

May 23, 1967

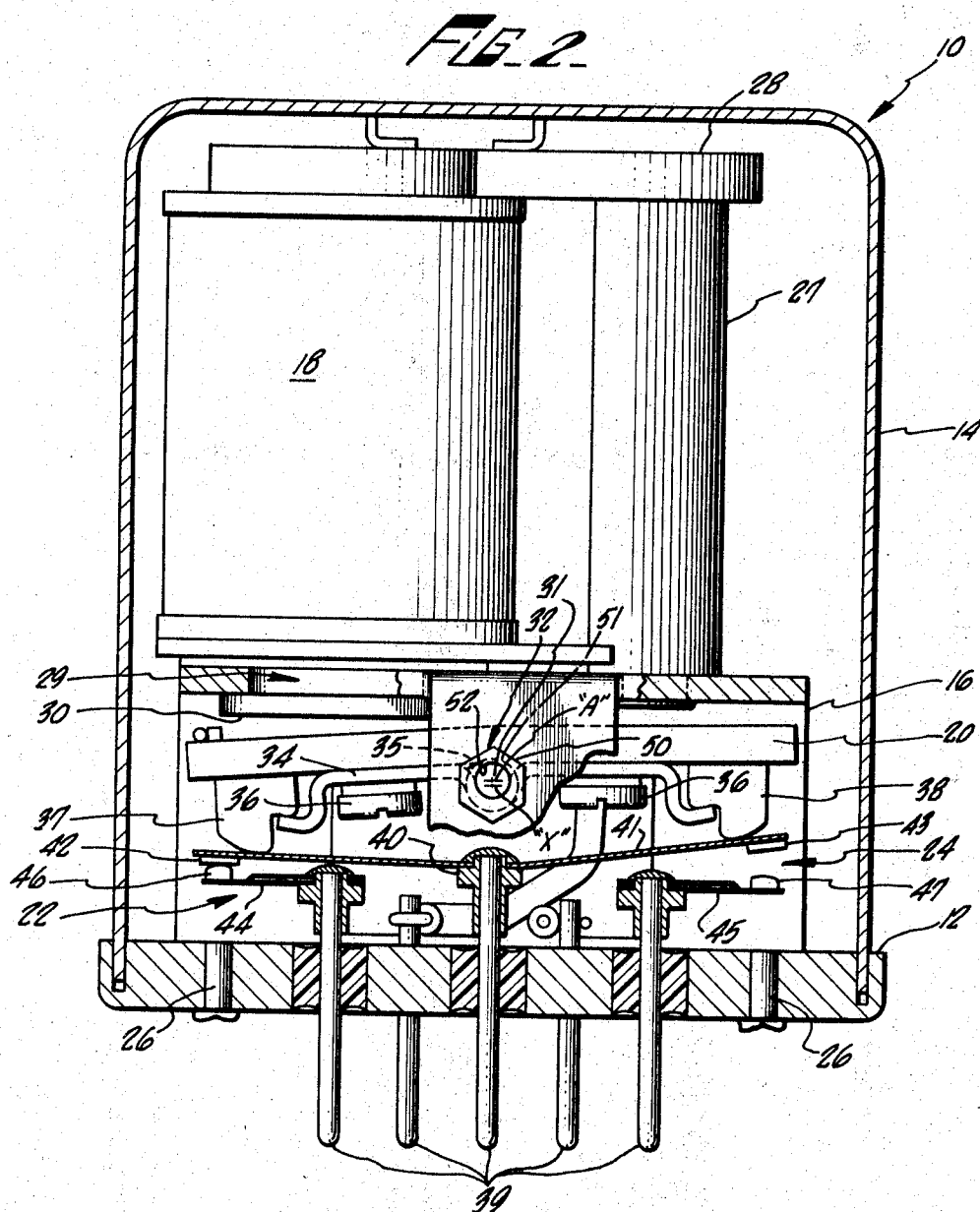
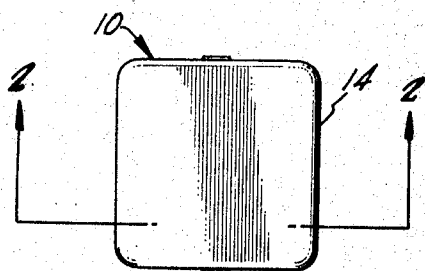
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3,321,722

RELAY WITH ADJUSTABLE ARMATURE

Filed Oct. 21, 1964

2 Sheets-Sheet 1



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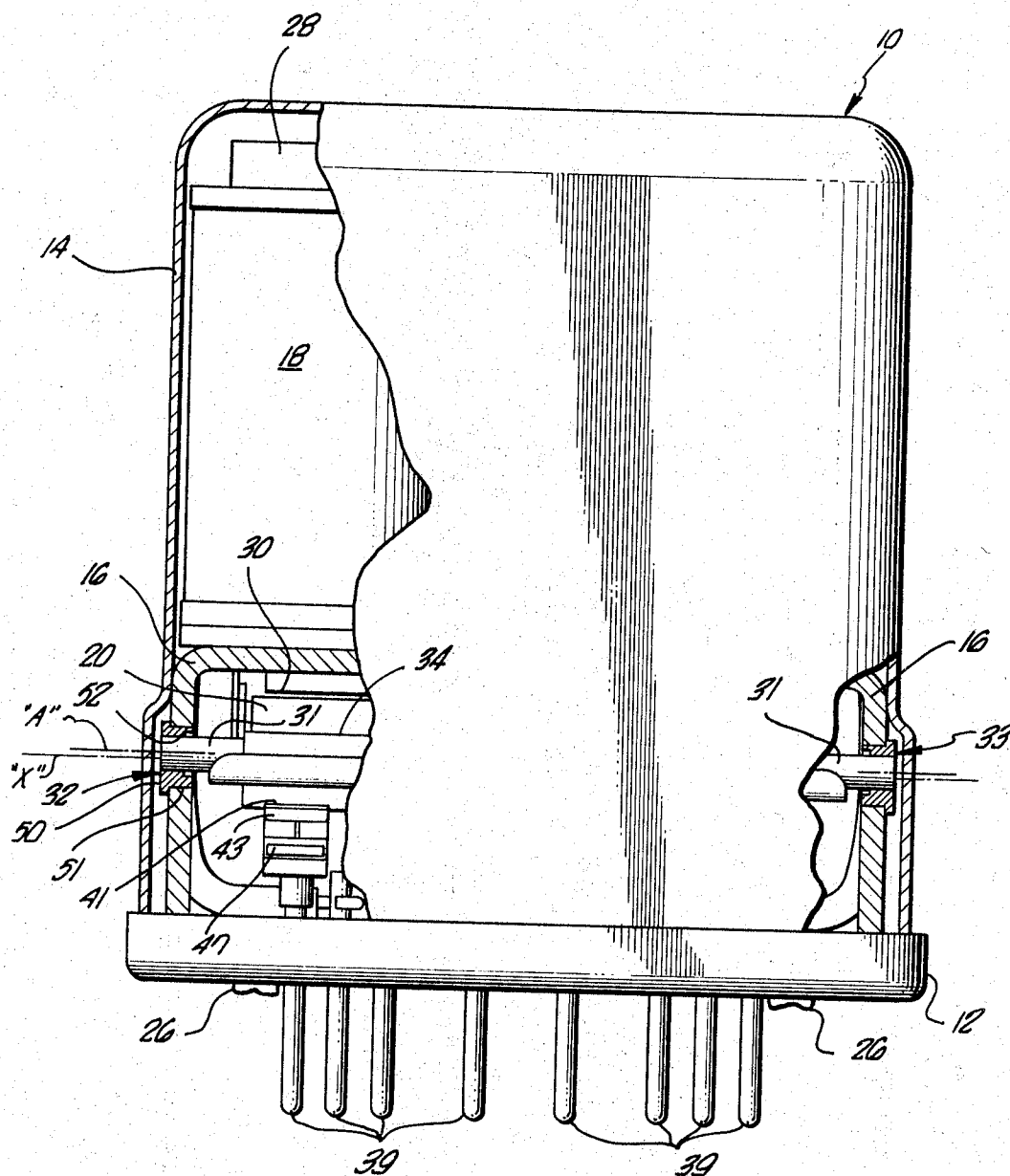


FIG. 3

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RELAY WITH ADJUSTABLE ARMATURE

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1 Claim. (Cl. 335-128)

This invention relates to relays, and in particular to a type of relay construction which does not require very precise parts and lends itself to adjustment of armature and pole pieces for maximum efficiency of a magnetic circuit.

Relays used in aircraft, guided missiles, and the like are required to withstand extreme amounts of shock and to operate under adverse conditions. Such relays are designed to meet or exceed requirements of an environment in which the vibration is typically 2,000 cycles per second. The shock and acceleration ratings must be more than 50 times the extra-terrestrial gravity, with a typical temperature operation range of -70° C. to 120° C. and a typical life requirement of 100,000 cycles. Keeping these requirements in mind, the construction of a relay capable of withstanding these requirements requires accurately made parts with close tolerances which in the past have been obtained by careful machining at a high cost.

The typical relay includes an electromagnet to operate an armature to either open or close one or more sets of electrical contacts. The "balanced" armature-type relay uses an armature which is pivoted and balanced about a midpoint and is more able to withstand extreme variations in the vibration, shock and acceleration. It is not unusual that the armature is fitted upon a supporting frame relative to the electromagnet within a tolerance of plus or minus .001 inch. In the past, it is typical that the balanced armature relay is checked against a standard to accurately locate the relative position of the parts. In most cases the parts are not accurately located and must be manually deformed to bring them within the tolerance. The time and cost of checking and adjusting the relays adds to the cost of the relay, and is a disadvantage in using relays as a part of a control system in military application and the like.

My invention provides a relay which eliminates the disadvantages of the known prior art balanced armature relays. It allows full adjustment of the armature relative to the pole faces, even though one of the parts of the relay has been deformed during fabrication or assembly. This allows the individual parts for the relay to be fabricated with looser tolerances and still perform with maximum efficiency.

Preferably, the pivot axis of the armature is adjustable relative to an electromagnet pole face so the axis may be made parallel or inclined to the pole face after the relay is in an assembled condition.

In the presently preferred form of the invention, the relay is formed with a frame having an electrically energizable coil including a core mounted thereon. An armature is pivotally mounted upon the frame and is aligned with the core so the armature may be magnetically attracted to the core pole face. A means for selectively regulating the position of the armature relative to the core pole face is coupled to the armature. In one form the regulating means is an eccentric sleeve mounted on the frame and disposed on opposite sides of the armature so the sleeves may be independently rotated to shift the armature pivot axis to be either parallel or inclined to the magnet pole face.

Other aspects of the invention will be apparent from the following description and accompanying drawings in which:

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FIG. 1 is a plan view of a relay constructed according to the present invention;

FIG. 2 is a partial cross-sectional view of a balanced armature relay embodying the present invention, the section taken along line 2-2 of FIG. 1; and

FIG. 3 is a partial side elevation of the balanced armature relay illustrated in FIG. 2.

Referring to the drawings, a relay 10 includes a header 12, a can 14, a frame 16, an electromagnet coil 18, a set of normally closed contacts 22 and a set of normally open contacts 24. The rectangular hollow can 14 is hermetically sealed upon the header 12 in well-known manner. The frame 16 is formed from sheet metal in a substantially inverted U shaped configuration and mounted upon the header 12 by a pair of downpending legs 26 which extend through the header 12 and are deformed at their extremity to rigidly engage the header against the frame. A cylindrical post 27 is mounted upon the upper surface of the frame 16, and has a yoke 28 cantilevered at right angles from the post. The yoke 28 is secured to the upper portion of post 27 by a conventional fastener (not shown). An elongated cylindrical conventional core 29 is secured at its upper surface against the yoke 28 and has an enlarged face 30 which extends beneath the frame 16. The conventional coil 18 is wrapped around the core 29 and is suspended between the yoke 28 and the frame 16.

The armature 20 has a generally rectangular configuration and is formed from a ferrous material which may be attracted to the pole face 30 of the core 29 when the coil 18 is energized. The armature 20 is pivoted relative to the pole face 30 upon a cylindrical pin 31 journaled within adjustable bearings 32 and 33 mounted within the frame 16. An elongated saddle 34 having an extended semi-circular pocket 35 formed therein is secured against the armature 20 by a pair of fasteners 36. The elongated pocket 35 mates with the pin 31, serves as a journal for the pin, and secures the armature against the pin. A spring (not shown) serves to bias the armature into the position illustrated in FIG. 2 in which the armature is spaced from the pole face 30. The coil 18, when energized by conventional leads (not shown), establishes a magnetic field which magnetizes the core 29 and pulls the armature 20 clockwise until it engages the pole face 30. A pair of insulated contact engaging noses 37 and 38 abut the lower portion of the armature 20 and are retained in position by the extremities of the saddle 34. The noses 37 and 38 transmit the motion of the armature 20 and operate the contacts 22 and 24.

A series of contact pins protrude outwardly from the header 12 and afford external connections with the contacts of the relay. The contacts 39 are rigidly held in position by potting materials such as compression glass which is disposed within header 12. The central contact 39 has a bushing 40 fixedly secured thereon and serves to support and pivot a central current carrying spring 41. At either end of the spring 41 is disposed a movable contact button 42 and 43. Flexible current carrying springs 44 and 45 are individually mounted upon the upstanding contact pins 39 and each have a respective contact button 46 and 47 disposed beneath and aligned with the respective movable contact buttons 42 and 43. Thus, in the position as illustrated in FIG. 2 there is electrical continuity between the contacts 42 and 46 while the contacts 43 and 47 are in the open position.

As the coil 18 is energized or de-energized, the armature 20 pivots about pin 31 to open and close the sets of contacts 22, 24.

The relay 10 is operable under extremes of environmental operating temperatures which will necessarily vary the amount of power available to move the armature 20 from the position illustrated in FIG. 2 to a posi-

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tion in which it abuts the pole face 30. Because these variations in temperature can vary the amount of power greatly, the relative position on the armature and the associated component parts relative to the pole face are necessarily required to be very accurate. This arrangement not only requires that the position of the component parts be accurately placed, but also that the distance between the pole face 30 and the armature 20 be accurately aligned after assembly, which entails considerable labor and which can be somewhat difficult to execute in the conventional relay, which requires that the individual components be deformed in order to change the position of the components.

The normally open contacts 24 must be checked to accurately position the contacts relative to each other and the normally closed contacts 22 must be checked to determine the amount of pressure existing between the two contacts.

The journal bearings 32 and 33 disposed on opposite sides of the frame 16 to support the pin 31 are used for adjusting the position of the armature relative to the core pole face.

The bearings 32 and 33 are symmetrical in shape and, as illustrated in FIG. 2, the bushing 32 includes a hexagonally shaped head 50 and an outer cylindrically shaped bearing surface 51 which is eccentrically positioned relative to the inner cylindrically shaped bearing surface 52. To illustrate the eccentricity between the outer bearing surface 51 and the inner bearing surface 52, the axis of rotation of the bearing surface 52 is illustrated in FIG. 2 as axis A and the axis of the outer bearing surface 51 is axis X. Since the pin 31 is mounted within the inner bearing surface 52, rotation of the bushing 32 within the frame 16 shifts the pin 31. Bushings 32 and 33 may be rotated relative to each other such that the pin 31 may be adjusted to be parallel or inclined to the frame 16 and to the pole face 30 of the core 29.

The operation of the present invention will now be described. Relay 10 is assembled as illustrated in the drawings and the coil 18 is tested to determine the amount of power required to move the armature between an energized and deenergized position. The relative

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spacing between the armature and the pole face 30 is measured along with the spacing between the normally open contacts. If error is found in the relative spacing of the components, either one or both of the bushings 32 and 33 are rotated to change the relative position of the armature with the pole face 30. The current carrying spring 41 is constantly biased against the insulated noses 37 and 38. A change in the armature position thus also changes the position of the movable contact buttons 42 and 43 mounted upon the spring 41. Thus, in rotating the bushing 32 or 33, the position of the armature 20 is shifted along with the position of the movable contacts 42 and 43. With the relay accurately aligned, the bushings 32 and 33 are secured to the frame 16 in a conventional manner such as staking or welding to prevent rotation of the bushings from the selected position.

What is claimed is:

A relay comprising:

a frame;

an electrically energizable coil secured to the frame and including a core having a pole face;

an armature;

an elongated pivot pin engaged with the armature; and a pair of spaced-apart eccentric bearings independently journaled through the frame and engaged with opposite ends of the pivot pin for supporting the armature to be movable toward and away from the pole face, whereby rotational adjustment of the eccentric bearings shifts the position of the pivot pin laterally with respect to the frame to adjustably position the armature with respect to the pole piece.

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