ABSTRACT

A switch is provided for insertion directly into a high voltage power line to provide means for electrically disconnecting an extension of the line. The switch employs an insulator having high tensile strength and a high dielectric constant which can physically support a power line and also withstand the electrical forces applied through the line. The electrical circuits are either completed or broken through action of a switch blade which can conduct electric current between hardware components connected to end fittings on the insulator. The end fittings are tapered and faced by steps to prevent their being pulled from the hardware or rotated with respect to the hardware.

6 Claims, 10 Drawing Figures
HIGH VOLTAGE IN-LINE DISCONNECT SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to switch assemblies for use in electric primary power distribution circuits. It relates particularly to in-line disconnect switches which are to be placed directly in mechanical as well as electrical series with the power lines in such a way that they also provide part of the mechanical structure of the lines. The switches carry the full current in the lines when they are closed; and provide effective electric open circuits in the lines when they are open, to enable electrical isolation of branches of a power network. The switch assemblies maintain structural links in the lines at a level strong enough to physically support the lines. The present invention relates further to means for maintaining positive angular alignment between the ends of the switch assemblies and to the maintenance of alignment of the electrical contact elements of the switch.

2. Description of the Prior Art

The prior art in-line disconnect switches for electrical power distribution systems include arrangements of insulators which are terminated by end fittings. The end fittings are secured to the insulators by cement which is intended to secure the end fittings from coming loose or rotating relative to the insulators and to each other. Characteristically, the end fittings have been cylindrical in form. The mounting hardware for the electric switch has been fastened to the end fittings by means of U-bolts or combinations of brackets and bolts. A patent exemplary of this prior art is U.S. Pat. No. 3,499,129 entitled "Line Tension High Voltage Current Interrupter," issued in the names of L. A. Hal- teen and W. H. Gilliland on Mar. 3, 1970.

It has been difficult with the prior art to maintain positive angular orientation between the mounting surfaces of the insulator end fittings and mating surfaces of the mounting hardware. Frequently, it has been necessary to adjust the switches in the field when they have slipped out of alignment. In addition, where the end fittings are cylindrical there is no positive means for preventing the insulator and end fitting assembly from sliding out of the U-bolt or other fastener along the longitudinal axis of the assembly or angularly about the axis.

SUMMARY OF THE INVENTION

Objects of the invention include the provision in an in-line disconnect switch of means to maintain angular orientation between an insulator, metallic insulator end fittings and mating surfaces of electric switch-blade mounting hardware. The objects include preventing the metallic insulator end fittings from sliding relative to the insulator either about or along the longitudinal axis of the insulator. Objects include preventing motion between the end fittings and mounting hardware. Other objects include holding the blades of the electric switch in alignment with each other.

To attain the objectives referred to above, a number of features have been incorporated in in-line switches according to the present invention. These include: (a) tapered end fittings on the ends of insulator rods to securely attach these parts together. Flat steps are provided on the insulator metallic end fittings with are engaged with flat surfaces on the switch castings, thereby preventing rotation of the switch casting relative to the metallic end fittings. The metallic end fittings are tapered and fitted to the switch castings so that tension applied from the insulator will not pull the end fittings from the castings. These features insure positive orientation and alignment between the insulator, the end fittings, the mounting hardware, and the switching elements at all times after the switch has been assembled.

BRIEF DESCRIPTION OF THE DRAWINGS

The above mentioned and other features and objects of this invention and the manner of obtaining them will become more apparent, and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view in partial section of an in-line disconnect switch according to the invention, FIG. 2 is a bottom view of the embodiment of FIG. 1,

FIG. 3 is a sectional view of a spacer of use in an in-line switch,

FIG. 4 is a view in partial section of a metallic end fitting used to support and secure insulators,

FIG. 5 is a side view of FIG. 4,

FIG. 6 is a bottom view of FIG. 5,

FIG. 7 is a plan view of a switch casting depicting hinge elements of use in the practice of the invention,

FIG. 8 is a bottom view of the casting shown in FIG. 7,

FIG. 9 is a side view of the casting shown in FIG. 7, and

FIG. 10 is a side view of the casting shown in FIG. 9.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Turning now to FIG. 1, there is disclosed a plan view of a completely assembled in-line disconnect switch according to the invention. In this view, the digit 2 refers to a ribbed porcelain insulator through which a fibre glass rod insulator 4 is extended into metallic end fittings at 6 and 8. A slurry of urethane is used as a sealant between the fibre glass rod 4 and the inner wall of the insulator 2. The end fittings 6 and 8 are crimp-fitted to the fibre glass rod to secure a strong fit. The metallic end fittings 6 and 8 incorporate flat steps which are secured against flat mating surfaces on the switch casting or switch support bodies. 12. The metallic switch blade 14 has in fact a double blade (indicated in FIG. 2 as 14 and 14') which is hinged to the switch casting, or hinge casting, 12 about a pivot point 16. A pull ring at 18 is latched by element 19 to the switch casting 10 and is designed to engage safe disconnect, through use of a proper tool, of the switch blade 14 from contacts affixed to the switch casting 10. A spring element at 20 is provided to engage the blade 14 to hold it open in a position 180° from its position when closed and to reduce the chances of accidental contact by linemen.

The switch castings 10 and 12 and the metallic end fittings 6 and 8 are secured together by a pair of U bolts 22 and 24, the ends of which are shown enclosed in FIG. 1 by respective nuts 26, 28, 30 and 32.

A bottom view of the assembly of FIG. 1 is shown in FIG. 2, where the same numbers are used to...
like parts. In this view, a further showing is provided of the manner in which the end fittings 6 and 8 are fastened to the switch castings 10 and 12 by U-bolts 22 and 24. In addition, a hinge element 32 is indicated to show means enabling the switch blades 14 and 14' to rotate about the pivot point 16, of FIG. 1.

FIG. 3 is a sectional view on an enlarged scale showing details of the spacer 34 from FIG. 2. This view shows the results attained by crimping the spacer by applying pressure at points 36 and 38. As indicated, the spacer deforms to grip the shaft at 40.

FIG. 4 shows a view, in partial section, of a metallic end fitting according to either 6 or 8, but labeled 6 in this view. The opening enclosed by the wall 44 is provided to receive one end of a rod of fibre glass 4 (FIG. 1) or a rod of other suitable insulting material of relatively high structural strength. Details of construction include the intersection 54 between a wall 50 and a wall 52, as well as an intersection between wall 44 and wall 50. A slurry of urethane, or other sealant, may be used to help seal any space between the wall 44 and an insulator rod. The metallic end fitting 6, in a preferred embodiment, is crimped around the fibre glass rod to insure a positive fit between the two elements and to prevent either lateral or rotary motion between the two.

The end fitting 6 includes a flat stop at 46 which is provided to enable positive contact to be established with the corresponding switch casting 12. The hole at 48 in the flat extension link 6' is provided to enable direct mechanical and electrical connections to be completed with a power line.

The end fitting 6 (as well as the end fitting 8) is a section of a cone, having the large end, or base of the cone situated at the top adjacent the flat extension link 6' in the view shown in FIG. 4. The resulting taper makes it possible to more effectively restrict motion parallel to the center line of the end fitting by use of clamps, such as 22 and 24 in FIG. 1. It will be seen from FIG. 1 that tensile forces applied to the fibre glass rod 4 and to the metallic end fittings 6 and 8 will be prevented from pulling 6 and 8 out of the clamps 22 and 24 by virtue of the force applied by the clamps and the taper on 6 and 8.

FIG. 5 is a side view of the metallic end fitting 6 showing a different orientation of the extension link 6' and the flat step 46. Fitting 6 is again shown to taper outward from the bottom.

FIG. 6 is a bottom view of FIG. 5. FIG. 6 indicates the positions of various parts of the opening in 6, depicting a wall at 44, and a junction at 54 between the flat end 52 of the opening and the wall 50. The extent of the conical taper of the end fitting 6 is indicated by the concentric rings 56 and 58.

FIG. 7 is a plan view of a switch casting oriented in the position of casting 12 (which may also be referred to as a hinge casting as distinct from 10) in FIG. 1, and depicting hinge elements 32. It is apparent from inspection of FIGS. 1 and 9 that the various openings shown in FIG. 7 correspond to the positions of fastener elements in FIG. 1.

FIG. 8 is a bottom view in partial section of FIG. 7 showing further details of construction of the hinge element 32 and of other parts of the hinge casting 12.

FIG. 9 is a side view of the switch casting of FIG. 7 depicting further relationships of the hinge element 32 as well as other features. Of particular interest is the flat area 46' which is provided to mate with the flat step 46 shown in FIGS. 4 and 5 to enable positive contact to be established between the metallic end fitting 8 and the switch, or hinge, casting 12.

FIG. 10 is a view showing the right side of the switch casting as depicted in FIG. 9. In this view, the hinge element 32 is shown from another view. The relationship of the flat area 46' to the casting 12 is shown in a new perspective.

While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

I claim:

1. An in-line disconnect switch, comprising insulation means including a rod formed from insulating material of high tensile strength, means securing a metallic end fitting to each end of the rod to enable a mechanical connection to be completed between two ends of a power line, said means securing said metallic end fittings and rod together serving to prevent rotation of said end fittings relative to each other about a longitudinal axis through the rod, an electric switch comprising switch support bodies interconnectable for electrical conductivity through mechanical linkages including a metallic switch blade, and means for mating together said switch support bodies and said metallic end fittings to prevent transnational and rotary motion between them, said means for mating including mating elements on at least one of said switch support bodies and on one of said metallic end fittings, and clamping means for holding together a mating element on at least one end fitting and a mating element on at least one switch support body to prevent rotary motion between the electric switch and the metallic end fittings.

2. A switch as claimed in claim 1, in which the rod formed of insulating material is of fibre glass, and the metallic end fittings are cramped to the rod.

3. A switch as claimed in claim 1, in which the rod formed of insulating material is of fibre glass, a chemical sealant is applied between the fibre glass rod and the metallic end fittings, and the metallic end fittings are cramped to the rod.

4. A switch as claimed in claim 1, in which each metallic end fitting is shaped externally substantially as a section of a cone, each metallic end fitting fits over one end of the rod so that its small end is located adjacent to the rod, and said clamping means in cooperation with the taper of said cone prevents translational motion resulting from forces tending to pull the end fittings towards the rod.

5. A switch as claimed in claim 1, in which the means for mating includes a flat portion on at least one end fitting and a matching flat portion on a corresponding switch body.

6. A switch as claimed in claim 1, in which each metallic end fitting is shaped externally substantially as a section of a cone.
each metallic end fitting fits over one end of the rod 
said means for mating includes a flat portion on each 
said clamping means in cooperation with the taper of 
said cone prevents translational motion resulting 

from forces tending to pull the end fittings towards 

the rod, and 
said clamping means in cooperation with the flat por-
tion of each end fitting and the matching flat por-
tion of each switch body prevents rotary motion 
between the end fittings and the switch bodies.