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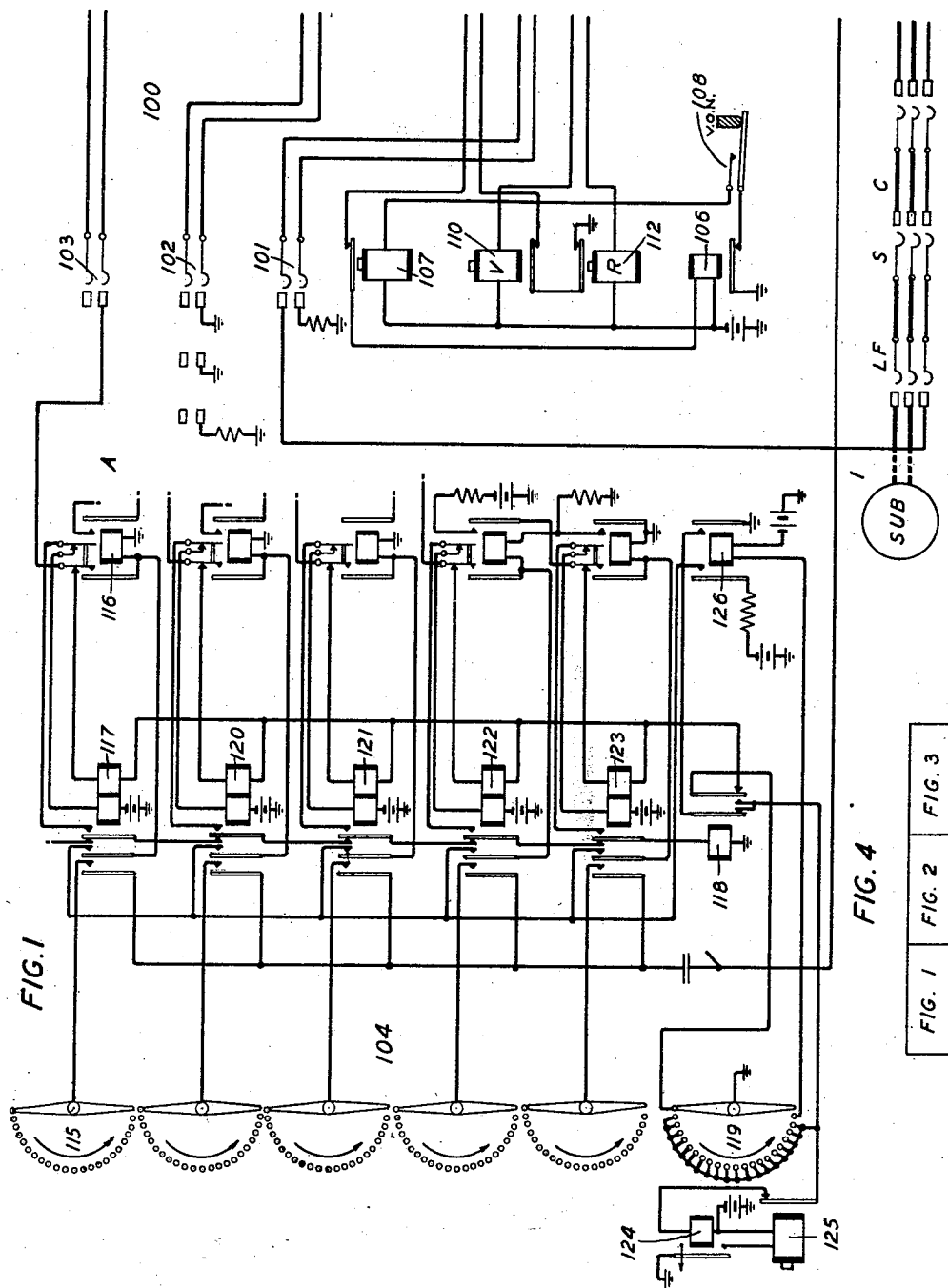
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TELEPHONE SYSTEM

Filed Dec. 6, 1930

3 Sheets-Sheet 1



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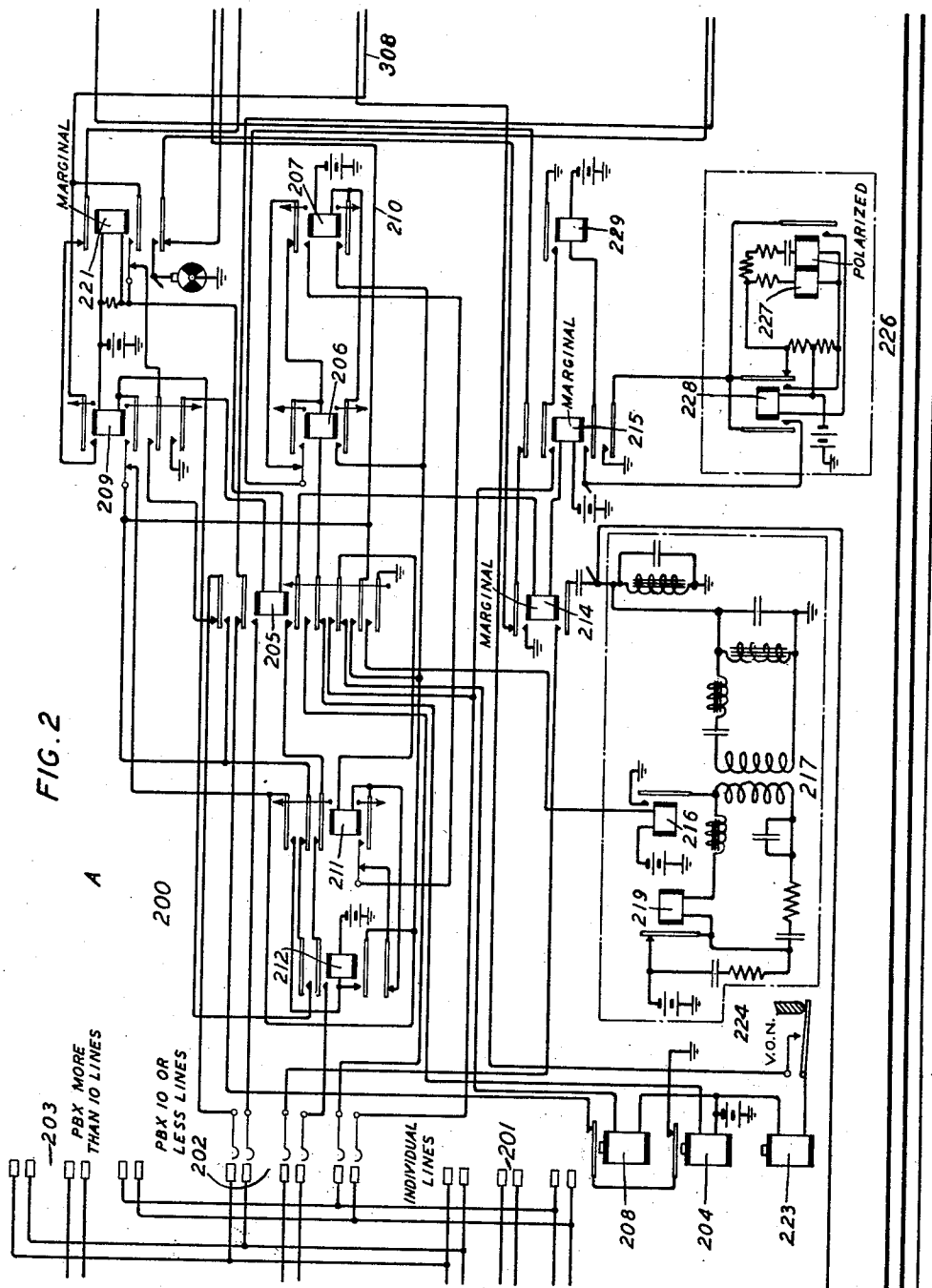
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3 Sheets-Sheet 2



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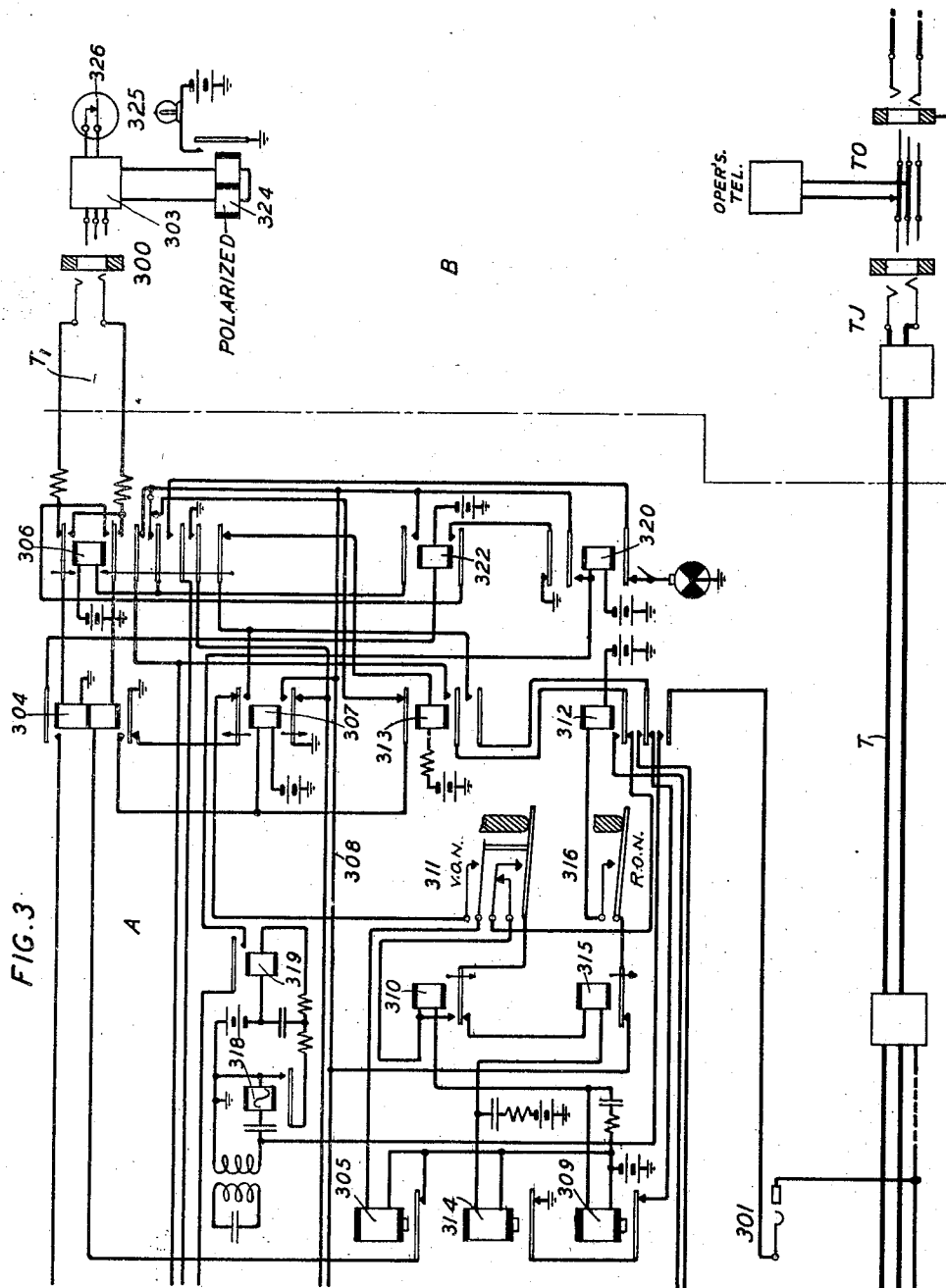
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TELEPHONE SYSTEM

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3 Sheets-Sheet 3



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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to means for checking calling subscribers' numbers, and the object of the invention is to simplify and improve the checking of numbers when applied to automatic systems.

Heretofore, systems have been used in which an operator may check the number given by a calling subscriber who has established automatically a connection to the operator's position by establishing automatically a separate connection to the calling subscriber's line and causing the application of a tone over this second connection, which tone is transmitted over the original connection back to the operator's position and heard by her if the calling subscriber gave the correct number.

A feature of this invention is an arrangement, in systems of this kind in which the calling subscriber has established an automatic connection to an operator's position in the distant office over a trunk line, whereby the operator may establish over a second trunk a separate number checking connection to the calling subscriber's line and to the trunk line used by the calling subscriber, and whereby an alternating current signal is applied from the separate connection to the subscriber's line for transmission over the automatic connection established by the subscriber back through the separate connection established by the operator to the subscriber's trunk line, and whereby means responsive to this alternating current signal and to the establishing of the separate connection to the subscriber's line causes a direct current signal to be transmitted over the second trunk line to the operator's position to light a lamp to indicate that the calling subscriber has given the correct number.

Another feature is an arrangement whereby if the number given by the calling subscriber was not correct and consequently no alternating current signal is received back through the separate connection established to the trunk used by the subscriber an interrupted direct current signal will be transmitted over the second trunk to the operator's position to flash the lamp thereat to in-

dicate this condition. This interrupted direct current signal is in this case effected by means solely responsive to the establishing of the separate connection to the wrong subscriber's number.

Another feature is an arrangement whereby, whether the lamp indicates either of these conditions, the separate number checking connection is automatically released when the signal is transmitted to the operator's position. This release is solely responsive to the establishing of the separate connection to a subscriber's line.

Another feature is an arrangement for applying number checking to private branch exchange lines. The arrangement is such that if the calling subscriber's line is one of a small group of private branch exchange lines this group is selected by a switch in the number checking connection in the same manner as the line of a single subscriber. This switch is then, due to certain conditions encountered on a special terminal for each line, caused to hunt over the entire group of private branch exchange lines. During this hunting, an alternating current signal is applied to the sleeve terminals of these lines in succession for transmission back through the connection used by the calling subscriber. If, on the other hand, the calling line is one of a large group of private branch exchange lines, this switch merely selects a single set of terminals representing a sub-group of this group of lines. This selection then causes an auxiliary switch to be actuated to hunt over and apply the alternating current signal to the sleeve terminals of all lines in this sub-group in succession. In this manner a group or a sub-group of private branch exchange lines, over a line of which a call has been made, is checked rather than the line itself.

This invention is illustrated in the accompanying drawings in which Figs. 1, 2 and 3 may be arranged as shown in Fig. 4 for the disclosure of a number checking system.

Referring to the drawings a connection from a calling subscriber's station at 1 is shown extending from a call originating office A through a line finder LF, a selector S and a connector C over a trunk T to a distant office

B, where trunk T terminates in a jack TJ at a number checking toll operator's position TO. A number checking connection embodying features of this invention is shown terminating in office B in a jack 300 and extending over trunk TC to office A, and the circuits as shown in Figs. 3, 2 and 1 may be used for number checking of individual lines, lines in private branch exchanges having less than ten lines and lines in private branch exchanges having more than ten lines.

To establish a number checking connection the operator at B seizes the number checking trunk TC and first dials two numbers to connect the trunk connector 301 with the trunk T and then dials four additional numbers to establish the connection to the sleeve of the calling subscriber's line in case of an individual line. This connection will extend over an intermediate connector 200 and a final connector 100. If the connection is for an individual line the intermediate connection 200 is actuated to select a set of terminals such as 201; if the connection is for a line in a P. B. X. having less than ten lines the intermediate connector 200 is actuated to select a set of terminals such as 202, and if the connection is for a P. B. X. having more than ten lines, a group of terminals such as 203 are selected by connector 200. In the final connector 100 if an individual line is desired the brushes 101 are selected by the connector 200, if a line in a P. B. X. having less than ten lines is desired brushes 102 are selected and if a line in a P. B. X. having more than ten lines is desired brushes 103 are selected. In the latter case the selection of a line in a P. B. X. having more than ten lines may be done by switches such as 104, which are selected by the selector 100 selecting a terminal representing a sub-group of lines in this P. B. X. Such sub-groups may comprise any number of lines up to 20 and have their sleeves connected to the banks in switch 104.

Assuming now that the operator at B has answered the call from subscriber 1 by inserting the answering plug of the regular toll cord shown diagrammatically at TO into trunk jack TJ and received his number she will proceed to check it. The number checking cord shown at 303 will be used for this purpose and the plug thereof will be inserted into the jack 300 of the number checking trunk TC. The number checking cord 303 may include a polarized relay 324 and a signal 325 controlled thereby. The windings of relay 324 may be connected in series to the tip and ring of the plug of this cord and a dial circuit 326 may also be provided in this cord for association with the tip and ring of the plug. The immediate effect of this connection will be the operation of relay 304 over a circuit from battery, armature and back contact of the release magnet 305, lower winding of relay 304, lower

inner armature and back contact of relay 306 to the ring conductor over the loop established through the dial circuit 326, back over the tip conductor, upper armature and back contact of relay 306, upper winding of relay 304 to ground. Relay 304 closes an obvious circuit for the actuation of relay 307. Relay 307 establishes a connection to ground on its lower armature and front contact for a common ground lead 308 and prepares the dialing circuit for the operation of the trunk connector 301. The operator now dials two numbers to actuate the trunk connector 301 to establish a connection to trunk T. On the release of relay 304 in response to the first impulse a circuit will be completed for the vertical magnet 309 from battery, winding of this magnet, winding of relay 310, vertical off-normal contacts 311, lower inner armature and back contact of relay 312, lower inner armature and front contact of relay 313, second lower armature and back contact of relay 306 to the common ground lead 308. It should be noted that on this first release of relay 304 relay 313 was operated over a circuit controlled by relays 306 and 307 so that this circuit for a vertical magnet 309 will be closed each time relay 313 is actuated by the release of relay 304. It should also be observed that relay 313 will be held operative until the vertical magnet 309 is actuated by a holding circuit from battery, winding of relay 313, lower outer armature and back contact of relay 306, lower outer armature and front contact of relay 313, second lower armature and back contact of relay 312, armatures and back contacts of vertical magnet 309 and rotary magnet 314 to ground. This insures the operation of the vertical magnet 309 for each release relay 304.

As the circuit for the vertical magnet 309 also extends through the winding of relay 310, this relay will operate and being slow in releasing will remain operative during the sending of this series of impulses. At the end of this series of impulses it will, however, release and prepare circuits for the reception of the second series of impulses for the operation of the rotary magnet 314. The circuit for the rotary magnet 314 may be traced from battery, winding of this magnet, winding of relay 315, lower armature and back contact of relay 310, vertical off-normal contacts 311 and the circuit to ground on lead 308 as hereinbefore traced. Relay 315 is operated in this circuit and remains operated during the pulsing. At the end of the second series of impulses the brush of the trunk connector 301 makes connection with the sleeve conductor of the trunk T used by the calling subscriber. Relay 315 now releases and closes a circuit for the operation of relay 312 from battery, winding of rotary off-normal contacts 316, armature and back

contact of relay 315 to ground on lead 308. Relay 312 prepares a connection from the sleeve of trunk T, through connector 301 over its lower outer armature and front contact to an alternating current responsive relay 318 which will be operated when an alternating current signal is received over this sleeve from the calling subscriber's line sleeve when connected to by switches 200 and 100 as will hereinafter be described. Relay 312 also prepares circuits for the control of these two switches.

The next operation on the part of the operator will be to send two series of impulses to control the intermediate connector 200 to select a final selector such as 100 for the extension of the connection to an individual line, to a P. B. X. office having less than ten lines, or to a P. B. X. office having more than ten lines. When the operator sends the next series of impulses, relay 313 will be operated as usual and the impulses will be transmitted over contacts of relay 312 for the operation of the vertical magnet 204 from battery, winding of this magnet, second lower armature and back contact of relay 205, winding of relay 206, upper armature and back contact of relay 207, make-before-break contacts of relay 206, lower inner armature and front contact of relay 312, inner lower armature and front contact of relay 313, second lower armature and back contact of relay 306 to ground on lead 308. The locking circuit for relay 313 will be extended from ground at the armature of vertical magnet 204, armature and back contact of rotary magnet 208, inner upper armature and back contact of relay 205, second lower armature and front contact of relay 312, lower outer armature and front contact of relay 313, lower outer armature and back contact of relay 306, winding of relay 313 to battery. Relay 206 also operates in the circuit for the vertical magnet 204. The circuit for this magnet and relay will therefore on the operation of relay 206 be extended through the upper armature and front contact of relay 206. Relay 206 in operating closes a circuit for the operation of relay 207 from battery, winding of this relay, lower armature and front contact of relay 206, inner lower make-before-break contacts of relay 209, conductor 210, second lower armature and back contact of relay 306 to ground on conductor 308. Relay 207 in operating prepares a locking circuit for itself through its lower armature and front contact to the ground on conductor 308, independent of relay 206 which is released at the end of this series of impulses. When the next series of impulses are sent the circuit will extend over the make-before-break contacts of relay 206, and upper armature and front contact of relay 207, lower make-before-break contacts of relay 211, lower outer armature and back contact of relay

212, winding of relay 211, third lower armature and back contact of relay 205, winding of the rotary magnet 208 to battery. It will be noted that the locking circuit for relay 313 will still extend to the ground at the vertical magnet 204 and be controlled by the armature and back contact of the rotary magnet 208. Relay 211 operates in series with the rotary magnet 208, remains operated during pulsing and closes the pulsing circuit through its lower armature and front contact independent of relay 212. At the end of this series of impulses relay 211 releases and circuits will be prepared for the control of the selected final connector 100.

When relay 211 operated a circuit was closed for the operation of relay 212 from battery, winding of this relay, upper outer armature and front contact of relay 211, make-before-break contacts of relay 209 to ground on conductor 210. Relay 212 in operating provides a locking circuit for itself through its lower inner armature and front contact directly to the ground on conductor 210 independent of relay 211. Now, therefore, when relay 211 releases a circuit will be completed for the operation of relay 209 from battery, winding of this relay, upper outer armature and front contact of relay 212, upper middle armature and back contact of relay 211 to ground on conductor 210. Relay 209 in operating closes an obvious circuit for the operation of relay 205. Relay 205 in operating closes a circuit for relay 106 of connector 100, from battery, winding of this relay, upper armature and back contact of the release magnet 107 to the release control terminal of the set of terminals through which connector 200 has been connected with connector 100. In this case the connection will extend through the upper terminal of the group 201 over the corresponding brush of connector 200, upper outer armature and front contact of relay 205 to ground on conductor 210. The purpose of the operation of relay 106 is to prevent the release of the connector 100 prematurely, as this relay opens the circuit for release magnet 107 which will be closed through the vertical off-normal contact 108 when the vertical magnet 110 moves the connector 100 off normal position. When relay 209 operates it prepares a locking circuit for itself through its lower inner armature and front contact to the ground on conductor 210 and also opens the locking circuit for relay 212 which is thereby released. It should be noted that the locking circuit for relay 207 is also opened by the operation of relay 209 so that this relay will also release at this time to prepare the circuits for the control of connector 100.

The intermediate connector 200 has been assumed to have selected a group of terminals 201 which will prepare the connector 100 for connection with a calling subscriber having

an individual line. The last two series of impulses will now send. The first impulse of the next series closes a circuit for the vertical magnet 110 from battery, winding of this magnet over the vertical pulsing terminal of the group 201, to wit, the fifth terminal, the corresponding brush of connector 200, second lower armature and front contact of relay 205, winding of relay 206, upper armature and back contact of relay 207, make-before-break contact of relay 206 over the pulsing conductor to ground on lead 308 as controlled by relays 312 and 313. The locking circuit for relay 313 will be extended over the second brush of connector 200 and the second or locking terminal of group 201, armatures and back contacts of the vertical magnet 110 and the rotary magnet 112. It should be noted that this locking circuit is also controlled by relay 205 and extends through the upper inner armature and front contact of this relay. Relay 206 operates in the pulsing circuit as before and closes the circuit for the operation of relay 207 which locks to the ground on lead 210. At the end of this series of impulses relay 206 releases while relay 207 remains operated so that the circuits will now be prepared for the operation of rotary magnet 112. The pulsing circuit for the rotary magnet extends from battery winding of this magnet, the sixth or rotary pulsing terminal of the group 201 and the corresponding brush of connector 200, third lower armature and front contact of relay 205, winding of relay 211, lower outer armature and back contact of relay 212, make-before-break contacts of relay 211, upper armature and front contact of relay 207 to the pulsing circuit extending to ground at lead 308. The locking circuit for relay 313 will be the same in this case as for the vertical magnet 112 as it is controlled by the armature of the rotary magnet 110. On the operation of relay 211 relay 212 operates over a circuit from the battery, winding of this relay, upper outer armature and front contact of relay 211, fourth lower armature and front contact of relay 205 to ground on lead 210 and locks to this ground independent of relay 211 which releases at the end of this series of impulses.

The circuits are now in condition for the transmission of alternating current signals over the sleeve connection extending from the calling subscriber to trunk connector 301 and alternating current responsive relay 318, as connector 100 has placed its brushes 101 in connection with terminals associated with the terminals representing the calling subscriber's line.

In connector 200, two marginal relays 214 and 215 control the operations in regard to the application of the alternating current signals over the sleeve of the calling subscriber's line. In this case, when an individual line is involved, relay 214 only operates due to

the condition on the lower terminal connected to the lower of the two brushes 101. This brush encounters a connection to ground through a resistance. This resistance is of such characteristics as to permit relay 214 to operate but prevent relay 215 from operating over a circuit completed from battery windings of relays 215 and 214, lower inner armature and front contact of relay 205, upper inner armature and back contact of relay 211, upper inner armature and front contact of relay 212, the fourth brush of connector 200, lower brush of connector 100 and corresponding terminal through the resistance to ground. It should be noted that on the operation of relay 205 a circuit was closed for the operation of relay 216, to start the alternating current producing device 217 to operate. This device consists of the usual interrupting relay 219 and a tuned circuit. Therefore, when relay 214 operates an alternating current signal from this source will be passed over the lower armature of front contact of relay 214, the third brush of connector 200 and the upper one of the brushes 101 of connector 100 to the sleeve of the calling subscriber's line.

This alternating current signal will now be transmitted over the sleeve of the connection through the line finder LF, selector S, connector C, to the selected terminal and brush of trunk connector 301, lower outer armature and front contact of relay 312 to the alternating current responsive relay 318. Relay 318 now operates and closes in turn an obvious circuit for relay 319. The operation of relay 319 closes a circuit for the operation of relay 320 from battery, winding of this relay, armature and front contact of relay 319, upper armature and back contact of relay 221, upper armature and front contact of relay 209 to ground on lead 308. Relay 320 locks to the ground on lead 308 through its upper inner armature and front contact independent of relays 221 and 209. A circuit is also closed by the operation of relay 214 as follows: battery winding of relay 322, upper armature and front contact of relay 304, upper outer armature and back contact of relay 315, upper armature and front contact of relay 214 to ground. The operation of relay 322 closes a circuit for the operation of relay 306 from battery, winding of relay 306, upper armature and front contact of relay 322 to ground on lead 308. Relay 306 in operating reverses the connection from battery and ground for the tip and ring conductors over trunk TC to cause the polarizing relay 324 to operate and light signal 325 to indicate to the operator at B that the calling subscriber gave the correct number. Relay 306 in operating also opens the connection to ground for lead 210 at its second lower armature and back contact and causes relay 209 to release. Relay 209 is slow

in releasing to permit relay 320 to operate and lock before it releases.

Relay 209 in releasing causes the release of relay 205 and this relay in turn causes the release of relays 207, 214, 216 and 106. Relay 214 disconnects the alternating current signal from the sleeve of the calling subscriber's line and releases relay 322. Relay 106 closes the circuit for the release magnet 107 so that connector 100 will now return to normal. Relay 212 also releases on the release of relay 205. The discontinuing of the alternating current signal and release of connector 100 causes also the release of alternating current responsive relay 318 and relay 319. The operator at B seeing signal 325 lighted will know that the calling subscriber gave the correct number and removes the plug of the cord 303 from the jack 300 of the number checking trunk TC. The removal of this plug causes the release of relays 304 and 307. A circuit is now completed for the release magnet 305 for the release of the trunk connector 301. This circuit may be traced from battery, winding of this magnet, vertical off-normal contacts 311, upper armature and back contact of relay 307, lower armature and back contact of relay 304 to ground. The release of relay 307 causes the release of relays 320 and 306. The release of relay 307 will also close a circuit for the release magnet 223 from battery, winding of this magnet, vertical off-normal contact 224 to ground at the lower armature and back contact of relay 307 to cause the connector 200 to return to normal.

A description will now be made of the checking of a connection from a P. B. X. subscriber in a P. B. X. of less than ten lines. In this case the intermediate connector 200 will select the group of terminals 202 of connector 100. When connector 100 has advanced its brushes 102 to the terminals of the first line in this P. B. X. group the lower brush will encounter a direct ground on the lower terminal of this line. In this case, therefore, both relays 214 and 215 will be operated. Relay 215 in operating closes a circuit from ground to the interrupting circuit arrangement 226 to close a circuit for the operation of relay 227 which in turn closes a circuit for the operation of relay 228 and this relay in turn opens the circuit for relay 227 which again releases relay 228. These relays will be alternately operated and released in this manner to establish momentary connections from ground through the lower outer armature and front contact of relay 215, left hand armature and front contact of relay 228, lower inner armature and front contact of relay 215, winding of relay 229 to battery to alternately operate and release this relay. Relay 229 now controls the circuit for the rotary magnet 112 which extends from battery, winding of this magnet, the sixth brush of the connector 200, upper in-

ner armature and front contact of relay 215, armature and front contact of relay 229 to ground reoperate connector 100 to pass from the terminal of one P. B. X. exchange line to another in this group until the terminal of the last line has been reached as ground will be encountered on these terminals. The lower terminal of the last line will have a connection through a resistance to ground to permit relay 215 to release to open the control circuits for rotary magnet 112. Relay 214 when operated applies the alternating current signal from source 217 to the upper terminal of each line in succession as the brushes 102 of the connector 100 pass over these terminals.

When the sleeve terminal of the P. B. X. line connected to trunk T is passed by the upper one of the brushes 102 the alternating current signal will be transmitted over the trunk through connector 301 to cause the operation of relay 318. The operations of the circuits from this time on are exactly the same as hereinafter described in connection with the number checking for an individual line.

A description will now be made of number checking for a P. B. X. subscriber's line when located in a P. B. X. having more than ten lines. In this case the connector 200 will select a terminal group such as 203 which indicates the P. B. X. number and the connector 100 will be actuated to select a sub-group of a subscriber's line in this P. B. X. In this sub-group the calling subscriber's line will be located. Brushes 103 will now be used and the lower brush will encounter a connection to ground through a high resistance. If the connections are made as shown in Fig. 1, the sub-group controlled by the brush and bank 115 will be selected by connector 100. As the lower one of the brushes 103 finds this high resistance condition to ground neither relay 214 nor relay 215 will be actuated. However, the connection from this terminal will as shown, extend from battery at the winding of relay 215 over the circuit hereinafter described, and through the lower one of the brushes 103, left hand make-before-break contacts of relay 116, right hand winding of relay 217, outer right hand armature and back contact of relay 218 to ground at the brush and first terminal of bank 119. Relay 117 operates in this circuit and provides a locking circuit for itself from battery, left hand winding, inner make-before-break contacts of relay 116, inner left hand armature and front contact of relay 117 and the corresponding armatures and back contacts of relays 120 to 123, winding of relay 118 to ground. Relay 118 operates in this circuit and closes a connection for the starting of the switch 104 to hunt over the terminal controlled thereby. This circuit will be closed from battery, winding of the start relay 124, armature and back contact of the

stepping magnet 125, outer right hand armature and front contact of relay 118 to ground at the brush and the first terminal of bank 119. Relay 124 in operating closes an obvious circuit for the stepping magnet 125 which in operating opens the circuit for relay 124. The relay 124 and magnet 125 are now alternately operated and released to actuate the switch 104 to connect its brushes with the terminal of the corresponding banks shown. The ground connection originally traced from the brush of bank 119 will be supplied to the succeeding terminal of this bank 119 for the actuation of relay 124.

As the brush of bank 115 passes over the succeeding terminals the alternating current signal will be supplied from the source 217, through the outer left hand armature and front contact of relay 117 and the brush of bank 115 in succession to the sleeves of the lines in the selected group, which are connected to the terminals of this bank. When the line connected to trunk T is encountered the alternating current signal will be supplied over the sleeve of this connection through the trunk connector 301 to cause the operation of relay 318. The operation from this time on in checking the number is the same as hereinbefore described in connection with an individual line. In this case, however, the operator at B will only know that the calling subscriber is located in a certain sub-group of a particular P. B. X. When the switch 104 has been advanced to the next to the last terminal a connection is established for the operation of relay 126 from ground on the brush of bank 119, and this relay in operating now closes a circuit for the operation of relay 116 from battery, left hand armature and front contact of relay 126, middle left hand armature and front contact of relay 117, winding of relay 116 to ground. Relay 116 in operating opens the locking circuit for relays 117 and 118 which now release. A circuit is thereby established for returning the switch 104 to normal. This circuit may be traced from the stepping relay 124, armature and back contact of stepping magnet 125, inner right hand armature and back contact of relay 118 to ground at the right hand armature and front contact of relay 126. The switch 104 in returning to normal opens a circuit for relay 126 which now releases.

Although this invention has been illustrated in connection with but a single system it should be understood that this disclosure is merely illustrative of the invention and that it may readily be applied to a number of other systems without departing from the spirit thereof.

What is claimed is:

1. In a telephone system, a first office, a second office, a subscriber's line at the first office, an operator's position at the second office, means for establishing a connection

from the subscriber's line to the operator's position, means for establishing a second connection from the operator's position to the subscriber's line, a signal at the operator's position and means responsive to the establishing of said connections for actuating said signal.

2. In a telephone system, a subscriber's line, an operator's position, means for establishing a connection from the subscriber's line to the operator's position, means for establishing a second connection from the operator's position to the subscriber's line, a signal at the operator's position, means responsive to the establishing of said connections for transmitting a direct current signal over the second connection to the operator's position and means responsive to said direct current signal for actuating said signal at the operator's position.

3. In a telephone system, a first and a second office, a subscriber's line at the first office, an operator's position at the second office, means for establishing a connection from said subscriber's line to said operator's position, means for establishing a separate connection to the subscriber's line from the operator's position, a signal at the operator's position, means for applying an alternating current signal through the portions of said two connections located at the first office, and means responsive to said alternating current signal and to the establishing of said connections for actuating said signal at the operator's position.

4. In a telephone system, a first and a second office, a subscriber's line at the first office, an operator's position at the second office, means for establishing a connection from said subscriber's line to said operator's position, means for establishing a separate connection to the subscriber's line from the operator's position, an alternating current signal source, means for applying a signal from said source through the portions of said two connections located at the first office, means responsive to said signal and to the establishing of said connections for transmitting a direct current signal over the second connection to the operator's position, a signal at the operator's position and means responsive to the direct current signal for actuating said signal at the operator's position.

5. In a telephone system, subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to the operator's position, means for establishing a second connection from the operator's position to a subscriber's line, a signal at the operator's position and means for actuating said signal in one manner if said second connection is established to the same subscriber from which the first connection was established and for actuating it in a different

manner if the second connection was established to a different subscriber's line.

6. In a telephone system, subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to said operator's position, means for establishing a connection from said operator's position to a subscriber's line, a signal at said operator's position, means responsive to the establishing of said second connection if it is established to the same subscriber's line from which the first connection was established for transmitting direct current signal of one character over said second connection to said operator's position and means responsive to the establishing of said second connection if it was established to another subscriber's line for transmitting a direct current signal of a different character to the operator's position and means for actuating said signal at the operator's position in different manners in response to the different direct current signals.

7. In a telephone system, a subscriber's line, an operator's position, means for establishing a connection from the subscriber's line to the operator's position, means for establishing a separate connection from the operator's position to the subscriber's line, means responsive to the establishing of said connections for indicating at the operator's position that these connections have been established, means for automatically releasing said second connection when said indication has been given at the operator's position.

8. In a telephone system, a subscriber's line, an operator's position, means for establishing a connection from the subscriber's line to the operator's position, means for establishing a separate connection from the operator's position to the subscriber's line, a signal at the operator's position, means responsive on the establishing of the second connection for actuating said signal and for automatically releasing said second connection and means for maintaining said signal actuated after the second connection has been released.

9. In a telephone system, a subscriber's line, an operator's position, means for establishing a connection from the subscriber's line to the operator's position, means for establishing a separate connection from the operator's position to the subscriber's line, a signal at the operator's position, means including two relays responsive on the establishing of the second connection for actuating said signal and for releasing the second connection.

10. In a telephone system, a group of subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to the operator's position, means for establishing connections from the operator's

position to the subscribers' lines in said group in succession, a signal at the operator's position and means responsive to the establishing of said connections for actuating said signal.

11. In a telephone system, a group of subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to the operator's position, means for establishing connections from the operator's position to the subscribers' lines in said group in succession, a signal at the operator's position, means responsive to the establishing of said connections for transmitting over a connection from the operator's position a direct current signal to the operator's position, and means responsive to said direct current signal for actuating said signal at the operator's position.

12. In a telephone system, a first office, a second office, a group of subscribers' lines at the first office, an operator's position at the second office, means for establishing a connection from any one of the subscribers' lines to the operator's position, switching means controllable from the operator's position for establishing a connection from the operator's position to a group of terminals connected to the sleeve conductors of said lines, means for actuating said switching means to hunt over said sleeve terminals in response to the establishing of the second connection to said group, switching means controllable from the operator's position for establishing a third connection from the second connection to the sleeve conductor of the first connection at the point where this first connection leaves the first office, means for applying an alternating current signal over the second connection to the sleeve conductor of the subscriber's line from which the first connection was established through the sleeve conductor of this connection and back over the third connection, means responsive to the reception of said alternating current signal over the third connection and to the establishing of the second connection for transmitting a direct current signal over the second connection to the operator's position, a visual signal at the operator's position and means responsive to said direct current signal for actuating said visual signal.

13. In a telephone system, groups of subscribers' lines, an operator's position, means for establishing a connection from any subscriber's line to the operator's position, means for establishing connections from the operator's position, to subscribers' lines in succession in any one of said groups of lines, a signal at the operator's position and means for actuating said signal in one manner if said connection from the operator's position is made to subscribers' lines of the group from which the first connection was established and for actuating said signal in a dif-

ferent manner if said connection from the operator's position is made to subscribers' lines in another group.

14. In a telephone system, a group of subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to the operator's position, means for establishing connections from the operator's position to the subscribers' lines in succession and for releasing said means after a connection has been made to the last subscriber's line in the group, and means responsive to the establishing of said connections for indicating at the operator's position that the first connection has been made.

15. In a telephone system, groups of subscribers' lines, an operator's position, means for establishing a connection from the operator's position to a point representing a group of lines, a switch responsive on the selection of said point for hunting over the subscribers' lines in said group, a signal at the operator's position and means responsive to the establishing of said connections and to the hunting operation for actuating said signal.

16. In a telephone system, groups of subscribers' lines, an operator's position, means for establishing a connection from the operator's position to a point representing a group of lines, a switch responsive on the selection of said point for hunting over the subscribers' lines in said group, a signal at the operator's position, means responsive to the establishing of said connections and to the hunting operation for transmitting over the connection from the operator's position at direct current signal to the operator's position and means responsive to said direct current signal for actuating the signal at the operating position.

17. In a telephone system, a first and a second office, a subscriber's line at the first office, an operator's position at the second office, means for establishing a connection from the subscriber's line to the operator's position including a sleeve connection from the subscriber's line to the point of the first connection where it leaves the first office, means for establishing a separate connection from the operator's position to the sleeve of the first connection at the subscriber's line, means for establishing a connection between said second connection at the first office and the other end of the sleeve, means for applying an alternating current signal over the second and third connections through said sleeve, means responsive to said alternating current signal and to the establishing of the second connection for transmitting a direct current signal to the operator's position over the tip and ring conductors of said second connection, a signal at the operator's position, and means responsive to said direct current signal for actuating said signal at the operator's position.

18. In a telephone system, subscribers' lines, an operator's position, means for establishing a connection from a subscriber's line to said operator's position, means for establishing a connection from said operator's position to a subscriber's line, a signal at said operator's position, means responsive on the establishing of said second connection if it was established to the same subscriber's line from which the first connection was established for transmitting a continuous direct current signal over the second connection to the operator's position, means responsive to the establishing of said second connection if it is established to a different subscriber's line to the one from which the first connection was established for transmitting an interrupted direct current signal to the operator's position, and means responsive to the continuous direct current signal for continuously operating the signal at the operator's position and for intermittently actuating the operator's signal in response to the interrupted direct current signal.

19. In a telephone system, a subscriber's line, an operator's position, means for establishing a connection from the subscriber's line to the operator's position, means for establishing a separate connection from the operator's position to the subscriber's line, and a relay responsive to the establishing of the second connection for releasing said second connection.

In witness whereof, I hereunto subscribe my name, this 25th day of November 1930.
RALPH L. QUASS.