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Reuting

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[54] **CONTACT SPRING SET**

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[58] **Field of Search** ..... 200/166 J, 166 C, 200/166 H, 166 F, 166 BH, 166 D

[56] **References Cited**

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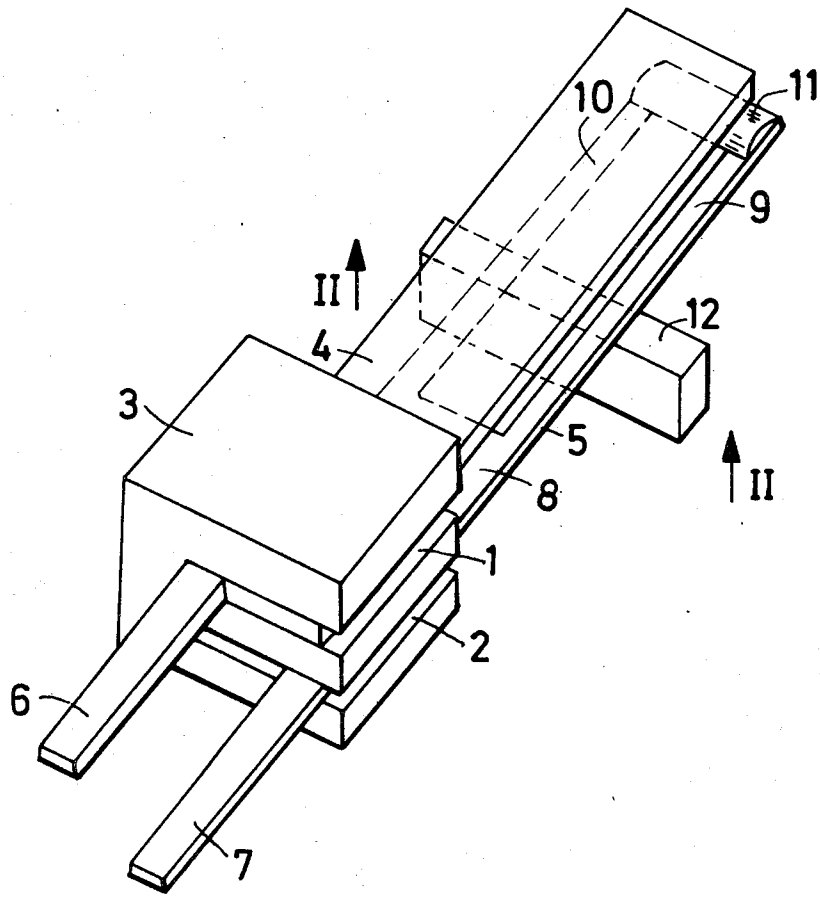
[57] **ABSTRACT**

A contact spring set has a generally rectilinear moving contact spring one end of which is movable into engagement with a co-operating counter-contact, the moving contact spring being provided at that end with a transverse contact of linear form extending at right angles to the longitudinal direction of the spring. The moving spring contact is in the form of two transversely spaced-apart parallel spring arms and the transverse linear contact extends between these two spring arms and joins them.

4 Claims, 2 Drawing Figures



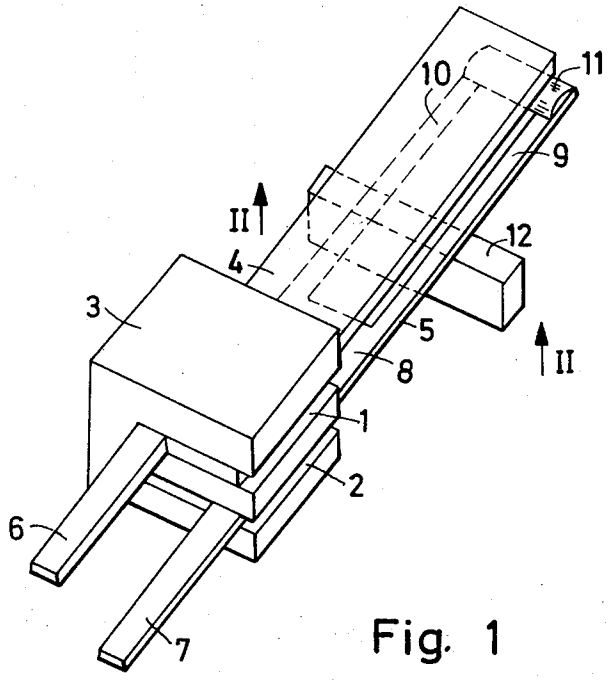


Fig. 1

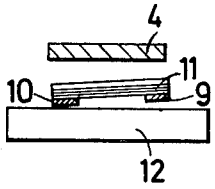


Fig. 2

CONTACT SPRING SET

The invention relates to a contact spring set comprising a contact spring which is gripped at one end, and at the free end of which there is provided a linear contact which extends transversely in relation to the longitudinal direction of the said spring and which co-operates with a counter-contact. Such contact spring sets are employed in electromagnetic relays, in which the co-operating contacts can operate as off-normal, normal or change-over contacts.

Hitherto, it has been usual, in contact spring sets for electromechanical relays, to provide the contact springs with point or tip contacts. In order to increase the reliability of contact making there are often also used therein double contacts which co-operate in pairs. In this form of construction of the contacts, the passage of the current is limited to a relatively small circular area around the point or points of contact, which may easily result in heating and rapid arc erosion of the contacts, especially in the switching of high-power currents.

In order to prevent this, the method has recently been adopted of providing the contact springs with so-called linear contacts. These linear contacts are, for example, prismatic or cylindrical form and riveted or welded on transversely to the longitudinal axis of the springs, so that the linear contacts and the counter-contacts touch one another over the whole length of a common surface line at closing, if the contact cross-sections are of appropriate shape. Owing to the fact that the contact profiles are generally flattened in the region of this surface line due to the elastic or plastic deformation of the contact material which always takes place, the passage of current in this arrangement takes place over an area which is extended along the surface line. In contrast to contact spring sets in which the contact springs are provided only with point or tip contacts, a lower electric contact resistance is present when linear contacts are provided. Consequently, with equal strength of current to be switched, heating and arc erosion of the contacts are substantially reduced owing to the fact that the current density in the transfer region is substantially lower than in contact spring sets having point or tip contacts.

A further advantage of linear contacts of, for example, prismatic form resides in that, owing to their greater mass, they take up the necessarily generated heat more rapidly and more favourably, and owing to the fact that their area of heat transmission to the contact spring is larger, they give up more heat to the said contact spring and to the ambient atmosphere. Consequently, it is possible with linear contacts to switch currents of higher power without variation of the construction of a relay and without any breakdowns due to arc erosion of the contacts or deficient transmission capacity.

However, such advantages of a linear contact over a point or tip contact can only be obtained, with otherwise substantially equal dimensions of the spring set, if it is ensured that the contact and the counter-contact can in fact touch one another along the whole — or at least almost the whole — surface line. For this purpose, it is not only necessary for the contact and the counter-contact to be parallel, or to have exactly equal curvature, in the region of their line of contact, but in addition the contact spring must be absolutely accurately

aligned, which is generally not the case owing to unavoidable faults in manufacture and inaccuracies in fitting. Consequently, there is only obtained a unilateral punctiform bearing of the linear contact, which must be eliminated by complicated, labour-intensive adjustment. This adjustment is particularly difficult in the case of spring sets which — following the trend towards miniatureisation — must interrupt currents of high strength with minimum dimensions. In such cases, the contact springs are generally made short and thick, and they are also made wide in order that they may be able to support a linear contact of maximum length. This necessarily results in a high resistance to twisting, which in turn opposes automatic application of the linear contact over its entire length. The adjustment is then particularly difficult and generally does not remain permanently effective.

The object of the present invention is to provide a contact spring set of the kind described at the beginning of this specification, wherein it is ensured, without adjustment work, that the linear contact always comes into contact with the associated counter-contact over its entire length. It is also intended that the spring force of the contact spring shall not be reduced in the direction in which it is actuated and that the contact spring shall have good transverse rigidity, so that lateral pitching movements or vibrations, which might result in an indeterminate contact-make, are prevented.

In accordance with the invention, this object is achieved by virtue of the fact that the contact spring comprises two spring arms which are connect3d together by the linear contact.

Due to this design, in which the two spring arms supply in common the necessary spring force in the direction of actuation, the two spring arms, in contrast to a contact spring consisting of only one arm, not only substantially reduce, with the same spring force, the resistance to torsion about the central axis of the contact spring, which in itself results in a better application of the linear contact to the counter-contact, but in addition any torsion of the contact spring which is necessary for obtaining parallelism between the linear contact and the counter-contact and hence a complete application along the common line of contact, is effected with optimum utilisation of the force available for the operation of the contacts; because if the contact spring is twisted slightly in relation to the counter-contact, the force transmission bar which is present in relays and which is actuated by the electromagnet, first acts on the spring arm which is furthest from the counter-contact.

In this way, the said spring arm is moved towards the counter-contact with the full available force, which corresponds to the torsion of the whole contact spring consisting of the two spring arms and is generally sufficient in itself to bring about a parallel alignment of the linear contact and of the counter-contact. In exceptional cases where this is not initially achieved, complete parallelism is established at the instant when one side of the linear contact encounters the counter-contact. At this instant, the actuating bar acts with its full force substantially only on the spring arm which is furthest from the counter-contact and thus ensures that the counter-contact and the linear contact encounter one another over their whole common line of contact. In this case, the contact force is distributed, in the end stage, substantially equally to the two spring arms and hence to the whole width of the linear contact.

Owing to the connection of the two spring arms by the linear contact in the design according to the invention, a high lateral stability of the whole contact spring is obtained. In a further development of the concept of the invention, this can be further improved by connecting together the spring arms in the region in which they are clamped for mounting. This also facilitates manufacture and assembly, since the distance between the two spring arms no longer has to be adjusted for in fitting and clamping of the linear contact. In order further to enhance the lateral stability, the spring arms may be constructed as leaf springs. However, a good lateral stability is also obtained if the spring arms are constructed as rod-type springs, since lateral pitching movements are substantially eliminated by the clamping and the connection of the spring arms by means of the linear contact.

In the contact spring set according to the invention, the linear contact and the counter-contact may co-operate as normally open or as normally closed contacts. It is equally possible to provide a further counter-contact, in which case the two counter-contacts and the contact spring co-operate to act as a change-over contact. In this case, linear contact is provided on both sides of the spring arms.

An embodiment of the invention will hereinafter be described with reference to the accompanying drawings, in which:

FIG. 1 is a view in perspective of a contact spring set constructed in accordance with the invention, and

FIG. 2 is a section through the said contact spring set along the line II—II of FIG. 1.

The illustrated contact spring set comprises a bearing block 3 of insulating material, which is formed whith two slots 1 and 2. A strip-form counter-contact 4 is disposed in the slot 1, while a contact spring 5 is held in the slot 2. The counter-contact 4 and the contact spring 5 comprise soldering lugs 6 and 7 respectively which project out of the bearing block 3 at the rear end.

The contact spring 5 is substantially U-shaped, i.e. it has in the region in which it is gripped in the bearing block a base portion 8, from which two spring arms 9 and 10 extend in parallel relation to one another. These two spring arms are connected together at their forward free end by a linear contact 11, which has the form of a bisected cylinder. For the actuation of the contact spring, the linear contact of which co-operates with the counter-contact to form a normally open contact, there is provided an actuating bar 12, which acts on the two spring arms 9 and 10 and which may be appropriately driven by the electromagnetic system of a relay.

In this design, the linear contact 11 and the counter-contact 4 need not be aligned exactly paralle' to one another in the inoperative position, so that no complicated adjustment work is necessary. If, for example, the spring arm 10 is further from the counter-contact 4 than the spring arm 9, as illustrated in FIG. 2, the actuating bar 12 first comes into contact with this spring arm 10 in its upward movement. The whole force of the actuating bar 12 thus first acts only on the said spring arm 10, whereby the whole contact spring 8 is slightly turned about its longitudinal axis, so that the linear contact 11 is generally already aligned parallel with the counter-contact 4. However, if this parallel alignment has not yet been completely reached, it is completed at the instant when the linear contact 11 bears against the counter-contact on the side of the spring arm 9. The actuating bar 12 then further acts with its whole force on the spring arm 10, so that the linear contact also completely bears against the counter-contact in the region of this spring arm 10. In the final stage, the linear contact is then pushed against the counter-contact 4 with substantially uniform distribution of force over its entire length.

It will be appreciated that the invention is not limited to the illustrated embodiment. Thus, the contact spring set may comprise, for example, a number of contact springs and corresponding counter-contacts. Also, the construction of the contact springs themselves may vary. The spring arms need not, for example, be connected together in the region of the points at which they are gripped. They may also consist of rod-type springs instead of leaf springs.

What I claim is:

1. In a contact spring set for use in a relay, said contact spring set being of the type which includes an insulating block and first and second contact members fixedly mounted in spaced relationship in said insulating block, said second contact member being selectively movable for engaging said first contact member in an electrical junction, an improved second contact member comprising, in combination, a pair of laterally spaced bars and a linear contact, said linear contact connecting said spaced bars at their free ends, said spaced bars having a length substantially greater than their width and being of a spring material, said bar spacing, length, width, and material cooperating to define means for twisting said second contact member about its longitudinal axis, when misaligned with said first contact member for engaging said linear contact with said first contact member in a substantially linear electrical junction when said improved second contact member is moved into engagement with said first contact member.

2. The improved contact spring set of claim 1 wherein said second contact member further comprises a base, said base being fixedly mounted in said insulating block, said pair of spaced bars extending outwardly from said base.

3. The improved contact spring set of claim 1 wherein said pair of spaced bars comprise leaf springs.

4. The improved contact spring of claim 1 wherein said pair of spaced bars comprise rod-type springs.

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