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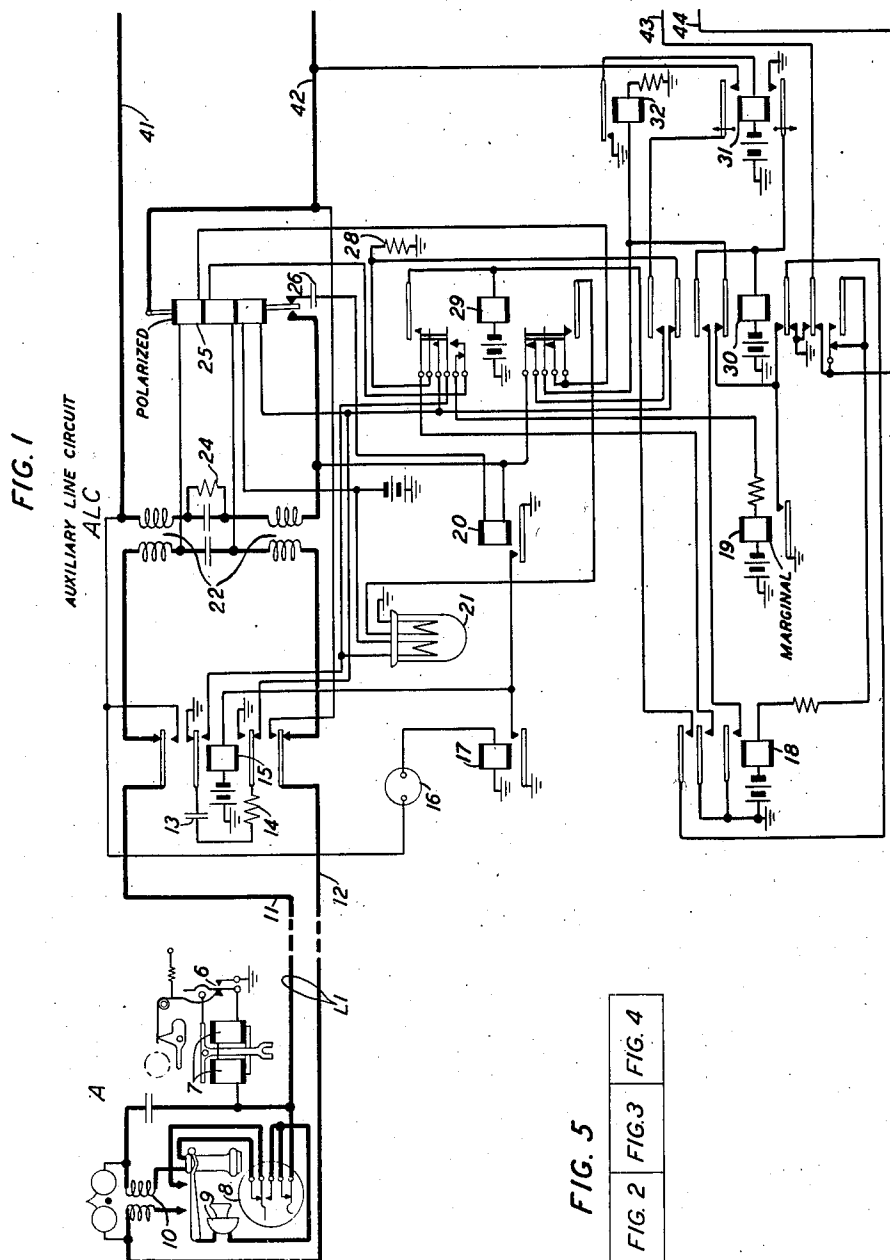
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2,336,866

TELEPHONE SYSTEM

Filed Aug. 28, 1942

4 Sheets-Sheet 1



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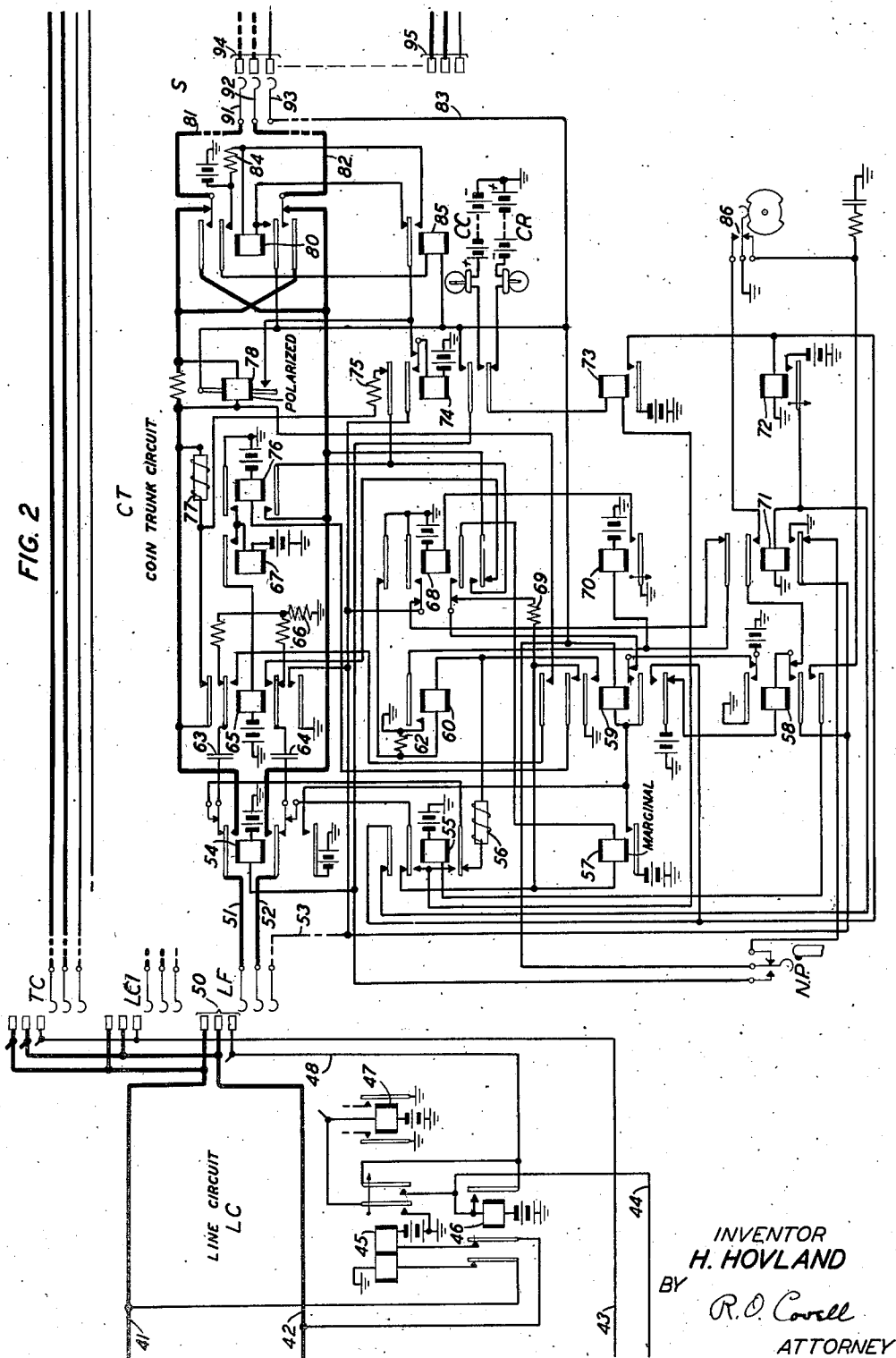
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4 Sheets-Sheet 2

FIG. 2



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TELEPHONE SYSTEM

Filed Aug. 28, 1942

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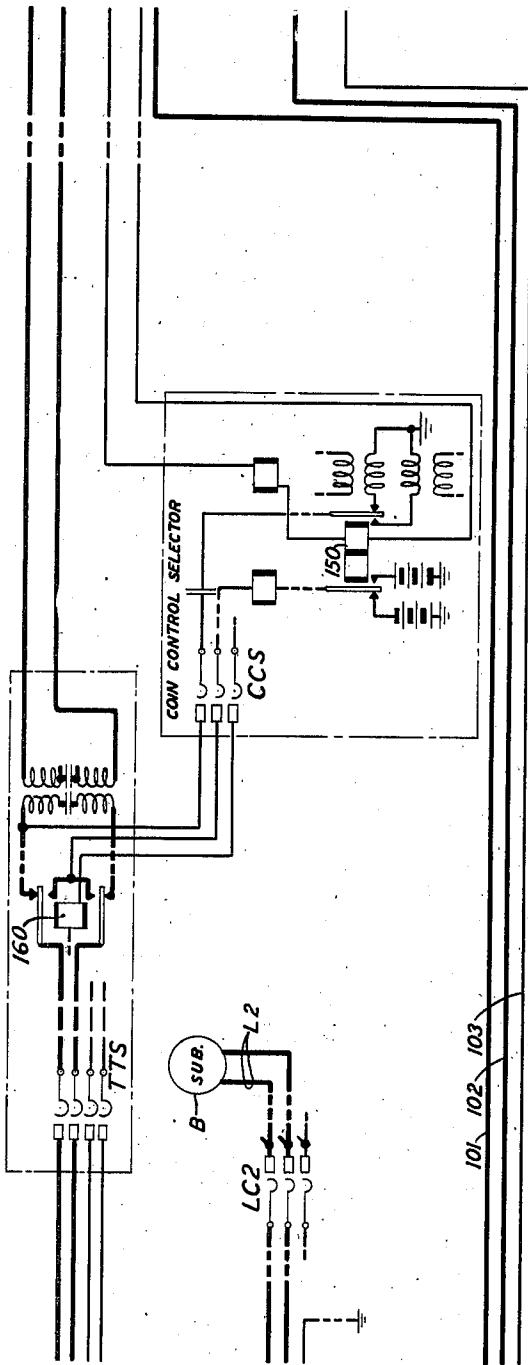


FIG. 3

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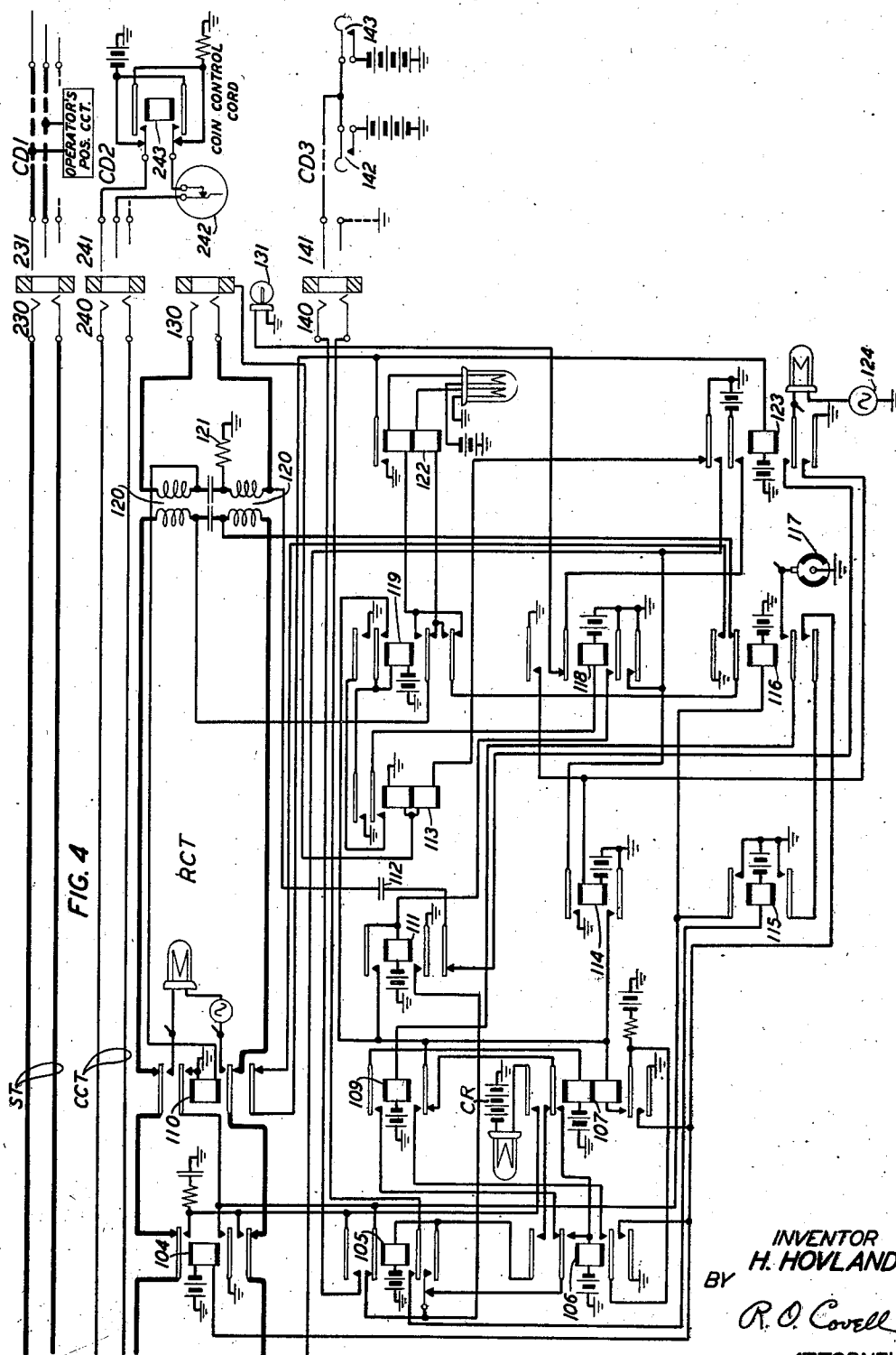
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,336,866

TELEPHONE SYSTEM

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Application August 28, 1942, Serial No. 456,483

6 Claims. (Cl. 179-6.3)

This invention relates to telephone systems and particularly to systems comprising coin stations of the prepayment type.

Objects of the invention are the improvement of systems comprising coin stations and particularly improvement of the line circuit apparatus associated with coin stations of the prepayment type thereby to increase the length of line over which satisfactory prepayment coin service is possible.

In automatic telephone systems it is known to provide an auxiliary line circuit including voice and signal repeating apparatus, if the associated line is a long or high-resistance line, to enable the completion and supervision of desired connections. This invention is a long line circuit associated with a coin station of the prepayment type arranged to repeat voice currents, to repeat selective, ringing and supervisory signals, and to transmit coin control current for collecting and refunding coins deposited at the subscriber's station. This line circuit is also arranged to mark the line busy as soon as the receiver is removed, or a leak condition exists, although no coin has been deposited; and arranged to start a line finder only in the case of a line leak of low enough resistance to operatively energize the impulse repeating relay so that the line will be connected to a first selector and a permanent signal will be operated in well known manner.

The invention and its features will be better understood by considering a system in which the invention is embodied, one such system being shown in the drawings which form a part of this specification. The invention is, however, not limited in its application to the specific system shown but is generally applicable to systems comprising coin stations of the prepayment type.

Referring to the drawings:

Fig. 1 shows a coin subscriber's station A, a line L1, and an auxiliary line circuit ALC;

Fig. 2 shows a line circuit LC, a line finder LF, a first selector S, a coin trunk circuit CT interconnecting the line finder and first selector, a toll connector TC, and a local connector LC1;

Fig. 3 shows a local connector switch LC2, a subscriber's line L2 and called station B, a toll transmission selector TTS, and a coin control selector CCS;

Fig. 4 shows a recording and completing trunk circuit RCT terminating in answering and coin control jacks 130 and 140 at a toll operator's position; Fig. 4 also shows a jack 230 connected to the toll transmission selector of Fig. 3 and a jack 240 connected to the coin control selector of Fig.

3; Fig. 4 also shows a cord circuit CD1 used for establishing connections at the toll operator's position, a cord CD2 used for automatically controlling the collecting or refunding of coins at a called subscriber's station, and a cord CD3 used for manually controlling the collection or refund of coins on a call incoming to an operator's position; and

Fig. 5 shows the relative position in which Figs. 1 to 4 inclusive, are to be placed to form an operative arrangement.

The subscriber's station A is of the usual type provided at prepay coin stations in automatic telephone systems and comprises a dial 8 for selectively operating the selector and connector switches used in establishing connections. The station A also comprises coin apparatus comprising the contacts 6 which are closed by the deposit of a coin and a coin control magnet 7 for collecting or refunding deposited coins. Reference may be had to the patent to O. F. Forsberg, No. 1,043,219, of November 5, 1912, for a description of a coin box for use at a prepayment coin station. The line finder switch LF, connector switches LC1, LC2 and TC, and selector switches S, TTS and CCS are all of the two-motion step-by-step type. Reference may be had to pages 53 to 67, inclusive, of the second edition of Automatic Telephony, by Smith and Campbell, for a description of the structure of switches of this type and for a description of the operation of such switches when used as local selectors and connectors. Reference may be had to the patent to R. L. Stokely No. 1,799,654, granted April 7, 1931, for the description of the operation of a step-by-step switch when used as a line finder. Reference may be had to the patent to Stokely 1,653,789, granted December 27, 1927, for a description of the operation of such switches when used as toll transmission selectors and toll connectors. Reference may be had to the patent to R. L. Stokely No. 1,586,537, granted June 1, 1926, for the description of a two-motion step-by-step switch used as a coin control selector. The coin trunk CT is similar to that disclosed in the patent to B. G. Dunham No. 1,569,623, granted January 12, 1926.

A clear and complete understanding of invention and its application in the system shown in the drawings will be facilitated by a description of the operations involved on local and toll calls initiated at station A. Assume first that the subscriber at station A removes the receiver to initiate a call. A circuit is thereupon closed from battery through the winding of relay 19, inner upper back contact of relay 29, middle

winding of polarized relay 25, lower left winding of repeating coil 22, outer lower back contact of relay 15, conductor 12 of line L1, left winding of retard coil 10, left contact of the receiver hook springs, transmitter 9, lower normally closed contacts of the dial 8, conductor 11 of line L1, outer upper back contact of relay 15, upper left winding of repeating coil 22, upper winding of polarized relay 25, outer lower back contact of relay 29 through the winding of relay 32 to ground. Relay 32 operates but relay 19 does not operate at this time because it is marginal and relay 25 is held non-operated by its lower, biasing winding. Relay 32 is so adjusted that it will not operate due to line leak unless the line leak is of low enough resistance to operate relay 25 as hereinafter described. The operation of relay 32 closes a circuit for operating the slow-to-release relay 31; and relay 31 closes a circuit for operating relay 30. The operation of relay 30 closes a bridge across conductors 41 and 42 to operate line relay 45 of line circuit LC. This circuit is traced from battery through the right winding of relay 45, inner back contact of cut-off relay 46, conductor 42, upper front contact of relay 31, outer upper front contact of relay 30, inner lower back contact of relay 29, lower right winding of repeating coil 22, resistor 24, upper right winding of repeating coil 22, conductor 41, through the outer back contact of relay 46 and left winding of relay 45 to ground. The aforementioned operation of relay 30 disconnects the winding of relay 18 and the winding of cut-off relay 46 of line circuit LC from conductor 43, connects ground to conductor 43 to mark this line busy in the banks of connector switches LCI and TC, and opens the normally closed circuit for energizing the lower, biasing winding of relay 25 to cause the operation of relay 25 and thereby close the bridge across conductors 41 and 42 independent of relays 29, 30 and 31. The operation of relay 45 closes a circuit for operating the group relay 47 and connects the winding of relay 46 to sleeve conductor 48. The operation of group relay 47 closes a circuit for starting the operation of an idle line finder LF; and when the brushes of the line finder engage the terminals 50, the cut-through relay (not shown) of line finder LF is operated in the manner described in the aforementioned patent to R. L. Stokely, No. 1,799,654. The connection of ground to conductor 53, when the cut-through relay of the line finder operates, causes the operation of cut-off relay 46 of line circuit LC and the operation of relay 18 of the auxiliary line circuit ALC. The operation of relay 46 causes the release of relay 45 and the release of relay 45 causes the release of relay 47, unless relay 47 is held operated by the line relay of another line circuit. Relays 18 and 46 are held operated, after relay 45 releases, through the front contact of relay 46, conductor 48 and the lower brush of line finder LF, to holding ground potential connected to conductor 53. The operation of relay 18 closes a locking circuit for relay 30.

Since an auxiliary line circuit is provided only for those lines which are long enough to require the use of such a circuit, the line finder LF includes normal post springs NP which are actuated when the brushes are on a level in which each of the lines is provided with a long line circuit. If the calling line to which the brushes of line finder LF are connected is a line which

is not a long line, the normal post springs NP are not actuated and in this case the associated coin trunk CT tests for the deposit of a coin and connects the impulse repeating relay 76 to the calling line. If the calling line is one with which a long line circuit ALC is associated, the normal post springs NP are actuated and in this case the test for the deposit of a coin is made by the long line circuit and dial impulses are repeated by the long line circuit directly to the first selector. The operation of the cut-through relay of the line finder closes a circuit for operating the line relay 60 of coin trunk CT. This circuit is traced from battery at the upper back contact of relay 58, inner lower back contact of relay 59, inner lower back contact of relay 69, resistor 69, inner upper back contact of relay 55, lower back contacts of relay 54, conductor 52, middle brush of line finder LF, conductor 20, front contact of relay 25 of the auxiliary line circuit ALC, lower right winding of repeating coil 22, resistor 24, upper right winding of repeating coil 22, conductor 41, brush and conductor 51 of line finder LF, upper back contacts of relay 54, lower back contact of relay 55, retard coil 56, and winding of relay 60, to ground at a back contact of relay 68. Relay 60 closes a circuit for operating slow-to-release relay 70 and connects ground through the upper back contact of relay 71 and inner upper back contact of relay 68, to conductor 53 to hold the line finder LF. This ground connection is further extended through the lower brush of line finder LF and conductor 48 to hold cut-off relay 46 of line circuit LC and relay 18 of auxiliary line circuit ALC. The aforementioned operation of relay 70 closes a circuit for operating relay 68. Relay 68 connects ground directly to conductor 53 to hold the line finder LF and to hold the cut-off relay 46 of line circuit LC and relay 18 of auxiliary line circuit ALC. The operation of relay 68 also opens the circuit path through resistor 69 and closes a circuit path from battery at the back contact of relay 58, through the inner lower back contact of relay 59, inner lower front contact of relay 68 and the winding of relay 57, thereby including the winding of relay 57 in series with the winding of relay 60. Relay 57 is marginal and does not operate on the call in question since the test for deposit of a coin is made by the auxiliary line circuit ALC as hereinafter described. (On a call from a line not provided with a long line circuit, relay 57 operates when a coin is deposited at the calling station.) The operation of relay 68 opens the short circuit around resistor 62 thereby to increase the non-operating margin of relay 57. The aforementioned operation of relay 68 also closes a bridge across conductors 81 and 82 of selector S to operate the line relay (not shown) in usual manner. This bridge is traced from conductor 81, through the upper back contact of relay 80, winding of polarized relay 78, retard coil 77, resistor 75, outer upper back contact of relay 74, outer lower front contact of relay 68, and lower back contact of relay 80, to conductor 82. The operation of the line relay of selector S causes holding ground potential to be connected to sleeve conductor 83 in the usual and well known manner, thereby causing the operation of relay 54. Relay 54 connects conductors 41 and 42 to the line conductors 81 and 82 of selector S so that the line relay of selector S is held operated by the aforementioned bridge across conductors 41 and 42 of auxiliary line cir-

cuit ALC. The operation of relay 54 causes the release of relays 63, 79 and 68 in the order named. Relay 54 also closes a circuit for operating relay 59, and relay 59 locks under control of relay 58. At its middle upper front contact, relay 59 connects the winding of relay 76 to the inner upper back contact of relay 55; but, with relay 54 operated, the winding of relay 76 is not connected to conductor 52 for response to dial impulses, as would be the case on a call from a line not provided with a long line circuit. Relay 78 does not operate in series with the line relay of selector S since the current through its winding is in the non-operate direction until the current is reversed due to answer of the called subscriber as hereinafter described. At its outer lower front contact, relay 59 closes circuits for operating relays 71 and 72, the circuit for operating relay 71 including the outer upper back contact of relay 55. The operation of relay 72 closes a circuit for holding relay 71 and locks relay 72 operated under control of relay 55. Relay 71 connects ground to conductor 53 to hold the line finder LF, the cut-off relay 46 of line circuit LC and relay 18 of line circuit ALC.

Dial tone is transmitted to the calling subscriber from the selector S, through repeating coil 22 of line circuit ALC, to the calling subscriber. The subscriber thereupon deposits a coin which actuates contacts 6 to connect ground through the windings of coin magnet 7 to both conductors of line L1, thereby increasing the current through the winding of relay 19 of line circuit ALC sufficiently to cause the operation of this relay. The operation of relay 19 closes a circuit including front contacts of relays 39 and 18 for operating relay 29. Relay 29 opens one of the connections between the lower right winding of repeating coil 22 and conductor 42, but the bridge across conductors 41 and 42 is maintained through the front contact of relay 25. Relay 29 locks to ground at a front contact of relay 18, includes one filament of lamp 21 in series with the middle winding of relay 25 in place of the winding of relay 19, includes the other filament of lamp 21 in series with the upper winding of relay 25 in place of the winding of relay 32, and closes the circuit through resistor 28 for energizing the biasing winding of relay 23 to condition relay 23 for response to dial impulses.

If a coin is deposited at station A prior to removal of the receiver, relay 32 may or may not operate; but relay 19 is operated due to the closure of coin contact 6. If relay 32 does not operate, relays 31 and 36 are not operated and the operation of relay 19 short circuits the winding of relay 32. Relay 25 operates over the calling subscriber's loop, closing the bridge across conductors 41 and 42 to operate line relay 45 so as to start an idle line finder and extend the connection to a coin trunk CT, through which the connection is further extended to a first selector S. When ground is connected to conductor 53 as above described, relays 46 and 18 are operated. The operation of relay 18 closes a circuit for operating relay 29, to ground at the inner lower back contact of relay 39, if this relay is not operated; or to ground at the front contact of relay 19, if relay 39 is operated. If relay 39 is not operated, the ground connected to conductor 53 is extended through conductor 43, front contact of relay 45, conductor 44, and middle lower back contact of relay 39, to conductor 43 to mark the line L1 busy in the banks of connectors LCI and TC.

When the calling subscriber dials the first digit

of the number of a station B with which a connection is desired, relay 25 is alternately released and reoperated as many times as there are units in the digit dialed, each dial impulse being repeated by the opening of the bridge across conductors 41 and 42 at the contacts of relay 25 to selectively operate the selector S in well-known manner. The trains of impulses created by the dialing of the succeeding digits of the called subscriber's number are in like manner repeated by relay 25 to operate intermediate selectors, if any (none being shown), and to operate a connector LC2 to extend the connection to the called line L1. The ringer at the called station B is operated in usual manner; and, when the call is answered, a supervisory relay in the connector effects a reversal of the current through conductors 81 and 82 causing the operative energization of the winding of polarized relay 78 of coin trunk CT. Relay 78 closes circuits for operating relays 74 and 39. Relay 74 locks to conductor 53 and connects coin collect battery CC to the winding of relay 73. Relay 80 locks to grounded conductor 83, closes a circuit for operating relay 85, and interchanges the connections between conductors 51 and 52 and conductors 81 and 82 so as to again reverse the current through the winding of relay 78. Relay 85 opens the operating circuit of relay 80 and prepares a short circuit for relay 80; which short circuit is closed when relay 73 reoperates, if the called subscriber is first to replace the receiver as hereinafter described. The talking connection between the calling and called stations includes repeating coil 22 of line circuit ALC.

When the calling subscriber restores the receiver to normal position at the end of conversation, relay 25 releases. The release of relay 25 opens the bridge across conductors 41 and 42, causing the release of the line relay (not shown) of the connector LC2; whereby ground is disconnected from the terminal engaged by brush 93 to cause the release of selector S and the release of relays 54 and 59 of coin trunk circuit CT. The connector LC2 is restored to normal in the usual manner after both the calling and called subscribers have placed the receiver in normal position. As soon after relay 59 releases as the pick-up interrupter 86 next closes its upper contact, relay 58 operates; and it locks to ground at the front contact of relay 71, independent of the interrupter. Relay 58 disconnects battery from resistor 69 to prevent the connection of this battery to conductor 52, the release of relay 54 having connected conductors 51 and 52 to the contacts of relay 55. As soon after relay 53 operates as the interrupter 86 closes its lower contact, relay 55 operates. If the call was answered and relay 74 is operated, the operation of relay 55 connects coin collect battery CC, through the winding of relay 73, front contacts of relay 55 and back contacts of relay 54, conductors 51 and 52, and brushes of line finder LF to conductors 41 and 42 of line circuit ALC. If the call was not answered and relay 74 is not operated, the operation of relay 55 connects coin return battery CR to conductors 41 and 42 of line circuit ALC. While the central office battery potential is insufficient to break down the gas-filled tube 16, the connection of either the coin collect or coin return battery to conductors 41 and 42 affects the break down of this tube and operation of relay 17. The operation of relay 17 closes a circuit for operating relay 15 thereby connecting conductors 41 and 42 directly to the conductors of line L1 to effect the

operation of coin control magnet 7 at station A. If coin collect battery is connected to these conductors, the magnet 7 is operated to collect the coin; if coin return battery is connected to the line conductors, the magnet 7 operates to return the coin. While magnet 7 is being operated, relay 73 of coin trunk CT operates, closing a holding circuit for relay 72. As soon after relay 55 operates as the lower contact of interrupter 86 is opened, relay 55 releases disconnecting the coin collect or coin refund battery from conductors 51 and 52, thereby deenergizing tube 16 and releasing relays 17, 15 and 73. The next closure of the lower contact of interrupter 86 again operates relay 55 to connect the coin control battery to the line; but, the coin having been either collected or refunded as the case may be by the first application of coin control battery, there is no ground connection at the coin box and relay 73 does not operate. With relay 55 operated and relay 73 normal, there is no circuit for holding relay 72 operated and consequently relays 72 and 71 release, in succession. When the lower contact of interrupter 86 is next opened, relay 55 releases, tube 16 deenergizes, and relays 17 and 15 release. The release of relay 71 disconnects holding ground potential from conductor 53 thereby causing the release of relays 58, 46 and 18, the release of line finder LF and the release of relay 74, if operated. If relay 30 is not operated, the release of relay 71 effects the disconnection of ground potential from the sleeve terminal of line LI in the banks of the connectors LCI and TC. If operated, relay 30 releases when relay 18 releases, disconnecting ground from conductor 43. The release of relay 18 also causes the release of relay 29 thereby completing the restoration of line circuit ALC to normal.

If the subscriber at station A makes a toll call, the selector S is operated to select the level in which the terminals are connected to recording completing trunks and to select an idle trunk in the group. Such a level and trunk are represented in the drawings by terminals 95, which are connected by a three-wire trunk to the trunk circuit RCT terminating at a toll operator's position. Upon selection of trunk circuit RCT, the bridge across conductors 41 and 42 is extended to conductors 101 and 102, thereby causing the operation of relay 122. Relay 122 operates relay 123. Relay 123 connects holding ground potential to conductor 103, lights the answering lamp 131, closes a circuit for operating relay 114, and connects the ringing current source 124, through condenser 112 to repeating coil 120 to transmit a ringing tone to the calling station. The connection of ground to conductor 103 holds selector S.

When the call is answered by inserting the plug 231 of a cord CD1 in jack 130, relay 113 operates. Relay 113 closes a circuit for operating relay 119. Relay 119 closes a circuit for operating relay 118 and interchanges the connections between the windings of relay 122 and conductors 101 and 102 to reverse the current therethrough so as to effect the operation of relay 78 of coin trunk CT. Relay 118 extinguishes the answering lamp and closes circuits for operating relays 111 and 114. Relay 111 opens the ringing tone path through condenser 112 and operates relay 116. Relay 114 connects holding ground to conductor 103 and locks relay 111. The operation of relay 116 closes a circuit for holding relay 123 and connects the winding of relay 109 to interrupter 117, the brush of which is connected to ground once

every second. The operation of relay 109, to ground through interrupter 117, closes a circuit through the upper winding of relay 107. Relay 107 operates, locks through its lower winding under control of relay 114, and closes a circuit for operating relay 104. Relay 104 disconnects conductors 101 and 102 from the windings of relay 122, and closes a holding circuit for relay 116. With relays 107 and 104 operated, coin return battery CR is connected to conductors 101 and 102, thence through brushes 91 and 92, front contacts of relay 80, front contacts of relay 54, conductors 51 and 52 and brushes of line finder LF to conductors 41 and 42 to effect the operation of tube 16 and relays 17 and 15, thereby extending the coin control circuit over line LI to operate coin control magnet 7 to refund the deposited coin. When the interrupter ground is opened, relay 109 releases causing the operation of relay 106. Relay 106 locks under control of relays 105 and 111, and closes a circuit for holding relay 104 operated. When relay 109 next operates under control of interrupter 117, the locking winding of relay 107 is short-circuited and relay 107 releases. The release of relay 107 opens the coin return battery connection. When relay 109 next releases, it closes a circuit for operating relay 105. Relay 105 locks under control of relay 111, causes the release of relays 106, 104 and 116 in succession and renders the coin control jack 140 effective for subsequent use in disposing of coins. The release of relay 104 reconnects conductors 101 and 102 to the windings of relay 122; and the release of relay 116 opens one of the paths for energizing the winding of relay 123, and disconnects the winding of relay 109 from interrupter 117. Thereafter coins may be collected or refunded by insertion of plug 141 of coin control cord CD3 in jack 140 and operation of coin collect key 142 or coin return key 143, relay 115 being operated in either case to effect the operation of relays 116 and 104 in succession. With relays 104 and 105 operated, the coin collect or coin refund battery is connected to conductors 101 and 102 to effect the collection or refund of any coins deposited at station A.

If a toll call from station A is completed on a delayed call basis, the toll operator establishes connection with the line LI through a switching trunk ST, a plug of a cord CD1 being inserted in jack 230. The toll transmission selector TTS and a toll connector TC are selectively operated under the control of the toll operator's dial to establish connection with the terminals to which conductors 41, 42 and 43 are connected. The cut-off relay 46 of line circuit LC and sleeve relay 18 of line circuit ALC are operated upon seizure of these terminals by ground potential connected to the sleeve brush of the connector TC in the usual manner. Relay 46 disconnects the line relay 45, and relay 18 effects the operation of relay 29, thereby connecting relay 25 to the left windings of repeating coil 22 for operation when the call is answered. The toll connector TC connects a ringing source (not shown) to conductors 41 and 42 thereby operatively energizing the winding of relay 20 which is normally connected in series with condenser 26 across these conductors. Relay 20 closes a circuit for operating relay 15 whereby conductors 41 and 42 are connected directly to conductors 11 and 12 of line LI so as to operate the ringer at station A. When the call is answered at station A the ringing current circuit is opened in the connector, releasing relays 20 and 15; and the talking circuit is closed

through the connector TC and toll transmission selector TTS. Relay 25 operates to bridge the right windings of repeating coil 22 across conductors 41 and 42 thereby operating the answering supervisory relay in the toll transmission selector in the usual manner. The toll operator may now dispose of coins by inserting the plug 241 of a coin control cord CD2 in jack 240 associated with coin control trunk CCT and coin control selector CCS. By dialing the required code, selector CCS is operated to connect with the toll transmission selector TTS. Relay 150 is controlled by relay 243 of the cord CD2 to connect coin collect battery or coin return battery through contacts of relay 160 of toll transmission selector TTS to effect collection or refund of coins at station A, the coin control battery being applied through line circuit ALC in the manner hereinbefore described. When the connection is released, relays 46, 18 and 29 are released restoring the line circuits to normal.

If the receiver is removed at station A without depositing a coin, or a leak condition of low enough resistance exists, relay 32 of auxiliary line circuit ALC is operated as hereinbefore described. Relay 32 causes the operation of relays 31 and 39 whereby ground potential is connected to conductor 43 to mark the line L1 busy in the banks of connectors LC1 and TC; and the call is extended through a line finder to a selector in the manner hereinbefore described. After this condition has existed for a predetermined interval of time, a permanent signal alarm is operated in the usual and well-known manner.

What is claimed is:

1. In an automatic telephone system comprising subscribers' stations including coin-box stations, comprising means for applying a ringing source to called lines and comprising coin collect and coin refund batteries for connection to coin subscribers' lines to effect the collection or return of coins deposited at the coin subscribers' stations as desired, a line, a subscriber's station connected to said line, said station comprising a directive impulse sender and coin-box mechanism for receiving and collecting or refunding coins, a line circuit individual to said line, said line circuit comprising a line relay and a line cut-off relay for disconnecting the incoming line conductors of said line circuit from said line relay, and an auxiliary line circuit connecting the first-mentioned line circuit to said line, said auxiliary line circuit comprising means responsive to the removal of the receiver at said coin subscriber's station for causing the operation of said line relay, voice current repeating means normally connecting the conductors of said line to the talking conductors of said line circuit, means for repeating directive impulses created by the operation of said sender, means responsive to the application of a ringing source to the talking conductors of said first-mentioned line circuit for connecting said conductors directly to said line, and means responsive to the application of coin collect or coin refund battery to the talking conductors of said line circuit for connecting said conductors directly to said line.

2. In an automatic telephone system comprising lines, a paystation connected to one of said lines, said station including a telephone instrument adapted to be connected across the conductors of said line by removal of the receiver from its normal position and including coin receiving means for connecting ground potential to the line upon deposit of a coin therein, a line

circuit for said line comprising line and line cut-off relays, and an auxiliary line circuit for said line, said auxiliary line circuit comprising two relays normally connected to said line, one of said two relays operatively responsive to removal of the receiver at said station, the other of said relays responsive only to the removal of the receiver and deposit of a coin in the coin receiving means thereat, means responsive to operation of said one of the two relays for closing a circuit for operating said line relay, and means responsive to the operation of the other of said two relays for closing an impulse repeating bridge across the line conductors of said first-mentioned line circuit.

3. In an automatic telephone system comprising lines, a paystation connected to one of said lines, said station including a telephone instrument adapted to be connected across the conductors of said line by removal of the receiver from its normal position and including coin receiving means for connecting ground potential to the line upon deposit of a coin therein, a line circuit for said line comprising line and line cut-off relays, and an auxiliary line circuit for said line, said auxiliary line circuit comprising two relays normally connected to said line, one of said two relays operatively responsive to removal of the receiver at said station, the other of said relays responsive only to the removal of the receiver and deposit of a coin in the coin receiving means thereat, means responsive to operation of said one of the two relays for closing a circuit for operating said line relay, means responsive to the operation of the other of said two relays for closing an impulse repeating bridge across the line conductors of said first-mentioned line circuit, and means responsive to the operation of said one of said two relays for marking said line busy prior to the deposit of a coin at said station.

4. In an automatic telephone system comprising lines, a paystation connected to one of said lines, said station including a telephone instrument adapted to be connected across the conductors of said line by removal of the receiver from its normal position and including coin receiving means for connecting ground potential to the line upon deposit of a coin therein, a line circuit for said line comprising a line relay and a line cut-off relay, an auxiliary line circuit interconnecting said line and the first-mentioned line circuit, said auxiliary line circuit comprising three relays normally connected in series to the conductors of said line, a first one of said relays being operatively responsive to removal of the receiver at said station, a second one of said relays being operatively responsive only to removal of the receiver and the deposit of a coin at said station, and means responsive to the operation of said first relay for marking said line busy prior to the deposit of a coin at said station, for closing a bridge across the line conductors of the first-mentioned line circuit to operate said line relay and for rendering said third relay operative in series with said first and second relays, the operation of said third relay effective to close a bridge across the line conductors of the first-mentioned line circuit independent of said first relay.

5. In an automatic telephone system comprising lines, a paystation connected to one of said lines, said station including a telephone instrument adapted to be connected across the conductors of said line by removal of the receiver

from its normal position, including coin receiving means for connecting ground potential to the line upon deposit of a coin therein and including directive impulse sending means, a line circuit for said line comprising a line relay and a line cut-off relay, an auxiliary line circuit interconnecting said line and the first-mentioned line circuit, said auxiliary line circuit comprising three relays normally connected in series to the conductors of said line, a first one of said relays being operatively responsive to removal of the receiver at said station, a second one of said relays being operatively responsive only to removal of the receiver and the deposit of a coin at said station, means responsive to the operation of said first relay for marking said line busy prior to the deposit of a coin at said station, for closing a bridge across the line conductors of the first-mentioned line circuit to operate said line relay and for rendering said third relay operative in series with said first and second relays, the operation of said third relay effective to close a bridge across the line conductors of the first-mentioned line circuit independent of said first relay, impulse controlled automatic switches for interconnecting calling and called lines, means responsive to the operation of said line relay for connecting the line conductors of said first-mentioned line circuit to a first one of said switches, means effective upon connection of said first-mentioned line circuit to a first one of said switches to operate said cut-off relay, means operative in response to the operation of said second relay and the connection of said first-mentioned line circuit to a first one of said switches for disconnecting said first and second relays from said line and for connecting said third relay in series with said line for response to directive impulses created by the operation of the impulse sender at said station, said third relay being effective to repeat said impulses to selectively operate automatic switches to establish a connection with a called line.

6. In an automatic telephone system comprising lines, a paystation connected to one of said lines, said station including a telephone instrument adapted to be connected across the conductors of said line by removal of the receiver from its normal position, including coin receiving

means for connecting ground potential to the line upon deposit of a coin therein and including directive impulse sending means, a line circuit for said line comprising a line relay and a line cut-off relay, an auxiliary line circuit interconnecting said line and the first-mentioned line circuit, said auxiliary line circuit comprising three relays normally connected in series to the conductors of said line, a first one of said relays being operatively responsive to removal of the receiver at said station, a second one of said relays being operatively responsive only to removal of the receiver and the deposit of a coin at said station, means responsive to the operation of said first relay for marking said line busy prior to the deposit of a coin at said station, for closing a bridge across the line conductors of the first-mentioned line circuit to operate said line relay and for rendering said third relay operative in series with said first and second relays, the operation of said third relay effective to close a bridge across the line conductors of the first-mentioned line circuit independent of said first relay, impulse controlled automatic switches for interconnecting calling and called lines, means responsive to the operation of said line relay for connecting the line conductors of said first-mentioned line circuit to a first one of said switches, means effective upon connection of said first-mentioned line circuit to a first one of said switches to operate said cut-off relay, means operative in response to the operation of said second relay and the connection of said first-mentioned line circuit to a first one of said switches for disconnecting said first and second relays from said line and for connecting said third relay in series with said line for response to directive impulses created by the operation of the impulse sender at said station, said third relay being effective to repeat said impulses to selectively operate automatic switches to establish a connection with a called line, said first relay being operatively responsive to a line leak only in case said line leak is of low enough resistance to maintain the operative energization of said third relay after connection of said line circuits to one of said automatic switches.

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