

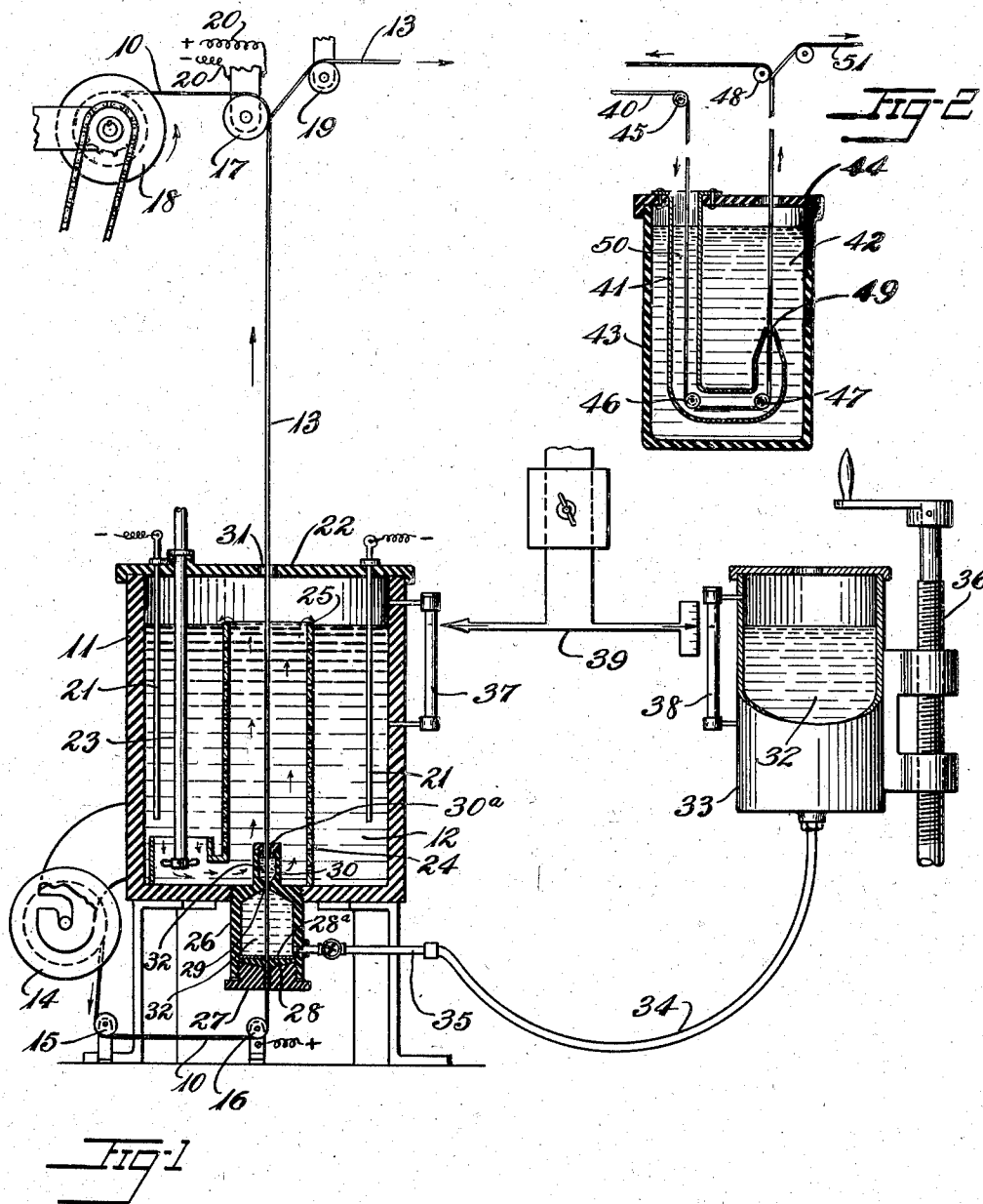
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METHOD AND APPARATUS FOR COATING STRIP MATERIAL

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METHOD AND APPARATUS FOR COATING
STRIP MATERIAL

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18 Claims. (Cl. 91-46)

This invention relates to the coating of wire, thread or other strip material from a liquid dispersion of the coating material, and especially to the coating of such strip material from a coagulable dispersion, such as an aqueous dispersion of rubber.

It has been proposed heretofore to coat wire with rubber by passing the wire up through an opening in the bottom of a tank of latex to coat the rubber during its passage through the latex, the opening being sealed against leakage of the latex by a member frictionally engaging the moving wire. This has involved the serious difficulty that the friction of the rubbing parts frequently has caused coagulation of the latex at the seal, resulting in the formation of objectionable lumps in the coating of the wire.

The chief objects of the invention are to provide for avoiding this difficulty, and to provide improved apparatus for coating wire, thread or other strip material. A more specific object is to provide a seal such that there will be no parts that rub one another in the immediate presence of the coating material, so that objectionable coagulation of the material at that position will not occur.

These and other objects will be apparent from the following description, reference being had to the accompanying drawing, in which:

Fig. 1 is an elevation, with parts in section and broken away, of coating apparatus embodying and made in accordance with the invention in its preferred form.

Fig. 2 is a similar view on a reduced scale of a modified construction.

In the embodiment of Fig. 1 a wire 10 is passed vertically upward through the bottom of a tank 11 containing a body of latex 12, either natural or artificial, to deposit upon the wire a rubber coating 13. The wire is led from a reel 14, mounted on the supporting framework, under a pair of pulleys 15 and 16 and up through the tank, being then drawn over a roller 17 and onto a driven receiving reel 18. While the rubber coating may, if desired, be left on the wire, as for insulating purposes, in the illustrated embodiment it is removed from the wire at the roller 17 and is led away over a roller 19 for subsequent use as elastic thread. The removal of the rubber strip from the wire is effected by longitudinally separating it and drawing it from the roller in split tubular shape, such separation being accomplished as the wire squeezes the rubber between it and the roller surface, the latter preferably being heated electrically

through connections 20, 20, to assist the separation, and the separation of the rubber being facilitated also by drawing the thread off under tension. This subject matter is described and claimed in my copending application, Serial No. 693,295, filed October 12, 1933, which has matured into U. S. Patent No. 2,042,536, granted June 2, 1936, for Strip rubber and method and apparatus for producing the same.

The deposition of the rubber upon the wire desirably is assisted electrophoretically, and for this purpose the tank 11 is of dielectric material, such as rubber, and contains cathodes 21, 21, the wire 10 being electrically connected, as at the pulley 16, to function as the anode. The cathodes 21, 21 are conveniently supported by a cover 22 for the tank.

Through the cover is disposed the shaft of an impeller 23 adapted to circulate the latex. The impeller preferably is positioned in the mouth of the shorter arm of a J-shaped tube 24, the longer arm of which is disposed about the wire 10 in the manner shown in the drawing, so that the latex will be circulated upwardly along the wire in the tube. This tube is of insulating material, such as rubber, and further, in order not to hinder the electrophoretic action, its wall adjacent the wire is perforated. The tube preferably is of such height that when the latex is in circulation the upper edge 25 constitutes a low spillway over which the latex flows away from the wire and carries with it froth and foreign matter which might objectionably lessen the uniformity of the coating if permitted to gather at the wire on the surface of the latex. In a large measure such froth and foreign matter will be trapped on the surface of the latex at the remote, low side of the spillway.

For sealing the wire-entering opening at the bottom of the tank there is provided a hollow bushing 26, preferably also of insulating material and screwed into the tank wall, having an apertured cap 27 holding a sealing element 28 of a soft resilient material such as rubber and a backing washer 28^a against a shoulder in the bushing wall, the arrangement being such that leakage of a fluid along the wire is prevented by a close frictional fit of the sealing element against the wire. At the upper end of the bushing chamber the wall is apertured at 29 for passage of the wire without contacting the bushing, and above this aperture preferably is provided a subchamber 30 at the upper end of which is provided another narrow perture at 30^a for passage of the wire, here also without contacting the

bushing. The cover 22 also is apertured at 31 for free passage of the wire, and the arrangement is such that between the pulley 16 and the roller 17 the wire contacts structure of the apparatus only at the sealing element 28.

A body of non-coagulable fluid 32 is provided in the bushing chamber and in the subchamber 30 to prevent the coagulable latex in the tank from contacting the wire at its zone of rubbing against the sealing element 28.

A reservoir tank 33 of the fluid 32 communicates with the bushing chamber through a hose 34 and valved pipe 35, and this tank is mounted for vertical adjustment, as by a screw support 36, at a height such that the bushing chamber and subchamber may be maintained full of the fluid against the pressure of the latex. Preferably the surfaces of the latex and the fluid in the reservoir tank are maintained at substantially the same level, and to facilitate this the two tanks are provided with gauge glasses 37 and 38 between which is mounted for vertical adjustment an indicating bar 39.

Some of the fluid 32 will be carried upward with the moving wire into the latex. Leakage in this direction is beneficial in retarding flow of the latex into the bushing where it is not wanted. This guarding action is assisted by the narrowness of the apertures 30^a and 28^a. While a small amount of latex may at times find its way downward into the subchamber 30, it is unlikely that any latex will penetrate as far as the main bushing chamber, so long as the proper level of the fluid 32 in the tank 33 is maintained.

In addition to its guarding function, the fluid 32, through which the wire passes before it enters the latex, has the result of lessening the likelihood that air will be pocketed on the surface of the wire and malform the rubber coating.

Because of the small leakage of the fluid into the latex, it is preferred that this fluid be such as to be readily miscible with the latex without polluting or materially diluting it. Water, which is one of the principal ingredients of the latex, is very satisfactory. Preferably ammonia or other stabilizing agent is added to the water in an amount such that when it goes into the latex the latter will be neither weakened nor strengthened as to the presence of such agent.

In operation, the wire 10 is drawn from the lower reel 14 to the upper reel 18, and in passing through the tank it is so guided as not to contact any of the tank or guiding structure except at the sealing element 28. Circulation of the latex by the impeller 23 upward through the tube 24 along the wire and then over the spilling edge 25 serves to keep froth and foreign matter away from the wire so that the deposited coating will be uniform and without lumps or malformations. With the aid of the gauges 37 and 38 and indicator 39, the liquid 32 in the tank 33 can be kept at the proper level so that the latex will be kept out of the bushing chamber and away from the zone of rubbing of the wire against the sealing element. The result is a uniform, smooth coating on the wire.

In the modification of Fig. 2 the wire 40, instead of entering the tank through an aperture in the wall, is conducted downward through the long arm of a J-shaped tube 41 immersed in a body 42 of latex contained in a tank 43. The tube may conveniently be supported by a removable cover 44 for the tank, and is thus easily removable for inserting a new wire. The wire is guided downward over a pulley 45, its direction is re-

versed by guide pulleys 46 and 47 mounted in the turn of the tube, and after emerging from the tank it is guided over a roller 48, the rubber coating being there removed as a thread 51, as in the embodiment of Fig. 1. From the tube the wire enters the latex through a narrow aperture 49 formed in the end of the small arm of the tube without touching the tube. A body 50 of fluid, similar to the fluid 32 of the Fig. 1 embodiment, is contained in the tube at a level approximately the same as that of the latex so that the latter will not back up into the tube. This guarding action is assisted also by the narrowness of the aperture 49 and by the upward carrying of a small amount of the fluid on the surface of the wire, so that the latex is kept out of the tube and therefore away from the zone of any rubbing surfaces at the guide pulleys 46 and 47 in the tube.

This embodiment has the advantage that there is no aperture in the tank wall requiring a seal and also that replacement of the wire can be conveniently effected without disturbing the latex in the tank.

If desired, the deposition of the rubber upon the wire may be assisted electrophoretically in this embodiment also, by expedients for the purpose such as are shown in the Fig. 1 embodiment, and also if desired a like circulating arrangement may be provided.

I claim:

1. Apparatus for coating strip material with a coagulable liquid dispersion, comprising a container adapted to hold a body of the coating dispersion having a free liquid surface, means having an aperture sufficiently large to permit free passage of the strip material located below the free liquid surface, guiding means wholly out of contact with the coating dispersion for introducing the strip material into the coating dispersion through said aperture without contacting the walls thereof and for withdrawing the strip material through the free liquid surface, and sealing means comprising a body of non-coagulable fluid which is miscible with the said coagulable liquid dispersion about the strip material adjacent the said aperture.

2. Apparatus as defined in claim 1 in which the coating dispersion is a coagulable rubber dispersion and the sealing fluid is a non-coagulable liquid which is miscible with the coating dispersion.

3. Apparatus as defined in claim 1 in which the coating dispersion is an aqueous dispersion of rubber and the sealing fluid is water containing a stabilizing agent for the dispersion.

4. Apparatus as defined in claim 1 including in addition means for maintaining a hydrostatic balance between the coating dispersion and the sealing fluid.

5. Apparatus for coating strip material from a liquid dispersion of the coating substance, comprising a dispersion container, means for guiding the strip material to be coated into the dispersion at a position below the surface thereof, and a structure containing a body of fluid through which the strip material passes at the submerged position of its entry into the dispersion, said structure comprising in succession a fluid chamber, a narrow-necked exit, a fluid subchamber, and a second narrow-necked exit through which the strip material is guided to reach the dispersion without contacting the walls of the exit, the arrangement being such that the dispersion is prevented from contacting the strip material

at all positions where the latter frictionally contacts other portions of the apparatus.

6. Apparatus for coating strip material with a liquid dispersion, comprising a dispersion container, means for guiding the strip material to be coated into the dispersion at a position below the surface thereof, and a structure containing a body of fluid through which the strip material passes at the submerged position of its entry into the dispersion, said structure comprising a guiding tube for the strip material having an entrance above the surface of the dispersion and a submerged, narrow-necked exit, the fluid in the tube being maintained at substantially the same level as the coating dispersion, the entire arrangement being such that the dispersion is prevented from contacting the strip material at all positions where the latter frictionally contacts solid portions of the apparatus.

7. Apparatus for coating strip material from a liquid dispersion of the coating substance comprising a dispersion container having an aperture in its wall below the surface of the dispersion, means for guiding the strip material to be coated through said aperture and dispersion and means for preventing leakage at said aperture, said means comprising a sealing structure contacting the strip material and containing a body of fluid separating the coating dispersion from the position of contact of the strip material with the sealing structure, the arrangement being such that the dispersion is prevented from contacting the strip material at all positions where the latter contacts other solid portions of the apparatus.

8. Apparatus as defined in claim 7 comprising a fluid reservoir communicating with the said sealing structure and mounted for vertical adjustment with relation to the dispersion container.

9. Apparatus for coating conducting strip material from an aqueous dispersion of rubber comprising a dispersion container, means for guiding the strip material to be coated through the dispersion without contact of the dispersion with the strip material where the latter contacts the guiding structure, means for assisting the deposition of the rubber upon the strip material electrophoretically, and means for circulating the dispersion in the container, said means comprising a structure directing the flow of the dispersion away from the strip material at its position of emergence from the dispersion.

10. Apparatus as defined in claim 9 in which the flow-directing structure comprises a perforated tube of dielectric material enclosing the strip material and disposed to direct the flow upwardly along the same within the tube and having its upper edge so positioned at the surface of the dispersion as to constitute a spillway for the dispersion to flow away from the strip material.

11. Apparatus for coating strip material from a liquid dispersion of the coating substance comprising a dispersion container, means for guiding the strip material to be coated through the dispersion, and means for circulating the dispersion in the container, said circulating means comprising a structure directing the flow of the dispersion away from the strip material at its position of emergence from the dispersion.

12. Apparatus as defined in claim 11 in which the flow-directing structure comprises a tube enclosing the strip material and disposed to direct the flow upwardly along the same within the tube and having its upper edge so positioned at the surface of the dispersion as to constitute a spillway for the dispersion to flow away from the strip material.

13. The method of coating strip material with a coaguable liquid dispersion which comprises providing a body of the coaguable liquid dispersion in superposed relation to a body of a non-coaguable liquid which is miscible with the said coaguable dispersion, providing a communicating opening between the two liquid bodies of a size to permit free passage of the strip material, maintaining a hydrostatic balance between the two liquids, and passing the strip material upward through the non-coaguable liquid, the said opening, and the coaguable liquid dispersion.

14. A method as defined by claim 13 in which the coaguable liquid dispersion is an aqueous dispersion of rubber and the non-coaguable liquid is water.

15. A method as defined by claim 13 in which the coaguable liquid dispersion is an aqueous dispersion of rubber and the non-coaguable liquid is water containing a stabilizing agent for the dispersion.

16. A method of coating strip material with a coaguable liquid dispersion, which comprises providing a body of the dispersion having a free liquid surface, passing the strip material through a body of a non-coaguable liquid which is miscible with the dispersion, then through an orifice directly from the non-coaguable liquid into the dispersion at a position below the free liquid surface thereof, and withdrawing the strip material through the free liquid surface of the dispersion, without frictional contact of the strip material with any solid within the dispersion.

17. A method as defined by claim 16 in which the coaguable liquid dispersion is an aqueous dispersion of rubber and the non-coaguable liquid is water.

18. A method as defined by claim 16 in which the coaguable liquid dispersion is an aqueous dispersion of rubber and the non-coaguable liquid is water containing a stabilizing agent for the dispersion.

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