April 7, 1931. H. HOVLAND 1,799,796

TELEPHONE EXCHANGE SYSTEM

Filed March 24, 1930 2 Sheets-Sheet 1

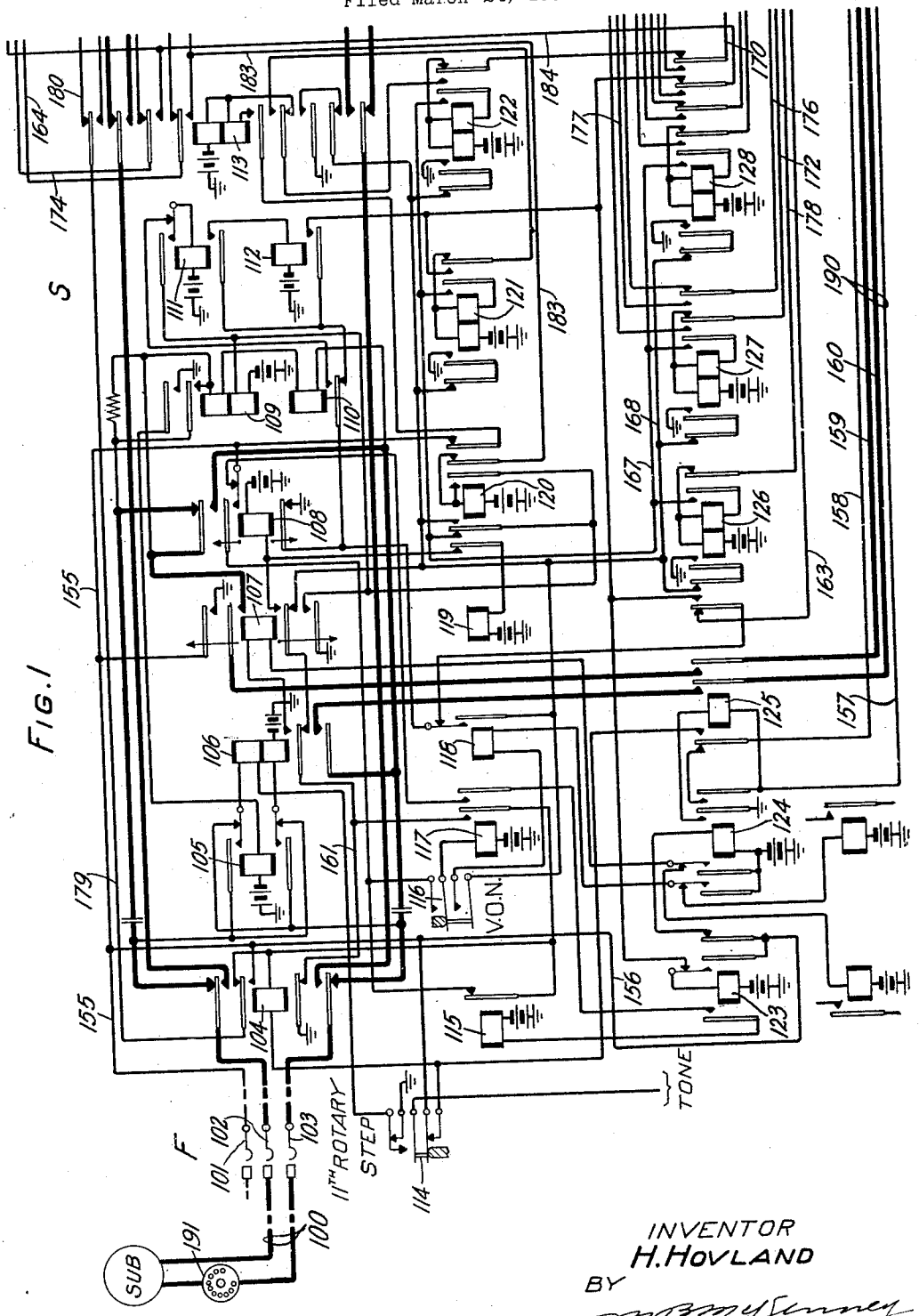

FIG. 1

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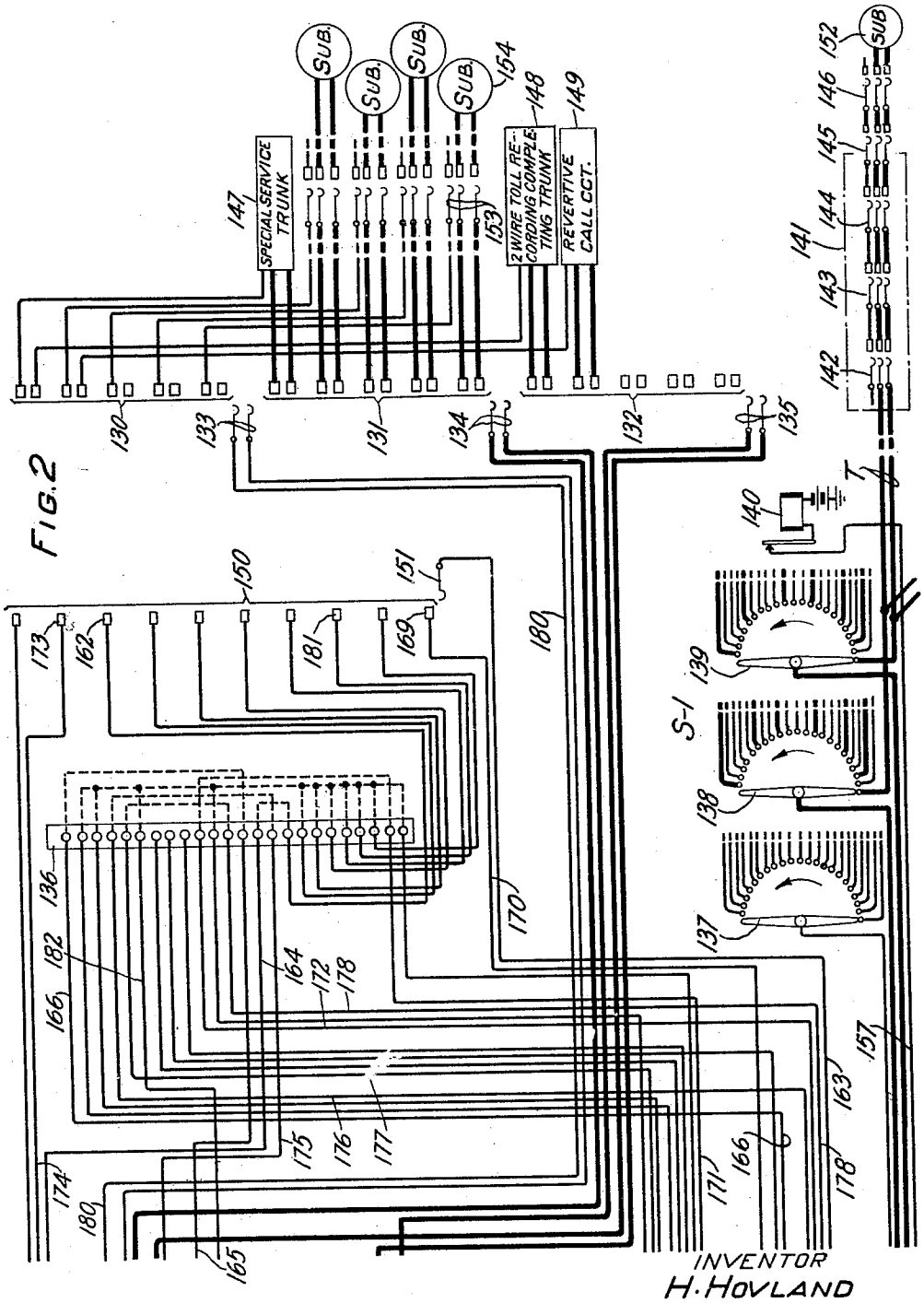

FIG. 2

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UNITED STATES PATENT OFFICE

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TELEPHONE-EXCHANGE SYSTEM

Application filed March 24, 1930. Serial No. 438,362.

This invention relates to telephone exchange systems and particularly to systems involving both central offices and branch offices.

The objects of the invention are to render the branch offices less dependent on the main offices, to enable a more reliable service, and to otherwise improve systems of this character.

A feature of this invention is a system in which a calling subscriber's line in a branch office is automatically extended to a local repeating selector switch comprising two sets of brushes and an impulse repeater and also is extended over an exchange trunk to the central office. The first digits the subscriber dials represent the name of the called office and cause the simultaneous operation of the local selector and the switches at the central office. The local switch operates in its primary movement in response to each of these code digits and releases successively as soon as each digit has been received. In each of its primary movements the selector operates a relay register, and these registers determine, as soon as all code digits have been dialed. whether the call is for a central office number or for a local line in the branch office. If it is for a central office line, the local selector is rendered ineffective to operate further, and the remaining digit impulses are sent to the central office. If, however, the call is for a branch line, the central office trunk is disconnected, and the local selector is permitted to complete its secondary operation to select a trunk through either of said sets of brushes as determined by the code digits initially dialed. The remaining digits dialed by the subscriber cause the extension of his line into connection with the called line in the branch office.

According to another feature, the register, which is variably set by the repeated operations of the local selector responsive to the code digit impulses, serves to absorb an accidental preliminary impulse without interfering with the proper operation of the system.

In the drawing, Fig. 1 shows a calling subscriber's line and a line finder switch in diagrammatic form and also a portion of a local repeating selector switch located in a branch or satellite office. Fig. 2 shows the remainder of the local repeating switch including the brushes which have access to local subscribers' lines and to certain types of trunk circuits. Fig. 2 also shows a trunk selecting switch having access to trunks outgoing to a distant central office which is diagrammatically illustrated in this figure.

A calling line in the branch office is automatically extended over a finder switch F to the repeating selector S. As soon as the line is extended to the selector switch S, the trunk selector S—1 is set in operation to select an idle trunk T extending to the central office 141 and there terminating in a first selector 142. The subscriber then proceeds to dial the designation of the wanted line, which as hereinbefore noted, consists of a code portion and a numerical portion. The code portion may consist of 1, 2 or 3 digits according to the manner in which the switch is wired at the connecting frame 136. If arranged for a three-digit code, which will be assumed for the present description, the impulses of each of the first three digits are repeated over the branch 190 through the selector S—1 and over the trunk T to the central office, causing the setting of the first three switches therein. Also, the selector S operates in its vertical movement and releases in response to each of these first three digits and in so doing causes the operation of certain ones of the register relays 113, 121, 122, 126, 127 and 128 to take a record of the code.

If the call is for a line in the branch office, the circuits are so arranged that after the third code digit has been dialed the trunk T extending to the central office is released, causing the release of the switches 142, 143 and 144, and the selector S is conditioned to operate vertically in response to the next digit and then to operate in its rotary movement to select a trunk extending to a succeeding switch 153. Thereupon the succeeding digits cause the operation of the switch 153 to extend the connection to the called local line 154.

It will be noted that the selector S has two sets of talking brushes 134 and 135 having

access to the respective banks of contacts 131 and 132 each consisting of ten levels and also a set of test brushes 133, one for each of the sets of talking brushes and a corresponding bank of test contacts 130. The brushes of the upper set 134, having access to the bank of contacts 131, serve to extend connections to local subscribers' lines by way of connector switches 153 and also to extend connections over the zero level to the special service trunks 147. The brushes of the lower set 135 have access to revertive call circuits 149 which appear in the ninth level of the bank 132 and to toll recording completing trunks 148 which appear in the tenth level of said bank. The revertive call circuits and toll recording trunks have special numbers. The seizure of these trunks will be explained more in detail hereinafter. The circuits leading to the brushes 133, 134 and 135 are connected to the contacts of the register relay 113 in such a way that when the relay is deenergized the upper set of brushes 134 is effective, whereas when the relay is energized the lower set 135 is effective. The operation of the relay 113 will depend upon the code designation sent by the subscriber.

The switch S is also provided with a brush 151 and a set of commutator segments 150, one segment for each of the ten levels in the switch. These commutator segments are wired at the connecting block 136 in any convenient way to give the desired code designations for local calls, central office calls, and special calls. According to the nature of this wiring at the connecting block, the register relays are operated in response to certain code digits during the preliminary setting and releasing of selector switch S.

If the code dialed determines that the call is for the central office, the vertical magnet of the selector S is rendered ineffective at the end of the third digit so that succeeding digits will not cause the setting of the selector S but will be repeated over the trunk T to cause the further setting of switches in the central office to complete the connection to the called subscriber's line 152.

A detailed description will now be given, and for this purpose it will first be assumed that the subscriber of line 100 in the branch office wishes to hold conversation with the subscriber of line 154 also located in the branch office. It will also be assumed that the digits 8 1 9 constitute the code portion of designations of local office calls. When the call is initiated, the line finder F responds and sets its brushes 101, 102 and 103 on the terminals of the calling line 100. At some time during its operation, the finder F places a ground potential on the sleeve conductor 155. This causes the operation of relay 124 in a circuit from battery, through the winding of said relay, outer right back contact of relay 123, conductor 156, to the grounded sleeve conductor 155. Relay 124 closes a circuit from battery through the winding and contact of stepping magnet 140 of the trunk selector S—1, conductor 157, outer right contact of relay 124, left back contact of relay 125, conductor 158, to the test brush 137 of said selector. If the switch S—1 is not already standing on an idle trunk, it will commence to operate and advance the brushes from terminal to terminal until the test brush 137 encounters a non-grounded terminal representing an idle trunk. So long as the brush 137 encounters grounded terminals the relay 125 is shunted and remains inert, but, when the test brush encounters a non-grounded terminal, the shunt is removed and relay 125 operates in the following circuit: Battery through the winding and contact of the magnet 140, conductor 157, winding of relay 125, to ground at the inner right contact of relay 124. Relay 125 in operating opens the previously-traced stepping circuit of magnet 140 causing the switch to come to rest. Relay 125 being of high resistance prevents the magnet 140 from operating.

When the line finder has found the calling line, relay 106 operates in a circuit from battery through its lower winding, lower normal contact of relay 105, uppermost back contact of relay 104, brush 102, over the loop of the calling line and returning through the brush 103, lowermost back contact of relay 104, upper normal contact of relay 105, upper winding of relay 106, to ground at the contacts 114. Relay 106 closes a circuit for operating the slow release relay 107 traceable from ground through the inner lower contact of relay 104, inner lower armature and front contact of relay 106, winding of relay 107, inner left contact of relay 124, to battery. Relay 107 places ground potential on the sleeve conductor 155 for the purpose of holding the line finder F. This relay also closes the loop of the branch circuit 190 in order to cause the energization of the impulse relay at the first selector switch 142 in the central office. The loop circuit may be traced from the conductor 159, through the outer right contact of relay 125, inner upper contact of relay 107, upper winding of relay 109, winding of relay 110, lowermost contact of relay 106, inner right contact of relay 125, to the other conductor 160. Relay 107 at its lowermost contact also closes a circuit for the lower winding relay 109. This relay is ineffective at this time however, since it will not operate with current in its lower winding alone and will not operate unless current flows in the proper direction in its upper winding. The relay 110 operates in the trunk loop and closes a circuit from battery through the winding and normal contact of relay 111, front contact of relay 110, to ground at the lower contact of relay 108. Relay 111 operates and

locks at its upper contact, to ground at the lower contact of relay 107.

The system is now in condition to receive the first series of impulses, and the calling party proceeds to operate his impulse dial 191. On the first impulse of the series, relay 106 releases and closes an energizing circuit for the vertical stepping magnet 119. This circuit may be traced from ground through the inner lower contact of relay 104, conductor 161, inner lower back contact of relay 106, inner lower front contact of relay 107, outer left contact of relay 120, through the winding of the magnet 119 to the battery. The slow-release relay 108 is energized in parallel with the magnet 119. Since the relays 107 and 108 are slow to relase they retain their armatures attracted during the receipt of impulses. The magnet 119 energizes and advances the brushes 133, 134 and 135 opposite the first level of contacts in the respective banks and also moves the commutator brush 151 into engagement with the first commutator segment. The relay 108 in operating shunts relays 109 and 110 so that the trunk loop now extends from conductor 159 through the outer right contact of relay 125, inner upper contact of relay 107, uppermost front contact of relay 108, lowermost contact of relay 106, thence to the other conductor 160. Relay 108 also causes the operation of relay 117 in the circuit from battery, through the winding of the latter relay, upper contacts 116, closed when the switch takes its first vertical step, inner upper front contact of relay 108, to the grounded conductor 155. Relay 117 operates and locks in a circuit from battery, through its winding, contacts 116, contact of the rotary magnet 115, inner contact of relay 117, to the grounded conductor 161. For each succeeding impulse, the magnet 119 advances the brushes one step, until they are finally positioned opposite the eighth level of contacts and the commutator brush 151 is in engagement with the eighth segment 162 representing the first digit 8 of the code designation.

As soon as relay 108 releases following the first digit, a circuit is closed for operating the register relay 128. The circuit may be traced from ground through the lower contact of relay 108, normal contacts of the release magnet 118, outer left back contact of relay 126, conductor 163, commutator brush 151, segment 162, through the connecting block 136 to conductor 164, inner upper back contact of relay 113, conductor 165, through the connecting block 136 to conductor 166. next to the inner right hand armature and back contact of relay 128, left winding of said relay to battery. The contact springs on relay 128 are so arranged that when the left winding is energized the relay will close its inner left and its inner right contacts without changing the position of the remaining contacts. The same is true of relays 121, 122, 126 and 127. Relay 128 closes a circuit for both of its windings traceable from battery through said windings, inner right contact, conductor 167, inner left back contact of relay 120, to ground at the lower front contact of relay 107. The right hand winding of the relay is not energized, however, since it is shunted by the presence of ground potential on the conductor 166 as above explained. Relay 128 at its inner left contact causes the operation of the release magnet 118. The circuit may be traced from ground, through the inner left and outer left contacts of relay 128, conductor 168, lower off-normal springs 116, winding of the release magnet 118 to battery. Magnet 118 energizes and restores the brushes of the selector S to their normal position. Magnet 118 also removes ground from conductor 166, thus removing the shunt from the right winding of relay 128 and this relay now fully energizes and operates its remaining contacts. When the switch shaft restores to normal, it shifts the off-normal springs 116 and allows the release magnet 118 and relay 117 to deenergize.

The subscriber next sends a single impulse representing the second digit 1 in the code designation. In response to this impulse, the vertical magnet 119 advances the brushes of the switch S one step and relays 108 and 117 operate. After an interval relay 108 releases, and a circuit is completed for operating the register relay 127. This circuit may be traced from ground through the lower contact of relay 108, thence as previously traced, to the commutator brush 151, segment 169, conductor 170, outermost right front contact of relay 128, conductor 171, through the connecting block 136, to conductor 172, through the middle right back contact of relay 127 and left winding of said relay to battery. Relay 127 shifts its inner right and inner left contacts, closes a circuit through its right winding to the grounded conductor 167, and also places ground potential on conductor 168 to cause the operation of the release magnet 118. Magnet 118 restores the switch to normal and removes ground potential from conductor 167 to permit relay 127 to operate fully. Relay 117 again releases.

The subscriber next transmits the third code digit 9, which causes the switch S to step to its ninth vertical position. When relay 108 releases following the series of impulses, ground is extended over the conductor 163, brush 151, segment 173, conductor 174, next to the inner upper back contact of relay 113, conductor 175, through the connecting block 136, to conductor 176, outermost front contact of relay 127, conductor 177, through the connecting block 136, to conductor 178, outer back contact and left winding of relay 126 to battery. Relay 126

operates partially and closes its inner left and inner right contacts, preparing a holding circuit through its right winding and also placing ground potential on conductor 168 to cause the operation of the release magnet 118. The magnet 118 releases the switch S and removes the shunt from the right winding of relay 126 whereupon this relay fully operates. Relay 126 causes the operation of relay 123, a circuit traceable through the winding and normal contact of the latter relay, outer left front contact of relay 126, normal contacts of the release magnet 118, to ground at the lower contact of relay 108. Relay 123 locks thruogh its inner right contact over conductor 156 to the grounded conductor 155. Relay 123 opens the circuit of relay 124, which releases and causes the release of relay 125. This opens the loop of the trunk T extending to the central office and permits the switches 142, 143 and 144, which have been operated in response to the first three digits, to restore to normal. The trunk T is now free and may be selected in connection with other calls.

The subscriber, continuing to dial, now sends the next series of impulses representing the first digit in the numerical portion of the designation. This series of impulses causes the selector S to function in the same manner as above described to step its brushes in a vertical direction to a position opposite the corresponding level of contacts. In this case, however, the commutator brush 151 is ineffective, since the conductor 163 is opened at the outer left contact of relay 126 and the release magnet 118 is not energized to restore the switch. When relay 108 next releases, the switch operates in its rotary movement to test the trunks in the selected level to extend the connection through to a connector switch, such as the switch 153. The circuit for the rotary stepping magnet 115 may be traced from battery through the winding of this magnet, left contact of relay 123, outer contact of relay 117, normal contacts of relay 108, to the grounded conductor 155. The magnet 115 advances the brushes to their first rotary position and in so doing opens its contact to cause the release of relay 117. Relay 117 in turn opens the circuit of the magnet 115 and the magnet deenergizes. If the first trunk is busy, relay 117 immediately energizes again in a circuit from battery through its winding, contacts 116, contact of the magnet 115, inner upper back contact of relay 104, conductor 179, uppermost back contact of relay 113, conductor 180, upper test brush 133, to the grounded test terminal. A parallel circuit may be traced through the winding of relay 104, contacts 114, to the grounded conductor 155. Relay 104, however, being shunted, does not operate. The relay 117 recloses the energizing circuit of the magnet 115, which steps the brushes to the next set of contacts, and causes the release of relay 117, which in turn releases the magnet. This procedure will continue until an idle trunk is found, at which time the relay 104 energizes in series with the relay 117. The relay 104 operates, but, due to its high resistance, relay 117 cannot energize and the rotary movement therefore ceases.

Relay 104 opens the circuit of the impulse relay 106 and extends the talking conductors of the calling line through to the brushes 134, thence over the selected trunk to the connector switch 153. Relay 106 releases, and after an interval relay 107 deenergizes. Before relay 107 can release to remove ground potential from conductor 155, a substitute ground potential is returned to this conductor from the succeeding switch over the upper test brush 133. The circuit may be traced over the upper test brush 133, conductor 180, uppermost back contact of relay 113, conductor 179, inner upper armature and front contact of relay 104, to the conductor 155. The relay 107 causes the release of relays 126, 127 and 128.

The next and final series of impulses are transmitted through the selector S and cause the setting of connector switch 153 to complete the connection to the called line 154.

After conversation has been completed and the subscribers replaced their receivers, ground potential is removed from conductor 155 causing the release of relay 104. Relay 104 closes a circuit as follows for the release magnet 119: ground through the inner lower contact of relay 104, inner lower back contacts of relays 106 and 107, off-normal spring 116, winding of release magnet 118, to battery. The magnet 118 restores the selector switch S to normal. The removal of ground potential from conductor 155 also permits the release of the finder switch F.

It will next be assumed that the subscriber of line 100 in the branch exchange wishes to make a central office call. In this case, the code portion of the designation will be made up of some combination of digits other than the combination 8 1 9, which is used for local calls. For example, the code combination for the particular call which he is making may be made up of the digits 3 4 5. He therefore transmits the first digit 3, which causes the selector switch S to operate in the manner above described to position its brushes opposite the third level of contacts in the banks and with the commutator brush 151 on the segment 181. When the slow relay 108 releases following the first series of impulses, a circuit is completed from ground through the lower contact of said relay, thence as previously traced, to the commutator brush 151, segment 181, through the connecting block 136, to the conductor 182, conductor 183, middle right contact and winding of relay 120 to battery. The contact

springs of the relay 120 are so arranged that this relay closes its inner right locking contact before it opens its middle right contact. Accordingly, the relay operates and locks to ground at the lowermost contact of relay 107. Relay 120 opens the circuit of the vertical magnet 119 so that succeeding series of impulses will have no effect on the selector switch S. Relay 120 also operates the release magnet 118 in a circuit from battery, through the winding of said magnet, off normal contacts 116, conductor 168, inner left front contact of relay 120, to ground at relay 107. The magnet 118 restores the switch to normal. The contact springs 116 on being opened as the switch reaches normal cause the deenergization of magnet 118 and the relay 117 which was operated as previously noted during the vertical movement of the switch. As hereinbefore explained, the first series of impulses is also repeated over the trunk T to cause the setting of the first selector switch 142 at the central office. The succeeding series of impulses, including the second and third digits of the code and the following numerical portion, are repeated to the central office where they cause the setting of the switches 143, 144, 145 and 146 to complete the connection to the called subscriber's line 152. In this case the talking connection extends from the calling line 100 through back contacts of relay 104, back contact of relay 108, front contacts of relays 106, 107 and 125, over branch 190 to the central office.

When the conversation is over, the replacement of the called subscriber's receiver causes in the well-known manner the release of the switches in the central office. The replacement of the calling subscriber's receiver causes the release of relays 106 and 107 and the consequent release of the selector switch S as previously described.

From the foregoing description, it will be noted that local calls to subscribers' lines in the branch exchange are completed through the upper set of brushes 134 of the selector switch S. Should it be desirable for a calling line to be extended to a toll recording completing trunk, which may extend to an operator's position at some distant office, or to a revertive call circuit terminating in automatic switches in the local exchange, the lower set of brushes 135 of the switch S are used for this purpose. The circuit 148 may be seized by sending a code designation consisting of the digits 110, whereas the circuit 149 is identified by the code designation 119. It will be noted that both of these designations have a digit 1 in the first two places. The second one of these digits causes the operation of relay 113, which shifts the talking circuit from the regular brushes 134 to the brushes 135. When the selector S is positioned in response to the first digit 1 dialed by the subscriber, a circuit is completed over the commutator brush 151, segment 169, conductor 170, outer right back contacts of relays 128 and 122, left winding of relay 122, to battery. Relay 122 partially energizes, and in so doing causes the energization of the release magnet 118 in the manner above described to restore the selector switch S. Thereupon, relay 122 fully operates in a circuit including both its windings. The next digit 1 sets the switch in the same vertical position and a circuit is now traceable over the conductor 170 through the outer right back contact of relay 128, outer right front contact of relay 122, next to the inner lower back contact and upper winding of relay 113 to battery. Relay 113 partially operates so as to close its inner lower front contact and also its middle lower armature and front contact. The ground potential applied to the middle lower armature and front contact of relay 113 causes the energization of release magnet 118 to restore the selector S to normal. As soon as the release magnet removes the shunt from the lower winding of relay 113, this relay fully operates over a circuit including both its windings and inner lower front contact and thence through the outer right contact of relay 120, to the grounded conductor 155. The third code digit, which may be 9 for example, causes the selector switch to advance nine vertical steps, and, when relay 108 releases, ground potential is extended over the brush 151, segment 173, conductor 174, next to the inner upper armature and front contact of relay 113, conductor 184, next to the outer right back contact of relay 128, contact and winding of relay 123, to battery. Relay 123 operates and locks to conductor 155, thereby causing the release of relays 124 and 125 so as to release the trunk to the central office; but in this instance the switch S is not released. The rotary magnet 115 now becomes effective to advance the brushes into the selected level of contacts to seize an idle trunk. The operation of the switch in its rotary movement is the same as already described. Release also takes place in the manner fully described hereinbefore.

The circuits are provided to take care of a preliminary impulse. To this end the digit 1 is not used in the first place for any code designation except in the two instances mentioned, in both of which the digit 1 also occurs in the second place. Should an accidental impulse be transmitted, it will cause the operation of the relay 122 as above explained. When the next digits are sent, they will cause the operation of the switch in the regular manner so that the preliminary impulse cannot interfere with the proper operation of the system. The preliminary impulse may precede the dialing of either code 119 or 110. In either case the preliminary impulse causes the operation of relay 122.

When the subscriber dials the first digit 1 of the code, this digit will now be recorded on the relay 113 instead of on the relay 122 as normally would be the case. The next digit 1 in the code when transmitted will be recorded on the relay 121. The circuit may be traced from the commutator brush 151, segment 169, conductor 170, outer right back contact of relay 128, outer right front contact of relay 122, next to the inner lower front contact of relay 113, outer right back contact and left winding of relay 121. Relay 121 in operating performs the same functions that relay 113 would have performed had the designation not been preceded by the preliminary impulse. Thus, the relay 122, whose normal function is to record the first digit 1, may be used for absorbing an accidental preliminary impulse, in which case the first digit 1 following is recorded on the relay 113, whose normal function is to record the second digit 1, and the second digit 1 is recorded on the relay 121 which normally does not function at all.

The switches employed to illustrate this system are, except as otherwise specifically noted, of the same general construction as the well known two-motion step-by-step switch.

While the invention is shown embodied in a particular kind of exchange system, it is not to be so limited but may be embodied in other types of systems.

What is claimed is:

1. In a telephone system, a line, an automatic switch having two sets of brushes, other switches, a circuit having two branches, one leading to said automatic switch and the second branch leading to said other switches, means for connecting said line to said circuit, means for sending impulses over said first branch to set said automatic switch, a repeater associated with said automatic switch for simultaneously repeating said impulses over said second branch to operate said other switches, means for automatically releasing said automatic switch following its setting, and means responsive to the setting of said switch for determining which of said branches is to be used for extending the connection from said line and which of said sets of brushes is to be used when the connection is extended over said first branch.

2. In a telephone system, an automatic switch having a primary movement in one direction for selecting groups of contacts and a secondary movement for selecting contacts, a plurality of sets of brushes for said switch, means for operating said switch in its primary movement, means for automatically releasing said switch following its primary setting, means controlled by the setting of said switch in its primary direction to select one of said sets of brushes for subsequent use, and means for operating said switch in its primary and secondary movements to extend a connection over the selected set of brushes.

3. In a telephone system, an automatic switch having a primary movement in one direction for selecting groups of contacts and a secondary movement for selecting contacts, a plurality of sets of brushes for said switch, means for repeatedly operating and releasing said switch in its primary direction, means controlled by the setting of said switch in its primary direction to select one of said sets of brushes for subsequent use, and means for operating said switch in its primary and secondary movements to extend a connection over the selected set of brushes.

4. In a telephone system, an automatic switch having a primary movement in one direction for selecting groups of contacts and a secondary movement for selecting individual contacts in a group, selector switches, a telephone line, means for extending a connection from said line to said automatic switch and also to said selector switches, means for operating said automatic switch in its primary movement, means for automatically releasing said switch following its primary setting, means controlled by the setting of said switch in its primary direction for releasing the connection extended to said selector switches, and means for operating said switch in its primary and secondary movements to extend a connection over one of said sets of brushes.

5. In a telephone system, a line, an automatic switch having a plurality of sets of brushes, selector switches, means for extending a connection from said line to said automatic switch and also to said selector switches, means for sending designation impulses over said line to operate said automatic switch in its primary direction, means for repeating said impulses to cause the operation of said selector switches, means for automatically releasing said automatic switch following its primary setting, means controlled by the setting of said automatic switch in its primary direction for causing the release of said selector switches, and means effective in response to the continued sending of impulses over said line for setting said automatic switch in its primary and secondary movements to extend a connection through one of said sets of brushes.

6. In a telephone system, a telephone line, an automatic switch having a primary movement in one direction for selecting groups of contacts and a secondary movement in another direction for selecting contacts, a plurality of sets of brushes for said switch, a series of selector switches, means for extending said line to said automatic switch and simultaneously in the direction of said selector switches, means controlled over said line for repeatedly operating said automatic

switch in its primary direction and for simultaneously operating said selector switches, means for releasing said automatic switch following each primary movement, means controlled by said automatic switch in its primary settings for causing the release of said selector switches and for causing the selection of one of said sets of brushes for use, and means effective under the control of said line for operating said automatic switch in its primary and secondary movements to extend said line over the selected set of brushes.

7. The combination in a telephone system of a subscriber's line, a selector switch having primary and secondary movements, a plurality of sets of brushes for said switch, a trunk line, means for extending the subscriber's line to said selector switch and simultaneously to said trunk line, means for sending impulses over the subscriber's line, means responsive to said impulses for repeatedly operating said selector switch in its primary direction, means for simultaneously repeating said impulses over said trunk line, registers operated in accordance with the primary settings of said selector switch, means controlled by said registers for selecting one of said sets of brushes for use, and means for operating said selector switch in its secondary movement to extend the subscriber's line over the selected set of brushes.

8. In a telephone system, an automatic switch having a primary movement to select groups of contacts and a secondary movement to select contacts in a group, a plurality of sets of brushes for said switch, selector switches, a telephone line, means for extending said line simultaneously to said automatic switch and to said selector switches, means for sending designation impulses over said line, means responsive to said impulses to give said automatic switch a preliminary primary setting, means responsive to said impulses to operate said selector switches, means effective in response to a certain preliminary setting of said automatic switch for selecting one of said sets of brushes for use, and means responsive to other preliminary setting of said automatic switch for rendering such switch unresponsive to subsequent impulses sent over said line.

9. In a telephone system, an automatic switch, a register comprising a plurality of relays associated with said switch, means for successively setting and releasing said switch, means for variably operating said register according to the settings of said switch, and means controlled by the register for absorbing a preliminary impulse sent to the switch.

10. In a telephone system, an automatic switch, a register comprising a plurality of relays associated with said switch, means for directively setting said switch in response to the transmission thereto of a single impulse, means for operating a certain one of said relays when said switch is operated by a single impulse, means controlled by the setting of said switch in response to subsequent impulses for operating other of said relays, means controlled by said relays for governing the subsequent operation of the switch, and means effective when the first impulse transmitted to the switch is an accidental one for absorbing such impulse and for preventing it from interfering with the proper operation of the switch.

11. In a telephone system, an automatic switch, a plurality of relays associated with said switch, means for successively setting and releasing the switch, means effective for operating one of said relays when the switch is operated by a single impulse, means for operating another of said relays when the switch is subsequently set by another single impulse, means for operating a third relay should the first single impulse transmitted to the switch be an accidental one, and means controlled by either said second or third relays for governing the subsequent operation of the switch.

In witness whereof, I hereunto subscribe my name this 21st day of March, 1930.

HENRY HOVLAND.