LE ROY CLARK.

ELECTRIC CABLE.

APPLICATION FILED MAR. 10, 1915.

1,231,568.

Patented July 3, 1917.

Fig. 1.

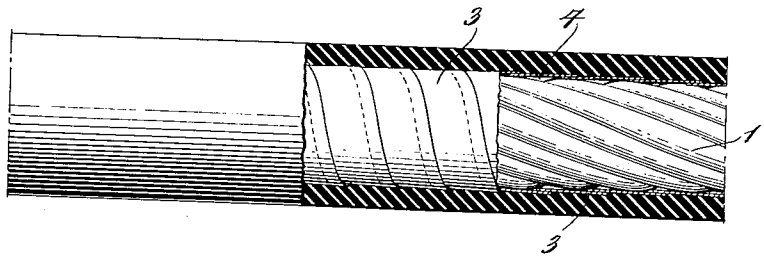


Fig. 2.

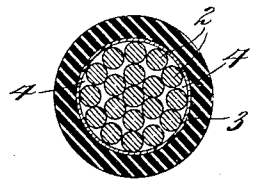
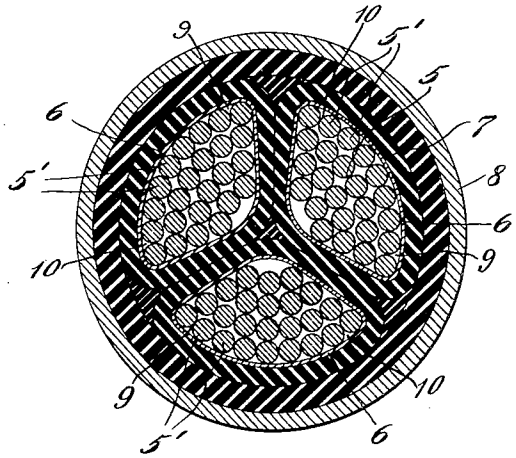


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

LE ROY CLARK, OF ENGLEWOOD, NEW JERSEY.

ELECTRIC CABLE.

1,231,568. Specification of Letters Patent. Patented July 3, 1917.

Application filed March 10, 1915. Serial No. 13,484.

To all whom it may concern:

Be it known that I, LE ROY CLARK, a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Electric Cables, of which the following is a full, clear, and exact description.

This invention relates to electric cables, and consists of a thin metallic flexible sheath which incases the conductor, providing a smooth exterior surface to which the coating of insulation is applied; the sheath preferably consisting of a strip of thin metallic ribbon or tape spirally wound around the conductor. A flexible sheath of this character may be used to advantage with the various types and makes of single or multiple conductor cables as well as with cables which are coated with various kinds of insulation such as rubber, rubber compounds, paper or cambric tape, or the like, and some of the beneficial results which are derived from its use will be hereinafter specifically enumerated, while others will be obvious to those skilled in the art.

In the accompanying drawings there are shown two standard types of cable equipped with metallic sheaths in accordance with the invention, and the figures are intended to be illustrative of the construction of the sheath and not to limit the scope of the invention to the specific types of cables shown.

Figure 1 shows a length of a single conductor cable constructed in accordance with the invention, portions of the insulation and sheath being broken away to clearly show the construction.

Fig. 2 is a transverse section through the cable shown in Fig. 1; and

Fig. 3 is a transverse section through a "sector" type of cable, showing a sheath incasing each of the three groups of strands forming the cable.

In the form of cable shown in Figs. 1 and 2 the single conductor 1 comprises a plurality of individual wires 2 which are twisted together in the usual manner to provide a round conductor, although for the purposes of this invention, instead of a single conductor a multiple conductor cable could be used consisting of a pluralty of conductors twisted together in the same manner, each conductor comprising a plurality of twisted individual wires.

Surrounding the conductor 1 is a flexible sheath 3 which is formed by winding a thin metallic ribbon or tape spirally around the entire length of the conductor preferably so that the edges of adjacent turns slightly overlap each other. In winding the ribbon around the conductor the turns are closely drawn and bound firmly to the conductor so that the joints between the overlapping edges are practically liquid-tight. In practice, a thin metallic copper ribbon of five mils in thickness has been used with good results, the edges of the adjacent turns overlapping for about a quarter the width of the ribbon. By winding the ribbon spirally around the cable, the flexibility of the cable is not impaired, since a narrow ribbon may be used with conductors of small diameter and the width of it increased for conductors of larger diameter where the arc upon which the conductor may be bent is relatively large.

A sheath of this character is of particular advantage where a coating of rubber or rubber compounds is used as the insulation. With existing forms of cable where the rubber is applied directly to the conductor itself, it has been found that since the rubber or rubber compounds which coat the conductor are applied to it when in soft condition and before vulcanizing, a considerable quantity of the insulation is wasted in filling the spirally disposed spaces or grooves 4 which occur between each pair of the exterior wires forming the conductor. When the sheath 3 is used, these grooves or crevices 4 are closed by the sheath and the rubber coating is applied to the outer surface of the sheath to which it adheres. The saving in the quantity of insulation necessary to coat the conductor is therefore considerable. Again, in most of the rubber or rubber compounds used for insulating purposes there is present an excess of free sulfur, which attacks the surface of the conductor and transforms a part of its copper content into copper sulfid, thereby lessening the carrying capacity of the conductor. To avoid this each individual wire forming a conductor has heretofore been coated with tin. Where the sheath is used

its exterior surface is alone tinned, which is a more economical construction.

Where paper or cambric tape is used instead of rubber, as the insulating coating, and applied directly to the conductor the oil or other liquid having insulating properties with which the paper or cambric is impregnated sinks into the conductor through the spaces or crevices between the individual wires. In time the paper or cambric tape becomes dry and its insulating properties thereby decreased. On the other hand if the sheath 3 is used, since the joints between the overlapping edges are practically liquid-tight, it will prevent any of the insulating liquids from being absorbed by the conductor, and they will therefore remain distributed throughout the layers of the paper or cambric insulation even after the cable has been in use for a considerable period of time.

Referring now to the construction shown in Fig. 3 which is that of the standard type of sector cable consisting of three conductors 5, each of which is, in cross section, shaped to conform to a sector of a circle. Each of the conductors 5 is incased in a flexible sheath 6 similar to the one described, over which is applied the coating 7 of insulation consisting of strips of paper tape wound spirally around the sheath, the paper tape being impregnated with suitable insulating oils or other liquid compounds. The complete cable is inclosed in a lead sheath 8 as is the usual construction. Here again the flexible sheath 6 is of particular utility. The twisted wires 5′ forming the exterior of the sector are separated more at the sharp corners 9 and 10 of a sector than on the sides of the sector, since they are bent more abruptly at these points.

When the paper tape is applied directly to the conductor, ridges and intervening grooves are formed in the first layers of paper tape, due to its contact with these separated wires, and when the other layers of insulating tape are applied over these, the ridges will be gradually less pronounced. In the formation of a sector cable of this character it is necessary, however, in forming the cable, to impart a slight twist to each conductor and its insulation. This twisting of the strands causes the ridges in the layers of paper tape surrounding the conductor to become more pronounced and the portions of the layers between the ridges to form into grooves which increase in depth in the outer layers of the insulation, where the so-called wrinkling is very pronounced. Air gaps will therefore be formed in the insulation when two conductors are fitted against each other in the completed cable. With low tension cables these air gaps are immaterial, but in high tension cables they are regarded dangerous since they weaken the insulation and hence increase the liability of the insulation breaking down across one of the air gaps upon a static discharge from one conductor to another. If the sheath 6 is used, and the paper tape is wound upon the same, the formation of the initial ridges in the paper tape is prevented and the formation of the deep grooves by the twisting of the conductors is therefore avoided, since the distortion in the coating of insulation will occur equally and form minute wrinkles throughout its entire length rather than form the deep grooves which are occasioned by the initial formation of ridges in the layers of tape which surround the conductor.

In high tension work the sheath is also of importance, since it prevents a static discharge from any of the conductors of the cable. As is clear, in order to have a static discharge from a high tension cable it is necessary that the conductor or wire be bent rather sharply to provide a point at which the discharge may occur. In the ordinary twisted conductor of circular cross section, since the twist imparted to the individual wires of the cable is practically uniform, this static discharge is not liable to occur at any particular point along the length of the conductor wire. However, in the formation of sector cables, since the conductor is of a sector-like shape, *i. e.*, triangular rather than circular in cross section, the wires as they pass over the sharp corners 9 and 10 of the sector, are bent more sharply than at other points along their length. This sharp bend has been considered by some as of sufficient sharpness to form a point at which a static discharge of electricity is likely, but where a copper sheath is used any liability of a discharge is entirely prevented, since the smooth exterior surface of the sheath provides no points at which the static discharge may occur, and the discharge can not take place from the conductors when incased within such a sheath.

Another advantage arising from the use of the sheath is that the bird-caging of any type of a conductor is prevented at all times. It is obvious that in handling a conductor, especially where lateral pressure or compression is applied to a length of cable before the insulation is applied the wires are liable to separate more or less and buckle, which is commonly referred to as bird-caging. In applying some forms of insulation it has therefore been necessary to temporarily tape the conductor before the insulation is applied. The sheath 6 acts as an efficient substitute for this tape and will prevent individual wires of the conductor from separating or leaving their fixed position within the conductor.

Other advantages of a metallic sheath of this character with specific types of cables

not specifically referred to herein, will be obvious to those skilled in the art, and I do not wish to be limited to any particular type of cable but only by the scope of the appended claims.

I claim:

1. An insulated electric cable comprising a conductor composed of a plurality of bare wires, a relatively stiff metallic ribbon wound spirally around said wires to break joints, said ribbon being electrically conductive and mechanically binding the wires together, and a layer of insulation applied directly to said ribbon.

2. An insulated electric cable comprising a conductor composed of a plurality of bare wires, a relatively stiff metallic ribbon wound spirally around the wires to break joints, said ribbon being electrically conductive and mechanically binding the wires together, and a layer of insulation composed of tape wound spirally around said ribbon.

3. An insulated electric cable comprising a conductor composed of a plurality of bare wires twisted together in the direction of their length, a relatively stiff metallic ribbon wound spirally around the wires to break joints forming a substantially smooth sheath inclosing said wires and mechanically binding the wires together, said ribbon being of electrically conductive material, and a layer of insulation applied directly to said ribbon.

4. In an insulated electric cable, a conductor substantially sector-shape in cross section and composed of a plurality of individual bare wires, a flexible metallic sheath surrounding the conductor comprising a stiff metallic ribbon bound spirally around said conductor to break joints, and a coating of insulation applied to said sheath.

5. In an electric cable, a plurality of conductors substantially sector-shaped in cross section and each composed of a plurality of bare wires, a flexible sheath surrounding each conductor comprising a current-carrying stiff metallic ribbon bound spirally around the wires of a conductor, a coating of insulation applied to each conductor, the said sector-shaped conductors being arranged to form a cable of substantially circular cross section, and an outer layer of insulation common to all of the conductors.

In witness whereof I subscribe my signature in the presence of two witnesses.

LE ROY CLARK.

Witnesses:
HENRY MONKLEY,
WM. M. STOCKBRIDGE.