United States Patent

Johnsen et al.

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[54] **MOTOR CURRENT RELAY**

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[52] **U.S. Cl.** **335/202**

[51] **Int. Cl.** **H01h 13/04**

[58] **Field of Search** 335/132, 202, 261

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[57] **ABSTRACT**

A small electromatic relay especially useful as a surge current relay wherein the component parts thereof are easily fabricated, relatively inexpensive to produce and the assembly of which is easily accomplished not requiring a high degree of skill wherein it is almost impossible to misassemble the components in other than their intended operable state.

20 Claims, 6 Drawing Figures

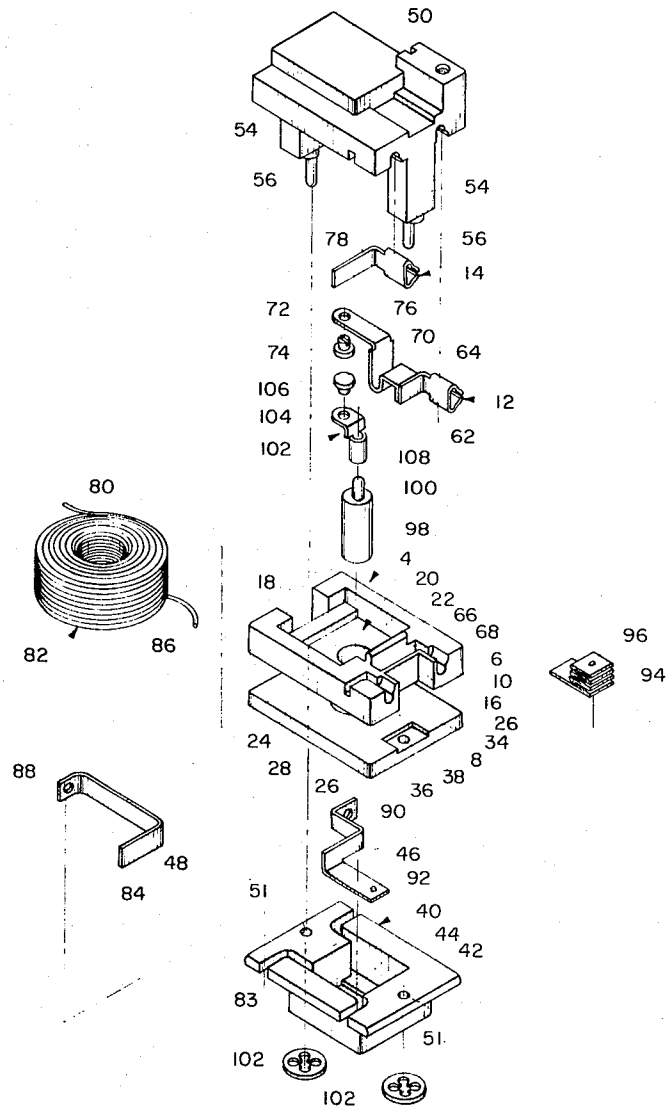


Fig. 1.

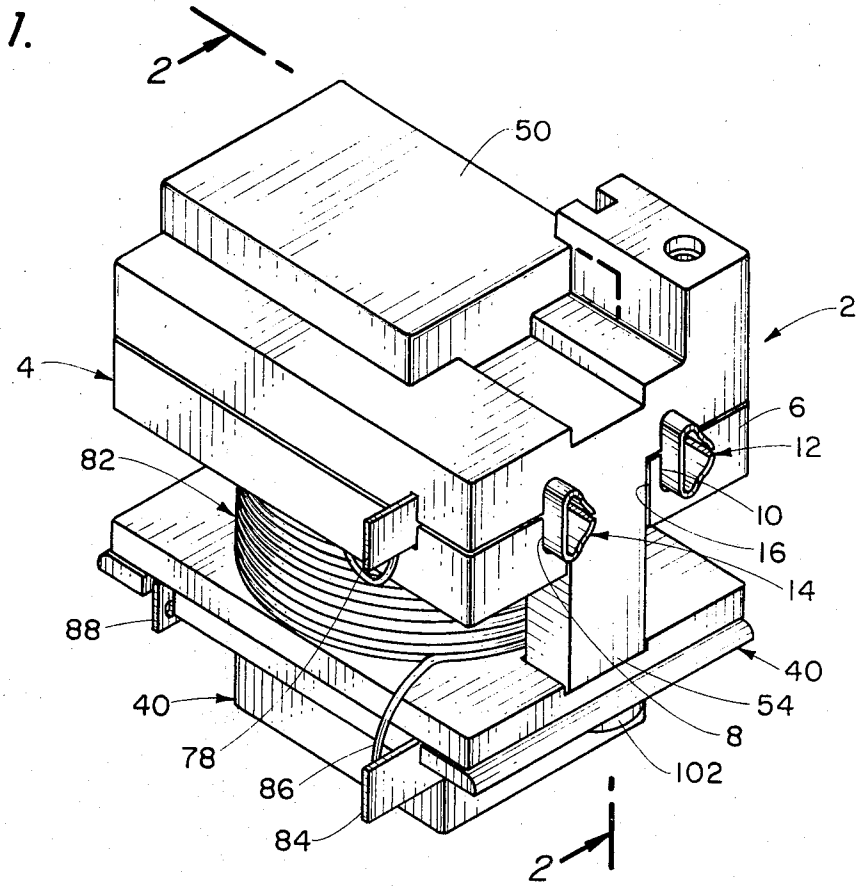
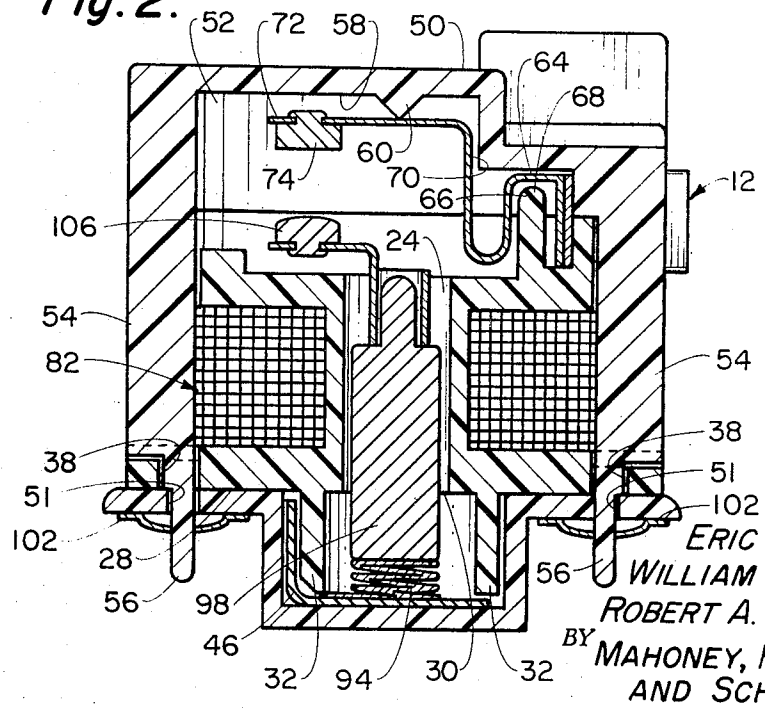
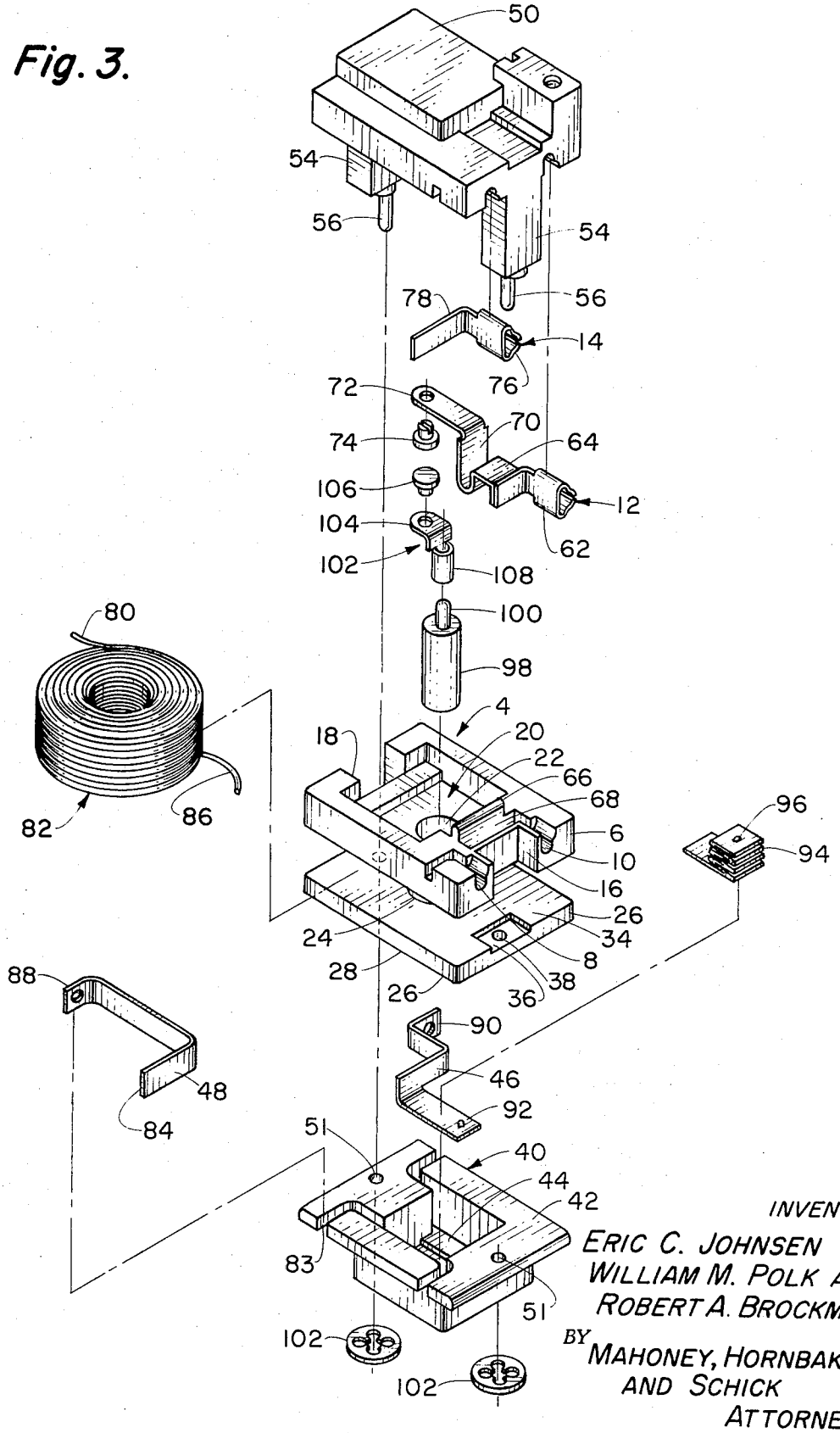


Fig. 2.



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Fig. 3.



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Fig. 4.

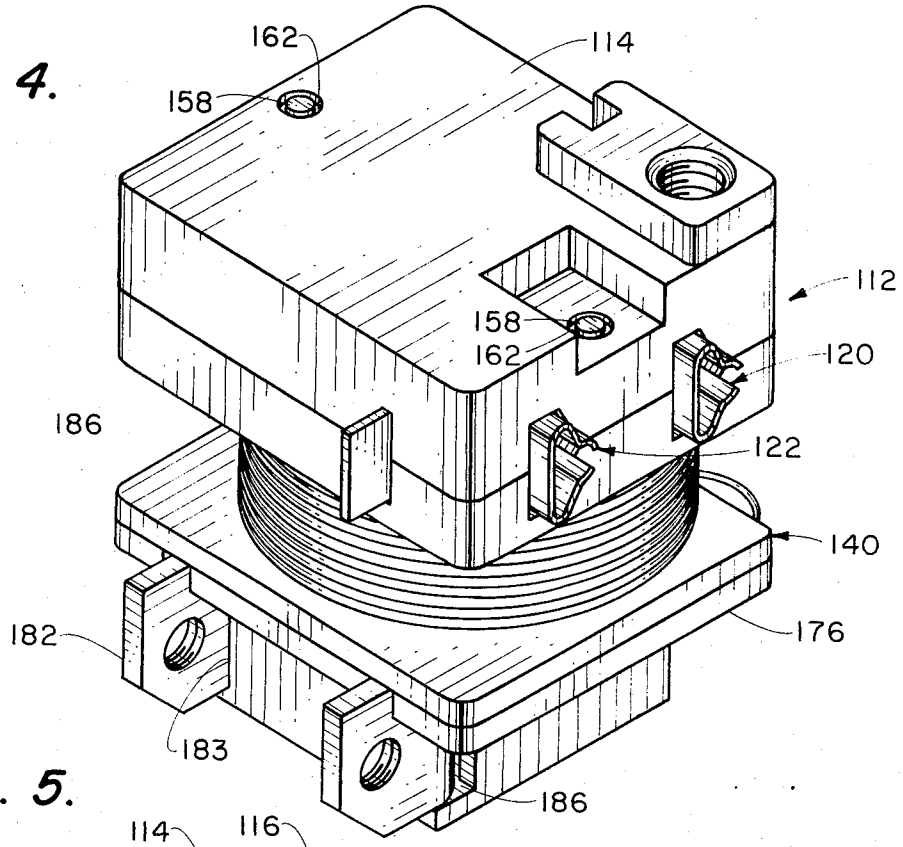
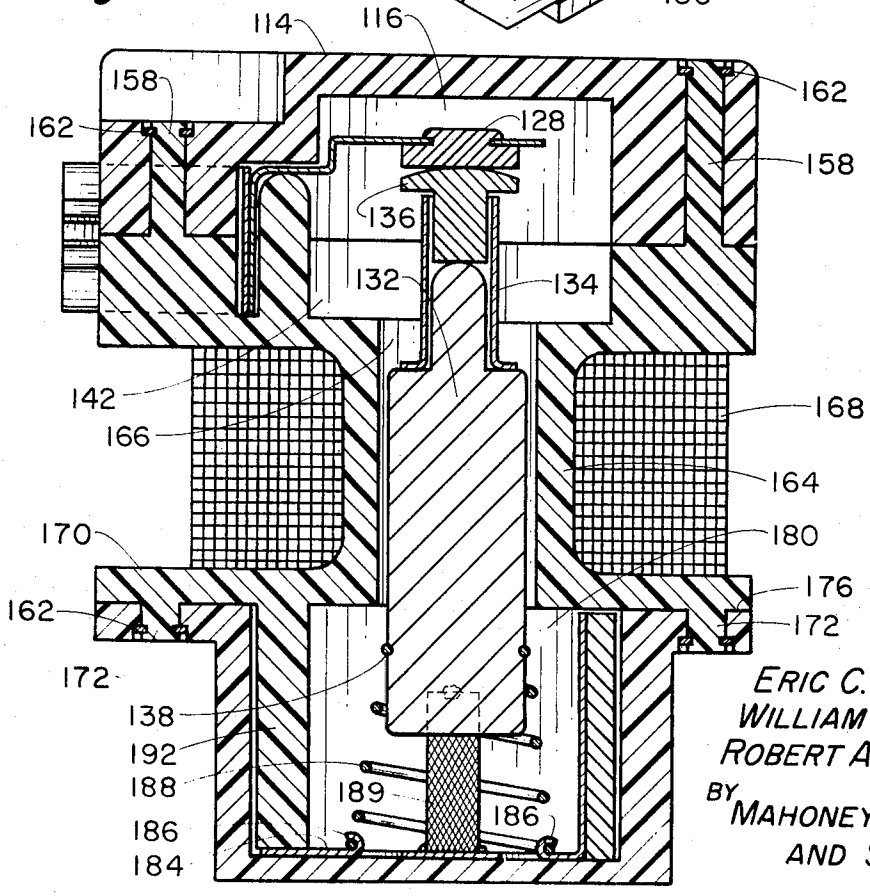
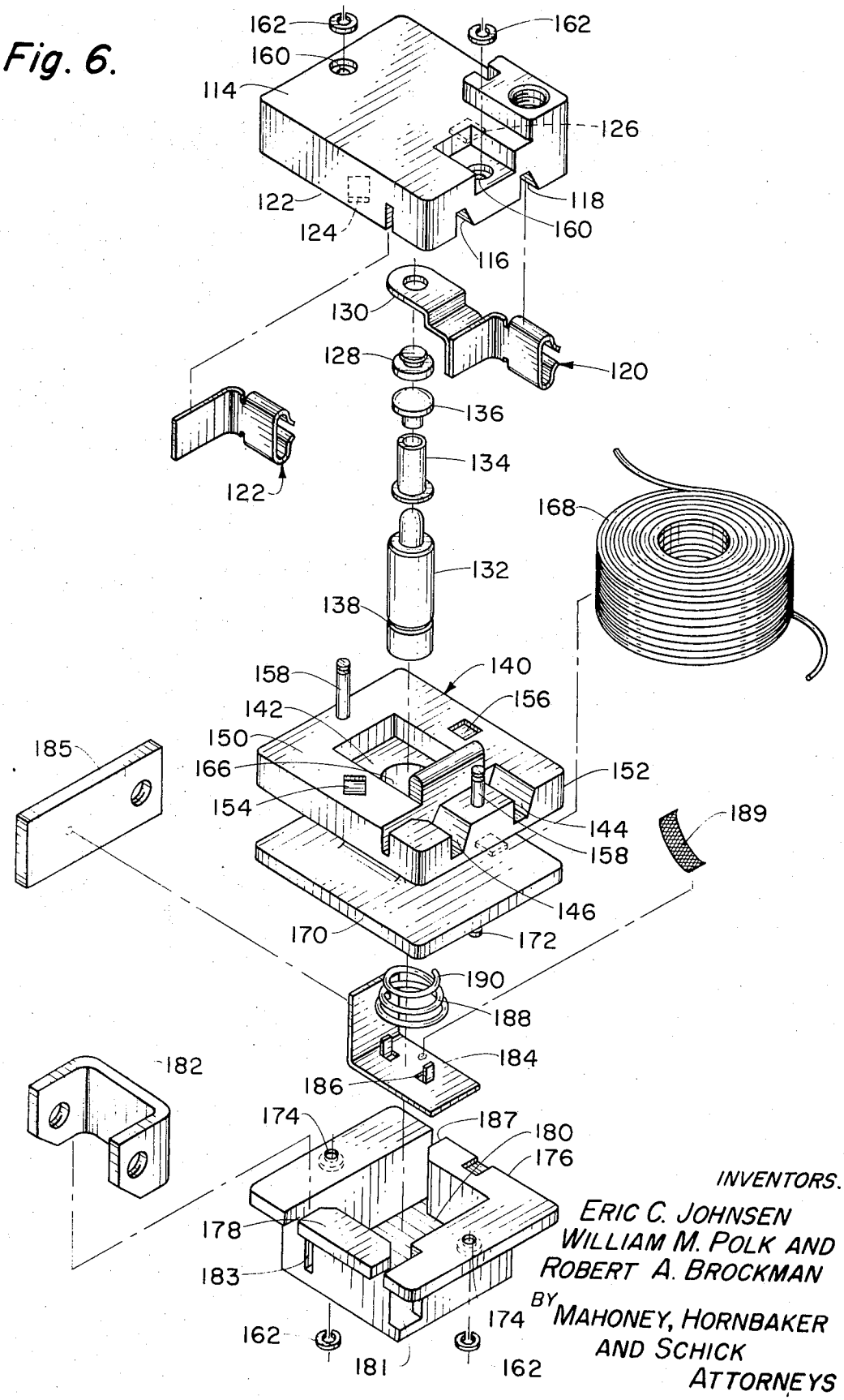


Fig. 5.



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Fig. 6.



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MOTOR CURRENT RELAY

BACKGROUND OF THE INVENTION

With ever increasing labor costs, it becomes necessary to design articles of manufacture particularly electrical switch structures and more particularly surge current relays which utilize easily fabricated components, and which components are easily assembled. In the assembly of electric switch structures, it is imperative that all components thereof are correctly assembled since any error in assembly, because of the very nature of the device, will produce a device which is totally inoperable for its intended use and function.

Therefore, this invention relates to electrical relay-type of switch structures which are compact, dependable in use and economical to manufacture, wherein the assemblage is such as to permit the use of the most unskilled type of labor.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a switch structure for use as a motor current relay having a single bridging contact.

It is another object of the invention to provide a switch structure and components thereof which can be easily manufactured and readily assembled into an operable switch unit.

It is still another and further important object of the invention to provide an inexpensive electromagnetic relay in which all of its component parts, including the housing and terminals, can be easily assembled in retained association with one another.

It is still another and further more specific important object of the invention to provide an inexpensive current relay which involves easily fabricated and assembled components and which can be inexpensively assembled into a dependable electromatic relay having but one armature contact.

These and further objects of the invention will become apparent from the hereinafter following commentary taken in conjunction with the drawings.

Basically, in an exemplary embodiment, the invention pertains an electrical switch comprising the combination of a main body member having an upper portion with at least two spaced channels receiving first and second stationary contact members in captive relationship therewith. The upper portion defines an upper recess chamber within which a bridging contact member as hereinafter defined, moves. A lower planar portion is connected to said upper portion through an innerset intermediate portion defining a housing within which an armature member reciprocally moves and the exterior surface of which carries an exciting coil to operate said armature member. A base member defining an upper planar portion for engagement with the lower surface of said lower planar portion of said body member, and forms the lower terminus of the path of travel of said armature member, said base member carrying third and fourth stationary terminal contact members in retained relationship and being adapted to be retained as an assembled switch in secure assembly. A cap member defining an enclosure over the path of travel of said armature member, has complementary channels to captively receive said first and second stationary contact members and includes retaining members for reception and securement in aligned relationship with other of said members. A bridging contact is mounted on, and moveable with said armature, for effecting electrical connection with one of said first and second stationary contact members and one of said third and fourth stationary terminal contact members upon energization of said exciting coil.

In one embodiment, the cap member has depending leg portions extending to the base portion straddling the exciting coil therebetween. In another embodiment, retaining pins are provided on the main body member for captive association with the cap and base members through expedients well known in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one electrical switch of this invention;

FIG. 2 is a view taken along the line 2—2 of FIG. 1;

FIG. 3 is an exploded view of the electrical switch depicted in FIGS. 1 and 2 illustrating the components thereof;

FIG. 4 is a perspective view of another embodiment of the electrical switches of this invention;

FIG. 5 is a cross-sectional view of the switch illustrated in FIG. 4; and

FIG. 6 is an exploded view of the electrical switch structure depicted in FIGS. 4 and 5 and showing the components thereof.

DESCRIPTION OF THE BEST EMBODIMENTS CONTEMPLATED

Referring to the drawings, wherein like numerals of reference designate like elements throughout, and specifically referring to FIGS. 1–3 inclusive, one embodiment of the electrical switch structure of this invention is illustrated.

Herein, the switch 2 comprises a main body portion 4 having an upper planar portion 6 recessed as at 8 and 10, to accommodate stationary contact members 12 and 14 in captive relationship. It will be noted that the upper portion is generally rectangular with side-notched portions 16 and 18 for purposes which will be described.

The upper portion 6 defines a main chamber or recess 20 opening into an elongated cylindrical-shaped chamber 22 formed by the side walls of an intermediate portion 24 connecting the upper portion 6 of main body 4 to a lower planar portion 26 similarly shaped to upper portion 6. The under-surface 28 of lower planar portion 26 is provided with an annular hole 30 which communicates to the intermediate portion 24. The lower surface 28 is provided with two spaced leglike members 32 for purposes of which will be described. The materials of construction for the main body member 4 may be of any of the electrically insulating plastics such as "Bakelite", "Lexan" and any of the compatible polymers such as polysulfone. Obviously, other materials will do just as well for not only the main body, but the other portions of the switch casing to be described. Because the moldable plastics are preferred, each of the components making up the exterior housing or casing, may be integrally molded. Thus, the spaced legs 32 are, in this instance, integrally molded with the main body as shown in FIG. 2 and extend substantially transverse the lower surface 28. The upper surface 34 is provided with opposed slots or recesses 36 having a central bore 38 for reasons to be hereinafter described.

The lower or base member 40 has an upper planar surface 42 adapted to abut in tight relationship to the lower surface 28 of lower portion 26 of main body member 4. The walls of body member 4 form a lower armature chamber or recess 44 as well as providing retention for stationary contact member 46 and stationary contact member 48. It will be noted that the side walls of the base member 40 are notched or configured so as to receive each of the stationary members 46 and 48 in the manner illustrated in the drawings such that electrical contact may easily be made with these terminals upon assembly of the switch. Laterally opposed bores 51 are provided in the base member 40 to align with and coincide with the bores 38 in lower portion 26 of main body member 4.

An upper cap member 50 of molded electrically insulating plastic, (same as the base member and the main body member heretofore described) is of plate-like configuration forming an upper armature recess 52 and having an interior contour to line up with and to rigidly retain, contact terminals 12 and 14 in assembled relationship as shown. Additionally, the interior configuration of cap member 50 is such so as to nestle in abutting relationship adjacent main body member 4 and is provided with opposed depending leg members 54 having pin-like protruberances 56 to be received through through-bores 38 and 51 in lower portion 26 and base member 40 respectively.

The interior surface 58 of cap member 50 is provided with a depending V-shaped protrusion 60 to retain stationary contact 12 in the position illustrated in FIG. 2.

Contact member 12 in this particular instance, may be of highly conductive material such as beryllium or copper and for purposes of disclosure, will be designated the S or starter terminal which is adapted to be connected to the output of a starter used in conjunction with an electrical motor. It will be noted that the S or 12 terminal has a first portion 62 by which swift easy electrical connection may be made by suitable electrical connecting means. The central or saddle portion 64 of terminal 12 is adapted to ride in overlying relationship to the ridge 66 formed by the notch or channel 68 adjacent the opposed notch 16. In side view the terminal 12 extends upwardly through a loop portion 70 and terminates at right angles with a contact portion 72 to which is secured an upper contact member 74 herein taking the form of a rivet or button contact. It will be noted that the upper contact 74 of the S or 12 terminal is yieldably supported within the upper armature recess 52 formed by cap member 50.

The terminal 14 is similarly provided with an end portion 76 by which easy electrical connection may be made, and may be designated the M terminal, having an extending L-shaped portion 78 to which one end 80 of exciting coil 82 may be connected. It will be noted that exciting coil 82 is composed of a number of windings of suitable electrical wire retained between the upper and lower planar portions of main body member 4 and more specifically disposed on the exterior wall of intermediate portion 24, best seen in FIG. 2.

As indicated, the stationary terminal 48 is received in the C-shaped channel 83 of base member 40 and is of somewhat C-configuration in elevation, having a protruding portion 84 for soldered attachment of the other end 86 of exciting coil 82. The opposite end 88 of the stationary terminal 48 of the "2 terminal", is provided with an aperture by which electrical connection may be made as is well known in this art and which needs no further elaboration.

The terminal 46 of highly conductive material, as is the case for all of the contact members used herein, is of a serpentine-like configuration being received within the lower armature recess 44 and having an extending terminal end 90 having an aperture therein by which electrical connection may also be made. The portion 92 received on the bottom surface of base member 40, has soldered thereto, a compression spring 94 of electrically conductive material, such as brass, shimstock or the like, which may be of the shape shown or C, S, or coil-shaped as desired. To the upper coil 96 of spring 94, is secured, as by solder or the like, an armature member 98 of general cylindrical configuration having a central post portion 100 adapted to receive a single bridging contact member 102 having a first portion 104 receiving a lower contact or rivet 106 in rigid retained relationship, and having a lower collar portion 108 which is crimp or friction fitted onto post 100 of armature 98.

In assembly, the bobbin or coil of wire 82 is firstly positioned on the exterior intermediate portion 24. Thereafter, the armature and bridging contact member is assembled and readied for soldered securement to the upper coil 96 of spring member 94 which has heretofore been soldered onto stationary contact 46 which itself has been positioned in the base member 40. The "2" or 48 terminal is positioned in the groove 83 and the main body member 4 positioned on the upper planar surface 42 of base member 40. The other contact members 12 and 14 are then positioned in their accommodating grooves 8 and 10 and the cap member 50 positioned so that the retaining legs 54 are received in the opposed slots 16 and 18 and the protruberances or pins 56 extend through the bores 38 and 51 formed in the main body and base members respectively. Upon tight abutting engagement, fastening means such as push-on fasteners 102 are frictionally engaged on the pins 56 to retain the electrical switch in the assembled condition.

Because of the contour of the components making up the electrical switch 2 and the easy mode of fabricating same, it is almost impossible to assemble the switch 2 in a fashion which will lead to non-operability. Because of the simplified design and configuration of the components making up the switch 2, an easily assembled functionally operative, surge current relay switching device is possible.

Referring now to the remaining figures of drawings, another embodiment of the invention is illustrated. Herein, switch 112 is provided with an upper cap portion 114 having side walls forming an interior upper armature recess 116 and having notches 118 in one wall thereof to accommodate stationary terminals 120 and 122. It will be noted that the under-surface 122 of the side walls making up cap member 114 is provided with opposed locating lugs 124 and 126, at a 90° displacement with respect to one another. In this instance, terminal 120 is of slightly different configuration than the S or 12 terminal previously described, but performs essentially the same function and is provided with similar rivet or upper contact 128 retained in the contact end 130 of terminal 120. The armature member 132 in this

instance, is provided with the same type of cylindrical configuration as the armature earlier described and also receives a cap-like sleeve member **134** within which has been secured in friction-fit or other manner, armature or bridging contact **136** adapted to engage the rivet contact **128** of terminal **120**. In this particular instance, the armature member **132** is formed with a spring retaining groove **138** for purposes which will be described.

The main body member **140**, in this instance, is quite similar to the main body member previously described and forms the same type of recess **142** as the earlier described embodiment and is provided with channels **144** and **146** congruent in shape to receive terminals **120** and **122** respectively in captive and retained relationship. The upper surface **150** of the upper planar portion **152** of main body **140** is provided with locating slots **154** and **156** to receive locating lugs **124** and **126** respectively when the cap member **114** is positioned onto main body member **140**. Instead of depending leg portions extending from the cap as earlier described, the intermediate main body portion has upstanding pin members such as **158** to be received by through-holes **160** provided in cap member **114**. The lock washers or rings **162** provide adequate securement. Obviously other means of securing may be utilized especially where the plastic materials are compatible with one another and are weldable as by heat and the like methods.

The main body member **140** is provided with intermediate portion **164** having a through-bore **166** to accommodate armature **132**, the exterior surface of which accommodates the exciting coil **168**. The lower planar portion **170** is likewise provided with retaining pins **172** which are adapted to be received by the through-bores **174** in the planar portion **176** of base member **178**. Base member **178** is provided with a configuration to form a lower armature recess **180** and to receive stationary terminal **182** within the confines thereof and to allow the protusion of the end portions thereof for which slots **181** and **183** are provided in the side walls. Also received within the recess **180** is stationary contact member **184** of L-shaped configuration having tangs **186** to be bent over in retaining relationship to coil spring member **188**. Protruding terminal **185** is welded to terminal **184** and a slot **187** is provided in the side wall to accommodate same. Obviously, this terminal contact is made separately for ease of manufacture but may be made as one integral member since the function is the same. To retain spring member **188**, with respect to its upper portion, the upper coil **190** of spring **188**, is positioned within the spring retaining groove **138** formed in the lower portion of armature **132**. To retain terminal **184** in fixed relationship, a bottom laterally extending plate or leg **192** is provided on the undersurface of lower planar portion **170** of main body portion **140**. To insure proper electrical carrying capability, and not solely depending upon the conductance of the spring member, a flexible, braided wire segment **189**, (of copper or brass for example), is provided. One end is spot welded to contact member **184** and the other to the armature **132**.

The essential operating characteristics of the latter described embodiment are as in the former and merely involves the well-known electro-magnetic circuitry wherein upon a current surge, an exciting current is generated in the exciting coil to cause the armature to move along the armature path upwards into the upper armature recess to make contact with the rivet or button contact on the upper terminal positioned thereover. The well-known function of relays illustrated and described herein will be well known to those of skill in the art. It should also be noted that the relays disclosed herein have been shown in exaggerated size in that in actuality the relays contemplated are of miniaturized size or version for use with refrigeration systems and specifically domestic refrigerators and the compressor thereof. However, it goes without saying that the principles of the invention as described, are suitably intended for relays of various sizes, all without detracting from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. An electrical switch comprising the combination: a main body member having an upper portion with at least two spaced channels receiving first and second stationary terminal contact members in captive relationship and defining an upper recess chamber in which a bridging contact member, as hereinafter defined, moves; a lower planar portion connected to said upper portion through an innerset intermediate portion defining a housing within which an armature member reciprocally moves and the exterior surface of which carries an exciting coil to operate said armature member; a base member defining an upper planar portion for engagement with the lower planar portion of said body member and forming the lower terminus of the path of travel of said armature member, said base member carrying third and fourth stationary contact terminal members in retained relationship and being adapted to be retained as an assembled switch in secured assembly; a cap member defining an enclosure over the path of travel of said armature member and having complementary channels to captively receive said first and second retaining contact members and having retaining members for reception and securement in aligned relationship with other of said members; and a bridging contact mounted on and moveable with said armature for effecting electrical connection with one of said first and second stationary contact members and one of said third and fourth stationary terminal contact members upon energization of said exciting coil.

2. The switch in accordance with claim 1 wherein said cap member is recessed to form an upper chamber into which one of first and second stationary contacts projects.

3. The electrical switch in accordance with claim 2 wherein said first and second electrical contacts are stationary terminals and wherein one of said terminals has a button protruberance juxtapositioned said bridging contact

4. The electrical switch in accordance with claim 3 wherein said bridging contact comprises a member which is press fitted onto a stub protruberance of said armature which is composed of ferromagnetic material.

5. The electrical switch in accordance with claim 4 wherein said bridging contact member carries a button contact for electrical contact and engagement with said button protruberance of said one of said first and second stationary contact terminals.

6. The electrical switch in accordance with claim 5 wherein at least one of said cap, main body and base members are provided with locating means to facilitate assembly thereof.

7. The electrical switch in accordance with claim 6 wherein said innerset, intermediate portion is tubular in configuration.

8. The electrical switch in accordance with claim 7 wherein said armature member is in electrical contact with one of said third and fourth stationary terminal contact members.

9. The electrical switch in accordance with claim 8 wherein said electrical contact between said armature and said one of said third and fourth stationary terminal contact members, is obtained through a biasing means which normally retains said bridging contact member out of electrical contact with one of said first and second stationary terminal contact members.

10. The electrical switch in accordance with claim 9 wherein said biasing means is a spring member.

11. The electrical switch in accordance with claim 10 wherein the lower surfaces of said planar portion of said main body member carries at least one plate-like projection projecting into said bottom member forming said lower terminus of the path of travel of said armature member.

12. The electrical switch in accordance with claim 11 wherein the interior surface of said cap member is configured so as to be received in nestled relationship with respect to said main body member.

13. The electrical switch in accordance with claim 12 wherein said cap, main body member and base member are formed of electrically insulating moldable plastic.

14. The electrical switch in accordance with claim 13 wherein retaining pins are disposed through at least two of said cap, main body and base members for obtaining rigid securement of said members with each other.

15. The electrical switch in accordance with claim 14 wherein at least said main body member is provided with locating means to facilitate placement of said cap member thereonto for assembly purposes.

16. The electrical switch in accordance with claim 15 wherein the base member is provided with opposed through-holes through which retaining pins are passed and upon which securement means are positioned to retain said cap member, main body member and base member in rigid secured relationship.

17. The electrical switch in accordance with claim 16, wherein means are provided to secure said biasing member to one of said third and fourth stationary terminal contact members.

18. The electrical switch in accordance with claim 17 wherein the said cap member has notched side walls to permit projection therethrough of said first and second stationary contact members.

19. The electrical switch in accordance with claim 18 wherein said upper portion of said main body portion is provided with channels to captively receive in coaction with said cap member, said first and second stationary contact members.

20. The electrical switch in accordance with claim 19 wherein a side wall of said base member is channelled to receive one of said third and fourth stationary contact members in retained relationship.

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