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CONTACTLESS SWITCH

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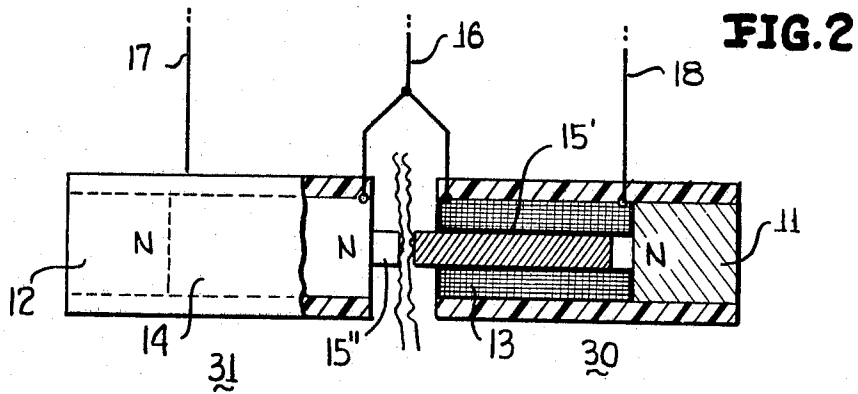
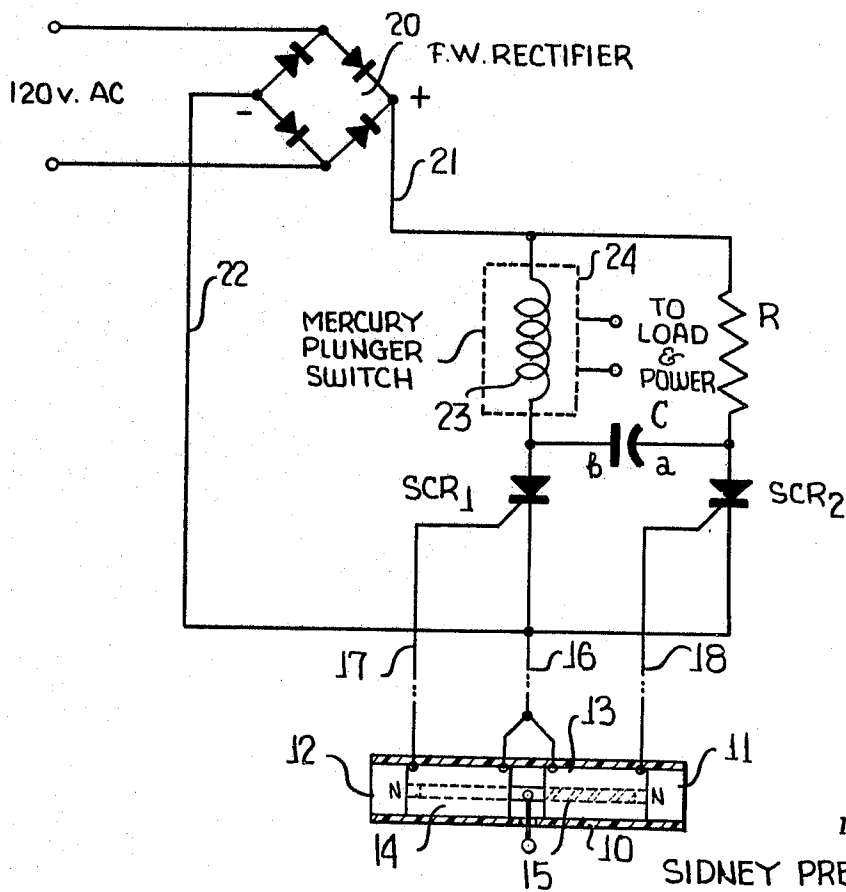


FIG. 1



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CONTACTLESS SWITCH

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1 Claim

ABSTRACT OF THE DISCLOSURE

A contactless switch for selectively making and breaking a circuit to a load, on which a pair of SCR's themselves controlled by inductive pulse generators having no contacts, serve to make and break a circuit to the load.

BACKGROUND OF THE INVENTION

In many known systems of supplying large currents to a load at will, the primary switch is a mercury switch. The latter includes an actuating coil or coils, which operate a magnetic plunger immersed in a pool of mercury, to modify the level of the pool. The level of the pool of mercury determines whether two separated contacts shall be open or closed. A mechanical switch having exposed contacts is provided for controlling current to the actuating coil of the mercury switch. The current carried by the mechanical switch may be small, but opening and closing of the contacts causes arcing, which can be a severe hazard in explosive environments. Other problem environments can also cause degrading of the contacts and in time lead to improper operation. To provide a degree of safeguard, bulky and expensive explosion proof housings for the switches are employed.

The present invention provides a system capable of switching heavy currents without requiring contact circuit making and breaking, and hence eliminates arcing and danger of explosion in danger areas. Long life is assured because no contacts are employed.

SUMMARY OF THE INVENTION

A source of DC voltage is connected in parallel, at its positive terminal to an operating coil of a mercury switch and to a resistance. These are connected to the anodes of SCR's, respectively, the cathodes of which are connected to the negative terminal of the supply. A capacitor joins the anodes. The gate (control electrodes) of the SCR's are connected to two coils, each associated with a permanent magnet and a plunger. Thereby, when a plunger is moved in one direction a positive pulse is generated in one coil and a negative pulse for movement of the plunger in the opposite direction. The SCR's are commutated to be turned on only in alternation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic circuit diagram of an embodiment of the invention, employing a single plunger; and

FIGURE 2 is a modification of the system of FIGURE 1, employing widely separated coils and a separate plunger associated with each of the coils.

DESCRIPTION OF PREFERRED EMBODIMENT

In FIGURE 1, 10 is an insulating sleeve, closed at both ends by permanent magnets 11 and 12. These may be assumed to have identical poles facing inwardly of sleeve 10. Immediately adjacent magnet 11 is a coil 13 and immediately adjacent magnet 12 is a coil 14. These may be identically wound, for the assumed polarities of the magnets.

The coils 13 and 14 are hollow and a plunger 15 of

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magnetic material fits snugly within the coils, but is free to move axially of the coils, i.e., toward and away from the magnets 11, 12 respectively, approaching one as it recedes from the other. The modifications of the reluctances of the magnetic circuits of the coils 13, 14 consequent on alternate movements of plunger 15 generates voltages in these coils which are always of opposite polarities, i.e. if movement of plunger 15 to the right, in FIGURE 1 generates a positive pulse in coil 13 it will generate a negative pulse in coil 14, and vice versa. A common lead 16, to the coils is connected to the cathodes of SCR₁ and SCR₂. Pulsing leads 17 and 18 proceed respectively to the gates of SCR₁ and SCR₂. A diode bridge rectifier 20 is connected to one AC line, and provides DC voltage of positive polarity on lead 21 and of negative polarity on lead 22. The latter may be considered a point of reference potential. Lead 21 proceeds to the anode of SCR₁ via the actuating coil 23 of a mercury plunger relay 24, which is connected to a load and its own voltage supply in the conventional and usual fashion. Lead 21 is connected via a relatively high resistance R with the anode of SCR₂. R is in part a current limiting resistance. Connected across the anodes of SCR₁ and SCR₂ is a capacitor C.

Assume that SCR₁ is conductive, and SCR₂ non-conductive. If a positive pulse is applied to the gate electrode of SCR₂ it becomes conductive. Simultaneously, a negative voltage is applied to the gate electrode of SCR₁, which has no effect on operation. The electrode a of capacitor C is at high potential prior to firing SCR₂, and the electrode b is at low potential. The capacitor C then discharges through SCR₂ and in so doing drains current from the circuit of SCR₁ sufficiently to render SCR₁ non-conductive. The function of capacitor C is to provide commutation, i.e., to assure that turning on SCR₁ will cause SCR₂ to turn off, and vice versa, to assure that turning on SCR₂ will turn SCR₁ off.

On moving plunger 15 to the left, in FIGURE 1, a positive pulse is applied to the control electrode of SCR₁ and a negative pulse to the control electrode of SCR₂. SCR₂ now cuts off and SCR₁ becomes conductive.

The function of the negative pulses is not to de-fire the SCR's, but this function is accomplished by the commutating capacitor C. It follows that it is not required that coils 14, 15 be adjacent and provided with a common plunger 15. These may be widely separated and provided with separate plungers 15', 15''. The system will commutate provided the plungers are inserted into the coils 13, 14 in alternation. The system then has application, for example, to a limit switch system, FIGURE 2, in which one plunger and coil 30 is located at one point along the route of a moving object (not shown), the other plunger and coil 31 is located at another point along the route, remote from the one point. The mercury plunger switch may then control a reversible motor, either to terminate its rotation, or to reverse its direction, or to actuate an indicator, and the motor may move the object.

While I have disclosed a preferred embodiment of my invention, it will be apparent that variations of the details of construction specifically illustrated and described herein may be resorted to without departing from the spirit and scope of my invention, as defined by the appended claim.

I claim:

1. A system for supplying current to a load at will, comprising:
 - a DC voltage source,
 - a first SCR,
 - a second SCR,
 - means connecting said load in series with said DC voltage source and with said first SCR,
 - actuatable member means for generating a positive pulse

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at the gate of only said first SCR in response to a first movement of said actuable member means and for generating a positive pulse at the gate of only said second SCR in response to a second movement of said actuable member means,

5 a commutative capacitor means connected between the anodes of said SCR's, and

an impedance connected in series between said DC voltage source and said second SCR, wherein said means for generating includes

10 a hollow sleeve,

two stationary permanent magnets located at the opposite ends of said sleeves,

two stationary coils each adjacent one of said permanent magnets within said sleeve and a common movable plunger extending into both said coils and movable simultaneously toward either one of said permanent magnets and away from the other of said permanent magnets, thereby to induce simultaneously a positive voltage in one of said coils and a negative voltage

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in the other of said coils on a movement of said common plunger toward said one of said coils.

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