

Feb. 9, 1960

J. R. BURCH
MAGNETIC SWITCH

2,924,685

Filed Sept. 26, 1957

3 Sheets-Sheet 1

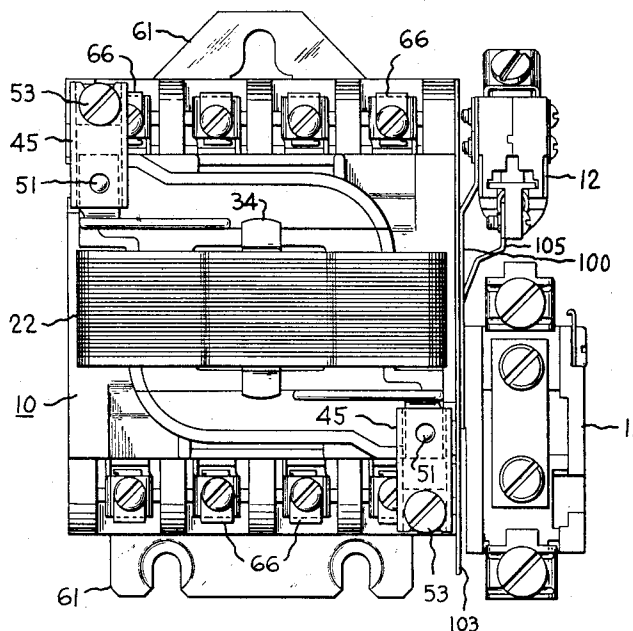


Fig. 1

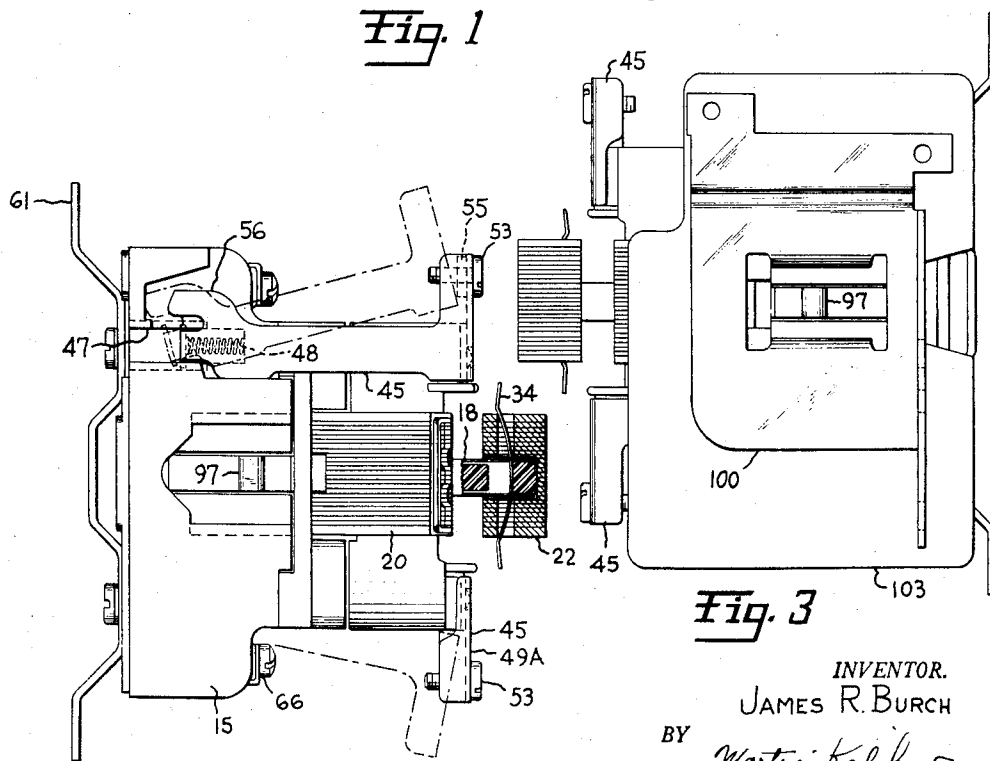


Fig. 2

Fig. 3

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Fig. 4

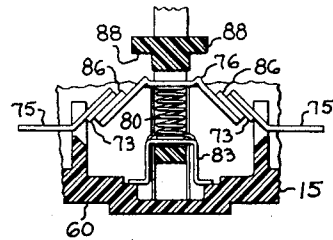
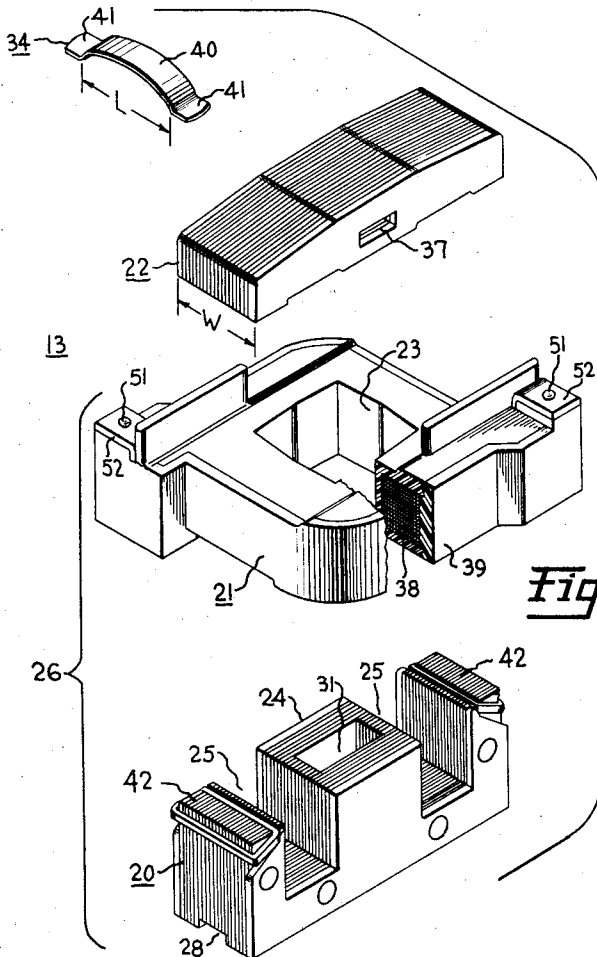
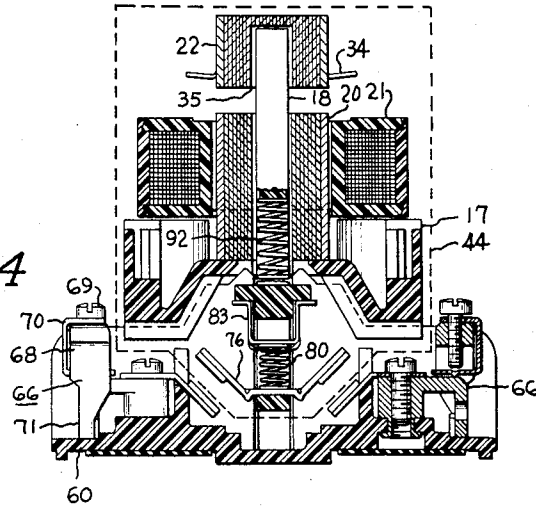


Fig. 5

Fig. 6

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3 Sheets-Sheet 3

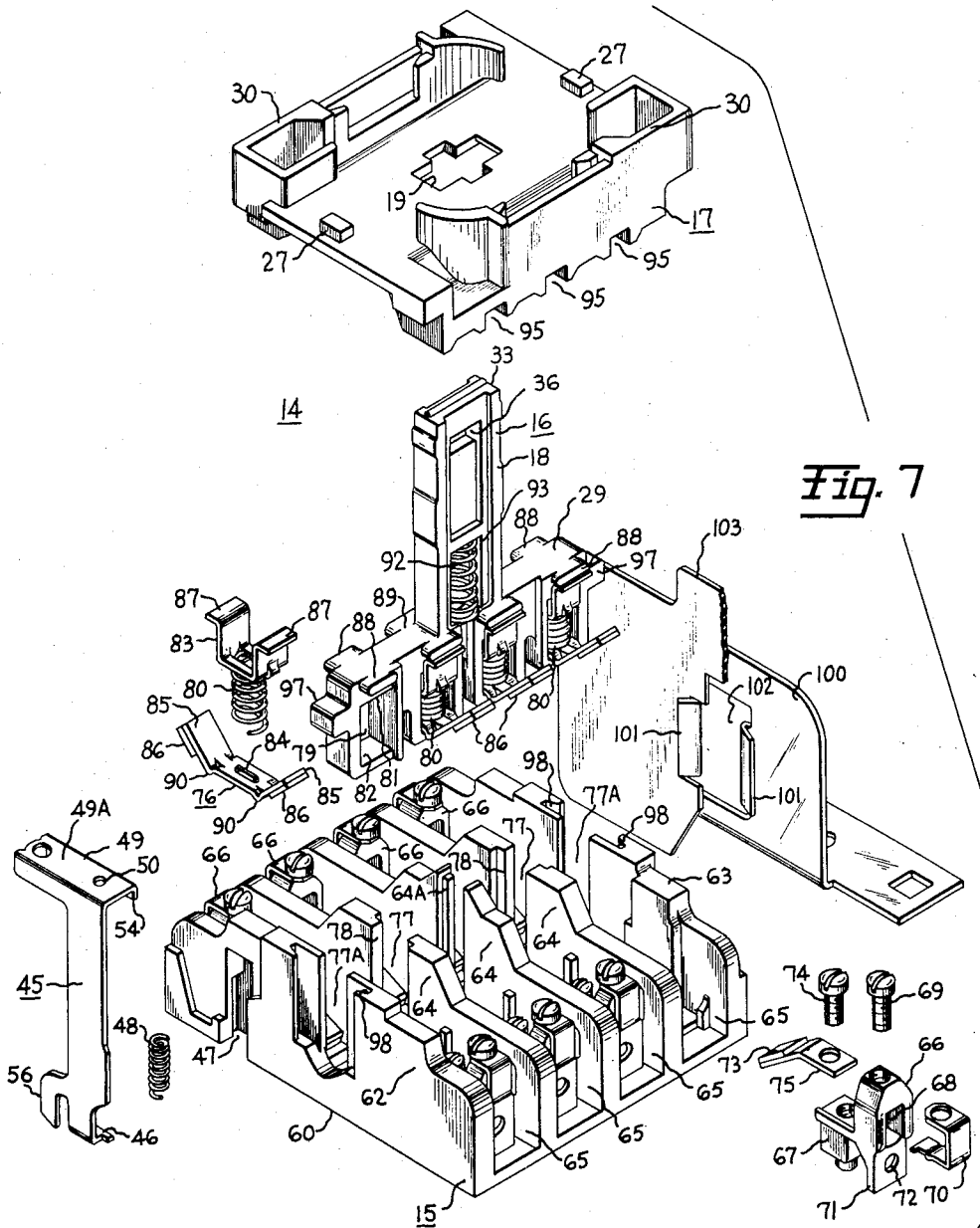


Fig. 7

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2,924,685

MAGNETIC SWITCH

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Application September 26, 1957, Serial No. 686,318

28 Claims. (Cl. 200—104)

My invention relates to magnetic switching devices and more particularly to magnetic contactors and to switching assemblies useful in such contactors.

Magnetic switching apparatus such as magnetic contactors have found wide application in assemblies of industrial control devices generally known as control panels. Among the prime considerations in the selection of control components for use in such panels is their size and weight. Accordingly, one of the principal objects of my invention is to provide an electromagnetic switching device generally known as a "magnetic contactor" having unusually small size and weight for a given voltage and ampere or power rating.

Other desirable features in the design of magnetic contactors are long life, reliable operation, rugged construction, and ease of mounting and of electrical connection both to the terminals of the switching assembly and to the terminals of the energizing coil. Still other important considerations are the ease of assembly, inspection and replacement of the various components of the magnetic contactor and particularly of the contacts and coil. It is also desirable that the contactor be able directly to actuate auxiliary switching devices and to support auxiliary electrical devices such as overload relays.

In general it has heretofore been thought essential or desirable in order to meet these many requirements that the electromagnetic apparatus be separately mounted alongside of the switching apparatus on a common supporting metal plate with the contacts generally visible above the electromagnet and the electromagnet operable against the force of gravity. This arrangement, however, results in a fairly long device, and the duplication in supporting structure for the principal components increases both the weight and cost of the device. Moreover, the use of switching contacts exposed for easy inspection and replacement results in failures due to dust and dirt as well as in lower voltage and current interrupting capacity and in greater danger to maintenance personnel from arcing or electrical shock. Accordingly, other important objects of the invention are to provide a magnetic contactor meeting all of the aforementioned design requirements and yet being of lower manufacturing cost, greater interrupting capacity and greater safety than prior devices. A further important object of the invention is to provide an electromagnetic contactor in which every major part of the device may be quickly and easily disassembled and replaced without the necessity of unscrewing one part from another and without the necessity of disconnecting any of the wire conductors fastened to the various switching or energizing terminals of the device.

A still further object of the invention is to provide a magnetic contactor in which the switching contacts are substantially totally enclosed but yet which may be easily inspected and made available for replacement by a single simple disassembly operation of the contactor apparatus without the necessity of disconnecting any of the wires connected to and from the contactor.

In general, in accord with the invention a magnetic con-

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tactor is provided in which the electromagnet is mounted directly on the switching assembly rather than alongside or below the switching assembly with the switching assembly acting as the sole support for the electromagnet.

This arrangement results in a contactor of unusually small size and weight.

In accord with another important aspect of the invention, the electromagnet and contact carrier of the switching assembly are removable as a unit from the base member of the switching assembly thereby to expose both the stationary contacts on the base member as well as the movable contacts on the contact carrier. The electromagnet is mounted on the base member by an easily detachable clamping means in order to permit this simple disassembly.

In accord with other features of the invention, the switching assembly is composed of a two part insulating housing totally enclosing the switching contacts with the upper housing member having means for positioning the electromagnet thereon. The stationary contacts are mounted in two rows on the central portion of the front surface of the base member and the contact carrier contains bridging contact members for engaging these stationary contacts upon reciprocation of the contact carrier under the influence of the electromagnet connected thereto. The base member contains insulating partitions between each pair of stationary contacts for electrically isolating each pole of the switch and for providing separate arcing chambers for the contacts. These partitions also provide guiding means for the reciprocation of the contact carrier.

In accord with another feature of the invention, terminals are mounted on opposite outer front surface portions of the base member alongside and respectively connected to the two rows of stationary contacts thereon. The electromagnet mounted on the switching assembly is dimensioned to overlie only the central portion of the base member containing the switching contacts whereby these terminals are all directly visible and accessible for connection from above the electromagnet so that when the device is mounted in a panel these terminals are all directly accessible from the front of the panel.

In accord with a further feature of the invention, the ends of the contact carrier extend through opposite side walls of the base member and means are provided on these side walls for supporting auxiliary switching devices in a position to be actuated by the projecting ends of the contact carrier.

In accord with a further specific feature of the invention, novel means are provided for resiliently biasing the contact carrier away from the base member whereby the electromagnet must always operate against the force of this biasing means and the contactor may be mounted in any position irrespective of the direction of the force of gravity upon the armature.

In accord with a still further feature of the invention, the various stationary and bridging contact members are disposed at an angle relative to the plane of reciprocation of the contact carrier and the bridging members are resiliently mounted on the contact carrier with two degrees of freedom of movement whereby the contact members engage with a slight wiping action and with automatic self alignment. The stationary and bridging contact members are also arranged for easy removal and reversal on their respective mountings whereby the contacts may be either easily replaced or changed from a normally open contact arrangement to a normally closed contact arrangement.

These and other novel features believed characteristic of the invention are set forth in the appended claims. The construction of the invention together with further objects and advantages thereof may be easily

understood, however, from the following description taken in connection with the accompanying drawings in which,

Figure 1 is a front or top view of electromagnetic switching apparatus including a magnetic contactor and an overload relay and auxiliary switching device mounted on the contactor;

Figure 2 is an elevation view of one side of the contactor of Figure 1 showing a cross-section of the armature mounting;

Figure 3 is an elevation view of the other side of the contactor of Figure 1 with a mounting plate for auxiliary devices but without the devices mounted thereon;

Figure 4 is a cross-sectional view of the magnetic contactor of Figure 1 showing the contacts in normally open position;

Figure 5 is a detail view showing the contacts in normally closed position;

Figure 6 is an exploded perspective view of the electromagnet portion of the magnetic contactor of Figure 1, and

Figure 7 is an exploded perspective view of the switching assembly portion of the magnetic contactor of Figure 1.

Referring to Figure 1, there is shown a magnetic contactor 10, an overload relay 11 and auxiliary switch 12 mounted on a side of contactor 10. The manner of mounting relay 11 and switch 12 and the manner of actuating switch 12 will be described more fully hereinafter.

Magnetic contactor 10 comprises an electromagnet 13, shown in exploded disassembled form in Figure 6, and a switching assembly 14, best seen in Figure 7. The entire magnetic contactor 10 is best shown in assembled form in Figures 1, 2, and 4. The switching assembly 14 comprises a base member 15, a movable contact carrying switching member 16, and a cover member 17. Switching member 16 has a stem portion or actuator 18 which extends through an aperture 19 in cover member 17 and a contact carrier 29 within the base and cover members. Electromagnet 13 comprises a core 20 of magnetic material, an enclosed coil member 21 and an armature 22 of magnetic material. Enclosed coil member 21 comprises conductor windings 38 within a molded plastic housing or case 39. The construction of coil member 21 and the method by which it is made form a portion of the subject matter of an application Serial No. 716,589 filed by J. Hamilton, P. H. Schoening, and R. L. Lundberg on February 21, 1958 and assigned to the present assignee. Core 20 is a three-legged or E-shaped core, while coil member 21 has a central aperture 23 of a diameter to accommodate the central leg 24 of core 20 whereby coil member 21 surrounds the central leg 24 and nests within the recessed areas 25 between the central and outer legs of core 20 to form a magnetic field generating core and coil assembly 26. Electromagnet 13 is mounted on and supported solely by switching assembly 14. More specifically, core 20 rests on the upper surface of cover member 17 and is positioned thereon by upstanding projections 27 which fit within notches 28 in the opposite bottom ends of core 20. Coil member 21 may also be further supported by resting on peripheral flanges 30 on the upper surface of cover member 17. Central leg 24 of core 20 has a rectangular central aperture 31 for accommodating the actuator 18 of switching member 16. The coil and core assembly 26 thus surrounds this switch actuator 18.

The armature 22 of electromagnet 13 is easily detachably secured to the upper end 33 of actuator 18 by means of a resilient clip 34, best seen in Figure 6. Actuator end 33 fits within a rectangular cavity 35 in the center of armature 22 and has a small rectangular aperture 36 adjacent the actuator end 33. Aperture 36 registers with a transverse rectangular passageway 37 through the center of armature 22. Spring clip 34 is

inserted through this aperture 36 and passageway 37 to make the connection between armature 22 and switching member 16. Spring clip 34 preferably has an arcuate central portion 40 having a length L equal to the width of armature 22 and has a pair of flat end portions 41 extending beyond opposite sides of armature 22. Armature 22 overlies the outer poles 42 of magnet core 20 and the arcuate portion 40 of spring clip 34 makes a loose coupling connection between armature 22 and actuator end 33 of switching member 16 whereby armature 22 may automatically align itself with the surfaces of poles 42 during contact therewith upon energization of electromagnet 13. Spring clip 34 grasps the opposite sides of armature 22 to retain itself in position. A slight upward and lateral push on either end 41 of clip 34 suffices to cause its removal.

It will be observed that once armature 22 is fastened to end 33 of switch actuator 18, the coil and core assembly 26 as well as the cover member 17 are trapped between the armature 22 and the contact carrier portion 29 of switching member 16. The electromagnet 13, cover member 17 and switching member 16 may then be handled as an electromagnetic switching unit, shown within dashed line 44 (Figure 4), without fear of possible loss or dislocation of any of the parts thereof.

This electromagnetic switching unit 44 is firmly clamped in an easily detachable manner on base member 15. More specifically, a pair of spring loaded clamping members 45, best seen in Figures 2 and 7, extend between the base member 15 and the upper surface of the enclosed coil members 21 on opposite sides of the contactor 10. Clamping members 45 are metal strips having an inwardly bent bottom end 46 trapped within an upwardly extending channel 47 formed in the molded insulating base member 15. A compression spring 48 is trapped between bottom end 46 of clamping member 45 and the top of channel 47 and serves to spring-load the clamping member. The upper end portion 49 of clamping member 45 is also bent inwardly to overlie the enclosed coil member 21. In order to securely position clamping member 45 on coil member 21, upper portion 49 of each clamping member 45 is provided with a small aperture 50 which accommodates a small pimple 51 formed in each of a pair of metal plates 52 extending along the upper surface of the enclosing case 39 of coil member 21 at opposite ends thereof. These metal plates 52 also comprise the terminals for the conductor windings 38 of coil member 21.

Upper portion 49 of each clamping member 45 also has a laterally extending portion 49A accommodating a screw-down terminal 53 for making an electrical wire connection thereto. Downwardly bent sides or lips 54 on the upper end of clamping member 45 serves to help trap the nut 55 of screw-down terminal 53.

Clamping members 45 may each be pivoted on their spring loaded bottom ends to permit clamping engagement and disengagement with the terminal plates 52 of coil member 21. An integral arm 56 of each clamping member 45 offset from its bottom portion extends within a shallow indentation in the side of base member 15 and serves to limit the amount of permissive pivotal motion of the clamping member. Arm 56 rides against the side surface of base member 15 and aids in preventing side-wise motion of the clamping member and in trapping the clamping member against falling out of groove 47.

It will thus be seen that clamping member 45 not only securely clamps switching unit 44 on base member 15, but also serves to provide means for making easily disengageable electrical connection with the windings of coil member 21. The clamping action provided by members 45 also serves securely to hold coil member 21 on magnet core 20 and further to clamp the coil and core assembly 26 firmly on cover member 17 and to clamp this cover member 17 firmly on base member 15.

Referring now to Figures 4, 5 and 7, the switching

assembly 14 will be described in detail. Base member 15 of switching assembly 14 is a generally rectangular member of molded insulating material such as mineral filled phenolic resin having good arc suppression and arc resistant properties. Base member 15 has a flat rear mounting surface or wall 60 adapted to be mounted directly on a supporting wall or on a mounting bracket 61, best seen in Figures 1 and 2. The base member 15 also has a pair of upstanding opposite side walls 62 and 63 respectively and a plurality of upstanding partitions 64 spaced between the side walls and extending parallel thereto. These partitions and side walls divide the base member 15 into a plurality of adjacent chambers 65 generally electrically isolated from one another.

A pair of terminals 66 preferably of the screw-down type as shown are mounted on the front surface of base member 15 within opposite ends of each chamber 65 to form two rows of terminals extending along opposite outer portions of the front surface of base member 15 in a direction perpendicular to the side walls 62 and 63. As best seen in Figures 4 and 7, these terminals 66 are mounted on base member 15 by means of a block portion 67 fastened to the rear wall 60 of base member by such means as riveting or spinning thereto. Each of the terminals 66 includes a wire connecting portion 68 having a fastening screw 69 threaded therethrough and a U-shaped metal strip 70 operated by screw 69 to trap a wire within the connecting portion 68. Terminal 66 also has a lower leg extension 71 for additional support, this extension 71 containing a threaded hole 72 for enabling an additional electrical connection to be made to the terminal, if desired.

Each of the terminals 66 carries a stationary contact 73 removably fastened thereto by such means as screw 74 threaded within block portion 67 of terminal 66. Contacts 73 attached to each pair of terminals 66 in each chamber 65 extend toward each other within the central portion of each chamber to form two parallel rows of stationary contacts extending along the central portion of base member 15. Each of the stationary contacts 73 is carried by an angularly bent conductive metal mounting strip 75 whereby the contacts 73 of each pair within each chamber 65 are angularly disposed relative to one another and at equal angles to the plane of reciprocation of switching member 16.

Electrical connection between each opposed pair of stationary contacts 73 is made by a plurality of contact bridging members 76 carried by the contact carrier portion 29 of switching member 16. Movable contact carrier 29 extends across the center portion of base member 15 through aligned slots or ravines 77 in the center of each partition 64. The contact carrier is guided for reciprocation toward and away from the rear wall of base member 15 by the end walls 78 of these partitions 64 defining opposite sides of these aligned slots, 77. These end walls 78 extend perpendicular to the rear wall of base member 15 whereby the plane of reciprocation of switching member 16 is also perpendicular to this rear wall.

Contact carrier 29 has a plurality of apertures 79 spaced along its length each within one of the chambers 65, the apertures extending through the contact carrier 29 in a direction along the length of the chamber. The contact bridging members 76 extend through these apertures and are held by means of springs 80 against either the upper or lower walls 81 and 82 respectively defining these rectangular apertures 79. Each compression spring 80 is carried by a U-shaped spring holder 83 and bears against the central portion of bridging contact member 76 around a spring positioning projection 84 on the bridging member 76. The opposite ends 85 of each contact bridging member 76 are angularly disposed relative to one another at angles supplementary to those of stationary contacts 73 and contain contacting surfaces 86 for engaging these stationary contacts 73. It will be

appreciated that each contact bridging member and pair of stationary contacts within each chamber 65 comprise a single pole of the switch.

When in the normally open position illustrated in Figures 4 and 7, spring holder 83 is positioned within the upper end of rectangular aperture 79 with its legs 87 resting on shoulder 88 on the upper wall 89 of contact carrier 29 of switching member 16. Contact bridging members are positioned on the lower wall 82 of the contact carrier portion 29 under spring 80 by means of ridges 90 at the corners of bridging member 76 between its central portion and its angularly bent end portions 85. The stationary contacts 73 are mounted to extend angularly toward the rear wall 60 of base member 15 relative to their mounting surfaces. The contacting ends 85 of the contact bridging members 76, however, extend angularly away from the rear wall 60 of base member relative to its central mounting portion.

When in the normally closed position illustrated in Figure 5, the spring holder 83 extends through the lower portion of rectangular aperture 79 with its opposite legs resting along the rear wall 60 of base member 15. The stationary contacts 73 are mounted on their respective terminals 66 with their contact surfaces angularly directed away from the rear wall 60 while the contacting end of the bridging members are angularly disposed toward this rear wall 60 with the central portion of each bridging member biased away from this rear wall by spring 80. Since neither the spring holder 83, spring 80 or contact bridging member 74 is fastened down to the contact carrier 29, it will be appreciated that it is a simple matter to reverse the positions of these components so as to change them from a normally open to a normally closed contact arrangement. It will also be appreciated that it is a simple matter to remove any contact bridging member from beneath spring 80 in order to replace or repair the contact bridging member or its contacts. This unattached mounting arrangement for the contact bridging member 76 is possible by virtue of the angular disposition of the contacting surfaces whereby the contacts themselves prevent lateral shift of the contact bridging member during operation. It will be appreciated that because of this unrestricted mounting arrangement, the contact bridging member may align itself automatically to make proper contact with the stationary contacts despite minor variations in horizontal or vertical location of the stationary contacts or even in their angular disposition. The angular disposition of the contacting surfaces also provides a slight desirable wiping or cleaning action of the contacting surfaces as they engage due to a slight resilience in the mounting strip 75, 76 for the stationary and movable contacts.

Means are provided for biasing the switching member 16 away from the rear wall 60 of base member 15 regardless of the direction of mounting of the switching assembly 14. Preferably, this biasing means comprises a compression spring 92 located within an aperture 93 in the actuator stem portion 18 of switching member 16. Spring 92 has an outer diameter greater than the width of actuator stem portion 18 whereby it extends beyond the opposite side walls of this actuator portion. The lower end of spring 92 thus rests on the top surfaces of opposing guiding end walls of the central partition 64A which end walls define one of the central slots 77 and also help guide the reciprocating movement of the switching member. Any depression of the switching member toward the rear wall 60 of the base member thus causes a compression of spring 92 thereby to return the switching member to its elevated position upon the removal of the depressing force. When the contactor is assembled, spring 92 is further positioned and trapped against removal by cover member 17 and by the core and coil assembly surrounding the actuator stem portion 18.

Cover member 17 is also preferably composed of molded insulating material similar to base member 15. A

plurality of channels 95 are formed in the under surface of cover member 17 to accommodate the upper central portions of the partitions 64 of base member thereby to securely position cover member 17 on base member 15 and to substantially totally enclose the central portion of the switching assembly. More specifically, cover member 17 encloses the stationary contacts 73 and the contact carrier 29 with its contact bridging members 76; and together with the partitions 64 provide separate arc suppressing chambers or chutes for each pole of the switching assembly. Cover member 17 also traps terminals 66 against removal from base member 15. This construction permits greater life, reliability, and current carrying capacity for the switch. Where the benefit of additional arc suppression provided by the cover member is not desired, it will be appreciated that cover member 17 may be omitted and the electromagnet 13 mounted directly on the base member 15 by other suitable means.

In order to facilitate the mounting and actuation of auxiliary devices such as overload relay 11 and switch 12, the side walls 62, 63 of base member 15 are also provided with slots 77A extending downwardly from the top and aligned with slots 77 in partitions 64. Contact carrier 29 is provided with projections 97 at its opposite end which extend through and slide within these slots 77A. The side walls 62, 63 are also provided with mounting channels 98 extending into these side walls from the outer surface thereof on either side of slot 77A and cut angularly into the walls in a direction along the length thereof. An auxiliary mounting bracket 100 having returned bent tangs 101 on either side of a central aperture 102 may be mounted on the side walls 62 or 63 by sliding the tangs 101 into channels 98. An insulating fibre plate 103 may be inserted between mounting bracket 100 and the side wall 62 of base member 15. The mounting bracket 100 is then trapped in place against removal by cover member 17 which overlies the top of channels 98. The projection 97 on each end of contact carrier 29 is accessible through the aperture 102 and mounting bracket 100 and is thus available for actuating the switching arm 105 of auxiliary switch 12. Both the auxiliary switch 12 and overload relay 11 may be mounted on auxiliary mounting bracket 100 in any suitable manner.

It will thus be seen that I have provided a magnetic contactor meeting the objectives of smaller size, lighter weight, lower cost, longer life and greater reliability. The switching unit may be easily removed for inspection of contacts without disconnecting any of the electrical connections to the terminals of the contactor. Each of the major components of the contactor may be quickly and easily disassembled for replacement or repair. Since the contacts are substantially totally enclosed during the operation, there is greater safety to operating personnel and dust-free contact operation. All of the terminals of the device are easily accessible from the front of a panel in which the device is mounted. Auxiliary electrical devices may be quickly and easily mounted on the sides of the contactor and the contactor may be quickly and easily adjusted for either normally opened or normally closed contact arrangement.

Although I have described a particular embodiment of the invention, many modifications may be made and it is to be understood that I intend by the appended claims to cover all such modifications that fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A readily demountable magnetic contactor comprising: a switch housing open at one side; a switching member mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing; a switch cover nested on the open side of said housing for enclosing said stationary contacts and said switching member; a magnetic core supported on said cover; a coil supported on said core;

said switching member having a switch actuator extending through and beyond said cover, core and coil; clamping means for releasably drawing said switch housing and said coil together thereby to hold said core and cover in position therebetween; said coil, core and cover being removable over the end of said switch actuator when said clamping means are released; and a magnetic armature detachably secured on the end of said actuator and overlying said core and coil.

2. A readily demountable magnetic contactor comprising: a switch housing open at one side; a switching member mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing; a switch housing cover nested on the open side of said housing for enclosing said stationary contacts and said switching member; a magnetic core supported on said cover; a coil supported on said core having an exposed pair of terminal members; said switching member having a switch actuator extending through and beyond said cover, core, and coil; a pair of clamping members each having one end engaging said switch housing and having on its other end a terminal connector engaging and making contact with one of said terminal members, said clamping members releasably drawing said switch housing and said coil together thereby to hold said core and cover in position therebetween; said coil, core, and cover being removable over the end of said switch actuator when said clamping members are released; and a magnetic armature detachably secured on the end of said actuator and overlying said core and coil.

3. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing enclosing said switch assembly; a magnetic core carried on said switch housing; a coil member carried on said core; clamping means extending between said coil member and switch housing for releasably clamping said coil member, said core and said switch housing together; an actuator for said switch assembly extending through said housing, said core and said coil member; and a magnetic armature overlying said core attached to the end of said actuator.

4. A readily demountable magnetic contactor comprising: a switch assembly; a housing for said switch assembly having a base member and a cover member; an actuator for said switch assembly extending through said cover member; an electromagnetic field generating assembly supported upon said cover member and surrounding said actuator; a magnetic armature overlying said field generating assembly and attached to the end of said actuator; and a clamping member having one end engaging said base member and the other end engaging said field generating assembly for releasably clamping said assemblies together.

5. A readily demountable magnetic contactor comprising: a switch assembly; a housing for said switch assembly having a base member and a cover member; a magnetic core supported upon said cover member; a coil on said core; an actuator for said switch assembly extending through said cover member, said coil and said core; a magnetic armature overlying said core and attached to the end of said actuator; and means for releasably clamping said base member and coil together thereby to hold said core and said cover member in position therebetween.

6. A readily demountable magnetic contactor comprising: a switch assembly; a housing for said switch assembly having a base member and a cover member; a magnetic core supported upon said cover member; a coil on said core; an actuator for said switch assembly extending through said cover member, said coil, and said core; a magnetic armature overlying said core and attached to the end of said actuator; and means for releasably clamping said base member and coil together thereby to hold said core and said cover member in position therebetween comprising a spring loaded clamping

member having one end engaging said base member and the other end engaging said coil.

7. A readily demountable magnetic contactor comprising a switch assembly; a housing for said switch assembly having a base member and a cover member; a magnetic core supported upon said cover member; a coil supported on said core having an exposed pair of terminal members; an actuator for said switch assembly extending through said cover member, said coil, and said core; a magnetic armature overlying said core and attached to the end of said actuator; and means for making electrical contact with said terminal members and for releasably clamping said base member and coil together thereby to hold said core and said cover member in position therebetween including a pair of spring loaded electrically conducting clamping members each having one end engaging said base member and the other end engaging said coil terminals.

8. A readily demountable magnetic contactor comprising: a switch assembly; an electromagnet mounted on said switch assembly and having a coil with at least one exposed terminal; and a spring loaded clamping member overlying and engaging portions of said coil and switch assembly respectively for releasably clamping said coil on said switch assembly, said clamping member having an electrically conductive portion contacting said coil terminal and carrying a wire connecting terminal.

9. A readily demountable magnetic contactor comprising: a switch assembly having an elongated actuator with a lateral aperture through one end thereof; an electromagnet having poles on either side of said actuator; an armature attached to said end of said actuator and overlying said poles, said armature having a cavity accommodating said actuator end and having side apertures communicating with said cavity in register with the aperture in said actuator end; and a spring clip inserted within said armature and actuator apertures to form an easily detachable connection between said armature and actuator.

10. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing open at one side enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a switch housing cover nested upon the open side of said housing, a stationary magnetic core structure resting upon said cover, and a winding supported on said core structure; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure and said cover in position therebetween; said switch actuator having an elongated switch operating projection extending respectively through apertures in said switch housing cover, said core structure, and said winding; and a magnetic armature detachably secured on the said end of said actuator overlying said stationary core structure.

11. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing open at one side enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a switch housing cover nested upon the open side of said housing, a stationary magnetic core structure resting upon said cover, and a winding supported on said core structure and having thereon a pair of terminal members; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure and said cover in position therebetween, said clamping members having terminal connectors thereon overlying and making electrical contact with said terminal members; said switch actuator having an

elongated switch operating projection extending respectively through apertures in said switch housing cover, said core structure, and said winding; and a magnetic armature detachably secured on the said end of said actuator overlying said stationary core structure.

12. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing open at one side enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a switch housing cover nested upon the open side of said housing, a stationary magnetic core structure resting upon said cover, and a winding supported on said core structure; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure and said cover in position therebetween; said switch actuator having an elongated switch operating projection extending respectively through apertures in said switch housing cover, said core structure, and said winding, the outer end of said switch operating projection having a lateral opening therethrough; a magnetic armature on the said end of said actuator overlying said stationary core structure having a cavity accommodating the end of said switch operating projection and having lateral apertures therein in register with the lateral opening in said switch actuator; and a spring clip inserted within said armature apertures and said opening to form an easily detachable connection between said armature and actuator.

13. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a stationary magnetic core structure resting upon said housing, and a winding supported on said core structure and having thereon a pair of terminal members; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure in position therebetween, said clamping members having terminal connectors thereon overlying and making electrical contact with said terminal members; said switch actuator having an elongated switch operating projection extending respectively through apertures in said switch housing, said core structure, and said winding, the outer end of said switch operating projection having a lateral opening therethrough; a magnetic armature on the said end of said actuator overlying said stationary core structure having a cavity accommodating the end of said switch operating projection and having lateral apertures therein in register with the lateral opening in said switch actuator; and a spring clip inserted within said armature apertures and said actuator opening to form an easily detachable connection between said armature and actuator.

14. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a stationary magnetic core structure resting upon said housing, and a winding supported on said core structure; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure in position therebetween; said switch actuator having an elongated switch operating projection extending respectively through apertures in said switch housing, said core structure, and said winding, the outer end of said switch operating projection having a lateral opening

therethrough; a magnetic armature on the said end of said actuator overlying said stationary core structure having a cavity accommodating the end of said switch operating projection and having lateral apertures therein in register with the lateral opening in said switch actuator; and a spring clip inserted within said armature apertures and said opening to form an easily detachable connection between said armature and actuator.

15. A readily demountable magnetic contactor comprising: a switch assembly; a switch housing open at one side enclosing said switch assembly; a switch actuating assembly including, in sequentially stacked relationship, a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, a switch housing cover nested upon the open side of said housing, a stationary magnetic core structure resting upon said cover, and a winding supported on said core structure and having a pair of terminal members thereon; a pair of elongated spring biased clamping members drawing said winding and switch housing together thereby to hold said core structure and said cover in position therebetween, said clamping members having terminal connectors thereon overlying and making electrical contact with said terminal members; said switch actuator having an elongated switch operating projection extending respectively through apertures in said switch housing cover, said core structure, and said winding, the outer end of said switch operating projection having a lateral opening therethrough; a magnetic armature on the said end of said actuator overlying said stationary core structure, said armature having a cavity accommodating the end of said switch operating projection and lateral apertures therein in register with the lateral opening in said switch actuator; and a spring clip inserted within said armature apertures and said actuator opening to form an easily detachable connection between said armature and actuator.

16. A switching assembly comprising: a switch mechanism; a switch housing enclosing said switch mechanism and having a base portion and side walls upstanding therefrom, said switch housing being open on another side adjacent said side walls; means for detachably mounting accessory devices against a side of said housing including a mounting member having surfaces interlocking with one of said side walls and being detachable therefrom by a sliding motion in the direction of said open side; and a cover member enclosing the open side of said housing and overlying a portion of said mounting member to prevent its withdrawal except upon removal of said cover member.

17. A switching assembly comprising: a switch mechanism; a switch housing open at one side enclosing said switch mechanism; said switch housing having on another side adjacent said open side a groove having one end opening on the open side of said housing for mounting accessory devices against said housing; mounting means for said accessory devices including a member having mating surfaces confined within said groove and slidably removable from said groove through said one end; and a cover plate enclosing the open side of said housing and covering the end of said groove to trap said mating surfaces within said groove against removal.

18. A contactor comprising: a switching assembly; a switch housing enclosing said switching assembly having a base portion and side walls, said switch housing being open on another side adjacent said side walls, said housing having also an aperture formed in one of said side walls opening from the interior of said housing; a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, said actuator having an end portion extending through said slot for actuating an accessory switch mounted against the side of said housing; means for mounting an accessory switch against a side of said housing including a mounting member having surfaces interlocking with one of said side walls and being

detachable therefrom by a sliding motion in the direction of said open side; an accessory switch attached to said mounting member and having a switch operating member extending within the path of movement of the end portion of said switch actuator for operation thereby; and a cover member enclosing the open side of said housing and overlying a portion of said mounting member to retain in assembled condition both said actuator and said mounting member, whereby upon removal of said cover member both said switch actuator and said mounting member may be withdrawn from said housing.

19. A contactor comprising: a switching assembly; a switch housing open at one side enclosing said switching assembly, said switch housing having on at least one side adjacent said open side a groove having one end opening on the open side of said housing for mounting accessory devices against said housing, said housing having also an aperture formed in said one side opening from the interior of said housing into said groove; a switch actuator mounted within said housing for reciprocating switch actuating movement and for withdrawal through the open side of said housing, said actuator having an end portion extending through said aperture for actuating an accessory switch mounted against the side of said housing; mounting means for accessory devices including a member having mating surfaces confined within said groove and slidably removable from said groove through said one end; an accessory switch attached to said mounting member and having a switch operating member extending within the path of movement of the end portion of said switch actuator for operation thereby; a switch housing cover covering the open side of said housing and the end of said groove to trap said switch actuator and said mounting member against removal from said housing, whereby upon removal of said cover both said switch actuator and said mounting member may be withdrawn from said housing.

20. A switching assembly comprising: a base member having a plurality of stationary contacts thereon; a switching member having a carrier portion carrying contacts for engaging said stationary contacts; a partition on either side of said carrier portion to guide said switching member for reciprocation toward and away from said stationary contacts; said switching member having an elongated aperture therein; a helical spring held captive within said elongated aperture and having a greater diameter than an adjacent lateral dimension of said switching member, one end of said spring engaging at least one of said partitions to bias said switching member in a direction away from said partition.

21. A switching assembly comprising: a base having a plurality of stationary contacts thereon, a switching member having a carrier portion carrying contacts for engaging said stationary contacts; and partitions on either side of said carrier portion to guide said switching member for reciprocation toward and away from said stationary contacts, said partitions forming with said base a plurality of arc chambers enclosing said stationary contacts, said switching member having a spring held captive therein and compressible in the direction of reciprocation, said partitions interfitting within reduced sections of said switching member adjacent said spring to form a stop or seat for the captive spring thereby providing a spring bias for said switching member.

22. A switching assembly comprising: an insulating base member having a plurality of parallel spaced partitions upstanding from a front surface thereof to form a plurality of side-by-side arc chambers, said partitions having aligned slots along a central portion thereof to form a passageway connecting said arc chambers; a switching member extending across said arc chambers within said passageway, said partitions interfitting within reduced cross-sectional areas of said switching member to guide said switching member for reciprocating movement within said slots; said switching member containing a

captive spring disposed within one of said areas of reduced cross section and extending beyond the sides thereof to seat upon one of said partitions thereby to provide a spring bias for said switching member; stationary contacts mounted on said base member in each arc chamber; and contact surfaces on said switching member for engaging said stationary contacts upon reciprocation of said switching member.

23. A switching assembly comprising: an insulating base member having a plurality of parallel spaced partitions upstanding from a front surface thereof to form a plurality of side-by-side arc chambers, said partitions having aligned slots along a central portion thereof to form a passageway connecting said arc chambers; a switching member extending across said arc chambers within said passageway, said switching member being guided for reciprocating movement within said slots by the edges of said partitions; stationary contacts mounted on said base member in each arc chamber; and contact members on said switching member for engaging said stationary contacts upon reciprocation of said switching member.

24. A switching assembly of minimum depth convertible from normally open to normally closed operation comprising: a base member; a contact carrier mounted for reciprocation toward and away from a front surface of said base member; a pair of stationary contacts mounted on said base member on either side of said contact carrier, each of said stationary contacts comprising a mounting portion detachably and reversibly mounted adjacent the front surface of said base member and each of said stationary contacts further comprising a contact surface offset from said mounting portion such that the direction of offset of said contact surfaces is reversed when said mounting portion is reversed; a bridging member carried by and extending beyond either side of said carrier member and having at each end a contact surface offset therefrom by an amount equal to the offset of said stationary contact surfaces; and a spring biasing said bridging member in one direction on said carrier member, said spring and bridging member being reversible end-for-end to reverse the direction of said bias and of the offset of said contact surfaces on said bridging member, whereby a minimum depth of said switching assembly is required to accommodate the convertibility of said switching assembly from normally open to normally closed operation.

25. A switching assembly of minimum depth convertible from normally open to normally closed operation comprising: a base member; a contact carrier mounted for reciprocation toward and away from a front surface of said base member; a pair of stationary contacts mounted on said base member on opposite sides of said contact carrier, each of said stationary contacts comprising a mounting portion detachably and reversibly mounted adjacent the front surface of said base member and each of said stationary contacts further comprising a contact surface angularly offset from said mounting portion, the reversal of said mounting portion being effective to change not only the angle of said contact surfaces with respect to said base member but also their distance from the front surface of said base member; a bridging member carried by said carrier member and having at each end a contact surface angularly offset therefrom at angles supplementary to the angles of said stationary contact surfaces; and a spring biasing said bridging member in one direction on said carrier member, said spring and said bridging member being reversible end-for-end on said carrier member to reverse the direction of said bias and the angle of the contact surfaces on said bridging member.

26. A switching assembly of minimum depth convertible from normally open to normally closed operation comprising: a base member and a contact carrier mounted for reciprocation toward and away from a front surface

of said base member; a pair of stationary contacts mounted on said base member on either side of said contact carrier, each of said stationary contacts comprising a generally planar mounting portion detachably and reversibly mounted parallel to said front surface of said base member and each of said stationary contacts further comprising a contact surface angularly offset from said mounting portion; said contact carrier having a transverse aperture therein; a bridging member extending through said aperture beyond either side of said carrier member and having at each end a contact surface angularly offset therefrom at angles supplementary to the angles of said stationary contact surfaces; and a spring within said aperture biasing said bridging member against one side of said aperture and holding said bridging member on said carrier member, said spring and bridging members being reversible end-for-end within said aperture, whereby reversal of said stationary contacts and said bridging member varies not only the angular relationships but also the distance from said front surface of all of said contact surfaces.

27. A magnetic contactor comprising: a switch housing having an insulating base member and side walls; an insulating carrier member mounted for reciprocating movement in a plane toward and away from a front surface of said base member; a pair of stationary contacts mounted on the front surface of said base member on either side of said plane of reciprocation; a bridging member carried by said carrier member and having contact portions cooperating with said stationary contacts; an electromagnet assembly carried upon said switch housing in a position overlying said stationary contacts; and terminal members mounted on said base member extending from said stationary contacts in opposite directions away from said plane of reciprocation to positions beyond the dimensions of said electromagnet assembly for accessibility on opposite sides of said electromagnet assembly.

28. A magnetic contactor comprising: a switch housing having an insulating base member and side walls; a switch actuating member mounted for reciprocating movement toward and away from a front surface of said base member, said switch actuating member having a carrier portion elongated in a direction transverse to the direction of reciprocating movement, the direction of elongation of said carrier member and the direction of said reciprocating movement defining a plane of reciprocation; a plurality of pairs of stationary contacts mounted on the front surface of said base member on opposite sides of said plane of reciprocation; a plurality of bridging members carried by said carrier member and having contact portions extending on opposite sides of said plane of reciprocation to engage said stationary contacts; an electromagnet assembly for operating said actuating member carried upon said switch housing in a position overlying said stationary contacts; and a plurality of pairs of terminal members mounted on said base member and extending from said stationary contacts in opposite directions away from said plane of reciprocation to positions beyond the dimensions of said electromagnet assembly for accessibility on opposite sides of said electromagnet assembly.

References Cited in the file of this patent

UNITED STATES PATENTS

648,432	Prentiss	May 1, 1900
1,833,948	Lansing	Dec. 1, 1931
2,064,632	Schmitt	Dec. 15, 1936
2,087,895	Bierenfeld	July 27, 1937
2,273,545	Van Valkenburg	Feb. 17, 1942
2,448,650	Aitken	Sept. 7, 1948
2,539,547	Mossman et al.	Jan. 30, 1951
2,616,998	Sala	Nov. 4, 1952
2,750,477	Brown et al.	June 12, 1956