

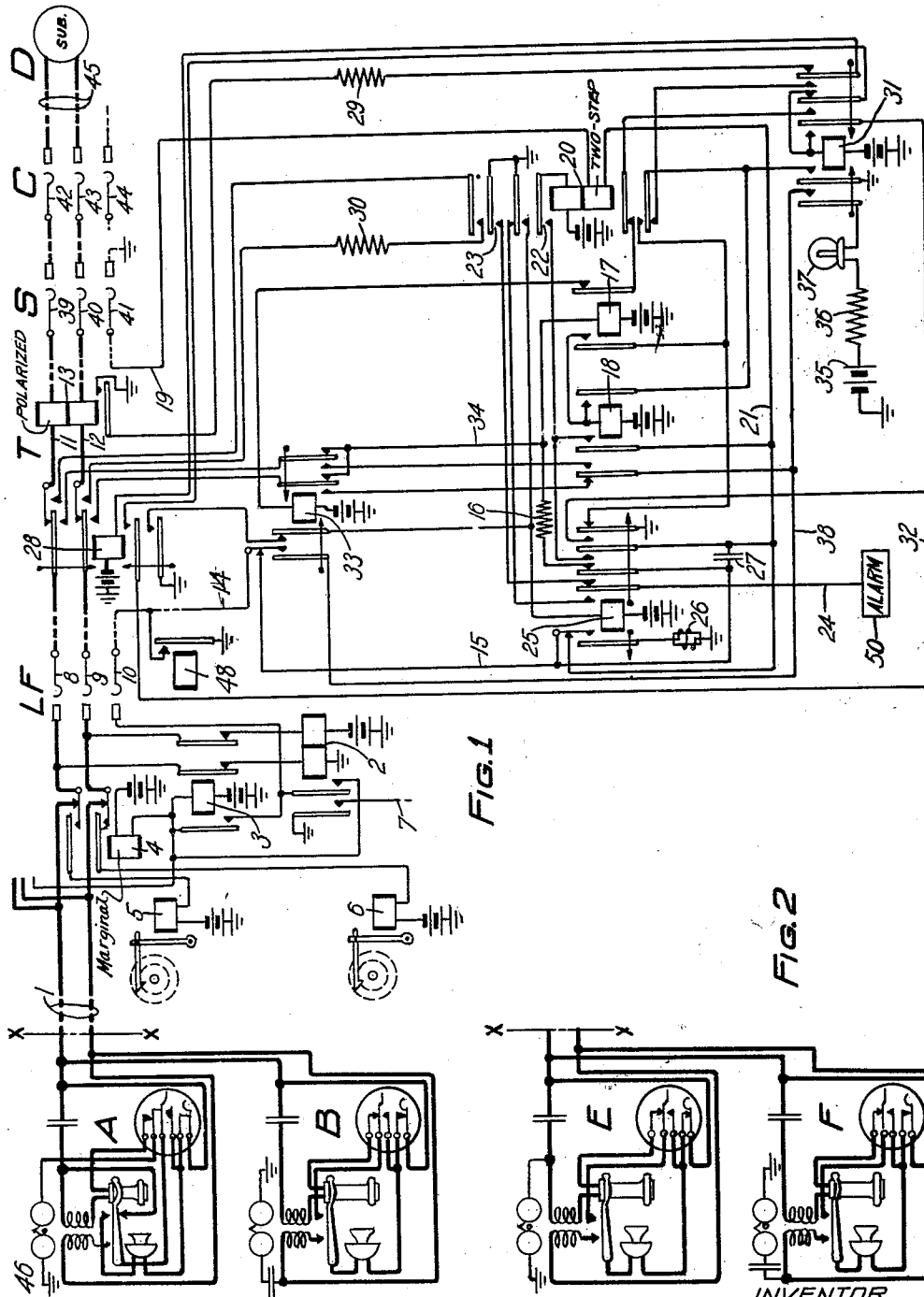
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TELEPHONE EXCHANGE SYSTEM

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TELEPHONE EXCHANGE SYSTEM

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This invention relates to telephone exchange systems and more particularly to improvements in party line message registration.

5 According to this invention a relay is provided in a two-party subscriber's line circuit for connecting the meter of one of the stations to the tip side of the identification trunk and for connecting the meter of the
10 other station to the ring side of the identification trunk. The winding of this relay is in parallel with the cut-off relay and is operated by booster battery after the called station has answered and the calling station
15 has been identified. This arrangement makes possible a saving of one or more leads between the identification trunk and the line circuit for operating the message registers.

Another feature of this invention resides
20 in so connecting the component parts of the subscriber's set as to remove the identifying ground during dialing and thus to make it unnecessary to furnish a pulse repeater in the identification trunk. This arrangement
25 minimizes the amount of equipment in the trunk, obviates the necessity of removing pulse repeating equipment when the connection is extended to an operator's position and obviates the difficulty experienced in repeating
30 dial pulses through more than one repeater in multi-office areas.

Referring to the drawings, Fig. 1 represents an automatic telephone system in which this invention is embodied; Fig. 2 shows an
35 alternative arrangement of the equipment at the stations of a two-party line.

In Fig. 1, A and B represent subscribers' stations on a party line, one of these being a calling station; D represents a called subscriber's station; LF represents a line-finder switch which has access to a group of lines including the line to which the stations A and B are connected; T represents a trunk whose associated equipment is arranged in
40 accordance with this invention to identify the calling station on a two-party line and to operate the message register which is individual to the calling station; S represents a selector switch which is permanently
45 connected by the trunk T with the line-finder

switch LF and which is controlled by the actuation of the calling device at the calling station to select an idle trunk which terminates at a connector switch having access to the line of the called station; C represents
55 a connector switch having access to a group of lines including the line to which the called station D is connected.

The subscriber's set at station A is known as the tip subset and is arranged so that the removal of the receiver from the receiver hook connects an identifying ground 46 to the associated line; this subset is equipped with a special dial so as to exclude the receiver from the connection to ground 46.
60 The subscriber's set at station B is known as the ring subset and is arranged so that no ground is connected to the line by the removal of the receiver from the receiver hook.
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The subsets at stations E and F are similar to those at stations A and B except that the dial at station E is of the same type as the dials at stations B and F and the receiver at station E is included in the connection to the
70 identifying ground 47. Each of these identifying ground connections is under the control of the off-normal springs of the associated dial, so that the ground is disconnected from the line as soon as the dial is moved
75 off-normal; this arrangement prevents the identifying ground from interfering with the satisfactory transmission of dial impulses when the various digits of a called subscriber's number are dialed. If the identifying
80 ground connection was not opened during dialing, it would be necessary to provide pulse repeating means in the identifying trunk circuit to insure proper operation of the step-by-step switches employed in establishing the
85 desired connection.

Those portions of the line-finder LF, selector S and connector C which are not involved in the disclosure of this invention have been omitted; the portions thus
90 omitted are represented diagrammatically by the broken lines which connect to the brushes of these switches.

The line-finder LF, which is represented by brushes 8, 9, and 10 and the associated
95 100

terminals, is similar to that disclosed in United States Patent No. 1,711,682, issued to Hovland May 7, 1929; the brushes 8, 9 and 10 represent one of the two sets of brushes as described in the Patent 1,711,682. The selector switch S which is represented by the brushes 39, 40 and 41 and the associated terminals, and the connector switch C, which is represented by the brushes 42, 43 and 44 and the associated terminals, are of the well known Strowger type similar to those described on pages 57 to 65 inclusive of the second edition of "Automatic Telephony" by Smith and Campbell.

The operation of a system in which the invention is embodied, as represented by the drawings, 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. Line relay 2 operates in an obvious circuit over the line 1 thereby connecting the winding of the cut-off relay 3 to the sleeve terminal associated with the line 1 in the bank of line-finder LF; line relay 2 also connects ground to lead 7 which is effective to cause an idle line-finder to hunt for the terminals of the calling line. During the time that this line-finder, which we will assume to be the line-finder LF, is hunting for the calling line the sleeve lead 14 of the trunk T is connected to ground at the front contact of relay 48 in the line-finder, relay 48 having been operated to start line finder LF. (For a detailed description of the operation of such a line-finder reference may be had to U. S. Patent 1,711,682.) When ground is thus connected to lead 14 a circuit is closed from battery through the winding of the identification test relay 17, through resistance 16, back contact of relay 25, lead 15, normally closed contacts of the continuity springs of relay 33, over lead 14 to ground at relay 48 of the line-finder LF. Relay 17 operates in this circuit and closes an obvious circuit for operating relay 18. The circuits for operating relays 17 and 18 are closed at this time to make certain that these relays are capable of operating when the calling line is tested to identify the calling station after the connection is released, as hereinafter described. Resistance 16 is equal to or greater than the resistance of the longest line to which the line-finder LF has access.

When the brushes 8, 9 and 10 of the line-finder LF come into contact with the terminals associated with the calling line 1 a circuit is closed from ground relay 48 of the line-finder LF, through sleeve brush 10, and through the front contact of relay 2, to the windings of the cut-off relay 3 and message register control relay 4. The cut-off relay 3 operates but relay 4 is marginal and does not operate until connected to a higher source of potential, as is hereinafter de-

scribed. The closing of the circuit through sleeve brush 10 is also effective to stop the hunting action of the line-finder. With the brushes 8 and 9 in contact with the tip and ring terminals of line 1 the line relay (not shown) of the selector S is operated in a circuit which includes leads 11 and 12 of trunk T, the line 1, and the subset at the calling station. (For a detailed explanation of the operation of the selector S reference may be had to pages 61 to 65 of the second edition of "Automatic Telephony" by Smith and Campbell). Ground (not shown) is thereupon connected at selector S over the sleeve lead 19 of trunk T, through the lower winding of relay 20, lead 21 normally closed contacts of the continuity springs of relay 25, lead 15, back contact of relay 25, resistance 16, and through the winding of relay 17, to battery. As long as ground at relay 48 of the line-finder LF is connected to lead 14 of trunk T, as hereinafter described, relay 20 does not operate for its lower winding is short-circuited by the ground connected to lead 14.

The operation of the cut-off relay 3 when the line-finder LF finds the calling line, as hereinafter described, causes the release of the line relay 2. The release of relay 2 disconnects ground from lead 7 whereupon relay 48 releases to disconnect the ground at its front contact from the sleeve brush 10 and from the sleeve lead 14 of trunk T. As a result the lower winding of relay 20 is energized to close its front contacts 22 and 23 without actuating any of its remaining contacts. The circuit for thus partially operating relay 20 is traced in part from the ground (not shown) at selector S, over lead 19 of the trunk T, through the lower winding of relay 20, lead 21, and through the normally closed contacts of the continuity springs of relay 25 to lead 15; from lead 15 one branch of the circuit is traced through the back contact of relay 25, resistance 16, and winding of relay 17 to battery; the other branch is traced from lead 15, through the normally closed contacts of the continuity springs of relay 33, lead 14, sleeve brush 10 of line-finder LF, to battery through the windings of cut-off relay 3 and message register control relay 4 connected in parallel. Relay 17 is held operated in the first mentioned branch of this circuit and cut-off relay 3 is held operated in the other branch. By the aforementioned partial operation of relay 20, a third branch of this circuit is closed from lead 21, through the inner left-hand front contact of relay 18, front contact 22 and upper winding of relay 20 to battery; the closing of this branch is effective to completely operate relay 20. With relay 20 completely operated, ground is disconnected

from alarm lead 24 and relay 25 is energized in an obvious circuit.

It is apparent that the complete operation of relay 20 depends upon the prior operation of relays 17 and 18. If relay 18 has failed to operate the partial operation of relay 20 is effective to operate the alarm circuit 50 by connecting ground at the front contact 23 of relay 20, through the inner right-hand back contact of relay 25, to lead 24. In this case the closing of the circuit, for operating the calling subscriber's message register, is prevented.

With relay 25 operated, as hereinbefore described, relays 17 and 18 are released and the alarm lead 24 is transferred to the back contact of relay 20. The release of relay 18 does not cause the release of relay 20 since the winding and front contact 22 of relay 20 are now connected through the next-to-the-outer right-hand front contact of relay 25, to lead 21. In operating, relay 25 also disconnects lead 15 from lead 21 and connects lead 15 to ground through retard coil 26. Thus relay 20 is held operated in the circuit from battery through its upper winding and front contact 22, through the front contact of relay 25, lead 21, lower winding of relay 20 and over lead 19 to ground (not shown) at selector S; the cut-off relay 3 is held operated in the circuit from battery through its winding, brush 10 of line-finder LF, lead 14, normally closed contacts of the continuity springs of relay 33, lead 15, left-hand front contact of relay 25, to ground through retard coil 26. This arrangement for holding the cut-off relay 3 operated permits number checking on toll calls. The path for the number checking tone from the sleeve brush 10 of the line-finder is traced through lead 14, normally closed contacts of the continuity springs of relay 33, lead 15, condenser 27, lead 21, lower winding of relay 20, and through the sleeve lead 19 of trunk T to the selector S. No further operation of the trunk equipment occurs until after the connection has been established and the called subscriber has answered, as is hereinafter described.

With the calling line extended over the trunk T to the selector S the actuation of the calling device at the calling station is effective to step the brushes of selector S up to the level of a group of trunks which terminate at connector switches having access to a group of lines including the called line 45. If the call originated at station A, the identifying ground 46 is disconnected from the line, when the calling device is operated, to insure proper operation of the selector S. The selector S then automatically selects an idle trunk in the selected group, thereby extending the connection from the calling line 1 through the

brushes 39 and 40 over the selected trunk to the windings of the line relay (not shown) of the associated connector switch C. Ground at connector switch C is then connected over the sleeve lead of the associated trunk and through the sleeve brush 41 of the selector S to the sleeve lead 19 of trunk T, to hold relay 20 operated; the ground at selector S, hereinbefore described as having been connected to lead 19, is disconnected after trunk T has been extended through the selector brushes to the connector switch. The connector switch now operates in response to the actuation of the calling device at the calling station to extend the connection from selector brushes 39 and 40 through the connector brushes 42 and 43 to line 45 which terminates at the called station D. (For a detailed description of the operation of the Strowger type of selector and connector switches reference may be had to pages 57 to 65 of the second edition of "Automatic Telephony" by Smith and Campbell). The called line having been found idle, a source of ringing current having been connected to the called line, and the called subscriber having answered, the source of talking current at the connector C for the calling subscriber's line is reversed, with respect to the tip and ring sides of the line, so as to operate the polarized supervisory relay 13 in the trunk T. The circuit for operating relay 13 may be traced from battery, through one side of the line relay (not shown) of the connector C, through brush 39 of selector S, upper winding of polarized supervisory relay 13, conductor 11 of trunk T, back contact of relay 28, brush 8 of line-finder LF, over the tip side of the calling line 1, through the subset at the calling station, ring side of line 1, brush 9 of line-finder LF, back contact of relay 28, conductor 12 of trunk T, lower winding of polarized supervisory relay 13, brush 40 of selector S, and through the other winding of the line relay (not shown) of connector C, to ground.

The operation of the polarized supervisory relay 13 closes a circuit from ground through the front contact of relay 13, resistance 29, back contact of relay 31, and through the winding of relay 28 to battery. Relay 28 operates in this circuit thereby disconnecting brushes 8 and 9 from conductors 11 and 12 and connecting both brushes through the back contacts of relay 33, over lead 34 to the winding of identification test relay 17. Relay 28 is slow to operate so that momentary operations of supervisory relay 13 will be ineffective to operate relay 28. Relay 28 also closes an obvious circuit for holding relay 25 operated independent of relay 20 and bridges resistance 30 across the conductors 11 and 12 of trunk T to prevent the release of the line relay (not shown) in con-

nector C during the test to identify the calling station. The identification test relay 17, thus connected to the tip and ring sides of the calling line 1, is operated if the call originated at station A since the subset at station A is arranged to connect the identifying ground 46 to the line when the receiver is removed from the receiver hook. The identification test relay 17 does not operate if the call originated at station B for the subset at this station is distinguished by the lack of an identifying ground connection.

The operation of relay 28 is also effective to close a circuit from ground through the outer right-hand front contact of relay 25, lead 32, inner lower front contact of relay 28, and through the middle right-hand back contact and the winding of relay 31 to battery. Relay 31 operates in this circuit and locks through its inner right-hand front contact and lead 32 to the same ground, independent of relay 28. If the call originated at station A so that the identification test relay 17 is operated, a circuit is closed by the operation of relay 31 for operating relay 18; this circuit may be traced from battery through the winding of relay 18, front contact of relay 17, lower front contact relay 20, to ground at the inner left-hand front contact of relay 31. Relay 18 locks through its right-hand front contact to the same ground independent of relays 17 and 20. Relay 31 is slow to operate so that the momentary operation of relay 17 due to a line charging current will not cause the operation of relay 18. The release of relay 28, which is caused by the operation of relay 31, reconnects brushes 8 and 9 of the line-finder LF to conductors 11 and 12 of trunk T so that conversation may be had between the subscribers at the calling and called stations. No further operation of the equipment associated with the trunk T occurs until the connection is released.

When the connection is released by replacing the receiver on the receiver hook at the calling station, the line relay (not shown) of connector C and supervisory relay 13 of trunk T are released. The selector switch S and the connector switch C are restored to normal in the usual manner. As a result, ground at the connector C is disconnected from the terminal with which the sleeve brush 41 of selector S is in contact thereby releasing relay 20 in the trunk T. The release of relay 20 closes a circuit for reoperating relay 28; this circuit is traced from battery through the winding of relay 28, outer right-hand front contact of relay 31, outer lower back contact of relay 20, and through the inner left-hand front contact of relay 31, to ground. Relay 20 opens the circuit through the winding of relay 25, but relay 25 is slow to release and the operation

of relay 28 closes a circuit from battery through the winding of relay 25 and through the inner left-hand back contact of relay 33 to hold relay 25 until the message register of the calling line has been operated. Since the receiver has been replaced on the receiver hook at the calling station the identification test circuit is open even though the reoperation of relay 28 reconnects the winding of test relay 17 through brushes 8 and 9 to the tip and ring sides of the line 1. But if a foreign ground is connected to the calling line, relay 17 is reoperated to prevent the operation of relay 33, as is hereinafter described. By preventing the operation of relay 33, the closing of the circuit for operating the message register is also prevented and ground is connected through the upper back contact of relay 20 and the inner right-hand front contact of relay 25 over lead 24 to operate the alarm circuit 50.

Assuming that relay 17 does not operate at this time, the operation of relay 28 is effective to close a circuit for operating relay 33; this circuit may be traced from battery through the winding of relay 33, back contact of relay 17, inner lower back contact of relay 20, middle right-hand front contact of relay 31, inner lower front contact of relay 28, lead 32, to ground at relay 25. Relay 33, in operating, disconnects the ground at retard coil 26 (through the front contact of relay 25 and over lead 15) from lead 14 and connects lead 14 (over lead 38 and through the outer left-hand front contact of relay 31, lamp 37 and resistance 36) to booster battery 35. This results in an increased current through the windings of the cut-off relay 3 and message register control relay 4. The marginal message register control relay is thus operated to disconnect the tip and ring sides of the line 1 from the corresponding line-finder terminals with which brushes 8 and 9 are in contact and to connect the tip terminal to message register 5 which is associated with station A (the tip subset) and to connect the ring terminal to message register 6 which is associated with station B (the ring subset). Although the holding ground through retard coil 26 was disconnected from sleeve lead 14 of line-finder LF when relay 33 operated, the connection to booster battery 35 is effective to prevent the release of the line-finder LF.

With relays 4, 28 and 33 operated the message register which corresponds to the station which originated the call, as identified by the test relay 17, is operated. If the call originated at station A, message register 5 is operated in the circuit from battery through its winding, front contact of relay 4, brush 8, front contact of relay 28, front contact of relay 33, front contact

of relay 18, and over lead 38 to booster battery. If the call originated at station B, message register 6 is operated in the circuit from battery through its winding, front contact of relay 4, brush 9, front contacts of relays 28 and 33, back contact of relay 18, and over lead 38 to booster battery.

The operation of relay 33, as hereinbefore described, also opened the circuit through the winding of relay 25 and the consequent release of relay 25 opens the circuits through the windings of relays 31 and 33. The release of either of relays 31 or 33 opens the circuits from booster battery 35 but since relay 25 is slow to release this circuit was closed long enough to insure the operation of the calling subscriber's register. The opening of the booster battery circuit releases the message register which was operated, releases the message register control relay 4 and the cut-off relay 3 and also causes the release of the line-finder and the return of brushes 8, 9 and 10 to normal. The release of relay 31 releases relay 28 and also releases relay 18, if previously operated. All of the equipment involved in the connection is now normal.

The invention is not limited in its application to a system which employs Strowger type switches and is applicable to all systems which are arranged for party-line message rate subscriber's stations.

What is claimed is:

1. 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 selector, means including a trunk for extending said line to said selector, means individual to said trunk for determining which of said stations is the calling station, and means individual to said line for connecting said message registers to said trunk.

2. 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 selector, means including a trunk for extending said line to said selector, means associated with said trunk for determining which of said stations is the calling station, a called subscriber's line, means including a connector for extending the connection from said selector to said called line, a relay operable by a reversal of current over the talking conductors of said trunk in consequence of the answer of the called subscriber, and means rendered effective by the operation of said relay for operating the register of said calling station over one of the talking conductors.

3. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, means at said calling station for dialing, an identifying

connection at said calling station, and means for opening said identifying connection during the operation of said dialing means and for automatically closing said connection after each opening.

4. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, means for distinguishing said calling station from the other stations on said line, a dial at said calling station, a selector, means including a trunk for extending said line to said selector, a pulsing circuit controlled by said dial for selectively operating said selector, and means for disconnecting said distinguishing means when said dial is moved off normal.

5. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, a dial at said calling station, an identifying connection at said calling station, a message register for each of said stations, a selector switch, means including a trunk for extending said line to said selector switch, means associated with said trunk for determining which of said stations is the calling station, a called subscriber's line, means including a connector for extending the connection from said selector switch to said called line, a supervisory relay operable by a reversal of current over the conductors of said trunk in consequence of the answer of the called subscriber, means rendered effective by the operation of said relay for operating the register of the calling station over one of the talking conductors of said trunk, and means for opening said identifying connection when said dial is moved off normal.

6. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, a message register individual to each of said stations, a called station, means including a trunk for extending a talking connection from said calling station to said called station, means associated with said trunk for determining which of said stations is the calling station, and a circuit which includes a single talking conductor of said trunk for operating the message register of said calling station.

7. In a telephone system, a line, a plurality of subscribers' stations including a calling station permanently connected to said line, a message register for each of said stations, a called station, means including a trunk for extending a talking connection from said line to said called station, means associated with said trunk for determining which of said stations is the calling station, a circuit including one of the talking conductors of said trunk for operating one of said message registers, and a second circuit including the other talking conductor of said trunk for operating another of said message registers.

8. In a telephone system, a line, a plurality of subscribers' stations including a calling station permanently connected to said line, a dial at said calling station, an identifying connection at said calling station, a message register for each of said stations, a called station, means including a trunk for extending a talking connection from said calling station to said called station, means associated with said trunk for testing said line to determine which of said stations is the calling station, a circuit including a single talking conductor of said trunk for operating that one of said message registers which is individual to said calling station, and means for holding said identifying connection open during the operation of said dial.

9. In a telephone system, a line having a plurality of subscribers' stations one of which is a calling station, a receiver and receiver hook at said calling station, an identifying connection at said calling station closed by the removal of said receiver from said receiver hook, said receiver being excluded from said connection, a dialing device at said calling station, a called station, means including a trunk for extending a connection from said calling station to said called station, means individual to said trunk for testing said line to determine which of said stations is the calling station, and means for opening said identifying connection while said dialing device is being operated.

In witness whereof, I hereunto subscribe my name this 23d day of May, 1929.

HENRY HOVLAND.

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