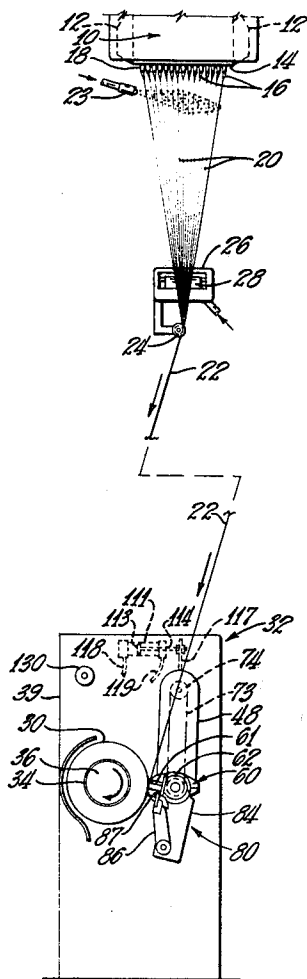


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[45] Patented Dec. 15, 1970
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[54] APPARATUS FOR WINDING TEXTILE MATERIAL
7 Claims, 12 Drawing Figs.
[52] U.S. Cl..... 242/18,
242/43
[51] Int. Cl..... B65h 54/08,
B65h 54/28
[50] Field of Search..... 242/18,
18B, 42, 43, 18G, 26

ABSTRACT: An apparatus for winding textile material into a cylindrical package on a rotating collector where a guide spaced from the package reciprocates the advancing material parallel to the axis of rotation of the collector and a member extending parallel to the axis of rotation of the collector presses against the surface of the package to lay the material on the package.



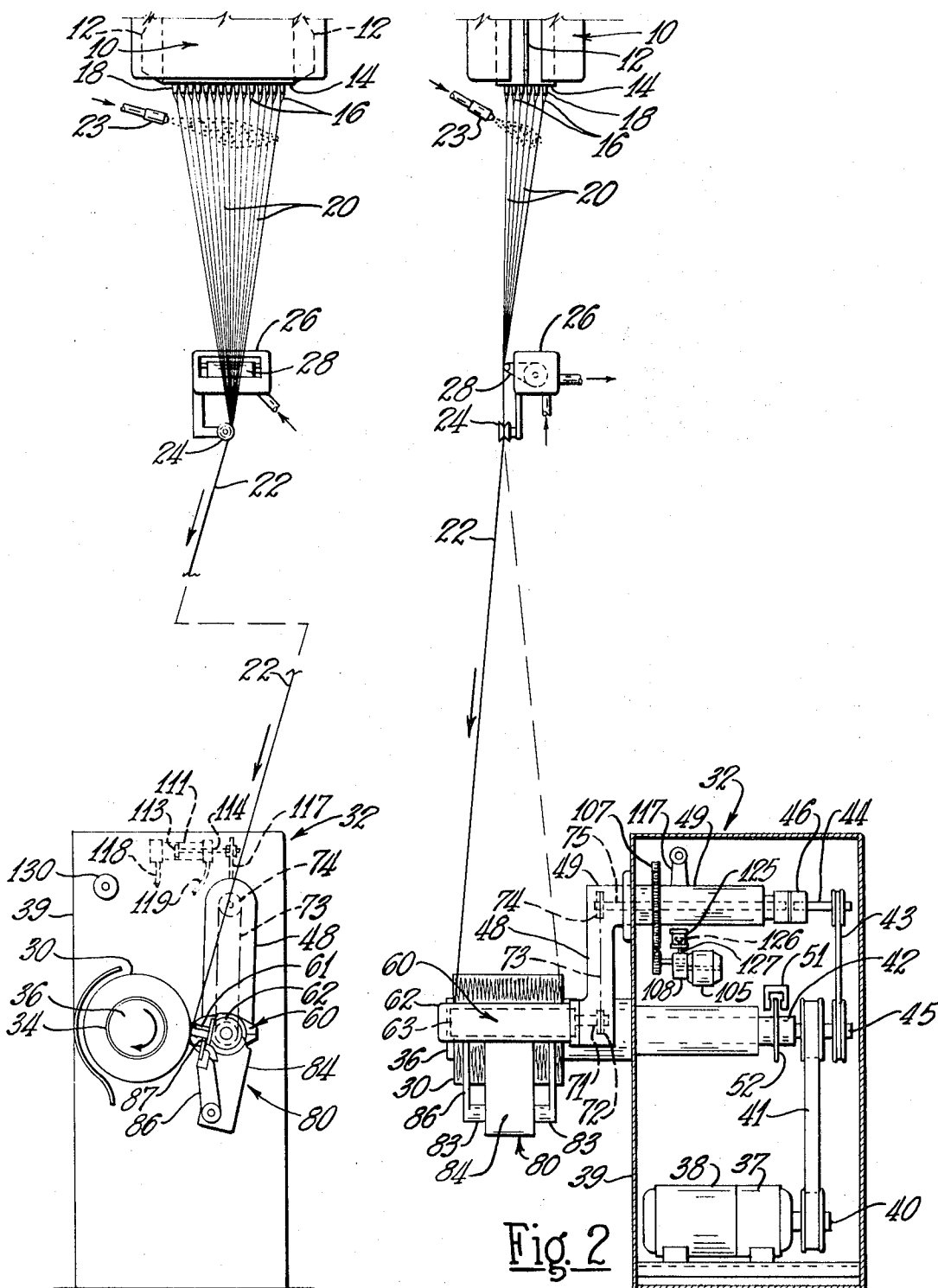
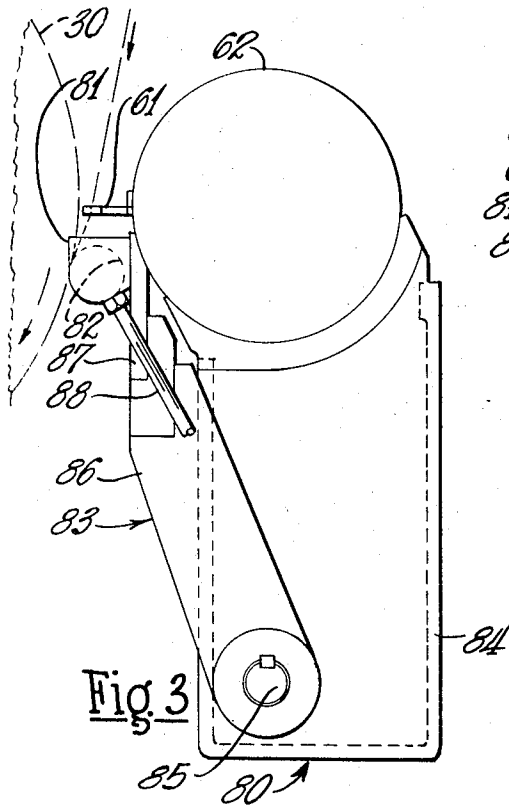
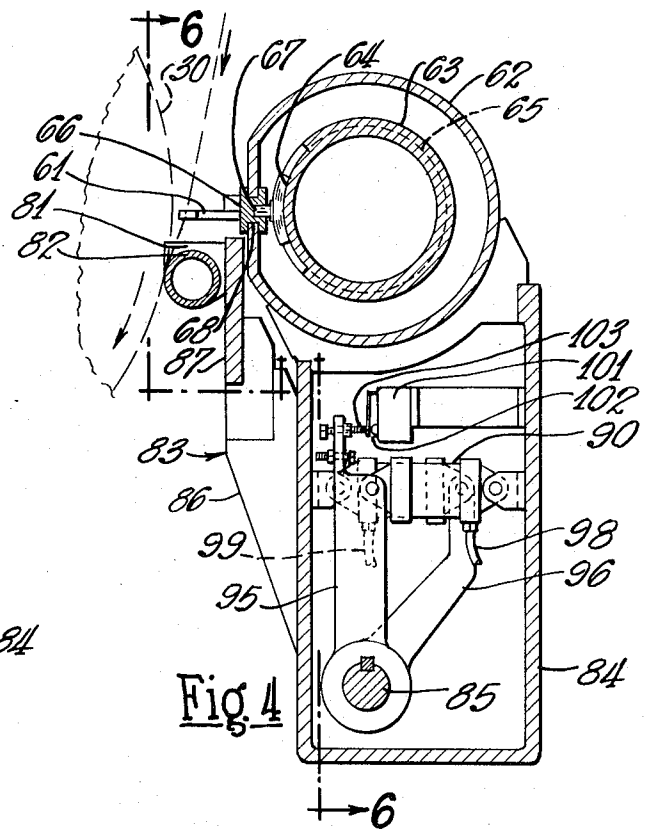
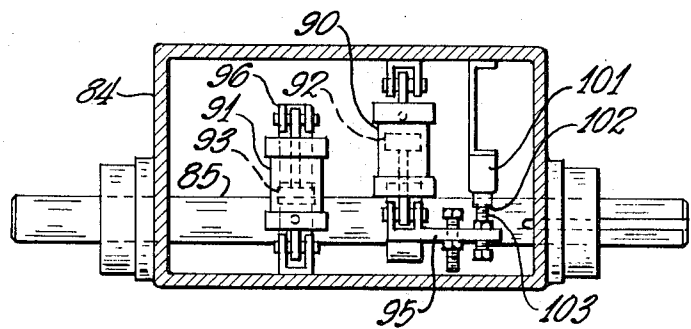


Fig. 1

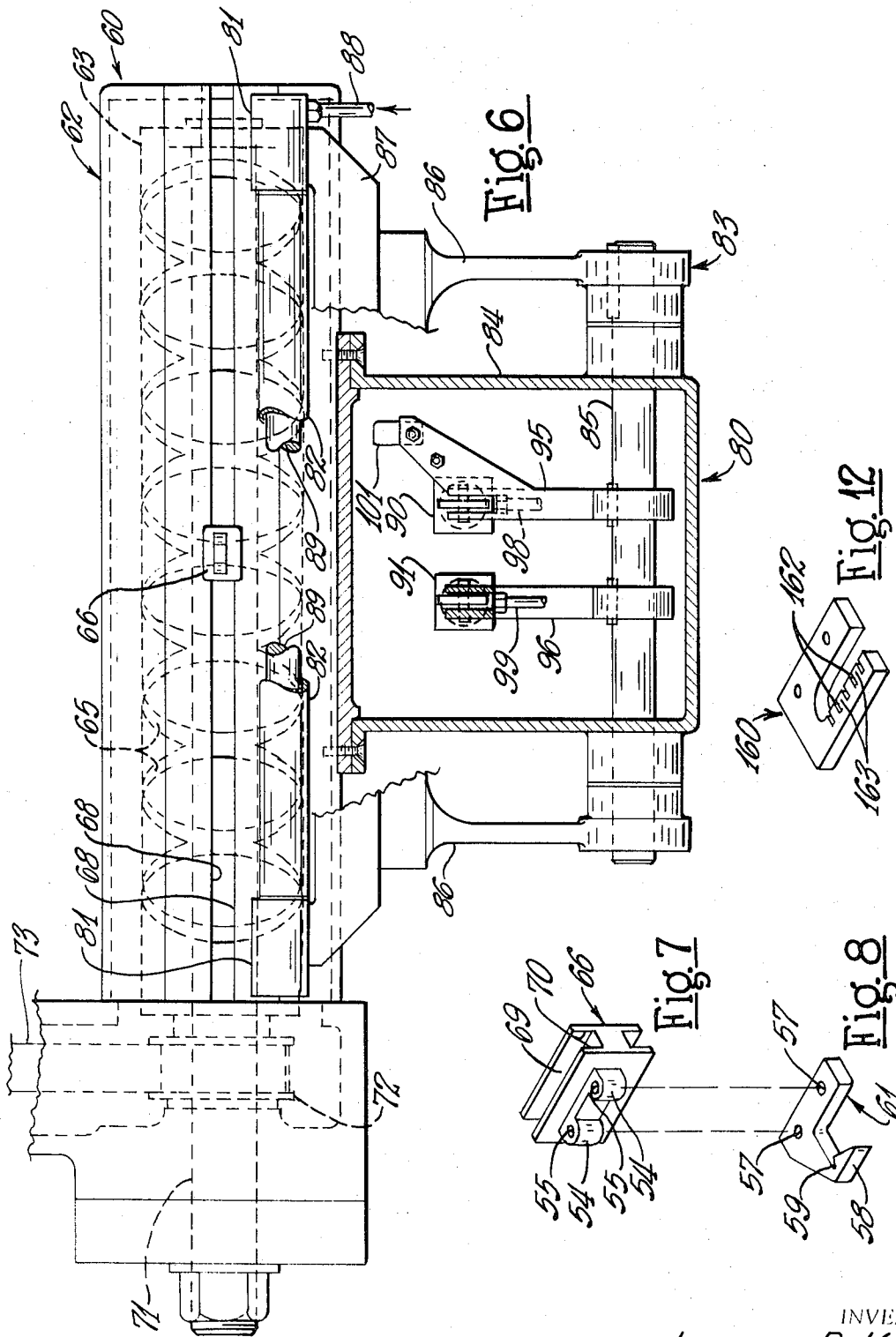
Fig. 2

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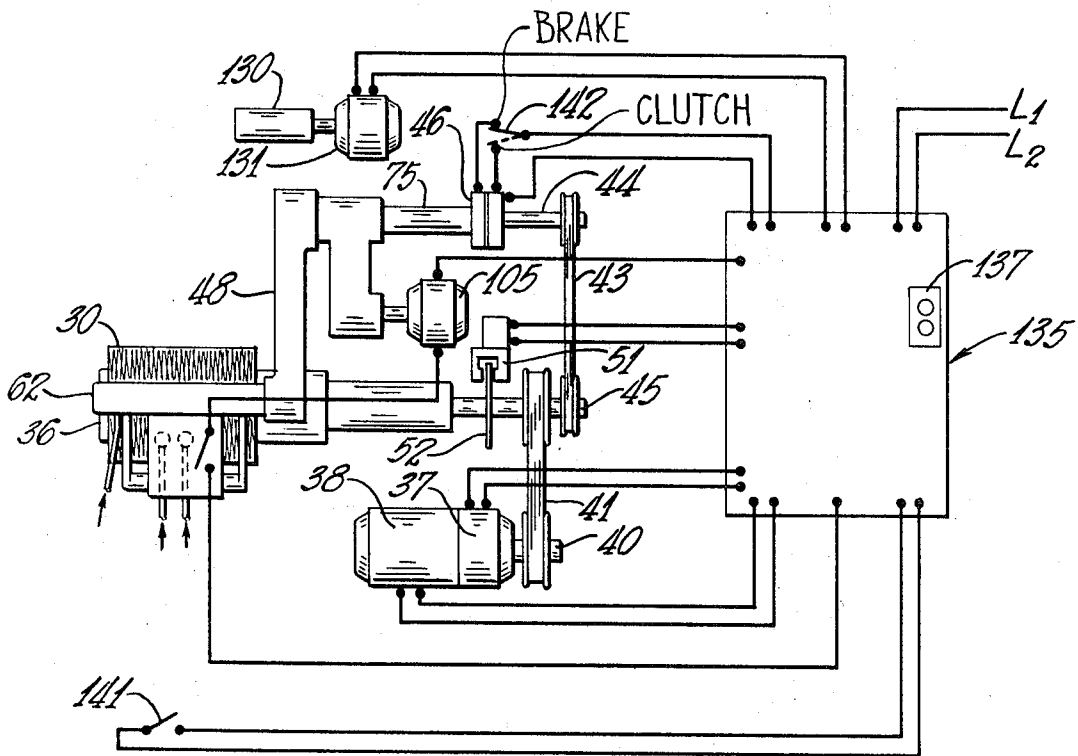


Fig. 9

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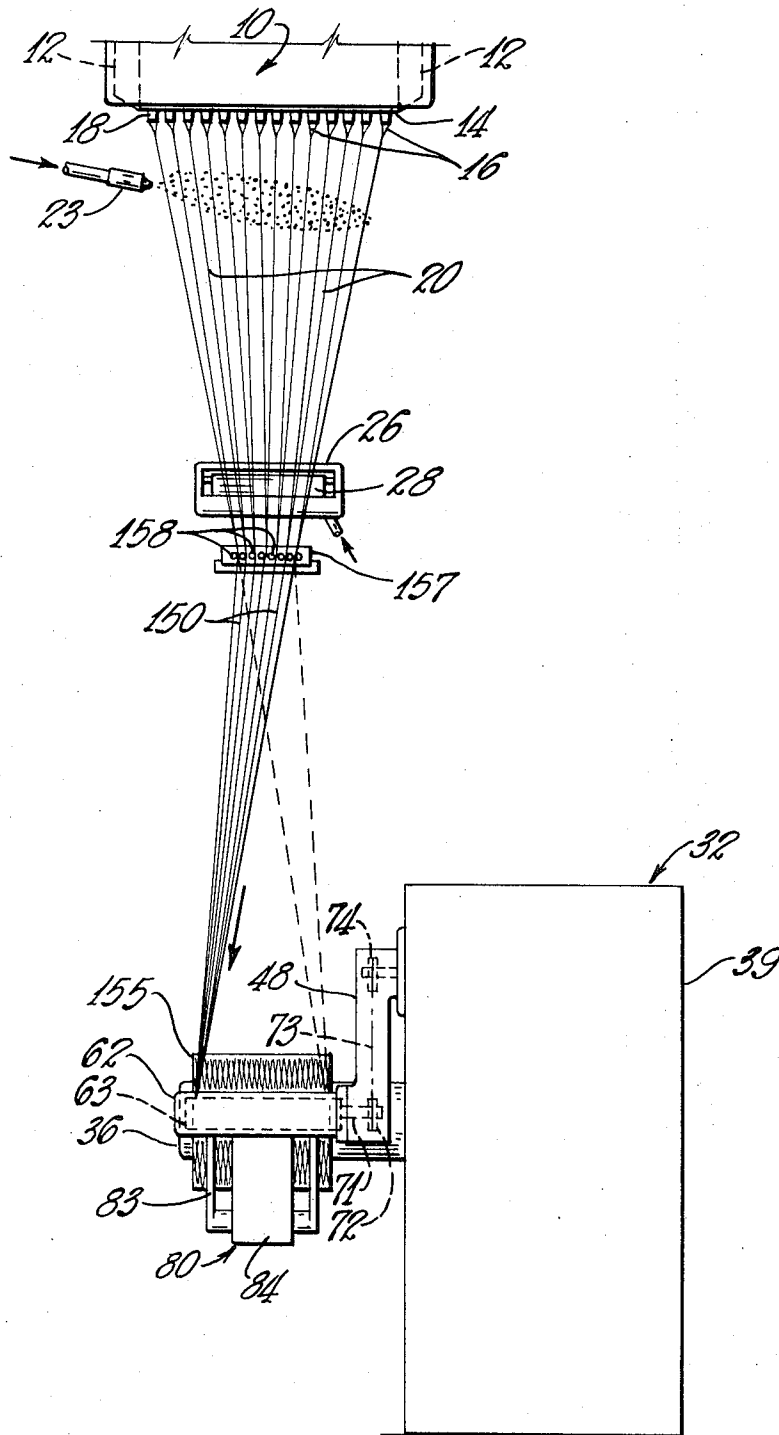
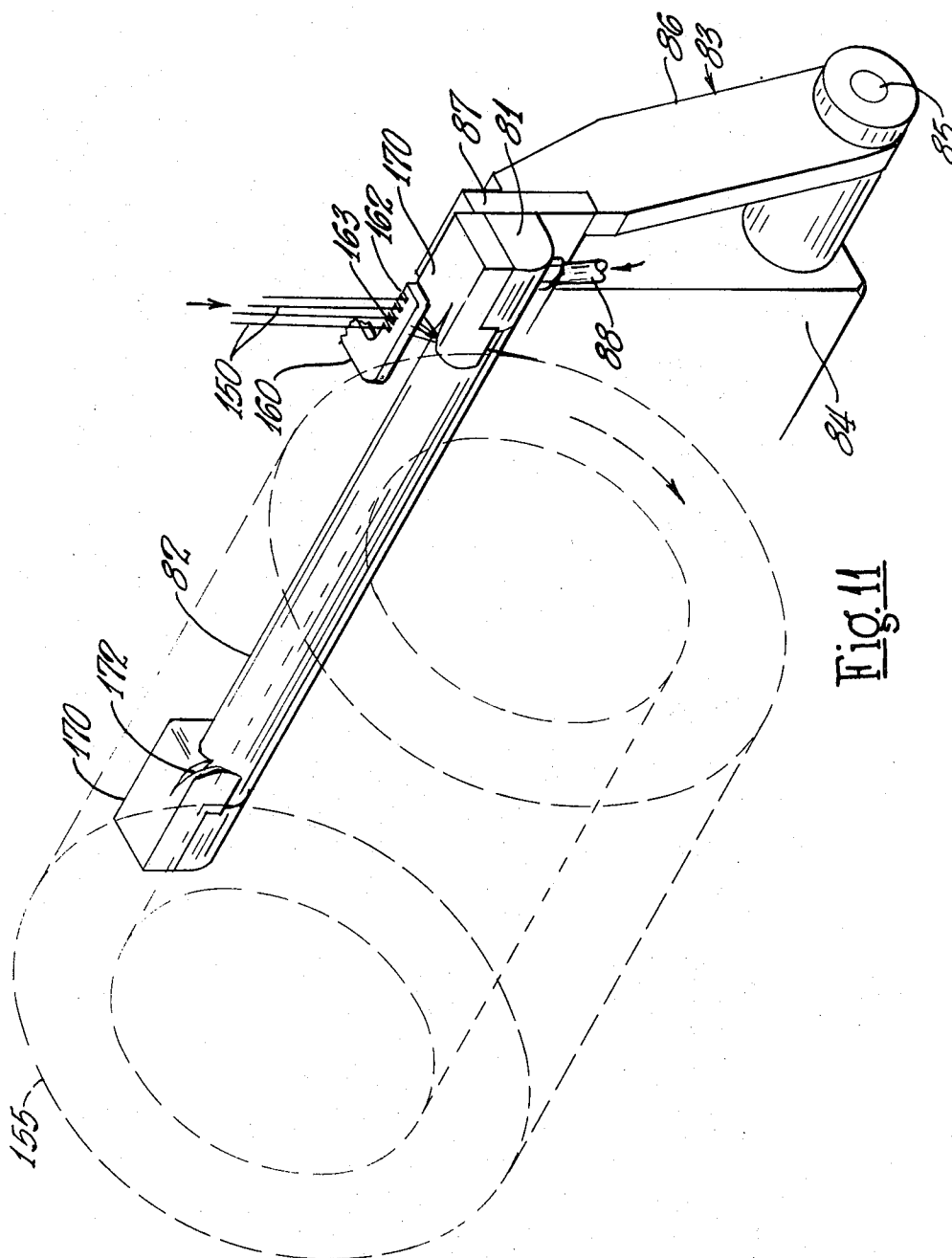


Fig. 10

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APPARATUS FOR WINDING TEXTILE MATERIAL

BACKGROUND OF THE INVENTION

It has been a goal to have the capability to increase the amount of textile material collected on a wound package. This goal has been especially prevalent in the glass fiber industry where wound packages are collected of the strand or roving made from glass filaments that are attenuated from glass streams. Unfortunately, numerous difficulties have thwarted the satisfactory achievement of the goal.

Until recently it has been the practice to wind packages of textile material, such as glass strands, by the use of winder apparatus that builds a package having tapered ends. While the tapered ends prevent sloughing of the strands, roving or other textile material, the amount of material that may be wound on this type of package is necessarily limited.

Winder apparatus has recently been developed that builds a wound package of textile material where the package is cylindrical in shape. This apparatus employs a reciprocating traverse guide designed for light contact with the lengthwise surface of the package as material is wound thereon. This apparatus does build larger wound packages of textile material; however, the winder is set upon with mechanical difficulties and collects a wound package that has limitations.

The winder builds a textile package that is not uniformly wrapped. Because the traversing device responds to the increase of the package diameter during collection of the material, the increase in diameter size brings about continual repositioning of the traversing guide radially of the package that gives rise to serious tension variations along the strand or textile material as it is wound onto the package. The result is a package wound with layers or convolutions that are loosely and more tightly wound throughout different portions of the package, i.e. the package has hard and soft radial layers. Such a wound package is not totally satisfactory for subsequent processing.

The variations or nonuniformities in the degree of tightness that the wound layers or convolutions of textile material conform in a cylindrical package effects the planar end surfaces of the package. A nonuniformly wound package produces end surfaces that have planar variations analogous in appearance to corrugations the variations are not desirable.

The winder apparatus has limited winding speed. The mass of the moving traverse guide and its associated items carried with it required by the design concept of the winder confines its use to lower speed textile winding operations or applications. Moreover, the winding speed is further limited by the unstable building action of the traversing device, i.e. excessive traverse resetting with ensuing strand tension variations, as the package diameter increases during collection of textile material onto the package.

Further, the winder cannot satisfactorily collect a wound package of textile material having a highly lubricious surface. Because the forming and processing of textile material such as glass strands and rovings employ sizing material or other protective coatings that may give a slippery or extremely smooth surface to the material for use in certain product applications, this prior art limitation is a definite restriction.

Additionally, the strand handling and traversing apparatus of the winder does not afford adequate control over textile material wound into a package from a plurality of side-by-side oriented material or strands. The operation of the winder does not provide control of the strands for grouping at the package ends, where the winder permits slack at the turn around zone of the side-by-side oriented strands. A tapered package is the result.

SUMMARY OF THE INVENTION

An object of the invention is an apparatus that collects textile material into a wound package having layers with substantially uniform tightness throughout all portions of the package.

Another object of the invention is an improved apparatus that collects textile material into a wound package of cylindrical shape.

Another object of the invention is an improved winder that can collect textile material into a wound package of cylindrical shape at high linear material speeds.

Yet another object is a winder that collects textile material into a wound package having substantially uniformly wound layers or convolutions using a component urged against the lengthwise surface of the package with substantially predetermined uniform force to lay the material on the package.

Still another object is an improved apparatus for collecting a plurality of side-by-side textile material into a wound package of cylindrical shape that provides selective grouping of the side-by-side of textile material at the ends of the package by locating a surface for contact with the material adjacent to the zone of lay of the textile material onto the ends of the package.

A further object is a winder that can effectively collect textile material having a highly lubricious surface into wound packages of cylindrical shape.

These and other objects are attained through use of a winder collecting textile material into a wound package of cylindrical shape on a rotating collector including a guide reciprocating parallel to the axis of rotation of the collector that engages the advancing material to move the material with it and an associated member parallel to the axis of rotation of the collector that presses against the surface of the package throughout its formation to lay the material on the package, and further having means for selectively gathering a plurality of side-by-side oriented material for distribution at the ends of the package.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat diagrammatic front elevation view of apparatus carrying out the method of forming and packaging textile material of continuous filaments of heat softenable material such as glass according to the principles of the invention;

FIG. 2 is a side elevation view partially in section of the apparatus illustrated in FIG. 1;

FIG. 3 is an enlarged front elevation view of the traversing apparatus, pressure member and control assemblage in package-forming position operating in accordance with the principles of the invention;

FIG. 4 is a side elevation view in section of the apparatus illustrated in FIG. 3;

FIG. 5 is a plan view in section of the apparatus illustrated in FIGS. 3 and 4;

FIG. 6 is a front elevation view partially in section of the apparatus illustrated in FIGS. 3-5;

FIG. 7 is an enlarged view of a traversing member used in accordance with the principles of the invention;

FIG. 8 is an enlarged view of a traverse guide for a single end of material, e.g. strand, used in accordance with the principles of the invention;

FIG. 9 is a schematic illustration of components of the apparatus of the invention for packaging textile material according to the principles of the invention;

FIG. 10 is a somewhat diagrammatic front elevation view of the apparatus shown in FIG. 1 modified to wind a plurality of side-by-side material such as strands of glass into a wound package;

FIG. 11 is a perspective view of the pressure member and a portion of the control device in package-forming position showing means for selectively grouping a plurality of side-by-side material for distribution onto the ends of the package; and

FIG. 12 is an enlarged view of a traversing guide employed with winding a plurality of side-by-side or oriented material such as strands according to the principles of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the method and apparatus of the invention are particularly valuable in a process for forming filaments of heat-softened mineral material such as glass where temperature

and speed effect glass fiber diameter and short term yardage variations and where the filaments are combined to form a roving(s) or strand(s) prior to collecting the material as a wound package, the method and apparatus may be used in a process to form and/or package textile material made from other fiber-forming materials. Thus, the use of glass to explain the operation of the invention is by example only, the invention having utility with other textile material.

Referring initially to FIGS. 1 and 2, a process for forming continuous filaments of heat-softened glass is shown where the glass filaments are combined into a roving or strand that is subsequently collected into a wound package. The figures show a container or feeder 10 that holds a supply of molten glass. The container 10 may be connected to a forehearth that carries molten glass from a furnace or connected to a means for supplying glass such as marbles that are reduced to a heat-softened condition by a melter or melting means associated with the container or feeder 10. The feeder 10 has terminals 12 at its ends that are adapted for connection with a source of electrical energy for supplying heat by conventional resistance heating to the glass held in the feeder 10 to maintain it at a proper fiber-forming temperature and viscosity. Moreover, the feeder 10 has a bottom or tip section 14 with a plurality of orifices or passageways for delivering streams 16 of the molten glass from the feeder 10. As illustrated in FIGS. 1 and 2, the openings in the bottom 14 comprise a plurality of depending orificed projections or tubular members 18.

The streams 16 are attenuated into individual continuous filaments 20 and combined into a bundle or strand 22 by a gathering shoe 24 located below the feeder 10.

While the filaments 20 may be protected only by application of water to them, it is desirable for certain end uses to apply to them a conventional size or other coating material. A nozzle or nozzles 23 may be located near the bottom 14 to spray the water onto the newly formed filaments 20, preferably prior to combining the filaments 20 into the strand 22. When the filaments have size applied to them, an applicator 28 supported within a housing 26 may be provided. The applicator 28 may be any suitable means known to the art such as an endless belt that moves to pass through a sizing or coating material held in the housing 26. As the filaments 20 pass across the surface of the applicator 28, some of the coating material transfers to them.

While it has been the practice to employ a container such as the feeder 10 with at least 1,000 openings in its bottom or tip section 14 and preferably containing 2,000 or more openings for simultaneously attenuating that number of filaments 20 from the streams 16, the apparatus of the invention may be used with equal success for bundles of strands having fewer filaments, e.g. 200—800 filaments.

The strand 22 collects as a package 30 on a winding machine 32. The strand 22 is reciprocated along the length of the package 30 and wound onto a collector such as a tube or sleeve 34 that has been telescoped over a spindle or collect 36, which is journaled for rotation on the winding machine 32.

A motor 38 mounted within the housing 39 of the winder 32 through an appropriate drive system moves the traversing apparatus and rotates the spindle 36. In the embodiment shown in FIGS. 1 and 2, the motor 38 is a constant-speed electrically energized motor that drives a rotor (not shown) of an associated eddy current clutch 37. The clutch 37 includes the drive rotor and an output shaft 40, the torque from the driven rotor being transferred to the output shaft 40 by magnetic flux. The horizontally extending shaft 42 with stepped-down end portion 45 is journaled for rotation and rotates the spindle or collect 36. The shaft 42 (and in turn collect 36) is rotated through a nonslipping belt 41, which connects shaft 42, i.e. stepped-down portion 45, with the output shaft 40. A nonslipping belt 43 connects shaft 42, i.e. stepped-down portion 45, with shaft 44 that is located above it. The shaft 44 is rotated by the movement of the shaft 42 through the belt 43. The traversing apparatus of the winder 32 is moved by the rotation of the shaft 44. As shown, a clutch/brake 46 connects

the shaft 44 with the traversing apparatus. Hence, when the brake portion of the unit 46 operates, the collet 36 may be rotated without moving the traversing apparatus.

In the winder illustrated, the rotation of the spindle 36 and speed of the traversing apparatus are moved together directly by the clutch 37 output, i.e. r.p.m. of shaft 40. The speed of the spindle 36 and traversing apparatus are mechanically locked together at a predetermined ratio.

A brake may be used to stop rotation of the spindle 36 and the movement of the traversing apparatus. FIGS. 2 and 9 show a disc brake acting on the shaft 42 including clamps 51 and a disc 52. The clamps may be moved into and out of engagement with the disc 52 by any suitable means such as a solenoid control means.

As is generally shown in FIGS. 1 and 2, the apparatus of the invention includes a strand-handling and traversing assemblage that is supported on the winder 32 by a pivotally mounted arm 48 having a horizontal portion 49 extending inwardly into the housing 39. The assemblage includes a traversing unit 60, a roller bail 82 and roller bail control unit 80.

When the strand-handling and traversing assemblage is in package-winding position, the location of the roller bail 82 is regulated to maintain it lightly pressed into contact against the lengthwise surface of the package 30. The apparatus regulating the location of the roller bail 82 responds to an increase in the diameter of the package 30 and pivots the arm 48 away from the enlarging package in repeated small increments until the package 30 is completed. The strand 22 reciprocates along the length of the package 30 and the roller bail 82 lays it onto the package, i.e. the strand 22 is introduced onto the package 30 between its lengthwise surface and the lengthwise surface of the roller bail 82.

Referring now to FIGS. 3 through 5, the traversing unit 60 is clearly shown and includes an strand traverse guide 61 that is mounted to reciprocate along the length of a tubular housing 62 extending horizontally and which is a part of the arm 48. Within the housing 62 is an actuating means 63 that through suitable connectors moves the traverse guide 61. As illustrated, the traverse activating means 63 is a cylindrically shaped barrel cam that is fashioned with grooves 65 for reciprocating the traverse guide 61 along the length of the package 30 as the cam rotates. In the embodiment illustrated, the axis of the actuating means 63 is parallel with the axis of the winding spindle or collet 36. The traverse guide 61 does not in any way contact the surface of the package 30.

The traverse guide 61 as illustrated is actually connected to a traversing member 66 that moves along the length of the tubular housing 62. The member 66 may be made of metal or rigid resinous material and, as shown in FIG. 7, is fashioned with grooves 69 along opposing edges, the grooves 69 leaving walls 70. The grooves 69 mate with the edges 68 of a lengthwise opening in the tubular housing 62. The opening, i.e. the edges 68, are parallel with the axes of rotation of the traversing means or cam 63 and the collet or spindle 36.

As shown in FIG. 4, a cam follower 67 connects the traversing member 66 with the cam actuating means 63. The follower 67 is secured at one end to the back of the traversing member 66. The other end of the follower includes an arcuate adapter portion 64 that fits into the grooves 65 of the cam actuating means 63. When the cam 63 rotates, the follower 67 moves back and forth along the length of the cam 63 (normally at high speed to reciprocate the traversing member 65, i.e. traverse guide 61, along the length of the package 30).

The traverse guide 61 engages the advancing strand 22 to reciprocate it. As shown in FIG. 8, the traverse guide 61 may include a hooklike portion 58 with a slot 59. The traverse guide 61 captures the strand 22 in the slot 59 of the hook-shaped portion 58.

As shown in FIGS. 7 and 8, the guide 61 is appropriately secured to the member 66. The traversing member 66 includes raised portions 54 having openings 55. The openings 54 in the rearward portion of the guide 61 are matched with

openings 55 of the member 66. A screw or bolt may be placed through the openings to fix the pieces together.

The cam actuating means 63, i.e. barrel cam, is positively rotated through a drive system. As illustrated in FIG. 6, the actuating means 63 has a shaft portion 71 extending from one end that is equipped with a sprocket 72. A nonslipping belt 73 operationally engages the sprocket 72 at the lower end internally of the arm 48. As is shown in FIG. 2, the nonslipping belt 73 engages within the arm 48 at its upper end a second sprocket 74 that mounts on a shaft 75. The shaft 75 extends into the winding machine 32 within member 49 and is rotated through movement of the shaft 44, when the clutch 46 is engaged, to move the drive system and positively rotate the barrel cam 63.

A roller bail control assembly 80 carried by the arm 48 on the tubular housing 62 operates to keep the roller bail 82 pressed against the lengthwise surface of the package 30 at the zone of lay or collection of the strand 22 on the package 30. The roller bail 82 maintains the strand's position as it is presented for incorporation into the package 30, i.e. lays the strand on the package. The control assembly keeps the roller bail 82 in light contact with the lengthwise surface of the package 30, normally in the range of from 1—5 pounds of force acting on the bail 82. It is preferable to keep the pressure of the bail 82 pressed against package 30 with a force of about 1—2 pounds. Because the strand 22 is still wet with size or coating material, the filaments 20 must be treated gently without any hard ironing, which gives rise to harmful interfila-ment abrasion.

The control assembly 80 includes means controlling the position of the arm 48, viz. incremental changes in position, to maintain, the tubular housing 62 located at a predetermined position in relation to the lengthwise surface of the package 30 as the diameter of the package increases with a corresponding change in the radial position of the lengthwise surface. Moreover, the control assembly 80 includes biasing means acting on the roller bail 82 with substantially uniform force throughout the formation of the package 30. The uniform biasing force acting on the roller bail 82 substantially precludes pressure changes of the bail 82 against the surface of the package 30 even as the arm 48 changes position.

In the embodiment as shown, the roller bail control assembly 80 includes an enclosure 84, which is secured to and depends from the bottom side of the tubular housing 62. Mounted for rotation at the lower end of the enclosure 84 is a horizontally extending pivot shaft 85 on the ends of which is keyed a roller bail mounting yoke 83 that is arranged with generally upwardly pointed arms 86 and a transverse member 87.

There are two air cylinders 90 and 91 with their associated pistons 92 and 93 respectively mounted within the enclosure 84. The pair of cylinders and pistons are arranged to oppose each other with a difference in force to bias the yoke 83. The cylinders 90 and 91 are suitably fixed to opposite interior surfaces of the walls of the enclosure 84 and the pistons 92 and 93 are connected to the pivot shaft 85 by suitable arms, piston 92 by a pressure arm 95 and piston 93 by a check arm 96. The arms 95 and 96 are suitably secured, as by keying, to the pivot shaft 85 and rotate it as the pistons 92 and 93 move linearly within the cylinders 90 and 91. When one of the pistons, e.g. piston 92 within the cylinder 90, moves in one direction, the second piston, e.g. 93, moves in the opposite direction within the second cylinder, e.g. 91. Air under pressure is supplied to the cylinders 90 and 91 through suitable means such as flexible tubings 98 and 99 from a conventional source (not shown).

As illustrated, the cylinders 90 and 91 and pistons 92 and 93 are the same size. Air at a higher pressure is introduced into the cylinder 90 than the air introduced into the cylinder 91. Because the force, i.e. air pressure, acting on the piston 92 is greater than the force acting on the piston 93, the pivot shaft 85 is urged to rotate towards the lengthwise surface of the package 30 (counterclockwise as shown in FIG. 3). The air

should be controlled to produce a light force of from 1 to 5 pounds against the lengthwise surface of the package 30.

Any suitable biasing means urging the yoke 83 to move as indicated above may be employed to keep the roller bail 82 in contact with the package 30. For example, the cylinders 90 and 91 and pistons 92 and 93 could be of different size with air at the same pressure introduced into the cylinders. Further, a spring arrangement may be employed.

Also mounted within the enclosure 84 is an electrical switch 101 that is in a circuit that controls the operation of a reset motor 105, which through suitable power transmission and speed-reducing mechanisms 107 and 108 (see FIG. 2) respectively move the arm 48 to pivot in small increments away from the lengthwise surface of the package 30. The switch 101 closes when the diameter of the package 30 grows to press its surface against the roller bail 82 to move the yoke 83 backwardly against the biasing force of the cylinder and piston arrangement. A pin 103 piercing the thickness of a laterally extending portion of the piston pressure arm 95 is in alignment with the switch 101 and is carried by movement of the arm 95. As the yoke 83 moves backwardly, the pivot shaft 85 moves the arm 95 (pin 103) to close the contacts 102.

The switch 101 may be a limit switch or the like. When the contacts 102 of switch 101 are closed, the motor 105 is energized to pivot the arm 48 slowly away from the package surface through suitable power transmission mechanism 107 and speed-reducing mechanism 108. As the pin 103 moves away from the switch 101, the switch remains closed until the contacts 102 break contact, whereupon the motor circuit is opened and the motor stopped. Any suitable switch may be used. Moreover, a timer, time delay relay or the like may be used with the switch 101 to control the operation of motor 105.

In practice, when the switch 101 closes the arm 48 pivots to move the roller bail 82 backwardly only a slight amount, in the range of less than one-fourth of an inch and usually not more than one-eighth of an inch. A reduction in roller bail pressure against the lengthwise surface of the package 30 caused by the slight movement of the arm 48 does not occur. The pressure against the lengthwise surface of package 30 is maintained substantially constant by the uniform forward force acting on the roller bail 82 by the yoke 83 through the operation of the cylinder (90, 91) and piston (92, 93) arrangement.

The motor 105 is preferably a synchronous type of comparatively slow speeds, e.g. 70 r.p.m. The power transmission mechanism and speed-reducing gearing may be of the planetary type, although any suitable mechanism may be used to effect a high ratio speed reduction between the motor 105 and the arm 48.

The roller bail 82 as illustrated is a tubular member mounted for rotation about its longitudinal axis on the transverse member 87 of the yoke 83. In practice the roller bail 82 is supported by a rod member 89 that extends through the bail 82 beyond its end. Platforms 81 secured to the transverse member 87 support the rod 89 at its ends. The rod member 89 is smaller than the inside diameter of the bail 82, thereby leaving an annular space between them internally of the bail 82. Water under pressure fills the annular space normally through the platform 81, i.e. at one end of the bail 82, from a source. As shown in FIG. 6 a flexible tube 88 carries the water from the source to one of the platforms 81. The water in the annular space provides the bearing surface supporting rotation of the roller bail 82 about its longitudinal axis.

The apparatus as disclosed herein builds a "way wound" package wherein the strand 22 winds in noncrossing relationship in each strand layer. When a package is wound from one strand the package tends to have an increased diameter at its end regions. Such increased diameter results from the slack given to the strand between the guide 61 and the package as the follower 67 reverses its direction at the ends (turn around regions) of the grooves 65 of the actuating means 63. The larger package diameter at the end regions of the package 30 increases the liability of strand 22 to slough off the package.

The continuous pressure of the roller bail 82 against the entire length of the package 30 throughout its build not only ensures uniformity between the strand layers but also precludes enlarged end regions on the package 30. The result is a cylindrically-shaped package with somewhat greater end region compaction.

The apparatus provides means for both initially moving the arm 48 to position the strand-handling and traversing assemblage carried thereon close to an empty collector, i.e. tube 34, telescoped on the collet 36 and subsequently moving the arm 48 to shift the assemblage away from the completed package 30, facilitating the removal of the completed package 30 from the collet 36. As illustrated in FIGS. 1 and 2, the arm 48 is pivoted by an air motor arrangement located within the housing 39 of the winder 32. The motor includes a mounted cylinder 111 having an associated piston 113 slidable therein with a piston rod 114 attached to it. The rod 114 is connected at its other end to a member 117 secured to and radially projecting from the horizontal extending portion 49 of the arm 48. Fluid such as compressed air is supplied into the cylinder 111 at either end through tubes 118 and 119 to move the piston 113 within the cylinder 111. Because the rod 114 is secured to the member 117 away from the surface of the portion 49, horizontal movement of the rod 114 moves the member 117 to rotate the portion 49, i.e. the arm 48. The arm 48 can be moved towards or away from the collet 36.

Means is also provided for releasing a planetary ring of the speed reduction mechanism 108 arranged between the motor 105 and the drive shaft 75 for driving the traverse cam 64. In the embodiment as illustrated in FIG. 2 a cylinder 125 has a piston 126 and piston rod 127 for actuating a clutch means (not shown) for engagement and disengagement with a planetary ring of the mechanism 108 to render ineffective the planetary speed-reducing mechanism between the motor 105 and the arm 48 to enable fluid under pressure such as compressed air introduced into the cylinder 111 to move the traverse arm 48 independently of the drive motor 105 and the speed-reducing mechanism 108.

A takeup or pull roll 130 is journaled in bearings (not shown) within the housing, the roll being driven by a motor 131 (shown in FIG. 7). The takeup roll 130 effects substantially continuous attenuation of the filaments 20 forming the strand 22 during periods that the collet 36 does not rotate, e.g. during the time the completed package is brought to rest, removed from the collet and an empty collector placed upon the collet preparatory to forming a new package. Through this arrangement, attenuation of the streams to filaments is maintained substantially continuous so that the thermal conditions in the feeder 10 are not appreciably impaired during transfer of the strand onto an empty collector.

As the package 30 builds, the rotational speed of the collet 36 reduces in a predetermined manner to maintain an essentially constant linear strand speed to keep the attenuated filaments 20 uniform in diameter. Of course, the speed of the reciprocating strand traverse guide 61 reduces in a proportional manner with the collet 36 to maintain a uniformly wound cylindrically shaped package.

As illustrated in FIGS. 2 and 9, the speeds of the collet 36 and traverse guide 61 are regulated together as the output shaft 40 rotates at various speeds. As the r.p.m. of the shaft 40 reduces, the speeds of the traverse guide 61 and collet 36 are reduced together in a fixed ratio. This ratio can be changed through astute variations in the size of sheaves and the like.

The rotational speed of the shaft 40 may be gradually reduced in a programmed manner various ways. One such way employs a suitable motor/clutch arrangement, as illustrated in FIGS. 2 and 9, where the circuits and program for controlling the several motors and the speed of the motor 105 are schematically illustrated. The speed of the motor 38 remains substantially constant throughout the buildup of the package 30 and the reducing speed of shaft 40 is effected through the eddy current clutch 37 by varying the electrical flux. The greater the flux density (magnetic force) the larger the per-

cent of the motor's output rotational speed (the input side of the clutch) is transferred to the output side of the clutch (shaft 40). As the package 30 builds, increases in diameter, the flux density in the clutch 37 is caused to collapse at a programmed rate through a control device or programmer of conventional design. The programmer (not shown) may be of a character disclosed and described in Smith U.S. Pat. No. 3,109,602.

Moreover, the speeds of the collet 36 and traverse guide 61 may be reduced at a rate that is either a straight line or curved line function as compared with time.

The sequence of operation of the apparatus of the invention can be followed with reference made to FIGS. 1, 2 and 9, where an operator begins by turning on the air and water supplies to the winder 32. A fresh tube, e.g. sleeve 34, is telescoped onto the collet 36.

Closing a switch 137 of the control box 135 provides electrical power to the winder 32 from a suitable source supplied to L₁ and L₂. When the switch 137 is closed, the motor 38 is energized; the roller bail control circuit is energized; the circuit for the clutch/brake 46 is energized; etc. Moreover, when the switch 142 is placed in the clutch position, the clutch of the clutch/brake 46 is energized to turn the shaft 75 with the shaft 44.

The arm 48 is caused by the air motor to move towards the collet 36 to position the roller bail 82 against the lengthwise surface of the tube 34. This is accomplished when the operator depresses the foot-operated switch 141, which energizes valve means (not shown) to admit air to the cylinder 111 through the tube 118. After the arm 48 is in position, valve means (not shown) provides air to the cylinder 125 to establish the drive connection between the motor 105 and the arm 48.

The collet 36 begins rotating when the operator releases the foot switch 141. The operator then breaks the advancing strand 22 from the rotating pull roll 130 and wraps the strand on the collet 36 outwardly of the sleeve 34. The advancing strand 22 is placed in the path of the traversing guide 61, which engages the strand, to begin construction of the package. As the strand package 30 builds, the collet r.p.m. and traversing guide speed are progressively reduced by the programmer through the determined collapse of the flux density in the clutch 37, the speed ratio between the collet 36 and guide 61 being maintained. Because of the gradual reduction in speed, a substantially constant linear strand speed is kept throughout the build of the package 20.

As the traveling strand 22 moves onto the sleeve 34, the traversing guide 61 reciprocates the strand 22 the full length of the sleeve 34 to build a "way wound" package wherein the strand winds in noncrossing relation in each strand layer in the package. Because the roller bail 82 presses against the lengthwise surface of the package 30 along the zone where the strand 22 is wound onto the package, it lays the strand 22 on the package 30 along the entire length of the package. As the diameter of the package 30 increases (the lengthwise surface moving outwardly of its axis of rotation), the roller bail 82 and the yoke 83 are moved backwardly against the biasing force of the piston/cylinder arrangement within the enclosure 84.

When the roller bail 82 moves backwardly only slightly, e.g. one-eighth of an inch, the pin 103 closes the contacts 102 of the limit switch 101 to complete the circuit that energizes the reset motor 105. The motor 105 in turn moves the arm 48 in a counterclockwise direction (as viewed in FIGS. 1 and 2) slowly until the contacts 102 are opened. The motor 105 is deenergized and the package winding continues with the arm 48 in the adjusted position until an increase in the diameter of the package 30 again moves the roller bail 82 backwardly to close the contacts 102 of the switch 101.

The arm 48 and its strand-handling and traversing apparatus repositions throughout the package build until the package 30 is completed. Although the arm 48 moves, the roller bail 82 maintains its contact with the lengthwise surface of the package and a substantially uniform force on the roller bail 82 persists by the biasing force of the cylinder/piston arrange-

ment in the enclosure 84 acting on the yoke 83. In a sense the roller bail 82 is floating between the pressure of the radially moving lengthwise surface of the package 30 and the biasing force acting on the roller bail 82.

The pneumatic arrangement of the cylinders (90 and 91) and pistons (92 and 93) functions to dampen unusual forces tending to move the position of the roller bail 82. For example, the pneumatic biasing force of the piston/cylinder arrangement will offer increased resistance for sudden variation in the package surface, however, such drastic variation should not occur.

When the package 30 is wound, electrical means (not shown) cause clamps 51 to engage a disc 52 to stop the rotation of the spindle 36, electrical power being concomitantly broken to the eddy current clutch 37. The air motor moves the arm 48 away from the completed package 30.

After the arm 48 moves away from the spindle 36, the operator removes the completed package 30 and places another forming sleeve on the spindle 36.

The invention may be employed to wind a plurality of separated textile material such as a number of glass strands into a cylindrical package. Referring to FIG. 10, a plurality of strands 150 are wound on the apparatus as a package 155. As in the case of the embodiment shown in FIGS. 1 and 2, individual continuous filaments are attenuated from streams of molten glass 16 which are provided through orifices such as orifices projections 18 from a container or feeder 10 holding molten glass. In the case of a plurality of strands, however, the individual filaments are not gathered into a single strand, e.g. the strand 22 illustrated in FIGS. 1 and 2; the filaments, as indicated in FIG. 10, are gathered into a plurality of strands 150, e.g. five strands, at a gathering shoe 157 above the winder 32. The shoe 157 has a plurality of strand separators such as rods 158.

The bundles 150 are wound onto the package 155 without losing their separate identity except for gathering that occurs at the ends of the package 155. As shown in FIG. 11, the strands 150 are pulled from the gathering shoe 157 onto the package 155 through a strand traverse guide 160, which reciprocates the strands 150 along the lengthwise surface of the package 155. The traverse guide 160 is secured to a carrier such as the traversing member 66 such as the strand traverse guide 61 is fixed to member 66. The guide 160 moves with the traversing member 66.

The strand traverse guide 160 accommodates a plurality of strands or filament bundles 150; in the FIG. 10 the number is five. As illustrated in FIGS. 11 and 12, the guide 160 includes a slot opening at one end and extending lengthwise. One edge of the slot, viz. the forward edge, contains a series of short narrow openings 162 forming a series of slots 162 and teeth 163 analogous to a comb. Each slot 162 accepts one strand 150. The teeth 163 maintain the spaced-apart relationship of the strands 150 immediately adjacent to the package 155.

The strands 150 are reciprocated along the length of the package 155 by the movement of the guide 160 and are wound onto the package 30 along the lengthwise zone where the roller bail 82 presses against its surface, the strands 150 laid on the package 30 between its lengthwise surface and the lengthwise surface of the roller bail 82.

A cylindrical package built from a plurality of side-by-side strands such as package 155 requires the strands 150 to be somewhat gathered as they are laid on package at its ends. If the strands are not gathered, the ends of the package are tapered, i.e. the diameter at the ends of the package is smaller than the remainder of the package. Practically speaking the strands must be grouped to average them at the ends of the package to build a square edge or cylindrical package. Hence, the strands are not gathered into one bundle; some of the strands remain separate and individual. While the strands actually forming the ends of the package are brought together into one bundle, the remaining strands maintain their separated relationship. The usual manner is to gather about 50 percent of the strands into a single bundle.

The strands are gathered, i.e. averaged or distributed, at the ends of the package 150 by contact with barriers or end stops 170 as shown in FIG. 11. The platforms 81 support the end stops 170 at the ends of the roller bail 82. The bottom of each stop 170 is arcuate to permit the end stop 170 to extend from its associated platform 81 inwardly over a portion of the roller bail 82. Moreover, as shown in FIG. 11 each end stop 170 has a narrow opening 172 located to be adjacent to the lengthwise surface of the package 155 when in operation position that the strands 150 enter for gathering or grouping prior to advancing onto the ends of the package 155.

The location of the end stops 170 with respect to the length of the reciprocating motion of the guide 160 determines the grouping of the strands. If the end stops 170 are moved outwardly too much, the strands 150 do not touch them. If the end stops 170 have a position too far inwardly, all the strands are brought together. The end stops must then be located to control the strands 150 and selectively group them, e.g. 50 percent of the strands gathered into one bundle and the others kept in individual separated relationship.

Other end stops may be employed. For example, an end stop may use an inclined plane surface as the strand contact surface, with or without a narrow opening or slot. Further, merely a slot in a horizontally extending sheet or member may be employed. The important aspect is the location of the end stops 170 close to the entry of the strand onto the package 155 for selective grouping of the strands 150.

The sequence of operation of the apparatus of the invention used to wind a package from a plurality of side-by-side strands or textile material, i.e. strands 150, is substantially the same as previously discussed with reference made to FIGS. 1, 2 and 8, where the operator begins by turning on the air and water supplies to the winder 32 and a fresh tube, e.g. sleeve 34, is telescoped onto the collet or spindle 36.

Electrical power is supplied to the winder 32 by pressing the switch 137 of the control box 135. When electrical power is supplied to the winder 32, the motor 38, the roller bail control circuit, the control circuit for the clutch/brake 46, etc. are energized. The arm 48 moves towards the collet 36 to position the roller bail 82 against the lengthwise surface of the sleeve 34 and the collet 36 begins rotating. The advancing strands 150 are broken from the pull roll 130 and wrapped on the collet 36 outwardly of the sleeve 34.

While the switch 142 is always in the clutch position for a single strand, it is initially in the brake position to facilitate locating the plurality of strands in the slots 162 of the guide 160. In the brake position the brake portion of the unit 46 is energized, precluding rotation of the shaft 75. Because the shaft 75 does not move, the traverse guide 160 remains stationary, the shaft 75 rotating only when the clutch portion of the clutch/brake 46 is energized through switch 142.

While the strand traverse guide 160 is stationary, the operator positions the individual advancing strands 150 within the narrow openings 162 of the strand traverse guide 160.

When the strands 150 are positioned in the narrow openings 162, the operator moves the switch 142 to the clutch position to reciprocate the guide 160 by establishing drive between the rotating shaft 44 and the shaft 75.

The "way wound" package 155 builds substantially as discussed in relation to the package 30 except for selective distribution of the strands 150 at the ends of the package 155. As the strand package 155 builds, the collet r.p.m. and traversing guide speed are progressively reduced together in fixed ratio as hereinbefore discussed through the predetermined collapse of the flux density in the clutch 37, which controls the speed of rotation of the shaft 40. Further, the roller bail 82 repositions by the movement of the arm 48 through the motor 105, the roller bail 82 maintaining contact with the lengthwise surface of the package 155 to lay the strands 150 on the package 155.

The strands 150 are selectively gathered or grouped just prior to entry onto the ends of the package 155 throughout the package build as the strands are carried by the movement of

the traverse guide 160 into the slots 172. Some of the advancing strands 150 are gathered together into a single bundle against the bottom of the slot 172, e.g. 50 percent of the strands. The other strands 150 remain separated. The strands 150 as grouped in the slots 172 immediately advance between the roller bail 82 and the lengthwise surface of the package 155.

Actually the strands 150 between the guide 160 and entry onto the package 155 follow the guide 160. The guide 160 arrives at the end of its reciprocating movement in one direction before the strands 155. To obtain the same "lead" over the strands 155 the guide 160 must travel a distance twice the "lead" distance before the traverse 160 regains control of the strands. During this period the strand distributes on the end of the package through the narrow opening 172 of the end stops 170.

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. Apparatus for packaging linear material comprising in combination:

a mounting;

a collector on the mounting rotatable about a fixed axis and onto which the linear material is wound as a package;

means for rotating the collector;

support means movable on the mounting;

a traverse guide for the material located proximate to the collector carried by the support means;

means for reciprocating the traverse guide to distribute the material on the collector;

a longitudinal member carried by the support means, the longitudinal member being movable relative to the support means, the longitudinal member being in contact with the peripheral surface of the package across the zone of lay of the material onto the package;

means responsive to the increase in diameter of the package moving the support means to maintain the traverse guide and longitudinal member at a predetermined position relative to the package through the formation of the package; and

biasing means urging the longitudinal member in opposing directions to dampen tendencies to movement from sudden forces applied to the longitudinal member and to urge the longitudinal member against the package with a substantially uniform pressure throughout the formation of the package.

2. Apparatus for packaging a linear bundle of fibers comprising in combination:

a mounting;

a longitudinal collector on the mounting rotatable about a fixed axis and onto which the linear bundle of fibers is wound as a cylindrical package;

means for rotating the collector;

support means movable on the mounting, the support means including a longitudinal housing extending lengthwise of the collector in a direction parallel to its axis of rotation;

a traverse guide for the linear bundle carried on the housing and spaced from the lengthwise surface of the package;

means within the housing for reciprocating the traverse guide parallel to the axis of rotation of the collector to distribute the material on the collector;

arm means including at least one arm pivotally mounted at one end and carried by the housing;

a cylindrical member mounted for rotation about its longitudinal axis on the other end of each of the arm means, the cylindrical member contacting the lengthwise surface of the cylindrical package at the zone of lay of the material onto the package;

control means responsive to the movement of the cylindrical member ensuing from change in the location of the

lengthwise surface of the enlarging package for repositioning the support means in small increments to maintain the cylindrical member and traverse guide each at a predetermined position relative to the lengthwise surface of the package throughout its formation; and

biasing means acting on the arm means in opposing directions to dampen tendencies to movement from sudden forces applied to the cylindrical member and to maintain the cylindrical member against the package with a substantially uniform pressure throughout the formation of the package.

3. The apparatus recited in claim 2 where the biasing means acting on the arms is fluid means.

4. Apparatus for packaging a linear bundle of fibers comprising in combination:

a mounting;

a longitudinal collector on the mounting rotatable about a fixed axis and onto which the linear bundle of fibers is wound as a cylindrical package;

means for rotating the collector;

support means movable on the mounting, the support means including a longitudinal housing extending lengthwise of the collector along its axis of rotation;

a traverse guide for the linear bundle carried on the housing and spaced from the lengthwise surface of the package;

means within the housing for reciprocating the traverse guide parallel to the axis of rotation of the collector to distribute the material on the collector;

an enclosure depending from the housing;

a pair of arms on the enclosure each pivotally mounted at one end;

a cylindrical member mounted for rotation about its longitudinal axis on the other end of each of the arms the cylindrical member contacting the lengthwise surface of the cylindrical package at the zone of collection of the material onto the package;

control means responsive to the movement of the cylindrical member ensuing from change in the location of the lengthwise surface of the enlarging package for repositioning the support means in small increments to maintain cylindrical member and traverse guide each at a predetermined position relative to the lengthwise surface of the package through its formation; and

biasing means within the enclosure acting on the arms in opposing directions to dampen tendencies to movement from sudden forces applied to the cylindrical member and to maintain the cylindrical member urged against the package with a uniform pressure throughout the formation of the package.

5. Apparatus for packaging a linear bundle of fibers comprising in combination:

a container holding heat-softened glass, the feeder having orifices for flowing a plurality of streams of the glass for attenuation into continuous fibers;

means for gathering the fibers into a linear bundle;

a mounting;

a collector rotatable about a fixed axis for attenuating the streams of glass into continuous fibers and onto which the linear bundle is wound as a cylindrical package;

means for rotating the collector;

support means movable on the mounting, the support means including a longitudinal housing extending lengthwise of the collector along its axis of rotation;

a traverse guide for the linear bundle carried on the housing and spaced from the lengthwise surface of the package;

means within the housing for reciprocating the traverse guide parallel to the axis of rotation of the collector to distribute the material on the collector;

an enclosure depending from the housing;

at least one arm on the enclosure each pivotally mounted at one end;

a cylindrical member mounted for rotation about its longitudinal axis on the other end of each of the arms, the

cylindrical member contacting the lengthwise surface of the cylindrical package at the zone of collection of the material onto the package;

control means responsive to the movement of the cylindrical member ensuing from change in the location of the lengthwise surface of the enlarging package for repositioning the support means in small increments to maintain the cylindrical member and traverse guide each at a predetermined position relative to the lengthwise surface of the package throughout its formation; and

pneumatic biasing means within the enclosure acting on the arms in opposing directions to dampen tendencies to movement from sudden forces applied to the cylindrical member and to maintain the cylindrical member urged against the package with a uniform pressure throughout the formation of the package.

6. Apparatus for packaging a group of side-by-side oriented linear bundles of fibers comprising in combination:

a container holding heat-softened glass, the feeder having orifices for flowing a plurality of streams of the glass for attenuation into continuous fibers;

means for gathering the fibers into a group of side-by-side oriented linear bundles;

a mounting;

a collector rotatable about a fixed axis for attenuating the streams of glass into continuous fibers and onto which the group of linear bundles of fibers are wound as a cylindrical package;

means for rotating the collector;

support means movable on the mounting, the support means including a longitudinal housing extending lengthwise of the collector along its axis of rotation;

a traverse guide for the group of linear bundles carried on the housing and spaced from the lengthwise surface of the package, the traverse guide including spaced-apart teeth between which a linear bundle is passed;

means within the housing for reciprocating the traverse guide parallel to the axis of rotation of the collector to distribute the material on the collector;

a enclosure depending from the housing;

a pair of arms on the enclosure each pivotally mounted at one end;

a cylindrical member mounted for rotation about its longitudinal axis on the other end of each of the arms, the cylindrical member contacting the lengthwise surface of the cylindrical package at the zone of collection of the material onto the package;

control means responsive to the movement of the cylindrical member ensuing from change in the location of the lengthwise surface of the enlarging package for repositioning the support means in small increments to maintain the cylindrical member and traverse guide each at a predetermined position relative to the lengthwise surface of the package throughout its formation;

pneumatic biasing means within the enclosure acting on the arms in opposing directions to dampen tendencies to movement from sudden forces applied to the cylindrical member and to maintain the cylindrical member urged against the package with a uniform pressure throughout the formation of the package; and

a stop at each end of the cylindrical member, the stop including a slot into which the group of bundles enters at the end of each reciprocation, the stop located to combine some of the bundles within the slot prior to their lay on the ends of the package.

7. Apparatus for packaging linear material comprising in combination:

a mounting;

a collector on the mounting rotatable on a fixed axis and onto which the linear material is wound as a package;

means for rotating the collector;

support means movably mounted on the mounting;

a traverse guide for the material located proximate to the collector carried by the support means;

means for reciprocating the traverse guide to distribute the material on the collector;

a longitudinal member carried by the support means, the longitudinal member further being mounted for movement relative to the support means, the longitudinal member being in contact with the peripheral surface of the package across the zone of lay of the material onto the package;

means responsive to the increase in diameter of the package moving the support means to maintain the traverse guide and longitudinal member at a predetermined position relative to the peripheral surface of the package throughout the formation of the package; and

biasing means providing forces acting in opposing directions to dampen tendencies to movement from sudden forces applied to the longitudinal member and to urge the longitudinal member against the package with a substantially uniform pressure throughout the formation of the package.