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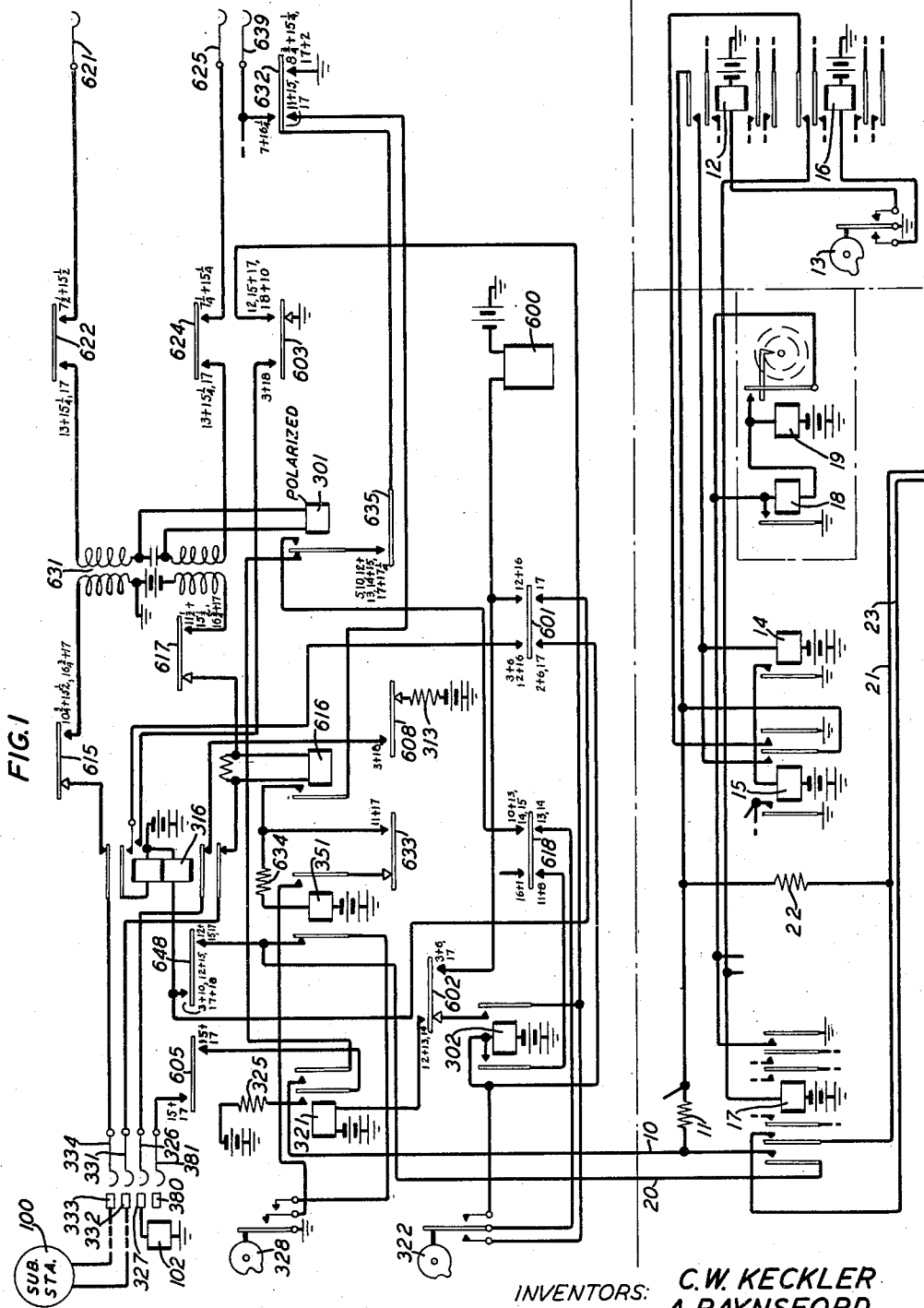
C. W. KECKLER ET AL

2,169,389

SELECTOR RELEASE CIRCUIT

Filed Sept. 11, 1937

3 Sheets-Sheet 1



INVENTORS: C.W. KECKLER
A. RAYNSFORD

BY *P. C. Smith*
ATTORNEY

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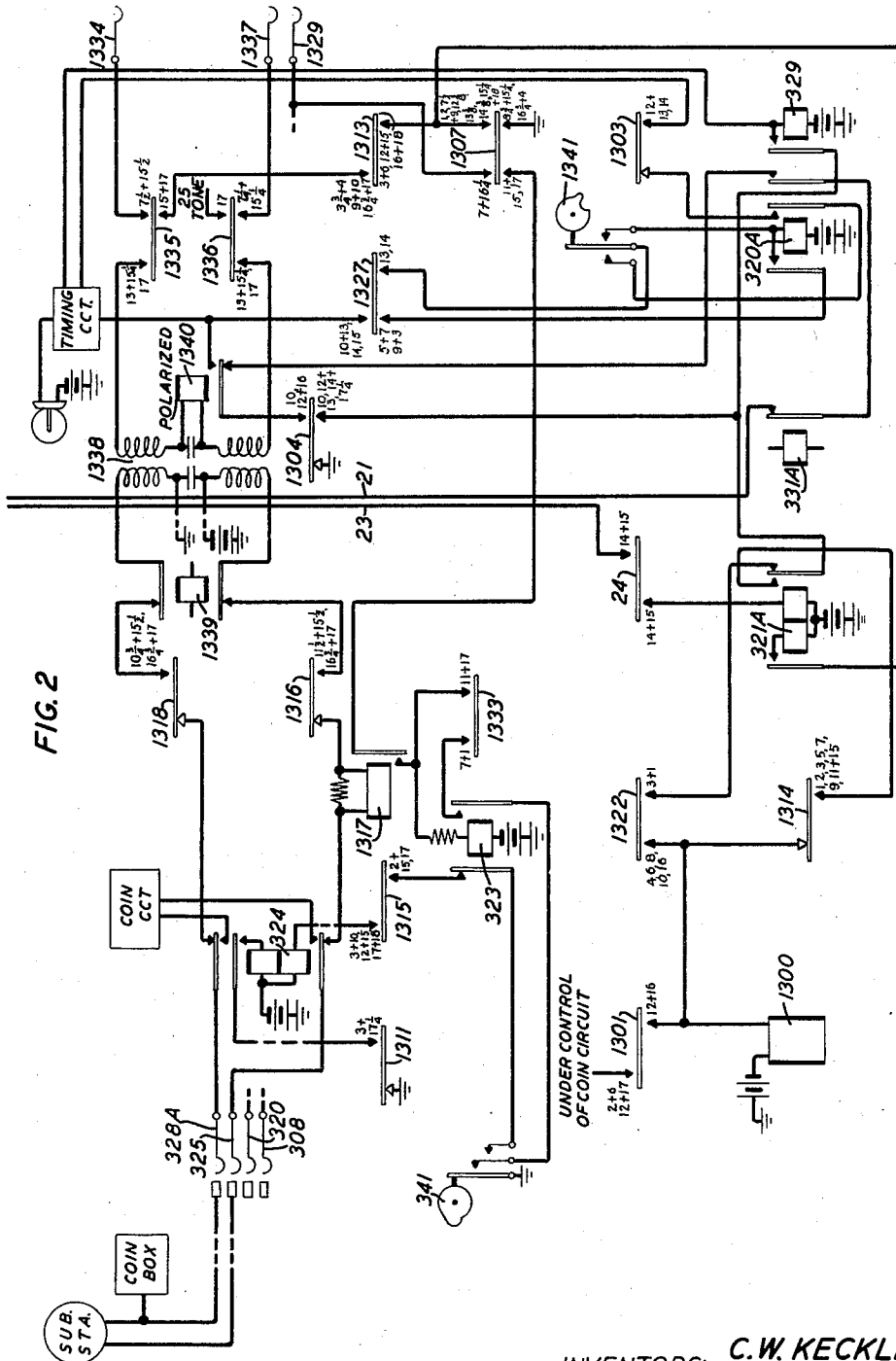
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A. RAYNSFORD

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ATTORNEY

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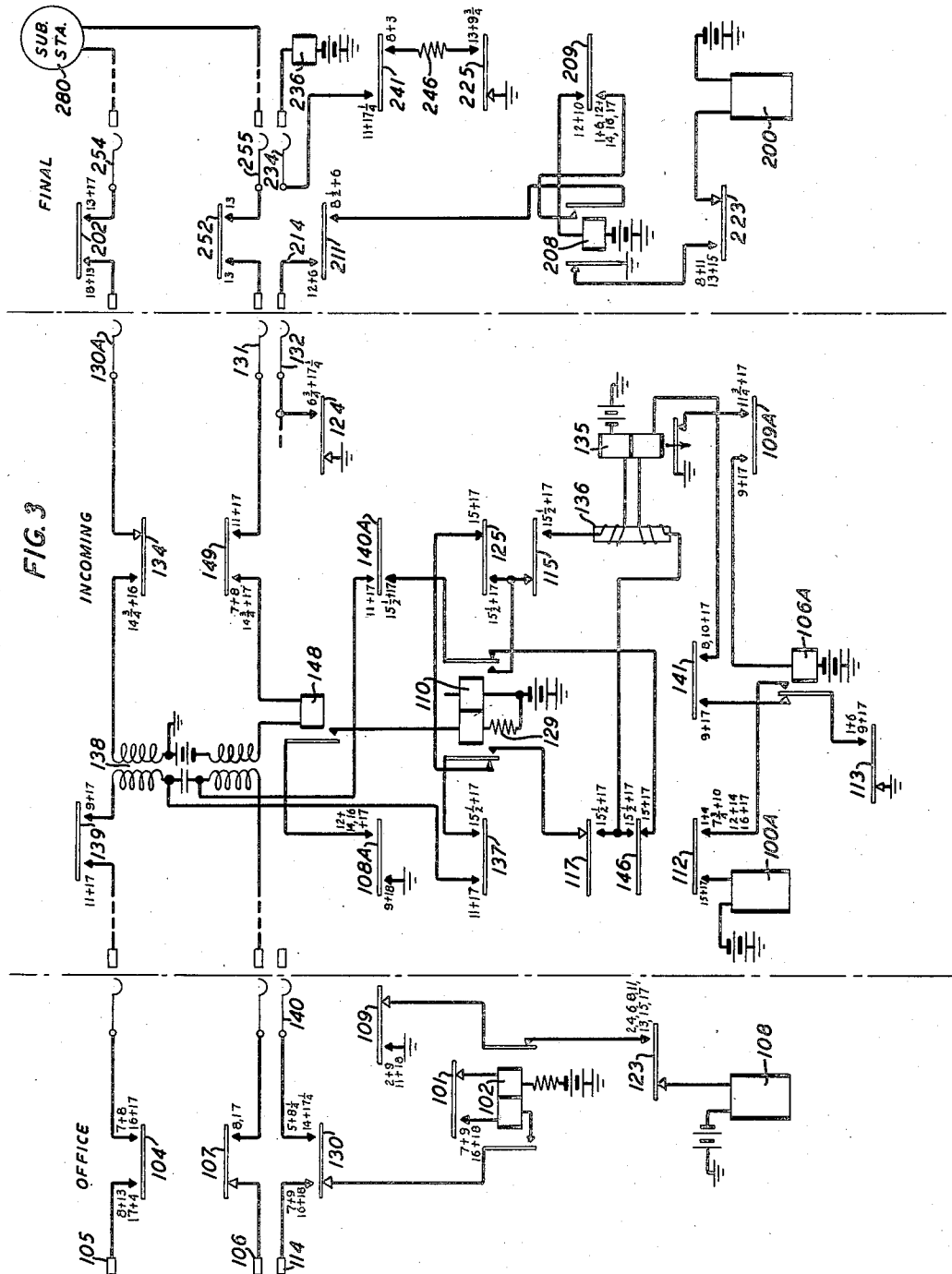
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A. RAYNSFORD

BY P. C. Smith
ATTORNEY

UNITED STATES PATENT OFFICE

2,169,389

SELECTOR RELEASE CIRCUIT

Charles W. Keckler, Summit, and Arthur Raynsford, Bergenfield, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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7 Claims. (Cl. 179—18)

This invention relates to telephone systems and more particularly to such systems in which telephone connections are normally under the control of the calling subscriber, and has for its object to facilitate the release of the called subscriber from such connections.

In the panel type telephone system, telephone connections are normally held by the calling subscriber and the restoration of the receiver of the called subscriber to the switchhook is ineffective to free that subscriber's line for other calls. Various means have been devised for placing the release under the control of the called subscriber in the step-by-step telephone system, but heretofore no such means has been devised for the panel system.

In accordance with the present invention, means is provided, common to a plurality of panel type district selectors, and responsive to release by the called subscriber for measuring a time interval and transmitting a signal to the district selector connected with the called line, which signal is effective in the case of non-coin district selectors to release the district selector and the connection, and in the case of coin district selectors is effective to advance the district selector sequence switch to a position in which the outgoing end of the connection is released and a signal is transmitted to the calling line.

The invention will be more clearly understood from a consideration of the following description taken in connection with the drawings in which Fig. 1 shows a portion of a non-coin type district selector and the common release control means;

Fig. 2 shows a portion of a coin district selector; and

Fig. 3 shows portions of office, incoming and final selectors for completing a connection to a called subscriber.

These drawings are skeletonized from complete circuits to show merely the talking circuit in talking positions, the holding circuits and the circuits involved in the release of the connection. For complete circuits and descriptions reference may be made to the following Patents 1,601,058, granted to C. H. Berry, September 28, 1926, for the Office selector; 1,658,829, granted to C. H. Berry, February 14, 1928, for the Incoming and final selectors; Patents 1,823,040, granted to A. E. Hague, September 15, 1931, for the Coin district selector and 1,855,598, granted to W. W. Carpenter et al. April 26, 1932, for the Noncoin district selector. With the exception of the release control circuit shown under the broken line in Fig. 1, reference numerals have been taken from the re-

spective patent drawings and where duplications would occur a suffix A has been added to distinguish between them for the purposes of the present disclosure.

Referring first to the non-coin circuits, after the connection has been set up as described in the above patents, a talking connection is established which includes the district selector of Fig. 1 and the office, incoming and final selectors of Fig. 2. The connection consists of three circuits established with the various sequence switches in talking position. The talking position for sequence switch 600 of the district selector is either position 13 or 14 and in either of these positions the calling subscriber at substation 100 controls a circuit extending from battery through the lower left winding of repeating coil 631, contacts of cam 617, winding of supervisory relay 616, outer lower back contact of relay 316, brush 331, terminal 332, through substation 100, terminal 333, brush 334, upper back contact of relay 316, contacts of cam 615, upper left winding of repeating coil 631, to ground. Relay 616 is operated when this circuit is established and closes a circuit from ground over the lower contacts of cam 632, front contact of relay 616, resistance 634, through the winding of relay 351 to battery. Relays 351 and 616, therefore, remain operated under the control of the calling subscriber throughout conversation.

With the incoming selector sequence switch 100—A in talking position 16 and the final selector sequence switch 200 in talking position 13, the called subscriber at substation 200 controls a circuit which may be traced from battery through the lower right winding of repeating coil 138, winding of supervisory relay 148, contacts of cam 149, brush 131 and its associated terminal, contacts of cam 252, brush 255 and its associated terminal, through the substation 200, brush 254, contacts of cam 202, brush 130—A, contacts of cam 134, upper right winding of repeating coil 138 to ground. Relay 148 is operated in this circuit and holds relay 110 operated in a circuit from battery through resistance 129, left winding of relay 110, front contact of relay 148, contacts of cam 100—A to ground. Relays 110 and 148, therefore, remain operated throughout the conversation under the control of the called subscriber.

With relay 110 operated, an intermediate circuit is closed, with the office selector sequence switch 108 in talking position 8, which may be traced from battery through the upper windings of relay 135 and coil 136, contacts of cam 115,

right front contact of relay 110, contacts of cam 140—A, lower left winding of repeating coil 138, ring brush of the office selector, contacts of cam 107, terminal 106, brush 625, contacts of cam 624, lower right winding of repeating coil 631, through the winding of polarized relay 301, upper right winding of repeating coil 631, contacts of cam 622, brush 621, terminal 105, contacts of cam 104, tip brush of the office selector, contacts of cam 139, upper left winding of repeating coil 138, contacts of cam 137, left front contact of relay 110, contacts of cam 117, lower windings of coil 136 and relay 135, contacts of cam 141, back contact of relay 106—A to ground over the contacts of cam 113. The direction of current flow in this circuit is such that polarized relay 301 is operated, closing a circuit from ground over the lower right contact of cam 632, the upper contact of cam 635, front contact of relay 301, right contacts of cam 618, to interrupter 322. When this interrupter closes its right contact the circuit is extended to the winding of relay 302 and battery. Relay 302 operates and locks over its left contact and the left contact of cam 618 to the ground controlled by relay 301. With relay 302 operated, the closure of the left contact of interrupter 322 extends ground over the right front contact of relay 302, left contacts of cam 602, winding of relay 321 and battery. Relay 321 controls the charge on the message register of the calling subscriber in the manner described in the Carpenter et al. patent.

Speech currents also traverse these paths being transmitted from one to another by the repeating coils 631 and 138.

With the district selector in talking position, the calling subscriber's line is marked busy and the cut-off relay 102 is held operated by battery through resistance 313, contacts of cam 608, inner lower back contact of relay 316, brush 326, terminal 327, winding of cut-off relay 102 to ground. The office selector is held busy by means of a circuit extending from ground over the lower right and upper contacts of cam 632, sleeve brush 639, sleeve terminal 114, left contacts of cam 130, left front contact and winding of relay 102, contacts of cam 181, right winding of relay 102 to battery, relay 101 having been operated previously. The outgoing trunk is also held busy by ground from the district selector extended over the upper contacts of cam 130 to sleeve brush 140.

The final selector is held busy by means of ground connected over the contacts of cam 124 to brush 132 which supplies locking ground for relay 208, previously operated, whose locking circuit extends from battery through the winding of relay 208, contacts of cam 209, front contact of relay 208, contacts of cam 211 to conductor 214 connecting with the terminal engaged by brush 132. The called subscriber's line is held busy by means of ground over the contact of cam 225, resistance 246, contact of cam 241, brush 234, to the winding of cut-off relay 236 and battery. It may be noted that in this case the calling office supplies ground to the cut-off relay, while the called office supplies battery to the cut-off relay.

At the termination of conversation, the restoration of the receiver to the switchhook by the called subscriber at substation 280 releases relay 148 in turn releasing relay 110. The release of relay 110 reverses the connection of relay 135 to the incoming side of the repeating coil 138, the connection now extending from battery through the upper windings of relay 135 and coil 136, contacts of cam 115, contacts of cam 125, left back

contact of relay 110 to cam 137 and thence as previously traced to the right armature of relay 110 and over the back contact thereof, contacts of cam 145, lower windings of coil 136 and relay 135 to ground as above traced. As a consequence, relay 301 of the district selector releases, in turn releasing relay 302. Formerly the circuits remained in this condition until the calling subscriber restored his receiver to the switchhook.

In accordance with the present invention, when relay 301 releases, a circuit is closed from ground over the lower right contact of cam 632, the upper contact of cam 635, back contact of cam 301, outer right contact of relay 321 to conductor 10 and through resistance 11 to the uppermost armature of relay 12. Relay 12 is operated and released at measured intervals by the operation of the interrupter 13, and at its next operation extends ground from conductor 10 over its uppermost armature to the winding of relay 14. Relay 14 in turn operates relay 15, which provides a holding circuit for relay 14 over conductor 10 independent of relay 12. A measured interval after the operation of relay 12, when interrupter 13 closes its left contact, a circuit is closed for relay 16 which closes a circuit from ground at the outer right front contact of relay 15 over the uppermost armature of relay 16 to the winding of relay 17 and battery. Relay 17 in operating connects ground to relay 18 and meter 19 for recording the fact that the release control circuit has been used. Relay 17 also connects the conductor 10 to conductor 20.

The connection of conductor 10 to conductor 20 completes a circuit from ground on these conductors over the contacts of cam 648, through the lower winding of relay 316 to battery. Relay 316 in operating locks in a circuit from battery through its upper winding and inner upper front contact to ground over the upper left and lower right contacts of cam 603. Relay 316 also opens the incoming end of the talking circuit, releasing relay 616, and when interrupter 328 opens, releasing relay 351. Relay 316 also closes a circuit from ground over cam 603, over the upper front contacts of relay 316, upper contacts of cam 601, to the winding of sequence switch magnet 600 and battery advancing the sequence switch to position 17.

With sequence switch 600 in position 17, relay 302 is reoperated in a circuit from battery through the winding of relay 302, lower contacts of cam 601, contacts of cam 648, back contact of relay 351, over the contacts of interrupter 328. Relay 302 locks under the control of the line finder commutator (not shown) and closes a circuit for sequence switch 600 from battery through the winding of sequence switch magnet 600, lower contacts of cam 602, right contact of relay 302 to ground over the right contacts of cam 603. Sequence switch 600 advances in this circuit to position 18 where the line finder switch and district selector switch are restored to normal, resulting in the advance of sequence switch 600 to position 1. For the details of this operation, reference is made to the Carpenter et al. patent above identified.

The advance of district selector sequence switch 600 from position 16 opens the ground connected to sleeve brush 639, thereby releasing relay 102 in the office selector circuit and closing a circuit from ground over the contacts of cam 109, left back contact of relay 102, contacts of cam 123, winding of sequence switch magnet 108 and battery. Sequence switch 108 advances

from position 8 opening the talking circuit, and disconnecting busy ground from brush 140. With sequence switch 108 in position 9 the office selector switch is restored to normal, after which sequence switch 108 is advanced to position 10 which is a second normal position. For the details of these operations, reference is made to the Berry Patent 1,601,058 above-mentioned.

The advance of sequence switch 600 from position 16 opens the circuit of relay 301 permitting relay 135 of the incoming selector to release. With relay 135 released, a circuit is closed from ground over the back contact of relay 135, contacts of cam 109—A, winding of relay 106—A to battery. Relay 106—A in operating closes a circuit from battery through the winding of sequence switch magnet 100—A, contacts of cam 112, front contact of relay 106—A to ground over the contacts of cam 113. Sequence switch 100—A advances in this circuit to position 18 where the incoming selector switch is restored to normal, after which the sequence switch is restored to position 1. The advance of sequence switch 100—A from position 17 disconnects ground from brush 132, opening the locking circuit of relay 208 which releases, closing a circuit from ground over its back contact, contacts of cam 223 to the winding of sequence switch magnet 200 and battery, advancing the sequence switch to position 15. From this position sequence switch 200 is advanced under control of an interrupter (not shown) to position 18 where the final selector switch is restored to normal, thereby advancing sequence switch 200 to position 1. The advance of sequence switch 200 to position 18 disconnects ground from brush 234, releasing the cut-off relay 225 and freeing the substation 280 for subsequent calls. For the circuits and their functioning beyond the advance from the talking position, reference is made to the Berry Patent 1,658,829 above identified.

Turning now to Fig. 2, which discloses schematically a coin district selector, the talking circuit established with sequence switch 1300 either in position 13 or position 14 extends from battery through the lower left winding of repeating coil 1338 lower contact of relay 1339, contacts of cam 1316 through the winding of supervisory relay 1317, lower back contact of relay 324, ring brush 325 of the line finder, through the subscriber's substation, tip brush 328—A of the line finder, upper back contact of relay 324, contact of cam 1318, upper back contact of relay 1339, upper left winding of repeating coil 1338 to ground. Relay 1317 operates in this circuit, in turn operating relay 323 in a circuit from battery through the winding of relay 323, front contact of relay 1317, contacts of cam 1307 and ground. The outgoing end of the talking circuit extends from ground in the incoming selector as previously traced to terminal 105 and thence over brush 1334, upper contacts of cam 1335, upper right winding of repeating coil 1338, winding of polarized relay 1340, lower right winding of repeating coil 1338, lower contacts of cam 1336, brush 1337 to terminal 106 of the office selector and thence to battery as traced for the non-coin district selector.

The current flow in this circuit is such that relay 1340 is operated. Relays 1317, 323 and 1340 remain operated throughout the conversation. With relay 1340 operated a circuit is closed from ground over the lower left and upper right contacts of cam 1304, front contact of polarized relay 1340, upper left and lower right contacts of cam 1327 to interrupter 1341. When inter-

rupter 1341 closes its right contact, it operates relay 302—A which locks under the control of relay 1340 and closes a circuit over the left contact of interrupter 1341, right contact of relay 302—A and the contacts of cam 1303 to the timing circuit which corresponds to Fig. 14 of the Hague patent above identified. When this timing circuit has started to function, ground is connected to the winding of relay 329 which operates and locks over its own right contact to the lower contacts of cam 1304. Relay 1340 also extends ground to the timing circuit as a signal that conversation has started.

When the conversation is completed, assuming that the called subscriber disconnects first, relay 110 is released as previously described reversing the connection of relay 135 to the talking conductors and releasing relay 1340. With relay 1340 released, ground is connected over the lower left and upper right contacts of cam 1304, back contact of relay 1340, outer left contact of relay 329, back contact of relay 331—A to conductor 21. This conductor, which is individual to the district selector of Fig. 2, is connected through resistance 22 in multiple with conductor 10, and the conductors individual to other districts. As previously described, relays 12 and 16 operate intermittently under the control of interrupter 13. Relay 12 extends conductor 21 to the winding of relay 14 which operates, in turn operating relay 15 which closes a holding circuit for relay 14 under the control of conductor 21. With relay 15 operated, when relay 16 operates, relay 17 is operated extending conductor 21 to conductor 23. The grounding of conductor 23 completes a circuit over the contacts of cam 24 through the right winding of relay 321—A to battery. Relay 321—A operates in this circuit and locks in a circuit through its left winding and left front contact to ground over the right contacts of cam 1307, closing a circuit from battery through the winding of sequence switch magnet 1300, contacts of cam 1314, right front contact of relay 321—A, to ground over the lower contacts of cam 1304. Sequence switch 1300 advances to position 16 in this circuit. The advance of sequence switch 1300 from position 15 opens the outgoing end of the talking circuit, permitting the office, incoming and final selectors to restore to normal as previously described. It also opens the incoming end of the talking circuit releasing relay 1317 which in turn releases relay 323. When sequence switch 1300 reaches position 16, the locking circuit of relay 321—A is opened and that relay releases, closing a circuit from battery through the winding of sequence switch magnet 1300, contacts of cam 1322, back contact of relay 321—A to ground over the lower contacts of cam 1304 advancing the sequence switch to position 17. In this position the circuit of relay 1317 is reclosed as well as the circuit of relay 323 to prevent the premature operation of relay 324. At the same time, an overflow tone is transmitted to the calling subscriber over a circuit which can be traced from tone source 25 over the upper right and lower left contacts of cam 1336 through the right windings of repeating coil 1338, the winding of polarized relay 1340 and the associated condenser, upper right and lower left contacts of cam 1335, contacts of cam 1313, right contacts of cam 1307 to ground. This overflow tone is transmitted through the repeating coil 1338 to the incoming talking circuit and the subscriber's receiver to inform him that he should restore his receiver to the switchhook. When he

does so, relays 1317 and 323 release. Since sequence switch 1300 is now in position 17, relay 324 is operated to permit the coin circuit to function and to bring about the complete restoration of the circuit and selectors to normal. These operations are described in detail in the Hague patent above identified.

The release control circuit of the lower part of Fig. 1 is, in general, used with a single district frame, relays 12 and 16 and interrupter 13 being common to all of the district selectors of the frame. Each of these relays carries four sets of contacts each of which is common to one-fourth the districts mounted on the frame. Each contact of relay 12 operates a set of relays 14 and 15 which in combination with the corresponding contact of relay 16 operates a set of relays like relay 17, to close an individual connection between the incoming and outgoing conductors 10 and 20 or 21 and 23 for each district on the frame. It may be noted that, although the probability of such an occurrence is slight, if a second district selector grounds its incoming conductor 10 at the time that relay 17 has been operated under the control of another district selector in the same group, the release function will take place immediately without waiting for a time interval measured by interrupter 13.

What is claimed is:

1. In a telephone system, a calling subscriber's line, a called subscriber's line, a selector switch, means including said selector switch for establishing a telephone connection between said calling and called subscribers' lines, means normally under the control of said calling subscriber's line for releasing said selector switch, means common to a plurality of said selector switches and controlled by said called subscriber's line for transmitting a release signal to said selector switch and means in said selector switch responsive to said signal for releasing said connection to free said called line.

2. In a telephone system, a calling subscriber's line, a called subscriber's line, a selector switch, means including said selector switch for establishing a telephone connection between said calling and called subscribers' lines, means normally under the control of said calling subscriber's line for releasing said selector switch, and means common to a plurality of said selector switches and controlled by said called subscriber's line for releasing said selector switch and said connection.

3. In a telephone system, a calling subscriber's line, a called subscriber's line, a selector switch, means including said selector switch for establishing a telephone connection between said calling and called subscribers' lines, means normally under the control of said calling subscriber's line for releasing said selector switch, timing means common to a plurality of said selector switches and controlled by said called subscriber's line for closing a circuit individual to said selector switch, and means controlled by

said circuit for releasing said connection to free said called line.

4. In a telephone system, a calling subscriber's line, a called subscriber's line, a selector switch, means including said selector switch for establishing a telephone connection between said calling and called subscribers' lines, means normally under the control of said calling subscriber's line for releasing said selector switch, release control means common to a plurality of said selector switches, means under the control of said called subscriber for transmitting a signal to said release control means, and means in said release control means for extending said signal to said selector switch.

5. In a telephone system, a plurality of telephone connections each including a calling line, a called line and a selector switch, means normally under control of the calling line for releasing the associated selector switch, release control means common to said selector switches, means under the control of any one of said called lines for transmitting a signal to said release control means, timing means and means responsive to the operation of said timing means for causing said release control means to extend said signal to the selector switch with which said called line is connected and means for simultaneously extending subsequent signals from other called lines in the group to the corresponding selector switches.

6. In a telephone system, a calling subscriber's line, a called subscriber's line, a selector switch, means including said selector switch for establishing a telephone connection between said calling and called subscribers' lines, means normally under the control of said calling subscriber for releasing said selector switch, and means common to a plurality of said selector switches and controlled by said called subscriber for releasing said connection and signaling said calling subscriber.

7. In a telephone system, a calling line having an individual message register, a calling line having a coin box, a district selector serving said message register line, a district selector serving said coin box line, called lines, means including said selectors for establishing telephone connections between said calling and called lines, means normally under the control of said calling subscribers for releasing said selector switches, means common to said selector switches and controlled by a called subscriber for transmitting a signal to the selector employed in the connection to said called line, means in said selector serving said message register line responsive to said signal for releasing said connection and said selector, and means in said selector serving said coin box line responsive to said signal for releasing said connection and signaling said calling line.

CHARLES W. KECKLER.
ARTHUR RAYNSFORD.