July 18, 1944. F. S. BARTLETT 2,353,987

LIQUID APPLICATOR

Filed June 6, 1941 2 Sheets-Sheet 1

Fig. 1

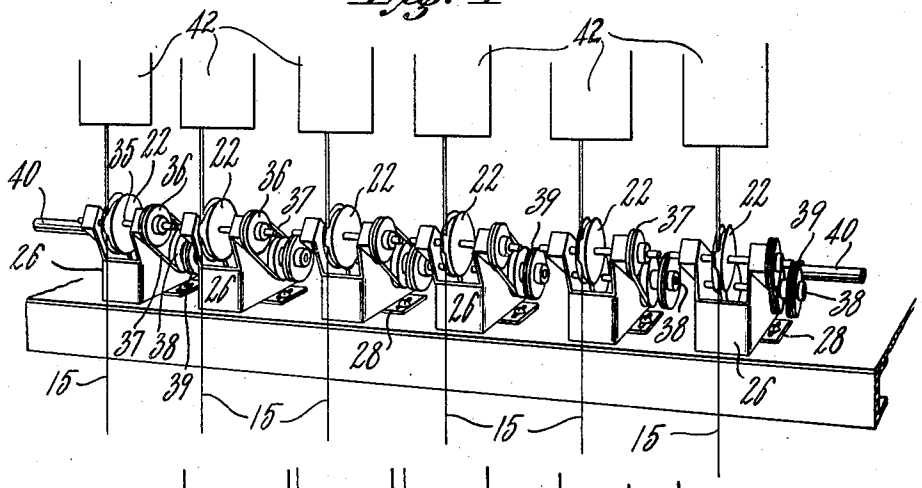


Fig. 2

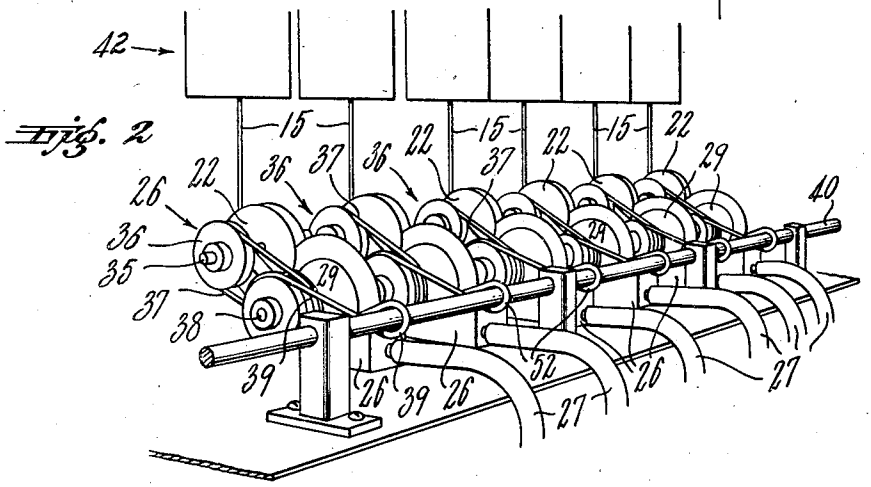
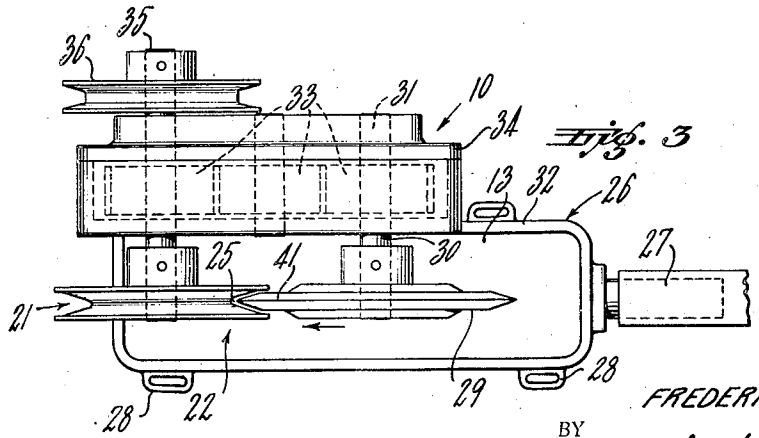


Fig. 3



INVENTOR.
FREDERICK S. BARTLETT

BY

Lester G. Budding

ATTORNEY

July 18, 1944. F. S. BARTLETT 2,353,987

LIQUID APPLICATOR

Filed June 6, 1941 2 Sheets-Sheet 2

Fig. 6

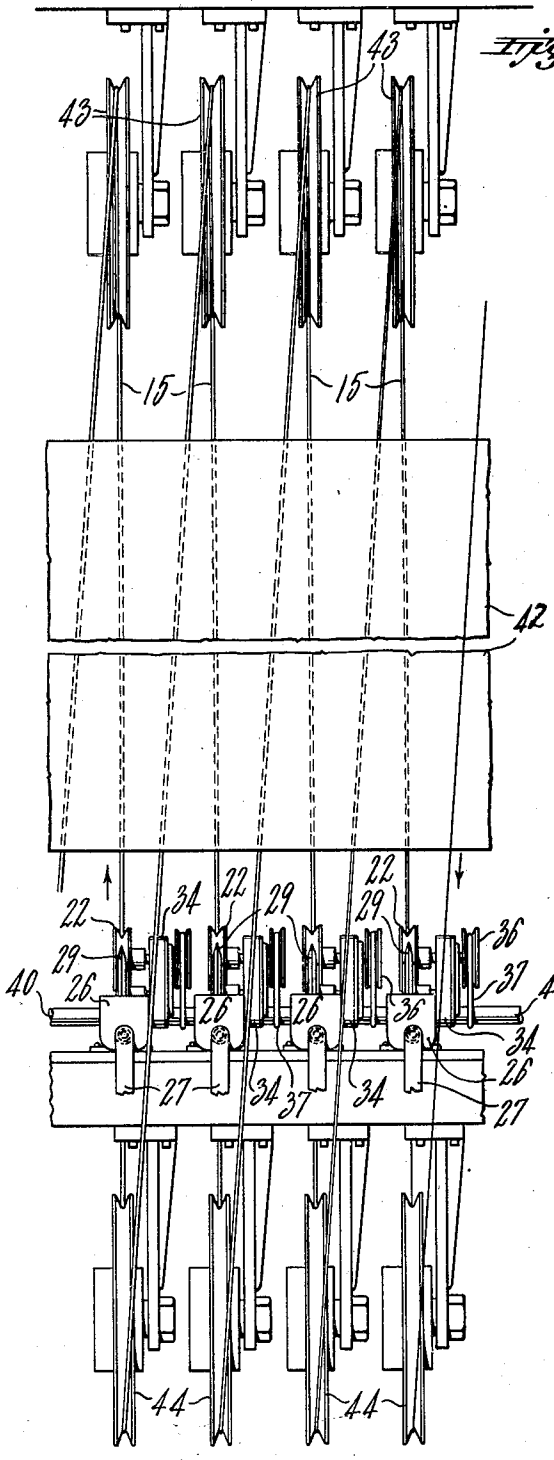


Fig. 4

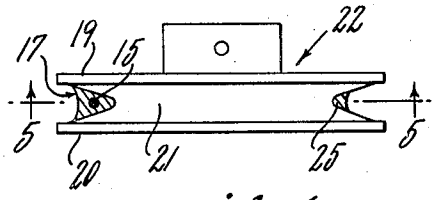
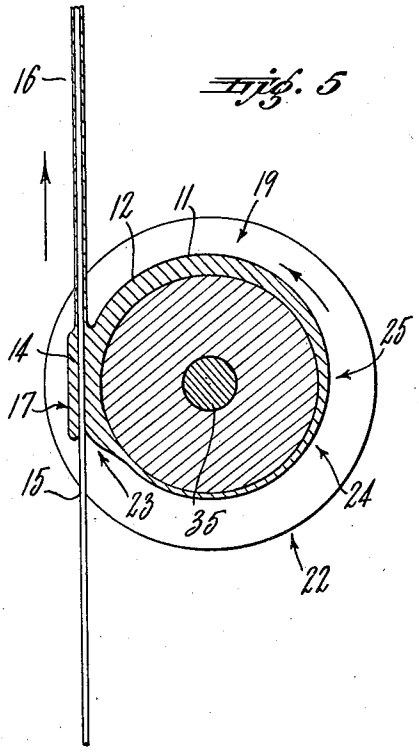


Fig. 5



INVENTOR.
FREDERICK S. BARTLETT

BY Lester G. Hudling

ATTORNEY

Patented July 18, 1944

2,353,987

UNITED STATES PATENT OFFICE

2,353,987

LIQUID APPLICATOR

Frederick S. Bartlett, Bristol, R. I., assignor to United States Rubber Company, New York, N. Y., a corporation of New Jersey

Application June 6, 1941, Serial No. 396,790

1 Claim. (Cl. 91—50)

This invention relates to the application of liquids to elongated articles such as wire, and is of particular utility when employed for applying liquid dispersions or solutions of insulating materials to conductors in the manufacture of insulated wire and cable, although the present invention may be used in any field for which it is adapted by the nature of my improvements.

The conductor to be coated may be composed of any metal or alloys used to conduct electricity, for example, copper, steel, iron, bronze, nickel, or the like, and may comprise a single solid wire, or a multiplicity of wires forming a cable. The individual wires may have a surface coating of metal such as tin, lead-tin alloy, zinc, or of other known or otherwise suitable materials, or the conductor may be provided with a separator such as cotton, rayon, paper, cellophane, or any similar material, used as a physical separator between the conductor and the rubber or rubberlike insulation.

The invention is equally available for applying dispersions, as hereinafter disclosed, to a fibrous strand, such as cotton, hemp, linen and the like, whether in the form of yarn, thread, rope, cable, or a braided, woven or crocheted structure, and is also applicable to the various filaments used in the arts, such as silk and rayon.

Any suitable liquid, whether of natural or synthetic origin, may be applied to the wire, and it is to be understood that the use of a solution or of a liquid dispersion as herein disclosed is merely illustrative of a wide range of suitable coating materials.

When a liquid dispersion is used, it may consist of liquid latex of any desired purity, consistency and concentration, preferably either prevulcanized in the liquid state, or containing curatives for subsequent vulcanization; or use may be made of an artificially prepared aqueous dispersion of a compound of rubber or rubber-like materials; while another satisfactory material for the intended use comprises a solution of a compound of rubber or rubber-like materials in a solvent other than water.

A conventional method for applying such dispersions or solutions has been to run a wire through a bath of insulating material, either by passing the wire around a pulley completely submerged in the bath, or by running the wire vertically through a stuffing box in the bottom of the bath.

Another method has been described in Letters Patent No. 1,870,990, wherein a wire is passed vertically through a tapered die on top of which is a small pool of the liquid dispersion. A third method consists in spraying the liquid dispersion onto the wire.

In the employment of the foregoing methods, certain disadvantages and inconveniences have been encountered which render their commercial use not altogether satisfactory, for various reasons, one reason being that liquid dispersions of the nature mentioned are liable to become unstable when subjected to friction, localized pressure, or excessive agitation, and tend to coagulate or partially coagulate, to the extent that the dispersion is unfit for use or the normal functioning of the applicating equipment is impaired.

For example, in applying such dispersions to wire by passing the wire around a pulley submerged in a bath of the dispersion, it is necessary to have the bearing of the pulley submerged completely in the dispersion, and there is often sufficient friction created in this bearing to produce local coagulation which will in turn "freeze" the bearing, so that it has been standard practice to provide pivot point bearings for this pulley, in order to reduce such friction to a minimum. This type of bearing, however, is not satisfactory when an appreciable load is applied to the pulley, because the pulley is apt to be pulled entirely out of its supporting bracket, or the male portion of the bearing is caused to rotate on its side, rather than on its point, which again produces harmful friction.

Secondly, a dip tank that is large enough to hold a pulley and its supporting bracket, holds a large volume of the liquid dispersion, and as the amount of the liquid dispersion applied to the wire is relatively very small compared to the volume in the tank, there have arisen difficulties in operation due to settling of compounding materials, resulting in a non-uniform product; while, due to normal surface evaporation, there has often been formed a surface skin which becomes attached to the wire, producing an inferior product. The large quantity of material involved constitutes an added disadvantage.

Thirdly, if the liquid dispersion is applied by passing the wire through a stuffing box or a tapered die, enough friction may be created to form coagulum in or about the stuffing box or die, and eventually all or a part of this coagulum may be transferred to the wire, thus turning out a substandard product.

Fourthly, spraying, as a means for coating an article such as wire, is apt to be somewhat inexact and wasteful, due to the relatively small diameter of an elongated article such as wire.

Under the above conditions, it is a primary object of the present invention to provide for applying liquid dispersions and similar liquids to wire and the like by a method which shall eliminate the foregoing and other disadvantages and incenveniences of operation, and which shall also reduce the time and cost of production, and improve the quality of the final product.

A cognate object of the invention is to provide improved apparatus by which the above method can be carried into effect, as illustrated and described in the accompanying drawings and specification and pointed out in the claim.

The invention consists in apparatus comprising means for feeding a substantially continuous length of conductor upwardly under tension in an upright path, in combination with means for feeding a substantially continuous stream of liquid in a curved path downwardly into intersection with said upright path, said means being constructed and arranged to operate at a speed ratio suitable to create, at the intersection of said paths, a puddle of the liquid maintained automatically by said feed ratio at a quantity adequate to form progressively on the wire a coating of the desired thickness.

The invention consists also in other features of the invention which, together with ancillary objects thereof, will appear as the following description of the embodiment of the invention selected for illustration proceeds.

In the accompanying drawings:

Fig. 1 is a view in perspective of apparatus for the application of a liquid dispersion to wire in the construction of which apparatus the present invention has been embodied;

Fig. 2 is a similar view in perspective of the illustrative form of apparatus of Fig. 1, taken on a larger scale, from a different direction;

Fig. 3 is a fragmentary detail view on a still larger scale, illustrating in plan a single applicator unit of modified form shown separately;

Fig. 4 is a fragmentary detail view in plan, on a still larger scale, of the applicator disc, shown separately from an applicator unit of any of the forms shown and illustrating the puddle of liquid traversed by a wire to be coated;

Fig. 5 is a vertical section on the line 5—5 of Fig. 4; and

Fig. 6 is a view of a part of the apparatus of Fig. 1 in front elevation.

Referring to the drawings, an apparatus for carrying into effect the novel method of the present invention is illustrated which has been found to afford satisfactory production upon a commercial scale, although it is shown merely by way of illustration, and its selection as a now-preferred embodiment of the invention is not intended to exclude the use of other suitable apparatus designed to meet the various requirements of particular applications of the invention.

The reference character 10 designates, in general, an applicator unit constituting means for feeding a substantially continuous stream 11 (see Fig. 5) of liquid, which may consist of a liquid latex of the desired purity, say with a total content of 42% solids, in a curved path 12 from a suitable source 13 (Fig. 3) of said liquid latex to a point of application 14 which is defined by the intersection of the path 12 with the upright path 14 of a wire 15 which, in the instance illustrated, constitutes the elongated article to which the liquid latex dispersion is to be applied, for the purpose of forming an insulating coating of rubber deposited from the liquid latex, this coating being indicated at 16 in Fig. 5.

The latex stream 11, as it advances downwardly in the curved path 12, encounters at the application point 14 an upward wiping action or drag of the wire 15, so that the flow of the stream is retarded, and a puddle 17 of the liquid, such as a latex dispersion, is created, as illustrated in Fig. 4 and in Fig. 5, the sides of the puddle being confined, in the instance illustrated, by the walls 19 and 20, of the grooved periphery of the applicator disc 22 which defines the curved path 12 of the stream 11, and which feeds the stream forwardly and downwardly as the disc 22 is rotated. Such rotation is effected at a speed ratio relatively to the feeding movement of the wire 15 suitable for maintaining the puddle 17 at a quantity adequate to form on the wire 15 a uniform coating 16 of the desired thickness. The thickness of the layer deposited depends essentially on the viscosity, temperature and solids content of the liquid and on the rate at which the wire passes through the puddle.

In pursuance of the invention, the stream 11 is preferably fed at a rate suitable to supply the puddle 17 with a quantity of liquid latex somewhat in excess of that required to form the coating progressively, and as the disc 22 continues to rotate, the excess of latex dispersion is continuously drawn away from the path of the wire 15, as indicated at 23, and is finally fed upwardly, in its own curved path, as at 24, until it becomes reincorporated with the main feed stream, as at 25, and it eventually reaches the puddle 17 again, to be utilized in the coating process to the extent required.

Various means for supplying fresh increments of liquid latex to the stream 11 may be utilized, and as a now-preferred construction for this purpose, referring to Figs. 1 and 2, each applicator disc 22 is shown as mounted suitably over a reservoir 26 which contains a chamber 13 (see Fig. 3) for a supply of the liquid latex that is fed through a conduit 27 into each reservoir, where its level is maintained relatively constant by any suitable means, such as a conventional form of external levelling device (not shown). Adjusting means, as for example the slotted lugs and bolts 28, are provided, to permit the applicator units 26 to be set to or from the wire 15.

The transfer of the liquid latex from each reservoir 26 to the grooved periphery of each applicator disc 22 may be accomplished by any suitable means, shown herein as a feed disc 29 carried and rotated by a shaft 30 (see Fig. 3) mounted in bearings 31 upon the wall 32 of the reservoir above the level of the liquid latex, so that the bearing does not communicate to the latex any deleterious effects of friction, thus avoiding any tendency to coagulation from that source, and also eliminating the possibility of having the bearing "freeze," as no accretions of liquid latex will reach the bearing. Each feed disc 29 is partially submerged in the liquid dispersion contained in one of the units 26, and is driven in a counterclockwise direction by suitable means, such as the train of gears 33 shown in Fig. 3, running to the shaft 30 of disc 29 from the driving shaft 35.

In Fig. 6, the pulleys 36 of the battery of applicator units 26 there shown are illustrated as driven directly by belts 37 running to a common countershaft 40.

Each disc 29 lifts the dispersion upwardly and forwardly over its top, and transfers the same

to its associated applicator disc 22 which is also driven in a counterclockwise direction by the drive shaft 35, on which it is shown as mounted directly. Each feeding disc 26 and its applicator disc 22 are driven in a 1 to 1 ratio, but inasmuch as the feeding disc is of greater diameter, there is a difference in relative circumferential speed, and hence there is a wiping action at the region 25 where the V-shaped circumferential edge 41 of the feeding disc travels between the walls 19, 20 defining the V-shaped groove 21 in the periphery of the applicator disc 22. (See Fig. 4).

This differential tends to flood the groove of the applicator pulley at 25 and the liquid dispersion thus fed to the applicator pulley is lifted and carried in the form of a substantially continuous stream 11 (see Fig. 5) through the curved path 12 defined by the groove therein, downwardly and around to the point of application 14, where the stream-path intersects the wire-path and the stream of liquid latex contacts the wire 15, a self-maintaining puddle 17 of the dispersion being created, which completely surrounds the wire, and from which puddle the wire emerges with a uniform coating 16 of the dispersion.

In the construction illustrated in Figs. 1 and 2, belts 37, like those above described, run from the pulleys 36 to pulleys on short shafts 38, and these in turn are driven by belts 39 running to the common driving shaft 40.

The speed of each applicator pulley 22 is desirably approximately 175 R. P. M. for coating a size 19 A. W. G. wire with a latex compound at 42% total solids. This speed may be changed when different size wires are coated or when different concentrations or different types of dispersions are used. It is to be noted that the showing of an inverted V-shaped periphery 41 on the feeding disc is not intended to exclude its formation with a concave V-shaped periphery, and that a satisfactory final result may be obtained by having only one grooved pulley acting as both a feeding disc and applicator disc for each unit; also that there may be two applicator discs having peripheral grooves cooperating face to face; also that the discs may have variously shaped grooves, and the faces of the grooves may be either smooth or serrated; and that the wire 15 may be fed in the same direction as the stream 11.

In the commercial operation of the invention it is preferred to provide as already described, a gang or battery of applicator units 10, so operated that the wire 15 will be given a first coat 16 of the dispersion, in the manner already described, and will be then dried and returned to another unit for a second application of dispersion which also will be dried, and so on with alternate applications of liquid dispersion and drying, as shown in Figs. 1, 2 and 6, until the coating 16 of dispersion has the desired wall thickness.

The applicators may be driven by individual motors (not shown), in place of the belt drive connections, between the drive pulleys 36 and a shafting common to a battery of such applicators, as shown at 40 in Figs. 1 and 2 of the drawings. The several sections 15 of the conductor are shown in those figures and in Fig. 6, as running through heaters 42 where the drying and vulcanization are performed, and the general organization of the apparatus appears clearly from Fig. 6.

The sections 15 of the wire are maintained under adequate tension as they run over rigidly mounted ball-bearing pulleys 43, 44 at the top and bottom of the drying tower, thus improving the operation mechanically and causing the wire to run smoothly through each puddle, preferably without making any physical contacts at the several applicator units, an important feature that is novel in such apparatus and is made possible only by the novel provisions of the present method, as will be understood clearly from the foregoing disclosure. It is to be understood, however, that with coatings of some materials, the contacts with the periphery of a pulley will not interfere with the successful practice of the invention.

It will also be apparent that this apparatus for carrying the improved method into effect provides efficient means for avoiding the disadvantages and inconveniences heretofore encountered in the application of liquid dispersions to wire and similar elongated articles, inasmuch as the causes of coagulation by friction have been eliminated, the exposure of large bodies of latex dispersions has been avoided, and adequate provision has been made for turning out a product of uniform excellence.

As various other modifications will occur to those skilled in the art, it is not intended to limit the invention otherwise than as set forth in the appended claim.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

Apparatus for applying an aqueous dispersion of rubber or rubber-like material to a moving strand to coat the strand without subjecting the dispersion to an appreciable amount of friction, comprising in combination a rotatable applicator having a grooved annular periphery for advancing a stream of said dispersion to an application station, a transfer disc for supplying the aqueous dispersion to the applicator groove without the disc contacting the applicator, means for rotating the applicator to carry said stream downwardly to the application station and means for turning said disc, means for feeding a substantially continuous length of said strand upwardly tangentially to said groove through a portion of said stream, to thereby create in said groove a self-renewing puddle of said dispersion that is supported in a suspended condition by the upward travel of the strand.

FREDERICK S. BARTLETT.