This invention relates to a telephone system and more particularly to improvements in intercepting operator's circuits for use in automatic telephone systems.

5 It is the object of this invention to provide improved intercepting operator's circuits for intercepting calls directed from various sources over automatic switches.

In an automatic telephone system, the duties of an intercepting operator are particularly to supervise calls from various sources that have been incorrectly directed to subscribers' lines or lines on which the service has been discontinued. A call associated with an intercepting operator's position does not reach a destination requiring a charge by the telephone company. Certain of such lines are equipped with call charging apparatus ordinarily operable when the line is connected to its destination. Other lines connected to the intercepting operator's position are associated at the initiating end with toll circuit lines or the like which require the operation of particular apparatus in the intercepting operator's circuits to properly supervise the operator at the called position.

A feature of this invention is in the provision of means in intercepting operators' circuits whereby the intercepting operator's cord circuit may automatically discriminate between a local and a toll call.

Another feature of this invention is in the provision of means whereby an intercepting operator receives a disconnect signal when a toll operator disconnects the cord circuit from the automatic switching apparatus.

A further feature of this invention is in the provision of bridged resistance operable in accordance with means for discriminating between calls from various sources to prevent the operation of call charging apparatus when a call is initiated by a local subscriber and to properly signal the tool operator when a call is initiated from such a source.

These and other features of the invention will be apparent from the following description taken in connection with the accompanying drawings.

Figs. 1 and 2 illustrate the incoming end of a toll line and a toll operator's cord circuit arranged for completing a call from a toll line to automatic switching apparatus.
battery, through the outer back contact of relay 116, left winding of relay 109, lowermost alternate contacts of key 115, which the operator has now thrown from the left-hand talking position to the right-hand dialing position, outer back contact of relay 110, ring conductor of plug 107 and jack 200, outer left back contacts of relay 201, and left winding of relay 203 to ground. The operation of relays 109 and 202 completes a series circuit for the operation of relays 203 and 110 from battery, through the back contact of relay 120, winding of relay 119, right winding and contacts of relay 109, sleeve contacts of the plug 107 and jack 200, left contact of relay 202 and right winding of relay 203 to ground. The operation of relay 119 closes an obvious circuit for relay 118 which then operates, thereby closing the dialing loop including the tip and ring of plug 107, the left contacts of relay 108 and through the relay of the wanted number. Relay 203, in operating, connects battery at its left front contact to the winding of relay 201 thereby causing its operation. Relay 201, in operating, opens at its outer left back contacts the operating circuit for relay 202 and closes at contact 214 a holding circuit for this relay from battery, left front contact of relay 203, right winding of relay 202, contact 214 of relay 201 to ground through the left winding of relay 202. Relay 201, in operating, also closes its innermost front contact thereby partially closing a bridge including relay 206 across the trunk conductors. The circuit is not completed, however, at this time as it is opened at the right-hand contacts of relay 203. Further, relay 201 in operating extends the trunk conductors to a distant office and locks through its contact 215 under control of relay 206. The combined operation of relays 109, 116 and 201 closes the trunk circuit including the winding of pulsing relay 204 in trunk selector TS at the machine switching office. This circuit may be traced from battery, back contact of release magnet 208, right-hand winding of pulsing relay 204, outer left back contacts of relay 211, inner left back contact of relay 212, resistance 217, outer left back contact of relay 212, outer front contact of relay 201, ring contacts of the jack 200 and plug 107, outer left back contacts of relay 110, inner left front contact of relay 109, winding of polarized relay 120, contacts of the dial 118, inner front contact of relay 116, outer left front contact of relay 109, tip contacts of the plug 107 and jack 200, inner front contact of relay 201, outer right back contact of relay 212, resistance 216 and inner right back contact of relay 212 to ground. Relay 204 operates in this circuit but polarized relay 120 does not operate at this time due to its connection in the circuit with respect to the polarity of the battery at the machine switching office.

The operation of relay 204 closes at its right front contact an obvious circuit for operating relay 222. Relay 222, in operating, closes its right front contact thereby preparing the energizing circuit for the vertical or primary magnet 223. In this circuit is included relay 224 which operates in series with primary magnet 223 as described later. Relay 222, in operating, also closes an energizing circuit for relay 257 which may be traced from ground, left front contact of relay 222, outer right back contact of relay 248, outermost right back contact of relay 211 and winding of relay 257 to battery. Relay 257 operates in this circuit for a purpose to be later described.

The next operation on the part of the operator, after having inserted plug 107 into jack 200 is to rotate the dial 118 to the first digit of the wanted number. As the dial returns to normal, the loop dialing circuit is interrupted a number of times corresponding to the digit selected and thereby causes the synchronous release of relay 204. This relay in turn closes the prepared circuit for the vertical or primary magnet 223 which now operates a corresponding number of times and in series with relay 224. It will be noted that relays 222 and 224 are slow to release and although the circuits for these relays are alternately opened, they will be held operated during the pulsing. The circuit for operating relay 224 and primary magnet 223 may be traced from battery, winding of magnet 223, winding of relay 224, outermost right back contact of relay 226, right front contact of relay 222 and right back contacts of relay 204 to ground.

The operation of relay 224 operates relay 205 over a circuit from ground on the left front contact of relay 222, front contact of relay 224 to battery through the winding of relay 228. Relay 205 locks over another circuit from ground on the left front contact of relay 222, middle right back contact of relay 226, inner right front contact and winding of relay 230 to battery.

When the selector takes its first step due to the energization of magnet 223, the “off normal” switch 226 operates, thereby closing a circuit for the operation of relay 229 which may be traced from battery, back contacts of magnet 208, upper alternate contact of “off normal” switch 228, winding of marginal relay 229, front contact of relay 224 to ground at the left front contact of relay 222. In attracting its right armature, relay 229 locks in a circuit including the back contact of rotary magnet 232 and its own right front contact. Relay 229, in operating, also closes a short circuit path around the winding of relay 226 which may be traced from
ground, left front contact of relay 222, the winding of relay 226 to ground at the right-front contact of relay 229 to prevent this relay from operating at this time.

With each interruption of the contacts of dial 118 during the transmission of the first digit, the vertical magnet 232 will be energized and step the brushes to the desired level of the switch bank. Upon the cessation of the impulses and the release of relay 224, which relay as stated held operated during the pulsing, a circuit for the rotary or secondary magnet 232 is closed from battery, winding of magnet 232, left front contact of relay 229, contact 233 of relay 232 to ground at the left front contact of relay 222. The energization of the rotary magnet 232 causes the brushes to be moved into contact with the terminals of the first trunk and by interrupting its contacts opens the locking circuit for relay 229 previously traced to cause its release which thus in turn breaks the energizing circuit of magnet 232. The switch will therefore, come to rest on terminals 308, 309, 310 and 311 and if terminal 310 is not characterized by a busy ground the switch brushes will remain associated with these terminals. Under these circumstances, the short circuit across the terminals of the winding of relay 226 will be opened when relay 229 releases and when the armature of magnet 232 restores to normal, relay 226 will operate in the following circuit: ground, left front contact of relay 222, winding of relay 226, normal contact of magnet 232, winding of relay 229, upper alternate contact of switch 233 and back contact of magnet 308 to battery. Relay 226 operates in this circuit, but relay 229 which is now interrupted will not operate at this time due to the high resistance introduced into the circuit by the winding of relay 226. Relay 226 in operating closes its left contacts thereby connecting the toll train through to the connector C.

If the first trunk upon which brushes 250, 251, 252 and 253 rest is busy, ground will be connected to its sleeve contact which corresponds to contact 310. In this case, relay 229 releases as before but relay 226 will not operate as it is still shortcircuited through its right inner back contact to ground on the sleeve of the busy trunk. Therefore, when the rotary magnet 232 releases its armature, relay 229 will again energize but this time to ground on the sleeve of the busy trunk. The rotary or secondary magnet 232 will now operate over a circuit from battery through its winding, left front contact of relay 229, contact 233 of relay 224 to ground at the left front contact of relay 222. This series of operations will continue until an idle trunk has been found at which time busy ground is connected to the sleeve by the operation of relay 229. It will be noted that the operation of relay 226 transfers the holding circuit for relay 238 to brush 253, contact 311, inner right back contact of relay 302, contact 310 and thence to the busy ground.

When the trunk associated with contacts 308, 309, 310, and 311 is seized an energizing circuit is completed for the relay 301 which may be traced as follows: ground through the left winding of relay 301, inner left back contact of relay 302, contact 251, outer left front contact of relay 226, left front contact of relay 304, middle left back contact of relay 245, lower right winding of repeating coil 243, resistance 220, outer right front contact of relay 238, upper right winding of repeating coil 242, inner left back contact of relay 248, inner left front contact of relay 226, brush 250, contact 308, outer left back contact of relay 302, right winding of relay 305, to battery through the right winding of relay 301.

Relays 301 and 305 operate in series. Relay 305 locks to ground over a circuit from battery through its left winding and left front contact, contact 332 of relay 306, contact 310, brush 252, inner right front contact of relay 226 to ground on the left front contact of relay 222. Relay 301 in energizing closes an obvious circuit for relay 306. Relay 306 operates and connects ground from its right front contact over lead 301 thereby making the connector C test busy to all local selectors. The operation of relay 306 closes the pulsing circuit for the primary magnet 316 which may be traced from ground on the back contact of relay 301 effective when this relay releases, left front contact of relay 303, conductor 312, normal contact of off-normal switch 313, conductor 314, winding of relay 315 to battery through the vertical magnet 316. Relay 315 and vertical magnet 316 do not operate at this time as relay 301 is operated.

The toll operator now manipulates the dial 118 in the toll cord TC in accordance with the tens and units digits of the desired subscriber's line. The dial interruptions release pulsing relay 204 as hereinbefore described which opens, at its left contact, the circuit for relay 301 which releases in synchronism with relay 204. Each release of relay 301 establishes the circuit hereinbefore traced to operate the vertical magnet 316. Relay 315 is operated upon the initial release of relay 301, and remains operated throughout the units series of dial interruptions. After the first impulse has been sent, off-normal switch 313 operates closing a new circuit for the operation of vertical magnet 316. This new circuit may be traced from ground on the back contact of relay 301, left front contact of relay 303, conductor 312, lowermost alternate contact of off-normal switch 313, right front contact and winding of relay 315 to battery through the winding of magnet 316. The operation of relay 315 establishes a circuit.
to operate relay 321 from battery through its left winding, left front contact of relay 315, left front contact of relay 305, contact 302 of relay 306, contact 310 and thence to the busy ground at the selector Fig. 2. Relay 321 is held operated by this ground under control of apparatus responsive to the operation of the toll operator's ringing key.

At the end of the series of interruptions for the tens digit, relay 315 releases thereby closing a circuit for the operation of rotary magnet 317 from ground on the back contact of relay 301, left front contact of relay 303, conductor 312, lowest alternate contact of off-normal switch 313, right back contact of relay 315, outer left back contact of relay 320, in parallel to battery over one circuit through the winding of relay 319, over another circuit through lowestmost back contact of relay 318 to battery through the winding of rotary magnet 317. The circuit is now in condition to receive the units digit impulses. These impulses interrupt the circuit for relay 301 thereby opening and closing the impulse circuit hereinafter traced. The initial release of relay 301 operates relay 319 and rotary magnet 317. Brushes 328, 329 and 330 are now rotated in response to the dial interruptions, to the wanted subscriber's line.

Relay 319 does not follow the impulses as it is slow to release and remains operated during dial interruptions. A testing circuit is thus established from brush 330 through its right front contact, contact 362 to battery through the winding of relay 320.

**Busy called station.**

If the dialed station is busy, relay 319 will remain operated a sufficient length of time to allow relay 320 to operate over a circuit from ground on the busy sleeve terminal 412, placed thereon by an associated connector. Upon the release of relay 319 relay 320 locks over a circuit from battery through its winding, contact 362 of relay 318, contact 368 of relay 319, inner right front contact of relay 320, conductor 331, to ground on the right front contact of relay 303. Relay 302 now operates from ground on trunk contact 310, contact 352 of relay 306, left front contact of relay 305, winding of relay 302, inner left front contact of relay 320, left back contact of relay 319, lower back contact of relay 318 to battery through the winding of rotary magnet 317. The operation of relay 302 opens the circuit between conductors 350 and 351 and 360 and 361 and contacts conductors 360 and 361 to contacts 308 and 309 respectively at its left contacts. This operation also disconnects relay 301 from contacts 305 and 306 and opens the connection between contacts 310 and 311 at its inner right back contact. Relay 301 does not release as it is held operated over a circuit from ground on the sleeve contact 310, inner right front contact of relay 302, resistance 346, right winding of relay 305 to battery through the right winding of relay 301. As relay 301 is held operated, relay 303 is also held operated thereby keeping ground connected to the local sleeve conductor 304.

The operation of relay 302 opens the locking circuit for relay 238 to cause its release and further opens the locking circuit for relay 321. The latter relay however, is slower to release than relay 238 and a locking circuit for relay 321 is established through the normal contacts of relay 238, traced from ground on the left front contact of relay 222, conductor 207, left back contact of relay 257, inner left back contact of relay 211, inner right back contact of relay 238, middle right front contact of relay 226, brush 253, contact 311 to battery through the winding and inner left front contact of relay 321. The release of relay 238 closes an operating circuit for relay 212 from ground on the left back contact of relay 238, winding of relay 212, lower alternate contact of off-normal spring 228 to battery on the back contact of magnet 208. The operation of relay 212 reverses battery and ground over the circuit traced, for the dial pulsing circuit associated with the windings of relay 204, thereby operating polarized relay 120 which opens the circuit for relay 119 in turn releasing relay 116 and opening the dialing circuit. The operation of relay 130 further opens the holding circuit for relay 109 to cause its release. The release of relay 109 establishes an operating circuit for relay 133 through the windings of relays 102 and 134, right contact of relay 109 to the sleeve ground. Relay 134 is marginal and does not operate in series with the high resistance sleeve of the toll trunk shown in Fig. 2. The operation of relay 133 establishes an obvious operating circuit for relay 110 which operation associates the talking conductors with supervisory relay 124 bridged across said talking conductors. The release of relay 298 as previously traced also closes a circuit for operating relay 241 from battery through its winding, middle right back contact of relay 238, lower right winding of repeat coil 242, middle left back contact of relay 248, left front contact of relay 204, outer left front contact of relay 226, brush 251, contact 300, inner left front contact of relay 302, conductors 360 and 345, outer right front contact of relay 320, outer right front contact of relay 302 to ground through interrupter 323. The interrupter 323 opens and closes the above traced circuit thereby operating and releasing relay 241. The operation of relay 241 closes an obvious circuit for relays 211 which follows the interruptions of relay 241.

Relay 211 being intermittently operated and released opens and closes a circuit for relay 124 which may be traced from battery on the back contact of release magnet 208,
left winding of relay 204, outer left back contact of relay 211, inner right front contact of relay 212, resistance 216, upper left winding of repeating coil 242, inner front contact of relay 201, tip of jack 200 and plug 107, outer left back contact of relay 206, inner front contact of relay 110, key 114, coil 133, inner back contact of relay 134, winding of relay 124, coil 136, key 114, outer front contact of relay 110, ring of plug 107 and jack 200, outer front contact of relay 201, lower left winding of winding coil 242, resistance 217, inner left contact of relay 212, right normal contact of relay 211, to ground through the left winding of relay 204. This circuit is opened and closed at contacts of relay 211 and causes relay 124 to operate and release thereby flashing lamp 125 as an indication to the operator that the desired subscriber's line or intercepting operator's trunk is busy. Relay 204 is maintained operated during the operation of relay 211 over a local circuit through the second right contact of relay 211.

Idle called station.

If the call were for a station such as 400 and it was found to be idle, brushes 328, 329 and 330 will rest on contacts 410, 411 and 412. Battery will be found on sleeve contact 412 and therefore a circuit would not be established for relay 329 which remains unoperated. A circuit is established from ground on the right front contact of relay 323, conductor 351, inner right back contact of relay 320, upper winding of relay 318, right back contact of relay 310, brush 320 to battery on the sleeve contact 412. Relay 318 operates over the circuit traced and locks a circuit from ground on the left front contact of relay 222, inner right front contact of relay 226, brush 252, contact 310, upper alternate contact of off-normal spring 313 through the uppermost front contact and lower winding of relay 318 to battery. The operation of relay 318 closes conductors 340 and 341 through the brushes 328 and 330 and opens the circuits for rotary magnet 317 and release magnet 353.

If the operation of relay 318 further associates a busy ground with the sleeve contact 412 over an obvious circuit which need not be traced and further establishes an operating circuit for relay 329 from battery through the winding of rotary magnet 317, lowest front contact of relay 318, winding of relay 302, left front contact of relay 305 and thence to the busy ground at the left contact of relay 222. The operation of relay 302 causes the release of relay 329 and the locking circuit for relay 324 is in the manner described under "Busy called station" excepting that when the dialing circuit is removed and replaced by the bridge through the supervisory relay 124, this relay operates from battery and ground supplied through the winding of relay 204 to light the lamp 125 as a signal to the toll operator that the desired subscribers line is idle.

The toll operator now operates ringing key 114 which connects ringing current over the tip and ring of jack 200, and thence through the repeating coil 342 to the winding of relay 258. Relay 258 operates and closes an obvious circuit for relay 248 which opens the operating circuit for relay 257 as traced above. Condenser 259 bridged across the talking conductors of selector TS during the energization of relays 257 and 311 is of service only when a private branch exchange subscriber is being re-run by the operator by means of generator 359 for the purpose of preventing the subscriber from getting a sharp click in his receiver at the time relay 248 operates in response to ringing relay 258. Relay 257 is slow to release, therefore with relay 248 operated the locking circuit traced above for relay 321 is opened momentarily allowing relay 321 to release and close a circuit for operating relay 322 from ground, interrupter 330, contact 373 of relay 318, left back contact of relay 322, middle left back contact of relay 321 to battery through the winding of relay 322 causing this relay to operate and connect ringing source 327 to the subscriber's station over a circuit from ground on the outer right back contact of relay 321, conductor 340, contact 331 of relay 318, brush 238, brush 328, contact 410 through subscriber's loop 400, contact 411, brush 329, contact 337 of relay 318, conductor 341, inner right back contact of relay 321 through resistance 372 to ringing source 327 through right front contact of relay 322. Relay 322 is locked through its left contact to the busy ground associated with contact 310. When the called subscriber 400 removes the receiver from the switchhook, relay 321 operates in a circuit from ground on the outer right back contact of relay 321, conductor 340, contact 331 of relay 318, brush 328, terminal 410 through the subscriber's loop, terminal 411, brush 329, contact 337 of relay 318, conductor 341 inner right back contact of relay 321, right winding of relay 321 to battery on the right front contact of relay 322 a silent period thereby operating relay 321 which locks over a circuit through its left winding and inner left front contact, contact 311, brush 253, middle right front contact of relay 226, inner right back contact of relay 223, left inner back contact of relay 211, left back contact of relay 257, to ground on the left front contact of relay 222. The operation of relay 321 disconnects the ring.
ing generator 327 through its inner right back contact and closes conductors 330 and 361 through to conductors 340 and 341.

**Toll calls intercepted.**

If the toll operator has dialed a number which has not been assigned to a subscriber or a number which has been changed, the connection is completed through to the intercepting operator’s trunk IOT, and the brushes 328, 329 and 330 will rest on contacts 420, 421 and 422. The operation of Figs 1, 2 and 3 is the same as described for a call to an idle subscriber’s station up to the point of seizeing the subscriber’s station and associating a ringing source with the line conductors. A circuit is closed from ground on contact 332 of relay 318, sleeve brush 320, terminal 422, left back contact of relay 402 to battery through the winding of relay 403 and also over the same circuit through terminal 422, through the left back contact of relay 401 to battery through lamp 426. Relay 402 now operates from the same ground traced above on contact 422, through the winding of relay 402 to battery through the right front contact of relay 406. Relay 402 operated locks to battery on its right front contact and opens the operating circuit for relay 403 through its left back contact. The intercepting operator upon observing the lamp 426 inserts the plug of cord 414 into jack 413. With the plug of cord 414 inserted in jack 413 a circuit is closed from ground through the right winding of relay 401, sleeves of jack 413 and plug 414 to battery through the winding of relay 405. Relays 405 and 401 operate in the circuit traced. Relay 405 performs no useful function at this time. A locking circuit for relay 401 is established from battery through its left winding to ground associated with contact 422. The operation of relay 401 extinguishes lamp 426. A circuit is now closed from battery through the winding of relay 241, middle-right-back contact of relay 238, lower right winding of the repeating coil 242, middle left back contact of relay 248, left front contact of relay 204, outer left front contact of relay 226, brush 251, contact 309, inner left front contact of relay 302, conductor 300, outer right front contact of relay 321, conductor 409, contact 331 of relay 318, brush 328, contact 420, inner left back contact of relay 404, conductor 424, inner right back contact of relay 408 to ground through the winding of relay 406. Relay 241 operates and establishes an obvious operating circuit for relay 211 which establishes a local holding circuit for relay 204.

This removes the battery and ground from the talking conductors, associated with the toll cord to release relay 124 and extinguish lamp 125. Relay 406 operates and closes an obvious circuit for relay 409 which operates and locks to ground on the front contact of relay 405. Relay 406 operated closes a circuit for operating relay 408 from ground on the left front contact of relay 409, outer left back contact of relay 423 to battery through the winding of relay 408. The operation of relay 408 establishes an operating circuit for relay 407 from battery through the winding of relay 241 and thence to conductor 424 as traced for the operation of relay 406 through the inner right front contact of relay 405, right and left windings of relay 407, conductor 425, tip of plug 414 and jack 413, conductor 430, outer left back contact of relay 404, contact 421, brush 329, contact 337 of relay 318, conductor 341, inner right front contact of relay 321, conductor 361, outer left front contact of relay 302, contact 308, brush 250, inner left front contact of relay 226, inner left back contact of relay 248, upper right winding of repeating coil 242 to ground through the right outer back contact of relay 238. Relay 408 further closes an obvious circuit for relay 423. The operation of relay 423 opens the operating circuit for relay 408 which is slow to release and remains operated until relay 407 operates at which time a holding circuit for relay 408 is established through its outer left front contact, front contact of relay 407, sleeve of plug 414 and jack 413 to ground through the winding of relay 401.

The operation of relay 408 further opens the operating circuit for relay 406 to cause its release. Relays 418 and 419 do not operate when the intercepting operators cord circuit is associated with a toll call and will later be described in connection with a call from a local station. The resistance of the left winding of relay 407 is sufficiently high to cause the release of relay 241. The release of relay 241 releases relay 211 to reestablish the circuit for relay 124 through the windings of relay 204. Relay 124 operates and lights lamp 125 to signal the toll operator. When the intercepting operator actuates the talking key 416, a shunt is connected around the left winding of relay 407 which is of a high resistance thereby allowing relay 241 to operate and cause the toll operator’s lamp 125 to be extinguished. The intercepting operator now intermittently actuates and releases key 416 to flash lamp 125 until the toll operator responds.

The intercepting operator now requests information from the toll operator regarding the called station and furnishes whatever information is necessary under the service condition. The toll operator then removes the plug of cord TC from jack 200. The intercepting operator restores key 416 thereby releasing relays 241 and 211. Both operating circuits for relay 204 are thus opened to cause its release. The release of relay 204 opens the circuit herebefore traced for relay 407 to cause its release and the release of relay 222. Relay 407 released opens the
locking circuit for relay 408 which releases and closes the circuit for lighting disconnect lamp 415 thus giving the intercepting operator a signal that the toll operator has disconnected.

The release of relay 204 also closes a circuit to restore the selector TS from ground on its right back contact, right back contact of relay 222, winding of release magnet 208 to battery through the middle alternate contact of off-normal spring 228. The restoration of selector TS removes the busy ground from contact 310 which causes the release of relay 318, also the holding circuit for relay 301 is opened at the tip and ring contacts 308 and 309. The release of relays 301 and 318 closes a circuit for operating release magnet 353. This circuit is traced from ground on the back contact of relay 301, left back contact of relay 303, contact 336 of relay 318, middle alternate contact of off-normal spring 313 to battery through the winding of magnet 353 and lamp 324. The operation of release magnet 353 restores connector C to normal.

The release of both these circuits may occur before the intercepting operator removes plug 414 from jack 413.

Local call intercepted.

An intercepted call from a local subscriber will now be considered. The local subscriber is shown at 300 in the upper left hand corner of Fig. 3. A circuit is extended by means well known to the art through the primary and secondary selectors PLS and SLS to the connector C, and relay 301 operates over a circuit from battery through its right winding, outer left back contact of relay 306, ring of the extended connection through switches PLS and SLS, including relay 375, dial 370, tip of the connection through switches PLS and SLS, inner left back contact of relay 306 to ground through the left winding of relay 303. Relay 301 follows the impulses sent from dial 370 and the connector C connects to the subscriber 400 of Fig. 4 or to the intercepting operator's trunk IOT in a manner similar to that described above for a toll call with three exceptions.

When the called party is busy, relay 320 operates as hereinbefore described but there is no ground on the conductor connected to contact 310, relay 302 will not be operated and a busy tone will be sent back to the calling subscriber 300 over a circuit from busy tone source 371, outer right back contact of relay 302, outer right front contact of relay 322, conductor 345 and 360, contact 333 of relay 302, conductor 350 to subscriber 360.

When connector C is associated with an idle line or the intercepting operator's trunk, relay 318 operates as previously described. Upon the operation of relay 318 the circuit for ringing relay 322 is established and ringing current is connected to the line or trunk through the contacts of relay 321. If the call is for a subscriber such as 400 and the receiver is removed from the switchboard in response to the ringing, a circuit is closed for operating relay 321 as previously described to disconnect this ringing current source from the line. Relay 306 operates over the subscriber's loop circuit, from battery through its right winding, conductor 330, contact 334 of relay 302, conductor 360, outer right front contact of relay 321, conductor 340, contact 331 of relay 318, brush 328, contact 410 though the subscriber's station 400, contact 411, brush 328, contact 337 of relay 318, conductor 341, inner right front of contact of relay 321, conductor 361, contact 335, conductor 351, to ground through the left winding of relay 306. Relay 306 operates and reverses the circuit for relay 301, thereby reversing battery to the calling subscriber 300 for operating polarized relay 375. The operation of relay 375 establishes a circuit for the operation of message register 374.

On a call which has been routed to an intercepting operator the operation of the trunk circuit relays 408 and 402 is the same as on a toll call. A circuit is now established for the operation of differentiating relay 404 as relay 321 of connector C is not operated. This circuit may be traced from battery on to the right front contact of relay 402, winding of relay 404, left front contact of relay 403, which is slow to release, contact 420, brush 328, contact 331 of relay 318, conductor 340 to ground on the outer right back contact of relay 321. Relay 404 operated locks to ground on its own right front contact and connects 420 to conductor 430 and contact 421 to conductor 430. If the intercepting operator inserts the plug 414 of cord circuit IOT in jack 413, as described under "Toll call intercepted" the operation is the same with the exception that polarized relay 415 now operates. The circuit of relay 406 and ringing trip relay 321 of connector C is closed as previously traced in connection with an intercepted toll call and relay 321 operates to trip the ringing current but relay 406 does not operate in series with relay 321. Consequently, relay 409 is not operated. The operating circuit for relay 415 may be traced from battery through its winding, outer right back contact of relay 406, conductor 425, tip of plug 414 and jack 413, conductor 430, inner left front contact of relay 404, contact 420, brush 328, contact 331, conductor 340, outer right front contact of relay 321, conductor 360, contact 334, conductor 350 to battery through the winding of relay 306. The battery connected to the winding of relay 306 is of a higher voltage than that in the intercepting operator's cord circuit IOT connected to the winding of relay 418 and thus the difference in voltage is impressed upon the winding of relay 418 in the proper direction to cause its operation. Relay 418.
operated closes an obvious circuit for operating relay 419 which locks to ground on the front contact of relay 405. Relay 419 operated operates relay 408 over a circuit from ground on the right front contact of relay 419, outer left back contact of relay 423 to battery through the winding of relay 408. Relay 408 in turn operates relay 423 over an obvious circuit and opens the operating circuit for relay 418 to cause its release. Relay 429 locks to ground on the front contact of relay 408 through its inner left front contact. The left and right windings of relay 407 are now associated with conductors 425 and 424 and thence over the tip and ring conductors through the connector to battery and ground through the windings of relay 306. The locking circuit for relay 408 is closed to ground on the sleeve of jack 413 as previously described.

It is apparent that since relay 409 is normal the shunt formed by key 416 for the left winding of relay 407 is opened. This prevents relay 306 from operating and reversing the battery through the subscriber's loop for operating the message register.

What is claimed is:

1. A telephone system, comprising a toll operator's position, local subscribers' stations, an intercepting operator's position, a trunk circuit, switches for extending a connection from either said local subscribers' stations or said toll operator's position to said intercepting operator's position over said trunk circuit, a cord circuit at said intercepting operator's position, and means in said trunk circuit for enabling said cord circuit to discriminate between a call from said local subscribers' stations or said toll operator's position.

2. A telephone system, comprising a toll operator's position, local subscribers' stations, an intercepting operator's position, a trunk circuit, switches for extending a connection from either said local subscribers' stations or said toll operator's position to said intercepting operator's position over said trunk circuit to said intercepting operator's position, a cord circuit at said intercepting operator's position, and a relay in said trunk circuit operable in accordance with the source from which the call is directed for enabling said cord circuit to discriminate between calls from said sources.

3. A telephone system, comprising a toll operator's position, a local subscriber's station, an intercepting operator's position, a trunk circuit, selector switches and a connector for extending a connection from either said local subscriber's station or said toll operator's position over said trunk circuit to said intercepting operator's position, a cord circuit at said intercepting operator's position, and means in said connector for controlling the operation of a relay in said trunk circuit to enable said cord circuit to discriminate between a call from said local subscriber's station or said toll operator's position.

4. A telephone system, comprising a toll operator's position, a local subscriber's station, a responsive device associated with said subscriber's station, an intercepting operator's position, a trunk circuit, switches for extending a connection from either said local subscriber's station or said toll operator's position over said trunk circuit to said intercepting operator's position, a cord circuit at said intercepting operator's position, and discriminating means in said trunk circuit for maintaining a high resistance bridge across said cord circuit during a call from a local subscriber's station to prevent said device from operating.

5. A telephone system, comprising a toll operator's position, a signal at said operator's position, a local subscriber's station, a trunk circuit, an intercepting operator's position, switches for extending a connection from either said local subscriber's station or said toll operator's position over said trunk circuit to said intercepting operator's position, a cord circuit for association with said trunk circuit at said intercepting operator's position, and a high resistance bridge in said intercepting operator's cord circuit, and a key in said intercepting operator's cord circuit for changing the resistance of said bridge in accordance with said discriminating means for operating said signal.

6. A telephone system comprising an operator's position, local subscribers' stations, a second operator's position, a trunk circuit, switches for extending a connection from either said local stations or said first operator's position to said second operator's position over said trunk circuit, a cord circuit at said second operator's position, and means in said trunk circuit for enabling said cord circuit to discriminate between a call from a local station and a call from said first operator's position.

7. In a telephone system, a toll operator's position, a local subscriber's station, an intercepting operator's position, a trunk circuit, switches for extending a connection from either said local station or said toll operator's position to said intercepting operator's position over said trunk circuit, a cord circuit at the intercepting operator's position, means at the intercepting operator's position to discriminate between a call from a local station and a call from the toll operator's position, a signal at the toll operator's position, and a key at the intercepting operator's position cooperating with said discriminating means to flash said signal.
8. In a telephone system, a toll operator's position, a local subscriber's station, an intercepting operator's position, a trunk circuit, switches for extending a connection from either the local station or from said toll operator's position to said intercepting operator's position over said trunk circuit, a cord circuit at the intercepting operator's position having a disconnect signal associated therewith, means in said trunk circuit to discriminate between a call from the local station and a call from the toll operator's position, and means controlled by the toll operator for rendering effective said signal.

9. A telephone system comprising a toll operator's position, a signal at said toll operator's position, a local subscriber's station, an intercepting operator's position, a trunk circuit, switches for extending a connection from either said local subscriber's station or said toll operator's position to said intercepting operator's position over said trunk circuit, a cord circuit at the intercepting operator's position for association with said trunk circuit, means for discriminating between calls from toll and local sources at said intercepting operator's position, a high resistance bridge in said intercepting operator's cord circuit, and means in said cord circuit operable in accordance with said discriminating means for shunting said high resistance to operate said signal at the toll operator's position.

In witness whereof, I hereunto subscribe my name this 14th day of August, A.D. 1925.

RAY L. STOKELY.