

July 10, 1956

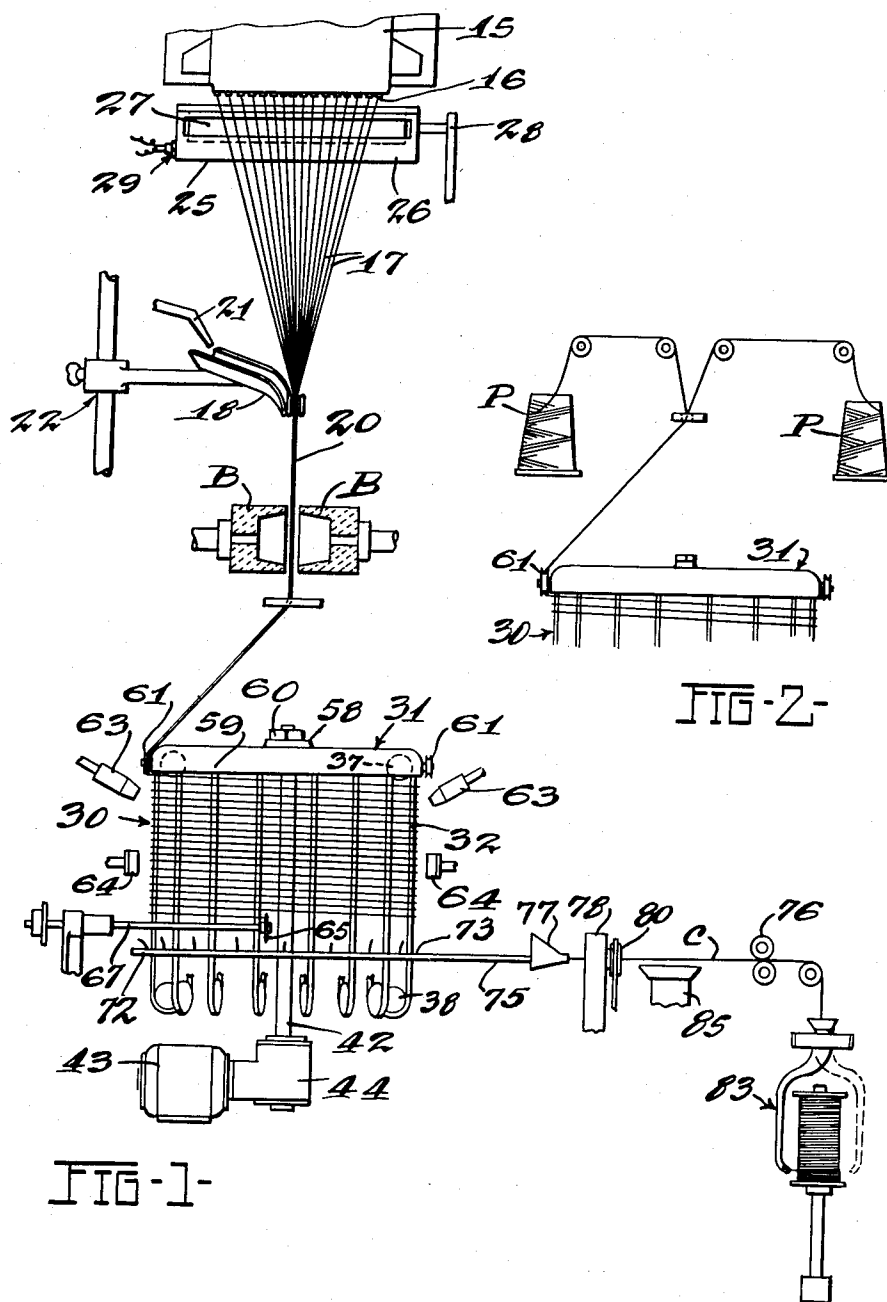
G. SLAYTER

2,753,677

METHOD AND APPARATUS FOR MAKING CORDAGE AND TWINE

Original Filed May 31, 1950

4 Sheets-Sheet 1



INVENTOR:
GAMES SLAYTER.

BY

Stachin & Querman
ATTYS.

July 10, 1956

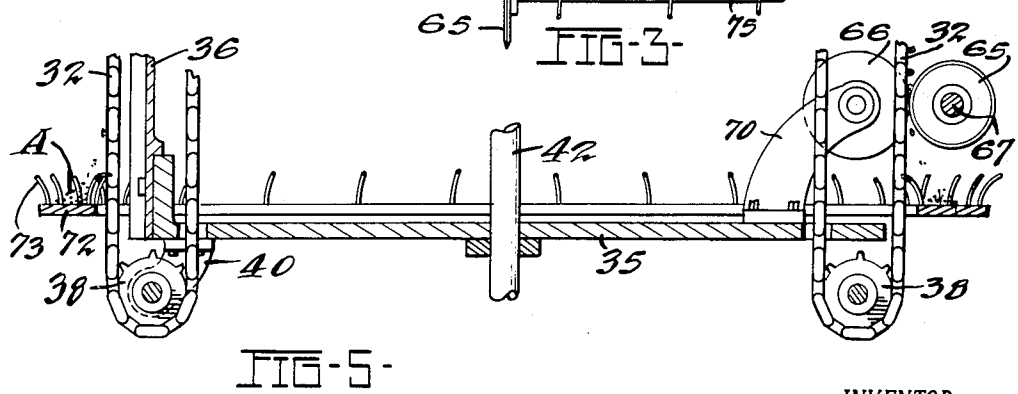
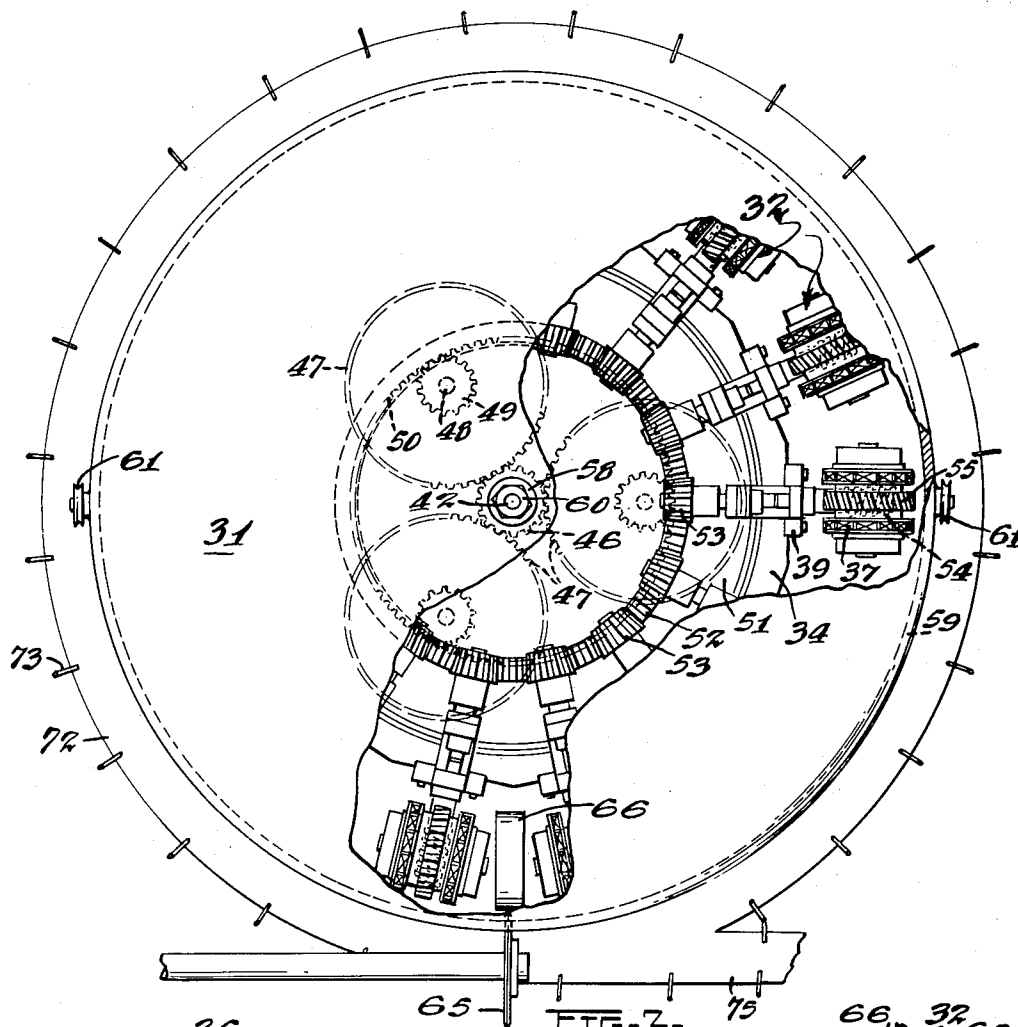
G. SLAYTER

2,753,677

METHOD AND APPARATUS FOR MAKING CORDAGE AND TWINE

Original Filed May 31, 1950

4 Sheets-Sheet 2



INVENTOR:
GAMES SLAYTER.
BY
Stallin & German
ATTYS.

July 10, 1956

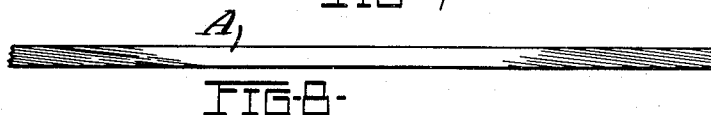
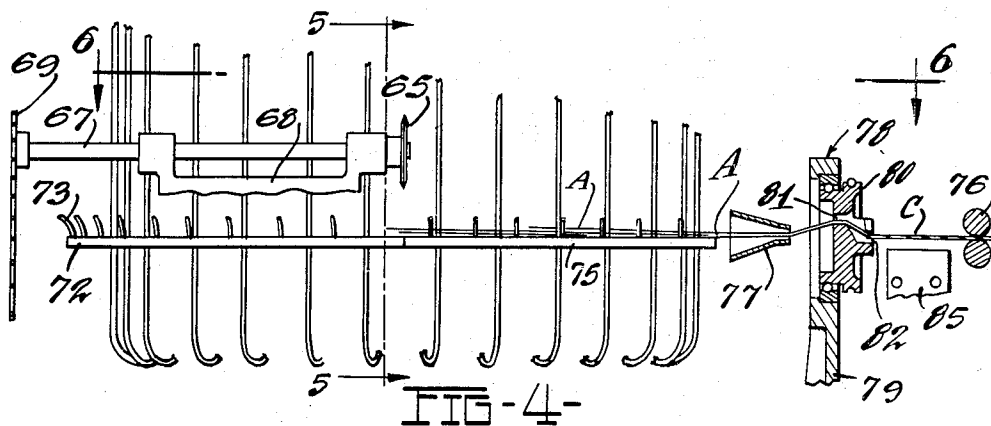
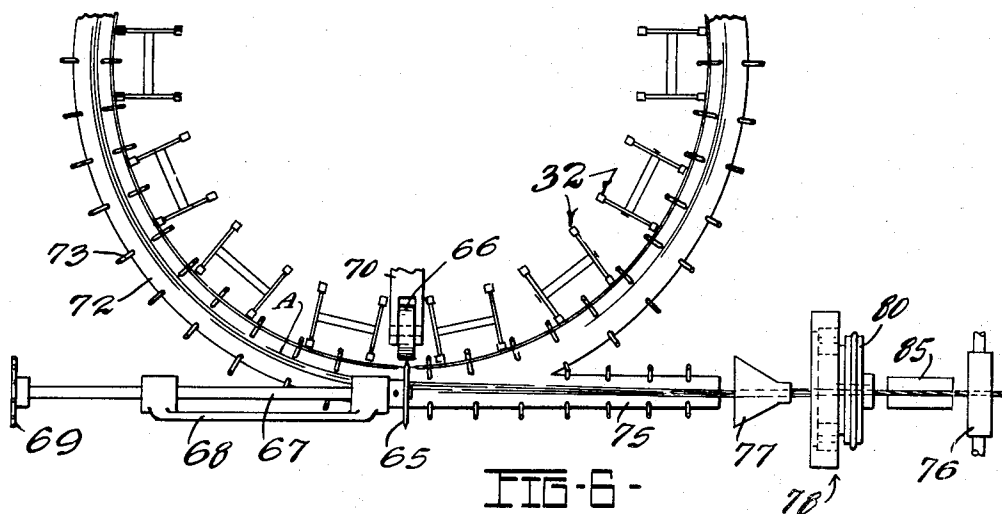
G. SLAYTER

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METHOD AND APPARATUS FOR MAKING CORDAGE AND TWINE

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4 Sheets-Sheet 3



INVENTOR:
GAMES SLAYTER.

BY
Stachin & German
ATTYS.

July 10, 1956

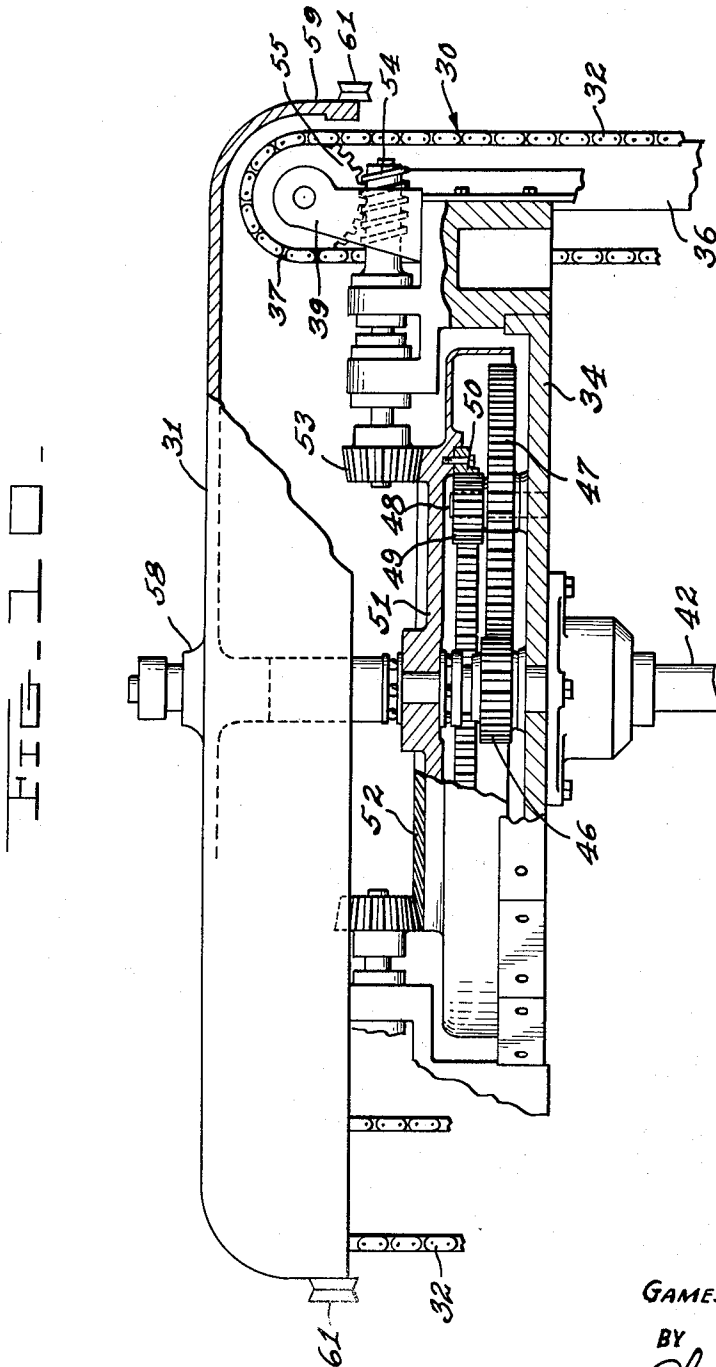
G. SLAYTER

2,753,677

METHOD AND APPARATUS FOR MAKING CORDAGE AND TWINE

Original Filed May 31, 1950

4 Sheets-Sheet 4



INVENTOR:
GAMES SLAYTER,

BY
Stallin & Gorman
ATTORNEYS.

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2,753,677

METHOD AND APPARATUS FOR MAKING CORDAGE AND TWINE

Games Slayter, Newark, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Original application May 31, 1950, Serial No. 165,129.
Divided and this application December 22, 1950, Serial
No. 202,248

8 Claims. (Cl. 57—2)

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The present invention relates to the production of textile strand material, especially cordage and twine, and more particularly to cordage made of glass fibers.

Cordage and especially twine are usually of a somewhat bulky nature and in most applications require considerable tensile strength in addition to quite high knot strength. Coupled with these requirements is the need to produce such a product at a relatively low cost since few applications of cord and twine will justify the more expensive textile products.

These requirements have previously been met by using a fibrous material of relatively coarse nature such, for instance, as sisal or hemp, and as a result a cord of considerable bulk could be built up in a relatively few twisting and plying operations.

In attempts to obtain in these products the advantages of inorganic materials and make cord and particularly twine from manufactured fibers such as glass fibers, where the fibers are relatively much finer than the conventionally used fibers, it has been impossible to achieve the necessary bulk and knot strength without going through many twisting and plying operations to combine a large number of strands into a single cord of the necessary large diameter. This represented a serious obstacle in the commercial adoption of cords made of glass and similar manufactured fibers.

It is an object of the present invention to overcome these difficulties and provide a method and apparatus for producing fully satisfactory cordage and twine of glass fibers.

It is another object of the invention to produce glass fiber cords and similar textile material having high tensile strength, good knot strength, and combining the bulk characteristics of staple type textile products with the high strength characteristics of continuous filament type products. The strand, twine or cord of the present invention combines the salutary features of both continuous filament and staple type fibers.

It is another object of the invention to provide a process and apparatus for making a cord having all the characteristics of a bulky cabled construction but capable of being produced without the many twisting and plying operations involved in building up conventional heavy cords. The invention produces a plied construction with a large number of strands twisted together but it does not require the series of consecutive twisting and plying operations that has previously been required to achieve such a construction.

It is another object of the invention to provide a complete and finished cord in a single operation by a closely connected series of steps.

It is still another object of the invention to convert a fiber forming material into fibers and immediately collect the fibers into an arrangement from which the fibers can be taken in the form of strands and simultaneously converted into a twisted and plied cord.

Other objects and advantages will be apparent from the following description and from the drawings, in which:

Figure 1 is a semi-diagrammatic elevational view of one form of apparatus that may be used in the practice of the invention;

Figure 2 is a semi-diagrammatic view of a modified form of the invention;

Figure 3 is a plan view with parts broken away of a group of elements forming a part of the strand collecting and conveying means;

Figure 4 is a fragmentary side elevational view of the apparatus;

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 4;

Figure 6 is a sectional plan view taken on the line 6—6 of Figure 4;

Figure 7 is a schematic view of a strand formed in accordance with the present invention;

Figure 8 is a view on a greatly enlarged scale of the strands of the preferred embodiment of the invention;

Figure 9 is a view on an enlarged scale of a strand formed on the apparatus disclosed in Figure 2, and

Figure 10 is an elevational view with certain parts shown in section of the upper end of the strand collecting and conveying means.

This application is a division of my copending application Serial No. 165,129, filed May 31, 1950.

The method and apparatus of the invention may be used to advantage in the production, collection and processing of fibers from various kinds of organic and inorganic fiber-forming materials, and is especially useful in the manufacture of fibers from glass or materials having similar characteristics. The invention provides cordage including baler and binder twine, ropes, cables, cable cores, yarns for rug and carpet base materials, core materials for braided ropes and the like, joint packing, pump packing, gasket material, friction elements, cordage for use where heat resistance is required, and sash cord, tire cord, tying cord and the like. The product of the invention may be made from yarns or strands of natural or synthetic organic or inorganic fibrous materials. Such fibrous materials may include glass, asbestos, mineral wool fibers, metallic fibers, rayon, nylon and the like, depending upon the particular end use desired of the product.

The invention will be described in connection with the manufacture of fibers from glass although most of the features of the invention are applicable to the production of fibers from other materials, such as synthetic resins, and certain features are also useful in the conversion of natural fibers into cords and twine.

Glass fibers of the continuous type are usually formed into strands each containing one hundred to two hundred filaments and having a filament diameter of from about .0001 to .0005 inch. Strands formed of these filaments are of relatively small diameter, ranging in size from about 7500 to 90,000 yards per pound, and it will be seen that a considerable number of such strands are required to provide a cord of substantial bulk. Previously, this could have been accomplished only by twisting and plying operations repeated a number of times, but such operations consume much time and labor and greatly increase the cost of the final material. The present invention reduces manufacturing of such cords or twine to a single operation at a substantial saving in labor and time with a corresponding reduction in cost.

In accordance with the invention, the fiber forming material, for instance, glass, is converted into fibers following conventional procedure and the fibers as they are formed are collected in strands and, if desired, secured together in the strands. The strands are then bundled together to build up a body of the required diameter and the body of bundled strands is then twisted to combine all the strands together into a cord having a high degree of mass integrity.

Preferably the arrangement of the strands into the bundle is achieved by cutting the strands into a multiplicity of short lengths and these short strands are then deposited one upon another to build up a body of the desired size. During the deposition of the cut strands there is relative movement between the body being built up and the strands being deposited so that each strand is displaced lengthwise with respect to the preceding strand and to the succeeding strand. As a result the body of deposited strands progressively lengthens as it builds up and takes the form of a continuous bundle of strands which, when it is twisted, results in a continuous cord.

During the making of the fibers and the collecting of the fibers in the strands, coating materials may be applied to the fibers in various ways and in several locations during the fabricating operations. It is preferred in the present invention to apply a coating of wax on the individual filaments which greatly reduces abrasion and at the same time forms a binder to hold the fibers together in the strand. The wax may be applied in a molten state by means of a roll applicator or at the gathering means that collect the fibers together into the strand. Of course, additional applications of wax or other materials may be applied during later operations if desired. It has been found desirable to apply the wax to the filaments in amounts ranging from 10% to 30% by weight of the glass, 15% to 20% being sufficient for most uses for which the twine and cordage are employed.

The preferred waxes may be plastic at normal room temperatures but not tacky since this would be undesirable in the finished product. Most suitable waxes become molten at 120° F. to 190° F. and cool at a fairly rapid rate. Waxes having a melting temperature of 150° F. to 170° F. have been found preferable. Suitable waxes include crese wax, Japan wax, mineral waxes, paraffin wax, microcrystalline waxes, vegetable waxes, carnauba wax, beeswax, and the like, and mixtures thereof.

Resinous binders and coatings may be combined with or may well replace waxes where the use of such materials is indicated. Resins may be applied to the strand as emulsions or dispersions in suitable solvents either by means of a roll applicator or at the gathering pad. The solution may also be applied by spraying it onto the strand at convenient points during the movement of the strand away from the point at which it is formed. Drying or curing of the resin when necessary may also take place along the path of the strand. Some resins found suitable for treating the strand include polyvinyl chloride, polyvinyl acetate and copolymers thereof, methyl methacrylate resins, phenol formaldehyde, urea formaldehyde, polyester resins, and other conventional thermosetting and thermoplastic synthetic resins. In addition, natural and synthetic rubber in the form of latex, and asphalt either molten or in solution may be applied to the fibers in the strand.

The apparatus illustrated in Figure 1 of the drawings is particularly suited to form fibers from glass or a similar material and to gather the fibers into a strand and then arrange the strand into a bulky cord of intertwisted strands. The strand of fibers is produced directly from a supply body of molten glass in a continuous attenuating operation. The apparatus illustrated may be utilized to form lengths of individual fibers or lengths of strands of fibers as desired, depending on the product to be subsequently fabricated from the fibrous material. With the apparatus shown in Figure 2 of the drawings, pre-formed strands of glass or other fibers or combinations thereof may be utilized as a supply from which the strands may be drawn for collection and further processing in the manner hereinafter described.

Referring now to the drawings and Figure 1 in particular, the numeral 15 designates a feeder or furnace adapted

to contain a supply body of molten glass or other fiber forming material and provided with a row of discharge orifices 16 from which the molten material flows in the form of streams 17. The feeder may be heated electrically by any suitable means (not shown) to maintain the material in a molten state. The streams of material are attenuated to fibers by gathering the streams into a bundle at a gathering roll or pad 18 to form a strand 20 and then applying tensile forces to the strand.

The gathering device 18 may be a graphite roll or a felt or fabric-covered pad any one of which may be adapted to apply a lubricant or a binder to the filaments as they are formed into a strand. The lubricating medium may be supplied to the device 18 from a suitable source thereof (not shown) through a tube 21 from which the fluid is discharged at a rate sufficient to thoroughly saturate the strand. While applying a lubricant or binder at the pad usually suffices to suitably impregnate the strand for some uses, however, it is desirable to coat the filaments individually when large amounts of coating materials, say 15% to 30% by weight of the fibers, is required on the strand. For this purpose a roll applicator is provided.

In association with the roll applicator, the device 18 is adjustably mounted on a support 22 to vertically position the pad with respect to the source of the streams. Also, the orifices 16 in the feeder are normally arranged in a row or several rows in parallel relation so that the streams flowing therefrom form a fan with the base of the fan at the gathering pad 18. Consequently moving the pad 18 on the support 22 varies the angularity of the filaments to each other and increases or decreases the length of the fan. The effectiveness of this adjustment is advantageous in coating the individual filaments by means of the roll applicator as will become apparent presently.

A roll applicator unit 25 is illustrated in Figure 1 of the drawings and is preferably adjustably mounted in any suitable manner for coating the fan of filaments between the feeder and the gathering pad 18. The unit comprises a casing 26 adapted to contain a supply body of the coating material. A roll 27 is journaled within the casing 26 in a manner to contact the filaments of the fan and transfer the coating material thereto. Driving means for the roll 27 may be provided through a sprocket 28 carried by the roll and connected with any suitable source of power. The applicator roll 27 is preferably greater in length than the width of the fan of filaments to assure contact with all of the fibers of the fan. Heating means such as a heating coil 29 may be provided in the casing 26 to maintain the coating material in a molten state when it is desired to coat the filaments with thermally sensitive material such as the waxes previously mentioned.

By adjusting the applicator unit toward the feeder, the molten coating may be applied to the filaments directly beneath the feeder while the filaments are still hot. Thus a protective coating can be applied to the filaments before they have had an opportunity to absorb atmospheric moisture or to be affected by dust in the air. When resinous materials are applied to the strand, the resin may be dried or cured by providing burners B or other heating means beneath the roll applicator and arranged to direct heat onto the coated strand.

The filaments in the fan are in tangential contact with the roll 27 and when the gathering pad 18 is in a lowered position, the filaments approach a right angle with respect to the axis of the roll. In this position a minimum amount of coating is applied to the strand. In order to increase the amount of coating on the filaments, the gathering pad 18 is raised on the support 22. This, of course, reduces the length of the fan and substantially decreases the angle of most of the filaments with respect to the axis of the roll. The fibers, particularly those at

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the edges of the fan, wipe across the surface of the roll more obliquely with the result that a greater amount of coating material is wiped from the roll by these filaments. While the material cools rapidly after application, the fibers are normally gathered into a strand before the coating material has had an opportunity to harden, so that as the fibers come together the coatings on the different fibers coalesce and all the filaments are bonded together in a strand. If this coalescence does not take place, further heat treatment during subsequent operations on the strand may serve to consolidate the coated filaments within the strand.

It is also within the scope of the invention to apply only a lubricant, such as water, light petroleum or vegetable oil, or the like, to the filaments at the gathering pad. The lubricant provides temporary integrity within the strand but permits the filaments to separate later if such is desired in subsequent fabricating operations.

The attenuation of the streams into filaments to form the strand 20 is accomplished by winding the strand about a substantially cylindrical collecting conveyor indicated generally by the numeral 30 by means of a cap flyer 31, a description of which follows. The strand conveyor 30 is preferably vertically disposed and spaced beneath the feeder 15 and comprises a plurality of flexible endless members 32 which form the supporting surface upon which the strand is collected.

The particular fiber forming and strand winding and collecting mechanism shown herein forms no part of the present invention, but is claimed in copending application Serial No. 135,558, filed December 29, 1949, for Method and Apparatus for Producing Fibers, now Patent No. 2,691,852. The mechanism is shown generally in Figures 3 to 6 of the accompanying drawings and includes the collecting conveyor 30 and winding cap 31 or flyer. The collecting conveyor 30, which includes the endless members 32 upon which the strand is supported, comprises substantially circular upper and lower plates 34 and 35 respectively connected at their peripheries by vertically extending channel members 36, thus forming a substantially cylindrical frame structure. The endless members 32 may be sprocket chains trained over pairs of sprockets 37 and 38 carried on brackets 39 and 40 suitably secured to the upper and lower plates 34 and 35. The chain members 32 are preferably arranged in pairs substantially equally spaced about the periphery of the plates.

The upper frame plate 34 forms a housing for the conveyor drive mechanism. This drive mechanism receives power from a vertical, axially disposed drive shaft 42 connected at its lower end to a drive motor 43 through a gear reduction unit 44 (Figure 1). The shaft 42 also provides rotary driving support for the cap flyer 31 which will be described in detail presently. A drive pinion 46 is keyed to the shaft 42 within the housing in the plate 34 and meshes with planetary gears 47 mounted on stub shafts 48 journaled within the housing. The gears 47 carry pinions 49 which mesh with a ring gear 50 carried by a cover plate 51 loosely journaled on the shaft 42 for rotation independently thereof. The cover plate 51 is provided on the upper surface with a beveled ring gear 52 having driving connection with beveled pinions 53, worms 54 and worm gears 55 for driving the conveyor chain sprockets 37. From the foregoing it is readily apparent that the linear movement of the chains 32 is controlled by the motor 43 through the medium of the gearing just described.

The cap flyer 31 or winder cap is preferably formed of a light weight material such as aluminum or reinforced plastic. As shown in Figures 1 and 3, the cap is formed with a central hub 58 and is provided at the periphery with a downwardly extending flange 59 substantially enclosing the upper end of the collecting conveyor unit 30. The cap is secured to the drive shaft 42 by clamping means 60 adjacent the hub 58. The cap

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31 is rotated directly by the drive shaft 42 and the speed of rotation may be varied over a wide range depending on the degree of attenuation desired in the strand. The cap is provided on the lower edge of the flange 59 with one or more rollers 61 or strand guides about which the strand is trained in winding the strand about the conveyor. It will be understood that although the cap rotates at a much faster rate than the sprockets 37, nevertheless the speed of rotation of the cap may be correlated with the linear speed of the conveyor chains 32 in order to provide a desired strand arrangement on the conveyor.

Rotation of the cap 31 attenuates the streams of glass and normally winds the strand formed therefrom around the conveyor in relatively closely spaced relation and substantially in the form of a sheet. With the strands thus arranged they may be further treated or coated if desired by spraying or wiping on a coating material. Spray guns 63 and drying burners 64 are shown in Figure 1 for accomplishing such treatment.

As the sheet of parallelly arranged strands approaches the lower portion of the conveyor, the strands are successively severed into uniform lengths A by means including a cutting roll 65 and a backing roll 66 (Figures 5 and 6). The cutting roll 65 may be mounted for rotation on a shaft 67 supported in a bracket 68 and driven by means of a sprocket 69 adapted to be connected with a suitable source of power not shown herein. The backing roll 66 is preferably mounted within the conveyor frame in a bracket 70 secured to the plate 35, the roll assuring a complete severance of the strands. Additional cutting rolls may be provided around the conveyor if it is desired to produce strands of shorter length. However, in the present form of the invention, it is preferred to have the strands of a length corresponding to the full circumference of the collecting conveyor. This may be in the order of two to six feet or more.

As the strands are severed they are released from contact with the surface of the conveyor and drop by gravity into a collecting trough 72 which is circular in form and is disposed in closely spaced relation to the surface of the conveyor. The sides of the trough 72 may be formed of a plurality of upwardly and outwardly extending pins 73. The pins on the inner side of the trough are arranged to project between the chains 32 and thus assure a positive disengagement of the severed strands from the chains. The trough is provided on the side adjacent the cutting roll with a tangential extension 75 which projects outwardly in a direction parallel with the axis of the cutting roll 65.

As the strands A fall into the trough 72 they are drawn along the extension 75 and form at this stage of the operation a roving or sliver in which the ends of the successively cut strands are spaced apart a distance regulated by the rate of withdrawal of the roving or bundle of strands. The strand or roving is drawn from the trough 75 by pulling rolls 76 located in alignment with and a slight distance from the end of the trough. The roving may be fed into a gathering funnel 77 or guide to condense the roving and thence through a twister mechanism 78 to form a cord. The twister 78 may be of any conventional construction, one suitable twister being described in detail in Patent No. 2,363,470 to Lannan and Vanucci. Such a device includes a stationary supporting frame 79 and a rotor 80 rotatably mounted therein. The rotor 80 which may be revolved by any suitable means, such as an electric motor, is provided with an eccentrically disposed opening 81 in one face communicating with an axial opening 82 in the opposite face.

As the rotor 80 turns it revolves the strand about its longitudinal axis and this rotation of the strand extends to the pulling rolls 76 on one side and into or along the circular portion of the trough on the opposite side of the twister. This twisting of the strand and of the compara-

tively loose roving in the trough tends to progressively twist or fold in the newly deposited strands in the trough and combines them into an integral body. The twisted cord is moved forwardly by the pulling rolls 76 and the twisted cord is then wound into a package by conventional winding machinery indicated at 83 where additional twist may be imparted to the strand if desired.

A heating device 85 (Figures 1, 4 and 6) may be disposed between the pulling rolls 76 and twister 78 to heat and soften the strand coating, when desired, to cause a greater degree of coalescence of the coatings on the different fibers. This heating and softening may also permit the individual filaments and strands to rearrange themselves within the body of the cord and substantially equalize the tension on the strands. Heating the coated strands at this point may also be utilized to complete the cure of resinous coating or to dry or otherwise affect other coatings on the strands.

Figure 2 of the drawings illustrates a modification of the invention in which preformed packages P of strand material in the form of twisted yarns are employed to form the basic fibrous material wound on the conveyor. These may be of glass or other material such as cotton, wool, rayon, or other fibers. Yarns from the packages are drawn from the packages and wound by the cap 31 onto the conveyor 30. The fibrous material on the conveyor is then severed at the bottom of the conveyor in the same way as described in connection with the form of the invention shown in Figure 1. Now, however, the finished strand is made up of a series of intertwisted lengths of yarns of intertwisted fibers as illustrated in Figure 9.

Figures 7, 8 and 9 illustrate the strand material of the present invention. Figure 7 depicts in extended form the relative relation of the strand material A cut successively from the conveyor. It will be understood that due to the drawing action of the pulling rolls 76 on the body of assembled strands, the successive strands are spaced in endwise relation throughout the length of the cord C. Thus a cord having some of the characteristics of a staple-type product is produced from continuous type glass filaments. The strand S shown in Figure 9 and formed in accordance with the apparatus of Figure 2 may be composed of any desired combination of either organic or inorganic fibrous materials from which it is desired to form a cord. Thus the composition of the cord may vary over a wide range in both size and type of material.

The twine, cord, rope or yarn of the present invention is made up of a multiplicity of discontinuous fibers and in this respect partakes to certain extent of the nature of staple fiber textile products. At the same time the discontinuous fibers are of such great length that the resulting product has much of the tensile strength found in continuous filament textiles. With the fibers in the individual strands all bonded together in the strand with the wax or other binding material, all the fibers of each strand act in concert to resist stresses and thus add greatly to the strength of the product. The finished cord or twine contains in cross-section sufficient fibers to have the required bulk but this is accomplished without the multiple plying and twisting operations heretofore found necessary. Each strand of interbonded fibers making up the cord is displaced lengthwise of the cord with respect to its immediate neighbors so that the cord is uniform in diameter and has high strength.

While the above description has emphasized the invention in the making of cords of intertwisted strands, it is also useful in producing rovings of individual separate fibers. For this object, it is only necessary to omit the binding material and either apply nothing to the strand or only a lubricant, such as water or light vegetable oil. (If water is employed, it is preferable to disperse in the water a small amount of a surface protective agent, such as octadecyl amine acetate.) In other respects, the

process is carried on in the same manner, and when the fibrous material on the conveyor 30 is cut and deposited in the trough 72, the fibers separate and fluff up so that there are now no strands in the finished cord but instead a multiplicity of long lengths of individual fibers.

Also, the cord or twine of the invention may be further processed as by being plied with like cords or with other cords of the same or different fibrous materials. If desired, it may be coated with rubber or other coating materials to be encased in a film of such materials, and it may be covered with strips of paper or other sheet material spirally about the cord or twine.

The present invention is also capable of many other modifications and such changes may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for making textile products comprising means for drawing a strand of fibers from a source thereof including a tubular conveyor and a rotatable cap flyer traveling around the circumference of the conveyor, a guide on said cap flyer for said strand arranged whereby the cap flyer carries the strand circumferentially around the conveyor and deposits it thereon, means for moving the conveyor transversely of the direction of rotation of the cap flyer to cause the strand to be deposited on the conveyor in a helical arrangement, a cutter in the path of the body of strands deposited on the conveyor to sever the strands transversely as they travel on the conveyor, means for catching the strands as they are cut and as they leave the conveyor, feeding means for moving the cut strands from the catching means in the direction of their length, and means for turning the body of cut strands about its longitudinal axis to thereby gather in newly cut strands as they are deposited in the catching means, whereby a twisted body of cut strands is continuously formed from the strands on the conveyor.

2. Apparatus for making textile products comprising means for drawing a strand of fibers from a source thereof including a tubular conveyor and a rotatable cap flyer traveling around the circumference of the conveyor, means for applying a coating material to the strand as it is drawn from its source, a guide on said cap flyer for said strand arranged whereby the cap flyer carries the strand circumferentially around the conveyor and deposits it thereon, means for moving the conveyor transversely of the direction of rotation of the cap flyer to cause the strand to be deposited on the conveyor in a helical arrangement, a cutter in the path of the body of strands deposited on the conveyor to sever the strands transversely as they travel on the conveyor, means for catching the strands as they are cut and as they leave the conveyor, feeding means for moving the cut strands from the catching means in the direction of their length, and means for turning the body of cut strands about its longitudinal axis to thereby gather in newly cut strands as they are deposited in the catching means, whereby a twisted body of cut strands is continuously formed from the strands on the conveyor.

3. The method of forming a cord of glass fibers including the steps of winding a strand of fibers about a cylindrical support in helical formation, advancing the strand axially of the support to a strand-severing zone, successively severing the convolutions of strand into predetermined lengths at the severing zone, collecting the severed strands, advancing the collected strands in the direction of their length to establish an end-to-end overlapping relation of successive strands, and continuously twisting the overlapping severed strands to form a twisted body.

4. The method of forming a cord of glass fibers including the steps of continuously winding a strand of glass fibers around a cylindrical support in successive convolutions, advancing the convolutions of strand lengthwise along the support, successively severing the convolutions of strand into predetermined lengths, collecting the severed lengths, continuously withdrawing the collected strand

lengths away from the convolutions of strand to establish an overlapping relation of successive strand lengths, and continuously twisting the overlapping strand lengths to form a cord.

5. The method of forming a cord of glass fibers in which the glass fibers are present in the form of a strand of individually coated filaments which includes winding the strand into a cylindrically shaped body of strand convolutions arranged in spaced relation, advancing the strand body in a direction axially thereof toward a severing zone, successively severing the strands of the strand body at the severing zone, continuously withdrawing the severed strands from said body in end-to-end overlapping relationship, and twisting the withdrawn strands together to form a continuous length cord.

6. Apparatus for making textile products including a tubular conveyor, means for winding a strand of fibers on the conveyor, said means including a rotatable cap flyer traveling around the circumference of the conveyor and carrying the strand therewith and continuously depositing the strand on the conveyor in a plurality of convolutions, means for moving the conveyor relative to the cap flyer in a direction normal to the plane of rotation of the cap flyer, a cutter disposed in the path of the strand convolutions and arranged to progressively sever the strand convolutions as they move into engagement with the cutter, means for catching the severed strands as they are cut, means for continuously withdrawing the severed strands in a direction tangentially of the tubular conveyor, and means for twisting the withdrawn strands to form a continuous cord.

7. Apparatus for making textile products including a cylindrically shaped conveyor, means for winding a strand of fibers on the conveyor in successive convolutions, means for moving the conveyor to advance the convolutions axially of the conveyor, a severing means disposed in the path of the convolutions arranged to successively sever the convolutions into predetermined lengths, means for collecting the strand lengths as they are cut, means for withdrawing the strand lengths from the collecting means in the direction of their length in end-to-end overlapping relationship, means for continuously turning the body of cut strands about its longitudinal axis to gather in newly cut strands as they are delivered to the collecting means whereby a twisted body of cut strands is continuously formed.

8. Apparatus for making textile products including means for winding a continuous strand of fibers into a plurality of convolutions to form a cylindrically shaped body, means for advancing the cylindrical body of strand convolutions in a direction of its axis, a strand-severing means disposed in the path of the advancing body of convolutions to successively sever the strand convolutions, means for collecting the lengths of strands as they are severed, feeding means for continuously moving the severed strands from the collecting means in the direction of length of the severed strands to form a continuous bundle of strands arranged in end-to-end overlapping relationship, and means for continuously turning the bundle of severed strands about its longitudinal axis to thereby gather in newly cut lengths of strands as they are severed and deposited in the collecting means whereby a continuous linear body of cut lengths of strands in twisted relation is continuously formed.

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