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METHOD AND APPARATUS FOR COATING TEXTILE FILAMENTS

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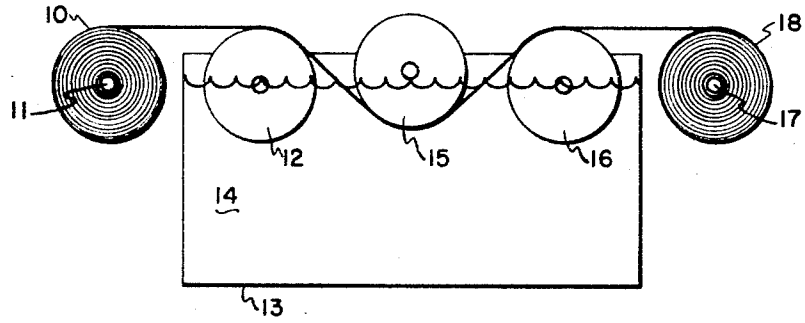


Fig. 1

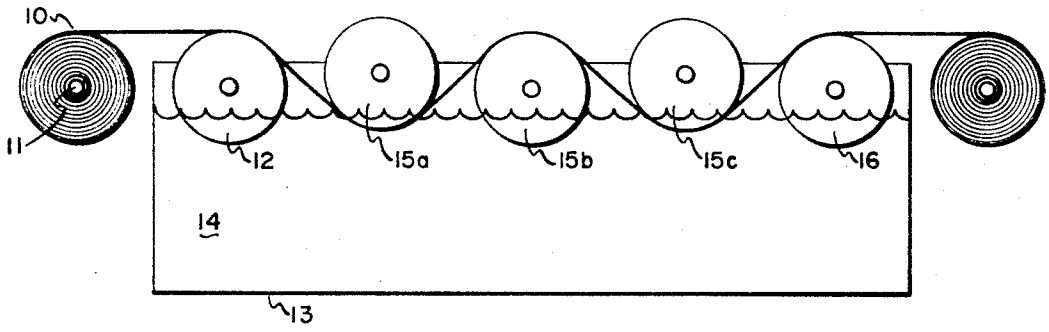


Fig. 2

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METHOD AND APPARATUS FOR COATING TEXTILE FILAMENTS

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ABSTRACT OF THE DISCLOSURE

Textile filaments are coated by passing the filaments through a series of equal, but alternately opposite bends during the passage of the filaments through a coating bath. This process thereby results in an opening-up of the filaments so as to expose all of the filaments to intimate contact with the coating bath and at the same time, undesirable twisting and breakage of the filaments are minimized.

This invention relates to a method for coating textile filaments and more particularly relates to such a method in which the filament strands are separated to receive the coating by bending the strands in alternating fashion.

Numerous methods and various types of apparatus are currently known and employed for the purpose of producing coated textile filaments or fibers. In many applications it is desirable that the coating protect the fiber against inter-filament chaffing by surrounding the individual filament with the coating composition. The extent to which this protection is accomplished is directly related to the percentage of filaments which are covered and to the thickness of coverage. These two factors are in turn directly related to the degree to which the filaments in a strand are separated during the coating operation.

It has now been found that the strand of filaments can be opened up by bending the strand in alternating fashion as it is being fed through the coating bath. When a strand is bent the filaments at the outer portion of the bend curvature travel faster than those at the inner portion and therefore separate from one another. This causes stresses to be unevenly distributed among the individual filaments with the result that there is a tendency for the filaments to break. For this reason it has been found necessary to alternate the direction of bending. Furthermore, the bends must alternate close enough together so that the strand does not have an opportunity to twist between bends and the bends must be equal in number. In this manner the stresses on the individual filaments are equalized.

The opposing bends must be in pairs but the pairs can be variously placed. For example, the bending unit can be placed horizontally, vertically or at any angle in between. The unit can be placed at a 90° angle with respect to the direction of travel of the strand or it can be slanted at any angle with or against the direction of travel.

It is essential that the strand be wet with coating during the initial part of the bending operation in order that the filaments be lubricated and protected while the strand is forced open.

Any number of cycles can be employed. From a practical standpoint, however, more than six bend cycles requires excessive stress in pulling the strand through the unit, resulting in some filament breakage and excessive tightness of wind on the take up roll.

The fibers to be coated in accordance with this invention include glass, asbestos, rock wool, Celite, cotton, linen, rayon, silk, hair, nylon, Orlon, etc. Any type of coating may be applied such as rubber, synthetic rubber, resin, metal, plastics, textile sizings, binders, lubricants and coupling agents such as a vinyl silane and the like.

A simple mechanism for proving the appropriate bending actions consists of a series of rods placed in a coating bath and perpendicularly to the direction of the strand travel. The strand is led over and under the rods alternately so that the strand is alternately bent in opposite directions as it passes through the coating bath. Instead of rods, the bend action can be accomplished by means of pulleys or rolls, or the strand can be passed through hollow bent tubes containing the coating solution.

The invention is described in more detail in the accompanying drawings in which

FIGURE 1 is a side elevational view of apparatus for forming continuous coated glass filaments in accordance with one embodiment of the invention and

FIGURE 2 is a side elevational view of another embodiment of the invention.

Referring now to FIGURE 1, a strand of alumina-boro-silicate glass composed of 200 to 1200 filaments varying in diameter from 0.00015 to 0.0007 inch is unrolled from package **10** on drum **11** and led directly to the top of roll **12** in coating tank **13**. From roll **12** the strand is dipped below the surface of coating solution **14** to the bottom of roll **15**, and thence up and out of the coating solution to the top of roll **1** from which it is led straightly away to drum **17** on which it is rolled to form package **18**. The amount of downward bend obtained at rolls **12** and **16** is only half that of the upward bend obtained at roll **15**. However, the sum of the downward bend at rolls **12** and **16** is substantially equal to the upward bend at roll **15**. Rolls **12** and **16** are transfer rolls which pick up the coating and transfer it to the strand. Roll **15** is generally placed higher than rolls **12** and **16** and in such a manner as to cause the strand to bend. Roll **15** can be raised or lowered and its position affixed as required to bend the strand to the appropriate extent so that the stress on the strand filaments is greater than that which the filaments can counteract by means of elongating. Although generally preferable, it is not a necessary requirement that the level of coating solution should be so high as to contact roll **15** or the equivalent.

When the strand from package **10** is passed over the top of roll **12** and bent downward through the coating bath around the bottom of the roll **15**, the multifilament strand is opened up to expose the individual filaments to the coating **14**. The filaments at the outer portion of the bend curvature travel faster than those at the inner portion with the result that the filaments separate.

FIGURE 2 is similar to FIGURE 1 except that it provides two alternating bend cycles, the outermost rolls **12** and **16** each contributing one-half of a downward bend portion of the cycle and equal to the bends obtained with each of rolls **15***a*, **15***b*, and **15***c*.

In experimenting with the coating of fiber strands, it was found that excessive filament breakage occurred when the bending was not alternated or when the bends were not alternated closely enough. When the bend system was not alternated, the filaments that had traveled over the outer portion of the bend were subjected to most of the stress involved in pulling the strand through the coating unit because the outer filaments had to travel a longer distance than the inner filaments which were carried along in slack fashion. When the bends were first alternated as shown in FIGURES 1 and 2, breakage was worse than before because the bends were so far apart that the strand had an opportunity to twist between bend locatings. In this case the filaments which had traveled over the outer curvature of the first bend at roll **12** could also be the same filaments that traveled over the outer curvature

of the opposing bend in roll 15 due to the fact that the strand had twisted between bends. In this way the magnitude of uneven stress was increased causing a more pronounced filament breakage. When the opposing bends were brought close enough together to prevent the strand from twisting between bends, very little filament breakage occurred. This, it has been found that the opposing bends should be no further apart than eight inches, preferably one-half to four inches distance, between the point at which the strand leaves one roll and contacts the next roll.

The nature of the present invention having been fully set forth and specific examples of the same given, what is claimed as new and useful and desired to be secured by Letters Patent is:

1. Method of producing coated textile fibers comprising passing strands of said fibers through a coating bath, subjecting said fibers, while in said coating bath, to a series of equal but alternatingly opposite bends whereby the filaments of the strand are opened up to contact the coating bath, and maintaining said strands untwisted between bends.

2. An apparatus for continuously coating textile fibers, comprising a tank containing a coating agent, means for feeding strands of said fibers into said tank, means for imparting a plurality of equal but opposite bends to said fibers while in said tank, means for preventing said strands from twisting between bends, and means for removing coated fibers from said tank.

3. An apparatus for continuously coating textile fibers comprising a tank containing a coating agent, an odd number of rolls in said tank, consisting of a first roll, median rolls and a final roll, means for feeding strands of fibers into one end of said tank onto the top of said first roll and in contact with each of said remaining rolls

in alternate fashion, means for maintaining said strands untwisted between said rolls and means for removing coated fibers from the top of said final roll, said rolls being positioned so that the fiber strands being coated will be subjected to a plurality of equal but opposite bends while in said tank.

4. An apparatus for continuously coating textile fibers comprising a tank containing a coating agent, an odd number of no greater than 5 bending elements in said tank, said bending elements consisting of a first element, median elements and a final element, means for feeding strands of fiber into said tank to the top of said first bending element and alternately in contact with each of said remaining bending elements, said bending elements being arranged horizontally and at 90° to the direction of strand travel, and no further than eight inches apart and located so that the fiber strands being coated will be subjected to a plurality of equal but opposite bends while in said tank and means for removing coated fibers from the top of said final bending element.

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U.S. Cl. X.R.

68—175; 118—419