April 14, 1959 E. G. BAKER ET AL 2,882,367

RELAY

Filed May 31, 1955

2 Sheets-Sheet 1

Fig. 1

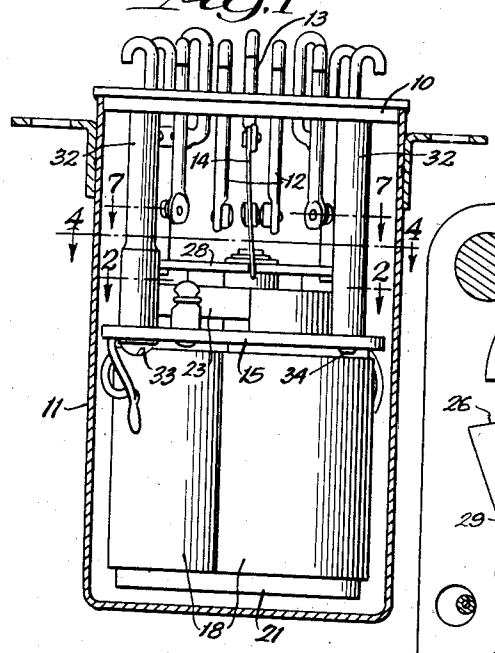


Fig. 2

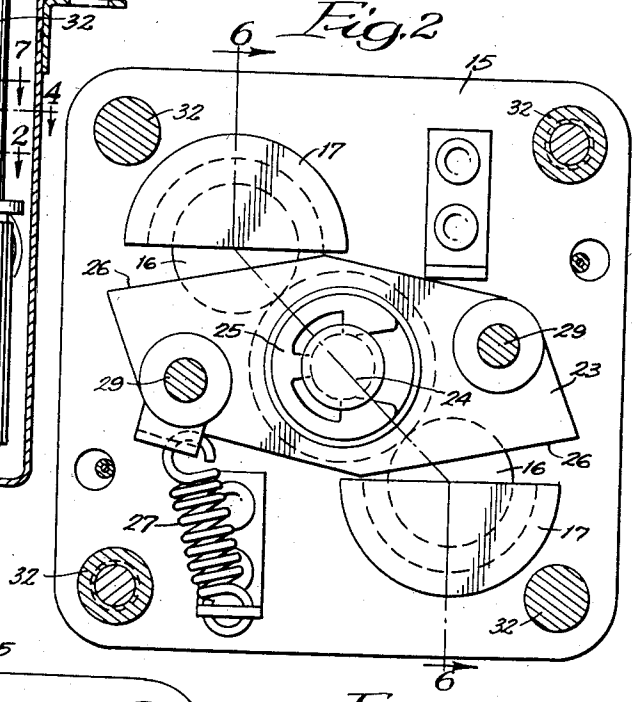


Fig. 3

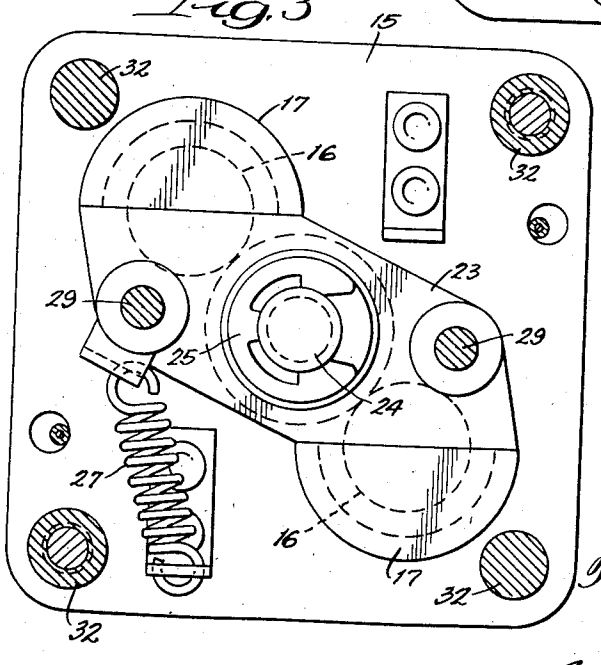
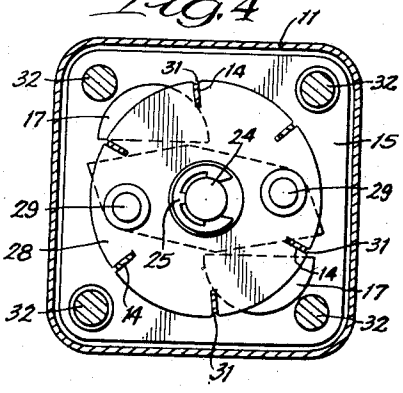


Fig. 4



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2,882,367

RELAY

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2 Sheets-Sheet 2

Fig. 5

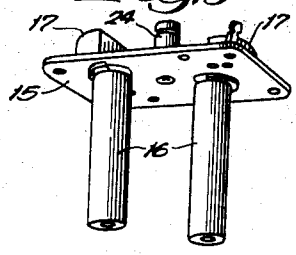


Fig. 6

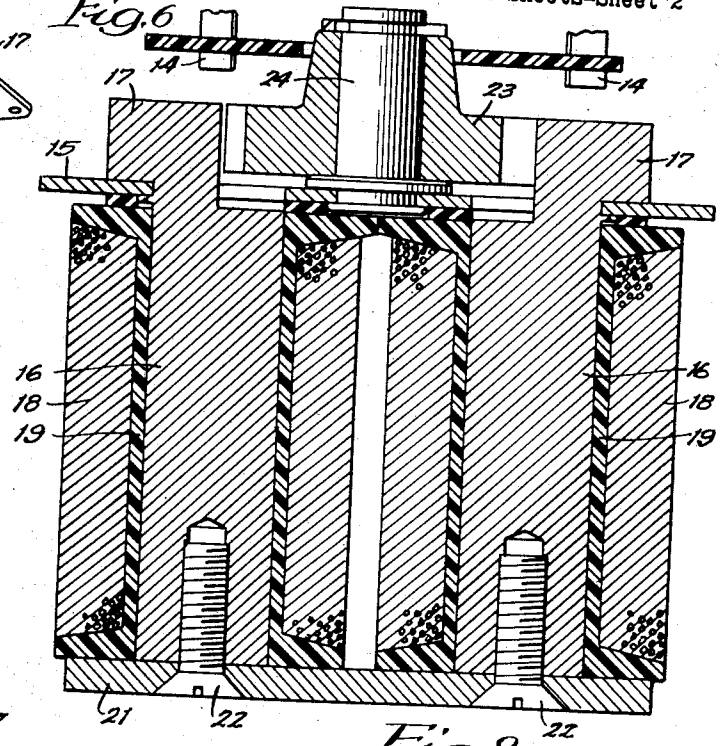


Fig. 7

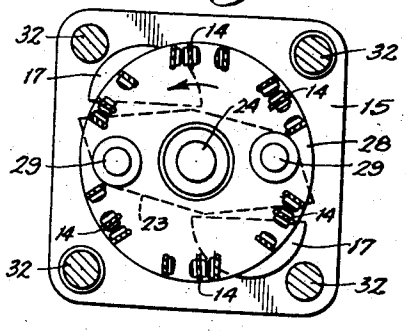
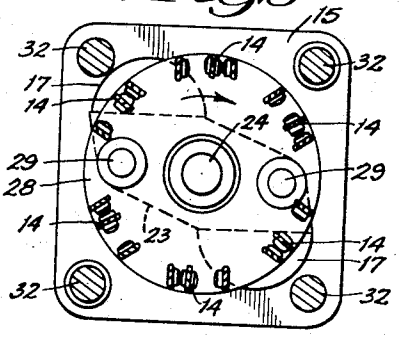


Fig. 8



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United States Patent Office 2,882,367 Patented Apr. 14, 1959

2,882,367

RELAY

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Application May 31, 1955, Serial No. 511,866

3 Claims. (Cl. 200—87)

This invention relates to relays and more particularly to multiple switch electrically operated relays.

Most relays, and particularly multiple switch relays, as heretofore constructed have been relatively large and bulky and have required a relatively large amount of electrical power for operation. For many uses such as in aircraft and various types of controls it is necessary that the relays be extremely small and compact and be operated by a relatively small amount of power. It is further essential that such relays be relatively inexpensive to manufacture and assemble, be constructed for hermetic sealing and maintain switch contact under conditions of vibration or acceleration.

It is one of the objects of the present invention to provide a relay which is extremely small and compact in size, which is capable of operation with a relatively small amount of power, which is simple and inexpensive to manufacture and assemble in a hermetically sealed container and which maintains tight switch contact under all operating conditions.

Another object is to provide a relay in which the magnetic operating unit and the switch unit are manufactured separately and are detachably connected to form a complete relay.

According to one feature of the invention, the switches in the switch unit are supported by a flat base which can function as a closure for the can enclosing the magnetic unit and the switches.

Still another object is to provide a relay in which the magnetic unit includes a rotatable armature and the switches include flexible contact strips operatively connected to the armature to be moved thereby.

According to one feature, the flexible contact strips are biased into engagement with one or the other of two fixed contacts by the armature and are bent after engagement with the fixed contacts to insure tight engagement even under vibration.

A further object is to provide a relay in which a plurality of flexible switch contacts are engaged in slots in a rotatable insulating disc to be simultaneously moved as the disc is turned and to provide an extremely simple assembly.

A still further object is to provide a relay in which the armature is rotatably mounted at its center and its ends are movable toward and away from spaced magnetic poles.

According to one feature, the poles are formed with flat parallel faces and the armature has flat end portions to engage the pole faces and to provide a uniformly variable air gap with the pole faces in the disengaged position.

According to another feature of the invention, the flat poles are formed on the ends of magnetic posts which are mounted in parallel spaced relation on a flat base to receive winding spools and to be connected beyond the spools by a magnetic core member.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a side elevation of a complete relay embodying the invention with the container in section;

Figure 2 is a partial sectional view on the line 2—2 of Figure 1;

Figure 3 is a view similar to Figure 2 showing the armature in operated position;

Figure 4 is a section on the line 4—4 of Figure 1;

Figure 5 is a partial perspective view of the core post and base assembly;

Figure 6 is an enlarged section through the magnetic coil assembly;

Figure 7 is a section through the switch contacts on the line 7—7 of Figure 1 with the coil in deenergized condition; and

Figure 8 is a view similar to Figure 7 with the coil in energized condition.

The relay of the present invention comprises a switch and header assembly constructed substantially as more particularly described and claimed in the co-pending application of John Schmidt, which issued as Patent No. 2,843,708, dated July 15, 1958. As shown, this assembly comprises a flat header plate **10** formed of steel, or the like, and ridged at its edge to fit into the open end of a can or container **11**. The header plate and the edge portion of the container may be tinned so that they can be soldered together after assembly to provide a hermetic seal.

The header plate carries a plurality of switch contact members, there being six double throw switches in the complete relay assembly as shown. Each switch comprises two fixed contacts **12** which may be mounted in the header plate, as described and claimed in the Schmidt application referred to above, and as further disclosed and claimed in the co-pending application of Theodore J. Obszarny, Serial No. 500,409, filed Apr. 11, 1955. A third contact pin **13** is secured in insulated relation with the header plate and has a flat end portion extending between the fixed contact pins **12**. A flexible contact blade **14** is secured to the bent over portion of the pin **13** and extends outward from the header plate between the ends of the fixed contact pins **12**. The contact pins **12** carry facing contacts and the contact blade **14** carries a double contact registering with the fixed facing contacts selectively to engage them.

The several flexible contact blades **14** are adapted to be moved simultaneously from one position to another by a magnetic armature unit which can be assembled separately from the switch and header plate assembly. The magnetic armature unit as shown comprises a base plate **15** which may be formed of sheet metal. The base plate has securely riveted or staked thereto a pair of spaced parallel magnetic posts **16**. The posts **16** extend through the base plate and terminate in spaced poles **17** which are formed with flat parallel pole faces, as best seen in Figures 2 and 3.

The magnetic poles **16** are adapted to receive windings **18** which may be wound on spools **19** of insulating material, such as paper or the like. The spools **19** slip over the posts **16**, as best seen in Figure 6. The spools may be secured in place and the magnetic circuit may be completed by a flat core piece **21** fitting over the ends of the posts and secured thereto by screws **22**. Leads for the windings **18** may be connected to terminals extending through the header so that the windings can be energized to magnetize the poles **17** by an external control circuit when desired.

Energizing of the windings rotates a rotatable armature **23** which is pivoted at its center on a pivot pin **24** rigidly secured to the central part of the base plate **15**. The armature **23** may be secured on the pivot pin by a C-washer **25** or a similar fastening so that it is freely rotatable on the pin. The armature as shown is formed with

flat faces **26** registering with the flat faces of the poles **17** to be moved into flat engagement therewith, as shown in Figure 3. When the windings are deenergized, the armature is turned to the position shown in Figure 2 with its pole faces spaced from the faces of the poles **17** by a tension spring **27**.

It will be noted that with the armature in its inoperative or deenergized position, as shown in Figure 2, the inner corners of the flat pole faces **26** on the armature lie closely adjacent to the faces of the poles **17**. A minimum air gap in the deenergized position is thus provided so that as soon as the windings are energized, the armature will be strongly attracted toward the pole faces and will move rapidly with a high degree of force into full engagement with the pole faces. Furthermore, since all of the pole faces are flat, the air gap varies at a uniform rate during the movement of the armature.

To connect the armature to the switches an insulating disc **28** is provided secured to the armature by pins **29** to turn therewith. The disc **28** is formed at its periphery with a plurality of radially extending slots **31** uniformly spaced to receive the flexible contact strips **14** of the switches. With the ends of the flexible strips **14** extending into the slots **31**, as shown in Figures 1 and 4, turning of the disc will simultaneously move all of the switch contact strips to operate the several switches simultaneously. Preferably, the amount of turning of the armature is so fixed that with the windings deenergized, the spring **27** will turn the disc until the contacts on the strips **14** engage one of the fixed contacts and will then turn the disc slightly further to flex the strip **14** thereby to hold the contacts in firm engagement even under conditions of vibration. Similarly, when the windings are energized and the armature is turned to the position of Figure 3, the contacts on the flexible strips **14** will engage the opposite fixed contacts and the strips **14** will be flexed slightly to hold the contacts in firm engagement. Thus, in either its operated or unoperated condition the relay provides firm switch contact to offer a minimum of resistance and to insure maintenance of contact even under severe operating conditions.

To assemble the parts, posts **32** are provided secured to the four corners of the header plate **10** and extending therefrom in the same direction as the switch contacts. The posts **32** are adapted to abut against the base plate **15** which is provided with suitable openings to receive fastenings, such as screws **33**, to secure the base plate rigidly to the header plate. Alternate ones of the posts may, if preferred, carry short pins **34** to project through reduced openings in the base plate so that the parts can be assembled in only one relative position. When the ends of the switch contact strips **14** have been fitted in the slots and the screws **33** installed, the base and header plate assemblies are connected together ready for mounting in the container or can **11**. When inserted in the container or can, the header plate may be soldered to the open end of the container to complete a hermetically sealed assembly. Thereafter, desired external circuits may be connected to the several contacts projecting through the header plate and the unit is ready for operation.

While one embodiment of the invention has been shown and described herein, it will be understood that it is illustrative only and not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. A relay comprising a flat base, a coil secured to and carried by one side of the base, an armature rotatably mounted on the base and lying on the other side of the base to rotate in a plane parallel to the base from a normal position when the coil is deenergized to an operated position when the coil is energized, a flat header plate, means to secure the header plate to said other side of the base in spaced parallel relation thereto, a plurality of switches carried by the header plate each including a fixed contact spaced from the header plate and an elongated flexible contact adjacent to the fixed contact and extending normal to the header plate toward the armature, the flexible contacts being in symmetrical array around the axis of the armature, and an insulating disc secured to the armature and having a plurality of slots therein to receive the ends of the flexible contacts respectively thereby to move all of the flexible contacts simultaneously as the armature turns.

2. A relay comprising a flat base, a coil carried by one side of the base, an armature rotatably mounted on the other side of the base to rotate in a plane parallel to the base from a normal position when the coil is deenergized to an operated position when the coil is energized, a flat header plate, means to secure the header plate to said other side of the base in spaced parallel relation thereto, a plurality of switches carried by the header plate each including a pair of spaced fixed contacts and an elongated flexible contact extending between the fixed contacts normal to the header plate toward the armature, the flexible contacts being in symmetrical array around the armature axis and being movable tangentially into engagement with the fixed contacts, an insulating disc carried by the armature and having a series of slots therein to receive the ends of the flexible contacts, and a spring urging the armature to turn in one direction to bias the flexible contacts simultaneously into engagement with one of the fixed contacts of the switches, energization of the coil turning the armature in the other direction to bias the flexible contacts simultaneously into engagement with the other fixed contacts of the switches.

3. A relay comprising a base, a magnetic core carried by the base terminating in a pair of spaced poles having flat parallel faces, a winding on the core to magnetize it, an armature rotatably mounted at its center between the poles and having flat parallel ends simultaneously to engage the flat pole faces when the armature is turned in one direction by magnetization of the core, a spring connected to the armature urging it to turn in the other direction, the flat pole faces terminating at their adjacent edges substantially on a line perpendicular to the pole faces and passing through the armature axis and the flat ends of the armature terminating in angular corners near the armature axis which lie closely adjacent to the flat pole faces when the armature is turned in said other direction to provide a small air gap in the magnetic circuit, a disc secured to the armature having a plurality of symmetrically arranged slots therein around the armature axis, and a plurality of switches symmetrically arranged around the armature axis, each including a pair of tangentially spaced fixed contacts and a flexible contact having its end extending into one of the slots so that when the armature is turned the flexible contacts will engage the fixed contacts and will be bent to insure tight engagement with the fixed contacts.

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