April 1, 1941. L. J. A. LE GOFF 2,236,947

ELECTRIC RELAY

Filed Jan. 18, 1939

Fig. 2

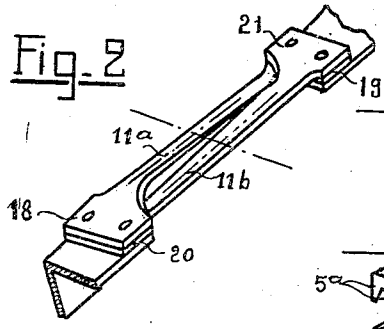


Fig. 1

Fig. 4

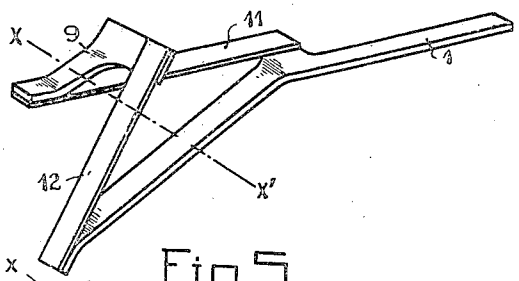


Fig. 5

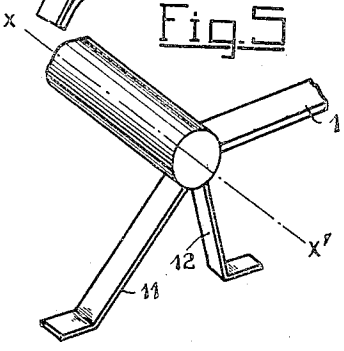
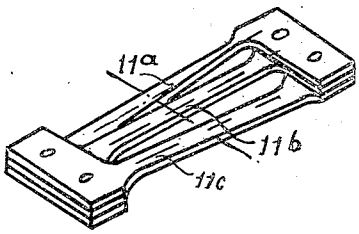


Fig. 3



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ELECTRIC RELAY

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4 Claims. (Cl. 175—336)

The present invention relates to electric relays such, for instance, as those used for operating electric contacts, shutters, screens and the like, but it is not limited in any way to relays used for these purposes.

The object of the present invention is to provide a relay of this type which is better adapted to meet the requirements of practice than those used up to this time.

According to an essential feature of the present invention, the movable part of the relay is, on the one hand, provided with an armature having teeth formed therein which are adapted to penetrate without contact in the intervals existing between the corresponding teeth of the pole pieces, and, on the other hand, mounted on the fixed part through springs made of blades or leaves disposed angularly with respect to one another.

This manner of mounting the movable part on the fixed part makes it possible to obtain an accurate guiding of said movable part, and therefore to avoid contacts between the respective teeth of the armature and the pole pieces. Furthermore, it improves the safety of operation of the device and makes it possible to dispense with the abutments generally provided for limiting the stroke of said movable part, this advantage being due to the existence of the teeth formed in the armature and the pole pieces, owing to which arrangement the magnetic effort passes through a maximum during the movement of the armature of the relay.

According to another feature of the present invention, in order to increase the safety of operation of the relay, the fixation of the movable part of the relay to the fixed part thereof is obtained by means of leaf springs each constituted by a plurality of elements arranged in such manner that the axis of each of said elements intersects the axis of rotation of the movable part.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is a perspective view of a relay made according to an embodiment of the present invention;

Fig. 2 is a detail view showing in perspective an arrangement of the springs serving for the fixation of the movable part to the fixed part, this spring arrangement including two elements;

Fig. 3 is a detail view analogous to Fig. 2 and relating to a modification;

Fig. 4 is a detail view of another spring arrangement;

Fig. 5 is a detail view of still another spring arrangement.

In the embodiment shown by Fig. 1, the relay according to the invention includes two arms 1 and 2 rigid with the armature 3—4 of said relay and connected to the fixed part of said relay, at their other ends respectively, through a spring pivoting connection. The armature 3—4 is operated by pole pieces 5 and 6 mounted on the ends of a core 7 around which is wound an energizing winding 8.

Thus, when armature 3—4 is attracted by pole pieces 5 and 6, the arms 1 and 2 can pivot with respect to the fixed part of the relay by deformation of the spring system.

The armature elements 3 and 4 are provided with teeth 3*a* and 4*a*, respectively, adapted to penetrate, without contact, into the intervals existing between corresponding teeth 5*a* and 6*a* provided in the pole pieces 5 and 6. As shown, these alternate teeth or ridges or projections and valleys are generally trapezoidal in cross-section, the base of any trapezoid comprising a valley being entirely imaginary, while the base of a trapezoid comprising a tooth merges into the body metal of the face on which the tooth is formed. This construction permits the intimate association of the cooperating faces, without contact taking place therebetween, thus increasing the flux density for rated ampere-turns. With an arrangement of this kind, I obtain, in the direction of the movement, a magnetic effort variable with the relative position of the armature and the pole pieces, in such manner that this effort passes through a maximum for a given position of the armature with respect to the pole pieces. In other words, in the course of the displacement of the armature, this magnetic force, which moves said armature against the action of antagonistic return forces (for instance, in the example illustrated by the drawing, the magnetic force moves the armature upwardly against the action of gravity on said armature and its support) first increases until the armature occupies said position corresponding to the maximum of said force. Then the magnetic force decreases and soon it does not any longer overcome the action of said antagonistic force so that it cannot move the armature upwardly any further.

Owing to this arrangement, it is unnecessary to provide mechanical abutments limiting the displacement of the armature under the action of the magnetic force, and this is a considerable

improvement over the prior art because such abutments are disadvantageous in that they are liable to involve seizing, sticking, or wedging.

The movable part of the relay (arms 1 and 2, with the armature 3—4 they carry) is connected to the fixed part (parts 9 and 10) through flat springs making an angle with one another. For instance, in the embodiment illustrated by Fig. 1, arms 1 and 2 are connected with said parts 9 and 10, rigid with the fixed portion of the relay, through springs 11—12 and 13—14 disposed at right angles to each other, respectively.

The relay above described may be used for actuating any device. For instance, as shown by the drawing, it serves to operate contacts 15—16, controlled through a bar 17 rigid with arms 1 and 2.

The spring blades which serve to fix the movable part of the relay to the fixed part thereof may be each constituted by several elements, the axis of each of said elements intersecting the axis x—x' about which the movable part of the relay is rotatable with respect to the fixed part.

An example of such a spring is shown by Fig. 2. Such a spring is made of two elements 11*a* and 11*b*. Element 11*a* is provided with two enlarged end-pieces 18 and 19 in which the fixation holes are provided. Element 11*b*, identical to the first mentioned element, is provided with enlarged end-pieces 20 and 21. It is arranged symmetrically in such manner that the end piece of one of the elements is located under the corresponding end-piece of the other element and inversely. Accordingly, the springs are slightly oblique with respect to each other and their axes intersect the axis of rotation of the movable system.

Fig. 3 shows a modification of the system, according to which the spring is constituted by three elements 11*a*, 11*b* and 11*c*.

Element 11*b* is located between the two other elements and elements 11*a* and 11*c* are slightly inclined so that each of them has one end piece above the corresponding end-piece of 11*b* and the other end piece under the other end piece of 11*b*.

Of course, the number of elements which constitute each spring can be multiplied at will. This spring arrangement including a multiplicity of elementary springs is advantageously utilized in the case of apparatus in which a high safety of operation is an essential feature, for instance relays for automatic signalling, especially on railway tracks. Owing to the use of a multiplicity of spring elements, an accidental breaking, due for instance to a defect in the matter of which the spring elements are made, does not bring the whole of the spring structure out of use, whereby the device can remain in operation, at least for a time.

As shown by Fig. 4, the lengths of the portions of each spring between its point of fixation and the axis of rotation of the movable part of the relay can be unequal.

When the shortest of these lengths becomes zero, each spring is disposed between the axis and a fixed support. An example of such an arrangement is given by Fig. 5. These springs may have their longitudinal axes in a common plane perpendicular or not to the axis of the movable part of the relay. This oblique relation of the longitudinal axis of each spring and of the axis of rotation can be applied to the other embodiments.

In all cases, each spring, working in a given direction, can be divided into elements, the angle of the projection of the springs on a plane perpendicular to the axis of rotation being a right angle, an acute angle or an obtuse angle.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What is claimed is:

1. A relay which comprises, in combination, a fixed part and a movable part having respective faces located opposite each other, one of said parts including an electro-magnet pole piece and the other the corresponding armature, a support rigidly positioned with respect to said fixed part, at least two springs for pivotally connecting said movable part to said support about a fixed axis perpendicular to the direction of said ridges, said springs consisting of elastic blades respectively each fixed at one end to said support and at the other end to said movable part, the planes of said springs intersecting each other along said axis, the faces of the said fixed and movable parts having interrelated parallel ridges thereon, of generally trapezoidal cross-section, the ridges of one face being adapted to engage snugly between those of the other face, without however contacting the latter, upon movement of said faces towards each other, the said springs being so associated with the movable part and the support as to permit the said snug relationship between corresponding ridges of the faces of the fixed and movable parts, while inhibiting lateral movement of said parts relative to each other sufficient to occasion contact between any portions of the said two faces.

2. A relay which comprises, in combination, a fixed part and a movable part having respective faces located opposite each other, said faces being provided with parallel ridges adapted to engage between one another, respectively when said parts are moved toward each other, one of said parts including an electro-magnet pole piece and the other the corresponding armature, a support rigidly positioned with respect to said fixed part, and at least two springs for pivotally connecting said movable part to said support about an axis perpendicular to the direction of said ridges, each of said springs being fixed at one end to said support and at the other end to said movable part, each said spring comprising two or more blade elements having their central portions lying side by side in intersecting but nearly parallel planes, the end portions of the blade elements being laterally extended from the central portions and so disposed that one end of a first blade element lies in contact with one side of the corresponding end of the second blade element, while the other end of the first blade element lies in contact with the opposite side of the other end of the second blade element.

3. A relay according to claim 2 in which each spring includes two blade elements the respective ends of which are fixed together so that each element has one end located over the corresponding end of the other element and the other end located under the corresponding end

of the other element, the intermediate parts of said elements lying side by side.

4. A relay according to claim 3 in which each spring includes three blade elements the respective ends of which are fixed together so that two of these elements each have one end located over the corresponding end of the third element and the other end located under the corresponding end of said third element, the intermediate parts of said three elements lying side by side.

LUCIEN JOSEPH ARMAND LE GOFF.