

March 6, 1934.

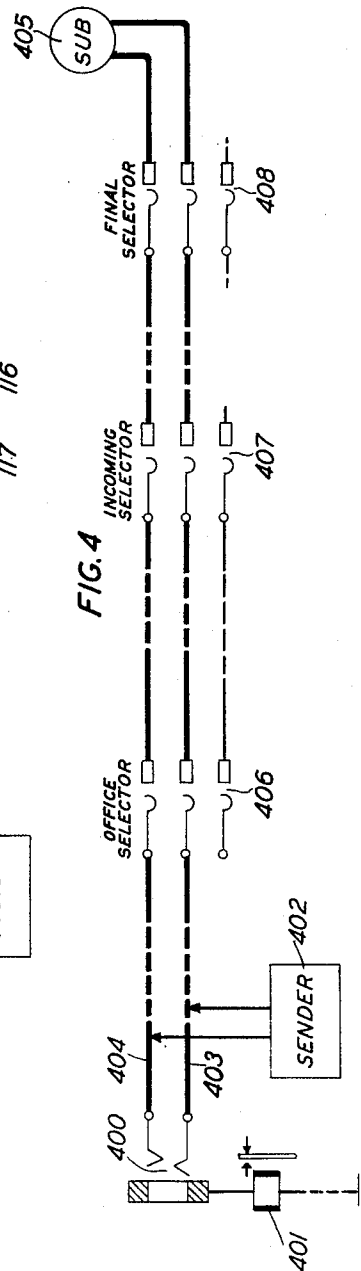
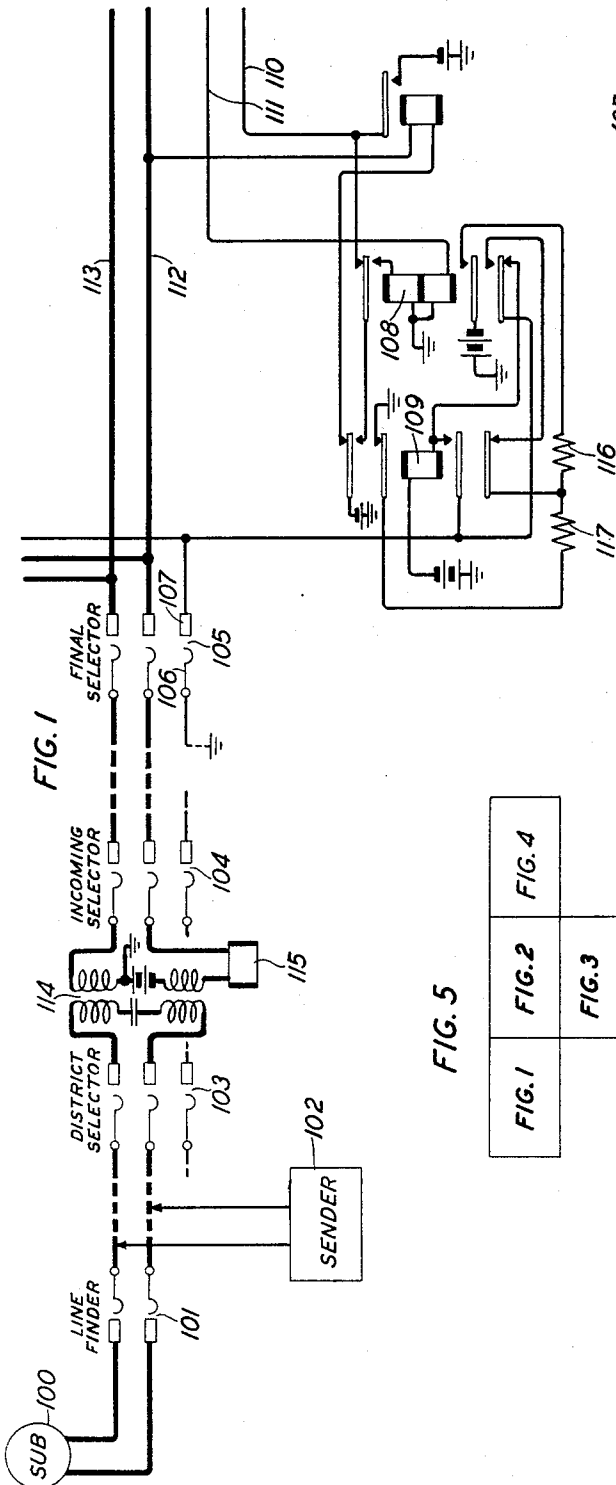
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1,950,129

TELEPHONE SYSTEM

Filed March 18, 1932

3 Sheets-Sheet 1



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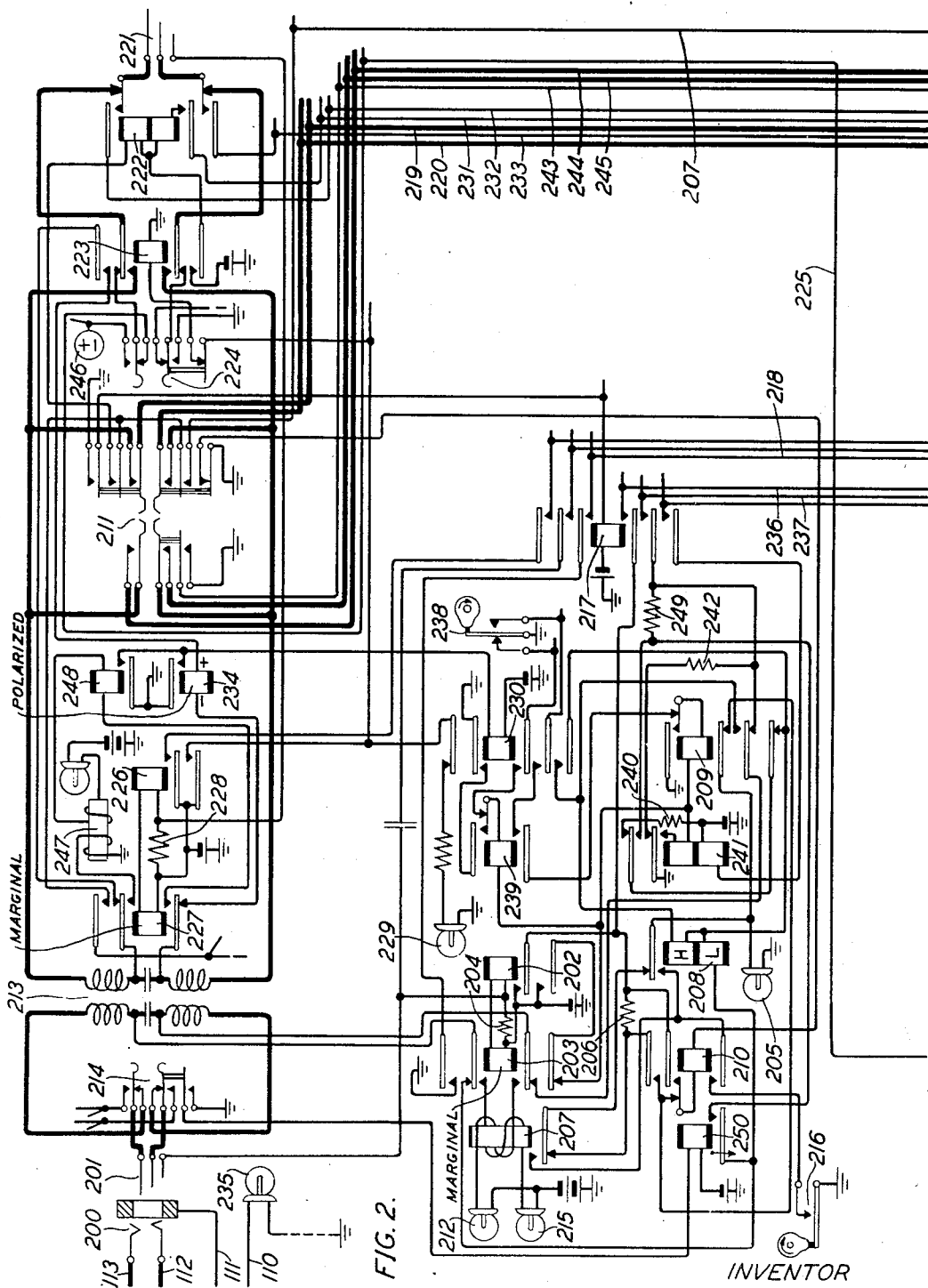
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3 Sheets-Sheet 2



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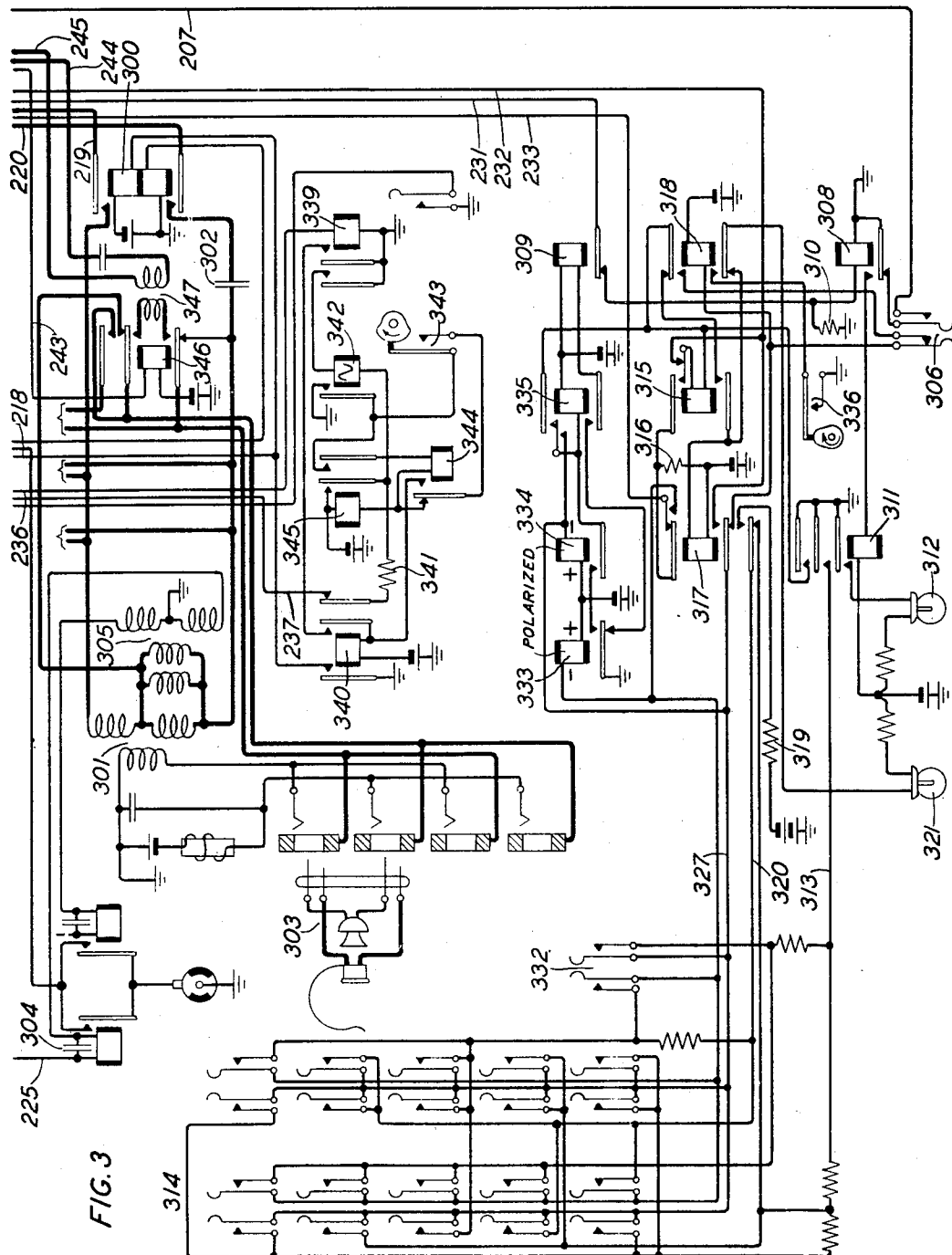
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1,950,129

TELEPHONE SYSTEM

Filed March 19, 1932

3 Sheets-Sheet 3



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1,950,129

TELEPHONE SYSTEM

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Application March 18, 1932, Serial No. 599,656

4 Claims. (Cl. 179—27)

This invention relates to a telephone system and more particularly to a system in which an operator is enabled to intercept calls which have been extended to blank terminals of selector switches in the establishment of either local or toll connections and to complete calls outside the office in which the calls originated. The object of the invention is to improve the apparatus of an intercepting operator's position in a system of this character whereby proper supervision may be passed back from the selector switches which are employed to extend an intercepted call when the called subscriber answers to the switches employed by the calling subscriber in extending the connection to the operator's position.

In the installation of telephone exchanges in which mechanical switching mechanism is employed for extending connections between subscribers' lines, it is the usual practice to divide the exchange area into a plurality of offices and to make provision in each office for ultimately giving service to 10,000 subscribers' lines. The number of offices in the exchange is so selected that at the outset no office is required to function to its ultimate capacity and therefore there may be switching units which are not employed to their fullest extent. This is especially true of incoming selector switches which have access to small groups or divisions of trunk lines and to final selectors which have access to individual subscribers' lines. Thus there will be a number of terminal sets in the banks of incoming selectors which are blank or not connected to working trunk lines extended to final selectors and terminal sets in the banks of final selectors which are blank or not connected to subscribers' lines.

If an incoming selector switch in response to dialing is positioned to extend a connection into a division of an office which has not yet been installed, or a final selector is positioned upon a blank terminal to which no subscriber's line has been connected, or upon the terminal of a line from which former service has been discontinued, or transferred to another office, the attempted connection is routed to a trunk terminating at an operator's position on the "A" switchboard.

The operator upon answering such a call with a cord circuit at her position ascertains from the subscriber the number which he has called and if he has dialed for a connection to a particular subscriber's line which has been given a new number terminating in another office of the exchange, she will proceed to extend the attempted connection through her cord circuit over

an outgoing trunk and selector switches to the desired subscriber's line in such other office.

When the connection has been thus established, a talking circuit between the calling and called lines will exist over the district, office, incoming and final selectors in the originating office, the operator's cord circuit and selectors in the terminating office. For supervisory purposes, for example call charging, it is necessary to pass a supervisory signal back to the district selector in the originating office when the called subscriber answers. Inasmuch as the operator's cord circuit is divided for transmission and supervisory purposes by a repeating coil, it thus becomes necessary or desirable to pass this answering supervisory signal around the repeating coil in the cord circuit.

In accordance with the present invention the cord circuit is provided with a group of relays for thus passing back an answering supervisory signal which functions when reverse battery is connected to the calling end of the cord circuit from the incoming selector in the terminating office following the response of the called subscriber. Should, however, the called line be busy and a busy-back flash be transmitted from the terminating office, the group of relays is arranged not to pass a supervisory signal back to the originating office.

This group of relays comprises a first relay which operates when the polarized supervisory relay of the cord circuit operates on reverse battery and prepares the circuit of a pick-up relay which operates over the back contacts of an interrupter when the interrupter reaches a position in which such contacts are closed. The pick-up relay when operated, locks and prepares a circuit for a third relay which in turn operates over the front contacts of the interrupter as soon as the interrupter has advanced to close its front contacts. When the third relay operates, it closes a low resistance bridge across the answering end of the cord circuit for establishing a supervisory loop back to the district selector in the originating office. This supervisory loop accomplishes the same function as though the final selector in the originating office had succeeded in terminating the connection on the terminals of the desired line and the subscriber whose line was connected thereto had responded in the usual manner.

The manner in which the invention functions will be more evident from the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 shows schematically a calling subscriber's

line, line finder, district, incoming and final selector switches, a sender in which the calling subscriber may cause the registrations of line designations and which in accordance with such registrations causes the setting of the selector switches, and an intercepting trunk circuit accessible from the final selector switch and terminating at the operator's position of Fig. 2;

Fig. 2 shows one cord circuit of an operator's position by means of which the operator may render assistance and intercepting service to calling subscribers;

Fig. 3 shows the telephone and keyset circuits of the operator's position;

Fig. 4 shows schematically a trunk circuit terminating in an office selector, incoming and final selector switches, a called subscriber's line and a sender under the control of the operator's keyset for controlling the selector switches for enabling the operator to complete connections; and

Fig. 5 is a diagram showing the manner in which the remaining figures should be arranged to show the complete circuits of the invention.

The cord circuit of Fig. 2 located at the "A" operator's position has access over the answering plug 201 to jacks of incoming trunks which may, for example, be intercepting trunks from final selector multiples as disclosed in Fig. 1, or from incoming selector multiples, or trunks incoming from district or office selector multiples over which calling subscribers have made calls for assistance in establishing connections or tie line trunks from other operators' positions or manual subscribers' lines. Over the calling plug 221 of the cord circuit the operator may have access to different groups of trunk circuits for completing connections. These groups of outgoing trunk circuits may be of the type disclosed in the application of W. B. Strickler, Serial No. 599,684, filed concurrently herewith, now Patent No. 1,897,083, granted Feb. 14, 1933. For the purposes of this description it will be assumed that the trunk circuit employed and disclosed schematically in Fig. 4 is of the type terminating in an office selector switch. The keyset and operator's position equipment shown in Fig. 3 is common to all of the cord circuits such as the cord circuit of Fig. 2 of the operator's position. The sender schematically shown by the rectangle in Fig. 4 is of the type disclosed in the aforementioned application of W. B. Strickler and is controlled from the operator's keyset in the manner fully described therein.

It will be assumed that the calling subscriber 100 initiates a call for a connection to a subscriber's line, the number of which is listed in the telephone directory, but which line has been given a new number assigned to another office of the exchange area. In response to the removal of the subscriber's receiver from the switchhook, his line becomes connected in the well-known manner by means of the line finder 101 to a sender 102. Upon receiving the usual dial tone from the sender the subscriber then proceeds to dial the digits of the designation of the desired line. The sender 102 registers the dialed digits and proceeds to set the selector switches 103, 104 and 105 to extend a connection to the terminals of the desired line. Since, as has been assumed, the desired line has been disconnected from the terminals upon which the final selector switch 105 has been set, the final selector makes connection with the terminals of an intercepting trunk which has been connected in lieu of the subscriber's line.

A circuit is therefore established from ground

in the final selector, over the sleeve brush 106 thereof, sleeve terminal 107 of the trunk, lower back contact of relay 108 to battery through the winding of relay 109. Relay 109 operates and locks directly to ground on sleeve terminal 107 and closes a circuit for trunk lamp 235 extending from battery, upper front contact of relay 109, upper back contact of relay 108, conductor 110 to ground through lamp 235. The operator upon noting the illumination of lamp 235 inserts plug 201 into jack 200 thereby establishing a circuit from ground through the lower winding of relay 108, conductor 111, sleeves of jack 200 and plug 201 to battery through the winding of relay 202 and the winding of marginal relay 203 in series and to battery in parallel therewith through the non-inductive winding 204 of relay 203. Relay 108 operates in this circuit locking over its upper winding and upper front contact, the upper front contact of relay 109 to battery opening at its upper back contact the circuit of lamp 235 thereby extinguishing the lamp. At the cord circuit relay 202 operates but due to the high resistance of the lower winding of relay 108, marginal relay 203 does not operate. Relay 202 upon operating closes a circuit for the supervisory lamp 205 extending from battery, over the inner contact of relay 202, resistance 206, back contact of relay 207, back contact of relay 208 to ground through lamp 205 and in parallel therewith from battery over the inner contact of relay 202, resistance 206, back contact of relay 207, back contact of relay 208, inner lower back contact of relay 209, inner normal contacts and winding of relay 210 to ground at the lower right normal contact of key 211. Relay 210 locks in a circuit from battery at the inner contact of relay 202, inner upper alternate contacts and winding of relay 210 to ground at key 211. The operator now throws her talking key 211 to the right opening the circuit of relay 210 which releases, and closing an obvious circuit for relay 217 which in turn establishes a circuit from battery, over the inner contact of relay 202, inner lower contact of relay 217, conductor 236 to ground through the winding of relay 339. Ringing current applied from the incoming selector 104 now flows over the ring brushes of incoming selector 104 and final selector 105, trunk conductor 112, rings of jack 200 and plug 201, lower normal contact of key 214, lower left winding of repeating coil 213, inner lower back contact of relay 203, middle lower back contact of relay 209, middle lower contact of relay 217, conductor 237, back contact of relay 340, resistance 341, winding of relay 342 to ground at the outer contact of relay 339. Relay 342 responds to the ringing current closing a circuit from ground at its contact, through the contacts of interrupter 343, back contact of relay 344 to battery through the winding of relay 345. Relay 345 operates and locks through its winding, the winding of relay 344, the outer front contact of relay 345 to ground at the contact of relay 342, but relay 344 being shunted does not operate until the interrupter 343 opens its contacts. Relay 345 at its inner contact closes an obvious holding circuit for relay 342 and thereby increases the current flowing over the ringing circuit from the incoming selector to such an extent as to cause the disconnection of the ringing current supply at the incoming selector and the cutting through of the talking circuit at the incoming selector. As soon as the talking circuit is cut through

at the incoming selector, a circuit is established from ground through the upper right winding of repeating coil 114, tip brushes of incoming selector 104 and final selector 105, trunk conductor 113, tips of jack 200 and plug 201, upper normal contact of key 214, upper left winding of repeating coil 213, upper back contact of relay 203, lower low resistance winding of relay 208, lower back contact of relay 209, upper back contact of relay 241 to battery through resistance 240 thus operating relay 208 which at its back contact extinguishes lamp 205. A circuit is also established from grounded battery through the lower right winding of repeating coil 114, winding of supervisory relay 115, ring brushes of incoming selector 104, and final selector 105, conductor 112, rings of jack 200 and plug 201, lower normal contact of key 214, lower left winding of repeating coil 213, lower back contact of relay 203, intermediate lower back contact of relay 209, resistance 242 to ground at the inner upper back contact of relay 240. Resistance 242 is high and therefore supervisory relay 115 at the incoming selector does not operate in this circuit.

When relay 344 operates and the interrupter contacts again close, relay 340 operates in a circuit extending from battery through its winding, the front contact of relay 344, contacts of interrupter 343 to ground at the front contact of relay 342. Relay 340 upon operating locks to ground at the front contact of relay 339, opens the initial operating circuit of relay 342 and closes a circuit extending from ground at its left contact, through the upper winding of relay 300 to battery.

Relay 300 operates and a talking path is thereupon established from the upper right winding of repeating coil 213, inner upper right contact of key 211, conductor 219, upper contact of relay 300, right winding of repeating coil 301, condenser 302, lower contact of relay 300, conductor 220, inner lower right contact of key 211 to the lower right winding of coil 213. Assuming that the operator's telephone set 303 is plugged up, the talking path just traced is inductively associated therewith through the left winding of repeating coil 301 and the operator is thereupon enabled to converse with the calling subscriber to ascertain information concerning the connection which he has attempted to complete.

It will be assumed that the line of the desired subscriber may be reached over the trunk circuit and selector switches disclosed in Fig. 4 and that therefore the operator first tests the trunk circuit by touching the tip of calling plug 221 to the sleeve of jack 400 of the trunk circuit. If the trunk circuit is busy, there will be battery potential on the sleeve thereof and this potential will be transmitted over the tip of plug 221, the upper normal contacts of relay 222, the inner upper back contact of relay 223, the upper normal contact of key 224, conductor 225, condenser 304 to ground through the right winding of repeating coil 305 which induces busy potential through the left winding of coil 305 and the back contacts of relay 346 into the operator's telephone set thus producing a click in her receiver. Assuming that she finds the trunk circuit of Fig. 4 idle and receives no click, she inserts the plug 221 into jack 400, thereby establishing a circuit extending from ground through the winding of sleeve relay 401 of the trunk circuit, sleeves of jack 400 and plug 221, windings of relay 226 and

marginal relay 227 in series to battery and in parallel therewith through resistance 228 to battery. Due to the high resistance of sleeve relay 401, sufficient current flows to operate relay 226, but marginal relay 227 does not operate.

Relay 226 upon operating closes a circuit extending from battery over its lower contact, the lower normal contact of key 224 to ground through the winding of relay 223 which operates opening the busy test circuit at its upper back contact and at its inner upper and inner lower front contacts connects the tip and ring contacts of plug 221 to the right windings of repeating coil 213. Relay 226 at its lower contact also establishes a circuit for lamp 229 extending over the upper back contact of relay 230. Preparatory to keying the digits necessary to complete the connection, the operator now depresses the key 306 and with the talking key 211 operated to the right, a circuit is established from ground at the lower back contact of relay 308, the right contact of key 306, conductor 307, the lower and upper intermediate alternate contacts of key 211, the upper winding of relay 222 to battery at the lower contact of relay 223. Relay 222 thereupon operates and locks in a circuit from battery over the lower contact of relay 223, lower winding and inner lower front contact of relay 222, conductor 231, back contact of relay 309 and in parallel to ground through resistance 310 and the winding of relay 308. Relay 308 operates in this circuit opening the initial operating circuit of relay 222 and closing an obvious circuit for relay 311 which operates. Relay 222 at its upper and lower alternate contacts disconnects the tip and ring contacts of plug 221 from the right windings of repeating coil 213 and connects these contacts over conductors 232 and 233 with the operator's keyset circuit.

Relay 311 upon operating closes an obvious circuit to light lamp 312, connects ground over conductor 313 for supplying operating ground to the keys of the keyset 314 and establishes a circuit from ground at its upper contact, through the winding and upper normal contacts of relay 315, conductor 232, upper alternate contacts of relay 222, tips of plug 221 and jack 400 to battery through the winding of the start relay, not shown, of the trunk circuit of Fig. 4. As described in the application of W. B. Strickler hereinbefore mentioned, the operation of the start relay of the trunk circuit causes the association of the trunk circuit with an idle sender such as that shown schematically at 402 in Fig. 4. As soon as the sender 402 has been attached to the trunk circuit, a circuit is established from ground at the sender over the ring conductor 403 of the trunk circuit, ring contacts of jack 400 and plug 221, lower alternate contacts of relay 222, conductor 233, upper normal contacts of relay 317, resistance 316 to battery. A relay in the sender operates in this circuit and closes a circuit from battery at the sender over the tip trunk conductor 404, tips of jack 400 and plug 221, upper alternate contacts of relay 222, conductor 232, upper normal contacts and winding of relay 315 to ground at the upper contact of relay 311. Relay 315 operates in this circuit locking over its upper alternate contacts through resistance 316 to battery and also closes a circuit from ground at the upper contact of relay 311, upper back contact of relay 318 lower contact of relay 315 to battery through the winding of relay 317. Relay 317 upon operating connects 48-volt battery through resistance 319 and the lower front contact of relay 317 to conductor

320 for supplying battery to key contacts of keyset 314 and connects the keyset over its inner lower front and upper alternate contacts to conductors 232 and 233 and thence to the sender. Relay 315 also closes a circuit extending from ground at the upper contact of relay 311, upper back contact of relay 318, lower front contact of relay 315, lower back contact of relay 318 to battery through lamp 321. Lamp 321 lights to indicate to the operator that the sender 402 is in condition to register the digits of the desired line designation.

The operator now proceeds to set up on the keys of her keyset 314 the office code and numerical designations of the subscriber's line 405 to which connection is to be extended and then depresses the start key 332. Through the operation of the keys of the keyset and the operation of the start key, registers of the sender 402 are set and a start combination is registered for starting the sender to function to establish the desired connection. Since the manner in which this is accomplished is not pertinent to the present invention, reference may be had to the aforementioned application of W. B. Strickler for a detailed description of the manner in which the sender functions in response to the keyset to register the line designation and to set the office selector 406, the incoming selector 407 and the final selector 408 to extend the desired connection to the subscriber's line 405. Following the registration of the start combination in the sender in response to the operation of start key 332, the sender connects 24-volt battery to both the tip conductor 404 and the ring conductor 403 of the trunk circuit thereby causing the operation of the two polarized relays 333 and 334 of the operator's keyset circuit. With both of these relays operated an obvious circuit is closed for relay 335 which locks to ground at the upper contact of relay 311 and connects ground over its upper contact to the sender over the tip trunk conductor 404 which causes the operation of a relay in the sender to remove 24-volt battery from the operating circuits of relays 333 and 334. Relay 333 now releases, but relay 334 is held operated by relay 335. Relay 333 upon releasing closes a circuit from ground at its back contact, lower front contact of relay 335, winding of relay 309 to battery. Relay 309 operates and opens the circuit of relay 308 which upon releasing in turn releases relay 311. Relay 311 upon releasing in turn releases relays 335, 334, 309, 315 and 317 and extinguishes lamps 312 and 321. Relay 311 upon releasing also releases relay 222 in the cord circuit. The operator's keyset circuit is now in normal condition.

If the operator disregards the pilot lamp 321 and starts keying a designation before the sender is attached and relay 317 has been operated from the sender a circuit will be closed for relay 318 from battery through its winding, inner lower back contact of relay 317, conductor 327 to ground on conductor 313 through contacts of any operated key of the keyset 314. Relay 318 upon operating locks over the left contact of key 306, upper front contact of relay 318 to ground at the upper contact of relay 311 and at its lower front contact connects lamp 321 in a flashing circuit through the contacts of interrupter 336. To prepare the keyset for use, the operator must depress key 306 to release relay 318.

Following the operation of the sender to set the selector switches of Fig. 4, the sender 402 is released and a talking circuit is established over trunk conductors 403 and 404 and the brushes

of office selector 406 to the incoming selector 407, this talking circuit extending from the tip trunk conductor 404 over the tips of jack 400 and plug 221, upper normal contacts of relay 222, which released when the operator's keyset was released following completion of keying, inner upper front contact of relay 223, upper right winding of repeating coil 213, upper back contact of relay 227, upper front contact of relay 223, winding of polarized supervisory relay 234, lower back contact of relay 227, lower right winding of repeating coil 213, inner lower front contact of relay 223, lower normal contacts of relay 222, rings of plug 221 and jack 400 to the ring trunk conductor 403.

When the called subscriber 405 answers current flowing over this talking path from the incoming selector is reversed in the well-known manner thereby causing the operation of polarized relay 234. Relay 234 causes the operation of relay 230 over an obvious circuit which in turn at its upper back contact opens the circuit of calling supervisory lamp 229. Relay 230 at its inner lower front contact establishes a circuit from ground as soon as interrupter 238 closes its left contact, through the upper normal contacts and winding of pick-up relay 239, lower back contact of relay 203 to battery at the lower contact of relay 202. Relay 239 operates and locks over its upper alternate contacts to ground at the upper front contact of relay 230 and as soon as interrupter 238 closes its right contact, establishes a circuit from ground at the right contact of interrupter 238, intermediate lower front contact of relay 230, lower front contact of relay 239, upper normal contacts and winding of relay 209, lower back contact of relay 203 to battery at the lower contact of relay 202. Relay 209 operates and locks directly to ground over its upper alternate contacts independent of the contacts of interrupter 238, opens the circuit previously traced from battery through the lower winding of relay 208 to ground at the incoming selector 104 and the circuit previously traced from grounded battery through the winding of supervisory relay 115 at the incoming selector and establishes a loop circuit extending from ground through the upper right winding of repeating coil 114, thence as traced through the lower winding of relay 208, lower front contact of relay 230, lower front contact of relay 209, thence as traced through the winding of supervisory relay 115 and the lower right winding of repeating coil 114 to battery. The current flowing over this circuit is now sufficient to operate relay 115 which then, in the well-known manner, controls the establishment of a supervisory condition in the district selector 103 indicating thereat that the called subscriber has answered the call. The upper high resistance winding of relay 208 is at this time shunted over the lower contact of relay 230.

If when the connection is made to the terminals of the called line 405, such line is busy, then the final selector 408 would in the well-known manner place a busy tone current on the talking circuit thereat, which tone current is transmitted through the windings of the repeating coil 213 and thence to the calling subscriber's line over the established connection and the calling supervisory relay 234 is intermittently operated to thereby intermittently operate relay 230 to flash the calling supervisory lamp 229. Since in this case relay 230 does not remain operated steadily, pick-up relay 239 does not have time

to operate from the interrupter 238 and remain locked so that relay 209 may be operated from the interrupter and locked and, consequently, the supervisory circuit established through the operation of relay 209 as previously described, is not rendered effective. It is thus apparent that the incoming selector 104 receives a supervisory signal upon the response of the called subscriber and not when the called line is found to be busy and a busy signal is sent to the operator's position.

Upon the termination of the conversation, the calling and called subscribers restore their receivers to the switchhooks. When the calling subscriber hangs up the line finder 101, district selector 103, incoming selector 104 and final selector 105 release in the well-known manner in turn releasing relay 109 and opening the locking circuit of relay 108. Until the operator withdraws plug 201 from jack 200, relay 108 remains operated and busy potential is maintained on the sleeve terminal 107 to prevent other final selectors from seizing the incoming trunk. This busy potential is applied over a circuit traceable from the sleeve terminal 107, the lower front contact of relay 108, lower back contact of relay 109, resistance 116, inner lower front contact of relay 108 to battery and from the lower back contact of relay 109 through resistance 117 to ground at the inner upper back contact of relay 109. The release of the incoming selector 104 and final selector 105 also opens the previously traced circuit through the lower winding of relay 208 whereupon relay 208 releases again closing the circuit of the answering supervisory lamp 205.

When the called subscriber hangs up, the polarized supervisory relay 234 releases in turn releasing relay 230 which at its upper contact closes the previously traced circuit for calling supervisory lamp 229 and at its inner upper front contact opens the locking circuit of relay 239 which then releases. The operator upon noting the lighted lamps 205 and 229 withdraws the plugs 201 and 221 from jacks 200 and 400 releasing all operated relays of the cord circuit and releasing relay 108 of the incoming trunk circuit and relay 401 of the outgoing trunk circuit of Fig. 4. Relay 108 upon releasing removes the busy potential from the sleeve terminal 107 of the incoming trunk thereby rendering it again selectable. Relay 400 upon releasing restores the operated apparatus of the outgoing trunk and the selectors of Fig. 4 release in the well-known manner.

Should the operator desire to monitor on an established connection, she may do so by throwing key 211 to the left thereby closing a circuit from ground, over the lower left contact of key 211, conductor 243 to battery through the winding of relay 344. The tip and ring conductors of the cord circuit are now connected over the upper and intermediate left contacts of key 211, conductors 244 and 245, through the right winding of repeating coil 345 and thence inductively over the left winding of coil 345, inner upper and lower front contacts of relay 344 to the operator's telephone set 303.

If the desired subscriber's line is one terminating in a manual office, then the operator connects the calling plug 221 to the jack of a trunk circuit terminating in the manual office. Such trunk circuits are provided with low resistance sleeve relays and consequently upon the insertion of plug 221 in the jack of such a trunk cir-

cuit the current flowing through the windings of relays 226 and 227 is of sufficient strength to operate both of these relays. In this case since it is not necessary to key the called line designation, the operator does not depress key 306 of her keyset circuit and relay 222 is therefore not operated. Relay 226 upon operating causes the operation of relay 223 and the lighting of lamp 229 as previously described. In case the operator desires to ring the called subscriber, she depresses the ringing key 224 thereby releasing relay 223 and closing a ringing circuit from ringing generator 246, over the upper alternate contact of key 224, upper back contact of relay 223, upper normal contacts of relay 222, thence over the established connection returning over the lower normal contacts of relay 222, lower back contact of relay 223, lower alternate contacts of key 224 to ground. When the ringing key 224 is again restored and relay 223 again operates, and with marginal relay 227 operated, a supervisory circuit is established upon the response of the called subscriber which may be traced in part from battery, right winding of retard coil 247, winding of supervisory relay 248, lower front contact of relay 227, lower right winding of repeating coil 213, inner lower front contact of relay 223, lower normal contacts of relay 222, thence over the established connection and returning over the upper normal contacts of relay 222, inner upper front contact of relay 223, upper right winding of repeating coil 213, inner upper front contact of relay 227 to ground through the left winding of retard coil 247. Relay 248 operates in this circuit closing an obvious circuit for relay 230 which in turn opens the circuit of supervisory lamp 229. When the calling and called subscribers restore their receivers to the switchhooks upon the termination of the conversation, the supervisory lamps 205 and 229 light in the manner previously described and the operator noting the illumination of these lamps withdraws the plugs 201 and 221 from the trunk jacks and the restoration of all apparatus employed in the connection is effected in the manner previously described.

If the call incoming to the operator's position is one initiated over a tie line from a manual operator's position and the intercepted operator desires to flash the manual operator she may do so by depressing the key 214 thereby opening the supervisory circuit extending over the answering plug 201 and operating slow-to-release relay 250. When key 214 is again released and during the releasing time of relay 250 a resistance bridge is closed from the tip contact of plug 201 through the upper left winding of repeating coil 213, upper back contact of relay 203, contact of relay 250, resistance 249, middle lower back contact of relay 209, inner lower back contact of relay 203, lower left winding of repeating coil 213 to the ring contact of plug 201. The connection of this bridge extinguishes the supervisory lamp at the manual operator's cord circuit. The repeated operation and release of the flashing key 214 causes the manual operator's supervisory lamp to be flashed in unison with the key.

Should the manual operator or a subscriber desire to flash the intercepting operator to recall the operator after she has restored her talking key 211, this may be done by momentarily opening the supervisory circuit incoming over the answering plug 201 of the intercepting operator's cord circuit, thus opening momentarily the circuit of relay 207 if relay 203 was operated in

answering the call, or opening the circuit of relay 208 if relay 203 was not operated. With either of these relays released the previously traced circuit for relay 210 is closed and relay 210 locks to ground at the right normal contact of key 211 and the circuit of lamp 205 is closed from ground, inner lower back contact of relay 209, upper front contact of relay 210, resistance 206 to battery at the lower contact of relay 202. As soon as either relay 207 or relay 208 reoperates when the incoming supervisory circuit is again established, with relay 207 operated, an intermittent shunt is established around lamp 205 extending from ground through contacts of interrupter 216, lower contact of relay 210, front contact of relay 208 to ground through lamp 205 or over the front contact of relay 207, back contact of relay 208 to ground through lamp 205 dependent upon whether relay 207 or relay 208 is at the time operated. Lamp 205 flashes as a recall signal. As soon as the operator notes the finishing lamp she throws her key 211 for listening and relay 210 releases opening the flashing circuit of lamp 205.

What is claimed is:

1. In a telephone exchange system, a calling line, a trunk circuit incoming to an operator's position, selector switches for extending a connection from said line to said trunk circuit, a cord circuit at said position for connection to said trunk circuit, a called line, an outgoing trunk circuit accessible to said cord circuit and other selector switches for extending a connection from said calling line over said first selector switches and said cord circuit to said called line, a supervisory relay in said cord circuit operable upon the response of said called subscriber, and means controlled by said relay after a predetermined interval for transmitting a supervisory signal to one of said first selector switches.
2. In a telephone exchange system, a calling line, a trunk circuit incoming to an operator's position, selector switches for extending a connection from said line to said trunk circuit, a cord circuit at said position for connection to said trunk circuit, a called line, an outgoing trunk circuit accessible to said cord circuit and other

selector switches for extending a connection from said calling line over said first selector switches and said cord circuit to said called line, a supervisory relay in said cord circuit, and means including a group of relays and an interrupter controlled by said relay for transmitting a supervisory signal to one of said first selector switches after a predetermined interval.

3. In a telephone exchange system, a calling line, a trunk circuit incoming to an operator's position, selector switches for extending a connection from said line to said trunk circuit, a cord circuit at said position having a repeating coil for connection to said trunk circuit, a called line, an outgoing trunk circuit accessible to said cord circuit and other selector switches for extending a connection from said calling line over said first selector switches and said cord circuit to said called line, a supervisory relay in the calling end of said cord circuit operable upon the response of said called subscriber, and means controlled by said relay after a predetermined interval for closing a supervisory circuit over the answering end of said cord circuit to one of said first selector switches.

4. In a telephone exchange system, a calling line, a trunk circuit incoming to an operator's position, selector switches for extending a connection from said line to said trunk circuit, a cord circuit at said position having a repeating coil for connection to said trunk circuit, a called line, an outgoing trunk circuit accessible to said cord circuit and other selector switches for extending a connection from said calling line over said first selector switches and said cord circuit to said called line, a supervisory relay in the calling end of said cord circuit operable upon the response of said called subscriber, an interrupter, a pick-up relay operable by said interrupter following the operation of said supervisory relay, a third relay operable by said interrupter following the operation of said pick-up relay, and a supervisory circuit extending over the answering end of said cord circuit to one of said first selector switches controlled by said third relay.

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