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INSULATED CONDUCTOR

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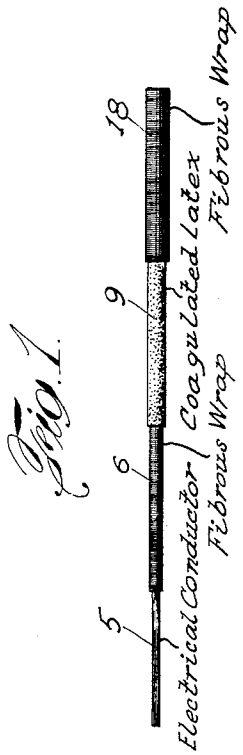


Fig. 1.

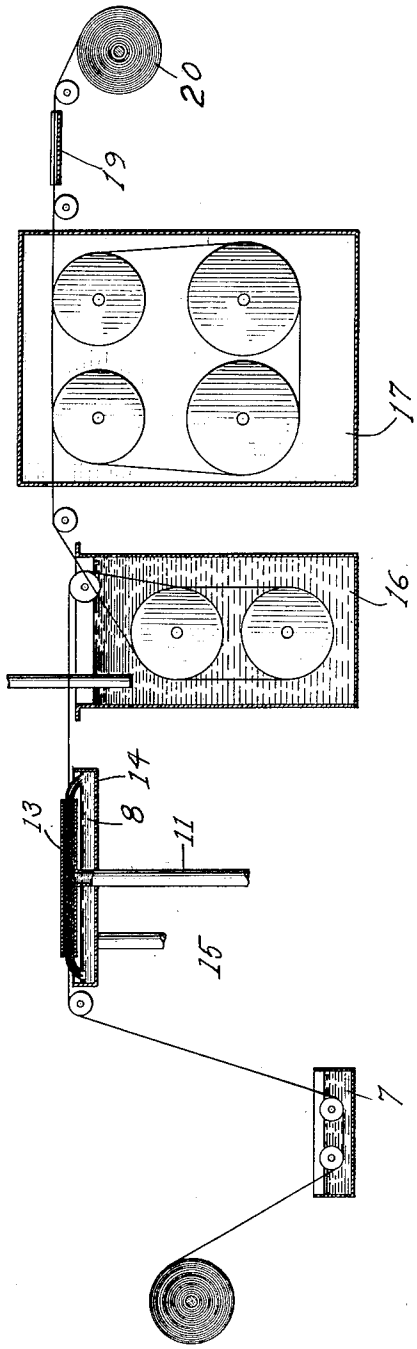


Fig. 2.

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INSULATED CONDUCTOR

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20 Claims. (Cl. 174—125)

This invention relates to insulated electrical conductors of that general type commonly employed in connecting different units of electrical equipment such, for example, as radio parts and the like.

Heretofore, insulation for conductors of this type has usually been made by compounding coagulated rubber with various fillers, breaking down the rubber by severe mechanical operations requiring costly equipment, and then softening the compound with suitable ingredients. When a sufficient degree of softening had been obtained, the material was applied to the wire by an extrusion process with the result that it was impossible to provide a conductor with insulation having an accurate or uniform wall thickness. At the same time, the rubber compound was injured in the mechanical treatment and depolymerized by the softening agents. An object of this invention is to provide a method of making insulated wire of the type set forth which will be free of the defects of such methods as have heretofore been practised and which will permit the formation of an insulating cover having a predetermined and uniform wall thickness.

A further object is to provide a conductor of the type set forth constructed and arranged to permit free stripping of the insulation therefrom to facilitate connecting and soldering operations. A still further object is to provide a conductor having an insulating cover freely movable longitudinally of the conductor so that the insulation can be slipped back to permit the conductor to be connected or soldered after which the insulation can be slid back flush with the connection or union.

These and other objects which will be apparent to those skilled in this particular art are accomplished by means of the invention illustrated in the accompanying drawing in which,

Fig. 1 is a view in elevation of an insulated conductor constructed in accordance with one embodiment of this invention, the different layers being progressively removed to illustrate the construction thereof, and

Fig. 2 is a diagrammatic outline of one form of apparatus which may be employed in carrying out the method of the present invention.

In manufacturing insulated conductors by means of the present invention, a stranded conductor 5 is preferably employed although it will be apparent that a single conductor is equally well adapted to this invention. The wire is the usual tinned wire commonly employed. It is first provided with a wrap 6 of suitable fibrous material such as the cotton cord illustrated, but it will be apparent that this wrap can also be formed of any other material commonly used as a separator. In the case of a cotton or other wrap having a fuzzy surface, the wrapped wire may be given a coating of glue which is immediately subjected to a wiping operation for the purpose of providing the wrap with a smooth surface on which the insulating material can be applied. However, this step can be omitted as it is perfectly feasible to apply the insulating material directly to the cotton or other wrap.

The wrapped conductor is then passed through a bath 7 of a suitable coagulant to deposit a layer of such coagulant on the surface of the wrap. From the coagulant bath the wire is passed through a coating bath 8 which deposits a coating of insulation 9 upon the surface of the wrap. The coating bath is preferably a latex dispersion and deposits a continuous, smooth and uniform covering or coating of latex around the conductor. The latex is quickly coagulated as a result of the coagulant on the surface upon which the latex is deposited. Any suitable latex dispersion can be employed, and the following mixture will provide a satisfactory bath:

	Parts
Concentrated latex	100
Zince soap	3
Sulphur	3
Anti-oxidant	.5
Captax	.35

The coating bath can be dyed so as to produce insulation of any desired color for identification or other purposes. The natural color is a light cream. The term latex, as employed in the present application, includes any rubber latex with or without compound ingredients as used in the rubber trade.

The present invention contemplates the application of the latex to the conductor in a novel manner by providing a flowing stream of the latex dispersion separate from the main bath and passing the conductor longitudinally through such a stream to have the coating of insulating material deposited thereon. In this way the coagulant on the conductor surface does not come into direct contact with the main body of material forming the coating bath so that the latter is not subjected to gradual coagulation as a result of any such contact. In effect, a stream of the coating fluid is caused to flow over the conductor in the coating operation. The part of the mechanism for accomplishing this is diagrammatically indi-

cated in the drawing and includes a pipe 11 leading from a main tank containing the coating bath proper (not shown) through which the coating fluid flows to a horizontally extending tube 13 through which the conductor passes. The coating material flows outwardly from the pipe 11 to opposite ends of the tube into a collecting tray or trough 14 which is connected by a return pipe 15 with the main tank. In this way, a constant stream of coating material flows through the tube and over the conductor which is being drawn continuously therethrough with the result that a uniform continuous coating of insulating material having the desired wall thickness is deposited upon the conductor.

The coated wire is drawn from the coating bath into and through a suitably arranged wash tank 16 containing water at approximately 60 to 70 degrees centigrade, the wire passing over suitable sheaves which are arranged so as to cause it to be subjected to a washing operation for any predetermined period. The washed wire is then dried by passing it directly from the wash tank into and through a suitable curing or drying oven 17, the temperature of which is maintained at 90 to 100 degrees centigrade. Here, also, the wire passes over suitably formed sheaves which are so constructed and operated as to subject the wire to the curing or drying effect of the oven for the necessary length of time. When the wire emerges from the drying oven, the coating of insulation is still somewhat tacky. A suitable protective covering, such as the illustrated wrap 18 of cotton cord, may or may not be applied to the insulation, and the rubber prevents the wrap from unwinding when the wire is cut. Obviously, a cotton braid can be substituted for the wrap, or a protective cover of silk or the like may be employed to provide the necessary cover.

The thickness of the rubber insulation can be accurately controlled in different ways. For example, the conductor can be passed through the coating bath a number of times, or it can be passed through successive coating baths, to build up any desired thickness of insulation. When this is done, the material will be subjected to a drying operation after each coating operation. Another way of controlling the thickness of the layer deposited by the latex solution is by adding an electrolyte to the glue which is applied to the surface of the first wrap. Calcium nitrate is satisfactory, but, of course, other salts can be used. If desired, formaldehyde may be used.

The coating bath may, obviously, be made up from numerous different formulas in addition to the one above given. One such variation is as follows:

	Parts
Latex	100
Zinc oxide	5
Stearic acid	3
Neozone A	.5
Sulphur	2.5
Suitable accelerator	.5

In making up the batches for coating, the different materials are first properly dispersed and are then added to the liquid latex in proportions necessary to give a stock having the desired formula.

The outer covering may be coated with any suitable finishing wax or lacquer that has the proper color and water proofing qualities. One such wax consists of paraffin with 5% carnauba wax added. Like the latex, this wax can be dyed any color. When no outer covering is provided, the wire leaving the drying oven is dusted with talc 19 and wound upon a suitable take-up reel 20.

It will be apparent that the present invention provides a continuous method of surrounding an electrical conductor with a flexible coating of insulation which is freely movable longitudinally of the conductor to permit free stripping, or to permit the insulation being displaced to permit a connecting or soldering operation, after which it can be slid back to cover the conductor. The insulation is in the form of a continuous sheath free of all seams, joints or the like, and the wire is easily solderable, not being discolored or blemished by an insulating covering adhering thereto.

I claim as my invention:

1. The method which consists in providing a substantially uniform layer of coagulant around an electrical conductor, providing an unbroken stream of latex and passing said conductor through said stream in a path generally aligned with the stream to form a coating of insulation around said conductor and drying said coating.

2. The method of insulating an electrical conductor which consists in surrounding said conductor with a fibrous wrap, providing an unbroken flowing stream of latex dispersion, and passing said wrapped conductor through said stream in a path generally aligned with the flow of the stream to deposit on the conductor a thin layer of latex rubber.

3. The method of coating filamentary material with rubber which comprises passing the filamentary material along a determinate path at a substantial angle to the vertical, said path including an unsupported and unguided reach of substantial length, flowing an unbroken stream of a coagulable rubber dispersion around the unsupported and unguided reach only of said filamentary material and positively directing the stream along said path for a determinate distance, and solidifying a coating of the dispersion upon the filamentary material.

4. The method of coating filamentary material with rubber which comprises passing the filamentary material along a substantially horizontal path through an unbroken stream of a coagulable rubber dispersion positively directed along and generally aligned with said path, and coagulating a layer of said dispersion upon said filamentary material.

5. The method which comprises coating a continuous length of filamentary material with a latex coagulant and passing the coagulant-coated filamentary material along a substantially horizontal path through a stream of latex directed along and generally aligned with said path.

6. Apparatus for coating filamentary material with a coagulable fluid composition comprising means for causing the filamentary material to travel in a path inclined at a substantial angle to the vertical without support or guidance for a substantial distance and means for positively directing an unbroken stream of the coagulable composition along and parallel to said path and around only the unsupported and unguided reach of the filamentary material.

7. Apparatus for coating filamentary material with a coagulable fluid composition which comprises means for causing the filamentary material to travel along a substantially hori-

zontal path without support or guidance for an appreciable distance, and means for surrounding only the unsupported and unguided portion of the filamentary material with an unbroken stream of the coagulable fluid composition, the latter means being so constructed and arranged as positively to direct the said stream of coagulable fluid composition along a path substantially parallel to and coinciding with the path of the filamentary material for a substantial distance.

8. Apparatus for coating filamentary material with a coagulable fluid composition which comprises means for causing the filamentary material to travel along a substantially horizontal path without support or guidance for an appreciable distance, a fluid conveyor extending along the path of the filamentary material at its unsupported and unguided reach only, and means for causing a stream of the coagulable fluid composition to flow in said conveyor along the path of and surrounding said filamentary material, said fluid conveyor being so constructed and arranged with respect to the path of the filamentary material as to direct flow of the stream of coagulable fluid composition wholly in a direction generally parallel to and, for a substantial distance at least, coinciding with the said path.

9. Apparatus for coating a filament with a coagulable fluid composition, comprising a tubular open-ended conduit disposed in a substantially horizontal position, means for passing the filament longitudinally through the tubular conduit in a widely spaced relation thereto, and means for flowing the coagulable composition through the conduit in such manner as substantially to fill the conduit for a substantial longitudinal distance, the apparatus being so related to the filament to be coated as to permit a free flowing of the coagulable composition about the filament, through the conduit and out the open ends of the conduit.

10. Apparatus for coating a filament with a coagulable fluid composition, comprising a tubular open-ended conduit disposed at a substantial angle to the vertical, means for passing the filament longitudinally through the tubular conduit in a widely spaced relation thereto, and means for flowing the coagulable composition longitudinally through the conduit in such manner as substantially to fill the conduit at least at one sectional flow area thereof, the apparatus being so related to the filament to be coated as to permit a free flowing of the coagulable composition longitudinally about the filament and through the conduit.

11. The method of coating a filament with a coagulable rubber dispersion which comprises maintaining a laterally confined freely flowing tubular stream of said dispersion, the direction of flow of the tubular stream being at a substantial angle to the vertical, and passing a filament longitudinally through the stream without materially obstructing the flow thereof.

12. The method of coating a filament with rubber which comprises maintaining a laterally confined freely flowing tubular stream of rubber latex, the direction of flow of the tubular stream being at a substantial angle to the vertical, coating the filament with coagulant, passing the coagulant-coated filament longitudinally through the stream without materially obstructing the flow thereof, and drying the resultant coagulated rubber upon the filament.

13. An electrical conductor insulated with an in-situ deposit of solids from latex, said deposit including the water-insoluble reaction product of a metallic salt and at least some of the normally water-soluble ingredients of said deposit naturally occurring in the latex.

14. An electrical conductor insulated with an in-situ deposit of solids from a concentrated latex, said deposit including the water-insoluble reaction product of a metallic salt and at least some of the normally water-soluble ingredients of said deposit naturally occurring in the latex.

15. An electrical conductor insulated with an in-situ deposit of solids from an aqueous dispersion of rubber, said deposit including an in-situ deposit of a water-insoluble metallic soap.

16. An electrical conductor insulated with an in-situ deposit of solids from latex, said deposit including a water-insoluble metallic soap of resin acids naturally occurring in the latex.

17. An electrical conductor insulated with an in-situ deposit of solids from latex, said deposit including a water-insoluble metallic salt of proteins naturally occurring in the latex.

18. An electrical conductor insulated with an in-situ deposit of solids from a concentrated latex, said deposit including an in-situ deposit of a water-insoluble metallic soap.

19. An electrical conductor insulated with an in-situ deposit of solids from a concentrated latex, said deposit including a water-insoluble metallic soap of resin acids naturally occurring in the latex.

20. An electrical conductor insulated with an in-situ deposit of solids from concentrated latex, said deposit including a water-insoluble metallic salt of proteins naturally occurring in the latex.

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