

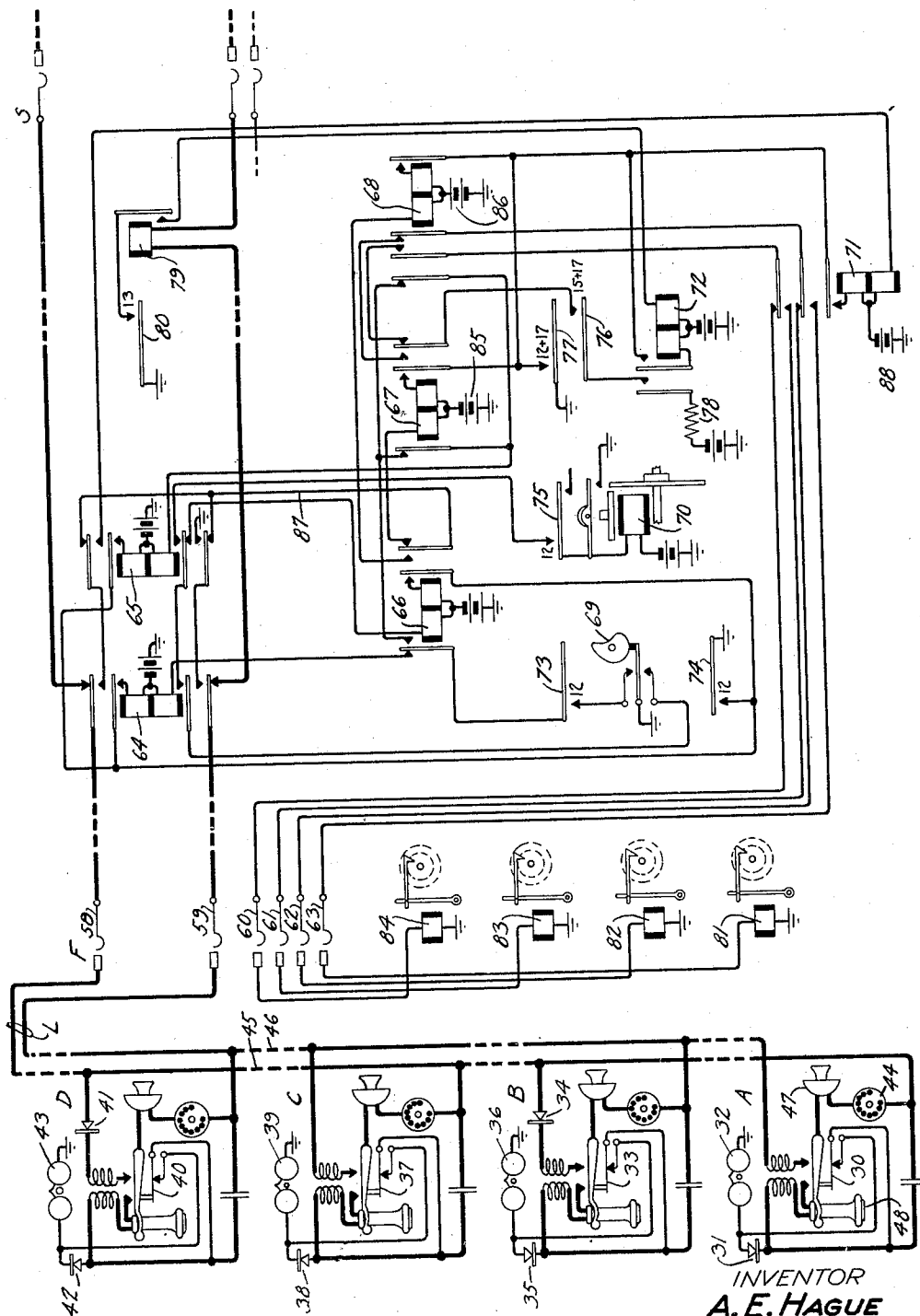
Nov. 10, 1931.

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1,831,385

TELEPHONE SYSTEM

Filed April 19, 1930



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TELEPHONE SYSTEM

Application filed April 19, 1930. Serial No. 445,553.

This invention relates to telephone systems and particularly to the identification of calling stations on party lines.

The objects of the invention are to secure a positive and reliable test of party lines to identify the calling party, to simplify the equipment used for this purpose, to effect an economy therein, and to otherwise improve systems of this character.

According to this invention, all of the stations of a four-party line are equipped with unidirectional devices which are connected in series with the signal bell windings to ground such that a test current of one polarity will, when applied to the line, flow through the bell windings at two stations, while current of opposite polarity will flow through the bell windings at the other two stations. In addition, two of the stations are arranged to close, when calling, an unobstructed path across the tip and ring conductors of the line, whereas the other two stations when calling close bridges through other unidirectional current controlling devices in such a manner that, if a test is made over the line as a loop, current will flow if the calling station is one of the first mentioned pair but will not flow if it is one of the second pair.

A feature of the invention is a circuit arrangement by which the directional devices, which control the flow of test current through the bell windings, are shunted when the receiver is on the switchhook so that ringing current can flow from the line directly to the bells and not be required to pass through said devices. The removal of the receiver opens the shunt and includes the bell winding and the directional current controlling device in a circuit to the line conductors for the identifying test.

An advantage of this arrangement is that both loop and ground return circuits may be used to test for the calling station. A further advantage is that by using the grounded bell winding as a part of the test circuit the impedance of this winding serves to prevent interference with the transmission characteristics of the line during conversation, thus obviating the necessity of providing a retardation coil for that purpose.

The drawing illustrates a party line in an automatic telephone system arranged for identification and message registration in accordance with the features of this invention.

The subscriber's line L is provided with four stations, A, B, C, and D. All four of these stations are equipped with unidirectional current carrying devices connected in different ways to enable a distinctive test to determine the calling station. These devices, being unidirectional or asymmetrical, permit current to flow in one direction but resist the flow of current in the opposite direction. At stations A and B the unidirectional devices 31 and 35 are connected between the line and the respective substation bell windings 32 and 36 in such a way that current of negative polarity is permitted to flow from the line through the windings of these bells to ground. At stations C and D, the devices 38 and 42 are connected in series with the bells 39 and 43 respectively in such a manner that current of positive polarity is permitted to flow from the line to ground. At stations B and D, the devices 34 and 41 are included in connections leading from the tip side of the line through one winding of the repeating coil, a switchhook contact, the talking transmitter and the impulse sender to the opposite side of the line. These devices are so connected as to resist flow of negative current when applied to the tip side of the line. The unidirectional current devices may be of any suitable type such as described in the Journal of the American Institute of Electrical Engineers for March 1927, page 215.

The line L extends to the central office and terminates in the contact bank of a line finder switch F, which is illustrated schematically by the brushes 58 to 63 inclusive. The line finder F extends the line to the brushes of the selector switch S, also shown schematically. The finder F and selector S may be of any suitable type such as the power-driven panel type switches described in the patent to McQuarrie No. 1,177,044, granted March 28, 1916, and in the patent to Craft et al. No. 1,123,696, granted January 5, 1915. The selector S and succeeding selector switches may be controlled by central office register

senders such as described in detail in the patent to Kopp No. 1,589,402, granted June 22, 1926 and in the patent to Stearn et al No. 1,395,977, granted November 1, 1921.

5 Since each of the four substations is provided with an individual message register at the central office, registers 81 to 84 inclusive, it is necessary to make a test of the line at some convenient time to determine which
10 substation has initiated the call. The testing equipment at the central office comprises two relays 67 and 68 and oppositely poled sources of current 85 and 86 together with relay 71 and the source of potential 88. The test is
15 divided into two parts, the first or preliminary test serving to determine which pair of stations is responsible for the call. The second or final test is made by the relay 71 and serves in combination with the first test to
20 identify the particular station that has initiated the call. The first test consists in applying first negative current from the source 85 and then positive current from the source 86 to the two sides of the line in simplex, and
25 the second part of the test consists in applying negative current from the source 88 to the tip side of the line and ground potential to the ring side of the line.

Taking up the detailed description, it will
30 first be assumed that a call is originated at the substation A. The initiation of the call sets the line finder F in operation to find the calling line. Following this, the called line designation is sent by the impulse transmitter 44 and recorded at the central office for
35 the purpose of operating the switch S and succeeding switches to complete the extension of the connection to the called line. At some convenient point in the extension of the connection the controlling sequence switch 70,
40 associated with the selector switch S and finder F, reaches some position such as position 12. As soon after the sequence switch reaches position 12 as the power driven interrupter 69 closes its upper contact, a circuit
45 is completed from ground through said contact of the interrupter, sequence switch spring 73, left back contact of relay 66, lower winding of relay 64 to battery. Relay 64
50 operates and locks through its upper winding and contact to ground at the contact of spring 74. With relay 64 actuated, the tip and ring conductors of the line L are extended through the brushes 58 and 59, front
55 contacts of relay 64, back contacts of relay 65, conductor 87, outer right back contact of relay 66, left winding of test relay 67 to the negative pole of battery 85. This test circuit it will be noted includes both the tip and ring
60 conductors of the line L. At the substation A, the tip conductor 45 extends through the impulse transmitter 44, talking transmitter 47, through the switch hook contacts, receiver 48, left winding of induction coil to the uni-
65 directional device 31. The ring conductor 46

extends through the right winding of the induction coil, switchhook contacts, receiver 48 and the left winding of the induction coil to the device 31. Since the negative pole of the source 85 is connected to the test circuit, 70
current will flow through the device 31 to the windings of the bell 32. Accordingly the relay 67 operates and locks through its right winding and contact to ground at spring 77.

When the interrupter 69 shifts its con- 75
tacts, a circuit is completed from ground through the lower contacts of said interrupter, inner lower armature and contact of relay 64, inner lower armature and back contact of relay 65, left winding of relay 66 80
to battery. Relay 66 operates and locks through its right winding and contact to the sequence switch spring 74. Relay 66 disconnects the test conductor 87 from the relay 67 and connects it through the left winding of 85
relay 68 to the positive pole of source 86. Due to the polarity of the device 31, current does not flow over the test circuit through the windings of the bell 32 to ground and the relay 68 does not operate. 90

On the next shift of the interrupter 69, a circuit is closed from ground through the upper contacts of the interrupter, spring 73, left armature and front contact of relay 66, 95
outer left armature and back contact of relay 68, lower winding of relay 65 to battery. Relay 65 operates and locks through its upper winding and contact to ground at sequence switch spring 74. Relay 65 disconnects the test conductor 87 from the line and 100
closes a loop circuit for performing the second part of the test. The operation of relay 68, as a result of the first part of the test, determines that the calling station is either the station A or the station B. The second 105
part of the test, next to be performed, will determine which one of these two stations has initiated the call. The loop circuit for the second test may be traced from the negative pole of battery 88 through the lower winding of relay 71, front contacts and upper- 110
most armatures of relays 65 and 64, brush 58, thence over the tip conductor 45 through the transmitters 44 and 47 at the station A, switchhook contacts, right winding of the induction coil and returning over the ring conductor 46, brush 59, lowermost arma- 115
tures and front contacts of relays 64 and 65 to ground. Relay 71 operates in this circuit and locks through its upper winding and contact to ground at the sequence switch spring 77. 120

Later when the interrupter 69 shifts its contacts, a circuit is completed from ground through the lower contacts of said interrupter, inner lower armatures of relays 64 and 65, sequence switch spring 75, through the winding of the sequence switch magnet 70 to battery. Thus the sequence switch advances into some subsequent position indi- 125

ating that the test has been completed. As the sequence switch moves out of position 12 the holding circuits of relays 64, 65, and 66 are opened, and these relays release.

If the call is successful and the called subscriber answers, a supervisory relay such as the relay 79 operates and completes a circuit from ground through sequence switch spring 80, contact of relay 79, right winding of relay 72 to battery. Relay 72 operates and locks through its left winding and contact to ground through the spring 77. Subsequently when conversation is completed and release is taking place, the sequence switch 70 moves through successive positions such as positions 15 to 17. While the sequence switch is moving through these positions, a circuit is completed for operating the register 81 individual to the calling station A. This circuit may be traced from battery through the resistance 78, outer contact of relay 72, sequence switch spring 76, outer right armature and front contact of relay 67, inner left armature and contact of relay 68, middle armature and front contact of relay 71, brush 63 to the winding of the register 81 to ground. The register 81 operates and charges the call against the substation A.

As the sequence switch 70 leaves position 17 the test relays 67 and 71 are released. The release of the finder switch F and selector switch S take place in the well-known manner.

If the call is initiated at the substation B instead of substation A, the relay 67 operates in the first part of the test the same as it did in the case above described. On the second part of the test, however, the relay 71 does not operate since current of negative polarity cannot flow from the tip conductor 45 through the device 34 to the ring conductor 46. Therefore the metering circuit may now be traced from battery resistance 78, contact of relay 72, spring 76, outer right armature and front contact of relay 67, innermost armature of relay 68, middle armature and back contact of relay 71, brush 62, winding of register 82 to ground.

Assume next that the call is initiated at the substation C. When the negative pole of source 85 is connected to the line, current will not flow since the device 38 is arranged to permit flow of positive current only. Accordingly the relay 67 does not operate. Later, however, the relay 68 is operated due to the flow of current from the positive source 86 through the device 38 and the winding of the bell 39 to ground. During the second part of the test, relay 71 is operated since there is no obstruction to the flow of current from the tip conductor 45 to the ring conductor 46 at the substation C. Under these conditions, the metering circuit may be traced from battery through the resistance 78, contact of relay 72, spring 76, outer arma-

ture and back contact of relay 67, middle armature and front contact of relay 68, uppermost armature and front contact of relay 71, brush 61 to the winding of the register 83, which is individual to the substation C.

Assume finally that a call is originated at the substation D. In this case the relay 67 remains inert, and the relay 68 operates the same as when the call originated at substation C since current flows from the source 86 through the device 42 and the windings of bell 43 to ground. On the second part of the test, however, relay 71 does not operate due to the device 41. Therefore the metering circuit may be traced from battery through the resistance 78, contact of relay 72, spring 76, outer right armature and back contact of relay 67, middle armature and front contact of relay 68, uppermost armature and back contact of relay 71, brush 60 to the winding of the register 84 individual to the substation D.

It will be noted that the devices 31, 35, 38, 42, individual to the respective substations A, B, C, and D, are normally shunted by the respective switchhook springs 30, 33, 37, and 40 while the receivers are on the hooks. This permits ringing current to flow from the line conductors directly to the ringers 32, 36, 39, and 43 without having to traverse the unilateral devices.

The devices 31, 35, 38, and 42 may offer only slight impedance to the flow of voice currents, but the transmission characteristics of the line are unimpaired owing to the high impedance of the windings by the substation bells. Thus the ground connections of the substation ringers are employed for testing purposes without interfering with the talking characteristics of the line and without the necessity of supplying an additional impedance for this purpose such as a choke coil.

While the invention has been illustrated in connection with systems of a certain type, it will be understood that it is not so limited but is applicable to various types of systems.

What is claimed is:

1. In a telephone system, a line having a plurality of stations thereon, signal devices, one at each station, individual test circuits for said stations, each test circuit including the signal device at the corresponding station, and means responsive to the flow of current in said circuits for discriminating one station from another.

2. In a telephone system, a line having a plurality of stations thereon, signal bells having actuating windings, one bell at each of said stations, individual test circuits for said stations, each test circuit including the winding of the corresponding signal bell, and means responsive to the flow of current in said test circuits for identifying one of said stations.

3. The combination in a telephone system of a line having a number of stations thereon, signal devices, one at each station, a source of potential, individual test circuits for said stations for connecting said line to said source, each test circuit including the signaling device at the corresponding station, and means responsive to the flow of current in said test circuits to enable a test for discriminating between said stations.

4. In a telephone system, a line having a plurality of stations thereon, call bells, one for each station, individual circuits for said stations, each circuit including the call bell at the corresponding station, a source of current, and means for controlling the direction of flow of current in said circuits to identify one station from another.

5. In a telephone system, a party line, signal bells having windings which offer a high impedance to talking currents, each station on the line being provided with one of said bells, individual test circuits for said stations, each circuit including the winding of the corresponding bell, and testing means controlled in accordance with the flow of current in said test circuits for identifying said stations.

6. In a telephone system, a line having a plurality of stations thereon, individual signal devices for said stations, individual test circuits for said stations, each test circuit including the corresponding signal device, current controlling devices, one in each of said circuits for controlling the flow of current therein, and means effective according to the flow of current in said circuits for identifying one of said stations.

7. The combination in a telephone system of a line having a number of stations thereon, individual signal devices for said stations, individual test circuits for said stations, each test circuit including the corresponding signal device, directional current controlling devices, one in each of said circuits for controlling the direction of current flow therein, and means effective according to the direction of flow of current in said circuits for identifying one of said stations.

8. In a telephone system, a line having a plurality of stations, individual signal bells for said stations, individual test circuits for said stations, each circuit including the corresponding signal bell, directional devices, one in each of said circuits, certain of said devices permitting the flow of current in one direction and other of said devices permitting the flow of current in the opposite direction, and means effective according to the direction of current flow in said circuits for identifying said stations.

9. In a telephone system, a line having two substations thereon, signal bells, one for each station, individual test circuits for said stations, each circuit including the correspond-

ing signal bell, a current controlling device in one of said circuits for permitting current of positive polarity to flow therein, another current controlling device in the other circuit for permitting the flow of current of negative polarity, and means dependent upon the direction of current flow for identifying one of said stations.

10. In a telephone system, a line having a plurality of stations, individual signal bells for said stations, means at each station for closing a bridge across the sides of said line, a test circuit including the sides of said line in series, means in certain of said bridges to prevent the flow of current in said test circuit, other test circuits including said signal bells, and means controlled by said test circuits for identifying one of said stations.

11. In a telephone system, a line having a number of stations thereon, individual signal bells for said stations, a test circuit including both sides of the line in parallel and said signal bells, means at each station for closing a bridge across the sides of said line, another circuit including the sides of said line in series, means in certain of said bridges to prevent flow of current in said second-mentioned test circuit, and means controlled by said test circuits for identifying one of said stations.

12. In a telephone system, a line having a number of stations thereon, individual signal bells for said stations, a test circuit including one of said bells, a second test circuit including another of said bells, a third test circuit excluding all of said bells, and means controlled by said test circuits for identifying one of said stations.

13. In a telephone system, a line having a number of stations thereon, individual bells for said stations, a first test circuit including one of said bells, a directional device in said test circuit for permitting the flow of current of one polarity, a second test circuit including another of said bells, a directional device in said second circuit for permitting the flow of current of opposite polarity, and means controlled by said test circuits for identifying one of said stations.

14. In a telephone system, a line having a substation thereon, a signal bell at said substation connected to said line, a unidirectional device in circuit with said bell for admitting current of a given polarity, and means for closing a shunt around said device.

15. In a telephone system, a line having a substation thereon, a signal bell at said substation connected to said line, sources of test current of different polarity, a current controlling device in circuit with said bell for permitting the flow of test current of a given polarity, a source of ringing current, and means for causing ringing current to flow to said bell without traversing said device.

16. In a telephone system, a line having a

station thereon, a grounded signal bell at said station connected to the line, a current controlling device in circuit with said bell for permitting the flow of test current of a given polarity, a source of ringing current for operating said bell, a circuit for shunting said current controlling device, and means controlled by the substation receiver for opening and closing said shunting circuit.

10 In witness whereof, I hereunto subscribe my name this 8th day of April, 1930.

ALFRED E. HAGUE.

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