March 24, 1942. L. H. ALLEN 2,277,623

TELEPHONE SYSTEM

Filed Oct. 12, 1939

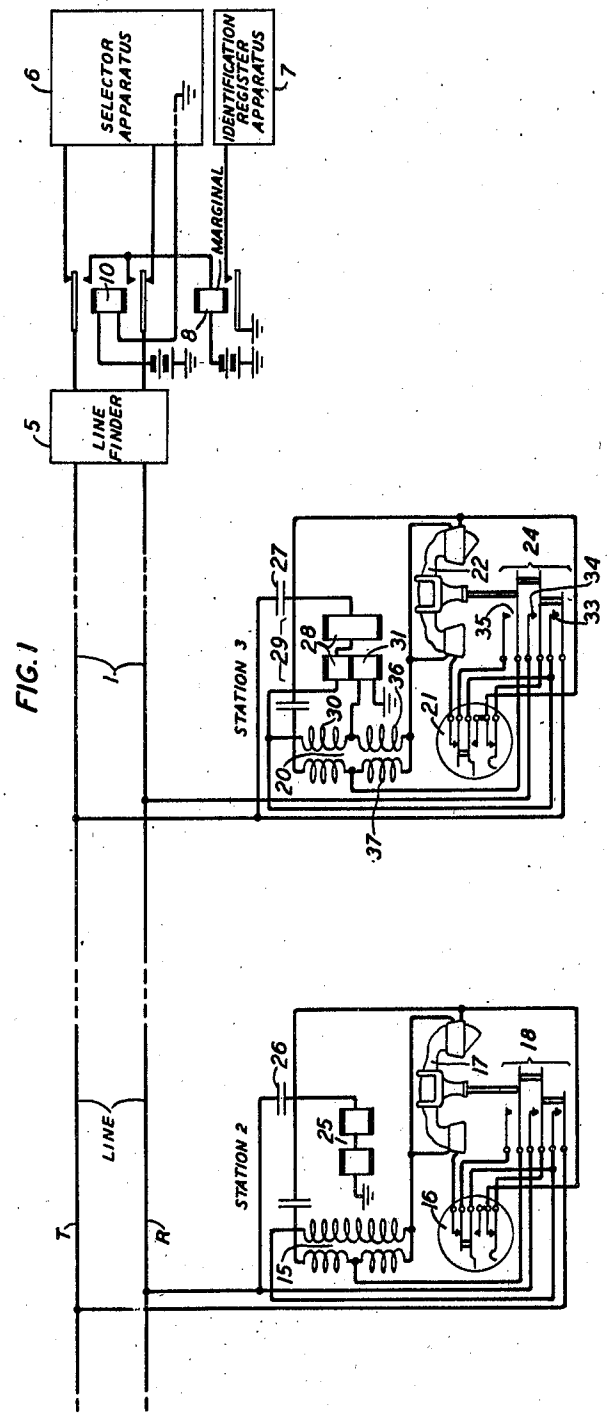

FIG. 1

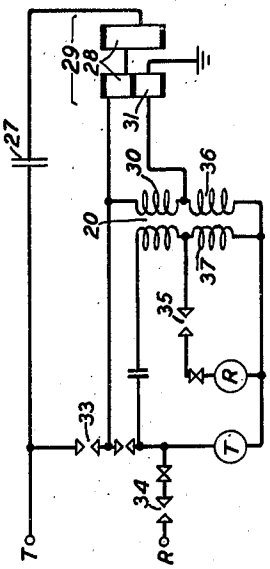

FIG. 2

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Patented Mar. 24, 1942 2,277,623

UNITED STATES PATENT OFFICE

2,277,623

TELEPHONE SYSTEM

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Application October 12, 1939, Serial No. 299,105

9 Claims. (Cl. 179—8.5)

This invention relates to telephone systems and particularly to improvements in subscriber station equipments for such systems.

It is an object of the applicant's invention to improve and simplify such subscriber station circuits.

Another object is to avoid deterioration from electrolytic corrosion that may occur due to the presence of moisture in subscriber station equipments.

Heretofore systems have been provided in which a plurality of subscriber station circuits are connected to a common line to a central office. Testing arrangements were provided, for example, in two party line circuits for identifying the calling party so that the proper station may be charged for an outgoing call. In such systems identification may be made by providing a low impedance path to ground for one of the party line circuits and by testing for the presence or absence of this path to ground. In the patent to W. H. Edwards 1,860,459 of May 31, 1932, for example, such a low impedance path is provided for connecting a portion of a high impedance ringer winding to ground at one of the stations for this circuit. In this system the induction coil windings were connected in a so-called split circuit arrangement. That is, one primary winding of the induction coil was connected normally to one side of the line and another primary winding was connected normally to the other side of the line and switching contacts which normally hold the circuit open are located between these two primary windings. If, therefore, any leakage occurs across the open switching contacts, a difference of potential is set up between the two primary windings resulting in electrolytic corrosion between the windings of the induction coil when exposed to moisture.

It is a feature of the applicant's invention to provide a substation circuit arrangement in which party line identification tests may be made without danger of electrolytic corrosion due to moisture. This feature is attained by a substation circuit arrangement in which all circuit making contacts between the two primary windings of the induction coil are removed and the inner ends of these windings are connected directly together, in which the low impedance winding of the ringer is included in a connection extending from a tap between the two primary windings to ground, in which these two windings are both normally disconnected from the line by means of a switching contact between one side of the line and the outer end of one winding and a second switching contact between the other side of the line and the outer end of the other winding, and in which the ringing circuit for operating the substation bell does not extend through any of the switching contacts. An advantage of this circuit arrangement is that any leakage currents flowing in the line do not set up potential differences between the windings of the induction coil, which would otherwise make it necessary to construct the coil in a moisture-proof case to avoid electrolysis. Another advantage is that one of the switching contacts which serves to isolate one of the coil windings of the line, also serves to close the shunt circuit around the high impedance winding of the ringer when the subscriber answers and to close the low impedance winding of the ringer to the line for party identification.

The invention has been illustrated in the accompanying drawing in which:

Fig. 1 shows a two party dial message rate circuit embodying the applicant's invention.

Fig. 2 shows a simplified diagrammatic form of the circuit at the substation in which the low impedance path to ground is provided for identification purposes.

Referring now to the drawing, the line 1 terminates at stations 2 and 3 at one end in and at a central office at the other end in the usual associated line-finder apparatus at 5 and selecting apparatus at 6 of any well-known type for extending a connection at the central office in response to dial pulses received over the telephone line. Suitable registering apparatus is indicated by means of a box 7 and a marginal relay 8 is shown for controlling the circuits leading to the registering apparatus. This relay may be connected to the tip and ring conductors of the line through the operation of a relay 10 over a circuit from ground through the selecting apparatus 6. Relay 8 may operate when station 3 is calling to register the fact in the registering apparatus at 7 whereas if station 2 is calling, this relay will not operate indicating thereby that station 2 is calling. The usual apparatus at station 2 of the telephone set are shown such as the induction coil 15, a dial 16, a transmitter-receiver handset 17 and cradle apparatus with switching contacts 18 controlled thereby. Similarly at station 3 an induction coil 20, dial 21, transmitter-receiver handset 22 and a cradle and switching contacts 24 controlled thereby have been shown. These stations are wired identically with the exception of the ringer arrangement. At station 2 a high impedance ringer 25 is connected through a con-

denser 26 directly to the ring conductor of the line whereas at station 3, the tip conductor is connected through the condenser 27, a high impedance winding 28 of a ringer 29, one primary winding 30 of the induction coil 20, a low impedance winding 31 of the ringer 29 to ground.

If the station 2 calls, high impedance ringer 25 is connected through the condenser 26 to the ring conductor and consequently the marginal relay 8 will not operate after it has been connected to the tip and ring conductors, thus indicating that the party at station 2 is calling. On the other hand if station 3 is calling and the handset 22 is removed from the cradle, the switching contacts 24 will operate to connect ground through the low impedance winding 31, the primary winding 30 and the switching contacts 33 to the tip conductors. This will operate the marginal relay 8 and cause it to close a circuit for registering apparatus 7, thus indicating that station 3 is calling. Switching contacts 34 and 35 are also operated when the handset 22 is removed. Switching contacts 34 connect the ring side of the line through the transmitter and the primary winding 36 through the low impedance winding 31 to ground and the switching contacts 35 connect the receiver across the portion 37 of the secondary winding of the induction coil.

If reference is now made to the Fig. 2, which has been included for the sake of clearance, it will be observed that the low impedance winding of the ringer is connected to ground for identification purposes, that the outer ends of the two primary windings are separated from the ring and tip conductors, respectively, and that the inside ends of these two windings are connected together, without the interposition of any switching contacts, and through the low impedance winding of the ringer to ground. If, therefore, leakage occurs between the switching contacts, potential differences are not set up between the two primary windings, to cause electrolytic corrosion between these windings. Such a condition is not possible in the applicant's circuit since the inner ends of the two primary windings are connected directly together.

What is claimed is:

1. In a telephone system, a line, a subscriber station telephone set comprising an induction coil having two primary windings, normally disconnected from the line, a condenser, a ringer having a high impedance winding and a low impedance winding, a circuit connecting one side of the line through the condenser and high impedance winding to the outer end of one primary winding, a permanent circuit connecting the inner ends of the two primary windings together and over a tap through the low impedance winding to ground, and means operative when the subscriber is calling for shunting said condenser and high impedance winding, connecting said one side of the line to said outer end of said one primary winding, and connecting the other side of the line to the outer end of the other primary winding.

2. In a telephone system, a line and a subscriber station telephone set comprising a handset, a cradle therefor and switch contacts operated when the subscriber removes the handset from the cradle, an induction coil having two primary windings, a ringer having a high impedance winding and a low impedance winding, a condenser, a circuit normally connecting one side of the line to ground through the condenser, the high impedance winding, one primary winding and the low impedance winding in series, a circuit extending from one side of the line through a normally open set of switch contacts to a mid-point between said high impedance winding and said primary winding, a circuit extending from the other side of the line through a normally open set of switch contacts through the other primary winding to a mid-point between said first-mentioned primary winding and the low impedance winding, said two last-mentioned circuits being closed through their associated switch contacts when the handset is removed from the cradle to shunt the high impedance winding and connect the two sides of the line to the two primary windings in parallel over the low impedance winding to ground.

3. In a telephone system, a line, a subscriber station telephone set including an induction coil having two primary windings connected together at their inner ends, normally open switching contacts, for connecting one side of the line to the outer end of one primary winding, normally open switching contacts for connecting the other side of the line to the outer end of the other primary winding, said two sets of switching contacts being closed when a subscriber calls, a circuit tapping the low impedance winding to ground from the inner ends of said primary windings, a condenser, a circuit from one side of the line through the condenser and the high impedance winding to the outer end of said first-mentioned primary winding so arranged that when said first-mentioned switching contacts are closed, said high impedance winding and condenser are short-circuited.

4. In a telephone system, a line, a subscriber station telephone set, comprising an induction coil having two primary windings connected in series, and a secondary winding, a ringer having a high impedance winding and a low impedance winding, a condenser, a circuit connecting the mid-point of said primary windings to ground through said low impedance winding, a circuit connecting one side of the line to said mid-point through said condenser, the high impedance winding and one primary winding in series, a transmitter, a receiver, three sets of contact springs, means for closing said sets of contact springs operative when a call is initiated from said telephone set, circuit means including one set of contact springs when closed for closing a shunt across said condenser and said high impedance winding, circuit means including another set of contact springs when closed for connecting the other side of the line to the mid-point through the transmitter, the secondary winding in parallel and the other primary winding in series, and circuit means including the third set of contact springs when closed for closing a connection for the receiver across a part of the secondary winding.

5. In a telephone system, a line having two conductors, a subscriber's station telephone set comprising an inductance coil having two primary windings connected together at their inner ends, a condenser, a ringer having a high impedance winding and a low impedance winding, a circuit connection from one conductor of the line through the condenser, the high impedance winding, one of the primary windings and the low impedance winding to ground, contacts operative when the telephone set is operated for calling by the subscriber for connecting the outer end of one primary winding to one line conductor and shunt for shunting the high impedance winding

and condenser and contacts operative when the telephone set is operated for calling by the subscriber for connecting the outer end of the other primary winding to the other conductor.

6. In a telephone system, a line having two conductors, a subscriber's station telephone set comprising a support, a handset normally resting on said support, an induction coil having two primary windings connected together at their inner ends, a condenser, a ringer having a high impedance winding and a low impedance winding, a circuit connection from one conductor of the line through the condenser, the high impedance winding and one of the primary windings and the low impedance winding to ground, switching contacts operating when the handset is removed from said support for connecting the outer end of said one primary winding in shunt of said high impedance winding and condenser, and switching contacts operated when the handset is removed for connecting the outer end of the other primary winding to the other conductor.

7. In a telephone system, a line, a subscriber's telephone set including a support, a handset containing a transmitter and receiver normally resting on said support, an induction coil having two primary windings and a secondary winding, a ringer having a high impedance winding and a low impedance winding, three sets of switch contacts normally open and arranged to close when the handset is removed from the support, a condenser, a circuit extending from one of the line conductors through the condenser, the high impedance winding, one of said primary windings and the low impedance winding to ground, a circuit for shunting said condenser and said high impedance winding through one of said sets of switch contacts when closed by the removal of the handset from the support, a circuit for establishing a connection from said ground to the other line conductor through said low impedance winding, the other primary winding, and the transmitter over a second set of switch contacts when closed by the removal of the handset from the support, and a circuit for establishing a connection over a portion of said secondary winding and the receiver through the third set of switch contacts when closed by the removal of the handset from said support.

8. In a telephone system, a line and a subscriber's station telephone set comprising a handset and a cradle therefor, switching contacts normally open and arranged to close when the subscriber removes the handset from the cradle, an induction coil having two primary windings permanently connected in series, a ringer having a high impedance winding and a low impedance winding, a condenser, a permanent circuit connecting one side of the line through the condenser, the high impedance winding, one primary winding and the low impedance winding in series to ground, a circuit from said one side of the line through normally open switching contacts for shunting the condenser and high impedance winding when said switching contacts are closed by the removal of the handset from the cradle, and a circuit extending from the other side of the line through normally open switching contacts, the other primary winding and the low impedance winding to ground established when said switching contacts are closed by the removal of the handset from the cradle, the connection of said grounded low impedance winding between said primary windings serving to furnish a test circuit over the two sides of the line when said switching contacts are closed, said switching contacts when open serving to open said test circuit and to isolate said primary windings without causing electrolytic action in said primary windings as a result of leakage currents flowing over said line and through said switching contacts when in their open condition.

9. In a telephone system, a line and a subscriber's station telephone set comprising a handset, a cradle therefor, an induction coil having two primary windings in series, a ringer having a high impedance winding and low impedance winding, a condenser, a permanent circuit connection between the inner ends of said two primary windings and one side of the low impedance winding, a permanent circuit connection between the other side of the low impedance winding to ground, a circuit including a normally open set of switching contacts between one side of the line and the outer end of one primary winding, a circuit including a normally open set of switching contacts between the other side of the line and the outer end of the other primary winding, a permanent circuit connection across said first-mentioned switching contacts through said condenser and high impedance winding, and means for closing said two sets of switching contacts on the removal of the handset from the cradle so as to shunt the condenser and the high impedance winding to balance the two primary windings with respect to the two sides of the line and to provide a low impedance path to ground for identifying the subscriber's station when calling, said switching contacts when open serving to open said low impedance path to ground without setting up potential differences between said two primary windings as a result of leakage currents flowing through said switching contacts when open.

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