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APPARATUS FOR TREATING THREAD

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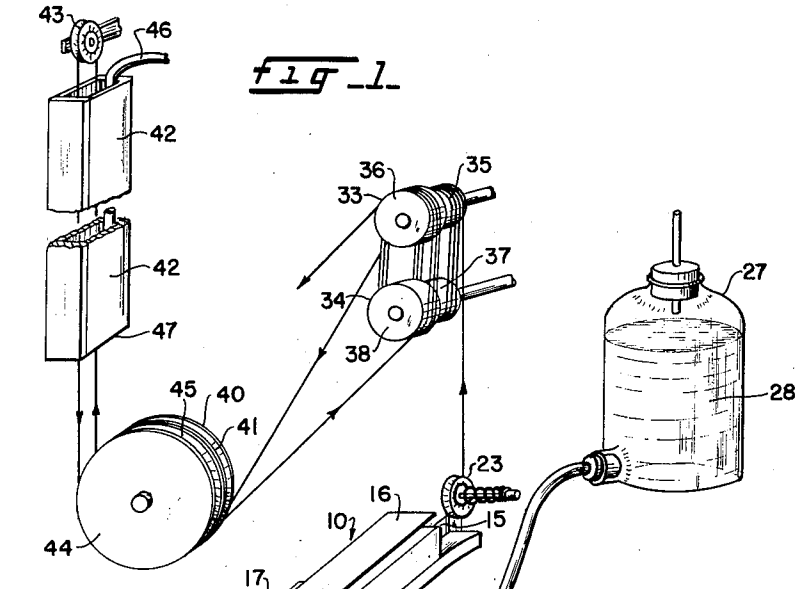



Fig. 1.

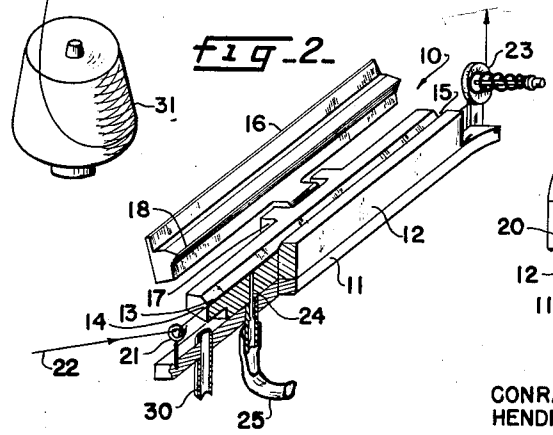



Fig. 2.

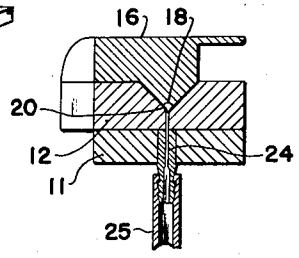



Fig. 3.

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# APPARATUS FOR TREATING THREAD

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This invention relates generally to an apparatus for treating thread and yarn, and more particularly to an apparatus for treating threads and yarn by apply a finish to continuously moving threads or yarn and by stretching the same in the presence of steam.

In the prior art, thread or yarn is passed through a tube to which is supplied a textile or tire yarn finish or lubricant. The thread or yarn is caused to contact the tube wall through which the finish is supplied whereby the thread absorbs some of the finish.

During the course of this finishing or lubricating process, the rapidly moving thread throws off finish or lubricant, which finish or lubricant is thrown out of the tube thereby soiling the equipment. This also results in a substantial loss of finish or lubricant. In addition, the finish or lubricant is not evenly distributed throughout the moving thread or yarn even though the finish or lubricant is evenly supplied to the tube.

It is therefore an object of this invention to provide an apparatus for treating thread or yarn that is free of the difficulties of the prior art.

It is a further object of this invention to provide an apparatus for treating continuously moving thread or yarn with a finish or lubricant whereby finish is completely absorbed by said thread or yarn.

It is another object of this invention to provide an apparatus for treating a moving thread or yarn whereby finish is not thrown out of the finishing device.

A further object of this invention is to provide an apparatus for treating continuously moving thread with a finish after which the finished thread is stretched in the presence of steam.

These and other objects of this invention will become apparent from a reading of the following detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of an apparatus according to this invention;

FIGURE 2 is a perspective view, partly in section, illustrating one embodiment of the finishing device of this invention; and

FIGURE 3 is a cross-sectional view taken along lines III—III of FIGURE 1 of the finishing device of one embodiment of this invention.

The objects of this invention are accomplished by supplying a quantity of finish to an elongated finishing or lubricating device. This device is an elongated tube having an internal diameter of not more than 1 mm. Thread or yarn is continuously passed through this device in contact with the finish. It is also preferred to guide the moving thread or yarn axially through the elongated divice.

It is essential to the successful operation of this process and apparatus that the internal diameter of the tube not exceed 1 mm. It has been found that it is only in such tubes that all of the finish or lubricant will be taken up or absorbed by the thread or yarn within the relatively short length of the tube.

It is believed that the thread which is continuously moving through this tube is caused to vibrate by its rapid movement. This inherent vibration results in a portion of



the finish which had been picked up by the thread being thrown off the thread and onto the wall of the finishing tube. In this invention the vibrating thread again picks up the finish which may or may not be thrown off again. This results in a substantially, if not complete pickup of the finish or lubricant by the thread while it is within the tube.

The minimum internal diameter of the tube is, of course, determined by the diameter of the thread. The only requirement is that the diameter be sufficient to permit uninterrupted passage of thread or yarn through the tube. It can readily be seen that the maximum diameter of 1 mm. is sufficiently large to permit the use of this process and apparatus on a variety of deniers. These extend up to and include the tire yarn deniers such as 1800 denier.

The length of the tube may vary within rather wide limits. The minimum length can be easily determined by placing a sheet of blotting paper at the discharge end of the tube and determining the amount of soilage. If such occurs, then the speed should be reduced, the length of the tube should be increased, the diameter decreased, or the amount of finish decreased. These determinations are simple and can be made by anyone skilled in the art.

The circumstances of each case will dictate the change that is to be made. Thus, if the amount of finish being supplied is that which is desired, then the speed should be reduced or the length of the tube increased. However, if the tube cannot be lengthened because of space limitations, then the speed or diameter may have to be changed. Thus, for a speed of not more than 400 meters per minute, it was found that a tube length of 15 cm. and an internal diameter of 1 mm. was sufficient to eliminate discharge of finish.

Since the use of this device and process results in complete pickup of the finish or lubricant, it is necessary that the quantity of finish supplied to the device be substantially equal to the amount that is to be picked up by the thread or yarn. Such amounts may be easily determined by means known to those skilled in the art. The amount is calculated as a percentage based on the weight of the thread or yarn.

As pointed out above, it is necessary that the finish or lubricant contact the thread or yarn in a tube whose diameter does not exceed 1 mm. in order that the finish or lubricant is evenly distributed on the thread or yarn. This evenness may be improved if the finish or lubricant is supplied to the tube from a capillary. It is only necessary for this added improvement that the supply duct of the tube be a capillary. Larger supply ducts may result in uneven pickup of the finish, thereby necessitating a longer tube or other modifications in the equipment or process to insure even distribution of the finish.

This process and apparatus is suitable for treating hydrophobic threads or yarns such as synthetic linear polyamides and polyesters such as polycaprolactam and polyethylene terephthalate. Also, it may be used for treating hydrophilic threads and yarns, such as viscose rayon.

It should be understood that the specific finish or lubricant used forms no part of this invention, and that any desired finish or lubricant may be used without departing from this invention. Thus, it is possible to use an aqueous or a non-aqueous finish. In addition, additives, such as antioxidants may be added to the finish or lubricant without departing from this invention.

The elongated tube or tubular member of this invention may be constructed in several ways. For instance, it may be a completely enclosed tube. However, introduction of thread or yarn into and through such a solid tube is rather difficult. It is, therefore, preferred that

the tubular member be constructed in two parts which are hinged together and which when closed form a channel longitudinally through the tubular member of an internal diameter of not more than 1 mm.

As pointed out above, the quantity of the finish or lubricant supplied to the elongated tube should be that amount which is to be distributed on the thread or yarn. To facilitate the control of the supply and the determination of the correct amount to be supplied, it has been found desirable to have the tube positioned at an angle relative to the horizontal. The entrance portion of the tube should be lower than the exit portion. It is also desirable to connect the capillary-shaped finish supply to the underside of the tubular member or elongated tube near the entrance portion.

With such a device, the finish supply is opened before thread is passed through the device. The finish dripping from the tube can be collected and measured. From the length of time that it takes a prescribed amount to be collected, it is a simple matter to calculate whether the supply is correct for the speed of the thread travel and the amount to be distributed on the thread. Such calculations are conventional and are well known to those skilled in the art.

The process and apparatus of this invention, while suitable for use wherever it is desired to apply a finish or lubricant to a moving thread or yarn, has found particular application in the lubricating of viscose rayon tire yarn prior to stretching in the presence of steam. In steam stretching, the yarns are first impregnated with a lubricant and then stretched in the presence of saturated steam. The object of this operation is to decrease the elongation of tire yarn and to increase its strength. Usually the finish is an aqueous emulsion of a conventional tire yarn lubricant.

This process was considered an improvement over the slashing process wherein the yarn was stretched while being wetted with an excess of finish. These yarns were then dried, which drying operation is not necessary in steam stretching because the quantity of finish used is less than that which the yarn can absorb. The one disadvantage of the steam stretching operation is that the oven dry strength of the cords formed from this yarn is lower than that of the cords composed of slashed yarn.

It has now been found that the oven dry strengths are substantially equal if the yarn is treated by the process and apparatus of this invention. Thus the finish or lubricant is supplied to the moving thread in an elongated tube whose internal diameter is less than 1 mm., after which the lubricated yarn is stretched in the presence of steam. For best results, the yarn prior to lubricating should be conditioned to a moisture content which is substantially equal to that desired in the processed yarn. Under normal circumstances, the moisture content should be between 12 and 14%.

The lubricant that is used for the steam stretched tire yarn is preferably a homogenous and non-aqueous lubricant. Examples of such lubricants are commercially available under the names Nopco and Stantex. These are a solvent refined mineral oil and a solvent extracted sulfonated mineral oil and a vegetable oil sulfonate, respectively. The tire yarn that is to be steam stretched should preferably contain about 0.1 to 1.5% by weight of the lubricant.

This steam stretching of yarn treated according to this invention results in tire yarn of reduced elongation, increased strength, and an oven dry strength substantially equal to that of slashed tire yarns. In addition, this process eliminates the costly drying operation of the slashing process.

Reference will now be had to the drawing for a complete description of one embodiment of the apparatus of this invention. Reference numeral **10** indicates generally one embodiment of the treating device of this invention which is mounted on a base plate **11** secured to a conventional machine frame (not shown). Treating device **10** comprises a body portion **12** having a channel **13** of substantially triangular cross-section, which extends from the entrance portion **14** to the exit portion **15** of body portion **12**.

A lid or top portion **16** is secured to body portion **12** by a hinge **17** or other conventional means. Lid or cover **16** is of substantially the same length as body portion **12**. The underside **18** of lid **16** has a trapezium shaped cross-section. Channel **13** and underside **18** are fashioned in such a manner that they mesh together and form a channel **20** of a diameter of not more than 1 mm. as is shown in FIGURE 3.

A guide **21** is mounted on base plate **11** near entrance portion **14** and positioned in such a fashion that thread **22** is guided axially into and through channel **20**. A disc brake **23** or other braking or tensioning device is mounted on base plate **11** near exit portion **15** to apply tension to thread **22** and assist in guiding the thread axially through channel **20**.

A capillary **24** extends through base plate **11** and body portion **12** and is connected to tube **25**. A control valve **26** is positioned in tube **25** between capillary **24** and a finish or lubricant supply vessel **27** which may be of any conventional design. A non-aqueous liquid lubricant **28** is placed in vessel **27** which vessel **27** is positioned on a higher level than capillary **24** in order that upon opening of valve **26**, lubricant **28** flows through tube **25** and capillary **24** to channel **20**.

As yarn **22** passes through channel **20** it picks up lubricant **28** and absorbs a portion thereof. The inherent vibration of yarn **22** causes a portion of lubricant **28** to be thrown off; however, the narrowness of channel **20** permits the yarn to pick it up again in order that substantially complete absorption is obtained and none is thrown from exit portion **15**. However, if yarn **22** does not pass through channel **20**, the lubricant flows toward entrance portion **14** because base plate **11** is inclined slightly from entrance portion **14** to exit portion **15**. This facilitates determination of the correct amount of lubricant that is to be supplied to channel **20**. The lubricant flowing from entrance portion **14** drops into outlet tube **30** extending through base plate **11** and into any collection vessel (not shown).

The apparatus illustrated in FIGURE 1 is used in conjunction with a stream stretching device for tire yarn. This yarn **22** is unwound from a spool **31** and guided via guides **32** and **21** into and through channel **20** by lifting lid **16** slightly while lubricant **28** is being supplied to channel **20**. Yarn **22** picks up lubricant **28** and absorbs the same, the amount to be absorbed and supplied to capillary **24** having previously been determined by methods known to those skilled in the art.

Yarn **22** after leaving channel **20** is guided via disc brake **23** to step rollers **33, 34**. Rollers **33, 34** are freely rotatable and are driven by the passage of yarn thereover during normal operation. Rollers **33, 34** are composed of two steps **35, 36** and **37, 38**, respectively, with steps **35** and **37** being of smaller diameters than steps **36** and **38**. The yarn passes several times around steps **35** and **37** as is more clearly shown in FIGURE 1.

The yarn next passes over freely rotatable guide roller **40** having a groove **41** in its periphery into chamber **42**. Yarn **22** passes through chamber **42** to reversing roller **43** to freely rotatable guide roller **44**, having a groove **45** in its periphery. Steam is supplied to chamber **42** from a source (not shown) by duct **46** which duct extends to the entrance portion **47** of steam chamber **42**. Thus the yarn is subjected to the action of steam while it remains in chamber **42**.

From roller **44**, the yarn is passed several times around the larger steps **36** and **38** of rollers **33, 34**, whereby the movement of the thread over these steps results in the

yarn being stretched in steam chamber **42**. The differences in the diameters of steps **35**, **37** and **36**, **38** determines the degree of drawing or stretching to which the yarn is subjected. It should be understood that step rollers are not essential to the success of this process, and that other means for drawing the yarn may be used, such as feed rollers and draw rollers, whose speeds are regulated to control the amount of drawing or stretching.

A conventional motor driven winding device (not shown) collects the yarn **22** as it comes from step **36** and thus it is this device which pulls the yarn through the apparatus during normal operation. It is possible to use any conventional yarn collection device for this purpose.

In operation, lubricant control valve **26** is adjusted to control the amount of lubricant **28** entering channel **20**. Yarn **22** is pulled through channel **20** where it absorbs completely all of the lubricant supplied thereto. Thereafter it is passed over rollers **33**, **34**, through steam chamber **42** and over rollers **33**, **34**, whereby it is stretched in the presence of steam. Throughout continued use of such an apparatus little if any lubricant soils the equipment of the treating apparatus.

As a further description of this invention, the following specific example is offered. It is to be understood that it is for purposes of illustration only, and it is not to be considered as limiting the scope of this invention.

*Example*

A viscose rayon tire yarn of an undrawn denier of 1800, a dry strength of 4.3 grams per denier, and an elongation of 23% was processed through the apparatus of FIGURE 1. The yarn also had been conditioned to a moisture content of 13%. This yarn, at a speed of 325 meters per minute, was passed through channel **20** to which was supplied a vegetable oil sulfonate containing a small amount of unsaponified material (commercially available under the name of Stantex) in such a quantity that 1.0% by weight of the lubricant was absorbed by the yarn. The yarn was stretched between the steps of rollers **33**, **34** while in chamber **42** to which saturated steam was supplied to maintain an average temperature of 100° C. in chamber **42**.

The area adjacent the exit of the treating device was free of lubricant. The yarn had a denier of 1620, a strength of 4.6 grams per denier, and an elongation of 13%. The oven dry strength of a cord manufactured from this yarn was 15.5 kg., whereas the cord prepared in the same manner but lubricated with an aqueous emulsion was 14.9 kg. A similar yarn which had been slashed and formed into a cord had an oven dry strength substantially equal to the cord manufactured from yarn treated according to this invention.

It can be seen from the foregoing that the process and apparatus of this invention prevent the accumulation of finish or lubricant on the finishing equipment. It also provides a process whereby finish is evenly distributed over a moving length of thread or yarn. In addition, it overcomes the disadvantages of the steam stretching operation in that there is no reduction in oven dry strength of the cords as compared to the slashed ones.

It should be understood that changes and modifications may be made in this invention without departing from the spirit and scope, which is to be limited only by the following claims.

What is claimed is:

1. An apparatus for applying finish to a continuously moving thread comprising an elongated thread receiving tube having an internal diameter of not more than 1 mm., means for passing thread through said elongated tube while imparting vibration thereto, and means for supplying finish to said tube for application to the vibrating thread traveling therethrough.

2. An apparatus for treating a continuously moving thread comprising an elongated member, said elongated member consisting of a body portion having a triangular channel therein, a top portion having a trapezium projection, a thread entrance and a thread exit, said triangular channel and trapezium projection cooperating to form a channel having a diameter of not more than 1 mm., means for guiding thread axially through said elongated member, capillary means for supplying finish to said body portion near said thread entrance, and means for regulating the supply of finish to said capillary means.

3. An apparatus according to claim 2 wherein said top portion is pivotally attached to said body portion.

4. Apparatus for applying finish to traveling thread comprising an elongated body portion having a longitudinal channel formed therein, an elongated cover portion having a projecting surface extending longitudinally thereof, the projecting surface on said cover portion and the channel in said body portion cooperating to define a confined thread treating zone having an internal diameter of not more than 1 mm., means for passing thread axially through said confined treating zone while imparting vibration thereto, means for applying finish to the vibrating thread passing through said confined treating zone, and means for removably securing said cover portion to said body portion to facilitate threading.

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