May 6, 1930. J. F. WATSON ET AL 1,757,030

ELECTRIC CABLE

Filed Jan. 12, 1928

Fig. 1.

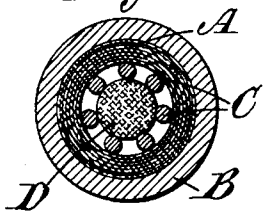


Fig. 2.

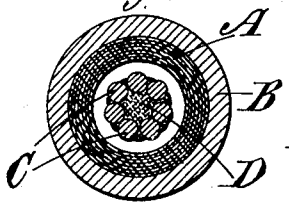


Fig. 3.

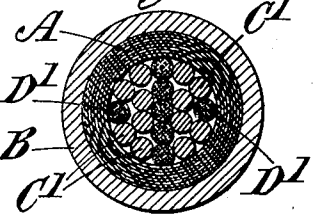


Fig. 4.

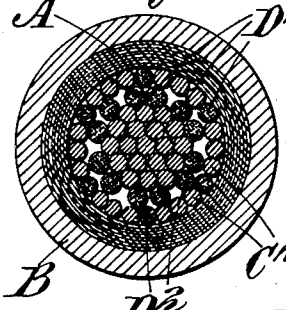


Fig. 5.

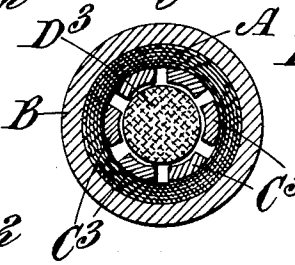


Fig. 6.

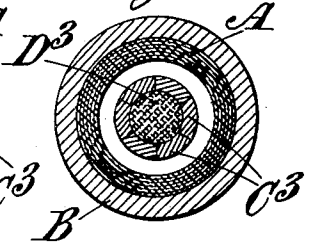


Fig. 7.

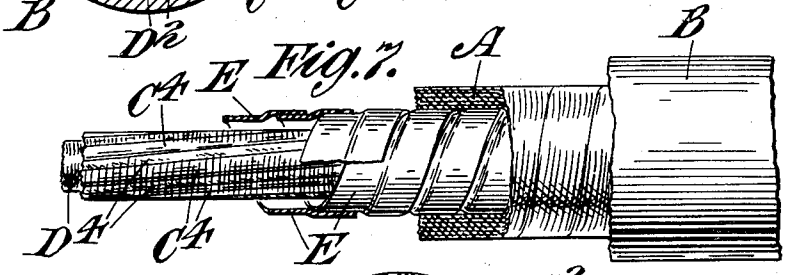


Fig. 8.

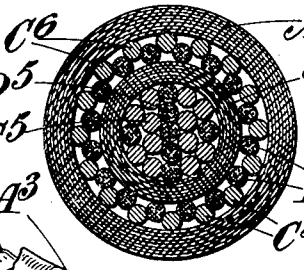


Fig. 9.



Inventors
J. F. Watson, P. V. Hunter & A. E. Wilson
Per Watson, Cost, Morse & Gruidle Attys.

Patented May 6, 1930 1,757,030

UNITED STATES PATENT OFFICE

JOHN FRANCIS WATSON, OF ABBEY WOOD, PHILIP VASSAR HUNTER, OF LONDON, AND ALFRED EDGAR WILSON, OF BROMLEY, ENGLAND

ELECTRIC CABLE

Application filed January 12, 1928, Serial No. 246,292, and in Great Britain April 25, 1927.

This invention relates to electric cables, particularly to high tension cables with one or more insulated conducting cores.

In the specification of our U. S. Patent No. 1,743,506, patented January 14, 1930, electric cables are described in which the di-electric is formed with a passage which, in the completed cable, surrounds the conductor and is of sufficient diameter to allow some movement of that conductor. Various ways in which such a passage may be formed are also described.

The present invention has the same object in view and is concerned with another way in which the desired passage may be made or, in other words, the desired freedom of movement of the conductor obtained.

It is to be understood that the term "conductor" as used in this specification refers to that part of the core which is surrounded by the di-electric; it may comprise strands or members of non-conducting material in addition to the metallic conducting members.

According to the present invention the conductor is so constructed that its diameter may be reduced, after the cable is made up, sufficiently to give the desired freedom of axial and/or radial movement between it and the di-electric. Thus instead of forming the passage initially it is produced by a reduction of the diameter of the conductor.

This reduction may be effected in any convenient way as, for example, by laying up the conductor with some of its strands, say in the outer layer or layers, made so that they are compressible or deformable, for instance, by applying tension to the conductor. These strands may be made of jute or loosely stranded paper, string or other similar substance, but are not necessarily of non-conducting material.

The tension or pull, when such force is used to reduce the diameter of the conductor, may be applied prior to jointing after the cable is laid, or to lengths of the cable at any stage before laying so that the clearance which is the object of the invention is produced.

It is to be understood that in carrying out this invention the paper or other di-electric may in some instances be directly around the conductor, although in other instances a tubular sheath, such as that mentioned in the specification of the pending application aforesaid, may be used to form a wall for the passage when formed by the reduction of the external diameter of the conductor. Such tubular sheath when present may with advantage be of conducting material or have its inner surface made conducting for the reasons mentioned in that prior specification.

It will be appreciated that although one core and one passage are referred to, the invention is applicable to multi-core cables and is indeed of particular utility when so applied.

In the accompanying drawings which illustrate various constructions of electric cables all according to this invention,

Figure 1 is a cross-section of a cable before the diameter of its conductor is reduced.

Figure 2 is a similar view after tension has been applied to the conductor,

Figures 3 and 4 are cross-sections of two other constructions of cable,

Figures 5 and 6 are views similar to Figures 1 and 2 but with the conductor constructed in a different way,

Figure 7 is a plan with parts broken away of another construction of cable,

Figure 8 is a cross-section of a concentric cable, and

Figure 9 is a plan with portions broken away of a three-core cable.

In Figures 1 to 7 the di-electric is indicated at A and will usually be of paper, and B represents an outer lead sheath which may or may not be present and does not itself form part of the present invention.

In Figure 1 the conductor of the cable is made by conducting members C laid up round a central member D of some compressible or deformable material. By applying tension to the conductor its diameter is reduced as shown in Figure 2, leaving a passage or space between it and the surrounding di-electric A.

In the cable shown in Figure 3 the conducting strands C^1 of the conductor are laid up with other strands D^1 of compressible or de-

formable material and in Figure 4 similar compressible or deformable strands D^2 are laid up with and under the outer layer of conducting strands C^2. Each of these figures shows the cross-section of the cable as made and before tension is applied to the conductor. When that tension is applied the passage or space is formed within the di-electric as described with reference to Figures 1 and 2.

It will be appreciated that, when the wires or conducting strands are laid up in helical form, the application of tension to the ends of these wires will tend to extend the helix and will thereby decrease the diameter of the helix, forcing the conducting strands into the compressible or deformable material so that the diameter of the entire conductor consisting of the members C and D is materially reduced. If desired, this tension can be applied to the entire conductor including the deformable material, but it will be apparent that the decrease in diameter of the conductor is effected primarily by the extension of the helix consisting of the conducting strands rather than by the extension and deformation of the cross-section of the individual strands.

In Figures 5 and 6 the conducting members C^3 are segmental and laid up round a central member D^3 of compressible or deformable material. Figure 5 shows the cable in section before the diameter of the conductor is reduced by applying tension to it, and Figure 6 is a cross-section of the cable after the tension has been applied and the passage formed between the di-electric and the conductor.

Figure 7 shows a portion of a cable having conducting strands C^4 laid up round compressible or deformable material D^4 as, for instance, in Figures 1 and 2, but inside the di-electric A is a tubular sheath E formed of over-lapping strip constituting the outer wall of the passage or space formed round the conductor when tension is applied to it.

Figure 8 is given merely as an example of one construction of concentric cable according to this invention. The inner conductor is made up of conducting strands C^5 and strands of compressible or deformable material D^5 and is surrounded by di-electric A^1. The outer conductor is made up of conducting strands C^6 and strands of compressible or deformable material D^6 and is covered with di-electric A^2. The figure shows the cable in cross-section as made. Tension applied to the inner and outer conductors will produce a passage or space between each conductor and its surrounding di-electric.

Figure 9 is an example of a multi-core cable according to this invention. It shows three conductors each made as described with reference to Figure 7 and comprising conducting strands C^7 laid up on compressible or deformable material D^7. The diameter of each conductor is reduced by applying tension to it and the outer wall of the passage or space thus formed is constituted by a tubular sheath E^1 to which the di-electric A^3 is applied. All three insulated cores may be surrounded by di-electric as at A^4 and the whole may be enclosed in a lead sheath B^1.

The tubular sheath E or E^1, when provided, may be of any desired construction and may be of metal or of non-metallic material. In the latter case it is preferred to render its inner surface conducting by coating it with metal foil.

It is to be understood that the passage or space formed between the di-electric and the conductor will not be an air space but will be filled with the oil or compound with which the cable is impregnated. If any oil or compound is withdrawn when tension is applied to the conductor it will be made good when the lengths are laid and jointed.

What we claim as our invention and desire to secure by Letters Patent is:—

1. A method of manufacturing an electric cable which consists in laying up the strands of the conductor so that its diameter can be reduced by applying tension to it, applying a covering of di-electric around the conductor and then applying tension to the conductor to reduce its diameter and form a space between it and the surrounding di-electric.

2. A method of manufacturing an electric cable which consists in laying up the strands of the conductor so that its diameter can be reduced by applying tension to it, applying a tubular sheath around the conductor, applying a covering of di-electric around the tubular sheath and then applying tension to the conductor to reduce its diameter and form a space between it and the tubular sheath so that the latter will continue to support the di-electric after the diameter of the conductor has been reduced.

In testimony whereof we have signed our names to this specification.

JOHN FRANCIS WATSON.
PHILIP VASSAR HUNTER.
ALFRED EDGAR WILSON.