Jan. 3, 1928. 1,655,258

W. E. BOYLE

HIGH TENSION CABLE JOINT

Original Filed March 22, 1923

FIG 1

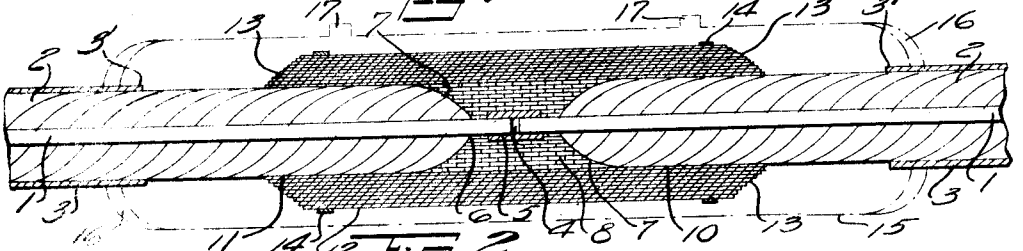


FIG 2

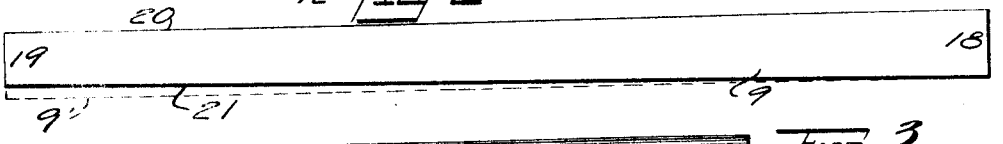


FIG 3

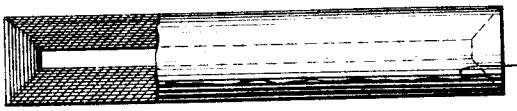


FIG 4

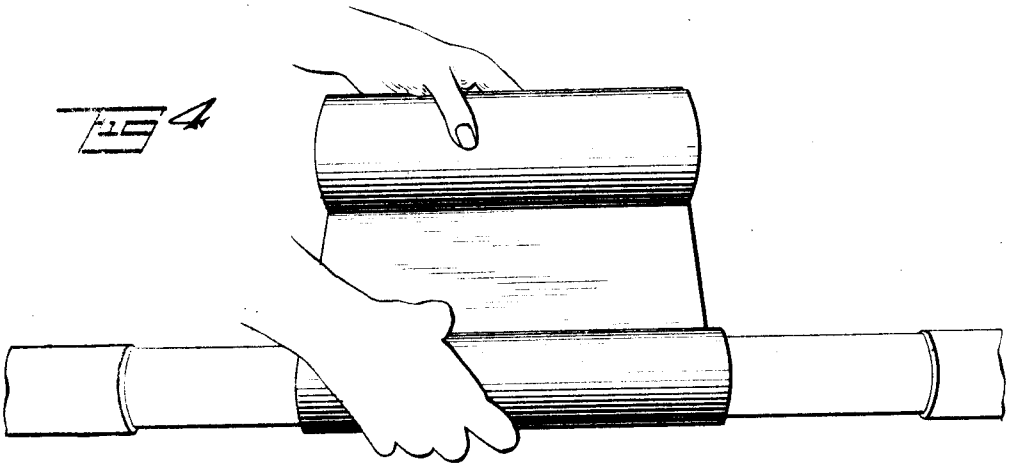
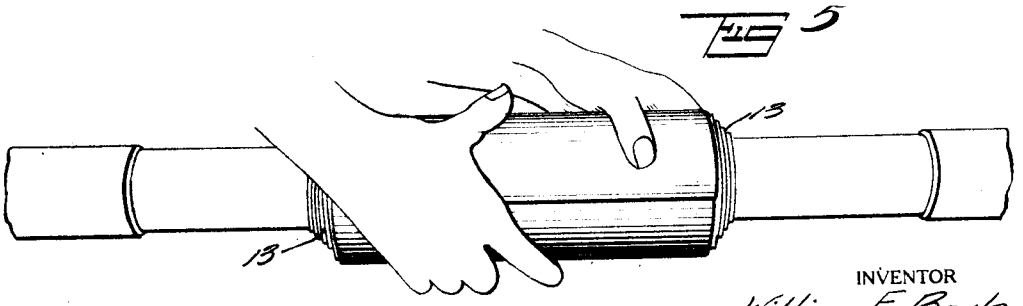


FIG 5



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UNITED STATES PATENT OFFICE.

WILLIAM EDWARD BOYLE, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO ENGINEERING PRODUCTS CORPORATION, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

HIGH-TENSION-CABLE JOINT.

Continuation of application Serial No. 626,756, filed March 22, 1923. This application filed May 23, 1924. Serial No. 715,314.

This invention relates to high tension cable joints.

This application is a continuation of my application Serial Number 626,756, filed March 22, 1923.

The object of the invention generally stated is a high tension cable joint for underground use which is capable of resisting to an unusual degree the ordinary break down and disruptive effects of electrical phenomena in high voltage transmission lines and particularly an improved method of insulation whereby an impaired cable may be economically joined and effectively insulated in the open air by an ordinary electrical worker to obtain a joint of a break down resistance equal to or greater than that of the original unimpaired cable.

In the progress of the art the voltages applied to underground cables are constantly being increased and it becomes increasingly difficult to obtain the necessary higher dielectric resistance with reasonable cost and within reasonable dimensions. The dielectric resistance must be effective as against puncture or creepage in any direction and involves the necessity of providing a joint as completely free as possible of entrapped air.

By my invention I am enabled to produce a cheap, relatively small, joint capable of withstanding very high voltages because it has not only a high dielectric resistance against puncture, or lateral resistance, but also a very high dielectric resistance in any possible creepage path between contacting insulation parts from the conductor at the joint to the cable sheath or to the metal enclosing the joint. My invention involves a joint in which the bared ends of the conductors to be joined are joined by a metal connector, preferably a sleeve; in which the bared ends of the conductor are covered by a tightly wound insulating tape until a covering is thus formed of the same diameter as the usual mill insulation of the cable, this tape preferably covering also previously enciled ends of the mill insulation; and in which the core formed of the mill insulation and the intervening tightly wound tape is surrounded by a continuous tightly wound roll of oiled paper or the like. The resulting joint is one which more thoroughly excludes air than any previous joint known to me and for this reason has a greatly increased dielectric resistance, both laterally and longitudinally.

I have found, however, that by using a slightly tapered sheet, it is possible to wind such a roll of sheet insulation, even though roughly cut, around the joint by hand more tightly than is possible if a sheet of uniform width and smooth cut is employed; and moreover that by winding the wide end of the sheet first upon the joint a roll of unusual tightness and firmness throughout its length is obtained, the comparatively mechanically imperfect or soft ends of a reversely wound roll or of a roll formed of a sheet of uniform width being obviated. The insulating roll may be formed of a single continuous strip would tightly about itself, but I have found it preferable in practice to divide the longer strips into longitudinally separated sections and wind these sections successively upon each other to form the roll. For example if the total length of strip and depth of roll exceed certain limits, a roll of greater uniformity in tightness and hardness throughout its depth with greater dielectric strength may thus be obtained.

For a better understanding of this invention, reference may be had to the following detailed description and the accompanying drawings wherein—

Fig. 1 is a longitudinal section through the cable joint;

Fig. 2 is a plan view of insulating strip employed in this invention;

Fig. 3 is a view of the strip rolled up;

Fig. 4 is a view illustrating the winding of the strip about the joint;

Fig. 5 is a view of the strip wound about the joint and being tightened and bound thereabout.

Referring to the drawings where like numerals designate similar parts throughout, a cable is illustrated (Fig. 1) having an interior conductor 1, a layer or covering of insulation 2 of suitable character and depth, and a metallic sheath 3 of the usual and standard character, this being a cable ordinarily employed in underground high tension transmission lines.

The cable is illustrated as having been

broken or impaired in the vicinity of point 4 and the present invention relates particularly to the repairing of the insulation at this point and the building up of the insulation thereabout of a character and in a manner to render the resistance of the cable to break down at this point equal to or greater than that of the unimpaired parts of the insulated cable. The conductor parts 1 of the cable are mechanically and electrically connected and joined together by means of a metallic sleeve 5 which surrounds and closely embraces the free ends of the conductor 1 and is secured and sealed thereto in any suitable manner, as for example, by sweating the same thereon. The insulation 2 of the cable is removed at the point 4 of the cable and to a short distance on the opposite sides thereof, as for example, to the points 6. The insulation 2 is also tapered off along the lines 7 down to the points 6. The bared portion of the conductor 1 and the sleeve 5 are then enclosed and surrounded by suitable filling-in insulating material 8 to a depth substantially that of the cable covering or insulation 2. This insulation 8 may consist of a spirally wound narrow strip of suitable insulating material such as cambric tape, this tape being wound as indicated until the cable is filled in completely along the tapered lines 7 and the circumference of the insulation 8 forms an approximate continuation of the circumference of the insulation 2. A tapered strip of oiled insulating paper 9 which is wide enough to bridge and overlap the tapered ends of the insulation 2 is then wound and bound tightly about the insulation 8 and the insulation 2 as a foundation, the strip being wound wide end first so as to form a built up insulation of cylindrical or roll form 10 about the joint, the gradually narrowing of the tapered strip resulting in a slight shortening of the length of the roll from the inner surface 11 to the outer surface 12. The drawings which are more or less diagrammatic show the building up of this tapered strip along the bevel or conical edges 13. After the insulating strip is wound very tightly about the splice to form the cylindrical roll 10 it may be secured or anchored in position in any suitable manner to obviate any tendency of the roll to loosen. I have illustrated diagrammatically a binding means 14 disposed about the circumference of insulation 10 at either end thereof for this purpose. After this operation a suitable metallic sheath or container 15 is positioned over the splice with its ends 16 turned over into engagement with the metalic sheath 3, and sealed thereto to enable a suitable filler, such as petroleum jelly or other insulator, to be contained within the annular chamber formed thereby about the splice; openings 17 are indicated for introducing this filler. This filler serves the double purpose of insulating and excluding air from about the splice.

The strip 9 may be of any suitable width and length, but I have found a paper strip 0.004 inches in thickness, approximately fifty (50) feet in length, fourteen (14) inches wide at the wide end 18 and gradually narrowing to a width of twelve (12) inches at the narrower end 19, suitable for a cable of 500 C. M. copper with 20/32" paper insulation, carrying a tension of 45,000 volts delta or 26,000 volts to ground. The strip 9 may be tapered in any suitable manner, and in the particular embodiment shown I have illustrated it as having an upper straight edge 20 and a lower tapered or biased edge 21, the lower edge having a tapered strip 9' removed therefrom in order to produce the gradually and progressively tapering strip desired. It is understood that the tapering is exaggerated in Fig. 2 for convenience in illustration and exposition. The strip thus formed is then wound and bound tightly about the splice as indicated in Figs. 4 and 5, with the wide end 18 wound adjacent to the foundation of insulation 8 and covering 2. I have found it convenient to wind the strip into a roll illustrated in Fig. 3 with the narrow end roll first and the wide end 18 outside as a preliminary step to beginning the winding of the same about the splice, Fig. 4 illustrating the beginning of the winding operation, although it is obvious that the strip may be wound about the splice as indicated in Fig. 5 without this preliminary rolling step. The drawings illustrate the preferred procedure of binding the joint with the tapered strip 9, when done by hand, and such hand operation consists essentially in first winding the strip more or less loosely about the joint and then after such loose winding without any particular efforts to a tight wrapping, the roll is gripped by the hands as indicated in Fig. 5 and the roll bound tightly by twisting the roll in the direction of wind to tighten the same, each successive superposed layer of turn tending to bind tightly throughout its width against the next lower layer and prevent thereby the formation of air chambers at any point therebetween through which leakage might take place with the resultant tendency to disruption and break down. The roll of oiled paper thus enclosing and binding the joint is noticeably solid and firm throughout its length, even at its ends.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

A high tension cable joint having the cable insulation removed from end portions of the conductors and penciled to a taper, a metallic connector joining the conductors, a mass of insulating material consisting of fab-

ric tape directly surrounding the bared conductors, the connector and the penciled portions of the cable insulation and built up to a diameter approximately that of the cable insulation to form a substantially continuous cylindrical foundation therewith, and a closely wound roll of insulating material surrounding the cylindrical foundation and formed of an elongated sheet of insulation tightly wound about the foundation and about itself.

In testimony whereof, I have signed my name to this specification.

WILLIAM EDWARD BOYLE.