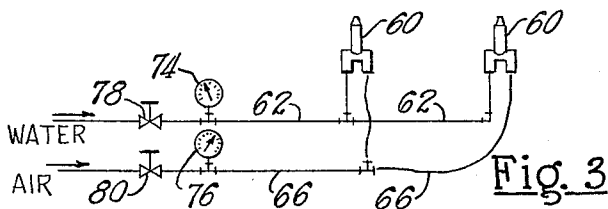
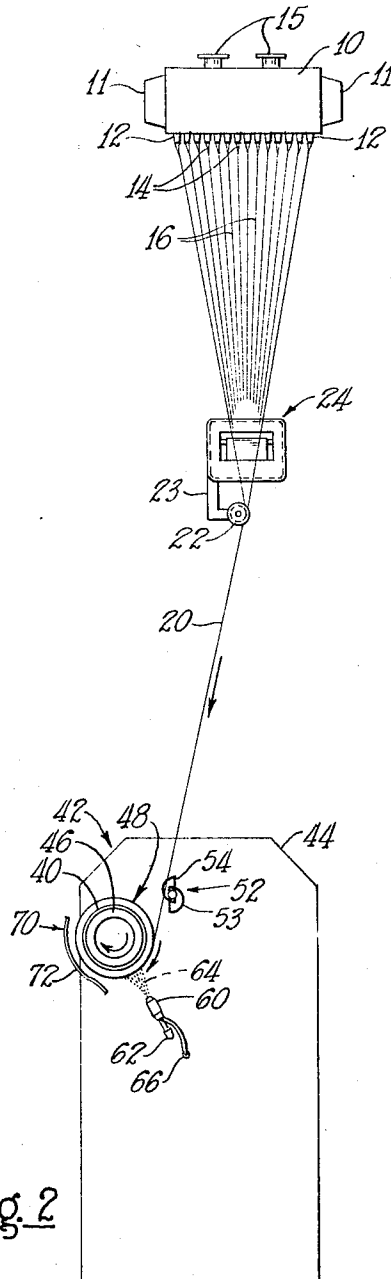
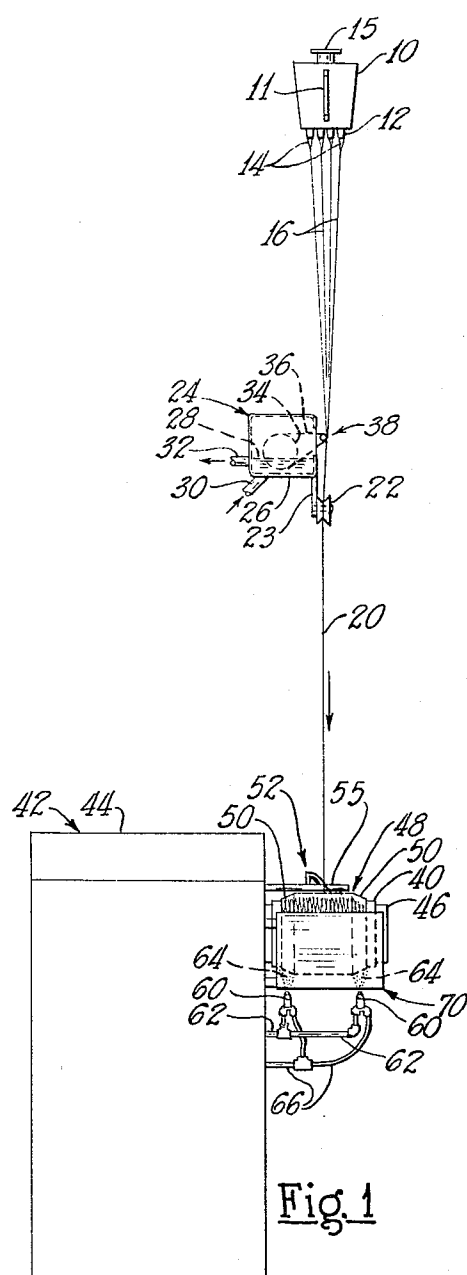


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METHOD AND APPARATUS FOR TREATING AND PACKAGING
STRANDS OF FILAMENTS
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METHOD AND APPARATUS FOR TREATING AND PACKAGING STRANDS OF FILAMENTS

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This invention relates to method of and apparatus for treating and packaging strands of coated filaments and more particularly to a method and apparatus for treating a strand of coated or sized filaments during package winding or collection to improve the uniformity of coating or size on the strand throughout the package.

In the formation of continuous filaments, particularly those formed of heat-softened mineral material such as glass, it is conventional practice to apply a size or coating material to the filaments prior to the winding of the filaments into a strand package. It is also a practice in winding or collecting a strand of filaments into a package to build a multi-layer strand package by winding the strand on a cylindrical tube and to fashion the package with tapered end regions in order to prevent or eliminate, as far as possible, the formation of "ringers" or loose convolutions at the end region of a package. The formation or taper of the ends is toward the central region of the package.

Glass filaments for textile uses are attenuated by winding a strand of the filaments into a package at high speeds of upwards of fifteen thousand or more linear feet per minute, the package being rotated at several thousand r.p.m. By reason of the rapid rotation of the strand collecting tube and the package builder system of tapering the package ends, the size or coating on the convolutions of strand exposed at the tapered end regions of the package tend to dry or set quickly. As the size or coating applied to the strand is in a mobile condition and as the strand acquires an excess of size from an applicator, the size on the successive layers of strand tend to flow or migrate onto the exposed convolutions of strand at the end regions of the package. As the size on the end regions is dried quickly, excess size from the successive layers recoats the dry size. This building up or accumulation of size or coating on the strand convolutions at the package ends results in nonuniform coating or size on the packaged strand. The regions of strand having size of excessive thickness in a woven textile appear as streaks which impair the quality of the product.

The present invention embraces a method of treatment of the strand during its collection into a package particularly at the tapered end regions of the package to effectively reduce or eliminate the concentration or excessive amount of size or coating material on the convolutions of strand at the end regions of the package.

Another object of the invention is the provision of a method of establishing an operating environment at a strand collecting station of a character to prevent or substantially eliminate premature drying or solidification of the size or coating on the strand at the end regions of the package during its formation.

Another object of the invention resides in a method of establishing a moist environment particularly at the end regions of a strand package during the collection of the strand of filaments to minimize the tendency for excess size or coating on successive layers of strand from accumulating on the tapered ends of the package.

Another object of the invention is the provision of a method of processing the strand of filaments into a wound package formation in a manner and in an environment which prevent premature drying or setting of a size or coating in any region of the package being formed

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whereby the size or coating on the strand remains substantially uniform on all regions of the strand throughout the package.

Another object of the invention resides in a method of preventing premature drying of size or coating material on filaments of a strand at the end regions of a strand package during its formation by projecting fluid at high velocities into the regions of the ends of the package to effect a penetration by the fluid of the boundary layer of air moving with the rotating package to thereby promote intimate contact of the fluid with the coated strand.

Another object of the invention resides in a method of enveloping the end regions of a package of strand of glass filaments during formation by a moisture saturated atmosphere by projecting water in finely divided form or steam at velocities adjacent the end regions of the package sufficiently high to penetrate the boundary layer of air adjacent the package to continuously maintain intimate contact of the water with the coated strand.

Another object of the invention resides in an apparatus or arrangement for establishing and maintaining a moist environment adjacent the end regions of a package of strand during collection of strand through the projection of water in finely divided form at high velocities adjacent the package.

Another object of the invention is the provision of means for projecting water at high velocities in atomized or finely divided form adjacent the ends of a package of strand being formed in combination with a shield or baffle means arranged to divert or redirect the moisture toward the package for maintaining the ends of the package enshrouded with moisture to retard or substantially eliminate the tendency of size or coating material on the strand at the ends of the package from drying or setting prematurely.

Another object of the invention is the provision of a method of and apparatus for treating a package of strand during its formation to avoid concentration or accumulation of size or coating on the strand at the end regions of the package and hence providing a linear textile material which, when woven into cloth, provides a cloth of uniform texture in appearance and a linear textile material in which the tension, during weaving, is more uniform with a reduction in the formation of fuzz and wherein the efficiency of transferring the textile strand onto bobbins is greatly improved.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is a front elevational view illustrating an apparatus for forming and collecting continuous filaments of heat-softenable material embodying an arrangement for carrying out the method of the invention;

FIGURE 2 is a side elevational view of the arrangement illustrated in FIGURE 1, and

FIGURE 3 is a schematic diagram of a fluid delivery arrangement for carrying out the method of the invention.

While the method and apparatus of the invention are particularly usable in the formation of wound packages of strand formed of filaments of glass or other heat-softenable material, it is to be understood that the invention may be utilized in the collection or packaging of other linear materials wherever the invention may be found to have utility.

Referring to the drawings in detail and initially to FIGURES 1 and 2, there is illustrated a conventional type of stream feeder 10 adapted to contain molten or heat-

softened glass or other heat-softened fiber-forming material, the feeder having a bottom wall or floor provided with a plurality of orificed tips or projections 12 through which streams 14 of the material are flowed and the streams attenuated to filaments 16 by winding the filaments on a rotating collector. The feeder 10 is formed of an alloy of platinum or rhodium or other material capable of withstanding the intense heat of the molten glass.

In the embodiment illustrated, the feeder 10 and material therein are adapted to be heated electrically by attachment of current conductors (not shown) to terminals 11, and batch or cullet, preferably in the form of spherically shaped bodies being introduced into the feeder through tubular means 15. The electric energy reduces the material to a softened or flowable state, the temperature being controlled by conventional means to maintain the glass at a proper viscosity so that the streams of glass flowing through the orificed projections 12 will be substantially uniform.

It is to be understood that a suitable stream feeder may be attached directly to a forehearth of a melting furnace whereby the feeder receives molten glass from a forehearth.

The filaments 16 are converged into a strand 20 by suitable means such as a gathering roll or member 22 supported by a bracket 23. A coating of liquid material or size is applied to the group of filaments by an applicator arrangement 24 which, in the embodiment illustrated, includes a receptacle 26 adapted to contain a size or coating material 28. It is preferable that the size or coating material be circulated through the receptacle, the coating material being delivered into the receptacle through a tube 30 from a circulating pump (not shown), an overflow tube 32 returning the excess size or coating to the pump for recirculation.

Partially immersed in the liquid size 28 in the receptacle is a roll 34 equipped with a belt 36 which acquires a film of the size or coating material transferred to the filaments by a wiping action of the filaments 16 contacting the film on the belt at the region indicated at 38, the roll 34 being driven or rotated by a motor or other conventional means (not shown).

The streams 14 are attenuated to fine continuous filaments 16 by winding the strand 20 of filaments upon a package collector, tube or sleeve 40 driven by a winding machine 42.

The winding machine or apparatus for collecting the strand into packages includes a housing 44 in which is journaled supported a collet or mandrel 46 rotated by a motor (not shown) contained within the housing 44, the driving means for the collet 46 being of conventional construction.

The collector tube or sleeve 40 is driven at a comparatively high speed whereby the attenuation of the filaments and packaging of the strand takes place at speeds of upwards of fifteen thousand feet per minute or more which requires rotating the collet 46 and the tube 40 at several thousand revolutions per minute depending upon the diameter of the sleeve. The collector tubes are usually six inches or more in diameter.

During the winding of the strand 20 upon the collector tube 40, the strand winding is controlled by a traverse means shaped to oscillate the strand to effect a crossing of individual convolutions of strand upon the package and the oscillating means reciprocated concomitantly to distribute the strand lengthwise of the package. The reciprocation of the traverse means is controlled to progressively shorten successive layers of strand in order to form a package 48 having tapered ends 50 in order to prevent sloughing off of convolutions of strands at the package ends.

A traverse means 52 illustrated in FIGURES 1 and 2 is formed with two generally semicircular spiral portions

53 and 54 fashioned of metal wire supported upon a shaft 55, the latter being arranged for rotation and reciprocation.

The traverse member 52 engages the strand 20 and is rotated to effect oscillation of the strand to effect a crossing of the individual convolutions of the strand as they are collected. Other forms of traverse such as a grooved roll may be used in lieu of the wire type traverse 52. The shaft 55 is rotated and reciprocated by conventional driving means, the reciprocation being controlled whereby the strand is collected in layers which are progressively shortened to form the tapered ends 50. The winding machine is provided with conventional means (not shown) for initiating rotation of the collet 46 and the packaging tube 40 and for stopping rotation of the collet when a completed package has been formed.

The invention particularly resides in a method of and means for establishing and maintaining a moisture saturated environment particularly adjacent the tapered end regions of the package being formed, the moisture saturated environment being of a character to prevent premature drying or setting of the size on the convolutions of strand at the tapered ends of the package during package formation. As the layers of strand are successively collected upon the package, the size or coating on the strand at the region of the package between the tapered ends does not tend to dry out quickly because of the deposition of successive of layers of size-bearing strand which isolates the size on the interior layers from the drying effects of ambient air.

However, the liquid size or coating on the convolutions of strand at the tapered ends of the package is exposed to the drying effect of the air, which by reason of the high speed rotation of the package, causes the size at the ends to quickly dry or set. As there is an excess of size or coating acquired by the filaments from the applicator at the region 38, the size on successive layers of strand as they are formed tends to flow onto the tapered ends causing an excessive amount or accumulation of fresh liquid size on the size or coating which has become dry. The strand, bearing an excess of size at the ends of the package, when formed into yarn and woven into fabric causes streaks in the fabric because of the spaced regions having an excess amount of size.

To obviate this difficulty, the present invention provides for the establishment and maintenance of a moisture saturated region whereby moisture is in intimate contact with the ends of the package to greatly retard or eliminate the tendency for the size or coating on the tapered end regions of the package from prematurely drying out or setting. Disposed adjacent the tapered end regions of the package being formed are nozzles 60 or means for projecting a fluid, such as water, by air pressure to atomize the water, the fine particles of water or mist being projected at sufficient velocity whereby the particles of water penetrate the boundary layer of air at the package and directly and intimately contact the strand on the tapered end regions 50 of the package 48.

The fluid preferably employed is water which is conveyed to the nozzles or delivery means 60 by pipes 62. The nozzles 60 are of a character for mixing water and compressed air whereby the water is projected at substantial velocities and finely divided as a mist or spray 64 directed against the tapered ends of the package. The compressed air is conveyed through pipes 66 to the water and air mixing nozzles 60 whereby the finely divided particles of water, mist or emulsion are projected from the nozzles 60 at high velocities preferably radially of the package.

It is found to be essential in order to prevent drying of the size or coating to project the fine particles of water at high velocities toward the ends of the package in order that the particles of water penetrate the air layer or air stream developed at the surface of the package because of the high speed rotation of the package. Thus, in

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order to eliminate the drying out of the size or coating at the ends of the package, the moisture or fluid is applied in a manner to penetrate the air layer to promote the establishment of a moisture saturated environment in direct contact with the convolutions on the ends of the package.

It is found that a baffle means promotes a confinement of the moisture at the surfaces of the package ends. As particularly shown in FIGURES 1 and 2, a baffle 70 is disposed adjacent the collet 46 and the package being formed.

The baffle 70 is preferably of a curvature of greater radius than the maximum radius of curvature of the finished package, the minimum distance of the baffle 70 from the package being at the region 72 spaced a slight distance away from and forwardly of the region of application of the moisture sprays 64 onto the package.

With a baffle arrangement, the surface of the package rotating at a high speed toward the region 72 entrains the moisture which tends to adhere to the end regions of the package assisted by the curvature of the baffle 70, a factor further reducing the tendency for air to engage the package ends by confining the moisture between the baffle and the package.

FIGURE 3 is a schematic illustration of the air and water mixing nozzles 60 and the tubes 62 and 66 for conveying water and air to the nozzles. A water pressure gauge 74 is connected with the water line 62 and an air pressure gauge 76 connected with the air pressure line 66. A control valve 78 is associated with the water line, and a control valve 80 is associated with the compressed air line for regulating the volumes of water and air delivered to the mixing nozzles.

While water is preferably employed as a drying retardant for the size or coating on the strand at the tapered regions of a package, it is to be understood that other fluids may be used for the purpose.

In lieu of the air and water mixing nozzles 60, suitable nozzles may be employed to project jets of steam onto the end regions of the package at a pressure to penetrate the boundary layer of air and establish a moisture saturated environment at the package ends. Where steam is employed for the purpose, compressed air is rendered unnecessary as the steam may be delivered at a desired pressure and velocity to penetrate the boundary layer of air at the package ends so as to assure intimate contact of the steam with the convolutions of strand at the tapered regions of the package. As the packages of strand are formed at approximately room temperatures, condensation from the steam jets adheres to the tapered regions of the package and provides a moist environment isolating the ends of the package from ambient air. While other liquids, atomized under the influence of air pressure, delivered at high velocity may be used to prevent premature drying at the ends of a package, water is preferred because of its availability and low cost.

It is to be understood that the method and arrangement of the invention is usable with automatic winding apparatus having an indexible head mounting two or more rotatable package winding collets for continuous filament attenuation.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. The method of processing strands of filaments wherein the filaments are attenuated from streams of heat-softened material by winding a strand of the filaments upon a collector rotating at comparatively high speed including winding the strand in a manner to form a package having tapered end regions, applying a size to the filaments prior to the collection of a strand of the filaments upon the collector, and continuously maintaining a moisture

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saturated environment adjacent and directly in contact with the tapered ends of the package being formed to prevent premature drying of the size.

2. The method of packaging a strand of filaments formed from heat-softened glass including coating the filaments with a size, winding the strand of coated filaments on a rotating collector, traversing the strand during winding to form a strand package, and projecting fluid toward the end regions of the package to maintain intimate contact of the fluid with the coated strand at the end regions.

3. The method of packaging a strand of filaments including winding the strand of filaments on a rotating collector, traversing the strand during winding to form a strand package, and projecting gas-entrained moisture toward the package being formed at velocities sufficient to effect penetration by the moisture of the boundary air layer at the ends of the package to establish and maintain intimate contact of the moisture with strand of the package.

4. The method of packaging a strand of filaments formed from heat-softened mineral material including coating the filaments with a size, winding the strand of coated filaments on a rotating collector, traversing the strand during winding to form a strand package having tapered end regions, projecting fluid containing moisture toward the tapered end regions of the package as they are being formed at velocities sufficient to effect penetration by the fluid of the boundary air layer at the package and establish and maintain intimate engagement of the fluid with the coated strand at the tapered ends, and confining the fluid at regions adjacent the package to promote a concentration of fluid adjacent the ends of the package.

5. The method of processing a strand of newly formed filaments of mineral material provided with a coating of liquid size including winding the strand on a rotating collector to form a package having tapered ends, and continuously projecting moisture directly onto the end regions of the package during its formation to retard flow of liquid size from other regions of the package toward the ends of the package.

6. Apparatus of the character disclosed, in combination with a feeder arranged to deliver a plurality of streams of heat-softened mineral material and a winding machine having a collet arranged to be rotated at comparatively high speed, said collet adapted to support a collector upon which is wound a strand of size coated filaments formed from the streams, said strand being collected in successive layers to form a strand package, and means disposed adjacent the end regions of the collector arranged to deliver fluid toward the end regions of the package at velocities sufficient to cause the fluid to penetrate the boundary air layer at the package to promote intimate engagement of the fluid with the strand at the end regions.

7. Apparatus of the character disclosed, in combination with a feeder arranged to deliver a plurality of streams of heat-softened mineral material and a winding machine having a collet arranged to be rotated at comparatively high speed, said collet adapted to support a collector upon which is wound a strand of size coated filaments formed from the streams, said strand being collected in successive layers on the collector wherein the layers are progressively shortened to form a strand package having tapered end regions, and means positioned adjacent the end regions of the collector arranged to project water and compressed air in directions generally radially of the package at velocities sufficient to cause the water to penetrate the boundary layer of air surrounding the package to impinge the water directly upon the strand at the tapered regions of the package.

8. Apparatus of the character disclosed, in combination with a feeder arranged to deliver a plurality of streams of heat-softened mineral material and a winding machine having a collet arranged to be rotated at comparatively high speed, said collet adapted to support a

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collector upon which is wound a strand of size coated filaments formed from the streams, said strand being collected in successive layers on the collector to form a strand package having tapered end regions, means disposed adjacent the end regions of the collector arranged to deliver water entrained by jets of compressed air toward the tapered end regions of the package at velocities sufficient to cause the water in atomized form to penetrate the boundary air layer at the package to promote intimate engagement of the water with the strand at the end regions, and baffle means arranged to confine the water adjacent the end regions of the package.

9. Apparatus of the character disclosed, in combination with a feeder arranged to deliver a plurality of streams of heat-softened mineral material and a winding machine having a collet arranged to be rotated at comparatively high speed, said collet adapted to support a collector upon which is wound a strand of size coated filaments formed from the streams, said strand being collected in successive layers on the collector to form a strand package having tapered end regions, and means disposed adjacent the end

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regions of the collector arranged to project jets of steam toward the tapered end regions of the package at velocities sufficient to cause the steam and moisture condensed therefrom to penetrate the boundary air layer at the package to promote intimate engagement of the steam and moisture with the strand at the end regions.

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