H. B. HOLMES & J. W. HARRIS.

INSULATING COATING AND METHOD OF FORMING AND APPLYING THE SAME.

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1,101,281.

Patented June 23, 1914

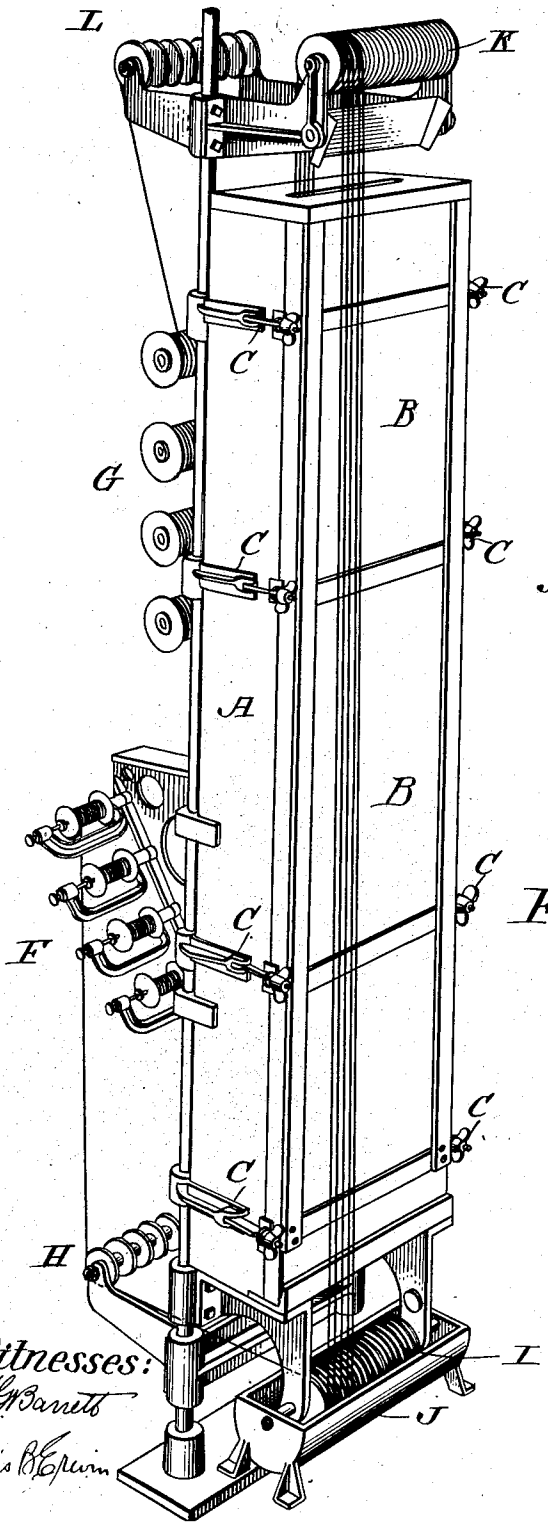


Fig. 1.

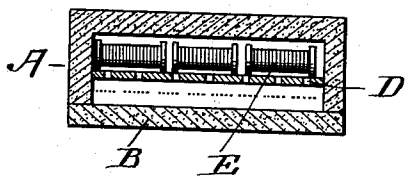


Fig. 2.

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UNITED STATES PATENT OFFICE.

HOWARD B. HOLMES, OF PARK RIDGE, AND JONATHAN W. HARRIS, OF WILMETTE, ILLINOIS, ASSIGNORS TO WESTERN ELECTRIC COMPANY, A CORPORATION OF ILLINOIS.

INSULATING-COATING AND METHOD OF FORMING AND APPLYING THE SAME.

1,101,281. Specification of Letters Patent. Patented June 23, 1914.

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To all whom it may concern:

Be it known that we, HOWARD B. HOLMES and JONATHAN W. HARRIS, both citizens of the United States, and residing, respectively, at Park Ridge and Wilmette, in the county of Cook and State of Illinois, have invented a certain new and useful Insulating-Coating and Method of Forming and Applying the Same, of which the following is a description, reference being had to the accompanying drawing, forming a part of this specification.

Our invention relates more particularly to an insulating coating for wires carrying electric currents (to take the place of the ordinary cotton and silk insulating coverings heretofore usually employed for them) and has for its object the production of a coating which shall possess to a higher degree than any coating heretofore employed the essential and desirable qualities and characteristics of such a coating. Among these qualities and characteristics of our new coating are, first, that it possesses great dielectric strength and consequently affords a high degree of insulation to the wire coated with it; second, that it is non-hygroscopic, which prevents its absorption of moisture with consequent deterioration of its insulating qualities, as well as injury to the wire; third, that it is both flexible and elastic to a marked degree, not only permitting the coated wire to be wound in the coils of electro-magnets or otherwise disposed without breaking the coating, but allowing the wire to be stretched to the limit of its own elasticity (as is frequently done in the winding of electro-magnet spools and coils) without fracturing the coating or separating it at any point from the wire; fourth, that it is neutral to re-agents to such an extent as to be insoluble and non-oxidizable under all commercial conditions to which it is liable to be subjected; and, fifth, that it possesses a high degree of resistance to heat, so that it is not affected by temperatures which are sufficient to char and destroy the strength and insulating qualities of cotton and silk coverings, nor by any higher temperatures to which it is likely to be subjected in commercial use.

The foregoing are the salient qualities and characteristics of the coating as finally applied to the wire, ready for commercial use, in addition to which our new coating preparation or material, in condition for application to the wire, is a homogeneous mixture of substantially fixed character and of such a nature and consistency as to adhere to the wire in a smooth layer or film of uniform thickness and be capable of hardening quickly upon the wire—qualities and characteristics which are essential to the proper application of the coating to the wire.

We have discovered that a coating material possessing the qualities and characteristics above described may be obtained by dissolving certain hydro-carbons in suitable solvents, in connection with certain fixed vegetable oils, and preferably also a small quantity of glue; and that such coating material may be properly applied to the wire by passing the latter through the coating material a considerable number of times and subjecting it after each passage to a sufficiently high degree of heat to drive off the solvents employed in preparing the mixture and destructively distil the residual elements to such an extent as to leave upon the wire a hard but elastic coating of such fixed and permanent character as will not be affected by the conditions of subsequent practical use.

The solid hydro-carbon from which we have obtained the best results is what is known as "ozocerite". In practice we employ a mixture of different grades of commercial ozocerite, in order to secure the desired proportions of pitch and wax, as hereinafter described; and we add to the mixture a small quantity of asphaltum for the purpose of producing a harder and smoother coating than would be produced by the use of ozocerite alone. We employ a vegetable oil which is of a non-drying, rather than a drying, character, and have obtained the best results from castor-oil. Castor-oil is converted by the destructive distillation to which we subject it into a gummy residue, and it is the addition of this element, or a suitable substitute for it, which gives the coating its marked degree of elasticity heretofore referred to—an elasticity which permits the coated wire to be stretched approxi-

mately one-third of its own length without fracturing the coating or separating it from the wire at any point.

While, as stated, we have obtained the best results from castor-oil, we have also secured fairly good results from oils which are non-drying to a less degree than castor-oil, such for instance as cotton-seed oil; and where, therefore, we refer to a non-drying oil in our specification and claims we desire to be understood as meaning an oil of such a character that the residue which is left by the destructive distillation of it in the application of the coating mixture to the wire will be substantially non-oxidizable under the conditions of subsequent practical use and which will therefore preserve the elastic quality of the coating under such conditions.

For the solvents we employ a graded series which will be gradually or successively driven from the coating material upon the wire when it is subjected to heat. Those which we preferably employ are, in the order of their volatility, (1) tetra-chlorid of carbon, (2) kerosene, (3) turpentine, and (4) mineral oil.

We have found that the final coating upon the wire is improved by the addition of a small quantity of glue to the coating mixture, but have not been able to discover any trace of glue remaining in the final coating and therefore believe that its beneficial effect is main derived from the fact that its addition to the mixture carries into the latter a considerable quantity of water whose expansion into superheated steam under the heat of the mixture serves to more thoroughly mix and combine the elements of the latter.

In preparing the coating mixture we take, for instance, 158 pounds of low grade or pitchy ozocerite, 16.5 pounds of commercially pure ozocerite, 11.5 gallons of castor-oil, 36.5 gallons of mineral oil of a specific gravity of .860, and 19.5 gallons of asphaltum dissolved in benzin, and place them in a mixing kettle and heat them to approximately 150 degrees centigrade, maintaining the mixture at or above this temperature for an hour or more, with constant agitation. This will cause the ozocerite to be melted and thoroughly dissolved. We then take one pound of glue, which has previously been thoroughly soaked in cold water, and add it in small quantities, with gentle agitation of the mixture. This addition of the glue will cause the mixture to froth more or less violently, which may be checked and controlled by the addition of turpentine. After all froth has disappeared, even on continued stirring, enough additional turpentine is added to the mixture to make a total quantity of 40 gallons of turpentine in the mixture, and then 42 gallons of kerosene are added and the mixture boiled for half an hour longer. The contents of the kettle are now cooled and filtered into settling tanks, and 6.6 gallons of carbon tetra-chlorid added and stirred in the mixture. The settling tanks are then covered and the solution allowed to stand for a considerable period of time, preferably as long as three days, before using. The basis or body of the coating mixture thus compounded is the solid hydrocarbon (ozocerite and asphaltum), constituting approximately 18% by weight of the fluid mixture; sufficient non-drying vegetable oil (castor oil) being added to insure that the coating when baked upon the wire will maintain the desired elasticity.

In applying the coating material to the wire we employ a suitable furnace having a vertical passage through it, a tank or trough for the coating material located beneath said furnace, and a series of guide pulleys above and below the furnace, those below being partially immersed in the coating material in the trough. The wire to be coated is carried in a suitably supported supply coil or spool and led thence around the first of the series of pulleys in the coating material beneath the furnace, thence upward through the furnace and over the corresponding pulley above the furnace, thence downward around the second pulley in the coating material beneath the furnace, thence upward through the furnace and over the second pulley above the same; and so on about all of the pulleys in the series, being preferably passed through the furnace half a dozen or more times. We heat the furnace to a temperature of from 260 to 370 degrees centigrade (depending upon the rate of movement of the wire through the furnace) and the coating material is of such character and consistency that during the first upward passage of the wire through the furnace the first film of the coating material then adhering to the wire is sufficiently hardened, the volatile elements of the mixture being driven off and the residual elements being destructively distilled to such an extent as to prevent further change under the conditions of practical use, but not sufficiently to impair the elasticity of the coating; and at each successive passage of the wire through the furnace the added film of coating material is likewise hardened, so that the coating is applied to the wire in successive films or layers, hardened upon the wire before the application of the succeeding film or layer. In this manner a perfectly uniform coating is applied to the wire, the thickness of the coating depending upon the number of times the wire is passed through the coating mixture and furnace.

In the accompanying drawing we have given a sufficient illustration of one form of furnace employed in connection with our invention to afford an explanation of the mode of operation above described, Figure 1 being

a perspective view of the furnace looking at one of its rear corners, and Fig. 2 a horizontal cross section of the same.

As shown, this furnace A is rectangular in cross section and of considerable height, and has a removable rear wall B secured to the body of the furnace by suitably applied nuts and bolts C. The walls of the furnace are composed of a preparation of asbestos or other fire-proof material, and the front and two side walls may be formed in one integral piece, as shown in Fig. 2.

The interior of the furnace is divided transversely, from top to bottom, by a perforated metal partition D and the forward one of the two vertical chambers thus formed within the furnace contains the electric heating coils E, by which the furnace is heated. The other one of the two chambers, between the partition wall D and rear wall B, is the one through which the coated wires are passed and in which they are subjected to the heat of the furnace, as indicated by the dots in Fig. 2. The wires to be coated are carried upon supply spools F suitably supported upon the front of the furnace, and after being coated are wound upon storage spools G also located upon the front of the furnace, above the spools F. The storage spools G are driven by power and serve to draw the wires from the supply spools F over the intermediate pulleys and through the furnace, and wind them up upon the spools G. The wires pass downward from the supply spools F over guide pulleys H, thence rearward beneath the furnace and around pulleys I mounted in a trough J containing the coating mixture, thence upward from the forward sides of said pulleys through the furnace and over the pulleys K mounted above the furnace. After the wires have been passed around the pulleys I and K and upward through the furnace a sufficient number of times to properly coat them, they are led forward from the pulleys K over guide pulleys L, thence downward around the storage spools G.

In practice we equip each furnace to coat eight separate wires, to which end there are eight supply spools F and eight storage spools G mounted upon the forward side of the furnace, only four of each appearing in Fig. 1, however, as the other four are hidden from view by the body of the furnace. To avoid confusion, we have shown in said figure only a single one of the eight wires, leading downward from the first or uppermost one of the four supply spools shown, thence beneath the first of the guide pulleys H, thence rearward over the first of the pulleys I in the trough J, thence upward through the furnace and over the first of the pulleys K at the top of the same, thence downward upon the outside of the furnace to and around the second pulley I in the trough J, thence upward through the furnace a second time, and so on around the pulleys K and I and through the furnace the desired number of times, after which the wire is led forward from the pulleys K over the first of the upper guide pulleys L, and thence downward around the upper storage spool G.

The details of the furnace, even so far as they have been illustrated and described, form no part of our present invention, and any other suitable form and arrangement of furnace and associated devices may be employed.

Having thus fully described our invention, we claim:

1. An insulating coating comprising a solid hydro-carbon and a non-drying vegetable oil subjected to destructive distillation.

2. An insulating coating comprising a solid hydro-carbon and castor-oil subjected to destructive distillation.

3. An insulating coating comprising ozocerite and castor-oil subjected to destructive distillation.

4. An insulating coating comprising ozocerite, asphaltum, and castor-oil subjected to destructive distillation.

5. An insulating coating comprising a solid hydro-carbon and a fixed vegetable oil subjected to destructive distillation.

6. An insulating coating mixture comprising solid hydro-carbons, an unsaponified non-drying vegetable oil, and volatile solvents, adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

7. An insulating coating mixture comprising a solid hydro-carbon, a non-drying vegetable oil, volatile solvents, and glue.

8. An insulating coating mixture comprising a solid hydro-carbon, an unsaponified non-drying vegetable oil, and light and heavy volatile solvents.

9. An insulating coating mixture comprising a solid hydro-carbon, a non-drying vegetable oil, light and heavy solvents, and glue.

10. An insulating coating mixture comprising ozocerite, a non-drying vegetable oil, and volatile solvents; adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

11. An insulating coating mixture comprising ozocerite, asphaltum, a non-drying vegetable oil, and volatile solvents, adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

12. An insulating coating mixture comprising ozocerite, a non-drying vegetable oil, volatile solvents, and glue.

13. An insulating coating mixture com-

prising solid hydro-carbons, castor oil, and volatile solvents, adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

14. An insulating coating mixture comprising ozocerite, castor-oil, and volatile solvents, adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

15. An insulating coating mixture comprising ozocerite, asphaltum, castor-oil, and volatile solvents, adapted for baking at a temperature which will drive off the solvents and will destructively distil the oil to form an enamel-like substance.

16. An insulating coating mixture comprising solid hydro-carbons, a non-drying vegetable oil, the proportion by weight of the hydro-carbons and said oil being substantially 5 to 2, and solvents to an amount sufficient to thin the compound suitably for application to wire.

17. The process of making an insulating compound which consists in mixing a solid hydrocarbon and a vegetable oil with volatile solvents, heating the mixture to dissolve and digest the constituents, adding a relatively small quantity of glue, and then additional solvent to control the frothing of the mixture, then cooling the mixture and thinning it when cooled by the addition of other solvents of greater volatility than the first mentioned solvents.

18. An insulating coating mixture for wires, comprising a solid hydrocarbon base constituting approximately 18% of the mixture by weight, a non-drying vegetable oil sufficient in quantity to impart to the coating when baked upon the wire an elasticity as great as the elasticity of such wire, and volatile solvents.

19. An insulating coating mixture comprising ozocerite, asphaltum, a fixed oil, volatile solvents and glue.

20. The process of making an insulating coating which consists in mixing a solid hydrocarbon with a non-drying vegetable oil at a relatively lower temperature, thus forming a coating mixture, and subjecting the coating mixture thus formed, after application to the article to be coated, to a relatively high temperature to destructively distil the non-drying vegetable oil and form a hard elastic enamel-like substance.

21. The process of making an insulating coating which consists in mixing solid hydrocarbon with a non-drying vegetable oil, heating the mixture until the hydrocarbon melts, thus forming a liquid coating mixture and subjecting the coating mixture, after application to the article to be coated, to sufficient heat to destructively distil the non-drying vegetable oil.

22. The process of making an insulating coating which consists in forming a coating mixture by dissolving, in a volatile solvent, a solid hydrocarbon and an oil having the property when subjected to destructive distillation of leaving a gummy residue, and subjecting the coating mixture, after application to the article to be coated, to a temperature suitable for the destructive distillation of said oil.

23. The process of making an insulating coating which consists in dissolving a solid hydrocarbon and castor oil in a volatile solvent, applying the solution to an article to be coated, and then subjecting the coating to a temperature approximating 260° to 370° C.

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