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APPARATUS FOR COATING TEXTILE STRANDS

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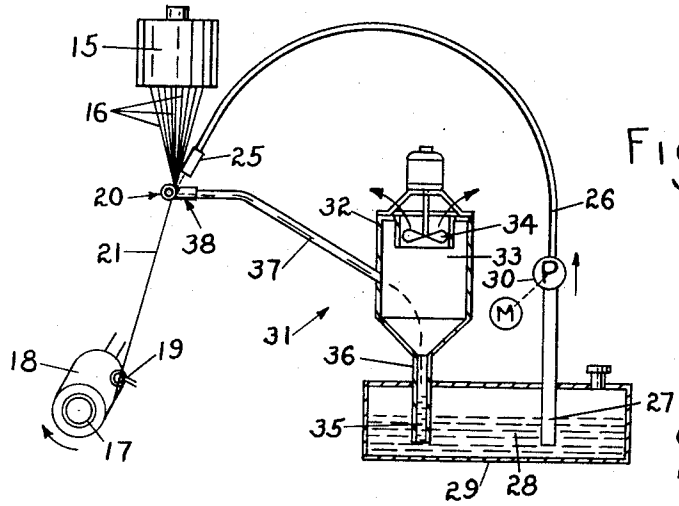


Fig. 1

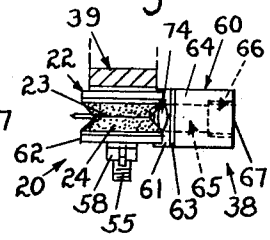


Fig. 6

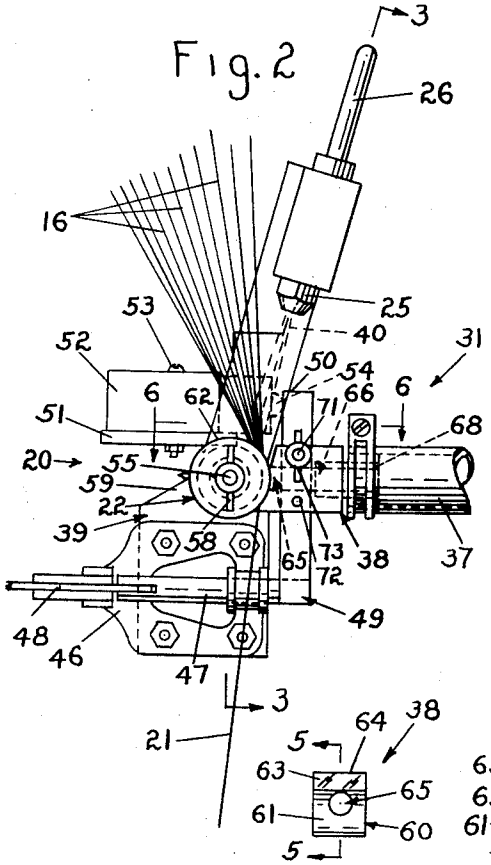


Fig. 2

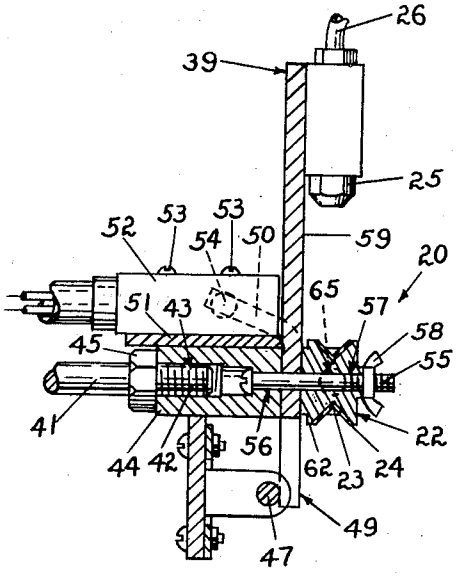


Fig. 3

Fig. 4

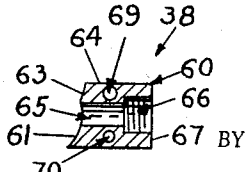


Fig. 5

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APPARATUS FOR COATING TEXTILE STRANDS

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8 Claims. (Cl. 118—11)

The present invention relates broadly to an improved method and apparatus for coating strands of textile material. More particularly, the invention pertains to a novel apparatus for recovering excess coating material in a process in which a multiplicity of fibers or filaments are grouped together in strand form and coated with a liquid coating material.

This invention is of particular utility and will be described herein with reference to its use in connection with the coating of strands of glass fibers produced by grouping continuous filaments of glass that are drawn and attenuated to extremely fine diameters. However, it is to be understood that the invention may also be used in connection with other processes and, in general, is adapted for use wherever filaments, natural or synthetic, are grouped and coated to form substantially continuous strands.

In forming continuous strands from finely drawn filaments by collecting said filaments at a guide, the common practice is to provide the guide with an applicator for evenly coating the surface of said filaments with a liquid, such as a lubricant, size or binder. The filaments are grouped together to form a strand as they pass over the guide, and are coated with the liquid lubricant, binder or size, which prevents the filaments within the strand from scratching each other, or the coating may serve to give mass integrity to the group of filaments in strand form thereby preventing loose ends from fraying or breaking apart from the strand.

In applying the coating to the strand, the guide may be provided with a pad of felt or other absorbent material which is saturated with the coating liquid and which serves to evenly distribute the coating liquid on the surface of the filaments as they pass thereover. The only known practical method to assure complete coverage is to apply an excess of the coating liquid. Excess coating liquid may be recovered by providing a suitable recovery vessel under the guide, although it has also been the practice not to bother with any recovery system whatsoever. In the above-mentioned process, where an attempt has been made to recover the excess coating material, it has been found that much of the material is lost due to evaporation and splattering. Evaporation of the coating material occurs both in the recovery vessel and at other points throughout the process where excess liquid is present, as on the strand leaving the guide.

Where an attempt has been made to cut down on losses of excess coating material due to evaporation or splattering, such as by cutting down on the amount of liquid applied to the guide, it has been found that this resulted in incomplete and non-uniform saturation of the applicator pad which, in turn, resulted in poor distribution of the liquid material on the strand.

The present invention aims to overcome the aforementioned difficulties by providing a novel method and apparatus for recovering the excess coating material by the utilization of a suction adjacent the point at which the coating material is applied to the continuous strand.

Another object of the invention is to provide a continuous process and apparatus for the application of a coating material to filaments being grouped into strands and for the recovery of excess coating material, the excess coating material being recycled and reused.

A further object of the invention is to provide a coating applicator and a coating recovery head complementing each other to form a restricted channel for the filaments.

A still further object of the invention is to provide mounting means for moving the coating recovery head out of complementary channel forming relation with the applicator to facilitate threading the filaments into the channel.

Yet another object of the invention is to provide means for automatically stopping the flow of coating material to the applicator when the recovery head is moved out of complementary relation to the applicator.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the drawings, in which:

Fig. 1 is an elevational view of the recovery apparatus of this invention shown in association with a filament forming and drawing apparatus;

Fig. 2 is an elevation of the binder applicator and recovery nozzle;

Fig. 3 is a section taken substantially on the line 2—2 of Fig. 3;

Fig. 4 is an end elevation of the binder recovery nozzle as viewed from the left of Fig. 2;

Fig. 5 is a sectional view of the binder recovery nozzle taken on the line 5—5 of Fig. 4; and

Fig. 6 is a plan view taken on the line 6—6 of Fig. 2 showing the cooperating relationship of the binder applicator and the recovery head.

Referring in particular to Fig. 1 of the drawings, the apparatus illustrated therein, by way of example, for mechanically drawing and attenuating molten glass in the form of continuous fine filaments includes a container or bushing **15** for molten glass. The molten glass flows in streams from the container through a plurality of small orifices in the bottom thereof and these streams of molten glass are drawn downwardly and attenuated into fine glass filaments **16** by means of a winding spindle **17** on which the filaments are wound into a package **18**, with the aid of a suitable traverser **19**, as is well known in the art.

Located intermediate the bushing and winding spindle is a guide **20** adapted to group the filaments **16** into a strand **21** and to apply a liquid coating material over the surface of the filaments **16** as they are grouped. The guide **20** is comprised of a V-grooved sheave **22** with the V-groove **23** covered with a pad **24** of felt or other absorbent material for receiving the coating material and for wiping it onto the filaments **16** as they are drawn over the pad.

The sheave **22** is the preferred form of the guide **20**, for the reason that the sheave may be rotated slightly as the pad **24** wears to present a new wiping surface for the filaments **16**. However, it is to be understood that the guide **20** may be formed in other suitable configurations without departing from the spirit of the invention.

The liquid coating material is applied to the filaments **16** as they converge at the guide **20** and for this purpose there is provided a nozzle **25** through which the liquid coating material is sprayed upon the applicator pad **24**, said nozzle being supplied with the liquid through a conduit **26**, the opposite end **27** of which is received within a supply of the coating solution **28** in a reservoir **29**. Interposed in the conduit **26** is an electrically powered pump **30** for elevating the liquid from the reservoir **29** to the nozzle **25**.

It is also considered within the scope of this invention

to provide the pump 30 with a by-pass and to insert a solenoid valve in the conduit 26 between the pump 30 and the nozzle 25.

The excess coating material which is applied to the pad 24 and/or strand 21 is recovered by a vacuum system indicated generally by the numeral 31. Essentially, this system comprises a chamber 32 defining a space 33. A partial vacuum is established and maintained within the chamber 32 by a blower 34 positioned in the upper portion of said chamber and by a fluid seal 35 formed by the liquid column in a conduit 36 depending from the lower portion of the chamber 32 with the lowermost end submerged in the coating solution supply 28 within the reservoir 29. Also leading from a side of the vacuum chamber 32 is a conduit 37 terminating at its outer end in a head 38 positioned adjacent the guide 20 substantially at the point at which the individual filaments 16 are grouped together into a strand 21. The head 38 is hereinafter designated as the recovery head and will be described in detail.

Referring now to Figs. 2 through 6, both the guide 20 and the nozzle 25 are mounted upon a bracket 39 with the coating material directed in a fine stream 40 upon the periphery of the pad 24 in the upper quadrant first contacted by the filaments 16. As is clearly shown in Fig. 2, the coating stream 40 is directed through the filaments 16 onto the pad 24 as the filaments converge at the apex of the V-groove 23, thereby wetting the filaments prior to collection into a strand and also wetting the pad 24 to assure complete coating of the surface of each filament as it is wiped by the pad.

The bracket is mounted to a framework (not shown) by a rod 41 having one end 42 engaging internal threads 43 of a boss 44 projecting laterally from the bracket 39. A jam nut 45 is provided to lock the assembly in position.

The lower end of the bracket 39 is provided with a toggle 46 wherein a shaft 47 moves in a line lying below and parallel to a plane containing the apex diameter of sheave 22. One end of the shaft 47 is connected to a manually operable handle 48 and the opposite end is joined to a lever 49 which extends upwardly adjacent the filament contacting side of the guide 20 and at its uppermost end 50 bends in a direction paralleling the axis of the boss 44.

A plate 51 is welded to the top of the boss 44 and a switch 52, having normally open contacts electrically connected in series with the motor for pump 30, is mounted to the plate 51 by fasteners 53. As shown in Figs. 2 and 3, the upper end 50 of the lever 49 is in operating contact with the plunger 54 of the switch 52. Thus it is seen, as the lever 49 is moved away from the Fig. 2 position, the switch 52 is opened and the pump 30 supplying the coating solution 28 to the nozzle ceases operation. If, as previously specified, the pump 30 is provided with a by-pass and a solenoid valve is inserted in the conduit 26 between the nozzle 25 and the pump 30, the switch 52 may be electrically connected in series with the solenoid valve instead of with the pump. In addition, the switch may be connected with a timer for recording the productive operating hours of the apparatus. This feature permits rapid threading of the filaments into the V-groove 23 without interference by the stream 40 of the coating liquid or waste thereof.

A screw 55 is press fit into a reduced diameter extension 56 of the bracket mounting hole 43 in the boss 44 and the threaded end of the screw extends through the bracket 39 and a hole 57 extending axially through the sheave 22. A wing nut 58 engages the threads on the screw 55 to clamp the sheave 22 to the face 59 of the bracket 39. As previously stated, this arrangement permits rotation of the sheave 22 and the pad 24 to present a new contact area for the filaments 16 when one contact area becomes worn.

The recovery head 38, shown in detail in Figs. 4 and 5, has a rectangular block-shaped body 60 with a face 61 contoured, as by a milling cutter, to the radius of the flange diameter 62 of the sheave 22. The face 61 terminates slightly above the horizontally extending centerline of the body 60 and proceeds in an inclined relief 63 to the top surface 64. A port 65, preferably circular in cross-section, penetrates the contoured face 61 of the body at the intersection of the centerlines to join an enlarged threaded opening 66 penetrating the opposed face 67. The opening 66 receives a fitting 68 to secure the conduit 37 to the recovery head 38. A pair of vertically aligned mounting holes 69 and 70 extend transversely through the head 38 above and below the port 65 in the recited order.

As shown in Fig. 2, a threaded stud 71 and a pin 72 extend in vertical alignment from the face of the lever 49 in a direction paralleling the screw 55, with the stud above and the pin below the horizontal centerline passing through the screw 55. The stud 71 and the pin 72 are spaced relative to the screw 55 so that the face 61 of the recovery head, when in the operating position shown in Fig. 2, is in radial contact with the periphery of the flanges 62 of the sheave 22 and the longitudinally extending centerline of the port 65 is coincident with the horizontal centerline passing through the sheave 22. A wing nut 73 engages the threads of stud 71 to hold the recovery head 38 in the specified position.

It is anticipated that in some installations it may be advantageous to rotate the bracket 39 and all parts carried thereby from the positions shown, however, the relative positions of the guide 20, the spray nozzle 25 and the recovery head 38 will remain substantially as shown.

It will be noted that the recovery head 38 is mounted on the lever 49. This provision is made so that the head 38 can be moved away from the guide 20 for threading the filaments 16 into the V-groove 23. Also, as previously recited, when the lever 49 and head 38 are removed from contact with the guide 20, the pump 30 is not operative due to opening of the contacts of switch 52.

Furthermore, particular attention is directed to Fig. 6, which clearly shows the channel 74 formed between the face 61 of the recovery head 38 and the V-groove 23 of the sheave 22. As the filaments 16 are biased into the apex of the V-groove 23 from the general direction shown in Fig. 2, they are confined within the channel 74 and it is at this point that a vacuum is applied through the port 65 to draw excess coating solution into the port for return to the reservoir by way of conduit 37.

In summarizing the operation of the present invention, excess coating material applied to the pad 24 and/or strand 21 is drawn into the port 65 of the recovery head from which it discharges through the conduit 37 into the vacuum chamber 32. The vacuum created within the chamber maintains a suction in the conduit 37 and the port 65 which draws the excess liquid coating material into the chamber 32 from which the liquid flows through the conduit 36 into the reservoir 29. The liquid coating material forms the fluid seal 35 in the conduit 36 leading to the reservoir, which seal acts, in conjunction with the vacuum blower 34, to maintain a constant vacuum in conduit 37.

Although a vacuum blower 34 is shown as being the preferred embodiment whereby suction is maintained in the vacuum system, other equivalent evacuating means well known to those skilled in the art may be used equally as well.

The recovery system of this invention also provides a continuous system whereby the excess coating material which is recovered and returned to the reservoir 29 may be recycled and applied to the guide 20 and/or strand 21 substantially at the point at which the individual filaments 16 are grouped together. Thus, the excess liquid coating material received in the reservoir 29 is pumped therefrom through the conduit 26, by means of the pump 30,

and is sprayed through the nozzle **25** onto the applicator pad **24**.

An important advantage of the invention is that the recovery of the excess coating material permits the application of an amount of liquid coating material in excess of that needed, thereby assuring complete and uniform saturation of the pad, resulting in improved distribution of the coating material on the filaments and strand without increasing the cost.

It is also contemplated that means other than the liquid spray device illustrated in the drawings may be used to apply the liquid coating material. For instance, a gravity flow of liquid through a conduit onto the applicator, thereby flooding said applicator, may be used. Additionally, a needle-type nozzle may be inserted into the applicator pad and liquid forced therethrough to flood said applicator pad.

Various liquid binders, sizes and lubricants well known in the art may be used in the above-mentioned process and the particular type of coating agent used does not form a necessary feature of this invention.

Although the invention has been specifically described with reference to the coating of strands formed by grouping substantially endless fibers or filaments of glass, it is equally useful for coating filaments and strands of other materials commonly found in the textile industry.

It has been found that with the present invention, and particularly with the recovery head **38**, it is possible to recover and re-use 50 to 75% of the amount of liquid coating material directed by the nozzle **25** onto the applicator pad **24**, thereby resulting in an appreciable saving of material. The recycling of the coating material **28** also results in improved efficiency and all that is required in the continuous operation of the method are periodic additions of coating material to the liquid reservoir **29**.

It is to be understood that the form of the invention herewith shown and described is to be taken as the preferred embodiment of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. In combination, apparatus for coating a multi-filament strand of infinite length including, a source for said filaments, a reservoir for containing a supply of said coating material in a liquid state, means for simultaneously collecting and coating said filaments, and means for continuously applying an excess of said coating material to said collection and coating means, the improvement comprising a head complementing said collecting and coating means to form a filament receiving channel therebetween, an orifice penetrating said head to communicate with said channel, conduit means extending said orifice to a terminus submerged in said coating supply within the reservoir, a chamber interrupting said conduit means and means for establishing and maintaining a partial vacuum in said chamber.

2. In combination, the apparatus as defined in claim 1 wherein said conduit means include a first conduit extending said orifice to the interior of said chamber and a second conduit descending from the interior of said chamber to said submerged terminus.

3. In combination, the apparatus as defined in claim 1 wherein mounting means are provided for moving said head out of complementary channel forming relation with said collecting and coating means to facilitate threading said filaments into said channel.

4. In combination, the apparatus as defined in claim 1 wherein said collecting and coating means includes a singly grooved sheave and said head nicludes a face contoured to radially contact a portion of the periphery of said sheave on both sides of said groove.

5. In combination, the apparatus as defined in claim 4 wherein the contacted peripheral portion of said sheave approximates an octant.

6. In combination, the apparatus as defined in claim 4 wherein said groove is faced with a pad adapted to permeation by said liquid coating.

7. In combination, apparatus for coating a multi-filament strand of infinite length including, a source for said filaments, a reservoir for containing a supply of said coating material in a liquid state, means for simultaneously collecting and coating said filaments, and means for continuously applying an excess of said coating material to said collecting and coating means, the improvement comprising a head complementing said collecting and coating means to form a filament receiving channel therebetween, an orifice penetrating said head to communicate with said channel, a chamber in elevated relation to said reservoir, means exerting an evacuating force upon the upper interior portion of said chamber, a first conduit descending from the lower interior portion of said chamber to a terminus below the surface of said coating material contained in said reservoir, and a second conduit joining an interior portion of said chamber at a point intermediate said upper and lower interior portions to said orifice.

8. In combination, apparatus for coating a multi-filament strand of infinite length including, a source for said filaments, a reservoir for containing a supply of said coating material in a liquid state, means for simultaneously collecting and coating said filaments, means including an electrically powered pump for supplying an excess of said coating material to said collecting and coating means, a coating recovery head complementing said collecting and coating means to form a filament receiving channel therebetween, an orifice penetrating said recovery head to communicate with said channel, means for generating a negative pressure within said orifice for withdrawing said excess coating material, a conduit extending from said generating means to a submerged terminus below the surface of said coating material supply contained in said reservoir, mounting means adapted to move said head away from and return said head to said complementary channel forming position, and a switch electrically connected in a circuit with said power pump and operable by said mounting means upon movement of said head to and away from said channel forming position to respectively complete and break said circuit.

No references cited.