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Stoneberger et al.

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[54] **PREPARING CABLE FOR SPLICING**

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[52] **U.S. Cl.** ..... **219/76,** 29/486, 29/628, 174/21 R

[51] **Int. Cl.** **B23k 9/04**

[58] **Field of Search** ..... 219/73, 76; 174/21 R, 22 R, 174/90; 29/486, 494, 628

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

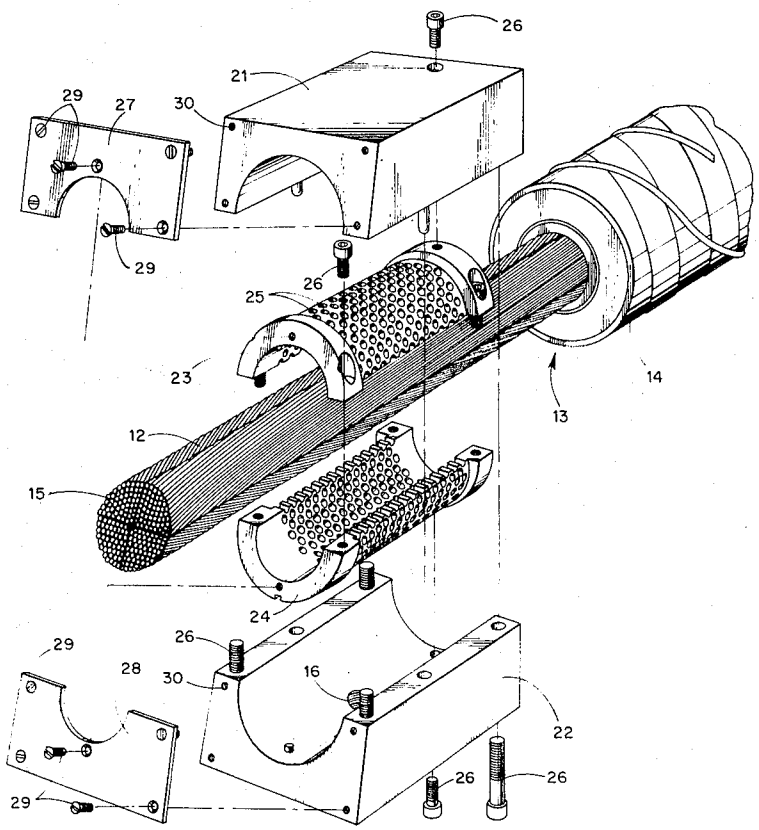
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[57] **ABSTRACT**

A high vacuum chamber surrounds each exposed end of a segmented aluminum conductive paper insulated cable for preventing the oil from the impregnated cable insulation from migrating to the end of the conductor after the aluminum conductor is cleaned with solvents to permit heliarc welding or buttering of the end of the conductor prior to splicing.

2 Claims, 2 Drawing Figures



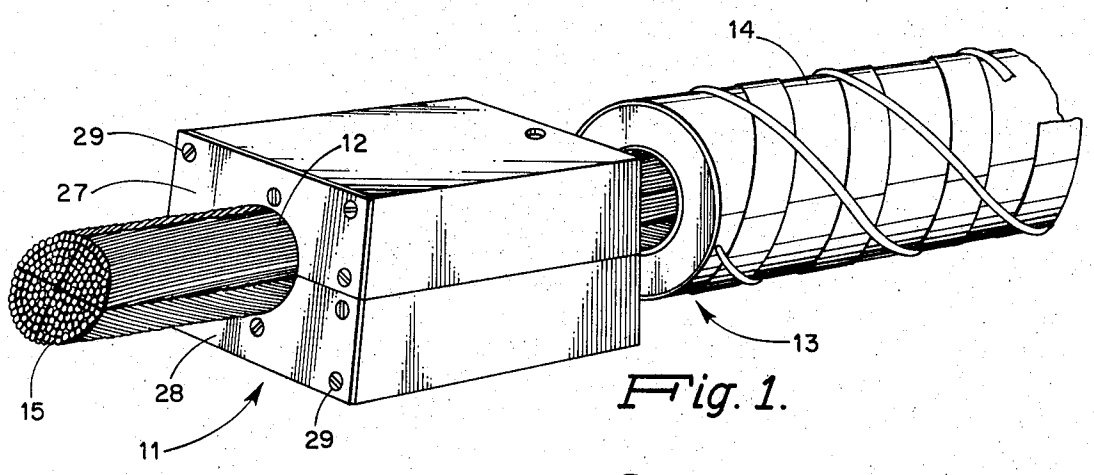

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Fig. 1.

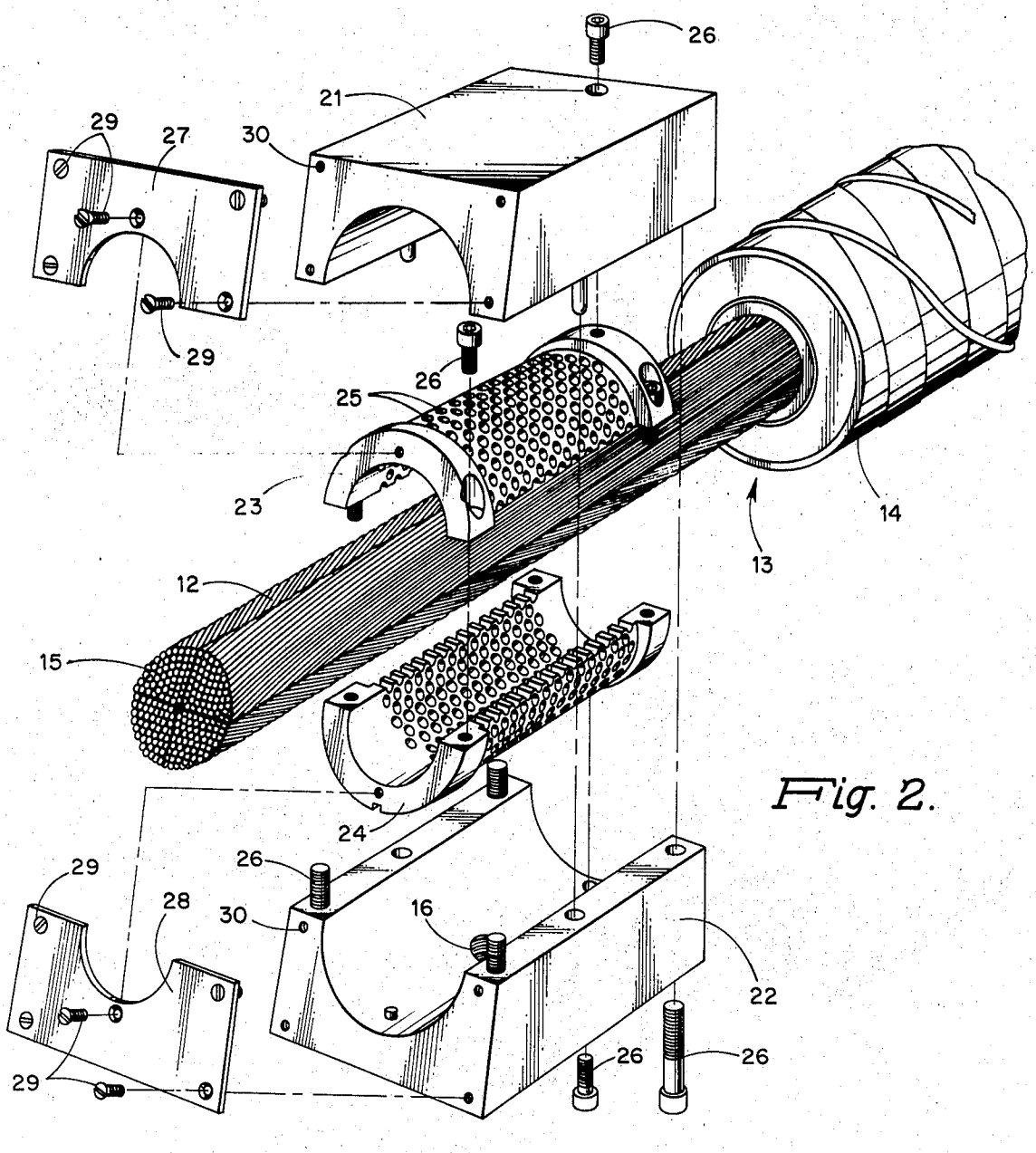

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Fig. 2.

PREPARING CABLE FOR SPLICING

BACKGROUND OF THE INVENTION

The present invention relates in general to preparing cables for splicing and more particularly concerns novel apparatus and techniques for preparing high voltage aluminum conductor paper insulated cable for splicing with techniques that save thousands of dollars in material and labor while effecting a marked reduction in hazards by using less potentially toxic and inflammable cleaning solvent by an enormous factor when compared to prior art techniques.

High voltage aluminum cable has a number of advantages for power transmission. It has high conductivity, relatively light weight and relatively low cost. A disadvantage of such cable is the difficulty in splicing one cable end to another.

Such cables are typically insulated with oil-impregnated paper insulation. Preparatory to splicing, the end of a cable is stripped of insulation, a bias cut made and the ends of the aluminum strands making up the cable welded together by heliarc welding, a technique commonly referred to as "buttering" the end. It is essential that the end of the cable be perfectly clean before buttering. To this end 36 gallons of chemical are typically poured over the cable end according to the prior art technique. A typical solvent is Freon TF costing $5 per gallon. An alternate solvent is Chlorothene NU. The problem is that as the end of the cable is heated while being buttered, oil tends to migrate towards the end. If even a drop of oil reaches the area being welded, an imperfect weld is produced that cannot be tolerated in a cable handling high powers. The prior art technique typically takes about 6 hours per splice with labor charges at $20/hour, not including capital costs of the expensive equipment required in connection with performing the weld and maintaining the humidity and temperature in the manhole where the splice is being made substantially constant. Moreover, there are serious problems of maintaining safe conditions for such a long period, there being danger of obnoxious fumes overcoming the workers and fires occurring in the manhole. At one manhole fire three men were kept in the hospital for 6 weeks following such a fire.

Accordingly, it is an important object of this invention to overcome one or more disadvantages enumerated above.

It is another object of this invention to achieve the preceding object while reducing material costs, labor costs and increasing safety in connection with splicing high voltage aluminum cables.

It is another object of the invention to achieve one or more of the preceding objects with apparatus that is relatively easy and inexpensive to fabricate and use.

SUMMARY OF THE INVENTION

The method according to the invention includes the steps of buttering the end of a stripped aluminum cable while evacuating the region around the stripped cable intermediate the end and the standing part of the cable to prevent contaminant from migrating to the end being buttered.

Apparatus according to the invention comprises means defining an annular volume for clamping relationship with a stripped end of the cable formed with openings on the inside wall thereof communicating with the annular chamber and an outlet for connection with a source of vacuum for evacuating the annular volume to withdraw foreign material tending to migrate toward the cable end from the cable.

Numerous other features, objects and advantages of the invention will become apparent from the following specification when read in connection with the accompanying drawing in which:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of an embodiment of the invention attached to a cable; and

FIG. 2 is an exploded view of the embodiment of FIG. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference now to the drawing and more particularly FIG. 1 thereof, there is shown a perspective view of an embodiment of the invention. The high vacuum zinc test chamber **11** surrounds the stripped portion **12** of cable **13** covered with paper insulation **14** when the biased stripped end **15** is buttered. A fitting **16** (FIG. **2**)is connected to a vacuum source not shown that evacuates the annular region surrounding the stripped cable to cause oil and other foreign material to be drawn into the chamber before it contaminates the strands being welded.

Referring to FIG. **2**, there is shown an exploded view of the embodiment of FIG. **1**. Chamber **11** comprises upper and lower outside portions **21** and **22**, respectively, formed with a semicircular interior for accommodating upper and lower inside inserts **23** and **24**, respectively, each formed with a mesh of openings **25**. Hex head bolts **26** fasten the assembly together clamped about the stripped portion **12** of cable **13** so that the openings **25** provide a substantial vacuum to the stripped cable portion **12** contacted to remove foreign materials before they migrate to the end **15** being buttered.

A stainless steel face plate having an upper portion **27** and lower portion **28** is secured to the end of the assembly by screws **29** in tapped holes **30** for preventing sputtered aluminum from damaging the chamber **11**.

Having described the structure, it is appropriate to consider the method by which it is used according to the invention. In a conventional manner the end of a cable to be welded is stripped and the end bias cut. The stripped end is then washed with eight ounces of cleaning solvent. This compares with the use of **36** gallons according to the prior art approach. The two halves of chamber **11** are then clamped about the stripped portion of the cable, preferably with the back face against the paper insulation. The hex bolts are tightened. It is to be understood that different inserts **23** and **24** may be used for cables of different diameter. The vacuum line is then connected to vacuum fitting **16**, and the vacuum source turned on to evacuate the region around the stripped end of the cable between the insulation and the end along a length of the cable that is greater than the cable diameter. Aluminum weld may then be applied to the end **15** while in contact with a heliarc welding rod to butter the end. The process just described is repeated upon a cable to be spliced to the first-mentioned cable.

While not a part of the invention, it may be helpful to understand the remaining steps in the complete splicing process. The two buttered ends are inserted in a connector comprising spaced rings joined by a number of rods to form a V-shaped recess between the two bias-cut cable ends. This recess is filled with aluminum weld while the Heliarc contacts the joint to fill the recess and establish good mechnical and electrical contact between the opposed faces of the ends. Paper tape is then wrapped around the bare portion in layers so that the splice is covered with insulation of substantially the same thickness as the rest of the cable. A complete splice following the principles of the invention can be made in only a half hour as compared with 6 hours according to the prior art approach. The savings in labor costs at $20 per hour are considerable. Furthermore, the saving of more than 31 gallons of cleaning solvent per splice effects still a further saving in costs. And the capital costs per splice are necessarily reduced because of the reduced time per splice. Of perhaps prime importance is the increased safety factor because of the small amount of cleaning solvent required per splice.

There has been described novel apparatus and techniques that effect marked savings in time, materials and labor while appreciably enhancing safety in connection

with splicing high voltage cables underground. It is evident that those skilled in the art may now make numerous uses and modifications of and departures from the specific apparatus and techniques disclosed herein. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features present in or possessed by the apparatus and techniques herein disclosed.

What is claimed is:

1. A method of buttering the end of a stranded cable that has been stripped of insulation which method includes the steps of,

first cleaning said end with a small amount of solvent,

then evacuating the region around a portion of the stripped end of the cable between the end of the insulation and the cable end along a length of the cable that is greater than the cable diameter while applying heat to butter the end while preventing contamination from migrating to the end being buttered to keep said end free of contaminant.

2. A method of buttering in accordance with claim **1** wherein said cable is high voltage stranded aluminum cable and the step of applying heat comprises contacting the cable end with a welding electrode.

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