ABSTRACT
An electric disconnect switch of high voltage capabilities constructed of relatively lightweight material and with a minimum of copper to reduce the dead weight load of the structure.

6 Claims, 3 Drawing Figures
CENTER BREAK DISCONNECT SWITCH

BACKGROUND OF THE INVENTION

This invention relates to electric switches and more particularly to a construction of such switches to effect a material reduction in the weight thereof without reducing the voltage capacities thereof.

In certain types of outdoor high voltage electrical switches, difficulties prevail in providing a switch construction in which parts, such as hinges, that are required to be good conductors as well as have mechanical strength exhibit good wear characteristics. This problem exists because of the high resistance oxide coating which forms on such lightweight materials such as aluminum due to atmospheric conditions. Also, when aluminum is structurally integrated with a different conducting material, such as copper, a corrosion coating is experienced. In an aluminum switch, which is a good electrical conductor, problems in providing the aluminum parts with a silver coating have been found to be impractical, extremely costly and generally not satisfactory since aluminum and silver are incompatible metals. Various constructions have been proposed as exemplified by the following related art:

U.S. Pat. No. 3,513,272 — Bridges
U.S. Pat. No. 3,544,741 — Kuhn
U.S. Pat. No. 3,544,742 — Frisk

SUMMARY OF THE INVENTION

In accordance with the present invention, an electrical disconnect switch is provided having a maximum of components of aluminum and a minimum of copper. The V-configured switch has aluminum arm structures, one of which is provided with a female aluminum contact insert. The other arm structure is provided with a tinned copper male insert adapted to mate in electrical conducting relationship with the female insert. The aluminum terminal pads serve both as a conductor base and also as one portion of a hinge assembly. The other portion of the hinge assembly, also aluminum, is bracketed to the terminal pad portion by a pair of pivot studs.

The contact ends of the switch arms are provided with male and female contact inserts adapted to electrically engage to establish an electrical circuit through the switch.

The construction set forth has advantages in that with the hinge assembly constructed of like material no differential in expansion or contraction due to different coefficients of expansion is experienced.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation of a V-configured center break disconnect switch embodying the invention;

FIG. 2 is an enlarged fragmentary view of a hinge assembly; and

FIG. 3 is an enlarged fragmentary view of the contact arrangement in the arm members.

Referring now to the drawings and more particularly to FIG. 1, the disconnect switch 10 shown, in which the invention has been incorporated, is a center break disconnect switch mounted in V-configuration. The switch 10 includes a base 11 which is adapted to be mounted on supporting structure 12. A pair of insulators 16 and 17 are supported on the base 11 at an angle of approximately 30° from the vertical plane. To this purpose the base 11 is provided with inclined or sloped surfaces 18 and 19, each of which mounts rotatable insulator supports 21 and 22, respectively. The insulator 16 is secured to the support 21 to rotate with it while the insulator 17 is mounted on the support 22 for rotation with it. Rotational movement is imparted to the support 21 by means of a lever arm 23 which is connected in a well known manner to a drive mechanism (not shown). A rotational input to the support 21 is imparted to the support 22 by means of gearing 24 disposed within the rotate base 11, or the rotate base assembly, and a female aluminum arm 28 supports an arm 29 of aluminum that carries a male contact member 28. The hinge structure 27 supports an aluminum arm 28, which is complementary to the arm 28, and carries a female contact member 28. Thus, movement of the arm 23 in one direction will effect a rotational movement of the insulator 16 in one direction to swing the arm 28 to an open position. Since the gearing or levers 24 operate to interconnect the insulators, the insulator 17 will also rotate simultaneously with the insulator 16 but in the opposite direction. Thus, the arms 28 and 31 will be moved in an arcuate path to open position.

The hinge assemblies 26 and 27 are identical, and therefore, a description of the hinge assembly 26 will also apply to the hinge assembly 27. As shown in FIG. 2, the hinge assembly 26 includes an aluminum terminal pad 41 which is adapted to receive a conductor 42 in electrically secured relationship. The hinge end 43 of the terminal 42 is inclined upwardly at an angle from the horizontal plane which is the same as the angle at which the insulator 16 and 17 are inclined from the vertical plane, which is illustrated preferred arrangement is 30°. The inclined portion 43 of the terminal pad 41 is formed with a boss 44 in which a bore 45 is formed. A cylindrical copper sleeve 51 having a coating of silver plating is disposed within the bore 45 of the terminal pad 41. The outside diameter dimension of the sleeve 51 is oversize with respect to the inside diameter of the bore 45 so that an interference fit is obtained between the wall of the bore 45 and the external surface of the sleeve 51 to establish a good electrical engagement therebetween.

The boss 43 serves as a hinge point about which the contact arm 28 pivots. To this end the sleeve 51 is formed with a threaded bore 52. A pair of copper hinge studs 53 and 54 having threaded ends 56 and 57, respectively, are threadedly engaged in the threaded bore of the sleeve 51. As shown, the outwardly extending ends of the studs 53 and 54 are of cylindrical form. The outer ends of the sleeve bore 52 are counterbored as at 61 and 62 to receive O-rings 63 and 64 that are mounted on the studs 53 and 54 below the cylindrical portion of the studs. With the studs 53 and 54 threaded into operative position in the sleeve 51, the O-rings 63 and 64 operate to seal the threaded joints from the weather and to exclude the corrosion effect of the environment from affecting the threaded joints.

As previously mentioned, the arm 28 is pivotable in an arcuate path of travel between open and closed positions. To this end, the end of the aluminum arm 26 adjacent the insulator 16 is provided with a female aluminum component 71. As shown, the hinge component 71 comprises a U-shaped main body 72. Extending lat-
erally from the cross bar 73 is a sleeve portion 74 which receives the end of the contact arm 28. The sleeve 74 is split to form yieldable clamp portions each of which has depending flanges 76, one of which is shown. Bolts 77 extending through the flanges 76 operate to effect clamping of the sleeve 74 around the end of the arm 28.

The lower leg portion 78 serves as a base which is adapted to be secured as with bolts (not shown) to the upper end of the insulator 16. Extending upwardly from the top surface of the base leg portion 78 is a C-shaped clamp 79 which is adapted to engage the cylindrical portion of the lower pivot stud 54. A bolt 80 extends through a suitable opening formed in the free end of the C-shaped clamp portions and is threadedly engaged in a suitable threaded bore formed in the fixed portion of the clamp. Thus, the lower end of the hinge component is securely clamped to the stud 54.

The upper extending leg of the U-shaped hinge portion is formed with a C-shaped clamp portion 81 which is adapted to be engaged on the cylindrical portion of the upper pivot stud 53. A bolt 82 extending through the free end of the C-shaped clamp is threadedly engaged in the fixed portion of the clamp to securely clamp the upper leg of the hinge to the stud.

With this arrangement, rotation of the insulator 16 will effect a like rotation of the hinge portion 71 relative to the terminal portion 41. With the hinge portion 71 securely clamped to the upper and lower pivot studs 53 and 54, the stud will rotate in the threaded sleeve 51 maintaining good electrical contact therebetween.

With this arrangement, an extremely lightweight mechanically strong disconnect switch having good electrical transfer characteristics is provided. A material reduction in the cost of the switch is realized and a neat appearing low profile structure is obtained. In addition, the arrangement of the silver plated upper pivot studs 53 and 54 in cooperation with the silver plated copper sleeve 51 reduce the amount of copper in the switch to a minimum.

With the hinge component 71 clamped to the copper studs 53 and 54, the pivotal movement of the hinge component 71 between closed and open position will effect a-like pivotal moment of the studs. This pivotal movement of the studs 53 and 54 within the sleeve 51 tends to reduce the electrical continuity between the threads of the studs and the threaded bore 52 of the sleeve 51. To prevent the loss of electrical continuity and still not interfere with the pivotal movement of the studs 53 and 54, a belleville spring washer 75 is disposed within the sleeve bore 51. The belleville spring washer 75 operates on the adjacent inner axial end faces of the studs 53 and 54 tending to force the studs away from each other. This force operates to eliminate any spacing which may occur between the upwardly facing surfaces of the threads of the stud 53 and the adjacent downwardly facing surfaces of the threaded bore 51, as viewed in FIG. 2; similarly, the stud 54 is maintained in position wherein the downwardly facing surfaces of its threads are maintained in intimate engagement with the adjacent upwardly facing threads of the sleeve bore 51. Thus, irrespective of the pivotal movement of the studs 53 and 54 relative to the sleeve 51, good electrical current transfer is maintained.

The male contact 29 carried by the arm 28 is formed with a tubular stem portion 86 which is received in the end of the tubular arm 28 with an interference fit therebetween. The female contact 32 is formed with a U-shaped aluminum body portion 87 having a tubular stem portion 88 which is received within the end of the tubular arm 31 with an interference fit therebetween.

The upper extending leg 89 of the U-shaped body 87 is adapted to support a resilient contact blade 91 which is screw fastened to the upper leg 89. The free end 90 of the resilient contact blade 91 is curved outwardly and backwardly with a smooth curvature to provide a corona reduction end thus eliminating the need for a separate corona shield. A leaf spring 92 is also secured to the upper leg 89, and it is disposed in overlying relationship to the resilient contact 91. A similar arrangement is provided for the lower contact. Thus, the lower extending leg 95 of the U-shaped contact body 87 supports a resilient contact 96 which is screw fastened to the leg. The free end 97 of the resilient contact blade 96 is likewise curved outwardly and backwardly with a smooth curvature to provide a corona reduction end. A leaf spring 98 is also secured to the leg 95, and it is disposed in overlying relationship to the associated resilient contact 96.

Each of the resilient contacts 91 and 96 are provided with contact blocks on pads 98 and 99 with which the male contact 29 will engage to establish good electrical engagement.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A current transfer hinge arrangement for a disconnect switch having at least one movable contact arm;
   - an aluminum terminal pad having a boss provided with a bore;
   - a copper sleeve having a threaded bore disposed in the bore of the boss of said terminal pad and in intimate current transfer engagement;
   - a pair of copper studs threadedly engaged in the threaded bore of said sleeve, each of said studs having a portion extending outwardly of said threaded bore in opposite directions;
   - an aluminum hinge operatively connected to said movable contact arm for supporting the contact for movement to open and closed positions; and,
   - a pair of spaced apart clamp members integrally formed on said hinge, said clamp members being secured to the extending ends of an associated arc of said studs;
   - wherein said hinge and the contact arm are movable relative to said terminal pad and a current transfer joint is established therebetween by said sleeve and said studs.

2. A current transfer hinge according to claim 1 wherein there is a resilient member within the threaded bore of said sleeve, said resilient member being operable to apply oppositely acting forces to said studs to bias said studs in opposite directions outwardly of the threaded bore of said sleeve thereby maintaining good current transfer engagement between the threads of said studs and the threads of the bore of said sleeve in any angular position.

3. A current transfer hinge according to claim 2 wherein said resilient member is a belleville spring washer.

4. A current transfer hinge according to claim 3 wherein said sleeve is copper having a coating of tin; said studs are copper having a plating of silver; and,
said terminal pad and said hinge as well as said contact arm are aluminum.

5. A current transfer hinge according to claim 4 wherein said hinge is provided with a contact arm clamping arrangement to effect a rigid supporting connection with said contact arm.

6. A current transfer hinge according to claim 1 wherein said sleeve is press-fit within the bore of the boss of said terminal pad.

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