

- [54] **SWITCH SPRING FOR A RELAY**
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- [58] Field of Search...**200/166 C; 335/196; 29/630 C**

- [56] **References Cited**
UNITED STATES PATENTS
 2,434,992 1/1948 Durst200/166 C X
 2,921,163 1/1960 Pfeleiderer200/166 C X

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Attorney—George H. Spencer et al.

[57] **ABSTRACT**
 A relay switch spring composed of an elongated flat strip which has a core made of an electrically conductive material surrounded by a sheath of material of a lower conductivity than the core material. The strip has a free end to which a contact is connected so that the contact engages both the core and sheath material.

4 Claims, 4 Drawing Figures

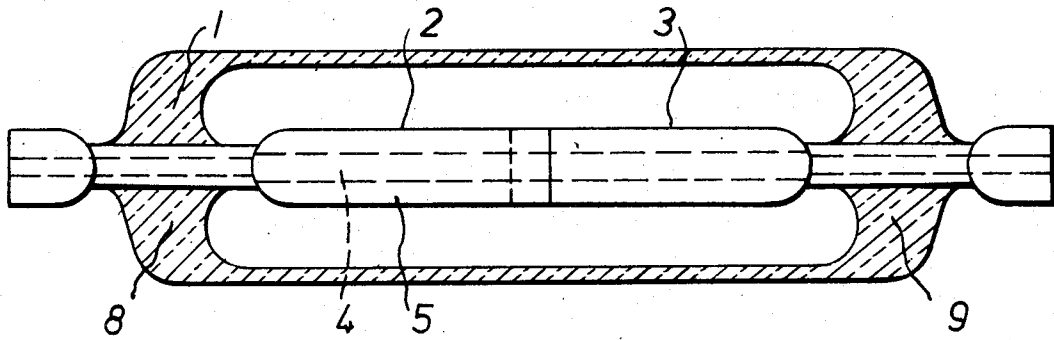


FIG. 1

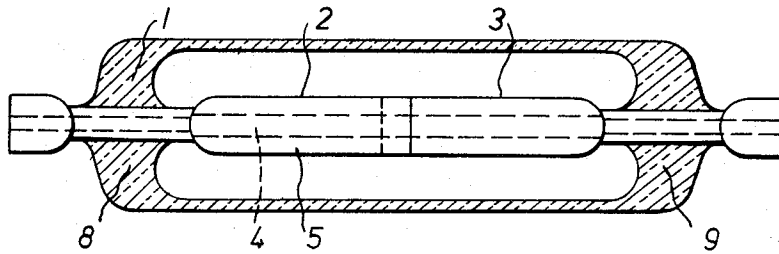


FIG. 2

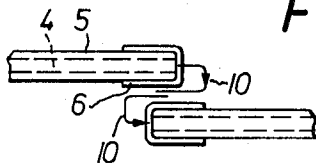


FIG. 3

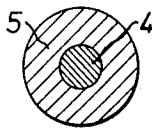
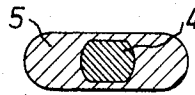


FIG. 4



SWITCH SPRING FOR A RELAY

BACKGROUND OF THE INVENTION

The present invention relates to a switch element, and more particularly to a switch spring for a relay such as a reed type relay.

A simple reed relay generally consists of two such switch springs which are made of a nickel-iron material usually in the ratio of 50:50. These springs are fused in a gastight manner in a glass tube. This ratio is chosen because of the glass fusing technique employed and for reasons associated with the magnetic phenomena involved. When these switch springs are subjected to a longitudinally directed magnetic flux, they attract one another and thus establish an electrical contact. This contact point is generally coated with a special contact material, e.g., gold or rhodium.

Since the switch springs are made of a nickel-iron material of the aforementioned ratio, a comparatively high resistivity, that is in comparison with the above-mentioned contact material, will be encountered. As a result it is generally the case that the resistance of reed contacts is much higher than the pure contact resistance, that is, at the point of contact.

It should be noted that attempts have been made to solve this problem. For example, it has been attempted to coat switch springs for reed relays with an electrically conductive material, e.g. copper, before they are fused. However, this has not led to any reasonable result since this material was always strongly attacked at the fusion point.

SUMMARY OF THE INVENTION

It is, therefore, a general object of the present invention to overcome the above described disadvantage of presently known switch springs for relays.

It is a more specific object of the present invention to provide a switch spring which may be used in a relay and which has a continuous core of an electrically conductive material and an equally continuous sheath surrounding the core of an electrically less conductive material.

It is another specific object of the present invention to provide a switch spring which may be used in a relay and which has a contact engaging both the core and sheath.

These as well as other objects which will become apparent in the discussion that follows are achieved, according to the present invention, by a switch spring for a relay such as a reed type relay, consisting of a continuous core of electrically conductive material, e.g., copper, silver, gold or platinum, and an equally continuous sheath of ferromagnetic material which surrounds the core and which is electrically less conductive than the core material.

In one embodiment, the spring is configured as an elongated strip having a free end which has a contact connected thereto. The contact engages both the core and sheath of the spring to establish therewith a conductive connection.

Such a switch spring can be easily fused in glass. The thickness of the electrically conductive core may be approximately one third of the thickness of the spring.

In one advantage of the present invention, it becomes possible to employ a wire provided with such a core to produce the switch springs. With otherwise

identical dimensions, it is possible to make reed contacts from such wire material with a resistance of 10 to 15 mΩ instead of the normally encountered resistances of 50 to 60 mΩ in switch springs of known construction.

A further advantage of such switch springs according to the present invention is that the number of "thermoelectric" junctions are reduced by two and that the remaining "thermoelectric" junctions are spatially closer together, that is, they are disposed only in the vicinity of the actual contact point. This solves the need for switching without thermal stresses which would adversely affect the switching operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of a reed relay employing switch springs according to the present invention.

FIG. 2 is an enlarged partial side view of the switch springs of FIG. 1 showing the contact ends thereof.

FIG. 3 is a cross-sectional view of one embodiment of the switch spring of the present invention made from a wire with a center core.

FIG. 4 is a cross-sectional view of a preferred form of a switch spring according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Because of the reliability of the contact resistances in reed relays employing the switch springs of the present invention, it is quite often found desirable to use the relays as check switches. However, such a contact unit is found to have an undesirable number of material junctions which, from a thermoelectric point of view, act as thermojunctions.

As a result, unsatisfactory high thermoelectric voltages are produced at these junctions. There are usually four junctions, namely, two copper-iron-nickel junctions and two iron-nickel-contact material (e. g., rhodium) junctions. Also, with a dissimilar contacting material on the two strips, the contacts themselves form a junction.

A solution is provided by the present invention to the high thermoelectric voltages problem by the provision of a novel configuration of the switch spring contact, to be described hereinafter.

FIG. 1 shows a glass vial or tube 1 and the two switch springs 2 and 3 which were fused into the frontal faces 8 and 9 respectively of the glass vial 1.

The switch springs 2 and 3 consist of an electrically highly conductive core 4 which may consist of copper, silver, gold or platinum, and an outer sheath 5 of a ferromagnetic material. In order to achieve proper bonding this is generally a nickel-iron alloy having a mixing ratio of 50:50.

Preferably, the switch springs 2 and 3 will be configured to have the flat shape shown in FIG. 4, although it should be understood that other and different shapes may be utilized as desired without departing from the scope of the invention.

A flat shaped spring as shown in FIG. 4 can be made for example of a cored wire having a cross-section as shown in FIG. 3 by flat pressing this cylindrical wire.

Referring to FIG. 2, the switch springs 2 and 3 are shown to include contacts 6 of highly conductive

material at their free ends. The contacts 6 are connected to the free end of the spring switches 2 and 3 so that they engage and securely contact, both the sheaths 5 and the cores 4. As a result, contact is made directly during switching, between the electrically highly conductive parts 4 and 6 of the two switch springs. The resulting conductive path is indicated by the arrows 10. When the contact coatings 6 are applied electrolytically, for example, there is readily produced a high conductance electrical contact between the inner core 4 and the contact material 6 so that the requirement for a reduced contact resistance is met.

By configuring the switch spring to have a core and a surrounding sheath, by choosing the exemplary category of materials mentioned above and by arranging the contacts at the free end of the spring body so that the contact is enhanced by a direct connection, via the contacts, between the cores of the two switch springs, the present invention achieves the desired objective of reducing the total switch contact resistance. For example, it has been found that the total switch contact resistance is reduced from a normal range of 50 to 60 mΩ to a range of 10 to 15 mΩ.

Also, because the contacts are configured to permit a direct connection between the cores of the two switch springs, the unsatisfactory "thermoelectric junction" problem is substantially eliminated. That is, referring to

FIG. 2, the current flow as indicated by arrows 10 will effectively by-pass two junctions, namely, the copper-iron-nickel junctions.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

I claim

1. A switch spring for a relay, composed of an elongated strip having a free end and comprising a continuous core of an electrically highly conductive material, a continuous sheath surrounding and coextensive with said core and made of a ferromagnetic material, and, at the free end of said strip, a contact which engages both said core and said sheath and thus is conductively connected therewith.

2. A switch spring as defined in claim 1 wherein said core is of copper, silver, gold, or platinum.

3. A switch spring as defined in claim 1 wherein said sheath is of a nickel-iron alloy.

4. Two switch springs each as defined in claim 1, disposed with their free ends adjacent one another so that upon movement of said free ends together said contacts on said springs come to bear against one another.

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