Oct. 27, 1964 J. H. ROWELL 3,154,653

CENTER PIVOTED ARMATURE ROTARY RELAY

Filed Feb. 16, 1962 2 Sheets-Sheet 1

Fig. 1

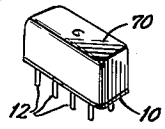


Fig. 2

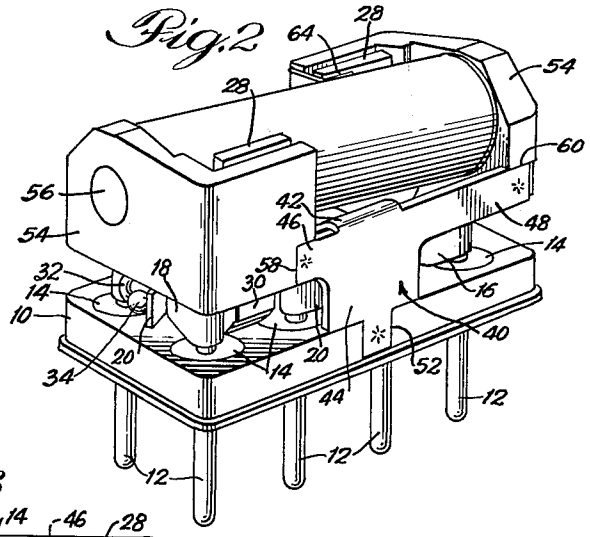


Fig. 3

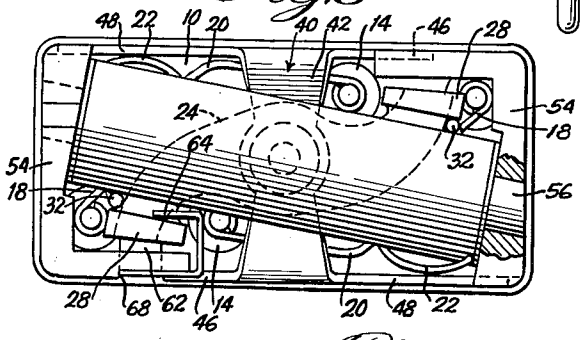


Fig. 5

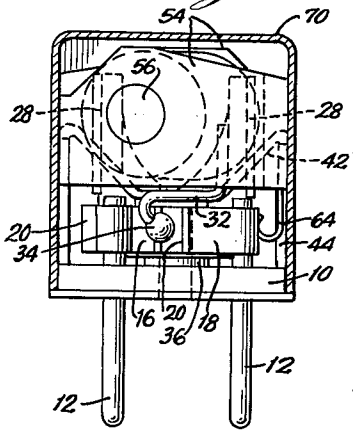
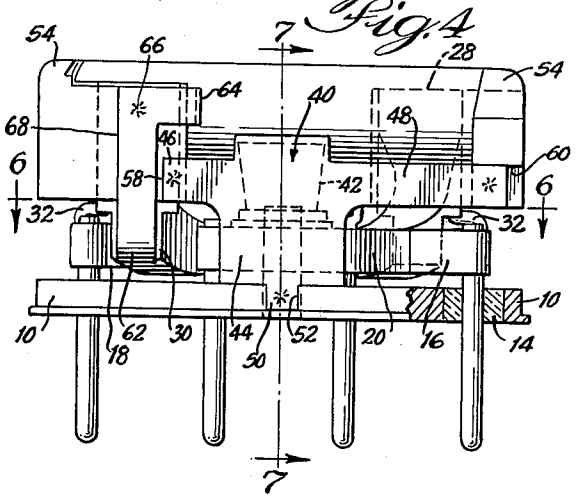


Fig. 4



INVENTOR:
James Henry Rowell,

BY Bair, Freeman & Molinare
ATTORNEYS.

Oct. 27, 1964 J. H. ROWELL 3,154,653

CENTER PIVOTED ARMATURE ROTARY RELAY

Filed Feb. 16, 1962 2 Sheets-Sheet 2

Fig. 6

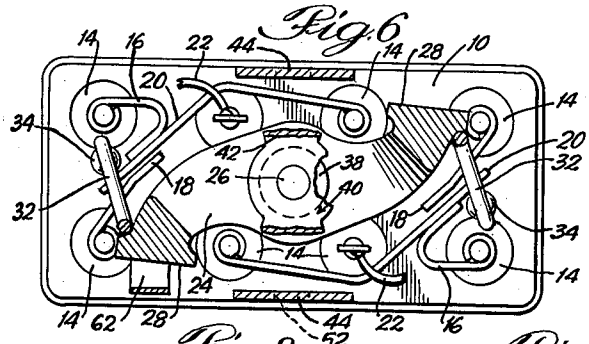


Fig. 7

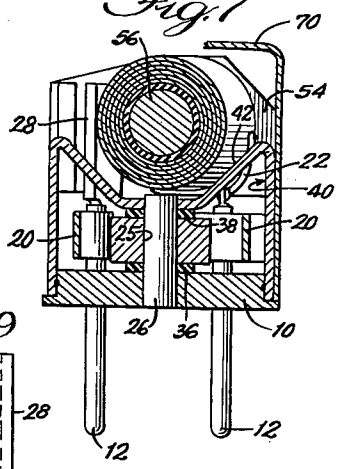


Fig. 8

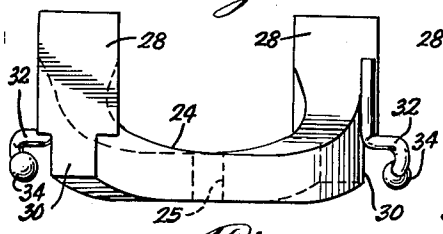


Fig. 9

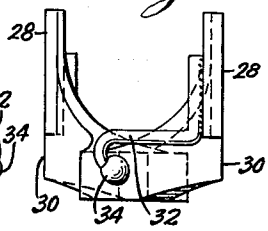
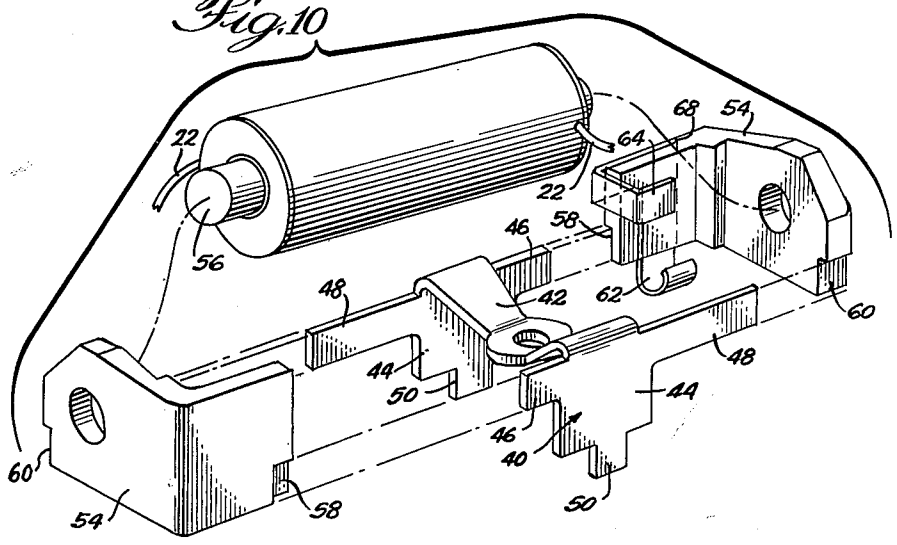


Fig. 10



INVENTOR:
James Henry Rowell,

BY Bair, Freeman & Molinare
ATTORNEYS.

United States Patent Office 3,154,653 Patented Oct. 27, 1964

3,154,653

CENTER PIVOTED ARMATURE ROTARY RELAY

James Henry Rowell, Joliet, Ill., assignor to Phillips-Eckhardt Electronic Corporation, Joliet, Ill., a corporation of Illinois

Filed Feb. 16, 1962, Ser. No. 173,746
7 Claims. (Cl. 200—87)

This invention relates to a miniature, compact rotary relay in which the parts are so designed as to provide compactness and thereby small size in order to produce a relay of minimum weight for missiles, airplanes and the like.

One object of the invention is to provide a relay header which has contacts on the top thereof which are so designed that space is provided among them for an armature pivot and the major portion of the armature itself, thereby eliminating the necessity of providing vertical space for the armature.

Another object is to provide a relay coil which occupies the space immediately above the contacts and armature, and which has pole pieces of L-shape lying in a horizontal plane to reduce the vertical space required therefor, such space being substantially the diameter of the relay coil.

Still another object is to provide the relay coil at an angle in the housing of the relay, so that at diagonally opposite sides thereof adjacent the ends of the coil, space is provided for armature pads to be attracted toward the L-shaped pole pieces when the relay coil is energized.

A further object is to provide a relay assembly that includes a support for the relay coil and its pole pieces which minimizes the vertical space required for its installation, and additionally serves as a retainer for the armature when the relay is assembled.

Still a further object is to provide a return spring for the armature which also has a stop for the armature, the return spring being conveniently assembled by a spot-welding operation in relation to one of the pole pieces.

Still a further object is to provide components of a rotary relay so designed as to minimize space, weight and volume, which considerations are paramount in missiles and the like as long as proper operation of the relay can be assured.

An additional object is to provide a header with the usual contact pins but a novel design of contacts, armature and coil with its pole pieces so that these parts cooperate with each other for proper operation of the relay, yet may be confined in a housing much smaller than previous miniature relays of this general type.

With these and other objects in view my invention consists in the construction, arrangement and combination of various parts of my rotary relay whereby the objects above contemplated are attained as hereinafter more fully set forth, pointed out in my claims and illustrated in detail on the accompanying drawings wherein:

FIG. 1 is a perspective view of a rotary relay embodying my invention and showing a full size illustration thereof.

FIG. 2 is an enlarged perspective view of the relay with the housing removed.

FIG. 3 is a plan view of FIG. 2.

FIG. 4 is a side elevation thereof.

FIG. 5 is an end elevation thereof with the relay housing shown in cross section.

FIG. 6 is a horizontal sectional view on the line 6—6 of FIG. 4 to show contact and armature details.

FIG. 7 is a vertical sectional view on the line 7—7 of FIG. 4 to show the relationship of armature and relay coil, and supporting and retaining means therefor.

FIG. 8 is a side elevation of the armature of the relay.

FIG. 9 is an end elevation thereof, and

FIG. 10 is an exploded perspective view of the relay coil, the pole pieces, a supporting bracket and a return spring of my relay.

On the accompanying drawings I have used the reference numerals 10 to indicate a header base of a relay and 12 the terminals thereof. Usually there are eight of the terminals 12, six of which are used for the contacts of a double pole-double throw switch, and the other two for the relay coil circuit. The header base 10 is of metal and the terminals 12 are insulated therefrom by molded insulation inserts 14 shown in FIG. 4 which is the usual construction for miniature relays of this general type. The lower ends of the terminals 12 may be in the form of prongs as illustrated, the length of which may be varied from that shown if desired, or the lower ends formed into eyes for soldering leads thereto also in the usual manner.

As best shown in FIG. 6 a pair of normally closed contacts 16 and a pair of normally open contacts 18 are provided in the form of leaf springs soldered to six of the terminals 12 as shown. The remaining two terminals have relay coil leads 22 soldered thereto, the relay coil being shown at 24 in FIG. 10. These two terminals accordingly supply the control current to the relay coil whereas the other six terminals are for appropriate controlled circuits. The leaf springs 16, 18 and 20 are bent to the shapes illustrated to provide among them space for an armature 24 pivoted on a pin 26 which is brazed into the header base 10 and thereby rigidly positioned relative thereto.

The armature 24 is S-shaped so as to pivot a few degrees, and its ends terminate in upwardly projecting rectangular pads 28 as shown in FIGS. 8 and 9. The ends of the armature are indicated 30 in FIG. 8 and it will be noted are narrow enough to operate with freedom between the adjacent terminals 12. The armature is so shaped as to be of substantially equal cross sectional area throughout its length to insure full and efficient utilization of the magnetic field, and may be formed of sintered ferrous material. Its odd shape also permits it to clear the relay coil, the contacts and the terminals of the relay. Soldered or welded to the pads 28 are actuating rods 32 terminating in glass beads 34 adapted to engage the contact blades 20 and move them from the contacts 16 to the contacts 18 when the armature is rotated counter-clockwise in FIG. 6.

FIG. 7 shows the armature 24 in cross-section at the pivot pin 26. Teflon washers 36 and 38 encircle the pivot pin 26 and are located above and below the armature. To retain the armature in position a supporting bracket is provided having a perforated, trough-like upper portion, a pair of sides 44 and each side provided with a plurality of arms 46, 48 and 50. The arms 50 are spot-welded in notches 52 of the header base 10 whereby the bracket is mounted with respect to the base.

The supporting bracket 40 supports a pair of L-shaped pole pieces 54 and a core 56 on which the relay coil 24 is wound. The pole pieces are provided with notches 58 and 60 which receive the arms 46 and 48 of the supporting bracket 40, and are held assembled relative thereto by spotwelding as illustrated in FIG. 2.

An armature return spring 62 is provided, and is of such shape that it also provides an armature stop 64. As shown in FIGS. 3 and 4 the spring 62 is spotwelded as at 66 against a shoulder 68 on one of the pole pieces which are also made of sintered ferrous material. Thus a simple stamping serves both as a return spring for the armature and a stop therefor, the armature being returned by the spring engaging one of its pads 28 against the stop 64 as shown in FIG. 3.

In the operation of my relay, energization of the relay

coil 24 magnetizes the L-shaped pole pieces 54 so that the portions thereof adjacent to the armature pads 28 will attract them to cause the blades 34 to engage the contact springs 20 and move them from the normally closed contact 16 to the normally open contact 18. Contact between 18 and 20 occurs just before the pads contact the pole pieces so as to insure the circuits being made, and a slight overtravel of the blades 20 to cause wiping action that insures clean contacts. In the closing direction the contacts 20 engage the contacts 16, and the beads 34 move on slightly spaced from the contacts 20. The angles at which the contact springs 16 are bent insure slight travel after engagement of 20 with 16 by reason of the spring pressure in the contacts 20 to cause wiping action between 16 and 20 also.

By nesting the armature 24 among the contacts 16, 18 and 20 and having its ends operate between certain of the terminals 12 as illustrated, all within substantially the height of the relay coil 24 represented by its diameter, the size of the relay is minimized. The pole pieces and the pads 28 of the armature 24 are so located as to eliminate requiring separate height dimensions for these particular elements of the relay. Thus the total height thereof is less than one-half the usual height of this general type of relay and may be enclosed within a housing 70 likewise of small height. The housing 70 is usually soldered around its lower edge to the header base 10 whereby a hermetically sealed relay unit is provided to exclude dust, moisture and the like that might cause malfunctioning of the relay.

By tilting the relay coil 24 at an angle as shown (particularly in FIG. 3) space is provided on diagonally opposite sides thereof for movement of the armature pads 24 from the normal position shown to an energized position rotated about 1 or 2 degrees counter-clockwise from the position shown. The arrangement disclosed allows room for the magnetic circuit without however sacrificing cross sectional area of the armature and pole face area at the outer faces of the pads 28. Placement of the coil at an angle immediately above the contacts and armature of the relay reduces dimensions and permits cradling of the coil with respect to the armature, all of which results in less size and weight of the completed relay assembly.

The angular arrangement of the contacts 16, 18 and 20 as shown in FIG. 6, in addition to promoting a wiping action for keeping the contacts clean, reduces the total force causing opening of the contacts under shocks and vibrations and permits adaptation and accommodation of shock forces to which the relay is subjected. Because of the angles at which the contacts are formed, greater shock and vibration forces are required to separate them yet they are readily separated by the action of a relatively small current in the relay coil 24.

The single stamping 62–64 provides an integral return spring and stroke positioner. The parts shown in FIG. 10, when assembled and then mounted on the header base 10 act as a retainer for the armature. The relay can be reduced to substantially half size because of the features disclosed.

Some changes may be made in the construction and arrangement of the parts of my rotary relay without departing from the real spirit and purpose of my invention and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

I claim as my invention:

1. In a rotary relay, a header comprising a header base and terminals mounted therethrough, contacts on said terminals within a predetermined height above said base, an armature within substantially said predetermined height and pivoted centrally among said contacts, said armature being S-shaped and provided with pole pads within a second predetermined height projecting above said first predetermined height, a relay coil and L-shaped pole pieces therefor within said second predetermined height, said pole pieces extending around diagonally opposite corners of said relay, a core for said relay coil at an angle from pole piece to pole piece to provide space between diagonally opposite sides of said coil and the poles of said pole pieces in which said pole pads may operate, and means carried by said armature for operating said contacts.

2. In a rotary relay, a header base, terminals extending upwardly therefrom, contacts on said terminals within a predetermined height above said base, a pivoted armature within substantially said predetermined height, said armature being provided with pole pads within a second predetermined height above said first predetermined height, a relay coil and L-shaped pole pieces therefor within said second predetermined height, said pole pieces extending around diagonally opposite corners of said relay, a core for said relay coil extending from pole piece to pole piece, means carried by said armature for operating said contacts, a supporting bracket for said pole pieces and said relay coil having arms connected with said pole pieces and with said base, and having a cross member for retaining said armature against said header base.

3. In a rotary relay, a header comprising a header base and terminals mounted therethrough, contacts on said terminals within a predetermined height above said base, an armature within substantially said predetermined height, a pivot pin mounted in said header base and extending through said armature, said armature being S-shaped and provided with pole pads within a second predetermined height projecting above said first predetermined height, a relay coil and L-shaped pole pieces therefor within said second predetermined height, said pole pieces extending around diagonally opposite corners of said relay, a core for said relay coil at an angle from pole piece to pole piece to provide space between diagonally opposite sides of said coil and the poles of said pole pieces in which said pole pads may operate, means carried by said armature for operating said contacts, and a supporting bracket for said pole pieces and said relay coil having portions connected with said pole pieces and with said base, and having a cross member for retaining said armature in opposition to said header base, said cross member having an opening receiving said pivot pin.

4. In a rotary relay, a header comprising a header base and terminals mounted therethrough, a pivot pin located centrally among said contacts, carried by said header base and projecting upwardly therefrom, contacts on said terminals within a predetermined height above said base, an armature within substantially said predetermined height and pivoted on said pivot pin, said armature being S-shaped and provided with pole pads within a second predetermined height above said first predetermined height, a relay coil and L-shaped pole pieces therefor within said second predetermined height, said pole pieces extending around diagonally opposite corners of said relay, a core for said relay coil at an angle from pole piece to pole piece to provide space between diagonally opposite sides of said coil and the poles of said pole pieces in which said pole pads may operate, means carried by said armature for operating said contacts, and a supporting bracket having a cross member for retaining said armature with respect to said header base.

5. A relay as claimed in claim 1 and a combined armature return spring and stop mounted on one of said pole pieces and comprising a member having a leaf spring blade engaging one side of one of said pole pads to normally bias said armature in one direction and having a stop for said pole pad on the other side thereof.

6. A relay as claimed in claim 1 and a combined armature return spring and stop mounted on one of said pole pieces.

7. A rotary relay as claimed in claim 2 wherein said contacts comprise normally open contacts, normally

closed contacts and contact springs between said normally open contacts and said normally closed contacts, said normally open contacts and said normally closed contacts being blade-like and disposed at an angle to provide for contact wiping action when said contact springs are closed thereagainst.

References Cited in the file of this patent

UNITED STATES PATENTS

1,104,077	Smith	July 21, 1914
2,506,792	Juhasz	May 9, 1950
2,993,150	Johnson	July 18, 1961
3,013,136	De Fligue	Dec. 12, 1961