United States Patent

Kane

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[54] REVERSIBLE MOVING CONTACT ARRANGEMENT

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[73] Assignee: **Honeywell Inc.**, Minneapolis, Minn.

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[52] **U.S. Cl.** ..... **200/166 BC**, 335/198

[51] **Int. Cl.** **H01h 3/00**, H01h 9/00

[58] **Field of Search** ..... 335/197, 198, 200, 132; 200/166 BC

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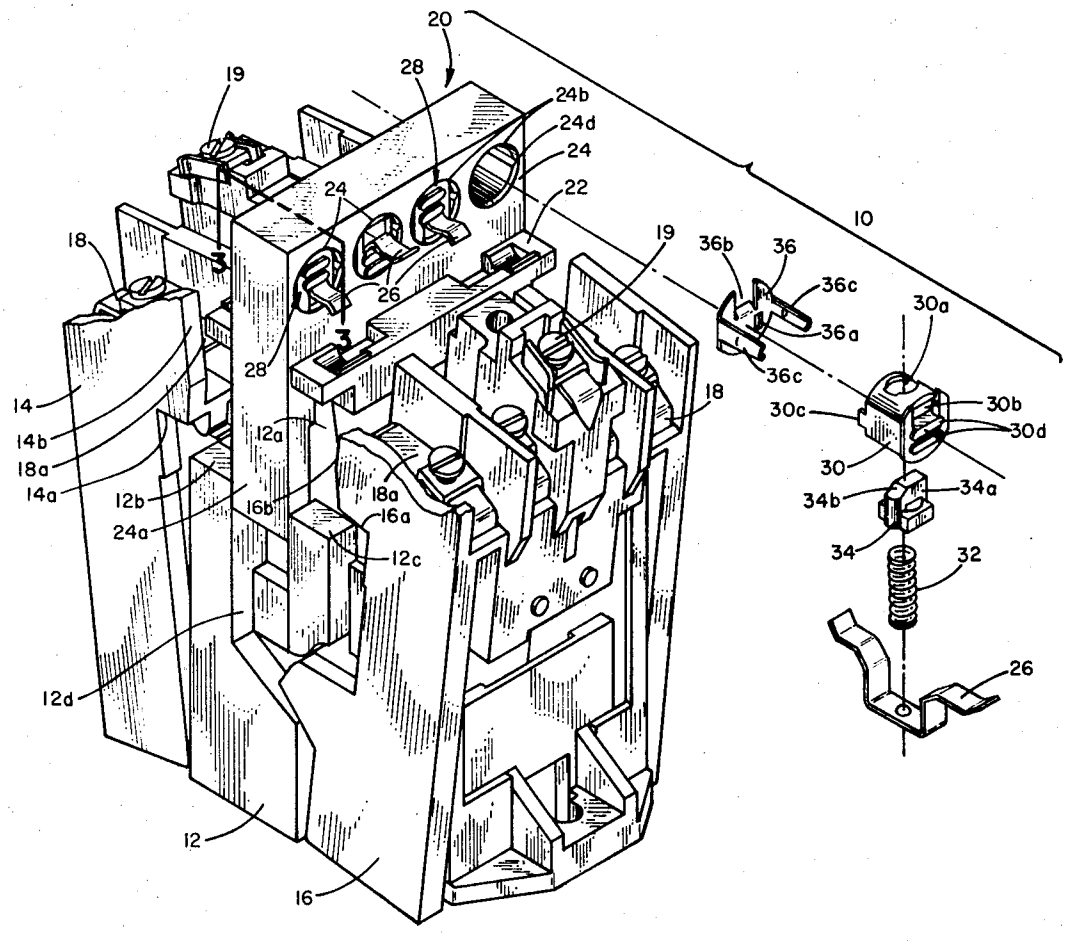
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[57] **ABSTRACT**

A moving contact arrangement, for a relay, for example, which allows for selective normally open and normally closed contact orientation with respect to fixed contacts by rotative movement between two opposite positions of a bridging bar carrying the moving contacts about an axis substantially parallel to and co-extensive with a straight line connecting the moving contacts.

10 Claims, 7 Drawing Figures



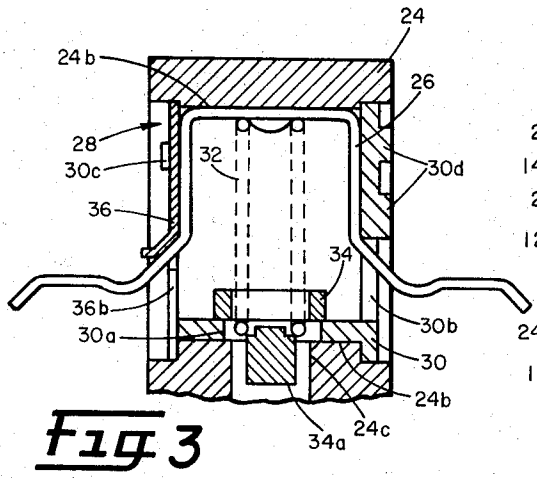


Fig 3

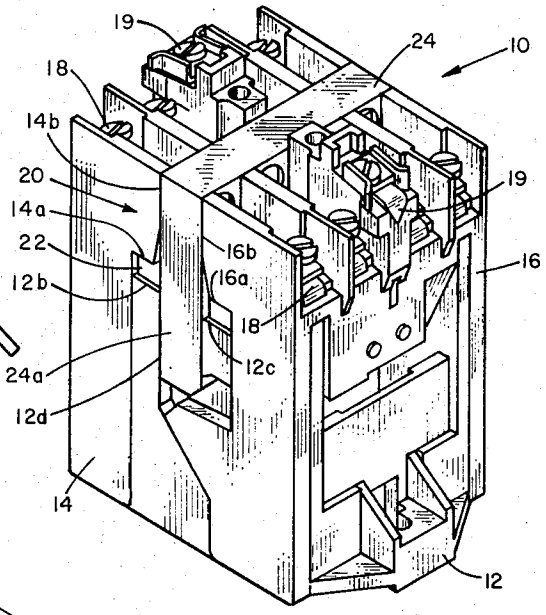


Fig 1

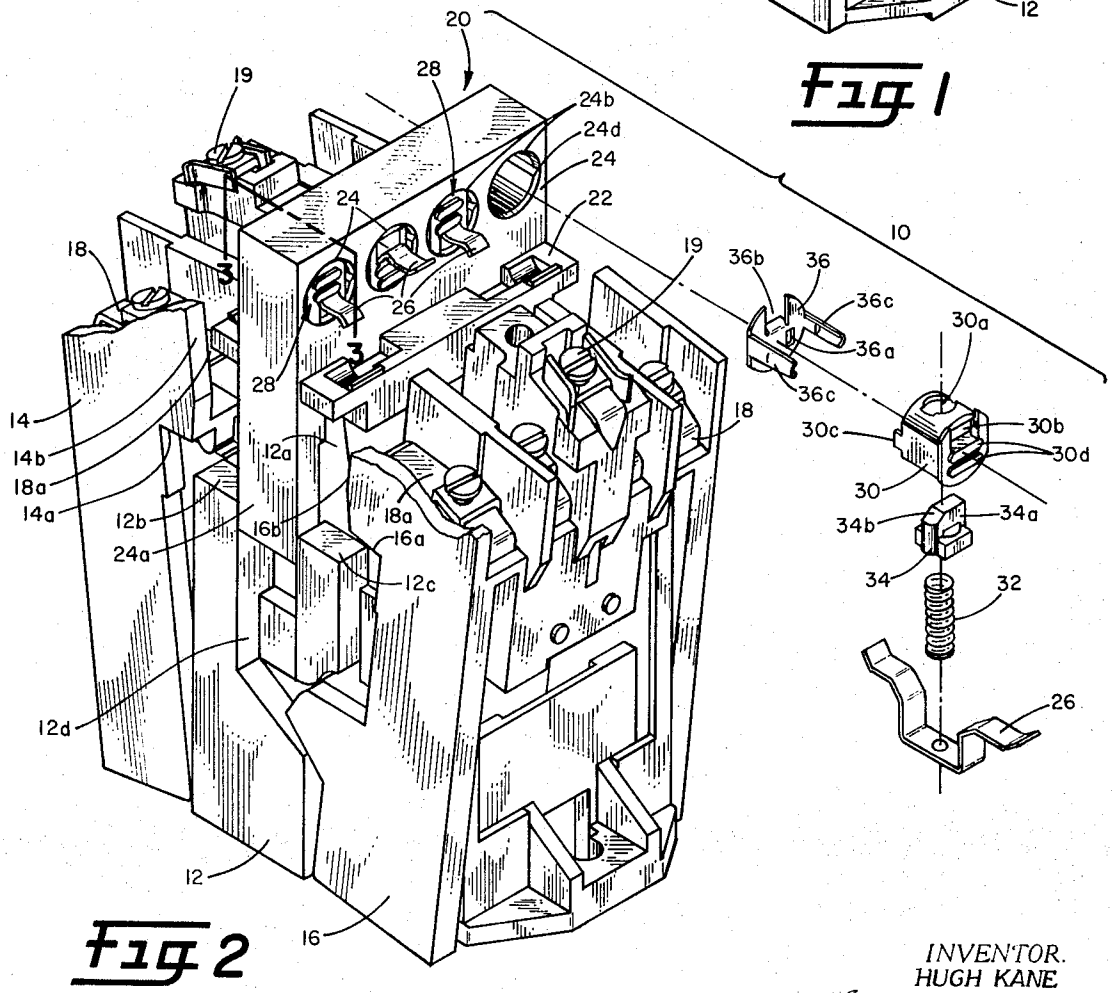


Fig 2

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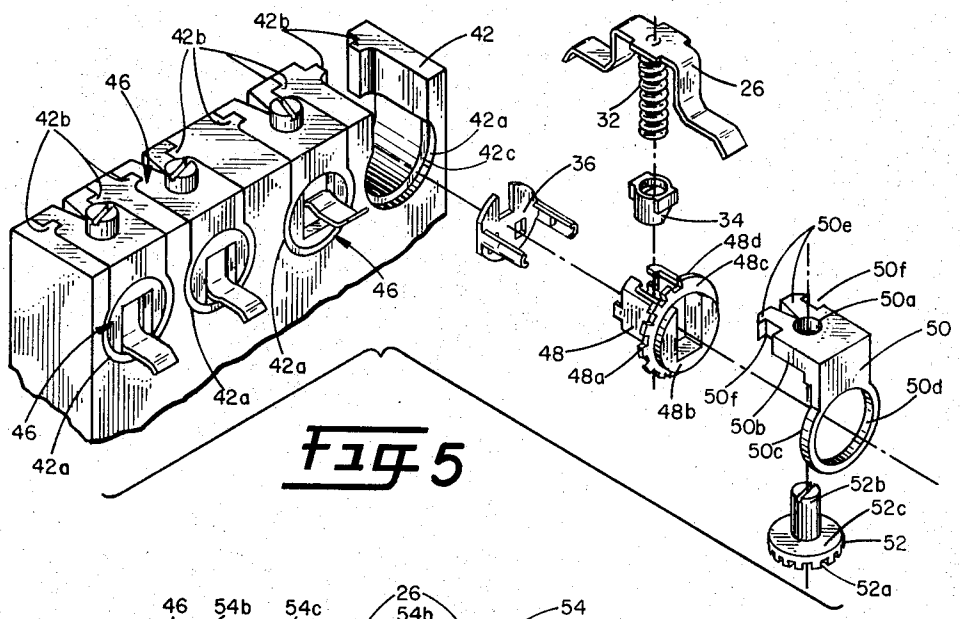


Fig 5

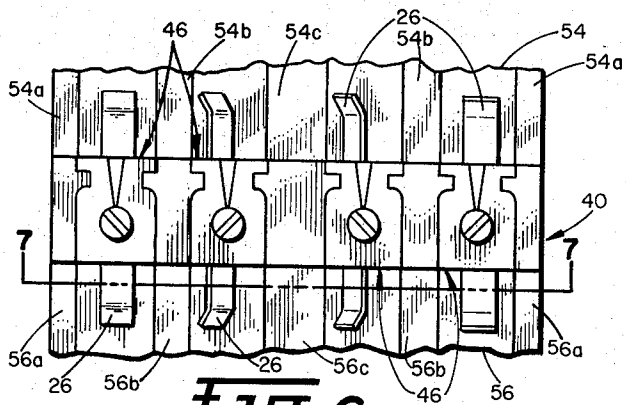


Fig 6

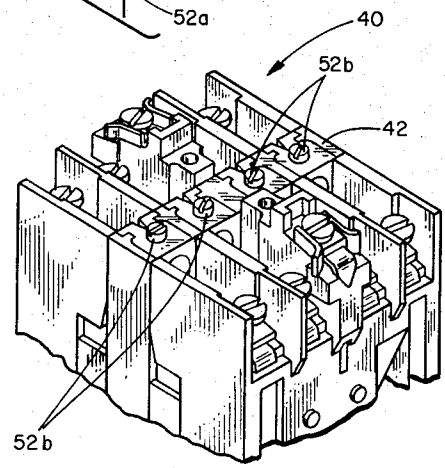


Fig 4

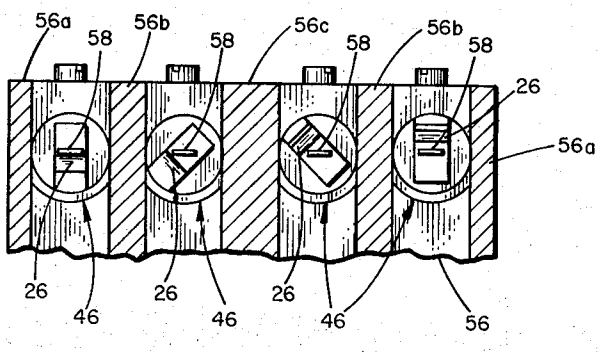


Fig 7

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REVERSIBLE MOVING CONTACT ARRANGEMENT

This invention is directed to a contact arrangement for a switching device wherein a moving contact bridging bar member can be selectively positioned with respect to the fixed contacts so as to provide a normally open or normally closed contact orientation.

In switching devices, such as relays, it is often necessary at the time of installation or even later to select the contact orientation of each of the poles, that is, normally open or normally closed. For this reason, it is desirable to be able to provide the desired pole orientation in the field: using the same relay, the same poles and the same parts; without encountering loose parts, the need for disconnecting of electrical wires from the fixed contacts and the need for special tools; and requiring but at most nominal disassembly.

The attributes above-described are incorportated in the present invention which in the preferred embodiments are in the form of relays. As disclosed, a moving contact carrier supports a moving contact bridging bar which is reciprocally movable with respect to fixed contacts to provide the switching function and rotably movable with respect to the fixed contacts to provide changes in contact orientation. Thus, as to the latter, the moving contact bridging bar is arranged to be rotated without the need of special tools while in place in the moving contact carrier about an axis which is parallel to and co-extensive with a straight line which extends between the moving contacts. This rotation positions the moving contact bridging bar so as to change the condition of the moving contacts with respect to the fixed contacts from normally open to normally closed or vice versa. Because of the manner of rotating the moving contact bridging bar with respect to the fixed contacts, an arrangement can be provided wherein no disassembly of the moving contact carrier from the remainder of the structure, with the attendant loose parts, or disconnecting of the electrical wiring is required.

It is an object of the present invention to provide a moving contact arrangement for a switching device which can be easily converted between normally open and normally closed orientation wherein at most a minimum of disassembly of the structure is involved, where no disconnecting of the electrical wiring is necessary, where no loose or different parts are involved and which requires no special tools.

This and other objects will become apparent from a reading of the following specification and claims when viewed with the drawing in which:

FIG. 1 is a perspective view of a switching device in the form of a relay in which the present invention finds application;

FIG. 2 is a perspective partial explosion view of the partially disassembled relay of FIG. 1 wherein details of the invention are visible;

FIG. 3 is a partial cross-sectional view of the moving contact carrier of FIG. 2 taken along the lines 3—3 thereof;

FIG. 4 is a partial perspective view of a relay of the type shown in FIG. 1 incorporating a modified form of the invention;

FIG. 5 is a partial perspective explosion view of the moving contact carrier of FIG. 4;

FIG. 6 is a top plan view of the relay of FIG. 4 with the moving contact bridging bars in various stages of rotation to bring about a change in contact orientation; and

FIG. 7 is a partial cross-sectional view taken along the lines 7—7 of FIG. 6 with the moving contact bridging bars in positions corresponding to that of FIG. 6.

A multi-pole relay **10** shown assembled in FIG. 1 and partially disassembled in FIG. 2 includes a base member **12** having a cavity **12***a* in which a magnetic frame member, not shown, is secured and a coil, not shown, is disposed. Pivotally associated and appropriately secured at the lower portions of the base member **12** are a pair of bifurcated housing members **14** and **16**, the upper portions of which are arranged to overlay the cavity **12***a* when in the assembled condition. The housing members **14** and **16** support a plurality of first terminal members **18** each of which include a fixed contact portion **18***a* and

further support coil terminals **19**. Disposed between the housing members **14** and **16** and arranged for association and relative inward and outward reciprocal movement therewith and with said base member **12** is an assembly **20** comprised of an armature, not shown, a bias plate **22** and a bifurcated moving contact carrier **24**. A plurality of U-shaped moving contact bridging bars **26** are supported by the moving contact carrier **24**, and the extremities are arranged when in the assembled condition for association with a respective pair of fixed contact portions **18***a* to provide the switching function. The moving contact carrier **24** and the armature, not shown, are suitably secured together with the bias plate **22** resiliently disposed therebetween for limited relative reciprocal movement therewith as will become apparent below.

In the assembled condition, as shown in FIG. 1, the bias plate **22** is seated on the posts **12***b* and **12***c* of the base member **12** and overlaid by the projections **14***a* and **16***a* of the housing members **14** and **16**, respectively, so as to be maintained as a prisoner therebetween. Further, in the assembled condition, the leg portions **24***a* of the moving contact carrier **24** are guided in slots **12***d* of the base member **12** and between opposite guide surfaces **14***b* and **16***b* of the housing members **14** and **16**, respectively, so as to allow for reciprocal movements of the carrier and the armature, not shown, toward and away from the magnetic frame, not shown, upon the energization and de-energization of the coil, not shown. Inward reciprocal movement of the moving contact carrier **24** from the "at rest position," shown in FIG. 1, upon energization results in relative movement with the bias plate **22** and the generation of a return force caused by spring means, not shown, disposed therebetween being compressed. Consequently, outward reciprocal movement upon de-energization is provided by the return force. Such reciprocal movements of course cause a change in the condition of the poles formed of the respective sets of fixed contact portions **18***a* and bridging bars **26**.

The foregoing general description is merely to set a framework for the invention and as such forms no real part of it. The inventive concept is set forth below.

Referring now specifically to FIG. 2, it will be appreciated that the moving contact carrier **24** includes four substantially cylindrical, stepped, through openings **24***b* in which the bridging bars **26** are disposed. Each of the bridging bars **26** is supported in an assembly **28** comprised of a substantially cylindrical, shouldered, hollow sleeve **30** having a bottom opening, not shown, coil spring **32**, T-shaped hollow spring retainer **34** and end piece **36**. Each assembly **28** is located in one of the stepped openings **24***b* of the moving contact carrier **24** as best shown in FIG. 3.

In initial assembly, the spring retainer **34** is disposed within and the extremity **34***a* thereof extends through and beyond the top opening **30***a* of the sleeve **30**. Further, the bridging bar **26** and the spring **32** are disposed within the sleeve **30** so that the bridging bar is opposite the spring retainer **34** and the spring is disposed therebetween. A first extremity of the bridging bar **26** passes through the opening **30***b* of the sleeve **30**. Thereupon the shouldered sleeve **30** with the assembled elements just referred to is slidably disposed in a stepped opening **24***b* of the moving contact carrier **24**. End piece **36** is secured to the sleeve **30** when in place in the opening **24***b* by plastically deforming tabs **30***c* which extend through apertures **36***a* provided in the end piece. As so constructed, the second extremity of the bridging bar **26** passes through the slot **36***b* provided in end piece **36**. While each assembly **28** is thus secured in place with respect to lateral movement in the moving contact carrier **24**, rotative movement thereof about the longitudinal axes of the openings **24***b* is permitted. To properly locate the assembly **28** in the two extreme positions which allow for the normally open and normally closed contact orientation, positioning means are provided. Thus, oppositely located depressions **24***d* are provided in the side walls of the stepped openings **24***b* for detent association with resilient fingers **36***c* of the end pieces **36**.

It should be noted in passing that as shown in FIG. 3, extremity 34*a* is disposed in opening 24*c* of the moving contact carrier 24 for engagement with a protrusion, not shown, of the bias plate 22 upon inward reciprocal movement of the moving contact carrier. This construction which is known in the prior art allows for equalization of force loading as seen by the magnetic structure whether a normally open or a normally closed contact orientation is involved. It will be appreciated that in the rotative process to bring about a normally closed contact orientation, the extremity 34*a* of the spring retainer 34 enters the opening 24*c* of the moving contact carrier as shown in FIG. 3. Further, where a normally open contact orientation is brought about, the extremity 34*a* is forced out of the opening as the cam surface 34*b* engages the side wall of the opening 24*c* causing movement of the spring retainer 32 toward the bridging bar resulting in a compression of spring 32.

Rotative movement of an assembly 28 with the relay 10 in the condition of FIG. 2 is brought about by means of a screwdriver bit or similar tool being introduced in the slot provided between protrusions 30*d* on the end face of the sleeve 30 and turning the same. Because of the proportions of the elements of the assembly 28, rotation of the assembly results in the bridging bar 26 assuming one of two positions, that is, normally open or normally closed, with respect to the fixed contact portions 18*a* when the relay 10 is assembled as shown in FIG. 1.

The desired positioning of the assemblies 28 can take place prior to installation of the relay 10 to provide the desired condition of each of the poles or it can take place after installation when already wired. In both cases, a nominal disassembly of the relay 10 to the condition shown in FIG. 2 and the exposure of the moving contact carrier 24 and associated assemblies 28 is all that is necessary to allow the desired rotative positioning to be brought about. It is apparent that where the relay 10 is wired no disconnecting of wires is required due to the pivotal manner of association of the housing members 14 and 16 with the base member 12 coupled with the location of the terminal members 18 and coil terminals 19 thereon and the rather small movement encountered thereby in such disassembly. To limit the movement of the housing members 14 and 16 with respect to the base member 12 during such disassembly and to preclude disassociation of the assembly 20 from the remainder of the relay 10 during such disassembly, the housing members can be limited in opening pivotal movement with respect to the base member by appropriate means so that the armature, not shown, can not clear the gap thus provided between the upper portions of the housing members.

With the relay 10 of FIGS. 1–3, an arrangement is provided which allows for change in contact orientation with the attributes above set forth although a nominal disassembly is involved. If it is desired to provide such an arrangement without any disassembly, attention is directed to the following.

Relay 40 as shown in FIG. 4 is for all practical purposes the same as that shown in FIG. 1 except for the moving contact carrier 42. Thus the moving contact carrier 42 includes means exposed proximate the top surface thereof which allow for rotation of the moving contact bridging bars to change contact orientation with respect to the fixed contact portions between normally open and normally closed without any disassembly of the relay 40 being required as will become apparent from the following explanation with respect to FIGS. 5–7.

Turning initially to FIG. 5, the moving contact carrier 42 includes four stepped through openings 42*a* in each of which an assembly 46 is arranged to be disposed. Each assembly 46 includes a moving contact bridging bar 26, coil spring 32, T-shaped hollow spring retainer 34 and end piece 36, all of which are identical with the same numbered elements of FIGS. 2 and 3. Further included in the assembly 46 is a substantially cylindrical hollow sleeve 48 generally the same as sleeve 30 of FIGS. 2 and 3 except for the inclusion of an integral gear sector 48*a* near the journal 48*b* thereof. Also included in the assembly 46 are a support 50 formed of a resilient plastic material and a driving gear 52 including teeth 52*a*. In initial assembly the bridging bar 26, the spring 32, spring retainer 34 and the end piece 36 are associated with the sleeve 48 in exactly the same manner as the corresponding elements are associated with the sleeve 30 of FIGS. 2 and 3. Following this, the shaft 52*b* of driving gear 52 is disposed in and through the opening 50*a* of the support 50 so that surface 52*c* of the gear engages lower surface 50*b* of the support. Thereupon the sleeve 48 with the assembled elements is located with respect to the support 50 so that surface 48*c* of the sleeve engages surface 50*c* of the support with the journal 48*b* of the sleeve slidably disposed in the opening 50*d* of the support. Such assembly causes driving engagement between the teeth 48*a* of the sleeve 48 and the teeth 52*a* of the driving gear 52. It should be noted that the resilience of the support 50 is relied upon to allow the driving engagement to take place; that is, the top portion and the downwardly extending portions of the support are spread apart during assembly to allow the teeth 48*a* of of the sleeve 48 and the teeth 52*a* of the driving gear 52 to interengage. After assembly and upon the forementioned portions of the support return to their normal position, the sleeve 48 and the driving gear 52 are maintained assembled and in proper relative position.

After the foregoing has been accomplished, the assembly 46 can be accommodated in an opening 42*a* of the moving contact carrier 42 by a sliding enterengagement therebetween whereby clevis extremities 50*e* of the support 50 are forced together so as to allow notches 50*f* to be associated with protrusions 42*a* of the moving contact carrier. This interengagement locates and positions the assembly 46 in place in the moving contact carrier 42. Also aiding in locating and positioning the assembly 46 in place is shoulder 42*c* provided in the opening 44 against which surface 48*d* of the sleeve 48 bears. To properly locate the assemblies 46 in the two extreme positions which allows for normally open and normally closed contact orientation, the same expedient utilized in FIGS. 2 and 3, that is, depressions 24*d* in the moving contact carrier 24 and resilient fingers 36*c* of the end piece, can be utilized. Alternatively the extreme positions can be determined by means which positively limit movement. Thus in the arrangement of FIG. 5 the gear sector 48*a* of the sleeve 48 is of such a length and so located as to not allow the extreme positions to be exceeded. Friction between the teeth 48*a* of the sleeve 48 and the teeth 52*a* of the driving gear 52 inhibit casual relative movement.

With the assemblies 46 in place in the moving contact carrier 42 as shown in FIG. 5, the carrier can be associated with the relay 40 as shown in FIG. 4. When so associated, it will be appreciated that the exposed extremity of the shaft 52*b* of the driving gear 52 can be engaged and rotated by a tool, such as a screwdriver for example, or manually, where properly formed. Rotation of the shaft 52*a* causes rotation of the driving gear 52 with the consequent rotation of the sleeve 48 due to the driving engagement between the teeth 52*a* of the driving gear and the teeth 48*a* of the sleeve. Such rotation of course results in changing the orientation of the bridging bars 26 with respect to the fixed contact portions of the terminals.

In FIGS. 6 relay 40 is shown in partial plan view without the terminal members in place and the bridging bars 26 undergoing rotation from a normally closed to a normally open orientation as the assemblies 46 are viewed from left to right. It will be noted that housing members 54 and 56 have outer walls 54*a* and 56*a*, barriers 54*b* and 56*b* and center walls 54*c* and 56*c* so proportioned and located as to accommodate the rotation of the bridging bars 26. Further, referring to FIG. 7, the fixed contact portions 58 of the terminal members are so proportioned and located between the walls and the barriers of the housing members 54 and 56 as to allow rotation of the bridging bars 26 thereabout. In FIG. 7, degrees of rotation of the assemblies 46 correspond to that of the bridging bars 26 directly thereabove as shown in FIG. 6; that is, the orientation is changed progressively from a normally closed to a normally open configuration.

It is apparent from the foregoing that the contact orientation of relay **40** can be changed between normally open and normally closed positions without any disassembly of the relay.

While I have disclosed two preferred embodiments of my invention, other forms are possible and therefore the scope of my invention should be determined from the following claims.

I claim:

1. A movable contact arrangement for a switch device comprising: a moving contact carrier arranged for reciprocating movement with respect to a switch housing; said carrier supporting a moving contact bridging bar assembly for association with spaced, fixed contact surfaces located proximate either extremity of said bridging bar and supported by the housing; the contact surfaces of said bridging bar and the fixed contact surfaces extending substantially transverse to the direction of movement of said carrier; said assembly being rotatable in place and with respect to said carrier about an axis substantially parallel to and co-extensive with a straight line connecting the contact surfaces of said bridging bar so as to relocate the bridging bar with respect to the fixed contact surfaces and thereby selectively provide a normally open or a normally closed contact orientation.

2. The arrangement of claim **1** wherein said bridging bar moving contact assembly includes a sleeve which is disposed in an opening contact carrier so as to allow for rotation of said assembly about the axis to thereby cause relocation of said bridging bar.

3. The arrangement of claim **2** wherein said sleeve and said opening are substantially cylindrical.

4. The arrangement of claim **3** wherein said sleeve includes means to be engaged for causing the rotation thereof.

5. The arrangement of claim **4** wherein said means comprises a tool engaging portion provided on an end face of said sleeve which is substantially parallel with the plane of movement of said moving contact carrier.

6. The arrangement of claim **4** wherein said means comprises a first gear portion associated with said sleeve, a second gear portion in driving engagement with said first gear and including an extension disposed so as to be engageable proximate a surface of said moving contact carrier which is substantially transverse to the plane of its movement.

7. The arrangement of claim **4** wherein said engagement means is operable from without said switch housing with said moving contact carrier remaining in place with respect to the housing and the fixed contact surfaces thereof to cause the contact surfaces of said bridging bar to be rotated about the fixed contact surfaces.

8. The arrangement of claim **2** wherein positioning means are provided to positively locate said bridging bar moving contact assembly in said moving contact carrier in the two extreme positions which allows for the normally open and normally closed contact orientations.

9. The arrangement of claim **8** wherein the positioning means are in the form of stops disposed between said moving contact carrier and said bridging bar moving contact assembly.

10. The arrangement of claim **8** wherein the positioning means are in the form of detents disposed between said moving contact carrier and said bridging bar moving contact assembly.

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