Nov. 13, 1934. M. E. NOYES 1,980,426

CONNECTER DEVICE FOR HOLLOW CABLES AND METHOD OF SECURING CONNECTIONS TO SUCH CABLES

Filed June 20, 1930 3 Sheets-Sheet 1

FIG. 1.

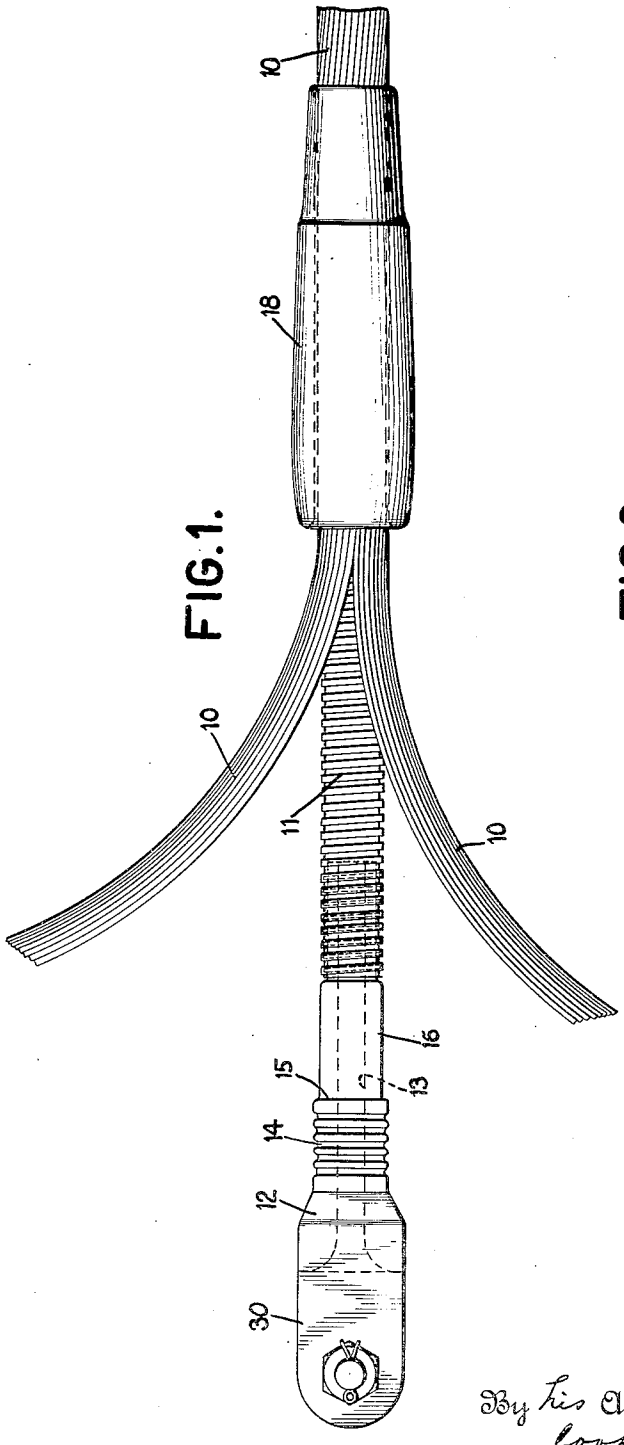
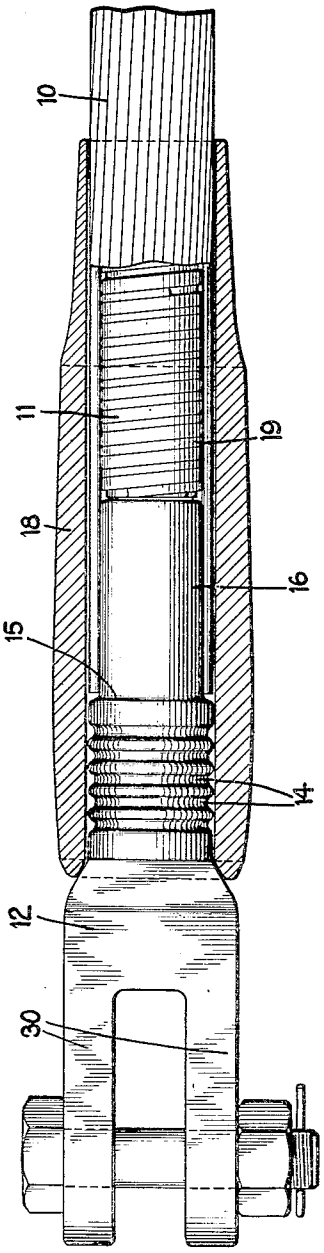


FIG. 2.



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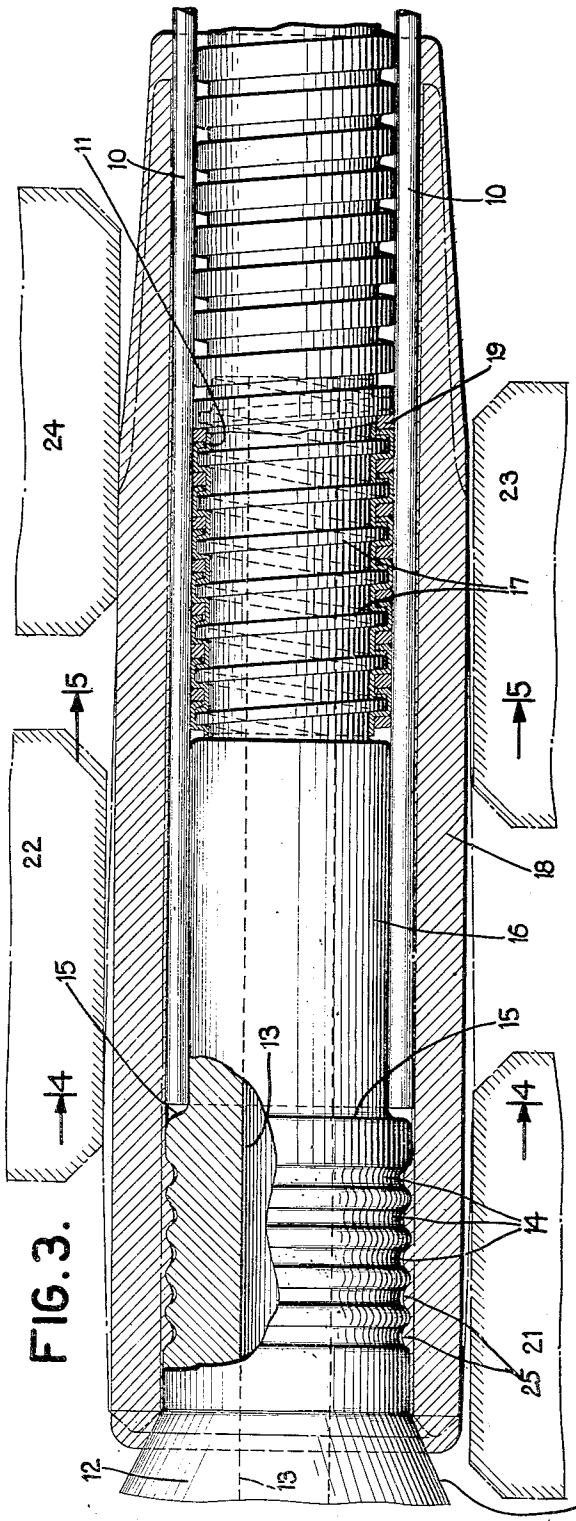


FIG. 3.

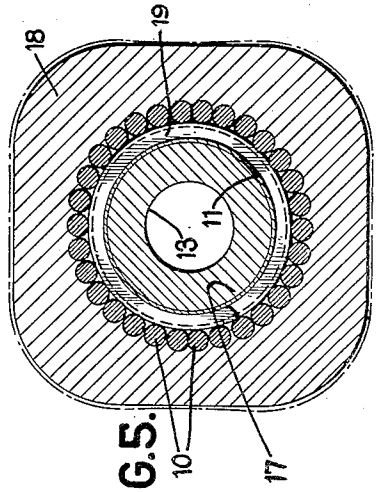


FIG. 5.

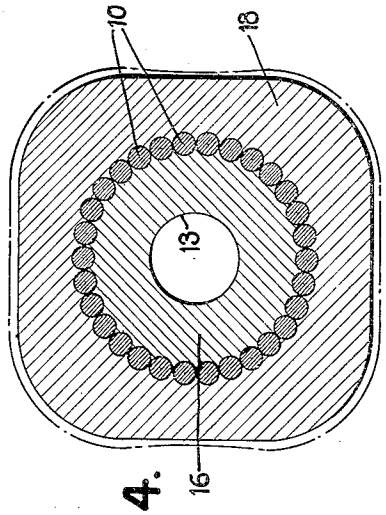


FIG. 4.

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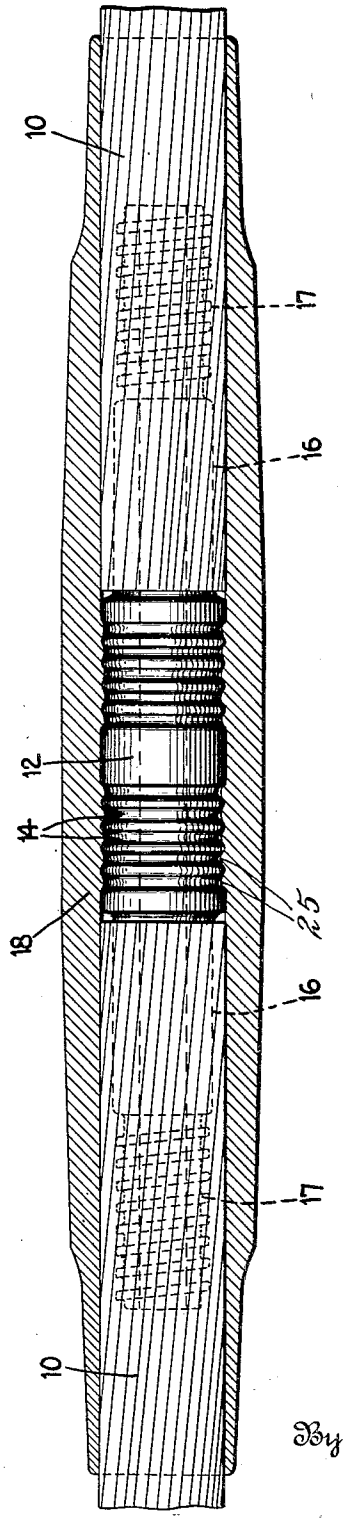


FIG. 6.

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UNITED STATES PATENT OFFICE

1,980,426

CONNECTER DEVICE FOR HOLLOW CABLES AND METHOD OF SECURING CONNECTIONS TO SUCH CABLES

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10 Claims. (Cl. 173—263)

In electrical cables for high voltage transmission lines corona loss is a factor which is taken into consideration in the design of cables and accordingly, to prevent such loss, cables have been constructed in which the overall diameter of the cable is increased. With such cable it is not necessary to increase the overall diameter of the conductors and also undue additional weight in the cables or conductors is not desirable. Accordingly, low corona loss cables have been previously designed in which aluminum conducting strands are wound upon the exterior surface of a hollow aluminum square locked tubing core. Such cables while well adapted to meet the requirements of low corona loss without undue weight, present certain difficulties when the cables are to be dead ended or supported or when individual cable sections are to be spliced.

The present invention is directed to a novel method and means for providing a connection between a hollow cable of this general class and a dead ending or strain relieving support and also to the provision of a construction and method of splicing independent sections of such hollow cable together.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawings which by way of illustration show what I now consider to be a preferred embodiment of the invention.

In the drawings:

Figure 1 shows a hollow cable of this class and one of the first steps of applying a connecter thereto;

Fig. 2 shows the second step with an exterior compression sleeve in position ready for subsequent compression;

Fig. 3 shows subsequent steps of compression;

Figs. 4 and 5 show detailed sectional views taken on lines 4—4 and 5—5 of Fig. 3, respectively, and in these figures the dot and dash lines represent the compression sleeve before compression and full lines represent the exterior contour of this part after compression; and

Fig. 6 shows the connecter used as a compression splice joint between two independent sections of cable.

In Figs. 1 and 3, the hollow cable proper comprises aluminum wire strands 10 wound upon the exterior surface of an aluminum square interlocked flexible tubing core 11. This tubing 11 is built up of inter-engaging helically coiled metal strips. Obviously a cable of this class offers high resistance to crushing from exterior clamping force, if such clamping force be applied radially. Otherwise care must be used to avoid crushing the cable. Accordingly, when such a cable is to be spliced or connected to a dead ending or strain relieving element, provision is made for preventing the crushing of the cable and preferably connections to the cable are established both exteriorly and interiorly. The interior parts prevent collapse of the cable and serve as an additional securing means.

The interior parts of the connecter will first be described. The part generally designated 12 is preferably made of aluminum and is made hollow as shown at 13 for the sake of lightness. It is provided with a number of grooves 14, with a shouldered portion 15, with an annular cylindrical portion 16 and with a threaded portion 17. The diameter of the cylindrical portion 16 is preferably substantially that of the exterior diameter of the flexible tubing core 11 and of the interior diameter of the strands 10 which are supported upon the tubing. The threaded portion 17 is properly shaped to thread into the interior of the convolutions of the flexible tubing core 11.

The so-called exterior part or compression sleeve is shown at 18. This is also preferably made of aluminum or the like for the sake of lightness. Initially the interior bore of this compression sleeve is straight as shown in Fig. 2.

The method of making a connection will now be described. The compression sleeve 18 is first slipped over the cable and backed off from the end a short distance. Thereafter the aluminum cable is wrapped at its end and at a short distance back from the end with adhesive tape not shown. The aluminum strands 10 at the end of the cable are then trimmed off evenly with a hack saw. The adhesive tape wrapping at the end of the cable is then removed and the aluminum strands 10 are bent back on a wide arc so as to avoid sharp bends (see Fig. 1). In this way the inner flexible tubing core 11 is bared. The inner flexible tubing core is then cut back a distance from the end, the distance being substantially that of the length of the cylindrical portion 16 of the element 12. For convenience in cutting, the flexible core may be wrapped with adhesive tape at the point of cutting, which adhesive tape is afterwards removed. The core or interior element is now painted with red lead on the threaded portion 17 and this threaded portion is screwed into the flexible tubing (see Fig. 1). Thereafter the adhesive tape is removed from the flexible tubing core and a length of flattened wire 19 is wound into the exterior

grooves of the flexible tubing core (see Fig. 3). The exterior of the flexible tubing which is served with the flattened wire and the cylindrical surface 16 is then painted over with red lead. Thereafter the aluminum conductor strands 10, which were previously bent back upon an arc, are brought down so that their ends overlie the cylindrical portion 16 of the inner element. The extreme ends of the strands 10 will now be disposed in proximity to the shoulder 15 (see Fig. 3). In bending back the strands 10 upon the surface 16, care is taken to smooth the wires down into a tight lay upon the cylindrical portion 16. It will be understood that the conductor strands 10 are preferably slightly spirally disposed with respect to the flexible core. However, in the drawings in Figs. 2 and 3, they are shown as extending straight with respect to the inner element. This disposition of these strands may be employed or they may be slightly spiralled with respect to the inner element if desired. Thereafter the corrugated or grooved portion 14 of element 12 and the end of the cable are thoroughly impregnated with red lead which is allowed to soak into the interstices between the strands of the cable. The wrapping of adhesive tape which was initially at a distance back from the end of the cable is now removed and the compression sleeve 18 is slipped along the cable until it tightly abuts the shouldered portion 20 of element 12, (see Fig. 3).

Thereafter the compression sleeve is exteriorly compressed by some suitable pressure applying means such as a hydraulic press. Preferably a series of separate compressing operations are employed and in compressing the sleeve, overlapping positions of the dies with respect to the sleeve are desirable. These overlapping positions are generally designated at 21, 22, 23 and 24 in Fig. 3. It will be understood that two half die members are employed which completely encircle the compression sleeve but for clarity of illustration the dies have been indicated on one side of the sleeve only.

By the compressing action, the metal of the compression sleeve is caused to flow inward and provides inter-engaging corrugations 25 which engage the grooves 14 on member 12. Also the material of the compression sleeve is compressed down into tight engagement with the strands 10 and these strands are thus exteriorly clamped and are interiorly compressed and clamped into engagement with the intermediate cylindrical portion 16 of element 12.

Figs. 4 and 5 show the compression sleeve compressed upon the inner element and upon the cable. In carrying out the compressing operations, preferably a less degree of pressure is desirable for the die positions 24 in order that the parts be not crushed at the relatively weakest point. The desired relative easement of pressure at the die positions 24 is automatically obtained by the sloping shape of the right hand end of the compression sleeve.

It will be understood that the flattened wire 19 serves as a filler in the grooves of the flexible tubing and thus aids in preventing collapse of the flexible tube material into what would otherwise be an open space.

In Figs. 1 and 2, the element 12 is shown as having a clevis end 30. It is obvious, however, that the element 12 can also be used for a compression spliced joint for connecting up two interconnecting joints of cable. When it is to be so used in lieu of the clevis portion 30 the element 12 would have it left hand end symmetrical with its right hand end as is indicated in Fig. 6.

By employing the method herein described, the connection of the hollow cable to the compression clamp is of two-fold nature. The inner flexible tube core is positively connected by the screw threads 17 to the inner element and in addition the outer aluminum wire strands 10 are also clamped to the interior element. Furthermore, the sleeve 18 is itself positively connected to the element 12 by the inter-engagement of projections 25 in grooves 14.

It is obvious that connecters of this class are equally applicable to hollow cables of the class described herein, either with or without a central reinforcing core cable of steel or other material. In the event that such a central core cable is employed, it would be independently jointed by means of a compression sleeve or some other suitable means well known to those familiar with the art.

What I claim is:

1. A cable connecter for making a connection to a cable having an inner flexible core with electrical conductors thereon, said connecter comprising a pair of elements, one element having a portion to engage within and with the inner flexible core, said element also having a substantially cylindrical portion adapted to directly receive and support the conductor strands, said element also having a grooved portion beyond the ends of the conductor strands, and a sleeve forming the other element of said connecter disposed without the conductor strands and compressed into engagement therewith and into engagement with the grooves upon the inner element for the purpose described.

2. In combination, a hollow stranded electrically conducting cable having a hollow supporting core, a connecter having an end portion extending into and engaging the end of the cable core, an intermediate portion engaged by the end portions of the stranded conductors, and a gripping sleeve tightly surrounding the assemblage and engaged with another portion of said connecter.

3. A cable connecter for a cable of the hollow core type in which conductors are supported by the core, said connecter having an end portion extending into and engaging the end of the cable core, said connecter having an intermediate portion engaged by the ends of the conductors, said connecter having another portion adapted for direct engagement with an exterior gripping element, and a gripping element surrounding the assemblage and engaged both with the conductors and with the last mentioned portion of the connecter.

4. The method of securing a connecter to a cable which cable has an inner flexible supporting core and electrical conductors surrounding and supported by the core, which comprises inserting the connecter into the flexible core and connecting it therewith, causing the electrical conductors to engage a peripheral portion of the connecter, and connecting the connecter to the cable end by forcing metallic connecting material into peripheral contact with the cable strands and the connecter.

5. A connecter for a hollow cable, said cable comprising conductor strands wound upon the exterior surface of an interlocked flexible tube having interior convolutions, said connecter including securing means cooperating with the cable interiorly and securing means cooperating with the cable exteriorly, said interior securing

means including a threaded connection with the interior convolutions of the interlocked flexible tube, and said exterior securing means including a compressed joint with the conductor strands of the cable.

6. A connecter for a hollow cable, said cable comprising conductor strands wound upon the exterior surface of a square interlocked tubing core having interior convolutions, said connecter including securing means cooperating with the cable interiorly and securing means cooperating with the cable exteriorly, said interior securing means including a positive threaded connection with the interior convolutions of the square interlocked tubing core, said exterior connection including a compressed joint with the conductor strands and an additional strengthening connection comprising a compressed joint which directly connects the exterior and interior securing means.

7. A cable connecter device for a hollow cable, said cable comprising conductor strands wound upon the exterior surface of an interlocked flexible tubing core, which core has interior convolutions, said connecter comprising an element having a threaded portion to engage the interior convolutions of the interlocked flexible tubing core and having another portion to receive the conductor strands themselves, said connecter also including an exterior compression sleeve element, the aforesaid connecter element also having a portion which is interengaged directly by the said compression sleeve element upon compression of the latter.

8. The method of securing a connecter to a cable, which cable has an inner flexible square interlocked tubing core with interior threads and which has electrical conductors wound upon the exterior surface thereof, which comprises inserting one element of the connecter into threaded engagement with the interior of the flexible square interlocked tubing core, placing another element of the connecter over both the conductors of the cable and over the first mentioned element of the connecter, then compressing the second element into engaging contact with the first element and into contact with the conductors.

9. A cable connecter device for a hollow cable, said cable comprising conductor strands wound upon the exterior surface of an interlocked flexible tubing core, which core has interior convolutions, said connecter comprising an interior element having a threaded portion to engage the interior convolutions of the interlocked flexible tubing core, said element having another portion to receive the conductor strands themselves, and said element having a further portion extending beyond said conductor strand receiving portion, and an exterior compression sleeve for interengagement with the conductor strands and with the interior element upon compression of said sleeve.

10. In combination, a hollow cable comprising conductor strands wound upon the exterior surface of a flexible interlocked tubing core, which core has interior convolutions, a connecter device including means for securing the connecter to the cable interiorly and means for securing the connecter to the cable exteriorly, said connecter device comprising an interior member having a threaded portion for engagement with the interior convolutions of the interlocked tubing core to secure and support the same, and said connecter comprising an exterior sleeve compressed into engagement with the interior member and conductor strands, said exterior sleeve being of such length that it extends beyond that portion of the cable which is supported by the interior member whereby the exterior sleeve and interior member are directly interengaged, and said sleeve being sloped towards the unsupported portion of the cable whereby the pressure applied to that portion of the sleeve during its application is lessened and crushing of the assemblage of cable and connecter at the relatively weakest point is prevented.

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