

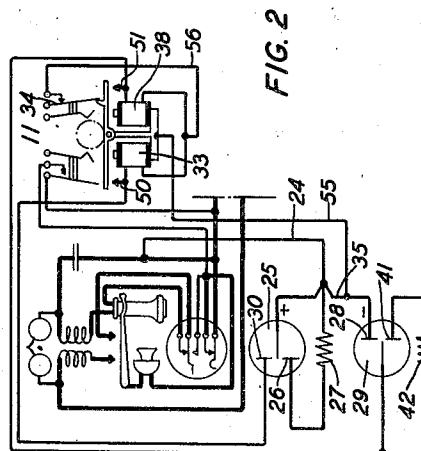
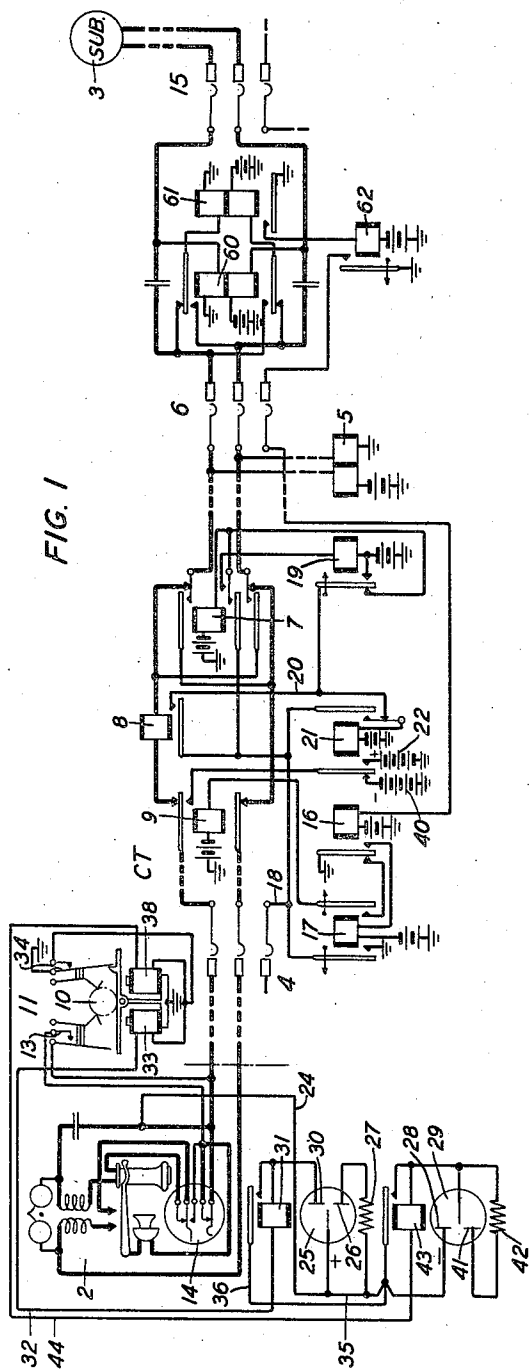
Dec. 1, 1936.

O. CESAREO

2,062,444

TELEPHONE SYSTEM

Filed March 13, 1935



INVENTOR
O. CESAREO

BY *A. G. Kingman*

ATTORNEY

UNITED STATES PATENT OFFICE

2,062,444

TELEPHONE SYSTEM

Orfeo Cesareo, Washington Township, Bergen County, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application March 13, 1935, Serial No. 10,779

9 Claims. (Cl. 179—6.3)

This invention relates to telephone systems and particularly to improvements in telephone systems of the coin controlled type.

In coin controlled telephone systems in use today the coin control magnet located at a pay station is designed to operate on a voltage of approximately sixty volts, which is the potential obtained at the coin box station from the coin-collect or coin-refund battery located at the central office and to non-operate at a potential of approximately forty volts, which is the potential obtained during a call from a flow of current to ground through the magnet from the talking battery at the central office. This comparatively high non-operate condition which is imposed on the magnet to prevent its false operation requires an insensitive adjustment on the magnet which limits the line loop over which the coin collector may be operated.

It is the object of this invention to increase the loop range over which coin collection in a telephone system is permissible.

This object is attained in accordance with a feature of the invention by removing the non-operate condition heretofore imposed on the coin magnet which constitutes a part of a telephone coin collector. This is effected by the use of a combination of polarized cold cathode gas-filled tubes which present an open circuit to ground from the central office battery and render it possible to operate the coin collector with a single magnet coil, thereby extending the line loop range by one thousand ohms, or by double the resistance of a single coil of the coin control magnet, it being necessary, heretofore, to operate the coin control magnet by way of its two coils, each coil having a resistance of approximately five hundred ohms.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawing in which,

Fig. 1 shows a calling subscriber's line provided with coin box equipment and the gas-filled tube circuit arrangement of this invention associated therewith, a coin-trunk circuit, a line finder through which the calling subscriber's line has access to the trunk, a selector associated with the trunk, a connector and a called subscriber's line to which a connection may be extended through the selector and connector from the calling subscriber's line, and

Fig. 2 shows a modified form of the invention in which the functions performed by the tube relays of Fig. 1 are performed by the coin collector.

In the several figures, only those parts of the system and apparatus which are necessary for a complete understanding of the invention have been shown in detail.

It is believed that the invention will be best understood from a description of the manner in which a call originating at a prepayment station is extended to a called station and the manner in which the coin collector mechanism functions to either collect or refund the coins deposited in the coin box at the calling station depending upon whether or not the call has been successfully completed.

Assuming therefore, that a subscriber at station 2 desires to be placed in telephone communication with a subscriber at station 3, he will remove the receiver from its switchhook whereupon the line finder 4 is actuated in a well-known manner to seize the calling line and connect it with the coin-trunk circuit CT. As the circuit for extending the connection to the trunk forms no part of this invention, no description will be made thereof.

It will be assumed, therefore, that upon the establishment of this connection a circuit will be completed through the calling subscriber's loop for the operation of the usual pulsing relay 5 of the selector 6. This circuit may be traced as follows: grounded battery, left-hand winding of relay 5, upper make-before-break contacts of relay 7, winding of polarized relay 8, back contact and upper armature of relay 9, tip conductor of trunk CT, through the line finder 4 and the loop closed through the subscriber's telephone set at station 2, ring conductor of the calling line, through the line finder 4, lower armature and back contact of relay 9, outer lower make-before-break contacts of relay 7, to ground through the right-hand winding of relay 5. Means in the selector 6, which has not been shown, causes, through the operation of relay 5, the transmission of a dial tone over the tip conductor to the calling subscriber to indicate that the circuits are now in condition for transmission of dial pulses.

The calling subscriber after having removed the receiver from the switchhook deposits a coin 10 in the coin box equipment indicated by the numeral 11, and upon hearing the dial tone proceeds to actuate his calling dial in accordance with the digits of the number corresponding to the called station 3. It will be noted that the deposit of coin 10 in the coin box opens the shunt circuit around the dial pulsing contacts which is normally maintained closed by the coin

box contacts 13. It is apparent that unless a coin is deposited in the coin box the dial 14 cannot be effectively operated.

The calling subscriber now dials the number of the desired subscriber and pulsing relays 5 and 61 respond to extend the connection. The pulses of the first digit operate the selector 6 to select the connector 15 which in turn is operated by pulses of the second and third digits to select the desired subscriber at station 3. Seizure of connector 15 causes relay 61 to operate over the closed loop of the calling subscriber's line and establish an obvious circuit for slow-to-release relay 62 which connects ground to the sleeve terminal of selector 6 marking this switch busy and holding it operated. The connector on finding the line of the desired subscriber, is operated in the well-known manner to transmit ringing current over the line to signal the called subscriber. As stated, the automatic switches 6 and 15 may be of any well-known design and their operations need not be described in detail. However, when the called subscriber removes the receiver from the switchhook an obvious circuit is established for relay 60 which operates to reverse the direction of current flow in the loop circuit of subscriber's station 2 which is in series with impulse relay 61. It is sufficient to state that when the called subscriber at station 3 responds to the signal by removing the receiver from its switchhook, current over the tip and ring conductors of the trunk CT is reversed.

This reversal of current causes the operation of polarized relay 8. It should also be mentioned at this time that after the seizure of the selector 6, the ground potential applied to the sleeve terminal thereof causes the operation of relay 16. This relay closes an obvious circuit for the operation of relay 17 which, in operating, closes a connection to ground for the sleeve conductor 18 of the line finder 4 to maintain the line finder busy, as is well known in the art.

Relay 8 in operating, closes a circuit for the operation of relay 7 extending from grounded battery, winding of relay 7, back contact and armature of relay 19, conductor 20, front contact and armature of relay 8 to the above-mentioned ground on the sleeve conductor of the line finder 4 applied at the upper inner armature and front contact of relay 17. Relay 7 in operating, provides a locking circuit for itself through its inner lower armature and front contact to ground on the sleeve conductor 18 independent of the original circuit through the front contact and armature of relay 8. Relay 7, operated, also reverses the tip and ring conductors towards the calling subscriber's line to cause the release of relay 8 and for other purposes of no importance with the present invention. Relay 7 also establishes a circuit for the operation of relay 19 extending from grounded battery, winding of relay 19, double front contacts and inner lower armature of relay 7 to ground on the sleeve conductor 18. This relay in operating, opens the original circuit for relay 7.

It will be noted that when relay 8 first operated, a circuit for the operation of relay 21 was established extending from grounded battery, winding and normal make-before-break contacts of relay 21, conductor 20, front contact and armature of relay 8 to ground on the sleeve conductor 18. Relay 21 locks directly to ground on the sleeve conductor 18 and accordingly remains operated when relay 8 releases as just described.

It will now be assumed that the period of con-

versation between the subscribers at stations 2 and 3 has ended and the calling party hangs up his receiver. This causes the selector 6 and connector 15 to be released in the well-known manner, with the result that relays 60, 61, and 62 and consequently relay 16 restore to normal. Relay 16 in releasing its armature closes a circuit for the operation of relay 9 extending from grounded battery, winding of relay 9, armature and right-hand contact of slow-to-release relay 17, to ground on the back contact and armature of relay 16. Relay 9 in operating establishes, at its upper armature and front contact, a circuit extending from the coin collect battery 22, front contact and left-hand armature of relay 21, conductor 23, front contact and upper armature of relay 9, tip conductor of trunk CT, tip terminals of line finder 4, tip conductor of the line of station 2, conductor 24, to the anode of gas-filled tube 25. The positive potential of battery 22 is also applied to cathode 26 by way of resistance 27. This potential is also applied to the cathode 28 of tube 29 but is of such a polarity as to have no effect on the tube 29.

It will be noted that the cathode 30 of tube 25 is connected to ground potential by way of the winding of relay 31, conductor 32, left-hand coil 33 of the coin collector 11 to ground at the coin contacts 34. The potential across the cathodes 26 and 30 of tube 25 is sufficiently great to cause the tube to break down across the gap between the two cathodes. This preliminary breakdown, or flashing, of the tube 25 occurs between the cathodes 26 and 30 and is thereafter maintained between the anode and cathode 30. Due to the breakdown of the tube 25, the circuit previously traced from battery 22 to the anode of tube 25 is completed to ground at the coin contact 34 by way of relay 31 and coil 33 of the collector 11. Relay 31, which is highly sensitive, operates in this circuit and establishes a locking circuit for itself which extends from the tip conductor of trunk CT, conductor 24, conductor 35, conductor 36, armature and front contact of relay 31, winding of relay 31, conductor 32, coil 33 to ground at contacts 34. It will be noted that the operation of relay 31 causes the tube 25 to be short-circuited, thereby effecting a low resistance path for the operation of coil 33 of collector 11 in series with relay 31. The coil 33 operates in this circuit causing the coin 10 deposited in the coin box to be collected.

The tube 25 being short-circuited becomes de-energized and resumes its normal condition.

It will be noted that relay 17 is slow-to-release so it will remain operated for a sufficient period of time to permit relay 9 to operate after relay 16 is released, the time of operation of relay 9 being determined by the slow release characteristics of relay 17. It should also be noted that when relay 17 operated, ground potential was applied at its left-hand armature and front contact to the sleeve conductor 18 of the line finder 4. This is for the purpose of maintaining the line finder 4 operated after the calling subscriber has returned his receiver to the switchhook which would ordinarily cause the line finder to release. The line finder must be maintained operated long enough to permit the collect battery current to pass over the subscriber's line to operate the coin equipment. After an interval of time relay 17 restores to normal removing the ground from the sleeve of line finder 4 which thereupon is released and the circuit from collect battery 22

to the coil 33 is broken whereupon relay 31 and the magnet coil 33 are deenergized.

In the event that the called subscriber at station 3 does not answer the call or the calling subscriber at station 2 abandons the call before the called subscriber answers, the coin magnet coil 33 becomes energized to cause the coin collector 11 to function and refund the coins deposited therein. In this event, relay 8 will not be operated, thus preventing the operation of relays 21, 7, and 19. However, as relay 16 is operated, the operation of relay 17 takes place. When therefore, the calling party releases the connection and relay 16 is released, current from the refund battery 40 will be transmitted through the back contact and left-hand armature of relay 21, through the front contact and upper armature of relay 9 to the tip conductor of the trunk CT to actuate the coin collector 11 to refund the coins deposited therein.

Current from the negative battery 40 being applied to the tip conductor of trunk CT passes through the line finder 4 to the tip conductor of the line of station 2, conductor 24 to the anode of tube 25 and also to the cathode 28 of tube 29. The direction of current in this case is such however as to have no effect on the tube 25. Tube 29, however, does break down across the cathodes 28 and 41, the latter being connected to ground potential by way of resistance 42, winding of relay 43, conductor 44, coil 38 of collector 11 to ground at the coin contacts 34. The tube 29 accordingly functions in a manner similar to that already described in connection with tube 25 to cause the energization of coil 38 which results in the operation of the collector 11 to refund the coins deposited therein.

In Fig. 2, which discloses a modified form of this invention, the sensitive relays 31 and 43 of Fig. 1 are omitted and the functions performed by these relays in the system of Fig. 1 are now performed by the coin control magnet itself.

The same numerals have been used in Fig. 2 to identify corresponding elements of Fig. 1. It is believed unnecessary to enter into a detailed description of the arrangement shown in Fig. 2 as it would entail, to a major extent, a repetition of the description made in connection with Fig. 1. However, a brief reference to the points of distinction between the two arrangements will be made.

It will be noted that contacts 50 and 51 have been added to the coin control magnet and correspond to the front contacts of relays 31 and 43, respectively, of Fig. 1. When tube 25 flashes, the coil 33 receives sufficient current to partially operate and cause the closure of contact 50 which short-circuits the tube 25 by way of conductor 55. The coil 33 now becomes fully energized and locks operated in the low resistance path including the tip conductor of trunk CT. This circuit extends from ground on the coin contacts 34, conductor 56, magnet coil 33, contact 50 and armature of coin collector 11, conductor 55, which is conductively associated with the armature of the coin collector, conductor 35, conductor 24 to the tip conductor of the trunk CT. The energization of coil 38 and the consequent closure of contact 51, in like manner, results in the locking of coil 38 to the tip conductor of trunk CT and the short circuiting of tube 39.

What is claimed is:

1. In a telephone system, a telephone line, a coin collector, a central office, a source of current at said central office, means for connecting said

source of current to said line, and a device normally maintaining an open circuit between said line and said coin collector and adapted to close a circuit between said line and said collector when said source of current is connected to said line whereupon said collector operates on current from said source.

2. In a telephone system, a telephone line, a coin collector, a central office, a source of current at said central office, means for connecting said source of current to said line, and a gaseous conductor normally maintaining an open circuit between said line and said collector and adapted to complete a connection between said line and said collector when said source of current is connected to said line whereupon said collector operates on current from said source.

3. In a telephone system, a telephone line, a coin collector, operating means for said collector including a coil of an electromagnet, a central office, a source of current at said central office of a certain voltage, a second source of current at said central office of a voltage different than that of said first source, means for connecting said current sources to said line, and means interposed between said coin collector and said line for completing a circuit from said line to said coil when said first source of current is connected to said line and for maintaining an open circuit between said coil and said second source of current when the latter is connected to said line.

4. In a telephone system, a telephone line, a coin collector, operating means for said collector including a magnet, a central office, sources of current of different voltages at said central office, means for connecting said sources to said line, and a voltage discriminating device interposed between said line and said collector for rendering said magnet operative when one of said sources of current is connected to said line and for preventing the operation of said magnet when another of said sources of current is connected to said line.

5. In a telephone system, a line terminating at a central office, a coin collector normally on open circuit with respect to said line, a source of current of a certain voltage at said central office, a second source of current at the central office of a voltage lower than that of said first source, voltage discriminating means connected between said line and said collector, said means being unresponsive to the voltage of said second source and responsive to the voltage of said first source for completing a circuit from said line to said collector and causing the operation of said collector, and means at the central office for connecting said current sources to said line.

6. In a telephone system, a telephone line, a coin collector normally on open circuit with respect to said line, a central office, a source of current at said central office, means for connecting said source of current to said line, a gaseous conductor interposed between said line and said collector and responsive to the voltage of said source for completing the connection between said line and said collector to effect the operation of said collector, and means effective upon the response of said gaseous conductor for short-circuiting said gaseous conductor and locking said collector to said line independently of said gaseous conductor.

7. In a telephone system, a line terminating at a central office, a coin collector normally on open circuit with respect to said line, a central office, a source of current of a definite voltage at said

central office, a gaseous conductor interposed between said line and said collector and having an anode and a cathode, means at said central office for impressing the voltage of said source on the anode of said gaseous conductor to cause said conductor to break down and complete the circuit between said line and said collector by way of the anode-cathode circuit of said conductor, and means in series with the cathode of said conductor operating as a result of the completion of the anode-cathode circuit of said gaseous conductor for short-circuiting said gaseous conductor and locking said collector to said line whereupon said collector operates on current from said source independently of said gaseous conductor.

8. In a telephone system, a line terminating at a central office, a coin collector including two independent operating coils, a source of current at said central office, a second source of current at said central office, said sources being of the same voltage and different polarities, a pair of polarized gas-filled tubes interposed between said line and said collector, each tube having an element thereof in series with a different coil of said

collector, means for connecting said first source to said line whereupon one of said tubes functions to complete an operating circuit to its respective collector coil to operate said collector in a certain manner, and means for connecting said second source to said line whereupon the other of said tubes functions to complete an operating circuit to its respective collector coil to operate said collector in a different manner.

9. In a telephone system, a telephone line, a coin collector normally on open circuit with respect to said line, a central office, a source of current at said central office, means for connecting said source of current to said line, a gaseous conductor interposed between said line and said collector and responsive to the voltage of said source for completing the connection between said line and said collector to effect the operation of said collector, and means controlled by said collector and effective upon the operation thereof for short-circuiting said gaseous conductor and locking itself to said line independently of said gaseous conductor.

ORFEO CESAREO.