This invention relates to a method of and apparatus for treating coating material applied to a core, and more particularly to a method of and apparatus for hardening coating material applied to a core in strand form.

Objects of the invention include the provision of a simple and efficient method of hardening coating material applied to a core and the provision of apparatus for practicing the method in an efficient and expeditious manner.

In one embodiment of the invention a wire is passed through a composition composed of a substantially non-combustible insulating material combined with suitable volatile, combustible substances whereby a coating adheres to the wire. As the wire emerges from the composition it is passed through a heated zone where some of the combustible substances are vaporized to render them more inflammable. It next passes through a combustion chamber where the vapors are ignited and where air under pressure, which has been heated by passing it along the combustion chamber, is admitted, wherein the insulating material is baked or hardened upon the wire by the heat of combustion of the combustible substances in the coating composition.

Further objects of the invention will be apparent from the following detailed description, taken in conjunction with the accompanying drawings, wherein

Fig. 1 is a transverse vertical sectional view of apparatus, embodying the features of the invention, by means of which the method may be practiced, and

Fig. 2 is a vertical sectional view taken substantially on the line 2—2 of Fig. 1 in the direction of the arrows.

Referring to the drawing wherein like reference characters designate the same parts throughout the several views, the numeral 3 designates a sheave around which a wire 4 which is to be coated with insulating material passes from a supply reel not shown to a pulley 5, fixedly mounted on a shaft 6 which is rotated by any suitable means. The wire 4 passes over and around the pulley 5 and then downwardly into an insulating composition 7 contained in a vessel 8 in which is mounted a cylindrical grooved pulley 9 for guiding the wire through the composition.

Supporting the pulley 9 is a shaft 10 which is journaled in bearings 11—11 formed in the walls of the vessel 8. An idler roller 15 is provided for removing any excess composition from the wire 4 and is rotatably mounted within an enlarged portion 16 of a tube 17 which extends into the composition and which in the preferred form of the invention is heated by a pair of electrical heating units 18—18 mounted on opposite faces thereof.

Near the upper end of the tube 17 a plurality of apertures 19—19 are provided for admitting air which has been heated in passing through a pipe 20 and a chamber 21 mounted closely adjacent the tube 17. The chamber 21 surrounds the tube 17, and the apertures 19—19 in the tube are provided on its front and rear surfaces while the air is admitted through the pipe 20 which is mounted on one side of the tube 17. The pipe 20 is connected to a tank 27 in which a supply of air is maintained under a uniform pressure by a suitable air compressor (not shown) and a valve 29 of any well known type is provided for controlling the amount of air passing through the pipe 20 to the chamber 21 for admission through the apertures 19 to the tube 17.

A spark plug 22 of any well known type is provided at the upper end of the tube 17 for the purpose of igniting the combustible substances in the coating composition. Alternatively, a small gas jet connected to a gas main and extending into the combustion chamber or any suitable igniter known to the art, might be utilized to ignite the solvents of the composition. The upper end of the tube 17 extends into a chamber 23 in which the process of combustion may be completed, the major part of the combustion taking place in the tube 17. A suitable slot 24 is formed in the upper end of the chamber 23 through which the wire 4 may pass to the pulley 5 after the coating material on the wire has been baked or hardened by its passage through the combustion chamber 23. Near the upper extremity of the chamber 23 an exhaust duct 25 is provided for drawing off the gases generated in the combustion chamber, this exhaust duct being provided with a suitable damper designated generally by the numeral 26.

It is believed that a better understanding of the invention may be had by referring to the following description of the operation of the embodiment thereof described in the preceding paragraphs. The wire 4 is passed from a suitable supply spool (not shown) around the sheave 3, over the pulley 5, down and around the pulley 6, over the roller 16, through the tube 17, and the chamber 23, around the pulley 5, again down and around the pulley 9 and through the tube 17 and chamber 23 to the pulley 5. The wire is threaded around the pulleys 5 and 9 and the roller 15 in this way several times (5 times in the embodiment shown), and the last pass of the wire is drawn from the pulley 5 to a take-up device of any suitable type (not shown).

The vessel 8 is filled to a level above the lower end of the tube 17 with an insulating composition consisting of a substantially non-combustible insulating material combined with a suitable volatile and combustible solvent or solvents. The term "substantially non-combustible" as used herein and in the appended claims is employed in...
a relative sense to distinguish between the substances which are baked on the wire and those which are burned to generate heat for hardening the composition. In the embodiment described herein, the solvents have a flash point which is under 200° F. and the remaining ingredients have a flash point between 700° and 900° F. and will burn only when heated to approximately 1400° F. By the term "solvent" as used above and hereinafter in the specification and annexed claim, is meant any substances which will combine with the insulating material to form a true solution, an emulsion, or a suspension, or a mixture of any of these states of matter. An insulating composition which may be employed with satisfactory results is disclosed in the United States Patent No. 1,101,281, issued June 23, 1914, to H. H. Holmes et al, with the exception that the carbon tetrachloride contained therein may be omitted to increase the inflammability of the solvents. This composition with the carbon tetrachloride omitted comprises substantially 158 pounds of low grade pitchy ozocerite, 16.5 pounds of commercially pure ozocerite, 11.5 gallons of castor oil, 286.6 gallons of mineral oil of a specific gravity of .860, 19.5 gallons of asbestos, 1 pound glue, 40 gallons of turpentine, and 42 gallons of kerosene.

Electrical energy is supplied from a suitable source not shown to the spark plug 22 to ignite the gases formed by the vaporization of the volatile and more readily combustible substances of the composition, which vaporization is materially aided by the heat generated by the heating elements 18 positioned at the front and rear of the chamber 17. The mechanisms for driving the take-up device and the pulley 5 are started when the wire 4 will be drawn through the insulating composition 7 and become coated thereby. A strand of coated wire passes vertically from the composition directly into the tube 17 and over the roller 15 without free access to the air, any excess of insulating composition being removed from the wire by the wiping action of the roller. The coated wire then passes upwardly through the tube 17 which is heated by the heating elements 18 and in which some of the volatile, combustible substances present in the coating on the wire are vaporized. The wire next travels past the apertures 19 in the tube 17 where a supply of air sufficient to burn substantially all of the solvents in the coating is admitted. The air thus admitted has been heated in passing through the pipe 20 and arranged adjacent the chamber 23 and is here mixed with the vapors produced in the lower end of the tube 17. In the lower end of the chamber 23, the mixture of vapors and air is ignited by the spark plug positioned adjacent the upper end of the tube 17 whereupon the solvents upon that portion of the wire passing at that instant through the upper portion of the tube 17 become ignited. Since the air under pressure admitted through the pipe 20 may be controlled by the valve 25, the combustion in the tube 17 and chamber 23 may be readily regulated and may be controlled so that the flame produced by the combustion of the solvents will produce sufficient heat to give a satisfactory product. The height of the flame in the combustion chamber, necessary to produce sufficient heat to give a satisfactory product, may be controlled by the amount of air admitted thereto and will vary materially depending upon the brittleness desired in the coating, the thickness of the coating, the quality and ingredients of the composition, the diameter of the wire, and the number of coats of composition on the wire. Consequently, these conditions can be satisfied by adjusting the length of the flame to meet the particular requirements. In the lower portion of the chamber 23 and the upper portion of the tube 17 substantially all of the solvents in the coating upon the wire are burned, and sufficient heat is generated at this point to bake the insulating material firmly upon the wire.

The wire now coated with a hardened insulating substance passes upwardly through the combustion chamber and through the hot products of combustion therein which are generated in the lower portion of the chamber, whereby the remaining solvents in the coating are driven off and the insulating material is completely hardened. The wire is then passed over the pulley 5 and again through the above outlined steps to add another coating of insulating material upon the wire. The wire may be repassed through the apparatus until the insulating coating thereon has assumed a thickness sufficient for the use to which it is to be applied.

One of the outstanding features of this invention is the preheating of the air admitted to the combustion chamber together with the fact that the air which is admitted is drawn from a source of supply which is easily regulated. The amount and characteristics of the insulating composition applied to the wire by this method and by the use of this apparatus may be very readily controlled. The fact that the combustion air is introduced to the combustion chamber at a constant temperature results in a greater uniformity of the product as compared with the production of an apparatus wherein the air is introduced at room temperature, since room temperature is necessarily a variable factor which affects the temperature in the combustion chamber. Furthermore, the preheating of the air effects a substantial economy in the amount of heat required to be generated by the heating elements. The fact that the combustion air is supplied under pressure facilitates a closer control of the combustion process, and makes possible the production of a more uniform product.

It is to be understood that the above illustrated embodiment is illustrative only and that various modifications of the apparatus may be made without departing from the scope of the invention which is to be limited only by the appended claim.

What is claimed is:

An apparatus for insulating electrical conductor which provides means for coating a conductor with a composition composed of insulating material and a volatile combustible solvent, the apparatus comprises an elongated combustion chamber, means for conveying a wire through said coating means and said combustion chamber, means in the chamber for causing a combustion of the volatile solvent of the coating composition to thereby furnish the heat necessary to consolidate the insulating material on the wire, and means for supplying air under pressure to said combustion chamber, said last named means having an air passage adjacent said chamber and extending lengthwise thereof for a substantial portion of its length, whereby the heat of combustion is utilized to preheat the air supplied to said chamber.

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