

Oct. 11, 1927.

E. JACOBSEN

1,644,727

BY PASS SELECTOR CIRCUIT

Filed May 8, 1926

3 Sheets-Sheet 1

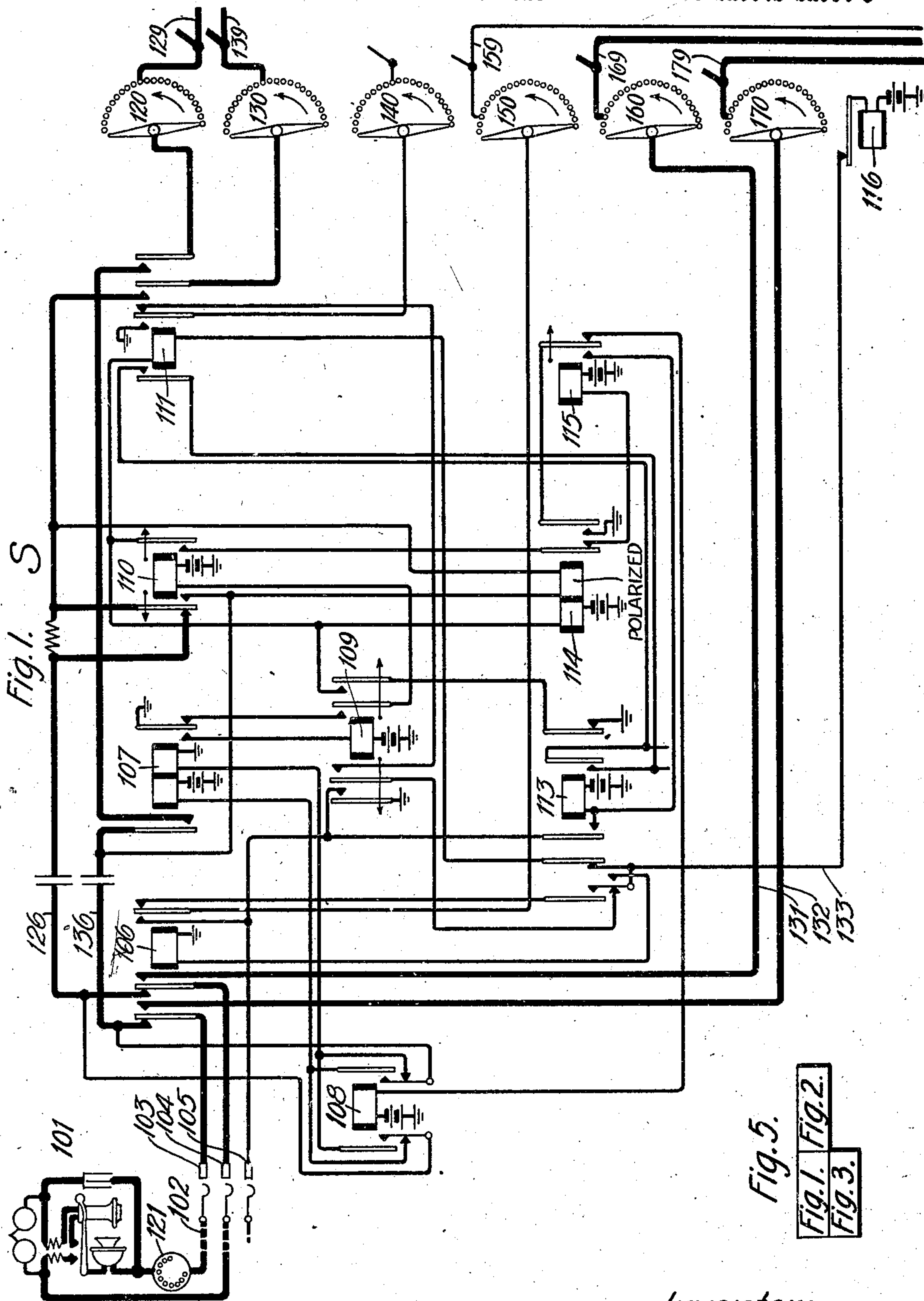


Fig. 5.

Fig. 1. Fig. 2.
Fig. 3.

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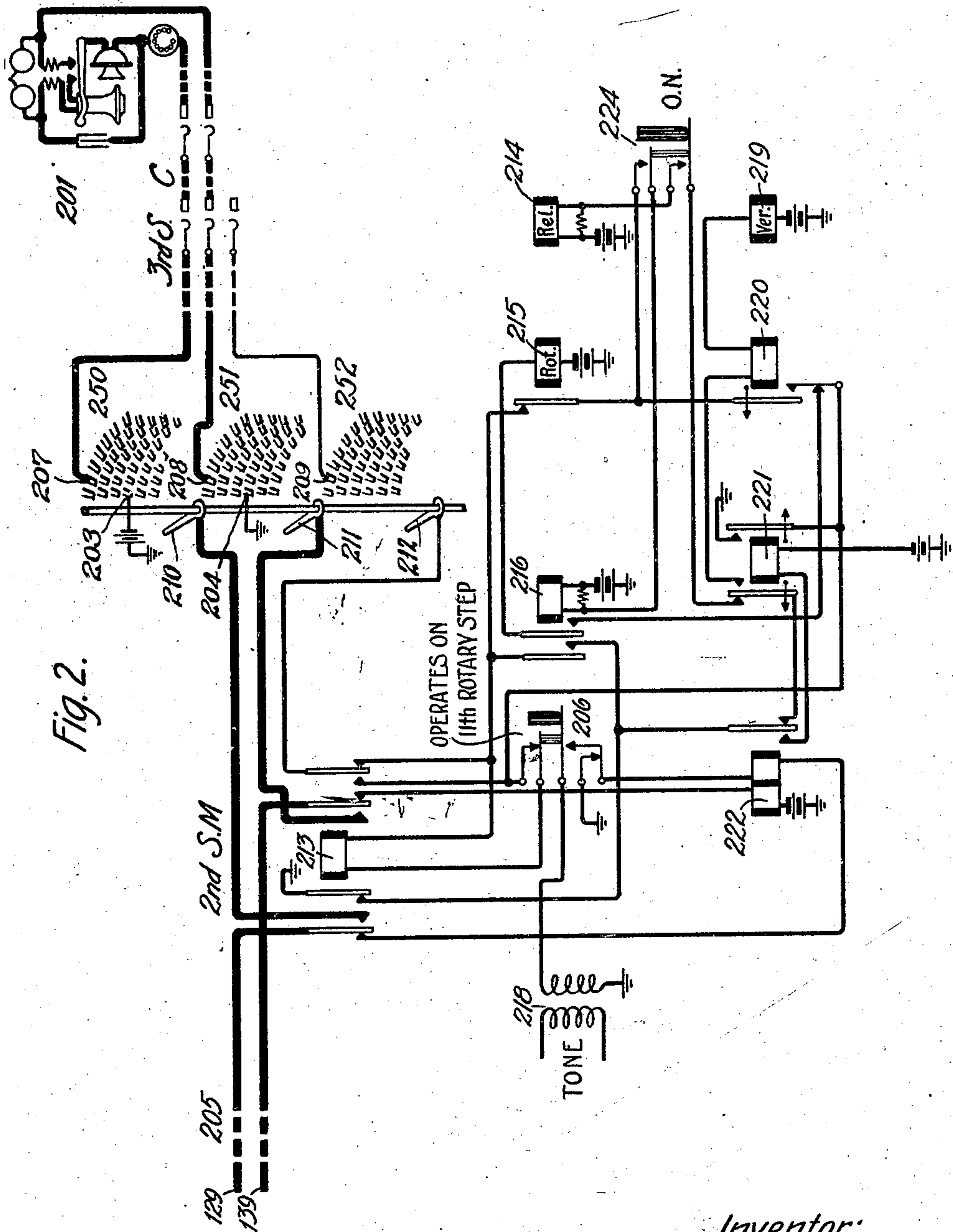
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3 Sheets-Sheet 2



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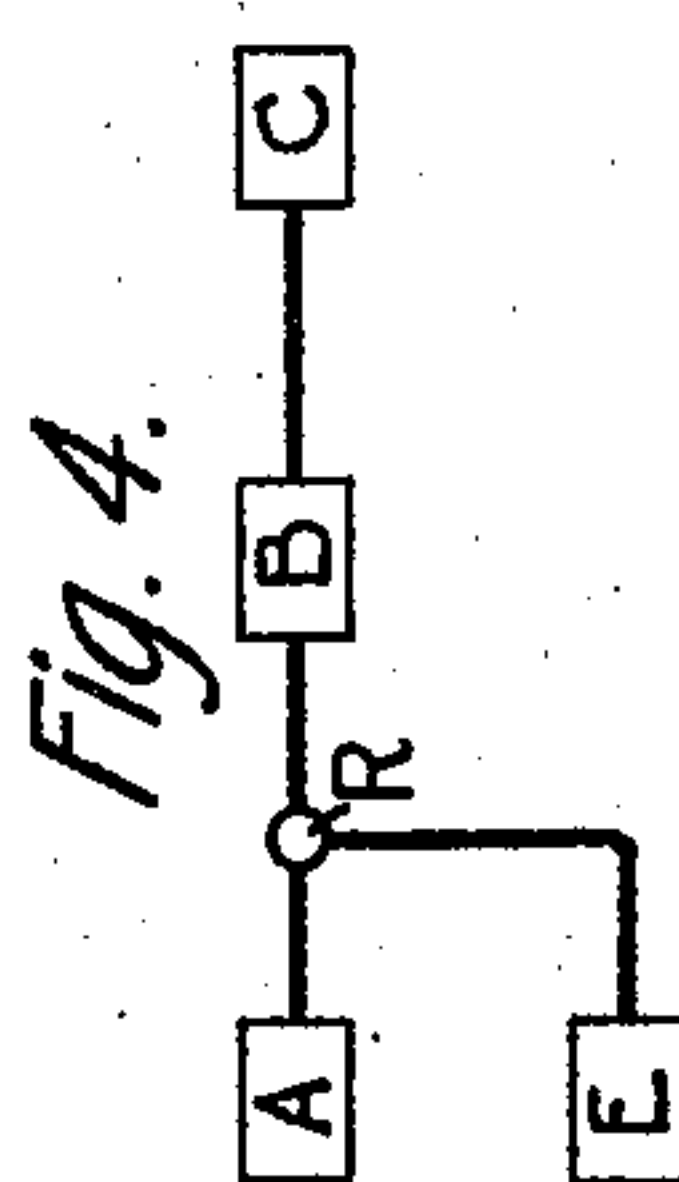
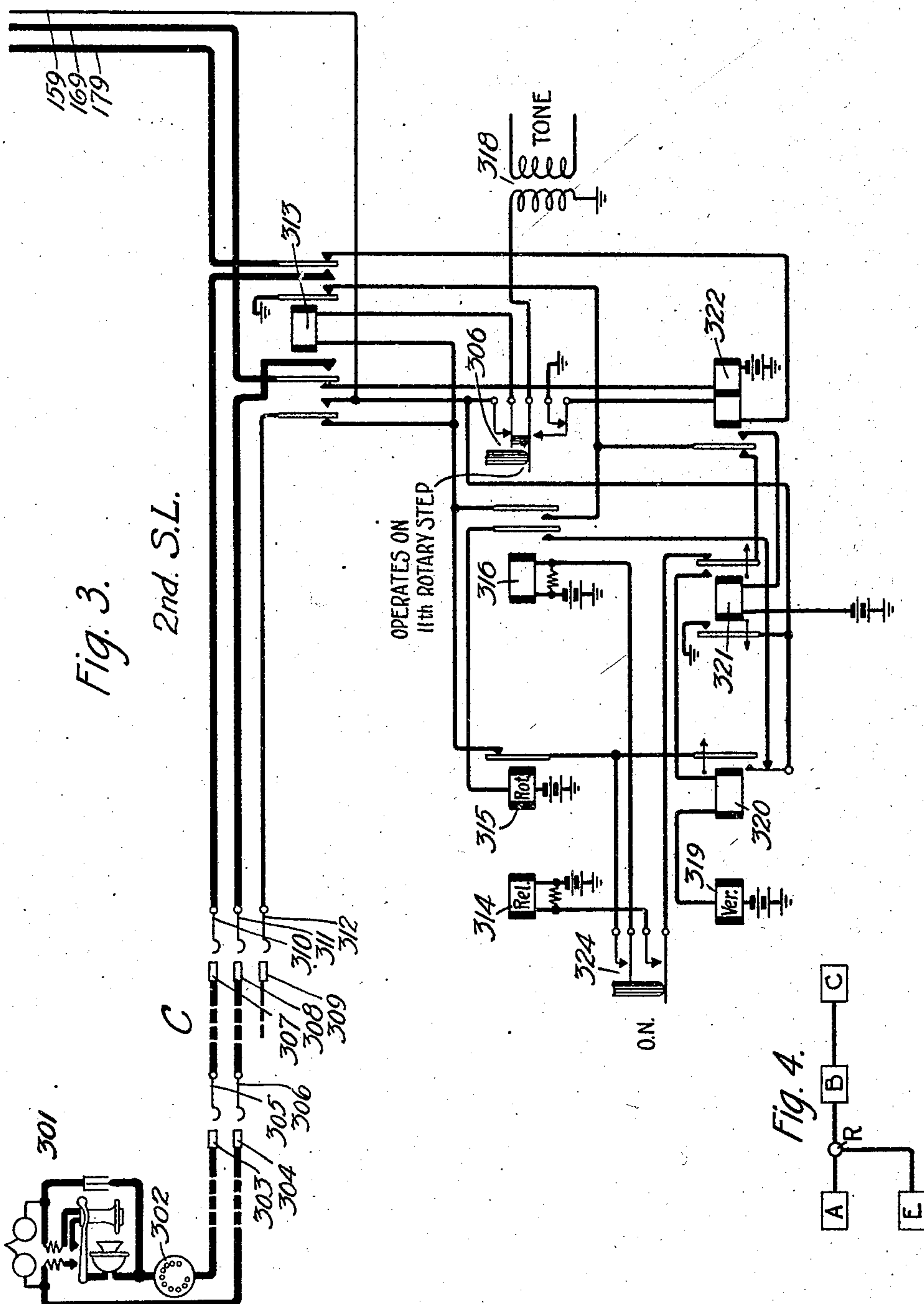
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3 Sheets-Sheet 3



Inventor:
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Patented Oct. 11, 1927.

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UNITED STATES PATENT OFFICE.

EMIL JACOBSEN, OF PLANDOME, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

BY-PASS SELECTOR CIRCUIT.

Application filed May 8, 1926. Serial No. 107,755.

This invention relates to telephone switching systems and particularly to exchange systems comprising one or more main offices and one or more local or satellite offices associated and connected therewith by trunk lines.

The principal object of this invention is to improve inter-office switching and to economize in the use of trunk lines between offices.

In systems of this character it has heretofore been the practice for a repeater to select a main office trunk and selector on all calls whether to a main office or a satellite office. When the call was for a satellite office an extra digit was dialed which caused the repeater to release the main office trunk and complete the call over a local trunk. The repeater after releasing the main office trunk hunted for an idle trunk to a tributary office with the same set of brushes which were originally used in connecting to the main office trunk.

In this invention the same end is attained with the use of a repeater having two sets of banks and brushes, trunks to the main office being connected to one set and trunks to a local office being connected to the other. Also it is not necessary to dial an extra digit in order to complete a call to a local subscriber as the repeater is caused to release the main office trunk and switch to the second set of brushes which are connected to the local office, by external means. Other advantages will be pointed out in the following description and claims.

The system disclosing the invention in one of its narrow aspects consists of a calling line in a satellite or local office, a by-pass selector and repeater circuit, a trunk to a main office, a main office selector and a trunk from the by-pass selector to a local selector in a local or satellite office. The by-pass selector is the principal feature of this invention being used for by-passing a call from a local subscriber to a local subscriber without the necessity of going through a main office. When a call is initiated whether for a local or main office subscriber, it is routed to a main office selector. Certain levels of this selector have battery and ground connected thereto and these levels are reached by the dialing of certain numbers which are assigned to local office subscribers. The battery and ground connected to these

levels operates a polarized relay in the by-pass selector which causes the release of the main office second selector switch and initiates the selection of a trunk to a second selector in a tributary office. This leaves the main office selector free for use by other by-pass selectors.

The number of digits dialed is the same for a call to a main office as it is for a call to a local office, that is, if it takes three digits to complete a connection to a subscriber's station in a main office, it will be necessary to dial three digits to reach the subscriber in a local office. A more clear conception may be obtained of the objects and operation of this invention from the following description in which:

Figure 1 shows the by-pass selector S with two sets of brushes, the upper set of which are connected to a selector in the main office and the lower connected to a selector in a tributary office.

Fig. 2 shows a second selector in a main office, the banks of which are shown connected to a subscriber's station in the main office and other banks to which battery and ground are connected for controlling the selectors. The brushes are shown in their normal position.

Fig. 3 shows a selector in a local office.

Fig. 4 is a diagrammatic representation of the system. A is a calling subscriber's line, R the by-pass selector, B the main office selector and C a subscriber's line at the main office. E is the selector in the local office and the line from R to E designates the trunk from the by-pass selector to the local office selector E.

When the subscriber at substation 101 removes the receiver from the switchhook, line switch 102 selects the by-pass selector S in a manner well known in the art. A circuit is closed for relay 107 from ground through its right winding, right back contact of relay 108, outer left back contact of relay 106, brush and terminal 103 of line switch 102, through the subscriber's loop 101, line switch 102, brush and terminal 104, inner left back contact of relay 106, left back contact of relay 108 to battery through the winding of relay 107. The operation of relay 107 closes the bridge formed by the right winding of relay 114 across the conductors to the arcs 120 and 130. The operation of relay 107 also operates relay 109 over an obvious cir-

cuit. The operation of relay 109 connects ground from its outer left front contact to terminal 105 holding line switch 102 operated. Relay 109 also prepares in part a circuit for stepping magnet 116 and test relay 111. If the selector brushes 120, 130 and 140 are in contact with a busy trunk such as 205 to the main office, ground will be connected to brush 140 thereby closing a circuit for magnet 116 from said ground, inner right back contact of relay 111, inner left front contact of relay 109, outer left back contact of relay 113 to battery through the interrupter contact and winding of magnet 116. A parallel circuit is also closed from ground on the outer right back contact of relay 113, outer right front contact of relay 109, winding of relay 111, middle left back contact of relay 113 to battery through the magnet 116. The ground on arc 140 acts as a shunt to the winding of relay 111 which does not operate, but magnet 116 operates and steps brushes 120, 130 and 140 until an idle trunk is found, at which time relay 111 operates in a series circuit through the winding of magnet 116. Magnet 116, however, does not operate as the resistance of relay 111 is too high. The operation of relay 111 closes the talking conductors through to arcs 120 and 130 and connects ground to the brush of arc 140 thereby making the trunk test busy to all other selectors. The operation of relay 109 also closes an obvious circuit from ground on the outer right back contact of relay 113 through the left winding of relay 114 thereby preparing it as a polarized relay. This relay, however, does not operate at this time over its left winding.

Subscriber 101 now operates dial 121 which opens the circuit through relay 107. The release of relay 107 does not release relay 109 as relay 109 is a slow-to-release type relay which holds up thereby closing a circuit from ground on the right back contact of relay 107, inner right front contact of relay 109 to battery through the winding of relay 110. Relay 110 is also slow-to-release and does not release at any time during dialing. The operating of relay 110 closes a circuit from ground on the outer right back contact of relay 113, outer right front contact of relay 109, right front contact of relay 110, inner back contact of relay 114 to battery through the winding of relay 115. As the dial 121 returns to normal, relay 107 follows the dial impulses and opens and closes the circuit from battery through the left winding of relay 222, inner right back contact of relay 213, conductor 139 of trunk 205, brush and arc 130, middle right front contact of relay 111, left front contact of relay 110, left front contact of relay 107, outer right front contact of relay 111, brush and arc 120, conductor 129 of trunk 205, outer left back contact of relay 213 to ground on

the lower normal contact of the eleventh rotary position off normal springs 217, through the right winding of relay 222. The opening and closing of the left contact of relay 107 causes relay 222 to operate and release. On the first operation of relay 222, relay 221 is operated over a circuit from ground on the inner left back contact of relay 213, front contact of relay 222 to battery through the winding of relay 221. The following release of relay 222 now closes a circuit from ground on the inner left back contact of relay 213, back contact of relay 222, left front contact of relay 221, winding of relay 220 to battery through the vertical magnet 219. During the following impulses relays 220 and 221 remain operated as they are of a slow-to-release type. The operation of vertical magnet 219 causes brushes 210, 211 and 212 to be moved upward to the desired level which contains terminals 207, 208 and 209. When these brushes leave their normal position the off normal springs 224 are closed to enable the closing in part of a circuit for relay 216 from ground on the right front contact of relay 221, front contact of relay 220, upper contact of off normal contact springs 224, to battery through the winding of relay 216. Relay 216 locks over a circuit from ground on the inner left back contact of relay 213, outer front contact of relay 216, back contact of magnet 215, upper contact of off normal contact springs 224 to battery through the winding of relay 216.

When the dial has returned to normal after dialing the first digit, relay 220 releases and a circuit is closed as follows for the rotary stepping magnet 215: battery, through the winding of said magnet, inner contact of relay 216, normal contact of relay 220 to ground at the right contact of relay 221. The magnet 215 advances the brushes 210, 211 and 212 to the first set of terminals. Magnet 215 also opens the circuit of relay 216, releasing this relay and the relay in turn opens the operating circuit of magnet 215 permitting it to release. If the first set of terminals engaged by the brushes is busy the relay 216 again operates in a circuit from battery through its winding, contacts 224, contact of magnet 215, right back contact of relay 213, brush 212 to the grounded busy terminal. Relay 216 operates closing the circuit for the magnet 215 which advances the brushes to the next set of terminals. This operation will be repeated until an idle trunk is found. A circuit is closed during the operation of magnet 215 from ground on the right front contact of relay 221, upper normal contact of the eleventh rotary position off normal contact spring 206, winding of relay 213, back contact of magnet 215, upper alternate contact of off normal contact spring 224 to battery through the winding of relay 216 in parallel with one from busy

ground on brush 212 through the outer right back contact of relay 213 and thence over the same circuit through the winding of relay 213. While the brush 212 is resting on a busy terminal relay 213 is shunted but as soon as an idle terminal is found this shunt is removed and relay 213 operates and connects conductors 129, 139 and 149 through to brushes 210, 211 and 212. Due to the resistance of the circuit relay 216 does not operate in series with relay 213.

It will be assumed that brushes 210, 211 and 212 are resting on terminals 207, 208 and 209 from which the connection would be completed to station 201 through the third selector and connector in a manner well-known to the art.

As this system has to do with the switching from a main office selector to a local office selector, an explanation of the wiring of arcs 250, 251 and 252 will be necessary. Certain levels on the switch over which brushes 210, 211 and 212 move are wired direct to lines in the main office such as line 201. If however, the call is for a line such as 301 in a local office, certain levels such as those containing terminals 203 and 204, corresponding to the first digit of the subscriber's number have battery and ground connected thereto for giving a battery reversal to the by-pass selector. When such a call is made, the operation of the main office selector switch will be different. After the first digit is dialed and the rotary magnet 215 is operated brushes 210, 211 and 212 are caused to hunt. No ground will be found on this bank for brush 212 therefore relay 213 will operate as described above and close the conductors 129, 139 and 149 through to brushes 210, 211 and 212 which are assumed to be resting on terminals 203 and 204. Battery and ground will be connected to these terminals and will close a circuit from battery on terminal 203, brush 210, outer left front contact of relay 213, conductor 129, arc and brush 120, outer right front contact of relay 111, left front contact of relay 107 through the polarized winding of relay 114, middle right front contact of relay 111, arc and brush 130, conductor 139, inner right front contact of relay 213 to ground on terminal 204 through brush 211. Relay 114 operates and opens the circuit through relay 115 which is slow-to-release and so holds up until a circuit has been closed for operating relay 113 from ground on the outer front contact of relay 114, front contact of relay 115 to battery through the winding of relay 113. Relay 113 operates and locks over an obvious circuit to ground on the outer left front contact of relay 109. The operation of relay 113 closes a circuit from battery through the winding of magnet 116, outer left front contact of relay 113 to ground through the

winding of relay 106. The operation of relay 113 also opens the circuits for relays 111 and 114 and allows them to release. The release of relay 111 opens the holding circuit for relay 213. The release of relay 213 closes a circuit for ground on its inner left back contact, back contact of relay 222, left back contact of relay 221, lower alternate contact of off normal contact spring 224 to battery through the winding of release magnet 214. The operation of release magnet 214 causes brushes 210, 211 and 212 to restore to normal thereby restoring the entire switch to normal.

If the brushes of arcs 150, 160 and 170 are resting on a busy trunk, ground will be connected to brush 150 thereby closing a shunt around relay 106 through its right back contact to the outer left front contact of relay 113. If relay 106 is shunted magnet 116 will be operated thereby stepping brushes 150, 160 and 170 until an idle trunk is reached when the shunt around relay 106 is removed allowing it to operate. Magnet 116 does not operate at this time as the resistance of relay 106 is too high. The operation of relay 106 disconnects conductors 126 and 136 from terminals 103 and 104 and connects conductors 131, 132 and 133 to terminals 103, 104 and 105 through the contacts of relay 106. When conductors 126 and 136 are disconnected, the circuit of relay 107 is also opened allowing it to release, in turn releasing relays 109 and 110.

Selector S is now in condition for the next digit to be dialed to the selector in the local office over leads 169 and 179. A circuit is closed from ground through the left winding of relay 322, outer right back contact of relay 313, conductor 179, brush and arc 170, conductor 132, outer left front contact of relay 106, terminal and brush 103 of line switch 102 through the subscriber's loop, brush and terminal 104, inner left front contact of relay 106, conductor 131, brush and arc 160, conductor 169, inner left back contact of relay 313 to battery through the right winding of relay 322. Relay 322 follows the dial impulses in the same manner as relay 222 and the operation of the circuit is the same as that described for the selector in Fig. 2. It will be noted that the numbering of the apparatus of Fig. 3 is the same as that of Fig. 2 with the exception of the hundreds digit.

After the brushes 310, 311 and 312 of the selector switch have been set on the terminals 307, 308 and 309 leading to a connector switch C additional impulses are transmitted by the subscriber to position this latter switch. In response to these impulses the connector C sets brushes 305 and 306 upon the terminals 303 and 304.

When subscriber 301 replaces the receiver on the switchhook, the release of the switches

in Fig. 3 is the same as that described for the selector in Fig. 2 when released by the by-pass selector.

What is claimed is:

1. In a telephone system, a selector having a plurality of banks and a single operating mechanism, a plurality of trunks, part of said trunks being connected to part of said banks, the remainder of said trunks being connected to the remainder of said banks, means for setting said switch to establish a connection through one of said banks, and means in said selector for automatically releasing said switch and re-establishing said connection through another of said banks.

2. In a telephone system, a selector having a plurality of banks, sets of brushes for co-operating with said banks, a single operating mechanism for driving said brushes, a plurality of trunks to a main office, a plurality of trunks to a local office, said main office trunks being connected to part of said banks, said local office trunks being connected to the remainder of said banks and means in said selector for switching from one group of trunks to the other.

3. In a telephone system, a repeater having two sets of terminal banks and two sets of brushes cooperating therewith, a trunk to a main office with a selector connected thereto, a trunk to a local office, said main office trunk being connected to terminals in one set of banks, said local office trunk being connected to terminals in the remaining set of banks, means in said repeater for causing said repeater to switch from one trunk to the other, and means in said selector for operating said first means.

4. In a telephone system, a by-pass repeater having two sets of terminal banks, a trunk to a main office with a selector connected thereto, a trunk to a local office, said main office trunk being connected to one set of said banks, said local office trunk being connected to the other set, said selector having different levels of terminals in its

banks, a source of potential connected to certain of said levels which are assigned to the same designation as that of the local trunk, and means in said repeater operated by said source of potential for causing said repeater to switch to said local trunk.

5. In a telephone system, a by-pass repeater having two sets of terminal banks, a trunk to a main office with a selector connected thereto, a trunk to a local office, said main office trunk connected to one set of said banks, said local office trunk connected to the other set, means to cause said repeater to connect with said main office trunk, said main office selector having different levels of terminals in its banks, sources of potential connected to certain of said levels to which are assigned the same designation as the local trunk, and a polarized relay in said repeater operated by said sources for causing said repeater to switch to said local trunk.

6. In combination, a repeater circuit comprising two sets of terminal banks with separate sets of brushes cooperating therewith, a main office trunk connected to one set of terminal banks, a local office trunk connected to the other set of said banks, a polarized relay and means actuated over said main office trunk for operating said polarized relay to cause said repeater to switch from one trunk to the other.

7. In a telephone system, a main exchange and a local exchange, a selector having a plurality of arcuate banks of contacts, wipers for engaging said contacts, a mechanism for operating all of said wipers in a step-by-step movement, a group of trunks leading from some of said banks to the main exchange, a second group of trunks leading from other of said banks to the local exchange, and means in said selector for switching from one group of trunks to the other.

In testimony whereof, I have signed my name to this specification this 7th day of May 1926.

EMIL JACOBSEN.