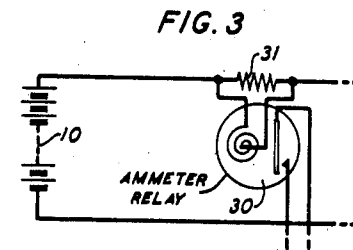
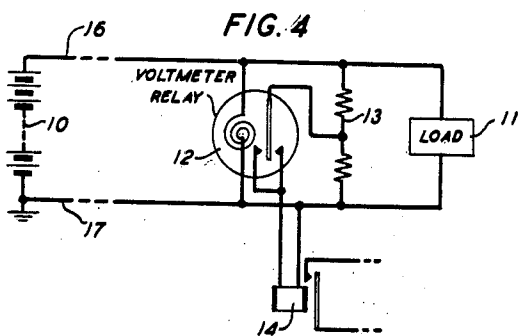
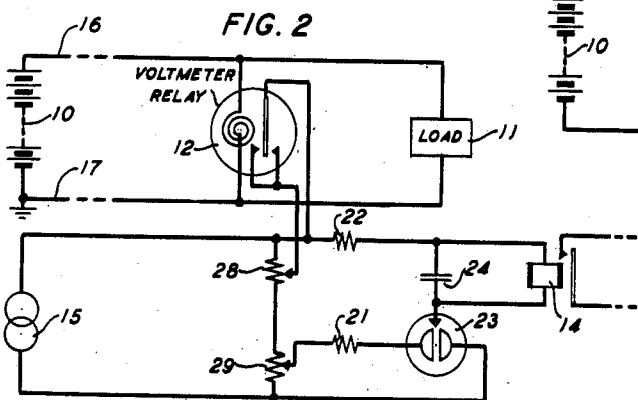
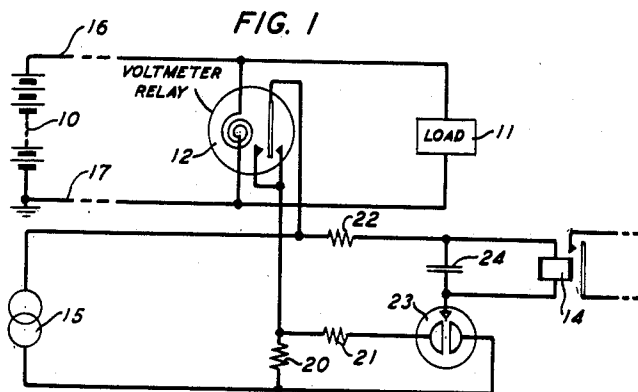


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ELECTRIC CIRCUITS
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ELECTRIC CIRCUITS

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6 Claims. (Cl. 175-320)

This invention relates to electric circuits and particularly to the operation of such circuits when controlled by the contacts of voltmeter relays, ammeter relays or similar devices, which are characterized by relatively small contacts and relatively light contact pressures.

The current carrying and interrupting capacities of translating devices, such as voltmeter and ammeter relays are necessarily low due, principally, to the fact that the operating contacts thereof are small and the contact pressures are light. Unless the current carried, or interrupted by such contacts is small, deterioration of the contact material results.

In some circuits, such as are found in electric power distribution systems, wherein voltmeter and ammeter relays find extensive use, excessive deterioration of the contacts has been guarded against by use of a potentiometer arrangement, which serves to reduce the voltage, to which the contacts are subjected, to a relatively small value. The circuits into which the contacts work, in such systems, are of relatively low resistance.

Under ideal conditions, the potentiometer arrangement mentioned above, serves satisfactorily in maintaining suitable control of the circuits with which the voltmeter and ammeter relays work. However, under certain conditions, the circuits controlled by the ammeter and voltmeter relays have been found to operate erratically. This erratic operation has been found to be produced by the high resistance of the relay contacts caused by dirt, or moisture film accumulated thereon. Under this condition, the low voltage derived from the potentiometer is insufficient to break down the high resistance dirt or moisture film, with the result that the circuit in which the relay contacts are included is not electrically closed by the contacts when circuit conditions require that they should be.

It is the object of this invention to preclude the possibility of erratic operation of circuits controlled by the contacts of voltmeter relays, ammeter relays and the like, which occurs when the relay contacts are fouled by dirt, moisture film, etc.

This object is attained in accordance with a feature of the invention by the provision of an auxiliary circuit which normally maintains a relatively high voltage across the control relay contacts when open, and which introduces a relatively high resistance in series with the contacts when closed, thereby insuring sufficient voltage to break down any dirt or moisture film which

might have accumulated on the contacts, and at the same time, maintaining the current which traverses the contacts, when closed, to a relatively small value.

A further feature of the invention resides in the use of a cold cathode, or trigger type tube which functions upon operation of the control relay contacts to complete a circuit for the operation of a translating device, whose purpose it is to record such contact operation, either by operating an alarm signal, performing an operation which serves to rectify, or overcome the condition which caused the operation of the contacts, or performing any other desirable and useful function.

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

Figs. 1 and 2 are circuit diagrams illustrating two embodiments of the invention and in each of which a voltmeter relay is employed as the control device;

Fig. 3 is a circuit diagram illustrating a portion of each of the circuits of Figs. 1 and 2, in which an ammeter relay is substituted for the voltmeter relays of Figs. 1 and 2; and,

Fig. 4 is a circuit diagram illustrating the arrangement in common usage today, and which is subject to erratic operation caused by the high resistance of the control relay contacts produced by dirt, moisture, etc.

The description to follow is directed to Fig. 4, which discloses a power distribution circuit and a circuit arrangement associated therewith, of the type in common use today. This circuit functions, when the terminal voltage at the load varies a predetermined amount from a desirable value, to operate a translating device, which performs any of the desirable functions hereinbefore attributed to such a device.

The power source is indicated by the storage battery 10 and the load is schematically shown at 11. Power from the source 10 is delivered to the load 11 by way of the line conductors 16 and 17. The operating coil of a voltmeter relay is connected directly across the line wires 16 and 17 and is responsive to the voltage across the load terminals. The armature of relay 12 will float at some scale reading commensurate with the voltage at the load terminals, and when this voltage varies from a predetermined desirable value, the armature will react accordingly, to close either its right or left contact, depending upon whether the voltage variation is an increase or a decrease. The circuit controlled by the con-

tacts of relay 12 has a relatively low resistance, so that unless the voltage impressed across them is held to a relatively small value, the current traversing the contacts, when closed, would be excessive and greater than the normal current carrying and interrupting capacity of the contacts. Deterioration of the contacts obviously would ensue.

In order to guard against excessive deterioration of the contacts, the potentiometer 13 is bridged across the line between the load 11 and the supply 10, and the armature of the relay 12 is connected to a point on the potentiometer, such that the voltage across the open contacts is relatively low. The result attained, therefore, by the use of the potentiometer is a relatively small current traversing the contacts when they are closed. When the voltage at the load terminals varies a predetermined amount, the right or left contacts of relay 12 are closed and translating device 14 operates to perform any desirable function, as for example, to operate an alarm signal.

With the arrangement just described, uniform operation of the circuit requires that the contacts of control relay 12 be free of dirt, moisture and the like. Should these contacts become dirty, or should they acquire a film of moisture, the contact resistance is increased considerably and, possibly, to a value such that the relatively low voltage across the contacts afforded by the potentiometer connection is insufficient to break down the dirt or moisture film and therefore to effect the operation of relay 14. Obviously, therefore, though a condition prevails to which the operating coil of relay 12 responds to effect the closure of the relay contacts, the circuit to relay 14 is not effectively completed and the relay 14 fails to operate. It is apparent, therefore, that the high resistance of the contacts of relay 12 caused by the presence of dirt or a film of moisture results in erratic operation of the circuit controlled by relay 12.

Reference will now be made to Fig. 1 which illustrates a circuit arrangement which precludes the possibility of such erratic operation of the circuit controlled by the relay 12. In this figure, as well as in Figs. 2 and 3, the elements bear the same designation numerals as corresponding elements of Fig. 4.

In the arrangement shown in Fig. 1, an auxiliary source of power 15, in the nature of a relatively high voltage source of alternating current is employed, and is included in a circuit which includes the resistance elements 20, 21 and 22, a cold cathode vacuum tube, or trigger type tube 23, a condenser 24 and the operating winding of translating device, or relay 14. The operating coil of control relay 12 is connected to line conductors 16 and 17 in the same manner as in Fig. 4, and the load 11 is supplied with power from the battery source 10. The contacts of relay 12, however, are connected directly across the terminals of the source 15 by way of the high resistance element 20.

As in the arrangement shown in Fig. 4, the operating coil of relay 12 is subjected to the terminal voltage of the load 11, and when this voltage varies a predetermined amount, the relay 12 functions to close its contacts. It will be noted that when the contacts of relay 12 are open, they are subject to the full voltage of the alternating current source 15. Resistances 20 and 21 are high, so that when the contacts close, the current traversing them is limited to a very low value. Closing of these contacts causes the control gap

of tube 23 to break down and this results in the breakdown of the main gap of the tube. The main gap conducts in one direction only, causing a direct current voltage to be built up across the condenser 24 of sufficient magnitude to operate the translating device 14. Resistance 22 is used to limit the current in the circuit of the tube which includes the main gap. When relay 14 operates it performs the same function, or functions, as does the corresponding relay of Fig. 4. By proper choice of the resistance 22, condenser 24 and relay 14, the correct operate and release time of relay 14 for a particular application may be obtained.

In the arrangement just described, wide variations in the resistance of the voltmeter relay contacts do not impair the functioning of the circuit. The contacts, when open, are connected directly across the full voltage of the alternating current source 15, which is of sufficient magnitude to break down any dirt or moisture film which may have collected on the contacts, so that the circuit to the translating device 14 will be completed when relay 12 operates to close its contacts. Also, when the contacts of relay 12 are closed, they introduce in circuit with themselves, the high resistance elements 20 and 21, so that the current traversing the contacts is maintained at a low level and well within the current carrying or interrupting capacity of the contacts.

The arrangement disclosed in Fig. 2 is substantially the same as that shown in Fig. 1. It differs from the latter in that the high resistance 20 of Fig. 1 is replaced by two adjustable resistances 28 and 29. In all other respects the two showings are identical and the principle of operation is the same. The adjustable resistances 28 and 29 provide means whereby the voltage across the contacts of relay 12 may be adjusted to any desired value.

Fig. 3 contemplates the showing of an arrangement similar to that of either Fig. 1 or Fig. 2, in which an ammeter relay 30 is used as the control relay in place of the voltmeter relay 12 shown in Figs. 1 and 2. In this case, the operating coil of the ammeter relay is responsive to the current traversing the supply line, rather than to the voltage at the load. Resistance 31 shunts the operating coil of relay 30 and functions to limit the current carried thereby.

What is claimed is:

1. In combination, a source of direct current, a load connected thereto, a relay having an operating coil responsive to variations in said load, a translating device, a source of high voltage alternating current, and means controlled by the operating coil of said relay for effectively connecting said translating device to said source of alternating current when the operating coil of said relay responds to a load variation of predetermined value, said means comprising a pair of low current carrying capacity contacts controlled by the operating coil of said relay and connected across said source of alternating current in series with a high resistance for limiting the current carried by said contacts when operated to closed position, and a gas-filled tube having a pair of control electrodes included in the circuit with said contacts and an anode circuit including the operating winding of said translating device.

2. In combination, a source of direct current, a load connected thereto, a relay having an operating coil connected across said load and responsive to voltage variations at the terminals of said load, a translating device, a high voltage auxil-

ary source of power, and means controlled by the operating coil of said relay for effectively connecting said translating device to said auxiliary source of power when said relay responds to a predetermined voltage variation at the terminals of said load, said means comprising a pair of low current carrying capacity contacts controlled by the operating coil of said relay and connected across said source of power in series with a high resistance for limiting the current carried by said contacts when operated to closed position, and a gas-filled tube having a pair of control electrodes included in the circuit of said contacts and an anode circuit including the winding of said translating device.

3. In combination, a source of direct current, a load connected thereto, a relay having an operating coil connected across said load and responsive to voltage variations at the terminals of said load, a translating device, an auxiliary source of high voltage alternating current, and means controlled by the operating coil of said relay for effectively connecting said translating device to said alternating current source when said relay responds to a predetermined voltage variation at the terminals of said load, said means comprising a pair of low current carrying capacity, contacts controlled by the operating coil of said relay and connected across said source of alternating current in series with a high resistance for limiting the current carried by said contacts when operated to closed position, and a gas-filled tube having a pair of control electrodes one of which is connected to one terminal of said alternating current source by way of a second high resistance and said contacts, and an anode circuit including a condenser and the operating winding of said translating device.

4. The combination set forth in claim 1, in which the high resistance included in series with the low current carrying capacity contacts is adjustable.

5. In combination, a source of power, a load supplied from said source, a voltmeter relay having an operating winding connected across the load and responsive to voltage variations at the terminals of said load, said relay having an armature and a pair of associated working contacts, an independent circuit comprising a source of alternating current, a gas-filled tube and a translating device, and means comprising the armature and a working contact of said voltmeter relay responsive to the operation of said relay for effectively connecting said tube to said source of alternating current to cause it to function to operate said translating device, said armature contacts being normally subjected to the full voltage of said alternating current source, and when operated being connected, in series with a current limiting resistance, across said alternating current source.

6. In combination, a translating device, a source of power, a gas-filled tube having a pair of control electrodes and an anode, the winding of said translating device being included in the anode circuit of said tube, a normally open circuit associated with said source of power and including a pair of low current carrying capacity contacts and a high resistance included in series therewith, a second high resistance interposed between one of the terminals of said first resistance and one of the control electrodes of said tube, a second source of power, and means controlled thereby for effectively closing said normally open circuit, whereupon the voltage of said first source is impressed on the control electrodes of said tube by way of said second high resistance and said tube fires to complete the anode circuit thereof, and a condenser included in the anode circuit of said tube for controlling the operation of said translating device.

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