MULTIPLE ELECTRIC CORD

INVENTOR

Maurice A. Wachstein

ATTORNEYS
My present invention relates to electrical cords of the multiple conductor type. It is among the objects of the invention to provide a cord of the above type substantially equal in performance to cords of more expensive construction, and which bears none of the external evidence of the longitudinal groove or cleft characteristic of the belts of certain low cost cords and which yet affords facility of longitudinal separation or bifurcation of the cord ends for terminal connection.

Another object is to provide a cord of the above type, involving but a single extruding operation, whether two or more conductors are to be imbedded in the rubber insulating composition, and involving but a single vulcanizing operation, all with the use of conventional manufacturing equipment.

Another object is to provide a cord of the above type, which, though it affords a substantially solid uninterrupted bridge of rubber between the entire thickness of the imbedded individual conductors, for maximum factor of safety against electrical failure, and though it is devoid of the added cost involved in the use of auxiliary tear strips, is yet readily split or bifurcated by simply drawing the constituent conductors apart from one end of the cord, without disturbance to the complete insulating jacket about each individual separated conductor end.

Another object is to provide a simple and expeditious method and rugged apparatus devoid of moving parts for executing said method to carry out the foregoing objects.

According to the invention the solid belt of flexible insulating composition, preferably rubber mix, imbedding the two or more parallel conductors, either bare or covered, is devoid of any concavity crease or groove, but the material of the belt is weakened preferably by being severed at the surface along median planes between the successive conductors, without effecting at the line of severance any gap or notch visible to the naked eye.

A preferred method, according to my invention, for producing the multiple electric cord, is to weaken or sever the belt by use of an appropriate penetrating tool after the cord has been vulcanized. The belt may thus be slit longitudinally from one or both faces thereof, the slit extending into the belt only to the desired extent, so as to leave substantially continuous the main body of the belt or that thickness of the belt intervening between the thicknesses of the individual conductors. Alternatively the weakening may be effected by a series of minute spaced perforations or piercings all in a median plane and through the thickness of the belt. If desired, a combination of slits and piercings may be resorted to.

Another feature is simple belt slitting apparatus comprising a thin cutting blade rigidly held in a chuck and protruding into a guide tunnel through which the multiple cord is pulled past said cutting edge or edges.

In the accompanying drawing in which are shown one or more of various possible embodiments of the several features of the invention, Fig. 1 is a perspective view of a length of twin cord according to my invention shown bifurcated at one end thereof.

Fig. 2 is a transverse sectional view on an enlarged scale, taken on line 2-2 of Fig. 1.

Fig. 3 is a view similar to Fig. 1 showing the application of the invention in a somewhat modified embodiment illustratively shown on a triple cord.

Fig. 4 is a view similar to Fig. 1 of another modification.

Fig. 5 is a view in longitudinal cross-section of apparatus for executing the slitting method.

Fig. 6 is a plan view of the apparatus shown in Fig. 5, and

Fig. 7 is a fragmentary view in cross-section taken on line 1-1 of Fig. 5 on a larger scale.

Referring now to Figs. 1 and 2 of the drawing, there is shown a twin electric cord comprising two conducting wires 10 and 11, usually of copper, which may be solid, stranded, or braided, and enclosed in a belt 12 extruded thereabout and therebetween and of flexible insulating composition, preferably a conventional rubber mix, which is vulcanized according to usual practice. The conductors may be protected by a coating 13 of tin or of cotton tape braid, or tape or of paper, regenerated cellulose, cellulose acetate, or any equivalent material.

The belt has no visible groove or cleft, and in cross section, as shown in Fig. 2, presents no notch or depression, its periphery being oval. The periphery is convex along its narrower sides, and since the belt is devoid of any concavity, it is designated in certain of the claims as convex throughout in periphery.

As shown in Figs. 1 and 2, the belt is longitudinally weakened along a median plane between the conductors, preferably by severance of the belt along a line of cleavage 14 extending inward from the surface, and preferably also from the opposite face along a further line of cleavage 15 in the same plane transversely of the belt.
The lines of cleavage extend only partway toward the middle of the belt thickness, to leave an uninterrupted solid body 16 of rubber composition, between the entire lengths and thicknesses of the conductors 10 and 11. As shown in Figs. 1, 2, and 22, the belt is formed so that each of the conductors 10 and 11 remains completely imbedded in a rubber jacket determined by the contiguous portion of the rubber belt.

In Fig. 3, the invention is shown applied to a triple conductor cord having conductor elements 30 and 31, these being slits 25 extending inward from the face of the belt midway between conductors 20 and 21 and a similar line of cleavage 24 between conductors 21 and 22. Similar lines of cleavage 25 and 26 preferably extend inward from the opposite face of the belt. As in the embodiment of Figs. 1 and 2, these cleavage lines are invisible to the naked eye and the drawing is intended to show their position merely. In this embodiment there is preferably shown in addition to the lines of cleavage a series of hair line narrow slits 27 which may, if desired, penetrate or pierce the entire thickness of the belt in the cleavage planes and serve to assure the bifurcation of the belt throughout its thickness substantially precisely along the plane of cleavage. The end of the conductor is shown bifurcated, with all but one of the bifurcations removed, and the one remaining 28 being the edge of the various hair line slits, which determine the solid bridges 28 that become severed in bifurcating the cord ends.

In the embodiment of Fig. 4, narrow hair line slits 48, similar to those of Fig. 3 are shown in the absence of the continuous line of cleavage. They are so minute in the direction transversely of the belt as not to prevent the lateral walls of the perforations from contacting, thus rendering invisible the guiding tea line, shown on the drawing solely to indicate its position.

In these various embodiments, substantially none of the composition is removed in the slitting and/or piercing operation. The walls of the slits or pierced slots are in contact with each other and preclude the objectionable ionization and eventual breakdown, encountered where, due to voids, air is imprisoned between conductors at different potentials. While the embodiment of Figs. 1 and 2 is preferred, especially in high voltage circuits, the pierced arrangement of the other embodiments does not materially increase the likelihood of breakdown when used in normal commercial circuits.

In a preferred method of producing the cord of Figs. 1 and 2, the parallel spaced conductors are embedded according to conventional methods into extruded composition to form the continuous rubber belt therefor, the forming die being convex or oval to render the belt devoid of any groove or cleft. After the belt has been vulcanized it is longitudinally slit from one or both faces thereof, by use of appropriate thin cutting tools by dot-and-dash line 14. In Fig. 1, the line of cleavage is but a hair line severing the rubber composition stock, so that in the completed cord the edges exposed at opposite faces of the line of cleavage are in physical contact with each other so resisting said edges substantially invisible to the naked eye and to afford no suggestion that the continuity of the belt has in any way been interrupted.

As suggested in Fig. 1, when the cord is to be installed, a simple pull along the lines of the arrows will cause the belt to tear in the plane determined by the lines 14 and 15 of cleavage for in that plane as is clear, the effective cross-sectional area of the belt is abruptly reduced and a preferential tear line exists therein through the thin web 16 between the inner edges of the slits. Thus and in like manner is it has that each of the conductors 10 and 11 remains completely imbedded in a rubber jacket determined by the contiguous portion of the rubber belt.

This apparatus comprises a pair of heavy base plates 30 and 31 rigidly bonded together in face to face relation, as by rivets 32. The base plates have matching grooves determining a guide or tunnel 33 extending substantially the entire length along the oval cross-sectional shape of the conductor belt and snugly housing the same. Chucks 34 and 35 are hinged about pins 36 in split jaws 37 integral with or rigidly affixed to the respective base plates 30 and 31 and extending into corresponding longitudinal grooves in the belt. The chuck plate 40 is made up of two leaves 40 and 41 which clamp therebetween a sharp cutting tool 42, such as an ordinary safety razor blade, screws 43 through a pair of the holes of said blade clamping the latter in place between the leaves of the chuck plate 40. The blade 42 extends obliquely with respect to the chuck with the extremity 44 of one cutting edge protruding into the tunnel 33 and along the median plane thereof.

Integral or rigid with one leaf 40 of the chuck is a lug or ear 45 through which extends a thread stud 46 lodged at its extremity 47 in a depression 48 in the corresponding base plate and surrounded by a coil spring 49 tending to raise the chuck about its hinge 36. The protruding end of the threaded stud 46 mounts a wing nut 50, by which the degree of penetration of the cutting blade is adjusted. The construction just set forth is duplicated for the other base plate 31, where, as is preferred, both faces of the conductor belt are to be slit.

In operation, the cord is simply pulled through the tunnel 33 of the apparatus and then wound about an appropriate reel (not shown). The tunnel accurately guides the belt so that it passes the cutting edge or edges 44, the longitudinal slit is formed. It is obvious to those skilled in the art that for slitting the three conductor cord, the chuck plates would be made of three leaves with two cutting tools cramped at opposite faces of the middle leaf.

It will thus be seen that there are herein described methods and apparatus in which the several features of this invention are embodied, and which in action attain the various objects of the invention and are well suited to meet the requirements of practical use. As many changes could be made in the above method and construction, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.
What I claim as new and desire to secure by Letters Patent is:
1. An electric cord comprising substantially parallel covered conductors, a belt of insulating composition intervening between and completely surrounding and embedding said covered conductors, said belt having interruptions at the exterior thereof along planes intervening between said conductors, said belt being substantially continuous in the region between the thicknesses of the conductors, said weakened areas having substantially sharp edges at the exterior of the belt so closely contiguous to each other as to be substantially invisible to the naked eye and to afford the appearance of a continuous, substantially uninterrupted and uncreased belt.

2. An electric cord comprising two or more parallel insulations covered electric conductors, a flexible rubber belt extending between and completely enclosing and closely embedding said conductors, said belt along certain transverse sections thereof being discontinuous along lines extending inward from the surface of the belt at an axis or axes midway between the conductors, said belt being continuous in the region between the thicknesses of said conductors.

3. An electric cord comprising two or more parallel insulations covered electric conductors, a flexible rubber belt extending between and completely enclosing and closely embedding said covered conductors, said belt being convex along its entire periphery and being slit along longitudinal planes intervening between the conductors, said slits extending inward from the surface of the belt and substantially invisible to the naked eye.

4. An electric cord comprising two or more parallel insulations covered electric conductors, a flexible rubber belt extending between and completely enclosing and closely embedding said conductors, said belt having perforations therein extending substantially in a common plane between the conductors and of width so small as to be substantially invisible to the naked eye.

5. An electric cord comprising a pair of parallel insulations covered electric conductors, a flexible rubber belt extending between and completely enclosing and closely embedding said conductors, said belt having minute transverse perforations therethrough in a common plane midway between the conductors.

6. An electric cord comprising two or more parallel insulations covered electric conductors, a flexible rubber belt extending between and completely enclosing and closely embedding said conductors, said belt having lines of cleavage longitudinally thereof in a plane or planes midway between the conductors and perforations transversely through the belt in the planes of said lines of cleavage.

7. The method of fabricating electric cords which consists in extruding about two or more spaced and parallel electrical conductors a solid belt of rubber, convex in cross-section throughout its periphery, vulcanizing said belt and then severing the vulcanized structure at the exterior along a plane or planes intervening between the conductor pairs.

8. The method of fabricating electric cords, which consists in extruding rubber composition about and between two or more parallel spaced electrical conductors to form a belt therefor, convex throughout its periphery, vulcanizing the structure and then penetrating the belt with a sharp tool to sever the material along selected regions in a common plane midway between and perpendicular to the common plane of the pairs of conductors.

9. The method of fabricating electric cords, which consists in extruding rubber composition about and between two or more parallel spaced electrical conductors to form a belt convex throughout its periphery, vulcanizing the structure and then slitting the belt at one or both sides of the belt, with a thin sharp blade along a line or lines longitudinally thereof and in a plane or planes substantially midway between and perpendicular to the common plane of the successive conductors, the material of the belt between the thicknesses of the conductors remaining substantially continuous.

10. The method of fabricating electric cords, which consists in extruding rubber composition about and between two or more parallel spaced electrical conductors to form a belt thereabout convex throughout its periphery, vulcanizing the structure and then transversely piercing the material of the belt in a series of minute perforations in a common plane or planes substantially midway between and perpendicular to the common plane of successive conductors.

11. The method of fabricating electric cords, which consists in extruding rubber composition about and between two or more parallel spaced electrical conductors to form a belt therefor, convex throughout its periphery, vulcanizing the structure and then longitudinally slitting the material of the belt along lines in planes substantially midway between successive conductors and also transversely piercing the material in the plane or planes of said slits.

MAURICE A. WACHSTEIN.