

Jan. 6, 1942

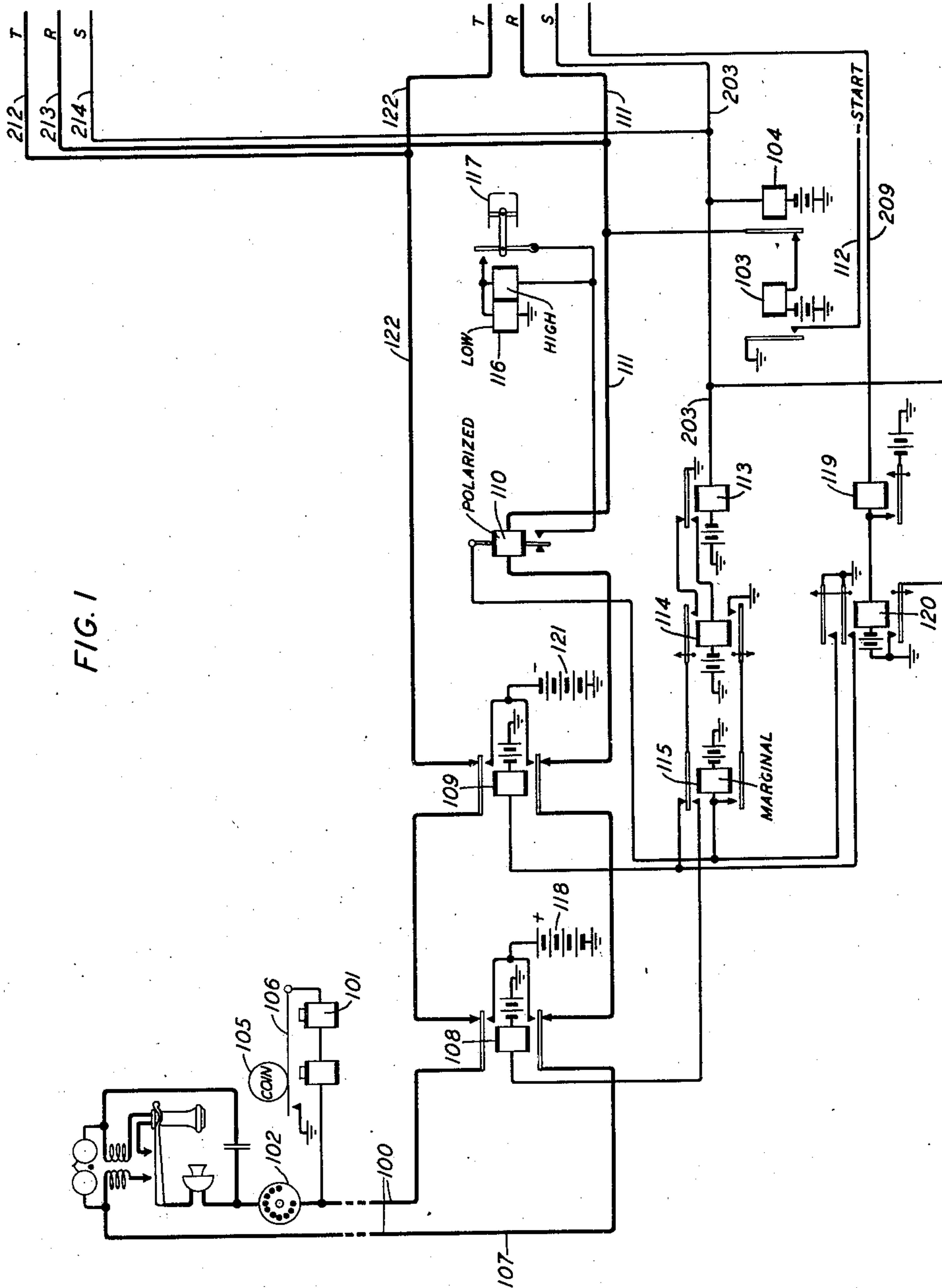
R. B. McCOWN ET AL

2,269,375

TELEPHONE SYSTEM

Filed Aug. 11, 1939

2 Sheets-Sheet 1



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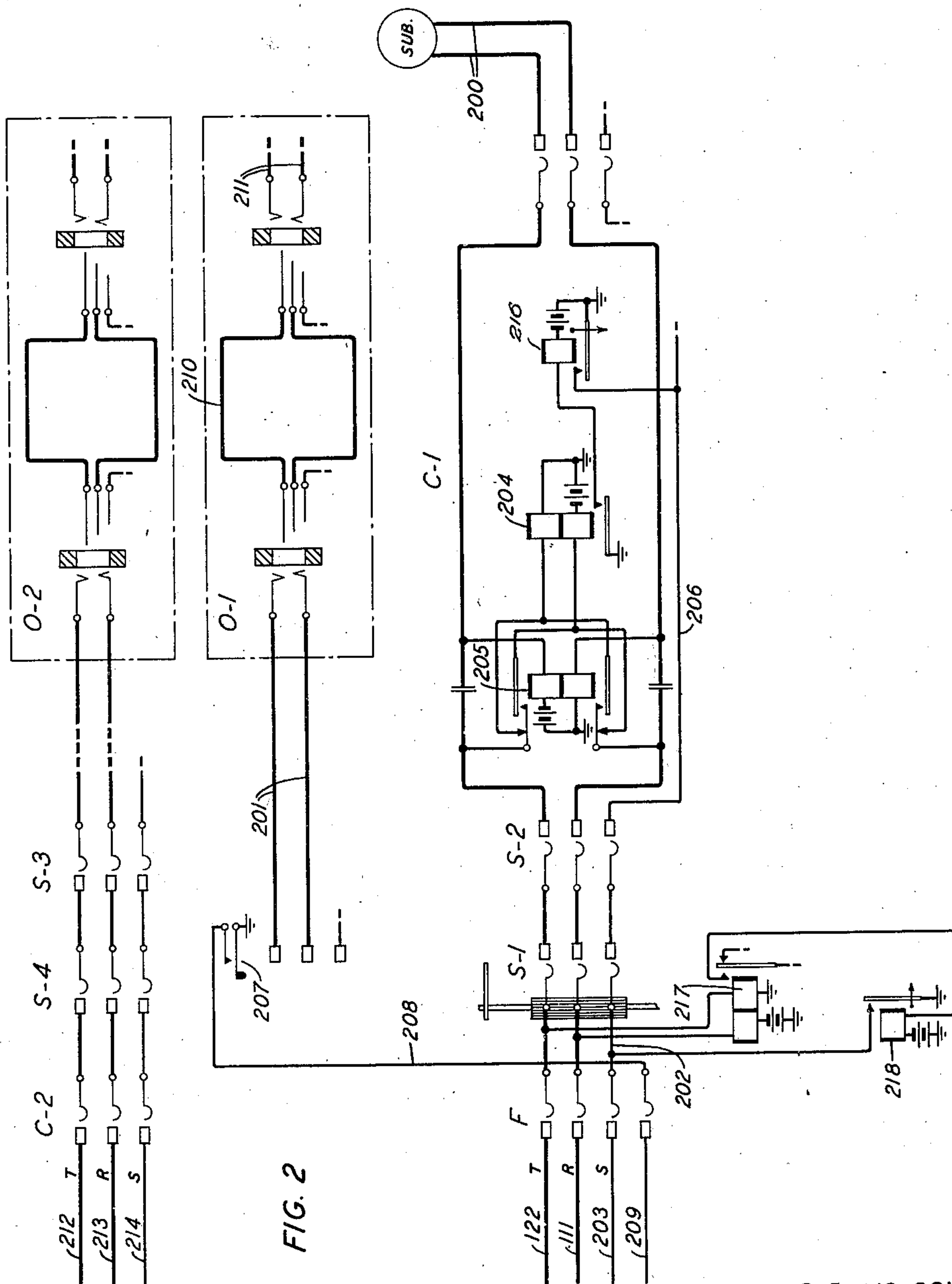
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2,269,375

TELEPHONE SYSTEM

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Application August 11, 1939, Serial No. 289,674

12 Claims. (Cl. 179—6.3)

This invention relates to telephone systems and particularly to those in which connections from pay-station lines are established either wholly or in part by automatic switches.

The objects of the invention are to improve the service available to the patrons of coin line stations; to simplify the duties of the operators in the establishment of connections involving pay-station lines; to minimize as much as possible the equipment for disposing of the deposited coins; and to effect other improvements in systems of this kind.

It has been the practice in the past to provide equipment in the coin trunks at the central office for disposing automatically of a coin deposited by the calling patron for a call which he establishes with his dial over automatic switches to a subscriber's line, the coin being collected or refunded automatically depending on the success of the call, and to provide further equipment whereby the operator, when the calling patron extends the connection to her position, may dispose of the coins deposited by him at her request.

According to the present invention the equipment heretofore provided for enabling the operator to dispose of deposited coins is dispensed with, and means is provided for disposing of all deposited coins automatically, both for connections which the calling patron completes with his dial and for connections established with the assistance of the operator.

A feature of the invention is a system in which a coin control mechanism discriminates between a call made by the calling patron of the coin line over automatic switches to a subscriber's line and a call extended by him to the operator's position. If the call is made to another subscriber without the assistance of the operator, the coin control mechanism disposes of the coin in the usual manner when the connection is released, collecting it if the call was successful or refunding it in the event the called party did not answer. If, however, the calling patron dials for the operator to assist him, the coin control mechanism, having distinguished the nature of the call, proceeds at once to refund automatically the initial coin deposited by the patron for the purpose of making the call and sets itself in condition to collect later, when the connection is released, any coins that may subsequently be deposited by the patron at the request of the operator.

Another feature of the invention is a system in which the coins, deposited at the request of the operator by the patron at the station of a coin

line to which the operator has extended a connection over a train of automatic switches, are collected automatically when the connection is released without any further act on the part of the operator.

The foregoing and other features of the invention will be discussed more fully in the following detailed specification.

In the drawings accompanying the specification:

Figure 1 discloses a pay station line extending to the central office and terminating in a coin control mechanism; and

Fig. 2 discloses a line finder switch, in which the pay station line appears, together with selectors and connectors for extending calls to subscribers' lines and also to the operator's position. This figure also illustrates a connection established to the pay-station line as a called line.

While the invention is not necessarily limited to a system using any particular kind of switching mechanism for establishing connections, it has been illustrated for convenience in a system employing switches of the well-known step-by-step type.

The pay-station line 100 is equipped with a coin receiving and disposal mechanism, including a coin relay 101, which may be of the usual pre-pay type or may be of the type shown in the application of F. A. Hoyt, Serial No. 274,129, filed May 17, 1939. The pay-station is also provided with an impulse dial 102 for setting the selective switches in the central office.

At the central office the pay-station line is provided with an individual coin control mechanism, which is interposed between the incoming conductors of the line 100 and the usual line and cut-off relays 103 and 104, respectively. The pay-station line, after extending through the coin control circuits, appears in the terminal bank of the line finder switch F. The finder F is associated with a first selector switch S—1 which, together with succeeding switches, such as selector S—2 and connector C—1, serves to extend the pay-station line to a local subscriber's line, such as the line 200.

The first selector switch S—1 also has access through its tenth level terminals to the operators' positions, such as position O—1, by way of trunks, such as the trunk 201.

The pay-station line 100 also appears in the contact bank of the connector switch C—2, over which it is seized as a called line. For example, the operator at position O—2 may extend a con-

nection to the pay-station line by way of selectors S—3 and S—4 and connector C—2.

The detailed operation of the system will now be described. For this purposes it will first be assumed that the patron at the pay-station of line 100 wishes to establish a conversational connection with the subscriber's line 200. To this end the calling patron deposits a coin 105 in the coin receiving mechanism and removes his receiver from the switchhook. A circuit is now completed from ground through the closed coin contacts 106, windings of the coin relay 101, thence through the switchhook contacts to line conductor 107, lower normal contacts of relays 100 and 109, winding of polarized relay 110, conductor 111, normal contact of cut-off relay 104, winding of line relay 103 to battery. Relay 103 operates in this circuit and places ground potential on the start conductor 112 to start the idle line finder F in operation. As soon as the finder F seizes the terminals of the calling pay-station line, the line is extended through to the windings of impulse relay 217 of the first selector S—1. Relay 217 operates slow-release relay 218, and the latter applies holding ground to the sleeve conductor 202. This grounded circuit is also extended through the brush of the finder switch over sleeve conductor 203 and thence in parallel through the winding of cut-off relay 104 and the winding of sleeve relay 113 to battery. These relays operate, and the line relay 103 is released. The tip and ring conductors of the calling line are now extended through the brushes of the finder switch F to the impulse receiving relay associated with the first selector switch S—1. The sleeve relay 113 in operating closes an obvious circuit for operating the slow-release relay 114. The circuits are now ready for the calling patron to transmit impulses.

When the dial 102 is manipulated to send the first series of impulses to the central office, relay 217 responds, and the selector switch S—1 is operated to extend the calling line through to the succeeding selector S—2. The selector S—2 responds to the second series of impulses and extends the connection to the connector switch C—1. During the extension of the connection from selector S—1 to selector S—2 and thence to connector C—1, the current flowing over the subscriber's line is in such a direction that the polarized relay 110 in the coin control mechanism remains inoperative. The calling line is now supplied with current from the connector C—1 over a circuit traceable from battery through the lower winding of relay 204, lower normal contacts of relay 205, thence over the lower side of the connection extending back through the calling line loop and returning over the upper side of the connection through the upper normal contacts of relay 205 and the upper winding of relay 204 to ground. Relay 204 operates and closes an operating circuit for slow-release relay 216. Relay 216 places holding ground on conductors 206, 202 and 203. The direction of current through the polarized relay 110, however, is still such that this relay does not operate. The next two series of impulses operate the connector switch C—1 to complete the connection to the called subscriber's line 200.

When the called subscriber answers, a circuit is closed for operating relay 205, and this relay causes a reversal in the direction of current flowing over the calling line 100. Current flowing in the reverse direction operates the polarized

relay 110 in the coin control circuit. When relay 110 first operates, it closes a circuit from battery through the winding of charge relay 115, contacts of relay 110 through the right high resistance winding and the left low resistance winding of relay 116 to ground. Relay 115 does not operate in this circuit, but relay 116 energizes and closes its contacts after a measured interval determined by the dash-pot 117. This interval is provided to insure that the operation of relay 110 is caused by the answer of the called subscriber and not by a momentary reversal of current or other disturbance in the connection. When the relay 116 closes its contacts, a short circuit is closed around the high resistance winding, and relay 115 now receives sufficient current to operate. Relay 115 when operated locks through its own lower contacts to ground at the closed contacts of relay 114. The established connection is now in condition for conversation.

At the termination of conversation the receivers are replaced on the switchhooks at the calling and called stations, and relays 204 and 205 of the connector switch are released. Ground potential is removed from the holding conductors 206 and 202 to initiate the release of the line finder, selector and connector switches. The removal of ground potential from the sleeve conductor 203 also causes the release of cut-off relay 104 and sleeve relay 113 in the coin control circuit. Relay 113 closes a circuit from ground through its back contacts, closed contacts of relay 114, which remains operated for an interval following the release of relay 113, front contacts of slow-release relay 115 through the winding of the coin collect relay 108 to battery. After an interval relay 114 releases and opens the circuit of relay 108 and also the locking circuit of relay 115. During the interval measured by the release time of relay 114, relay 108 applies current from the positive pole of the coin collect battery 118 to both conductors of the line 100. This current flows through the windings of the polarized coin relay 101 and operates it in the proper direction to collect the deposited coin 105. The equipment is now restored to its normal condition in readiness for the next call.

If the called line 200 is found busy or the called subscriber fails to answer when ringing current is applied to his line, relay 205 remains deenergized and no reversal of current occurs. Hence the polarized supervisory relay 110 does not operate, and no circuit is closed for the operation of the marginal charge relay 115. When, therefore, the calling party hangs up his receiver and relay 113 releases, a circuit is closed from ground through the upper contacts of relay 113, upper contacts of slow relay 114, upper back contacts of relay 115 through the winding of relay 109 to battery. Relay 109 energizes and connects the negative pole of the coin refund battery 121 to the conductors of line 100. Current from the source 121 operates the coin relay 101 in the proper direction for refunding the coin to the calling party.

Similarly, if a call is made from the pay station for which no charge is necessary, the circuits may be arranged in any well-known manner to omit the current reversal and the operation of the polarized relay 110. Consequently the deposited coin is refunded to the calling party when he replaces his receiver on the switchhook.

Assume next that the patron at the pay station of line 100 wishes to make a toll call needing the assistance of the operator at position O—1.

To reach the operator the calling patron deposits a coin 105, removes his receiver from the switchhook, and manipulates his dial 102 to transmit a series of ten impulses. The deposit of the coin and the removal of the receiver cause the operation of line relay 103, which in turn causes the line finder F to seize the pay-station line 100. The transmission of the series of ten impulses results in the operation of the selector switch S—1 to its tenth level of terminals. The selector S—1 hunts in this level and seizes an idle trunk 201 extending to the position O—1.

When the shaft of the selector S—1 advances to the tenth level, it closes the level contacts 207 to send a discriminating signal back to the coin control circuit identifying the call as one that is being extended to the operator's position. The circuit for transmitting this signal may be traced from ground through the contacts 207, conductor 208, through the lowermost brush of the line finder F, conductor 209, through the windings of relays 119 and 120. Relay 120 operates immediately, but relay 119 is slow to act and does not close its contacts until an interval has expired following the operation of relay 120. Relay 120 closes an operating circuit for relay 115 and the latter relay locks to the closed contacts of relay 114, which has already operated as previously described in a circuit closed at the front contacts of the sleeve relay 113. Relay 120 also closes an obvious circuit for the coin return relay 109 and applies ground potential to the sleeve conductor 203. Relay 109 disconnects the tip and ring conductors of the line 100 from the connection extending toward the line finder and connects these conductors to the negative pole of coin refund battery 121. During the time the line 100 is disconnected from the line finder by the relay 109 the sleeve relay 113, the cut-off relay 104, and the operated switches F and S—1 are prevented from releasing by the ground potential maintained on the sleeve conductor 203 by the relay 120. Current flowing from the battery 121 energizes the coin relay 101, and this relay operates in the proper direction to refund the coin 105 to the calling patron. After the measured interval expires, the slow-operate relay 119 attracts its armatures and closes a short circuit around the winding of relay 120. Relay 120 being slow to release maintains its contacts closed for a further interval after the operation of relay 119. At the end of this further interval relay 120 releases and opens the circuit of the collect relay 109. Relay 109 disconnects the coin refund battery 121 from the line and recloses the talking conductors of the extended connection. Thus the coin control mechanism distinguishes a call that is being made to the operator's position, refunds the initial coin immediately, and operates the charge relay 115 to prepare for the automatic collection, at the end of conversation, of any coins that may subsequently be deposited at the pay station.

The operator at position O—1 responds to the call by inserting the answering plug of her cord circuit 210 in the jack of the trunk 201. She obtains the necessary information from the calling patron and proceeds to complete the desired connection over an outgoing circuit 211 to the called subscriber's line. She also requests the calling patron to deposit in the coin box the amount necessary to cover the charge for the particular call requested. When the called party answers, the usual supervisory signal is displayed at the operator's position, but it is not necessary

on this type of call to reverse the current flowing back over the connection through the polarized relay 110 and the calling line 100. It is not necessary to reverse the current because the charge relay 115 in the coin control circuit has already operated as explained by reason of the fact that the connection was extended to the operator's position. Furthermore, the coin control circuit is set to collect any coins that may be deposited at the request of the operator.

At the end of conversation the calling patron replaces his receiver on the switchhook, and the operator obtains the usual supervisory signal, whereupon she proceeds to disconnect her cord circuit from the trunk 201. The line finder and selector switches release and ground potential is removed from the sleeve conductor 203 permitting the release of relays 104 and 113. Relay 113 closes a circuit through its back contacts through the closed contacts of slow-release relay 114 through the front contacts of the operated charge relay 115 and the winding of coin collect relay 108 to battery. Relay 108 applies the collect battery 118 to the line, and the deposited coins at the substation are collected. After an interval the slow-release relay 114 releases, releasing in turn the charge relay 115 and collect relay 108.

Assume next that a connection is extended to the pay-station line 100 over a train of automatic switches, such as selectors S—3 and S—4 and connector C—2, from an operator's position O—2. The operator O—2 may be a toll operator who has finally succeeded in setting up a delayed call to a subscriber's line at the request of the patron at the pay-station of line 100 and she now calls pay-station line 100 over the selector and connector switches. Since the patron of the pay-station line 100 has initiated the call it will be necessary for him to deposit the requested coins, which should be collected at the end of conversation. To this end the direction of current supplied from the connector switch C—2 over the called pay-station line 100 is such that the relay 110 operates when the patron at the pay-station removes his receiver. The operator at position O—2, by means of the usual impulse dial, sets the selectors S—3 and S—4 and the connector C—2 on the terminals of the pay-station line 100. The connector switch C—2 applies ground potential in the usual manner to the sleeve conductor 214, causing the operation of cut-off relay 104 and sleeve relay 113. The line is signaled in the usual manner, and the party at the pay-station replies by removing the receiver from the switchhook. When he removes his receiver, a circuit is closed for supplying current from the connector C—2 to the line 100 through a current supply relay similar to the relay 205 illustrated in the connector switch C—1. It will be noted from inspection that the current supply circuit extends from the negative pole of battery over the upper winding of the relay (corresponding to relay 205) thence over the tip conductor of the connector switch C—2, conductor 212 to the tip conductor 122 thence over the loop of the line 100 and returning over the ring conductor through the winding of relay 110, conductor 111 to the ring conductor 213 through the brush of the connector switch C—2 through the lower winding of the relay (corresponding to relay 205) to ground. Current flowing in this direction operates the polarized relay 110, which causes the operation of the charge relay 115 in the manner hereinbefore de-

scribed. After the patron at the pay-station has deposited the amount requested by the operator the parties are free to proceed with the conversation.

At the end of conversation the switches S—3, S—4 and C—2 are released, and holding ground potential is removed from the sleeve conductors 214 and 203. Relays 104 and 113 release, and a circuit, hereinbefore traced, is closed for operating the coin collect relay 108 to effect the collection of the coins deposited at the pay-station.

What is claimed is:

1. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, discriminating means individual to said pay-station line and dependent on the impulses transmitted for determining whether the call is being extended to said subscriber's line or to said position, and means controlled by said discriminating means for automatically refunding the deposited coin.

2. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, discriminating means dependent on the number of impulses sent over the pay-station line for determining whether the call is being extended to said subscriber's line or to said position, and means controlled by said discriminating means for refunding the coin deposited in said receiving device and for collecting any subsequently deposited coins at the termination of the call.

3. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, discriminating means controlled by said automatic switch for determining whether the call is extended to the subscriber's line or to said operator's position, and means controlled by said discriminating means when a call is extended to said position for refunding the deposited coin immediately and preparing for the subsequent collection of any coins deposited thereafter at the request of the operator.

4. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating

said switch to extend a call either to said subscriber's line or to said operator's position, discriminating means dependent for its operation upon the extent of movement of said automatic switch for determining when a call is being extended to said operator's position, means effective at the termination of a call to said subscriber's line for collecting or refunding a deposited coin, and means controlled by said discriminating means when a call is extended to said position for refunding the deposited coin immediately and for collecting subsequently any further coins that may be deposited thereafter at the request of the operator.

5. In a telephone system, a line having a pay-station thereon, an impulse sender and a coin receiving device at said pay-station, a coin control mechanism associated with said line, an automatic switch, means responsive to the initiation of a call at said pay-station for extending said line to said switch, a subscriber's line, an operator's position, means responsive to impulses transmitted over the pay-station line for operating said automatic switch to extend a connection either to the subscriber's line or to said operator's position, means responsive to said coin control mechanism upon the release of a connection extended to said subscriber's line for disposing automatically of a coin deposited in said receiving device, discriminating means controlled in accordance with the directive operation of said switch for determining when a call is made to said operator's position, and means responsive to said discriminating means for causing said coin control mechanism to refund a deposited coin when the call is made to said operator's position and for preparing said control mechanism to collect automatically at the termination of the call any further coins that may be deposited in said receiving device.

6. In a telephone system, a non-numerical switch, a pay-station line appearing in the terminals of said switch, an impulse sender and a coin receiving device at the pay-station of said line, a coin control mechanism connected in said line between the pay-station and the terminals of said switch, an automatic switch, means responsive to the initiation of a call at said pay-station for operating said non-numerical switch to extend the pay-station line to said automatic switch, means responsive to the transmission of impulses over said line for operating said automatic switch to extend calls from said pay-station line, means for rendering said control mechanism effective to dispose of coins deposited in said receiving device at the termination of calls extended from said pay-station, other automatic switches for extending connections to said pay-station line, and means responsive to the extension of a call to said line over said other automatic switches for rendering said control mechanism effective to collect automatically a coin deposited in said receiving device.

7. In a telephone system, a non-numerical switch, a pay-station line appearing in the terminals of said switch, an impulse sender and a coin receiving device at said pay-station, a coin control mechanism individual to said line and connected therein between said pay-station and the terminals of said switch, an automatic selector switch, means responsive to the deposit of a coin in said device for operating said non-numerical switch to extend said pay-station line to said selector switch, means responsive to im-

pulses transmitted over said line for operating said selector switch to further extend said line, an operator's position, other automatic switches controlled by said operator for extending a call to said pay-station line, and means responsive to the extension of a call by way of said other automatic switches to said pay-station line for rendering said control mechanism effective to collect a deposited coin upon the termination of the call.

8. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, a coin control mechanism individual to and forming a part of said pay-station line, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, means effective when a call is extended to said operator's position for transmitting a signal from said automatic switch to the coin control mechanism in said pay-station line, and means responsive to said signal for causing said control mechanism to automatically refund the coin deposited at said pay-station.

9. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, means at the operator's position for answering a call extended thereto, means effective when a call is extended to the operator's position and independent of the operator's act in answering the call for sending a signal to said pay-station line, and means responsive to said signal for automatically refunding the deposited coin.

10. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, a subscriber's line, an operator's position, an automatic switch, a coin control mechanism individual to and forming a part of said pay-station line, means responsive to the deposit of a coin in said device for extending said pay-station line to said automatic switch, means responsive to impulses sent over said pay-station line for directly operating said switch to extend a call either to said subscriber's line or to said operator's position, means effective when a call is extended to the operator's position for transmitting a signal to said coin control mechanism, means responsive to said signal for causing the automatic refund of the deposited coin, and means also operated in response to said signal for preparing said coin control mechanism to collect unassisted by the operator any coins that may subsequently be deposited at the request of the operator.

11. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, subscribers' lines, an operator's position, an automatic selector switch, a non-numerical switch effective when a coin is deposited in said device for extending said pay-station line to said selector switch, means responsive to impulses transmitted by said impulse sender over said pay-station line for directly operating said selector switch to extend a call either to a subscriber's line or to said operator's position, means at the operator's position for answering a call and for further extending it to a subscriber's line, means effective when a call is extended to said operator's position for transmitting a signal through said non-numerical switch to said pay-station line, means responsive to said signal for automatically refunding the deposited coin and further means responsive to said signal for automatically collecting without the assistance of the operator or the called party all coins that may subsequently be deposited at the request of said operator.

12. In a telephone system, a pay-station line, an impulse sender and a coin receiving device at said pay-station, subscribers' lines, an operator's position, an automatic selector switch, a non-numerical switch effective when a coin is deposited in said device for extending said pay-station line to said selector switch, means responsive to impulses transmitted by said impulse sender over said pay-station line for directly operating said selector switch to extend a call either to a subscriber's line or to said operator's position, means at the operator's position for answering a call and for further extending it to a subscriber's line, a circuit closed by the movement of said selector switch when it is operated to extend a call to the operator's position for transmitting a signal through said non-numerical switch to said pay-station line, relay means individual to said pay-station line and responsive to said signal for causing the immediate refund of the coin deposited at the pay-station, other relay means individual to said pay-station line and also responsive to said signal, and coin collect mechanism operable under control of said other relay means for collecting any coins subsequently deposited at said pay-station at the request of the operator.

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