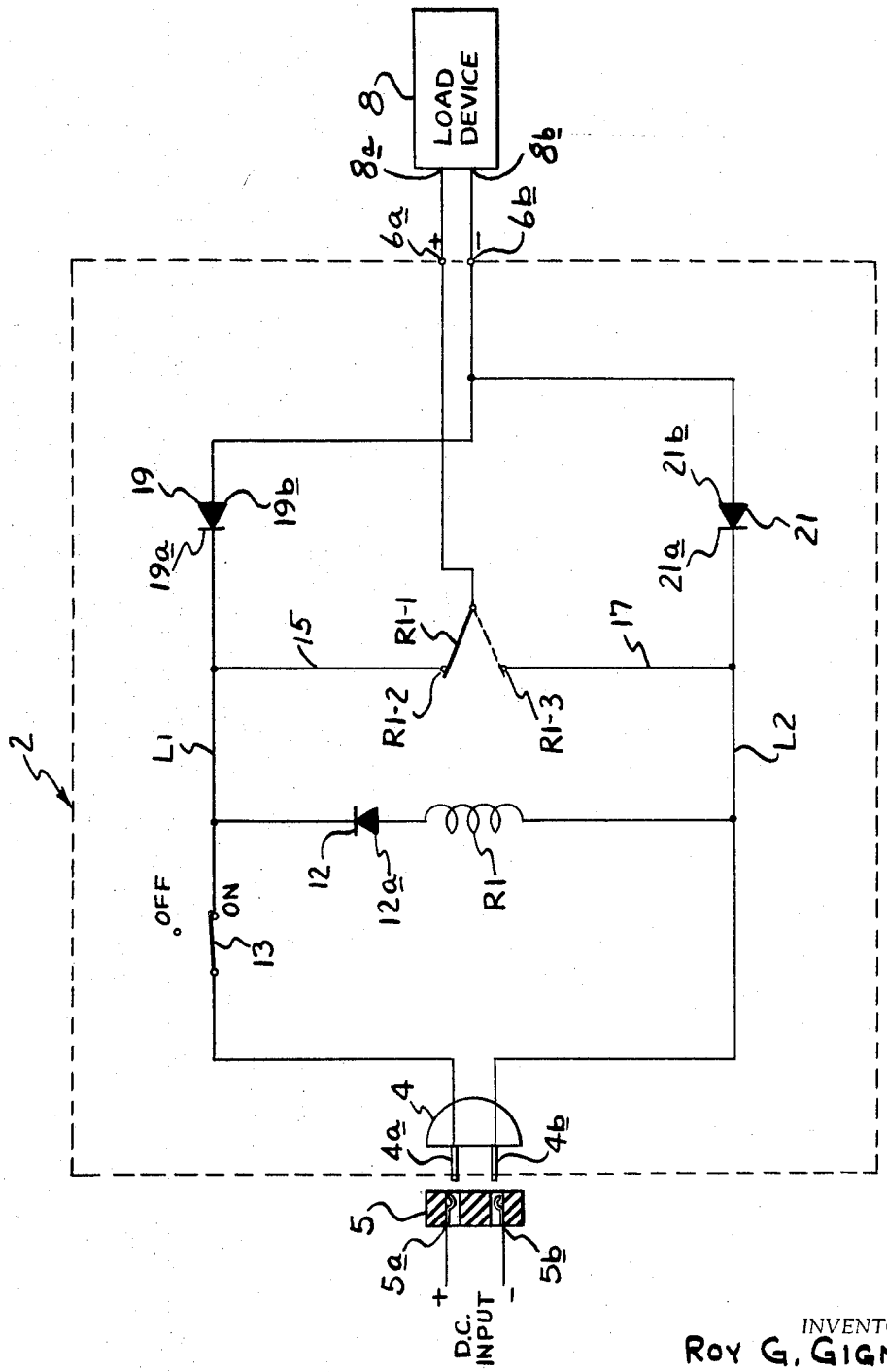
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DIRECT CURRENT POLARITY CONTROL CIRCUIT

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DIRECT CURRENT POLARITY CONTROL CIRCUIT

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This invention relates to a circuit for ensuring a consistent polarity across a pair of load terminals for random positioning of a D.C. voltage source across a pair of direct current input terminals.

Direct current polarity control circuits performing the function above described are well known in the art. They generally include a relay and a rectifier in series across a pair of direct current input terminals, the rectifier effecting energization of the relay for a first relative polarity across the input terminals and effecting the de-energization of the relay for the opposite relative polarity across said input terminals. The relay is generally provided with double pole, double throw contacts which normally ensure the proper polarity across the load terminals for the energized and de-energized conditions of the relay respectively, since these conditions of the relay are normally tied in directly with the polarity of the voltage applied to the input terminals. However, this circuit suffers from one important disadvantage which is that failure of the relay to operate in the normal manner due to an open circuit in the relay coil or the like can cause a voltage of improper polarity to appear across the load terminals, which could seriously damage the load connected to these terminals.

The present invention overcomes this disadvantage by ensuring a proper polarity across the load terminal when the relay is in proper operating condition, and the complete disconnection of the input voltage from the load terminals in case the relay is not operating. In such case, the load is protected against the presence of a voltage condition across the load terminals which is of an improper relative polarity.

Another important advantage of the invention is that it not only has the functional advantage referred to, but it also results in a substantial reduction in cost of the circuit involved. For example, a cost reduction as much as fifteen percent (15%) can be achieved by utilizing the circuit of the present invention in low current circuits.

The accompanying drawing is a circuit diagram illustrating one example of the invention.

An exemplary direct current polarity control circuit of the present invention is identified in the drawing by reference numeral **2**. The circuit is arranged to form an integral unit with an input plug connector **4** insertable into a suitable wall or other outlet socket **5** having socket terminals **5***a* and **5***b* connected to a suitable source of direct current voltage. The socket terminal **5***a* is permanently connected to the positive terminal of the voltage source and the socket terminal **5***b* is permanently connected to the negative terminal. The plug connector **4** has plug terminals **4***a* and **4***b* which constitute input terminals to the circuit **2**. The circuit **2** has load terminals **6***a* and **6***b* across which input terminals **8***a* and **8***b* of a suitable load device **8** is connected. It is assumed that the load device is one wherein the input terminal **8***a* must be positive with respect to the input terminal **8***b* either to ensure proper operation of the load device **8** or to protect the same from damage and that the plug connector **4** can be inserted into the socket **5** in either one of two positions so that plug connector terminal **4***a* may be either positive or negative with respect to the plug connector terminal **4***b*. The direct current polarity control circuit **2** ensures that the load terminal **6***a* is positive with respect to the load terminal **6***b* independently of whether plug connector terminal **4***a* is in contact with socket terminal **5***a* or **5***b*.

A bus **L1** is connected to plug connector terminal **4***a* through an on-off switch **13** and a bus **L2** in connected to the plug connector terminal **4***b*. A series circuit including a rectifier **12** and the coil of a relay **R1** are connected in series between the busses **L1** and **L2**. The anode **12***a* of the rectifier **12** is connected to the upper end of the relay coil and the cathode **12***b* of the rectifier **12** is connected to the bus **L1**. Thus, whenever the bus **L1** is positive with respect to the bus **L2**, the rectifier **12** will block the flow of direct current to the relay coil so that the relay **R1** will remain in a de-energized state. When the bus **L1** is negative with respect to the bus **L2**, the rectifier **12** will conduct direct current to the relay coil to energize the same.

Relay **R1** has a movable contact **R1–1** which, in the de-energized state of the relay, contacts a stationary contact **R1–2** connected by a conductor **15** to the bus **L1**. In the energized state of the relay **R1**, the movable contact **R1–1** is connected to a stationary contact **R1–3** connected by a conductor **17** to the bus **L2**.

The circuit of the invention is completed by a pair of rectifiers **19** and **21**. The cathode **21***a* of the rectifier **21** is connected to the bus **L2** and the anode **21***b* thereof is connected to the load terminals **6***b*. Thus, when the relay **R1** is de-energized due to the fact that the bus **L1** is positive with respect to the bus **L2**, the path of current flow between the busses includes stationary contact **R1–2** connected to bus **L1**, movable contact **R1–1**, load terminal **6***a*, the load device **8**, load terminal **6***b* and rectifier **21** connected to bus **12**. In such case, the load terminal **6***a* is positive with respect to load terminal **6***b*.

The cathode **19***a* of rectifier **19** is connected to the bus **L1** and the anode **19***b* thereof is connected to the load terminal **6***b*. When the bus **L1** is positive with respect to the bus **L2**, which is the condition when the relay **R1** is de-energized, the rectifier **19** is in a non-conductive state because the cathode **19***a* thereof is positive with respect to its anode **19***b*.

When the bus **L1** is negative with respect to the bus **L2**, so that the rectifier **12** will conduct current to energize the relay **R1**, movable contacts **R1–1** will separate from the stationary contact **R1–2** and make contact with the stationary contact **R1–3**. Then, the path of current flow between the busses **L1** and **L2** can be traced through the conductive rectifier **19** connected to the bus **L1**, load terminal **6***b*, load device **8**, load terminal **6***a*, movable contact **R1–1** and stationary contact **R1–3** connected to bus **L2**. In this case also, the load terminal **6***a* is positive with respect to the load terminal **6***b*. When the bus **L1** is negative with respect to the bus **L2**, the rectifier **21** is in a non-conductive state because its cathode **21***a* is then positive with respect to its anode **21***b*.

One of the main advantages of the invention, as above indicated, is the reliability of the circuit in the event the relay **R1** should fail to operate. Thus, if the coil of the relay **R1** were to be open circuited, since the relay **R1** cannot be energized when the bus **L1** is negative with respect to the bus **L2**, movable contact **R1–1** of the relay **R1** remains in contact with its stationary contact **R1–2** but then will not result in the feeding of the positive voltage on the plug connector terminal **4***b* to the load terminal **6***b* which could damage the load device **8** because the rectifier **21**, as above indicated, will then be in a non-conductive state because the cathode **21***a* is positive with respect to the anode **21***b* and there is no other path for this positive voltage to reach load terminal **6***b*. Similarly, if for some reason movable contact **R1–1** should become stuck to the stationary contact **R1–3** when the relay **R1** is energized, the subsequent de-energization of the

relay will not result in a voltage of improper polarity on the load terminals because the rectifier **19** will block continuity between load terminal **6***b* and the then positive bus **L1**.

As above indicated, in addition to the functional advantage of the circuit just explained, utilization of the rectifiers **19** and **21** results in a substantial reduction in the cost of the circuit in comparison to a circuit of the type heretofore utilized where the relay **R1** was provided with two sets of movable and stationary contacts.

I claim:

1. A direct current polarity control circuit connected between a first and a second direct current input terminal across which a direct current voltage source is to be connected in a random fashion, so that the input terminals may have either one of two relative polarities, and a first and a second load terminal across which a direct current voltage is to be applied having a consistent relative polarity, said circuit comprising: a relay and a first rectifier connected in series across said input terminals for effecting the energizing for said relay when said input terminals have a first relative polarity and the de-energizing of said relay when said terminals have the opposite polarity, said relay having a movable contact connected to said first load terminal and a first and a second stationary contact respectively connected to said first and second input terminals, said movable contact being connected to said first stationary contact when said relay is de-energized and to said second stationary contact when said relay is energized, a second rectifier connected between said second load terminal and said second input terminal for coupling the direct current input voltage to said load terminals when the relay is de-energized, and for decoupling the input voltage from the load terminals when said input terminals have said first relative polarity, and a third rectifier connected between said second load terminal and said first input terminal for coupling the voltage of said input terminals to said load terminals when said relay is energized and for decoupling the input voltage from said load terminals when the voltage across said input terminals has said opposite polarity.

2. A direct current polarity control circuit having a connector with a first and a second input terminal which can be randomly removably connected in either of two ways to a mating connector coupled to a source of direct current voltage, so that said input terminals may have either one of two relative polarities, and a first and a second load terminal across which a direct current voltage is to be applied having a consistent relative polarity, said circuit comprising: a relay and a first rectifier connected in series across said input terminals for effecting the energizing for said relay when said input terminals have a first relative polarity and the de-energizing of said relay when said terminals have the opposite polarity, said relay having a movable contact connected to said first load terminal and a first and a second stationary contact respectively connected to said first and second input terminals, said movable contact being connected to said first stationary contact when said relay is de-energized and to said second stationary contact when said relay is energized, a second rectifier connected between said second load terminal and said second input terminal for coupling the direct current input voltage to said load terminals when the relay is de-energized, for decoupling the input voltage from the load terminals from said load terminals when said input terminals have said first relative polarity, and a third rectifier connected between said second load terminal and said first input terminal for coupling the voltage of said input terminals to said load terminals when said relay is energized and for decoupling the input voltage from said load terminals when the voltage across said input terminals has said opposite polarity.

No references cited.

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