March 29, 1949. R. N. ROWE 2,465,933

ELECTRIC SWITCH

Filed March 7, 1946

4 Sheets-Sheet 1

FIG. 1

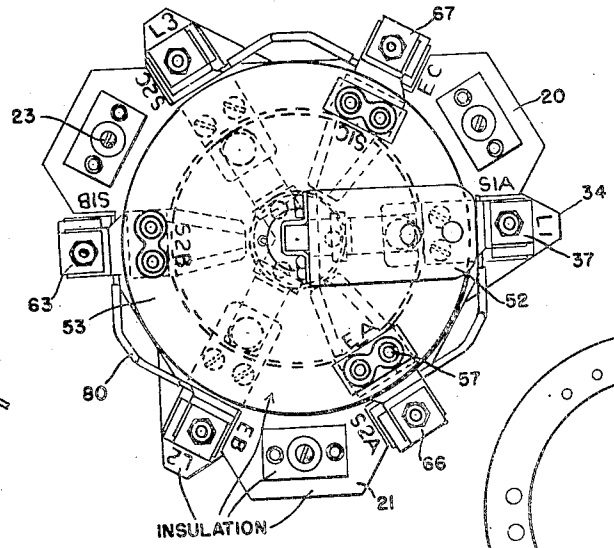


FIG. 1A

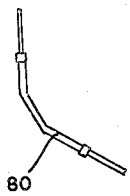


FIG. 3

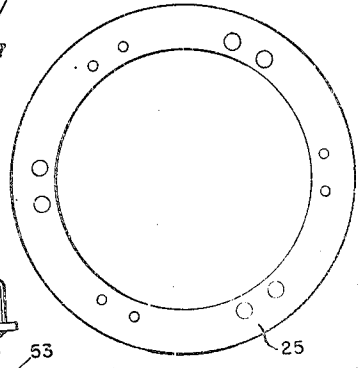


FIG. 2

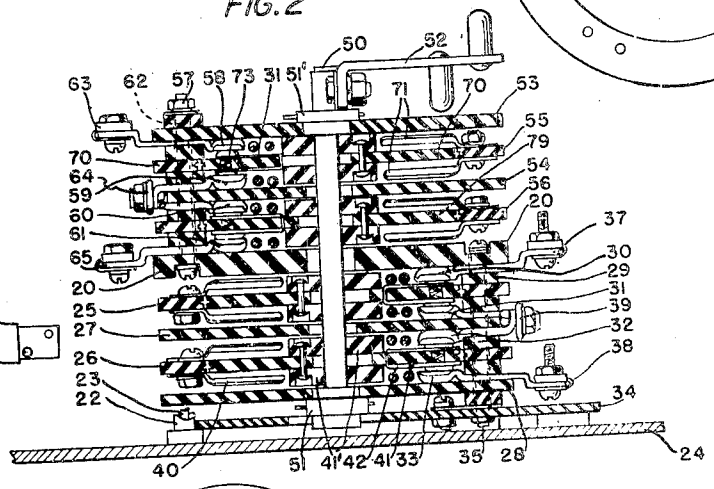


FIG. 2A

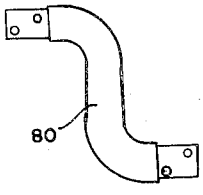
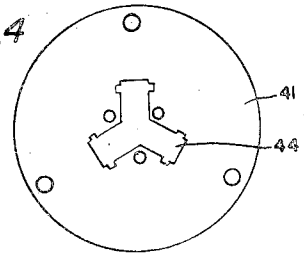


FIG. 4



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FIG. 5

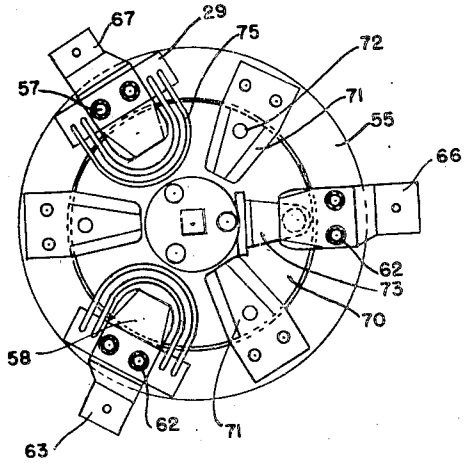


FIG. 6

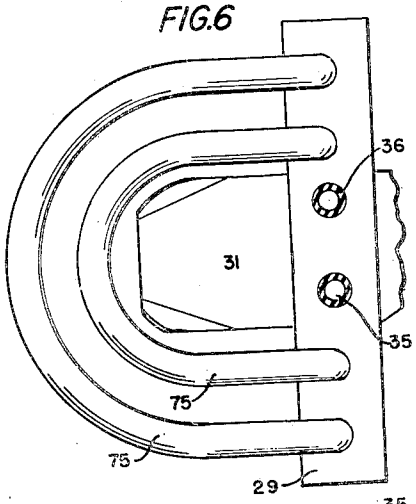


FIG. 7

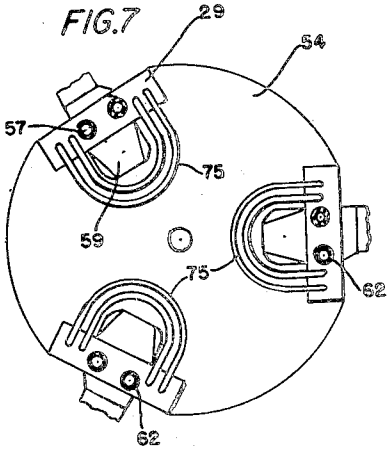
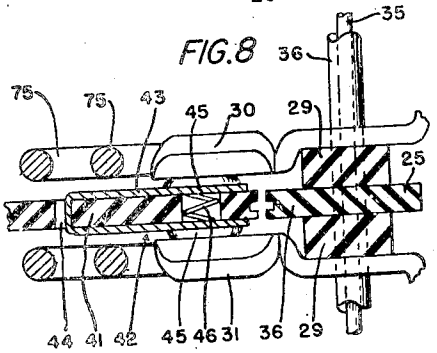


FIG. 8



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FIG.11

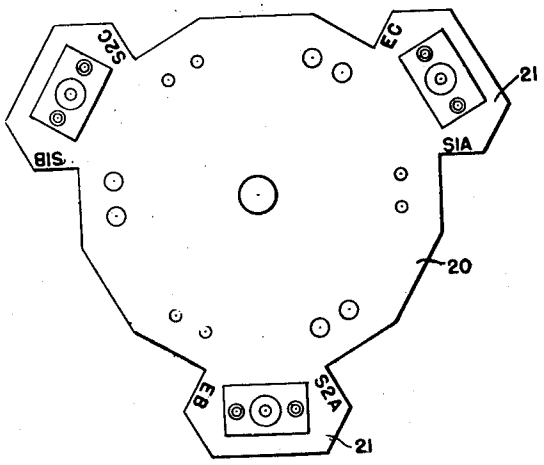


FIG.9

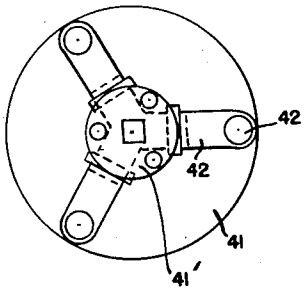


FIG.10

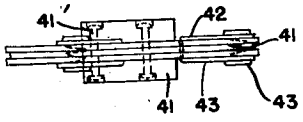


FIG.12

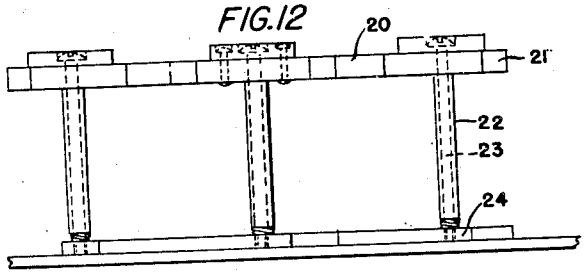


FIG.13

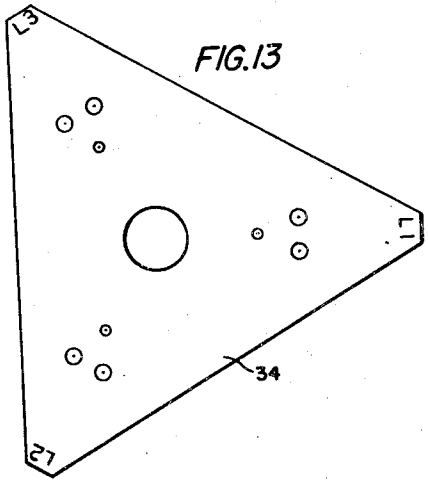
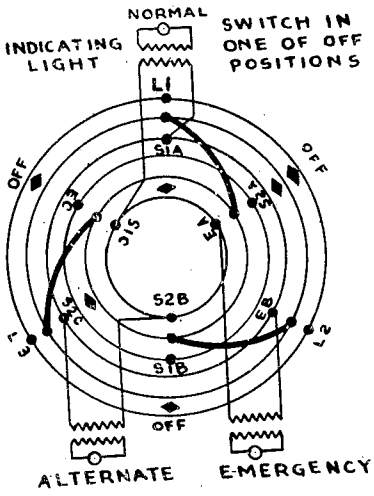


FIG.14



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ELECTRIC SWITCH

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FIG.19

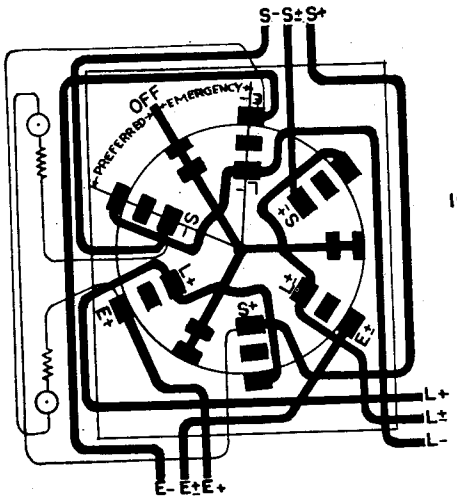


FIG.15

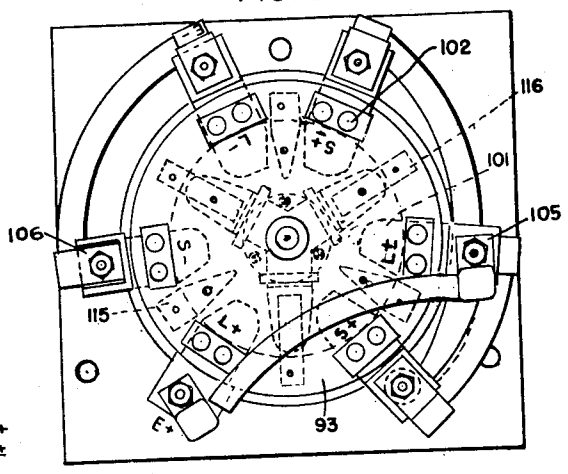


FIG.16

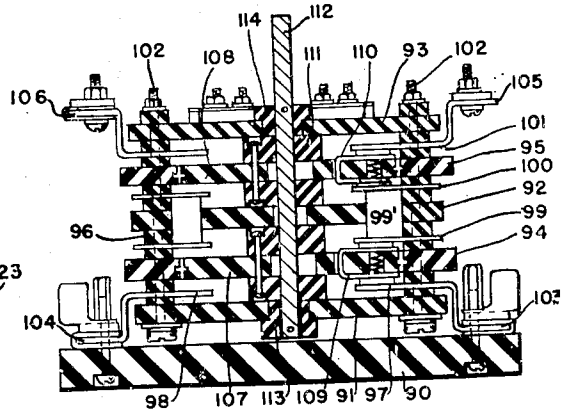


FIG.20

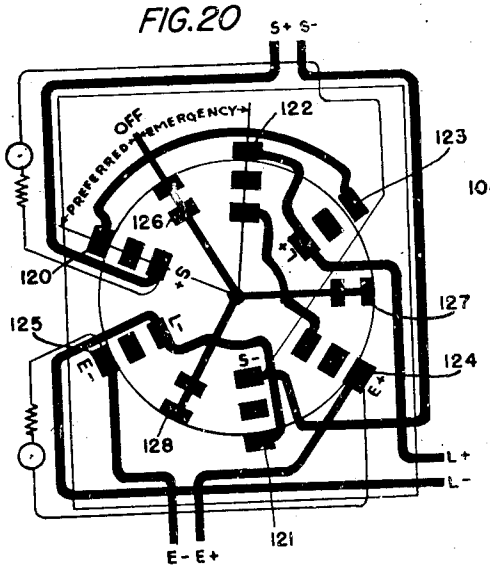


FIG.17

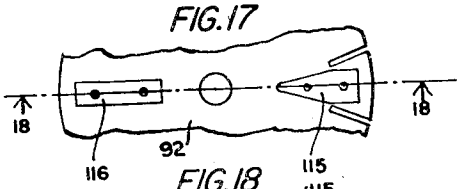
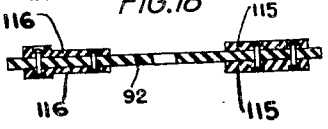


FIG.18



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Patented Mar. 29, 1949 2,465,933

UNITED STATES PATENT OFFICE

2,465,933

ELECTRIC SWITCH

Raymond N. Rowe, Plainville, Conn., assignor to The Trumbull Electric Manufacturing Company, Plainville, Conn., a corporation of Connecticut

Application March 7, 1946, Serial No. 652,586

7 Claims. (Cl. 200—6)

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My present invention relates particularly to the construction of switches which are adapted for use with operating mechanism of transfer switches such as set forth in my prior applications, Serial Number 619,998, filed October 3, 1945, and Serial Number 619,999, filed October 3, 1945, now Patent No. 2,460,599, February 1, 1949. In such switches, I provide mechanism for changing quickly from one source of power to another or vice versa from one load to another.

One object is to provide a compact, rugged and reliable construction capable of withstanding prolonged extraordinary stresses, mechanical as well as electrical. In many cases, such switches are subjected to severe physical shocks which in the absence of special precautions would be likely to loosen, weaken or break metal parts. When such switches are completely reversible, that is, when it is necessary to provide for breaking the circuit when turning in either direction from a closed circuit condition, it becomes necessary to depart from conventional lines and make special arrangements for protecting the contacts.

Fig. 1 is a plan or face view of a three-pole switch embodying my invention intended particularly to provide for connecting a load to any one of three sources of power and having three "off" positions alternating with the three "on" positions.

Fig. 1*a* is a detail plan view of one of the connector strips of Fig. 1.

Fig. 2 is a vertical sectional view of the switch of Fig. 1.

Fig. 2*a* is a side view of the connector strip of Fig. 1*a*.

Fig. 3 is a plan view of one of the stationary contact carrier rings.

Fig. 4 is a plan view of one of the rotor contact carrier discs.

Fig. 5 is a plan view of a ring and its inner disc with contacts, arc dispersers or deionizers and stabilizers in place.

Fig. 6 is a detached plan view of a part of one of the contacts with its associated arc disperser on a larger scale.

Fig. 7 is a plan view of a lower stationary contact carrier disc with contacts and arc dispersers.

Fig. 8 is an enlarged fragmentary partial section showing stationary and rotatable contacts and arc dispersers.

Fig. 9 is a plan view of one of the switch rotor discs with contacts.

Fig. 10 is an edge view of the same.

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Fig. 11 is a plan view of the central insulating support or base.

Fig. 12 is a side view of the base and showing the supporting posts.

Fig. 13 is a plan view of the bottom insulating plate.

Fig. 14 is a diagrammatic view of the circuits of the switch of Figs. 1 and 2 in the "off" position, the large circles suggesting the insulating discs, the small dots representing the stationary contacts, the diamonds representing the movable contacts and the heavy curved lines the outside connections.

Fig. 15 is a plan view of a three-pole switch for connecting either of two sources of current to a given load, the switch having a single "off" position with an "on" position at either side of the "off" position.

Fig. 16 is a vertical sectional view of the switch of Fig. 15.

Fig. 17 is a detail view of a part of the central disc of Fig. 16.

Fig. 18 is a sectional view on the plane of the line 18—18 of Fig. 17.

Fig. 19 is a diagrammatic view of the circuits of the switch of Figs. 15 and 16.

Fig. 20 is a diagrammatic view of the circuits of a two-pole switch.

Such switches are usually enclosed in receptacles or boxes as shown in my former applications and secured to the bottom of the box. The switch consists of a compact stack of stationary insulating discs and rings with stationary contacts mounted between them and having outwardly projecting terminals and smaller discs carrying the movable contacts rotatable within the stationary rings.

The central disc **20** has outwardly extending projections **21** and serves as a support for all the other discs and rings and is itself supported on insulating pillars **22** and secured by bolts **23** to a base plate **24** which may be the bottom of the enclosing box (not shown). Secured beneath disc **20** are two rings **25** and **26** and two discs **27** and **28** with spacers such as **29** and contacts **30**, **31**, **32** and **33** between adjacent members. These parts are all secured to the disc **20** and the bottom plate **34** by three pairs of bolts **35** which pass through the respective contacts but are insulated therefrom by sleeves **36**. Each contact has a projecting terminal lug such as **37** or **38** shaped to receive a circuit connection, or it is to be connected to a superposed contact such as at **39**.

Each ring **25**, **26** has secured to it, on opposite sides and between the adjacent contacts on the

same level, a guard or stabilizing arm 40 which projects inwardly over the edge of the inner rotor disc 41 which is on the same plane as the ring to which the arms are secured.

Each rotor carries one or more contacts 42 (Fig. 8) and each contact consists of a conductor strip 43 which extends through a slot 44 in the rotor and terminates in a contact surface 45 on each side of the rotor. These ends of each contact are pressed apart by a spring 46 so as to ensure proper engagement with the stationary contacts above and below.

Each rotor 41 has a hub made up of two smaller discs 41', 41' secured to it and these hubs are all mounted to rotate with the main shaft 50 which is stepped in a bearing 51 at the bottom and in a bearing 51' at the top and has an actuating lever 52 at the upper end.

Above the central disc 20 are two more insulating discs 53, 54 and rings 55, 56 secured to the disc 20 by three pairs of bolts 57 insulated from the contacts 58, 59, 60 and 61 by sleeves 62. These contacts have terminals 63, 64, 65, 66 and 67. Rotors 70 (similar to rotors 41) are mounted on shaft 50 within the rings 55 and 56 and positioned by guard arms 71, 71 and 71 (similar to arms 40). Each guard arm has a recess 72 filled with some solid lubricant so that as the contact 73 or 45 of the rotor 70 or 41 passes in either direction it will receive a coating which will greatly prolong the life of the contact.

To dissipate or disperse the arc which forms when the circuit is broken, I may provide a special arc dissipating device or deionizer surrounding the tip of each stationary contact. This consists of two bow-like metal rods 75, 75, the ends of which are mounted in one of the spacers 29. This acts to divide and deionize the arc and prevents it from jumping to adjacent metal parts such as the guard arm 71 and acts equally well whether the switch is turned in one direction or the other. Each spacer with its deionizer is removable from the bolts on which it is mounted.

The necessary connnections between the contacts in the various levels is effected by special jumpers 80 (Figs 1a and 2a) connected to the respective terminals.

In the form shown in Figs. 1, 2 and 14, the terminals and contacts are arranged so that the three leads to the load are connected to the three terminals on disc 28 at the lowest level indicated at L1, L2 and L3 in Fig. 1 (L1 being 38 in Fig. 2).

The leads from the so-called "Normal" source are connected to terminals S1A, S1B and S1C, (S1A being 37 on ring 25; S1B being 65 on disc 20 and S1C being mounted below the upper disc on ring 55).

The "Alternate" source is connected to terminals S2A, S2B and S2C (S2A being mounted on disc 20; S2B being 63 on ring 55; and S2C being mounted on ring 25).

The "Emergency" source is connected to terminals EA, EB and EC (EA being mounted on ring 55; EB being mounted on ring 25; and EC being mounted on disc 20).

The circuit diagram of Fig. 14 shows the connections for one combination of three power sources for one load. The concentric circles represent the various stationary discs with their stationary contacts represented by small black dots; the inner circles representing the top layer of contacts and the outer circle the lower layer. The small black diamonds represent the contacts carried by the rotors. It will be seen that the stationary contacts are arranged in groups sixty degrees apart circumferentially and that the rotatable contacts are arranged so as to close the circuit when rotating from the "off" position of Fig. 14 in either direction. If rotated anti-clockwise 60° the circuit will be closed through the normal source of current; 60° more anti-clockwise will break the circuit; and rotation 180° from the position of Fig. 14 will connect the Alternate source of current. A rotation 60° clockwise from the "off" position of Fig. 14 will connect the Emergency source. A 60° turn from any "on" position in either direction will break the circuit.

The simplified form of Figs. 15 and 16 is arranged to close a circuit through and transfer power from either of two sources to a load circuit. The stationary and rotatable contacts are all carried by insulating discs and rings supported by a base 90 and intended to be housed in a suitable enclosure (not shown).

The stationary frame work consists of discs 91, 92 and 93 with intervening rings 94 and 95 spaced apart by spacers 96 and contacts 97, 98, 99, 100, 101, etc. Contacts such as 99 and 100 are carried by disc 92 and connected by a web 99'. The stack of discs, rings, spacers and contacts are all held together but insulated from pairs of bolts 102. The lower and upper contacts have laterally extending circuit, terminals 103, 104, 105, 106 etc. Within the rings 94 and 95 are located the rotor discs 107, 108 which carry the rotatable contacts 109, 110 etc.

Each rotor has a hub 111 made up of two discs mounted to rotate with shaft 112. This shaft is supported in suitable bearings 113, 114 and provided with any suitable means for rotating or turning the shaft about 40° in either a right or left direction from a central "off" position to an "on" position for the Preferred or Normal source or to the Emergency source.

Each of the stationary discs has insulating stops or barriers such as 115 and 116 (Figs. 15, 17 and 18) secured to it between the adjacent stationary contacts. For instance, the central disc 92 has these barriers on both sides, the top disc 93 has such barrier on its lower face and the bottom disc 91 has such barrier on its upper face.

Fig. 19 is a diagram showing a circuit arrangement and relative location of contacts for a three-pole switch for a three-wire system, such as that of Figs. 15 and 16. The three contacts L−, L+ and L± of the inner row of contacts represents the switch contacts on the upper level of the stack to which the load leads are connected.

The leads from the Normal current supply are connected to the alternate contacts S−, S+ and S± on the upper level. The leads from the second source of supply are shown connected to three of the outer row of contacts E−, E+ and E± representing contacts at the lowest level of the stack. The other contacts in the outer row are connected to the respective load contacts on the inner row. The rotor contacts are arranged between the stationary contacts so that when the rotor is turned anticlockwise the preferred source of current is connected to the load circuit, and when the rotor is turned in the other direction, the load is transferred to the Emergency source.

The diagram of Fig. 20 of circuits shows one simple arrangement for a two-pole switch which will be readily understood. The stationary vertical groups of contacts 120, 121 and 123 represent the contacts for connection to the Preferred

source of current, the inner contacts S+, S− and L+ representing those at the top of a stack, and the stationary groups 122, 124 and 125 representing those for connection to the Emergency or alternative source. The contacts 126, 127 and 128 represent the contacts carried by the rotor. The "load" terminals are designated by the letters L+ and L−.

It should be understood that other arrangements of contacts and circuits may be provided for in order to obtain other switching effects.

It will be seen from the foregoing that the upper and lower discs with the intervening rings and spacers constitute a rugged frame work for the rotating parts which are thus substantially enclosed. It also ensures a maximum spacing between parts of opposite polarity or potential and affords great dielectric strength so that a switch of maximum capacity can be built in a minimum space.

The "off" position guards which engage the movable contacts in the three position switch hold them against rattling or shifting when the switch is in an "off" position. They also establish definite "off" positions for the switch as a whole so that the contacts cannot be accidentally partially closed when disconnected from the actuating mechanism. The lubrication of the moving switch contacts every time the switch is turned to an "off" position is also highly desirable to ensure long life for the switch.

The use of semi-circular deionizing pieces which surround the ends of the stationary switch contacts increases the interrupting capacity of the switch, are inexpensive and easy to install. They are so designed that they function equally well when the switch is turned right handed or left handed to open the circuit.

It is possible for such a structure to withstand severe physical shock.

I claim:

1. A transfer switch comprising a stack of stationary insulating discs with insulating rings alternating therewith, stationary contact members and spacers mounted between various discs and rings and having terminal portions of the contact members extending beyond the outer edges of the rings and discs, clamp bolts passing through said discs, rings and contact members but insulated from the latter members and securing them all together, insulating discs mounted concentrically inside of said rings, switch contact members carried by said inner discs for moving between and coacting with said stationary contact members and an actuating shaft for said inner discs having bearings in the top and bottom stationary discs.

2. A transfer switch comprising a stack of stationary insulating discs with insulating rings alternating therewith, stationary contact members and spacers mounted between various discs and rings and having terminal portions of the contact members extending beyond the outer edges of the rings and discs, clamp bolts passing through said discs, rings, spacers and contact members but insulated from the latter members and securing them all together, an insulating disc mounted concentrically inside of each of said rings, switch contact members carried by said inner discs for moving between and coacting with said stationary contact members, guard arms carried by said rings and extending over the outer edges of the inner discs between their switch contacts and having means for lubricating the contacts and an actuating shaft for said inner discs.

3. A transfer switch comprising a stack of stationary insulating discs with insulating rings alternating therewith, stationary contact members mounted between various discs and rings and having terminal portions of the contact members extending beyond the outer edges of the rings and discs, clamp bolts passing through said discs, rings and contact members but insulated from the latter members and securing them all together, insulating discs mounted concentrically inside of said rings with their edges in close proximity to the inner edges of the surrounding rings, switch contact members carried by said inner discs for moving between and coacting with said stationary contact members, guard arms carried by said rings and extending over the edges of the inner discs between the switch contacts and an actuating shaft for said inner discs having bearings at the top and bottom of the stationary discs.

4. A transfer switch comprising a stack of stationary insulating discs with insulating rings alternating therewith, stationary contact members mounted between various discs and rings and having terminal portions of the contact members extending beyond the outer edges of the rings and discs, clamp bolts passing through said discs, rings and contact members but insulated from the latter members and securing them all together, insulating discs mounted concentrically inside of said rings, switch contact members mounted in slots in said inner discs for moving between and coacting with said stationary contact members, guard members mounted between switch contacts and an actuating shaft for said inner discs having bearings in the top and bottom stationary discs.

5. A transfer switch comprising a stack of stationary insulating discs with rings interposed between adjacent discs and rotatable discs mounted inside the rings with their outer edges close to the inner edges of the respective rings, stationary switch contacts mounted between the first mentioned discs and adjacent rings and extending inwardly over the inner discs, and coacting inner contacts carried by the inner discs, the stationary contacts and the inner contacts being arranged in groups to provide three off positions and an on position between each two adjacent off positions, the rotatable and stationary contacts being so constructed as to facilitate rotation of the rotatable discs and their contacts in either clockwise or anticlockwise direction from any of said positions to either adjacent position.

6. A transfer switch comprising a stack having upper and lower stationary insulating discs and at least one other stationary disc between them and a stationary insulating ring between each two adjacent stationary discs, an inner disc mounted to turn within each ring, stationary contacts clamped between each ring and the adjacent stationary disc and having terminals outside of said stationary discs and extending over the outer edge of an inner disc, inner contacts carried by said inner discs and coacting with the inner ends of the stationary contacts, and guard arms carried by said rings and overlapping the inner discs between the stationary contacts, said inner contacts being mounted in three groups spaced apart from each other circumferentially and the stationary contacts being mounted in three groups spaced apart circumferen-

tially and adapted to be engaged by inner contacts by a turning of the inner discs in either a clockwise or anticlockwise direction.

7. A three-pole transfer switch comprising a stack having top and bottom stationary insulating discs and at least one other stationary insulating disc between them and a stationary insulating ring between each two adjacent discs, an inner disc mounted to turn within each ring, stationary contacts clamped between each ring and the adjacent stationary disc and having terminals outside of said stationary discs and extending over the outer edge of an inner disc and inner contacts carried by said inner discs and coacting with the stationary contacts, said inner contacts being mounted in three groups spaced apart from each other circumferentially and the

stationary contacts being mounted in three groups spaced apart circumferentially and adapted to be engaged by inner contacts by a turning of the inner discs in either a clockwise or anticlockwise direction.

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