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TELEPHONE EXCHANGE SYSTEM

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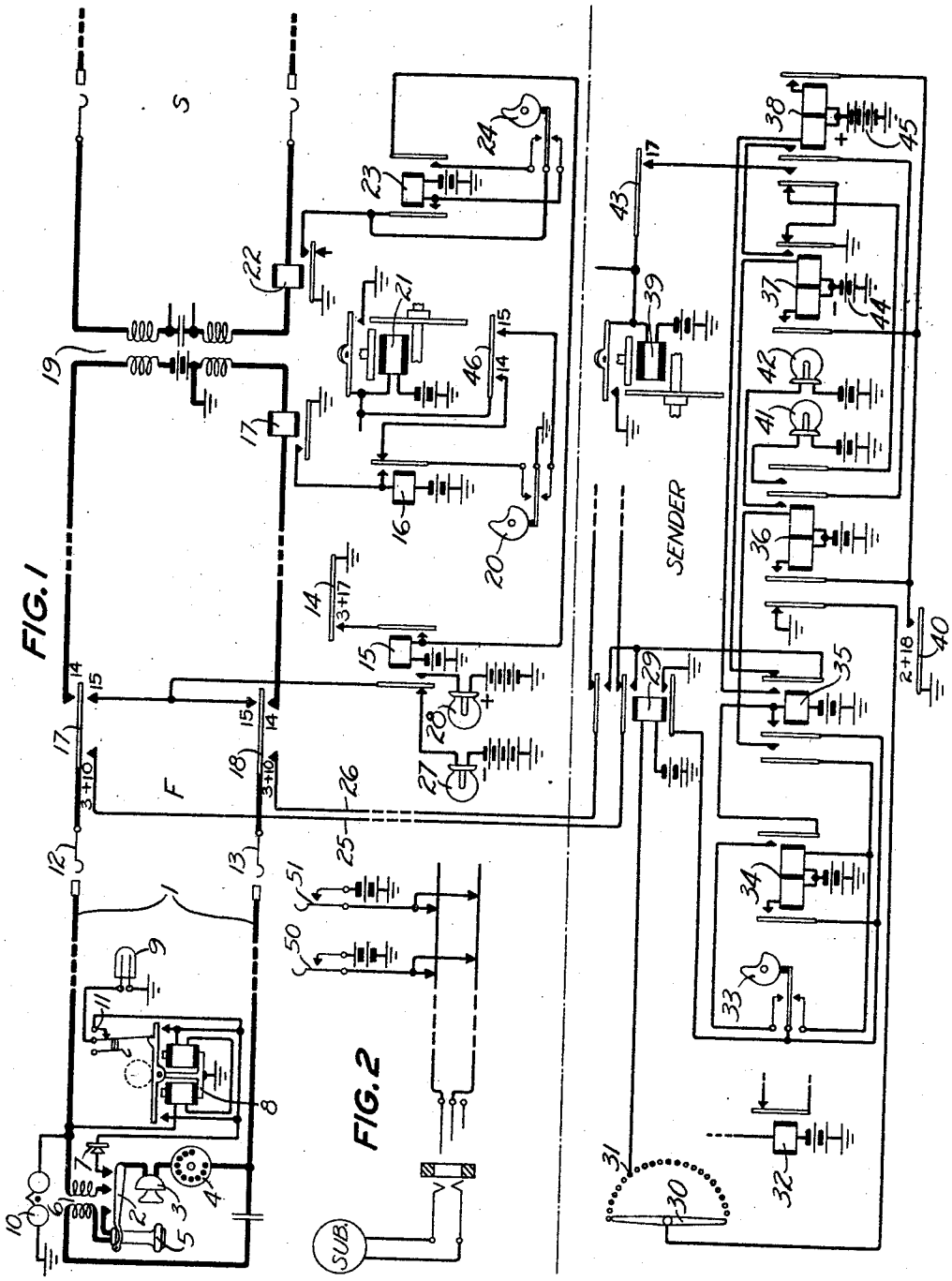

INVENTOR
R. E. COLLIS
BY W. W. McKenney

ATTORNEY

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RAYMOND E. COLLIS, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEPHONE-EXCHANGE SYSTEM

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This invention relates to telephone exchange systems and particularly to improvements in coin controlled systems.

Its object is to render more positive and dependable the tests that are made of a coin line to determine the presence or absence of a deposited coin at the calling station.

Heretofore, it has been the practice to test the calling line by closing a test circuit including the line conductors, the coin magnet and the deposited coin. This test depends on the circuit having a resistance within certain values in order to distinguish between the actual deposit of a coin at the substation and an unstandard ground connection on the line, which may be either accidentally or fraudulently made by the calling party. The test is, therefore, a marginal one and subject to variations.

According to the present invention, these marginal tests are avoided and a more reliable test is secured by means of a system in which a unidirectional device is placed in the test circuit at the substation. By applying, at the central office, test current of one polarity and then of the opposite polarity, the presence or absence of the coin is positively indicated.

A feature of the invention is a system in which the coin magnet is excluded from the test circuit, thus obviating the necessity of selecting values of test current which will not falsely actuate the magnet.

A further feature of the invention is a system in which the return of the coin is permitted whether the subscriber's receiver is on or off the switchhook, but the collection of the coin is prevented until the receiver is replaced on the switchhook.

In the drawing, Fig. 1 illustrates the invention applied to a subscriber's line in an automatic telephone system. Fig. 2 illustrates the subscriber's line terminating at a manual position, together with the operators' keys for collecting and refunding coins. Inasmuch as the invention is not limited to any particular type of system, only those details have been shown which are essential to an understanding of the invention.

The telephone line 1, which is illustrated as a coin box line, is equipped with the usual apparatus at the substation including a talking transmitter 3, a receiver 5, a switchhook 2, impulse sender 4, induction coil 6 and ringer 10. In addition to these elements, the substation is also equipped with a coin or token device comprising the polarized operating magnet 8, together with the usual associated elements for collecting and returning coins or tokens. This device may be of the general type shown in the patent to Forsberg No. 1,117,485, granted November 17, 1914. The deposit of a coin closes and latches the contacts 11 to cause the initiation of the call at the central office. When the coin magnet 8 is partially operated subsequently, it closes one or the other of its contents to complete its own circuit directly to ground to insure the proper operation thereof.

Heretofore, it has been customary to connect the coin magnet in a circuit from the tip side of the line to ground, the circuit leading through contacts which are closed on the deposit of the coin in the chute. In the present case, however, the circuit extending to ground includes a space discharge device 9 the characteristics of which are such that current of low potential will not be permitted to flow, whereas current of sufficiently high potential will break down the resistance of the device 9 and flow through the circuit to ground. It is a further characteristic of the discharge device 9 that current of either polarity will flow, provided its potential is sufficient.

The coin control circuit is further provided with a uni-directional device 7 which is included in a path in shunt of the coin magnet 8 when the contacts of the switchhook 2 are closed, namely, when the receiver is off the switchhook. The device 7 is so connected that it permits current of positive polarity to flow in a circuit traceable over the conductors of the line 1 through the device 7 and thence through the coin control contacts and the device 9 to ground. Being asymmetric, it will not permit current to flow in the opposite direction. Any suitable uni-directional current carrying device may be employed, such as the one described in the Journal of the

American Institute of Electrical Engineers for March, 1927, page 215.

The line 1 extends to the central office and terminates in the contact bank of a line finder switch F, which is illustrated schematically by the brushes 12 and 13. The line finder F extends the line to the brushes of a selector switch S also shown schematically. The selector S and other succeeding switches are controlled by a central office sender, partially shown below the horizontal broken line, to complete the connection to the called subscriber's line. The line finder F and the selector switch S may be of the standard power driven type, such as shown and described in the patent to Mills, No. 1,504,261, granted August 12, 1924 and in the patent to Henry, No. 1,575,336, granted March 2, 1926. The manner in which the switch S and succeeding switches are controlled by the central office sender is also fully described in these patents. Moreover, these patents describe the way in which substation coin boxes are controlled either to collect or to refund the coins.

Considering the system illustrated in the present disclosure more in detail, the calling party at the substation of line 1 on intiating a call causes the line finder F to operate to seize the line and extend it to the first selector S and also to an idle sender. The seizure of the link circuit between the finder and the selector causes the controlling sequence switch 21 to advance to some position, as for instance between positions 3 to 10, to extend the tip and ring conductors of the line through the contacts of sequence switch springs 17 and 18, over conductors 25 and 26, through the back contacts of relay 29 to an impulse receiving circuit not shown in detail. The calling party proceeds to manipulate his impulse transmitter 4 to record the designation of the called subscriber's line on registers in the sender in the well known manner. During the transmission of the digit impulses, a control switch having the brush 30 and stepping magnet 32 is advanced from position to position. When the units digit has been received the control switch advances its brush 30 into engagement with the contact 31. A circuit is now completed from battery, through the winding of relay 29, contact 31, brush 30, to ground at the contact of relay 36. Relay 29 operates, disconnects the conductors 25 and 26 from the impulse circuit and connects them over a circuit traceable through the right armature and back contact of relay 35, right winding of test relay 37 to the negative pole of low potential battery 44. Thus the source of low potential battery is connected through the winding of relay 37 to both the tip and ring conductors of the calling line. This preliminary test is to determine whether a false potential exists on either side of the line. The test circuit extends over the tip side of the line, winding of the magnet 8, coin control contacts 11 to the terminal of the device 9. Other circuits extend over the tip and ring conductors of the line and contacts of the switchhook 2 to the device 7. Since the source of current is of low potential current will not flow through the device 9 and since the potential is negative current will not flow through the uni-lateral device 7. Accordingly, if a false ground potential does not exist on either the tip or ring conductor the relay 37 remains inert.

As soon, following the operation of relay 29, as the interrupter 33 closes its lowermost contacts, a circuit is completed from ground through the lower contact of relay 29, lower contacts of interrupter 33, right winding of relay 34 to battery. Relay 34 operates and locks through its left winding and contact and the contact of relay 29. When the interrupter again closes its upper contacts, a circuit is completed from ground, through the lower contact of relay 29, upper contacts of interrupter 33, right contact of relay 34, winding of relay 35 to battery. Relay 35 operates and locks through the contact of relay 29. Relay 35 at its right armature shifts the test circuit so that it now extends through the left winding of test relay 38 to the positive pole of the high potential source of current 45. The potential of source 45 being positive and high, current flows over the tip side of the line through the right winding of induction coil 6, contacts of the switchhook, uni-lateral device 7, contacts 11, discharge device 9 to ground. Another path may be traced over the ring side of the line, through the impulse transmitter 4, talking transmitter 3, switchhook 2, device 7 and thence to ground as before. A branch path extends from the tip side of the line through the windings of the magnet 8 and thence through the contacts 11 and the device 9 to ground. Since the magnet 8, however, is of high resistance it is practically shunted by the paths extending through the device 7. In this manner the subscriber's line is tested by means of a circuit which excludes the coin magnet and therefore, does not depend upon any marginal operation for the test relay. The relay 38 operates in the circuit mentioned and locks through its right winding to ground through the spring 40 of the sender sequence switch 39, which has advanced to some position between positions 2 and 18.

As soon as the interrupter 33 again closes its lower contact, a circuit is completed from ground, through the contacts of relay 29, lower contacts of the interrupter, left contact of relay 35, right winding of relay 36 to battery. Relay 36 operates and locks through its left winding and contact to the sequence switch spring 40. Relay 36 at its outer left contact opens the circuit of relay

29 which releases and in turn releases the relays 34 and 35. Thus the tip and ring conductors of the subscriber's line are disconnected from the test relays and reconnected to the impulse circuit.

The test having been completed, if a standard condition is found, namely, if neither side of the line has a false ground and if a coin has been deposited, relay 37 is in a deenergized condition and relay 38 is operated. This condition serves to notify the sender at some subsequent time that the call may proceed. This may be effected by moving the sequence switch 39 out of some position, such as position 17, by means of a circuit from ground, through the right back contact of relay 37, left front contact of relay 38, spring 43 to the winding of the sequence switch magnet 39.

If the call is successful, a supervisory relay 22 is operated when the called subscriber answers. Following the operation of relay 22 a circuit is completed from ground through the front contact of said relay, lower contacts of the interrupter 24, winding of relay 23 to battery. Relay 23 operates and locks to the contact of relay 22. On the next closure of the upper contacts of interrupter 24, a circuit is completed from ground, through the upper contacts of said interrupter, right contact of relay 23, winding of relay 15 to battery. Relay 15 operates and locks through the spring 14 of sequence switch 21 to ground. The operation of relay 15 is an indication that the call has been successful and that the coin should be collected at a subsequent time.

During the conversational period the sequence switch 21 is in some position, such as position 14, where the contacts of the springs 17 and 18 are closed to complete the calling subscriber's line through to the left windings of the repeating coil 19. In this position relay 17 is operated and in turn operates the relay 16.

At the end of conversation, the calling subscriber replaces his receiver on the switchhook and causes the release of relay 17. Relay 16 also releases, provided the upper contacts of the interrupter 20 are open. As soon, after relay 16 releases, as the interrupter 20 closes its upper contacts, a circuit is completed from ground, through the upper contacts of said interrupter, back contact of relay 16, left contact of sequence switch spring 46 to the winding of magnet 21 to battery. Sequence switch 21 is driven out of position 14 and into some subsequent position as position 15.

While the sequence switch is in position 15, a circuit is closed from the positive pole of the high potential coin collect battery, through the lamp 28, front contact of relay 15 and thence in parallel to the contacts of sequence switch springs 17 and 18, over the tip and ring sides of the line, through the winding of the magnet 8, contacts 11, through the discharge device 9 to ground. Since receiver 5 is on the switchhook the shunt path around the magnet 8 is opened and the coin collect current operates the magnet to collect the coin. When the interrupter 20 again closes its lower contact, sequence switch 21 is driven out of position 15 and into some subsequent position and the coin collect circuit is opened.

Had the call been unsuccessful the relay 22 would not have been operated and accordingly the relay 15 would remain inert. Under these circumstances the sequence switch 21 on reaching position 15 closes a circuit from the negative pole of high potential coin refund battery, through the lamp 27, back contact of relay 15 and thence over the tip and ring sides of the line through the magnet 8, contacts 11 and device 9 to ground. Current flowing in this circuit is in such a direction that the polarized magnet 8 operates its armature to refund the deposited coin.

At the time the line is tested, should a ground potential exist on either the tip or ring conductors, the relay 37 will operate. According to whether or not a coin has been deposited the relay 38 will operate or remain deenergized. With both relays 37 and 38 operated a circuit is closed from battery, lamp 42, front contact of relay 36, front contacts of relays 38 and 37 to ground. In the event that neither relay 37 nor relay 38 operates, a circuit may be closed from battery, through lamp 41, contact of relay 36, back contacts of relays 38 and 37 to ground. The lamps 41 and 42 are located at the monitoring operator's position and serve to notify her of the unstandard conditions existing.

By means of this novel circuit arrangement a coin line may be tested to determine the presence or absence of the coin without the necessity of a marginal test relay at the central office or elsewhere. This is true for the reason that the coin operating magnet 8 is excluded from the test circuit and being excluded there is no danger of accidentally operating the coin magnet while the test is taking place. Accordingly, a high potential source of testing current may be used, so that a positive and accurate test may be effected. Moreover, since the shunt path around the coin magnet is controlled by the switchhook contacts it is possible to permit the refund of the coin while the receiver is off the switchhook, but the collection of the coin with the receiver off the hook cannot take place. If coin collecting current is applied to the line while the receiver is off the hook it is merely shunted around the magnet 8 and does not operate it.

While the present invention has been illustrated in connection with an automatic telephone system of a given type, it is to be understood that it may be applied to various types

of systems including those automatically operated and those in which connections are established and controlled by operators. Fig. 2, for example, illustrates diagrammatically a coin line appearing at an operator's position. Keys 50 and 51 serve to apply coin collect and refund current to the line in any well-known manner.

What is claimed is:

1. In a telephone system, a line having a station thereon, means at said station for receiving a token, a device on said line allowing current to flow in one direction and resisting its flow in the opposite direction, and a test circuit including said device for determining the presence of a token in said token receiving means.

2. In a telephone system, a line having a substation thereon, means at the substation for receiving a coin, a current controlling device on said line for allowing current to flow in one direction and resisting its flow in the other direction, a test circuit including said device, and means for applying current of different polarities to said test circuit to determine the presence or absence of a coin.

3. In a telephone system, a line having a substation thereon, means at the substation for the deposit of a coin, a unidirectional device at the substation for permitting the flow of current in one direction over the line and resisting the flow of current in the other direction, and a test circuit including said device for determining the presence or absence of a coin.

4. The combination in a telephone system of a telephone line, a coin control mechanism at the substation of said line, a device for said line for permitting the flow of current in one direction and resisting its flow in the opposite direction, and a test circuit closed by the deposit of a coin in said mechanism and including said device for determining the presence of the coin.

5. The combination in a telephone system of a line having a substation, means at the substation for receiving a token, a magnet for disposing of a deposited token, a device on said line allowing current to flow in one direction and resisting its flow in the opposite direction, a test circuit including said device for determining the presence of the token in said receiving means, and means for actuating said magnet.

6. In a telephone system, a telephone line having a substation thereon, means at the substation for receiving a coin, a device at the substation for permitting current to flow in one direction and resisting its flow in the opposite direction, a magnet at the substation for disposing of a deposited coin, means for actuating said magnet, and a test circuit including said device and excluding said magnet for determining the presence of a deposited coin.

7. The combination in a telephone system of a line having a substation thereon, means at said substation for receiving a coin, a magnet, means for operating the magnet to collect or refund the coin, a current controlling device for permitting the flow of current in one direction and resisting its flow in the opposite direction, a test circuit including said device for determining the presence of a coin, and means including said device for preventing the collection of the coin until the telephone receiver is replaced on the switchhook.

8. The combination in a telephone system of a line having a substation thereon, means for receiving a deposited coin at the substation, a magnet for collecting or refunding the deposited coin, a device for permitting current to flow in one direction and resisting its flow in the opposite direction, a test circuit including said device for determining the presence or absence of a coin, means for operating said magnet to refund the coin whether the receiver is on or off the switchhook at said substation, and means including said device for preventing the collection of the coin until the receiver is replaced on the switchhook.

9. In combination, a line having a substation thereon including a receiver switchhook and a coin receiving device, means for disposing of a coin deposited in said device, and a circuit controlled by said switchhook for rendering said disposing means ineffective.

10. In combination, a telephone line having a substation thereon including a receiver switchbook and means for receiving coins, a device for collecting and refunding the coins, and a circuit closed by said switchhook for rendering said device ineffective to collect a coin.

11. In a telephone system, a line having a substation thereon comprising a receiver switchhook and a receptacle for the deposit of coins, a device for collecting and refunding the deposited coins, and a circuit closed by said switchhook in its alternate postion for rendering said device ineffective to collect a coin.

12. The combination in a telephone system of a line having a substation thereon comprising a switchhook and a coin receptacle, a magnet for collecting and refunding deposited coins, and a circuit closed by said switchhook for shunting said magnet to prevent the collection of a coin.

13. In a telephone system, a line having a station thereon, means at said station for receiving a token, means controlled by a deposited token for closing a ground connection to the line, means for making a preliminary test to detect the presence of an unstandard ground connection on said line, and means for making a different test subsequently for the presence of a ground connection due to the deposit of a token.

14. In a telephone system, a line having a station thereon, means at said station for receiving a token, means controlled by a deposited token for closing a ground connection to the line, means for making a preliminary test to detect the presence of an unstandard ground connection on said line, and means for applying to the line current of a definite polarity for making a subsequent and different test for the presence of a ground connection due to a deposited token.

15. In a telephone system, a line having a station thereon, means at said station for receiving a coin, a magnet for disposing of a deposited coin, a test circuit which excludes said magnet, means actuated by the deposit of a coin for preparing said circuit, a source of current, and means operated in response to the flow of current from said source over said test circuit in a predetermined direction for determining the presence of a coin.

16. In a telephone system, a station, coin receiving means at said station, a test circuit, a current controlling device in said circuit arranged to permit the flow of current of high potential and to impede the flow of current of low potential, means controlled by the deposit of a coin in said receiving means for rendering said test circuit effective, and means for applying current to said circuit to determine the presence of a coin in said receiving means.

17. In a telephone system, a station, coin receiving means at said station, a test circuit, a current controlling device in said circuit arranged to permit the flow of current of high potential and to impede the flow of current of low potential, a polar device in said circuit arranged to permit the flow of current in one direction and to resist its flow in the opposite direction, means controlled by the deposit of a coin in said receiving means for rendering said test circuit effective, and means for applying current of a given polarity to said circuit to determine the presence of a coin in said receiving means.

18. In a telephone system, a coin receiving device, means for disposing of a coin deposited in said device, a circuit, means for applying current of opposite polarities to said circuit, and means effective according to the polarity for causing said current to flow through said coin disposing means to operate it or around said disposing means to prevent its operation.

In witness whereof, I hereunto subscribe my name this 12th day of September, 1928.

RAYMOND E. COLLIS.