

April 12, 1960

W. G. DENNISON ET AL
ELECTROMAGNETIC DEVICE

2,932,704

Filed March 18, 1958

2 Sheets-Sheet 1

Fig. 1

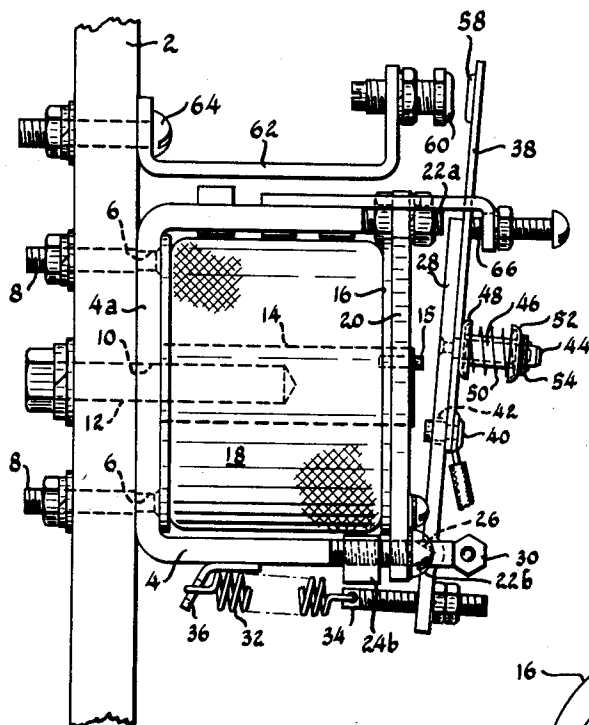


Fig. 2

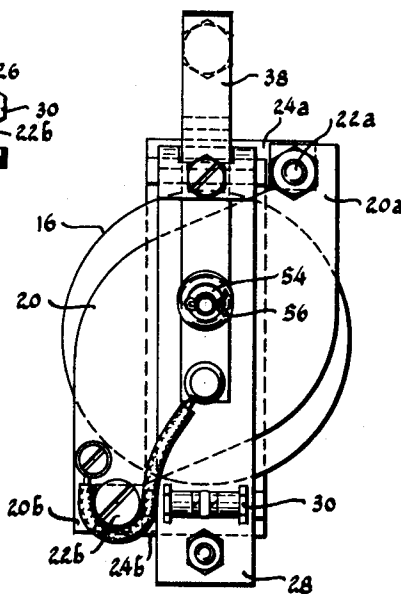
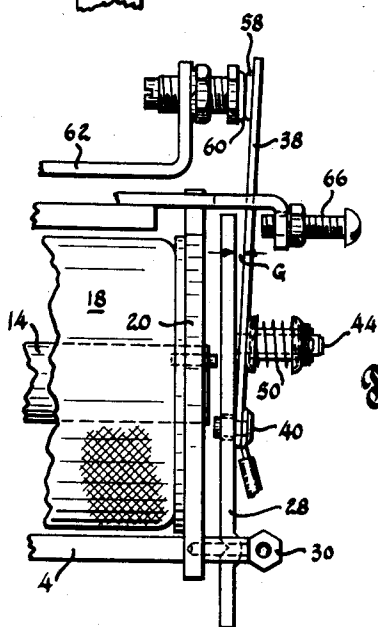


Fig. 3



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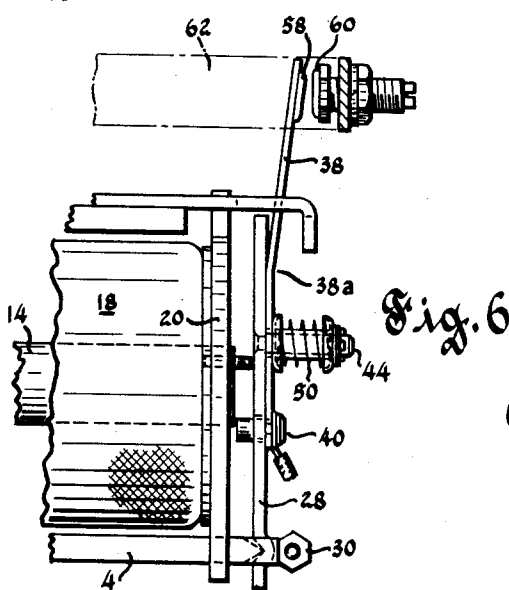
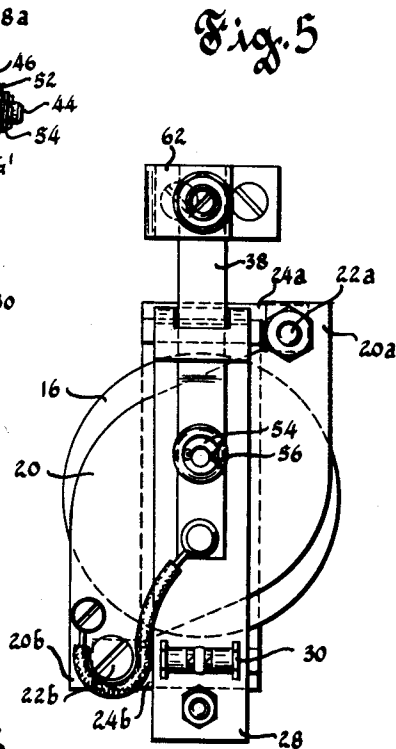
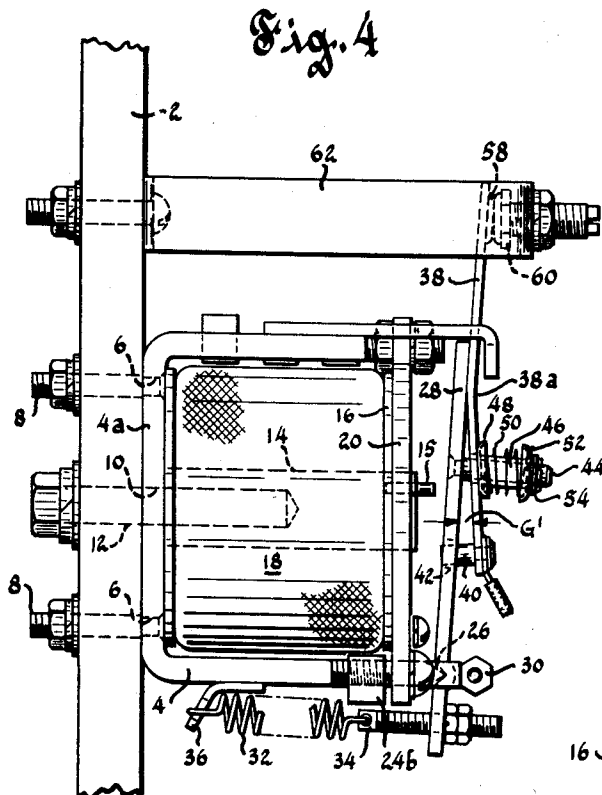
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1

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ELECTROMAGNETIC DEVICE

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Application March 18, 1958, Serial No. 722,343

3 Claims. (Cl. 200—87)

This invention relates to shock proof devices and more particularly to damped electromagnetic switches having shock proof contact means.

An object of the invention is to provide improved shock proof contact means for an electromagnetic switch.

Another object of the invention is to provide such switch with improved damping means for preventing contact chattering as the operating current passes through its critical values in a load sensing device.

A further object of the invention is to provide such switch with improved damping and shock proof means having simplicity of construction and ease of assembly.

Other objects and advantages of the invention will hereinafter appear.

In the drawings,

Figure 1 is a front elevation view of the electromagnetic device having normally open contacts;

Fig. 2 is a top view of the device of Fig. 1;

Fig. 3 is a fragmentary front elevation view of the device of Fig. 1 showing the contacts in their closed operating position;

Fig. 4 is a front elevation view of a modified electromagnetic device having normally closed contacts;

Fig. 5 is a top view of the device of Fig. 4; and

Fig. 6 is a fragmentary front elevation view of the device of Fig. 4 showing the contacts in their open operating position.

Referring to Figs. 1 and 2, there is shown an electromagnetic switch device known as a relay or contactor rigidly mounted on a support 2. The relay is provided with a generally C-shaped frame member 4 having spaced countersunk apertures 6 in its yoke portion 4a accommodating flat-head bolts 8 or the like for securing the frame member to support 2. Yoke portion 4a is provided with a further aperture 10 intermediate to apertures 6 for receiving a core extension 12 threaded into an axial bore in one end of a core 14, the latter having a non-magnetic pin 15 press-fitted into an eccentrically positioned opening in its free end. Support 2 is provided with correspondingly spaced apertures for receiving the bolts and core extension and rigidly securing frame member 4 and core 14 to the support so that core 14 extends horizontally between the upper and lower parallel legs of the C-shaped frame member. An insulating bobbin 16 having a coil 18 wound thereon is slidably received on the core in the space between the core and the frame legs and secured therein by a clamping plate 20. Plate 20 is provided with apertured portions 20a and 20b extending outwardly in opposite directions along opposite sides of frame member 4 and a central aperture for accommodating the free end of core 14. Threaded bolts or screws 22a and 22b or the like extend through these outwardly extending portions to rigidly secure clamping plate 20 to a pair of brackets 24a and 24b attached to and overlapping the respective leg portions of the frame member through rivets or the like.

The free end of the lower leg portion of frame member 4 is provided with a fulcrum 26 for pivotally supporting

2

a longitudinal armature 28 having a cooperating pivotal bearing adjacent the lower end of the latter and a pin assembly 30, more clearly shown in Figs. 2 and 3, for retaining armature 28 on its fulcrum. A return biasing spring 32 is secured at one end through a threaded bolt 34 to the extreme lower end of armature 28 and at its other end to a stationary bracket 36 rigidly secured as by welds, rivets or the like to the lower leg portion of frame member 4.

A spring-biased contact finger 38 is mounted on the outward side of and in overlapped end relation to armature 28 and extends from the intermediate portion of the armature to a point beyond the free end of the latter. The lower end portion of contact finger 38 is provided with a pivotal connection to armature 28 comprising a perpendicular pin 40 rigidly secured to the lower end portion of the contact finger and extending through and beyond an aperture 42 in the intermediate portion of the armature. An outwardly extending pin 44 is rigidly secured between aperture 42 and the free end of the armature and extends through an aperture in the contact finger. The portion of pin 44 extending outwardly of contact finger 38 is provided with a tubular spacer 46 of predetermined length as hereinafter described. Surrounding pin 44 adjacent the contact finger is a cup washer 48 having an aperture sufficiently large to accommodate pin 44 but insufficient to receive spacer 46. Spacer 46 is surrounded with a helical compression spring 50 which is retained by another oppositely disposed cup washer 52, one or more adjusting shim washers 54 of predetermined thicknesses, and retaining means such as cotter pin 56 or the like received in a transverse aperture adjacent the free end of pin 44, the latter being more clearly shown in Fig. 2.

The free end of contact finger 38 is provided with a contact element 58 in cooperative relation to a stationary contact element 60, the latter being adjustably mounted through its threaded shank to one leg of a generally U-shaped bracket 62. The other leg of bracket 62 is rigidly secured to support 2 by a bolt 64 or the like. Stationary contact element 60 in Fig. 1 is arranged between movable contact element 58 and support 2 so that the contacts are normally open when the electromagnet is deenergized and close to complete an external circuit upon energization thereof. An adjustable stop 66 is provided to limit movement of the armature under the influence of return spring 32.

In the modification shown in Figs. 4, 5 and 6, reference characters identical to those of Fig. 1 have been employed to indicate like elements. The modification is similar to Fig. 1 except that contact finger 38 has been modified and bracket 62 has been modified and stationary contact element 60 has been rearranged on the latter to provide normally closed contacts. Thus, U-shaped stationary contact supporting bracket 62 extends around contact finger 38 and stationary contact element 60 extends inwardly for cooperation with movable contact element 58. Contact finger 38 carrying the movable contact element is bent outwardly at point 38a to a predetermined angle G' with the remainder of the contact finger for the purposes hereinafter described.

The operation of the invention will now be described. Referring to Fig. 1, when coil 18 is energized with direct current with a superimposed alternating current component, armature 28 and contact finger 38 pivot in the counterclockwise direction until contacts 58 and 60 close as shown in Fig. 3. The stationary contact element is adjusted so that abutment of the movable contact thereagainst effects pivoting of pin 40 in aperture 42 and separation of the free end of the armature from the contact finger to a predetermined angle G shown in Fig. 3. This angle of separation affords vibration resistance to the

contacts when the energizing current is decreased. When the current through the operating coil decreases to a critical value, armature 38 vibrates as it moves slowly away from core pin 15, the latter being provided for the well-known purpose of preventing sticking of the armature in its closed position. This vibration is absorbed at gap G rather than at the contacts. When the current decreases further, armature 38 moves slowly in the clockwise direction and gap G decreases to zero. At this point, the armature is influenced by the flux in the gap to a substantially lesser degree and spring 32 pulls the armature and contact finger 38 as a unit quickly back to stop 66. Gap G is adjusted to cause positive opening thereof when the electromagnetic device operates near the critical current value.

The modification shown in Figs. 4, 5 and 6 operates in a similar manner except that the critical vibration occurs on increasing current rather than decreasing current. Upon energization, when the current in the operating coil approaches the critical value (the critical value being defined as the value of current at which the armature starts to move), gap G' fluctuates as the armature vibrates. When the armature starts to move, contact finger 38 pivots on bend 38a and the contacts remain closed. As gap G' decreases with increased current, the armature is increasingly influenced by the flux and vibration thereof is absorbed. When gap G' decreases to zero, the armature is influenced by the flux to a substantially greater degree, and the armature and contact finger move as a unit to quickly separate the contacts and thereby interrupt the aforementioned external circuit.

Spacer 46 surrounding pin 44 functions to retain the contact finger in its position under shock conditions. Spacer 46 has a predetermined length to permit opening of gap G sufficiently to absorb armature vibration and to prevent opening of the gap to the extent that might permit pin 40 to jump out of aperture 42 under shock conditions. Also pin 40 has a length so that it extends through armature 38 and a predetermined amount therebeyond to cooperate in maintaining the contact finger in its assembled position. The contact pressure is rendered adjustable by shims 54.

While the invention described herein is effectively adapted to fulfill the stated objects, it is to be understood that we do not intend to confine our invention to the particular preferred embodiments disclosed, as they are susceptible of various modifications within the scope of the appended claims.

We claim:

1. In a switch, in combination, a stationary contact, a movable contact arranged in cooperative relation to said stationary contact, operating means comprising an armature member and a contact lever for opening and closing said contacts, means affording free separation in a given direction of said contact lever from said member, said means comprising a separable pin connection between one end of said lever and an intermediate portion of said member and spring means spaced from said connection for biasing an intermediate portion of said lever toward the free end of said member, said member and said lever

being forced apart against the bias of said spring means to provide a gap therebetween when said contacts are closed for absorbing vibration of said member and preventing transmission of said vibration to said movable contact, means preventing separation of said lever from said member in other directions for a predetermined amount of separation in said given direction, the last mentioned means comprising said connection and a spacer element for restricting compression of said spring means.

2. In an electromagnetic circuit maker and breaker having a stationary contact, a movable contact and electromagnetic means for effecting alternate closure and opening of said contacts, the improvement comprising means for effecting quick and positive opening of said contacts without chattering thereof, said means being effective at the critical current changing value wherein the contact pressure is reduced from its maximum value, said means comprising a movable armature, a separable contact finger biased against said armature for movement therewith in the open range of movement of said contacts and for movement relative thereto in the contact closed range of movement of said armature, a first pin rigidly secured to said contact finger at one end thereof and extending through an oversize pivotal aperture in said armature, said pin having a length to prevent lateral displacement of said contact finger relative to said armature for a predetermined amount of separation thereof, a second pin rigidly secured to said armature at a point spaced from said aperture and extending through an aperture in said contact finger, a tubular sleeve surrounding said second pin, a helical spring having cup-shaped washers on either end surrounding said second pin and said sleeve for biasing said contact finger toward said armature and cooperating with said sleeve for restricting separation of said contact finger from said armature to afford a predetermined gap therebetween when said contacts are closed and to prevent dislodgement of the first pin from said aperture in said armature under shock conditions, and readily adjustable means on the free end of said second pin for adjusting the compression of said spring.

3. The invention defined in claim 2, wherein said contacts are normally closed, and said contact finger is bent intermediate to its ends in a direction away from the armature to afford a gap between the overlapped portions of said contact finger and said armature when said contacts are closed, said spring effecting closure of said gap upon energization of said electromagnetic means followed by quick opening of said contacts.

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