June 19, 1934. W. H. MATTHIES 1,963,754

TELEPHONE SYSTEM

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FIG. 1

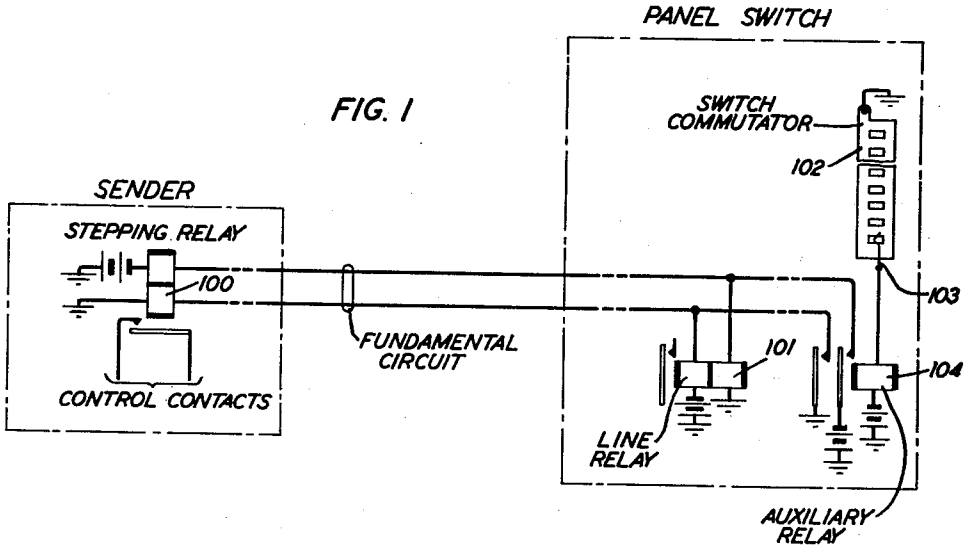
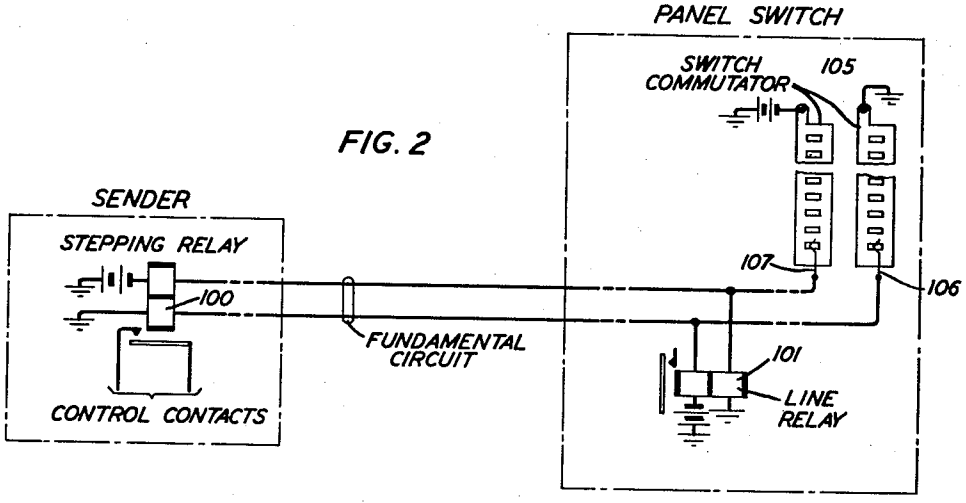


FIG. 2



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TELEPHONE SYSTEM

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6 Claims. (Cl. 179—16)

The present invention relates to telephone systems in general, but is concerned more particularly with telephone systems wherein automatic switches are employed in setting up connections. The main object of the present invention is to provide a new and improved control circuit for use in a revertive impulse control circuit extending between an automatic switch and a register controller or sender from which said switch is controlled.

In general, automatic switches in telephone systems are controlled in two distinct ways; one way is by the transmission of trains of impulses from a subscriber's line or from a register controller. Step-by-step switches are generally employed to respond to these impulses and are provided with stepping magnets which advance the switch shaft one step for each impulse received. The other way is by the transmission of trains of impulses from the automatic switches to a sender which has been previously set by impulses transmitted from a subscriber's line or from an operator's switchboard. The switches employed in the systems of the latter type are generally driven from a mechanical power driver which is in continuous operation, and the application of which to the switches when required is effected by an electromagnetically operated clutch or gearing. The control circuit extending between the revertive control switch and the sender has come to be known as the fundamental circuit.

The method of control over the fundamental circuit will now be briefly outlined. After the registering portion of the sender has been set, or partly set, the fundamental circuit is closed between the switch to be set and the sender, operating the line relay in said switch and thereby causing the switch to make its first movement. Each time the switch moves a predetermined distance, as determined by the impulse registration in the sender, it connects ground to the fundamental circuit, thereby providing a local holding circuit for the line relay and short-circuiting the stepping relay which forms a part of the fundamental circuit and is in series with the line relay. Upon being thus short circuited, the stepping relay falls back. The result is that the stepping relay operates when the fundamental circuit is first closed and falls back each time the switch moves a predetermined distance, the operations of the stepping relay thus continuing until, depending upon the setting of the associated registering apparatus in the sender, the fundamental circuit is opened therein, and the further movement of the switch is stopped.

Now the fundamental circuit has a limited range of operation which depends upon two factors, among others, namely, the ohmic resistance of the fundamental loop and the voltage of the battery supply, the latter, in most cases being the usual 48 volt signaling battery available in telephone offices.

The object of this invention is to increase the pulsing range of the fundamental circuit. It is proposed to do this by using a double wound line relay at the selector and a double wound stepping relay in the sender arranged in a circuit having grounded battery through one of the windings of the line relay and a corresponding winding of the stepping relay and a separate circuit of opposite polarity through the other windings respectively of the line and stepping relay, both legs of the circuit being series aiding with respect to the direction of current flow through both windings of each of the relays. It is obvious that by this arrangement of two battery supplies in booster relation to each other, the pulsing range of the fundamental circuit is practically doubled. The release of the stepping relay for each advance of the switch is here effected by a ground and battery connection to the two conductors of the loop in such a manner that the line relay is held while the stepping relay is released, while at the same time the effect of any difference in earth potential between the two ends of the trunk is, of course, canceled since a potential that would increase the current in one leg of the circuit decreases the current in the other leg.

Referring now to the drawing, Fig. 1 shows schematically a portion of a panel switch, a portion of a sender, and a fundamental circuit extending between the two and Fig. 2 shows a modification of the invention disclosed in Fig. 1.

Referring now particularly to Fig. 1, one leg of the fundamental circuit is disclosed extending from battery through the upper winding of a stepping relay 100, the upper conductor of the fundamental circuit to ground through the right winding of the usual line relay 101 of a panel selector. The other leg of the fundamental circuit extends from ground through the lower winding of the stepping relay 100, lower conductor of the fundamental circuit to battery through the left winding of the line relay 101. Above and to the right of the line relay there is shown the commutator 102 of the panel selector and the commutator brush 103. The commutator is a metallic strip having insulated openings therein as shown. The lower terminals of

the line relay are connected to the poles of the usual exchange battery while the commutator strip, which has heretofore been connected to ground, is in this case connected, through the brush, to the winding of an auxiliary relay 104 whose contacts when operated, connect battery and ground respectively to the two conductors of the fundamental circuit in such a manner as to shunt both windings of the stepping relay and complete a circuit through each of the windings of the line relay.

When the registering portion of the sender has been set, the circuit is closed as shown through the full and dotted lines, whereupon the line relay operates and the panel switch starts to move in the well known manner. The stepping relay in the sender also operates with its windings in series with the windings of the line relay and the stepping relay, when operated, closes its contacts. As the panel switch moves, the brush 103 passes over the conducting segments of the commutator 102. Each time it does so a local circuit is closed to operate the auxiliary relay 104 which, on operating closes battery and ground to the fundamental circuit as a result of which the stepping relay in the sender is shunted and released and the line relay in the panel switch is held. With the release of the stepping relay, its contacts are opened and a revertive impulse is registered. Each time the commutator brush passes on to an insulated segment, the local circuit for the auxiliary relay is opened causing said relay to release and the current flow through the fundamental circuit is re-established whereupon the stepping relay again operates and closes the control contacts. This operation continues until the counting relays or other counting apparatus that the sender may contain arrives in a condition predetermined by the registering apparatus, whereupon the fundamental circuit is opened in the sender causing the line relay in the panel switch to fall back and stop the movement of the switch.

Referring now to Fig. 2, the disclosure therein is the same as Fig. 1 as regards the sender and is similar as regards the panel switch, the difference being that the auxiliary relay is replaced with a commutator 105 having two strips and two brushes 106 and 107 instead of the one strip and one brush as in Fig. 1 and that the two strips are connected to ground and battery respectively and the brushes are connected respectively to the legs of the fundamental circuit.

When the fundamental circuit of Fig. 2 is closed through the line relay and stepping relay over the full and dotted lines, as shown, both relays operate and the panel switch starts to move as a result of the operation of the line relay. As the panel switch operates the brushes move over the commutator strips. Each time the brushes encounter conducting portions of the commutator strips, battery and ground are applied to the fundamental circuit providing thereby a local holding circuit for the line relay and shunting the windings of the stepping relay, causing it to release or retract its armature to open the control contacts. Each time the brushes pass from a conducting to an insulated segment, the local holding circuit of the line relay is opened and the normal current flow is resumed over the fundamental circuit with the result that the stepping relay reoperates. When the panel switch has advanced the distance predetermined by the register setting in the sender and the fundamental circuit is opened therein, the stepping relay and the line relay both fall back and the movement of the panel switch ceases as a result of the deenergization of the line relay.

Obviously, with the arrangement of either Fig. 1 or Fig. 2 the pulsing loop of the fundamental circuit is greatly extended since each leg of the circuit has an independent power supply or double the power supply of the well known arrangement in which only one source of battery is available over the entire circuit. The effect of any difference in earth potential between the two ends of the fundamental is, of course canceled; since a potential that would increase the current on one leg of the circuit decreases the current in the opposite leg.

What is claimed is:

1. In a revertive impulse control circuit, a first relay, a pair of conductors, a second relay, a circuit including one winding of each of said relays and one of said conductors, a circuit including another winding of each of said relays and the other of said conductors, means responsive to the closure of said circuits for generating a series of impulses, and means responsive to each of said impulses for applying a battery potential of the proper polarity to each of said conductors for holding said first relay and releasing said second relay to register each of said impulses.

2. In a telephone system, a first relay, an impulse source controlled by said first relay, a pair of conductors, a second relay, a circuit including one winding of each of said relays and one of said conductors, a circuit including another winding of each of said relays and the other of said conductors, and means responsive to the closure of said two circuits for operating said impulse source for applying battery potential of the proper polarity to each of said conductors for holding said first relay and releasing said second relay for each impulse generated by said source.

3. In a telephone system, a selector, a relay associated with said selector for controlling the movement thereof in a series of steps, a pair of conductors, another relay, a circuit including one winding of each of said relays and one of said conductors, a circuit including another winding of each of said relays and the other of said conductors, and means in said selector responsive to the operation of said first relay for applying battery potential of the proper polarity to each of said conductors for holding said relay in said selector and for releasing said first relay for each step said selector advances.

4. In a telephone system, a selector switch having a control relay and a commutator, a sender for controlling the selective movement of said switch and having a stepping relay and a control circuit having one leg thereof extending from battery at said sender through one winding of said stepping relay and one winding of said control relay to ground at said switch and having the second leg thereof extending from battery at said switch through a second winding of said control relay and a second winding of said stepping relay to ground at said sender, said relays both operative when both legs of said circuit are closed, said commutator being operative in the movement of said switch to connect battery to the first leg of said control circuit and to connect ground to the second leg of said control circuit for holding said control relay and for intermittently shunting said stepping relay.

5. In a telephone system, a selector switch having a control relay and a commutator, a sender for controlling the selective movement of said

switch and having a stepping relay, a control circuit having one leg thereof extending from battery at said sender through one winding of said stepping relay and one winding of said control relay to ground at said switch and having the second leg thereof extending from battery at said switch through a second winding of said control relay and a second winding of said stepping relay to ground at said sender, said relays both operative when both legs of said circuit are closed, and a relay intermittently operable by said commutator in the movement of said switch to connect battery to the first leg of said control circuit and to connect ground to the second leg of said control circuit for holding said control relay and for intermittently shunting said stepping relay.

6. In a telephone system, a selector switch having a control relay and two commutators, a sender for controlling the selective movement of said switch and having a stepping relay, and a control circuit having one leg thereof extending from battery at said sender through one winding of said stepping relay and one winding of said control relay to ground at said switch and having the second leg thereof extending from battery at said switch through a second winding of said control relay and a second winding of said stepping relay to ground at said sender, said relays, both operative when both legs of said circuit are closed, said commutators being operative respectively in the movement of said switch to connect battery to the first leg of said control circuit and to connect ground to the second leg of said control circuit for holding said control relay and for intermittently shunting said stepping relay.

WILLIAM H. MATTHIES.