May 31, 1960 F. E. ROMMEL 2,938,979

MOUNTING OF ELECTRICAL CONTACTS

Filed Dec. 20, 1957

Fig. 1.

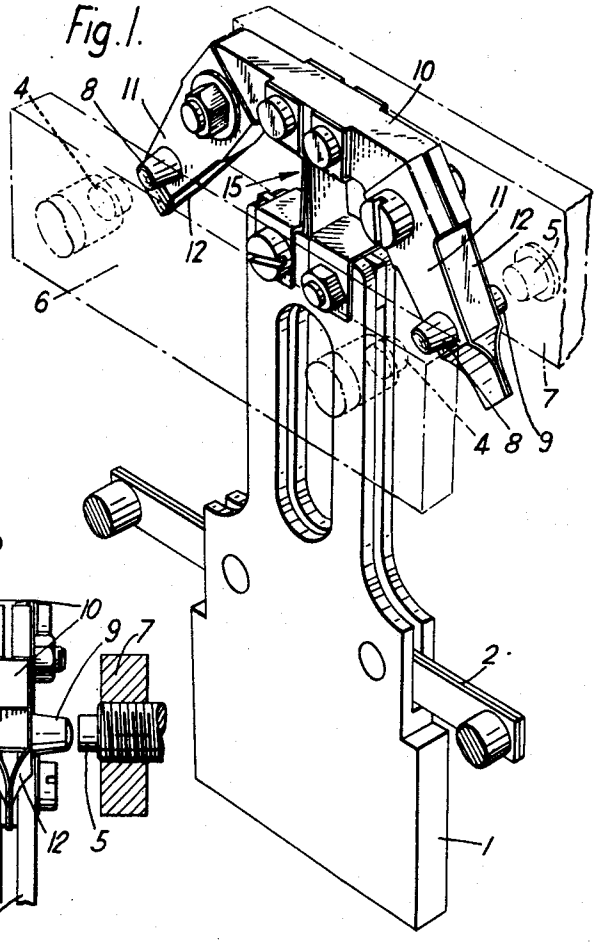



Fig. 2.

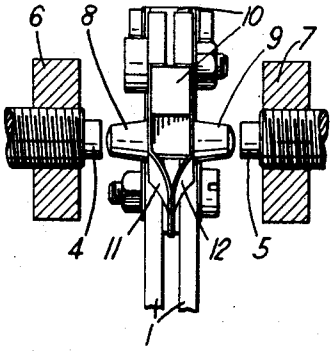
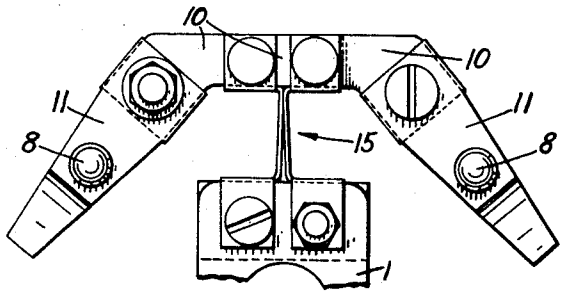



Fig. 3.

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# MOUNTING OF ELECTRICAL CONTACTS

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10 Claims. (Cl. 200—104)

This invention relates to electrical devices such as telegraph relays and double change-over switches in which two pairs of electrical contacts are supported by two corresponding carriers which are capable of relative movement to bring the two pairs of contacts together.

It is desirable to ensure, in such devices, that when the two pairs of contacts are brought together the engagement of two of them does not prevent the engagement of the other two. This is liable to happen if one pair of contacts has been incorrectly adjusted or has been subjected to excessive wear. Hitherto, the engagement of all the contacts has been ensured by pivotally mounting one of the carriers so that this carrier turns after engagement of the first two contacts and thereby brings the other two contacts into engagement, whereupon the new position of the pivoted carrier is maintained by friction. However, such a form of mounting is liable to the drawback that a pivoted carrier may be displaced accidentally by hand and two of the contacts may then remain in engagement with one another until the device is next operated.

According to the present invention, at least one of the carriers is mounted on a leaf-spring structure which is substantially rigid in the direction of the relative movement of the carriers but which is capable of a twisting movement, against its own restoring torque, in a direction to ensure that, when the carriers are moved relatively to bring the contacts together, each of the contacts is brought into engagement with its corresponding contact. The employment of such a structure ensures that when the carriers are brought together all the contacts engage even if one pair is slightly maladjusted or worn, whilst when the carriers are moved apart or when they are released after accidental displacement by hand the contacts return exactly to their initial relative positions.

When the invention is applied to a relay, the leaf-spring structure on which one of the carriers is mounted may be attached to the frame of the relay or alternatively to the armature. In the latter case, the contacts supported by this carrier are the moving contacts of the relay whilst the other pair of contacts are the static contacts. When the relay is of the kind in which a second pair of static contacts is provided and the armature supports a second corresponding pair of moving contacts, the first and second pairs of contacts being arranged to engage alternately as the armature moves back and forth, it is preferred to attach the leaf-spring structure to the armature since then only one such structure is required.

In order that the invention may be more easily understood and readily carried into effect a relay constructed according to it will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the armature of the relay showing in dotted lines the static contacts and their carriers;

Figure 2 is a side elevation of the top of the armature showing the moving and the static contacts at one side; and

Figure 3 is a front elevation of the top of the armature.

The electro-magnetic circuits and the general construction of the relay are not important and are not therefore shown but they could be in accordance with, for example, United States patent specification No. 2,559,399. The relay is provided with an armature **1** which is pivotally supported by a laminated suspension strip **2** the ends of which are secured to the frame of the relay. Four pairs of electrical contacts are provided. Two of these pairs, shown at **4** and **5** are static ones which are adjustably mounted in corresponding carriers **6** and **7** rigidly attached to the frame of the relay, whilst the other two pairs, shown at **8** and **9** are the moving contacts and these are supported by a common carrier **10** through leaf-springs **11** and **12**.

The carrier **10** which is in the form of a block of insulating material, is mounted on a leaf-spring structure which is indicated generally at **15** and which is attached at its lower end to the armature **1**. This structure **15** comprises two facing leaf-springs which are held in close engagement with one another at the top end and are separated slightly from one another at their lower ends, their facing surfaces being substantially in a plane which is parallel to and mid-way between the paths of movement of the contacts **8** and **9**. By arranging these facing surfaces in this way the structure **15** is substantially rigid in the direction of movement of the carrier **10** so that the positions of the contacts **8** and **9** are accurately determined by the position of the armature **1**. In addition, by separating the two springs slightly from one another at their lower ends the structure **15** is not able to be turned easily about a horizontal axis passing through the lower end of the structure **15** parallel to the direction of the contact movement. However, the structure **15** is able to twist, against its own restoring torque, about a vertical axis and thereby ensures that each of the two contacts **8** is brought into engagement with the corresponding contact **4** when the armature is moved forward, even if one of these contacts **4** is not accurately positioned. Of course, both the contacts **9** are brought into engagement with the contacts **5** on reverse movement of the armature.

After engagement of a moving and a static contact the spring **11** or **12** carrying the former rubs frictionally at its end on the other leaf-spring **12** or **11** and thereby absorbs energy and reduces contact chatter. The springs **11** and **12** are of such stiffness as to require a very much greater force to deform them than is required to twist the leaf-spring structure **15**; for example in the relay shown the former force is some 10 or 20 times the latter. In addition, the springs **11** and **12** must be stiff enough to prevent them collapsing onto one another when the relay is acted upon by its maximum operating current. Any such collapsing would permit the armature to come too near a pole face of the signals magnetic structure of the relay, and possibly into engagement with this face.

In a modified construction (not shown), the moving contacts **8** and **9** are carried at the ends of leaf-springs which are moved by an armature as disclosed in our United States patent specification No. 492,155, filed on Mar. 4, 1955, and now Patent No. 2,823,282, issued Feb. 11, 1958.

I claim:

1. An electrical device comprising a first carrier, a first pair of electrical contacts supported by said first

carrier, a second carrier mounted to be capable of movement relatively to said first carrier, a second pair of electrical contacts supported by said second carrier and arranged for cooperation with said first pair of electrical contacts, a leaf-spring structure supporting one of said carriers, and support means supporting said structure and movable relatively to the other of said carriers to bring about the relative movement of said carriers and of said contacts, said structure comprising a flat leaf spring lying substantially parallel to the direction of relative movement of the contacts so as to constitute a substantially rigid connection in this direction between said support means and the said one carrier, said spring also lying at an angle to a line between the contacts on a carrier, said structure being able to twist, against its own restoring torque, to ensure that when the support means and the said other carrier are moved relatively to bring the contacts together, each of the said contacts is brought into engagement with its corresponding contact.

2. In an electromagnetic relay, the combination comprising an armature, a leaf-spring structure mounted on said armature, a carrier mounted on said structure, a pair of electrical contacts supported by said carrier and moved by said carrier on movement of said armature, a second pair of electrical contacts mounted for cooperation with the first pair of electrical contacts, and a second carrier arranged to support said second pair of electrical contacts, said structure comprising a flat leaf spring lying substantially parallel to the direction of contact movement so as to constitute a substantially rigid connection in this direction between the said armature and the carrier mounted on the said structure, said spring also lying at an angle to a line between the contacts on a carrier, said structure being capable of a twisting movement, against its own restoring torque, in a direction to ensure that when said armature is moved to bring the two pairs together, each of the said contacts is brought into engagement with its corresponding contact.

3. In an electromagnetic relay, the combination comprising an armature, a leaf-spring structure mounted on said armature, a carrier mounted on said structure, first and second pairs of electrical contacts supported on opposite sides of said carrier and movable with said carrier, third and fourth pairs of electrical contacts mounted for cooperation respectively with said first and second pairs, and second and third carriers arranged to support respectively said third and fourth pairs of electrical contacts, said structure comprising a flat leaf spring lying substantially parallel to the direction of movement of said first carrier so as to constitute a substantially rigid connection in this direction between the said armature and the said first carrier, said spring also lying at an angle to a line between the contacts on a carrier, said structure being capable of a twisting movement, against its own restoring torque, in a direction to ensure that when said armature is moved to bring two pairs of contacts together, each of the contacts of the said two pairs is brought into engagement with its corresponding contact.

4. In a relay according to claim 3, the combination also comprising four leaf springs, each secured to said first carrier and carrying a corresponding one of the contacts of said first and second pairs, each of said springs being arranged in engagement with another of said springs and rubbing frictionally on this spring to absorb energy on engagement of contacts.

5. An electrical device comprising a first carrier, a first pair of electrical contacts supported by said first carrier, a second carrier mounted to be capable of movement relatively to said first carrier, a second pair of electrical contacts supported by said second carrier and arranged for cooperation with said first pair of electrical contacts, a leaf spring structure supporting one of said carriers, and support means supporting said structure and movable relatively to the other of said carriers to bring about the relative movement of said carriers and of said contacts, said structure comprising two facing leaf springs held close to one another with their facing surfaces lying substantially in a plane parallel to and midway between the paths of movement of said contacts and with their lengths extending substantially perpendicular to the said paths, whereby said structure is substantially rigid in the direction of said paths but is capable of a twisting movement, against its own restoring torque, in a direction to ensure that, when the said support means and the said other carrier are moved relatively to one another to bring the pairs of contacts together, each of the said contacts is brought into engagement with its corresponding contact.

6. A device according to claim 5, said leaf springs being mounted in close engagement at one end and slightly separated from one another at the other end.

7. In an electromagnetic relay, the combination comprising an armature, a leaf spring structure mounted on said armature, a carrier mounted on said structure, a pair of electrical contacts supported by said carrier and moved by said carrier on movement of said armature, a second pair of electrical contacts mounted for cooperation with the first pair of electrical contacts, and a second carrier arranged to support said second pair of electrical contacts, said structure comprising two facing leaf springs held close to one another with their facing surfaces lying substantially in a plane parallel to and midway between the paths of movement of the contacts of said first pair and with their lengths extending substantially perpendicular to the said paths, whereby said structure is substantially rigid in the direction of said paths but is capable of a twisting movement, against its own restoring torque, in a direction to ensure that when said armature is moved to bring the two pairs together, each of the said contacts is brought into engagement with its corresponding contact.

8. In a relay according to claim 7, the improvement of mounting the said leaf springs of said structure in close engagement at one end and slightly separated from one another at the other end.

9. In an electromagnetic relay, the combination comprising an armature, a leaf spring structure mounted on said armature, a carrier mounted on said structure, first and second pairs of electrical contacts supported on opposite sides of said carrier and movable with said carrier, third and fourth pairs of electrical contacts mounted for cooperation respectively with said first and second pairs, and second and third carriers arranged to support respectively said third and fourth pairs of electrical contacts, said structure comprising two facing leaf springs held close to one another with their facing surfaces lying substantially in a plane parallel to and midway between the paths of movement of the contacts of said first and second pairs and with their lengths extending substantially perpendicular to the said paths, whereby said structure is substantially rigid in the direction of said paths but is capable of a twisting movement, against its own restoring torque, in a direction to ensure that when said armature is moved to bring two pairs of contacts together, each of the contacts of the said two pairs is brought into engagement with its corresponding contact.

10. In a relay according to claim 9, the improvement of mounting the said leaf springs of said structure in close engagement at one end and slightly separated from one another at the other end.

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