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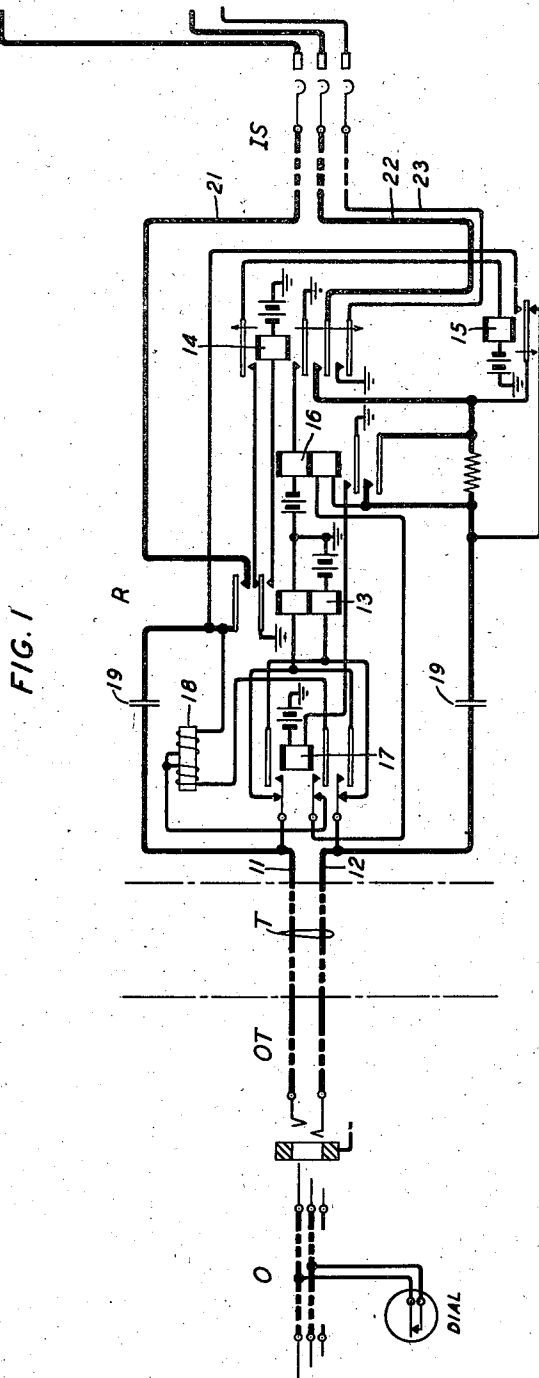
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2,151,767

TELEPHONE SYSTEM

Filed Aug. 4, 1936

2 Sheets-Sheet 1



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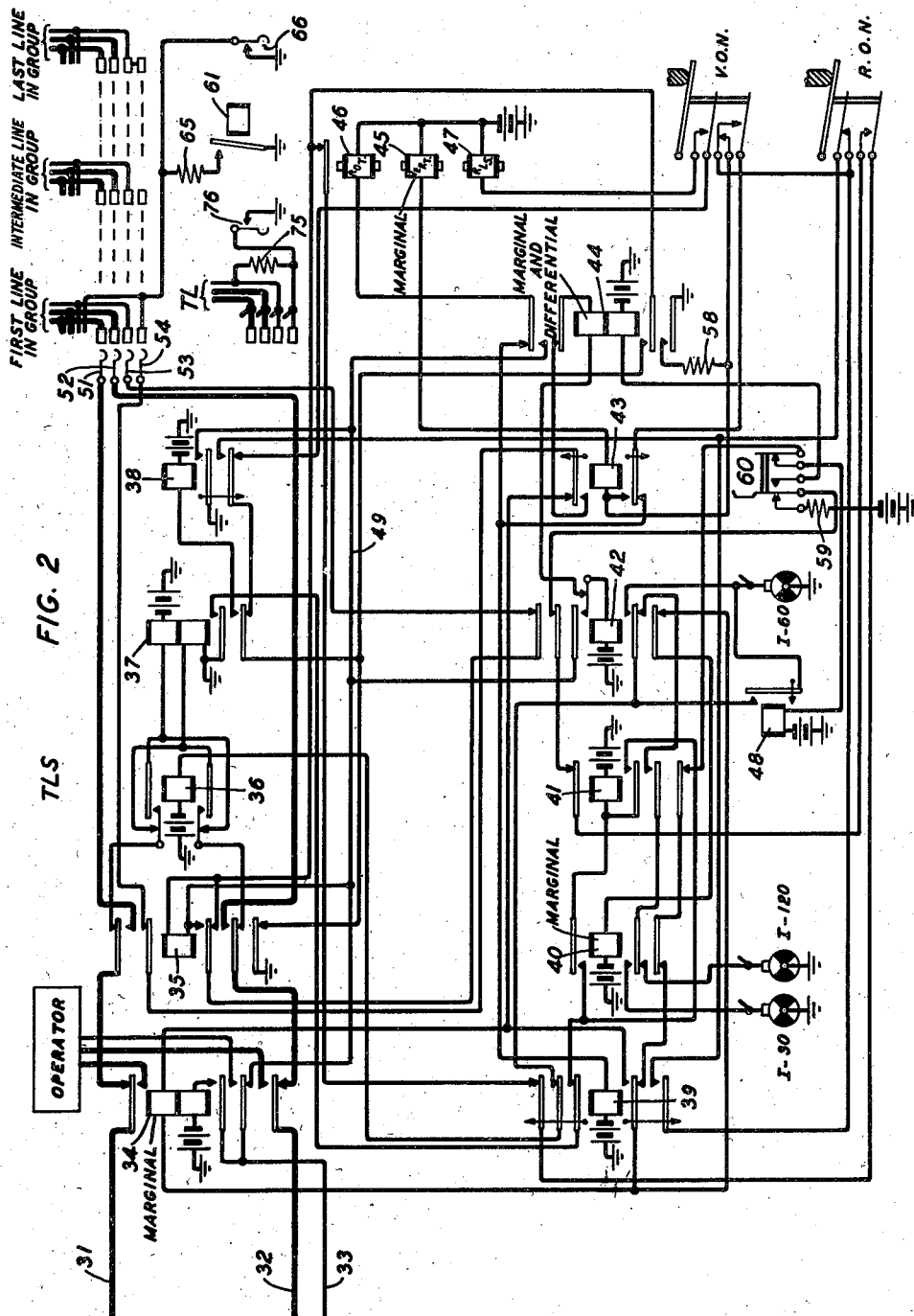
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TELEPHONE SYSTEM

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Application August 4, 1936, Serial No. 94,149

10 Claims. (Cl. 179—27)

This invention relates to telephone systems and particularly to systems in which automatic switching equipment is used for completing desired connections.

5 The invention has for its object the provision of improved switching means for selecting toll lines and for increasing the efficiency and adaptability of such equipment.

10 In systems comprising directly controlled automatic switches, it is known to provide connector switches arranged to select a particular set of terminals which set may be connected to the first line of a group and if the first line is busy to hunt for an idle line in the group, one or
15 more groups of lines being connected to a single level of the terminal bank. It is also known to provide selector-connector switches which are arranged to automatically hunt for an idle terminal on certain levels and to be directly advanced
20 on other levels to a desired set of terminals. Accordingly to this invention a two-motion selector switch having a plurality of groups of lines connected to the terminals of one level, or each of several levels, is arranged to be directly
25 operated to select a particular set of terminals, which terminals may be connected to the line of a single-line group or to the first line of a multi-line group; and is arranged to hold the brushes on the first set of terminals of a
30 group in case all of the lines in the group are engaged and to transmit a camping signal to the calling station, to thereafter change the signal when a line in the group becomes idle, and in response to an impulse from the calling station
35 to seize the line with which the brushes are connected if this line has become idle and to hunt for the idle line if the group is a multi-line group and the first line of the group is not idle. This switch is further arranged to transmit an all-
40 lines-busy signal to the calling station if the brushes are advanced to the last line of a multi-line group and this line is found busy; it is also arranged to divert all calls to any group to a special operator whenever the traffic over the
45 lines of the group in question warrants the handling of these calls by such an operator.

These and other features of the invention will be more completely described by considering a telephone system in which the invention is embodied, one such system being illustrated schematically in the drawings which form a part of this specification. The invention is, however, not limited in its application to the particular system shown but is, in general, applicable to all systems employing automatic switches in which a

plurality of groups of lines are connected to a single group of terminals and to systems employing automatic switches for selecting toll lines.

Referring to the drawings:

Fig. 1 represents a toll office comprising an operator's position O and an outgoing trunk circuit OT and another toll office comprising the repeater R and an incoming selector IS;

Fig. 2 represents a toll-line selector in the second toll office.

10 The operator's position O, which is represented by a single cord and a dial may be similar to that shown in Figs. 1 and 2, and described in detail, in Patent 1,859,929 granted to J. B. McKim May 24, 1932; and the trunk OT, which is represented
15 by a jack and the broken lines connected thereto, may be similar to that shown in Fig. 4 of the McKim patent. The incoming selector IS in the second and intermediate toll office may be of the well-known two-motion step-by-step type and is represented by its brushes and a single set of terminals, all associated control equipment being
20 represented by the broken lines; for a description of the construction and operation of such a switch, reference may be had to pages 53 to 65 inclusive of the 2nd edition of "Automatic Telephony" by Smith and Campbell. The repeater R and toll-line selector TLS are shown in detail;
25 the selector is of the two-motion step-by-step type, the terminal bank of which is represented by the first, an intermediate, and the last sets of terminals of a group of lines on one level and by a single set of terminals on another level. The terminals of certain levels, including the level represented by a single set of terminals, are connected to toll lines each of which leads to a different distant toll office; when the brushes are
30 directly advanced to a set of terminals in such a level, the switch does not trunk hunt. The terminals of other levels, including the one represented in the drawings, are connected to one or more groups of toll lines, the brushes being directly advanced on such levels to the first set of terminals in the group and automatically
35 advanced to hunt for an idle line in the group, if any be idle. To enable the trunk-hunting operation on multi-group levels, level springs are provided for actuation when the brushes are raised to such a level. The terminals of the lines of each multi-line group are connected as are the terminals of the group shown in the drawings;
40 that is, the talking terminals and sleeve or test terminal of each line are connected to the corresponding conductors of the line; the fourth terminal of the first line in each group is con-
45 50 55

nected to a group key 66 and through a resistor 65 to the back contact of the associated normally operated all-lines-busy relay 61; the fourth terminal of the last line in each group is strapped to the sleeve terminal of the set; and there is no connection to the fourth terminal of intermediate lines. Reference may be had to Patent 1,688,617 granted to R. W. Engsborg October 23, 1928 for a disclosure of a group-busy circuit arrangement comprising a normally operated relay. On the levels to which the single-line toll groups are connected, the talking terminals and sleeve terminal are connected to the talking and sleeve conductors of the toll line, and the fourth terminal is connected to the sleeve terminal through a resistor 75. There is no all-lines-busy relay for such a group. A group key 76 is provided for each of the single-line groups, this key being connected to the fourth terminal of the line.

Each of the groups of toll lines, both single-line and multi-line groups, is assigned a route or group number which consists of two or more digits. If the incoming selector IS of Fig. 1 is omitted, the number consists of only two digits; and if one or more additional selectors are included in the selecting train between the incoming selector IS and the toll-line selector TLS, the group number consists of four or more digits. As shown, with only the selector IS in addition to the toll-line selector, three digit numbers are used. When an operator at position O in the first toll office wishes to establish connection with a toll line which terminates in the other of the offices represented in the drawings, which other office is reached over interoffice trunks T, the plug of a cord is inserted in the jack of an outgoing trunk circuit OT and the desired toll-line group number is dialed. The dial impulses are repeated in the second toll office by the repeater R to operate the incoming selector IS and a toll-line selector TLS to select the first line of the desired group of toll lines. If the group key of any group is operated at the time the group is selected, the call is diverted to the request operator for completion. If the group key is not operated and the selected line is idle the connection is completed to this line. If, however, the selected line is busy and it is the only line in the group, and less than the maximum allowable number of selectors are already camping on this group, a camping signal is transmitted to the calling operator; if more than this number of selectors are camping on the group, an all-lines-busy signal is transmitted to the operator. If the busy line is the first one of a group and there is at that time an idle line in the group, the selector hunts for an idle line; but if upon reaching the last line of the group, this line should also be found busy, the all-lines-busy signal is transmitted to the operator. If all of the lines in a multi-line group are busy when the first line of the group is selected and less than the maximum allowable number of selectors are already camping on the group, the associated all-lines-busy relay will have been released and the selector camps on the first line, a camping signal being transmitted to the operator. If all of the lines in a selected multi-line group are busy and the maximum allowable number of selectors are already camping on the group waiting for an idle line, the selector proceeds to trunk-hunt, the brushes are advanced to the last line of the group and the all-lines-busy signal is transmitted to the operator. As soon as a line in the group on which a selector is camping becomes idle, the signal is changed to indicate that there is an idle line avail-

able, and an additional dial impulse is then effective to close the testing circuit.

The establishment of a connection by the toll operator through the toll-line selector TLS will now be described in detail. When the operator at position O inserts the plug of a cord in the jack connected to trunk OT, the position dial is connected to the conductors of trunk T as described in detail in the aforementioned McKim patent, thus completing a circuit over conductors 11 and 12, through the outer back contacts of relay 17 of repeater R in the intermediate toll office for operating the line relay 13 of this repeater. Relay 13 closes a circuit for operating the slow-to-release relay 14. Relay 14 connects ground potential to sleeve conductor 23 and closes a circuit through the biasing winding of relay 16. With both of relays 13 and 14 operated, a bridge is connected across the line conductors 21 and 22 of the associated incoming selector IS to cause the operation of the line relay (not shown) of this selector. The bridge is traced from conductor 21 through the outer front contact of relay 13, right winding of impedance coil 18, middle back contact of relay 17, lower winding of relay 16, back contact of relay 15, and through the middle lower front contact of relay 14 to conductor 22. The current through the lower winding of relay 16 is at this time in the non-operating direction. When the toll operator at position O dials each digit of the number of the desired toll group, relay 13 releases and reoperates in response to each dial impulse, thereby repeating the impulses over conductors 21 and 22. Being slow in releasing relay 14 remains operated during dialing. The release of relay 13 in response to the first impulse of each digit closes a circuit for operating relay 15; and since relay 15 is slow in releasing, the intermittent closure of this circuit by relay 13 in response to each succeeding impulse of a digit is effective to hold relay 15 operated until all of the impulses in the train have been received. At its front contact, relay 15 short-circuits the impedance 18 and lower winding of relay 16, thereby improving the transmission of impulses over conductors 21 and 22.

The train of impulses created by the dialing of the first digit of the toll group number and transmitted through repeater R over conductors 21 and 22 effects the operation of the incoming selector IS to select a group corresponding to the digit dialed. The brushes are then automatically advanced to hunt for and seize an idle set of terminals in the selected group, which set of terminals is connected to a toll-line selector TLS. Upon extension of the connection from repeater R through the brushes of selector IS, the ground potential at the lowermost front contact of relay 14 is connected over conductor 23 to the sleeve conductor 33 of the toll-line selector TLS; and a circuit is closed for operating the line relay 37. This circuit is traced from battery through the upper winding of relay 37, lower back contacts of relays 35, 35 and 34, conductor 32, brush of selector IS, conductor 22, middle lower front contact of relay 14, back contact of relay 15, lower winding of relay 16, middle back contact of relay 17, right winding of impedance coil 18, uppermost front contact of relay 13, conductor 21, brush of selector IS, conductor 31, upper back contacts of relays 34, 35 and 36, and through the lower winding of relay 37 to ground. Relay 37 operates, closing a circuit for operating the slow-to-release relay 38. At its inner front contact relay 38 connects ground through conductor 49 75

and the inner lower back contact of relay 34 to sleeve conductor 33; but this is of no consequence when the repeater R is included in the connection since holding ground potential is connected to sleeve conductor 33 over conductor 23 from the repeater. In case the toll lines connected to the banks of toll-line selector TLS are arranged to supply holding ground potential, it would not be necessary to include the repeater R in the connection, in which case the ground at the inner contact of relay 38 would be effective to hold the preceding selector IS until the selector TLS seizes an idle toll line in a selected group. When the calling operator dials the second digit of the number of the desired toll-line group, the impulses are repeated by relay 13 of repeater R to cause the alternate release and reoperation of relay 37. The release of relay 37 in response to the first impulse of the train closes a circuit from ground at the lowermost back contact of relay 35, back contact of relay 37, outer front contact of relay 33, normally closed contacts of the rotary-off-normal springs RON and vertical-off-normal springs VON, winding of relay 43, and through the winding of the vertical-stepping magnet 45 to battery. Relay 43 and magnet 45 are operated by the current in this circuit, the operation of magnet 45 being effective to raise the brushes of the switch one step, to the first level of the bank. The vertical-off-normal springs VON are actuated when the shaft leaves normal position, the circuit through the windings of relay 43 and magnet 45 being thereafter closed through the lower front contact of the VON springs in series with the lower front contact of relay 43 instead of through the middle contact of the VON springs. When relay 37 reoperates at the end of the first impulse, the circuit through the windings of relay 43 and magnet 45 is opened. Magnet 45 releases but relay 43, being slow in releasing, remains operated until all of the impulses in the train have been received by relay 37. Relay 38, being slow in releasing, remains operated during the response of relay 37 to dial impulses. Magnet 45 is in this manner operated in response to each impulse received by relay 37, the brushes being advanced, step by step to the level corresponding to the digit dialed.

When the calling operator dials the third digit of the number of the desired toll-line group, relay 37 releases and reoperates in response to each impulse. The release of relay 37 in response to the first impulse of this train closes a circuit from ground at the lowermost back contact of relay 35, lowermost back contact of relay 37, lowermost front contact of relay 38, normally closed contact of the RON springs, lower front contact of the VON springs, lower back contact of relay 43, thence through the winding of relay 39 to battery and thence through the uppermost back contact of relay 44 and the winding of the rotary-stepping magnet 46 to battery. Relay 39 and magnet 46 are operated, the operation of magnet 46 being effective to rotate the brushes of the switch into engagement with the first set of terminals in the selected level. The RON springs are actuated as soon as the brushes are stepped out of their normal rotary position, the energization of magnet 46 and relay 39 being maintained by closure of the outer lower front contact of relay 39 before the upper contact of the RON springs is opened. When relay 37 reoperates at the end of the first impulse, magnet 46 releases but relay 39 is slow in releasing and remains operated until all of the impulses of the train have

been received by relay 37. The brushes are advanced step by step, by the release of relay 37 and operation of magnet 46 in response to each succeeding impulse of the train, to the set of terminals corresponding to the last digit of the desired group member.

Assume first that calls to the selected group are not then being diverted to a request operator as hereinafter described, and that the line thus selected constitutes a single-line group so that trunk hunting is not required. This being the case the level contacts 60 are not actuated; and, when relay 39 releases, the line to which the brushes have been directly advanced is tested for its busy or idle condition by brush 53. If the selected line is idle, relay 35 is operated by current in a circuit from battery through resistor 59 and left back contact of springs 60, back contacts of relays 42 and 41, lower contact of the RON springs, uppermost back contact of relay 39, contact of the rotary-stepping magnet, winding of relay 35, to ground on conductor 49. The release of relay 39 also closes at its lower back contact, a circuit through the winding of relay 49 and brush 54, but relay 43 is slow in operating and its operation at this time is prevented by the operation of relay 35. Relay 35 disconnects relay 37 from conductors 31 and 32 and extends the connection from these conductors through brushes 51 and 52 to the talking conductors of the toll line. The release of relay 37 causes the release of relay 38, relay 35 being held operated over conductors 49, 33 and 23 by ground potential at the lowermost front contact of relay 14 of repeater R. This ground potential is also extended through the inner lower front contact of relay 35 and the uppermost back contact of relay 42 through brush 53 to the sleeve terminal of the toll line to guard this line against seizure by any other selector having access thereto. Relay 35 holds until the operator at position O releases the connection by removing the plug of the cord from the jack of trunk OT at which time relay 13 of repeater R is released. The release of relay 13 causes the release of relay 14 and opens the bridge across conductors 21 and 22. The release of relay 14 disconnects the holding ground potential from conductors 23, 33 and 39 thereby causing the incoming selector IS to be restored to normal in well-known manner and causing the release of relay 35 of toll-line selector TLS. The release of relay 35 closes the circuit for operating release magnet 47 and the toll line selector TLS is thereupon restored to normal in usual manner.

If the selected toll line constitutes a single-line group and is busy, the guarding ground potential encountered on the sleeve terminal by brush 53 is connected through the uppermost back contact of relay 42 and the inner lower back contact of relay 35 to short-circuit the winding and thus prevent the operation of relay 35 when relay 39 releases. Before the slow-to-release relay 39 opens its inner lower front contact, the guarding ground potential on this sleeve terminal is also connected through resistor 75 to the fourth terminal, thence through brush 54, inner upper back contact of relay 35, upper back contact of relay 43, inner lower front contact of relay 39, lowermost back contact of relay 42 to the winding of relay 40. If at that time the number of selectors already camping on this line is less than the allowable maximum number, the marginal relay 40 is operated by the current in this circuit. The inner lower front contact of relay 39 maintains a short circuit around the upper winding of relay

34 to prevent the operation of relay 34 in case the brush 54 encounters ground potential from an operated group key of some line over which the brushes pass during their advance in response to the last digit of the dialed group number. When this short circuit is opened by the release of relay 39, relay 40 remains operated; but relay 34 is marginal and, with resistor 75 in the circuit, does not operate. The release of relay 39 closes a circuit through the upper front contact of relay 49, inner upper back contact of relay 39 and inner lower front contact of relay 37, for operating relay 41. Relay 41 locks through its inner lower front contact independent of relay 40. With relays 40 and 41 operated and relay 39 released, the winding of relay 36 is connected through the middle upper back contact of relay 39, inner lower back contact of relay 42, lowermost front contact of relay 41 and lower front contact of relay 40 to the 30 impulse per minute source I—30. Relay 36 is thereupon alternately operated and released thirty times per minute, each operation causing an interchange of the connections between conductors 31 and 32 and the windings of relay 37 and the consequent reversal of current over these conductors and through the lower winding of polarized relay 16 of repeater R. Relay 16 is thereby operated each time relay 36 operates and in turn causes a corresponding operation of relay 17. Each operation of relay 17 interchanges the connections between conductors 11 and 12 and the windings of relay 13; the current over these conductors to the toll operator's position is thereby reversed thirty times per minute as a signal to the operator that the group is busy and that the selector is camping on the group waiting for a line to become idle. When the line does become idle, the guarding ground potential is disconnected from the sleeve terminal and relay 40 releases, but relay 35 cannot operate as long as relay 41 remains operated. The release of relay 40 transfers the winding of relay 36 from the thirty impulse per minute source I—30 to the one hundred and twenty impulse per minute source I—120, thereby changing the signal transmitted to the operator to a line-idle signal. If then the calling operator dials the digit 1, the impulse thus created is repeated by relay 13 of repeater R to cause the momentary release of relay 37. The release of relay 37 causes the release of relay 41 thereby preventing the further operation of relay 36 and enabling operation of relay 35 and extension of the connection to the toll line in question.

If when the line of a single-line group is selected, the line is busy and the maximum allowable number of selectors are already camping on this line, the drop in potential through the common resistor 75 is sufficient to prevent the operation of the marginal relay 40; but the increased drop in potential, upon adding the circuit through relay 42 of the selector in question, is not sufficient to cause the release of the corresponding relays in the selectors already camping on this line. Since neither of relays 35 or 40 have been operated, the release of relay 39 closes a circuit from the busy ground encountered by brush 54, through a back contact of each of relays 35 and 43, upper winding of relay 34, lower back contact of relay 39, back contacts of relays 40 and 41, and through the right contact of level springs 60 to the winding of relay 48. Relay 48 thereupon operates and connects the sixty impulse per minute source I—60 to the winding of relay 36 and an all-lines-busy signal is thereupon transmitted

to the calling operator by the resulting repeated operation of relay 36. Relay 48 is slow in operating so that it will not be operated falsely before relay 35 opens its operating circuit in a case where relay 35 does operate. When the operator removes the plug from the jack of trunk OT, the connection is released and the selectors restored to normal as hereinbefore described.

Assume next that the selected line is the first line of a multi-line group; in which case the level is one on which the level springs 60 are actuated. If the first line in the group is idle, connection therewith is completed by the operation of relay 35 as hereinbefore described except that the circuit for operating relay 35 includes the lower winding of relay 44 and front contact of level springs 60 instead of resistor 59 and the back contact of these springs. Being marginal, relay 44 is not operated by the energization of its lower winding in series with the winding of relay 35. If, however, this first line is busy but not all of the lines in the group are busy, the ground potential on the sleeve terminal encountered by brush 53 short-circuits the winding, and prevents the operation of relay 35 and causes the operation of relay 44. Relay 44 closes a circuit from ground at its lowermost front contact, through resistor 58, winding of relay 43 and winding of the vertical-stepping magnet 45. Relay 43 is operated in this circuit but resistor 58 limits the current to prevent operation of the marginal magnet 45. At its upper front contact, relay 44 closes a circuit for operating the rotary-stepping magnet 46, the brushes being thereby advanced one step to the next set of terminals. The operation of magnet 46 causes the release of relay 44 and relay 44 opens the operating circuit of magnet 46. If this next line is idle, relay 35 is operated as hereinbefore described to complete the connection therewith. If the next line is busy and is not the last line of the group, relay 44 is reoperated and closes the circuit through the windings of relay 43 and magnet 46. Magnet 46 is thus reoperated to step the brushes to the next set of terminals. Being slow in releasing, relay 43 remains operated while the brushes are hunting for an idle line. The brushes are in this manner advanced step-by-step to each succeeding set of terminals in the group until an idle line is found.

If, however, the brushes are advanced to the last set of terminals in the group and the line connected thereto is also busy, the guarding ground potential on the sleeve terminal is connected through brush 53 to prevent the operation of relay 35 and, since relay 43 is slow in releasing, is also connected through the fourth terminal and brush 54, inner upper back contact of relay 35, upper front contact of relay 43, inner upper back contact and upper winding of relay 44, and through the continuity spring and winding of relay 42 to battery. The energization of the upper winding of relay 44 in series with brush 54 electromagnetically opposes the energization of its lower winding in series with brush 53 so that relay 44 does not reoperate. Relay 42 operates, opens its operating circuit, and closes a locking circuit through its inner upper front contact over conductor 49 to holding ground potential at relay 14 of repeater R. At its lower front contact, relay 42 connects the winding of relay 36 to the sixty impulse per minute source I—60, an all-lines-busy signal being transmitted to the calling operator by the repeated operation of relay 36.

If when the brushes are selectively advanced to the first set of terminals in a desired group, all of the lines in the group are busy, the associated all-lines-busy relay 61 will have been released. In such a case the guarding ground potential on the sleeve terminal is connected through brush 53 to prevent the operation of relay 35; and ground potential is connected through the back contact of relay 61, resistor 65, fourth terminal and brush 54, inner upper back contact of relay 35, upper back contact of relay 43, inner lower front contact of relay 39, lowermost back contact of relay 42, to the winding of relay 40. If the maximum allowable number of selectors are already camping on this group, the increased drop in potential through resistor 65 prevents the operation of relay 40 of the selector in question but does not cause the release of the corresponding relays of these other selectors. In this case, relay 44 is operated by its lower winding and the brushes are advanced to the last line of the group to operate relay 42 and thereupon transmit an all-lines-busy signal to the calling operator, all as hereinbefore described. If, however, less than the maximum allowable number of selectors are already camping on the group, relay 40 operates; when relay 39 releases, the circuit for operating relay 41 is closed and the 30 impulse per minute camping signal is transmitted to the calling operator as hereinbefore described. When a line in the group becomes idle, the release of relay 61 causes the release of relay 40, thereby changing the signal to a 120 impulse per minute signal under the control of source I—120. If the operator then dials the digit 1, the impulse thus created and transmitted through repeater R causes the momentary release of relay 37. The release of relay 37 causes the release of relay 41 to start the hunting operation of the selector. Whenever the traffic over a particular group of toll lines makes it desirable that all calls thereover be completed by the request operator, the group key associated therewith is operated to prevent seizure of any line in the group by a toll-line selector. For instance, if the key 66 has been operated, the ground potential thereby connected to the fourth terminal of the first line of the group is effective when this group is selected to operate the marginal relay 34 when the release of relay 39 opens the short circuit around the upper winding of this relay. Relay 34 locks through its lower winding and inner lower front contact over conductor 33 to ground at relay 14 of repeater R. The call is thus diverted through the outer front contacts of relay 34 to the request operator.

What is claimed is:

1. In a telephone system, a calling station, a two-motion selector switch, groups of lines connected to the terminal bank of said switch, a plurality of groups being connected to one level of the bank, means comprising an impulse sender at said station for selecting any one of said groups by advancing the brushes of said switch into engagement with the first set of terminals in the desired group, means effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes to hunt for an idle line, means effective upon engagement of the brushes with the terminals of any idle line in a selected group to seize said line, electromagnetic means effective if all of the lines in a selected group are busy for disabling the means for automatically advancing the brushes from the first set of terminals in the

group and for disabling the means for seizing an idle line, and means responsive to an impulse from said impulse sender after one of the lines in the selected group becomes idle for again rendering operative the means for advancing the brushes and the means seizing an idle line.

2. In a telephone system according to claim 1, means for transmitting a distinctive signal to the calling station while the brushes are standing on the first set of terminals in a selected group and all of the lines in said group are busy.

3. In a telephone system according to claim 1, means for transmitting a distinctive signal to the calling station while the brushes are standing on the first set of terminals in a selected group and all of the lines in the group are busy, and means for changing the character of the signal when a line in the group becomes idle.

4. In a telephone system, a toll operator's position, selectors, each selector comprising a two-motion switch, groups of toll lines multiplied to the terminal banks of said switches, a plurality of groups being connected to one level of the banks, means comprising an impulse sender at said position for advancing the brushes of any of said switches to select the first set of terminals in any group, means in each selector and effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes from the first set of terminals to hunt for an idle line, electromagnetic means in each selector and effective if all of the lines in a selected group are busy for preventing the automatic advance of the brushes from the first set of terminals in the group, means in each selector under the control of the operator at said position and render operative when a line in the group, on the first set of terminals of which the brushes are standing, becomes idle for causing the advance of the brushes to select an idle line, means in each selector for transmitting a distinctive signal to the operator at said position while the brushes are being held on the first terminal of a selected group and all of the lines in the group are busy, and means in each selector for transmitting a different signal to the operator if all of the lines in a selected group are busy and the brushes of a predetermined number of the other switches have previously been advanced to and are standing on the first terminal of this group.

5. In a telephone system according to claim 4, means in each selector for changing said distinctive signal to another different signal when a line in a group, on the first set of terminals of which the brushes are being held, becomes idle.

6. In a telephone system, a toll operator's position, selectors, each selector comprising a two-motion switch, groups of toll lines multiplied to the terminal banks of said switches, a plurality of groups being connected to one level of the banks, means comprising an impulse sender at said position for advancing the brushes of any of said switches to select the first set of terminals in any group, means in each selector and effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes from the first set of terminals to hunt for an idle line, electromagnetic means in each selector and effective if all of the lines in a selected group are busy for preventing the automatic advance of the brushes from the first set of terminals in the group, means in each selector under the control of the operator at said position and rendered operative

when a line in the group, on the first set of terminals of which the brushes are standing, becomes idle for causing the advance of the brushes to select an idle line, means in each selector for transmitting a distinctive signal to the operator at said position while the brushes are being held on the first terminal of a selected group and all of the lines in the group are busy, and means in each selector for advancing the brushes to the last set of terminals in a selected group if all of the terminals in the group are busy and the brushes of a predetermined number of the other switches have previously been advanced to and are standing on the first terminal of this group.

7. In a telephone system, a toll operator's position, selectors, each selector comprising a two-motion switch, groups of toll lines multiplied to the terminal banks of said switches, a plurality of groups being connected to one level of the banks, means comprising an impulse sender at said position for advancing the brushes of any of said switches to select the first set of terminals in any group, means in each selector and effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes from the first set of terminals to hunt for an idle line, electromagnetic means in each selector and effective if all of the lines in a selected group are busy for preventing the automatic advance of the brushes from the first set of terminals in the group, means in each selector under the control of the operator at said position and rendered operative when a line in the group, on the first set of terminals of which the brushes are standing, becomes idle for causing the advance of the brushes to select an idle line, means in each selector for transmitting a distinctive signal to the operator at said position while the brushes are being held on the first terminal of a selected group and all of the lines in the group are busy, and means in each selector for advancing the brushes to the last set of terminals in a selected group if all of the terminals in the group are busy and the brushes of a predetermined number of the other switches have previously been advanced to and are standing on the first terminal of this group and for thereupon transmitting to the operator at said position a distinctive signal differing from said first mentioned signal.

8. In a telephone system, a calling station, a two-motion selector switch, groups of lines con-

nected to the terminal bank of said switch, a plurality of groups being connected to one level of the bank, means comprising an impulse sender at said station for advancing the brushes of said switch to select the first set of terminals in any group, means effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes to hunt for an idle line, keys, one for each of said groups of lines, and means effective upon selection of any of said groups of lines and operation of the key individual to the selected group for preventing the seizure of any line in the group.

9. In a telephone system, a calling station, a two-motion selector switch, groups of lines connected to the terminal bank of said switch, a plurality of groups being connected to one level of the bank, means comprising an impulse sender at said station for advancing the brushes of said switch to select the first set of terminals in any group, means effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes to hunt for an idle line, keys, one for each of said groups of lines, an operator's position, and means effective upon selection of any of said groups of lines and including the key individual to the selected group for diverting the call to said operator's position.

10. In a telephone system, a calling station, a two-motion selector switch, groups of lines connected to the terminal bank of said switch, a plurality of groups being connected to one level of the bank, means comprising an impulse sender at said station for advancing the brushes of said switch to select the first set of terminals in any group, means effective if the first line of a selected group is busy and a succeeding line in the group is idle for automatically advancing the brushes to hunt for an idle line, electromagnetic means effective if all of the lines in a selected group are busy for preventing the automatic advance of the brushes from the first set of terminals in the group, means rendered operative when a line in a group, on the first set of terminals of which the brushes are standing, becomes idle and a signal is thereafter received from the calling station for causing the advance of the brushes to select an idle line.

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