

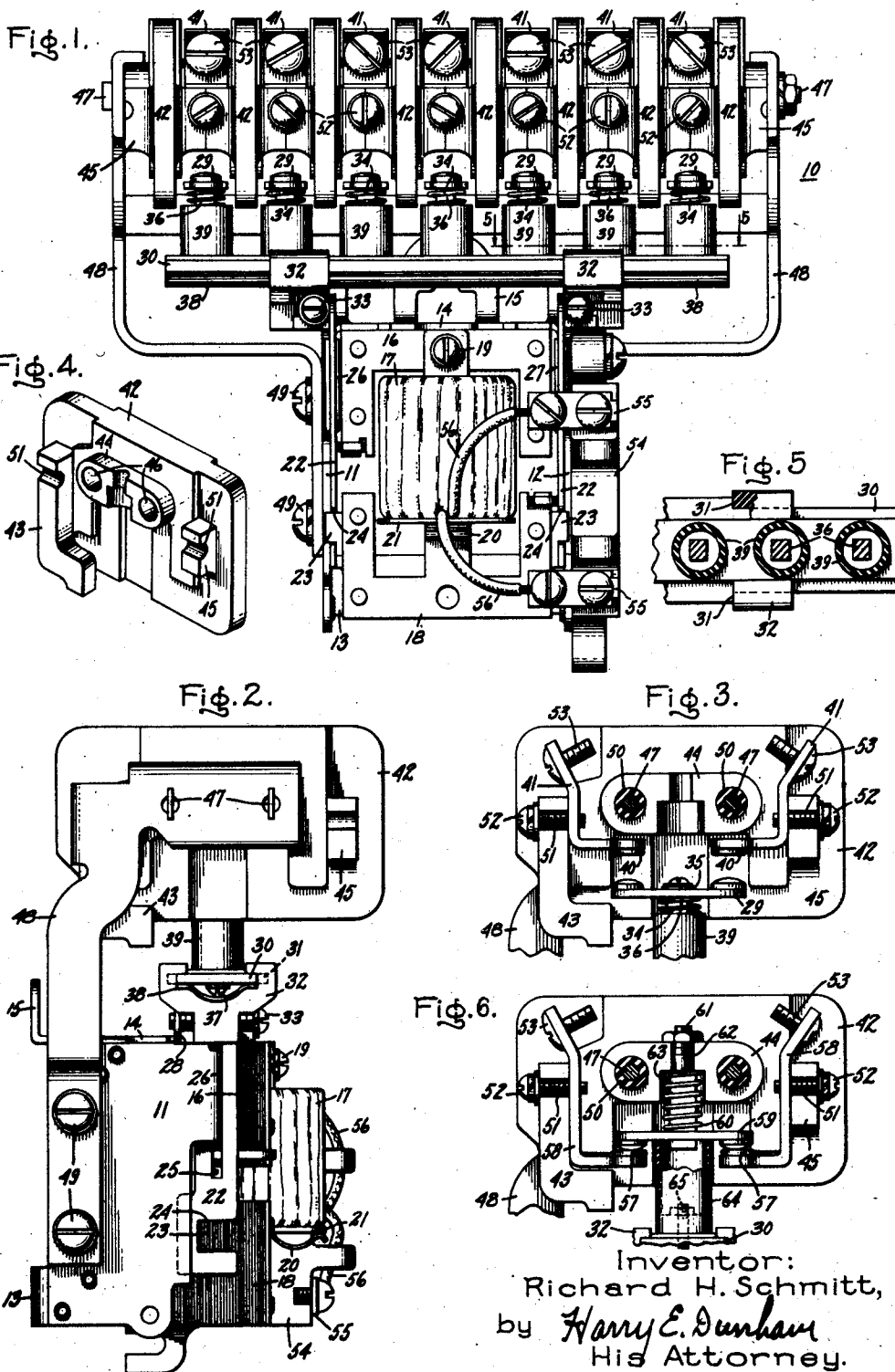
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ELECTROMAGNETIC SWITCH

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ELECTROMAGNETIC SWITCH

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My invention relates to electromagnetic devices, more particularly to electromagnetically operated, multiple pole switches or contactors, and has for an object the provision of a simple, reliable, and inexpensive device of this character.

Heretofore, various types of multiple pole electromagnetic switches have been provided, all of which are to a large extent satisfactory for the purposes intended. Much is yet to be desired, however, in switches of this type, which are of small size, which are inexpensive to construct and which are reliable and economical in their operation. Furthermore, it is desirable that switches of this type be highly flexible in their application, being readily convertible from normally open to normally closed devices and being readily convertible to provide a different number of poles. Accordingly, it is a further object of my invention to provide an electromagnetically operated, multiple pole switch which is simple and inexpensive to construct and which has a high degree of reliability in its operation, together with a high degree of flexibility in its application.

In carrying out my invention in one form, I provide an electromagnetic switch comprising an operating bar mounted for reciprocal movement transversely of its axis to operate between open and closed circuit positions, a plurality of pairs of relatively movable switch members which are disposed along the bar. A plurality of symmetrical insulating barriers are arranged to form individual arcing chambers for each pair of switch members, and electromagnetic means are provided for moving the operating bar transversely to operate the switch members.

More specifically, the electromagnetic operating means comprises a stationary magnetic member mounted on a frame between a pair of spaced-apart plates and a pair of elongate members or push rods, one of which is arranged adjacent each plate. Means are provided for supporting and guiding each of the push rods for longitudinal movement along the plates, and a movable magnetic member is supported on the adjacent ends of the push rods in co-operating relation with the stationary magnetic member. The opposite end of each of the push rods is secured to one of two grooved blocks which are respectively slidable over the ends of the operating bar, the two grooved blocks serving to support the bar intermediate its ends. Each of the symmetrical insulating barriers is provided with similar projecting portions on its

opposite faces, and a pair of arms extending from the frame of the switch are provided for supporting the barriers adjacent the operating bar in face-to-face relation with each other, so that the projecting portions on each barrier engage similar projecting portions on the next adjacent barriers to form arcing chambers therebetween. The relatively movable pairs of switch members are disposed within these arcing chambers for operation by the operating bar.

For a more complete understanding of my invention, reference should now be had to the drawing, in which Fig. 1 is an elevational view of an electromagnetic switch embodying my invention; Fig. 2 is an end view of the switch shown in Fig. 1; Fig. 3 is a fragmentary sectional view taken through the center of one of the arcing chambers, the contact structure being shown in elevation; Fig. 4 is a perspective view of one of the symmetrical insulating barriers embodying my invention; Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 1; and Fig. 6 is a sectional view similar to Fig. 3, illustrating a modified form of my invention.

Referring now to Figs. 1 to 5, inclusive, of the drawing, in carrying out my invention in one form, I provide an electromagnetic switch comprising a frame having a pair of spaced-apart plates 11 and 12 connected adjacent their ends by a pair of cross members 13 and 14. As shown, the cross member 13 is bowed out slightly from the plates 11 and 12, and the cross member 14 is provided with an extending ear 15. As will be apparent from the description which follows, the entire electromagnetic switch is supported by the frame comprising the plates 11 and 12, and accordingly, no subbase is necessary, the cross member 13 and the ear 15 serving to support the electromagnetic switch directly upon a panelboard or the frame of a machine.

Mounted between the plates 10 and 11, I provide an operating electromagnet comprising an E-shaped stationary magnetic member 16, an energizing winding 17, and a movable E-shaped magnetic member 18. The stationary magnetic member 16 is mounted on the frame by a single screw 19 which is arranged to threadedly engage an ear (not shown) which extends outwardly from the cross member 14. This screw 19 also serves to secure to the stationary magnetic member 16 a pair of spring arms 20, only one of which is shown, which spring arms resiliently support the energizing winding 17 on the middle leg of the E-shaped magnetic member 16. As shown best in Fig. 2, the ends of the spring

arms 20 opposite from the screw 19 are bent outwardly and engage an insulating disk 21 which supports the energizing winding 17.

As shown, the movable magnetic member 18 is supported in co-operating relation with the stationary magnetic member 16 and the energizing winding 17 by a pair of elongate members or push rods 22, one of which is arranged adjacent each of the plates 11 and 12. Both the stationary magnetic member 16 and the movable magnetic member 18 are of laminated construction for alternating-current operation, and a plurality of the laminations of the movable magnetic member 18 extend outwardly from opposite sides thereof to form supporting ears 23 arranged to engage co-operating notches 24 formed in the push rods 22. Each of the push rods 22 is provided with an elongate slot 25, the slot 25 in one of the push rods co-operating with a finger 26 extending from the plate 11, and the slot 25 in the other push rod co-operating with a finger 27 extending from the plate 12. The slots 25 and the fingers 26 and 27 co-operate to guide the push rods 22 for longitudinal movement along the plates 11 and 12, and as shown best in Fig. 2, the upper end of each of the push rods 22 is provided with an extending ear 28. It will be understood of course that the movable magnetic member 18 and the push rods 22 are biased by gravity to the lowermost position shown in the drawing, the extending ears 28 on the push rods 22 engaging the upper edges of the plates 11 and 12, as shown best in Fig. 2, to provide stops.

The push rods 22 support the movable contact structure of the switch, which contact structure comprises a plurality of movable contacts 29 resiliently supported, as shown best in Fig. 1, on an operating bar 30. This operating bar 30 is provided at its opposite ends with portions of reduced width so as to form shoulders 31 thereon, and a pair of grooved insulating blocks 32 which are slidable over the reduced ends of the bar 30 into engagement with the shoulders 31 serve to support the bar intermediate its ends. As shown best in Fig. 2, these grooved blocks 32 are secured to the ears 28 on the push rods 22 by means of suitable screws 33. It will thus be seen that when the push rods 22 are moved longitudinally along the plates 11 and 12 upon energization of the winding 17, the operating bar 30 and the movable contacts 29 carried thereby will be moved upwardly.

As shown best in Figs. 1 and 3, each of the movable contacts 29 is resiliently supported by a spring 34 which normally biases the contact 29 into engagement with a washer 35 on the end of a guide post 36 which slidably extends through an aperture, not shown, in the contact member 29. The lower end of the springs 34 bear against the operating bar 30, and the posts 36 are secured to the bar 30 by means of screws 37 (Fig. 2) which extend through the bar. As shown in Fig. 2, the screws 37 are insulated from other metallic parts of the electromagnetic switch by means of a strip of insulating material 38 which extends along the lower side of the bar 30 and is held in place by the grooved blocks 32. Suitable cylindrical guides 39, formed of insulating material, are provided for each of the springs 34.

Arranged adjacent the movable contact members 29, I provide a plurality of pairs of spaced-apart fixed contacts 40 which are carried by suitable conductor bars 41, the conductor bars

41 being supported on symmetrical insulating barriers 42. These symmetrical insulating barriers 42 are preferably formed of molded insulation material and, as shown in Fig. 4, the opposite faces of each barrier are provided with a plurality of projecting portions 43, 44, and 45 and with a pair of apertures 46, which apertures extend through the barrier between its opposite faces.

As shown, a plurality of these insulating barriers 42 are supported in face-to-face relation with each other adjacent the movable contacts 29 by means of a pair of supporting rods 47, which extend through the apertures 46. The opposite ends of these rods 47 are supported by a pair of arms 48 extending upwardly from the spaced plates 11 and 12, the lower ends of the arms 48 being secured to the plates 11 and 12 by suitable screws 49. As shown in Fig. 3, the rods 47 are surrounded by tubular insulating members 50 so as to prevent arcing between the adjacent poles of the switch.

It will be apparent that when the insulating barriers 42 are assembled in face-to-face relation, the projecting portions 43, 44, and 45 on each barrier will engage similar projecting portions on the next adjacent barriers so as to form partially enclosing arcing chambers therebetween within each of which a pair of the relatively movable contacts 29 and 40 is adapted to engage and disengage each other, the contacts 29 being movable through an open side of the arcing chamber. Thus, any arc drawn between the contacts 29 and 40 will be confined by the arcing chamber so as to prevent flashover between the adjacent poles of the switch.

Although the stationary contacts 40 may be mounted in any suitable manner within the arcing chambers formed by the insulating barriers 42, I prefer to provide the projections 43 and 45 on the insulating barriers 42 with semicircular grooves 51, and to provide suitable fastening means, such as the screws 52, which extend through the apertures that are formed by the grooves 51 when the barriers 42 are assembled in face-to-face relation. As shown best in Fig. 3, these screws 52 engage the conductor bars 41 on which the stationary contacts 40 are mounted, and the opposite ends of the conductor bars 41 which extend outwardly from the arcing chamber formed by the projections 43, 44, and 45 are provided with suitable terminal screws 53.

As shown, the projections 43, 44, and 45 are spaced inwardly from the outer edges of the barriers 42, and accordingly, when the barriers 42 are assembled in face-to-face relation, a plurality of parallel grooves are formed within which the outer ends of the conductor bars 41 and the terminal screws 53 are entirely disposed. That is, the terminal screws 53 and the conductor bars 41 do not extend outwardly beyond the edges of the barriers 42, and accordingly, the barriers protect these members from damage due to accidental blows. Likewise, a uniform outline and a pleasing appearance of the electromagnetic switch 10 are obtained.

In order that the energizing winding 17 may be conveniently connected in a control circuit, I provide a terminal block 54 formed of insulating material, which block is secured to the plate 12 and carries a pair of terminal plates 55 to which the lead wires 56 of the coil 17 are connected. The terminals 53 extend upwardly from the arcing chambers formed by the insulating barriers 42 and are readily accessible for connection in

any suitable circuit or circuits to be controlled. It will be apparent now, that when the winding 17 is energized, the movable magnetic element 18 will be attracted toward the stationary magnetic element 16, thereby operating the push rods 22 and the operating bar 30 to move the contacts from the open circuit position shown in Figs. 1, 2, and 3 to a closed circuit position in which the contacts 29 engage the contacts 40.

Disassembly of my improved switch for purposes of inspection may be accomplished simply by removing the screw 19, whereupon the magnetic elements 16 and 18 and the energizing winding 17 may be removed as a unit, the leads 56 having been disconnected, without disturbing the remaining parts of the switch. The push rods 22 may thereafter be pressed inwardly until the slots 25 are free of the fingers 26 and 37, whereupon the push rods 22, the blocks 32 and the bar 30 with the movable contacts 29 thereon may be removed as a unit from the frame. Inspection of the stationary contacts 40 may be made through the open lower side of the arcing chambers, and disassembly of the arcing chambers for replacement of the contacts or the insulating barriers may be accomplished simply by withdrawing the rods 47.

It will be apparent now that switches embodying my invention are simple in construction and may be readily assembled and disassembled. Likewise, it will be seen that the switch 10 may be converted into a switch having a greater or a less number of poles by providing suitably shaped supporting arms 48 for supporting any desired number of insulating barriers and by providing an operating bar 30 having the desired number of movable contacts thereon.

The switch shown in Figs. 1 to 5, inclusive, is of the normally open type. It is sometimes desirable to utilize a normally closed switch or a multiple pole switch having certain poles normally closed and certain other poles normally open, and accordingly, I have shown in Fig. 6 a normally closed switch embodying my invention.

Referring to Fig. 6, suitable stationary contacts 57 are mounted on conductor bars 58 within the arcing chamber formed by the barriers 42. These conductor bars 58 are similar to, but somewhat longer than, the conductor bars 41 shown in Fig. 2. In this type of switch, the contacts 57 are secured to the upper side of the conductor bars 58, as viewed in the drawing, and a movable contact member 59 is normally biased into engagement with the contacts 57 by a spring 60 which surrounds a guide post 61, one end of which slidably extends through the contact member 59. As shown, the other end of the post 61 is supported by the projecting portion 44 on the barrier 42, each of the barriers being provided with a semicircular groove 62 which is similar to the grooves 51 in the projecting portions 43 and 45. The semicircular groove 62 is provided with an enlarged portion 63, which portion co-operates with a similar portion in the next adjacent barrier to form a seat for the spring 60 when the barriers are assembled in face-to-face relation.

In order to operate the movable contact 59 to the open circuit position against its bias, the operating bar 30 in this form of my invention is provided with a cylindrical operating finger 64 which is secured to the bar 30 by a suitable screw 65. It will be apparent now that when the operating winding 17 is energized, the bar 30 will

be operated as described in connection with Figs. 1 to 5, and the contact 59 will be moved against its bias to open the circuit between the fixed contacts 57.

Switches embodying my invention may thus be provided with a plurality of normally open contacts, with a plurality of normally closed contacts, or with a combination of normally open and normally closed contacts. Accordingly, it will be apparent that switches embodying my invention are very flexible in their operation.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. An electromagnetic device comprising a frame having a pair of spaced apart plates, a pair of elongate movable members each of which is arranged adjacent one of said plates, guide means associated with each plate and each movable member for supporting and guiding said members for longitudinal movement relative to said plates, means for moving said members longitudinally of said plates including a stationary magnetic element mounted on said frame between said plates and a movable magnetic element supported on adjacent ends of said elongate members in cooperating relation with said stationary element, and control means supported on the adjacent ends of said elongate members opposite from said movable magnetic element.

2. An electromagnetic device comprising a frame having a pair of spaced apart plates, a pair of elongate movable members each of which is arranged adjacent one of said plates, guide means associated with each plate and each movable member for supporting and guiding said members for reciprocal vertical movement along said plates, means for reciprocating said elongate members including a stationary magnetic member supported on said frame between said plates and a movable magnetic member supported below said stationary magnetic member on the lower adjacent ends of said elongate members, and control means supported on the upper ends of said elongate members above said stationary magnetic member.

3. An electromagnetic device comprising a frame having a pair of spaced apart plates, a pair of elongate members each of which is arranged adjacent one of said plates and provided with a notch adjacent one end, guide means associated with each plate and the adjacent movable member for supporting and guiding said members for movement along said plates, means for moving said members along said plates including a stationary magnetic member mounted on said frame between said plates and a movable magnetic member provided with ears extending from opposite sides thereof for engaging said notches to support said movable magnetic member between said elongate members, and control means operable by movement of said elongate members along said plates.

4. An electromagnetic device comprising a frame having a pair of spaced apart plates, a pair of elongate movable members each of which is arranged adjacent one of said plates and provided with a notch adjacent one end, guide means associated with each plate and the adjacent mov-

able member for supporting and guiding said members for movement along said plates, means for moving said members along said plates including a stationary laminated magnetic member mounted on said frame between said plates and a movable laminated magnetic member, a plurality of laminations of said movable magnetic member having outwardly projecting portions forming supporting ears on opposite sides of said member, said ears cooperating with said notches to support said movable magnetic member between said elongate members, and control means operable by movement of said elongate members.

5. An electromagnetic device comprising a frame having a pair of spaced apart plates each of which is provided with a laterally extending finger, a pair of movable members each of which is arranged adjacent one of said plates and provided with an elongate slot for cooperating with the finger extending from the adjacent plate whereby said members are guided for movement along said plates, means for moving said members along said plates including a stationary magnetic element mounted on said frame between said plates and a movable magnetic element supported on adjacent ends of said movable members, and control means supported on the adjacent ends of said movable members opposite from said movable magnetic element.

6. An electromagnetic device comprising a frame having a pair of spaced apart plates each of which is provided with an inwardly extending finger, a pair of elongate push rods between said plates each of which is arranged adjacent one of said plates and provided with an elongate slot for cooperating with the finger extending from the adjacent plate to guide said rods for movement along said plates, means for moving said rods along said plates comprising magnetic structure including a stationary E-shaped magnet mounted on said frame between said rods and a movable E-shaped magnet supported by said rods in spaced relation to said stationary magnet, means for energizing said magnetic structure to attract said movable magnet and move said rods along said plates, and control means supported on the adjacent ends of said rods opposite from said movable magnet.

7. An electromagnetic device comprising an operating bar, a pair of supporting blocks having grooves therein, said blocks being respectively slidable onto opposite ends of said bar for supporting said bar intermediate its ends, a pair of push rods one of which is secured to each of said blocks, electromagnetic means for moving said push rods to move said operating bar transversely of its axis, and control means spaced along said bar for operation thereby.

8. An electromagnetic device comprising an operating bar having reduced ends so as to form spaced apart shoulders on said bar intermediate said ends, a pair of grooved blocks respectively slidable over said reduced ends into engagement with said shoulders for supporting said bar, a pair of push rods respectively secured to said blocks, means for guiding said rods for movement to operate said bar transversely of its axis, electromagnetic means for moving said rods, and control means spaced along said bar for operation thereby.

9. An electromagnetic device comprising an operating bar having reduced ends forming spaced apart shoulders on said bar intermediate said ends, a pair of grooved blocks respectively

slidable over said reduced ends into engagement with said shoulders for supporting said bar, a pair of substantially parallel, elongate operating members respectively secured to said blocks, a frame having a pair of spaced apart plates adjacent said operating members, guide means associated with said plates and said members for guiding said members for longitudinal movement along said plates, electromagnetic means mounted between said plates and including a movable element for operating said members to move said bar transversely of its axis, and a plurality of control means spaced along said bar for simultaneous operation thereby.

10. An electromagnetic device comprising an operating bar, a pair of grooved blocks respectively slidable over the ends of said bar for supporting said bar, means for positioning said blocks on said bar, a pair of push rods respectively connected to said blocks and extending outwardly therefrom in substantially parallel relation, a frame comprising a pair of spaced apart plates respectively adjacent said push rods, guide means associated with each plate and the adjacent rod for guiding said rods for movement along said plates, electromagnetic means for moving said rods including a stationary magnetic member mounted on said frame between said plates and a movable magnetic member supported in cooperating relation with said stationary magnetic member on the ends of said rods remote from said blocks, and a plurality of switch members spaced along said bar for operation thereby.

11. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with a plurality of spaced, similar outwardly projecting portions on opposite sides thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projecting portions on the next adjacent barriers to form arcing chambers therebetween, the spaces between said projecting portions forming apertures in the walls of said arcing chambers, contact members movable relative to each other between open and closed circuit positions within each arcing chamber and means extending through said apertures for supporting certain of said contacts.

12. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with a plurality of similar, spaced projecting portions on opposite sides thereof and with an aperture extending therethrough transversely to said opposite faces, fastening means including an insulated rod extending through said apertures for securing said barriers together in face-to-face relation, said projecting portions on each barrier engaging similar projections on the next adjacent barriers to form arcing chambers therebetween, the spaces between said projecting portions forming apertures in the walls of said arcing chambers, contact members movable relative to each other between open and closed circuit positions within each arcing chamber and conductor means extending through said apertures in said chamber walls for supporting certain of said contacts.

13. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with similar outwardly projecting portions on opposite faces thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engag-

ing similar projections on the next adjacent barriers to form therebetween arcing chambers having at least one open side, stationary contact means supported within each of said chambers, movable contact means operable into and out of engagement with said stationary contact means, and means extending through said open side of each of said chambers for operating said movable contact means.

14. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with similar outwardly projecting portions on opposite faces thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projections on the next adjacent barriers to form therebetween arcing chambers having at least one open side, stationary contact means supported within each of said chambers, movable contact means supported within each of said chambers and normally biased into engagement with said stationary contact means, and means extending through said open side of each of said chambers for operating said movable contact means out of engagement with said stationary contact means.

15. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with similar outwardly projecting portions on opposite faces thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projections on the next adjacent barriers to form therebetween arcing chambers having at least one open side, stationary contact means supported within each of said chambers, and movable contact means associated with each of said chambers operable into and out of said chambers through said open side selectively to engage and disengage said stationary contact means.

16. An electric switch comprising a plurality of symmetrical insulating barriers each of which is provided with similar outwardly projecting portions on opposite sides thereof, at least one of said similar projecting portions on each side of said barrier having a groove in the face thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projecting portions on the next adjacent barriers to form arcing chambers therebetween, said grooves in said projecting portions cooperating to form an aperture through a wall of each of said arcing chambers, contact members disposed within said arcing chambers, and means including a member extending through said aperture for supporting certain of said contact members.

17. An electromagnetic switch comprising a frame having a pair of spaced apart plates, a pair of elongate movable members each of which is arranged adjacent one of said plates, guide means associated with each plate and each movable member for supporting and guiding said members for longitudinal movement relative to

said plates, means for moving said members longitudinally including a stationary magnetic member mounted on said frame between said plates and a movable magnetic member supported on adjacent ends of said elongate members in cooperating relation with said stationary magnetic member, an operating bar, means for supporting said operating bar on the adjacent ends of said elongate members opposite from said movable magnetic member, a plurality of switch means spaced along said operating bar for operation thereby between open and closed circuit positions when said elongate members are moved longitudinally, a pair of supporting arms extending from said frame, and a plurality of symmetrical insulating barriers supported by said arms in face-to-face relation with each other, each of said barriers having similar outwardly projecting portions on opposite faces thereof arranged to engage similar projecting portions on the next adjacent barriers to form therebetween individual arcing chambers for each of said switch means.

18. In an electric switch, the combination of a plurality of symmetrical insulating barriers each of which is provided with similar projecting portions on opposite faces thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projecting portions on the next adjacent barriers to form arcing chambers therebetween, said projecting portions being spaced inwardly from the edges of said barriers and forming in conjunction therewith a plurality of grooves surrounding said arcing chambers, contacts supported within each of said arcing chambers and terminal members arranged in said grooves and connected to associated ones of said contact members, the depth of said grooves being such that said terminal members are entirely disposed therewithin.

19. In an electric switch, the combination of a plurality of symmetrical insulating barriers each of which is provided with similar projecting portions on opposite faces thereof, means for supporting said barriers in face-to-face relation, said projecting portions on each barrier engaging similar projecting portions on the next adjacent barriers to form arcing chambers therebetween, said projecting portions being spaced inwardly from the edges of said barriers to form in conjunction therewith a plurality of grooves surrounding said arcing chambers, conductor bars supported between said barriers with one end of each bar extending into one of said arcing chambers and the opposite end of each bar disposed in said surrounding groove, contact means carried by the ends of said bars within said chambers, and terminal members in said grooves carried by said opposite ends of said bars, the depth of said grooves being such that said terminal members are entirely disposed therewithin.

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