

Jan. 7, 1936.

A. C. POWELL

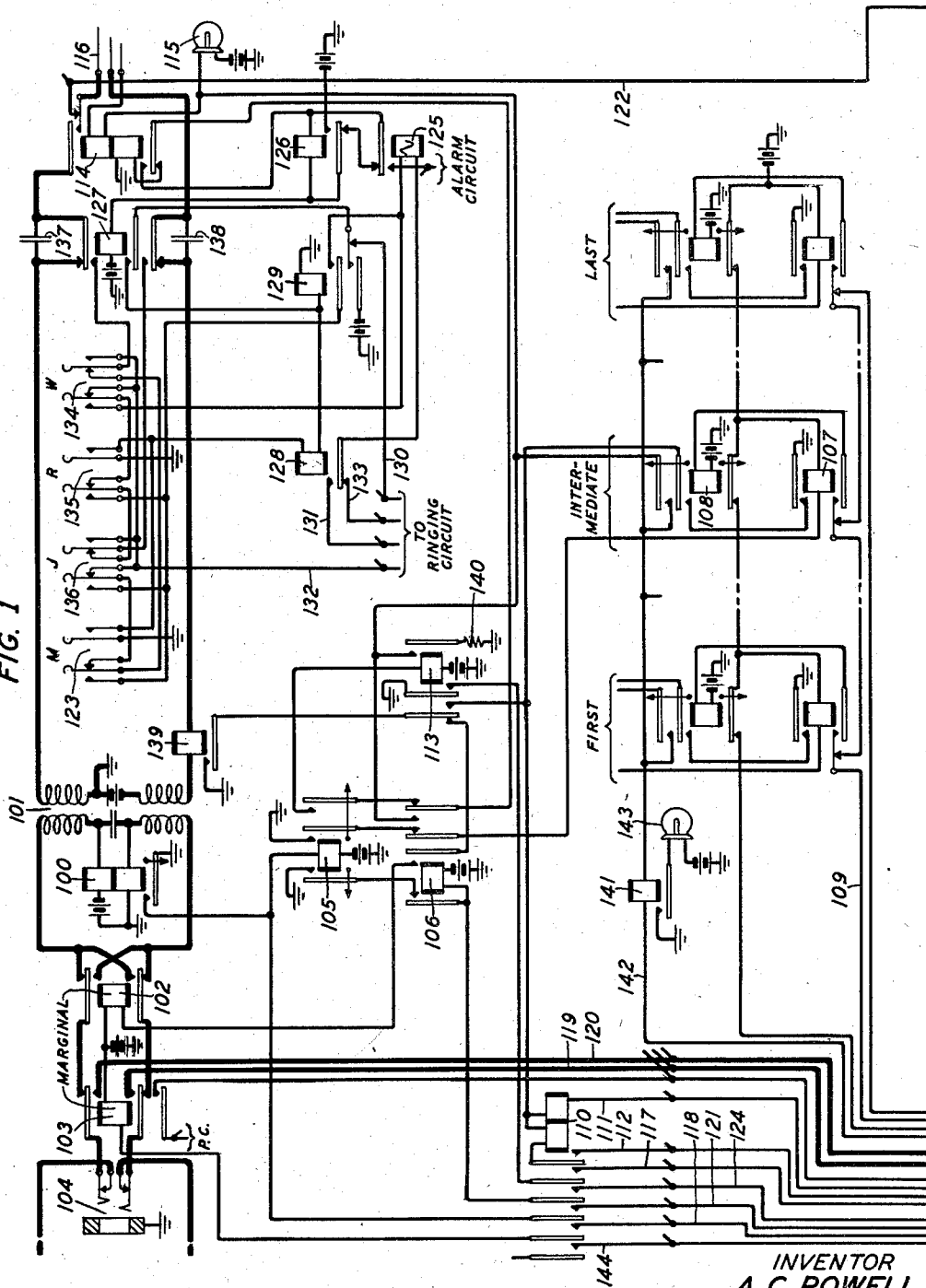
2,027,197

TRUNK CIRCUIT

Filed Nov. 17, 1934

3 Sheets-Sheet 1

FIG. 1



INVENTOR
BY A. C. POWELL
P. C. Smith
ATTORNEY

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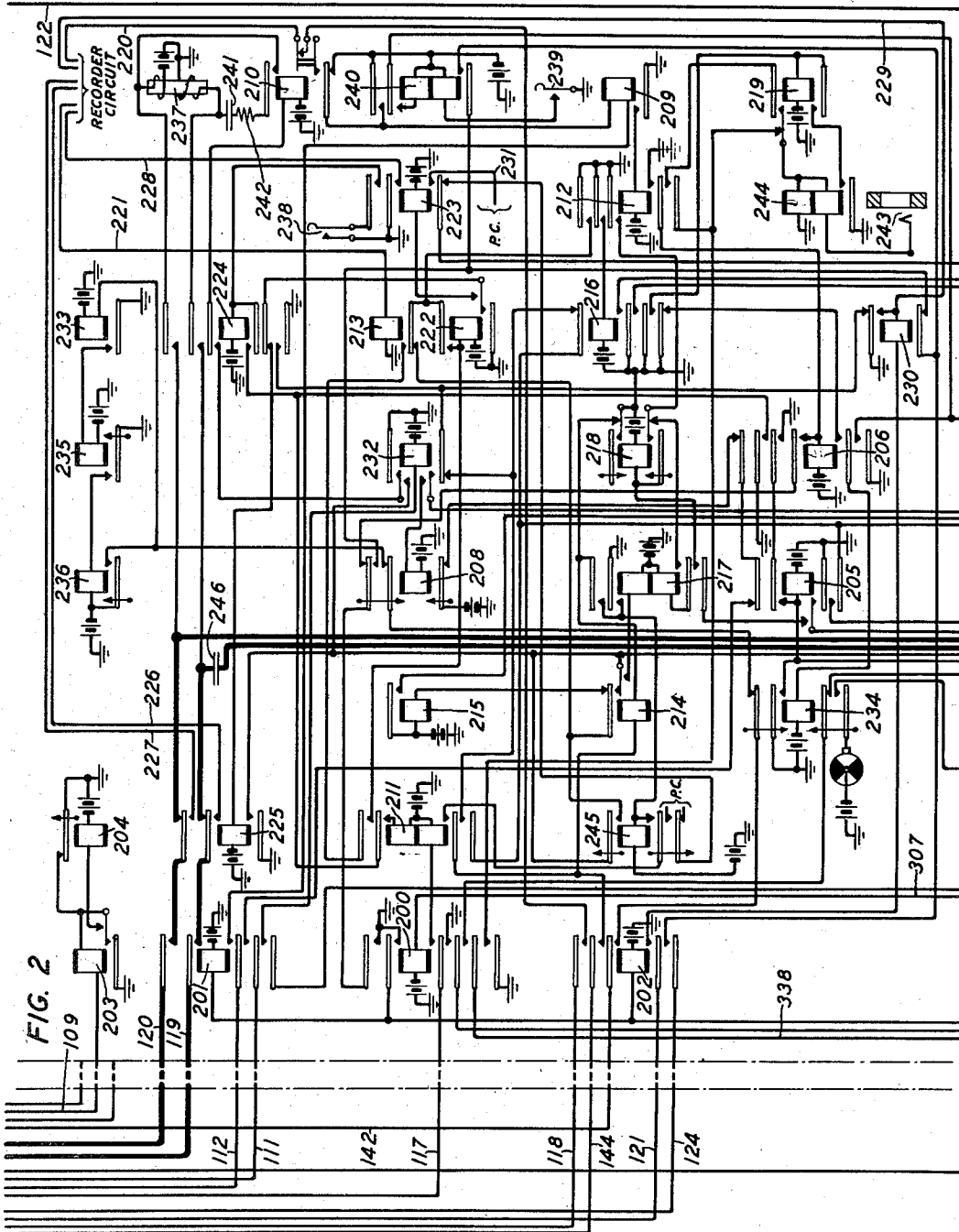
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3 Sheets-Sheet 2



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BY
P. C. Smith

ATTORNEY

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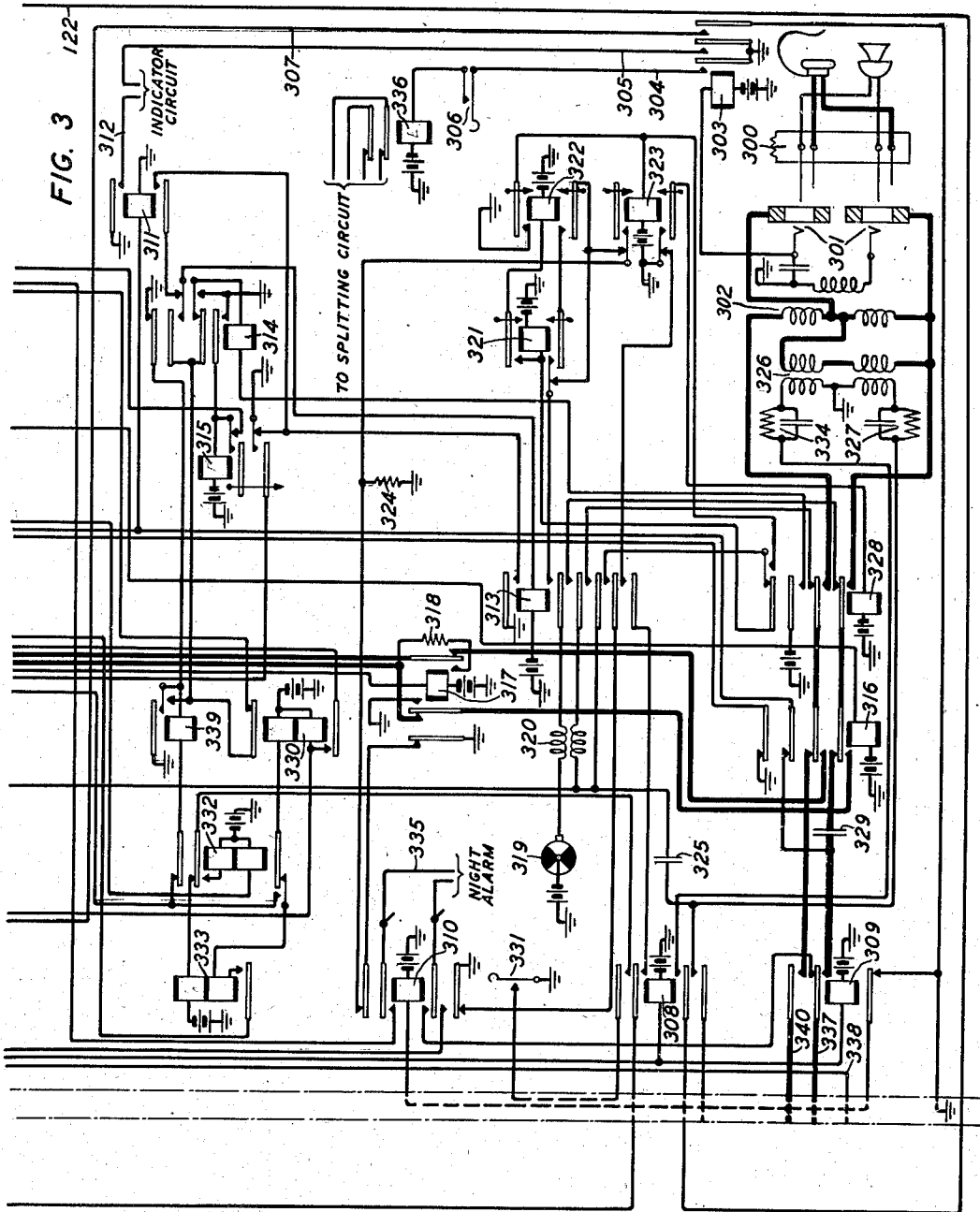
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3 Sheets-Sheet 3



INVENTOR
A. C. POWELL
BY

P. C. Smith
ATTORNEY

UNITED STATES PATENT OFFICE

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TRUNK CIRCUIT

Albert C. Powell, New York, N. Y., assignor to
Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

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6 Claims. (Cl. 179—27)

This invention relates to telephone systems and more particularly to incoming trunk circuits terminating in connecting plugs at a B operator's position, in connection with which the B operator automatically receives the called subscriber's number from the originating office either orally, or visually as in the case where display call indicator equipment is provided.

In such systems the calling trunks are connected in a predetermined sequence, either to the operator's telephone set, in case the called number is to be passed orally, or to the call indicator equipment, when the call is to be displayed visually. In both instances a signal lamp is steadily lighted before the operator for each calling trunk and as soon as a trunk is connected to the operator's set, or indicator, the lamp of that trunk is caused to flash and certain current impulses are transmitted back over the trunk to inform the originating operator, or dial equipment, to transmit the wanted subscriber's number.

The performance of the foregoing functions in the proper sequence requires an arrangement of sequence relays common to the B operator's position. Once the position circuit has started to work on a calling trunk, all other calling trunks are locked out and held in abeyance until the sequence relays have gone through their cycle of operation and the operator has released her telephone set, or the indicator, from the trunk.

It may happen that trouble develops in the automatic sequence relays of the position during the handling of a call and the normal cycle of operations is arrested. Under this condition the operator will not receive any calls, although a number of lamps are steadily lighted at her position indicating trunks on which calls are waiting.

In connection with such systems therefore it is desirable to provide some auxiliary means, under control of the operator, whereby in cases of emergency she may manually "by-pass" the automatic sequence equipment and connect the calling trunks, one by one, to her telephone set or display indicator.

An object of the invention is to provide such emergency answering facilities in systems of the before described character.

A feature of the invention, whereby the foregoing object is attained, resides in the provision of an emergency jack arrangement with which a calling trunk plug may be connected, which functions to by-pass the sequence relays of the position and cause the trunk conductors to be

immediately connected to the operator's telephone or display indicator.

The invention will be more clearly understood from the following description when read in connection with the accompanying drawings, in which

Fig. 1 shows one of the trunk circuits appearing at an operator's position, together with the sequence relays of three trunks, and

Figs. 2 and 3 show the operator's position equipment and the emergency jack above-mentioned.

A recorder circuit suitable for use with this position equipment is shown in U. S. Patent 1,968,420, granted to the present inventor on July 31, 1934.

When the operator occupies her position, she inserts her head-set plug 300 in the position jack 301, thereby completing a circuit from ground through the right winding of repeating coil 302, contacts of jack 301 and plug 300, through the head-set transmitter and back way of contacts of plug 300 and jack 301 to the winding of relay 303 and battery. Relay 303 connects direct ground to conductor 304 to prepare the emergency key 306 and to conductor 305 leading to the idle position indicator. It also connects ground from the position splitting and grouping circuit, indicated by the space between the two vertical broken lines at the left of Figs. 2 and 3, to conductor 307 and the winding of relay 200.

Relay 200 operates and at its inner upper contact connects ground to the windings of relays 201 and 202 to connect the position equipment with the splitting circuit where connections extend in multiple toward all the trunks included in the operator's division. Over its second lower contact relay 200 causes the operation of relays 308 and 309, which complete other connections between the control circuit and the splitting circuit.

When, now, an incoming call is directed to the trunk of Fig. 1, a circuit is closed from battery through the upper winding of relay 100, upper left winding of repeating coil 101, upper back contacts of relays 102 and 103, tip contact of test jack 104, over the tip conductor of the incoming trunk, through the winding of a relay at the distant office, back over the ring conductor of the trunk, ring contact of jack 104, lower back contacts of relays 103 and 102, lower left winding of repeating coil 101, lower winding of relay 100 to ground. Relay 100 operates, in turn operating relay 105.

The operation of relay 105 closes a circuit from

battery through the winding of relay 113, outer right contact of relay 105, outer right back contact of relay 106, lower back contact and lower winding of relay 114 to ground. Relay 114 is not operated in this circuit but relay 113 does operate, closing a circuit from ground over its right contact through resistance 140 and lamp 115 to battery, indicating to the operator that a call is waiting on the associated trunk.

Relay 105 also connects ground over its inner right contact, inner right back contact of relay 106 to the winding of relay 107 of the sequence relays. If no trunk lower than this in the chain is connected with the operator's position, the circuit of relay 107 extends over the normal contacts of the sequence relays corresponding to relay 108 of all such trunks to battery. Relay 107 operates as soon as this circuit is completed and, if no call is waiting on a trunk higher than this one in the chain, closes a circuit from battery through the winding of relay 108, lower front contact of relay 107, lower normal contacts of the corresponding sequence relays of the earlier trunks, conductor 109, winding of relay 203, back contact of relay 204, to ground. Relay 203 locks to ground at its outer lower front contact and extends its locking ground to the winding of relay 204 which operates, holding open the ground normally supplied to conductor 109.

When relay 108 operates, it closes a circuit from ground through resistance 140, right contact of relay 113, outer upper contact of relay 108, winding of relay 141, conductor 142, inner upper contact of relay 202, upper back contact of relay 234, inner upper back contact of relay 208, winding of relay 233 to battery. Relay 233 operates, in turn operating relays 235 and 236 which are slow to operate. Relay 236, after an interval measured by this slow to operate characteristic, connects direct battery in shunt of the winding of relay 233 and relay 233 releases, in turn releasing relays 235 and 236. With relay 236 released the shunt is removed from relay 233 and the cycle repeats as long as the circuit is maintained. The direct battery furnished by relay 236 also shunts lamp 115 causing it to flash. Relay 141 also operates and releases in this flashing circuit, causing the pilot lamp 143 to flash likewise.

When both relays 107 and 108 have operated, a circuit is closed from ground over the upper contact of relay 107, inner upper contact of relay 108, right winding of relay 110, conductor 111, middle lower contact of relay 201, back contacts of relays 205 and 206, lower back contact of relay 208 to battery. Relay 110 operates, locking from the same ground through its left winding and first left contact, conductor 112, inner lower front contact of relay 201, winding of relay 209, lower back contact of relay 210, to battery. Relay 110 connects the multiple contacts leading from the position circuit, individually to this trunk.

Since the circuit of relay 113 as above traced includes the back contact of relay 114, which is opened as long as the plug 116 is in a multiple jack, the operation of relay 113 indicates that the plug has been removed from the multiple and the call may progress normally. Relay 113 transmits this information to the control circuit by connecting ground to conductor 117 over the second left contact of relay 110, conductor 117 extending over the inner lower front contact of relay 209 to the lower winding of relay 211 and battery.

Relay 209 operates in the locking circuit of relay 110 above traced, in turn operating relay 212.

At its middle upper contact relay 212 completes the circuit of relay 216 and at its inner upper contact prepares locking circuits for relays 217 and 218. At its inner lower contact relay 212 operates relay 206 and at its lowermost contact prepares a circuit for the emergency operation of the control circuit. Relay 216 operates relay 219.

Relay 206 locks over its inner upper front contact, upper back contact of relay 208 to ground over the outer upper front contact of relay 209. It also closes a locking circuit for relay 211 which extends from battery, through the upper winding and inner upper front contact of relay 211 to ground at the outer upper front contact of relay 206. In addition, it closes a circuit from ground at its outer lower contact through the winding of relay 316 to battery. Relay 316 disconnects the talking conductors leading toward the operator's repeating coils from one connection through the grouping circuit and extends them toward the connection leading toward the trunk being served.

The fact that the trunk is one incoming from a panel type office is indicated to the control circuit when relay 110 operates by the completion of a circuit from battery through the winding of relay 103, fifth left contact of relay 110, conductor 118, outer upper front contact of relay 202, normal contacts of relay 210 over conductor 220 through the recorder circuit and back over conductor 221 to the winding of relay 213 and ground. Relay 213 operates but relay 103, being marginal, cannot operate in series with relay 213. Relay 213 closes a circuit from ground at the outer upper contact of relay 212, front contact of relay 213, outer upper contact of relay 211, winding of relay 222 and battery. Relay 222 at its upper front contact, locks directly to the contact of relay 212 and at its inner lower contact closes an obvious circuit for relay 223. At its outer lower contact, relay 222 closes a circuit from ground over this contact, lower back contact of relay 224, winding of relay 225 and battery. Relay 225 disconnects conductors 119 and 120, which have been extended by the operation of relay 201 to the upper armatures of relay 225, from the operator's telephone circuit and extends them over the front contacts of these armatures to conductors 226 and 227, leading to the recorder circuit in preparation for receiving the wanted number from the panel sender. Relay 225 also closes a circuit from ground over its lower contact to the winding of relay 317 and battery. Relay 317 further disconnects the operator's telephone from the talking conductors in the control circuit and connects high resistance 318 across these conductors to stabilize condenser 246 and prevent a click in the operator's receiver.

Relay 223 connects ground over its inner upper contact to conductor 228 to operate a relay in the recorder circuit which in turn connects direct ground to conductor 220 in shunt of the winding of relay 213, releasing relay 213 and operating relay 103. Relay 223 also prepares the peg count circuit for this type of trunk. The operation of relay 103 disconnects the incoming trunk conductors from battery and ground through the windings of relay 100 and connects them over conductors 119 and 120 to the receiving relays of the recorder circuit, thereby signaling the distant sender that the designation may be sent out. The disconnection of the trunk conductors from relay 100 permits that relay to release, but relay 105 is maintained operated in a circuit ex-

tending from ground supplied by the recorder circuit, over conductor 229, winding of relay 230, inner lower contact of relay 202, conductor 121, fourth contact of relay 110 to the winding of relay 105 and battery. Relay 230 operates in this circuit, locking to ground at its upper front contact.

When relay 213 releases, a circuit is closed from ground at the outer upper front contact of relay 212, back contact of relay 213, back contact of relay 214, winding of relay 215 and battery. Relay 215 connects battery over its front contact to the winding of relay 311 and ground. Relay 311 connects ground to conductor 312 leading to the position indicator circuit and also closes a circuit from battery through the winding of relay 313, normal contacts of relay 314, lower contact of relay 311, to ground at the normal contacts of relay 315.

Relay 313 locks to ground at its upper front contact, over the contacts of relays 314 and 311 but independent of relay 315. It also closes a circuit from the tone source indicated by high speed interrupter 319, primary winding of tone coil 320, first lower contact of relay 313, normal contacts of relays 321 and 323 to ground through resistance 324. Relay 313 also closes a circuit from ground through the lower left winding of repeating coil 326, network 327, condenser 325, secondary winding of tone coil 320, second lower contact of relay 313, inner upper back contact of relay 328, inner lower front contact of relay 316, left front contact of relay 317 to ground. The tone induced in the secondary winding of coil 325 is transmitted to the operator's telephone through coil 326 to warn her that the wanted number is about to be displayed.

Relay 313 also closes a circuit from ground at the lower back contact of relay 310, fourth lower contact of relay 313, outer back contact of relay 328, winding of relay 321 and battery. Relay 321 opens the primary tone circuit and extends its operating ground to the winding of relay 322. Relay 322 recloses the tone circuit and operates relay 323. Relay 323 again opens the tone circuit and operates relay 328. Relays 321, 322 and 323 are slow to operate, thereby providing for two measured impulses of tone. Relay 328 disconnects the secondary of the tone coil from the talking conductors and connects the operator's head-set thereto, but this action is ineffective since the talking conductors are opened at the contacts of relays 317 and 225.

Relay 328 at its uppermost armature opens the circuits of relays 321 and 322 and closes a circuit from battery through the winding of relay 323, outer upper front contacts of relay 328, fourth lower contact of relay 313 to ground at the back contact of relay 310, thereby holding relay 323 operated which in turn holds relay 328 operated. At its third upper front contact, relay 328 connects battery to the winding of relay 314, completing a circuit which extends over the inner upper back contact of relay 314, back contact of relay 330 to ground at the middle lower contact of relay 216. Relay 314 operates, locking to ground over its middle front contact. It also connects ground to the winding of relay 315, and over the normal contacts of relay 315 and the lower front contact of relay 223 to conductor 231 leading to the call indicator peg count meter. When relay 315 operates it disconnects this ground. Relay 315, being slow to release, does not reclose its normal contact until appreciably after relay 314 removes the operating ground

thus insuring that the meter is operated only once. Relay 315 also closes a circuit over its lower front contact through the winding of relay 205 and battery. Relay 205 locks to ground at the middle upper front contact of relay 206.

Relay 314 opens the circuit of relay 313 previously traced, but by means of its make before break contacts extends the circuit over its outer upper front contact, back contact of relay 330 to ground at the middle lower contact of relay 216 before the first circuit is broken, holding relay 313 operated.

When the complete designation has been received, the circuit of relay 103 is opened in the recorder circuit and that relay releases, restoring the connection of the trunk conductors to relay 100. Relay 100 reoperates, connecting ground to the winding of relay 105, holding that relay operated and shunting the winding of relay 230 which releases.

The operator, having seen the wanted number displayed by the recorder, prepares for signaling the subscriber by operating the proper ringing key, for example key 123. She then operates the position release key 331, closing a circuit from ground over the key contact, through the splitting circuit, outer upper contact of relay 308, upper back contact of relay 332, upper winding of relay 333 to battery. Relay 333 closes a circuit from battery, through the upper winding of relay 330, lower back contact of relay 332, lower winding and contact of relay 333, outer lower front contact of relay 205, outer lower contact of relay 211 back contact of relay 232 to ground at the back contact of relay 230. Relay 330 locks in a circuit from battery through its lower winding and contact, to ground at the middle lower contact of relay 205. Relay 330 opens the circuit of relay 313 causing that relay to release, in turn releasing relays 323 and 328. Relay 328 in turn releases relays 314 and 315.

Relay 330 extends its locking ground over the outer lower contact of relay 201 to the winding of relay 232 and battery. With relay 230 released, relay 232 closes a circuit from ground at the upper back contact of relay 230, inner lower front contact of relay 232 through the winding of relay 208 to battery. It also extends this same ground over its outer lower front contact to the lower winding of relay 332 and battery. Relay 332 locks in a circuit from battery through its upper winding and upper front contact, outer upper contact of relay 308 to ground on the release key 331 therefore remaining operated as long as the key remains depressed. Relay 332 opens the operating circuits of relays 333 and 330 and the locking circuit of relay 333 releasing relay 333. Relay 232 also provides an additional holding circuit for relay 317.

Relay 208 in operating opens the locking circuit of relay 206 but relay 206 remains operated under the control of relay 212. Relay 208 also disconnects battery from the operating circuit of relay 110, and opens the circuit of relay 233, thereby stopping the flashing of lamps 115 and 143 and releasing relay 141. It also connects ground from the outer upper contact of relay 200, upper front contact of relay 208, lower back contact of relay 230, outer lower contact of relay 202, conductor 124, third contact of relay 110, winding of relay 106 and battery. Relay 106 locks over its left front contact to ground at the left front contact of relay 105, and opens the circuit of relay 107 which releases, in turn releasing relay 108 and relay 110, completing the dis-

connection of the trunk from the position circuit. Relay 106 also opens the circuit of relay 113 which releases. In addition it closes a substitute circuit for lamp 115 extending from
 5 ground through the lower winding of relay 114, back contact of relay 114, outer right front contact of relay 106 to lamp 115 and battery. The release of relay 107 opens the circuit of relay 203 which releases, in turn releasing relay 204.
 10 Relay 204, being slow in releasing holds ground disconnected from conductor 109 momentarily to insure the operation of the sequence relay corresponding to relay 108 associated with the lowest numbered trunk awaiting connection to the
 15 control circuit.

The release of relay 110 opens the operating path for relay 106 and also releases relay 209. Relay 209, releases relay 212 and that relay in turn releases relays 222, 216, 215 and 206. Relay 206 in releasing releases relays 211 and 316 and opens the holding circuit of relay 205 which in turn releases relays 330, 232 and 208. Relay 216 opens the circuit of relay 219 while relay 215 releases relay 311. Relay 222 releases relays 223 and 225, relay 225 in turn releasing relay 317 and opening the tip and ring conductors leading to the recorder circuit. Relay 223 also releases the relays of the recorder circuit.

The operator next tests the wanted line by
 30 touching the tip of plug 116 to the sleeve of the multiple jack. If the line is busy, battery on the sleeve of the jack will complete a circuit over the tip of plug 116, upper normal contact of relay 114, conductor 122, inner lower contact of
 35 relay 308, network 334, upper left winding of repeating coil 326 to ground, producing a click in the operator's receiver.

If the line is idle, no such click is heard and the operator inserts the plug 116 in the jack of
 40 the wanted line. The grounded jack sleeve characteristic of the idle line completes a circuit over the sleeve of plug 116, upper winding of relay 114, lamp 115 and battery. Relay 114 operates, opening the circuit previously traced for lamp
 45 115 and closing a circuit from ground on the sleeve of the multiple jack, sleeve of plug 116, upper winding of relay 114, outer right front contact of relay 106, lower front contact of relay
 50 114, back contacts of relays 125 and 126, in parallel with the winding of relay 126, winding of relay 127 to battery. The closure of this circuit for relay 127 shunts lamp 115, darkening it, but relay 127 operates, closing a circuit from ground
 55 over the right contact of key 123, winding of relay 128, inner lower front contact of relay 127, normal contact of relay 129, to pick-up conductor 130, to which battery is connected by the ringing circuit previous to the start of the ringing period. A parallel circuit is closed from
 60 ground through the winding of relay 129. When the pull-up battery is connected to conductor 130, relays 128 and 129 operate and relay 129 closes a locking circuit for both relays to battery over its outer lower front contact. With relays
 65 127, 128 and 129 operated, the ringing circuit is closed from ground over conductor 132, left normal contacts of keys 134 and 135, right normal contacts of key 136, outer lower front contact of relay 127, ring of plug 116, through the ringer
 70 at the called substation, tip of plug 116, upper front contacts of relays 114 and 127, right normal contact of key 134, left operated contact of key 123, inner front contact of relay 129, winding of relay 125, front contact of relay 128 to con-

ductor 131 which leads to the two-ring commutator of the ringing machine.

The wanted subscriber is signalled over this circuit, ringing tone being transmitted back toward the calling subscriber through condensers
 5 137 and 138, and, when he removes his receiver, the resistance of the circuit is decreased to permit relay 125 to operate. Relay 125 opens the shunt around the winding of relay 126 and that relay operates, locking to battery at its front contact. This battery shunts the winding of relay
 10 127 which releases, disconnecting the called line from the ringing circuit, releasing relay 125, and reclosing the shunts around condensers 137 and 138. Relay 127 in releasing also opens the circuit of relays 128 and 129.

With relay 127 released, relay 139 operates in series with the called substation and closes a circuit from ground at its contact, left back contact of relay 113, inner right front contact of relay
 20 106, winding of relay 102 and battery. Relay 102 reverses the connection of battery and ground through the windings of relay 100 to the incoming trunk as a signal to the district selector that the called subscriber has answered. Relays 102, 25 100, 105, 106, 139, 126 and 114 of the trunk circuit remain operated throughout the call.

When the called subscriber restores his receiver at the termination of the conversation, relay 139 releases, in turn releasing relay 102 to signal
 30 the district selector. When the selector releases, opening of the circuit of relay 100, that relay releases, in turn releasing relays 105 and 106. With relay 106 released, relay 126 also releases and the shunt is removed from lamp 115 which now lights
 35 as a disconnect signal to the operator. When the operator removes the plug from the jack, relay 114 also releases and lamp 115 is extinguished, restoring the trunk completely to normal.

If the trunk of Fig. 1 is reselected while plug
 40 116 is still in the jack of the wanted line or a busy back jack, relay 114 will be held operated from the sleeve of the jack. Relays 100, 105, 107, 108, 110, 203, 204 and 209 operate as above, and lamps
 45 115 and 143 flash to indicate the incoming call. Relay 113 cannot operate with relay 114 operated and therefore relay 211 cannot operate. When relay 110 operates, relay 213 is operated in series with relay 103. Since relay 211 is not operated,
 50 relay 222 cannot operate and no signal can be transmitted to the sender. Likewise, no tone can be given to the operator and release key 331 is ineffective. The operator, observing the flashing lamp, will withdraw the plug of the trunk cord from the multiple jack permitting relay 113 to
 55 operate and the remaining operations to take place as previously described.

If, for any reason, the district selector does not make trunk closure following the transmission of the wanted number for example, because
 60 the call has been abandoned, relay 100 cannot reoperate to shunt relay 230, and the release key 331 is ineffective. Similarly, if the recorder is not satisfied, it does not open the circuit of relay 103, relay 100 cannot reoperate and the call cannot be completed.

In this case, the operator may close key 238, completing a circuit from ground over key 238, outer upper contact of relay 223, winding of relay
 70 224 and battery. It may be noted that, since relay 223 is operated only when the control circuit is used with call indicator trunks, key 237 is effective only in connection with call indicator calls. Relay 224 locks over its inner lower contact to the outer upper front contact of relay 206 and
 75

releases relay 225, disconnecting the trunk from the recorder. With relay 224 operated, battery and ground through coil 237 are connected to the trunk conductors. The release of relay 225, in turn releases relay 317 which extends the trunk conductors to the operator's telephone. If the subscriber is still connected with the trunk the operator may obtain the number of the line wanted. Having done so, she operates key 239 closing an obvious circuit for relay 240 which locks under the control of relay 206. Relay 240 prepares a circuit for relay 106 and closes battery to the windings of relays 209 and 110 to hold those relays operated until after relay 106 has been operated. With relay 224 operated, the release key 331 is made effective and, when relay 232 operates, a circuit is closed from battery through the winding of relay 210, inner upper front contact of relay 224, to ground at the upper front contact of relay 232. Relay 210 opens one connection of battery to relay 110, opens the circuit of relay 103 permitting that relay to release and restore the talking connection to the trunk, and connects resistance 242 and condenser 241 around coil 237 to protect the contacts of relay 103.

In order to take care of calls which may reach the trunk of Fig. 1 when no operator is located at the position, the withdrawal of the telephone plug from the position jack releases relay 303 in turn releasing relays 200, 201, 202, 308 and 309. Relay 309 at its lower back contact extends ground through the splitting circuit to the winding of relay 310 and battery. Relay 310 closes a circuit for reoperating relays 201 and 202, and relay 202 closes the previously traced flashing circuit for lamps 115 and 143. Relay 310 also extends the night alarm conductor 335 to a contact of relay 216 so that, if a call is directed to this position the night alarm will sound and the trunk lamp flash. Relays 209, 212, 216 and 206 operate as previously described. Since relay 200 is not operated, relay 211 cannot operate and the call awaits the attention of the operator.

If the automatic listening equipment in the position fails, the operator operates the splitting keys (not shown) until the particular group giving trouble is located. Then the normal trunks are handled from adjacent positions and the faulty trunks are operated on a jack listening basis. When a trunk is seized, relays 100, 105 and 113 operate as before and lamp 115 is lighted steadily to ground over the right front contact of relay 113 and resistance 140. Since the sequence relays are assumed to be at fault, the lamp 115 will not flash and relay 110 will not operate. Key 306 is then operated, in turn operating relay 336, opening the sequence chain. The operator then inserts plug 116 in emergency jack 243. Since the sleeve of this jack is not grounded, relay 114 does not operate. A circuit is closed, however, from battery through the lower right winding of repeating coil 101, winding of relay 139, lower back contact of relay 127, ring of plug 116 and jack 243, lower winding of relay 244, normal contacts of relay 219, to ground at the lowermost contact of relay 200. Relays 139 and 244 operate in this circuit. Relay 139 closes a circuit from ground at its front contact, outer left front contact of relay 113, right winding of relay 110, conductor 111 and thence to battery as previously traced. The circuit then functions as previously described. When relay 216 operates, it closes a circuit for relay 219 which locks over its lower front contact

and the contact of relay 244 to ground. Relay 219 also closes a substitute circuit from ground at the lowermost contact of relay 200, outer lower contact of relay 212 and the front contact of relay 219 to the lower winding of relay 244, in place of the circuit above traced over the normal contact of relay 219, thus placing the holding of relays 244 and 139 under the control of relay 212. The operation of the release key causes the operation of relay 106 and the release of relay 113 as previously described, relay 113 opening the circuit of relays 110 and 209. Relay 209 in turn releases relay 212. When relay 212 releases the shunt around the upper winding of relay 244 is removed. Relay 244 remains operated through its two windings, but, due to the high resistance of the upper winding, relay 139 is released. Although the circuit of relay 102 may be closed momentarily, following the closure of the back contact of relay 113, the release of relay 139 follows so closely that it does not remain operated for a sufficient length of time to cause the call charging apparatus at the originating office to function. When plug 116 is removed from jack 243 for insertion in the jack of the wanted line, relays 244 and 219 release and the call is completed in the usual manner.

The control circuit of Figs. 2 and 3 will serve four types of trunks, namely, trunks of the type shown for completing calls from panel offices equipped with call indicator impulsers, similar trunks incoming from tandem offices equipped with call announcer machines, similar trunks incoming from manual offices and trunks of a different type also incoming from manual offices.

The operation of the control circuit in connection with the trunk types not shown is very similar to the operation described above. In the case of trunks incoming from tandem offices, conductor 118 is grounded directly, the back contacts of relay 103 are permanently bridged and the winding of relay 102 is connected over the outermost contact of relay 110 to conductor 144. Therefore, as soon as relay 110 operates, relay 103 is operated to connect the trunk conductors with the control circuit and relay 214 operates in a circuit from battery through the winding of relay 102 connected to conductor 144, middle upper contact of relay 202, winding of relay 214, upper normal contacts of relay 218 to ground. Relay 214 in turn operates relay 317 and relay 217, which locks under the control of relays 218 and 212 and provides a supplementary holding ground for relay 214. Relay 317 performs the functions previously described. Relay 209 operates in the locking circuit of relay 110 in turn operating relays 212, 216, 206 and 219. Relay 217 operates relay 245 which closes a second holding circuit for relay 317 and prepares the peg count circuit. If relay 211 is operated to indicate that the trunk plug is not in a multiple jack, relay 245 extends its operating ground over the inner lower contact of relay 211 in shunt on relay 214 which releases, to operate relay 215 and initiate the generation of the order tones. Relay 102 is operated, reversing the battery and ground connection to the tandem office. When the order tones have been generated, relay 205 operates as previously described, operating relay 218 which locks to the inner upper contact of relay 212, and releases relays 217, 245 and 102 to terminate the signal to the tandem office which now transmits the wanted number by call announcer. The remaining operations are substantially the same as for the call indicator trunk.

For a straightforward trunk, incoming from a manual office, conductor 118 is grounded and the back contacts of relay 103 bridged as for the call announcer trunk. Neither relay 103 nor relay 102 is connected through to the position control circuit and therefore neither relay 213 nor relay 214 is operated. Therefore relay 215 operates directly after relay 212 operates and starts the tone relays. Relay 317 is not operated and therefore the order tones are transmitted over the front contacts of relay 316, back contacts of relay 317, back contacts of relay 225, front contacts of relays 201 and 103 to the incoming trunk and the operator at the manual office. It is apparent therefore that with manual operation, the transmittal of the order tones and wanted number is not delayed by the presence of the trunk plug in a multiple jack. However, until relay 211 is operated, the operation of key 331 is ineffective to operate relay 330 and relay 106 cannot be operated to permit the ringing relays to operate.

In handling calls on the other type of trunk incoming from manual offices, relays 203 and 204 are operated from the sequence relays. Battery connected to conductor 337 closes a circuit over the inner upper front contact of relay 309, inner upper back contact of relay 316 to the winding of relay 311 and ground. Relay 311 initiates the operation of the tone relays. When the trunk is connected through to the position control circuit, battery connected to conductor 338 completes a circuit over the third lower contact of relay 200, lower back contact of relay 234, upper back contact of relay 332, winding of relay 339, outer upper back contact of relay 314 and ground. Relay 339 locks to ground at its outer contact. Since relay 316 is normal, the tones are transmitted over the normal contacts of relays 328 and 316 and the front contacts of relay 309 to the splitting circuit and thence to the trunks of the type not shown. When relay 328 operates, after the order tones have been sent out, it connects the trunk to the operator's telephone and operates relay 314. With relay 314 operated the holding circuit for relay 313 is extended to ground at the inner contact of relay 339. Relays 315 and 205 are operated as before. With this type of trunk the insertion of the trunk plug in the jack of the wanted line releases relay 339 restoring the control circuit to normal.

What is claimed is:

1. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto and terminating in connecting plugs thereat, call receiving equipment thereat, control means common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack arrangement, and circuit means associated with each calling line and responsive to connection of its associated plug with said emergency jack to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means.

2. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto and terminating in connecting plugs thereat, a supervisory relay for each calling line, call receiving equipment thereat, control means

common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack, means responsive to the connection of the plug of the calling line with said emergency jack to operate said supervisory relay, and means under the control of said supervisory relay to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means.

3. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto and terminating in connecting plugs thereat, a supervisory relay for each calling line, call receiving equipment thereat, control means common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack, means responsive to the connection of the plug of the calling line with said emergency jack to operate said supervisory relay, means under the control of said supervisory relay to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means and means to release said supervisory relay prior to the disconnection of said plug from said emergency jack.

4. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto, and terminating in connecting plugs thereat, a supervisory relay for each calling line, call receiving equipment thereat, control means common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack, means responsive to the connection of the plug of the calling line with said emergency jack to operate said supervisory relay, means under the control of said supervisory relay to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means and means responsive to the disconnection of said line from said control means to release said supervisory relay prior to the disconnection of said plug from said emergency jack.

5. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto and terminating in connecting plugs thereat, a supervisory relay for each calling line, call receiving equipment thereat, control means common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack, means responsive to

the connection of the plug of the calling line with said emergency jack to operate said supervisory relay, means under the control of said supervisory relay to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means, means to disconnect said line from said control means, charge controlling means under the control of said supervisory relay after said disconnection takes place, and means to prevent the effective premature operation of said charge controlling means.

6. In a telephone trunking system, an operator's position, a plurality of calling lines incoming thereto and terminating in connecting plugs thereat, a supervisory relay for each calling line, call receiving equipment thereat, control means common to said position for extending said calling lines to said receiving equipment, relay means associated with said lines and automatically responsive to calls thereon to connect said calling

lines to said control means one at a time in a predetermined sequence and to cause said control means to extend such lines to the receiving equipment, an emergency jack, means responsive to the connection of the plug of the calling line with said emergency jack to operate said supervisory relay, means under the control of said supervisory relay to connect such line to the control means and to cause the control means to extend the line to the receiving equipment independent of the sequence relay means, means to disconnect said line from said control means, charge controlling means under the control of said supervisory relay after said disconnection takes place, and means responsive to said disconnecting means to prevent said supervisory relay from effectively operating said charge controlling means as long as said plug remains in said emergency jack.

ALBERT C. POWELL.

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