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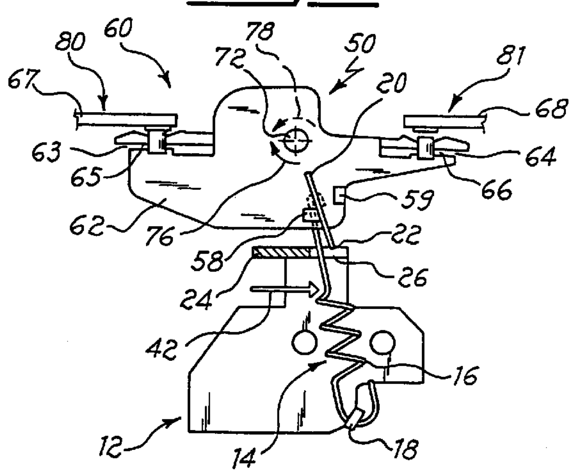
(54) Balanced slider, vibration and shock resistant, for movable contacts of auxiliary thermal switches and the like

(57) A balanced slider (60) comprises a movable equipment (62) rotating about a shaft (72) and provided with two movable contact arms (65, 66) cooperating with corresponding fixed contact arms (67, 68), the rotating movable equipment (62) being actuated by a snapping mechanism essentially comprised of a rigid tang (20) resting at a first end on a cantilever protrusion (24) of an anchoring bracket (12) and operating between two each other opposed reliefs (58, 59) integral with the movable equipment (62) and held in position by a spring (16) connected at a side to the rigid tang (20) and at the opposed side to a prolonging protrusion (18) of the supporting bracket (12) itself. To cause the snapping of the above mentioned mechanism, an intermediate point of the spring (16) is actuated by a force (42) directed essentially perpendicular with respect to a longitudinal axis of the spring (16) itself.

Fig.2



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Description

The present invention relates to an assembly of a slider and snap member used to convert a distorsion of one or more bimetal members in a snapping action on movable contacts of control and/or signalling auxiliary switches associated to electromechanical devices such as circuit breakers contactors and the like.

Specifically, the present invention relates to a slider, for the above mentioned use, particularly resistant to stresses due to shocks and local vibrations.

Since long time are well known assemblies of snapping member s and linear sliders, usable for converting the movement of bimetal means of thermal switches in a snapping of movable contacts of auxliary control and/or signalling switches.

These assemblies work rather well, however, having a slide member interested by linear movements, are prone to uncontrolled movements, due to stresses connected with accelerations due, for example, to shocks and vibrations, making unsafe the snapping of the movable contacts themselves.

As a consequence, it exists the need of thermal auxiliary thermal switches, driven by the above mentioned bimetal members, which are the most the possible resistant to the above mentioned stresses, particularly to linear stresses which are, at least partially aligned with the slider having the duty of transferring the movement of the snapping member s to the above mentioned movable contacts of auxiliary switches. The problem is particularly serious when electric devices are to be installed on machines producing strong vibrations, because these vibrations can make unsafe the snapping of auxiliary thermal switches having, as a consequence, either untimed circuit breaking when actually there are not overcurrent conditions to justify the circuit breaking or unduly delayed circuit breaking resulting in damages by overheating of protected devices and thus in failure of the protection.

US-A-4,423,296 discloses and claims a shock and vibration resistant electrical switch, of the kind suited to control high currents, consisting of two mass balanced counterrotating members controlled, through two opposed springs, by an actuating lever. This switch is obviously shock and vibration resistant, but suffers of the drawback of massive, encumbering and very complicated construction, so that it cannot be employed as auxliary switch of the kind controlled by a snapping member.

DE-A-2 030 210 discloses and claims a shock and vibration resistant switch in which it is tried to improve such a resistance by increasing the moment of inertia of a movable equipment and by adding some damping means. The switch could operate rather well, but is extremely complicated, expensive and needing frequent servicing.

DE-A- 2 035 549 discloses and claims a two pole rapid switch, obviously rather shock and vibration resistant, consisting of a snap-controlled balanced rotor, provided with two permanent magnets, able to drive two dry-reed contacts. This system is apreciable but is limited to control dry reed contacts and is not suited to control ordinary contact pairs in ambient air

A substantial sensitiviness reduction to mechanical external stresses on a slider can be obtained, according to the present invention, by using a slider pivottally moving around a rotation axis arranged to be the most the possible symmetrical with repect to the masses of the slider itself, so that the consequences of substantially linear external stresses are substantially null.

Particularly, is used a slider rotating around an axis arranged the most the possible near its mass center.

More particularly, the above mentioned slider has an essentially symmetrical distribution of moments of inertia of parts thereof, so that the stresses due to linear accelerations give substantially null results.

The features of the present invention will be particularly defined in the appended claims. However other features and advantages will result more apparent from the following detailed disclosure of an embodiment, not to be considered as limiting the disclosure, and provided with the enclosed drawings, in which:

- figure 1 is a diagrammatical view of a linear slider, associated to a snapping member , tipical of the prior art;
- figure 2 is a diagrammatical view of a rotating slider according to the present invention; and
- figure 3 is a front elevation view of a practical embodiment of a rotating slider according to the present invention.

Let us consider in advance figure 1 to completely understand how the acceleration stresses due to shocks and vibrations can interfer with a linear slider of the prior art. According to figure 1, an assembly 10 of snapping member and slider is formed by an anchoring bracket 12 supporting the snapping member 14 consisting of a spring 16 connected through a first end to a small bracket 18 located at a lower end of the anchoring bracket 12 and through an opposed second end to an intermediate point of a rigid tang 20 resting on a V-shaped slot 22 provided in an upper face of a square cantilever protrusion 24 integral with the bracket 12 and provided with a slot 26 for the passage of the upper end of the spring 16. The rigid tang 20 is engaged in a rectangular slot 28 of a saddle slider 30 formed by a bar 32 of insulating material provided with two other slots 33 and 34 having inserted movable contact arms 35 and 36 to be engaged with fixed contact arms 37a, 37b and 38a, 38b, respectively, forming a pair 40 of nomally open contacts and a pair 41 of normally closed contacts.

The operation of this prior art assembly, having linear movement is the following one:

normally the spring 16 mantains the rigid tang 20 located as depicted in figure 1, that is resting against the walls of the rectangular slot 28, containing the contacts of the movable arm 35 resting against the contacts of the fixed arms 37a and 37b, so that the saddle slider 30 remains in the position depicted in figure 1, assuring the closure of the pair 40 of normally closed contacts.

When to the spring 16 is applied a force 42 coming, for example, from bimetal relay assembly, this force begins to strain the spring 16 shifting rightwards its application point till this point occurs on the right side of a straight line lying on the rigid tang 20 and connecting the application point of the force of the spring 16 with the resting point of the tang itself in the V-shaped slot 22 on the protrusion 24. When the application point of the force 42 is on the right side of the straight line on the rigid tang 20, the drive of the spring 16 assures a direction inversion of the tang 20 resting on the opposed wall of the slot 28, assuring a shifting of the bar 32 of the saddle slider 30 which moves the movable contasct arm 35 out of engagement with the fixed contact arms37a and 37b and the movable contact arm 36 in engagement with the fixed contact arms 38a and 38b, allowing the opening of the normally closed contacts 40 and the closure of the normally open contacts 41.

It is understood how the presence of stresses due to shocks and/or vibrations can be translated into accelerations of the saddle slider 30 which, at last, are translated into both variations of the contact forces, existing between the movable and the fixed contacts, and incertitude in the snapping point because, when the spring 16 is near the straight line lying on the rigid laminate 20, it is sufficient a small shifting, either leftwards or rightwards of the laminate 20 itself for having it snapping, under the tensile bias of the spring 16, either leftwards or rightwards, with consequent incertitude of the snapping point or, what is worse, with repeated alternate snappings of the snapping member 14. It is understood how the presence of mechanical stresses can be damaging for this prior art device.

Reference is made to figures 2 and 3 to understand both the structure and the operation of the slider according to the present invention.

Referring in advance to figure 2, in which to members identical or similar to those present in figure 1 are given the same numerals, it is seen that an assembly 50 of snap member and slider comprises an anchoring bracket 12 supporting a snap member 14 completely similar to that depicted in the prior art of figure 1, comprising in fact also a spring 16 connected, at a first end, to a small lower bracket 18 and, at a second end, to a rigid tang 20, also completely similar to the tang of figure 1, also in its engagement with the V-shaped slot 22 into the square cantilever protrusion 24 also having a slot 26 for the passage of the spring 16. What is making the present invention different from the prior art, is a slider 60, of rotating kind, consisting of a movable equipment, or body, of insulating material 62 pivotable around a pin 72 fastened to support means (not shown) of the whole mechanism. This movable equipment 62 is provided near its pivot, just a little thereunder, with two opposed reliefs alternatively engaged with the rigid tang 20 of the snap member 14. Movable contact arms 65 and 66, supported by respective seats 63 and 64, cooperate with fixed contact arms 67 and 68 to form a normally closed contact pair 80 and a normally open contact pair 81.

The details of the slider according to the invention and the annexed mechanisms thereof are seen in detail in the figure 3. According to the above mentioned figure, the rotating slider 60 is produced through moulding as a body 62 of insulating material having substantially symmetrical shape about a rotation pin 72. To assure its movement, the body 62 is provided with two opposed reliefs 58 and 59 against which is engaged the rigid tang 20 of the snap member 14.

The whole assembly of the rotating slider 60, of the snap member 14 and the contact arms, both movable 65 and 66 and fixed 67a, 67b, 68a, 68b, are contained in a housing 74 generally moulded in a proper insulating material of the kind largely employed in the art of manufacturing control and maneuvring electric devices.

The operation of the invention is completely understood referring to figures 2 and 3 and, particularly, to figure 2.

As it happens in the prior art depicted in figure 1, a force 42, coming for example from an assembly of bimetallic thermal relays, is applied to the spring 16 in the same point corresponding to that of figure 1. The snapping always occurs according to the same principle, because this part of the mechanism does not differ from the prior art. What basically differs is the slider 60 which, instead of being a linearly movable saddle slider, is rotating.

Of course, with a rotating slider must change also the components provided to transmit the movement from the snap member 14 to the slider 60. In fact, instead of the slot 28 through the bar 32, are employed two reliefs 58 and 59 coming out from the body 62 of the slider 60.

When the thermal relays do not operate, the bias of the spring 16 on the rigid tang 20 makes it to lean against the relief 58, aiming to rotate clockwise the slider 60 according to the arrow 76 and carrying the contacts of the movable arm 65 to rest against the contacts of the fixed arms 67a and 67b (as better seen in figure 3) thus assuring the closure of the normally open contact pair 80 and the opening of the normally closed contact pair 81. When, on the contrary, the thermal relays operate, the force 42 shifts the spring beyond the straight line lying on the rigid tang 20, causing the snapping and the rotation of the rigid tang 20 itself to rest against the relief 59. This rest changing rotates counterclockwise the slider 60 according to an arrow 78 carrying the contacts of the movable arm 66 in touch with the contacts of the fixed arms 68a and 68b (figure 3) and the contacts of the movable contact arm 65 out of touch with the contacts of the fixed contact arms 67a and 67b, thus closing the normally open contact pair 81 and opening the normally closed contact pair 80.

Of course, it is selfevident that this rotating slider 60 is substantially resistant to shock and vibration stresses of linear kind owing to the engagement of the slider itself to rotate around a pivot located near the mass center of the slider 60.

What has been hereabove disclosed regards a particular embodiment of the present invention, not to be considered in limiting sense, so that many similar and equivalent provisions will be devised by those skilled in this art without coming out from the coverage scope as defined by the appended claims.

For example, not necessarily the rotating slider 60 must have the shape depicted in figures 2 and 3; it could have any other shape, provided that it is symmetrical with respect to the pivot 72. Also, not necessarily the spring 16 must be of elicoidal shape, it could be of any other kind, provided that it operates in tension and is stiff enough in transversal direction to allow the application of the force 42 coming, for example, from a thermal relay. At last, the number of movable contact arms can be different from two.

Claims

1. Balanced slider (60), vibration and shock resistant, for reducing sensitiveness to mechanical stresses, characterized in that it is just one in number and is moved rotatively around a pivot (72) arranged to be the most the possible symmetrical with respect to masses of a body (62) of the slider (60) itself, so that the effects of essentially linear stresses are paratically null.

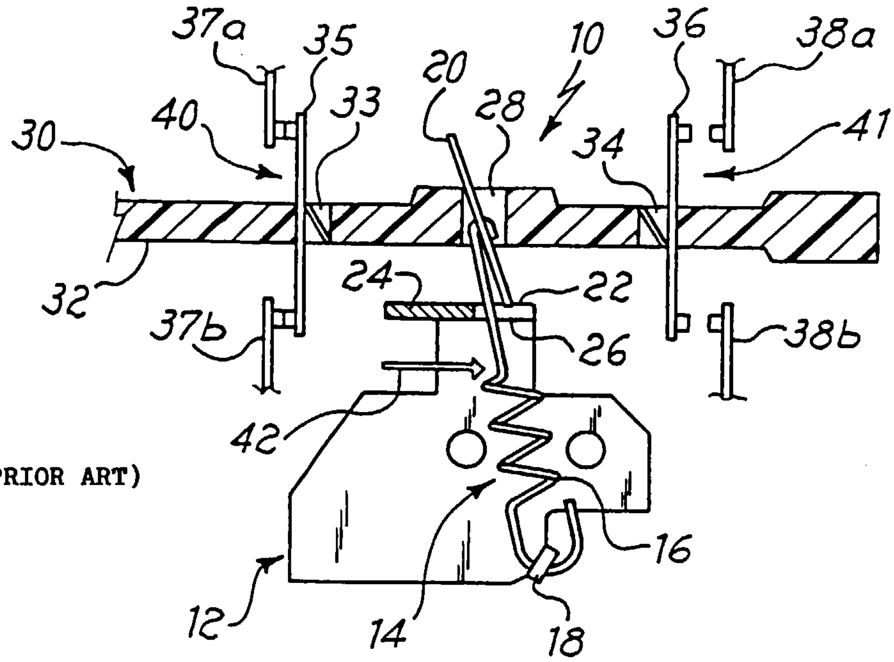
2. Balanced slider, vibration and shock resistant, as in claim 1, characterized in that the pivot (72) is arranged to be the nearest the possible to its mass center.

3. Balanced slider, vibration and shock resistant, as in claim 1, characterized by having an essentially symmetrical distribution of inertia moments of its portions, so that the stresses due to linear accelerations have substantially null reuslts.

4. Balanced slider, as in preceding claims, characterized by comprising a body (62) of insulating material, turnable around a pivot (72) fastened to a case (74), provided with seats (63, 64) housing movable contact arms (67a, 67b; 68a, 68b), and two opposed protrusions (58, 59) suited to engage a rigid tang (20) of a snapping member (14).

5. Balanced slider, as in claim 4, characterized in that the seats (63, 64) housing the movable contact arms (65, 66) are each other opposed and equidistant with respect to the pivot (72) of the insulating material body (62) of the slider itself.

Fig.1



(PRIOR ART)

Fig.2

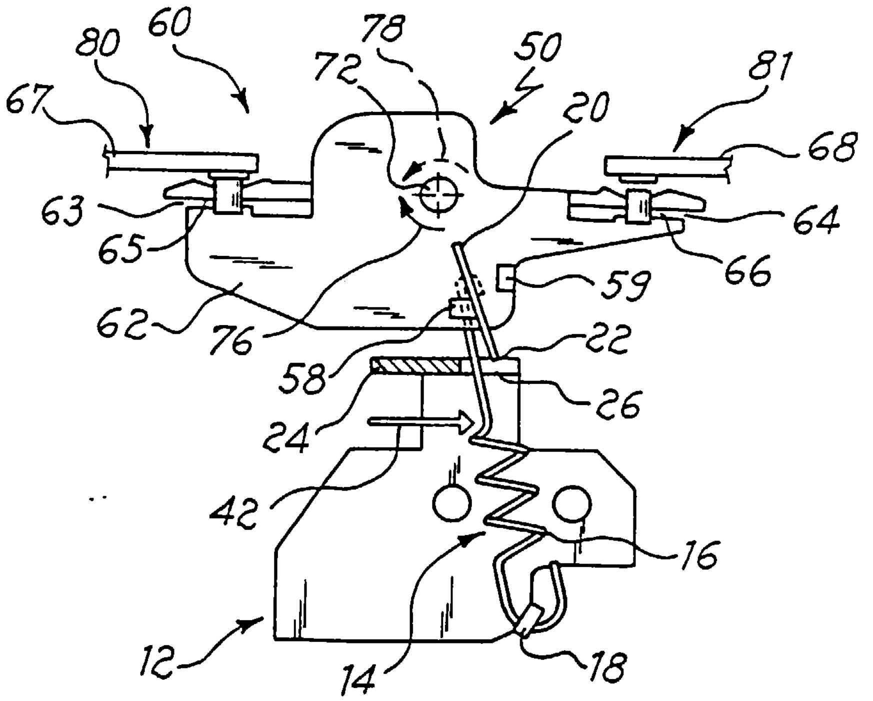
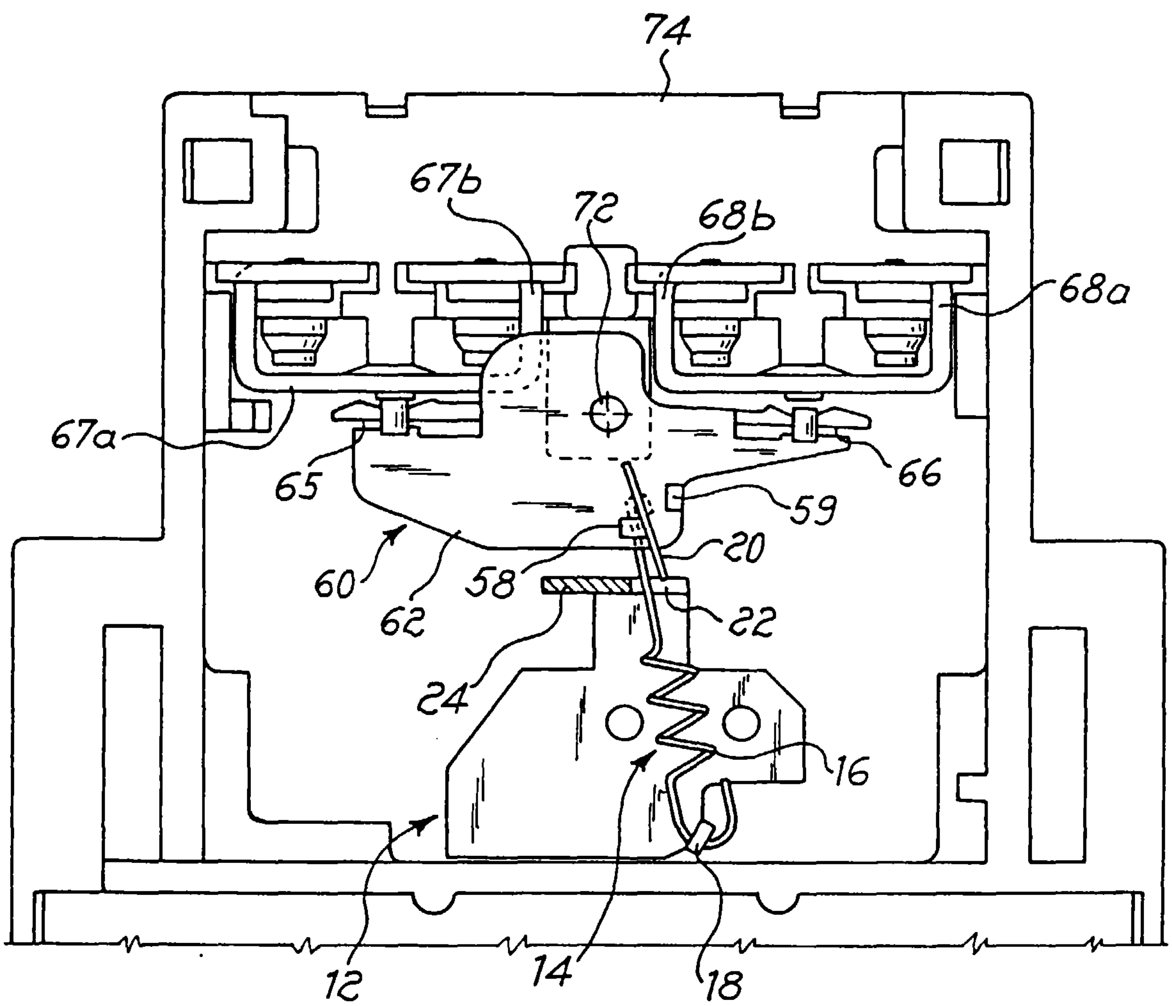


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 97 20 1911

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,Y	US 4 423 296 A (MCSPARRAN JOSEPH F) 27 December 1983 * claim 1 *	1	H01H5/06 H01H50/30
D,Y	DE 20 30 210 A (TEVES GMBH ALFRED) 30 December 1971	1	
A	* page 5, paragraph 2 - page 6, paragraph 2; figure 2 *	2	
D,A	DE 20 35 549 A (MERK GMBH TELEFONBAU FRIED) 20 January 1972 * claim 1; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 September 1997	Janssens De Vroom, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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