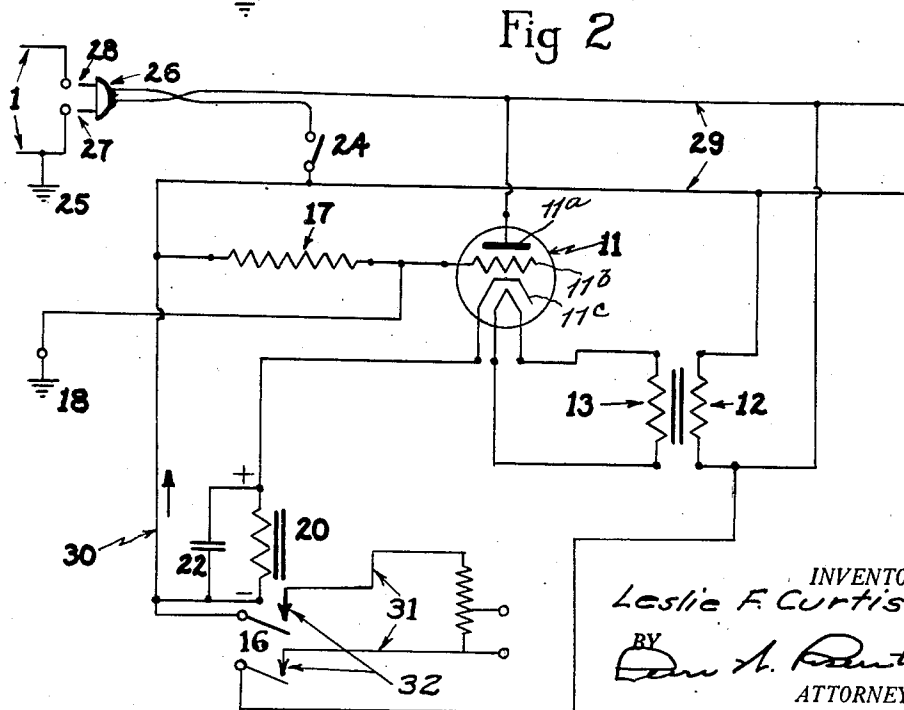
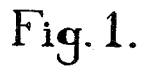


1,979,317

Filed March 23, 1933



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UNITED STATES PATENT OFFICE

1,979,317

ELECTRIC RELAY

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Application March 23, 1933, Serial No. 662,205

8 Claims. (Cl. 179—184)

My invention relates to improvements in relays; and particularly electrical relays for enabling a supply circuit to be connected to a work circuit without risk of mishap or personal hazard when any of the devices must be operated in the latter circuit with a definite relation to ground.

An object of the invention is to provide an electric relay adapted to be connected to an alternating current supply circuit in a manner that insures closure of the relay when the leads of the work circuit are properly united to the conductors of the supply circuit, but cannot result in closure if the relation between said leads and said conductors is reversed.

Another object of the invention is to provide an electric relay for connecting a loud speaker to a source of signal voltage applied between the neutral wire of a lighting circuit and the safety ground of the system, when a conducting plug is properly inserted in a lighting circuit outlet; and for preventing the completion or closure of the circuit if the plug is not properly inserted.

Another object of the invention is to provide a rectified current for energizing the field of an electrodynamic loud speaker by means of a thermionic tube, which also controls the operation of a protective relay.

The above and other objects and advantages of the invention are clearly set forth in the ensuing description and the novel features of my improvement are defined in the appended claims. But this disclosure is explanatory only and changes may be made in various ways without departing from the principle of the invention or exceeding the scope of the terms in which the appended claims are expressed.

On the drawing:

Fig. 1 is a diagrammatic view showing one form of my electrical relay circuit; and Fig. 2 shows another form.

The same numerals indicate the same parts throughout.

Referring first to Fig. 1, I show a pair of conductors or mains 1 connected to branch circuits 2 and 3. These branch circuits may have current consuming devices therein and one of these branch circuits, such as the circuit 3, is adapted to be connected so as to supply current to my improved electrical relay and enable the latter to be operated therefrom. In the line of each of the conductors 1 is a coil 4, the two coils 4 being inductively related and serving as reactors in a manner as is set forth in the application

of William F. Cotter and Marion E. Bond for a patent on a Program distribution system, Serial No. 662,252, filed on even date herewith. The mains 1 may also be connected to a watt-hour meter 5, with the reactors 4 between said meter and the branch circuit 3. Electrical circuits for lighting and power are provided with a safety ground where the circuit enters the customer's premises, as shown at 25. The conductor or main 1 connected through the meter and one reactor to the safety ground will be called the grounded side of the line. The two sides of the branch circuit 2 may be provided with terminals 6 for connection to a source of signal current, such as audio or other current, in such a manner that signals can be imposed between the grounded side of the branch circuit 2 and the safety ground to be transmitted through one of the mains 1 and the safety ground to a loud speaker 9a in the circuit united to branch 3, as will now be set forth. The method of connecting a radio receiver or other source of signals, not shown, to the circuit 2 and the advantage and purpose of such connection is fully disclosed in the application of Cotter and Bond aforesaid and is not part of the invention described herein. My invention may, however, be employed not only to effect proper connection of the loud speaker to the line 1, but also in the conductors between the line and the receiver from which signals are impressed upon the line, to insure proper connection of said receiver thereto.

The circuit 3 has the two sides thereof joined to a pair of terminals 7 so that connection can be made between the terminals 7 and a pair of terminals 8 of the circuit of the relay system. The operating coils for the loud speaker are indicated at 9 and 10, the body of the speaker being diagrammatically indicated adjacent these coils to reveal their function. I prefer to describe my invention in connection with an electrodynamic loud speaker including a speech coil and a field coil; the numeral 9 indicating the former and the numeral 10, the latter. To provide current from the mains 1 for the field coil 10, a rectifier 11 of the vacuum tube type may be utilized. This tube has an anode 11a connected by a wire 14 through one pair of terminals 7 and 8 to the grounded side of the supply circuit 3. At 12 is indicated the primary of a transformer, the secondary 13 of which supplies current to the heater circuit of the tube for the cathode 11c when the primary is connected to the supply circuit by closing the on-off switch 24. Con-

connected to the wire 14 between the anode and the circuit 3 is a conductor 15, which may include a fuse 23, leading to the movable contact 16 adapted to engage a fixed contact joined to one terminal of the speech coil 9. The opposite terminal of the coil 9 is to be grounded by a clip 18 adapted to engage a water pipe or any other convenient connection to the earth. The grid 11b of the tube is also connected to ground through a resistance 17.

One side of the switch 24 is also connected through a wire 19 and an indicator lamp 21 to one terminal of a relay coil 20. The other terminal of this coil 20 is joined to the dynamic field coil 10 which is further connected to the cathode element of the vacuum tube. Coil 20 when energized draws up the contact 16 and closes the circuit from the grounded side of the circuit 1 through the speech coil 9 to ground clip 18.

A filter condenser 22 is connected across elements 10, 20 and 21.

In operation the terminals 7 may be part of an outlet connection or wall socket and the terminals 8 may be the tongues or prongs of the usual plug for such a socket connected by a cord to the primary winding 12 and the leads 14 and 19 through the switch 24. The primary winding is thus connected across the mains 1 and may supply alternating current at suitable voltage to the filament of the vacuum tube. When the connection is made as shown, so that the anode is united to the grounded side of the supply circuit, rectified current is provided by the vacuum tube and the speaker is energized and gives forth the signals imposed between the grounded side of the circuit 2, and earth. If, however, the connections between the terminals 7 and 8 are reversed, so that the anode is connected to the ungrounded side of the supply circuit, the tube will rectify insufficient current to operate the relay. Therefore no damage can result to the speech coil 9 as would be the case if it were connected directly between the ungrounded side of the supply circuit 1 and ground. Thus the owner of the device can always connect the speaker to the supply line with perfect safety and with complete assurance that no mishap can take place. If the terminals 7 and 8 are correctly joined, the coil 9 and the vacuum tube rectifier anode will be connected to the grounded side of the supply circuit 1, and if these connections are reversed, no harm can be done, since the relay will not close at all.

I can also utilize my invention for safely connecting in a similar way to an alternating current supply circuit, any other circuit which requires, in order to give voltage to ground or to avoid personal hazard, that a definite terminal of the connected device be at ground potential. In Fig. 2, I show a pair of alternating current leads grounded at 25, and at 26 is an ordinary plug connector having terminals 27 and 28. The conductors joined to these terminals are indicated at 29, the filament transformer having its primary 12 connected across these conductors and its secondary 13 leading to the heater of the vacuum tube rectifier as before. In one side of the circuit 29 is the switch 24 and this side of circuit 29 is also connected by a lead 30 to a relay coil 20 in circuit with the cathode of the rectifier. The same conductor is joined to the grid of the rectifier through a resistance 17 and between said resistance and grid is a ground connection 18. The filter condenser 22 is joined

across the terminals of the relay coil 20 and this relay coil, when rectified current flows there-through, actuates the movable contacts 16 into engagement with fixed contacts 32. These contacts close a work circuit indicated at 31 across the leads 29 which may include any device to be operated and at the same time protect it or the operator against injury in case the connections between the supply circuit and the relay circuit are wrongly made. If the plug connector 26 is correctly united to the supply circuit 1, the rectifier will produce direct current and energize the relay 20 to close the circuit 31. If, however, the plug 26 is reversed, then the vacuum tube rectifier will not operate and the relay 20 will fail to close the contacts 16 and 32.

Thus in both the circuits of Figs. 1 and 2, the work circuit can be properly controlled and is made to depend upon a specific connection with the supply circuit. The grid of the vacuum tube is always connected to the ground and the relay coil or other load is in the cathode circuit and is operated by the current rectified by the tube. When the anode is also connected to ground by the proper insertion of the plug, the grid and plate are at the same potential and the tube acts as a diode, passing rectified current from the anode to the cathode. The amount of current is determined by the resistance of the relay, voltage of the line, and other factors. When the plug is improperly connected to the supply line the tube starts to rectify but builds up a negative bias on the grid due to the resistance drop in the relay coil 20 or the coil 20 and the field 10. The rectified current is then limited to a very small value insufficient to operate the relay because of said negative grid bias. The equipment to be protected is therefore not connected when the plug is improperly inserted.

Having described my invention, what I claim is:

1. The combination of an alternating-current energizing circuit having one side grounded, a relay coil, and means including a three electrode rectifier with anode connected to said grounded side and grid connected to ground, and connections for enabling said coil to be energized only when properly connected to the energizing circuit, so that in the event of incorrect connections no current flows in a circuit controlled by the relay.

2. The combination of an alternating-current energizing circuit having one side grounded, a circuit containing a relay and means including a three electrode rectifier with anode connected to said grounded side and grid connected to ground, and connections for joining the last-named circuit to the energizing circuit adapted to enable current to flow in the circuit of the relay only when the latter is properly connected to the energizing circuit.

3. The combination of an alternating-current energizing circuit having one side grounded, a relay coil and the speech coil and field coil of a dynamic loud speaker and means including a three electrode rectifier with anode connected to said grounded side and grid connected to ground, and connections adapted to enable current to be supplied to said coils only when properly connected to the energizing circuit so that damage to the speaker is avoided in case of improper connection.

4. The combination of an alternating-current energizing circuit having one side grounded, a relay coil, circuits containing said coil and in-

cluding a three electrode rectifier with anode connected to said grounded side and grid connected to ground, and connections having contacts therein arranged to be closed only when said circuits are properly connected to the energizing circuit.

5 5. The combination of an alternating-current energizing circuit having one side grounded, a relay circuit having a three electrode vacuum tube rectifier therein, said rectifier having an anode adapted to be connected to said grounded side and a grid connected to ground, and a connection between the cathode and the opposite side of said energizing circuit, a relay coil in said connection, a loud speaker field coil also in said connection, a conductor controlled by the relay coil extending from the anode to the ground, a speech coil of a loud speaker in said conductor and contacts controlled by said relay in said conductor.

6. The combination of an alternating-current energizing circuit having one side grounded, a relay circuit connected thereto and having therein a three-element vacuum tube rectifier with an anode joined to said grounded side and a grid connected to ground, a permanent connection between the grid of said tube and one side

of the energizing circuit, a relay coil in circuit with the rectifier, and a circuit controlled by said relay.

7. The combination of an alternating-current energizing circuit having one side grounded, a relay circuit, a three-element vacuum tube rectifier therein, said rectifier having an anode adapted to be connected to said grounded side and a grid connected to ground, a connection between the cathode and the opposite side of said energizing circuit, a relay coil in said connection, a conductor extending from said grounded side to ground, a speech coil of a loud speaker in said last-named conductor and contacts controlled by said relay coil in said last-named conductor.

8. The combination of an alternating-current energizing circuit having one side grounded, a relay circuit connected thereto and having therein a three-element vacuum tube rectifier with an anode joined to said grounded side and a grid connected to ground, a permanent connection including a resistance between the grid of said tube and one side of the energizing circuit, a relay coil in circuit with the rectifier, and a circuit controlled by said relay.

LESLIE F. CURTIS.

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