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2,014,232

TELEPHONE SYSTEM

Filed July 20, 1933

2 Sheets-Sheet 1

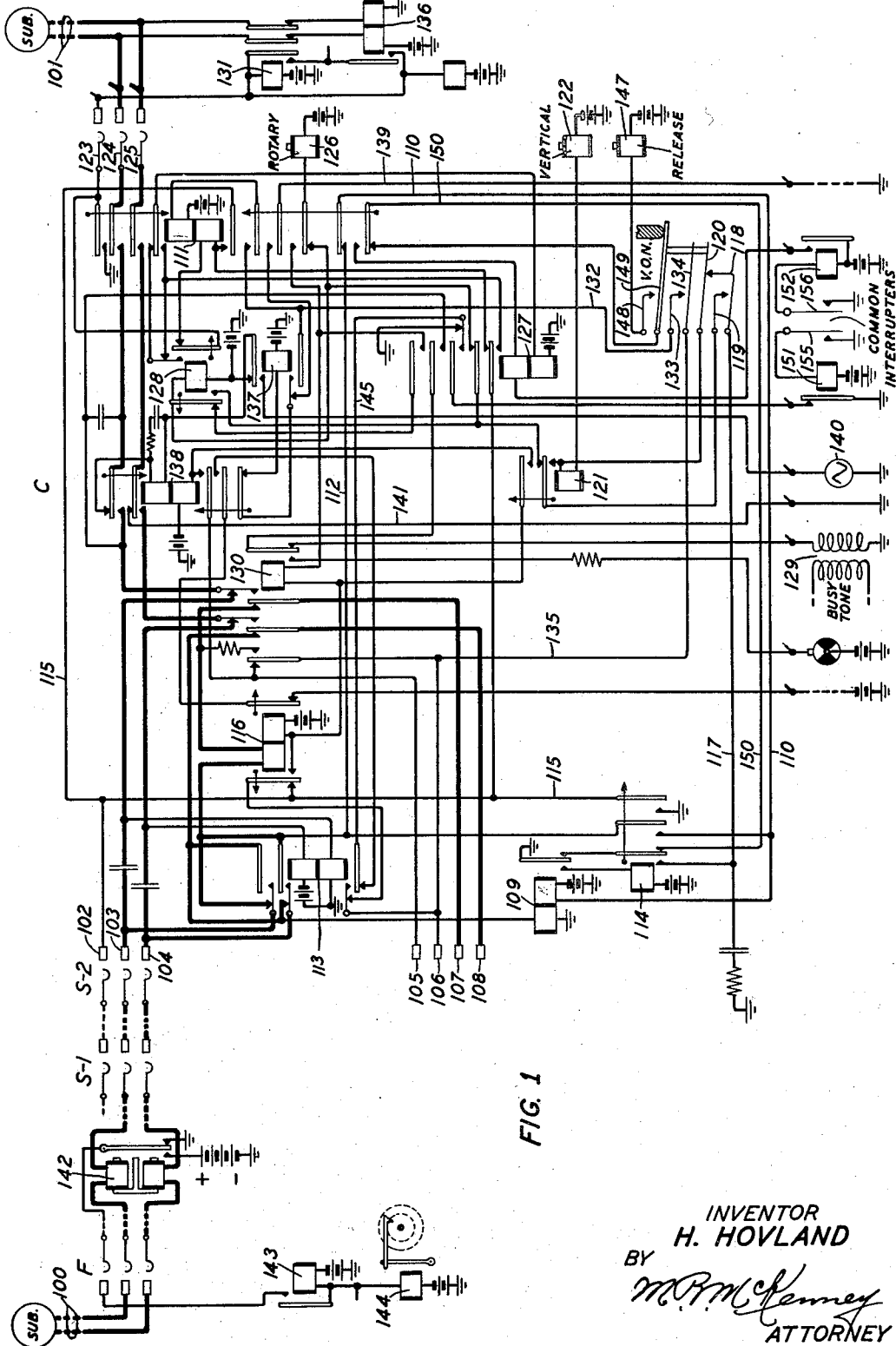


FIG. 1

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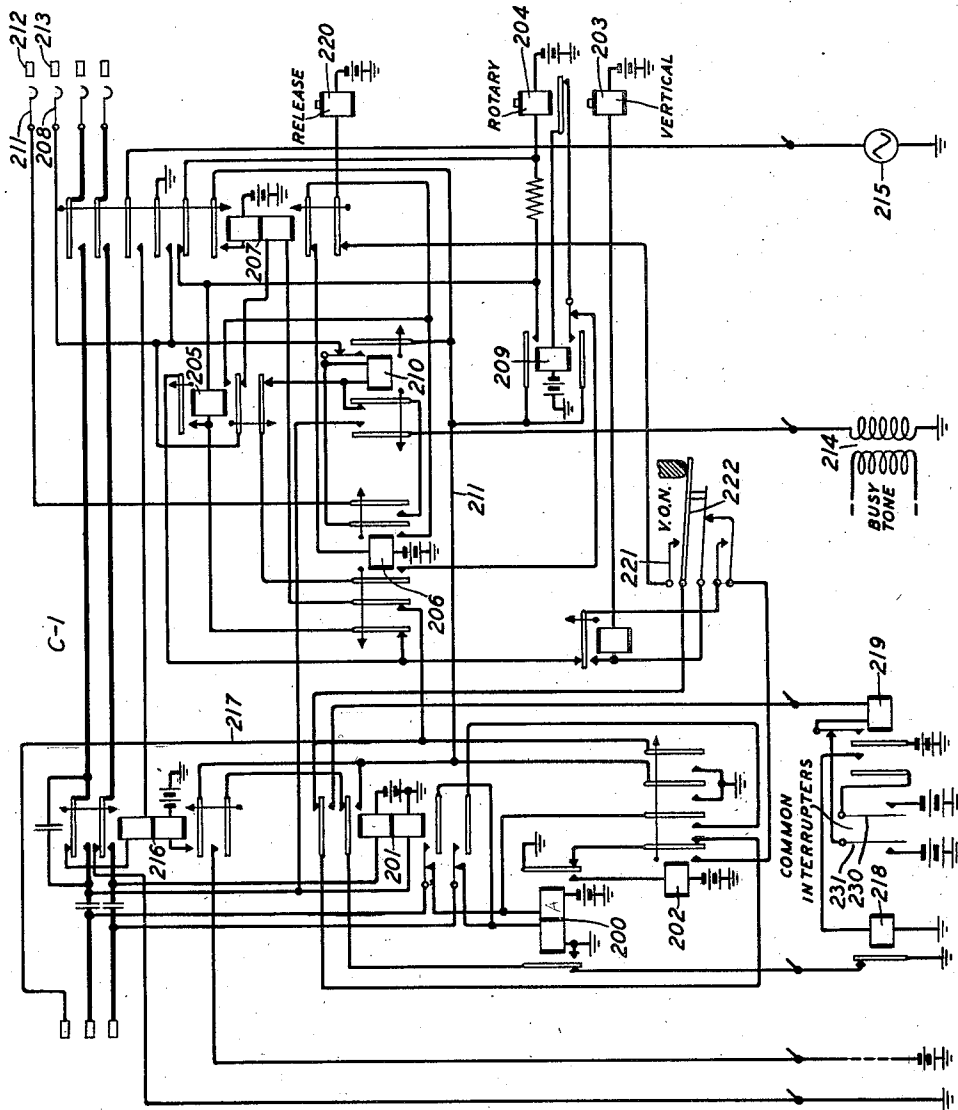


FIG. 2

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TELEPHONE SYSTEM

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Application July 20, 1933, Serial No. 681,268

16 Claims. (Cl. 179—16)

This invention relates to automatic telephone systems and particularly to systems, such as those using step-by-step switches, in which an established connection is held under control of one of the switches, usually the last one in the train.

The objects are to give the calling subscriber control over the release of an established connection and at the same time to safeguard the called subscriber's line against seizure by the central office switches for a reasonable period of time following release by the calling party; to prevent the equipment from being held out of service indefinitely due to trouble; to prevent the equipment that has already been used for one call and has not yet been fully released from interfering with the operation of the equipment that is being used in the establishment of a second connection, and to otherwise improve systems of this character.

It is well known to have the calling subscriber control the release of the entire connection, including the selector and connector switches, when he replaces his receiver on the switchhook. In such cases, however, if the called subscriber does not hang up his receiver immediately, his line is extended by a finder or equivalent switch the same as it would if he were originating a call. This takes out of service equipment that might otherwise be used by other subscribers.

It has also been proposed heretofore, particularly in systems employing switches of the step-by-step type, to have the calling subscriber release all switches except the connector switch, this switch remaining in its set position until the called subscriber retires. With this plan the connector switch is held unduly long in case the called subscriber does not hang up his receiver. Moreover, a trouble condition in the line may hold the connector indefinitely.

According to the present invention, these difficulties are overcome, in systems of the character above described, by the provision of means whereby the calling subscriber on replacing his receiver causes the removal of the holding potential in the connector switch to permit the immediate release of all switches preceding the connector, but without causing the release of the connector switch. After a brief interval the holding potential is replaced to prevent the connector switch from being seized by other selectors while it is being held by the called subscriber. After a still further interval, the connector switch is automatically released although the called subscriber may still have his receiver off the hook. This interval between the time when

the calling subscriber hangs up his receiver and the release of the connector switch is sufficiently long to enable the called subscriber to hang up his receiver.

Another feature of the invention is an arrangement in which the circuit that feeds current from the connector switch in the direction of the calling subscriber's line is opened during the interval that the connector switch is unguarded so that if the connector is seized during this interval, current will not flow from the connector over the trunk in the direction of the calling subscriber's line that is seeking to establish a new connection. The reason for this is to prevent the operation of a polarized supervisory relay due to the fact that the battery and ground leads in the connector are reversed since the called subscriber has already answered.

Other features of the invention will appear from the following detailed description when considered in connection with the accompanying drawings.

Fig. 1 of the drawings illustrates in schematic form a calling subscriber's line 100, a line finder switch F and first and second selector switches S—1 and S—2. The drawings also show the details of a connector switch C and a called subscriber's line 101. Fig. 2 shows the details of a connector switch C—1 involving a modification of the invention.

The finder, selector and connector switches shown in the drawings are of the well known two-motion step-by-step type; but the invention is, of course, applicable to systems which use other types of switches and employ different trunking arrangements.

A detailed description will now be given of the circuits shown in Fig. 1, assuming that the subscriber of the local line 100 wishes to converse with the subscriber of line 101. When the calling subscriber lifts his receiver, the line finder F operates in the well-known manner to seize the calling line. Thereupon the calling subscriber operates his dial to set the selector switches S—1 and S—2. Selector switch S—2 in its hunting movement seizes the terminals 102, 103 and 104 of an idle connector C. It may be noted at this point that the connector switch C serves for both local and toll connections. For example, when a toll call is made this connector is seized by a toll selector (not shown) through the terminals 105, 106, 107, and 108.

Seizure of the connector switch by the selector S—2 results in the closure of a circuit for the impulse relay 109 by means of which the calling sub-

scriber controls the vertical and rotary movements of the connector. This circuit can be traced from battery through the right-hand winding of relay 109, conductor 110, armature and contact of relay 111, conductor 112, upper normal contact of relay 113, thence over the ring side of the line and returning over the tip side through the inner upper normal contact of relay 113 to ground through the left-hand winding of relay 109. Relay 109 operates the slow-to-release relay 114 which applies ground at its outermost contact over conductor 115 to the multiple test terminal 102 in the local selector banks and also through the left contact of relay 116 and the lower contact of relay 113 to the test terminals 106 in the toll selector banks. Relay 114 also alters the loop circuit just traced for the relay 109 so that the relay 109 is now independent of the relay 111. This will be seen by tracing the circuit from battery through the right winding of relay 109, through the middle contact of relay 114, thence to the subscriber's line and thence over the subscriber's line and returning as above explained through the left winding of relay 109.

The calling subscriber now manipulates his dial to transmit the first series of impulses, and relay 109, upon releasing in response to the first opening of the circuit, completes the stepping circuit for the vertical magnet from ground through the armature and back contact of relay 109, front contact of relay 114, conductor 117, closed springs 118 and 120, through the winding of slow-release relay 121, vertical magnet 122, to battery. Relay 121 operates and remains energized during the series of impulses and magnet 122 steps the brushes 123, 124, and 125 one vertical step. On the first vertical step of the switch the off-normal contacts are shifted so that the pulsing circuit over conductor 117 now extends through springs 118 and 119, lower armature and front contact and winding of relay 121 to the vertical magnet. The magnet 122 responds to the succeeding pulses in the first series and advances the brushes of the connector to the desired level of lines.

Following the first series of pulses the circuit of relay 121 is maintained open for a sufficient interval to permit its release. Relay 121 upon releasing shifts the pulsing circuit from the vertical magnet 122 to the rotary magnet 126. When, therefore, the first impulse of the next series is received, relay 109 releases, and the stepping circuit is completed over conductor 117, springs 118 and 119, inner armature and back contact of relay 121, next to the inner armature and back contact of the test relay 127, back contact of relay 111, through the winding of the rotary magnet 126, to battery. A parallel branch of this circuit extends through the winding of the slow-release relay 128, to battery. Relay 128 operates, and the rotary magnet 126 advances the brushes 123, 124 and 125 into engagement with the first subscriber's line in the chosen level. Relay 128 alters the stepping circuit so as to render it independent of the test relay 127. Therefore, when the second and all succeeding pulses of the second series are received, they are delivered to the rotary magnet over a circuit including the conductor 117, contacts 118 and 119, back contact of relay 121, thence through the left front contact and armature of relay 128, back contact of relay 111, to the magnet 126. At the end of the second series of pulses the brushes of the connector come to rest on the terminals of the called subscriber's line 101.

The called line is now tested, and, if found busy, the test relay 127 operates in a circuit from battery through its lower winding, inner upper armature and back contact of relay 111, through the right front contact of relay 128, which relay is holding its armature attracted for a brief interval following the delivery of the last pulse, to the test wiper 123 and the busy test terminal of the called line. Relay 127 operates and in so doing prevents the application of ringing current 10 to the called line and, furthermore, applies a busy-tone source to the calling subscriber's line to notify him that the called line is engaged. The circuit for the busy-tone current may be traced from the busy-tone coil 129, right-hand back contact of relay 130, front contact of relay 127, thence to the upper talking conductor and to the calling subscriber's station. The calling subscriber hearing the busy tone replaces his receiver on the hook, thus causing the release of the switches in a manner to be explained more in detail hereinafter.

Assume, however, that the called subscriber's line is idle at the time. In this case the test relay 127 fails to operate at the end of the rotary movement of the switch, and, when relay 128 restores its armatures, a circuit is completed for relay 111. This circuit may be traced from battery through the winding of the cut-off relay 131 of the called line, brush 123, right-hand back contact of relay 123, lower winding of relay 111, back contact of relay 127, to the grounded conductor 115. Relay 111 operates and locks in a circuit from battery through its upper winding and through its front contact, conductor 132, off-normal springs 133 and 134, conductor 135, lower normal contact of relay 113, left back contact of relay 116, to the grounded conductor 115. The cut-off relay 131 in operating disconnects the line relay 136, and relay 111 at its uppermost armature applies a busy potential to the terminals of the called subscriber's line. Relay 111 also applies ground potential to the holding conductor 115 in a circuit from ground through its uppermost armature, right back contact of relay 128, lower winding and contact of relay 111, to the conductor 115. Another branch of this circuit extends from the lower winding of relay 111, through the back contact of relay 127 to the conductor 115.

A circuit is now prepared by the operation of relay 137 for ringing the called subscriber's line. This relay operates in a circuit from battery through its winding, lower back contact of the ringing trip relay 138, lower normal contact of relay 137, front contact of relay 111, conductor 139, and thence to ground through a pick-up interrupter (not shown) as soon as said interrupter reaches its next closing point. Relay 137 in operating locks through its winding and lower front contact, thence over conductor 132, to the grounded conductor 135 as above traced. Relay 137 applies ringing current in a circuit from the ringing source 140, upper front contact of relay 137, upper winding and uppermost back contact of the slow-operating trip relay 138, front contact of relay 111, brush 124, thence over the loop of the called line and returning through brush 125, front contact of relay 111, back contact of relay 138, conductor 141, to ground. The relay 138, being of a marginal character, does not operate in series with the ringer at the called station.

When the called party responds by removing his receiver, the resistance of the loop is suffi-

ciently reduced to permit the trip relay 138 to attract its armatures and disconnect the ringing source. Relay 138 locks through its lower winding and front contact, back contact of relay 130 to the grounded conductor 135. Relay 138 in operating releases relay 137. Relay 113 is now operated in series with the called subscriber's line in a circuit traceable from battery through the upper winding of said relay, thence over the lower talking conductor, through the contacts of relays 130, 138 and 111 and returning over the upper talking conductor, through the contacts of these same relays to ground through the lower winding of relay 113. Relay 113 at its upper front contacts reverses the direction of current from the windings of relay 109, to the calling subscriber's line. This reversal of current may serve the well-known purpose of operating a polarized relay 142. The reversal of current through the winding of relay 142 may be used to effect any desired supervisory function including indication of the answer of the called subscriber. Since the calling subscriber's cut-off relay 143 is in an operated condition, the message register 144 of the calling line is operated in a circuit closed at the front contact of the polarized relay 142.

When relay 113 operates, it shifts the holding circuits of relays 111 and 138 to the back contact of the test relay 127. The holding circuit of relay 111 now extends from battery through the upper winding and front contact of said relay, and thence as traced over conductors 132 and 135, lower front contact of relay 113, conductor 145, to ground at the back contact of relay 127. The holding circuit of relay 138 may be traced from battery through its lower winding and front contact, back contact of relay 130, and thence to ground as just traced at the back contact of relay 127.

Talking current is supplied to the calling line through the windings of relay 109 and to the called subscriber's line, through the windings of relay 113.

It will be assumed that the calling subscriber is the first to replace his receiver when the conversation is finished. This results in the release of relay 109. Relay 109 completes a circuit, while slow relay 114 is maintaining its armatures, over conductor 117, and thence as previously traced through the winding of slow-release relay 128, to battery. Relay 128 operates, and, after a brief interval, relay 114 releases. Relay 114 on releasing removes ground potential from conductor 115 and also opens the circuit of relay 128. Since relay 128 is now maintaining its armatures retracted for a brief interval, the circuits previously traced from ground through the upper front contact of relay 111 to the holding conductor 115 are held open momentarily. With all sources of ground potential thus removed from the conductor 115 the selector switches S—1 and S—2 and the finder switch F are permitted to release while the connector remains in its set position. After the momentary interval expires, relay 128 again releases, and ground is reapplied to the conductor 115 and the multiple terminals 102 to guard the connector switch from a possible seizure by other hunting selectors. It will be noted, however, that there was a brief interval in which the connector switch is unguarded and is subject to seizure by a selector. During this interval the current supply through the windings of relay 109 is in such a direction that unless some provision were made, the polarized relay 142 in the

connection thus seeking a connector switch might operate and cause a false actuation of the calling subscriber's message register. Such an operation is prevented in this system by opening the connection of the battery source through the right winding of relay 109. This opening occurs at the middle armature and contact of relay 114. If, therefore, a selector S—2 seizes the connector C at any time during the unguarded interval, no current will flow from the battery source through the right winding of relay 109 over the connection, through the polarized relay 142, because the circuit for such current flow is now open at the contact of relay 114.

Should the called subscriber hang up his receiver soon after the calling subscriber, he causes the release of relay 113, which in turn releases relays 111 and 138. The release magnet 147 is now energized in a circuit through off-normal springs 148 and 149, lower back contact of relay 111, conductor 150, to ground through the back contacts of relays 114 and 109. The magnet 147 restores the connector switch to normal and deenergizes upon the opening of the off-normal springs 148 and 149.

It will next be assumed that the called subscriber delays the replacement of his receiver for a considerable period after the calling subscriber hangs up his receiver. To prevent the connector switch C from being held indefinitely by the closure of the called subscriber's loop, which might be caused by the failure of the subscriber to replace his telephone or by a fault in the line, a timing mechanism is provided in common to a number of connector switches. This timing mechanism includes the relays 151 and 152 together with suitable power driven interrupters 155 and 156. At the time the calling subscriber replaces his receiver, a circuit is completed from ground through the back contacts of relays 109 and 114, conductor 150, lower front contact of relay 111, upper winding of relay 127, to the front contact of the common timing relay 152. As soon thereafter as relay 152 is operated by the interrupter 156, relay 127 energizes and locks in a circuit from battery through its lower winding, front contact of relay 111, lower front contact of relay 127, conductor 115, inner lower front contact and lower winding of relay 111, right back contact of relay 128, to ground at the uppermost armature of relay 111. Relay 127 at its make-before-break contact transfers the conductor 145 from the ground connection at the normal contact of relay 127 to the ground connection at the armature and back contact of the timing relay 151. This means that the holding circuits of relays 111 and 138 hereinbefore traced have now been placed under the control of the timing relay 151. At the end of a definite interval following the operation of relay 152, relay 151 is energized by the interrupter 155 and releases relays 111 and 138. With relay 111 released the circuit for release magnet 147 is closed as above explained, and the connector switch C restores to normal.

The connector switch C—1 shown in Fig. 2 is similar in many respects to the one shown in Fig. 1. In this modification of the invention when the calling line is extended to the connector switch as previously described over a selector switch S—2, the impulse relay 200 operates in a circuit from battery and ground through its right and left windings, thence over contacts of the relay 201, to the calling subscriber's line. Relay 200 operates the slow-release relay 202, 75

and, when the first series of impulses are sent, the vertical stepping magnet 203 responds to advance the brushes to the proper level of lines. On the next series of impulses the rotary stepping magnet 204 is actuated in series with the slow relay 205, and the brushes are stepped to the terminals of the called subscriber's line.

If the called line is busy, relay 206 operates following the last pulse in the series from battery through its winding, contact of relay 207, lower front contact of relay 205, to ground on the test brush 208. When relay 205 releases, a circuit is closed from battery through the winding of relay 209, contact of the rotary magnet 204, and thence through contacts of relays 209, 206, 205 and 210, to the grounded test brush 211. Relay 209 operates, and, if the line on which the connector has been positioned is the first line in a group of trunks to a private branch exchange, the magnet 204 steps the brushes to the next line and releases relay 209. This stepping action continues until an idle line is found or until the last line in the group is reached in the well-known manner. It should be explained that the test terminals 212 and 213 of direct lines are not connected together, whereas those for private branch exchange groups are connected together in all cases except for the last trunk in the group.

Assuming that the called line is a direct line, the relay 206 operates as explained, but relay 209 fails to operate due to the absence of ground potential on the test terminal 212 of the busy line. Relay 210 now operates in series with relay 209 in a circuit connected to the grounded test terminal 213. Relay 210 being of high resistance does not permit the relay 209 to operate. Relay 210 locks in a circuit traceable from battery through the winding of relay 209, contact of magnet 204, contact of relay 209, contacts of relays 206 and 205, winding and right front contact of relay 210, to the grounded conductor 211. The busy-tone source 214 is now connected to the calling line through the contacts of relay 210.

If the called subscriber's line is idle, relay 206 fails to operate when the test is made, and, upon the release of relay 205, a circuit is closed from battery through the cut-off relay of the called line over terminal 213, thence over a circuit traceable through the lower winding of relay 207, to ground at the outer armature of relay 202. Relay 207 operates and locks to the grounded conductor 211. The tip and ring conductors are now extended through to the called subscriber's line, and ringing current is applied from the generator 215. When the called subscriber answers, the tripping relay 216 operates and disconnects the ringing source and completes the talking circuit for conversation. The called subscriber's line is included in series with the winding of battery feed relay 201, and this relay operates, reversing the direction of current over the calling subscriber's line. It will be noted that the circuit for the supply of current to the calling line from battery through the right-hand winding of relay 200 is controlled by a contact of relay 202.

The holding conductor 217 is grounded at the contact of relay 202 and also by means of a path extending through the middle left contact of relay 206, lower winding of relay 207, inner back contact of relay 205, to ground at the front contact of relay 207.

When the calling subscriber replaces his receiver following conversation, relay 200 releases, and a holding circuit is closed for relay 207, traceable from battery through the upper winding and

contact of said relay, conductor 211, upper front contact of relay 201, left back contact of relay 200, to ground at the back contact of the common timing relay 218. Relay 200 also closes an obvious circuit for the reoperation of relay 205. Relay 205 opens the path from ground at the contact of relay 207, to the holding conductor 217. After an interval the slow-release relay 202 retracts its armatures, and the last source of ground is removed from the holding conductor 217, and the circuit of relay 205 is opened. The removal of ground from the holding conductor releases the preceding switches, and, after a brief interval, relay 205 again releases and replaces ground potential on conductor 217 to guard the connector switch. During the unguarded interval battery potential is disconnected from the incoming circuit at the contact of relay 202.

Upon the first closure of the common interrupter 231, relay 219 operates over an obvious circuit and locks. Upon the next closure of the interrupter 230, relay 218 operates and opens the holding circuit of relay 207. If the called subscriber has not replaced his receiver by this time, the release of relay 207 opens the circuit of relay 201, and relay 201 releases to in turn close the following circuit for the release magnet 220: battery through the winding of said magnet, contact of relay 207, off-normal springs 221 and 222, contacts of relays 201, 202 and 200, to ground. Magnet 220 restores the switch to normal.

By means of these circuit arrangements it is possible for the calling subscriber to immediately release all of the switches, except the last one, which is held under the control of the called subscriber and will release provided he replaces his receiver within a reasonable time after the calling subscriber. However, in case he delays, the connector is automatically released after a time interval is measured. Moreover, provision is made whereby other subscribers attempting to establish a connection are safeguarded against false operation of the equipment in the event a connector switch is seized during the unguarded interval necessary to enable the release of the switches preceding the connector.

What is claimed is:

1. The combination in a telephone system of a line, a selector switch and a connector switch for establishing a connection to said line, means in said connector for maintaining a holding condition for the established connection, means for removing said holding condition to release the selector switch without releasing said connector switch, and timing means for causing the release of said connector after an interval of time following the release of said selector switch.

2. The combination in a telephone system of a line, a plurality of selective switches operated in succession to establish connection to said line, means in one of said switches for maintaining a holding condition for the established connection, means for removing said holding condition to cause the release of all except said last mentioned switch, and timing means for causing the release of said last mentioned switch after a definite interval following the release of said other switches.

3. In a telephone system, a calling line and a called line, a selector switch and a connector switch for establishing a connection between said lines, means in said connector switch for maintaining a holding condition for the established connection, means under the control of the calling subscriber for removing said holding con-

dition to release the selector switch without releasing said connector switch, means controlled by the called subscriber for releasing said connector switch, and timing means for causing the release of said connector after an interval following the release of said selector switch.

4. In a telephone system, a calling line and a called line, a selector switch and a connector switch for establishing a connection from the calling line to the called line, means for maintaining a potential on the established connection for holding said selector switch, means controlled by the calling subscriber for removing said potential to release the selector switch without releasing said connector, and a timing device for causing the release of the connector switch after a predetermined interval following the release of said selector.

5. The combination in a telephone system of a calling line and a called line, a selector switch and a connector switch for establishing a connection between said lines, means in said connector for maintaining a potential on the established connection to hold said selector switch, means under the control of the calling subscriber for removing said potential to cause the release of said selector switch without releasing said connector, means for replacing said potential to prevent a reseizure of said connector, means controlled by the called subscriber for releasing said connector switch, and timing means effective if the called subscriber does not replace his receiver to cause the release of said connector switch.

6. The combination in a telephone system of a telephone line, a plurality of selective switches operated in succession to establish a connection to said line, a control circuit extending through said switches, means in a particular one of said switches to maintain a potential on said control circuit to hold the other of said switches against release, means for momentarily removing said potential to cause the release of said other switches without releasing said particular switch, and timing means for causing the release of said last mentioned switch.

7. In a telephone system, a calling line and a called line, selector switches and a connector switch for setting up a connection between said lines, release control means in said connector responsive to the restoration of the calling subscriber's receiver for causing the immediate release of said selectors without releasing said connector, means controlled by the called line for causing the immediate release of the connector after said selectors have released, and time measuring means for effecting the release of said connector in case the called subscriber does not replace his receiver.

8. In a telephone system, a calling line and a called line, selector switches and a connector switch for setting up a connection between said lines, release control means in said connector responsive to the restoration of the calling subscriber's receiver for causing the immediate release of said selectors without releasing said connector, means controlled by the called line for causing the immediate release of the connector after said selectors have released, a time measuring device responsive to the replacement of the calling subscriber's receiver to begin counting a period of time, and means effective at the end of said period to release the connector switch if the called party still has his receiver off the switchhook.

9. The combination in a telephone system of

lines, a selective switch for establishing connections to said lines, a connecting circuit incoming to said switch, means for setting said switch, means for maintaining a potential on said circuit to guard the switch against seizure, a source of current connected to said incoming circuit, means for removing said guarding potential and for disconnecting said source of current from said incoming circuit while the switch remains in its set condition, and means for replacing the guarding potential to prevent the seizure of said switch.

10. The combination in a telephone system of lines, a selective switch for establishing connections to said lines, a connecting circuit incoming to said switch, means for setting said switch, means for maintaining a potential on said circuit to guard the switch against seizure, a source of current connected to said incoming circuit, means effective while said switch remains in its set condition for removing said guarding potential and for disconnecting said source to prevent the flow of current in said incoming circuit in case the switch is seized while unguarded, and means for replacing the guarding potential on said incoming circuit.

11. The combination in a telephone system of lines, a connector switch, a trunk leading to said connector switch, selectors for establishing a connection over said trunk to said connector, means for setting said connector to extend a connection to one of said lines, means in the connector for maintaining a guarding condition on said connection, a source for supplying current to the established connection, means in the connector for connecting said source to said trunk, means effective while said connector remains in its set condition for removing the guarding condition to cause the release of said selectors and to disconnect said source from said trunk, and means for restoring said guarding condition to prevent seizure of said connector by one of said selectors.

12. In a telephone system, subscribers' lines, a connector switch for making connections with said lines, a trunk incoming to said connector having terminals, means in said connector for placing a busy and a holding potential on said terminals, selector switches for establishing a connection to said trunk, means for setting said connector switch, a source for supplying current to the established connection, means in said connector for connecting said source to said incoming trunk, means effective while said connector remains in its set condition for removing said busy potential to cause the release of said selector switches and to disconnect said source from said trunk, and means for restoring said busy potential to prevent the seizure of said connector by one of said selectors.

13. In a telephone system, a calling line and a called line, a connector switch for making a connection to the called line, a trunk circuit incoming to said connector provided with connecting terminals, selector switches for seizing said terminals to extend a connection to said connector switch, means for setting said connector switch, means in said connector switch for maintaining a busy and a holding potential on said incoming trunk terminals, a source for supplying current to the established connection, means in said connector for connecting said source to said incoming trunk, means controlled by the calling subscriber for removing said potential to cause the release of said selector switches and for disconnecting said source of current from said trunk without releasing said connector switch, means

for restoring said potential to prevent the reseizure of said connector by one of said selectors, and means controlled by the called subscriber for releasing said connector switch.

- 5 14. In a telephone system, a calling line and a called line, a connector switch for making a connection to the called line, a trunk circuit incoming to said connector provided with connecting terminals, selector switches for seizing said terminals to extend a connection to said connector switch, means for setting said connector switch, means in said connector switch for maintaining a busy and a holding potential on said incoming trunk terminals, a source for supplying current to the established connection, means in the connector switch for connecting said source to the incoming trunk, means effective when the called subscriber answers for reversing the direction of current flow from said source, means effective while said connector remains in its set condition for removing the busy potential from said trunk to cause the release of said selectors and for disconnecting said source from said trunk, and means for restoring said busy potential to prevent reseizure of said connector by one of said selector switches.

- 15 15. The combination in a telephone system of a calling line and a called line, a connector switch, a trunk incoming thereto, selector switches for extending a connection from the calling line to said connector switch, means for operating said connector switch to establish a connection to the called line, means for maintaining a potential on said trunk circuit, a source for supplying current to the established connection, means in the connector for connecting said source to said incoming

ing trunk, means effective when the called subscriber answers for reversing the direction of current flow from said source, means in the established connection responsive to such reversal of current, means effective while said connector remains in its set condition for removing said potential to cause the release of said selectors and for disconnecting said source from said trunk, and means for restoring said potential to prevent the reseizure of said connector by one of said selectors.

16. The combination in a telephone system of a calling line and a called line, a connector switch having a trunk incoming thereto, selector switches for establishing a connection from the calling line to said connector switch, means for operating said connector to complete the connection to the called line, means in the connector switch for maintaining a potential on said trunk, a source for supplying current to the established connection, means in the connector switch for connecting said source to said incoming trunk, means responsive to the replacement of the calling subscriber's receiver for removing said potential to cause the release of said selector switches without releasing said connector and for disconnecting said source from said trunk, means for restoring said potential to said trunk to prevent reseizure of the connector by one of said selectors, means controlled by the called subscriber for releasing said connector switch, and time controlled means for releasing said connector switch in case the called subscriber fails to replace his receiver on the switchhook.

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