July 18, 1944. E. R. GOLDFIELD 2,353,719

CABLE END CONSTRUCTION

Filed Sept. 29, 1941

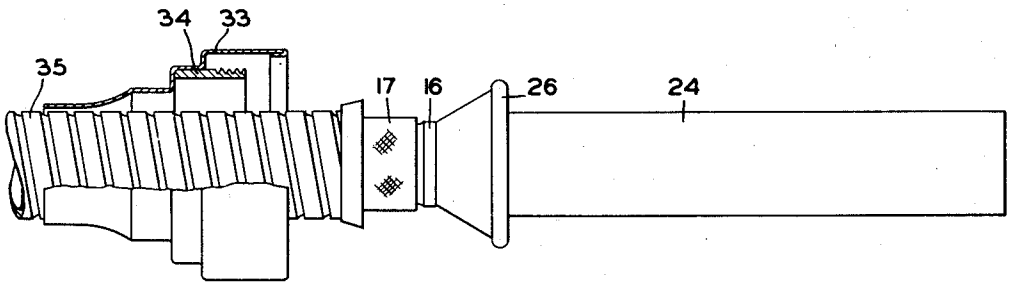


FIG.-1

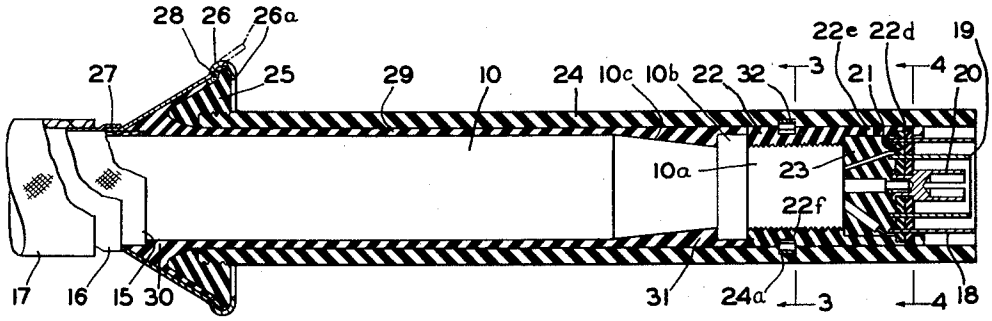


FIG.-2

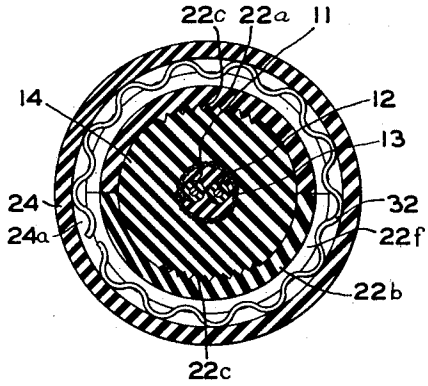


FIG.-3

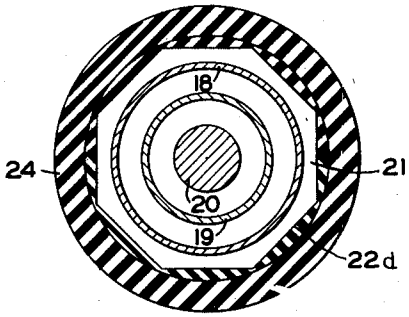


FIG.-4

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CABLE END CONSTRUCTION

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Application September 29, 1941, Serial No. 412,705

4 Claims. (Cl. 174—75)

This invention relates to improvements in the end construction of high tension cables, such as are used for instance with X-ray equipment.

An object of the present invention is to provide improved means for securing electrical contact members to the end of a cable with an elongated insulating sleeve adapted to coact with a complementary contact member and all of this without disturbing the original cable construction and protective coatings to such an extent that the cable tends to break down under use.

The invention resides in the arrangement and manipulation of the parts as will more clearly appear from the accompanying drawing and description and the essential features thereof will be summarized in the claims.

In the drawing, Fig. 1 is an elevational view of a cable end equipped with my improved construction, a portion of a ferrule connecting assembly being broken away to more clearly show the arrangement of the parts; Fig. 2 is an enlarged central longitudinal section through the right-hand portion of the device of Fig. 1; while Figs. 3 and 4 are enlarged transverse sectional views taken along similarly numbered lines of Fig. 2.

The cable construction here shown is particularly adapted for use in connection with the male contact member illustrated and described in my Patent No. 2,238,319, granted April 15, 1941, although it will be understood that the construction and principles here disclosed are applicable for other uses.

The cable 10 is of a well known type wherein a pair of electrical conductors 11 and 12 are covered with individual insulation and housed in an internal metallic sheath 13 which serves also as a third conductor. These are then covered with a very heavy layer of insulation 14 which may be of a rubber compound or the like. Next outside of this comes a wound layer of semi-conducting tape 15, an outer metallic sheath 16, and a final cover 17 of cotton braid.

In the application here illustrated the conductors 11, 12 and 13 are for the filament current of the X-ray tube and the cable contacts are preferably arranged to permit relative rotary movement between the connected cable contacts so that the equipment may be readily handled without unnecessarily twisting or distorting the relatively stiff cables. To this end the three conductors are secured to contact members having annularly arranged concentric contact surfaces so as to permit this relative rotation as described in my above mentioned patent. A portion of the insulation 14 is cut away at the end of the cable so as to expose short lengths of the conductors 11, 12 and 13. A portion of the sheath 13 may be cut away and the rest of the sheath twisted to form a more easily connected filament. One of these conductors is soldered to the outer contact ring 18, one to the inner contact ring 20, and one to the intermediate contact ring 19. A base 21 comprising a noncircular wafer serves as a rigid mounting for the three contact members. The wafer here shown comprises a pair of sheets of laminated canvas impregnated with insulating compound. A split bushing 22 surrounds the base 21 and the extreme end 10a of the cable 10 forming a housing for the same. Preferably this bushing is of molded Bakelite including shredded paper if desired, and comprises two halves 22a and 22b. These bushing portions may be provided with knurled spots 22c which engage the roughened surface of the cable end 10a so that in the final assembly relative motion between the bushing and the cable end is prevented. A noncircular groove 22d in the bushing is complementary to the peripheral edge of the base 21 and closely surrounds and embraces the same when the bushing is in final position so as to prevent relative rotary or endwise movement between the contact base and the bushing. An opening 22e through the wall of the bushing permits the pouring of a high melting point insulating compound, such as rosin, into the space 23 between the contact base and the end of the cable.

An elongated substantially rigid insulating sleeve 24 surrounds the contact members and the split bushing and the end of the cable for several inches. Preferably the sleeve 24 has a length of three or four inches or more for the purpose described in my above mentioned patent. The sleeve here shown may be of laminated paper impregnated with Bakelite. On the inner end of this sleeve is threaded a plug flare 25 which may be formed of molded Bakelite or other similar insulating material. A ferrule 26 of brass or the like is rigidly connected, as by soldering, at the point 27 with the terminal end of the metallic sheath 16. This may be done by sliding the annular end of the ferrule under the end of the metallic sheath with practically no disturbance of the cable covering at this point. It will be understood by those skilled in this art that the formation of any slight air pockets in the cable covering at this point eventually leads to break-down of the cable. The flared end of the ferrule is spun over as at 26a to rigidly secure

the plug flare 25 and therefore the sleeve 24 to the end of the cable and the cable sheath. A cork insert 28 may be inserted between the flared portion of the ferrule and the plug flare to retain the sealing compound. The sleeve 24, the plug flare and the ferrule are sealed to the cable 10 by a high melting point insulating wax 29, such as Chatterton's compound. To better retain this sealing compound the cable insulation is cut to provide an annular shoulder 10b and a tapered annular groove 10c. The compound then forms a tight seal for a number of inches along the internal surface of the sleeve and provides control rings of insulating material at the points 30 and 31 so as to stop the corona effect which tends to break down the insulation during use.

In the completed device an annular groove 24a in the sleeve 24 registers with an annular groove 22f in the bushing 22. Lying partly in each of these grooves is a resilient corrugated split ring 32 of Vinylite, Celluloid, fiber or the like. This prevents relative longitudinal movement between the sleeve 24 and the bushing 22.

In forming the cable end construction described above the cotton braid 17 is first removed for about 6¼'' from the end of the cable. The metal sheathing 16 is then removed to a point about 6'' from the end of the cable and the tape layer 15 is removed for about 5⅞'' from the end of the cable. The tapered groove 10c is then ground into the rubber insulation and the extreme end of the cable is cut down to provide the shoulder 10b. The heavy rubber insulation 14 is then removed for about ½'' from the end of the cable to expose the conductors 11, 12 and 13. The insulation is removed from these conductors and the three conductor leads are soldered to their respective contact members. The ferrule trim cap 33 and the retaining adapter ring 34 are then slipped on the end of the cable, after which the flexible conduit support assembly 35 is slid into the proper position. It will be understood that these parts firmly hold the cable to the housing of an X-ray tube or the like when the parts are finally assembled for use.

The ferrule 26 with its outer flange 26a in the dot-dash condition of Fig. 2 is then slipped over the end of the cable and under the metal sheathing 16 at the point 27. The ferrule is then soldered to the sheathing. The two halves of the split bushing 22 are then placed in position about the cable end 10a and contact base 21 and hot rosin is poured into the space 23 and allowed to cool. The cork washer 28 is then placed in position and the skinned end of the cable is cleaned thoroughly with carbon tetrachloride or the like. The locking ring 32 is then placed in the groove 22f of the bushing and the groove is coated with a quick drying insulating varnish having a high shearing strength, such as Glyptal. The sleeve 24 is then heated to about 200° F. and a thin coating of Glyptal is applied two inches into the inside of the sleeve at the contact end, leaving about one-half inch clean at the extreme end. The sleeve 24 is then slid over the bushing 22 until the locking ring 32 is covered. Chatterton's compound is then coated over the cable from the ferrule 26 down to the end of the sleeve carrying the plug flare 25 which at this time is just covering the locking ring 32. The sleeve is then moved to its final position as shown in Fig. 2, at which time the locking ring groove 24a will aline with the bushing groove 22f and the resilient ring will expand into both grooves. At this time the plug flare 25 will seat practically against the ferrule 26 and should be held in this position until the Chatterton's compound is cooled. The ferrule flange 26a is then spun from the dot-dash position of Fig. 2 to the full line position there shown and any excess sealing compound is cleaned off.

I have thus provided a cable end construction which is rather easy to make and assemble and which firmly holds all of the parts in desired position when completed, while at the same time disturbing the original cable construction by only a very small amount and that not sufficient to interfere with a long life of the cable free from break-down of the insulation.

What I claim is:

1. A high tension cable having electrical conductors surrounded by insulation which in turn is surrounded by a metallic sheath terminating short of the end of said insulation, a plurality of electrical contact members secured to the terminal ends of said conductors, a noncircular base rigidly connected with said contact members, a substantially rigid insulating sleeve open at both ends and surrounding said contact members and said insulation from the end of said cable to a point adjacent the terminus of said sheath, said base forming the main closure means for the terminal end of said sleeve, means sealing said sleeve to said cable insulation, means interlocked with said noncircular base and preventing relative movement between said contacts and said sleeve, and means rigidly connecting said sleeve to the terminal end of said sheath.

2. A high tension cable having electrical conductors surrounded by insulation which in turn is surrounded by a metallic sheath terminating short of the end of said cable, electrical contact members secured to the terminal ends of said conductors, a substantially rigid insulating sleeve surrounding said contact members and said insulation from the end of said cable to a point adjacent the terminus of said sheath, means sealing said sleeve to said cable insulation, a ferrule rigidly connected to said sleeve and to the terminal end of said sheath, a split bushing between the extreme end of said cable and said sleeve, means preventing relative endwise movement between said bushing and said sleeve, and means preventing relative rotative movement and relative endwise movement between said bushing and said contact members.

3. A high tension cable having electrical conductors surrounded by insulation which in turn is surrounded by a protective sheath terminating short of the end of said cable, a plurality of annular contact members secured respectively to the terminal ends of said conductors, a noncircular insulating base to which said conductors are rigidly secured, a substantially rigid insulating sleeve surrounding said contact members and said insulation from the end of said cable to a point adjacent the terminus of said sheath, a ferrule connecting said sleeve and the terminal end of said sheath, high melting point insulating wax sealing said sleeve and said ferrule to said cable insulation, a split bushing within said sleeve and surrounding said base and the end of said cable, there being a groove in said bushing closely embracing said base, said bushing having a friction contact with said cable end preventing movement between them, high melting point insulating compound within said bushing between said base and the end of said cable, there being registering annular grooves in

said bushing and said sleeve, and a resilient corrugated ring lying in said grooves.

4. A high tension cable having a plurality of electrical conductors surrounded by insulation common to all of them and which in turn is surrounded by a metallic sheath terminating short of the end of said insulation by a distance of the order of several inches, a contact base, a plurality of contact members mounted rigidly on said base, said members being arcuately formed about a common center so as to be rotatable relative to coacting contact members, said first named contact members being connected respectively to the terminal ends of said conductors, a substantially rigid insulating sleeve open at both ends and surrounding said insulation from the end of said insulation to a point adjacent the terminus of said sheath, means sealing said sleeve to said cable insulation and preventing relative rotation between them said contact base forming the main closure means for the terminal end of said sleeve, means preventing relative rotation between said contact base and said sleeve, and means rigidly connecting said sleeve to the terminal end of said metallic sheath.

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