MINERAL-FILLED CABLE CONNECTION

Filed Oct. 30, 1963

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

INVENTOR:
AZRIEL JAY RABINOWITZ

ATTORNEY
This invention relates generally to mineral-insulated cable connections and, more particularly, to a mineral-filled connection for joining together mineral-insulated cables.

Mineral-insulated cable, commonly known simply as MI cable, generally comprises one or more high conductivity conductors spaced and insulated from one another by finely divided magnesium oxide powder encased and compressed within a moisture-proof flexible metal sheath. The cable is usually used as a self-contained resistance heating element for preventing ice formation on drive-ways, rain gutters and the like. In addition, it has also been employed in power transmission applications in lieu of conduit-encased conductors.

In splicing such cable, in view of its customary use as a heating element, it is highly desirable to achieve connections having temperature rise and heat dissipation characteristics which approach as closely as possible the characteristics of the cable itself. It is also desirable that these connections be moisture-proof, since moisture has serious adverse effects on the mineral insulating materials most commonly used.

Previously, a variety of MI cable connection techniques have been used to achieve these ends. One method among those previously known involves baring and connecting the conductors at the ends of two cables, positioning a relatively large diameter tubular sleeve around the cable ends at the joined conductors, plugging one end of the sleeve around one cable, positioning the sleeve vertically with axial filling with powdered magnesium oxide, removing the unplugged end, then plugging the second end, and finally crimping or otherwise securing each end of the tubular sleeve to the sheath of the corresponding cable. Usually, it is desirable and necessary to tamp the powder into the case before plugging the second end.

This method suffers from the difficulty and inconvenience of axially filling the sleeve through a peripheral opening at one end, as well as from the inability to inspect for complete filling and proper powder distribution, and from the necessity of positioning the partly completed joint vertically during filling.

It is thus an object of the present invention to provide a connector construction for MI cable wherein mineral insulating powder fill may be evenly distributed about the spaced apart conductors and visually inspected for complete filling and compaction.

Other objects are to provide such a construction which avoids end filling, which is adjustable to a variety of cable sizes, which can be employed with compression tools, and which can be completed while held in a comfortable horizontal position.

These and other objects of the invention are attained and new results accomplished, as will be readily apparent from a consideration of the connection and related parts described hereinafter, particularly pointed out in the appended claims, and shown in the attached drawings, in which:

FIGURE 1 is a plan view of a connection formed in accordance with this invention, shown partly sectioned along the longitudinal axis to illustrate the novel inner construction;

FIGURE 2 is a plan view of the open side tubular insulation support which forms a part of the connection of FIGURE 1;

FIGURE 3 is a transverse sectional view taken in the plane 3—3 of FIGURE 1;

FIGURE 4 is a longitudinally sectioned view of a modified form of connection employing a reducer plug;

FIGURE 5 is a pictorial view of the reducer plug employed in FIGURE 4;

FIGURE 6 is a pictorial view of the modified insulation support employed in the modified connection of FIGURE 4.

In general, the invention comprises a connection incorporating a powder case which is basically a tubular element provided with a longitudinal opening such as an open seam. Powdered magnesium oxide is poured into the joint through the opening of the powder case. Except for the longitudinal opening, the case substantially encircles the ends of the MI cable being connected.

More specifically, as is shown in FIGURE 1, the connection is provided with an outer sleeve 10, which may be indented at each end, as at 12 and 14, to MI cables 16 and 18 respectively. In the connection shown, the ends of the cables are stripped back, exposing the bared conductors 20 and 22. These are spliced together by means of copper or similar splicing sleeves 24 and 25 which are crimped to the opposed ends of the corresponding pairs.

The powder case illustrated in FIGURES 1 and 2 comprises the tubular sleeve 26 which encloses the ends of the MI cable, the open, longitudinally extending seam 28 being expandable to accommodate different cable sizes. In this design, the case may advantageously be made of springy material, such as beryllium copper to resiliently grip and secure the cable ends in position.

The powder case in this embodiment is preferably made slightly smaller in inside diameter than the outside diameter of the MI cable. The wall thickness, for a case made of beryllium copper, may be as little as .005", which is sufficient to produce the desired gripping action in a sleeve of ordinary resiliency. This powder case design permits several sizes of MI cables to be accommodated, since the seam will very much wider, or close narrower, depending on whether a larger or smaller cable is being spliced.

Powdered magnesium oxide 30 similar to or identical to the insulation within cables 16 and 18 is evenly distributed over the spliced conductors, through the open seam 28, after conductors 20 and 22 have been crimped and the powder case has been positioned. The conductors within the connection are thus surrounded and spaced apart by the insulating magnesium oxide when the powder case is completely filled. Subsequently, the outer compression sleeve 10, which has previously been positioned over one of the cables, may be slid along the cable over the powder case and indented in position to form a completed, sealed and insulated connection.

As can be seen in FIGURES 2 and 3, an upset tab 32 is formed adjacent each end of the powder case to abut and position the opposed ends of the MI cables. The tabs maintain spacing of the cables during the powder filling operation and insure proper positioning of the spliced conductors.

If it is desired to connect an MI cable to a cable of reduced size, an adaptor 40 may be employed, as shown in FIGURE 4. The adaptor, preferably made of metal, is formed with an outside diameter substantially corresponding to the inside diameter of the compression sleeve 16a, but with sufficient clearance to permit the compression sleeve to slide thereon. The adaptor is provided with a reduced diameter portion 42 to permit insertion within the end of the powder container. An inner bore 44 permits the MI cable 16a to be inserted therein. The shouldered portion 42 may be crimped to the MI
cable 16a to fix the adaptor thereto, and prevent relative movement.

The powder case 26a illustrated in FIGURE 6 and shown in use in FIGURE 4, is a modification of the sleeve illustrated in FIGURE 1, and is especially useful with adaptors such as illustrated. It is formed with a seamless end 48, which encircles the MI cable 18a. The seamless end 48 also extends under the compression sleeve 10a to permit indentation of the compression sleeve through the seamless end 48 to the MI cable 18a. The seam opening 28a extends over the open conductors 20a and 22a, and over the adaptor shoulder 42. When powdered insulation has been poured through the seam 28a and the space between the conductors and the inner compartment of the powder case has been completely filled, the compression sleeve 10a is pulled over the powder case and the ends compressed to secure the sleeve, powder case and cables. As is shown in FIGURE 4, compression forces would be applied through seamless end 48 of the powder case for one cable, and through the adaptor 26a for the other cable, respectively.

The spliced connection embodying this invention, and compressed in the manner previously described, forms a moisture-proof joint, wherein the voltage and temperature rating of the connection approaches that of the MI cable itself.

The joint eliminates potting compounds, and brazing techniques hitherto employed. End tamping or filler plugs are avoided with an accompanying saving in time and skilled labor.

The present invention permits of visual inspection of the soundness of the joint during completion, which is a decided improvement over end-filling wherein such inspection is not possible. In addition, in end-filling the installer must continuously tamp the inserted powder until it "feels" firm. If excess powder is accidently inserted endwise, the joint must be tilted or reversed in vertical position to "pour out" the excess. Joints made by the end-filling method further require a sealing sleeve of finite thickness which must be inserted between the cable sheath and outer sleeve and then secured in position; as a result, end-filled connections generally require larger outer compression sleeves than connections made in accordance with this invention.

The invention has thus been described, but it is desired to be understood that it is not confined to the particular forms or usages shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of the invention; therefore, the right is broadly claimed to employ all equivalent instrumentalities coming within the scope of the appended claims, and by means of which objects of this invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to obtain these objects and accomplish these results.

I claim:

1. An insulating splice connection, comprising: a first electrical cable of the type having a conductor enclosed within a flexible metal sheath which is filled with powdered insulating material; a second electrical cable; an exposed conductor extending from one end of said first cable; an exposed conductor extending from one end of said second cable; a tubular powder case having the opposite ends thereof fitted over the ends of said first and second cables respectively; said exposed conductors being interconnected within said case; an open longitudinal slit portion in said powder case of permitting introduction of loose powder insulating material into the interior of said case; powder insulating material filling the interior volume of said case between said first and second cables and surrounding the exposed conductors therein; and an outer sleeve enclosing said powder case and covering the said longitudinal slit portion; said sleeve being sealed to said cables at the ends thereof.

2. The connection of claim 1, wherein the powder case is provided with at least one inwardly extending projection abutting the end of one of the cables and positioning the case relative thereto.

3. The connection of claim 1, wherein the outer sleeve is compressed to the exterior periphery of the cables to seal the connection therebetween.

4. The connection of claim 1, wherein the powder case is made of springy material for gripping the periphery of at least one of the cables.

5. The connection of claim 1, wherein the outer sleeve is compressed to at least one of the cables through the powder case.

6. The connection of claim 1, wherein an adaptor is provided for one end of the powder case, said adaptor having a central bore and an end portion of reduced diameter inserted into the powder case, and a cable having a diameter less than the interior of said powder case is positioned within the bore of the adaptor.

References Cited by the Examiner

UNITED STATES PATENTS

297,927 4/1884 Goebel X
3,146,299 8/1964 Norton

FOREIGN PATENTS

461,239 2/1937 Great Britain.

ROBERT K. SCHAEFER, Primary Examiner.

DARRELL L. CLAY, Examiner.