May 12, 1931. L. H. JOHNSON ET AL 1,804,778

TELEPHONE SYSTEM

Filed Sept. 12, 1929 2 Sheets-Sheet 1

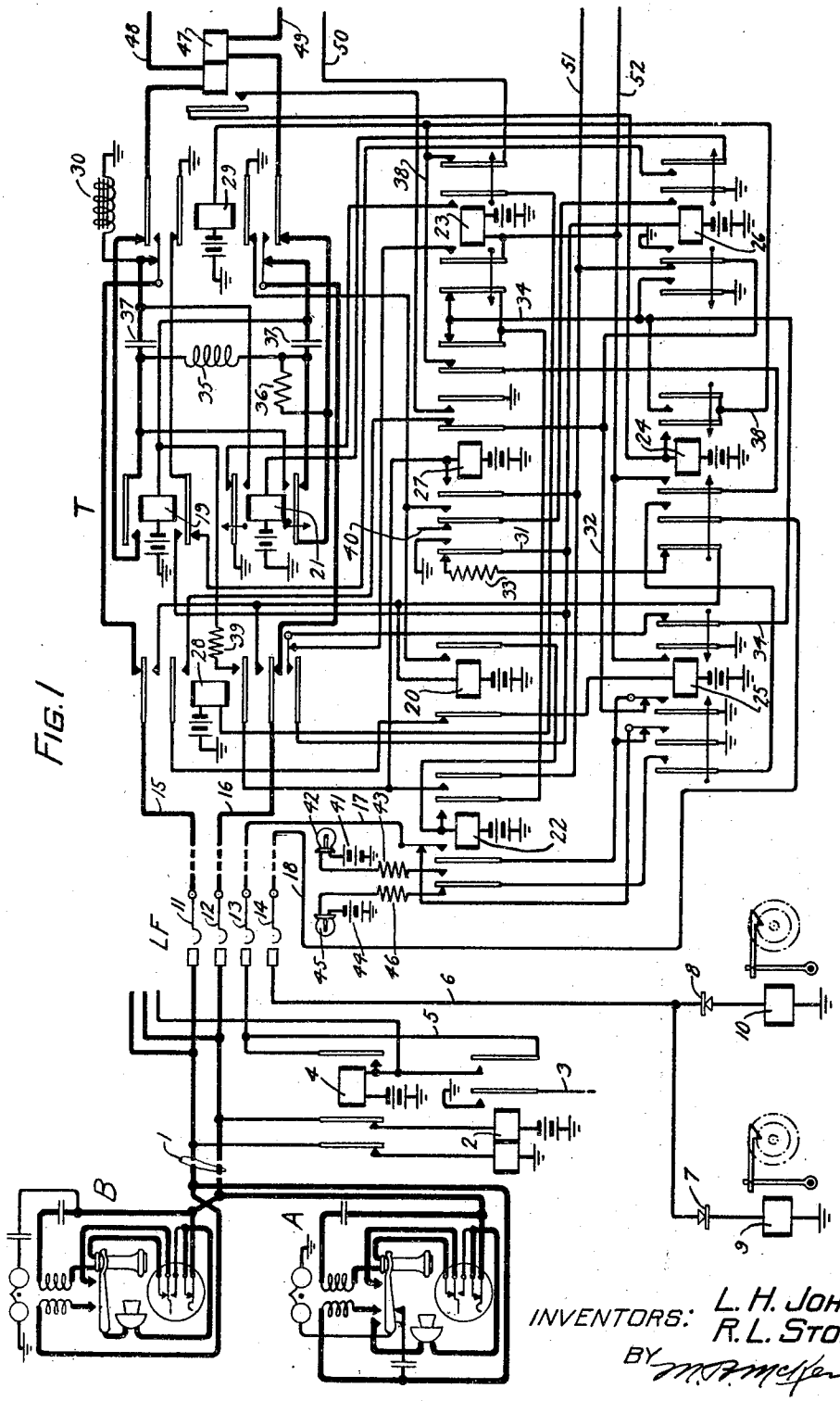

FIG. 1

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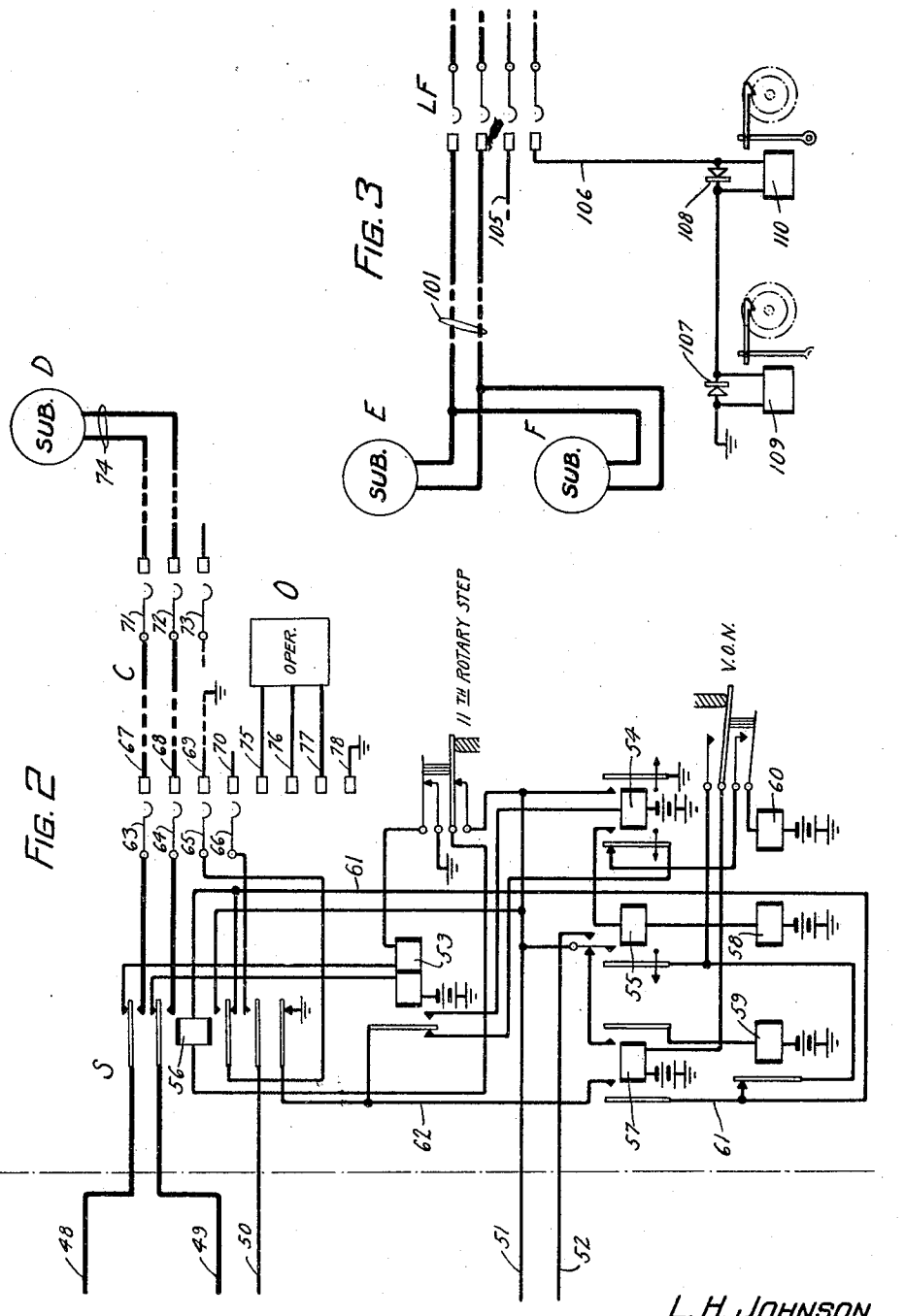

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed September 12, 1929. Serial No. 392,114.

This invention relates to telephone exchange systems and more particularly to measured service for party lines.

The object of the invention is to minimize the amount of equipment necessary to provide for the selective operation of the message registers associated with a party line.

According to this invention two non-polarized message registers which are individual respectively to two stations of a party line are connected to one operating lead, a positive source of current being provided for operating one of said registers and a negative source of current being provided for operating the other of said registers.

According to another feature of this invention unidirectional current flow devices are so connected, in combination with two message registers, to one operating lead that one of the registers is operated by current over this lead in one direction and the other register is operated by current over this lead in the opposite direction. A potential of the proper polarity is impressed upon the operating lead to operate the register which corresponds to the station at which the call has originated.

Referring to the drawings Fig. 1 shows two subscribers' stations A and B connected to the line 1, the associated line circuit including a message register for each station, a line-finder LF and an identification trunk circuit T. Fig. 2 shows a selector circuit S, a connector circuit C, a called subscriber's station D, and an operator's position O. Figs. 1 and 2 together illustrate a system in which this invention is embodied. Fig. 3 shows an alternative arrangement for operatively connecting the individual message registers in the line circuit of a two-party line.

The subscriber's set at station A is arranged so that ground is connected to the line when the receiver is removed from the receiver hook to originate a call. The subscriber's set at station B is arranged so that ground is not so connected when a call is originated thereat. The line 1 terminates in the banks of line-finder switches, one of which is used for finding and extending the line 1 when a call is originated at either of stations A or B, and terminates in the banks (not shown) of connector switches, which are used in completing connections when either of stations A or B is the called station. The line 1 is also connected through the back contacts of the cut-off relay 4 to the windings of the line relay 2 in the usual manner. The cut-off relay 4 is connected by the operation of line relay 2 to the sleeve terminal associated with the line terminals of line 1 in the line-finder and connector banks. A fourth terminal, associated with the line 1 in the line-finder banks only, is connected to the message registers 9 and 10 of stations A and B, respectively. The registers 9 and 10 are connected in parallel, a unidirectional current carrying device 7 being in series with register 9 and a similar device 8 being in series with register 10. The devices 7 and 8 are oppositely poled so that the register 9 operates when a positive potential of sufficient magnitude is connected to the associated terminal of the line-finder bank and the register 10 operates when a negative potential is connected to this terminal.

The line-finder switch LF, which is represented schematically by brushes 11, 12, 13 and 14 and the terminals with which the brushes are in contact, is of the well known Strowger type. The line-finder circuit which may be similar to that disclosed in the co-pending application of Henry Hovland Serial No. 374,358, filed June 28, 1929, is schematically represented by the broken lines connecting to the brushes 11, 12, 13 and 14.

The trunk circuit T, which links the line-finder LF with its associated selector S (shown in Fig. 2) is arranged to test the calling line, with whose terminals the brushes of the line-finder LF are in contact, to determine which of the stations on this line has originated the call and if the call is one for which a charge should be made, to selectively control the operation of the corresponding message register when the called station answers. This trunk circuit is similar to that disclosed in the above mentioned Hovland application except that the circuit for operating one of the registers includes a positive potential and the circuit for operating the other includes a negative poten-

tial, and neither of them includes the sleeve conductor of the line-finder and trunk circuits.

The selector switch S and connector switch C are of the Strowger type. The selector circuit is shown in detail but the connector circuit is represented schematically by the broken lines leading to brushes 71, 72 and 73 of the connector switch. For more complete descriptions of Strowger type selector and connector switches reference may be had to pages 53 to 65 inclusive of the second edition of "Automatic Telephony" by Smith and Campbell.

The operation of the system represented by Figs. 1 and 2 will now be described in detail. Assume that a call is originated by the removal of the receiver from the receiver hook at either of stations A or B, that the called station is the station D, and that the calling station should be charged if a talking connection is established. The line relay 2, which is thereupon energized in an obvious circuit connects ground to group lead 3 and connects the winding of cut-off relay 4 to the sleeve terminals of the line 1 in the banks of the line-finders having access thereto. Assume that the line-finder LF hunts for and extends the line 1 through brushes 11 and 12 to the trunk circuit T, and that the cut-off relay operates in a circuit through sleeve brush 13 to ground in the line-finder circuit. Line relay 2 releases when the cut-off relay operates and the cut-off relay now holds through its own front contact. (For a detailed description of the operation of the line-finder circuit reference may be had to the above mentioned application of Hovland.)

With the line-finder brushes 11 and 12 connected to the tip and ring conductors of the line 1, line relay 19 of the trunk T operates in a circuit which may be traced from battery through its winding, through the back contact of the lower armature and continuity springs of relay 29, middle lower back contact of relay 28, conductor 16, line-finder brush 12, ring conductor of line 1, through the calling subscriber's instrument, back over the tip conductor of line 1, through line-finder brush 11, conductor 15, upper back contact of relay 28, back contact of the upper continuity springs of relay 29, and through retard coil 30, to ground. Relay 19 closes a circuit from ground, through the inner upper back contact of relay 29, lower front contact of relay 19, conductor 31, and through the winding of relay 26 to battery. Relay 26 operates thereby connecting ground through its inner left-hand front contact, over conductor 32, through normally closed contacts of both sets of continuity springs of relay 25, and through the normally closed contacts of the continuity springs of relay 22, to the sleeve conductor 17 of the line-finder LF, so as to hold the cut-off relay 4 and to prevent the release of the line-finder switch.

The aforementioned operation of relay 19 closes a circuit for operating the line relay 53 of the selector S; this circuit may be traced from battery through the left-hand winding of relay 53, inner upper back contact of relay 56, ring conductor 49, right-hand winding of polarized supervisory relay 47, outer lower back contact of relay 29, lower back contact of relay 21, retard coil 35, upper front contact of relay 19, outer upper back contact of relay 29, left-hand winding of relay 47, tip conductor 48, outer upper back contact of relay 56, right-hand winding of relay 53, upper back contact of the 11th rotary-step springs, to ground. The line relay 53 closes a circuit from battery through the winding of relay 54, front contact of relay 53, conductor 62, and through the outer lower back contact of relay 56, to ground. Relay 54 operates, thereby connecting ground through its right-hand front contact to the sleeve conductor 51 of the trunk T.

The aforementioned operation of relay 19 also closes a circuit for operating relay 20; this circuit may be traced from battery through its winding, back contact of relay 24, resistance 33, outer left-hand back contact of relay 27, conductor 31, front contact of relay 19, and through the inner upper back contact of relay 29, to ground. Relay 20 closes a circuit for operating relay 22, which may be traced from battery, through the winding of relay 22, front contact of relay 20, and through the inner lower back contact of relay 29, to ground. Relay 22 locks through its inner right-hand front contact, through the outer right-hand back contact of relay 27 in parallel with the left-hand back contact of relay 23, conductor 34, and through the outer left-hand front contact of relay 26, to ground. In operating, relay 22 connects sleeve conductor 17 through the front contact of its continuity springs, through the back contacts of the inner continuity springs of relay 25, over conductor 32 to ground at relay 26, so as to hold cut-off relay 4 and prevent the release of the line-finder switch. Relay 22 also closes a circuit, for operating relay 27, which may be traced from battery through the winding of relay 27, outer right-hand front contact of relay 22, over sleeve conductor 51, to ground at relay 54 of selector S. Relay 27 locks through its inner left-hand front contact to the ground on sleeve conductor 51. In operating, relay 27 causes the release of relay 20 and closes an obvious circuit for holding relay 26.

The circuit through the winding of the identification test relay 20 was closed as hereinbefore described, so as to be sure that this relay is in condition to determine which of

the stations on the calling line has originated the call, when the identification test circuit is closed as hereinafter described. Should relay 27 fail to operate at this time the ground connected through the inner-right-hand front contact of relay 26 and the inner left-hand back contact of relay 27 to conductor 40 is effective to operate an alarm. Therefore relay 24 is not operated even though the call is completed and the charging circuit is not closed when the connection is released.

When the subscriber at the calling station dials the first digit of the number of the called station, the line relay 19 of trunk T is alternately released and reoperated each time the subscriber's line loop is opened and closed at the dial. Each release and reoperation of relay 19 opens and closes the bridge through the retard coil 35 (across the tip and ring conductors 48 and 49 of the trunk to the selector S) and the line relay 53 of selector S is alternately released and reoperated in response to the dialing of the first digit of the called number. The first release of line relay 19 of trunk T closes a circuit, for operating relay 21, from battery through the winding of relay 21, outer right-hand front contact of relay 26, back contact of relay 19, and through the inner upper back contact of relay 29 to ground. Relay 21 is slow to release and remains operated until all of the impulses created by the dialing of the first digit have been received. In operating, relay 21 short-circuits the winding of the retard coil 30, thus reducing the impedance of the dialing loop, and also short-circuits the winding of retard coil 35 and resistance 36 to reduce the impedance of the trunk loop to the windings of the line relay 53 of selector S. At the end of the train of impulses relay 19 reoperates and relay 21 releases. Resistance 36 is connected from the armature to the back contact of relay 21 to prevent the opening and closing of the trunk loop when relay 21 releases. Relay 26 is slow to release and holds during the receipt of each train of pulses which are originated by the dialing of the digits of the called station's number.

When the line relay 53 of selector S releases upon receipt of the first impulse, a circuit is closed from battery, through the winding of the vertical stepping magnet 58, winding of relay 55, left-hand front contact of relay 54, back contact of relay 53, conductor 62, and through the outer lower back contact of relay 56, to ground. The magnet 58 and relay 55 both operate in this circuit. Relay 55 is a slow-to-release relay and remains operated until all of the impulses corresponding to the first digit have been received. Relay 54 is also slow to release and holds during the receipt of this train of impulses. The operation of magnet 58 steps the shaft and brushes of selector S up to the first level of bank terminals. The reoperation of line relay 53 releases the magnet 58. Each successive release and reoperation of relay 53 causes the operation and release of magnet 58. The shaft and brushes of the selector are therefore raised, step-by-step, to the level through which the call may be extended toward the called station.

As soon as the shaft of selector S is moved off normal the vertical off normal springs VON are actuated and, with relay 55 operated as hereinbefore described, a circuit is closed for operating relay 57 from battery through its winding, upper contact of the VON springs, front contact of relay 55, and over sleeve conductor 51, to ground at relay 54. Relay 57 locks in a circuit from battery through its winding and the upper contact of the VON springs, through the back contact of the rotary stepping magnet 59, conductor 61, left-hand front contact of relay 57, and through the outer lower back contact of relay 56, to ground. The operation of relay 55 is also effective to connect ground from sleeve conductor 51 through a front contact of relay 55 to conductor 52 and thus cause the operation of relay 23 of the trunk circuit T. Relay 23 locks through its left-hand front contact, normally closed contacts of the continuity springs of relay 28, and through the right-hand back contact of relay 25, over conductor 34, to ground at relay 26. The operation of relay 23 causes the release of relay 22.

When all of the pulses, originated by the dialing of the first digit of the called number have been received, the release of relay 55 of selector S disconnects the ground over sleeve conductor 51 from conductor 52; and the release of relay 21 of trunk T closes a circuit, for operating relay 28, from battery through the winding of relay 28, right-hand front contact of relay 23, and through the upper back contact of relay 21, to ground. In operating, relay 28 (*a*) transfers the tip and ring conductors 15 and 16 from the windings of relay 19 and retard coil 30 to the winding of identification test relay 20, (*b*) closes a circuit, for holding line relay 19, from battery through the winding of relay 19, resistance 39, inner lower front contact of relay 28, inner left-hand front contact of relay 27, over sleeve conductor 51, to ground at relay 54 of selector S, and (*c*) opens the locking circuit of relay 23. Relay 23 releases since its operating circuit (over conductor 52) has been opened by the release of relay 55 of selector S. The release of relay 23 causes the release of relay 28, whereby conductors 15 and 16 are disconnected from the winding of relay 20 and reconnected to the windings of line relay 19 and retard coil 30.

If the call originated at station A the identification test relay 20 operates during the time that its winding is connected over conductors 15 and 16, through line-finder brushes 11 and 12 and over the tip and ring conductors

of line 1, to the identifying ground at the instrument of station A. If the call originated at station B, relay 20 does not operate for there is no identifying ground connection at station B. If relay 20 operates relay 22 operates; and relay 22 locks through its inner right-hand front contact and the outer left-hand back contact of relay 23, over conductor 34 to ground at relay 26. Relay 22 controls the message register operating circuit so that the register which corresponds to the calling station is operated, as hereinafter described, when a completed call, for which a charge is to be made, is released by the calling subscriber.

The release of relay 55 of selector S, after the dialing of the first digit, is also effective to close a circuit for operating the rotary stepping magnet 59; this circuit may be traced from battery through the winding of magnet 59, right-hand front contact of relay 57, normally closed contact of relay 55, over sleeve conductor 51, to ground at relay 54. The rotary magnet 59 rotates the shaft of selector S one step, so that the brushes 63, 64, 65 and 66 make contact with the terminals of the first trunk in the previously selected level. The operation of the rotary magnet causes the release of relay 57. The release of relay 57 causes the release of the rotary magnet, thereby closing a circuit from battery through the winding of relay 57, upper contact of the VON springs, back contact of magnet 59, conductor 61, winding of relay 56, lower contact of the 11th-rotary-step springs, over conductor 51 to ground at relay 54. Conductor 61 is also connected, through the inner lower back contact of relay 56 and the sleeve brush 65, to the sleeve terminal of the first trunk in the selected level. If this trunk is idle relay 56 operates and relay 57 does not operate; but if the trunk is busy the winding of relay 56 is short-circuited by the busy ground on the sleeve terminal so that relay 57 operates and relay 56 does not operate. The reoperation of relay 57 causes the reoperation of the rotary stepping magnet 59. The alternate operation and release of relay 57 and magnet 59 continues to advance the brushes of selector S step-by-step from one set of terminals to the next until the terminals of an idle trunk are encountered.

The operation of relay 56, when an idle trunk is found, disconnects the tip and ring conductors 48 and 49 from the windings of line relay 53 and extends these conductors through brushes 63 and 64 over tip and ring conductors 67 and 68 of the selected trunk to the windings of the line relay (not shown) of connector C. Relay 56 also establishes a temporary busy condition on the test terminal of the selected trunk by connecting the sleeve conductor 51 through the inner lower front contact of relay 56 to the sleeve brush 65. Relay 53 releases thereby causing the release of relay 54. Relay 54 is slow to release so that the ground at its right-hand front contact is not disconnected from sleeve conductor 51 until sufficient time has elapsed for the operation of the line relay of connector C to have been effective to cause a permanent busy ground to be connected, through brush 65 and the inner lower front contact of relay 56, to sleeve conductor 51.

When the remaining digits of the called station's number are dialed by the calling subscriber, line relay 19 and slow-to-release relay 21 of trunk T repeat the impulses over the trunk conductors 48 and 49 through the selector circuit S, to the line relay (not shown) of the connector C. The connector C is thus controlled to select the terminals of the line 74 of the called station. For a detailed explanation of the operation of the connector circuit reference may be had to pages 57 to 61 inclusive of the second edition of "Automatic Telephony" by Smith and Campbell.

Assume that the line 74 is idle when connection is established therewith, that ringing potential is connected to the line, that the subscriber at the called station answers, and that the call is one for which the calling subscriber should be charged. When the receiver is removed from the receiver hook at the called station, the windings of the line relay (not shown) of the connector C are reversed, in the usual manner, with respect to the tip and ring conductors 48 and 49 of the trunk T; and as a result the current through the windings of the polarized supervisory relay 47 is in the direction to operate this relay. The circuit for operating relay 47 may be traced from battery through one winding of the line relay (not shown) of the connector C over the tip conductor 67, through brush 63, outer upper front contact of relay 56, conductor 48, left-hand winding of relay 47, outer upper back contact of relay 29, upper front contact of relay 19, retard coil 35, lower back contact of relay 21, outer lower back contact of relay 29, right-hand window of relay 47, conductor 49, inner upper front contact of relay 56, brush 64, over the ring conductor 68, and through the other winding of the line relay (not shown) of connector C, to ground. The talking circuit may at this time be traced from trunk conductors 15 and 16 through back contacts of relays 28 and 29 and through condensers 37 to the trunk conductors 48 and 49 which connect to the selector S.

The operation of the supervisory relay 47 closes a circuit for operating relay 24; this circuit may be traced from battery through the winding of rely 24, front contact of relay 47, and through the right-hand front contact of relay 27, to ground. Relay 24 locks through its right-hand front contacts and over conductor 34 to ground at relay 26. Relay 24 closes an obvious circuit from ground

at relay 26 over conductors 34 and 38 for operating relay 29. Relay 29 disconnects the windings of line relay 19 and retard coil 20 from trunk conductors 15 and 16 and disconnects retard coil 35, resistance 36 and condensers 37 from trunk conductors 48 and 49. Relay 19 releases and the talking circuit is now traced directly from conductors 15 and 16, through the back contacts of relay 28, front contacts of relay 29, and windings of supervisory relay 47 to conductors 48 and 49. The line relay (not shown) of connector C is held operated in the circuit which includes the calling line until the calling subscriber releases the connection.

When the calling subscriber replaces the receiver on the receiver hook the line relay (not shown) of connector C releases. The connector switch is returned to normal in the usual manner. When the sleeve ground at connector C is disconnected from the sleeve terminal with which brush 65 is in contact, relay 56 of selector S and relay 27 of trunk T are both released. The release of relay 56 closes a circuit for operating the release magnet 60 and selector S is returned to normal in the usual manner. In releasing, relay 27 closes a circuit for operating relay 23; this circuit may be traced from battery through the winding of relay 23, conductor 52, inner left-hand front contact of relay 24, middle right-hand back contact of relay 27, conductor 38, outer right-hand front contact of relay 24, and over conductor 34, to ground at relay 26. Relay 23 closes the circuit for operating relay 28. Relay 26 is slow in releasing so that it holds, after relay 27 releases, until relay 28 operates. Relay 28 prevents the release of relay 26 by closing a holding circuit which may be traced from battery through the winding of relay 26, outer lower front contact of relay 28, right-hand back contact of relay 25 and over conductor 34, to ground at relay 26. The operation of relay 28 transfers the connection from the calling line, over conductors 15 and 16, to the winding of test relay 20. Since the calling subscriber has hung up the receiver test relay 20 fails to operate unless ground has been falsely (or otherwise) connected to the line. If relay 20 does not operate relay 25 operates in a circuit which may be traced from battery through the winding of relay 25, back contact of relay 20, inner upper front contact of relay 28, inner right-hand back contact of relay 27, and over conductor 32 to ground at relay 26. If relay 20 operates the operation of relay 25 is prevented for relay 25 is slow in operating. In this case the line-finder does not release and the ground connected, through the inner right-hand front contact of relay 26 and the inner left-hand back contact of relay 27, to conductor 40 is effective to operate an alarm.

The operation of relay 25 closes a circuit for operating the calling subscriber's message register. If the call originated at station A the charging circuit is traced from the positive pole of battery 41, through lamp 42, resistance 43, outer left-hand front contact of relay 22, outer left-hand front contact of relay 25, outer left-hand front contact of relay 24, conductor 18, line-finder brush 14, over conductor 6, through the unidirectional current carrying device 7 and through the winding of message register 9, to ground. If the call originated at station B the charging circuit is traced from the negative pole of battery 44 through lamp 45 and resistance 46, outer left-hand back contact of relay 22, outer left-hand front contacts of relays 25 and 24, over conductor 18, through line-finder brush 14, over conductor 6, through the unidirectional current carrying device 8 and through the winding of message register 10, to ground. Relay 25 connects ground through its right-hand front contact to conductor 52 to hold relay 23. This ground connection is extended from conductor 52 through the inner left-hand front contact of relay 24 and the middle right-hand back contact of relay 27, to conductor 38 thereby holding relays 24 and 29. If relay 22 has been operated relay 25 also connects ground through the inner left-hand front contacts of relays 25 and 22 to the sleeve conductor 17, in place of the ground over conductor 32. Relay 25 opens the holding circuit for relay 26 which is slow in releasing. The release of relay 26 causes the release of relays 22 and 25. The release of relay 25 causes the release of relays 23, 24 and 29. The release of relay 23 causes the release of relay 28. Since relay 26 is slow to release the charging circuit is closed for a sufficient length of time to insure the operation of the calling subscriber's register. The release of relay 26 causes the release of cut-off relay 4 and causes the line-finder to be restored to normal.

If a call is completed to a subscriber and no charge is to be made for the call, the polarized supervisory relay 47 is not operated and therefore the charge control relay 24 is not operated. Relay 27 holds to the ground on the sleeve conductor 51 until the connection is released. Relay 27 holds relay 26, and relay 26 holds relay 23. Relay 29 is not operated and the talking circuit includes the condensers 37; talking battery is supplied to the calling station through the windings of the line relay 19 and retard coil 30. When the connection is released, relay 19 releases thereby opening the bridge across the trunk conductors 48 and 49 to release the line relay (not shown) of connector C. When the sleeve ground at connector C is disconnected relay 27 releases. The release of relay 27 causes the release of relay 26 thereby disconnecting ground from conductor 32 so as to

cause the return of the line-finder LF to normal.

If the first digit dialed by the calling subscriber is such that the selector S seizes an idle trunk leading to an operator's position, the terminal with which the brush 66 makes contact is grounded; conductor 78 of the trunk which leads to the operator's position O is, therefore, connected to ground as indicated. When relay 56 operates, this ground is connected through brush 66, lower front contact of relay 56, conductor 50, and through the right-hand back contact of relay 23, to the winding of relay 29. Relay 29 operates thereby extending the connection from the calling line over trunk conductors 15 and 16 to trunk conductors 48 and 49 and through the brushes of selector S to the trunk leading to the operator's position. Talking battery is supplied to the calling station from the operator's position; and the current through the windings of the polarized supervisory relay 47 is not effective to operate relay 47 unless the call is further extended by the operator, in which case the operator may reverse the battery connected to the trunk so as to operate relay 47. In the latter case the message register of the calling subscriber is operated, in the manner hereinbefore described, when the connection is released by the calling subscriber.

Referring to Fig. 3 the subscriber's stations E and F are connected by the line 101 to terminals in the bank of line-finder LF; the line and cut-off relays are not shown but the line relay is connected to line 1 and the cut-off relay is connected to sleeve conductor 105 in the usual manner. The message registers 109 and 110 are connected in parallel over conductor 106 to the fourth terminal associated with the line 101 in the bank of line-finder LF. The unidirectional current carrying device 107 is in parallel with the winding of register 109 and the device 108 is in parallel with the winding of register 110 instead of these devices being respectively connected in series with the registers as shown in Fig. 1. This arrangement causes the operation of register 109 when the positive charging battery is connected to conductor 106 since the device 107 offers a relatively high resistance to the flow of current and register 110 does not operate since its winding is shunted by the relatively low resistance which device 108 offers to the flow of current. When the positive charging battery is connected to conductor 106, register 110 operates since the device 108 offers a relatively high resistance to the flow of current and register 109 does not operate since its winding is shunted by the relatively low resistance which device 107 offers to the flow of current.

The invention is not limited to systems using Strowger type, or any particular type, of switches nor to any particular type of system but is applicable to all party line measured service systems.

What is claimed is:

1. In a telephone system, a line, a plurality of subscribers' stations permanently connected to said line, a message register individual to each of said stations, a conductor permanently connected to a plurality of said registers, and means for controlling the direction of current over said conductor to selectively operate said registers.

2. In a telephone system, a line, a plurality of subscribers' stations permanently connected to said line, a message register individual to each of said stations, a conductor permanently connected to a plurality of said registers, a positive source of current, a negative source of current, means for connecting said positive source to said conductor to operate one of said registers, and means for connecting said negative source to said conductor to operate another of said registers.

3. In combination, a plurality of metering devices, a conductor permanently connected to said metering devices, means for producing a current in said conductor, and means individual to each of said devices for controlling said current to selectively operate said devices.

4. In a telephone system, metering devices, a conductor permanently connected to a plurality of said devices, means individual to each of said devices for rendering said plurality of devices selectively responsive to currents of different characteristics.

5. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, message registers one for each of said stations, a conductor common to a plurality of said registers, and means associated with the register of said calling station for rendering said register responsive to current of a certain characteristic.

6. In a telephone system, a line having a plurality of subscribers' stations, one of which is a calling station, a message register for each of said stations, a conductor permanently connected to said registers, and means including a unidirectional current carrying device associated with each of said registers for selectively operating the register of said calling station.

7. In a telephone system, a plurality of metering devices, a conductor permanently connected to two of said devices, means individual to one of said two devices for rendering said one responsive to current in said conductor in one direction, and means individual to the other of said two devices for rendering said other responsive to current in said conductor in the opposite direction.

8. In a telephone system, a line, two subscribers' stations permanently connected to said line one of said stations being a calling

station, a message register for each of said stations, a conductor permanently connected to said message registers, means for determining which of said stations is the calling station, and means including said conductor and a unidirectional current carrying device for selectively operating the register of said calling station.

9. In a telephone system, a line, a plurality of subscribers' stations permanently connected to said line, means at each of said stations for distinguishing it from the others, a message register individual to each of said stations, a conductor permanently connected to said registers, means individual to each of said message registers for rendering them selectively responsive to current in said conductor, means for testing said line to determine which of said stations is the calling station, and means for operating the register of said calling station.

10. In a telephone system, a line, two subscribers' stations permanently connected to said line, means at each of said stations for distinguishing it from the other, a message register individual to each of said stations, a conductor permanently connected to said registers, means associated with one of said registers for rendering said one responsive to current in one direction, means associated with the other of said registers for rendering said other responsive to current in the opposite direction, means including a trunk for extending said line when a call is originated at either of said stations, testing means associated with said trunk for determining which of said stations is the calling station, and means for operating the register of said calling station.

In witness whereof, we hereunto subscribe our names this 10th day of September, 1929.

LEWIS H. JOHNSON.
RAY L. STOKELY.