May 7, 1940. P. BAKKER 2,199,534

TELEPHONE SYSTEM

Filed Nov. 12, 1938 3 Sheets-Sheet 1

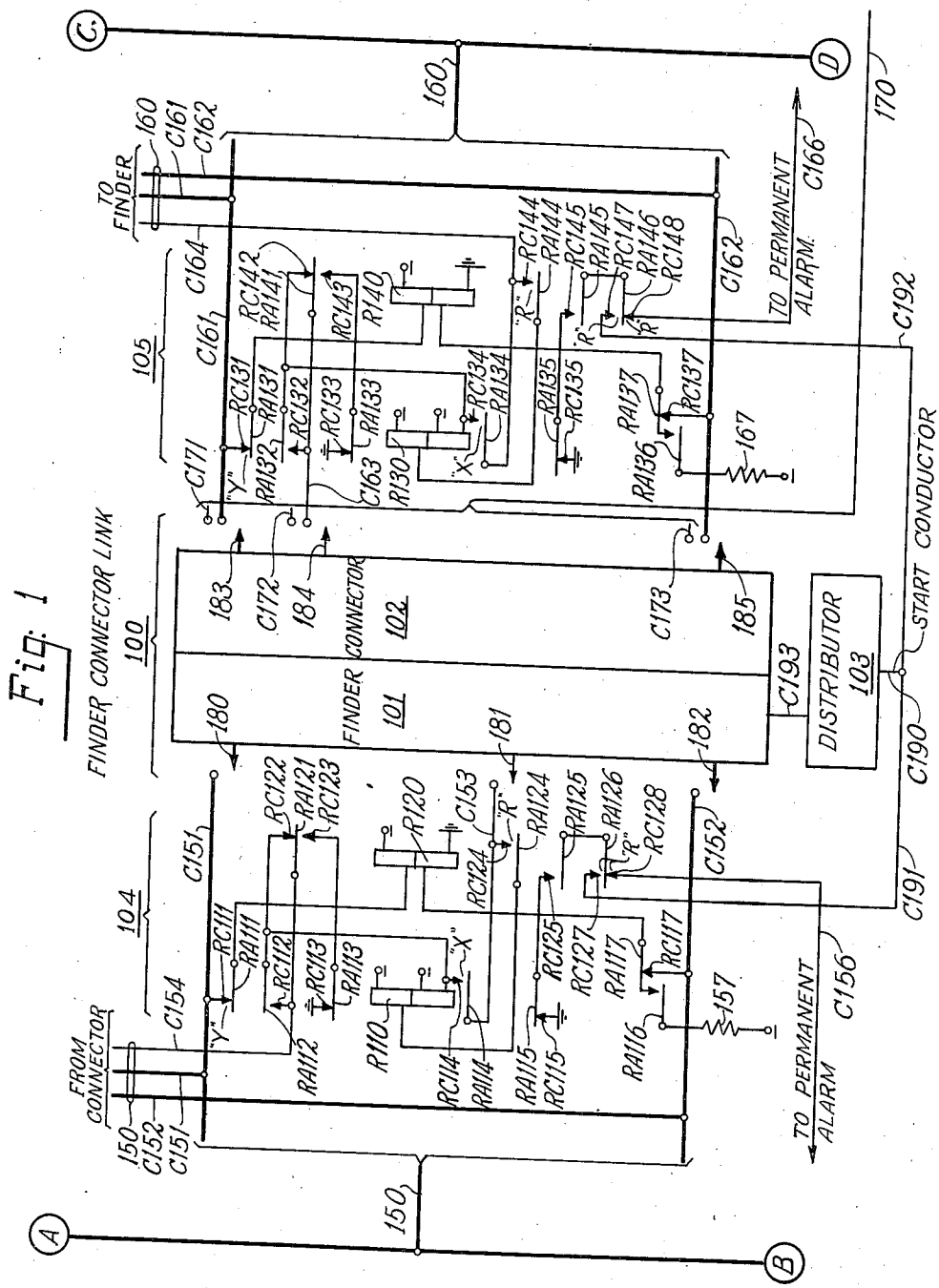

Fig. 1

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TELEPHONE SYSTEM

Filed Nov. 12, 1938 3 Sheets-Sheet 2

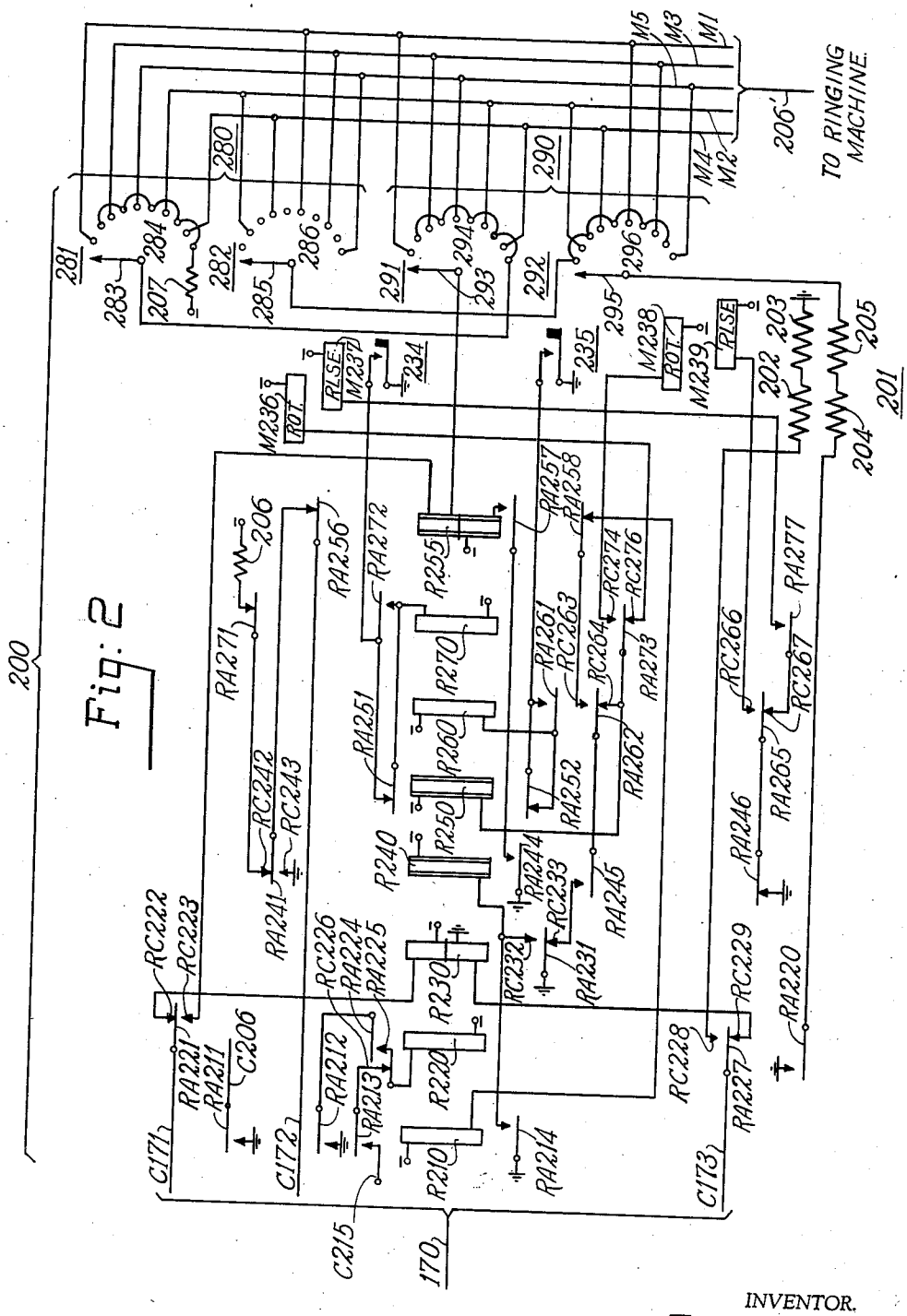

Fig. 2

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TELEPHONE SYSTEM

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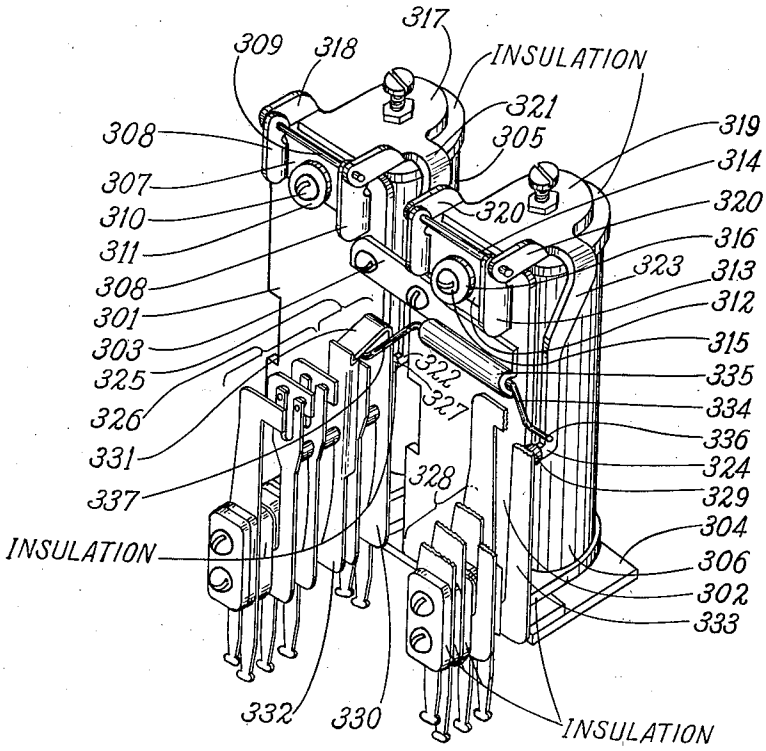

Fig. 3

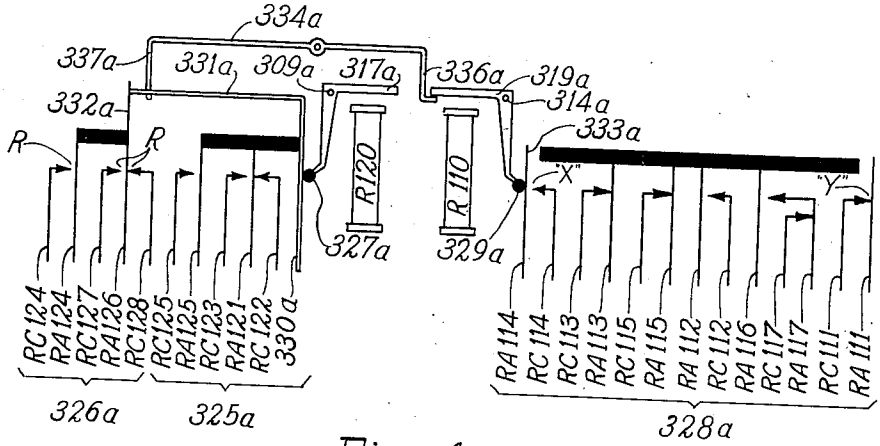

Fig. 4

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UNITED STATES PATENT OFFICE

2,199,534

TELEPHONE SYSTEM

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Application November 12, 1938, Serial No. 239,990

26 Claims. (Cl. 179—17)

The present invention relates to automatic telephone systems and more particularly to improved line circuits associated with the lines thereof.

In an automatic telephone system, usually a line circuit is individually associated with each line thereof, which line circuit conventionally comprises separate and distinct line, cut-off and lockout relays mounted upon a supporting panel. These three relays are ordinarily so connected and arranged that the automatic switches in the system having access to a line are controlled in accordance with the various operations thereof to set up, by way of the line, outgoing call connections from and incoming call connections to a subscriber substation associated with the line, and that the line is marked as busy to the automatic switches having access thereto in the event a fault appears upon the line. Furthermore, these relays are so connected and arranged that the automatic switches in the system having access to the line are controlled in accordance with other operations thereof to set up, by way of the line, reverting call connections between two of the subscriber substations associated with the line, in the event the line is of the multiparty type.

While line circuits of the type briefly described above are entirely satisfactory in operation, they are more expensive to manufacture and to maintain in service than is desirable, primarily due to the fact that three separate and distinct relays are required in each line circuit in order to render the previously mentioned services by way of the associated line.

In order to reduce the manufacturing and maintenance costs of line circuits, improved line circuits disclosed in the copending application of Clarence E. Lomax, Serial No. 234,751, filed October 13, 1938, were developed. Also, in the above-mentioned Lomax application, a combined line and cut-off relay is disclosed, which is incorporated in the improved line circuits disclosed therein. Briefly, the combined line and cut-off relay disclosed in the above-mentioned Lomax application comprises a support, line and cut-off magnets carried by the support, contact actuating members respectively associated with the magnets, a contact set operatively associated with each of the members, and a latching arrangement for controlling the operation of the member associated with the line magnet in two steps. The latching arrangement is controlled by the operation of the member associated with the cut-off magnet and is so constructed and arranged that the member associated with the line magnet is only partially operated when the line magnet winding is energized prior to the energization of the cut-off magnet winding, that this member is fully operated when the line magnet winding is energized subsequent to the energization of the cut-off magnet winding, and that this member is operated from a partially operated position to a fully operated position when the cut-off magnet winding is energized subsequent to and while the line magnet winding is energized. The contact sets operatively associated with these members are controlled in accordance with the various operations thereof.

Also the line circuits disclosed in the previously mentioned Lomax application embody line and cut-off magnet control circuits, automatic switch control circuits and line marking circuits, which are controlled by the contact sets, and which are so connected and arranged that the automatic switches in the system are controlled thereby to render, by way of a subscriber line with which the line circuit is associated, calling, called and reverting call services to the subscriber substations associated with the subscriber line.

Although the improvements as disclosed in the previously mentioned Lomax application considerably reduce the manufacturing and maintenance costs of line circuits, further reductions in these costs are desirable and may be realized by further simplifying the various circuits embodied in the line circuits and by employing in the line circuits improved combined line and cut-off relays of the construction and arrangement disclosed in the copending application of John E. Ostline, Serial No. 240,001, filed November 12, 1938.

The combined line and cut-off relay disclosed in the above-mentioned Ostline application comprises a support, line and cut-off magnets carried by the support, a movable contact actuating member operatively associated with the line magnet, a movable contact actuating member operatively associated with the cut-off magnet, a first contact set operatively associated with the first-mentioned member, a second contact set operatively associated with the second-mentioned member, a third contact set, and mechanical means for operatively associating the third contact set with the first-mentioned member. Each of the contact sets has a normal position and is movable away from its normal position in response to the operation of the one of the members with which it is operatively associated. Also, the combined line and cut-off relay comprises means for biasing each of the contact sets to its normal position, and means controlled by the operation of the second-mentioned member for releasing the mechanical means, whereby the third contact set is not moved away from its normal position in the event the first-mentioned member is operated subsequent to the operation of the second-mentioned member and the third contact set is returned to its normal position in the event the second-mentioned member is operated

subsequent to the operation of the first-mentioned member. Also, the mechanical means is reset when both of the members are restored.

Accordingly, it is an object of the present invention to provide an improved line circuit adapted for use in an automatic telephone system which comprises line and cut-off relays, which two relays are connected and arranged in an extremely simple manner and so related that the automatic switches in the system are controlled thereby to render, by way of a subscriber line with which the line circuit is associated, calling, called and reverting call services to the subscriber substations associated with the subscriber line.

It is another object of the invention to provide an improved line circuit of the type described adapted for use in an automatic telephone system which is extremely economical to manufacture and which is positive in operation in order to control the automatic switches in the system in a thoroughly reliable manner, whereby the desired services may be rendered to the subscriber substations associated with the subscriber lines in the system.

A further object of the invention is to provide an improved automatic telephone system in which there are incorporated improved line circuits of the type described, each including an improved combined line and cut-off relay of the construction noted.

The features of the present invention are illustrated as being incorporated in an automatic telephone system including a plurality of subscriber lines, some of the lines being of the multiparty type, each line having an improved line circuit of the type described incorporating an improved combined line and cut-off relay of the construction noted individually associated therewith, and a number of finder-connector links for setting up connections between the various lines. A number of subscriber substations are associated with each of the lines of the multiparty type; and a distributor of the preselective type is provided for the purpose of assigning idle ones of the links to the use of calling ones of the lines in a predetermined order.

In accordance with one feature of the invention, the line circuit is adapted for use in an automatic telephone system including a line accessible to an automatic switch and comprises, in combination, line and cut-off relays, a first contact set operatively associated with the line relay, a second contact set operatively associated with the cut-off relay, a third contact set, and means normally effective operatively to associate the third contact set with the line relay, each of the contact sets having a normal position and being operative away from its normal position in response to the operation of the one of the relays with which it is operatively associated. Also, the system comprises means responsive to the creation of a calling condition on the line for causing the line relay to be operated, means responsive to the seizure of the line by the automatic switch for causing the cut-off relay to be operated, means controlled by the operation of the cut-off relay for rendering the first-mentioned means ineffective, means controlled by the operation of the second contact set away from its normal position for causing the line relay to be operated, and automatic switch control circuits and line marking circuits governed by the contact sets. More particularly, the means which is normally effective operatively to associate the third contact set with the line relay comprises a blocking or latching element which is tripped when the cut-off relay is operated. Furthermore, means is provided for biasing each of the contact sets to its normal position, whereby the third contact set is not operated away from its normal position in the event the line relay is operated subsequent to the operation of the cut-off relay and the third contact set is returned to its normal position in the event the cut-off relay is operated subsequent to the operation of the line relay. Finally, the latching element is reset when both of the line and cut-off relays are restored.

In accordance with another feature of the invention, a telephone system is provided which comprises a line, a number of finder and connector switches having access to the line, a line circuit of the connection and arrangement described associated with the line, and a distributor associated with the finder switches and operative to cause an idle one of the finder switches to operate and seize a line marked as a calling line. Also, the system comprises means responsive to the creation of a calling condition on the line for causing the line relay to be operated, means controlled by the operation of the first and third contact sets away from their normal positions for initiating operation of the distributor and for marking the line as a calling line, means responsive to the seizure of the line by one of the finder switches for causing the cut-off relay to be operated, and means controlled by the operation of the cut-off relay for releasing the latching element, whereby the third contact set is returned to its normal position. Furthermore, the system comprises means controlled by the operation of the second contact set away from its normal position for causing the line relay to be retained operated, means controlled by the return of the third contact set to its normal position for arresting the operation of the distributor, means for releasing the one finder switch, means responsive to the release of the one finder switch for causing the cut-off relay to be restored, means controlled by the return of the second contact set to its normal position for causing the line relay to remain operated in the event a calling condition remains on the line, and means controlled when the first contact set is operated away from its normal position and the second contact set is returned to its normal position for marking the line as busy to the connector switches.

In accordance with a further feature of the invention, the telephone system comprises means controlled by the operation of the first contact set away from its normal position for marking the line as busy to the connector switches and signal means controlled when the first contact set is operated away from its normal position and the second and third contact sets are returned to their normal positions.

In accordance with a further feature of the invention, the telephone system comprises a line, a plurality of subscriber substations associated with the line, a number of finder-connector links having access to the line, a line circuit of the connection and arrangement described associated with the line, and a distributor associated with the links and operative to cause the finder switch of an idle one of the links to operate and seize a line marked as a calling line. Also, the system comprises means responsive to the creation of a calling condition on the line for causing the line

relay to be operated, means controlled by the operation of the first and second contact sets away from their normal positions for initiating operation of the distributor and for marking the line a calling line, means responsive to the seizure of the line by the finder switch of the one link for causing the cut-off relay to be operated, and means controlled by the operation of the cut-off relay for releasing the latching element, whereby the third contact set is returned to its normal position. Furthermore, the system comprises means controlled by the operation of the second contact set away from its normal position for causing the line relay to be retained operated, means controlled by the return of the third contact set to its normal position for arresting the operation of the distributor, impulse responsive means included in the selector switch of the one link and operative to cause ringing current to be projected by way of the one link over the line subsequent to the termination of the calling condition thereon and to cause the line relay to remain operated, and means responsive to the answering of the call at a called one of the substations for causing the one link to be released and for creating a new calling condition on the line. Finally, the system comprises means responsive to the release of the one link for causing the cut-off relay to be restored, means responsive to the creation of the new calling condition on the line for causing the line relay to remain operated subsequent to the return of the second contact set to its normal position, and means controlled when the first contact set is operated away from its normal position and the second contact set is returned to its normal position for marking the line as busy to the connector switches of the links.

Further features of the invention pertain to the particular arrangement of the circuit elements thereof, whereby the above-outlined and additional features are attained.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings in which Figs. 1 and 2, taken together, illustrate diagrammatically a telephone system including improved line circuits and embodying the present invention; Fig. 3 is a perspective view of a combined line and cut-off relay adapted to be incorporated in the line circuits shown in Fig. 1; and Fig. 4 illustrates diagrammatically the arrangement of the switch springs associated with the combined line and cut-off relay when it is incorporated in the line circuits shown in Fig. 1.

Referring now more particularly to Figs. 1 and 2 of the drawings, the telephone system there illustrated comprises an exchange having a plurality of subscriber lines including the subscriber lines 150 and 160 terminating thereat, and provided with a plurality of finder-connector links including the link 100 for setting up connections between the various subscriber lines. Also a distributor 103 is provided for assigning idle ones of the links to the use of calling ones of the subscriber lines; and a number of reverting call switches, including the reverting call switch 200, are provided for the purpose of projecting code ringing current over a subscriber line when a reverting call is initiated thereon. More specifically, the exchange has an ultimate capacity of one hundred lines, and the number of links is determined by the amount of traffic which the exchange is required to handle, usually ten links being adequate to render satisfactory service.

Each of the links may be identical to the link 100 which comprises a finder portion or switch 101 and a connector portion or switch 102, each having access to each subscriber line in the system. The finder switch and the connector switch included in each link may be one of any of a number of well-known types. However, it is preferable that each of these switches includes a switching mechanism of the Strowger type and the usual control apparatus therefor, the wipers of the switching mechanism included in the finder switch 101 being illustrated at 180, 181 and 182, and the wipers of the switching mechanism included in the connector switch 102 being illustrated at 183, 184 and 185. Also the connector switch 102 comprises impulse responsive apparatus of any desired type for projecting code ringing current over an idle called subscriber line after it has been seized by the switching mechanism included therein, which is so connected and arranged that a divided ringing circuit may be employed in the system. The distributor 103 may be one of any of a number of well-known types. However, it is preferable that the distributor 103 is of the preselective type, such that an idle link is selected to be assigned to the use of a calling line prior to the initiation of a call on the line.

At least a number of the subscriber lines terminating at the exchange are of the party type, the subscriber lines 150 and 160 being party lines, each serving a number of subscriber substations, respectively, including the subscriber substations A, B and C, D. Each of the subscriber substations is provided with a telephone instrument, a dial mechanism, and a ringer. The subscriber substations associated with each party line are arranged in two groups, the ringer at each substation in the first group being connected between one line conductor of the subscriber line and ground, and the ringer at each substation in the second group being connected between the other line conductor of the subscriber line and ground, whereby a divided ringing circuit is employed in the system.

A line circuit is individually associated with each subscriber line in the system, the line circuit 104 being individually associated with the subscriber line 150, and the line circuit 105 being individually associated with the subscriber line 160. The line circuit 104 comprises a combined line and cut-off relay including a line magnet or relay R120 and a cut-off magnet or relay R110; and the line circuit 105 comprises a combined line and cut-off relay including a line magnet or relay R140 and a cut-off magnet or relay R130. Preferably, the line circuits are of identical connection and arrangement, each comprising a combined line and cut-off relay of the construction and arrangement of that disclosed in the previously mentioned copending Ostline application and shown in Fig. 3. Also, each of the combined line and cut-off relays includes a switch spring assembly of the construction and arrangement shown in Fig. 4.

Each of the reverting call switches may be identical to the reverting call switch 200 which comprises two minor switches 280 and 290, a line relay R230, a hold relay R240, two transfer relays R260 and R270, a ring cut-off relay R255, a switch-

ing-through relay R220, two control relays R210 and R250, the control and controlled circuits therefor, and a transformer 201. The minor switch 280 comprises two rotary switches 281 and 282 provided with contact banks 284 and 286, respectively, and associated wipers 283 and 285, respectively, a rotary magnet M236 for simultaneously rotating the wipers of the rotary switches 281 and 282, and a release magnet M237 for releasing the wipers of the rotary switches 281 and 282 and for causing these wipers to be returned to their normal positions. Also two switch springs 234 are associated with the wipers of the rotary switches 281 and 282, which are actuated into engagement when these wipers are rotated by the rotary magnet M236 away from their normal positions. The minor switch 290 comprises two rotary switches 291 and 292 provided with contact banks 294 and 296, respectively, and associated wipers 293 and 295, respectively, a rotary magnet M238 for simultaneously rotating the wipers of the rotary switches 291 and 292, and a release magnet M239 for releasing the wipers of the rotary switches 291 and 292 and for causing these wipers to be returned to their normal positions. Also two switch springs 235 are associated with the wipers of the rotary switches 291 and 292, which are actuated into engagement when these wipers are rotated by the rotary magnet M238 away from their normal positions. Also it is noted that the reverting call switch 200 is connected and arranged to project code ringing current over a calling subscriber line by way of the trunk line 170 when a connection is established therebetween by way of an operated one of the links, in such a manner that a divided ringing circuit may be employed in the system.

As best shown in Fig. 3 of the drawings, the combined line and cut-off relay which is incorporated in each of the line circuits employed in the system comprises a supporting plate including two portions 301 and 302 suitably secured together by an arrangement including a strap 303 and an outwardly extending plate 304. The portions 301 and 302 of the supporting plate respectively carry line and cut-off magnets 305 and 306 arranged in spaced parallel relationship with respect to each other and to the corresponding portions of the supporting plate, each being provided with a suitable energizing winding. Also, the magnets 305 and 306 are arranged closely adjacent to each other and comprise, together with the portions 301 and 302 of the supporting plate, a unitary structure. A supporting bracket 307 provided with two upwardly extending arms 308 carrying a pivot pin 309 is secured to the upper portion 301 of the supporting plate by an arrangement comprising a screw 310 and a washer 311; and a supporting bracket 312 provided with two upwardly extending arms 313 carrying a pivot pin 314 is secured to the upper portion 302 of the supporting plate by an arrangement comprising a screw 315 and a washer 316. An armature 317 provided with two rearwardly extending arms 318 is pivotally supported on the pivot pin 309 adjacent the pole face of the core of the line magnet 305; and an armature 319 provided with two rearwardly extending arms 320 is pivotally supported on the pivot pin 314 adjacent the pole face of the core of the cut-off magnet 306. The armature 317 is provided with a downwardly extending arm 321 having a rearwardly projecting finger 322 on the outer end thereof extending to the rear of the portion 301 of the supporting plate adjacent the right-hand edge thereof; and the armature 319 is provided with a downwardly extending arm 323 having a rearwardly projecting finger 324 on the outer end thereof extending to the rear of the portion 302 of the supporting plate adjacent the right-hand edge thereof. Two contact sets or switch spring assemblies 325 and 326, each comprising a plurality of individual flexible switch springs suitably insulated from each other and from the portion 301 of the supporting plate, are secured to the rear side of the portion 301 of the supporting plate and cooperate with an insulating button 327 carried by the finger 322 in such a manner that the individual switch springs in these switch spring assemblies are actuated into engagement and disengagement with each other in a predetermined manner, when the armature 317 is rotated about the pivot pin 309. Also, a contact set or switch spring assembly 328, comprising a plurality of individual flexible switch springs suitably insulated from each other and from the portion 302 of the supporting plate, is secured to the rear side of the portion 302 of the supporting plate and cooperates with an insulating button 329 carried by the finger 324 in such a manner that the individual switch springs in this switch spring assembly are actuated into engagement and disengagement with each other in a predetermined manner, when the armature 319 is rotated about the pivot pin 314.

More particularly, the switch spring assembly 325 comprises a spring 330 provided with a flexible rearwardly extending flange or latching element 331 adjacent the upper portion thereof which normally abuts or engages the upper portion of a spring 332 included in the switch spring assembly 326. Accordingly, when the armature 317 is rotated in a clockwise direction about the pivot pin 309, as viewed in Fig. 3, the insulating button 327 carried by the finger 322 engages the spring 330 and flexes the upper portion thereof rearwardly. This rearward movement of the spring 330 actuates the individual switch springs included in the switch spring assembly 325 into engagement and disengagement with each other in a predetermined manner more fully described subsequently. Furthermore, the flange 331 provided on the upper portion of the spring 330 engages the upper portion of the spring 332 and flexes the upper portion thereof rearwardly. This rearward movement of the spring 332 actuates the individual switch springs included in the switch spring assembly 326 into engagement and disengagement with each other in a predetermined manner more fully described subsequently. When the armature 319 is rotated in a clockwise direction about the pivot pin 314, as viewed in Fig. 3, the insulating button 329 carried by the finger 324 engages a switch spring 333 included in the switch spring assembly 328 and flexes the upper portion thereof rearwardly. This rearward movement of the switch spring 333 actuates the individual switch springs included in the switch spring assembly 328 into engagement and disengagement with each other in a predetermined manner more fully described subsequently.

As previously noted, the switch spring assemblies 325 and 326 are normally simultaneously actuated away from their normal positions by the movement of the armature 317. However, an arrangement is provided for rendering the actuation of the switch spring assembly 325 independent of the actuation of the switch spring assembly 326 and for releasing the switch spring as-

sembly 326, thereby to cause the latter switch spring assembly to be returned to its normal position in the event that it is actuated. This arrangement comprises a rocking bar 334 comprising a bearing portion rotatably secured between the rear wall of the portion 302 of the supporting plate and a tab 335 formed integral with the strap 303 and arranged closely adjacent to the rear wall of the portion 302 of the supporting plate. Furthermore, the rocking bar 334 comprises an outwardly and downwardly extending arm 336 arranged in the path of movement of the arm 323 carried by the armature 319 and an outwardly and rearwardly extending arm 337 arranged beneath the flange 331 provided on the upper portion of the spring 330 included in the switch spring assembly 325. When the armature 319 is rotated in a clockwise direction about the pivot pin 314, the arm 323 thereon engages the arm 336 on the rocking bar 234, thereby to cause the rocking bar to be rotated in a clockwise direction upon its bearing, as viewed in Fig. 3. When the rocking bar 334 is rotated in a clockwise direction upon its bearing, the arm 337 thereof engages the flange 331 provided on the upper portion of the spring 330 included in the switch spring assembly 325 and flexes the flange 331 upwardly and out of abutting relation with the upper portion of the spring 332 included in the switch spring assembly 326. At this time, if the armature 317 occupies a non-operated position and is subsequently operated, only the switch spring assembly 325 will be actuated. However, if the armature 317 occupies an operated position, the switch spring assembly 326 will be released and returned to its normal position due to the fact that the outer end of the flange 331 provided on the upper portion of the spring 330 is flexed out of abutting relation with the upper portion of the spring 332. Thus, it will be apparent that in the event the winding of the line magnet 305 is energized prior to the energization of the winding of the cut-off magnet 306, the switch spring assemblies 325 and 326 are simultaneously actuated away from their normal positions. However, in the event the winding of the cut-off magnet 306 is energized prior to the winding of the line magnet 305, only the switch spring assembly 325 is actuated upon the energization of the winding of the line magnet 305. Finally, in the event that the winding of the cut-off magnet 306 is energized subsequent to the energization of the winding of the line magnet 305, the switch spring assembly 326 is released and returned to its normal position when the winding of the cut-off magnet is energized. The switch spring assembly 328 is actuated away from its normal position directly in accordance with the energization of the winding of the cut-off magnet 306 and the actuation thereof is independent of the sequence of energizing the windings of the line and cut-off magnets 305 and 306, respectively.

Referring now more particularly to Fig. 4 of the drawings, it will be observed that the switch spring assemblies associated with the line and cut-off magnets R120 and R110, respectively, corresponding to the switch spring assemblies incorporated in the line circuit 104, are so constructed and arranged that, when the line magnet R120 is energized, the armature indicated at 317a is rotated in a clockwise direction about the pivot pin 309a, thereby to cause the insulating button 327a carried thereby to flex the upper portion of the spring 330a. This movement of the spring 330a is effective to actuate the switch spring assembly 325a, thereby to move the switch springs RA125 and RC125 into engagement, to move the switch springs RA121 and RC122 into disengagement, and to move the switch springs RA121 and RC123 into engagement. Also, this movement of the spring 330a causes the flange 331a carried by the upper portion thereof to engage the spring 332a included in the switch spring assembly 326a, thereby to actuate the latter switch spring assembly. This actuation of the switch spring assembly 326a is effective to move the switch springs RA126 and RC128 into disengagement, to move the swtich springs RA126 and RC127 into engagement, and to move the switch springs RA124 and RC124 into engagement. This movement of the switch springs RA124, RC124 and RA126, RC127 is effective to close the R contacts associated therewith; and this movement of the switch springs RA126, RC128 is effective to open the R contacts associated therewith. Subsequently, when the cut-off magnet R110 is energized, the armature indicated at 319a is rotated in a counterclockwise direction about the pivot pin 314a, thereby to cause the insulating button 329a carried thereby to engage the switch spring 333a included in the switch spring assembly 328a and flex the upper portion thereof, thereby to actuate the individual switch springs included in this switch spring assembly. This movement of the switch spring 333a is effective to move the switch springs RA114 and RC114 into engagement, thereby to close the X contacts associated therewith. Subsequent movement of the switch spring 333a is effective to move the switch springs RA113 and RC113 into disengagement, to move the switch springs RA115 and RC115 into disengagement, to move the switch springs RA112 and RC112 into engagement, to move the switch springs RA116 and RA117 into engagement, and finally, to move the switch springs RA117 and RC117 into disengagement. Final movement of the switch spring 333a is effective to move the switch springs RA111 and RC111 into disengagement, thereby to open the Y contacts associated therewith.

Also, when the armature 319a is rotated in a counterclockwise direction about the pivot pin 314a, the arm 336a of the rocking bar 334a is engaged, thereby to cause the rocking bar to be rotated in a clockwise direction about its pivot. This rotation of the rocking bar 334a is effective to cause the arm 337a thereof to flex the outer end of the flange 331a provided on the upper portion of the spring 330a included in the switch spring assembly 325a out of engagement with the upper portion of the spring 332a included in the switch spring assembly 326a. The switch spring assembly 326a is then released and the individual switch springs thereof are actuated to their normal positions, thereby to move the switch springs RA124, RC124 and RA126, RC127 into disengagement and to move the switch springs RA126, RC128 into engagement. Also, it is noted that in the event the cut-off magnet R110 is energized prior to the energization of the line magnet R120, the switch spring assembly 328a is actuated, in the previously described manner, incident to the energization of the cut-off magnet R110, and the flange 331a provided on the upper portion of the spring 330a included in the switch spring assembly 325a is flexed out of engagement with the upper portion of the spring 332a included in the switch spring assemby 326a. Accordingly, when the line magnet R120 is then energized, only the

switch spring assembly 325a is actuated, in the previously described manner.

The connection and arrangement of the system will best be understood from a consideration of the following description, with reference to Figs. 1 and 2 of the drawings, of the operation of the apparatus incorporated therein to set up the different connections between the various subscriber lines.

A call which is to be extended from the subscriber substation A to the subscriber substation C is first initiated at the substation A by removing the receiver of the telephone instrument thereat from its hook, thereby to complete a bridge path at the telephone instrument at the substation A between the line conductors C151 and C152 of the subscriber line 150 extending to the substation A. When this bridge path is completed between the line conductors of the subscriber line 150, a bridge circuit is completed for energizing in series the upper and lower windings of the line magnet R120 in the line circuits 104 individually associated with the subscriber line 150, which extends from battery at the upper winding of R120 by way of the upper winding of R120, RA111, RC111, C151, the bridge path at the substation A between C151 and C152, C152, RC117, RA117 and the lower winding of R120 to ground. When energized over the above-traced circuit, the line magnet R120 operates, thereby to actuate the two switch spring assemblies associated therewith in order to close the R contacts associated with the switch springs RA124, RC124 and RA126, RC127, and to open the R contacts associated with the switch springs RA126 and RC128. More particularly, the line magnet R120 completes, at RA125 and RC125 and at RA126 and RC127, a path for applying ground potential to the start conductor C190 extending into the distributor 103, this path extending from ground at RC115 by way of RA115, RC125, RA125, RA126, RC127 and C191 to the start conductor C190. This application of ground potential to the start conductor C190 initiates the operation of the distributor 103 and causes the distributor to operate and assign the previously selected idle link to the use of the calling subscriber line 150. Assuming that the illustrated link 100 is assigned by the distributor 103 to the use of the calling subscriber line 150, the distributor also marks with ground potential by way of the conductor C193 the level in the contact bank of the Strowger mechanism included in the finder switch 101, wherein the calling subscriber line 150 terminates. Also, the line magnet R120 completes, at RA124 and RC124, a path for applying battery potential to the control conductor C153, this path extending from battery at the upper winding of the cut-off magnet R110 by way of the upper winding of R110, RA124 and RC124 to the control conductor C153. This application of battery potential to the control conductor C153 marks the radial position of the contact set in the level in the contact bank of the Strowger mechanism included in the finder switch 101, wherein the subscriber line 150 terminates. Further, the line magnet R120 completes, at RA121 and RC123, a path for applying ground potential to the control conductor C154 of the subscriber line 150 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, thereby to mark the subscriber line 150 as busy thereto immediately and prior to the time the finder switch 101 of the link 100 operates to seize this subscriber line, this path extending from ground at RC113 by way of RA113, RC123 and RA121 to the control conductor C154.

The Strowger mechanism included in the finder switch 101 then operates to move the wipers 180, 181 and 182 thereof in the vertical direction to the level wherein the calling subscriber line 150 terminates. This Strowger mechanism then operates to move the wipers thereof in the radial direction to the radial position of the contact set wherein the calling subscriber line 150 terminates, at which time the wipers 180 and 182 thereof engage the contacts terminating the line conductor C151 and C152, respectively, and the wiper 181 engages the contact terminating the control conductor C153 of the calling subscriber line 150. The presence of battery potential upon the control conductor C153 completes a circuit for energizing a relay in the finder switch 101 operative to arrest further operation of the Strowger mechanism included therein, which relay also operates to complete a path for applying ground potential to the wiper 181. This application of ground potential to the wiper 181 completes a circuit for energizing in multiple the upper and lower windings of the cut-off magnet R110. This circuit extends from the grounded wiper 181 by way of the contact terminating the control conductor C153 to C153, one branch of this path extending from C153 by way of RC124, RA124 and the upper winding of R110 to battery, and the other branch of this path extending from C153 by way of RA114, RC114 and the lower winding of R110 to battery. Also, this application of ground potential to the wiper 181 prepares a path, traced hereinafter, for applying ground potential to the control conductor C154 of the subscriber line 150 extending to the contact banks of the Strowger mechanism included in the links of the connector switches having access thereto, thereby subsequently to mark the subscriber line 150 as busy to the connector switches of these links.

When energized over the above-traced circuit, the cut-off magnet R110 operates to complete, at RA116 and RA117, a holding circuit for energizing the lower winding of the line magnet R120, this circuit extending from battery at the resistor 157 by way of the resistor 157, RA116, RA117 and the lower winding of R120 to ground. Also, the cut-off magnet R110 interrupts, at RA117 and RC117 and at RA111 and RC111, points in the original bridge circuit for energizing the upper and lower windings of the line magnet R120, thereby to free the line conductors C151 and C152 of the subscriber line 150 of impedance elements. Further, the cut-off magnet completes, at RA112 and RC112, and at RA114 and RC114, the previously mentioned path for applying ground potential to the control conductor C154, this path extending from the grounded wiper 181 by way of the contact terminating the control conductor C153, C153, RA114, RC114, RA112 and RC112 to the control conductor C154. Further, the cut-off magnet R110 interrupts, at RA113 and RC113, a point in the previously traced path for applying ground potential at RC113 to the control conductor C154 and interrupts, at RA115 and RC115, a point in the previously traced path for applying ground potential at RC115 to the start lead C190 extending into the distributor 103. Also, upon operating, the cut-off magnet R110 releases the latching arrangement for retaining the restoring switch spring assembly associated with the line magnet

R120 in its actuated position, thereby to allow the individual switch springs included in this switch spring assembly to be returned to their normal positions. More particularly, the switch springs RA124 and RC124 are moved into disengagement, thereby to open the R contact associated therewith; and the switch springs RA126 and RC127 are moved into disengagement, thereby to open the R contact associated therewith. Finally, the switch springs RA126 and RC128 are moved into engagement, thereby to close the R contact associated therewith. When the R contact associated with the switch springs RA124 and RC124 is opened, the previously traced circuit for energizing the upper winding of the cut-off magnet R110 is interrupted, this magnet being retained in its operated position at this time due to the completed holding circuit for energizing the lower winding thereof. When the R contact associated with the switch springs RA126 and RC127 is opened, a further point in the path for applying ground potential to the start lead C190 extending into the distributor 103 is interrupted, and when the R contact associated with the switch springs RA126 and RC128 is closed, a point in a circuit, traced hereinafter, is prepared for applying ground potential to the control conductor C156 extending to a permanent alarm device. Also, at this time, the line magnet R120 remains in its operated position due to the completed holding circuit for energizing the lower winding thereof. When ground potential is removed from the start conductor C190 extending into the distributor 103, the distributor 103 operates to select an idle link in the group of links to be assigned to the use of the next calling subscriber line, and when the finder switch 101 seizes the calling subscriber line 150, the connector switch 102 operates to condition the Strowger mechanism included therein to be responsive to dialed digits.

The subscriber at the substation A then dials the first digit of the directory number of the called subscriber line at the dial mechanism thereat, thereby to transmit a first series of impulses over the loop circuit extending by way of the subscriber line 150 between the substation A and the connector switch 102. Impulse responsive apparatus in the connector switch 102 operates in response to this first series of impulses in order to cause the wipers 183, 184, and 185 of the Strowger mechanism included therein to be moved in the vertical direction to the level in the contact bank therein, wherein the called subscriber line 160 is terminated. The subscriber at the substation A then dials the second digit of the directory number of the called subscriber line at the dial mechanism thereat, thereby to transmit a second series of impulses by way of the previously mentioned loop circuit to the connector switch 102 in order to cause the wipers noted of the Strowger mechanism included therein to be moved in the radial direction to the position of the contact set in the contact bank therein, wherein the called subscriber line 160 is terminated. The subscriber at the substation A then dials the third digit of the directory number of the called substation C at the dial mechanism thereat, thereby to transmit a third series of impulses by way of the previously mentioned loop circuit to the connector switch 102 in order to cause the connector switch to select a corresponding code ringing current to be projected over the called subscriber line 160 in the event this subscriber line is idle.

At this time the wipers 183 and 185 engage the contacts in the contact bank terminating the line conductors C161 and C162, respectively, and the wiper 184 engages the contact in the contact bank terminating the control conductor C163 of the called subscriber line 160. At this time ground potential appears upon the control conductor C163 in the event the called subscriber line 160 is busy. On the other hand, battery potential appears upon the control conductor C163 in the event the called subscriber line 160 is idle.

Assuming that the called subscriber line 160 is busy, ground potential derived in the line circuit 105 appears upon the control conductor C163 thereof, thereby to complete a path for energizing a busy relay included in the connector switch 102, which busy relay operates to cause busy tone current to be returned over the loop circuit extending to the calling subscriber substation A, in the usual manner. The production of busy tone in the receiver of the telephone instrument at the calling substation A indicates to the subscriber thereat that the desired connection cannot immediately be had due to the busy condition of the called subscriber line 160. The subscriber at the calling substation A then releases the operated link 100 and the line circuit 104 by replacing the receiver of the telephone instrument at the substation A upon its hook. The exact manner in which these operated pieces of apparatus are released is described in detail hereinafter.

Assuming that the called subscriber line 160 is idle, battery potential appears upon the control conductor C163 thereof, this battery potential being derived at the lower winding of the cut-off magnet R130 and extending therefrom by way of the lower winding of R130, RC142 and RA141 to the control conductor C163. This application of battery potential to the control conductor C163 completes a path for short-circuiting the busy relay included in the connector switch 102, thereby to cause the connector switch 102 to operate and project ringing current of the previously selected code over the called subscriber line 160 in order to cause the ringer at the substation C to operate in a characteristic manner. This characteristic operation of the ringer at the substation C indicates to the subscriber thereat that the substation C is the called substation. Also, a switch-through relay in the connector switch 102 operates to apply direct ground potential to the wiper 184. This application of direct ground potential to the wiper 184 completes a circuit for energizing the lower winding of the cut-off magnet R130, this circuit extending from the grounded wiper 184 by way of the contact terminating the control conductor C163, C163, RA141, RC142 and the lower winding of R130 to battery. When energized over the above-traced circuit, the cut-off magnet R130 operates to complete, at RA132 and RC132, a holding circuit for energizing the lower winding thereof, this circuit extending from the grounded control conductor C163 by way of RC132, RA132 and the lower winding of R130 to battery. Also, the cut-off magnet R130 completes, at RA134 and RC134, a path for applying ground potential to the control conductor C164 of the subscriber line 160 extending to the contact banks of the Strowger mechanisms included in the finder switches of the links having access thereto, thereby to mark the subscriber line 160 as busy thereto, this path extending from the grounded control conductor C163 by way of RC132, RA132, RC134 and RA134 to the control conductor C164. Further, the cut-

off magnet R130 interrupts, at RA133 and RC133, a path in the circuit for applying ground potential to the control conductor C163 when the line magnet R140 operates, and interrupts, at RA135 and RC135, a point in the path for applying ground potential to the start conductor C190 extending into the distributor 103. Finally, the cut-off magnet R130 interrupts, at RA131 and RC131 and at RA137 and RC137, points in the bridge circuit for energizing the upper and lower windings of the line magnet R140 and completes, at RA136 and RA137, a holding circuit for energizing the lower winding of the line magnet R140, this holding circuit extending from the battery at the resistor 167 by way of the resistor 167, RA136, RA137 and the lower winding of R140 to ground. Also, upon operating, the cut-off magnet R130 releases the latching arrangement for causing the two switch spring assemblies associated with the line magnet R140 to be actuated simultaneously.

When energized over the above-traced circuit, the line magnet R140 operates to actuate only the switch spring assembly directly associated therewith, thereby to interrupt, at RA141 and RC142, a point in the previously traced original circuit for energizing the lower winding of the cut-off magnet R130. The subscriber at the substation C then answers the call by removing the receiver of the telephone instrument thereat from its hook, thereby to cause the connector switch 102 to operate in order to interrupt the projection of ringing current over the called subscriber line and to complete an established communication connection between the calling subscriber line 150 and the called subscriber line 160 by way of the operated link 100.

Assuming that the release of this established connection is under the control of the last subscriber to replace the receiver of the telephone instrument at his substation upon its hook, when the last subscriber at one of the substations replaces the receiver of the telephone instrument thereat upon its hook, the operated link 100 is released in the usual manner, thereby to interrupt the established connection extending between the subscriber lines 150 and 160. When the link 100 is released, ground potential therein is removed from the wiper 181, thereby to interrupt the previously traced holding circuit for energizing the lower winding of the cut-off magnet R110. The cut-off magnet R110 then restores to interrupt, at RA114 and RC114, a further point in the holding circuit for energizing the lower winding thereof and a point in the path for applying ground potential to the control conductor C154 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto. Also, upon restoring, the cut-off magnet R110 interrupts, at RA112 and RC112, a further point in the previously traced path for applying ground potential to the control conductor C154, prepares, at RA113 and RC113, a point in the previously traced path for applying ground potential, at RC113, to the control conductor C154, and prepares, at RA115 and RC115, a point in the previously traced path for applying ground potential, at RC115, to the start conductor C190 extending into the distributor 103. Finally, the cut-off magnet R110 interrupts, at RA116 and RA117, a point in the previously traced holding circuit for energizing the lower winding of the line magnet R120 and prepares, at RA117 and RC117 and at RA111 and RC111, points in the previously traced bridge circuit for energizing the upper and lower windings of the line magnet R120.

The line magnet R120 then restores to complete, at RA121 and RC122, the previously traced path for applying battery potential, at the lower winding of the cut-off magnet R110, to the control conductor C154 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, thereby to mark the subscriber line 150 as idle. Also, the line magnet R120 interrupts, at RA121 and RC123, a point in the previously traced path for applying ground potential, at RC113, to the control conductor C154 and interrupts, at RA125 and RC125, a further point in the previously traced path for applying ground potential, at RC115, to the start conductor C190. Finally, the line magnet R120 interrupts, at RA125 and RC125, a point in a path, traced hereinafter, for applying ground potential to the control conductor C156 extending to a permanent alarm device. Also, it is noted that when both the cut-off magnet R110 and the line magnet R120 restore, the latching arrangement for causing the two switch spring assemblies associated with the line magnet R120 to be actuated simultaneously is reset. At this time the subscriber line 150 is marked as idle to the finder and connector switches of the links having access thereto and the line circuit 104 is completely released.

Also, when the link 100 is released, ground potential therein is removed from the wiper 184, thereby to interrupt the previously traced holding circuit for energizing the lower winding of the cut-off magnet R130. The cut-off magnet R130 then restores, thereby to interrupt, at RA132 and RC132, a further point in the holding circuit for energizing the lower winding thereof and a point in the previously traced path for applying ground potential to the control conductor C164 of the subscriber line 160 extending to the contact banks of the Strowger mechanisms included in the finder switches of the links having access thereto, thereby to mark the subscriber line 160 as idle. Also, the cut-off magnet R130 interrupts, at RA134 and RC134, a further point in the previously traced path for applying ground potential to the control conductor C164. Further, the cut-off magnet R130 prepares, at RA133 and RC133, a point in the path for applying ground potential, at RC133, to the control conductor C163 of the subscriber line 160 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, and prepares, at RA135 and RC135, a point in the path for applying ground potential, at RC135, to the start conductor C190 extending to the distributor 103. Finally, the cut-off magnet R130 prepares, at RA131 and RC131 and at RA137 and RC137, points in the bridge circuit for energizing the upper and lower windings of the line magnet R140 and interrupts, at RA136 and RA137, a point in the previously traced holding circuit for energizing the lower winding of the line magnet R140.

The line magnet R140 then restores to complete, at RA141 and RC142, a point in the previously traced path for applying battery potential, at the lower winding of the cut-off magnet R130, to the control conductor C163 of the subscriber line 160 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, thereby to mark the subscriber line 160 as

idle. Also, the line magnet R140 interrupts, at RA141 and RC143, a point in the path for applying ground potential, at RC133, to the control conductor C163. Finally, the line magnet R140 interrupts, at RA145 and RC145, a further point in the path for applying ground potential, at RC135, to the start conductor C190 and interrupts, at RA145 and RC145, a point in the path for applying ground potential, at RC135, to the control conductor C166 extending to the permanent alarm device. Also, it is noted that when both the cut-off magnet R130 and the line magnet R140 restore, the latching arrangement for causing the two switch spring assemblies associated with the line magnet R140 to be actuated simultaneously is reset. At this time the subscriber line 160 is marked as idle to the finder and connector switches of the links having access thereto and the line circuit 105 is completely released.

It will be understood that a call which is to be extended from the subscriber substation C to the subscriber substation A is first initiated at the substation C by removing the receiver of the telephone instrument thereat from its hook and is subsequently completed to the substation A in the same manner that the previously described call from the substation A was extended to the substation C. The release of this established connection is under the control of the last party to replace the receiver of the telephone instrument at his substation upon its hook, as previously noted.

A reverting call which is to be extended from the subscriber substation A to the subscriber substation B is first initiated at the substation A by removing the receiver of the telephone instrument thereat from its hook, thereby to complete the previously traced bridge circuit for energizing the upper and lower windings of the line magnet R120. When thus energized, the line magnet R120 operates, as previously explained, in order to complete, at RA121 and RC123, the previously traced path for applying ground potential to the control conductor C154 of the subscriber line 150 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, thereby to mark the subscriber line 150 as busy immediately. Further, the line magnet R120 completes, at RA124 and RC124, the previously traced path for applying battery potential, at the upper winding of the cut-off magnet R110, to the control conductor C153 of the subscriber line 150 extending to the contact banks of the Strowger mechanism included in the finder switches of the links having access thereto, thereby to mark the radial position of the contact sets in the contact banks terminating the subscriber line 150. Finally, the line magnet R120 completes, at RA125 and RC125 and at RA126 and RC127, the previously traced path for applying ground potential, at RC115, to the start conductor C190 extending into the distributor 103. This application of ground potential to the start conductor C190 causes the distributor 103 to operate to assign a previously selected idle link in the group of links to the use of the calling subscriber line 150. Assuming that the illustrated link 100 is assigned to the use of the calling subscriber line 150, this application of ground potential to the start conductor C190 and this application of battery potential to the control conductor C153 marks the position of the contact set in the contact bank of the Strowger mechanism included in the finder switch 101 at which the subscriber line 150 is terminated. The finder switch 101 then operates, in the previously described manner, thereby to seize the calling subscriber line 150. When the calling subscriber line 150 is seized, the cut-off magnet R110 operates to release the latching arrangement for restraining the restoring switch spring assembly associated with the line magnet R120 in its actuated position and to complete, at RA114 and RC114, the previously traced holding circuit for energizing the lower winding thereof. Also, the cut-off magnet R110 completes, at RA116 and RA117, the previously traced holding circuit for energizing the lower winding of the line magnet R120, completes, at RA112 and RC112, the previously traced path for applying ground potential to the control conductor C154 of the subscriber line 150, thereby to mark the subscriber line 150 as busy to the connector switches of the links having access thereto, interrupts, at RA111 and RC111 and at RA117 and RC117, the previously traced bridge circuit for energizing the windings of the line magnet R120, and interrupts, at RA115 and RC115, the previously traced path for applying ground potential to the start conductor C190. The restoring switch spring assembly associated with the line magnet R120 then restores to its normal position, as previously noted, thereby to interrupt, at RA124 and RC124, a point in the holding circuit for energizing the upper winding of the cut-off magnet R110, to interrupt, at RA126 and RC127, a further point in the previously traced path for applying ground potential to the start conductor C190, and to prepare, at RA126 and RC128, a point in the previously mentioned circuit for applying ground potential, at RC115, to the control conductor C156 extending to the permanent alarm device. At this time the line and cut-off magnets R120 and R110, respectively, are completely operated, and the restoring switch spring assembly associated with the line magnet R120 is restored to its normal position, as previously noted.

The connector switch 102 is conditioned to be responsive to a series of dialed digits at this time. The subscriber at the substation A then dials at the dial mechanism thereat successively two predetermined digits into the connector switch 102, thereby to cause the connector switch to operate and select the first trunk line terminating thereat to which an idle reverting call switch is connected. When these two predetermined digits are successively dialed the connector switch 102 operates as a trunk hunting connector switch in order to select a trunk line associated with an idle one of the reverting call switches or to return busy tone current over the loop circuit extending to the calling subscriber substation A in the event that all of the reverting call switches are busy. Assuming that the illustrated reverting call switch 200 is the first idle switch, the connector switch 102 operates to seize the trunk line 170 extending thereto. The reverting call switch 200 is marked as idle or busy, respectively, by the presence of battery or ground potential upon the control conductor C172 of the trunk line 170. At this time, the reverting call switch 200 being idle, battery potential appears upon the control conductor C172 of the trunk line 170, the path for connecting battery potential to the control conductor C172 extending from battery at the resistor 206 by way of the resistor 206, RA271, RC242, RA241, and

RA256 to the control conductor C172. When the connector switch 102 selects the trunk line 170 extending to the idle reverting call switch 200, further operation thereof is arrested due to the presence of battery potential upon the control conductor C172 thereof, in the usual manner.

When the trunk line 170 is thus seized by the connector switch 102, this connector switch operates to complete a loop circuit between the calling subscriber substation A and the line relay R230 in the reverting call switch 200, this loop circuit extending from ground at the lower winding of R230 by way of the lower winding of R230, RC229, and RA227 to C173, and from battery at the upper winding of R230 by way of the upper winding of R230, RC222, and RA221 to C171, the line conductors C171 and C173 of the trunk line 170 being connected by way of the operated link 100 to the line conductors C151 and C152, respectively, of the calling subscriber line 150, and the telephone instrument at the substation A being included in a bridge path extending between the line conductors C151 and C152 of the subscriber line 150. When energized over the above-traced circuit the line relay R230 operates to complete, at RA231 and RC232, an obvious circuit for energizing the hold relay R240. When thus energized the hold relay R240 operates to interrupt, at RA241 and RC242, a point in the path for applying battery potential to the control conductor C172 of the trunk line 170, and completes, at RA241 and RC243, a path for applying ground potential to the control conductor C172, this path extending from ground, at RC243, by way of RA241, and RA256 to the control conductor C172. This application of ground potential to the control conductor C172 of the trunk line 170 marks this trunk line as busy to the connector switches of the links having access thereto, and causes the switch-through relay in the connector switch 102 to operate. When the switch-through relay in the connector switch 102 operates, ground potential in the operated link 100 is removed from the wipers 181 and 184 of the finder and connector switches 101 and 102, respectively, the link 100 and the line circuit 104 being retained in its operated position at this time due to the application of ground potential to the control conductor C172 of the trunk line 170. Also, upon operating, the relay R240 prepares, at RA245, a point in an impulse circuit traced hereinafter for energizing the rotary magnets M236 and M238 of the minor switches 280 and 290, respectively, included in the reverting call switch 200.

The subscriber at the calling substation A then dials at the dial mechanism thereat a third digit corresponding to the last digit of the directory number of the calling substation A, thereby to transmit a series of impulses by way of the previously mentioned loop circuit to the line relay R230. The relay R230 follows the dialed impulses in the usual manner, restoring each time the loop circuit is interrupted and operating each time the loop circuit is completed. Each time the relay R230 restores, it interrupts, at RA231 and RC232, the circuit for energizing the hold relay R240, and completes, at RA231 and RC233, a circuit for energizing in multiple the relay R250 and the rotary magnet M236 of the minor switch 280. The last-mentioned circuit extends from ground, at RA231, by way of RC233, RA245, and RA262 to RC264, one branch of this circuit extending from RC264 by way of the winding of R250 to battery, and the other branch extending from RC264 by way of RA273, RC276, and the winding of M236 to battery. The relays R240 and R250, being of the slow-to-release type, remain operated during impulsing. Each time the circuit for energizing the rotary magnet M236 is completed and interrupted, this magnet operates to drive the wipers 283 and 285 of the rotary switches 281 and 282, respectively, included in the minor switch 280 one step away from their normal positions. When the wipers noted of the rotary switches 281 and 282 are driven away from their normal positions, the switch springs 234 are actuated into engagement, thereby to prepare a circuit traced hereinafter for energizing the transfer relay R 270, this circuit being interrupted at this time, at RA251, by the operated relay R250. In response to this digit the wipers 283 and 285 of the rotary switches 281 and 282, respectively, are driven a number of steps away from their normal positions corresponding to this dialed digit and into engagement with corresponding contacts in the associated contact banks 284 and 286, respectively. At the conclusion of the third digit the line relay R230 reoperates, thereby to interrupt, at RA231 and RC233, the circuit for energizing in multiple the relay R250 and the rotary magnet M236 in order to cause the relay R250 to restore shortly thereafter and to arrest further operation of the rotary magnet M236. Upon restoring, the relay R250 completes, at RA251, the previously mentioned circuit for energizing the transfer relay R270, this circuit extending from ground, at the switch springs 234, by way of the switch springs 234, RA251, and the winding of R270 to battery. When thus energized the relay R270 operates to complete, at RA272, an obvious holding circuit for energizing the winding thereof, to interrupt, at RA273 and RC276, a further point in the previously traced circuit for energizing the rotary magnet M236, and to prepare, at RA273 and RC274, a point in a circuit traced hereinafter for energizing in multiple the relay R250 and the rotary magnet M238 of the minor switch 290.

The subscriber at the calling substation A then dials at the dial mechanism thereat a fourth digit corresponding to the last digit of the directory number of the called substation B, thereby to transmit another series of impulses by way of the previously mentioned loop circuit to the line relay R230. The relay R230 follows the dialed impulses in the usual manner. Each time the relay R230 restores it interrupts, at RA231 and RC232, the circuit for energizing the hold relay R240, and completes, at RA231 and RC233, the previously mentioned circuit for energizing in multiple the relay R250 and the rotary magnet M238 of the minor switch 290. The last-mentioned circuit extends from ground, at RA231, by way of RC233, RA245, and RA262 to RC264, one branch of this circuit extending from RC264 by way of the winding of R250 to battery, and the other branch extending from RC264 by way of RA273, RC274, and the winding of M238 to battery. Each time the circuit for energizing the rotary magnet M238 is completed and interrupted, this magnet operates to drive the wipers 293 and 295 of the rotary switches 291 and 292, respectively, included in the minor switch 290 one step away from their normal positions. When the wipers noted of the rotary switches 291 and 292 are driven away from their normal positions the switch springs 235 are actuated into engagement, thereby to prepare a circuit traced hereinafter for energizing the transfer relay R260, this circuit being interrupted at

this time, at RA252, by the operated relay R250. In response to this digit the wipers 293 and 295 of the rotary switches 291 and 292, respectively, are driven a number of steps away from their normal positions corresponding to this dialed digit and into engagement with corresponding contacts in the associated contact banks 294 and 296, respectively. At the conclusion of the fourth digit the line relay R230 reoperates, thereby to interrupt, at RA231 and RC233, the circuit for energizing in multiple the relay R250 and the rotary magnet M238 in order to cause the relay R250 to restore shortly thereafter and to arrest further operation of the rotary magnet M238. Upon restoring, the relay R250 completes, at RA252, the previously mentioned circuit for energizing the transfer relay R260, this circuit extending from ground, at the switch springs 235, by way of the switch springs 235, RA252, and the winding of R260 to battery. When thus energized the relay R260 operates to complete, at RA261, an obvious holding circuit for energizing the winding thereof, to interrupt, at RA262 and RC264, a further point in the previously traced circuit for energizing in multiple the relay R250 and the rotary magnet M238, and to prepare, at RA262 and RC263, a circuit traced hereinafter for energizing the relay R210.

Shortly after the conclusion of the fourth digit dialed the subscriber at the substation A replaces the receiver of the telephone instrument thereat upon its hook, thereby to interrupt the loop circuit extending to the line relay R230 in order to cause the latter relay to restore. Upon restoring, the relay R230 completes, at RA231 and RC233, the previously mentioned circuit for energizing the relay R210, this circuit extending from ground, at RA231, by way of RC233, RA245, RA262, RC263, RA258, and the winding of R210 to battery. When thus energized the relay R210 operates to complete, at RA211, an obvious path for applying ground potential to the ringing machine start lead C206, to prepare, at RA212, a holding circuit traced hereinafter for energizing the switch-through relay R220, to complete, at RA213, a path extending from battery, at the winding of R220, by way of the winding of R220, RA225, RC226, and RA213 to the ring pick-up lead C215 for applying battery potential to C215, and to complete, at RA214, an obvious holding circuit for energizing the hold relay R240. The hold relay R240, being of the slow-to-release type, does not restore incident to the restoration of the line relay R230, and is retained in its operated position over the above-mentioned holding circuit for energizing the winding thereof. Accordingly, ground potential is not removed from the control conductor C172 of the trunk line 170 incident to the restoration of the line relay R230.

Shortly thereafter and at the beginning of a code ringing cycle, ground potential is applied in the ringing machine to the ring pick-up lead C215, thereby to complete a circuit for energizing the switch-through relay R220, this circuit extending from the grounded ring pick-up lead C215 by way of RA213, RC226, RA225, and the winding of R220 to battery. When thus energized the relay R220 operates to complete, at RA224 and RA225, a holding circuit for energizing the winding thereof extending from ground, at RA212, by way of RA224, RA225, and the winding of R220 to battery, and to interrupt, at RA225 and RC226, the original circuit for energizing the winding thereof by way of the ring pick-up lead C215. Also, the relay R220 interrupts, at RA221 and RC222, and at RA227 and RC229, further points in the loop circuit for energizing the line relay R230, and completes, at RA221 and RC223, and at RA227 and RC228, points in a circuit traced hereinafter for projecting ringing current from the ringing machine associated with the trunk line 206' by way of the operated reverting call switch 200, the trunk line 170, and the link 100 over the subscriber line 150, the exact circuit for projecting ringing current from the ringing machine associated with the trunk line 206' over the subscriber line 150 depending upon the positions of the wipers of the rotary switches included in the minor switches 280 and 290, in a manner more fully described subsequently.

As previously noted, a divided ringing circuit is employed in the system, a first group of subscriber substations associated with each party line having ringers thereat connected between one line conductor of the party line and ground, and a second group of subscriber substations associated with each party line having ringers thereat connected between the other line conductor of the party line and ground. The operation of the reverting call switch 200 depends upon whether the calling and called subscriber substations A and B are in the same group. In the event these subscriber substations are in the same group, the reverting call switch 200 operates to cause ringing current of the code corresponding to the called subscriber substation to be projected over the line conductor of the subscriber line 150, to which the ringers at each of the subscriber substations A and B are connected. In the event these subscriber substations are in different groups, the reverting call switch 200 operates first to cause ringing current of the code corresponding to the called subscriber substation to be projected over the line conductor of the subscriber line 150, to which the ringer at the called substation B is connected, and then to cause ringing current of the code corresponding to the calling subscriber substation to be projected over the line conductor of the subscriber line 150, to which the ringer at the calling substation A is connected. Also, it is noted that the subscriber substations associated with the subscriber line 150 and having ringers connected to one line conductor thereof are assigned directory numbers comprising a third odd digit, and the subscriber substations associated with the subscriber line 150 and having ringers connected to the other line conductor thereof are assigned directory numbers comprising a third even digit.

Assuming that the third digit of the directory number of the calling subscriber substation A is the No. 1, and the third digit of the directory number of the called subscriber substation B is the No. 3, the wipers of the rotary switches of the minor switch 280 engage the first contacts in the associated contact banks, and the wipers of the rotary switches of the minor switch 290 engage the third contacts in the associated contact banks. At this time a circuit is completed for projecting ringing current of the code corresponding to the called subscriber substation B over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M3, the third contact in the contact bank 294 and the associated wiper 293 of the rotary switch 291, the upper winding of the ring cut-off relay R255, RC223, and RA221, to the line conductor C171 of the trunk line 170, and therefrom by way of the

operated link 100, the line conductor C151 of the subscriber line 150, and a condenser and the ringer at the called substation B, to ground. Also, a circuit is prepared for energizing the upper winding of the ring cut-off relay R255, which is completed when the subscriber at the substation B answers the call by removing the receiver of the telephone instrument thereat from its hook, this circuit extending, when completed, by way of the previously traced path to the line conductor C151 of the subscriber line 150, and therefrom by way of the bridge path at the substation B between the line conductors C151 and C152 of the subscriber line 150, C152, the operated link 100, the line conductor C173 of the trunk line 170, RA227, RC228, and the windings 202 and 203 of the transformer 201 to ground.

Assuming that the third digit of the directory number of the calling subscriber substation A is the No. 2, and the third digit of the directory number of the called subscriber substation B is the No. 4, the wipers of the rotary switches of the minor switch 280 engage the second contacts in the associated contact banks, and the wipers of the rotary switches of the minor switch 290 engage the fourth contacts in the associated contact banks. At this time a circuit is completed for projecting ringing current of the code corresponding to the called subscriber substation B over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M4, the fourth contact in the contact bank 296 and the associated wiper 295 of the rotary switch 292, and the windings 205 and 204 of the transformer 201 to ground at RA220. This ringing current traversing the windings 204 and 205 of the transformer 201 induces a corresponding ringing current in the windings 202 and 203 thereof, which traverses a path extending from ground by way of the windings 203 and 202, RC228, RA227, to the line conductor C173 of the trunk line 170, and therefrom by way of the operated link 100, the line conductor C152 of the subscriber line 150, and the condenser and the ringer at the called substation B to ground. Also, a circuit is prepared for energizing the upper winding of the cut-off relay R255, which is completed when the subscriber at the substation B answers the call by removing the receiver of the telephone instrument thereat from its hook, this circuit extending, when completed, from battery at the resistor 207, by way of the resistor 207, the second contact in the contact bank 284 and the associated wiper 283 of the rotary switch 281, the fourth contact in the contact bank 294 and the associated wiper 293 of the rotary switch 291, the upper winding of R255, RC223, RA221, the line conductor C171 of the trunk line 170, and the operated link 100 to the line conductor C151, and therefrom by way of the bridge path at the substation B between the line conductors C151 and C152 of the subscriber line 150, and a portion of the previously traced circuit to ground, at the winding 203 of the transformer 201.

Assuming that the third digit of the directory number of the calling subscriber substation A is the No. 1, and the third digit of the directory number of the called subscriber substation B is the No. 2, the wipers of the rotary switches of the minor switch 280 engage the first contacts in the associated contact banks, and the wipers of the rotary switches of the minor switch 290 engage the second contacts in the associated contact banks. At this time a circuit is completed for projecting ringing current of the code corresponding to the called subscriber substation B over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M2, the second contact in the contact bank 296 and the associated wiper 295 of the rotary switch 292, and the windings 205 and 204 of the transformer 201 to ground at RA220. This ringing current traversing the windings 204 and 205 of the transformer 201 induces a corresponding ringing current in the windings 202 and 203 thereof which is projected by way of the previously traced path over the line conductor C152 of the subscriber line 150 to ground at the ringer at the called substation B. Also a circuit is completed for projecting ringing current of the code corresponding to the calling subscriber substation A over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M1, the first contact in the contact bank 284 and the associated wiper 283 of the rotary switch 281, the second contact in the contact bank 294 and the associated wiper 293 of the rotary switch 291, the upper winding of the ring cut-off relay R255, RC223, RA221, the line conductor C171 of the trunk line 170, the operated link 100, the line conductor C151 of the subscriber line 150, and a condenser and the ringer at the calling substation A to ground. The ringing machine operates to complete the circuits for applying ringing currents to the ringing conductors M1 to M5, inclusive, sequentially, thereby to cause the ringer at the called substation B and the ringer at the calling substation A to be operated alternatively. Also a circuit is prepared for energizing the upper winding of the ring cut-off relay R255, which is completed when the subscriber at the substation B answers the call by removing the receiver of the telephone instrument thereat from its hook, this circuit extending, when completed, from the ringing conductor M1 by way of the previously traced path to ground at the winding 203 of the transformer 201.

Assuming that the third digit of the directory number of the calling subscriber substation A is the No. 2, and the third digit of the directory number of the called subscriber substation B is the No. 1, the wipers of the rotary switches of the minor switch 280 engage the second contacts in the associated contact banks, and the wipers of the rotary switches of the minor switch 290 engage the first contacts in the associated contact banks. At this time a circuit is completed for projecting ringing current of the code corresponding to the called subscriber substation B over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M1, the first contact in the contact bank 294 and the associated wiper 293 of the rotary switch 291, the upper winding of R255 and a portion of the previously traced circuit including the line conductor C151 of the subscriber line 150 to ground at the ringer at the called substation B. Also a circuit is completed for projecting ringing current of the code corresponding to the calling substation A over the subscriber line 150, this circuit extending from the ungrounded terminal of the ringing machine winding by way of the ringing conductor M2, the second contact in the contact bank 286 and the associated wiper 285 of the rotary switch 282, the

first contact in the contact bank 296 and the associated wiper 295 of the rotary switch 292, and the windings 205 and 204 of the transformer 201 to ground, at RA220. This ringing current traversing the windings 204 and 205 of the transformer 201 induces a corresponding ringing current in the windings 202 and 203 thereof which is projected by way of the previously traced circuit including the line conductor C152 of the subscriber line 150 to ground at the ringer at the calling substation A. As previously noted, the ringers at the called and calling subscriber substations B and A, respectively, are operated alternatively. Also a circuit is prepared for energizing the upper winding of the ring cut-off relay R255, which is completed when the subscriber at the substation B answers the call by removing the receiver of the telephone instrument thereat from its hook, this circuit extending, when completed, from the ringing conductor M1 by way of the previously traced path to ground at the winding 203 of the transformer 201.

When the subscriber at the called substation B answers the call, one of the previously traced circuits for energizing the upper winding of the ring cut-off relay R255 is completed, depending upon whether the calling and called substations A and B, respectively, are in the same or different groups, as previously noted. When thus energized the ring cut-off relay R255 operates to complete, at RA257, a holding circuit for energizing the lower winding thereof, this circuit extending from ground, at RA244, by way of RA257 and the lower winding of R255 to battery. Also the relay R255 interrupts, at RA256, the previously traced path for applying ground potential to the control conductor C172 of the trunk line 170, and interrupts, at RA258, the circuit for energizing the relay R210, thereby to cause the latter relay to restore. Upon restoring, the relay R210 interrupts, at RA211, the previously traced path for applying ground potential to the ringing machine start lead C206 in order to arrest further operation of the ringing machine associated with the reverting call switch 200, to interrupt, at RA212, the holding circuit for energizing the relay R220 in order to cause the latter relay to restore, and to interrupt, at RA214, the previously traced holding circuit for energizing the hold relay R240. Shortly thereafter the hold relay R240 restores to interrupt, at RA244, the holding circuit for energizing the lower winding of the ring cut-off relay R255 in order to cause the latter relay to restore shortly thereafter, and to complete, at RA246, a circuit for energizing the release magnet M239 of the minor switch 290, this circuit extending from ground, at RA246, by way of RA265, RC266, and the winding of M239 to battery. When this energized the release magnet M239 operates to release the wipers of the rotary switches 291 and 292 of the minor switch 290, thereby to cause these wipers to be returned to their normal positions. When the wipers noted of the rotary switches of the minor switch 290 are returned to their normal positions, the switch springs 235 are actuated into disengagement, thereby to interrupt the holding circuit for energizing the transfer relay R260. The transfer relay R260 then restores to interrupt, at RA265 and RC266, the circuit for energizing the release magnet M239, and to complete, at RA265 and RC267, a circuit for energizing the release magnet M237 of the minor switch 280, this circuit extending from ground, at RA246, by way of RA265, RC267, RA277, and the winding of R237 to battery. When thus energized the release magnet M237 operates to release the wipers of the rotary switches 281 and 282 of the minor switch 280, thereby to cause these wipers to be returned to their normal positions. When the wipers noted of the rotary switches of the minor switch 280 are returned to their normal positions, the switch springs 234 are actuated into disengagement, thereby to interrupt the holding circuit for energizing the transfer relay R270. The transfer relay R270 then restores to interrupt, at RA277, the circuit for energizing the release magnet M237. Upon restoring, the hold relay R240, the ring cut-off relay R255, and the transfer relay R270 complete, at RA241 and RC242, at RA256 and at RA271, respectively, the previously traced path for connecting battery at the resistor 296 to the control conductor C172 of the trunk line 170, thereby to mark this trunk line as idle to the connector switches of the links having access thereto. At this time the reverting call switch 200 is completely released for further use.

The ring cut-off relay R255 in the reverting call switch 200 operates when the call is answered at the called substation B to interrupt, at RA256, the path for applying ground potential to the control conductor C172 of the trunk line 170, thereby to interrupt the previously traced holding circuit for energizing the lower winding of the cut-off magnet R110 in the line circuit 104 individually associated with the subscriber line 150. The cut-off magnet R110 then restores, to complete, at RA117 and RC117 and at RA111 and RC111, a bridge circuit for energizing the windings of the line magnet R120, thereby to retain this line magnet in its operated position. This circuit extends from ground at the lower winding of R120 by way of the lower winding of R120, RA117, RC117, C152, the bridge path including the telephone instrument at the called subscriber substation B between the line conductors C152 and C151 of the subscriber line 150, C151, RC111, RA111 and the upper winding of R120 to battery. Also, upon restoring, the cut-off magnet R110 interrupts, at RA116 and RA117, the previously traced holding circuit for energizing the lower winding of the line magnet R120, interrupts, at RA114 and RC114, a further point in the holding circuit for energizing the lower winding thereof, interrupts, at RA112 and RC112, a further point in the previously traced path for applying ground potential by way of the control conductor C153 of the subscriber line 150 to the control conductor C154 thereof, and completes, at RA113 and RC113, the previously traced path for applying ground potential, at RC113, to the control conductor C154 of the subscriber line 150 extending to the contact banks of the Strowger mechanisms included in the connector switches of the links having access thereto, thereby to mark the subscriber line 150 as busy. Finally, the cut-off magnet R110 completes, at RA115 and RC115, the previously mentioned path for applying ground potential to the control conductor C156 extending to the permanent alarm, this path extending from ground at RC115 by way of RA115, RC125, RA125, RA126 and RC128 to the control conductor C156. This application of ground potential to the control conductor C156 causes the permanent alarm device associated therewith to be actuated, thereby to indicate to an operator that the subscriber line 150 is busy on a reverting call or due to a permanent fault thereof thereon. Due to the fact that the

bridge circuit for energizing the upper and lower windings of the line magnet R120 is completed at RC111 and RA111 and at RA117 and RC117 prior to the interruption of the holding circuit for energizing the lower winding thereof at RA116 and RA117, as previously noted, the line magnet R120 remains in its operated position. At this time the line circuit 104 is operated to lock the subscriber line 150 out of service; and talking battery is supplied by way of the previously traced bridge circuit to the telephone instrument at the called subscriber substation B.

As previously noted, when the subscriber at the called substation B answers the call the reverting call switch 200 is released, thereby to interrupt the circuit for projecting ringing current over the subscriber line 150 in order to cause further operation of the ringer at the calling subscriber substation A to be arrested. When the operation of the ringer at the calling subscriber substation A is arrested, the subscriber thereat is advised that the subscriber at the called substation B has answered the call. The subscriber at the substation A then removes the receiver of the telephone instrument thereat from its hook, thereby to complete an established connection between the calling and called subscriber substations A and B, respectively, for two-way communication therebetween, talking battery being supplied to the substation A by way of the previously traced bridge circuit.

The release of this established connection between the subscriber substations A and B is under the control of the last subscriber to replace the receiver of the telephone instrument at his substation upon its hook. When the last subscriber replaces the receiver of the telephone instrument at his substation upon its hook, the bridge circuit for energizing the upper and lower windings of the line magnet R120 is interrupted, thereby to cause this line magnet to restore, as previously noted. At this time the established connection between the subscriber substations A and B is completely released, and the line circuit 104 individually associated with the subscriber line 150 is released, thereby to mark this subscriber line as idle to the finder and connector switches of the links having access thereto.

It will be understood that a reverting call which is to be extended from the subscriber substation C to the subscriber substation D is first initiated at the substation C by removing the receiver of the telephone instrument thereat from its hook and is subsequently completed to the substation D in the manner that the previously described reverting call from the substation A was extended to the substation B. The release of this established connection is under the control of the last party to replace the receiver of the telephone instrument at his substation upon its hook, as previously noted.

Also it is noted that a timing arrangement is incorporated in the connector switch 102 which is operative in the event the switch-through relay therein does not operate within a predetermined time interval, due to the fact that the connector switch has not been fully operated to seize a line accessible thereto, to cause ground potential to be removed from the wiper 181. For example, the link 100 may be seized in the previously described manner by the appearance of a fault on one of the subscriber lines, in which case the connector switch 102 thereof would not be operated subsequently to seize a line accessible thereto in order to cause the operation of the switch-through relay therein, whereby ground potential would be removed from the wiper 181, as previously noted. Under these conditions where ground potential is removed from the wiper 181, the holding circuit for energizing the cut-off magnet in the line circuit associated with the line having the fault thereon is interrupted, thereby to cause the cut-off magnet to restore. Upon restoring, the cut-off magnet in the line circuit associated with the line having the fault thereon causes the line to be locked out of service in the manner described previously in connection with the extension of a reverting call between the subscriber substations A and B. Also, ground potential is applied to the control conductor associated therewith extending to the permanent alarm device, thereby to cause the permanent alarm device to be operated. The operation of the permanent alarm device for an unreasonable time interval indicates to an operator that the associated line is locked out of service upon a permanent fault thereon rather than merely being busy due to a reverting call thereon.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A line circuit adapted for use in a telephone system including a line accessible to an automatic switch, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means responsive to the seizure of said line by said automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, additional means controlled by the operation of said second contact set away from its normal position for causing said line relay to be operated, and circuits for controlling said automatic switch governed in accordance with the positions of said contact sets.

2. A line circuit adapted for use in a telephone system including a line accessible to an automatic switch, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, said line relay being operative in response to the creation of a calling condition on said line, said cut-off relay being operative in response to the seizure of said line by said automatic switch, means controlled by the operation of said cut-off relay for actuating said mechanical means,

additional means controlled by the operation of said second contact set away from its normal position for causing said line relay to be operated, and circuits for controlling said automatic switch governed in accordance with the positions of said contact sets.

3. A line circuit adapted for use in a telephone system including a line provided with at least one line conductor and accessible to an automatic switch, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a first circuit including said line conductor for said line relay, a holding circuit for said line relay, said first circuit being completed in response to the creation of a calling condition on said line, whereby said line relay is operated, said cut-off relay being operative in response to the seizure of said line by said automatic switch, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for completing said holding circuit and for interrupting said first circuit, whereby said line relay is retained operated, and circuits for controlling said automatic switch governed in accordance with the positions of said contact sets.

4. A line circuit adapted for use in a telephone system including a line provided with at least one line conductor and accessible to an automatic switch, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a first circuit including said line conductor for said line relay, a holding circuit for said line relay, said first circuit being completed in response to the creation of a calling condition on said line, whereby said line relay is operated, said cut-off relay being operative in response to the seizure of said line by said automatic switch, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for completing said holding circuit and for interrupting said first circuit, whereby said line relay is retained operated, and circuits for controlling said automatic switch governed in accordance with the positions of said contact sets.

5. In a telephone system, a line, a number of automatic switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, control means operative in response to the operation of said first and third contact sets away from their normal positions for causing an idle one of said automatic switches to seize said line, means responsive to the seizure of said line by said one automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the return of said third contact set to its normal position for arresting the operation of said control means, and additional circuits for controlling said automatic switches governed in accordance with the positions of said contact sets.

6. In a telephone system, a line, a number of finder switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said finder switches and operative to cause an idle one of said finder switches to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by one of said finder switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, and means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor.

7. In a telephone system, a line, a number of finder switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said finder switches and operative to cause an idle one of said finder switches to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said

first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by one of said finder switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, and means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor.

8. In a telephone system, a line provided with at least one line conductor, a number of finder switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said finder switches and operative to cause an idle one of said finder switches to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a first circuit including said line conductor for said line relay, a holding circuit for said line relay, means responsive to the creation of a calling condition on said line for causing said first circuit to be completed, whereby said line relay is operated, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by one of said finder switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for completing said holding circuit and for interrupting said first circuit, whereby said line relay is retained operated, and means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor.

9. A line circuit adapted for use in a telephone system including a line accessible to a number of automatic switches, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means responsive to the seizure of said line by one of said automatic switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means for releasing said one automatic switch, means responsive to the release of said one automatic switch for causing said cut-off relay to be restored, means controlled by the return of said second contact set to its normal position for causing said line relay to remain operated in the event a calling condition remains on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

10. A line circuit adapted for use in a telephone system including a line accessible to a number of automatic switches, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, said line relay being operative in response to the creation of a calling condition on said line, said cut-off relay being operative in response to the seizure of said line by one of said automatic switches, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means for releasing said one automatic switch, said cut-off relay being restored in response to the release of said one automatic switch, said line relay remaining operated subsequent to the return of said second contact set to its normal position in the event a calling condition remains on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

11. A line circuit adapted for use in a telephone system including a line provided with at least one line conductor and accessible to a number of automatic switches, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a first circuit including said line conductor for said line relay, a holding circuit for said line relay, said first circuit being completed in response to the creation of a calling condition on said line, whereby said line relay is operated, said cut-off relay being operative in response to the seizure of said line by one of said automatic switches, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for completing said hold-

ing circuit and for interrupting said first circuit, whereby said line relay is retained operated, means for releasing said one automatic switch, said cut-off relay being restored in response to the release of said one automatic switch, means controlled by the return of said second contact set to its normal position for completing said first circuit and for interrupting said holding circuit, whereby said line relay remains operated to said second position in the event a calling condition remains on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

12. In a telephone system, a line, a number of automatic switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said automatic switches to seize said line, means responsive to the seizure of said line by said one automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means for releasing said one automatic switch, means responsive to the release of said one automatic switch for causing said cut-off relay to be restored, means controlled by the return of said second contact set to its normal position for causing said line relay to remain operated in the event a calling condition remains on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

13. In a telephone system, a line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said finder switches and operative to cause an idle one of said finder switches to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by one of said finder switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor, means for releasing said one finder switch, means responsive to the release of said one finder switch for causing said cut-off relay to be restored, means controlled by the return of said second contact set to its normal position for causing said line relay to remain operated in the event a calling condition remains on said line, and means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches.

14. In a telephone system, a line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said finder switches and operative to cause an idle one of said finder switches to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by one of said finder switches for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor, means for releasing said one finder switch, means responsive to the release of said one finder switch for causing said cut-off relay to be restored, means controlled by the return of said second contact set to its normal position for causing said line relay to remain operated in the event a calling condition remains on said line, means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches, and signaling means controlled when said first contact set is operated

away from its normal position and said second and third contact sets are returned to their normal positions, thereby to indicate the presence of a fault on said line.

15. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of automatic switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said automatic switches to seize said line, means responsive to the seizure of said line by said one automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, impulse responsive means operative to cause ringing current to be projected by way of said one automatic switch over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one automatic switch to be released and for creating a new calling condition on said line, means responsive to the release of said one automatic switch for causing said cut-off relay to be restored, means responsive to the creation of the new calling condition on said line for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

16. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of automatic switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, said line relay being operative in response to the creation of a calling condition on said line, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said automatic switches to seize said line, said cut-off relay being operative in response to the seizure of said line by said one automatic switch, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, impulse responsive means operative to cause ringing current to be projected by way of said one automatic switch over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one automatic switch to be released and for creating a new calling condition on said line, said cut-off relay being restored in response to the release of said one automatic switch, said line relay remaining operated subsequent to the return of said second contact set to its normal position in response to the creation of the new calling condition on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

17. In a telephone system, a line provided with at least one line conductor, a plurality of subscriber substations associated with said line, a number of automatic switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a first circuit including said line conductor for said line relay, a holding circuit for said line relay, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, said first circuit being completed in response to the creation of a calling condition on said line, whereby said line relay is operated, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said automatic switches to seize said line, said cut-off relay being operative in response to the seizure of said line by said one automatic switch, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for completing said holding circuit and for interrupting said first circuit, whereby said line relay is retained operated, impulse responsive means operative to cause ringing current to be projected by way of said one automatic switch over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one automatic switch to be released and for cre-

ating a new calling condition on said line, said cut-off relay being restored in response to the release of said one automatic switch, means controlled by the return of said second contact set to its normal position for completing said first circuit and for interrupting said holding circuit, whereby said line relay remains operated to said second position in response to the creation of the new calling condition on said line, and means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions for marking said line as busy to said automatic switches.

18. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of finder-selector links having access to said line, a line circuit associated with said line and including line and cut-off relays, a distributor associated with said links and operative to cause the finder switch of an idle one of said links to operate and seize a line marked as a calling line, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor and for marking said line as a calling line, means responsive to the seizure of said line by the finder switch of said one link for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor, impulse responsive means included in the selector switch of said one link and operative to cause ringing current to be projected by way of said one link over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one link to be released and for creating a new calling condition on said line, means responsive to the release of said one link for causing said cut-off relay to be restored, means responsive to the creation of the new calling condition on said line for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position, and means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to the connector switches of said links.

19. A line circuit adapted for use in a telephone system including a line accessible to a number of finder and connector switches, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, means responsive to the seizure of said line by said automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, additional means controlled by the operation of said second contact set away from its normal position for causing said line relay to be operated, and circuits for controlling said finder and connector switches governed in accordance with the positions of said contact sets.

20. A line circuit adapted for use in a telephone system including a line accessible to a number of finder and connector switches, said line circuit comprising, in combination, line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, said line relay being operative in response to the creation of a calling condition on said line, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, said cut-off relay being operative in response to the seizure of said line by one of said finder switches, means controlled by the operation of said cut-off relay for actuating said mechanical means, additional means controlled by the operation of said second contact set away from its normal position for causing said line relay to be operated, and circuits for controlling said finder and connector switches governed in accordance with the positions of said contact sets.

21. In a telephone system, a line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said

connector switches, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said finder switches to seize said line, means responsive to the seizure of said line by said one finder switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, and additional circuits for controlling said finder and connector switches governed in accordance with the positions of said contact sets.

22. In a telephone system, a line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, control means operative in response to the operation of said first and third contact sets away from their normal positions for causing an idle one of said finder switches to seize said line, means responsive to the seizure of said line by said one finder switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the return of said third contact set to its normal position for arresting the operation of said control means, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be operated, means for releasing said one finder switch, means responsive to the release of said one finder switch for causing said cut-off relay to be restored, means for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position in the event a calling condition remains on said line, and additional means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches.

23. A line circuit adapted for use in a telephone system including a line accessible to a number of finder and connector switches, said line circuit comprising, in combination, line and cut-off relays, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said finder switches to seize said line, means responsive to the seizure of said line by said one finder switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means for releasing said one finder switch, means responsive to the release of said one finder switch for causing said cut-off relay to be restored, means for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position in the event a calling condition remains on said line, additional means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches, and signaling means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions, thereby to indicate the presence of a fault on said line.

24. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, control means operative in response to the operation of said first and third contact sets away from their normal positions for causing an idle one of said finder switches to seize said line, means responsive to the seizure of said line by said one automatic switch for causing said cut-off relay to be operated, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the return of said third contact set to its normal position for arresting the operation of said control means, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, impulse responsive means operative to cause ringing cur-

rent to be projected by way of said one finder switch over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one finder switch to be released and for creating a new calling condition on said line, means responsive to the release of said one finder switch for causing said cut-off relay to be restored, means responsive to the creation of the new calling condition on said line for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position, and additional means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches.

25. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of finder and connector switches having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, mechanical means for operatively associating said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, said line relay being operative in response to the creation of a calling condition on said line, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to said connector switches, means controlled by the operation of said first and third contact sets away from their normal positions for causing an idle one of said finder switches to seize said line, said cut-off relay being operative in response to the seizure of said line by said one finder switch, means controlled by the operation of said cut-off relay for actuating said mechanical means, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, impulse responsive means operative to cause ringing current to be projected by way of said one finder switch over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one finder switch to be released and for creating a new calling condition on said line, said cut-off relay being restored in response to the release of said one finder switch, said line relay remaining operated subsequent to the return of said second contact set to its normal position in response to the creation of the new calling condition on said line, additional means controlled when said first contact set is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to said connector switches, and signalling means controlled when said first contact set is operated away from its normal position and said second and third contact sets are returned to their normal positions, thereby to indicate the presence of a reverting call on said line.

26. In a telephone system, a line, a plurality of subscriber substations associated with said line, a number of finder-connector links having access to said line, a line circuit associated with said line and including line and cut-off relays, a first contact set operatively associated with said line relay, a second contact set operatively associated with said cut-off relay, a third contact set, means normally effective operatively to associate said third contact set with said line relay, each of said contact sets having a normal position and being operative away from its normal position in response to the operation of the one of said relays with which it is operatively associated, a distributor associated with said links and operative to cause the finder switch of an idle one of said links to operate and seize a line marked as a calling line, means responsive to the initiation of a call at a calling one of said substations for creating a calling condition on said line, means responsive to the creation of a calling condition on said line for causing said line relay to be operated, means controlled by the operation of said first contact set away from its normal position for marking said line as busy to the connector switches of said links, means controlled by the operation of said first and third contact sets away from their normal positions for initiating operation of said distributor, means controlled by the operation of said third contact set away from its normal position for marking said line as a calling line, means responsive to the seizure of said line by the finder switch of an idle one of said links for causing said cut-off relay to operate, means controlled by the operation of said cut-off relay for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position, means controlled by the operation of said second contact set away from its normal position for causing said line relay to be retained operated, means controlled by the return of said third contact set to its normal position for arresting the operation of said distributor, impulse responsive means included in the connector switch of said one link and operative to cause ringing current to be projected by way of said one link over said line subsequent to the termination of the calling condition thereon and to cause said cut-off relay to remain operated, means responsive to the answering of the call at a called one of said substations for causing said one link to be released and for creating a new calling condition on said line, means responsive to the release of said one link for causing said cut-off relay to be restored, means responsive to the creation of the new calling condition on said line for causing said line relay to remain operated subsequent to the return of said second contact set to its normal position, and additional means controlled when said first-contact position is operated away from its normal position and said second contact set is returned to its normal position for marking said line as busy to the connector switches of said links.

PIER BAKKER.