

Jan. 23, 1945.

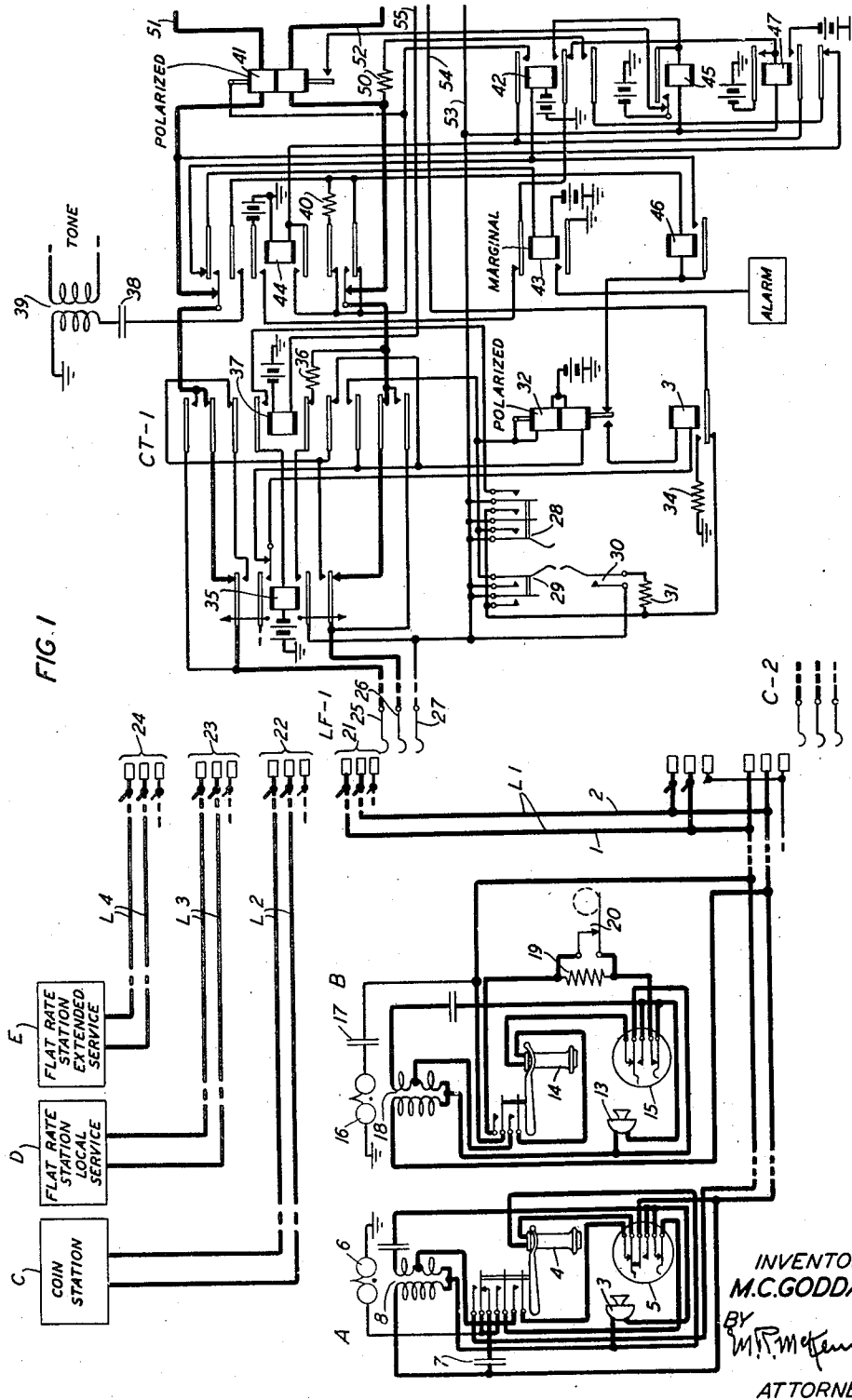
M. C. GODDARD

2,367,769

TELEPHONE SYSTEM

Filed March 23, 1940

3 Sheets-Sheet 1



Jan. 23, 1945.

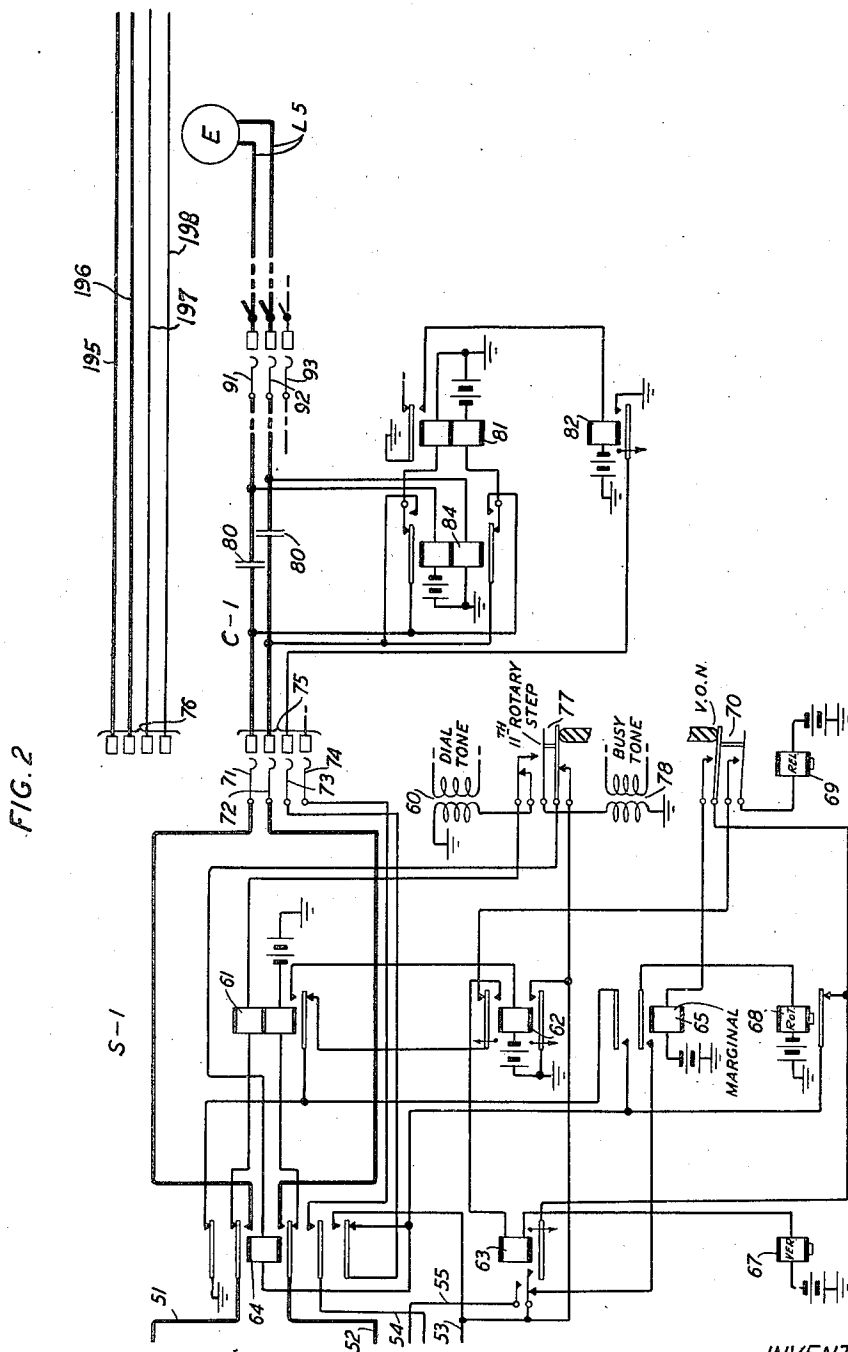
M. C. GODDARD

2,367,769

TELEPHONE SYSTEM

Filed March 23, 1940

3 Sheets-Sheet 2



INVENTOR
M.C.GODDARD
BY
W.T. McKenney
ATTORNEY

Jan. 23, 1945.

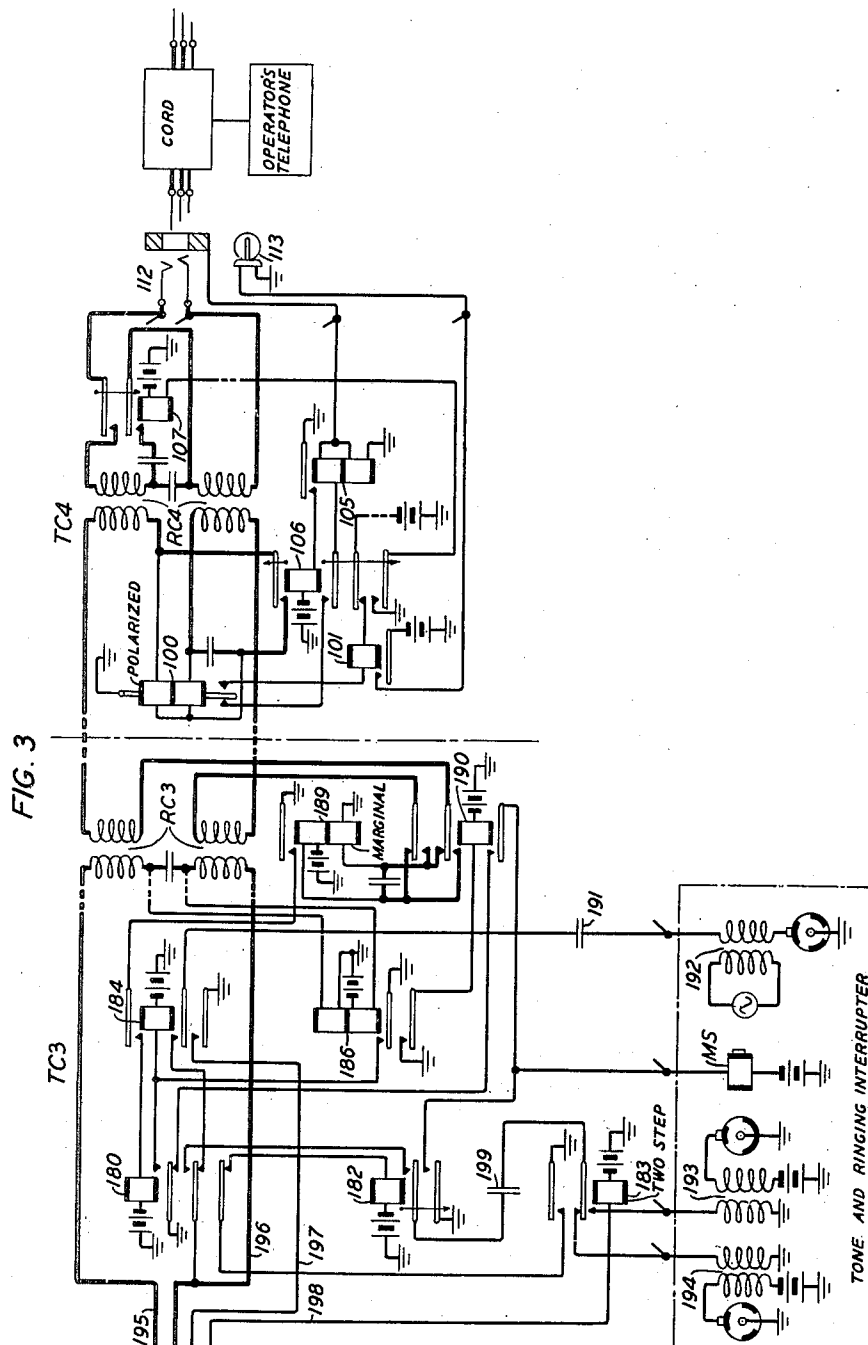
M. C. GODDARD

2,367,769

TELEPHONE SYSTEM

Filed March 23, 1940

3 Sheets-Sheet 3



INVENTOR
M.C. GODDARD
BY *M.T. McInerney*
ATTORNEY

UNITED STATES PATENT OFFICE

2,367,769

TELEPHONE SYSTEM

Myron C. Goddard, Garden City, N. Y., assignor
to Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application March 23, 1940, Serial No. 325,511

10 Claims. (Cl. 179-6.3)

This invention relates to telephone systems and particularly to systems comprising subscriber controlled switching mechanism for completing desired connections.

Objects of the invention are an increase in the efficiency and flexibility of automatic telephone systems.

A feature of the invention is a telephone system comprising a trunk circuit common to both coin and non-coin subscribers' stations and arranged to make a test when taken for use to determine whether or not the call is from a coin station and, if so, to prevent completion of a talking connection when the called subscriber answers until the calling subscriber has deposited a coin. To enable determination of the character of the calling station, either the non-coin subscribers' stations or the coin subscribers' stations are arranged to connect ground potential through a high impedance to the line conductors upon removal of the receiver to initiate a call.

A second feature of the invention is a telephone system comprising coin and non-coin subscribers' stations in which both coin and non-coin stations are connected to a single line and in which means comprising a trunk circuit is provided for identifying the character of the calling station and for preventing the completion of a talking connection when the called subscriber answers, if the call originated at the coin station, until the calling subscriber has deposited a coin.

Another feature of the invention is a telephone system comprising coin lines, non-coin lines, and lines each of which is connected to a coin station and also to a non-coin station, and including a trunk circuit common to all of said lines and arranged to make a test when connected to any line having a coin station thereon for determining whether the calling station is a coin station and, if so, to prevent closure of a talking connection when the called subscriber answers until the calling subscriber deposits a coin.

Another feature of the invention is means including a trunk circuit common to subscribers' lines serving both coin stations and non-coin stations for testing a connected calling line to determine the character of the calling station, for holding open the connection between a calling coin station and a called line until the calling subscriber deposits a coin, and on calls to an operator for indicating the character of the calling station.

A clear and complete understanding of the invention will be facilitated by considering a tele-

phone system in which the invention is embodied, one such system being represented schematically in the drawing which forms a part of this specification. The invention is not limited in its application to the particular system shown but is generally applicable to automatic telephone systems comprising coin and non-coin subscribers' stations.

Referring to the drawings:

Fig. 1 shows subscribers' lines L1, L2, L3 and L4, flat-rate subscribers' stations A, D and E, coin subscribers' stations B and C, a line-finder switch LF-1, a connector switch C-2, and a trunk circuit CT-1; and

Fig. 2 shows a selector S-1 permanently associated with the line finder LF-1 and trunk circuit CT-1 of Fig. 1, a connector C-1, a called subscriber's line L5 and station E, and trunk circuits TC-3 and TC-4 associated with a trunk T to an operator's position.

The line-finder switch LF-1, selector S-1 and connector switches C-1 and C-2 are of the well-known two-motion step-by-step type. Reference may be had to pages 53 to 65, inclusive, of the 2nd edition of "Automatic Telephony" by Smith and Campbell for a complete description of the structure of such switches and their operation when used as selectors and connectors. Reference may be had to the patent to R. L. Stokely No. 1,799,654 granted April 7, 1931, for a description of the operation of such a switch when used as a line finder. The line-finder switch LF-1 is represented in the drawings by a set of brushes 25, 26 and 27, four sets of terminals 21, 22, 23 and 24 and three sets of shaft-operated contact springs 28, 29 and 30. The magnets, relays and other apparatus associated with switches LF-1 are not shown in the drawings. The selector S-1 is shown as having direct access to connector switches C-1 but it is of course understood that intermediate selectors may be provided if the numbering system so requires. The connector C-1 is represented in the drawings by brushes 91, 92 and 93, one set of terminals, relays 81, 82 and 84 and talking condensers 80; and the connector C-2 is represented in the drawings by a set of brushes and two sets of terminals, none of the associated relays, magnets and other apparatus being shown.

The subscriber's station A is a local-service, flat-rate station comprising a transmitter 3, receiver 4, dial 5, a ringer 6 normally connected through condenser 7 to the lower conductor of line L1, and an induction coil 8. Upon removal of receiver 4 from the hook, both conductors of

line L1 are connected through the ringer 6, to ground. The subscriber's station B is a local service post-payment coin-box station comprising a transmitter 13, receiver 14, dial 15, a ringer 16 normally connected through condenser 17 to the upper conductor of line L1, an induction coil 18, a resistor 19, and coin contacts 20. The line L1 is connected to two sets of terminals in the banks of connector switches C—2, the line conductors 1 and 2 being transposed in their connection to these two sets of terminals so that the source of ringing current (not shown in the drawings) will be connected to the conductor 2 to actuate the ringer 6 when station A is called and to conductor 1 to actuate the ringer 16 when station B is called. The station A is arranged so that upon removal of the receiver to originate a call, ground potential is connected through ringer 6 and contacts of the receiver-hook switch to both conductors of the line L1 to indicate that the calling station is a non-coin station. The station B is arranged so that upon removal of the receiver to originate a call, there is no connection of ground potential to the conductors 1 and 2. Station B includes coin-operated contacts 20 and a resistor 19 normally short-circuited by these contacts. The station C is a local-service, coin station similar to station B; the station D is a local-service, flat-rate station; and the station E is an extended-service, flat-rate station.

The terminals 21, to which the line L1 is connected, represent a level of the line-finder bank in which the lines are either coin or non-coin local-service lines, or lines serving both coin and non-coin, local-service stations; the terminals 22, to which the line L2 is connected, represent a level in which the lines are all local-service, coin lines; the terminals 23, to which the line L3 is connected, represent a level to which the lines are all local-service, flat-rate lines; and the terminals 24, to which the line L4 is connected, represent a level in which the lines are all extended-service, flat-rate lines, that is, the lines of subscribers having free access to certain subscribers outside of the local area. The contact springs 28 are actuated when the brushes 25, 26 and 27 are on a level containing both coin and non-coin lines or lines serving both coin and non-coin stations; the contact springs 29 are actuated when the brushes are on a level containing coin lines only; the contact springs 30 are actuated when the brushes are on a level containing local-service, flat-rate lines only; and none of the contact springs 28, 29 and 30 are actuated when the brushes are on a level containing extended-service, flat-rate lines only.

The coin trunk CT—1 comprises a polarized test relay 32 for testing a calling line if it is in a group in which there are both coin and non-coin lines or lines having both coin and non-coin stations connected thereto. Relay 33 is auxiliary to relay 32, and relays 35 and 37 control the connection of test relay 32 to the calling line. Relay 41 is a polarized supervisory relay which operates when the called subscriber answers to initiate a coin test on a call from a coin station to determine whether the calling subscriber has or has not deposited a coin. Relays 41, 42, 43, 44, 45 and 46 function to make the test and to hold the talking circuit between the calling and called stations open until the coin has been deposited.

Since there are three classes of calling subscribers, it is necessary that means be provided for indicating, on calls to an operator, the class of the calling station. The trunk circuits TC—3

and TC—4 are similar to the trunk circuits of the same designation disclosed in the patent to R. B. Buchanan et al., No. 2,233,282 issued Feb. 25, 1941. These trunk circuits are arranged to give the operator a tone signal of one character on calls from one class, a tone signal of a different character on calls from a second class, and to give the operator no tone signal on calls from lines of the third class. In order that the trunk circuit will know the character of the calling station, a control conductor 54 is provided between the line finder LF—1 and a brush 74 of selector S—1 through which an identifying signal may be transmitted to the trunk circuit TC—3. If the calling station is a coin station, contact springs 28 or 29 are actuated to connect ground directly to conductor 54; if the calling station is a local-service, flat-rate station, contact springs 30 are actuated; or if a station test has been made, relay 33 has been actuated (as hereinafter described) to connect ground through a resistance 34 to conductor 54; and if the calling station is an extended-service, flat-rate station none of springs 28, 29 or 30 are actuated, and relay 33 is not operated, and there is no connection of ground potential to conductor 54.

Assume now that a call is originated at the local-service, flat-rate station A, and that the line finder LF—1 is thereupon actuated in the usual manner to connect with the set of terminals 21 and thereby close a circuit for operating the line relay 61 of the associated selector S—1. The circuit for operating relay 61 is traced from battery through the lower winding of this relay, a back contact of relay 64, conductor 52, lower winding of relay 41, back contacts of relays 44, 37 and 35, brush 26 of line finder LF—1, conductor 2 of line L1, left winding of induction coil 8, transmitter 3, normally closed contacts of dial 5, through the middle front contact of the receiver-hook switch thence through the ringer 6 to ground and also through the upper front contact of the receiver-hook switch, conductor 1 of line L1, brush 25 of line finder LF—1, back contacts of relays 35, 37 and 44, upper winding of relay 41, conductor 51, a back contact of relay 64, upper winding of relay 61, normally closed contact of the "11th rotary step" springs 77 and through the left winding of dial tone source 60 to ground. Relay 61 is operatively energized and closes a circuit for operating relay 62. Relay 62 connects ground potential to conductor 53 to hold the line finder LF—1 in usual manner. The polarized relay 41 does not operate in series with the line relay 61 since the current through its windings is not in the operating direction.

When the calling subscriber dials the first digit of the number of the subscriber with whom connection is desired, relay 61 is alternately released and reoperated in response to each impulse of the train created by the dialing operation. The first release of relay 61 closes a circuit for operating relay 63 and vertical stepping magnet 67. The operation of magnet 67 steps the brushes up to the first level of the bank. The vertical off-normal springs 70 are actuated when the shaft and brushes move out of normal position thereby closing a circuit which includes front contacts of relays 63 and 62 for operating relay 65. The release of relay 61 at the end of the first impulse causes the release of magnet 67 but relay 63 is slow in releasing and for this reason remains operated until after relay 61 has reoperated at the end of the last impulse in the train. Relay 62 is also slow to release and for this reason does

not release while relay 61 is responding to dial impulses. Relay 65 closes a locking circuit which includes the back contact of rotary stepping magnet 68, the outer front contact of relay 65 and a back contact of relay 64. The release and reoperation of relay 61 in response to each succeeding impulse of the train created by the dialing of the first digit effects a reoperation and release of magnet 67, thereby stepping the brushes up to the level corresponding to the digit dialed. When relay 63 releases, after all of the impulses in the train have been received, a circuit is closed for operating the rotary stepping magnet 68 thus advancing the brushes into engagement with the first set of terminals in the selected level. The operation of magnet 68 causes the release of relay 65 and the release of relay 65 causes the release of magnet 68. If the trunk, selector or connector circuit connected to the engaged set of terminals is busy, the test terminal is marked by a busy, ground potential which effects the reoperation of relay 65. The circuit for reoperating relay 65 is traced from battery through the winding of this relay, upper contact of the VON springs 70, back contact of magnet 68, lower back contact of relay 64, and through test brush 73. The reoperation of relay 65 effects the reoperation of magnet 68 thus advancing the brushes to the next set of terminals in the level. The advance of the brushes is, in this manner, continued until an idle set of terminals is encountered; or, if all of the trunks in the selected level are busy the brushes are advanced by an eleventh rotary step to an overflow position in which springs 77 are actuated to disconnect the dial tone source 90 and connect the all-trunks-busy tone source 78 to the calling line. If and when an idle set of terminals is encountered, the terminal engaged by test brush 73 is not marked by ground potential and relay 65 does not reoperate; but relay 64 is operated in series with the winding of relay 65 to extend the connection from conductors 51, 52, 53 and 54 to and through brushes 71, 72, 73 and 74 to the trunk or other circuit connected to the engaged terminals. Relay 64 disconnects relay 81 from conductors 51 and 52 thereby causing the release of relays 81 and 82. Since relay 82 is slow in releasing, it maintains the connection of ground to conductor 53 until the circuit connected to the selected set of terminals effects the connection of holding ground potential to the terminal engaged by brush 73. Assuming that the terminals of the selected level are connected directly to connector switches and that the seized terminals 75 are connected to the connector circuit C-1, the operation of relay 64 connects conductors 51 and 52 to the windings of line relay 81, thereby operating relay 81. Relay 81 closes a circuit for operating relay 82; and relay 82 connects ground potential to the terminal engaged by test brush 73 to hold relay 64 of selector S-1 and to hold the line finder LF-1 after relay 62 of selector S-1 releases.

When relay 63 operated, upon release of relay 61 in response to the first dial impulse as above described, ground at the lower front contact of relay 62 was connected through the front contacts of relay 63 to conductor 55 thereby operating relay 37 of the coin trunk circuit CT-1, and since the call originated in a line group having both coin and non-coin stations, the operation of relay 37 initiates a test to determine the character of the calling station. The springs 28 having been actuated when the brushes of the line finder LF-1 were raised to the level including the ter-

minals 21 of line L1, relay 37 closes a circuit for operating relay 35. The circuit for operating relay 35 includes a front contact of relay 37, a front contact of springs 28, conductor 53 and the lower front contact of relay 62 of selector S-1. With springs 28 actuated, the upper biasing winding of polarized relay 32 is energized to prepare this relay for testing the calling line; and when relay 37 operates, the lower winding of relay 32 is energized, operating relay 32. While relay 37 is operated, the connections between the line L1 and conductors 51 and 52 include the outer front contacts of relay 37, which contacts close before the adjacent back contacts are opened so that the connection between the line L1 and selector S-1 is continuously maintained. When relay 63 of selector S-1 releases at the end of the dialing of the first digit, relay 37 releases, opening the operating circuit of relay 35. Since relay 35 is slow in releasing, the conductors of the calling line are momentarily connected through front contacts of relay 35 and back contacts of relay 37 to the lower winding of test relay 32. The call having originated at station A, relay 32 is held operated over line conductors 1 and 2, to ground through the ringer 6. While this test is in progress, conductor 52 is connected through resistor 36, the inner lower back contact of relay 37 and the inner lower front contact of relay 35 to conductor 53 to operatively energize the lower winding of line relay 61 of selector S-1 or the lower winding of the line relay 81 of the connector C-1 if the connection has been extended by selector S-1. When relay 35 releases, it closes a locking circuit through the lower winding of relay 32 in series with the winding of auxiliary relay 33 before it opens the connection between the lower winding of relay 32 and the conductors of the calling line. Thus, on the call being described, relay 32 remains energized and relay 33 operates when relay 35 releases. The operation of relay 33 connects ground through a resistor 34 to conductor 54 as an indication that the call is from a local-service, flat-rate station.

The calling subscriber dials the remaining digits of the called subscriber's number, the last two digits being effective to control the operation of the connector switch C-1. The brushes 91, 92 and 93 are thus advanced into engagement with terminals of the called line L5. If the line is idle, the called station E is signaled by connecting a ringing current source (not shown) to the line in usual manner. When the call is answered, the supervisory relay 84 of connector C-1 is operated to interchange the connections between the conductors incoming to connector C-1 and the windings of relay 81, thereby reversing the current through conductors 51 and 52. The polarized relay 41 is operated by the reversed current but is without effect on the call being described because of the aforementioned operation of relay 32. The talking connection between the calling and called stations includes condensers 30 of connector C-1. When the calling subscriber replaces the receiver on the receiver hook, relay 81 releases. The release of relay 81 causes the release of relay 82 and the release of relay 82 disconnects the holding ground potential from the terminal engaged by brush 73, thereby effecting the release of relay 64 of selector S-1 and the release of the holding relay (not shown) of the line finder LF-1. When the called subscriber also replaces the receiver, relay 84 releases and the connector C-1 is restored to normal in usual manner. The release of relay 64 closes a circuit for operating the release

magnet 69 thus restoring the selector S—1 to normal. The circuit of magnet 69 is opened at springs 70 when the shaft reaches normal.

Assume next that a call is initiated at station B, that the call is extended, as above described, by line finder LF—1 and selector S—1. When the lower winding of relay 32 is connected to the calling line, as above described, relay 32 releases because there is no identifying ground connection at the coin station B. Since relay 32 releases, relay 33 is not operated and conductor 54 is connected through the back contact of relay 33 and the middle contact of springs 28 directly to ground. When relay 35 releases, the calling line is reconnected to conductors 51 and 52 and the dialing of the remaining digits completes the connection through a connector C—1 to a called line L5. When the call is answered and relay 41 operates due to the reversal of the current through its windings, a circuit is closed for operating relay 46. This circuit is traced from battery at the back contact of relay 45, through the front contact of relay 41, lowermost back contact of relay 44, winding of relay 46, back contact of relay 32, through a front contact of springs 28 to ground on conductor 53. Relay 46 operates and closes circuits for operating relays 42 and 43. Relay 42 closes a circuit from battery through the back contact of relay 45, and front contact of relay 41, for operating relay 44. Relay 44 locks under control of relays 41 and 45, but independent of relay 42. Relay 44 opens the talking connection between the calling and called stations and closes a circuit from battery through the winding of relay 43, front contact of relay 44, back contacts of relays 37 and 35, brush 25, conductor 1, receiver hook contacts and coin contacts 20 at station B, contacts of dial 15, transmitter 13, left winding of induction coil 18, conductor 2, brush 26, back contacts of relays 35 and 37, front contact of relay 44, winding of relay 46, back contact of relay 32, front contact of springs 28, to ground on conductor 53. Relays 43 and 46 are held operated by the current in this circuit and tone source 39 is connected through condenser 38 and a front contact of relay 44 in parallel with relay 46 thereby transmitting a tone signal to the calling station to indicate that the called subscriber has answered and that a coin should be deposited. Relay 42 also closes a circuit including resistor 50 and a back contact of relay 47 for holding relays 41 and 81 operated. When a coin is deposited, the contacts 20 are momentarily opened, thereby inserting the high resistance of resistor 19 in series with relays 43 and 46. Relay 46 remains operated but relay 43 is marginal and releases, closing a circuit for operating relay 45. Relay 45 locks and opens the circuit for holding relay 44. The release of relay 44 opens the test circuit through relays 43 and 46 and closes the talking connection between the calling and called stations. The release of relay 46 causes the release of relay 42 and prevents the reoperation of relay 43. The release of relay 42 opens the holding circuit through resistor 50 for relays 41 and 81; and relays 41 and 81 are now held under control of the calling station. Release is effected, as above described, on a call from station A, the disconnection of ground from conductor 53 being effective to release relay 45.

In order to discourage an attempt on the part of the calling subscriber, by manipulation of the dial or otherwise, to complete the talking connection without deposit of a coin, the circuit is arranged so that release of relay 46 causes the re-

lease of relay 42; and the release of relay 42, while relay 43 is released, closes a circuit for operating relay 47. Relay 47 locks, holds relay 44 operated and opens the holding circuit through resistor 50 so that relays 41 and 81 release. The selector S—1 and line finder LF—1 are thereupon restored to normal and the calling subscriber becomes connected to another selector S—1 as if originating a new call. When ground is disconnected from conductor 53, relay 47 releases and so also do relays 42, 43 and 46, if then operated. The release of relays 41 and 47 causes the release of relay 44.

If, on a call originating at station A of line L1, or at any other local-service, flat rate station on a line in a group of lines serving both coin and non-coin stations, the selector S—1 is directly operated to select a level in which the terminals are connected to trunks to an operator's position, the station identification test is made when relay 63 releases at the end of the first train of dial impulses, as hereinbefore described. The selector is automatically operated to hunt in the selected level and seize a set of terminals 76, connected to an idle outgoing trunk circuit TC—3. The operation of relay 64 connects the calling line to the trunk circuit TC3, operating line relay 186. Relay 183 closes circuits for operating relays 184 and 190. Relay 184 connects ground, through conductor 197, to the terminal engaged by brush 73 to hold relay 64 operated. This ground potential is further extended through a front contact of relay 64 to conductor 53 to hold the line finder LF—1 in usual manner. Relay 190 closes a circuit for operating the motor start relay MS of the common tone and ringing interrupter. Relay 193 interchanges the normally closed connections between the windings of relay 189 and the right windings of repeating coil RC3 to reverse the current through the conductors of the trunk so as to operate the polarized relay 100 of trunk circuit TC4. Relay 100 closes a circuit for operating relay 101; and relay 101 closes a circuit for lighting the answering lamp 113, to signal an operator. The ringing tone source 192 is connected through condenser 191, inner lower contact of relay 184, and a back contact of relay 180, to conductor 196 to transmit a ringing tone to the calling line to indicate that an operator is being signaled. The shaft-operated springs 28 being operated, the station identification test having been made, and relay 33 having been operated, as above described on the call from station A to station E, ground potential is connected through resistor 34, front contact of relay 33, conductor 54, middle lower front contact of relay 64, and through brush 74 to conductor 198 of trunk circuit TC—3 to partially operate relay 183, to close a circuit for operating the slow-to-release relay 182. When the call is answered by inserting the plug of a cord in jack 112, battery (not shown) is connected through the sleeve conductor of the cord and jack to the windings of relay 105. Relay 105 operates, closing a circuit for operating relay 106. Relay 106 short-circuits the high resistance, upper winding of relay 109, thereby increasing the current through the conductors of the trunk to operate the marginal relay 189 of trunk circuit TC3. The operation of relay 106 causes the release of relay 191 to extinguish lamp 113 and closes a circuit for operating relay 107 to close the talking connection between repeating coil RC4 and the answering operator's telephone. The operation of relay 199 closes a circuit for operating relay

180. Relay 180 closes a circuit for holding relay 184 so as to place the connection under the joint control of the calling subscriber and answering operator, opens the ringing tone circuit through condenser 191, and causes the release of relay 182. While relay 182 is releasing, the right winding of tone source 194 is connected through the back contact of relay 183, condenser 199, and front contacts of relays 182 and 180 to conductor 196, thereby momentarily transmitting a distinctive tone to the answering operator to indicate that the calling station is a local-service, flat-rate station. The trunk circuit TC-3 does not reverse the current through conductors 51 and 52 when the operator answers and, for this reason, relay 41 is not operated.

If, on a call originating at station B of line L1, or at any other coin station on a line in a group of lines serving both coin and non-coin stations, the selector S-1 is directly operated to select a level in which the terminals are connected to an operator, the station identification test is made as hereinbefore described, and the selector is automatically operated to seize a set of terminals 76 connected to an idle outgoing trunk circuit TC-3. The operation of relay 64 connects the calling line to the trunk circuit TC-3, which thereupon effects the operation of the calling signal at the operator's position and connects ground potential to the terminal engaged by brush 73 to hold relay 64 and to hold the line finder LF-1. The shaft-operated springs 28 being operated and the station identification test having been ineffective to operate relay 33, ground potential is connected from conductor 53, through the middle contact of springs 28, back contact of relay 33, conductor 54, front contact of relay 64, and through brush 74 to conductor 198 to completely operate relay 183. When the call is answered, relay 180 is operated, as above described. While relay 182 is releasing, the right winding of tone source 193 is connected through a front contact of relay 183, condenser 199, front contacts of relays 182 and 180, to conductor 196, thereby momentarily transmitting a different distinctive tone to the answering operator to indicate that the calling station is a coin station. Since the trunk circuit TC-3 does not reverse the current through conductors 51 and 52 when the operator answers, relay 41 does not operate and the talking connection is completed without the deposit of a coin at the calling station.

Assume next that a call is initiated at a coin station such as C on a line in a group of lines serving coin stations only, in which case the springs 29 are actuated when the brushes of the line finder LF-1 are on the level in which the terminals of the calling line are located. Upon connection of the calling line to the trunk circuit CT-1, the selector S-1 is directly operated to select a level corresponding to the first digit dialed by the calling subscriber. Since the springs 28 are not actuated, the operation of relay 37 does not cause the operation of relay 35, and no station identification test is made when relay 37 releases. If the call is completed through a connector C-1 to a called subscriber's line, the reversal of current when the call is answered effects the operation of relay 41 and, with ground connected through the right contact of springs 29 to the winding of relay 46, the trunk circuit CT-1 operates, as above described, on the call from station B to hold the talking connection open until a coin is deposited at the calling sta-

tion. If, however, the call is a call to the operator, seizure of the outgoing trunk circuit TC-3 effects the operation of the calling signal at the operator's position. The trunk circuit TC-3 does not reverse the current through conductors 51 and 52 when the operator answers, and relay 41 remains normal so that the talking connection is completed without the deposit of a coin at the calling station. Due to the connection of ground potential from conductor 53 through the left contact of springs 29, back contact of relay 33 to conductor 54 and thence through brush 74 to trunk circuit TC-3, this trunk circuit effects the transmission of the coin-station tone to the answering operator in the manner above described.

Assume next that a call is initiated at a local-service, flat-rate station such as D on a line in a group of lines serving subscribers' stations all of the same class, in which case the springs 30 are actuated when the brushes of line finder LF-1 are on the level in which the terminals of the calling line are located. Upon connection of the calling line to trunk circuit CT-1, the selector S-1 is directly operated to select a level corresponding to the first digit dialed by the calling subscriber. Since springs 28 are not actuated, no station identification test is made. If the call is completed through a connector C-1 to a called subscriber's line, the operation of relay 41 due to the reversal of current when the call is answered does not cause the opening of the talking connection as on a call from a coin station because, without springs 28 or 29 actuated, there is no connection of ground potential to the winding of relay 46. If the call is a call to the operator, seizure of an outgoing trunk circuit TC-3 effects the operation of the calling signal at the operator's position. Ground potential is connected from conductor 53, through the contact closed by the actuation of springs 30, resistor 31, back contact of relay 33, conductor 54 and brush 74 to the trunk circuit TC-3 to momentarily effect the transmission of the local-service, flat-rate tone to the answering operator. Since the trunk circuit does not reverse the current through conductors 51 and 52 when the operator answers, relay 41 does not operate.

Assume now that a call is initiated at an extended-service, flat-rate station such as E on a line in a group serving subscribers' stations all of the same class, in which case none of the springs 28, 29 and 30 are actuated when the brushes of line finder LF-1 are on the level in which the terminals of the calling line are located. Upon connection of the calling line to trunk circuit CT-1, the selector S-1 is directly operated to select a level corresponding to the first digit dialed by the calling subscriber. Since springs 28 are not actuated, no station identification test is made. If the call is completed through a connector C-1 to a called subscriber's line, the operation of relay 41 due to the reversal of current when the call is answered does not cause the opening of the talking connection as on a call from a coin station because, without springs 28 or 29 actuated, there is no connection of ground potential to the winding of relay 46. If the call is a call to the operator, seizure of an outgoing trunk circuit TC-3 effects the operation of the calling signal at the operator's position. Since none of springs 28, 29 and 30 are actuated, there is no connection of ground potential either directly or through a resistance to conductor 54 and relays 183 and 182 of the trunk circuit TC-3 are not operated. Therefore, no class of service tone is

transmitted to the answering operator, the lack of tone being indicative of the fact that the call originated at an extended-service, flat-rate station.

What is claimed is:

1. In a telephone system, subscribers' lines, a group of said lines including both coin and non-coin lines, means including a trunk circuit for establishing a talking connection between any line in said group when calling and a called line, means for connecting any calling line in said group to said trunk circuit, means including testing means in said trunk circuit for determining whether a connected calling line is a coin line or a non-coin line, and means in said trunk circuit effective only if the calling line is a coin line for holding open the talking connection between the calling and called lines until a coin has been deposited by the calling subscriber.

2. In a telephone system, lines, subscribers' stations connected to said lines, some of said stations being coin stations and others being non-coin stations, a trunk circuit common to said lines, means for connecting a calling line to said trunk circuit, means including testing means in said trunk circuit for determining whether the calling station is a coin station or a non-coin station, subscriber controlled means for completing a connection from the calling line connected to said trunk circuit to a called line, and means in said trunk circuit for holding the talking connection between a calling coin station and the called line open until a coin is deposited by the calling subscriber.

3. In a telephone system, subscribers' lines, coin stations, non-coin stations, means at said stations distinguishing the coin stations from the non-coin stations, a trunk circuit common to lines serving both coin and non-coin stations, means for connecting a calling line to said trunk circuit, means in said trunk circuit for testing a connected calling line to determine whether the calling station is a coin station or a non-coin station, subscriber controlled means for completing a talking connection from the calling line connected to said trunk circuit to a called line, and means in said trunk circuit effective only in case the call is from a coin station for holding the talking connection open until a coin is deposited by the calling subscriber.

4. In a telephone system, subscribers' lines including a line having a non-coin station and a coin station connected thereto, a trunk circuit, means for connecting said lines to said trunk circuit upon the initiation of a call at either of said stations, and means including testing means in said trunk circuit for determining whether the calling station is a coin station or a non-coin station, subscriber controlled means for completing a connection from the calling line to a called line, and means in said trunk circuit effective only if the calling station is a coin station for holding the talking connection between the calling and called lines open until a coin is deposited at the calling station.

5. In a telephone system, subscribers' lines, means comprising a selector for establishing a connection between a calling line and a called line, a party line having both a flat-rate station and a coin-box station connected thereto, means effective upon the origination of a call at either one of said stations for connecting said party line to said selector, a trunk circuit included in the connection between said line and said selector, means at said stations effective upon origination of a call to indicate whether the call is from the flat-rate or from the coin-box station, testing means in said trunk circuit for determining which of said stations is the calling station, and means in said trunk circuit effective only if the call is from a coin-box station for opening the talking connection between the calling and called lines in response to the answer of the called subscriber and for again closing the talking connection in response to the deposit of a coin at the calling station.

6. In a telephone system, subscribers' lines, a group of lines including lines serving coin stations only, lines serving non-coin stations only, and a line serving both a coin and a non-coin station, a trunk circuit, means for connecting any of the lines in said group to said trunk circuit, means including testing means in said trunk circuit for determining whether a connected calling station is a coin station or a non-coin station, subscriber controlled means for completing a connection with a called line, and means in said trunk circuit for holding the talking connection between the calling and the called lines open until a coin is deposited at the calling station.

7. In a telephone system, subscribers' lines including a line serving a coin station and a non-coin station, a trunk circuit, means for connecting said line to said trunk circuit responsive to the initiation of a call at either of said stations, means, including means in said trunk circuit for testing said line, for determining whether the calling station is a coin station or a non-coin station, an operator's position, trunks terminating at said position, subscriber controlled means for completing a connection from the calling line to a called line or to one of said trunks, an outgoing trunk circuit associated with each of said trunks and arranged to transmit a calling signal to the operator's position responsive to the connection of a calling line thereto and arranged to transmit either one of two tones to the operator, means including means in the first-mentioned trunk circuit for transmitting a signal to a connected outgoing trunk circuit indicative of the character of the calling station, and means in said outgoing trunk circuit responsive to said signal for transmitting to the answering operator the particular one of said tones which corresponds to the character of the calling station.

8. In a telephone system, subscribers' lines including a line serving a coin station and a non-coin station, a trunk circuit, means for connecting said line to said trunk circuit responsive to the initiation of a call at either of said stations, means, including means in said trunk circuit for testing said line for determining whether the calling station is a coin station or a non-coin station, an operator's position, trunks terminating at said position, subscriber controlled means for completing a connection from the calling line to a called line or to one of said trunks, an outgoing trunk circuit associated with each of said trunks and arranged to transmit a calling signal to the operator's position responsive to the connection of a calling line thereto and arranged to transmit either one of two tones to the operator, means in the first-mentioned trunk circuit effective only on a call from said coin station to another subscriber's line for holding the calling connection between the calling and called lines open until a coin is deposited at the calling station, means including means in the first-mentioned trunk circuit for transmitting a signal to a connected outgoing trunk circuit, said signal

indicative of the character of the calling station, and means in said outgoing trunk circuit responsive to said signal for transmitting to the answering operator the particular one of said tones which corresponds to the character of the calling station.

9. In a telephone system, subscribers' lines, subscribers' stations connected to said lines, said stations including local-service flat-rate stations, extended-service flat-rate stations, and coin stations, one of said lines serving a coin station and a non-coin station, a trunk circuit, means for connecting a calling line to said trunk circuit, means, including means in said trunk circuit for testing a calling line, for determining whether the calling station is a coin station or a non-coin station, an operator's position, trunks terminating at said position, subscriber controlled means for completing a connection from the calling line to a called line or to one of said trunks, an outgoing trunk circuit associated with each of said trunks and arranged to transmit a calling signal to said position responsive to connection of a calling line thereto, means including means in the first-mentioned trunk circuit for indicating to a connected outgoing trunk circuit the character of the calling station, and means in said outgoing trunk circuit for indicating to the answering operator the character of the calling station.

10. In a telephone system, subscribers' lines, 30

5 subscribers' stations connected to said lines, said stations including local-service flat-rate stations, extended-service flat-rate stations, and coin stations, one of said lines serving a coin station and a non-coin station, a trunk circuit, means for connecting a calling line to said trunk circuit, means, including means in said trunk circuit for testing a calling line, for determining whether the calling station is a coin station or a non-coin station, an operator's position, trunks terminating at said position, subscriber controlled means for completing a connection from the calling line to a called line or to one of said trunks, an outgoing trunk circuit associated with each of 10 said trunks and arranged to transmit a calling signal to said position responsive to connection of a calling line thereto, means in the first-mentioned trunk circuit effective only on a call from a coin station to another subscriber's line for holding the talking connection between the calling and called lines open until a coin is deposited at the calling station, means including means in the first-mentioned trunk circuit for indicating to a connected outgoing trunk circuit the character of the calling station, and means in said 15 outgoing trunk circuit for indicating to the answering operator the character of the calling station.

MYRON C. GODDARD.