May 24, 1932. J. B. McKIM 1,859,929

TELEPHONE SYSTEM

Filed Aug. 8, 1930 3 Sheets-Sheet 1

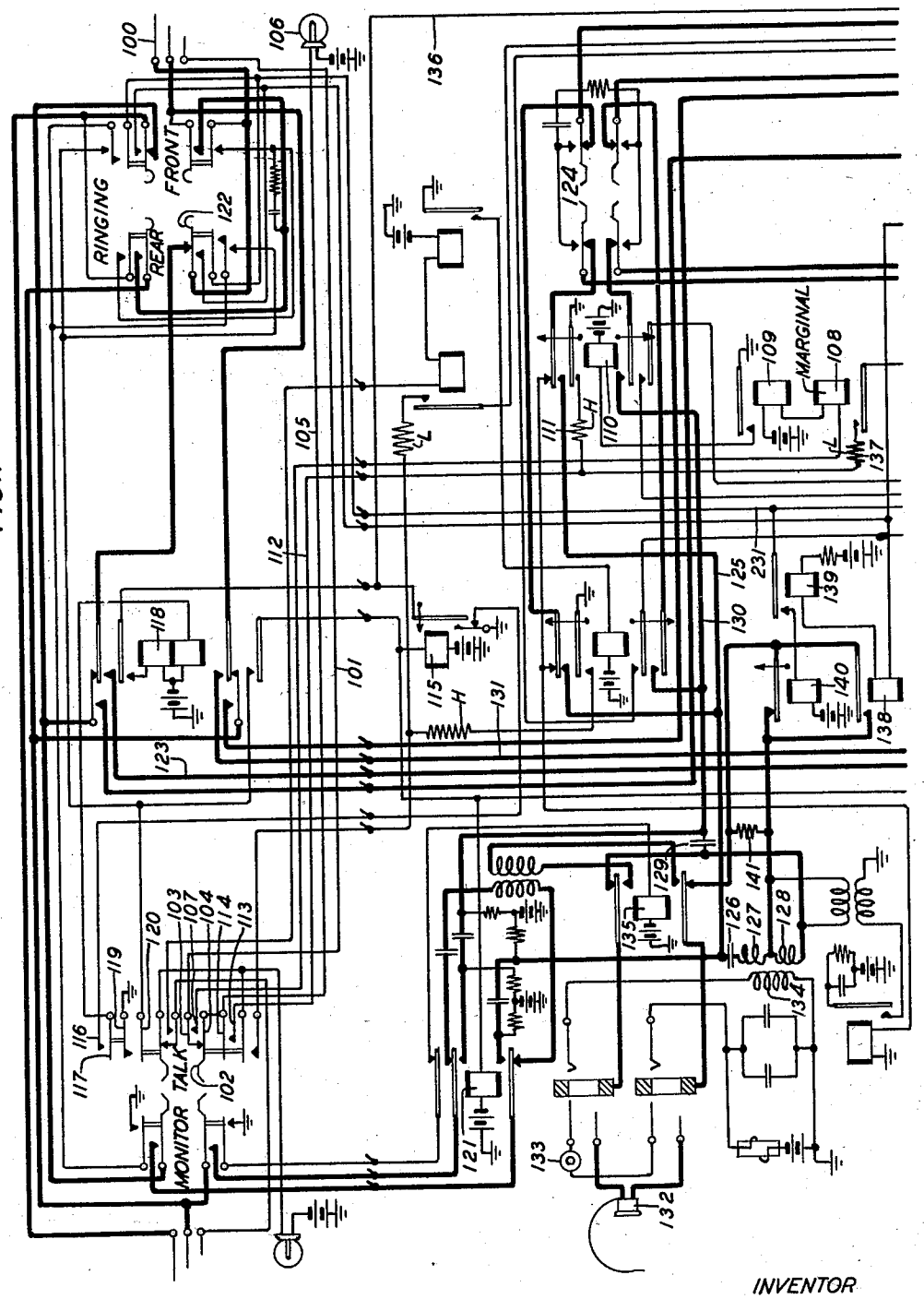

FIG. 1

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TELEPHONE SYSTEM

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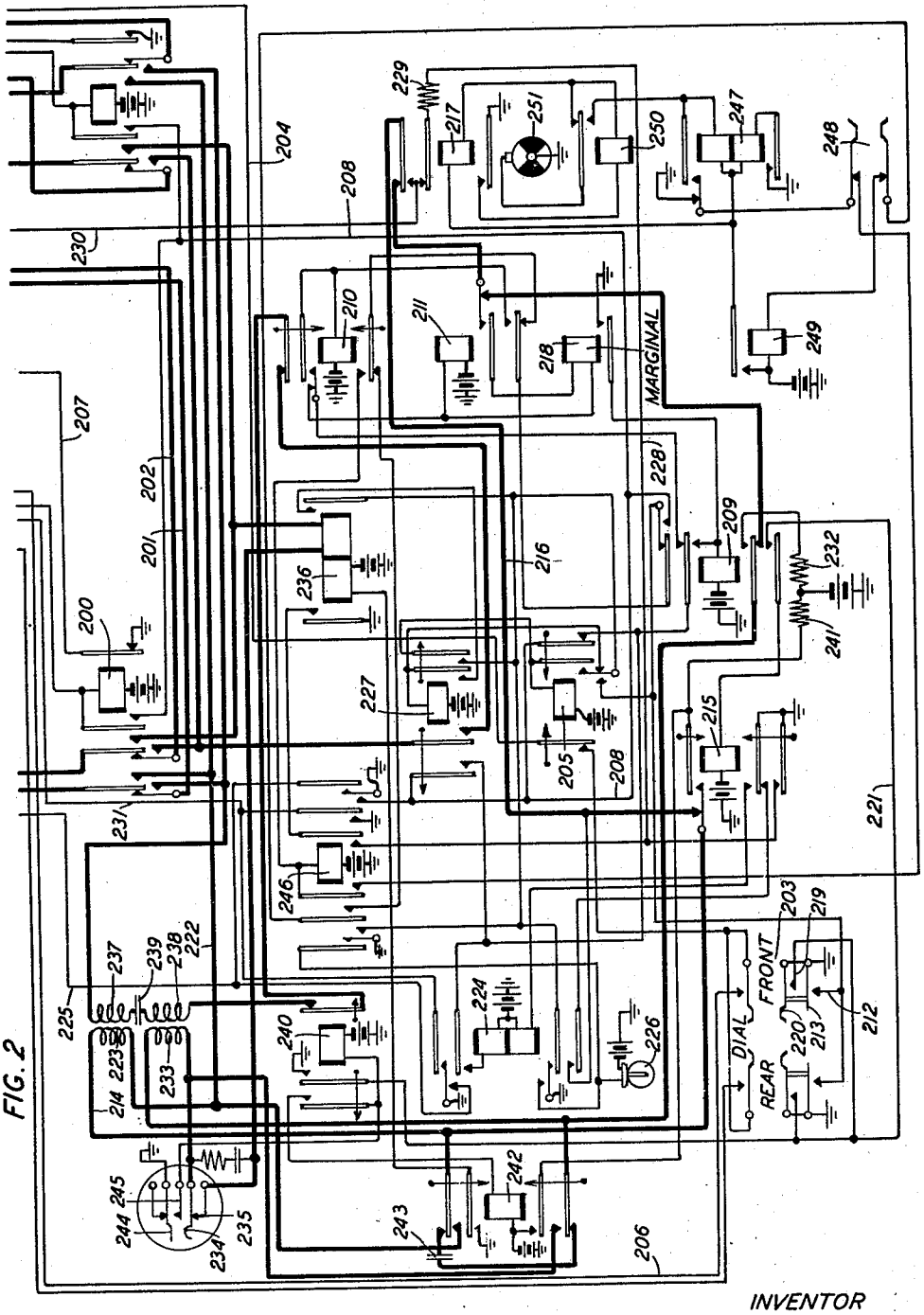

FIG. 2

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TELEPHONE SYSTEM

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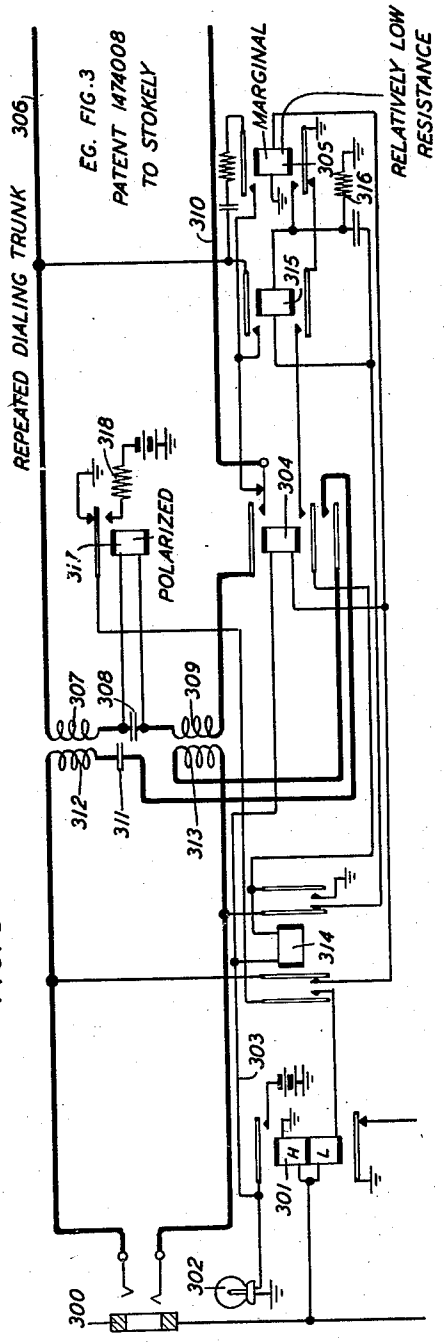

FIG. 3

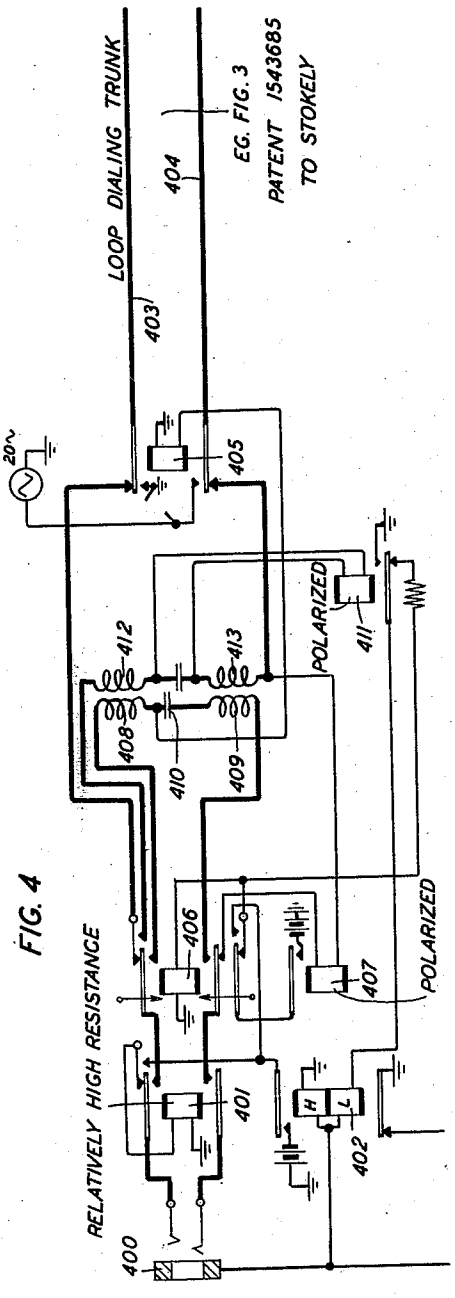

FIG. 4

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Patented May 24, 1932 1,859,929

UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed August 8, 1930. Serial No. 473,791.

This invention relates to telephone systems and particularly to operator controlled trunking means leading to automatic switches.

In accordance with one feature of the invention a trunk line is provided with a switching arrangement responsive to the off normal means of an associated dial for converting the trunk from one suitable for the transmission of voice frequency currents to one suitable for the transmission of signaling impulses whereby during the periods in which the dial is normal signaling tones may be transmitted over the trunk to the operator.

In accordance with another feature of the invention a dialing circuit associated with a cord circuit is locked to the cord under control of a means in the trunk whereby the release of the dialing circuit is prevented until after the trunk has been put in condition for the transmission of voice frequency currents.

The drawings consist of three sheets of circuit diagram which should be placed with Figure 2 below Figure 1 and Figures 3 and 4 to the right of Figure 1. Figure 1 shows a cord circuit and part of the common apparatus associated therewith. Figure 2 shows the operator's dialing circuit. Figure 3 shows a repeated dialing trunk circuit adapted for use with the cord circuit of Figure 1 and Figure 4 shows a loop dialing trunk also adapted for use with the cord circuit of Figure 1.

Let it be assumed that a connection is to be extended over the trunk of Fig. 3. Plug 100 is inserted in jack 300, whereupon a circuit is established from ground, the upper high resistance winding of relay 301, sleeve of jack 300, sleeve of plug 100, conductor 101, contacts 103 and 104 of talking key 102, conductor 105, supervisory lamp 106 to battery. Relay 301 is energized in this circuit and through its upper armature and front contact operates busy signal 302. Relay 301 also places battery potential on conductor 303 which may be traced through the windings of relays 304 and 305 in series. Relay 304 becomes energized, but relay 301 being marginal does not operate at this time. Since supervisory signal 106 is in circuit with the high resistance winding of relay 301, it does not become lighted at this time.

Upon the operation of relay 304 a circuit is established from the tip conductor 306, winding 307 of the trunk repeating coil, condenser 308, winding 309 of the trunk repeating coil, upper armature and front contact of relay 304 to ring conductor 310. Through its lowermost armature, relay 304 closes a connection in the trunk leading from the repeating coil to the jack so that voice and tone currents coming in over the trunk may be transmitted to the cord circuit.

The operator actuates talking key 102. Conductor 101 is now extended through contacts 103 and 107 to the windings of relays 108 and 109 in series. Relay 108 is marginal and does not operate in series with the high resistance winding of relay 301, but relay 109 becomes operated in this circuit. Relay 109 through its armature and front contact causes the energization of relay 110, whereupon a circuit is closed from ground, inner upper armature and front contact of relay 110, resistance 111, conductor 112, contacts 113 and 114 of talking key 102, conductor 105, supervisory lamp 106 to battery. Resistance 111 being of practically the same value as the high resistance winding of relay 301, the supervisory lamp 106 does not become lighted at this time.

Upon the operation of talking key 102 a circuit is closed from ground, normal contacts of relay 115, contacts 116 and 117 of talking key 102, lower winding of relay 118 to battery. Relay 118 becomes energized and establishes a circuit from ground, contacts 119 and 120 of talking key 102, front contact and lower outer armature of relay 118, winding of relay 115 to battery and in parallel therewith through the winding of relay 121 to battery. Relays 115 and 121 become operated in this circuit and relay 115 closes a circuit through its front contact and armature and thence through the upper inner armature and front contact and upper winding of relay 118. Upon the operation of relay 115 the original energizing circuit for relay 118 is broken, but through the continuity contacts of relay 115 the holding circuit

through the upper winding of relay 118 is closed before the circuit through the lower winding is opened.

Relay 118 is the agency through which the cord circuit is associated with the common apparatus shown below in Figure 1 and Figure 2. While it appears that relay 118 is responsive to the talking key 102 it will be shown hereinafter that this relay is locked and will be held energized under control of the common dialing key even though the individual talking key be returned to normal.

A talking circuit may be traced from condenser 311, winding 312 of the trunk repeating coil, tip of jack 300, tip of plug 100, normal contacts of rear ringing key 122, upper outer armature and front contact of relay 118, conductor 123, outermost left hand armature and back contact of relay 200, conductor 201, normal contacts of rear splitting key 124, upper outer armature and front contact of relay 110, conductor 125, condenser 126, windings 127 and 128 of the operator's set induction coil, condenser 129, conductor 130, front contact and inner lower armature of relay 110, lower normal contacts of rear splitting key 124, conductor 202, back contact and middle left hand armature of relay 200, conductor 131, front contact and inner lower armature of relay 118, ring of plug 100, ring of jack 300, winding 313 of the trunk repeating coil, lower outer armature and front contact of relay 304 to condenser 311. The operator's set comprises receiver 132 and transmitter 133. The transmitter is connected in a local circuit including the primary winding 134 of the induction coil. The receiver is connected through the back contacts of relay 135 across the winding 128 of the operator's set induction coil, so that tones or voice currents which may be now transmitted over the trunk will be heard by the operator.

Let it be assumed that the operator listening in on the trunk is assured that everything is in condition for the dialing operation. Since plug 100 is connected to the front cord, the operator will actuate front dialing key 203. A circuit is now closed from ground, front contact and armature of relay 115, conductor 136, conductor 204, back contact and left hand armature of relay 205, upper contacts of front dialing key 203, conductor 206, lower outer armature and front contact of relay 110, winding of relay 200 to battery and ground. Relay 200 is operated in this circuit. Through the movement of its right hand armature, relay 200 removes a ground from conductor 207 to prevent the lighting of supervisory lamp 106 through the low resistance 137. Relay 200 also closes a circuit from the ground connection through which it is operated to its innermost left hand armature and front contact, conductor 208, outer right hand armature and back contact of relay 205, inner upper armature and back contact of relay 209, normal contacts of the inner upper armature of relay 210, windings of relay 211 to battery. Relay 211 closes a circuit from battery, winding of relay 210, front contact and outer lower armature of relay 211, upper outer armature and back contact of relay 209, contacts 212 and 213 of front dialing key 203 to ground. Relay 210 operates in this circuit, breaking the original energizing circuit for relay 211. Relay 210 locks up through its inner upper armature and front contact to the ground originally supplied for the operation of relay 211.

Since the trunk of Fig. 3 is a repeated dialing trunk, the marginal relay 305 will be of relatively low resistance, so that a circuit may now be traced from ground, winding of relay 305, back contact and innermost left hand armature of relay 314, tip of jack 300, tip of plug 100, normal contacts of rear ringing key 122, upper outer armature and front contact of relay 118, conductor 123, outermost left hand armature and front contact of relay 200, conductor 222, repeating coil winding 223, conductor 214, normal contacts of the upper armature of relay 215, conductor 216, upper outer armature and back contact of relay 217, front contact and inner lower armature of relay 211, the winding of relay 218, winding of relay 211 to battery. Relay 211 is maintained operated in this circuit and relay 218 becomes operated. Relay 218 becoming energized, closes a circuit through the winding of relay 209 to battery. Relay 209 operates and extends this ground connection through its front contact and inner upper armature over the back contact and outer right hand armature of relay 205, conductor 208, front contact and innermost left hand armature of relay 200, winding of relay 200 to battery. This ground is also extended back over the original energizing circuit for relay 200 to the armature of relay 115, so that now the relay 118 is held under control of relay 209 and front dialing key 203. Under this condition relay 118 will remain locked and the dialing circuit will still be associated with the cord even though talking key 102 is returned to normal.

The operation of relay 209 also establishes a locking circuit from ground, contacts 213 and 212 of front dialing key 203, the alternate contacts of the upper outer armature of relay 209, conductor 208, the outer right hand armature and back contact of relay 205, the inner upper armature and front contact of relay 209, winding of relay 209 to battery. Upon the operation of relay 209, the holding circuit of relay 210 which was established through the inner upper armature and back contacts of relay 209 is broken so that relay 210 now returns to normal.

Further, upon the operation of relay 209 a circuit is established from ground, contacts 219 and 220 of front dialing key 203, conduc-

tor 221, front contact and outer lower armature of relay 209, winding of relay 215 to battery and ground. Relay 215 becomes energized in this circuit and closes a circuit from ground, its inner lower armature and front contact, lower winding of relay 224 to battery and ground. Relay 215, in operating, opens the circuit at the normal contacts of its upper armature for relays 211 and 218 and though an alternate circuit is provided through the front contact and lower outer armature of relay 224, this is also opened by relay 215 and relays 211 and 218 release. Relay 224 locks through its upper winding, its front contact and inner upper armature to the ground found on the upper inner armature of relay 209. Relay 224, in operating, closes a circuit from ground, the alternate contacts of the upper outer armature of relay 224, conductor 225 to the windings of relays 115 and 121, thus maintaining these relays operated under control of the dialing key 203.

Further, through its operation, relay 224 closes a circuit from ground, the alternate contacts of the inner lower armature of relay 224 to dial pilot lamp 226 to indicate to the operator that she may proceed with dialing. A circuit is also completed from ground to the alternate contact and inner lower armature of relay 224, the normal contacts of the inner right hand armature of relay 205, winding of relay 227 to battery. Relay 227 operates in this circuit.

Upon the operation of relay 215 a circuit is established from ground, the lower outer armature and front contact of relay 215, conductor 228, resistance 229, inner upper armature and back contact of relay 217, conductor 230, windings of relays 138 and 139 in series to battery. Relay 138 closes a circuit originally closed by relay 140, so that upon the energization of relay 140 no circuit change takes place. The relay 140 is energized from ground, front contact and outer upper armature of relay 224, conductor 231, armature and front contact of relay 139, winding of relay 140 to battery.

The operation of relay 209 closes a circuit from battery, resistance 232, front contact and inner lower armature of relay 209, induction coil winding 233, dial contacts 234 and 235, right hand winding of relay 236, front contact and middle left hand armature of relay 200, conductor 131, front contact and inner lower armature of relay 118, ring of plug 100, ring of jack 300, inner right hand armature and back contact of relay 314, winding of relay 315, front contact and lower armature of relay 305 to ground. Relays 236 in the dial circuit and 315 in the trunk circuit operate at this time.

A holding circuit is now established for relay 227 from the winding of relay 227, inner right hand armature and front contact of relay 227, front contact and right hand armature of relay 236 to ground supplied at the inner lower armature of relay 224. A holding circuit is now established for relays 224 and 209 from ground, contacts 213 and 212 of front dialing key 203, alternate contacts of the upper outer armature of relay 209, conductor 208, through the outer left hand armature and front contact of relay 227, the upper inner armature and front contact and upper winding of relay 224 and in parallel therewith, the upper inner armature and front contact and winding of relay 209 to battery.

Relay 227 extends a connection from ground, front contact and inner lower armature of relay 224, front contact and outer right hand armature of relay 227, winding of relay 205 to battery and this relay locks through its inner right hand armature and front contact to the ground on the inner lower armature of relay 224. Another holding ground for relay 205 may be traced from contacts 213 and 214 of front dialing key 203, through the front contacts of the inner right hand armature of relay 205. Relay 205 opens the original energizing circuit for relay 227.

The relays of the dial circuit having operated in the manner described, it will be found that the induction coil including windings 223 and 233 is effectively interposed in the talking circuit between conductors 201 and 202 and conductors 123 and 131. This talking circuit may be traced from conductor 201 through the alternate contacts of the outer left hand armature of relay 200, windings 237 and 238 and condenser 239, back contact and right hand armature of relay 240, upper outer armature and back contact of relay 210, front contact and inner left hand armature of relay 227, alternate contacts of the inner left hand armature of relay 200 to conductor 202. Conductor 123 may be traced through the outer left hand armature and front contact of relay 200, conductor 222, winding 223 of the induction coil, conductor 214 through the upper outer armature and back contact of relay 242, condenser 243, back contact and lower outer armature of relay 242, winding 233 of the induction coil, dialing contacts 234 and 235, right hand winding of relay 236, front contact and middle left hand armature of relay 200 to conductor 131.

Thus talking currents coming in over conductors 123 and 131 will by induction be transmitted to conductors 201 and 202 and thence to the operator's telephone set.

When the dial is moved off normal a circuit is established from ground, off normal contacts 244 and 245, winding of relay 240 to battery. Upon the operation of relay 240, this ground is extended over the outer left hand armature and front contact of relay 240 to the winding of relay 242, so that this relay now becomes operated. With re-

lay 242 operated a circuit is extended from battery, front contact and inner lower armature of relay 242, upper armature and front contact of relay 215, upper outer armature and front contact of relay 242, front contact and outermost left hand armature of relay 200, conductor 123, front contact and upper outer armature of relay 118, normal contacts of rear dialing key 122, tip of plug 100, tip of jack 300, inner left hand armature and back contact of relay 314, winding of relay 305 to ground.

This direct battery connection to relay 305 short circuits the winding of relay 304 which now returns to normal and since relay 315 has become operated, a direct connection from conductor 306, through the upper armature and front contact of relay 315 and the normal contacts of the upper armature of relay 304 is established to conductor 310. The pulsing circuit may be traced from battery, resistance 232, front contact and inner lower armature of relay 209, outer lower armature and front contact of relay 242, dial contacts 234 and 235, right hand winding of relay 236, front contact and middle left hand armature of relay 200, conductor 131, front contact and inner lower armature of relay 118, ring of plug 100, ring of jack 300, inner right hand armature and back contact of relay 314, winding of relay 315, front contact and lower armature of relay 305 to ground.

As the dial returns to normal, contacts 234 and 235 will be intermittently opened and both relays 236 and 315 will respond. Relay 315 opens the shunt circuit across conductors 306 and 310 intermittently to step the switches of the trunk in a well-known manner. Relay 236 intermittently opens the circuit of relay 227, but this relay being slow to release does not respond and remains in its operated condition.

When the dial has returned to normal relays 240 and 242 will release and since the direct battery connection to relay 305 is now broken, relay 304 will again become operated to establish the path through the trunk for tone and voice currents. In a like manner the induction coil comprising windings 223, 233, 237 and 238 will become effective so that the operator may listen in on the trunk during the periods when the dial is at normal.

When dialing is completed the dial key 223 is restored and relay 215 returns to normal. The tip lead which during the operation of relay 215 was connected through resistance 241 to battery is now connected through the normal contacts of the upper armature of relay 215, the front contact and outer lower armature of relay 224, the back contact and inner lower armature of relay 215 to ground. This ground connection now short circuits relay 305 and relay 305 therefore releases. Upon the return of relay 305 to normal, resistance 316 is connected in series with the winding of relay 315 which has heretofore been traced through the right hand winding of relay 236.

A circuit is now established from ground, the lower armature and back contact of relay 305, lower armature and front contact of relay 315, the front contact and inner lower armature of relay 304, winding of relay 314, upper armature and front contact of relay 301 to battery. Relay 314 becomes operated in this circuit and locks to ground through its front contact and outer right hand armature. Relay 314 at its inner right hand armature opens the circuit of relays 135 and 236. Relay 304 remains operated in series with relay 305, but relay 305 being marginal does not operate.

Since the circuit of relays 315 and 236 is opened, relay 236 becomes deenergized and after an appropriate interval relay 227 returns its armatures to normal. Since relay 227 restores, the locking circuits for relays 224 and 209 are opened. These relays return to normal. Relay 209 in releasing opens the holding circuit for relay 200 and this relay releases. Relay 224 in restoring opens the holding circuit for relay 205 and this restores to normal, thus returning all of the relays shown in Fig. 2 to their normal condition.

The group of relays 138, 139 and 140 constitute a click prevention means whereby a resistance 141 is introduced into the operator's receiver circuit during the release of the dial circuit. When the front dialing key 203 is restored and relay 215 returns to normal, the ground for holding relays 138 and 139 is removed and these relays release quickly. The release of relay 138 opens the shunt around resistance 141 and the release of relay 139 opens the circuit for the energization of relay 140. Relay 140, however, being slow to release does not close the shunt about resistance 141 for an appreciable time so that during the release of the operator's dial circuit, the transmission efficiency of the operator's set is reduced.

After the operation of relay 314, the low resistance winding of relay 301 is connected through the front contact and outer left hand armature of relay 314 to the armature of relay 317. Relay 317 as indicated is polarized and responds to a reversal of current over the trunk leading from Fig. 3. Before the called subscriber answers the armature of relay 317 will rest against its back contact so that the low resistance winding of relay 301 will now be included in the circuit of the supervisory lamp 106. If the talking key 102 has been restored to normal, then this circuit will act directly on supervisory lamp 106 and cause this signal to operate. If the talking key 102 is still operated, then the marginal relay 108 will be energized and since relay 200 has now been restored to normal, the low resistance

137 will become effective and supervisory lamp 106 will be operated.

When the called subscriber answers then a reversal will take place in a manner well known and now the low resistance winding of relay 301 will be connected through the front contact of relay 317, resistance 318 to battery, so that signal lamp 106 will become dark as an indication to the toll operator that the called subscriber has answered.

Whenever the operator restores talking key 102 to its normal condition, relays 115, 118 and 121 release and the common apparatus all becomes dissociated from the cord circuit.

From the foregoing it will be seen that as long as the dial key in the operator's dialing circuit is operated that the dial circuit is locked to the cord whether or not the talking key 102 is restored to normal.

When the dial key is restored, the dial circuit may not be unlocked from the cord until the trunk has received a signal and in response thereto transmitted back a signal to the dial circuit. The signal transmitted to the trunk circuit upon the restoration of the dial key consists in the change in condition on the tip circuit controlled by the upper armature of relay 215 whereby a direct ground connection is substituted for a battery connection through the resistance 241. This signal causes the deenergization of relay 305 in the trunk circuit. In response to this signal and when it is assured that the trunk is in proper condition for the transmission of voice currents, a signal will be transmitted back to the dial circuit. This signal consists in the opening of the circuit of relay 236 which will only take place upon the operation of relay 314 and the operation of this relay depends on the fact that relay 304 has been properly operated. It is only when in response to this signal from the trunk that relay 236 becomes deenergized that the controlling relay 227 will be released to cause the restoration of the other relays in the dial circuit and finally the release of relay 200.

If the plug 100 is inserted into jack 400 then the operations heretofore described will take place up to the point of the operation of relay 218. In the present instance the trunk tip relay 401 is of relatively high resistance as compared with the trunk tip relay 305 which is of relatively low resistance. In series with relay 401 relay 218 will not operate, but relay 211 will remain operated for the time being. Relay 401, however, will operate and through the alternate contacts of its upper armature will lock itself to battery through the upper armature and front contact of relay 402. The tip circuit thereupon is opened and relay 211 will become deenergized. A circuit may now be traced from ground, contacts 213 and 212 of front dial key 203, back contact and upper outer armature of relay 209, lower outer armature and back contact of relay 211, lower armature and front contact of relay 210, winding of relay 246 to battery, whereupon relay 246 becomes operated. Relay 246 locks in a circuit from ground, normal contacts of the upper armature of relay 247, upper contacts of key 248, front contact and innermost left hand armature of relay 246 to battery.

Upon its operation relay 246 closes a circuit from ground, front contact and outermost left hand armature of relay 246, dial pilot light 226 to battery, thus operating the dial pilot light as a signal to the operator that she may proceed to dial. Relay 246 in moving its outer right hand armature closes a circuit from ground, alternate contacts of the outermost right hand armature of relay 246, conductor 208, front contact and innermost left hand armature of relay 200 to lock this relay energized. A ground is also extended from the outermost right hand armature of relay 246, over conductor 225 to hold relays 115 and 121 operated. Through its middle right hand armature relay 246 places a ground on conductor 231 to cause the operation of relay 140 in the same manner as hereinbefore described. Relays 138 and 139 are operated from a ground on conductor 228 which is connected through the front contact and innermost right hand armature of relay 246 under control of relay 236.

Further, through the operation of relay 246 a circuit is closed from ground, the alternate contacts of the outermost left hand armature of relay 246, the normal contacts of the inner right hand armature of relay 205, winding of relay 227 to battery. Relay 227 becomes operated in this circuit.

Relay 227 locks in a circuit under control of relay 236 as hereinbefore described. Relay 227 also closes a circuit from ground, the alternate contacts of the outermost left hand armature of relay 246, the front contact and outer right hand armature of relay 227, winding of relay 205 to battery. Relay 205 becoming operated locks itself in a circuit including its inner right hand armature and front contact to the alternate contacts of the outermost left hand armature of relay 246. The original energizing circuit of relay 227 is now opened and this relay is left under the control of relay 236.

Relay 210 is now held locked in a circuit including its winding, its inner upper armature and front contact, back contact and inner and upper armature of relay 209, front contact and outer left hand armature of relay 227, the alternate contacts of the outermost right hand armature of relay 246 to ground.

The trunk of Fig. 4 is known as a loop dialing trunk. Battery and ground connections will be supplied from the selector switch beyond to conductors 403 and 404, so that a circuit may now be traced from conductor

403, the upper armature and back contact of ringing relay 405, the back contact and upper armature of relay 406, the front contact and upper armature of relay 401, tip of jack 400, tip of plug 100, normal contacts of rear ringing key 122, upper outer armature and front contact of relay 118, conductor 123, outermost left hand armature and front contact of relay 200, repeating coil winding 223, conductor 214, normal contacts of the upper armature of relay 215, upper outer armature and back contact of relay 217, normal contacts of the inner lower armature of relay 211, back contact and inner lower armature of relay 209, repeating coil winding 233, dial contacts 234 and 235, right hand winding of relay 236, front contact and middle left hand armature of relay 200, conductor 131, front contact and inner lower armature of relay 118, ring of plug 100, ring of jack 400, lower armature and front contact of relay 401, inner lower armature and back contact of relay 406, winding of polarized relay 407, back contact and lower armature of relay 405 to conductor 404. Current supplied from the selector switch on the trunk will cause the operation of relay 236 and at the same time hold the line relay of the selector switch operated. The current flowing in this circuit will be in such a direction that polarized relay 407 will not operate.

When the dial is moved off normal, relays 240 and 242 will become operated as hereinbefore described and the voice frequency path to the operator's set will be opened at the right hand armature of relay 240, while the windings 223 and 233 of the repeating coil are short circuited by the outer armatures of relay 242. As the dial returns to normal the pulsing contacts 234 and 235 will be intermittently operated so that the selector switch will be stepped in a well-known manner.

When dialing has been completed and the dial key has been restored to normal, the dialing circuit is still held locked to the cord circuit under control of relay 407 in the trunk. When the trunk has been put in proper condition the polarized relay 407 will be operated and a circuit established for relay 406. Relay 406 becomes operated and locks through the alternate contacts of its lower outer armature to the battery supplied at the upper armature of relay 402. Relay 406, in operating, opens the tip and ring circuit of the distant selector switch and connects them to the windings 412 and 413 of the trunk repeating coil, at the same time connecting the trunk repeating coil windings 408 and 409 in circuit with the operator's dialing circuit. Since a condenser 410 is now included in this circuit, relay 236 will be deenergized with the result that the signal now received back from the trunk will cause the dial circuit to be released. Since relay 227 becomes deenergized upon the release of relay 236, the circuit for relay 210 which depended on the outer left hand armature and front contact of relay 227 is opened and this relay becomes deenergized. Thereupon a circuit is completed from ground, the alternate contacts of the outermost left hand armature of relay 246, the alternate contacts of the inner right hand armature of relay 205, back contact and upper outer armature of relay 209, lower outer armature and back contact of relay 211, lower armature and back contact of relay 210, front contact and middle left hand armature of relay 246, lower normal contacts of key 248, winding of relay 249 to battery. Relay 249 becoming operated connects battery to the winding of relay 217 which becomes operated in series with the back contact and armature of relay 250 and the interrupter 251 to ground. Upon the operation of relay 217 a ground is connected to the winding of relay 250 which when the interrupter 251 comes to an insulated segment is effectively placed in series with the winding of relay 217. Thereupon relay 250 becomes operated and places the interrupter circuit in connection with the upper winding of relay 247, so that upon the interrupter reaching a live segment, relay 247 will become operated and will lock through its lower winding. When relay 247 becomes operated the holding circuit for relay 246 is opened and this relay restores to normal. When relay 246 becomes deenergized, then the dial pilot light 226 becomes dark as an indication that the dial circuit is released. Relay 246 opens the holding circuit for relay 200 and this relay causes the dial circuit to be dissociated from the cord circuit.

The polarized relay 411 corresponds to the polarized relay 317 and performs the same functions in controlling the cord supervisory signal 106.

What is claimed is:

1. In a telephone system, a trunk circuit, a cord circuit for cooperation with said trunk circuit, a dialing circuit associated with said cord circuit, means for locking said dialing circuit to said cord circuit and interlocking means in said trunk circuit for controlling said locking means.

2. In a telephone system, a trunk circuit, a cord circuit for cooperation with said trunk circuit, a dialing circuit, means for associating said dialing circuit with said cord circuit, and means in said dialing circuit and said trunk circuit constituting interlocking means to prevent the release of said dialing circuit from said cord circuit until said trunk circuit is prepared for the release of said dialing circuit.

3. In a telephone system, a trunk circuit, a cord circuit for cooperation with said trunk circuit, a dialing circuit, means for associating said dialing circuit with said cord circuit,

manually operable means in said dialing circuit for preparing for the release of said dialing circuit from said cord circuit, means responsive thereto for transmitting a signal to said trunk circuit, means in said trunk circuit responsive to said signal for transmitting a signal back to said dialing circuit and means in said dialing circuit responsive thereto for releasing said dialing circuit from said cord circuit.

4. In a telephone system, a trunk circuit, means for establishing a path therethrough for the transmission of voice frequency currents, means for changing said path to one suiable for the transmission of signaling impulses, a cord circuit for cooperation with said trunk circuit, a dialing circuit, means for associating said dialing circuit with said cord circuit, said means including a key, means responsive to an operation of said key for preparing for the release of said dialing circuit from said cord circuit, means in said trunk circuit responsive to said releasing means for locking in said first means and additional means in said dialing circuit responsive to said last means in said trunk circuit for completing the release of said dialing circuit from said cord circuit.

5. In a telephone system, a trunk circuit, means for establishing a path therethrough for the transmission of voice frequency currents, means for changing said path to one suitable for the transmision of signaling impulses, cord circuits for cooperation with said trunk circuit, a dialing circuit common to said cord circuits, means for associating said dialing circuit with one of said cord circuits, said means including a key, means responsive to an operation of said key for preparing for the release of said dialing circuit from said cord circuit, means in said trunk circuit responsive to said releasing means for locking in said first means and additional means in said dialing circuit responsive to said last means in said trunk circuit for completing the release of said dialing circuit from said cord circuit.

In witness whereof, I hereunto subscribe my name this 4th day of August, 1930.

JAMES BURTON McKIM.