

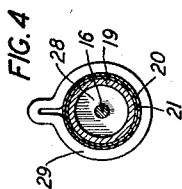
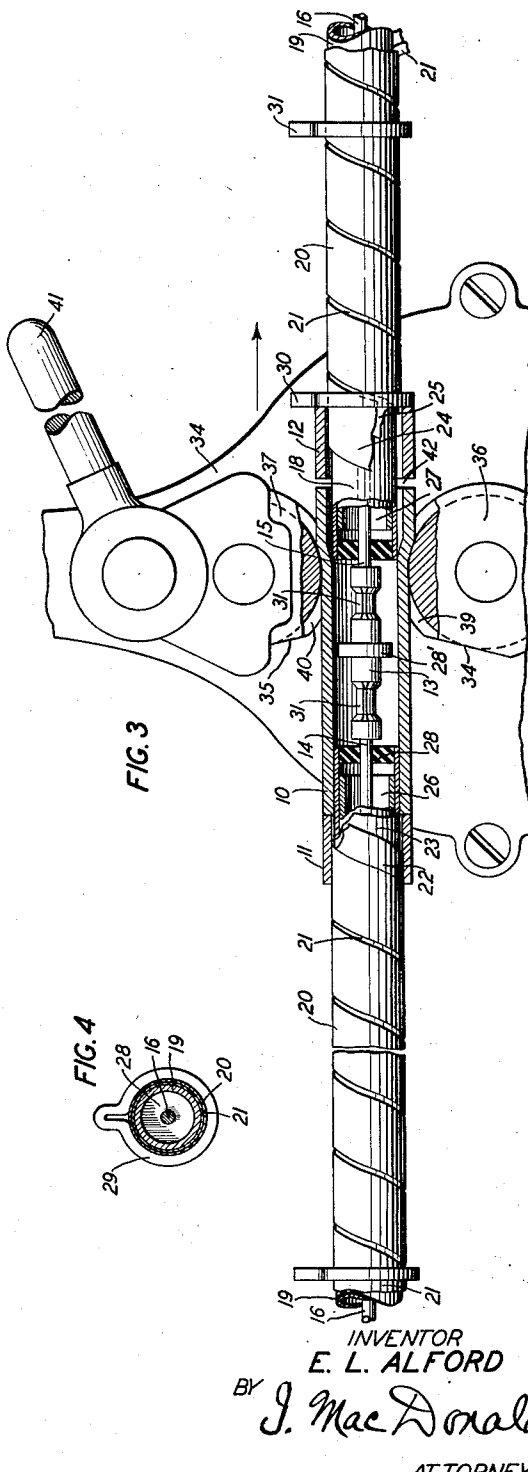
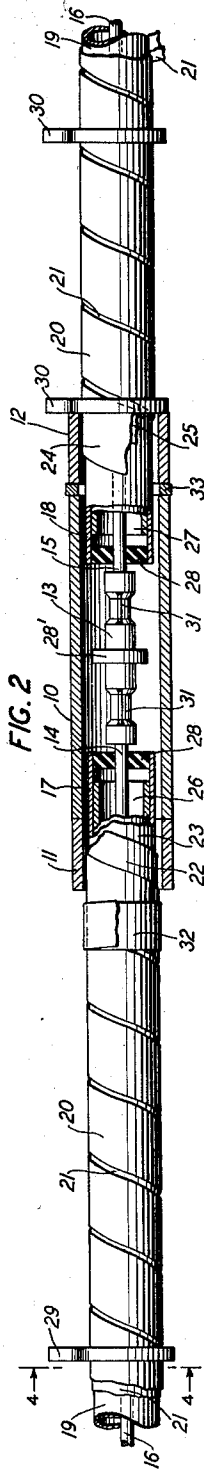
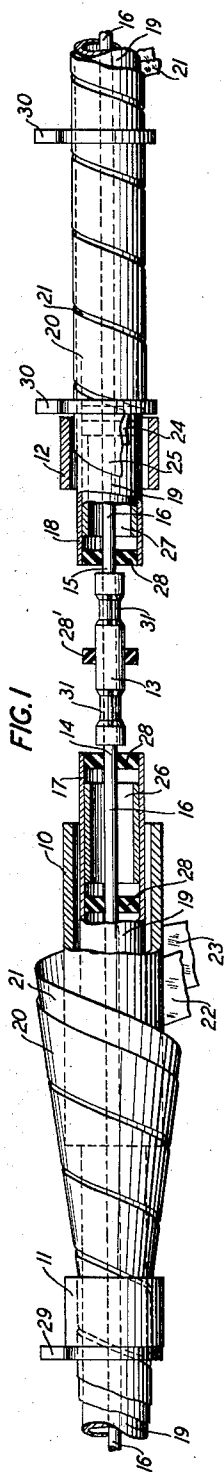
Jan. 16, 1951

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2,538,225

METHOD AND MEANS FOR JOINING COAXIAL CABLES

Filed Dec. 29, 1945



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2,538,225

METHOD AND MEANS FOR JOINING
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Application December 29, 1945, Serial No. 638,350

4 Claims. (Cl. 174—21)

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This invention relates to joints or splices for electrical conductors and more particularly to a method of making joints in conductors of the coaxial type, one or more of which may be enclosed in a suitable protective sheath to form a cable.

The object of this invention is the provision of a method and means for splicing coaxial conductors which will eliminate, to a large extent, the introduction of fine metallic particles into the joint during the making of the joint as has been experienced with the method now employed, and the consequent short-circuiting of the conductors in the cable.

Another object of the invention is the provision of method and means for making joints in coaxial conductors which will require considerably less pressure on the component parts to form a gas-tight and an electrical joint having a high conductivity.

The coaxial conductor to which the splice of this invention is particularly adaptable comprises, a tubular outer conductor of relatively thin conducting material and a centrally disposed solid inner conductor which is supported concentrically within the outer conductor and insulated therefrom by means of a plurality of suitably spaced discs or bushings of insulating material. In order to provide electromagnetic shielding for the conductors, a plurality of metallic tapes are helically wound around the outer or tubular conductor. One or more conductors may be enclosed in a lead sheath to form a suitable cable.

Cables employing one or more encased coaxial conductors are known as "coaxial cables" and are employed for transmitting electrical currents of very high frequency and it is important that the joints in the conductors be made in such a manner that the efficiency of the cable will not be impaired.

The present invention relates to a method and means for making joints in coaxial conductors of the above-described type and comprises, inserting in the ends of the outer conductors, in contact with the inner surfaces thereof, short metallic reinforcing sleeves, positioning on the outside of each outer conductor over the metallic tapes and adjacent the ends thereof a short metal sleeve, positioning over one end of the conductor and underlying the metallic tapes, a third metallic sleeve having a length somewhat longer than the other two sleeves, joining together the central solid conductors by means of a suitable sleeve, locating the large sleeve over the joint of the inner conductors with its ends overlying a sub-

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stantial portion of the outer conductor and the reinforcing sleeve, positioning the small sleeves in abutting relation with the large sleeve and then subjecting the whole assembly to the compressing action of a suitable tool for forcing the large sleeve into intimate contact with the outer surfaces of the outer conductors and the small sleeves, at each end thereof, into intimate contact with the steel tapes, to provide a gas-tight joint having substantially the same electrical characteristics as these of the conductors.

The invention will be more clearly understood from the following detailed description when read in connection with the following drawings of which:

Fig. 1 is a fragmentary view, partly in section of the joint of this invention in its early stage of preparation, with the central conductors joined together, the reinforcing sleeves in place, the tapes held in position by the rings and the small outside sleeves in place over the ends of the outer conductor and the tapes;

Fig. 2 is a view similar to Fig. 1 except that the tapes are now in position around the outer conductors and the sleeves have been moved in position with the large sleeve over the joint of the inner conductors and the small sleeves over the ends of the tapes;

Fig. 3 is a view similar to Fig. 2 and discloses suitable means for forcing the sleeves into intimate contact with the outer conductors and metallic tapes to provide a completed joint; and,

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 3 and illustrates in detail the crimping ring for holding the metallic tape in position while making the joint.

As shown in the drawing, the joint of this invention comprises three sleeves, namely, a large central sleeve 10 and the two small end sleeves 11 and 12. The central sleeve 10 is centrally disposed over the sleeve 13, which serves to join the ends 14 and 15 of the central conductors 16—16 together, and embraces the outer surfaces of the ends 17 and 18 of the outer conductors 19—19 for a short distance on each end. The small end sleeves 11 and 12 are positioned over the ends of the metallic tapes 20 and 21, the sleeve 11 engaging the ends 22 and 23 and the sleeve 12 engaging the ends 24 and 25.

Located in the conductors 16—16, a short distance from each end thereof, are the reinforcing sleeves 26 and 27. Suitable insulating discs or spacers 28 maintain the solid conductors 16—16 centrally disposed within the outer conductors 19—19.

In making the joint of this invention, the lead sheath (not shown), which encloses the conductors to be joined, is removed some distance from the ends thereof in the well-known manner, to expose the coaxial conductors located therein. The ends of the conductors to be joined are prepared in the following manner. A suitable ring 29 is threaded over the outside of the metallic tapes 20 and 21 of the conductor to the left of the splice and crimped thereover some distance from the end thereof. The next step is to remove a portion of the metallic tapes 20 and 21 at the end of the conductor to expose a portion of the outer conductor 19, as shown in the drawing, then proceed to cut and remove a small section of the outer conductor 19 leaving exposed, however, beyond the tapes 20 and 21 and end portion 17. The removal of a portion of the outer conductor 19, exposes the solid inner conductor 16 and its associated spacer 28 which is also removed. A portion of the conductor 16 is cut off so that it projects only a short distance beyond the end of the outer conductor 19. Thus we have the solid or central conductor 16 projecting a short distance beyond the end of the outer conductor 19 and the outer conductor 19 projecting a short distance beyond the end of the metallic tapes 20 and 21. After the above steps have been completed, a reinforcing sleeve or bushing 26 is inserted in the outer conductor 19, a short distance beyond the end 17 thereof and an insulating spacer 28 is positioned in the end of the outer conductor 19 with its outer face flush with the end 17 of the outer conductor 19.

With the metallic tapes 20 and 21 held in tight contact around the outer conductor 19 by any suitable means, a small sleeve 11 is threaded thereover and positioned some distance back from the end 17 of the outer conductor 19 which may be against the ring 29 as shown in Fig. 1. A large sleeve 10 is positioned over the outer conductor 19 and slid under the tapes 20 and 21 a sufficient distance so that the end thereof is slightly in back of the end 17 of the conductor 19 as shown in Fig. 1.

The end 18 of the right-hand conductor which is to be joined with the left-hand section, heretofore described, is prepared in a similar manner except that the tapes 20 and 21 are not loosened but are held in place by means of clamping rings 30—30 and no large sleeve is positioned thereon.

With the ends of the conductors to be joined prepared as heretofore described and with the ends 17 and 18 of the outer conductors 19—19 in alignment and with the ends 14 and 15 of the inner conductors 16—16 directly opposite each other and spaced apart slightly, a metallic splicing sleeve 13 is positioned over the ends thereof and compressed thereon, as shown at 31—31 in the various figures, to join the ends 14 and 15 of the central conductors 16—16 together, an insulating disc 28' is positioned over the sleeve 13 at its midpoint.

With the joint prepared as shown in Fig. 1 and as described above, it is now ready for closure and as shown in Fig. 2 this is accomplished by sliding the sleeve 10 over the outer conductors 19—19 so as to cover the splice and bear against the temporary spacer 33 which in turn is positioned against the small sleeve 12, making sure that the tapes 20 and 21 on the left-hand conductor end are tightly wound around the outer conductor 19. The small sleeve 11 is slid along its length until it bears against the end of the sleeve 10 as shown in Fig. 2. With the sleeves

10, 11 and 12 in position as shown in Fig. 2, a length of adhesive tape 33 is wound around the tapes 20 and 21 adjacent the sleeve 11 to prevent movement thereof.

As shown in Fig. 2, the joint is now in condition for the final operation which is forcing the sleeves 10, 11 and 12 into intimate contact with the tapes and outer conductors to form a gas-tight joint having a high conductivity. It has been found that the rolling tool shown in Patent 1,896,512 to Hayford et al. dated February 7, 1933 is particularly adapted for use with this type of joint since it is not cumbersome to handle and can be operated with a minimum amount of torque.

The first step in rolling the sleeves 10, 11 and 12 into intimate engagement with the tapes 20 and 21 and the ends 17 and 18 of the outer conductors 19—19, is to position the rolling tool 34 to the left of the sleeve 11 with the flats 35 and 36 of the rollers 37 and 38 parallel. The conductors and sleeves are then positioned in the grooves 39 and 40 of the rollers 37 and 38 and the handle 41 rotated in a clockwise direction to cause the rollers 36 and 37 to traverse the sleeves as shown in Fig. 3 and compress the sleeves 10, 11 and 12.

The temporary spacer 33 may be removed any time after the rolling action of the central sleeve 10 begins as it only serves to provide sufficient space 42 for the sleeve 10 to expand.

The tool 34 is removed from the cable by rotating the rollers 37 and 38 until the flats 36 are again parallel.

While I have shown and described herein the preferred embodiment of my invention, it is to be understood that various modifications and changes may be made therein without departing from the spirit of the invention and I do not limit myself to the use of any particular tool for forcing the sleeves into contact with the component parts of the joint.

What is claimed is:

1. In combination with a pair of coaxial conductors each comprising an outer protective metallic sheath, an outer conductor and an inner conductor, of means for joining the ends of said conductors together which comprises, means for joining the ends of the inner conductors together, metallic bushings located inside the outer conductors for reinforcing said conductors, a metallic sleeve positioned over the inner conductor joining means in engagement with the outer surfaces of the outer conductors and extending over said reinforcing bushings, metallic sleeves located one at each end of said first sleeve over said protective sheath, all of said sleeves secured in position by having a force applied thereto along the outside surfaces thereof to establish an intimate contact between said first sleeve and said outer conductors, and between said end sleeves and said protective sheath.

2. In combination with a pair of coaxial conductors each comprising a plurality of outer protective metallic tapes, an outer conductor and an inner conductor, of means for joining the ends of said conductors together which comprises, means for joining the ends of the inner conductors together, metallic reinforcing bushings located inside the outer conductors, a metallic sleeve positioned over the inner conductor joining means in engagement with the outer surfaces of the outer conductors and extending over said reinforcing bushings, metallic sleeves located one at each end of said first sleeve in

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contact with said metallic tapes, all of said sleeves secured in position by having a force applied thereto along the outside surfaces thereof to establish an intimate contact between said first sleeve and the outer conductors, and between said end sleeves and said metallic tapes.

3. In combination with a pair of coaxial conductors, each comprising an outer protective metallic sheath, a single hollow outer conductor and a solid inner conductor, of means for joining the ends of said conductors together which comprises, means for joining the ends of the inner conductors together, metallic reenforcing bushings located inside the outer conductors, a metallic sleeve positioned over the inner conductor joining means and in engagement with the outer surfaces of the outer conductors and extending over said reenforcing bushings, metallic sleeves located one at each end of said first sleeve in contact with said metallic sheath, all of said sleeves secured in position by having a force applied thereto along the outside surfaces thereof to establish an intimate contact between said first sleeve and the outer conductors, and between said end sleeves and said metallic sheath.

4. A method for making a joint in coaxial conductors having a solid central conductor, a hollow outer conductor and a layer of tape armoring over said outer conductor which comprises, removing from the ends of the conductors sufficient tape armoring to expose the outer conductor, removing a portion of the outer conductor to expose the inner conductor, inserting in the ends of the outer conductor in contact with the inner

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surfaces thereof, short metallic reenforcing bushings, positioning over the tape armoring adjacent the ends of said outer conductor sleeve members, positioning over one end of the outer conductor and underlying the armoring tapes, a third metallic sleeve, joining together the ends of the central conductor, locating the third sleeve over the joint of the inner conductor with its ends overlying a substantial portion of the outer conductor and said reenforcing bushings, positioning the end sleeves in abutting relationship with the ends of the third sleeve and then subjecting the whole assembly to the compressing action of a suitable tool for forcing the third sleeve into intimate contact with the outer surfaces of the outer conductor and the end sleeves into intimate contact with the armoring tape.

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