Patented Feb. 23, 1943

2,312,058

UNITED STATES PATENT OFFICE

2,312,058

METHOD OF INSULATING AND COVERING ELECTRICAL CONDUCTORS

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No Drawing. Application September 13, 1939, Serial No. 294,666

1 Claim. (Cl. 154—2.27)

Our invention relates to an improved method of covering wire, more particularly to the covering of a wire with an insulating compound and an outer protective composition covering.

More specifically our invention is directed to an improved method for the application of an outer covering to the rubber compound insulation of an electrical conductor in replacement of the conventional saturated fibrous braid.

Still more specifically our invention has for an object the provision of a method involving application of the rubber compound insulation direct to the conductor by a strip method as distinguished from extrusion, and the application also by the strip method, directly about this insulation, of a covering possessing superior characteristics as compared with the conventional saturated fibrous braid used heretofore.

Before proceeding with a detailed description of our invention, it may be well for clarity of description to make reference to covered, rubber-compound-insulated conductors as conventionally constructed prior to our invention.

These prior constructions embody a rubber compound insulation and a covering of saturated fibrous braid. The function of the fibrous braid is primarily to protect the insulation against mechanical injury and "sun-checking." However, these braids soon deteriorate and rot away from the insulation due to the destructive influence of molds and bacteria, especially in the presence of moisture. Then again, the surface resistivity of these braids is low, with the result that the braids frequently develop static or corona discharge in service in ducts at from 2000 to 5000 volts. Cotton braids also have other disadvantages, such as their inflammability, lack of flexibility at low temperatures and poor resistance to abrasion, acids, alkalis, oils and other chemicals.

We intend employing a composition outer covering, comprising polymerized chlorinated butadiene or plastic polymer, instead of the saturated fibrous braids heretofore used. This outer covering or sheath has excellent mechanical properties and resistance to abrasion, acids, alkalis, oil, etc., and is immune to mold growth. It protects the insulation against sun-checking, is flexible at low temperatures, resistant to heat, and inasmuch as it contains chemically combined chlorine it is relatively non-inflammable. Furthermore, this composition does not develop static or corona discharge when in service in ducts at from 2000 to 5000 volts, and since it has excellent ozone resistance it will not readily be attacked or corona cut in the event some ozone is formed.

In the practice of our invention an insulating compound, which is to be applied directly to the conductor to be insulated, is put through a feeding mill for calendering. When the proper thickness has been attained the compound is cut into strips and wound upon a suitable cylinder or roll with cloth interposed between adjacent layers. Eventually this material is rewound, the cloth being removed in the process, and the strips spliced together to form a length say of 3000 feet.

When a conductor is to be insulated, the conductor and the continuous insulating strip are led through suitable apparatus which shapes the insulation about the conductor. This operation is repeated as many times as necessary to build up an insulating layer of the desired thickness.

The outer covering, especially on small cables, has to be applied about the insulation in a thin layer only, say for example a covering fifteen mils thick, and for this reason it is not practicable to apply it by the extrusion method.

Accordingly we proceed as follows: The composition which is to constitute the outer covering comprises polymerized chlorinated butadiene or plastic polymer. This material is first milled, and then calendered upon a tin sheet which is first given a thin coating of shellac or any other mould solution. The thickness of the tin sheet depends on the size of cable to be insulated and ranges from twelve to thirty mils and the layer of composition applied to it may be as thin as ten mils. The thin layer of mould solution which is applied to the tin causes the uncured composition to adhere to the tin backing and permits free stripping of the tin after vulcanization has been completed.

After the outer covering composition has been applied to the tin sheet, the assembly is cut into strips of the necessary width, the ends of the strips joined and then the continuous strip thus produced together with the insulated conductor are run through the same or a similar machine as was employed for application of the main wall of insulating compound, which, as will be appreciated, shapes the tin-backed composition about the conductor insulation. As the tin-backed composition moves to this apparatus it passes along a steam heated table or other suitable equipment which slightly warms the composition. This serves to promote adherence of the composition to the insulating compound and

upon vulcanization gives a dense, non-porous layer.

After the application of the outer covering composition the assembly is subjected to a vulcanizing operation in the usual manner, after which the tin backing is stripped off, leaving a smooth, dense, polished surface on the sheath.

We have found that by applying both the insulation and the outer covering or jacket by the strip method as hereinabove described, very accurate control is assured over the thickness of the insulation and jacket. This is of material advantage as will be appreciated by those skilled in this art. We find also that we obtain a firm bond and strong adhesion between the insulation and the outer covering without recourse to adhesives or cements. Furthermore, the insulation and outer covering can be run in the same operation thereby cutting factory costs. As above mentioned, the mould solution applied to the tin backing prior to the application of the outer covering composition causes the uncured composition to adhere to the tin during the calendering operation and permits free stripping of the tin after vulcanization, leaving a dense, smooth, highly polished surface.

The resulting jacket or sheath compound in addition to serving as a mechanical protector has good electrical characteristics which provides additional insulation over the conductor even after prolonged immersion in water. Fibrous braids of course provide little, if any, insulation and upon immersion become quite conducting.

We have obtained satisfactory results with the following compound, which, it will be understood, is set up merely as an example of a suitable material for the outer covering or jacket, it being understood that the formula may be varied without departing from the spirit and scope of our invention:

	Per cent
Chloro-2-butadiene-1-3 plastic polymer	50–60
Magnesium oxide	2–6
Wood rosin	0–3
Factice	9–4
Carbon black	20–10
Inert mineral ingredients	20–0
Softening oils	0–5
Softeners	0–6
Sulphur	0–1
Accelerator	0–2
Zinc oxide	2–6

This stock has a curing range of 250° F. for one hundred minutes to 305° F. for sixty minutes. In compounding, the ingredients are added to the polymer in the order given.

What we claim is:

The continuous method of insulating electrical conductors and bonding an outer protective layer thereto, which method comprises continuously applying one or more layers of an unvulcanized rubber insulating compound to the conductor by the strip method until an insulating layer of the desired thickness has been built up, continuously advancing an elongated composite strip, composed of tin coated on one face with a mould solution and a superimposed layer of uncured compound composed mainly of polymerized chlorinated butadiene calendered thereto, to bring the strip and the unvulcanized insulating compound into superimposed relation with the butadiene in contact with the said compound, the strip immediately prior to reaching said position passing through a heated zone so as to heat the butadiene and promote its adherence to the insulating compound, shaping the elongated strip transversely of its length about the uncured insulating compound, curing the insulating compound and butadiene, and finally removing the tin.

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