

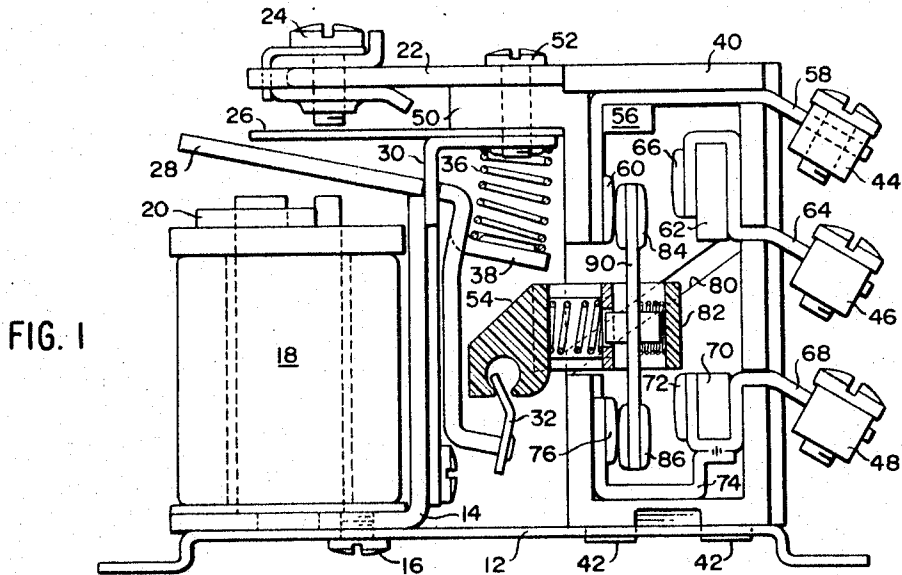
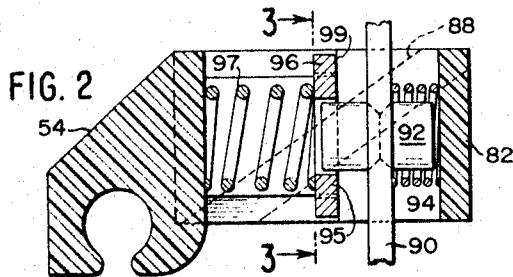
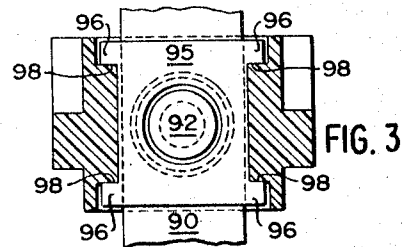
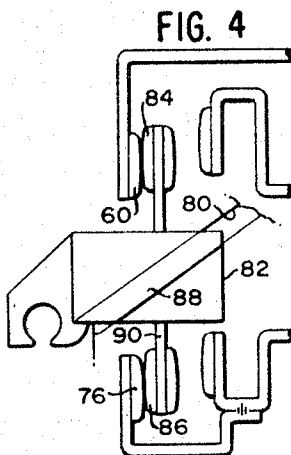
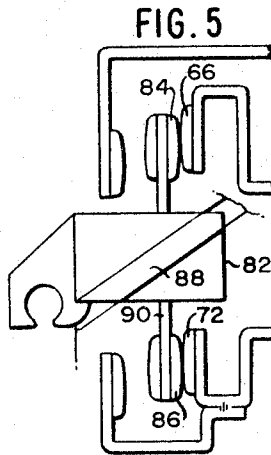
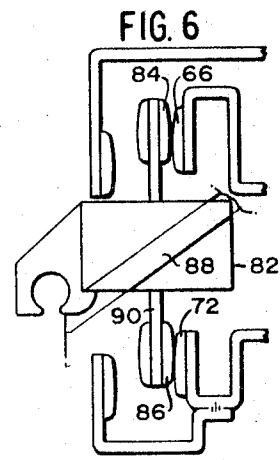
Sept. 2, 1969

J. J. SCHATTLER

3,465,270

HEAVY DUTY RELAY WITH WIPING CONTACTS

Filed July 6, 1967



INVENTOR.

JAMES J. SCHATTLER

BY

Kennedy, Jerney & Hildreth

ATTORNEYS

1

2

3,465,270 HEAVY DUTY RELAY WITH WIPING CONTACTS

James J. Schattler, Marshfield, Mass., assignor to Joseph Pollak Corporation, Boston, Mass., a corporation of Massachusetts

Filed July 6, 1967, Ser. No. 651,614

Int. Cl. H01h 67/02

U.S. Cl. 335—132

5 Claims

ABSTRACT OF THE DISCLOSURE

A heavy duty relay for industrial applications including individually removable contacts, each spring loaded and centered against a positive stop; wiping action between fixed and movable contacts being provided by off-axial overtravel in two directions. The entire relay may be easily dismantled and stacking of multiple sets of contacts all operated by the same relay coil is possible. The linkage between the armature and the contact carrier includes a plastic yoke slipped over a metal bridging bar of a pivoted armature minimizing friction and facilitating disassembly.

Multipole relays for various functions are extremely common and well-known. The prior art is replete with such relays in which individual contact members are separately mounted and separately attached to an armature. However, the available relays are generally limited in their current handling capacity. This statement holds true except in those situations where highly expensive components are used and where the total cost of the relays or controllers seriously limits their fields of use.

Available relays are also subject to other disadvantages, especially in the less expensive and less complicated types. By way of example, relay failures are often encountered because of contact burning or oxidation. It has been recognized that automatic wiping action can be provided as contacts make or break to inhibit burning and oxidation, but the mechanisms for such action are invariably complex and expensive.

The primary object of the present invention is to reduce the cost and complexity of heavy duty industrial relays without sacrificing desirable features found in expensive structures such as wiping action to lengthen contact life, easy disassembly for part replacement or substitution and flexibility in stacking of sets of contacts.

Another object of the present invention is to increase the reliability and efficiency of industrial relays.

A further object of the present invention is to facilitate the interchangeability of parts and components of relays to broaden their fields of application.

In general, the present invention stems from the concepts of mounting movable relay contacts in a carrier which traverses a diagonal or off-axis path between sets of fixed contact, the movable contacts being spring mounted in the carrier in such a fashion that overtravel occurs with each excursion of the carrier between opposing sets of fixed contacts. Implementing this arrangement is a hinged armature pivotally responsive to the flow of current in a relay coil in a direction normally opposed by spring pressure, the armature being coupled to the movable contact carrier by a simple detachable yoke and lever linkage. For a better understanding of the present invention together with other and further objects, features and advantages, reference should be made to the following specification which should be read in conjunction with the appended drawing in which:

FIG. 1 is a view in elevation of a relay incorporating the present invention, the movable contacts of the relay

being at their furthest point of travel in a normally closed situation;

FIG. 2 is a fragmentary view of the details of the spring-loaded movable contact support;

FIG. 3 is a cross-sectional view of the structure of FIG. 2 taken along the line 3—3;

FIG. 4 is a fragmentary elevation of the relay of FIG. 1 showing the first position assumed by the movable contacts as the relay is energized and wiping action begins;

FIG. 5 is a view similar to that of FIG. 4 but showing the movable contacts as they first engage the normally open contacts; and

FIG. 6 is another view similar to that of FIG. 4 showing the final position of the movable contacts at the conclusion of wiping action.

The specific relay shown in FIG. 1 has sets of double break double throw contacts, only one set of which is visible. Actually, similar sets of such contacts may be stacked together for common operation as is explained in greater detail hereinbelow, or single pole, single or double throw or latching arrangements may be provided by simple modifications.

The relay of FIG. 1 includes a mounting plate 12 on which a coil frame 14 may be mounted by suitable means such as screws 16. In the coil frame there is disposed a relay coil 18 which may be of conventional nature including a plastic spool and magnet wire of sufficient size and number of turns to provide the necessary mechanical action at any desired operating current or voltage. The core of the relay coil is laminated and extends above the spool, the laminations preferably being retained in a shading ring 20.

A terminal board 22, preferably of plastic, extends outwardly above the relay coil and terminal members with screw connectors for energizing the relay coil are mounted on that board. The terminal 24 visible in this view is typical of the coil terminals. Between the terminals and the relay coil proper, a plastic insulating sheet 26 is disposed to prevent possible shorting.

A relay armature 28 is pivotally mounted upon the coil frame 14. The armature is generally flat along its upper surface and is bent downwardly approximately 90° to form a small angle to the axis of the relay coil. At its lower extremity, it is bent, again roughly at an angle of 90°, in a direction away from the relay coil. At the major bend adjacent its top surface, clearance slots are cut through the armature.

Downwardly extending legs of an armature bracket 30 extend through the slots and are fastened to the coil frame 14 to form a hinge to retain the armature in pivotal relationship to the coil frame 14. The downwardly extending portion of the armature 28 may be bifurcated and its extremities are bridged by an armature bar 32 which is staked in place. An armature stop (not shown) contacts the armature bar and serves to limit the pivoting travel of the armature.

A compression spring 36 mounted between the armature bracket 30 and an integral tab 38 struck from the armature normally holds the armature in position such that the armature bar 32 is in contact with the armature stop. A contact module 40, preferably of plastic such as Bakelite, within which fixed and movable contacts are mounted is positioned on the mounting plate 12 by means of tongues 42 fitted into a suitably dimensioned slot in the mounting plate. Extending out from the module are terminals 44, 46 and 48 which are provided with any type of conventional connectors such as the screws shown or quick-connect, plug-in, solder or other variety. The terminals 44, 46 and 48 lead to the normally open contact, the normally closed contact and the common contact, respectively, as will be shown and described in greater detail

hereinbelow. The module 40 is typical of a plurality of modules which may be used in a stacked array in the relay structure.

Extending from the module, to the left as seen in FIG. 1, is an integral tab 50 through which a screw 52 passes to hold the module in assembled relationship to the armature bracket 30, the tongue 42, of course, cooperating to support the module. Extending out from the interior of the module on the same side as the tab 50 is a member 54 formed of a suitable plastic insulating material such as Bakelite plastic and having a keyhole slot cut in its lower surface to form a yoke. The yoke 54 may be slipped into place over the armature bar 32 to couple the yoke for movement with the armature bar as the armature bar pivots.

The contact module 40 has the general shape of a hollow box within which various mounting abutments are formed. The first of these abutments 56 is adjacent the upper left hand corner of the module and serves to retain a connecting strip 58 in position in the module. The strip 58 supports the terminal 44 and extends through the side of the module and around the abutment 56. At its extremity, a fixed contact 60 is attached. The contact 60, like the other contacts of the relay, may be of tungsten, silver, platinum or other conventional contact material. A second abutment 62 serves as the retainer for a connector strip 64 similarly supporting and running from the terminal 46 through the module wall to a fixed contact 66. Similarly, a connector strip 68 extends from the terminal 48 through the wall of the module 40 and about an abutment 70. At its extremity there is attached a fixed contact 72. Welded or otherwise fixed midway of the connector strip 68 is a second connector strip 74 at the end of which there is attached a fixed contact 76.

The module 40 is provided with a cover which has been removed as the device is shown in FIG. 1 to permit the viewing of internal components. However, the cover plate (not shown) is provided with a tongue which extends between the tongues 42 of the module 40 into the locating slot in the mounting plate 12. At its upper end, the cover plate may be held in place by insertion in a slot (not shown) formed in the top of the module 40. In the back wall of the module 40, as it is seen in FIG. 1, a diagonal keyway 80 is cut and a corresponding keyway is cut in the cover plate. A movable contact carrier 82 is provided with diagonal keys formed on its side members, the keys being arranged for sliding movement in the keyways 80 and the matching keyway formed in the cover plate. Double-faced movable contacts 84 and 86 are supported by the carrier 82 in a manner which may be better understood by reference to subsequent figures of the drawing.

Referring specifically to FIG. 2, the yoke 54 may be seen in its preferred form as an integral extension of the carrier 82. One of the diagonal keys 88 formed on the side walls of the carrier 82 is indicated by the dashed lines. The carrier 82 is generally box-shaped, the top and bottom being open and having various internal supporting shoulders. The double-faced contacts 84 and 86 are carried by a metallic arm 90 having a central opening in which a pin 92 is retained. The arm may be peened about a reduced central diameter or otherwise fixed to the pin 92. Wrapped loosely about the right hand extension of the pin 92 is a coil spring 94, the ends of which bear upon the arm 90 and upon the interior surface of the right hand end of the carrier 82. The left hand extension of the pin 92 passes through a generally rectangular guide 95. The guide 95 is provided with tongues 96 formed at each of its corners and these tongues cooperate with shoulders 98 to retain the guide in position in the left hand portion of the carrier 82 (see FIG. 3). Between the guide 95 and the interior surface of the left hand wall of the carrier 82 is another coil spring 97. The coil spring 97 normally retains the guide 95 against a shoulder 98 formed roughly

midway in the opposite side walls of the carrier 82. The spring 97 is, of course, somewhat stronger than the spring 88 and, in this connection, it should be pointed out that the showing of FIG. 2 is identical to that of FIG. 1 insofar as the position of the carrier 82 in the module 40 is concerned. In other words, all elements are in the positions assumed when the relay coil 18 is not energized and the major relay spring 36 is effective to hold the armature against its stop with the contacts in a normally closed position.

For purposes of explanation of relay operation, FIGS. 1 and 2 indicate the carrier to be at its extreme left excursion. FIG. 4 indicates the position of the elements assumed immediately upon excitation of the relay coil 18. In FIG. 4 it may be seen that the movable contacts 84 and 86 have not broken from the fixed contacts 60 and 76. In fact, they have moved only in an upward direction in a wiping action despite the diagonally right carrier movement. This maintenance of the movable contacts against the fixed contacts results from the expansion of the spring 94 during the initial carrier movement.

As the carrier 82 continues on its course diagonally upward to the right, the spring 97 holds the guide 95 against the shoulder 98 and the movable contacts 84 and 86 remain in the position they assumed in the showing of FIG. 4. This position is maintained until contact is made between the contacts 84 and 86 with the fixed contacts 66 and 72, as seen in FIG. 5. After contact is made, as shown in FIG. 5, the carrier 82 continues its diagonally upward movement moving the guide 95 to the left within the carrier against the pressure of the spring 97. As the spring 97 compresses, the movable contacts 84 and 86 are vertically displaced to the position shown in FIG. 6, a wiping action taking place between the contacts 84 and 86 and the contacts 66 and 72, respectively. As this action ensues, the spring 94 expands, but it is of less strength than the spring 97 and efficient wiping action is had.

When the relay coil is deenergized, the spring 36 forces the armature to pivot in a clockwise direction drawing the yoke diagonally downward. Again, a wiping action takes place as contact is broken between the contacts 84 and 86 and the contacts 66 and 72, respectively, as the former contacts move downwardly during the expansion of the spring 97. Wiping action again occurs after the contacts 84 and 86 meet the contacts 60 and 76, respectively, the movement of the contacts 84 and 86 being downward as the carrier performs its overtravel to the left. The spring 94 is effective to hold the contacts 84 and 86 against the contacts 60 and 76, respectively, because the spring 97 is not opposed to the action of the spring 94; it expands only to the limit possible by reason of the guide 95 encountering the shoulder 98.

The operation of the basic relay, apart from the contact operation may easily be seen by considering FIG. 1. Normally, the spring 36 forces the armature tab 38 downwardly away from the armature bracket 30. The armature 28, under such conditions, is pivoted with the armature bar 32 at its lower extremities against an armature stop (not shown) and its upper surface displaced from the shading ring 20. With the passage of appropriate current through the relay coil, the armature pivots in a counterclockwise direction against the force of the spring 36. The armature bar 32 moves upwardly in a short arc following a path generally diagonal to the mounting plate 12 and carrying the yoke 54 along a similar course. As will be seen and better understood from the description of contact operation above, the yoke 54 is integral with the movable contact carrier which travels along a similar path to open and close circuits with fixed contacts as desired. With the opening of contacts upon either energization or deenergization of the relay, wiping action is the initial movement. With the closing of contacts, irrespec-

5

tive of the direction of carrier travel, wiping action is again the first relative contact movement.

The construction of the relay of the present invention is such that as many as five contact modules can be operated with the one basic coil; in fact, even more modules can be handled with minor modifications of the electrical drive. Various normally open and normally closed individual and interconnected circuit arrangements are possible as are latching and other special relay applications.

All contacts are enclosed and thus protected from dust and dirt minimizing maintenance problems and the entire relay structure may easily be disassembled when infrequent service problems arise. Upon disassembly, either major replacements such as entire modules or minor replacements such as contacts are easily replaced.

While what has been shown and described constitutes a preferred embodiment of the present invention, modifications and alternatives within the purview of the invention will be obvious to those skilled in the art. Accordingly, the invention should be limited only by the spirit and scope of the appended claims.

What is claimed is:

1. In a heavy duty relay having a coil, means for energizing said coil, at least a movable contact, at least a first fixed contact and a second fixed contact, said first fixed contact being spaced from said second fixed contact, and an armature having at least a portion thereof movable upon energization of said coil, the combination of a movable contact carrier, means detachably coupling said movable contact carrier to said portion of said armature, means for constraining said movable contact carrier to travel along a predetermined path between said first and said second fixed contact in response to movement of said portion of said armature, means resiliently mounting said movable contact in said movable contact carrier in a normally fixed position therein, the distance between said first fixed contact and said second fixed contact being less than the length of said predetermined path to permit overtravel of said carrier at both ends of said predetermined path, the axis of said first fixed contact being displaced from that of said second fixed contact, said predetermined path forming an angle with both said axes whereby overtravel of said carrier beyond the points of closing of said movable contact with said fixed contacts causes relative motion and wiping action between said movable and fixed contacts.

6

2. In apparatus as defined in claim 1, the combination in which said constraining means comprises a housing surrounding said movable contact carrier and fixed in position relative to said armature and said carrier and means disposed between said housing and said carrier to limit motion therebetween to said predetermined path.

3. In apparatus as defined in claim 2, the combination in which said fixed contacts are mounted on opposite sides of and within said housing, one of said fixed contacts being displaced vertically from the other, said housing having at least a keyway formed along a path between said contacts and said carrier having at least a key formed thereon and fitted for sliding motion in said keyway.

4. In apparatus as defined in claim 3, the combination in which said means resiliently mounting said movable contact in said carrier comprises a pair of opposed compression springs, said carrier having an opening formed therein with opposed internal walls disposed normal to the axes of said fixed contacts, one of said compression springs being disposed between one side of said movable contact and one of said internal walls, the other of said compression springs being disposed between the other side of said movable contact and the other of said internal walls, said springs causing said movable contact to close with said fixed contacts during overtravel of said carrier whereby wiping action takes place between said movable contact and said fixed contacts during overtravel of said carrier.

5. In apparatus as defined in claim 4, the combination in which a stop is formed in said carrier against which said movable contact is normally held by one of said springs, said one of said springs exerting greater force against said movable contact than that exerted by said other spring.

References Cited

UNITED STATES PATENTS

1,271,535	7/1918	Bijur.	
2,625,630	1/1953	Eckles.	
2,671,836	3/1954	Anger	335—193
2,792,469	5/1957	Callaway	335—129
2,924,685	2/1960	Burch.	

BERNARD A. GILHEANY, Primary Examiner

H. BROOME, Assistant Examiner