

Feb. 3, 1942.

J. DAVIDSON, JR

2,271,681

TELEPHONE SYSTEM

Filed Aug. 11, 1939

3 Sheets-Sheet 1

FIG. 1

FIG. 2	FIG. 4
FIG. 3	

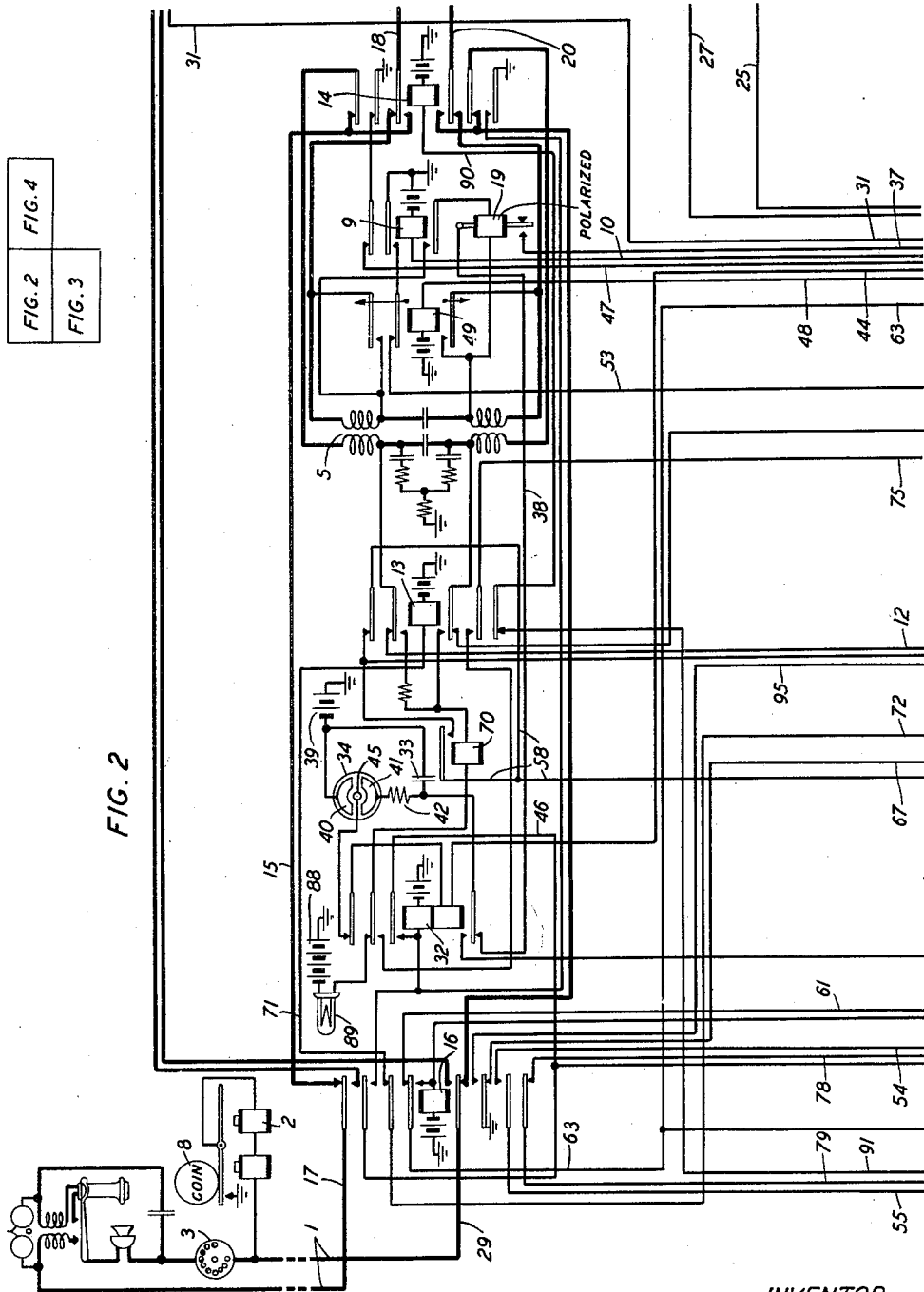


FIG. 2

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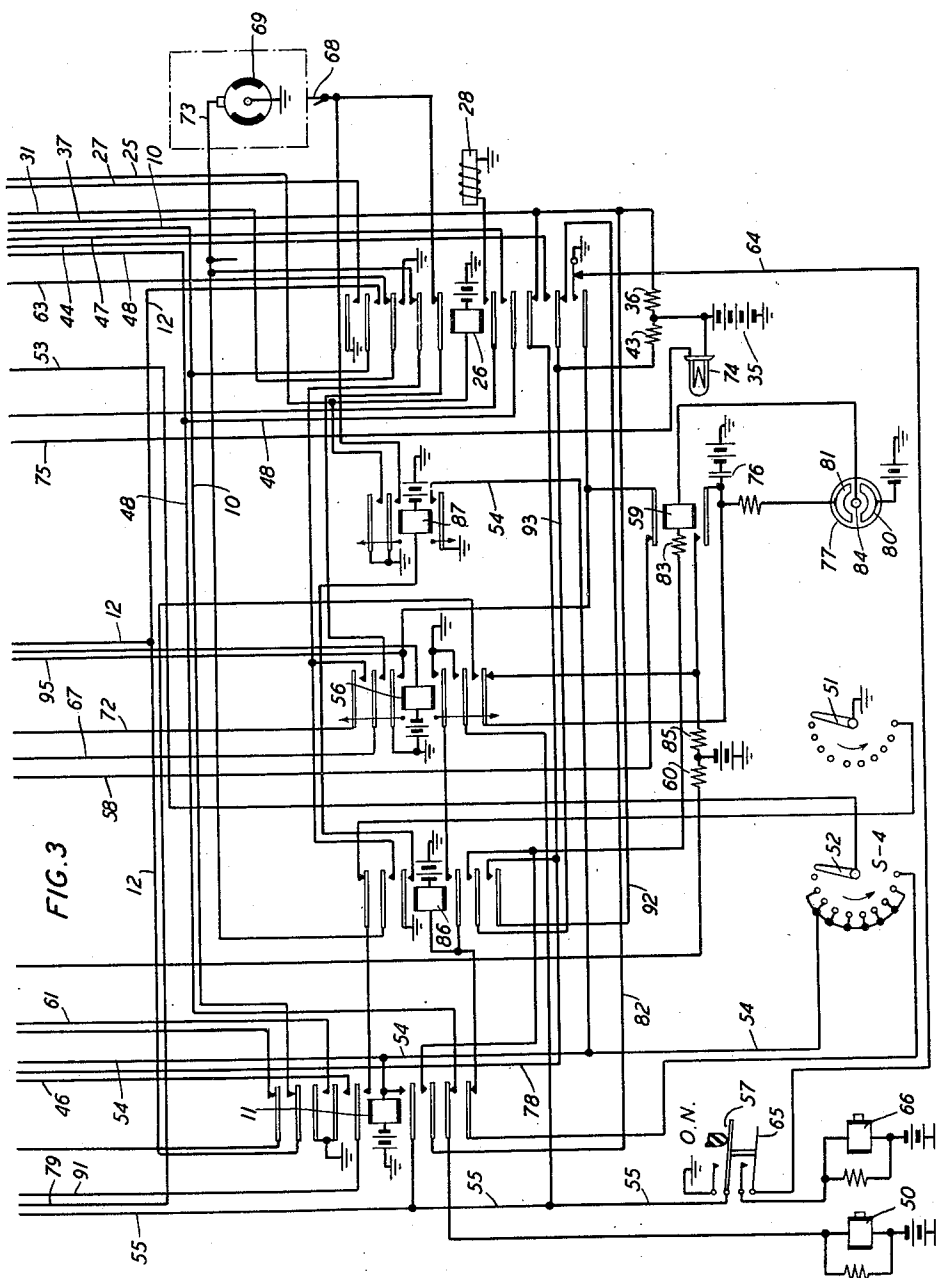
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3 Sheets-Sheet 2



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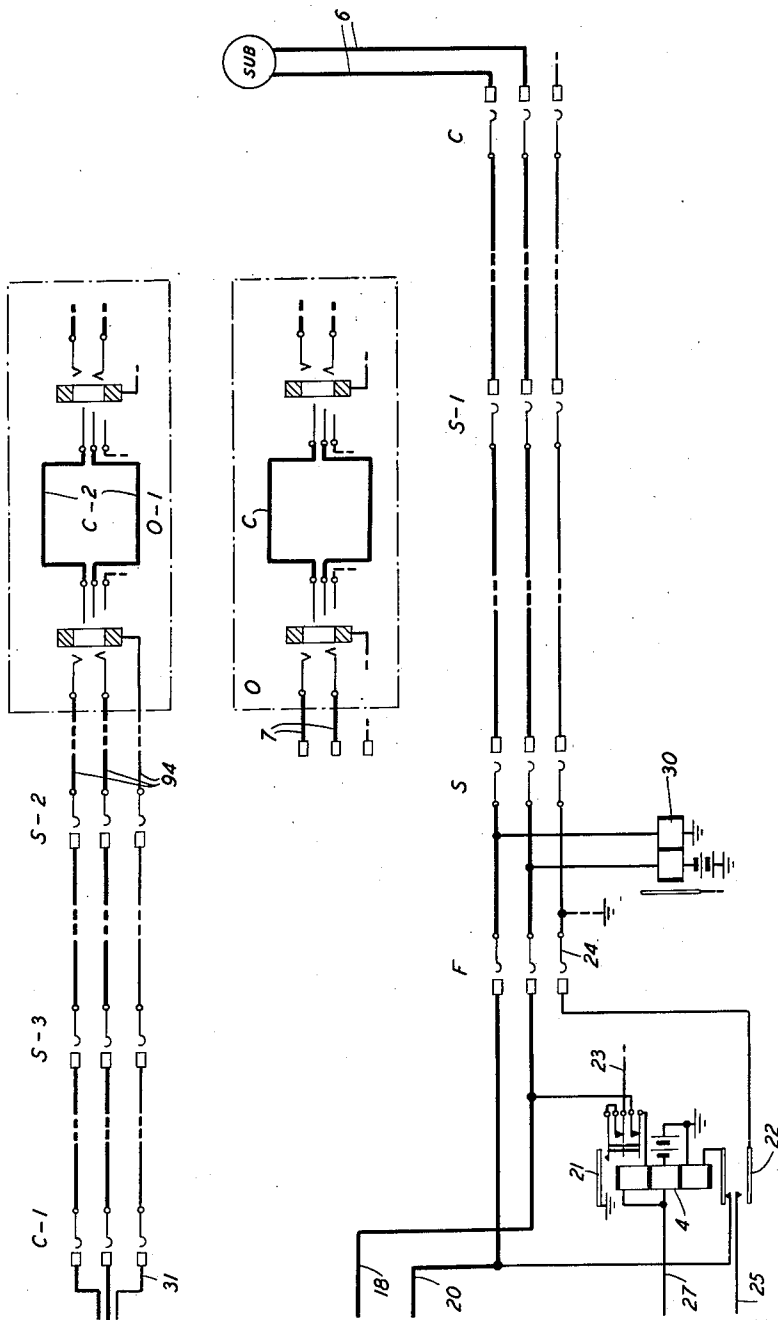
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TELEPHONE SYSTEM

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3 Sheets-Sheet 3

FIG. 4



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2,271,681

TELEPHONE SYSTEM

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Application August 11, 1939, Serial No. 289,518

10 Claims. (Cl. 179-6.3)

This invention relates to telephone systems and particularly to those in which calls from pay station lines are made either wholly or in part by means of automatic switches.

The objects of the invention are to obtain improvements and uniformity in the service available to the patrons of coin line stations; to simplify the work of the operators in the establishment of connections involving pay station lines; to discriminate between calls from a pay station line to subscribers' lines and calls to the operator's position; and to effect other improvements in systems of this kind.

It has been proposed heretofore to provide equipment in 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 make further provision on calls to the operator's position for relieving her of the duty of disposing of any coins that may be deposited at her request.

According to the present invention the foregoing objects are realized by a system of this general character in which the coin control mechanism in the central office is capable of discriminating between a connection established from the pay station line to a subscriber's line and a call established from the coin line to the operator's position, the discrimination being accomplished by impulse operated means responsive to the impulses transmitted over the pay station line for the purpose of setting the automatic switches to establish the desired connection. More specifically, the coin control mechanism receives the directive impulses transmitted over the pay station line and utilizes them for selectively operating automatic switches to establish the connection and also for operating simultaneously an auxiliary switching device which determines the nature of the call by the number of impulses it receives. If the call is being made to a subscriber's line, the control mechanism is conditioned for disposing of the coin in the usual manner at the termination of the call. If, however, the discriminating switch determines that a call is being made to the operator's position, the control mechanism refunds the initial coin immediately and prepares to collect, at the termination of the call, any coins that may be subsequently deposited.

A feature of the invention is a coin control mechanism in which the charge relay that de-

notes the successful completion of a call is operated at the end of an interval following the response of the called party, the interval being measured by charging a time measuring condenser from the source of coin disposal current and by utilizing the charge on the condenser for rendering a discharge tube effective to operate the charge relay.

Another feature of the invention is a coin control mechanism in which the coin disposal current is removed automatically from the pay station line at the end of a measured interval following its application thereto, provided it has not been previously removed by the successful disposition of the coin at the pay station. If the disposal mechanism at the pay station fails to refund the initial coin on a call to the operator, the interval is measured at the central office, the coin disposal current is removed from the line, and the connection is established nevertheless to permit conversation between the calling patron and the operator. If the failure to dispose of the coin occurs at the termination of a call, the interval is similarly measured, the coin disposal current is removed from the line, and the coin control mechanism is released, freeing the line for further calls. The time interval during which disposal current is applied to the line is measured by charging a condenser to a value sufficient to ionize a gas-filled tube.

The foregoing and other features of the invention will be described more fully in detail in the following specification and will also be set forth in the appended claims.

In the drawings accompanying the specification:

Fig. 1 shows the manner in which Figs. 2, 3 and 4 should be arranged;

Fig. 2 discloses a pay station telephone line and a portion of the coin control mechanism individual to the line at the central office;

Fig. 3 shows the remainder of the coin control mechanism including a step-by-step discriminating switch; and

Fig. 4 discloses the line circuit of the pay station line, and illustrates diagrammatically the automatic switches serving to extend calls from the pay station line to subscribers' lines and to an operator's position which is also illustrated diagrammatically. This figure also shows in diagrammatic manner an operator's position and a train of automatic switches by which the operator extends connections to the pay station line.

While the invention is not necessarily limited to systems using any particular kind of switch-

ing 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 1 is equipped with a coin receiving and disposal mechanism, including a coin relay 2, which may be of the usual prepay type or of the type disclosed 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 3 for setting the selective switches in the central office.

At the central office the pay station line is equipped with an individual coin control mechanism, which is interposed between the incoming conductors of the line and the combined line and cut-off relay 4. The pay station line, after extending through the coin control circuits, including the repeating coil 5, appears in the terminal bank of the line-finder switch F. The finder F is associated with a first selector S, which, together with succeeding switches, such as selector S—1 and connector C, serves to extend the pay station line to a local subscriber's line 6.

The first selector switch S has access through its tenth level of terminals to operators' positions, such as position O, by way of an operator's trunk, such as the trunk 7.

The pay station line 1 also appears in the contact bank of the connector switch C—1, over which it may be seized by the operator at position O—1 by way of selector switches S—2 and S—3.

The detailed operation of the system will now be described, assuming first that the patron at the pay station 1 wishes to converse with the subscriber at the substation of line 6. To initiate the call the patron at the pay station deposits a coin 8 and removes the receiver from the switch-hook. The closure of the coin contacts completes a circuit for operating the impulse relay 9 in the coin control mechanism at the central office. This circuit may be traced from battery through the winding of said relay, conductor 10, normal contacts of relay 11, conductor 12, normal contacts of relay 13, upper left winding of repeating coil 5, normal contacts of relay 14, conductor 15, normal contacts of relay 16 thence over the line conductor 17 through the switch-hook contacts, windings of the coin relay 2 and the closed coin contacts to ground. The impulse relay 9 operates in this circuit and closes a bridge across the tip and ring conductors extending toward the line-finder switch F. This bridge closure results in the completion of a circuit from battery through the middle and upper windings of line relay 4, normal contacts of said relay, conductor 18, normal contacts of relay 14, upper right winding of repeating coil 5, closed contacts of impulse relay 9, winding of polarized relay 19, lower right winding of repeating coil 5, normal contacts of relay 14, conductor 20, normal contacts and lower winding of relay 4 to ground. The relay 4 is energized sufficiently in this circuit to close its contacts 21 and 22, but the high resistance of the upper winding of said relay prevents the relay from fully operating to open its remaining contacts. The finder start circuit is now closed from ground through the contact 21, normally closed contact of relay 4 to conductor 23.

When the line finder F reaches the terminals of the calling pay station line, the test circuit of the finder is closed over brush 24 through the

closed contacts 22, conductor 25, winding of sleeve relay 26 to battery. Relay 26 operates and closes a circuit from ground over its front contacts, conductor 27 through the middle winding of relay 4 to battery. Relay 4 is fully energized in this circuit and opens its normally closed contacts. The opening of these contacts severs the start conductor 23 and disconnects the three windings of the relay from the line conductors 18 and 20. Relay 26 connects the balancing coil 28 to the opposite side of the pay station line 1 for the purpose of balancing the impulse relay 9. The connection for this coil may be traced from ground through the winding of the coil, closed contacts of relay 26, normal contacts of relay 13, lower left winding of coil 5, normal contacts of relay 14, normal contacts of relay 16 to the conductor 29 of line 1. Relay 26 also places ground potential on the sleeve conductor 31 to render the pay station line 1 busy to the connector switch C—1. Furthermore, relay 26 closes an operating circuit for relay 56 which may be traced from battery through the winding of the latter relay, normal contacts of relay 13, conductor 58, normal contacts of relay 59 to ground at the closed contacts of relay 26. Relay 56 operates and locks through its own front contacts independently of relay 26. The tip and ring conductors 18 and 20 are now extended through the line-finder switch F to the impulse relay 30 of the first selector switch S. The circuit for relay 30 may be traced from battery through its left winding over the brush of finder switch F, conductor 18, thence as previously traced through the repeating coil 5 and the closed contacts of impulse relay 9 and returning over conductor 20 to the finder switch F and the right winding of relay 30 to ground. The circuits are now in condition for the transmission of impulses from the calling pay station.

When the calling patron manipulates the dial 3 to transmit the first series of impulses, relay 9 responds by opening and closing the circuit of the impulse relay 30, and the first selector switch S is operated step by step in response to these impulses. On each release of the impulse relay 9, during the first series of impulses, a circuit is closed from ground through the normal contacts of relay 14, back contacts of relay 9, conductor 47, closed contacts of relay 26, conductor 48 thence in parallel through the winding of slow-release relay 49 and through the normal contacts of relay 11 and the winding of the stepping magnet 50 of the auxiliary discriminating selector switch S—4. Relay 49 operates and remains operated during the impulse series, and the magnet 50 steps the brushes 51 and 52 from position to position. When relay 49 first operates, it closes a short circuit around the right windings of the repeating coil 5 to exclude these windings from the pulsing circuit extending toward the selector switches. At the end of the first series of impulses relay 49 releases after an interval, and a circuit is completed from ground through the front contacts of relay 9, back contacts of relay 49, conductor 53 to the brush 52 of selector S—4. Since the calling patron has dialed a subscriber's number the first digit is something other than "0," and the selector S—4 advances to some position other than its tenth position. Consequently the circuit above traced over conductor 53 extends through the brush 52 and the terminal on which the brush is standing thence over conductor 54 to the winding of relay 11 to battery. Relay 11 operates in this circuit and locks through

its locking contacts over conductor 55 to ground at the contacts of relay 56 and also through the off-normal contacts 57.

The calling patron now transmits the succeeding series of impulses to operate the selector switch S—1 and the connector switch C to complete the connection to the called subscriber's line 6. While the connection is being extended over selectors S and S—1 and connector switch C the direction of current flowing through the polarized relay 19 is such that the relay does not attract its armature.

When the called subscriber answers by removing his receiver from the switchhook, the direction of current flowing from the supply source in the connector C back over the connection is reversed in the well-known manner to cause the operation of polarized relay 19. The operation of relay 19 marks the beginning of an interval of time which is measured between the response of the called subscriber and the operation of the charge relay 32. This interval is measured by the charging of condenser 33 to a value sufficient to ionize the gas-filled discharge tube 34. The condenser 33 is charged from the source of coin disposal current 35, and the circuit therefor may be traced from the positive pole of said source through the resistance 36, conductor 37, closed contacts of relay 19, conductor 38, normal contacts of relay 32, condenser 33 to the negative pole of battery 39 and thence to ground. The charging time of condenser 33 is determined by the value on the resistance 36, and the interval measured is sufficient to protect the charge relay 32 against false operation because of momentary reversals of current or other current disturbances in the connection. When condenser 33 reaches the ionizing voltage of the tube 34, a discharge is set up in the gap formed by the cathode 40 and control electrode 41, the condenser 33 being connected across this gap through a resistance 42. With the tube ionized a discharge is produced across the main gap, and current flows in the anode circuit which includes the lower winding of the charge relay 32. This circuit may be traced from the positive pole of coin disposal source 35, resistance 43, closed contacts of relay 26, conductor 44, lower winding of relay 32, normal contacts of said relay, anode 45 and cathode 40 of the tube 34 to the negative pole of battery 39. Current flowing in this circuit energizes the relay 32 sufficiently to close first its locking contacts, whereupon a circuit is completed for fully energizing the relay to open and close its remaining contacts. The latter circuit for the relay may be traced from battery through its upper winding and locking contacts to conductor 46 thence to ground at the front contacts of relay 11. Relay 32 in operating opens the anode circuit of tube 34, and the tube deionizes. Relay 32 connects the negative pole of battery through resistance 60 to one pole of the condenser 33, whereby the condenser is discharged, since the opposite pole is also connected to the same pole of battery.

The established connection is now in condition for conversation, talking current being supplied to the calling line through the relay 9 and the coil 28 and the left windings of the repeating coil 5. The called line is supplied with talking current from the connector switch C, and the intermediate part of the connection, including the right windings of coil 5 and the automatic switches, is energized by current supplied in the well-known manner from the connector switch C. 75

At the termination of conversation the calling patron replaces his receiver on the switchhook at the pay station, and relay 9 releases. Relay 9 opens the bridge circuit across the tip and ring conductors to permit the release of connector C, selectors S and S—1 and line finder F. The removal of ground potential from the sleeve conductor 25 results in the release of sleeve relay 26 in the coin control mechanism. Relay 26 releases the line and cut-off relay 4 and disconnects the impulse relay 9 and retard coil 28 from the line 1. The line 1 is now maintained busy in the connector multiple by means of a circuit from ground through the closed contacts of relay 11, conductor 61, normal contacts of relay 16, conductor 63, back contacts of relay 26 to the sleeve conductor 31. Relay 26 also causes the release of the discriminating auxiliary selector switch S—4 by closing a circuit from ground through the normal contacts of the relay, conductor 64, off-normal contacts 65 of the switch S—4 through the winding of release magnet 66 to battery. Furthermore the relay 26 in releasing closes a circuit from ground through the normal contacts of relay 16, conductor 67, closed contacts of relay 56, closed contacts of relay 26 to the start conductor 68. The start conductor 68 serves in any well-known manner to start the machine-driven interrupter 69 in operation.

Since the call was successful and the charge relay 32 operated at the time the called party answered, the coin deposited at the pay station should now be collected. Collection of the coin is accomplished by applying the positive coin collect battery 35 to the tip and ring conductors of the line 1 through the winding of relay 70. The coin collecting circuit is prepared by operating relay 13 in a circuit from battery through the winding of said relay, conductor 71, normal contacts of relay 16, conductor 72, closed contacts of relay 56, normal contacts of relay 26, conductor 73 through the interrupter 69 to ground. Relay 13 operates with each closure of the interrupter 69 and closes the coin collect circuit from the positive pole of battery 35 through the resistance lamp 74, conductor 75, closed contacts of relays 13 and 32, winding of relay 70 thence in parallel through the closed contacts of relay 13 and the left windings of the coil 5 and the contacts of relay 14 to the conductors 17 and 29 of the pay station line 1. Since conductor 29 is connected to ground through the coin relay 2 and the closed coin contacts, current flows through the relay 2 in the proper direction for collecting the coin 8. It will be noted that relay 56 depends upon its own locking circuit following the release of relay 26 and that this locking circuit passes in parallel through a back contact of relay 13 and a front contact of relay 70. At each closure of interrupter 69, therefore, relay 13 opens one branch of the locking circuit of relay 56. If, however, the coin collect circuit is properly closed, relay 70 operates and closes the other branch of the locking circuit to maintain the energization of relay 56. As soon as the coin relay 2 fully energizes in response to the successive applications of coin collect current it collects the coin and opens the coin contacts to remove ground potential from conductor 29. Thereupon relay 70 releases, and, upon the next operation of relay 13, the locking circuit of relay 56 is opened. Relay 56, although slow to release, now becomes deenergized, since the interrupter 69 maintains the relay 13 operated for a time which is greater than the release inter-

val of relay 56. Relay 56 opens the start conductor 68 of the interrupter 69 and releases relay 11, which removes ground potential from the sleeve conductor of the connector multiple to render the line 1 free for incoming calls. Relay 11 also opens the locking circuit of relay 32, and the coin control circuit is thus restored to normal.

In the coin collecting operation just described it was assumed that the circuits performed their functions in the normal manner and that the coin was collected immediately. It sometimes happens, however, that the coin controlling mechanism is unable to dispose of the coin. In such a case it is desirable to measure a suitable interval of time during which the coin disposal current is repeatedly applied to the line by the intermittent operation of the relay 13 and to discontinue these attempts at the end of the measured interval and restore the circuits to their normal condition although the efforts to dispose of the coin were unsuccessful. The interval of time is measured by the condenser 76, which is charged from the coin disposal battery 35 to a voltage sufficient to ionize the control gap of the gas-filled tube 77. The circuit for charging the condenser 76 is closed by the release of relay 26, which occurs at the beginning of the coin collect operation, and may be traced from the positive pole of battery 35 through resistance 36, back contact of relay 26, conductor 78, back contacts of relay 16, conductor 79, front contacts of relay 56 of one pole of condenser 76, the other pole being connected to the negative pole of battery. The charging time of condenser 76 is determined by the value of resistance 36; and, if the coin has not been disposed of by the end of the measured interval, the voltage of condenser 76 causes ionization of the control gap of the tube 77. This gap is formed by the cathode 80 and the control electrode 81. When the tube ionizes, current flows in the anode circuit, which may be traced from positive pole of battery 35, resistance 43, back contacts of relay 26, conductor 82, closed contacts of relay 11, resistance 83, winding of relay 59, anode 84, cathode 80 to the negative pole of battery. Relay 59 operates in this circuit and opens the holding circuit of slow-releasing relay 56. Relay 56 releases and, in the manner above explained, restores the circuits to their normal condition. When the relay 11 releases following the release of relay 56, the anode circuit of tube 77 is opened, and relay 59 releases. During the time relay 59 is operated the condenser 76 is discharged by a circuit from the negative pole of battery through resistance 85, closed contacts of relay 59 to one terminal of condenser 76, the other terminal being connected to the same pole of battery.

Assume next that the patron at the pay station of line 1 wishes to make a call requiring the services of the operator. To call the operator he deposits a coin, removes his receiver from the switchhook, and manipulates the dial 3 to transmit a series of ten impulses corresponding to the designation "0." The removal of the receiver and the deposit of the coin results, as previously described, in the operation of impulse relay 9, line relay 4, sleeve relay 26, relay 56, and in the operation of line-finder switch F. The impulse relay 9 responds to the series of ten impulses and repeats them to the first selector switch S and to the discriminating selector S-4. Switch S steps its brushes to the tenth level and seizes an idle trunk 7 therein leading

to the operator's position 0. The stepping magnet 50 of the selector S-4 steps the brushes 51 and 52 to the tenth position terminals. In this position a circuit is closed for operating relay 86. This circuit may be traced from battery through the winding of said relay, normal contacts of relay 11, tenth position terminal and wiper 52, conductor 53, through the back contact of relay 49, which releases after an interval following the termination of the impulse series, to ground at the front contact of the operated impulse relay 9. Relay 86 locks to a front contact of operated relay 56 and closes an obvious circuit for operating the slow-releasing relay 87. Relay 87 connects ground to the start conductor 68, places a supplemental ground potential on the sleeve conductor 25 and closes an obvious operating circuit for relay 11.

Since the call has been extended to the operator's position 0 it is desirable to refund the initially deposited coin 8 immediately. This is accomplished by the operated relay 86, which closes a circuit as follows for operating the relay 13 to apply coin collect current to the line 1: Battery through the winding of relay 13, conductor 71, normal contacts of relay 16, conductor 72, closed contacts of relay 56, closed contacts of relay 86, conductor 73 to the interrupter 69. At each operation of relay 13 a circuit is closed for connecting the negative pole of coin refund battery 88 to the tip and ring conductors of the pay station line. This circuit may be traced from battery 88, resistance lamp 89, normal contacts of charge relay 32, winding of relay 70 and thence in parallel as above traced through the contacts of relay 13 to the conductors 17 and 29 of the line 1. These conductors being grounded by the coin contacts, current flows through the coin relay 2 in the proper direction for refunding the coin to the patron. At each operation of relay 13 the impulse relay 9 is released, opening in turn the circuit extending toward the operator's position. The finder F and selector S, however, are prevented from releasing during these momentary releases of relay 9 by relay 87, which is operated at this time to maintain a holding ground potential on the sleeve conductor 25. When the coin is refunded and the coin contacts are opened, relay 70 releases. Since relay 13 is operated at this time under the control of interrupter 69, both branches of the holding circuit of relay 56 are opened, and relay 56 releases. Relay 56 opens the holding circuit of relay 86 which in turn opens the circuit of slow-release relay 87. Relay 56 opens the circuit of relay 13 to discontinue the application of coin refund current, and relay 87 removes holding potential from the sleeve conductor 25, disconnects ground potential from the start lead, and opens the operating circuit of relay 11. Relay 11 remains locked through its locking contact to ground at the off-normal contacts 57 of the switch S-4. As soon as relay 13 releases it recloses the operating circuit of relay 56, provided relay 59 has not operated. Relay 56 reoperates and locks through its own front contact. Relay 86 closes a circuit for relay 14. This circuit may be traced from battery through the winding of relay 14, conductor 90, back contacts of relay 13, conductor 91, front contacts of relay 11 through the back contacts of relay 86, tenth position terminal and brush 51 to ground. Relay 14 disconnects the repeating coil 5 and extends the tip and ring conductors of the coin line 1 directly through to the tip and ring

conductors of the connection extending to the operator's position. Relay 14 also operates the charge relay 32 in an obvious circuit. Relay 32 locks through its own contact to ground at the front contacts of relay 11.

The connection is now established through to the operator's position ready for conversation between the calling patron and the operator, the initial coin has been refunded to the patron, and the coin control circuit is in condition to effect the automatic collection, at the termination of the call, of any further coins that may be deposited at the pay station. Talking current is supplied to the pay station line from the operator's position.

While the refunding current is being applied to the pay station line the condenser 76 measures an interval of time in the manner above described. If the control mechanism is unable to refund the coin during this interval, the condenser 76 assumes a full charge, and the tube 77 ionizes, and the relay 59 operates in the anode circuit. The charging circuit for condenser 76 may be traced from positive pole of battery 35, resistance 36, conductor 92, closed contacts of relay 86, conductor 78, contacts of relay 16, conductor 79, front contacts of relay 56 to the condenser 76. When the tube ionizes at the end of the measured interval, the anode circuit, including relay 59, is closed from the positive pole of battery 35, resistance 43, conductor 93, closed contacts of relay 86, resistance 83, winding of relay 59 to the anode 84, the cathode 80 thence to the negative pole of battery. Relay 59 operates and opens the holding circuit of relay 56. Relay 56 releases and causes the release of relays 86 and 87 as above described. Relay 56 also releases relay 13 to discontinue the application of coin refund current to the pay station line. Also the circuit of relay 14 is closed as above described. Relay 14 operates and completes the established connection through to the operator's position for conversation although the mechanism has failed to refund the deposited coin.

The operator answers the call with her cord circuit C, converses with the calling patron, sets up the desired connection and requests the deposit of the necessary coins in payment for the call.

At the end of conversation the operator receives the usual supervisory signals and disconnects cord circuit C from the jack of the trunk 7. The selector S and finder F are released, and ground potential is removed from the sleeve conductor 25, causing the release of sleeve relay 26. Relay 26 releases the line relay 4 and the selector switch S—4. Selector S—4 opens the circuit of relay 14, and this relay releases. Since the charge relay 32 was operated at the time the initial coin was refunded, the release of relay 26 causes the operation of relay 13 and the application of coin collect current to the line in the manner fully described hereinbefore. As soon as the coin is collected, relay 56 releases, causing the release of relay 11, which in turn releases the charge relay 32. Thus the collection of coins deposited at the pay station, when a call is set up by the operator, is performed automatically at the termination of the call and without any assistance on the part of the operator.

A description will now be given of the operation of the system when a call is extended to the pay station line 1. The line 1 may be called by a subscriber who sets up a connection auto-

5 matically over a train of switches, or it may be called by an operator who similarly extends a connection thereto over a train of switches. Assume, for example, that a party at the pay station of line 1, having first called the operator to obtain a toll connection, has replaced his receiver on the switchhook and is waiting for her to recall him. As soon as the operator obtains the desired party she makes connection with a trunk 94 by means of her cord circuit C—2. The cord circuit C—2 is illustrated at position 0—1 although this cord may be located at the same position with the cord circuit C, illustrated at position 9. The trunk 94 extends to a selector switch S—2 which is operated by impulses transmitted by the operator to select a switch S—3, and switch S—3 together with connector switch C—1 are successively operated to extend the connection to the coin control circuit individual to the pay station line 1. As soon as the connector C—1 seizes the coin control circuit, relay 16 therein is operated over a circuit traceable from battery through the winding of said relay, normal contacts of relay 11, conductor 63, normal contacts of relay 26, conductor 31 to ground in the connector switch C—1. Relay 16 locks through its own front contacts to the grounded sleeve conductor 31 independently of the relay 11. Relay 16 disconnects the tip and ring conductors of the line 1 from the coin control circuit and extends these conductors to the connector switch C—1. It also operates relay 56 in a circuit from battery through the winding of said relay, normal contacts of relay 13, conductor 58, contacts of relay 59, conductor 95 to ground at the front contacts of relay 16. Relay 56 locks to its own front contacts independently of relay 16. Relay 11 now operates in a circuit from battery through its winding, front contact of relay 16, conductor 55 to ground at the front contact of relay 56. Relay 11 locks to the grounded contact of relay 56 independently of relay 16. With relays 16 and 11 operated, a circuit is closed for energizing the charge relay 32 traceable from battery through the upper winding of relay 32, front contacts of relays 16 and 11 to ground. Relay 32 operates and locks through its own contact directly to the grounded contacts of relay 11. The coin control mechanism is now prepared to collect automatically any coins that may be deposited at the pay station at the request of the operator.

At the end of conversation the connection is released, and the removal of ground potential from the sleeve conductor 31 permits the release of relay 16. The sleeve conductor 31 is immediately grounded by the release of relay 16 to prevent seizure of the pay station line by another connector switch. The ground potential for making the sleeve conductor 31 busy is supplied from the front contacts of relay 11, conductor 61, back contacts of relay 16 thence as traced to conductor 31.

When relay 16 releases, it initiates the coin collecting operation by grounding the start wire 68 by way of conductor 67, closed contacts of relay 56 and normal contacts of the sleeve relay 26. Relay 16 also completes a circuit for relay 13 from battery through the winding of the latter relay, conductor 71, back contacts of relay 16, conductor 72 and thence as previously traced to the interrupter 69. If there is no coin on deposit, or as soon as the deposited coin has been collected, the operation of relay 13 together with the released condition of relay 70 results in the

release of relay 56 and the restoration of the circuits to their normal condition in the manner hereinbefore described.

What is claimed is:

1. In a telephone system, a pay station line, 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, an impulse sender at the pay station for transmitting impulses to directively operate said automatic switch to extend a call either to said subscriber's line or to said operator's position, an auxiliary switch also responsive to said impulses for discriminating between calls to said subscriber's line and calls to said operator's position, and a coin control mechanism responsive to said auxiliary switch for automatically refunding a coin deposited in said receiving device.
2. In a telephone system, a pay station line, 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, an impulse sender at the pay station for transmitting impulses to operate said automatic switch directive-ly to extend a call either to said subscriber's line or to said operator's position, an auxiliary switch also responsive to said impulses for discriminating between calls to said subscriber's line and calls to said operator's position, a coin control mechanism for disposing of coins deposited in said receiving device, and means effective when the said auxiliary switch takes a position indicating a call to the operator for causing said coin control mechanism to refund a coin initially deposited in said device and to prepare for the collection of subsequently deposited coins.
3. In a telephone system, a pay station line, 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, an impulse sender at the pay station for transmitting impulses to operate said automatic switch directive-ly to extend a call either to said subscriber's line or to said operator's position, impulse responsive means operated in synchronism with said automatic switch by the impulses transmitted over said pay station line for identifying a call extended to the operator's position, and coin control mechanism associated with the extended connection and controlled by said impulse responsive means for refunding immediately a coin deposited in said receiving device at the pay station.
4. In a telephone system, a line having a pay station thereon, an automatic selector switch, a line finder responsive to the deposit of a coin at said pay station for extending said line to said automatic switch, a subscriber's line, an operator's position, coin control mechanism individual to said line, a dial at said pay station for transmitting impulses over said line, an auxiliary switch associated with said coin control mechanism, impulse repeating means for repeating said impulses to said automatic switch to extend calls either to the subscriber's line or to said operator's position and for repeating said impulses to said auxiliary switch, and means effective when said auxiliary switch takes a setting corresponding to a call to the operator's position for causing said coin control mechanism to refund the deposited coin and to prepare for the subsequent collection of coins that may be deposited later.
5. In a telephone system, a pay station line, a subscriber's line, automatic switches for extending a connection from said pay station line to said subscriber's line, a source of current for disposing of coins deposited at said pay station, a charge relay, a condenser for measuring an interval of time following the response of the called subscriber, a charging circuit for said condenser, means for closing said charging circuit when the called subscriber answers, a discharge tube rendered operative by the charge on said condenser at the end of the measured interval, an operating circuit for said charge relay rendered effective by said discharge tube, and means controlled by said charge relay for applying said coin disposal current to said pay station line.
6. In a telephone system, a pay station line, a subscriber's line, automatic switches for extending a connection from said pay station line to said subscriber's line, a source of current for disposing of coins deposited at said pay station, a charge relay, a condenser for measuring an interval of time following the response of the called subscriber, a charging circuit for said condenser including said source of coin disposal current, means for closing said charging circuit when the called subscriber answers, a discharge tube rendered operative by the charge on said condenser at the end of the measured interval, an operating circuit for said charge relay rendered effective by the operation of said discharge tube, and means controlled by said charge relay for applying said source of disposal current to the pay station line to collect a coin deposited at the pay station.
7. In a telephone system, a pay station line, a coin receiving device at the pay station of said line, automatic switches for extending a connection from said pay station line, a source of current for disposing of coins deposited in said coin receiving device, means for connecting said source to the pay station line, means including a time measuring condenser for measuring an interval of time following the connection of said source to the pay station line, a charging circuit for said condenser including said source of coin disposal current, and means responsive to the charge on said condenser at the end of the measured interval for disconnecting said source of current from the pay station line.
8. In a telephone system, a pay station line, a coin receiving device at the pay station of said line, a subscriber's line, automatic switches for extending a connection from said pay station line to said subscriber's line, a source of current for disposing of a coin deposited in said coin receiving device, means for connecting said source to the pay station line, means for releasing the established connection and for restoring said pay station line to its normal condition in response to the successful disposition of the deposited coin, means including a time measuring condenser for measuring an interval of time following the connection of said source to said pay station line, a charging circuit for said condenser including said source of coin disposal current, and means controlled by the charge on said condenser at the termination of the measured interval for disconnecting said source from the pay station line and for restoring said line to its normal condition.

tion in the event of failure to successfully dispose of the deposited coin.

9. In a telephone system, a pay station line, a coin receiving device at the pay station, a subscriber's line, an operator's position, an automatic switch, means effective when a coin is deposited in said device and a call initiated at said pay station for extending the pay station line to said automatic switch, a sender at the pay station for transmitting impulses to operate directly said automatic switch to extend a call either to the subscriber's line or to said operator's position, means at the operator's position for answering the call, an auxiliary switch also responsive to said impulses for discriminating between calls to said subscriber's line and calls to said operator's position, and coin control mechanism responsive to said auxiliary switch and independent of the act of the operator in answering the call for automatically refunding a coin deposited in said receiving device.

10. In a telephone system, a line having a pay station thereon, a coin receiving device at said pay station, subscribers' lines, an operator's posi-

tion, an automatic switch, means responsive to the deposit of a coin in said device for extending said pay station line to said automatic switch, a sender at the pay station for transmitting impulses to operate said automatic switch directly to extend a call either to one of said subscribers' lines or to said operator's position, an auxiliary stepping switch also responsive to said impulses for discriminating between calls to a subscriber's line and calls to said operator's position, means under the control of the operator for answering a call extended to her position and for further extending it to one of said subscribers' lines, a coin control mechanism for disposing of coins deposited in said receiving device, and means independent of the act of the operator in answering a call extended to her position and effective when said auxiliary switch steps to a position indicating that the call is being extended to said position for causing said coin control mechanism to refund the coin initially deposited in said device and to prepare for the collection of subsequently deposited coins.

JOHN DAVIDSON, JR.