

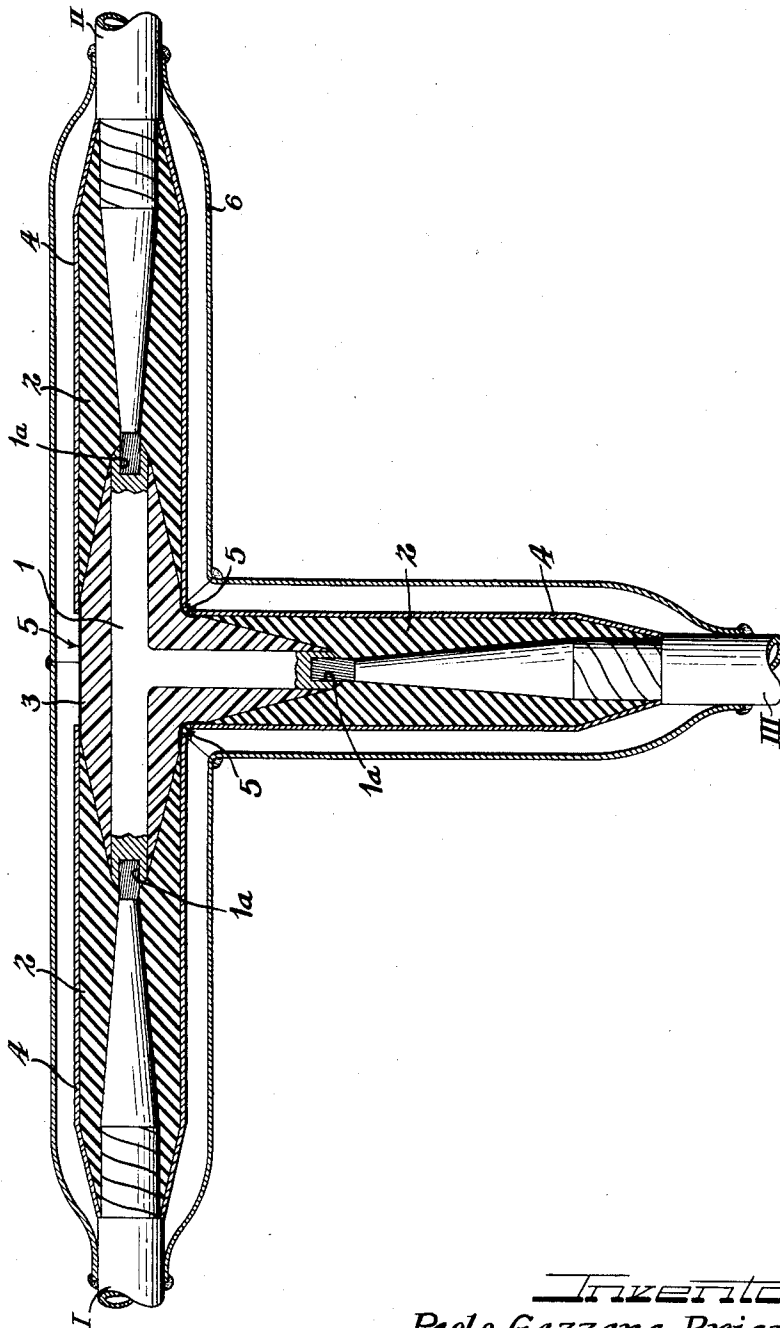
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BRANCH JOINT FOR ELECTRIC CABLES

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BRANCH JOINT FOR ELECTRIC CABLES

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6 Claims. (Cl. 174-73)

This application is a continuation in part of my co-pending application Serial No. 424,729 filed April 21, 1954.

The present invention relates to the improvements in the construction of joints for high voltage electric cables and is particularly, although not exclusively, applicable to branch-type joints wherein three or more conductors are electrically joined.

It is one of the objects of the present invention to provide a connector for the conductors of high voltage cables for effecting a branch-type connection, which connector is so insulated as to eliminate the difficulties heretofore encountered in applying hand made taping insulation to branch joint connections, particularly at the crotch of the connection.

It is another object of the present invention to overcome the taping difficulties heretofore encountered. This is accomplished by covering the connector, which may be of any standard shape, with a sufficient thickness of insulating plastic material which may be cast or molded around the connector, using an insulation having the typical property of perfectly adhering to the connector surface, thereby eliminating any space that might otherwise result between the connector and the solid insulating mass, since such space would be subjected to electrical stress that is responsible for rapid deterioration of the insulation. The plastic insulating material must have a very high dielectric strength and very low dielectric losses.

It is a still further object of this invention to provide an improved single or multi-branch joint for high voltage electric cables of all types, wherein there is provided a metal connector joining the bared ends of the cable conductors, which connector is embedded in a special solid dielectric of similar shaped made of one or more synthetic resins, preferably of the ethoxyline type, in case loaded and suitably hardened, so that the connector and the dielectric are in contact with one another at their interfaces, and firmly bonded together by exceptionally high adhesion forces. The synthetic resins which are suitable for the purposes of the present invention are preferably those derived from the ethylene oxides or its homologues, case loaded with inorganic excipients (as, for instance, quartz, coalin, etc.), to which are to be added the proper hardening agents, namely those known as ethoxyline, epoxyde, epichlorhydrin and epoxy resins, as well as the products known under the trade name of "Araldite" or "Araldit," both as casting and bonding resins. Resins of the above-mentioned type show a very low casting shrinkage, of the order of .1% to 2% by volume, and a very high adherence strength with very low dielectric losses.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

The single figure of drawing is a cross sectional view

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of a T-shaped branch connecting joint connecting three high voltage cables.

Reference may now be had more particularly to the drawing. A T-shaped branch-type joint which is built up in accordance with the present invention joins three single core, high voltage electric cables I, II and III. At 1 there is indicated a T-shaped metallic connector embedded in a solid special dielectric 3 which is also T-shaped and which is tapered at each of its three ends. The dielectric 3 is a monolithic structure. Said monolithic structure may be made both by casting and molding or may be built up at the site, but preferably it is prefabricated as an assembly with the connector 1.

The dielectric 3 is a synthetic resin. The synthetic resins which mainly serve this purpose are preferably those derived from ethylene oxide or its homologues, in case loaded with inorganic excipients (as, for instance, quartz, caolin, etc.), to which the proper hardening agents are to be added, namely those known as ethoxyline, epoxy, epichlorhydrin and epoxyde resins. These resins, suitable for dielectric 3, are marketed under trade-names as follows: "Araldit," or "Araldite," produced by Ciba, Inc., of New York; "Epon" or "Epikote" produced by Shell Chemical Corp., of New York; "Devran" produced by DeVoe & Reynolds Co., Inc., of Louisville; "C-8" produced by Bakelite Co. of New York. The resins here used for dielectric 3, it is apparent, may be any of the insulating resins described in my pending application above referred to.

The ends of the three branches of the connector 1, covered by the insulation 3 as above set forth, may be connected to the respective current carrying conductors of the cables I, II and III and suitably joined thereto. A compression jointing is preferred and for this purpose a hydraulic press may be employed for pressing the metal strands constituting the respective cable conductors into the respective sockets 1a at the ends of the connector 1. In lieu of a press fit, the cable conductors may be soldered in the respective sockets 1a. When the mechanical and electrical connections have been made between the stranded ends of the cable conductors and the respective sockets of the connector 1, the insulation 2 is applied as by manually winding sealing tape in place, as is known in the art. Thereafter, metallic screens 4 are formed by winding metallic tape, generally of copper, around the insulation 2 and joining said screens to the grounded sleeve or screen surrounding the corresponding cable.

The surfaces 5 of the connector insulation 3 are rendered electrically conductive previous to the assembly of the connector with the cable, or it may be done during or after such assembly. The surfaces 5 are rendered electrically conductive in any way known in the art, as, for instance, by spraying conductive material thereon, such as copper or tin, or by graphitization, or by coating with varnish having a conductive material such as, for instance, carbon black, incorporated therein, or in any other desired manner. The surfaces 5 could be formed by applying to the insulation 3, at those places, a layer of the same insulation as the insulation 3 but having a conductive material (such as, for instance, carbon black) incorporated therein as set forth in my co-pending application Serial No. 424,729, or the surfaces 5 could be formed by applying to the insulation 3 a metallic screen of a corresponding shape which either may perfectly adhere to the dielectric being bonded with the synthetic resins of the "Araldite" bonding type, or may even be separated from the dielectric by means of an interposed layer of insulating oil or compressed gas.

The entire cable joint as above set forth is enclosed within a metallic box or casing formed by three similar

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sleeves 6 one end of each of which is tapered to be slidable onto the cable sheath and the opposite ends of which are shaped to interfit to form a T-shaped joint. These interfitted ends of the three sleeves are joined by soldering or the like to form a hermetic seal, and the opposite end in each case is joined by a wiped solder joint with the cable sheath, as is known in the art.

The dielectric 3 has a very high dielectric strength, a very high tensile strength, and adheres to the connector 1 with high adhesive force (of the value of 100 to 300 kg./sq. cm.). The physical characteristics of that dielectric are set forth in my pending application Serial No. 424,729 to which reference may be had.

In compliance with the requirements of the patent statutes I have herein shown and described a preferred embodiment of the present invention. It is, however, to be understood that this is merely one example of the application of the principles of the present invention which may be carried out in different ways within the purview of the principles hereinabove set forth and the following claims.

What is considered new and desired to be secured by Letters Patent is:

1. A branch joint for at least three converging high tension electric cables each having surrounding grounded means, a surrounding conductive casing into which the conductors extend and from which they are insulated, which casing is adapted to be grounded, a metallic connector within the casing and connecting the cable conductors converging in the joint, which connector includes branches for the converging cable conductors, the connector including its branches comprising a one piece structure which is embedded in a monolithic mass comprising a solid dielectric of the same shape, made of synthetic epoxy resin, and is bonded to it by high adhesion forces at the entire facing surfaces between them thus eliminating any empty space between the connector and the solid insulating mass which could be subjected to electric stresses, and a conducting shield surrounding the dielectric mass and located within the casing and electrically connected to but spaced from the casing, and means electrically connecting said conducting shield and casing with the aforesaid surrounding grounding means.

2. A branch joint for at least three high tension electric cables each having a conducting surrounding sheath, a one piece metallic connector having parts for receiving at least three cable conductors, said parts converging in the joint, which connector is embedded in a one piece solid dielectric of the same shape, made of synthetic resins based on ethylene oxide, and is bonded to it by high adhesion forces at the entire facing surfaces between them thus eliminating any empty space between the connector and the solid insulating mass which could be subjected to electric stresses, and a conductive shield covering the outer surface of the solid dielectric at the juncture of the converging parts thereof, said shield being an integral part of and bonded to the dielectric, and means electrically connecting said conductive shield with said sheath.

3. A high voltage cable joint for the conductors of cable cores that are surrounded by grounded means comprising a grounded conductive casing into which a cable conductor extends, said cable conductor having covering insulation which tapers to a minimum thickness adjacent to the conductor end, a connector and insulator assembly in said casing, the latter assembly being a monolithic body comprising cable conductor receiving connector means within a one piece solid mass of dielectric material intimately united with and surrounding the connector means and tapering to a minimum thickness toward one end thereof that is adjacent to the cable conductor receiving end of the connector, wrapped insulation extending between the tapered end of said dielectric mass and the tapered insulation at the cable

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end, a first conductive shield bonded to and covering and in intimate contact with the entire outer part of the dielectric at the portions thereof of maximum thickness, and a second conductive shield covering the wrapped insulation and in intimate contact therewith over substantially the entire outer part thereof and connected with said first conductive shield and with the casing.

4. A branch type joining connector for a high tension electric cable, said connector comprising a one piece metallic body having at least three terminal branches converging toward a common point, a one piece solid dielectric in which said connector is embedded with the ends thereof exposed each for receiving a cable conductor, said dielectric being molded around the connector and intimately bonded therewith by high adhesion forces and being of maximum thickness in the region surrounding the point of convergence of the branches and tapering to a minimum thickness surrounding the cable conductor receiving ends of the branches, said tapering portions being centered about the respective terminal branches, an electrically conductive shield covering the dielectric at the portions thereof of maximum thickness, said connector and solid insulation comprising a unitary structure, wrappings of insulation surrounding each of the tapered portions of the dielectric, and conductive shields around the wrappings and electrically connected to the shield on the dielectric.

5. A branch joint for joining the corresponding conductors of at least three converging high tension electric cables, characterized in that there is provided a one piece metallic connector for the corresponding conductors of the cables, said connector having converging branches one for each of the cable conductors being joined, said connector being embedded in a monolithic mass of solid dielectric of the same number of branches and in the same angular relationship as are the branches of the connector, the dielectric being bonded to the connector by high adhesion forces at the entire facing surfaces between them thus eliminating all empty spaces between the connector and the dielectric which could be subjected to electrical stresses, there being an electrical conductive layer bonded to covering the surface of the dielectric between the intersection of the respective branches of the dielectric and constituting an intimate part of the connector, a conductive casing surrounding and spaced from the connector, and means electrically connecting the conductive layer with said casing, each of said branches of the connector extending at least to the end of the surrounding branch of the monolithic mass dielectric.

6. Means for joining the corresponding conductors of at least three converging high tension electric cables each including a surrounding grounded sheath, said means comprising a one piece metallic connector for the corresponding conductors of the cables, said connector having converging branches one for each of the cable conductors being joined, said connector being embedded in a monolithic mass of solid dielectric of the same number of branches and in the same angular relationship as are the branches of the connector, the dielectric being bonded to the connector by high adhesion forces at the entire facing surfaces between them thus eliminating all empty spaces between the connector and the dielectric which could be subjected to electrical stresses, the dielectric of each branch being of a frusto conical shape of a minimum diameter at the end of the surrounded branch and of progressively increasing diameter in the direction of convergence of the branches, there being an electrical conductive layer covering the surface of the dielectric between the intersections of the respective branches of the dielectric and bonded thereto, each of said branches of the connector extending at least to the end of the surrounding branch of the monolithic mass dielectric, wrapped insulation covering the tapered ends of the respective branches of the dielectric, and conductive shields surrounding and in intimate contact with the entire outer surfaces of the

wrapped insulation of the respective branches and extending up to and electrically connected with the first mentioned conductive layer.

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