Nov. 5, 1963 N. H. KOERTGE ETAL 3,109,904

ELECTROMAGNETIC RELAY

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Fig. 1

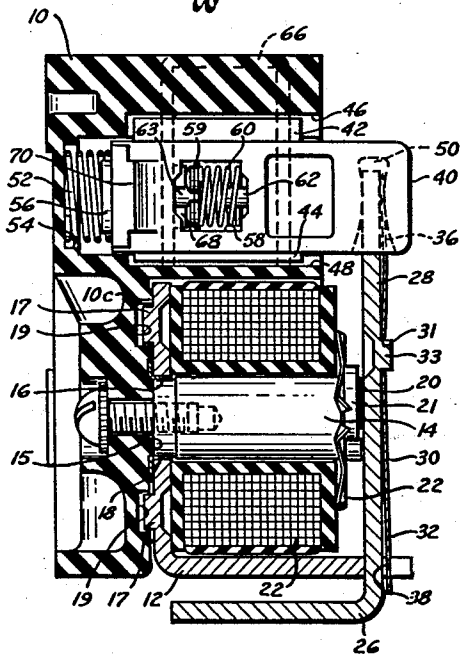


Fig. 2

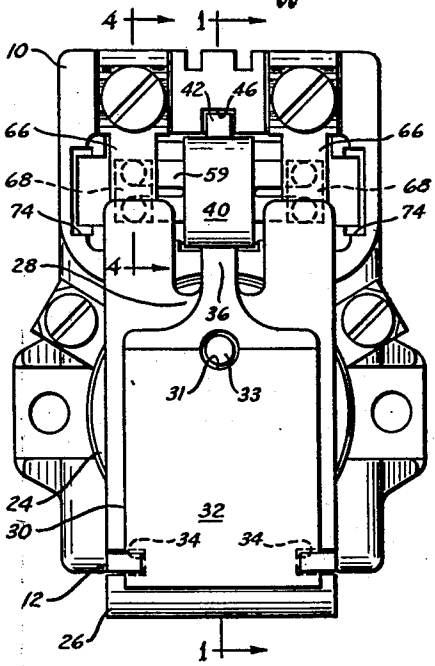


Fig. 4

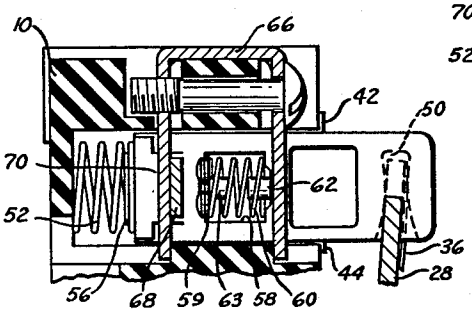
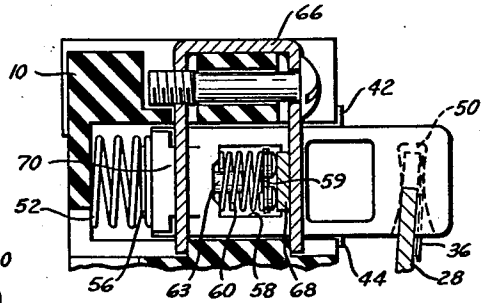


Fig. 5



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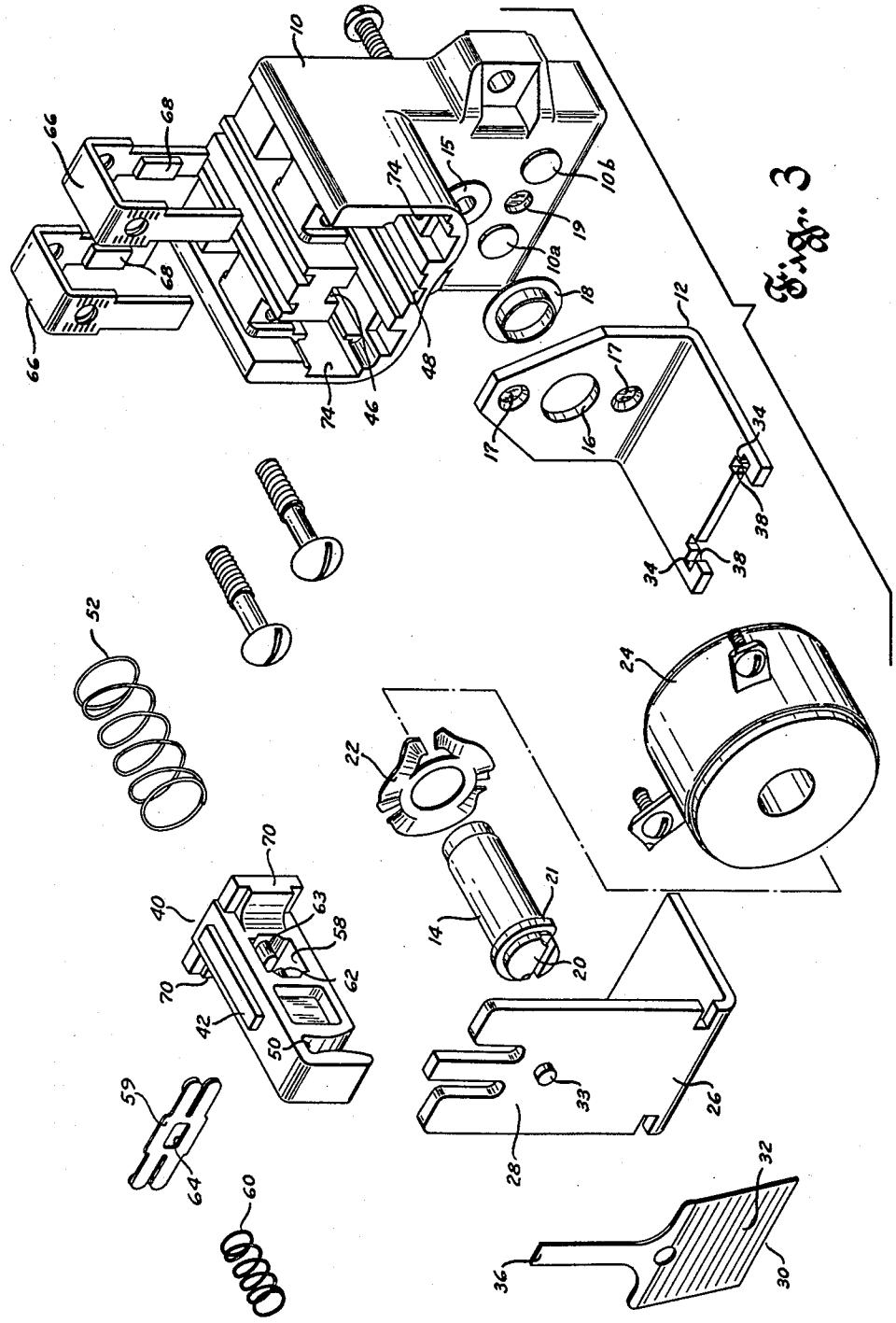


Fig. 3

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Fig. 7

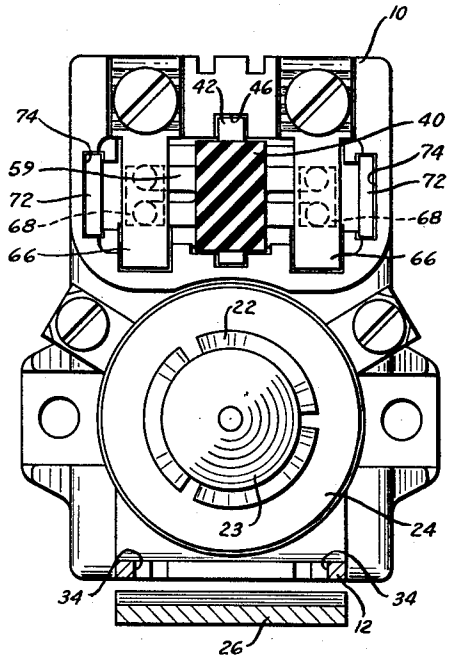
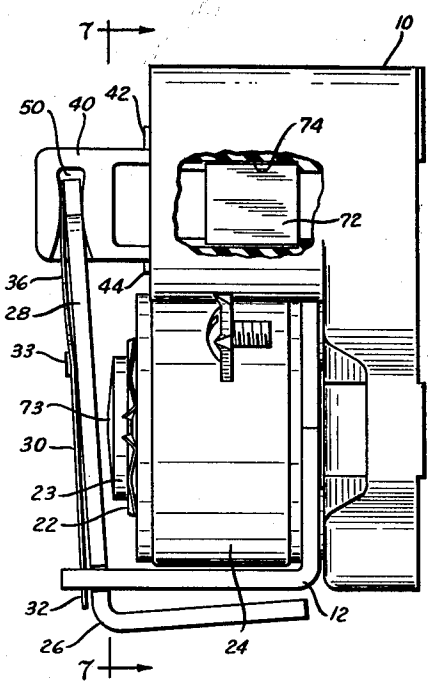


Fig. 6



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ELECTROMAGNETIC RELAY

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This invention relates to an improved electrical relay.

One object of this invention is to eliminate the magnet frame tolerances from consideration in computing the wear allowance of a relay.

Another object is to provide such a relay which is inexpensive and easily assembled.

Still another object is to reduce contact bounce in the relay.

A further object is to provide a stationary contact arrangement affording ready convertibility from normally open to normally closed contact operation.

The first object is accomplished by providing an aperture in the magnet frame through which the core may pass so that its bottom end can be secured directly to a molded base (on which tolerances can be closely held) instead of to the frame (which inherently has wider tolerances than a molded piece).

The second object is accomplished partly by mounting the coil on the core against a top of the core enlarged to prevent the coil from sliding off and further by constructing the other parts of the relay so that the armature lever slides onto the end of the magnet frame and extends into engagement with a movable contact carrier. Then this whole assembly is completed by snapping a spring plate into engagement between the contact carrier and magnet frame to hold the armature lever in place.

The third object is accomplished by constructing the armature lever in an L-shape which increases armature inertia thereby reducing armature bounce or chattering when the relay is energized, and affords an inertia moment such that external shocks imposed on the relay have little effect in displacing the armature position.

The fourth object is accomplished by use of a U-shaped stationary terminal having a threaded hole in each leg of the U with such holes being aligned and providing a terminal screw having threads adjacent its outer end only with the remainder of the shank of the screw being small enough to pass freely through the threaded holes. The housing is formed to receive the two legs of the contact so that a portion of the housing fits closely between such legs. When the threaded end of the screw has been turned through the threads in the hole in the top leg the screw drops down to the bottom leg and is screwed therein. The head of the screw then captures a conductor against the top leg and compresses such leg against the housing portion between the legs of the U.

Other objects and advantages will be pointed out in, or be apparent from the specification and claims, as will obvious modifications of the two embodiments shown in the drawings in which:

FIG. 1 is a side sectional view of the relay of the present invention;

FIG. 2 is a front view of the relay;

FIG. 3 is an exploded view of the relay;

FIG. 4 is a partial sectional view taken on line 4—4 in FIG. 2 showing the movable and stationary terminals in normally open position;

FIG. 5 is a partial sectional view similar to FIG. 4 showing the movable and stationary terminals in normally closed position;

FIG. 6 is a side view of the present relay adapted for D.C. operation; and

FIG. 7 is a sectional view taken on line 7—7 in FIG. 6.

Referring to the drawings, a molded housing **10** provides a mounting base for the other parts of the relay.

In conventional relays having a separate core and magnet frame the core is mounted directly on the magnet frame. Since the armature contacts the core when the coil is energized this construction results in the wear allowance of the movable contacts being affected by the tolerances of both the core and the magnet frame. In the present construction the tolerances of thickness magnet frame **12** are eliminated from consideration in figuring the wear allowance for the contacts by the unique way in which the core **14** is mounted with respect to the magnet frame. A circular hole **16** is cut in the magnet frame large enough for the core and a nonmagnetic eyelet **18** to pass therethrough. The frame seats on three very short upstanding spaced bosses **10***a*, **10***b* and **10***c* whose heights with respect to one another and to the portion of the housing which locates the stationary contacts can be closely controlled during molding of the housing. Dimples **17** pressed downward from the magnet frame are received in depressions **19** in the housing to properly locate and hold the frame on the housing. A boss **15** having the same height as the bosses **10***a*, **10***b* and **10***c* control the mounted height of the core. The top end **20** of the core is enlarged either by mounting a D-shaped shading coil **21** therein (in A.C. relays) or by providing a mushroom shaped head **23** (in D.C. relays) which retains a spring washer **22** and a coil **24** thereon when such parts are mounted on the core from the bottom end. After the washer and coil are thus mounted on the core, the lower end of the core is secured to the housing **10** by a screw which passes through the housing and into a threaded hole in the core. The screw is tightened and this pulls the enlarged upper end of the core against the spring washer which holds the core and coil against housing. Since the core passes through the magnet frame and seats directly on the housing, magnet frame thickness tolerances are eliminated from consideration in figuring the wear allowance for the movable contacts.

The construction and mounting of armature lever **26** of the present invention greatly reduces both armature bounce (and hence contact bounce) when the relay is energized and bouncing caused by vibrations induced by other devices mounted on a common panel. Lever **26** is L-shaped and is notched so that it slides over and pivotally cooperates with the magnet frame. The short leg of the armature serves to add mass and to provide it with an inertia moment inhibiting bounce when the longer leg strikes the core upon coil energization. The mass of the armature lever is distributed by the L-shaped construction so that shocks on the panel on which the relay is mounted tend to be canceled out as respects the lever thereby preventing externally induced lever bounce.

The top **28** of the L-shaped lever extends upwardly from its bearing on the magnet frame past the end of coil core **14** and into engagement with a movable contact carrier **40** which is biased to normally hold lever **26** out of contact with the coil core. Lever **26** is held in place by a spring plate or clip **30** which has a body portion **32** which extends through notches **34** in the magnet frame to hold lever **26** on the frame. Plate **30** has an aperture **31** which snaps over projection **33** on lever **26** to hold the plate in place. A tongue **36** projects upwardly from the plate body and into engagement with the contact carrier so that the plate is biased to bear against the outside edges **38** of notches **34** in the magnet frame. The inherent flexure of the plate is such

that it biases lever 26 into engagement with the magnet frame. Thus the armature bears downwardly against the frame when the coil is deenergized thereby insuring that the pick-up voltage at which the relay operates will be substantially constant. The spring plate also holds the armature in engagement with the constant carrier.

The contact carrier 40 is slidably guided inside the housing by ribs 42 and 44 on the carrier which mate with grooves 46 and 48, respectively, in the housing. These ribs are of a different size so that the carrier can only be assembled right side up in the housing. A notch 50 opens downwardly from the carrier and the top portion of lever 26 extends therein as well as the tongue of the spring plate. The sides of notch 50 are arcuate to accommodate movement of the armature lever and spring plate tongue when the carrier reciprocates. The carrier is biased toward the housing exterior by a coil spring 52 which seats in a depression 54 in the housing at one end and around a boss 56 on the carrier at the other end. The carrier has a window 58 therein in which a movable contactor 59 is mounted by means of a spring 60 which fits around a pin 62 projecting into the window at one end and bears against terminal 59 at the other end. A pin 63 projects into the window from the other side to provide a mount for the spring when the terminal is reversed. The terminal has a central opening 64 through which such other pin projects when the terminal is in the position shown.

Another novel feature of this device is the way the stationary terminals 66 are reversibly mounted to cooperate with the reversible movable terminals to provide either normally open or normally closed switch operation. Each stationary terminal is U-shaped and has a silver contact plate 68 secured to the inside of one leg. The housing is apertured to accommodate and orient the legs of each stationary terminal so that one leg is on either side of the movable contactor portions which extend laterally from the contact carrier. Each stationary terminal is held in place by a screw which passes through the legs of the terminal and the housing. This screw has threads only adjacent its end so that it is turned through the top leg and then drops down to the other leg into which it is then screwed. Thus it does not engage the top leg so that, when a wire is captured under the head of the screw, the screw head exerts a compressive force on the top terminal leg and forces it toward the bottom leg so that the legs tightly grip the housing portion therebetween. This "drop through" feature also reduces the time necessary to insert the terminal screw into operative position in the stationary terminal. The contact carrier has a flange 70 on one end which catches on legs of the stationary terminals and serves to hold the carrier in the housing when the movable contactor and stationary terminals are in normally open position as shown in FIG. 4. When the movable contactor and stationary terminals are reversed as shown in FIG. 5, a normally closed contact relay is provided. As shown in FIGS. 6 and 7, when a D.C. relay is desired, a pair of permanent magnets 72, which aid in extinguishing the arcs, are inserted in grooves 74 in the housing and a mushroom headed core 73 is employed.

Assembly of the present device is quick and simple. The core, spring washer, coil and magnet frame are secured by a screw to the raised boss portions of the housing. Then the movable terminal is mounted in the carrier and it is inserted in the housing. The stationary terminals are then dropped into place and secured by the unique terminal screws described above. The notched armature lever is inserted on the end of the magnet frame and the top of the lever fits into the carrier notch. Then the spring plate is snapped in place and the relay is fully assembled.

Although but two embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

We claim:

1. In an electromagnetic device, a housing, movable and stationary contacts in said housing, a magnet frame mounted on said housing, an armature lever movably mounted on said magnet frame, means connecting said lever to said movable contact, and means for eliminating said frame as a factor in computing the wear allowance for said movable contact including an aperture in said frame, and a coil core passing through said aperture with clearance with respect to said frame and having its bottom end mounted directly on and secured to said housing.

2. The combination according to claim 1, wherein said frame has a non-magnetic collar lining the aperture and a reduced cross section portion of said core extends through and is held in alinement in said aperture by said collar.

3. The invention according to claim 2 wherein a coil is mounted on said core and said core has means serving to retain said coil on said core.

4. The invention according to claim 3 wherein said means of said core comprises an enlarged portion overlying an adjacent portion of said coil.

5. The invention according to claim 3 wherein said means of said core comprise a shading coil seating in a slot in one end of said core and surrounding a portion of said core and overlying an adjacent end of said coil.

6. The combination according to claim 2, wherein said housing is molded of insulating material and said frame and core are mounted on upstanding projections which are individual thereto but which have co-planar mounting surfaces.

7. The combination according to claim 6, wherein a spring washer is disposed about said core between its enlarged portion and the adjacent portion of said coil to hold the coil tight against said frame and said frame tight against the coplanar mounting surfaces of said projections.

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