May 22, 1962 T. W. KENYON ETAL 3,036,176

ELECTRICAL RELAY

Filed Aug. 11, 1959 2 Sheets-Sheet 1

Fig. 3.

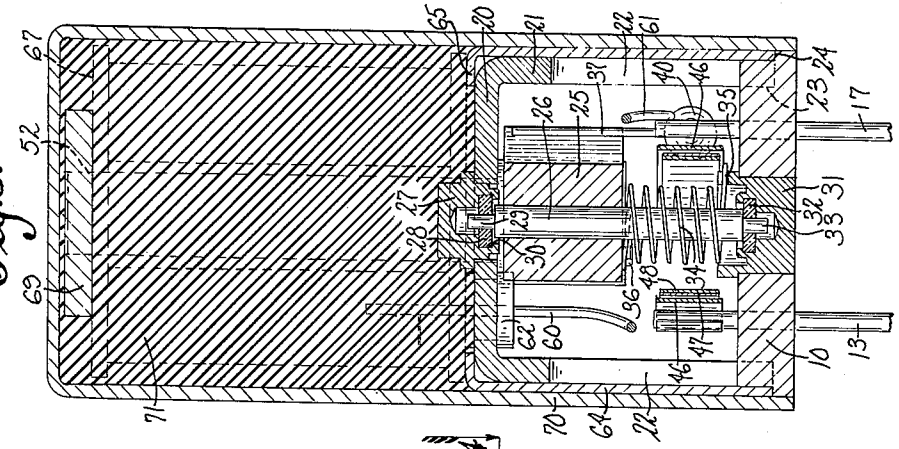


Fig. 2.

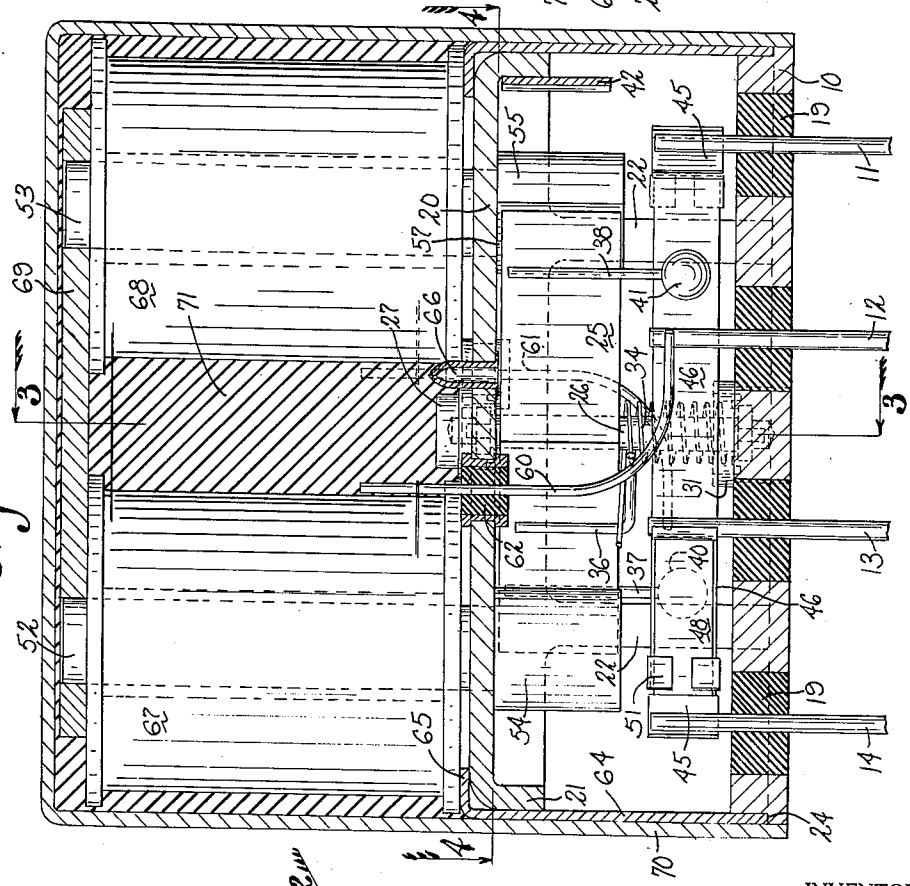
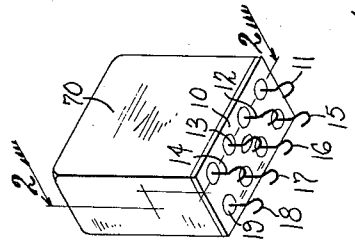


Fig. 1.



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May 22, 1962 T. W. KENYON ETAL 3,036,176

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2 Sheets-Sheet 2

Fig. 4.

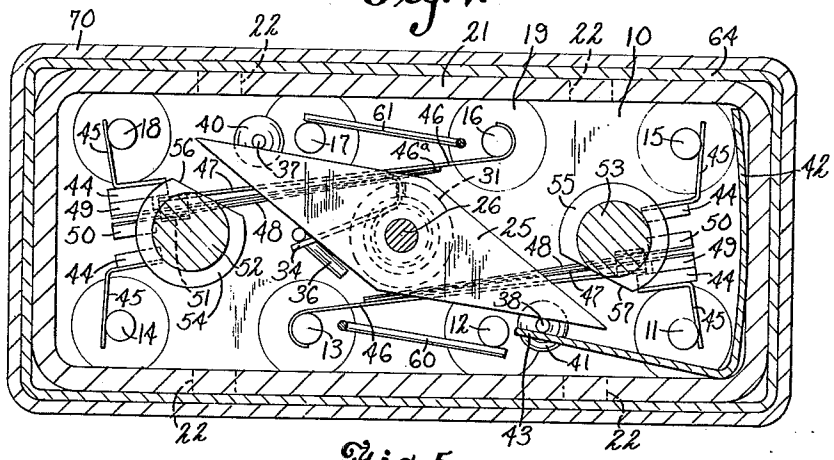


Fig. 5.

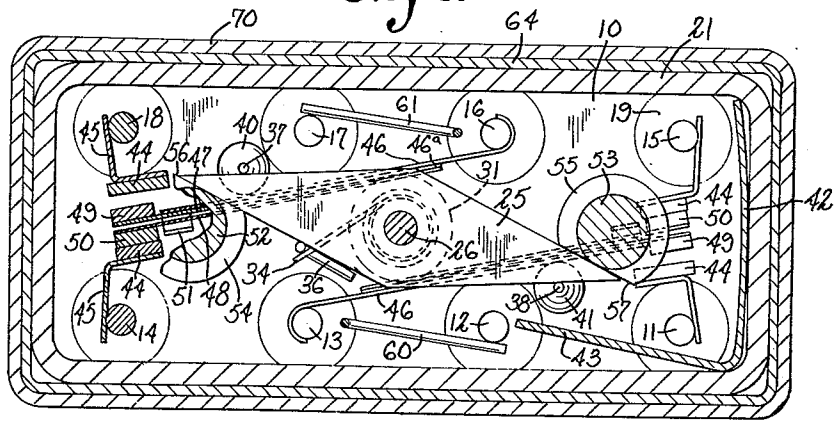


Fig. 6.

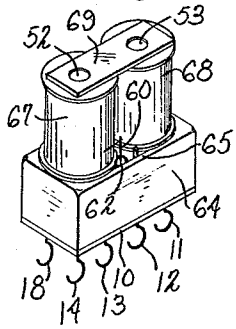


Fig. 7.

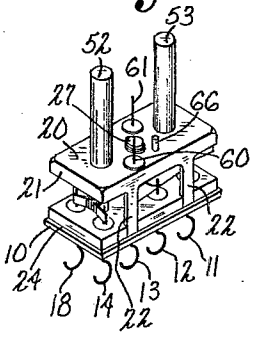
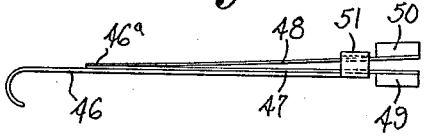


Fig. 8.



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3,036,176

ELECTRICAL RELAY

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Filed Aug. 11, 1959, Ser. No. 832,932
11 Claims. (Cl. 200—104)

This invention relates to electrical relays and more particularly to a relay of miniature size which will be reliable and dependable in operation and will not be affected in operation, by outside forces.

The relay is also so constructed that it may be hermetically sealed to prevent the entrance of moisture which might affect its operation and is so constructed that it will operate in any position in which it may be placed.

It is contemplated by the present invention to provide a relay having an armature mounted to rotate about a pivot or axis, the parts being so designed that the armature will be substantially balanced about this axis so that its movement will not be affected by outside forces. Moreover, the various elements are so assembled that they occupy a minimum of space and are in a compact arrangement so that the entire structure will be of very small dimensions and at the same time give reliable and dependable performance.

One object of the present invention is to provide a new and improved rotary electrical relay.

Still another object of the invention is to provide an improved electrical relay of the rotary type, the elements of which may be compactly arranged so as to provide a miniature structure.

Still another object of the invention is to provide a relay of the character described which may be sealed against the entrance of air and moisture and which at the same time will be of small size and dependable in operation.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

FIG. 1 is a perspective view of a relay embodying our invention;

FIG. 2 is a sectional view on line 2—2 of FIG. 1;

FIG. 3 is a sectional view on line 3—3 of FIG. 2;

FIG. 4 is a sectional view on line 4—4 of FIG. 2;

FIG. 5 is a view similar to FIG. 4 showing the armature and associated parts in another position;

FIG. 6 is a perspective view of the assembled structure before the cover is placed thereon;

FIG. 7 is a view similar to FIG. 6 with the omission of the coils and inner casing or can; and

FIG. 8 is a top plan view of the compensated contacts employed in the structure.

Referring particularly to FIGS. 2 and 3 of the drawings, the relay comprises a header or base-supporting structure 10 having mounted therein a plurality of conducting terminals 11 to 18 inclusive although the numbers of these terminals may be varied depending upon the number of circuits which it is desired to close by the relay. Each of these terminals may be sealed in and insulated from the header or support 10, as shown at 19, the ends of these terminals projecting upwardly from the header to lie within the space between it and an upper supporting bridge or plate 20.

The plate 20 is a relatively thin flat member of substantially rectangular shape as illustrated and is provided with a depending flange 21 at each of its four edges. Projecting downwardly from this flange are integrally formed legs 22, there being two upon each of the longer sides of the plate, which members are received in recesses

23 of the header 10 and welded thereto. Thus the supporting plate 20 is held in spaced relation with the header and the outer faces of the legs 22 are set inwardly from the side edges of the header member. The latter is also provided with a narrow shelf 24 extending about all four sides thereof for a purpose to be hereinafter described.

An armature 25 substantially diamond shaped in form (FIG. 5) is secured to a shaft 26 (FIG. 3), this shaft having an upper bearing in the plate 20 and a lower bearing in the header 10. To this end a bearing cup 27 is mounted in the plate 20 and sealed thereto, this cup supporting a jeweled bearing 28 which rotatably receives the reduced end 29 of the shaft 26. The rim of the bearing cup may be spun over the bearing, as shown at 30, to hold the latter in place. A similar bearing cup 31 is sealed into an opening in the header 10 and likewise carries a jeweled bearing 32 supporting the lower reduced end 33 of the shaft 26 so that this shaft and the armature are rotatably mounted within the assembly consisting of the spaced members 10 and 20.

The shaft 26 is of greater length than the width of the armature and embracing the shaft below the armature is a torsion spring 34 having one end secured at 35 in the bearing cup 31. The other end of this spring (FIG. 2) bears against an L-shaped pin 36 rigidly secured to one face of the armature so that the tension of the spring normally tends to rotate the armature in a clockwise direction, as shown in FIG. 4.

Secured at each side of the armature 25 adjacent the end thereof are pins or fingers 37 and 38 which depend downwardly from the armature and are provided upon their lower ends with beads 40 and 41 of nonconducting material. A stop limiting clockwise movement of the armature is provided in the form of a relatively thin L-shaped sheet metal member 42 (FIGS. 2 and 4) mounted within the flange 21 below the plate 20, and one end 43 of this member engages the pin 38 to form a limiting stop to the movement of the armature under the force of the spring 34.

Contacts 44 which may be of some such metal as silver or gold are secured to each of the corner terminals 11, 14, 15 and 18 by means of L-shaped plates 45 of any suitable material such as beryllium copper, for example, these plates being welded to the terminals and to the contacts. Welded to each of the terminals 13 and 16 are the ends of resilient actuating or spring members 46, the other ends of which are free. Welded in superposed relation to one side of each actuator member, as at 46a, are the resilient spring contact arms 47 and 48, which respectively carry contacts 49 and 50 at their free ends. These arms extend in diverging relation from their point of connection and the contacts 49 and 50, as shown in FIGS. 4 and 5, lie between the contacts 44 of the pairs of terminals. The free end of each of the actuators or spring members 46 is provided with flanges 51 which are turned over the outer face of the associated contact arm 48 so that each of the contact arms 47 and 48 will be loosely embraced between these flanges and the body of the actuator or spring member 46 so that, while they will be moved by the actuator or spring member, some play will be allowed between the latter and the contact arms.

Magnet coils are mounted above the plate 20 and to this end cores 52 and 53 are mounted above the plate and extend downwardly through openings in the plate where the projecting ends are provided with heads 54 and 55 constituting the magnet poles slightly larger in diameter than the core rods. These members extend snugly through the openings in the plate and are sealed therein. As shown in FIGS. 4 and 5 these head members are provided with flat faces 56 and 57 to be engaged by the adjacent flat faces of the diamond-shaped armature 25 when

the latter is attracted toward the magnet cores. Wires 60 and 61 are connected respectively to the terminals 12 and 17, these wires extending upwardly through openings in the plate 20 and sealed therein, as shown at 62 (FIG. 2), these wires serving to energize the magnet coils as will be hereinafter explained.

When the parts thus far described have been assembled they may be sealed against the entrance of air thereto by the cover or can 64, the sides of which extend downwardly to the shelf 24 of the header 10 to which they are sealed. At its upper end the cover 64 is provided with a peripheral inwardly extending flange 65 which overlies the plate 20 and is sealed thereto. Thus the terminals within the member 64 together with the movable and fixed contacts and the armature are within a sealed enclosure, thus preventing the entrance of air or moisture thereto. The plate 20 is provided with an exhaust tube or vent 66 from which the air may be exhausted and the space within the cover or can 64 filled with an inert gas, if desired, the tube 66 being thereafter closed.

Coils 67 and 68 embrace the cores 52 and 53 and are supported by the plate 20 and a plate 69 of magnetic material connects the upper ends of these cores so as to complete a flux path. The wires 60 and 61 previously described are connected to the windings of the magnets to carry current therethrough from the terminals 12 and 17.

The entire structure when assembled may be completely enclosed within an outer cover or metal can 70 closely embracing the structure and fitting tightly against the inner cover 64. This member is completely closed except at the bottom thereof where it is sealed against the peripheral edge of the header or supporting base 10. If desired, the space within the outer cover 70 and above the plate 20 may be filled with a plastic insulating material, as shown at 71.

In operation the parts of the device normally stand in the position shown in FIG. 4 when the magnet is not energized, the armature being urged to this position by the spring 34 where the pin or finger 38 lies against the stop 43. Spring actuators 46 are normally biased toward one of the associated contacts 44 so as to hold the contacts 49 in engagement therewith. It will be noted that while the contacts 49 are engaged with the contacts 44, it will also be noted that the arm 47 which carries the contact 49 is slightly spaced from the actuator or spring member 46 although it is normally tensioned to lie against the actuator or spring member, as shown in FIG. 8. Thus a slight overtravel of the actuator or spring member 46 has been permitted after engagement of the contacts 49 and 44.

If the magnet is now energized, the armature 25 will be rotated on its axis to the position shown in FIG. 5 where the flat sides of the armature engage the flat sides 56 and 57 of the magnet poles 54 and 55 which is the position shown in FIG. 5 of the drawings. Here it will be noted that the contacts 44 of the terminals 14 and 15 are engaged by the contacts 50 carried by the resilient contact arms 48. Here also it will be noted that the arms 48 are slightly spaced from the flanges 51 although normally tensioned to abut these flanges, as shown in FIG. 8. Thus again a slight overtravel of the actuator 46 is permitted after engagement of the contacts. With this construction it will be seen that at both limits of rotation of the armature a moderate overtravel will be permitted after the contacts are engaged, which overtravel, however, due to the light spring contact arms 47 and 48, will not increase the contact pressure appreciably.

This compensation is particularly advantageous in that, when overtravel of the armature is permitted, the adjustment of the moving parts does not need to be so accurately perfected in order that a plurality of contacts may be closed by the movement of the armature. If, for example, one contact is closed prior to the other, the overtravel will permit continuing movement of the armature until the second is closed, whereas, if no overtravel were permitted, each contact would have to be accurately adjusted so that engagement of both would be made simultaneously.

All of the movable parts of the relay mounted in the space between the header 10 and the plate 20 supported in spaced relation from the header will be sealed against the entrance of air or moisture and, if desired, when the air is exhausted therefrom, this space may be filled with an inert gas, thus preventing corrosion and contributing to the life of the relay and to its efficient and reliable operation.

While we have shown and described a preferred embodiment of our invention, it will be understood that it is not to be limited to all of the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the claims.

What we claim is:

1. An electrical relay comprising a header, a plurality of pairs of fixed contacts carried by the header; a plurality of terminals also carried by the header; a plurality of movable contacts; each movable contact comprising a spring member attached at one end to a terminal, a first resilient contact arm, and a second resilient contact arm, each connected at one end to the spring member and extending therefrom in diverging relation to position their free ends between a pair of fixed contacts, the spring member being biased so that the first contact arm engages the first contact of the pair of fixed contacts; means on each spring member embracing the contact arms and limiting the amount of their divergence from each other; an electromagnet supported above the header; a rotary armature substantially balanced about its axis; and means carried by the armature to engage the spring member; whereby when the spring member is moved responsive to movement of the armature, the first contact arm is moved out of engagement with the first fixed contact of the pair and the second contact arm is moved into engagement with the second fixed contact.

2. The invention as defined in claim 1, in which the means carried by the armature are a plurality of fingers.

3. The invention as defined in claim 1, in which the electromagnet is U-shaped.

4. The invention as defined in claim 1, in which the spring members of the movable contacts are extended to form the first contact arms of each movable contact.

5. The invention as defined in claim 4, in which the means carried by the armature is adapted to engage the spring member at a location between its associated terminal and fixed contacts.

6. The invention as defined in claim 1, in which the means carried by the armature engages the first contact arm.

7. The invention as defined in claim 6, in which the means carried by the armature engages the first contact arm at a location between its associated terminal and fixed contact.

8. The invention as defined in claim 1, in which the armature and electromagnet are spaced from the supporting member; in which the terminal, the spaced contacts, the resilient contact arms, and the spring member are all located in the space between the armature and the supporting member; and in which the finger depends from the armature to engage the spring member upon rotation of the armature.

9. The invention as defined in claim 1, which also includes a plate member secured in spaced relation above the supporting member, and a cover member sealed to the supporting member and plate member to tightly close the space therebetween; in which the terminal, the spaced contacts, the resilient contact arms, the spring member, the armature, and the means carried by the armature are all located within the enclosed space; and in which the electromagnet is carried on the upper side of the plate

member but has its poles extending into the enclosed space to actuate the armature.

10. The invention as defined in claim 1, which also includes a plate member disposed above the supporting member and in spaced relation thereto, and means for sealing the space between the supporting member and the plate member against the entrance of air; the terminal, the space contacts, the resilient contact arms, the spring member, the armature, and the means carried by the armature, all being located in the sealed space between the plate member and the supporting member, and the electromagnet being supported at the upper side of the plate member and having its poles extending into the sealed space to actuate the armature.

11. The invention as defined in claim 1, in which the armature carries pairs of fingers symmetrically arranged and in which the fixed contacts, movable contacts, and terminals are symmetrically arranged on the header.

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