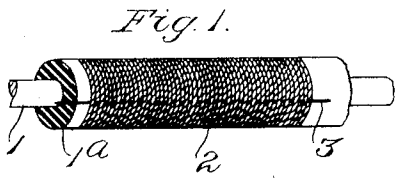
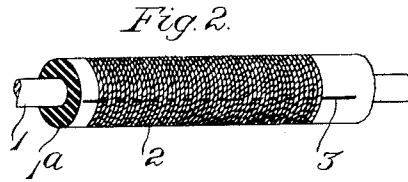
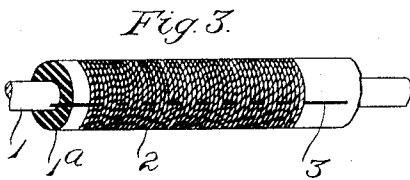
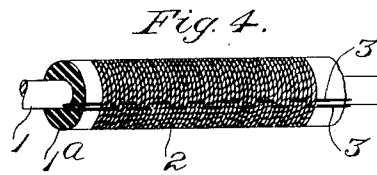
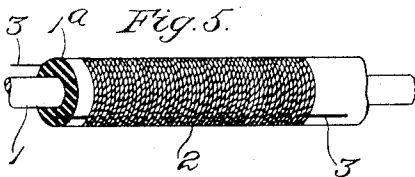
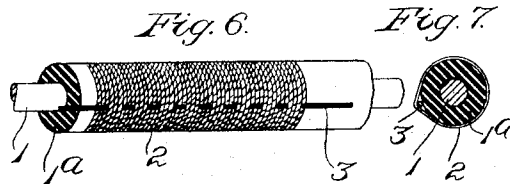
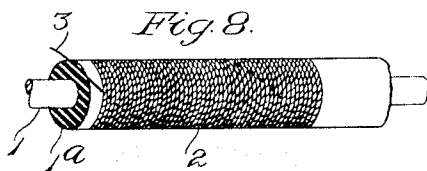
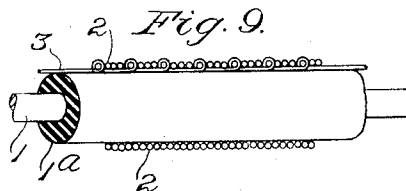
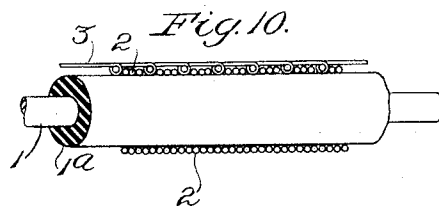


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ELECTRIC CONDUCTOR.
APPLICATION FILED DEC. 2, 1912.

1,216,337.

Patented Feb. 20, 1917.



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UNITED STATES PATENT OFFICE.

ALFRED H. McCULLOCH AND CAROLINE D. McCULLOCH, OF BOSTON, MASSACHUSETTS.

ELECTRIC CONDUCTOR.

1,216,337.

Specification of Letters Patent.

Patented Feb. 20, 1917.

Application filed December 2, 1912. Serial No. 734,494.

To all whom it may concern:

Be it known that we, ALFRED H. McCULLOCH and CAROLINE D. McCULLOCH, citizens of the United States, residing at Boston, in the county of Suffolk, State of Massachusetts, have invented a certain new and useful Improvement in Electric Conductors, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

The invention is an improvement in the coverings which are applied to electrical conductors, electrical cables, electrical tubing, and other products of manufacture, including conduits for air, steam, and electrical wires. The improved covering may be applied for the purpose of insulation, or for prevention of chemical disintegration or fire, or for protection from mechanical wear and injury, or for the purpose of concealment, or as a finish to produce the desired surfacing, color, or appearance.

The three forms of coverings which are most generally applied at the present time to electrical conductors, etc., are the spirally wound covering, the braided covering, and the woven covering. The spirally wound covering has the advantages of economy of material, of requiring only simple machinery for its application, and of being very rapidly applied. Such covering, however, as heretofore applied, has a number of material drawbacks or disadvantages. It is liable to displacement and to separation of its turns or coils, to unwrapping, and to fraying out when exposed to certain conditions. It is ill adapted, therefore, to withstand the action of the wipers and the other treatment in waxing, polishing, and weatherproofing the same. Consequently in many cases it is superseded by the braided covering and the woven covering. These, however, in their turn have the drawback or disadvantage that both contain a far greater proportion of material than the spirally wound covering, rendering them proportionately more expensive, owing to the fact that in a braided covering one set of threads is overlaid by another, thereby making two thicknesses of threads, while in a woven cov-

ering the warp-threads and weft-thread or threads also overlies one another in a plurality of thicknesses. In addition, the machinery required for the application of braided and woven coverings is complicated and much more costly than that required for applying spirally wound coverings, and is far slower in its performance of the work of applying coverings, so that the day's output of a machine applying either a braided covering or a woven covering is very much less than that of a machine applying a spirally wound covering, and the cost of applying the covering is proportionately greater.

We have discovered that by combining with the turns or coils of the spirally wound covering one or more solitary lines of binding for the said turns or coils we can obviate the drawbacks or disadvantages of such form of covering, and render the spirally wound article suitable for employment in connections in which it has been found possible heretofore to employ only articles with braided or woven coverings, without noticeable increase in the amount of covering material employed, and in most cases without lessening the speed of manufacture.

In accordance with our invention we provide a covering comprising one or a plurality of spirally wound threads, yarns, wires or tapes, and one or more solitary lines of binding for the spiral turns or coils. Preferably, each of such lines of binding comprises a longitudinal thread, yarn, wire or tape passing in and out alternately so as to underlie one or more of the spiral turns, and then overlie one or more thereof, and so on in an alternating succession, the said longitudinal thread or the like thus engaging with the spiral turns in manner to bind the latter in place. Two or other small number of the longitudinal threads, etc., may be employed in a line of binding. The interlacing thread or the like binds the spiral winding firmly upon the object covered, so that the winding cannot unwrap, and holds the turns thereof so that they cannot separate from one another and so as to prevent portions of the covering from slipping lengthwise upon

the wire or other object, away from adjoining portions as sometimes occurs when covered wires are forced through narrow holes or other passages.

5 Our invention is illustrated in the accompanying drawings, in which—

Figure 1 represents a short length of wire having applied thereto a spirally-wound covering embodying the invention.

10 Figs. 2 to 10 show other embodiments of the invention.

Having reference to the drawings:—

In the respective embodiments of the invention the central wire is marked 1 in each instance, its coating of insulating material being marked 1^a, the spirally-wound coverings are marked 2, and the threads which are employed for the solitary lines of binding are marked 3. Fig. 1 shows a single binding thread engaged with the turns of the spirally-wound covering by passing over a single spiral turn, then under a single-spiral turn, then over a single turn, and so on successively. Fig. 2 shows a single binding thread which passes over two turns of the spirally-wound covering, then under two turns thereof, and so on successively. Fig. 3 shows a single binding thread passing over and under three spiral turns in alternating succession. More than one wire may be inclosed within the covering. The number of separate threads wound spirally in adjoining coils may be increased as high as is found practicable, and the number of turns over and under which the binding thread passes may be greater than here shown. Fig. 4 shows a solitary line of binding produced by the employment of two binding threads which oppose each other in their engagement with the spiral turns, so that one thereof passes over four turns while the other passes under such turns, and vice versa. Fig. 5 shows the spirally-wound covering bound by two solitary lines of binding located diametrically opposite each other.

The function of the longitudinal binding thread or threads is not that of covering the inclosed wire, but is that of binding in place the successive turns of the spirally wound wrapping which constitutes the covering. The said longitudinal binding thread or threads conveniently is or are utilized to serve as a marker or markers for distinguishing the particular wire, by being made of color or material different from that of the spirally-wound covering. Ordinarily the longitudinal binding threads may consist of the smallest number of threads and the least quantity of material that will fulfil the requirements of their service as binders, and as markers when they are utilized as such. For many purposes a single longitudinal binding thread will suffice for both

binder and marker. In some cases, the binding threads may be sufficiently coarse to produce a prominent line along the covering that can be felt, as in Figs. 6 and 7, to thus enable the wires to be distinguished by the sense of touch.

We do not confine ourselves to the use of the same material for the spirally wound covering and the binding, and while we have referred to binding threads we contemplate the use of threads, yarns, tapes, or wires as circumstances may require. In a case in which two longitudinal binding threads are employed, we sometimes vary their distinguishing characteristics by the use of dissimilar materials, colors, sizes, or shapes, so that the two longitudinal threads will present a contrast between themselves to the sight and to the touch. While in most cases the binding thread is extended in a straight line parallel with the axis of the wire, in some cases we cause it to extend in a helical direction, as in Fig. 8. We have shown but a single covering layer in the case of each of the illustrated embodiments of the invention, but in practice we shall apply two or more layers, one outside the other, in all cases in which a plurality of layers is required.

Figs. 9 and 10 illustrate modifications in each of which the longitudinal binding thread loops around the spiral turns or coils of the covering. In Fig. 9 the portions of said binding thread between successive loops underlie the turns or coils, and the loops face outward from the wire. In Fig. 10 the corresponding portions lie outside the turns or coils, and the loops face inward toward the wire. Both of these modifications provide for more positively locking the spiral turns or coils in place. The binding threads of these modifications furnish markers which may serve either visually or as mechanical projections, and the outwardly facing loops of Fig. 9 may occur at any desired periodic intervals to serve for purposes of differentiating identification.

What we claim as our invention is:—

1. The herein described spirally-wound covering, with all the turns or coils in a layer wrapped or wound in the same direction, and having combined with the spiral turns or coils comprising such layer a solitary line of binding for such turns or coils.

2. The herein described spirally-wound covering with all the turns or coils in a layer wrapped or wound in the same direction and having combined with the spiral turns or coils comprising such layer, a solitary line of binding consisting of a longitudinal thread or threads engaging with successive turns or coils.

3. The herein described spirally-wound covering, with all the turns or coils in a

layer wrapped or wound in the same direction, and having combined with the spiral turns or coils constituting the said layer a marker consisting of a longitudinal thread or the like engaged with the said turns or coils and constituting the chief longitudinal binding therefor.

In testimony whereof we affix our signatures, in presence of two witnesses.

ALFRED H. McCULLOCH.

CAROLINE D. McCULLOCH.

Witnesses:

NATHAN B. DAY,

CHAS. F. RANDALL.

Copies of this patent may be obtained for \$1.00 each, by addressing the Commissioner of Patents, Washington, D.C.