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(54) AN ELECTRICAL CONTACT ARRANGEMENT

(71) We, SCHLEICHER GmbH & Co RELAIS-WERKE KG, a German Kommandit Gesellschaft of Pichelswerderstrasse 3-5 1000 Berlin 20, Federal Republic of Germany, do hereby declare the invention,

for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The invention relates to an electrical contact arrangement having a plurality of sets of contacts.

A relay having positive switching of contacts is known from German Auslegeschrift No. 1,912,077 and substantially comprises a U-shaped core yoke having an energising winding and an angled armature, the longer limb of which carries a contact-operating slider. The end carrying the contact of a leaf spring extending longitudinally and serving as a centre contact spring is mounted in a recess of this contact-actuating slider without play. The other end of the centre contact spring is clamped in a body made of insulating material comprising several layers. The outer contact springs are located at both sides of the centre contact spring and extend from the clamping point at a sharp angle to the centre contact spring. On welding of two contact pins together, the relative movement of the contact pins which normally occurs during switching is eliminated and from two contact springs respectively and the insulating body a triangular connection is formed which must accommodate the operating forces of the drive system.

By eliminating the relative movement of the contact pins, the contact springs of course take up the forces longitudinally, which forces may lead to deformation of the contact springs and thus to mis-switching. On the other hand, with the described contact arrangement, a relative movement of the contacts only occurs as long as there is a sufficient separation of the contact. As the contact separation decreases with time however as a result of burning of the contacts, mis-switching must be taken into consideration to an increasing extent particularly when the lifespan is advancing.

From German Gebrauchsmuster No. 1,906,109 an electromagnetic wire-spring relay is shown in which, of course, the problem of positive contact movement did not occur. The relay is equipped with two switching contacts. The movable centre contact springs comprise wire, are bent in U-shape and have two limbs of different length. While the end of the longer limb terminates in an element for connection to the current and is firmly clamped in a body made of insulating material, the end of the shorter limb is located between rigid outer contacts. A plastics intermediate member bringing about the switching movement is moulded on to one limb of an angled armature and engages into the contact spring with the free end thereof almost at the same level.

Furthermore, German Auslegeschrift No. 1,278009 shows an electromagnetic relay having a hinged armature. This relay contains a yoke fixed to a baseplate the centre limb of which carries a coil. A hinged armature is pivotably mounted in front of this limb. Moreover, the baseplate carries the outer contact pins fixed to rigid contact carriers; the other ends of the contact carriers project as soldering tags beyond the baseplate. The movable centre contact spring substantially comprises a two-part leaf spring. While the first leaf spring is also fixed to a contact carrier located in the baseplate, the end of the second leaf spring is provided with the centre contact pins. The connection of the two spring parts takes place by means of a plastics body connected in fixed manner to the hinged armature.

In this and in the previously described

relay the problem of positive contact movement remains unsolved as in both cases the very soft switching behaviour does not permit positive contact movement. Of course in both cases and in a simple manner it has been possible to avoid multiple supply of current to movable switching elements by means of stranded wires and soldering points obtained thereby.

The present invention therefore seeks to create a positive contact movement arrangement having a high switching reliability.

According to the invention, there is provided an electrical contact arrangement having a plurality of sets of contacts each set comprising two rigid stationary contacts mounted on an insulating base and a movable contact spring of generally v-shape one arm being clamped to the base and the other arm carrying a movable contact movable between the stationary contacts and an actuating element engaging all of the said other arms at a point on the triangle formed by the movable contact spring and a line between the movable contact and the location of the rigid connection of the contact spring to the base.

The invention will now be described in greater detail, by way of example, with reference to the drawing, the single figure of which shows a side view of a switching contact.

In the drawing a body of insulating material is designated 1, a movable contact spring bent to a v-shape is designated 2, comprising two spring arms 2*a*, 2*b* and a contact actuating element is designated 3 by which the spring arm 2*a* of the movable contact spring is closely engaged on both sides, said arm 2*a* carrying at one end a contact 6*a*. Two short rigid co-operating contact arms 4, 5 are fixed in the body 1 made of insulating material. The end of the spring arm 2b is fixed to a short rigid arm 6 which is also clamped firmly in the body 1 of insulating material.

The mode of operation of the positive contact movement arrangement is as follows: in the position of rest of the switching contact spring 2, the contact 6*a* thereon lies on a rigid co-operating contact 5*a* on the arm 5 under prestress. A force F acts on the contact-actuating element 3, and the point C is moved over the arc *b* having the radius $\overline{BC}$. Thus the contact 6*a* covers the distance $\overline{AA_1}$ by the time the prestress is reduced but before changeover of the contact. Further movement of the contact-actuating element 3 brings the contact 6*a* into abutment with a second co-operating contact 4*a* on the arm 4; the point C thus moves farther along the arc *b*. The movable contact 6*a* then moves on the rigid co-operating contact 4*a* by the distance $\overline{D_1D}$.

If now, in the case of a fault, the centre contact 6*a* is welded to one of the co-operating contacts 4*a*, 5*a*, then an extremely stable triangular connection is formed by the spring arms 2*a*, 2b and the line joining the contact 6*a* and the end of the arm 6, which line is maintained rigid by the rigidity of the arms 4, 5 and 6 and the body 1. The force F urges the point C of the spring arm 2*a* to follow the arcs *a* or *d* having the radii $\overline{AC}$ or $\overline{DC}$ according to which one of the two co-operating contacts 4*a*, 5*a* is welded to the movable contact 6*a*. The spring arm 2*b* on the other hand is urged to follow the arc *b* having the radius $\overline{BC}$. As the spring arms 2*a*, 2*b*, are connected at point C to form a unit they are unable to follow these arc paths, i.e. under load, the contact actuating element 3 causes tension and compression loads to occur in the spring arms 2*a*, 2*b*, these loads increasing by a multiple the power requirements for the drive system, and prevent further operation of the switch. According to the predetermined conditions (the length, thickness and material of the movable contact spring) it may be necessary to stiffen the spring arm 2*a* in certain areas by means of additional reinforcement. As a result, during normal actuation of the contact spring 2 by means of the contact-actuating element 3, the large relative movement of the contacts with respect to one another, which has already been described above is favourably achieved.

In order that the previously described movements can be carried out, it is absolutely necessary that the point of engagement for the contact-actuating element 3 should lie at a point on the above described triangle. The point of engagement of the contact actuating element 3 is dependent on the desired relation of the forces at points A, D and C. The optimum spacing between the contact-actuating element 3 and the movable contact 6*a* for perfect switching behaviour is approximately 30% of the total length of the spring arm 2*a* in the embodiment shown.

A positive contact movement arrangement for several switching contacts presupposes that all the contacts are moved by means of a joint actuating element. If in such a contact arrangement as described above welding of a contact takes place then the position of all the movable contact springs 2 is established simultaneously to be the same since they are all engaged by the contact-actuating element 3, which has little or no play.

WHAT WE CLAIM IS:-

1. An electrical contact arrangement having a plurality of sets of contacts each set comprising two rigid stationary contacts mounted on an insulating base and a movable contact spring of generally v-shape one

arm being clamped to the base and the other arm carrying a movable contact movable between the stationary contacts and an actuating element engaging all of the said other arms at a point on the triangle formed by the movable contact spring and a line between the movable contact and the location of the rigid connection of the contact spring to the base.

2. A contact arrangement according to claim 1, wherein the spacing between the contact-actuating element and the movable contact is approximately 30% of the total length of the spring arm carrying the contact.

3. A contact arrangement according to claim 1 or 2, wherein the spring arm carrying the movable contact is stiffened in certain regions by means of additional reinforcement.

4. A contact arrangement according to claim 1, wherein the point of contact is directly adjacent the clamping point of the rigid co-operating contacts.

5. An electrical contact arrangement substantially as described herein with reference to the drawings.

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1571589 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*