July 4, 1950 S. MINNECI 2,513,953

ELECTRIC SWITCH

Original Filed May 1, 1946

Fig. 1.

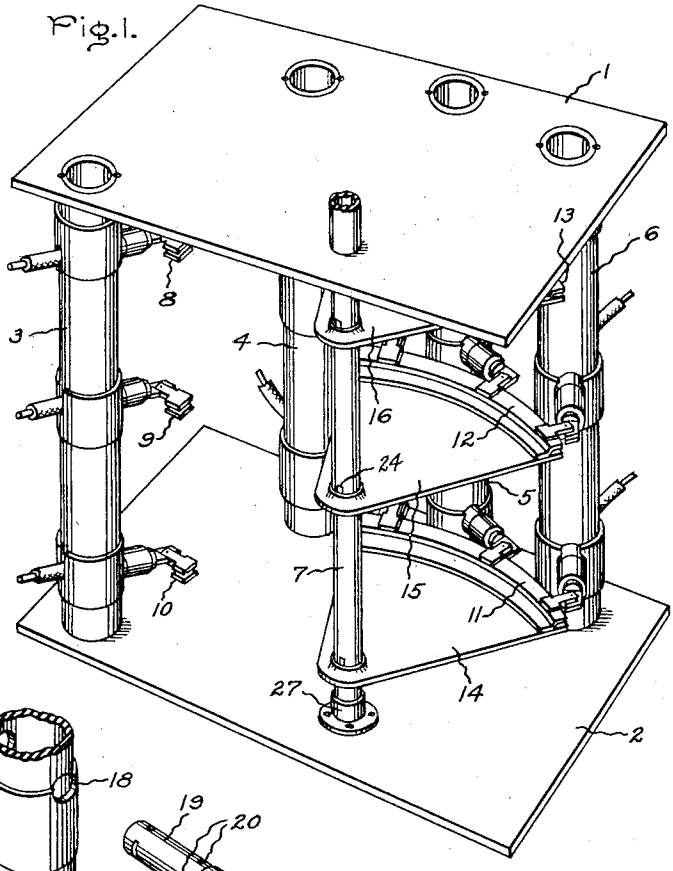


Fig. 2.

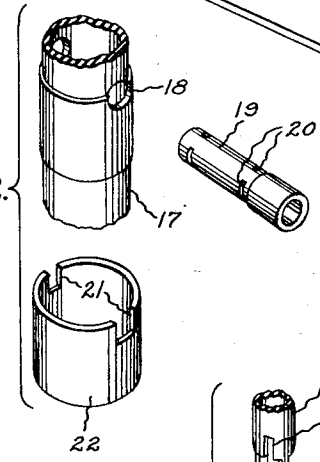


Fig. 3.

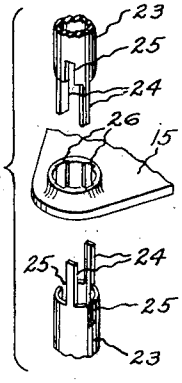


Fig. 4.

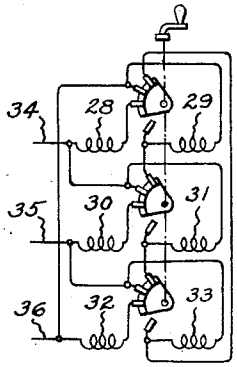
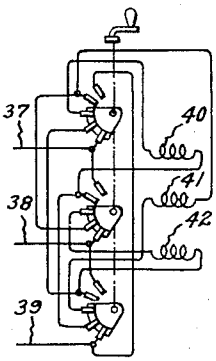


Fig. 5.



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UNITED STATES PATENT OFFICE

2,513,953

ELECTRIC SWITCH

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2 Claims. (Cl. 200—11)

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This is a division of my application Serial No. 666,293, filed May 1, 1946 and assigned to the same assignee.

The invention relates to electric switches and more particularly to improvements in high voltage switches for changing transformer connections.

It is often desirable to be able to easily to change the connections between the windings of a transformer. For example, one of the windings of a polyphase transformer may have a plurality of coils per phase and by connecting these coils either in series or in parallel the voltage and current rating of the transformer may be materially varied. Also it is frequently desirable to be able to reverse the phase of one of the windings of a polyphase transformer; that is to say, to reverse the direction of the individual phase windings. Switches for accomplishing these purposes are known but they usually include a number of metal parts in addition to the actual contact elements themselves, and as the voltage rating of the circuits to which they are connected increases, the size of the switches also increases in order to obtain sufficiently great creepage paths and arc-over distances and the presence of extra metal in the switches requires that they be extra large. However, in large high voltage transformers it is often desirable to mount the switches in the transformer tank and under the surface of its cooling and insulating liquid. It is therefore highly desirable that such switches be as small as possible so as to reduce the volume of liquid which they displace to as low a value as possible and so as to prevent increasing the size of the transformer tank any more than is absolutely necessary.

In accordance with this invention there is provided a novel and simple switch construction in which all of the parts except the actual current carrying parts are made of insulation and the invention is characterized by a novel construction of the insulating parts so as to give them the necessary mechanical strength.

An object of the invention is to provide a new and improved electric switch.

Another object of the invention is to provide a compact polyphase electric switch construction which employs the maximum amount of insulating material and the minimum amount of metallic conducting material.

The invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

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In the drawing Fig. 1 is a perspective view of an embodiment of the invention, Fig. 2 is a detailed exploded view of a part of one of the stationary contact carrying assemblies of the switch shown in Fig. 1, Fig. 3 is a detailed exploded view of a part of the movable contact carrying assembly shown in Fig. 1, Fig. 4 is a circuit diagram illustrating the connections of the switch shown in Fig. 1 for making series-parallel connections between windings, and Fig. 5 is a connection diagram of a modified switch construction for obtaining phase reversal.

Referring now to the drawing and more particularly to Fig. 1, the switch is illustrated as comprising a pair of end plates or supports 1 and between which extend four stationary contact carrying assemblies 3, 4, 5 and 6 and one movable contact carrying assembly 7. These parts are made entirely of insulating material which may be fabric which has been impregnated with a thermosetting or polymerized synthetic resin, so as to form a very hard and mechanically strong material. The switch shown in Fig. 1 is a three-phase switch in which the contacts for each phase are in the same plane and the contacts for the different phases are placed in different planes, the planes being all perpendicular to the axis of the movable contact carrying assembly. Thus, each stationary contact carrying assembly is shown as having three stationary contacts which are equally spaced from each other. These contacts are identified as 8, 9 and 10 in connection with the stationary contact carrying assembly 3 and it will be understood that the other stationary contact carrying assemblies have corresponding contacts. Likewise, the movable contact carrying assembly has three movable contacts indicated as arcuate metal strips 11, 12 and 13 which are attached to segmental insulating members 14, 15 and 16 respectively.

As shown most clearly in Fig. 2, each stationary contact carrying assembly comprises a main insulating tube 17 which has a separate hole 18 drilled through it for each of its stationary contacts. Each stationary contact is carried by a tube of similar insulating material which is inserted through the hole 18 in the main tube 17. The tube 19 is provided with notches 20 in opposite sides and these are engaged by a pair of notches 21 in a sleeve member 22 of insulating material which is slid over the tube 17 and may be held in place by means of suitable insulating varnish and tape. The stationary contact in each case is carried by a conductor which passes through the tube 19 and, as shown in Fig. 1,

each stationary contact is a double or split contact which grips the top and bottom surfaces of its cooperating arcuate movable contact.

The details of the movable contact carrying assembly 7 are shown in Fig. 3. This consists of a number of tubular members 23, the ends of which are provided with projections 24 and indentations 25, the ends of the pieces 23 being similar in shape. The segmental movable contact carrying members are all the same and in Fig. 3 a portion of the member 15 is illustrated. This is provided with an opening having a number of keyway-like grooves or slots 26 into which the projections 24 are fitted, the two members 23 being turned 180 degrees relative to each other when their projections 24 are fitted into opposite slots 26 in the opening in the member 15. The projections 24 of each member 23 extend out beyond the opposite side of the member 15 and into the indentations 25 on the other member 23. In this way all three parts shown in Fig. 3 are securely locked together as the sliding fit between the various parts can be made as tight as necessary.

The bottom of the shaft on which the movable contact carrying assembly rotates is preferably seated in a sleeve bearing member 27 which is preferably made of the same insulating material.

In Fig. 4 the switch is shown diagrammatically with its contacts in the same relative positions that they are shown in Fig. 1 and these contacts are connected to windings 28 and 29, 30, 31, 32 and 33 and to the conductors 34, 35 and 36 of a three-phase circuit. Each pair of axially aligned coils or windings belong to a different phase of the three-phase system and in the position of the switch shown in Fig. 4 these pairs of coils are connected in parallel, coils 30 and 31 being connected in parallel between line conductors 34 and 35, coils 32 and 33 being connected in parallel between line conductors 35 and 36, and coils 28 and 29 being connected between line conductors 36 and 34 so that the three-phase connection is a delta connection. When the movable contact carrying assembly is rotated to its opposite position in which each movable contact bridges only between the lower-most pair of contacts for each phase, (as viewed in Fig. 4) which corresponds to a bridging connection between the left-hand pair of stationary contacts of each phase in Fig. 1, it will be seen that the coils of each phase will be connected in series between the same pairs of line conductors.

In the modification shown in Fig. 5 an additional stationary contact has been added for each phase and as will be seen from Fig. 1 that this can readily be accomplished by inserting another stationary contact carrying assembly corresponding in all respects to those which are shown in the space between the assemblies 3 and 4. In this figure the switch serves to interconnect a three-phase circuit comprising conductors 37, 38 and 39 and three windings 40, 41 and 42 in such a way that winding 42 is connected between conductors 37 and 38, winding 41 is connected between conductors 38 and 39 and winding 40 is connected between conductors 37 and 39. The connection is therefore a delta connection of these windings with respect to the three-phase circuit. When the switch is moved to its other extreme position in which each arcuate movable contact bridges its three upper-most cooperating contacts, as viewed in Fig. 5, instead of its three lower-most as shown, then the terminal connections of the three windings are reversed while they are still connected between the same pairs of line conductors.

While there have been shown and described particular embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention and, therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. A high voltage polyphase switch comprising two end plates of insulating material separated by a plurality of hollow parallel tubes of insulating material whose ends fit into holes in said plates, one of said tubes being at the center of an arc of a circle and the rest of said tubes being equally spaced on said arc, said center tube being rotatable on its axis and carrying a plurality of axially spaced arcuate rotatable bridging contact members, and a plurality of fixed contacts mounted on each of the remaining tubes by means of smaller straight insulating tubes which pass diametrically through said remaining tubes and which extend generally tangentially with respect to said arcuate bridging contact members, said fixed contacts extending radially inward with respect to said arcuate bridging contact members in order to reduce the overall dimensions of said switch, said fixed contacts being axially spaced so as to be in the path of movement of the respective rotatable contacts, said rotatable contacts serving selectively to bridge between any adjacent pair of fixed contacts.

2. A unitary three-phase series paralleling and phase reversing switch comprising, in combination, a pair of end plates of insulating material, at least five parallel tubes of insulating material for separating said plates, one of said tubes being rotatably mounted on the axis of an imaginary cylinder, the remaining tubes being equally spaced on the periphery of said imaginary cylinder, three arms of insulating material rigidly attached at equally spaced points to said rotatable tube, said arms having arcuate shaped ends and being provided with arcuate shaped bridging contacts, a plurality of smaller insulating tubes passing diametrically through said remaining tubes and extending generally tangentially with respect to the arcuate ends of said arms, and individual fixed contact members mounted respectively on the ends of said tubes and extending radially inward with respect to the arcuate ends of said arms in order to reduce the overall dimensions of said switch, said fixed contacts being so spaced that they are in the path of movement respectively of said bridging contacts.

SALVATORE MINNECI.

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