

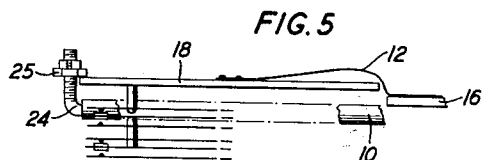
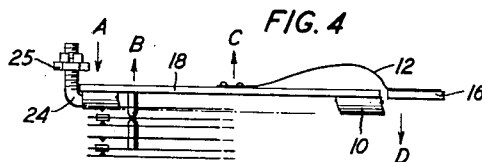
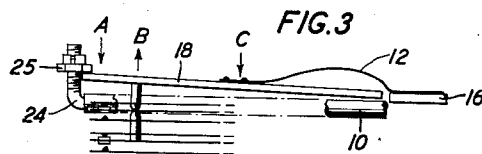
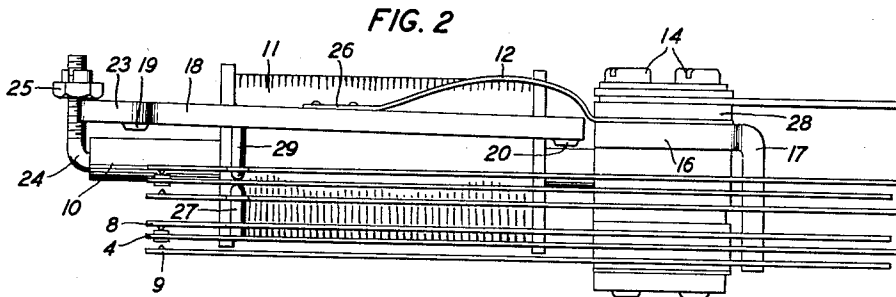
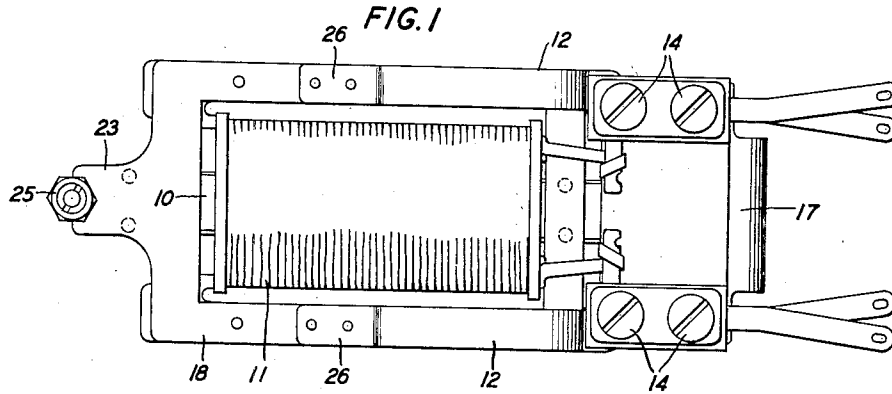
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RELAY

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RELAY

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1 Claim. (Cl. 175-345)

This invention relates to electromagnetic switching devices and has for its object to provide more satisfactory operation of such devices, and in particular to eliminate contact chatter or the false operation of contacts in such devices.

A major cause of false contact motion is armature rebound or return motion of the armature after reaching its normal unoperated position when it is released. In operation, the electromagnetic pull causes the armature to move into the operated position, thus bending the springs on which the contacts are mounted. In release, the springs return to their non-operated position and force the armature into its corresponding position, where it strikes a stop fastened to the core structure. For fast operating circuits this return motion must be rapid, and the impact of the armature on the stop causes it to rebound. If this rebound returns the springs to the point where the contacts touch each other, false operation or chatter results.

It is the object of this invention to provide electromagnetic relays in which chatter caused by armature rebound is materially reduced. To this end a flat type relay is provided with an armature which is held to the frame by means of a cantilever spring fastened to the armature at or near its mid-point. This type of armature mounting makes it possible for the armature to move either in rotation about an imaginary axis located close to the clamping point of this cantilever spring, or in rotation about the point at which the spring is fastened to the armature. It can therefore have any motion composed of these two types of rotation. The kinetic energy possessed by the armature when it strikes the stop nut on release may therefore be dissipated in oscillatory motion in which the operating studs remain approximately stationary, thus avoiding return motion of the studs and of the contact springs on which they act.

This and other features of the invention which contribute to the greater efficiency of the relay will be readily understood from the following detailed description read with reference to the accompanying drawing in which:

Figs. 1 and 2 are respectively a top plan view and a side elevation of a relay embodying the features of the invention;

Figs. 3, 4 and 5 are schematic representations of the armature and the forces acting thereon with the relay unoperated, fully operated and at the moment of release, respectively.

The relay core 10 is substantially cylindrical throughout its length and on an intermediate

portion thereof supports a relay coil 11. The front portion of the core 10 is flattened to provide a pole-piece of suitable area. A back stop for the armature utilized in this construction comprises an L-shaped pin 24 having one end thereof protruding from the front end of the core 10 and the other portion extending at right angles thereto and threaded to accommodate a nut 25. The core 10, back stop 25 and armature 18 are arranged to reduce the leakage flux to a minimum.

An L-shaped bracket comprising arms 16 and 17 is welded to the rear portion of the core 10. The depending portion 17 of the bracket serves as a means for mounting the relay on a relay rack, while the portion 16 which extends the entire width of the relay constitutes a support for the spring assemblies which are located on either side of the relay and secured to the bracket 16 by means of screws 14. The spring assemblies comprise the usual contact spring combinations. The passive or stationary contact springs, such as 8 and 9, which are relatively thick, carry one or more contact elements disposed preferably at right angles to the longitudinal axes of the springs. The companion active or movable springs, such as spring 4, are relatively thin, carry the required number of contact points which are disposed in accordance with the contact elements of the stationary springs.

Mounted above the bracket portion 16 and held in place by screws 14 and clamping plate 28 are a pair of cantilever springs 12 extending in a direction parallel to the longitudinal axis of the core 10 as well as parallel to the spring assemblies.

The armature 18 is formed as a rectangular loop surrounding the coil 11 and has an elongated projection at its forward end to engage the back stop nut 25. The armature 18 is riveted to the cantilever springs 12 at the points 26 which are at the approximate centers of the long sides of the rectangle, and the springs 12 are so tensioned that the rear end of the armature is slightly out of engagement with the core. The armature acts on the movable springs, such as spring 4, by means of studs 29 and 27 which pass through the passive springs, such as spring 8. The reaction of the movable springs on the studs 27 and 29 holds the projection 23 of the armature 18 against back stop nut 25. The projection 23 and the rear cross-piece are provided with non-magnetic studs 19 and 20 to hold them out of magnetic contact with the pole-piece of core 10.

This mounting of the armature minimizes

chatter due to the motion of the armature since the armature has two degrees of freedom, rotary movement about the point 26 where the armature is riveted to the spring and angular motion about either end when that end is in engagement with a fixed part of the relay. When coil 11 is energized, the armature is drawn toward the core 10, there being a slight rotation of the armature about the point of suspension 26 in combination with a motion of translation until the armature rests at each end against the core 10. When the coil is deenergized the armature moves toward the release position, the motion initially being predominantly a rotation about the rear cross-piece. When the projection 23 strikes the nut 25, the rebound tends to reverse the direction of motion at the projection 23, while the central portion of the armature tends to continue in its prior motion. The resulting motion is then predominantly a rotation about an axis close to the studs 29, and the restraint imposed by the springs 12 will cause this motion to assume an oscillatory characteristic. This motion may then continue until the kinetic energy of the armature is dissipated without further motion of the studs 29, thus avoiding any return motion of the contact springs and consequent chatter.

Figs. 3, 4 and 5 show steps in the functioning of the relay. In Fig. 3, in which the armature is at rest with the relay coil deenergized, the upward pressure by the contact springs represented by the arrow at B is equalized by the downward forces exerted by the back stop nut 25 at A and the cantilever spring at C. In this case, as mentioned above, the rear end of the armature

is free. In Fig. 4 the armature is shown at rest with the relay coil energized. In this case the downward attractive force of the coil as indicated at A and D is acted against by the upward force of the contact springs at B and the cantilever spring 12 at C. Fig. 5 shows a transient position of the armature following the deenergization of the relay coil. The armature is shown as it rests against the back stop nut 25 at the outer end, the cantilever spring 12 slightly flattening and the inner end of the armature thrown upward in absorbing the energy stored in the spring.

What is claimed is:

In an electromagnet structure having a heel piece, a core extending forwardly therefrom and a coil on said core, an armature in the form of a hollow rectangle surrounding said coil and cooperating at its ends with the forward and rear ends of said core, and a pair of cantilever springs having their rear ends secured to said heel piece and their forward ends attached to the side members of said armature at points intermediate the forward and rear ends thereof, said springs being arched adjacent to their points of attachment to said heel piece with the concave side toward said armature to permit freedom of movement of the rear end of said armature away from the rear end of said core and tensioned to normally hold the rear end of said armature out of engagement with said core whereby said armature is adapted to move toward said core at both of its ends upon the energization of said coil.

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