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OILPROOF FLAME RESISTING CONDUIT, CABLE, ETC.,
AND METHOD OF MAKING SAME
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Fig. 1.

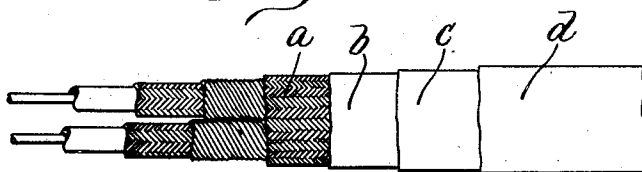
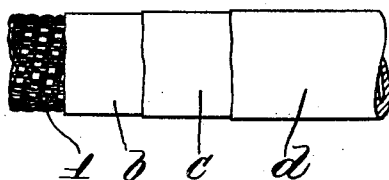


Fig. 2.



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UNITED STATES PATENT OFFICE

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OIL-PROOF FLAME-RESISTING CONDUIT, CABLE, ETC., AND METHOD OF MAKING SAME

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The present invention relates to flexible pitch coating of cable or conduit makes the non-metallic conduit for receiving and protecting the insulated wires of electric light and power circuits, and to the insulated

conductors and cables of such circuits, in buildings and other situations where protection against mechanical injury, fire, water, and other injuries liable to cause a short circuit, is important. Among other circumstances in which such protection is valuable, is use with the electrical equipment of automobiles, the wires of which are, in service, liable to conditions which would cause rapid deterioration if not guarded against, such as wetting with lubricating oil, gasoline and water, impact of grit and water driven by the wind or the splash of the wheels, and so forth. Hence the wires for this and other purposes where oil may be encountered, require protection from oil as well as from fire and water. Within the meaning of the word "oil" as used in this specification to define the quality of protection given by articles embodying the present invention, I include gasoline and other so-called light oils, as well as lubricating oil, grease, etc.

It has been the object of this invention to provide protection for electrical conductors combining immunity from access of oil to the rubber insulation with resistance to fire and to penetration of water to the conductors. In carrying out this object I have utilized lacquers containing cellulose derivatives as the oil-proofing agent in combination with the flame-proofing and water-proofing agents heretofore generally used in the product of commercial protected electrical cable and conduit for electrical conductors. One phase of the invention resides in such combination.

The agent or compound which most satisfactorily meets the established standards for flame-proofing such manufactures is stearin pitch. Indeed from the commercial viewpoint, having regard to its availability and cost, and the cost of applying it, this material is practically essential. But this compound is soluble to some extent in the solvents or thinners used with cellulosic lacquers, so that the application of such lacquer to the stearin

Hence in order to produce the first phase or feature of the invention, above mentioned, I was confronted with the problem of so applying the lacquer that the final coated article would not be sticky. I have solved this problem in two ways, both embodying the same generic invention, which constitutes the second phase of the present invention. One consists in applying the lacquer in two or more coats with a curing period between the first and second coats, as hereinafter more particularly described. The other consists in applying an intermediate coat or film of a different substance, as silicate of soda, between the stearin pitch surface and the lacquer coating.

Before describing the invention in further detail, I would say that the articles or manufactures treated according to this invention are single insulated conductors having an outer braided or woven sheath or jacket, cable consisting of two or more conductors arranged side by side, and all enveloped by a braided or woven jacket, an open woven tube of suitable structure and character to serve the uses of electric conduit, and the like structures; all being known in the art. The treatment according to the invention involves an effect only on the outer sheath or jacket of such conductors or cables, and on the electrical conduit. Inasmuch as such conduit is itself a sheath or jacket, differing from the sheath of a cable or conductor principally in that it is originally completed apart from the wires which it is intended to embrace, instead of being manufactured directly upon them, the entire class of manufactures to which the invention is applicable may be comprehensively considered and designated as sheathing for electrical conductors, for the purpose of generic definition in this specification and in the following claims.

In the drawings herewith,—

Fig. 1 is an elevation showing a fragment, partially dismembered, of a sheathed cable embodying this invention; and

Fig. 2 is a similar view of an electrical

conduit illustrating another embodiment of the invention.

The cable of Fig. 1 consists of two or more electrical conductors, each provided with its own insulating and protective covering, of any suitable character, and both enveloped by a braid or woven sheath *a* composed of cotton or other suitable porous strands. *b* represents a flame-proofing coating preferably of stearin pitch, as usual, deposited on the sheath *a*. *c* is a sealing coat or layer, of suitably aged cellulosic lacquer or dried silicate of soda enveloping the coat *b*, as herein-after more fully described. *d* is the final or finishing layer of cellulosic lacquer enveloping the intermediate layer *c*.

In the second embodiment of the invention, shown in Fig. 2, the numeral 1 represents a conduit made preferably as a seamless woven tube of strands having suitable qualities for articles of this class, the nature of which is well understood by those acquainted with this art. *b*, *c* and *d* are coatings of the same nature and applied in the same sequence as above described in connection with Fig. 1. It is to be understood that the terms "coat" and "layer" used in the foregoing description are not intended to have any limiting significance as to the number of applications of the compounds used to build up each layer. That is, the herein designated coats or layers may be single or composite; a composite coating being, for the purposes of this specification, one made up of two or more individual applications or coatings of the compound.

The manner in which water-proofing and fire-proofing substances or compounds are applied to the sheathing structures is not material to the present invention. Neither is the number of such substances and the number of coatings or impregnations in which the substances are applied; nor the identity of the substances themselves, except as to that phase of the invention which involves a particular mode of applying cellulosic lacquer upon stearin pitch. It is sufficient that before being treated with lacquer, the sheathing has been treated, according to practices well known and long used, or otherwise, so as to be resistant to penetration by water and to combustion when exposed to flame in suitable measure to meet the requirements of the service for which it is designed. The article may have both a water-proofing compound and a flame-proofing compound, or a flame-proofing compound alone. If treated with stearin pitch as the flame-proofing substance, it may or may not be provided with a coating or impregnation of water-proofing agent beneath the stearin pitch coating. In practice, however, commercially salable conduit and sheathed conductors of this class must have fire- and water-resisting properties sufficient to comply with the standards established by the National Board of Fire Underwriters.

The lacquer which I use in oil-proofing sheathing of the character here defined comprises a cellulose compound or derivative as a base mixed with a sufficient quantity of solvents to make the solution freely fluid, and a content of castor oil or equivalent miscible emollient agent to make the dry residue of the lacquer flexible. I have used and may use various commercial lacquers of which the base is either nitrocellulose or cellulose acetate and the solvents are any substances having adequate solvent action. As between lacquers which have greater or less inflammability, I prefer to use those which are less inflammable; although the quantity of cellulose compound left after drying of the lacquer on the sheathing is so thin and has such small mass that it does not cause a fire hazard even when having a highly inflammable composition, because it develops too little heat in burning to affect the fire-proofing material.

The solvents (acetone, amyl acetate, the ketones, etc.) which have the most active solvent action on the cellulose compounds, and one or more of which practically must be used in making the lacquer and thinning it to the fluidity necessary for coating the sheathing, have also a solvent action upon stearin pitch. In practice the lacquer is applied by passing the sheathing (that is, open conduit or sheathing containing a wire or wires) through a bath of the lacquer solution. The solvents are thus brought into thorough and intimate contact with the coating material already on the sheathing and, when this material is stearin pitch, soften and make it sticky.

One of the methods by which I overcome this unavoidable ill effect is to subject the article, after its first treatment of lacquer, to a curing or aging step, by which the sticky surface is solidified. The aging step may be performed variously. In practice I prefer to carry it out by first passing the lacquer coated goods through a heated oven or curing chamber through which a circulation of air is maintained and then exposing them to the open air for about three hours. The oven is heated to a temperature of about 180° F. and the goods are passed through at a rate which causes any given point to remain in it for about two minutes. Wide variations are possible in these particulars, however, for the temperature may be anything between about 150° F. and about 300° F., and the time of heat curing slightly less or considerably more than two minutes; provided that, if the temperature is high enough to melt stearin pitch, the goods must not be exposed to it long enough to soften the pitch envelope. Such forced curing is valuable in that it causes a glossy surface to be developed on the lacquer. Air laden with the vapor of the solvents is continuously withdrawn from

the oven and fresh heated air substituted. The subsequent air curing period need not continue for as long as three hours, but may be as short as one hour. On the other hand, it may be much longer than three hours with good effect on the product, but considerations of cost require limitation to about the time stated during working hours, or to over-night periods in the case of goods lacquered at the end of the working day. Generally, although not necessarily, two coats are applied and aged in this way, and two outer coats afterwards applied; although the invention includes a single sealing coat, or more than two, and any number of outer coats, of lacquer.

Thus the stearin pitch element of the article is sealed in and safeguarded against attack by the solvents in a subsequent coat or coats of lacquer.

An alternative mode of protecting the stearin pitch element for the same purpose is to apply a coat of sodium silicate or equivalent solution which will adhere to and dry on stearin pitch, and to which cellulose lacquer will in turn adhere without dissolving it.

After the coating of stearin pitch has been thus sealed and protected by either of the means above described, any desired number of additional or top coats of lacquer may be applied in a similar way. At the conclusion of the process the surface of the coated article is smooth and glossy and possesses substantially perfect impermeability by oil and water. The surface film is tough, flexible and elastic, but not sticky. Thus the finished product is water-proof, oil-proof and flame-proof, and is adapted to serve the purpose of protecting electrical wires from injury by these agencies. The toughness and flexibility of the coating protects the article also against abrasion and damage by the impact of flying particles of sand, etc. in circumstances where it is exposed to the impact of such particles.

What I claim and desire to secure by Letters Patent is:

1. An oil-proof and flame-proof insulated electrical conductor, cable, conduit, and the like, having an envelope of stearin pitch as its flame-proofing element and having also a sealing coat over said envelope and an outer film of dried cellulose lacquer over said sealing coat.

2. The method of covering a stearin pitch coated article with a solution of cellulose derivative having as the solvent a substance which is also a solvent of stearin pitch, which consists in first sealing the surface of the stearin pitch coating against attack by the solvent in the after-applied solution, and then applying a top coat of said solution.

3. The method of covering a stearin pitch coated article with cellulose derivative dissolved in a solvent which has also solvent effect on stearin pitch, comprising first cover-

ing the stearin pitch coating with such solution, then drying the film of applied solution, and finally applying a top coat of the same solution.

4. The improvement in the method of covering a stearin pitch surface with cellulose lacquer dissolved in a liquid which is also a solvent for stearin pitch, which consists in applying and drying a sealing coat on the stearin pitch surface to protect it from attack by the solvent in the lacquer, and subsequently applying the surface film of lacquer.

5. The method of oil-proofing a stearin pitch coated article which consists in applying cellulose lacquer to the surface of such article, drying the lacquer, and applying a top coat of lacquer over the dried surface thereof.

6. The method of making non-sticky on the surface a sheathing of the character specified which has been provided with a flame-proofing coat of stearin pitch, which consists in covering the stearin pitch coat with cellulose lacquer, aging the lacquer coat by subjecting the coated goods to heated dry air at a temperature between 150° F. and 300° F. and further exposing the goods to the open air for a period in the neighborhood of three hours, and then applying a top layer of cellulose lacquer and drying the same.

In testimony whereof I have affixed my signature.

JOSEPH A. KENNEDY.