

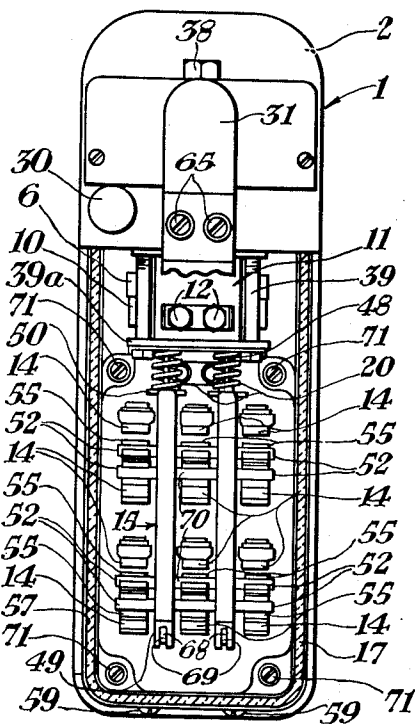
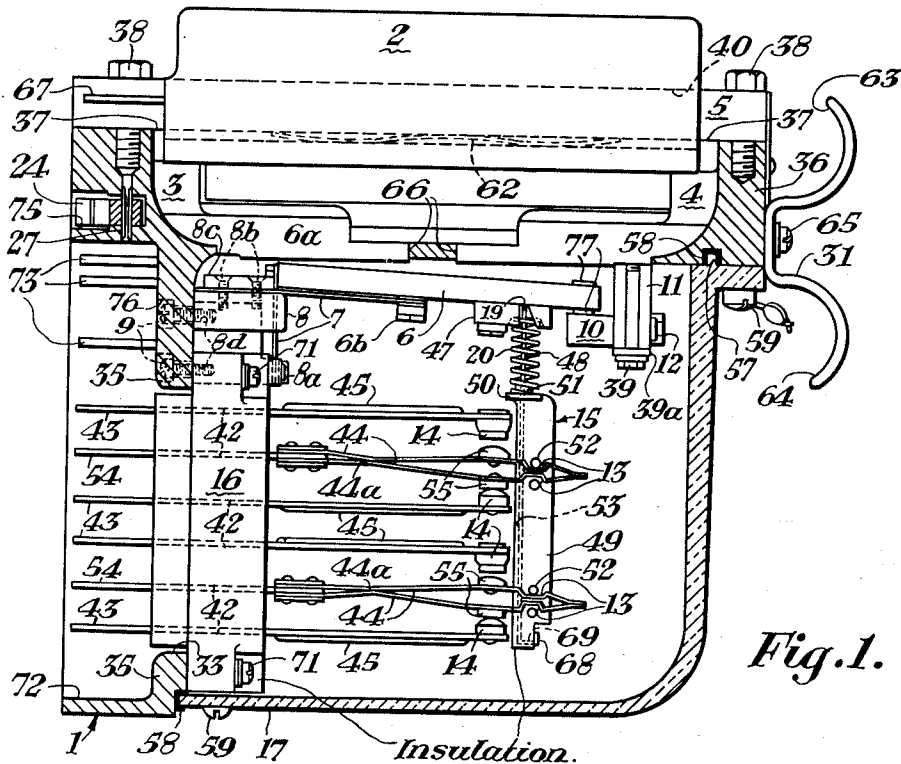
May 27, 1958

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2,836,774

MAGNETIC HOLD-DOWN DEVICES

Original Filed Oct. 4. 1954



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MAGNETIC HOLD-DOWN DEVICES

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Original application October 4, 1954, Serial No. 459,970.
Divided and this application December 19, 1955, Serial No. 553,897

4 Claims. (Cl. 317—171)

My invention relates to electrical relays and more particularly to a plug-in relay whose contacts are held in their deenergized position by a magnetic hold-down device, and is a division of my copending application Serial No. 459,970, filed October 4, 1954, and entitled Electrical Relays.

In previous plug-in type relays considerable difficulty has been encountered in maintaining the contacts of the relays in their adjusted positions, due to relay frame distortion caused by changes in temperature and humidity and at the same time in keeping the contact bounce to a minimum.

It is therefore an object of my invention to provide a novel plug-in relay having a substantially warp-resistant frame member, with the pole pieces of the relay arranged to form an integral part of the warp-resistant frame and having a novel hold-down pole piece secured to one of the pole pieces for cooperation with the relay armature.

It is another object of my invention to provide the magnetic hold-down pole piece with protective means for prevent demagnetization.

Another object of my invention is to provide a novel plug-in relay consisting of few and simple parts which are relatively inexpensive to manufacture and assemble, and which when assembled provide a compact, rugged and reliable relay.

Other objects, purposes and characteristic features of my invention will be in part obvious from the accompanying drawings, and in part pointed out as the description of my invention progresses.

In practicing my invention I provide a relay of the plug-in type having a metallic one piece frame, constructed as by casting, that will not warp and which relay is capable of maintaining a tight seal, between a transparent cover and the frame, under varying weather conditions. The frame also includes a pair of pole pieces that are machined and then cast into the frame, with one of the pole pieces provided with a downwardly extending magnetic hold-down pole piece for cooperation with the relay armature in its deenergized position.

In describing my invention in detail, reference will be made to the accompanying drawings in which corresponding parts are identified by corresponding reference characters and in which:

Fig. 1 is a vertical sectional view showing one form of plug-in relay embodying my invention.

Fig. 2 is a front view of the relay embodying my invention, with portions broken away to illustrate, to better advantage, certain details of construction.

Referring to the drawings, the relay comprises a frame member 1 of suitable nonmagnetic material, such as die cast aluminum. This frame member 1 consists of a vertical portion 35 and a horizontal forwardly extending portion 36. The portion 36 includes two pole members or pole pieces 3 and 4 of magnetizable material which are preferably first machined and then cast into the horizontal portion 36 of the frame member 1. The two pole

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pieces 3 and 4 are L-shaped and are cast within the horizontal portion of the frame member with the ends 37 of the vertical legs of the pole piece either projecting above or terminating flush with the upper surface of the horizontal portion 36 of the frame member 1. The upper ends 37 of the L-shaped pole pieces 3 and 4 are subsequently ground to provide a good magnetic circuit contact with a core member 5 which passes through, and supports, an energizing coil 2. The core member 5 is secured to the portion 36 of the frame member 1 and against the upper ends 37 of the L-shaped pole pieces 3 and 4, by cap screws 33. The L-shaped pole pieces 3 and 4 are so cast within the frame portion 36 that a space or gap is formed between the adjacent inner ends 66 of the horizontal legs of the pole pieces, which space is filled with the nonmagnetic material of the frame.

An armature 6 is pivotally secured to the vertical portion 35 of the frame member 1 by a suitable hinge connection (Fig. 1) comprising a support block 8 and three hinge springs 7. One of the hinge springs is vertically disposed to prevent vertical displacement of the armature, and is secured at its lower end to the support block 8 by screws 8a. The upper end of this vertical hinge spring 7 is secured to one end of the armature 6 by screws 6a. The other two hinge springs 7 are horizontally disposed on opposite sides of the vertical spring 7 to prevent horizontal displacement of the armature, the inner ends of the two springs being secured to the top surface of the support block 8 by screws 8b and a retainer 8c, while the outer ends are secured to the bottom surface of the armature by screws 6b. The block 8 is secured to the vertical portion 35 of the frame member 1 by support block adjusting screws 9 passing through enlarged openings 76 in the frame member 1 and threaded into suitable screw openings 8d in the support block 8. With this arrangement the armature air gap between the horizontal legs of the pole pieces 3 and 4, in the frame 1, and the armature 6 may be adjusted by shifting the armature support block 8 vertically along the member 35. The armature 6 underlies and cooperates with the pole pieces 3 and 4.

Supported by the pole piece 4 is a hold-down pole piece member 10 secured by means of screws 12 to a permanent magnet 11. The permanent magnet 11 is secured to the pole piece 4 by bolts 39, which are made of a magnetizable material and disposed on opposite sides of the permanent magnet 11. Located below the permanent magnet 11 and extended between the bolts 39 is a securing plate 39a, constructed of magnetizable material. The bolts 39 and plate 39a not only act as a support for the magnet 11 but in addition act as a shunt to by-pass any stray flux surges, thus preventing demagnetization of the magnet 11. The bolts also act to provide a low reluctance flux path for better hold-down of the armature as described hereinafter. The hold-down feature of the pole piece functions to cause the relay armature to be responsive to only one direction of current flow through the coil 2, when the armature is in the deenergized position. That is the flux flow through the armature magnetic circuit, including the hold-down pole piece and its securing bolts 39, for one direction of coil 2 current, will strengthen the flux set up by the permanent magnet 11, thus holding the armature more firmly in its deenergized position. For current through coil 2 in the other direction the flux in the armature circuit will oppose and overcome the permanent magnet 11 and attract the armature 6 to its energized position. It should be noted that the hold-down pole piece 10 also serves as a back stop to limit movement of the armature away from the pole pieces 3 and 4. The armature is provided with the usual nonmagnetic core pins 77 to prevent the armature from magnetically sticking to the pole piece 10.

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The coil 2 has an opening 40 for receiving the core member 5. The coil 2 is further provided with a coating of substantially hard insulating material which supports two electrical prongs 67 at the rear end thereof. This arrangement eliminates the necessity of passing coil lead-in wires into the enclosed area of the relay contacts, which will hereinafter be described, and then through the vertical portion 35 of the frame 1. Located between the coil 2 and the frame member 1 is a vibration dampener leaf spring 62 which tends to hold the coil firm, thus eliminating excessive movement.

The vertical portion 35 of the frame member 1 is provided with a rearwardly facing terminal receiving opening 72 for receiving the plug-in ends of the fixed contact members 43, the contact base members 54 and indexing pins 73. Located within the vertical portion 35 of the frame member 1 and opening into the terminal opening 72 is a contact block opening 33. Secured by suitable bolts 71 to the portion 35 and extending into the contact block opening 33 is a contact support member or block 16 made of suitable insulating material. The contact support block 16 is provided with a plurality of openings 42 for receiving the ends of the fixed contact members or lugs 43 and movable contact base members or lugs 54. Each of the contact members 43 is provided with reinforcing ribs 45 and contact point members 14. Each of the movable contact base members 54 has secured thereto movable contact leaf members 44 of spring material in a manner described hereinafter.

Attached to the movable armature 6 by a securing block 47 is a U-shaped armature contact actuator drive wire 48 (see Figs. 1 and 2). The U-shaped drive wire 48 is secured to the securing block 47 by the horizontal portion passing through an opening 19 in the securing block 47, leaving the two actuator drive wire ends extending downwardly from the securing block 47 and armature 6. The two downwardly extending ends of the drive wire 48 are secured to a contact actuating member 15. The contact actuating member 15 is of insulating material and comprises two vertical members 49, of U-shaped cross section, which are held in spaced-apart parallel relationship by integral vertically spaced-apart horizontal pins 70. The drive wire 48 passes through grooves or channels 53 formed in members 49. The ends of the drive wire 48, after passing through the grooves 53 are turned upwardly as at 68 to engage the lower portion of the members 49. Extended outwardly from each of the vertical members 49 are projecting pins 52. At the upper end of each of the U-shaped members 49 is an enlarged spring seat portion 50 and a vertically extending smaller spring guide 51. At the lower ends of the vertical U-shaped members 49 are contact actuator drive wire slots 69 for receiving the up-turned ends 68 of the drive wire member 48.

Located between the drive wire securing block 47 and the upper ends of the U-shaped members 49 of the member 15, and located about the two downwardly extending actuator drive wire portion 48, are two actuator pressure spring members 20. These pressure springs 20 act to force the actuating member away from the armature member 6 and down against the hooked portion 68 of the drive wire member 48.

Referring to the contacts, each of the movable contact base members 54 has secured thereto, on opposite sides thereof, one end of a movable contact leaf spring member 44. Each of the two members 44 which are secured to the same base member 54 turns inwardly and contacts each other at a point 44a and then bows away from the other member in such a manner that when the unsecured ends of these members are forced together, the portion between the point 44a and the unsecured ends are well separated. Attached to the bowed portion of each of the members 44 is an electrical contact member 55 adapted to engage an associated one of the fixed contacts 14 in a manner hereinafter described.

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Formed in the members 44, between the contact members 55 and the unsecured ends of the members 44, are transverse grooves 13. When the members 44 are inserted between adjacent pairs of movable contact projecting pins 52 or between adjacent pairs of horizontal pins 70, of the member 15, the transverse grooves 13 of the leaf spring members 44 engage the pins 52 or 70 firmly. In order for the contact leaf spring members 44 to pass between the projecting pins 52 or horizontal pins 70, of the member 15, the leaf spring members must be compressed. This causes the unsecured ends of the contact leaf spring members 44 to come into contact with each other and helps to cause each of the transverse grooves 13 of the members 44 to seat against the movable contact projecting pins 52 or horizontal pins 70 of the member 15. This eliminates all lost motion between the members 15 and the members 44, as well as placing the leaf spring members under an initial pressure for reducing contact bounce.

Located within a groove 57 near the peripheral edge of the frame member 1 is a gasket or filler member 58. The gasket or filler member 58 is arranged to cooperate with a transparent cover member 17 to provide a weather-tight seal for the relay contacts. The cover member 17 is secured to the frame member 1 by suitable bolts 59. It will be noted that the cover member is provided with a projecting edge which fits within the gasket member 58 providing a better seal.

Secured to the forward end of the frame member 1, by bolts 65, is a relay handle member 31 provided with finger grip loops 63 and 64. With this arrangement the relay may be removed from its base mounting member 23, by merely inserting two fingers through the finger loop members 63 and 64 of the handle 31 and at the same time pressing a movable latch actuating rod button 30 inwardly to release a movable latch member 24 from the fixed hooked member (not shown). With the latch released, the operator pulls upon the finger loops 63 and 64, unplugging the relay from its base member. Further details of the relay latch may be found in my copending application No. 459,970, filed October 4, 1954, and entitled Electrical Relays.

Upon energization of the relay coil 2 the armature 6 is pulled upwardly to its attracted position in which the core pins 77 engage the pole piece 4. Movement of the armature to its attracted position lifts the contact actuator 15 and movable contact leaf spring members 44, to thereby close the front contacts of the relay. It will be noted that the front contacts are made before the core pins 77 strike the pole piece 4. This causes the bowed leaf springs supporting the front contacts to be compressed, thus holding the contacts firmly together.

Although I have herein shown and described only one form of relay embodying my invention, it is to be understood that various changes and modifications may be made within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In a relay, a pole piece, an armature movable between an energized and a deenergized position, a hold-down means for said armature, said hold-down means comprising a permanent magnet secured to said pole piece, a hold-down pole piece secured to said permanent magnet in a position to cooperate with said armature in its deenergized position, said securing means comprising magnetizable bolts for preventing demagnetization of said permanent magnet due to a stray current surge.

2. In a relay having a magnetic path including pole pieces and a cooperating armature; a combination hold-down pole piece and stop means comprising a permanent magnet, magnetizable means for securing said hold-down pole piece and stop means in magnetic cooperation with one of said pole pieces, said stop means being secured to said permanent magnet in a position to cooperate with

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said armature, said magnetizable securing means providing a shunt path for protecting said permanent magnet against demagnetization due to stray flux.

3. In a relay having a magnetic path including pole pieces and a cooperating armature; a combination hold-down pole piece and stop means including a permanent magnet, magnetizable bolt means for securing said hold-down pole piece and stop means to one of said pole pieces, said bolt means being parallel to and of substantially equal length as said permanent magnet to provide a shunt path for said magnet for preventing demagnetization of said magnet due to a stray flux, a stop member secured to said permanent magnet for limiting movement of said armature and for providing a good flux path to said armature for the flux of said permanent magnet.

4. In a relay having a magnetic path including pole pieces, a coil and a cooperating armature; a hold-down

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means for said armature said hold-down means comprising a permanent magnet secured to said pole piece by magnetizable bolts extending substantially the full length of said magnet, and stop means secured to said magnet in a position to limit the armature in its movement, said hold-down means acting to prevent armature movement from its deenergized stop means position upon improper direction of current flow through said coil.

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