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PROTECTION DEVICE FOR REVERSE POLARITY IN D.-C. GENERATORS

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Fig. 1

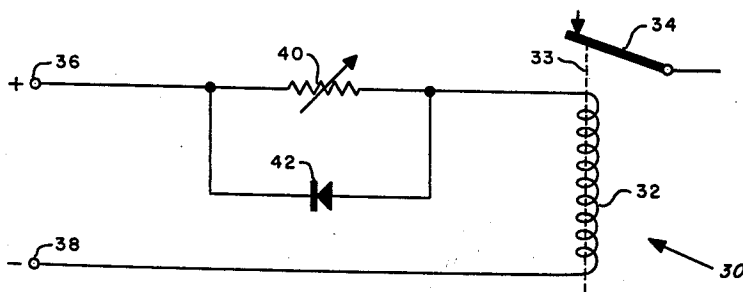
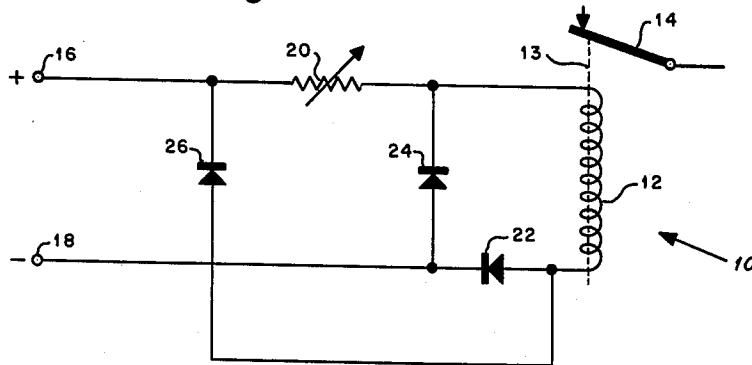


Fig. 2

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PROTECTION DEVICE FOR REVERSE POLARITY IN D.C. GENERATORS

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2 Claims. (Cl. 317-31)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The invention relates to protection devices for reverse polarity in direct current generators.

One of the primary objects of the present invention is to provide novel reverse polarity protection in direct current generator systems in which constant polarity is required to be maintained across an actuating relay coil. In prior art protection systems a separate polarized relay was used to sense for reverse polarity. The prior existing method not only required a separate sensing relay but also required an overvoltage relay.

Accordingly, another object of the invention is the provision of novel reverse polarity protection in direct current generator systems that is of less cost, weight, and occupies less space. The weight and space characteristics are especially important in airborne equipment.

Another object of the invention is to provide a novel arrangement for protecting direct current generators that is sensitive and responsive to low voltages of reverse polarity in addition to being sensitive and responsive to overvoltages of normal polarity.

The invention further resides in certain novel features of construction, combinations and arrangements of parts, and further objects and advantages of the invention will be apparent to those skilled in the art to which it pertains from the following description of the present preferred embodiments thereof described with reference to the accompanying drawing, which forms a part of this specification, and wherein the same reference characters represent corresponding parts, and in which:

FIG. 1 is a schematic electrical diagram of an apparatus embodying the invention; and

FIG. 2 is a schematic electrical diagram of an apparatus embodying another form of the invention.

It is to be understood that the invention is not limited to the details of construction and arrangements of parts shown in the drawing and hereinafter described in detail, but is capable of being otherwise embodied and of being practiced or carried out in various ways. It is to be further understood that the phraseology or terminology employed herein is for the purpose of description and there is no intention to herein limit the invention beyond the requirements of the prior art.

FIG. 1 shows a device for providing reverse polarity protection in a direct current generator system in which constant polarity is required to be maintained across a relay indicated generally by the reference numeral 10 and comprising a relay coil 12, armature 13, and a protection switch 14.

The relay 10 in FIG. 1 operates to close the protection switch 14 when a voltage of normal polarity across two terminals 16, 18 becomes excessive and when a relatively low voltage of reverse polarity occurs across the terminals 16, 18.

More particularly, when a voltage of a normal polarity is applied across the relay coil 12, the terminal 16 operates as a positive (+) pole and the terminal 18 operates as a negative (-) pole, as shown in FIG. 1. The apparatus comprises a calibrating resistor 20 and three diodes 22, 24

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and 26. The resistor 20 provides external resistance to the relay coil circuit for temperature compensation and calibration, and is series connected between the positive terminal 16 and the relay coil 12 in a conventional manner. When a direct current voltage of normal polarity is applied across the terminals 16, 18, the calibrating resistor 20 is adjusted to preclude actuation of the armature 13 of the relay coil 12 below a selected voltage. Accordingly, the relay 10 normally functions as an over-voltage device.

The circuit, in normal operation, provides for the conductance of electricity from the positive terminal 16 to the negative terminal 18 via the resistor 20, the relay coil 12, and the diode 22. The diodes 24, 26 are selected to present a high resistance to the passage of current of normal polarity and therefore only conduct current of a negligible quantity.

When voltage of reversed polarity occurs or is applied across the terminals 16, 18, the diode 22 presents a high resistance and only the diodes 24, 26 conduct the relay coil current. Accordingly, during the reverse polarity condition, electricity flows from the terminal 18 through the diode 24, the relay coil 12, and the diode 26 to the terminal 16, the diodes 24, 26 being shunt connected across the line and bypassing the normal function of the resistor 20. More particularly, the diode 24 directly connects the terminal 18 with the normal input side of the relay coil 12 in such a manner that there is no intervening calibrating resistor. The diode 26 directly connects the terminal 16 with the outlet end of the relay coil 12. Since the diode 22 is highly resistive to current of a reversed polarity, only a negligible amount of current will be permitted to pass therethrough.

Because resistor 20 is bypassed, the relay 10 will be operated with a lower voltage than that normally required. For example, with normal polarity, 32 volts will cause the switch 14 to be closed while only 6 volts of reverse polarity will operate the relay 10.

Where the direction of current flow through the relay coil is not important to proper relay operation, reverse polarity and overvoltage protection can be achieved by shunting a calibrating resistor with one diode.

More particularly, referring to FIG. 2, a relay, indicated generally by the reference numeral 30, comprises a relay coil 32, an armature 33, and a protection switch 34. The relay coil 32 is connected across a pair of terminals 36, 38. The terminal 36 is normally a positive (+) pole and the terminal 38 is normally a negative (-) pole. A calibrating resistor 40, similar to the resistor 20, is series connected between the terminal 36 and the relay coil 32. A diode 42 is shunt connected to the resistor 40 and is arranged to resist the passage of current during normal polarity and to bypass the resistor 40 during reverse polarity. Accordingly, a lesser voltage will operate the relay 30 when the polarity is reversed than is required during the normal polarity condition.

It is apparent from the foregoing that the embodiment of FIG. 1 is used when the relay is polarity sensitive and the embodiment of FIG. 2 is used when the relay is not polarity sensitive.

One of the features of the invention is the ability of the novel circuits of FIGS. 1 and 2 with the use of only one relay to sense overvoltage of normal polarity and also to sense voltage of a reversed polarity before the voltage reaches a magnitude great enough to cause damage to the electrical system.

It is the intention to hereby cover not only the above-mentioned modifications of the preferred constructions shown, but all adaptations, modifications, and uses thereof which come within the practice of those skilled in the art to which the invention relates, and the scope of the appended claims.

What is claimed is:

1. An overvoltage protection device for a direct current generator system comprising, a source of direct voltage, a relay having a polarity sensitive and responsive coil adapted to operate a switch when electrically energized, a calibrating resistance, first diode means, second diode means, and third diode means, each of said diode means being highly resistive to the passage of current in one direction therethrough, said calibrating resistance, said coil, and said first diode means being respectively series-connected to said source to conduct current in one direction through said coil during a normal electrical polarity condition and to operate the switch when an overvoltage occurs, the overvoltage level being determined by the adjustment of said calibrating resistance, said second diode means, said coil, said third diode means being respectively series-connected to conduct current in said one direction through said coil and bypass said calibrating resistance and said first diode means during the occurrence of reversed electrical polarity, said second diode means and said third diode means thereby bypassing said calibrating resistance during the occurrence of the reversed polarity for causing the operation of the switch at a lower voltage than permissible during the normal electrical polarity condition.

2. An overvoltage protection device for a direct current generator system comprising, a source of direct voltage, a relay having a polarity sensitive and responsive coil adapted to operate a switch when electrically energized,

a resistance, first unidirectional conducting means, second unidirectional conducting means, and third unidirectional conducting means, each of said unidirectional conducting means being highly resistive to the passage of current in one direction, said resistance, said coil and said first unidirectional conducting means being respectively series-connected to said source to conduct current during a normal electrical polarity condition and to operate the switch when an overvoltage occurs, the overvoltage level being determined by said resistance, said second unidirectional conductive means, said coil, said third unidirectional conductive means being respectively series-connected to said source and to conduct current in said one direction through said coil and bypass said resistance and said first unidirectional conductive means during the occurrence of reversed electrical polarity, said second unidirectional conductive means and said third unidirectional conductive means thereby bypassing said resistance during the occurrence of the reversed polarity for causing the operation of the switch at a lower voltage than permissible during the normal electrical polarity condition.

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