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ADJUSTABLE ARMATURE FOR AN ELECTROMAGNETIC RELAY

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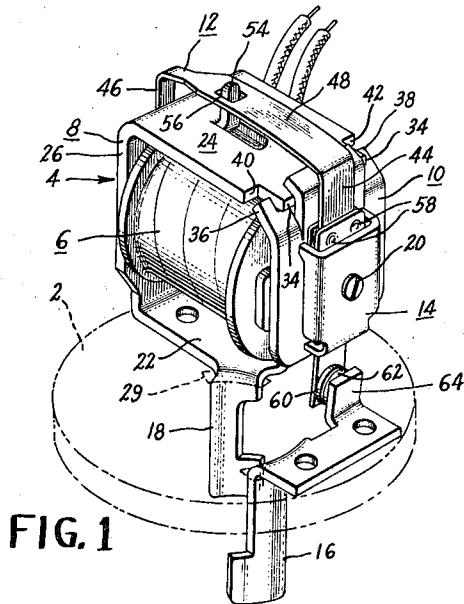


FIG. 1

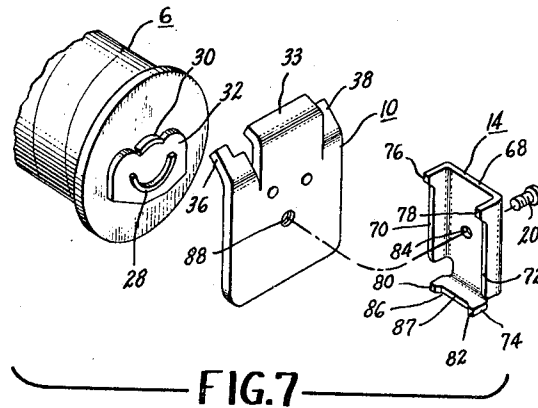


FIG. 7

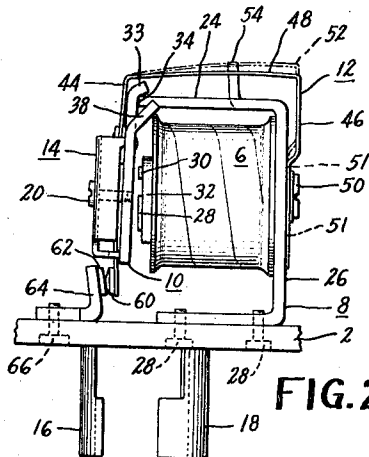


FIG. 2

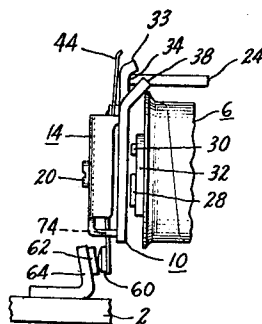


FIG. 3

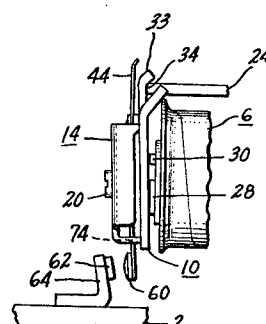


FIG. 4

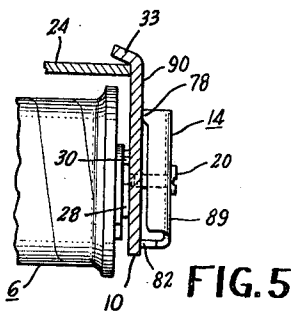


FIG. 5

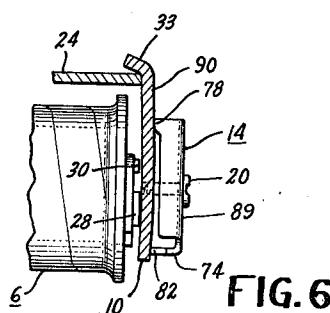


FIG. 6

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ADJUSTABLE ARMATURE FOR AN ELECTROMAGNETIC RELAY

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4 Claims

ABSTRACT OF THE DISCLOSURE

An electromagnetic relay of the "clapper" type in which an armature pivotally mounted on a support is attracted to a pole face by energization of an electromagnetic coil and in which the pivotal armature operates a movable contact arm which makes or breaks an electrical contact. Movement is imparted to the contact arm by means of a generally U-shaped bracket which is connected to the armature by an adjustment screw threadably attached to the armature, by means of which adjustment of the air gap between the armature and the pole face is obtained.

BACKGROUND OF THE INVENTION

The invention relates to an electromagnetic relay, and more particularly, to a relay wherein the gap between the armature and the pole faces of a magnetic core may be adjusted by mere rotation of an adjustment screw which is threadably connected to the armature.

While the invention is designed to have general utility in "clapper" type relays, a specific example of an electromagnetic relay where it may be used is disclosed and claimed in application Ser. No. 542,612, filed Apr. 14, 1966 by James R. Burch and entitled Composite Photoelectric Relay Including An Electromagnetic Relay, now Patent No. 3,401,311, which is assigned to the same assignee as the present application.

Electromagnetic relays are commonly used for remote switching and controlling of electrical apparatus. One commonly known type of electromagnetic relay is armature or "clapper" type wherein energization of a coil attracts a pivotal armature to a pole face. Pivoting of the armature in turn effects movement of a contact arm which makes or breaks an electrical contact.

In the design of such an electromagnetic relay, the air gap between the armature and pole face is a critical dimension. This air gap determines to a large extent the electromagnetic force needed to make or break the electrical contact. It is not unusual that this air gap be maintained within a tolerance of plus or minus .001 inch. Because of the number of parts involved in the assembly of an electromagnetic relay, however, it is not feasible to attempt to maintain such a tight tolerance by merely manufacturing all of the parts to close tolerance. The air gap is generally set, therefore, after the electromagnetic relay has been assembled. In the past, complicated systems have been used to adjust the air gap. For example, rotatable, eccentric sleeves have been employed to shift the pivot axis of the armature. While such prior art designs can achieve close tolerances for the air gap, they are of costly and bulky construction.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide novel and improved means for adjusting the air gap between an armature and a pole face including a simple adjustment means connected to the armature.

Briefly stated, the object of this invention is achieved

by providing an adjustable armature for an electromagnetic relay with an adjustment screw threadably connected to the armature. The head of the adjustment screw bears against a bracket such that rotation of the screw pulls the armature away from the pole face and thereby adjusts the air gap between the armature and the pole face. After the air gap has been adjusted to the desired position, the head of the adjustment screw may be staked or epoxied to the bracket to prevent further rotation of the adjustment screw.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter of the invention which is sought to be protected, an understanding of the invention may be gained from the following detailed description of a preferred embodiment in connection with the accompanying drawings, of which:

FIGURE 1 is a perspective view of an electromagnetic relay embodying the invention;

FIGURE 2 is a side view of the electromagnetic relay of FIGURE 1 with some portions removed and others broken away showing the electromagnetic relay with the relay armature in its dropped out position wherein the associated contacts are normally engaged;

FIGURE 3 is a side plan view similar to FIGURE 2 with further portions removed, showing the relay armature in a second position during its pick-up movement;

FIGURE 4 is a side plan view similar to FIGURE 3, showing the relay armature in its picked-up position wherein the associated contacts are disengaged;

FIGURE 5 is a side plan view from the side opposite to that of FIGURE 3 with further parts removed, showing the armature in contact with both of the pole faces of the magnetic core;

FIGURE 6 is a side plan view similar to FIGURE 5, showing the armature slightly bowed due to rotation of the adjustment screw, and further showing the armature out of contact with one of the pole faces;

FIGURE 7 is an exploded view showing the end of the coil, the pole faces of the core, the armature, the bracket, and the adjustment screw, with their related positions.

DESCRIPTION OF A PREFERRED EMBODIMENT

The invention is illustrated as applied to an electromagnetic relay similar to the one described in detail of the previously mentioned application. The following description of the electromagnetic relay, given in connection with FIGURES 1 through 4 should aid, however, in appreciation of the present invention. Referring first to FIGURE 1, a single molded insulating base 2 is shown which provides support for the components of an electromagnetic relay 4. The electromagnetic relay includes an actuating coil 6 surrounding a magnetic core, a support frame 8, an armature 10, a resilient conductive spring 12, a bracket 14, a pair of metal members 16 and 18 for making electrical connection with the load desired to be controlled, and an adjustment screw 20 for adjusting the air gap between the armature 10 and the pole faces of the core as will be described in more detail later.

As best shown in FIGURE 2, the support frame 8 generally comprises a U-shaped member including a pair of parallel legs 22 and 24 and a right portion 26. The leg 22 may be attached to the insulating base 2 by means of screws 28, while the metal member 18, which is formed as part of the leg 22, extends through an opening 29 in the base 2 as shown in FIGURE 1.

The coil 6 is supported on the frame 8 by staking a magnetic core, portions of which are shown as pole faces 28 and 30, passing through the coil, to the right portion

26 of the frame 8. A conductive electrical shunting ring 32 surrounds pole face 28 of the core.

The armature 10 is pivotally supported upon the free end of the leg 24 of the frame 8 with a bent tab 33 thereof extending over an edge 34 of the leg 24 of the support frame 8. A pair of tabs 36 and 38 are bent out of the plane of the armature 10 and extend into a pair of notches 40 and 42 in the leg 24 of the support frame 8 so as to prevent the tab 33 from slipping off of the edge 34 of the leg 24.

Referring still to FIGURE 2, the resilient conductive means 12 is shown in the form of a U-shaped leaf spring which includes legs 44 and 46, and a bight portion 48. The leg 46 is attached to the bight portion 26 of the support frame 8 by means of a connecting screw 50. The screw 50 extends through an elongated slot shown by dotted lines 51 in the leg 46 of conductive means 12 which permits vertical movement of the conductive means 12 between the position shown by solid lines of FIGURE 2 and the position shown by dotted lines 52 of FIGURE 2. A tab portion 54 is bent out of the plane of the leg portion 24 of the support frame 8 and extends through an opening 56 in the bight portion 48 of the resilient conductive means 12 to prevent side movement of the resilient conductive means 12 with respect to the support frame 8.

The armature 10 is connected to the leg portion 44 of the resilient conductive means 12 by means of a pair of rivets 58. Located on the free end of the leg portion 44 of the resilient conductive means 12 is an electrical contact 60. The electrical contact 60 is positioned so as to make and break engagement with a fixed electrical contact 62 located on an upstanding portion 64 of the metal member 16 which is attached to the insulating base 2 by means of screws 66.

The leg portion 44 of the resilient conductive means 12 provides an adjustable spring bias on the electrical contact 60 as will now be described. The resilient conductive means 12 is formed with a substantially right angle bend between the leg portion 46 and the bight portion 48, while the leg portion 44 is formed at an angle of approximately 120° with the bight portion 48 of the resilient conductive means 12. Since the leg portion 46 of the resilient conductive means 12 is attached to the leg portion 26 of the support frame 8 by means of the attachment screw 50, the electrical contact 60 will be biased into contact with the fixed contact 62 as shown in FIGURE 2. The spring load or pressure applied to the abutting contacts 60 and 62 may be adjusted by variably positioning the slot 51 in the leg 46 of resilient means 12 with respect to the bight portion 26 of the support frame 8. With the resilient conductive means 12 in the position shown by the solid lines in FIGURE 2, the force applied between the contacts 60 and 62 is greater than that applied when the screw 50 secures the conductive means 12 to the frame 8 in the position shown by the dotted lines 52 in FIGURE 2.

The bracket 14, which forms a central part of this invention and which is best shown in FIGURES 1 and 7, is preferably a generally U-shaped member which includes a bight portion 68, a pair of parallel legs 70 and 72, and a third leg 74 located at one end of the bight portion 68. Four feet 76, 78, 80 and 82 are located on four corners of the legs of the U-shaped member for contact with the armature 10 as will be described. The bight portion 68 of the U-shaped member includes a circular opening 84 for receiving the adjustment screw 20 which is threaded into the armature 10. The screw 20 thus serves the dual function of permitting adjustment of the armature 10 and connecting the bracket 14 to the armature 10.

In addition to supporting the screw 20, the bracket 14 may also serve as a contact weld breaker. To this end, a notch 86 is provided in leg 74 between feet 80 and 82

for receiving a portion of the leg member 44 of the resilient conductive means 12 just above the electrical contact 60, as best shown in FIGURE 4. The notch 86 defines an edge 87 of the leg 74 with the edge 87 being spaced from the leg member 44 when the contacts 60 and 62 are engaged and being moved into engagement with the leg member 44 in response to movement of the armature 10 toward the magnetic core.

Briefly describing the operation of the electromagnetic relay, reference will be made to FIGURES 2, 3 and 4. With the actuating coil 6 deenergized or only slightly energized, the armature 10 assumes the position shown in FIGURE 2, with the movable contact 60 firmly engaging the fixed contact 62 due to the previously mentioned spring force in the resilient member 12. Partial energization of the actuating coil 6 establishes a magnetic force sufficient to cause the armature 10 to be attracted towards the pole faces 28 and 30 of the magnetic core. When this occurs the armature 10 moves away from the free end of the leg portion 44 of the resilient conductive means 12 until the edge 87 of the bracket 14 is moved into abutment with the free end of the leg portion 44 as shown in FIGURE 3. As the armature 10 moves toward the core upon partial energization of the actuating coil, the edge 87 of the bracket 14 is moved into contact with the free end of the leg portion 44 of conductive means 12 so that further movement of the armature 10 toward the core causes the edge 87 of the bracket 14 to forceably move the contact 60 away from the fixed contact 62. Finally, the armature 10 engages the pole faces 28 and 30 of the core as shown in FIGURE 4. If any welding of the contacts 60 and 62 should occur, the weld will be broken and the contacts 60 and 62 will immediately open when the edge 87 of the bracket 14 hits the free end of the leg portion 44 of the conductive means 12.

The operation of the preferred embodiment of the mechanism for adjusting the air gap between the armature 10 and the pole faces 28 and 30 of the core will now be described with respect to FIGURES 5 and 6. As best shown in FIGURE 5, the armature 10 is manufactured with tolerances such that the air gap between the armature 10 and the pole faces 28 and 30 is always too small. In accord with a preferred embodiment of the invention adjustment of the air gap to obtain proper pull-in and drop-out currents consists of bending a portion of the armature away from the pole faces 28 and 30 by some desired amount in response to rotation of screw 20. This bending operation is accomplished by pulling on the armature 10 by rotating the screw 20 which is threadably attached to the armature 10 by means of a threaded opening 88 (FIGURE 7) in the armature 10. As best shown in FIGURES 5 and 6, the head of the adjustment screw 20 bears against an outer surface 89 of the bracket 14, while the four feet 76, 78, 80, and 82 of the bracket 14, bear against an outer surface 90 of the armature 10. Clockwise rotation of the adjustment screw 20 as viewed from the right hand end of FIGURE 5 thus results in bending of a portion of the armature 10 away from the pole faces 28 and 30 as is shown in FIGURE 6. FIGURE 5 shows the position of the armature 10 and the pole faces 28 and 30 prior to this clockwise rotation of the adjustment screw 20, while FIGURE 6 shows the relative position after such a rotation. As thus described, an accurate air gap dimension between the pole faces 28 and 30 and an inner surface of the armature 10 can be obtained by a mere rotation of the adjustment screw 20. After the desired air gap is obtained, the adjustment screw 20 may be rigidly attached to the outer surface 89 of the bracket 14 by means of epoxy, staking, or welding to prevent further rotation of the adjustment screw 20.

The preferred embodiment of the adjustable armature mechanism has been described in connection with an electromagnetic relay in which the contacts 60 and 62 are normally biased closed. It should be obvious to one skilled in the art that, with only slight modifications, the

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invention will also be appropriate for use with an electromagnetic relay in which the contacts are normally biased open. Armature 10 in the preferred embodiment has been described as being manufactured with tolerances such that the air gap between the pole faces 28 and 30 and the inner surface of armature 10 is normally too small. With certain modifications, the armature could be manufactured with an air gap which is normally too large and the adjustment screw 20 would then close down this air gap. Further, the invention is applicable to a relay wherein the bracket 14 serves as a support for the screw 20 without functioning as a contact weld breaker.

While a preferred embodiment of this invention has been shown and described, it will be obvious to those skilled in the art that there are certain changes and modifications such as the above which may be made without departing from this invention in its broader aspects and, therefore, it is intended that the appending claims cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In combination, a pivoting armature for an electromagnetic relay, a bracket for making or breaking contact between a pair of electrical contacts upon pivoting of said armature in response to energization of an electrical coil, and an adjustment screw for adjusting said armature, said bracket including a bight portion and a plurality of spaced feet which bear against a surface of said armature, said bight portion including an opening receiving said adjustment screw, said screw having a head which bears against said bight portion and having a threaded end which is threadably connected to said armature such that rotation of said screw causes movement of said armature with respect to said bight portion of said bracket.

2. In an electromagnetic relay including a base, a fixed contact supported by said base, a magnetic core supported by said base, an actuating coil surrounding at least a portion of said core, an armature mounted for movement toward said coil upon energization of said core, a movable contact engageable with said fixed contact, resilient means supporting said movable contact, and a bracket adjacent an outer surface of said armature opposite an inner surface which contacts said core, the improvement comprising said bracket having a bight portion with an opening

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and a plurality of spaced feet bearing against said outer surface of said armature, and a screw extending through said opening of said bight portion, said screw having a threaded end in threaded engagement with said armature and having a head bearing against said bight portion such that rotation of said screw causes bending a portion of said armature away from said core.

3. The relay as described in claim 2 wherein said resilient means extends between said outer surface of said armature and said bracket, said bracket having an edge which engages said resilient means to move said movable contact in response to movement of said armature toward said core.

4. In an electromagnetic relay including a base, a fixed contact supported by said base, a magnetic core supported by said base, an actuating coil surrounding at least a portion of said core, an armature mounted for movement toward said core upon energization of said coil, a movable contact engageable with said fixed contact, resilient means supporting said movable contact, and a bracket for translating movement of said armature to said resilient means upon energization of said coil, the improvement comprising said bracket being in the form a generally U-shaped member which includes a bight portion, a pair of generally parallel legs attached to said bight portion, a third leg attached to the end of said bight portion, and a plurality of feet located on the corners of said legs bearing against an outer surface of said armature opposite an inner surface which contacts said core, and a screw extending through said bracket having a head bearing against said bight portion and threadably connected to said armature such that rotation of said screw moves said armature with respect to said core.

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U.S. Cl. X.R.

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