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J. H. MULLEN ET AL

3,519,967

RELAY WITH MODULAR CONTACT ASSEMBLY

Filed Nov. 30, 1967

3 Sheets-Sheet 1

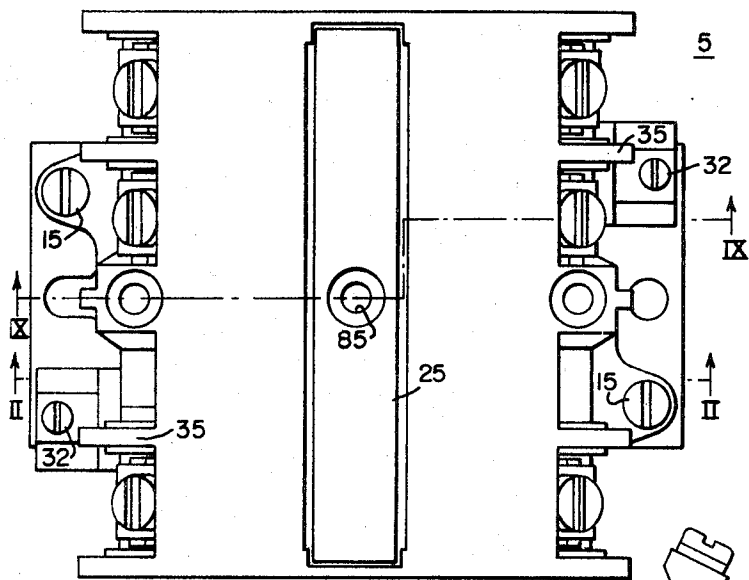


FIG. 1.

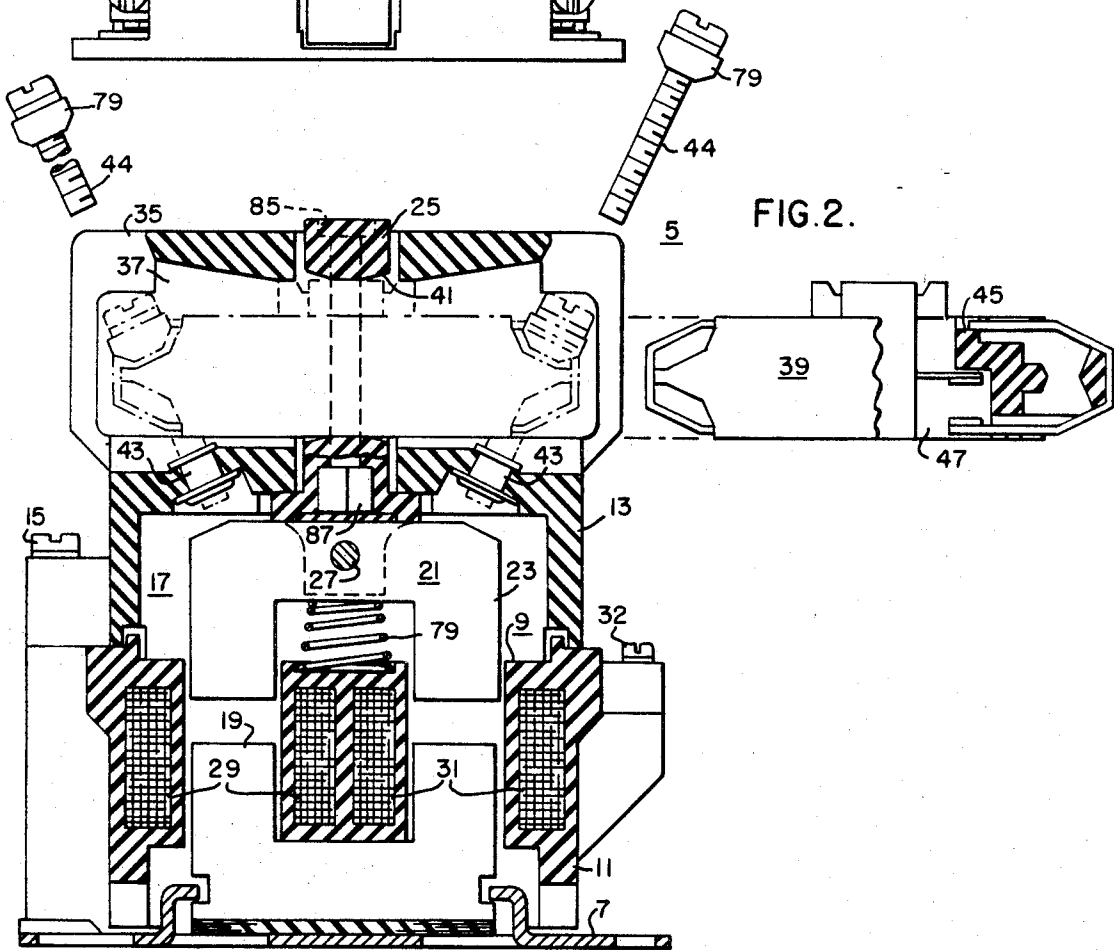


FIG. 2.

WITNESSES

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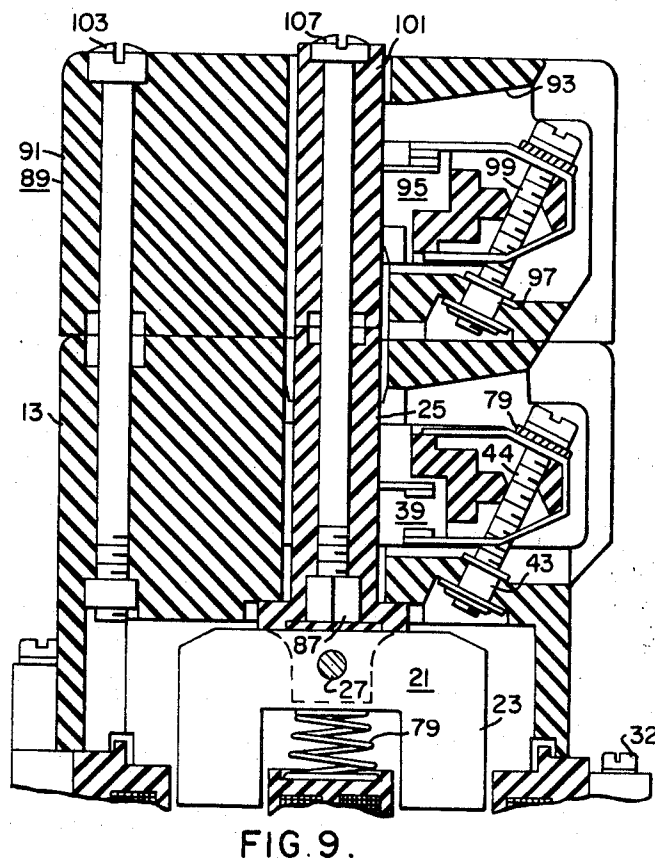
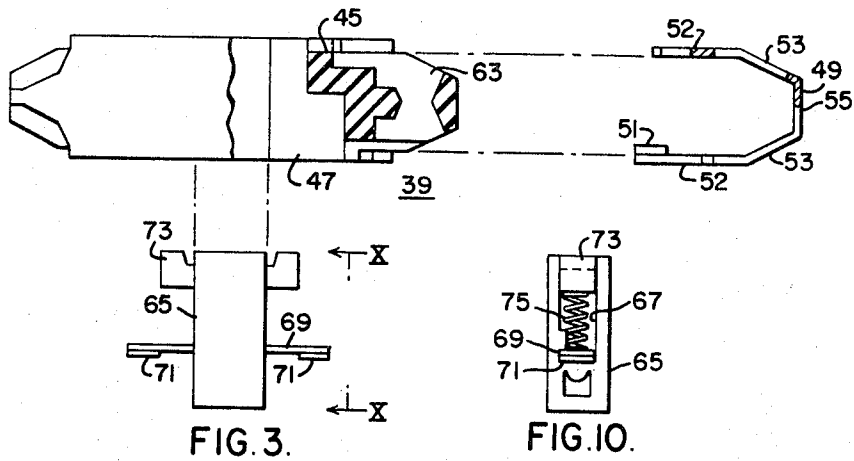
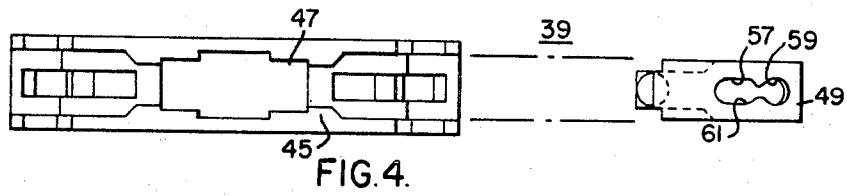
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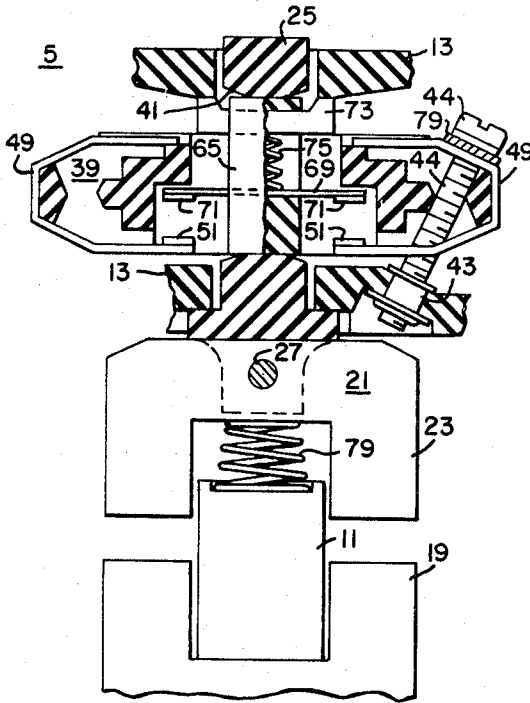


FIG. 5.

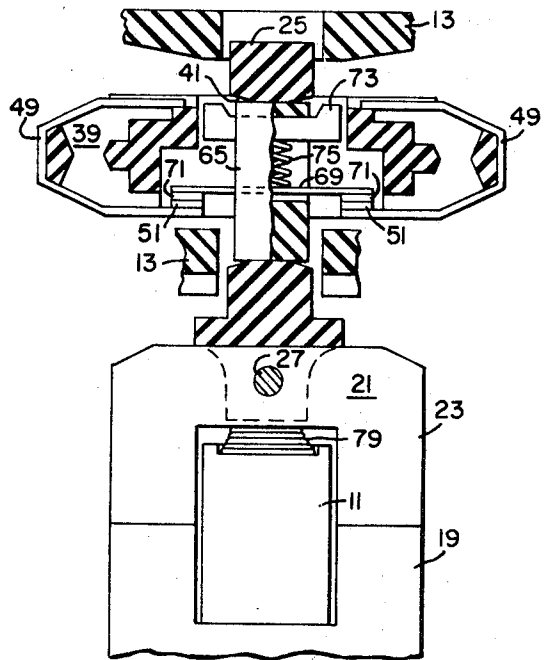


FIG. 6.

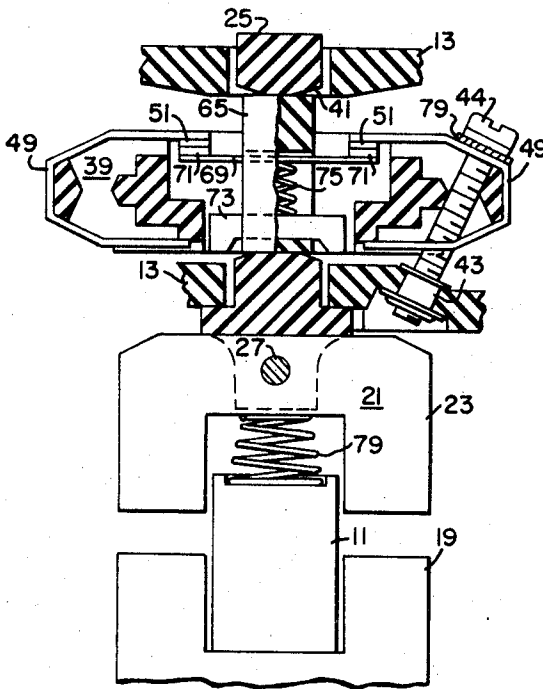


FIG. 7.

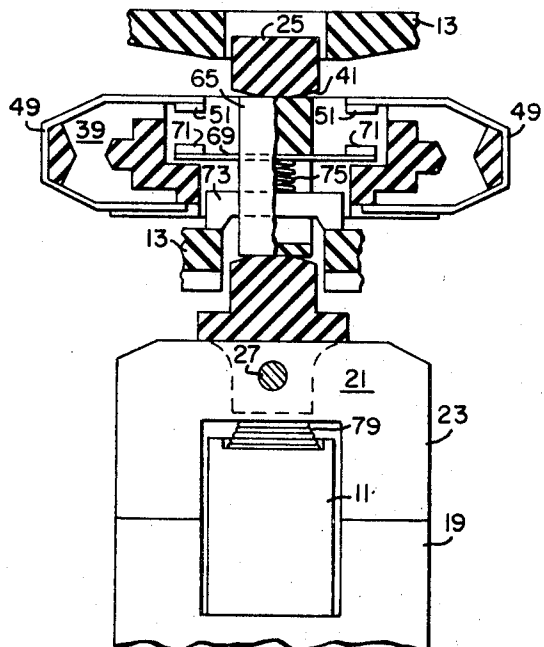


FIG. 8.

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RELAY WITH MODULAR CONTACT ASSEMBLY
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10 Claims

ABSTRACT OF THE DISCLOSURE

An improved relay in which modular contact assemblies are reversible to provide normally open and normally closed operation. The contact assemblies are provided with generally U-shaped terminal conductors. Pole terminal screws extend angularly through the legs of the terminal connectors to fasten the assemblies in position on the relay and to connect conductive wire to the flat faces on the terminal connectors.

SUMMARY OF THE INVENTION

A relay comprises a plurality of modular contact assemblies that can be removed and replaced in an inverted position to reverse the operation of the contact assemblies. Each modular contact assembly is reversible without necessitating replacement of the spring means or of the contact structures in the assembly. Improved spring biasing means provides for operation of the relay with overtravel and contact pressure in either of the positions of the assembly. The pole terminal screws mount the modular contact assemblies in the relay. The modular contact assemblies are provided with terminal conductors that are constructed such that the pole terminal screws, that are angularly positioned, can be used to mount the contact assemblies and to also connect flat slanted faces of the terminal conductors to conducting wires that are connected to the contact assemblies at the installation. Additional layers of contact assemblies can be mounted on the relay so that the same basic relay construction can be used for four, eight or twelve pole applications.

OBJECTS OF THE INVENTION

An object of this invention is to provide an improved relay comprising modular contact assemblies that are removable and reversible to provide normally open or normally closed operation.

Another object of this invention is to provide an improved modular contact assembly that can be removably connected to a relay in either of two positions to provide normally open or normally closed operation.

DRAWINGS

FIG. 1 is a top plan view of a relay constructed in accordance with principles of this invention with one of the modular contact assemblies removed;

FIG. 2 is a sectional view taken along the line II—II of FIG. 1 with the removed modular contact assembly being shown in an exploded position;

FIG. 3 is a view, with parts broken away, of parts of one of the modular contact assemblies seen in FIGS. 1 and 2;

FIG. 4 is a top plan view of parts of the modular contact assembly seen in FIG. 3;

FIG. 5 is a sectional view illustrating parts of the relay of FIG. 2 with the relay in an unactuated position;

FIG. 6 is a view similar to FIG. 5 with the relay in the actuated position;

FIG. 7 is a view similar to FIG. 5 with the modular contact assembly shown in the reversed position;

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FIG. 8 is a view similar to FIG. 7 with the relay being shown in the actuated position;

FIG. 9 is a partial sectional view taken generally along the line X—X of FIG. 1 with an additional contact layer added in order to provide for eight pole operation; and

FIG. 10 is an end view along the line X—X of FIG. 3 looking in the direction of the arrows.

DESCRIPTION

Referring to the drawings, there is shown, in FIGS. 1 and 2, a four pole relay 5 with one of the modular contact assemblies removed. The relay 5 comprises a metallic mounting plate 7 and an insulating relay housing 9 mounted on the plate 7. The relay housing 9 comprises a molded insulating base 11 and a molded insulating top 13. A pair of mounting screws 15 secured the housing parts 11, 13 together and mount the housing 9 on the base 7. An electromagnetic control mechanism 17 is supported in housing 9.

The control mechanism 17 comprises a generally U-shaped magnetic laminated core member 19 and an armature structure 21 that comprises a generally U-shaped magnetic laminated armature 23 and an insulating operating member 25 connected to the armature 23 by means of a pin 27. A pair of coils 29 and 31 are embedded, during a molding operation, in the molded housing base 11 as integral parts of the housing base 11. The parts are mounted with each of the coils positioned over a different leg of the U-shaped yoke 19. The upper housing part 13 is molded with a plurality of barriers 35 forming four cavities 37 that are separated by the barriers 35 and that are provided to receive four modular contact assemblies 39. Only three of the modular contact assemblies are shown in position in FIG. 1 with the section line being taken through the empty cavity 37 and with the fourth modular contact assembly being shown in FIG. 2 exploded from the mounted position for the purpose of clarity. As can be seen in FIG. 1, the insulating operating member 25 extends across the relay, and this member 25 is provided with a separate window-opening 41 in each of the four cavities 37. A pair of metallic inserts 43 are fixedly secured to the housing part 13 at the bottom of each of the cavities 37. Each of the metallic inserts 43 is provided with a tapped opening therein for receiving a separate threaded pole terminal screw 44.

Each of the modular contact assemblies 39 (FIGS. 2—4) comprises a molded insulating contact housing 45 having a cavity 47 therein. A separate terminal conductor 49 is supported at each of the two opposite ends of each contact housing 45. Each of the terminal conductors 49 is generally U-shaped (FIGS. 3 and 4), and a stationary contact 51 is fixedly secured to one leg of each conductor 49. As can be seen in FIG. 3, the opposite legs of each terminal conductor 49 are generally parallel in proximity to the free ends thereof and they are bent over to provide slanted parts 53 between the end parts of the legs and the bight portion 55. Each of the legs 52, 53 of each terminal conductor 49 is provided with opening means 57 therein with each opening means comprising a generally circular opening part 59 and an elongated opening part 61. Each insulating contact housing 45 is provided with an opening 63 (FIG. 3) at each of the two opposite ends of the housing 45. A separate molded insulating contact carrier 65 (FIGS. 3 and 10), having a window-opening 67 therein, is positioned in the cavity 47 of each of the contact housings 45. A separate bridging contact member 69, having a pair of contacts 71 supported on the opposite ends thereof, is positioned in each window-opening 67. A separate insulating generally U-shaped spring retainer 73 is positioned in each window-opening 67, and a separate coil compression spring 75 is supported between each spring retainer 73 and the associated bridging

ing contact member 69. When it is desired to assemble the modular contact assembly 39, the spring retainer 73 and bridging contact member 69 are placed in position on the contact carrier 65 with the spring 75 disposed between the members 73, 69. Thereafter, the contact carrier 65 is moved up through the cavity 47 into the contact housing 45, and the two terminal conductors 49 are moved endwise into position in suitable slots in the contact housing 45 to position the stationary contacts 51 under the movable contacts 71 to retain the contact carrier 65 in position. The modular contact assembly 39 is then moved endwise into the associated cavity 37 (FIG. 2) to the position shown in broken lines in FIG. 2. Thereafter, the pole terminal screws 44 are moved into position going through the circular openings 59 (FIG. 4) in the upper legs of the terminals 49 and through the elongated openings 61 in the lower legs of the terminals 49 and through the elongated openings 61 in the lower legs of the terminals 49 to be screwed into the tapped insert 43. As can be understood with reference to FIGS. 1 and 2, each of the pole terminal screws 44 comprises a threaded shank with a screwhead and an inverted generally U-shaped member 79 that is positioned over the shank under the screwhead to engage a conducting wire that would be positioned under the member 79 and adjacent the associated flat slanted surface 53 (FIG. 3) of the terminal conductor 49. With the contact assembly 39 in the position shown in FIGS. 2, 5 and 6, the pole unit is provided for normally open operation. When it is desired to change the operation of the pole unit, the pole terminal screws 44 are removed and the modular contact assembly 39 is moved endwise out of the associated cavity 37 and turned over; then moved endwise back into the associated cavity 37 to the position shown in FIGS. 7 and 8. In this case, each pole terminal screw 44 will go through the circular opening 59 (FIG. 4) in the leg that supports the stationary contact and through the elongated opening 61 in the other leg, and into the associated tapped insert 43 to secure the modular contact assembly 39 in position. In this case, it can be understood that the slanted surface 53 of the leg that supports the stationary contact of each of the terminals 49 will be positioned adjacent the associated member 79 (FIGS. 7 and 8) to receive a conducting wire that would be placed between the surface 53 and the member 79 to connect the associated terminal conductor 49 to the conducting wire. The modular contact assembly 39 is reversible by removing the pole terminal screws 44 and thereafter removing and turning over the contact assembly 39 before replacement and mounting of the screws 44, without necessitating a disassembly of the parts of the modular contact assembly. With the slanted surfaces 53 provided and with the pole terminal screws 44 going in at an angle as shown in the drawings, it can be understood that when another contact layer is mounted over the first layer (FIG. 9) the screws 44 of the lower layer are readily accessible for adjustment with a screwdriver type tool.

As will be understood with reference to FIGS. 5-8, when the modular contact assembly 39 is moved into the associated cavity 37 the contact assembly 39 moves through a window-opening 41 in the insulating operating member 25 and the contact carrier 65 is aligned with the operating member 25 so that vertical reciprocal movement of the insulating operating member 25 will operate to vertically reciprocate the contact carrier 65.

Referring to FIG. 5, the relay 5 is shown in the unactuated position with a nesting coil-type kickout spring 79 positioned between the housing base 11 and the bight portion of the armature 23 to bias the armature structure 21 to the upper unactuated position shown. With the armature structure 21 in the upper position, the insulating contact carrier 65 is maintained in the upper position wherein the movable contacts 71 are spaced from the stationary contacts 51. Upon energization of the coils 29, 31 (FIG. 2) the armature 23 is attracted toward the yoke

19 whereupon the armature structure 21 is moved to the actuated position seen in FIG. 6 compressing the kickout spring 79 that moves into the nested compressed position shown in FIG. 6. During this movement of the armature structure 21, the contact carrier 65 is moved down to move the contacts 71 into engagement with the contacts 51, and the contact carrier 65 is moved an additional distance to provide overtravel and contact pressure during which additional movement the contact spring 75 is further compressed. As can be seen in FIG. 6, the spring 75 is compressed between the bridging contact structure 69 and the spring retainer 73 which engages the upper end of the contact carrier 65. When the coils 29, 31 are deenergized, the kickout spring 79 returns the armature structure 21 and contact carrier 65 to the upper unactuated position seen in FIG. 5. During the initial part of this movement, the kickout spring 79 and contact springs 75 serve to move the armature structure 21 toward the upper position seen in FIG. 5 until the bridging contact member 69 engages the contact carrier 25 at the bottom of the window-opening 67, and thereafter the kickout spring 79 alone serves to move the armature structure to the upper unactuated position seen in FIG. 5.

When the modular contact assembly 39 is mounted on the relay in the reversed position (FIG. 7) and the relay is in the unactuated position, the kickout spring 79 biases the armature structure 21 to the upper position seen in FIG. 7 in which position the contacts 51, 71 are closed. In the position seen in FIG. 7 the armature structure 21 is in the full upper position and the contact carrier 25 is moved upward slightly past the initial closed position of the contacts with the contact spring 75 being compressed slightly to provide overtravel and contact pressure. When the relay is energized, the armature structure 21 is operated down to the actuated positions seen in FIG. 8. During the initial part of this movement, the spring retainer 73 moves with the contact carrier 25 until the opposite legs of the spring retainer engage the housing part or stationary stop part 13 of the relay (FIG. 8) and thereafter the spring retainer 73 remains stationary while the contact carrier 25 is moved to the fully actuated position seen in FIG. 8. During this movement, the contact spring 75 is compressed and the contacts are moved to the fully opened position. When the relay is then deenergized the compressed kickout spring 79 and the compressed contact spring 75 operate to move the armature structure 21 upward, and when the contact carrier 25, at the bottom of the window-opening, engages the spring retainer 73 the kickout spring 79 thereafter alone serves to move the armature structure 21 to the unactuated normally closed position seen in FIG. 7. During the movement to the normally closed position seen in FIG. 7 the contacts 71 first engage the contacts 51 and there is a slight additional movement upward during which movement the contact spring 75 is additionally compressed to permit overtravel and provide contact pressure in the closed position.

As will be understood with reference to FIGS. 1 and 2, the hereinbefore described relay is a four pole relay with the common operating member 25 moving to simultaneously move the four contact carriers 65 of the four modular contact assemblies 39 during operation of the relay. The four modular contact assemblies 39 can be mounted on the relay to provide four normally open poles, four normally closed poles, or a mixture of normally open and normally closed poles depending on the particular control requirement.

Referring to FIGS. 1 and 2, it will be noted that the insulating operating member 25 is provided with an opening 85 therein, and a nut 87 is captured in the operating member 25 at the bottom of the opening. Referring to FIG. 9, another contact layer 89 of pole units comprises an insulating housing 91 having four cavities 93 therein similar to the cavities 37 for receiving four modular contact assemblies 95 that are identical to the contact assem-

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blies 39. An eight pole relay is disclosed in FIG. 9.

Tapped inserts 97 are supported on the housing 91 for receiving pole terminal screws 99 that mount the modular contact assemblies 95 to the housing 91 in the same manner as was hereinbefore described with regard to the modular contact assemblies 39. An operating member 101, similar to the operating member 25, having four window-openings for receiving the four modular contact assemblies 95, is mounted on the housing 91 for reciprocal vertical movement. The housing 91 is mounted on the relay housing part 13 by means of two bolts 103 (only one of which is seen in FIG. 9) with the operating member 101 being positioned on top of the operating member 25 and with an opening in the operating member 101 aligned with the opening 85 (FIG. 1) in the operating member 25. A bolt 107 is extended through the aligned openings in the operating members 101 and 25, and threaded into the nut 87 to secure the operating members 101 and 25 together. Thus, when the armature structure 21 is vertically reciprocated in the manner hereinbefore described, the operating member 101 moves with the operating member 25 and the four modular contact assemblies 95 of the upper layer 89 are simultaneously operated with the four modular contact assemblies 39. It can be understood that an additional contact layer 89 could be mounted on top of the two layers seen in FIG. 9 to provide a twelve pole relay in the same general manner as was hereinbefore described with regard to the eight pole relay.

We claim as our invention:

1. A relay comprising an insulating relay housing, an electromagnetic control mechanism supported on said relay housing and comprising a movable armature structure,

a modular contact assembly comprising an insulating contact housing, a pair of stationary contacts supported in said contact housing, a pair of generally U-shaped terminal conductors supported on said contact housing at opposite ends of said contact housing, each of said stationary contacts being connected to a different one of said terminal conductors, a movable bridging contact structure, a contact carrier carrying said bridging contact structure and being movable on said contact housing to move said bridging contact structure between two operating positions into and out of bridging engagement with said stationary contacts,

mounting means removably mounting said modular contact assembly on said relay housing in a first position with said contact carrier operatively connected to said armature structure such that upon energization of said control mechanism said armature structure is moved in a first direction to move said contact carrier to move said bridging contact structure from one to another of said operating positions, said mounting means being operable to removably connect a separate conducting wire to each of said terminal conductors, means for disconnecting said mounting means and removing said modular contact assembly and then mounting said modular contact assembly in a reversed position on said relay with said mounting means in which reversed position said contact carrier is operatively connected to said armature structure such that upon movement of said armature structure in said first direction said contact carrier is moved to move said bridging contact structure from said other to said one operating position, and said mounting means being operable to removably connect a separate conducting wire to each of said conducting terminals when said modular contact assembly is mounted in said reversed position.

2. A relay according to claim 1, said terminal conductors being mounted on said contact housing at opposite ends of said contact housing with the opposite legs of each terminal conductor extending generally toward the

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other terminal conductor, each of said terminal conductors comprising a pair of surfaces on the opposite legs thereof which surfaces converge toward the associated end of the contact housing to thereby provide opposite slanted terminal-connecting surfaces that are slanted relative to the direction of spacing of said stationary contacts.

3. A relay according to claim 1, said armature structure being movable in said first direction upon energization of said control mechanism and in a second direction opposite the first direction upon deenergization of said control mechanism, opening means in both legs of each of said terminal conductors, a pair of tapped means on said relay housing and a separate pole terminal screw for each of said tapped means, each of said pole terminal screws extending through the opening means in both of the legs of the associated terminal conductor and being threaded into the associated tapped means in said relay housing, each of said pole terminal screws being screwable in the associated tapped means to connect and disconnect a conducting wire to a first leg of the associated terminal conductor, and when said modular contact assembly is mounted in said reversed position each of said pole terminal screws extending through the opening means in both of the legs of the associated terminal conductor and being threaded into the associated tapped means on said relay housing with each pole terminal screw being screwable in the associated tapped means to connect and disconnect a conducting wire to the other leg of the associated terminal conductor.

4. A relay according to claim 3, each of said terminal conductors comprising a pair of opposite surfaces on the opposite legs thereof that converge toward the associated end of the contact housing to provide a pair of opposite slanted terminal-connecting surfaces, each of said tapped means being positioned to receive the associated pole terminal screw at an angle relative to the direction of movement of said bridging contact structure, and said slanted terminal-connecting surfaces and said angular mounting of said pole terminal screws being such that when said modular contact assembly is mounted in said first position the axis of each pole terminal screw is generally normal to a first slanted terminal-connecting surface of the associated pair of slanted terminal-connecting surfaces and when said modular contact assembly is mounted in said second position the axis of each pole terminal screw is generally normal to the second slanted terminal-connecting surface of the associated pair of slanted terminal-connecting surfaces.

5. A modular contact assembly comprising an insulating housing, a pair of terminal conductors mounted on said housing at opposite ends of said housing, each of said terminal conductors comprising a generally U-shaped conductor and being positioned on said housing with the opposite legs thereof extending generally in the direction toward the other terminal conductor, opening means in both legs of each of said terminal conductors, a stationary contact connected to one leg of each of said terminal conductors, a bridging contact structure, a contact carrier carrying said bridging contact structure and being movable between two positions to move said bridging contact structure into and out of engagement with said stationary contacts, and a separate pole terminal screw for each of said terminal conductors extending through the opening means in both legs of the associated terminal conductor and being operable to removably mount said modular contact assembly on a relay and to removably connect a conducting wire to the associated terminal conductor.

6. A modular contact assembly according to claim 5 said modular contact assembly being reversibly mountable on a relay in either a normally open position or a normally closed position, in the normally open position each of said pole terminal screws extending first through the opening means in one leg and then through the opening means in the other leg of the associated terminal conductor with the screwhead being in proximity to the one

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leg to removably connect a conducting wire to the one leg of the associated terminal conductor, and in the normally closed position of said modular contact assembly each pole terminal screw extending first through the opening means in the other leg and then through the opening means in the one leg of the associated terminal conductor with the screwhead being in proximity to the other leg of the associated terminal conductor to removably connect a conducting wire to the other leg of the associated terminal conductor.

7. A modular contact assembly according to claim 6, each of said generally U-shaped terminal conductors comprising a pair of opposite slanted terminal-connecting surfaces on the opposite legs thereof that converge in the direction toward the associated end of said housing, said opening means in each of said terminal conductors being shaped to receive the associated pole terminal screw such that in the normally open position of the modular contact assembly the axis of the screw is generally normal to one of the associated slanted terminal-connecting surfaces and in the normally closed position of the modular contact assembly the axis of the screw is generally normal to the other of the associated slanted terminal-connecting surfaces.

8. A relay comprising an insulating relay housing, an electromagnetic control mechanism supported on said relay housing and comprising an armature structure, kickout spring means, upon energization of said control mechanism said armature structure moving in a first direction against the bias of said kickout spring means from an unactuated position to an actuated position charging said kickout spring means, upon deenergization of said control mechanism said charged kickout spring means biasing said armature structure in a second direction to said unactuated position,

a modular contact assembly removably mountable on said relay in a normally closed position and removably mountable on said relay in a normally open position,

said modular contact assembly comprising an insulating contact housing, a pair of spaced stationary contacts on said contact housing, a contact carrier having a window-opening therein and being supported on said contact housing for reciprocal movement, a bridging contact structure on said contact carrier in said window-opening with a pair of movable contacts thereon at opposite sides of said window-opening, a spring retainer on said contact carrier in said window opening, a contact spring in said window-opening between said bridging contact structure and said spring retainer, said relay comprising a stationary stop part,

when said modular contact assembly is mounted on said relay housing in said normally closed position and said armature structure is in said unactuated position said kickout spring means biasing said armature structure to bias said contact carrier to an unactuated normally closed position wherein said bridging contact structure engages said stationary contacts and wherein said kickout spring means operating against said armature structure operates against said spring retainer to charge said contact spring to thereby provide contact pressure between said bridging contact structure and said stationary contacts, upon energization of said control mechanism said armature structure moving to said actuated

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position to move said contact carrier to an actuated position during which movement said contact carrier moves said bridging contact structure to the open position and during which movement said spring retainer engages said stationary stop part of said relay to charge said contact spring, and upon deenergization of said control mechanism said charged kickout spring means and said charged contact spring moving said armature structure and said contact carrier toward said unactuated position until said contact carrier engages said spring retainer whereupon said kickout spring means moves said armature structure said contact carrier said spring retainer and said bridging contact structure to said unactuated normally closed position,

when said modular contact assembly is mounted on said relay housing in said normally open position and said armature structure is in said unactuated position said kickout spring means maintaining said armature structure and said contact carrier in the unactuated position wherein said bridging contact structure is in a normally open position, upon energization of said control mechanism said armature structure being moved to said actuated position against the bias of said kickout spring means to move said contact carrier to the actuated position wherein said bridging contact structure engages said stationary contacts with said contact carrier moving an additional distance after said contacts engage during which additional movement said contact spring is charged between said bridging contact structure and said spring retainer to provide contact pressure between said bridging contact structure and said stationary contacts, and upon deenergization of said control mechanism said charged kickout spring means and said charged contact spring moving said armature structure and said contact carrier until said bridging contact structure is engaged by said contact carrier whereupon said kickout spring means continues to move said armature structure said contact carrier said spring retainer and said bridging contact structure to said unactuated normally open position.

9. A relay according to claim 8, and a plurality of said modular contact assemblies each of which is removably mountable on said relay in said normally closed position and removably mountable on said relay in said normally open position.

10. A modular contact assembly according to claim 9, said armature structure comprising an armature and an insulating operating member connected to said armature, said insulating operating member having opening means therein, and each of said modular contact assemblies being removably mountable on said relay in said normally closed and normally open positions with the associated contact carrier being disposed in said opening means to be operated by said armature structure.

References Cited

UNITED STATES PATENTS

3,099,728	7/1963	Scheib	335—198
3,238,329	3/1966	Russo	335—132
3,249,716	5/1966	Haydu	335—198

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