminals of said bank being divided into groups, a primary magnet for advancing the brushes to select a group of terminals, a group testing brush, a group test terminal for each of said groups of terminals, a secondary magnet for advancing the brushes to select an idle set of terminals in a selected group, and means for starting the operation of the selector, groups of lines, each group being connected to the terminals

of a different one of said groups of terminals in the bank of each of said selectors, group relays, one for each of said groups of lines, each group relay being connected to the associated one of the group test terminals of each of said selectors, busy relays for each of said lines, a circuit closed upon selection of a group of terminals by one of said selectors for operating the associated group relay, and a circuit closed by said group relay for connecting a guarding potential to the associated group test terminals of the other selectors to prevent selection of the group by another selector, said last-mentioned circuit comprising a back contact of a busy relay of the first idle line in the group and a front contact of a busy relay of each of any preceding busy lines in the group.

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