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His Attorney.
This invention relates to electric switches and more particularly to improvements in high voltage switches for changing transformer connections. Certain features of the complete rotary type switch shown in Fig. 1 form the subject matter of my divisional application, Serial No. 700,026, filed October 15, 1947.

It is often desirable to be able 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.

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 2 between which extend four stationary contact carrying assemblies 3, 4, 5 and 6 and one movable contact carrying assembly 1. These parts are made entirely of insulating material which may be fabric which has been impregnated with a thermostetting 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 attached to a conductor which passes through the tube 19 and, as shown in Fig. 1, each stationary contact 8, 9 and 10 is a double or split...
connect which grips the top and bottom surfaces of its cooperating arcuate movable contact 12, 12 and 11, respectively.

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 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 28 into which the projections 24 are fitted, the two members 25 being turned 180 degrees relative to each other when their projections 24 are fitted into opposite slots 28 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 25. 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 37, 38 and 39 of the 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 37 and 38, and coils 32 and 33 being connected between line conductors 38 and 39, 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 lowermost 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 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 inter-