June 2, 1970 R. K. JOSENHANS 3,516,035

MINIATURE FLAT PACK LATCHING RELAY

Filed Dec. 27, 1968 2 Sheets-Sheet 1

FIG. 1

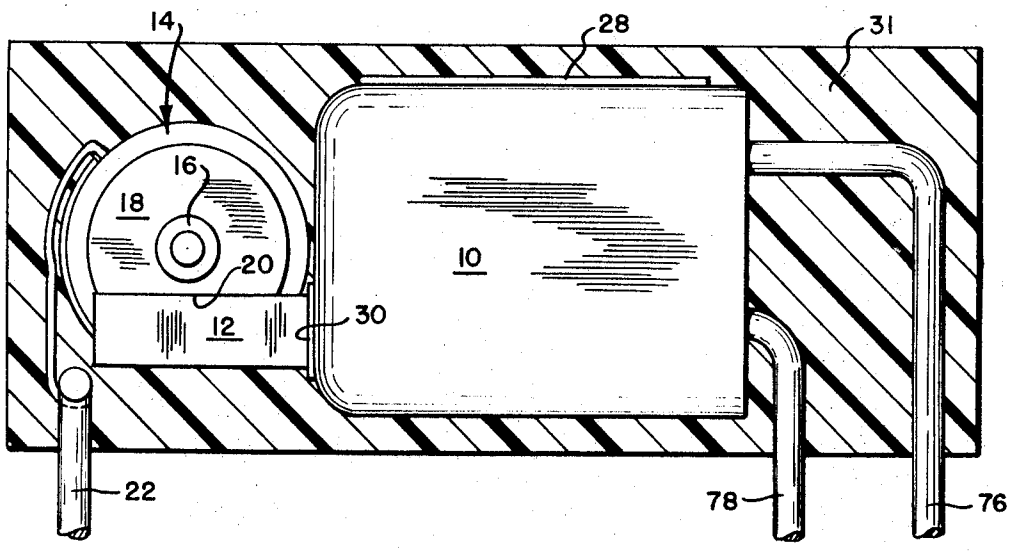
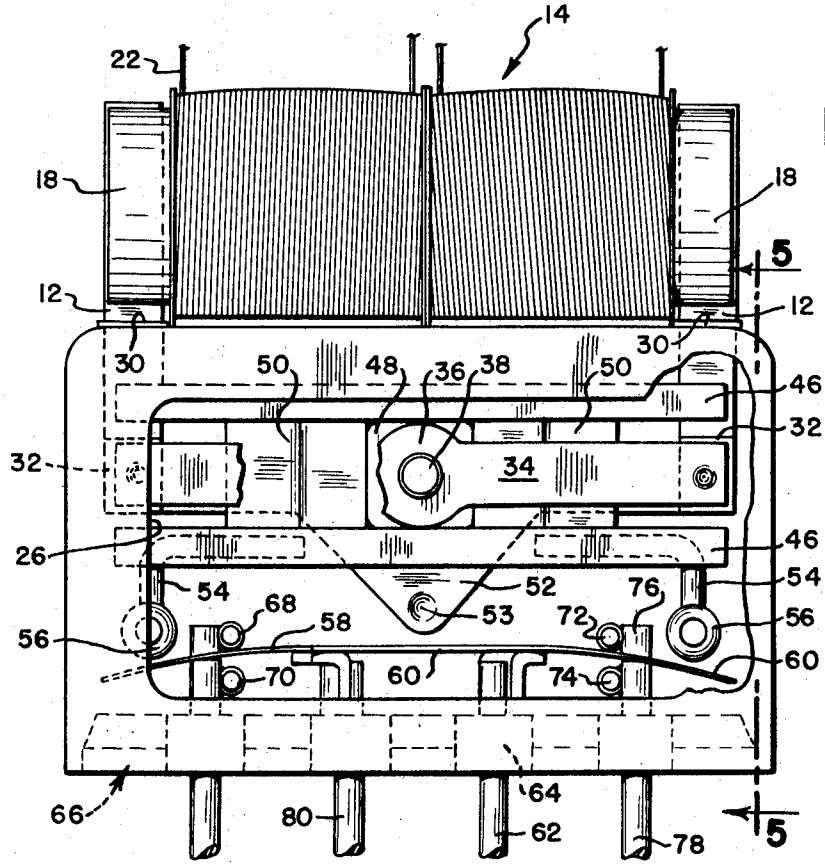


FIG. 2



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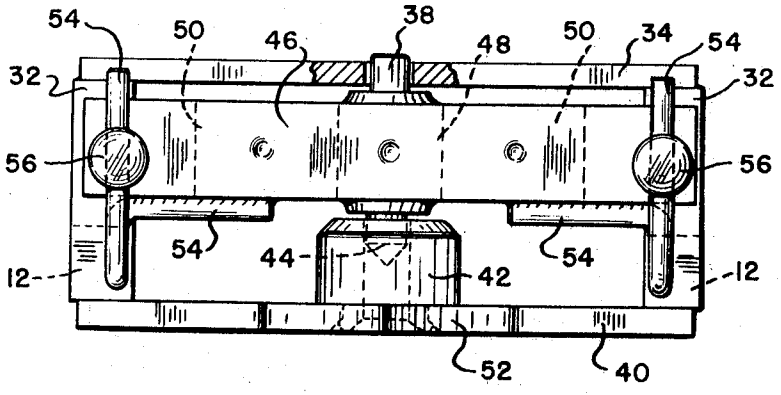


FIG. 3

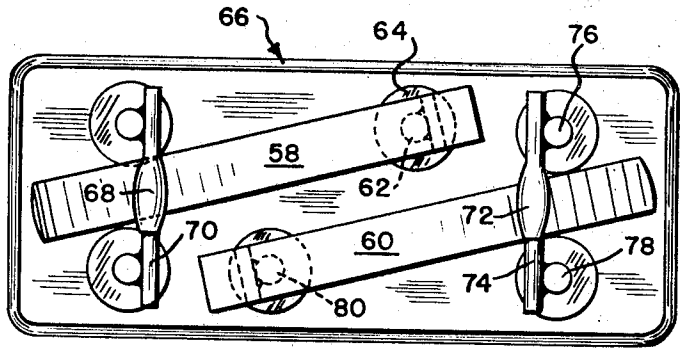


FIG. 4

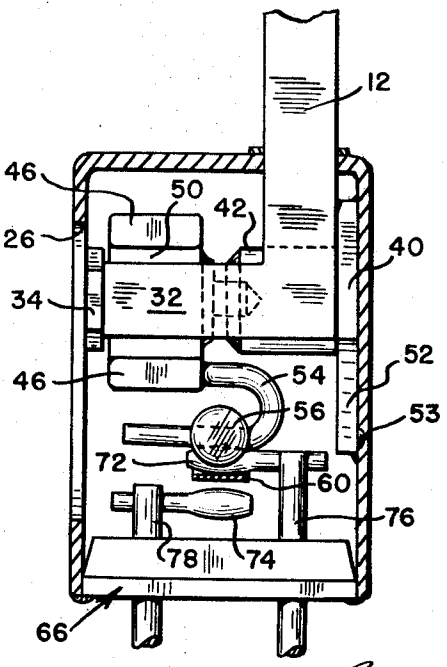


FIG. 5

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MINIATURE FLAT PACK LATCHING RELAY

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Int. Cl. H01h 45/02
U.S. Cl. 335—202 16 Claims

ABSTRACT OF THE DISCLOSURE

The disclosed relay comprises a hermetically sealed housing, one end of which includes a header carrying terminals, switches and contacts located within the housing. The housing also contains an armature assembly associated with a pair of spaced pole pieces extending through the opposite end of the housing and hermetically sealed thereto. A core bobbin assembly is mounted outside the housing, the core having core blocks as its opposite ends resting on the respective pole pieces. The bobbin carries latch and reset coils, each connected to a pair of terminals. The armature is mounted on a pivot midway between the pole pieces in a manner to provide a frictionless arrangement. The respective ends of the armature are provided with actuating means for actuating the switches inside the header, and all of the components are embedded in a molding resin with the terminals projecting therefrom.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to improvements in miniature latching relays of the type provided with a latch coil, an armature, movable contacts to be actuated with respect to fixed contacts and terminals connected with the contacts.

Description of the prior art

Microminiature magnetic relays are well known, most of which include the features described above in defining the field of the invention. One example of a prior art construction is illustrated in Molyneux U.S. Pat. No. 2,916,584.

SUMMARY OF THE INVENTION

In accordance with the present invention, the improved relay comprises a hermetically sealed housing, one end of which is provided with a header through which metal terminals extend in glass-to-metal seals. On the inside of the housing the header carries pairs of spaced fixed contacts cooperating respectively with movable spring contacts which are moved from one fixed contact to the other of the pair.

The hermetically sealed housing also contains an armature pole piece assembly including a pair of substantially spaced pole pieces, an elongated armature extending between the pole pieces and pivoted centrally by a frictionless pivot bearing. Portions of the spaced pole pieces extend through and project from the end of the housing opposite the header and they are hermetically sealed to the housing.

An actuating coil assembly located outside the hermetically sealed housing comprises a core-bobbin carrying an actuating coil or coils, such as latching and reset windings. The ends of the core which extend through the bobbin structure are fitted with core blocks which are respectively mounted on the portions of the pole pieces extending from the housing.

The pole pieces are advantageously made of magnetic material, such as steel, advantageously rectangular in cross-section, for example square, and of an L-shaped structure.

The armature advantageously comprises a pair of spaced armature plates welded centrally to a bearing block carrying a bearing shaft and also to a magnet. The shaft is supported in a pair of spaced magnetic metal plates such as steel plates connecting the end portions of the pole pieces. This assembly is secured in place and attached to the housing. The ends of the armature plates respectively straddle the pole pieces and are movable with respect thereto by energizing the coil windings which rock the armature on its pivot.

In a preferred construction the armature is located in an edgewise and spaced relationship with respect to the movable contacts mounted on the header, and each end portion of the adjacent armature plate carries means for actuating the adjacent movable contact including glass sleeve on a wire. The housing is initially provided with a window opening for inspecting the operation of the armature and movable contacts.

Advantageously, the hermetically sealed housing comprises a stocked component and it and electromagnetic coil unit are encapsulated in a molding compound, such as an epoxy resin to provide a generally rectangular-shaped unit from which the contact terminals and coil terminals extend.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in connection with a single embodiment shown in the attached drawings forming a part of this application.

In the drawings:

FIG. 1 is a sectional view showing the components of the relay of the present invention assembled and encapsulated in a molding plastic or resin, portions of which are shown in section;

FIG. 2 is an elevational view of one side of the housing with the window sealing plate removed and with parts shown broken away to reveal one end portion of the inside mechanism;

FIG. 3 is a view looking up in FIG. 2 from a position below the armature and switch actuating means;

FIG. 4 is a view taken at the position of FIG. 3 but looking toward and showing the header together and its terminals and the contacts mounted thereon; and

FIG. 5 is a view taken on the line 5—5 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing, the improved latching relay comprises a hermetically sealed housing **10** containing the armature pole piece assembly, the fixed and movable contacts and switching arrangement. Portions of spaced pole pieces **12** project from the end of the housing opposite the header and support a core-coil assembly **14** having a core **16** projecting from each end. A core block **18** is mounted on each end of the core and provided with a flattened surface **20** resting on a pole piece **12**. Latching and reset coils are provided on the core **16**, and each coil is provided with a pair of terminals, one terminal of which is shown at **22**. In the present embodiment, six terminals are mounted in the header, two of which are respectively shown at **76** and **78**.

The housing **10**, as shown in FIG. 2, is provided on one side with a window **26** which is covered and sealed by a sealing plate **28** (FIG. 1). This plate is welded to the face of the housing over the window opening **26**, after the components in the housing have been installed and tested. The terminals **76** and **78** are hermetically sealed in the header and the header in turn is welded

into the end of the housing opposite the position of the core-coil assembly, so that a hermetic seal at that end is provided. At the opposite end each pole piece **12**, square in cross-section, is sealed to the housing by means of a sealing ring **30** welded to the housing and to the pole piece. All of the terminals and components of the relay assembled together as shown in FIG. 1 are molded into a block **31** of plastic material, such as an epoxy or equivalent resin, so that they are completely encapsulated. A suitable molding compound is a fiber glass-filled epoxy compound. A relay in accordance with the embodiment disclosed is a rectangular-shaped block having a height of about 0.7 cm., a width of about 1.2 cm. and a length of about 1.7 cm.

As shown in FIG. 5, the pole pieces are L-shaped with their long legs extending along but somewhat spaced from the wall of the housing opposite the window **26** and then through the end wall of the housing **10**. The short legs **32** of the pole pieces **12** extend toward the window and are connected by a magnetic metal plate **34**, such as steel. The ends of this plate are welded to the respective ends of the legs **32** to connect the two pole pieces, and the plate **34** is provided with a central bearing opening **36** for receiving one end of the armature bearing shaft **38**. A second steel or other magnetic metal armature support plate **40** (FIGS. 3 and 5) is mounted in spaced relation directly in back of the plate **34** with its ends respectively welded to the back of the pole pieces **12** opposite the legs **32**. This plate **40** is provided centrally with a bearing bushing **42** having a bore for receiving the tapered end **44** of the armature pivot shaft **38**.

The armature itself, as shown in FIG. 2, comprises spaced parallel armature plates **46** of magnetic material, the respective ends of which overlap in spaced relation the respective legs **32** of the pole pieces **12**. The central portion of the armature comprises an armature block **48** carrying the armature shaft **38** supported in the plates **34** and **40** as described. Magnet blocks **50** are mounted between the armature plates **46** on the respective sides of the bearing block **48** and welded to the armature plates **46**. The magnet comprised of the two blocks is magnetized so that the top is south and the bottom north, as seen in FIG. 2.

The steel plate **40** attached to the back of the pole pieces **12** bears against the back of the housing **10** and integrally includes a downwardly-projecting pointed portion **52** (FIG. 2), the lower end of which is welded **53** to the inside wall of the housing **10**. This weld, together with the fact that the pole pieces **12** are welded to the housing, rigidly supports the armature and pole piece assembly in the housing.

In the operation of the relay, the armature is rocked by the energizing of the coil windings. Therefore, the respective ends of the lower armature plate **46** carry a welded-on actuating means (FIGS. 2 and 3) including a wire **54** welded to the edge of the lower plate **46** and bent around to extend transversely toward the window opening **26** and carrying a fused glass sleeve or bead **56** which can be located directly over the movable contact member.

According to FIGS. 2 and 4 the actuating beads **56** are arranged to respectively actuate movable, flexible spring leaf type contacts **58** and **60**. The movable contact plate **58** is welded to a terminal **62** sealed in a dark glass seal **64** mounted in a header **66** with a bias toward upper stationary contact **68** and movable by actuating bead **56** to engagement with lower stationary contact **70**. The stationary contact **68** and **70** are arranged similar to the contacts at the other end, as shown in FIG. 5, and they are welded to wire terminals sealed in glass seals in the header **66** as shown.

The movable spring contact **60** extends between similar fixed contacts **72** and **74**, is biased into engagement with the contact **74** by the adjacent actuating blass bead **56**,

as shown in FIGS. 2 and 4. The fixed contacts **72** and **74** are welded respectively to terminals **76** and **78**, while the movable contact **60** is welded to a terminal **80**.

The header **66** has an inset peripheral portion which fits in the bottom of the housing, as shown in FIG. 2.

The latching relay described above is especially constructed for easy application to printed circuit boards—100 grid spacing. The pairs of terminals connected to the latching and reset coils, such as the one **22** are separate from the housing **10** and connected, through suitable switches, not shown, with a source of current for energizing these coils. When the latching coil is energized, the armature is rocked on its pivot to actuate the appropriate movable contact blade **58** or **60** into engagement with the lower fixed contact **70** or **74**. If the circuit to the latching coil is broken, the permanent magnet **50** will hold the armature in the latched position if desired until the reset coil is energized through its terminals. This will permit either the switch blade **58** or the switch blade **60** to return to the fixed contact **68** or **72** and the armature will be held in that position by the permanent magnet **50**, after the current to the reset coil is interrupted.

The switching as shown in FIGS. 4 and 5, is arranged as two-pole double throw. The contact chamber provided in the housing **10** is hermetically sealed, not only by the welding as mentioned above, but also by the fact that the entire housing is encapsulated in a solid molded resin. The hermetic seal in the housing **10** has a rating of less than 1×10^{-8} atmosphere cc./sec.

The power requirement for operating the coils is 145 milliwatts maximum transfer at 25° C. and the latch and reset time amounts to 2.5 milliseconds maximum at nominal coil voltage at 25° C. The hermetically sealed chamber assures conformance with other environments, such as fungus, sand, and dust, humidity, altitude and other conditions. The housing furthermore seals off the components mounted therein, so that there is no contamination which might arise from vaporization of insulating materials contained in the core coil assembly.

I claim:

1. In a latching relay of the type including a housing containing an armature associated with pole pieces, a switch having a movable switch contact to be actuated by the armature, a header comprising a wall of the housing, and an actuating coil assembly including latching and reset coils associated with the pole pieces for operating the armature, the improvement wherein portions of the pole pieces project in spaced relation from the housing, and wherein the actuating coil assembly is located outside the housing and provided with a core, the respective ends of which are set in direct engagement with the projecting portions of the pole pieces outside the housing.

2. A relay as claimed in claim **1**, wherein the housing, projecting pole pieces and actuating coil assembly are completely encapsulated and molded in a plastic molding compound to provide a solid one-piece structure from which the switch terminals extend, and terminals for latching and reset coils extending from the molded structure.

3. A relay as claimed in claim **2**, wherein the electric path to said coils is located outside the housing.

4. A relay as claimed in claim **1**, wherein the core includes a core block at each end, said core blocks and projecting pole pieces having flat engagement surfaces.

5. A relay as claimed in claim **1**, wherein the armature is an elongated structure mounted on a central pivot and provided with spaced projecting portions at each end, respectively straddling the pole pieces in spaced relation to provide for the pivoting or rocking movement of the armature.

6. A relay as claimed in claim **5**, wherein the armature comprises a pair of spaced armature plates mounted on the central pivot with the plates at the ends of the armature respectively straddling the pole pieces in spaced relation.

7. A relay as claimed in claim 5, wherein the armature is pivotally mounted on a shaft parallel to the pole pieces where their spaced ends straddle or overlap the pole pieces.

8. A relay as claimed in claim 5, wherein each end portion of the armature carries an actuating means for engaging and moving the movable switch contact.

9. A relay as claimed in claim 8, wherein the actuating means includes a length of wire extending transversely to the movable switch contact, and a glass sleeve through which the wire extends located directly over and adapted to engage the switch contact.

10. A relay as claimed in claim 7, wherein the pole pieces are L-shaped with their short legs parallel to each other and respectively overlapped by the spaced projecting end portions of the armature.

11. A relay as claimed in claim 7, including a pair of spaced support plates, in which the armature shaft is mounted, the respective ends of each of said plates being attached to the pole pieces at spaced points.

12. A relay as claimed in claim 11, wherein the ends of one support plate are respectively attached to the projecting ends of the short legs of the pole pieces and the ends of the other support plate are respectively attached to the back of the pole pieces at the juncture of the short legs with the long legs of the L-shaped pole pieces.

13. A relay as claimed in claim 12, wherein the housing includes a window opening through which the armature assembly, switch, switch contacts and inside of the header are visible, and welding firmly securing said other support plate to the wall of the housing opposite the window.

14. A relay as claimed in claim 1, wherein the switch is mounted on the header inside the housing and includes a pair of spaced fixed contacts between which the movable switch contact extends, and terminals extending respectively from the movable switch contact and the pair of switch contacts through seals in the header.

15. A molded plastic relay in which the relay components except for terminals are completely encapsulated in a plastic molding compound, wherein said components include a hermetically sealed housing and a separate actuating coil assembly, the housing containing an armature associated with pole pieces portions of which project from the housing into the plastic, and a movable switch contact to be actuated by the armature, the actuating coil assembly being located in the plastic material outside the housing and having a core, the respective ends of which are set in direct engagement with the projecting portions of the pole pieces outside the housing.

16. A relay component comprising a housing unit containing a pole piece-armature assembly fixed to a wall of the housing and including a pair of spaced pole pieces portions of which project from the housing in sealed and spaced relation, a movable switch contact to be actuated by the armature and mounted on a header comprising a wall of the housing, and a terminal hermetically sealed in the header and connected to the movable switch contact.

References Cited

UNITED STATES PATENTS

2,916,584	12/1959	Molyneux	335—166
3,040,143	6/1962	Peay	335—202
3,124,671	3/1964	Juptner	335—202
3,202,782	8/1965	Mathison	335—202
3,253,096	5/1966	Richert	335—125
3,333,216	7/1967	Stehlik	335—151

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335—125