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Patents Law, 5727 - 1967

תעודת פטנט
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HIGH VOLTAGE REED SWITCH		ממסר למתח גבוה

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תעודה זו הינה אישור כי דבר מתן הפטנט* נרשם בפנקס הפטנטים.

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*** תנאי תוקף הפטנט ראה בגב התעודה**

HIGH VOLTAGE REED SWITCH RELAY

This invention relates to electric engineering and more particularly to reed switch relays with high voltage insulation used between the input and output and can be used in over-current protection systems in high voltage power supplies in powerful lasers and radars.

Reed switch relays with high voltage insulation containing comprising a permanently located reed switch, control coil and high voltage insulator inserted between them are known [1], [2].

The drawback of these devices is their limited field of use because of inadjustable (uncontrolled) zeroing threshold, which is very important for their use as current relays in high voltage electric installations.

As a prototype a high voltage reed switch relay which consists of a permanently fixed insulating body formed with cylindrical chamber and a mobile insulator formed as a cylindrical tube inserted in this chamber, a coil with Π-shaped ferromagnetic core inside a fixed insulator and a reed switch eccentric to a ferromagnetic shunt mounted in a mobile insulator [3]. Moreover, owing to the eccentricity, in turning the mobile insulator the reed switch is remoted from the Π-shaped ferromagnetic core poles and is replaced with the ferromagnetic shunt. In this way efficient control of the relay engagement threshold is enabled.

The limitation of this device is its limited field of applications owing to the low response time of reed switches (1-2 milisec). This response time is sufficient for over-current protection of high voltage electric power supplies, however it is insufficient for protection from sudden electrical shorts caused by insulation breakdown which are accompanied by high amplitude current impulses with a high slope of the leading edge (the di/dt value). In this case the response time must be tens of microseconds.

The object of this invention is to extend the possible uses of the device by decreasing its response time at sharp sudden current changes in the input circuit.

To attain the above object an additional chamber is added to the fixed insulating body that holds impulse current transformer, electric amplifier and output switching element, with the primary current transformer winding formed with a high-voltage

insulated wire to be operated under full working voltage of the device, and the secondary winding is connected to the input of electronic amplifier whose input is connected to the control circuit of the switching element, such as thyristor, moreover the reed switch outputs leaving the mobile insulator and entering the mentioned additional chamber are connected to the mentioned control circuit of the switching element are connected to the same switching element control circuit.

Further, the electronic amplifier has one more energy accumulator connected in its supply circuit which is formed with condenser and diode connected in the open circuit of one of the ingoing wires of the external power supply.

To attain the object of the invention, in addition to that the device can be engaged by a certain current level reached in the controlled high voltage circuit, its engagement can be initiated following drastic current changes in the controlled circuit, which is typical for sudden break-downs of high voltage insulation in the electric system subject to protection. As this takes place, the time of the device response is reduced, firstly owing to that the reed switch engagement is well before the current in the controlled circuit reaches the threshold value, and secondly owing to deducting the reed switch short circuit time from the total engagement time of the device.

Fig. 1 shows the fixed insulating body design: horizontal cross-section

Fig. 2 shows the high voltage reed switch relay assembly: vertical cross-section

Fig. 3 shows a possible version of the electric diagram.

High voltage reed switch relay shown in Fig.1 consists of insulating body 1 formed with cylindrical chamber 2 with the control coil, cylindrical chamber 3 provided for the mobile insulator and rectangular chamber 4 provided for the current transformer with electronic amplifier and output switching device. Control coil 5 (Fig. 2) is formed with ferromagnetic core 6, whose poles 7 point to reed switch 8. Reed switch 8 reed switch eccentric to a ferromagnetic shunt 9 mounted in mobile insulator 10 with a position locator formed as dielectric bolt 11. The control coil and mobile insulator chambers are closed by partition insulators 12 and 13 respectively with coil and reed switch outputs passed through them. The mobile insulator chamber with reed switch is filled with silicon, and the control coil chamber - with epoxy encapsulator. Reed switch

14 outputs point towards chamber 4, enter it via similar partitioning insulator and are connected to output switching element control circuit 15 formed with a thyristor (Fig. 3).

The PCB in the same chamber holds impulse current transformer 16 formed on ferrite ring 17, electronic amplifier 18 whose output is connected to a terystor used as switching element control circuit 15. Accumulating condenser 19 and diode 20 are located on the same PCB. The primary winding of current transformer 16 is formed as a piece of high voltage wire passed through the hole in ferrite ring. The primary winding of current transformer and control coil 5 can be connected to the same circuit of the controlled current or to different circuits.

The device operates as follows:

In normal operation mode of the electric device the current flowing through high voltage circuit and consequently in control coil 5 is too low for engagement of reed switch 8. Permanent load current flowing through the primary winding of impulse current transformer 16 is not transformed to the secondary winding and the signal does not arrive at amplifier input 18. Thyristor 15 is cut off and no signal appears at the device output. In emergency insulation breakdown a drastic current change occurs in the control circuit that causes voltage impulse generation at the secondary winding of transformer 16. This voltage is amplified by amplifier 18 and is supplied to control diode of thyristor 15. The terystor is momentarily triggered and discharges accumulating condenser 19 to the external working element (for example controlled high voltage discharger). When emergency is not accompanied with no very quick current changes, the voltage generated at the secondary winding of impulse transformer 16 which is proportional to the current change rate in the control circuit, is insufficient to trigger terystor 15. In this case the current in the controlled circuit is increased to the value of reed switch 8 engagement threshold. Engagement of reed switch 8 results in cutting off thyristor control circuit 15 and its triggering. As this takes place, similarly to what was mentioned above, condenser 19 is discharged on the external working element. Reed switch 8 is adjusted to the preset engagement current by turning mobile insulator 10 around its axis. In this turn reed switch 8 is drawn away from poles 7 of the control coil and is replaced with ferromagnetic shunt 9. Consequently the reed switch sensibility is decreased and the

engagement current is increased accordingly. After the engagement current is adjusted to the appropriate value, the location of mobile insulator 10 is fixed with bolt 11.

Accumulation condenser 19 together with diode 20 makes the device independent on the external power supply in an emergency.

INFORMATION SOURCES

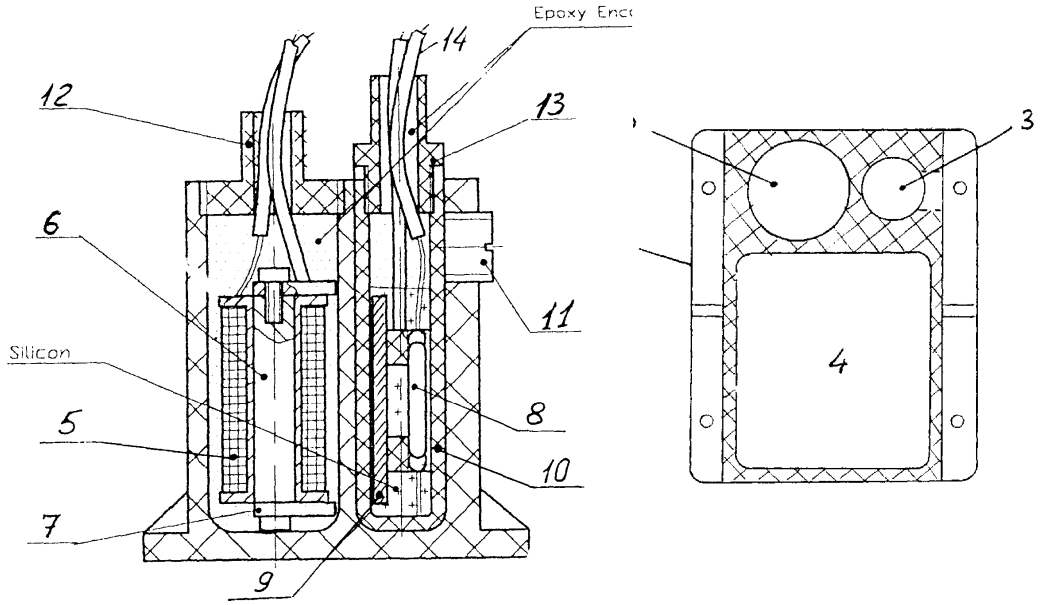
1. USSR Inventor's license N 836704, class H01H51/28, 1981
2. USSR Inventor's license N 1101920, class H01H51/28, 1984
3. USSR Inventor's license N 1379927, class H01H51/28, 1984

What is claimed is:

1. High voltage reed switch relay consisting of a fixed insulating body with a cylindrical chamber and a mobile insulator formed as a cylindrical tube inserted in this chamber, a coil with Π-shaped ferromagnetic core in the fixed insulator and a reed switch reed switch eccentric to a ferromagnetic shunt mounted in mobile insulator f e a t u r i n g that in order to extend the application fields an additional chamber is added to the fixed insulating body in which impulse current transformer, electronic amplifier and output switching element are located, with the primary winding of the transformer formed as a wire coated with high voltage insulator to be operated under full working voltage of the device, and the secondary winding connected at the electronic amplifier input whose output is connected to the switching element control circuit, such as thyristor, with the reed switch outputs leaving the mobile insulator and entering the mentioned additional chamber connected to the same switching element control circuit.

2. High voltage reed switch relay in claim no. 1 f e at u r i n g an electronic amplifier with an additional energy accumulator in the supply circuit formed as a condenser and a diode connected in the diode connected in the open circuit of one of the input wires of the external power supply.

Inventor V. Gurevitch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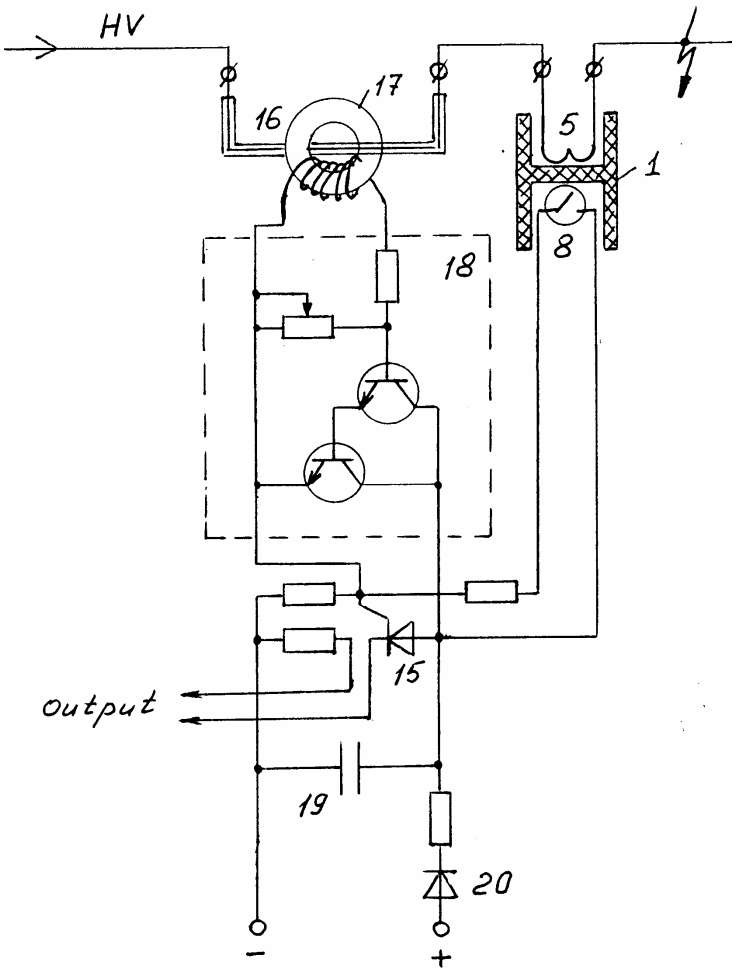
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