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Philipps et al.

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[54] **PACKAGE OF SATURATED UNSIZED GLASS FILAMENTS**

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[73] Assignee: **Owens-Corning Fiberglas Corporation,** Toledo, Ohio

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[21] Appl. No.: **277,949**

Related U.S. Application Data

[60] Continuation of Ser. No. 138,843, April 29, 1971, abandoned, which is a continuation of Ser. No. 2,760, Jan. 14, 1970, abandoned, which is a division of Ser. No. 493,505, Oct. 6, 1965, Pat. No. 3,498,770.

[52] **U.S. Cl.**..... **206/205,** 57/140 G, 206/410, 242/18 G, 242/159

[51] **Int. Cl.**..... **B65d 81/22,** B65d 85/67

[58] **Field of Search**..... 65/2, 3, 9; 206/46 PV, 206/46 ST, 46 R, 59 A, 59 B, 64; 220/3, 83; 242/18 G, 178, 159, 166, 42

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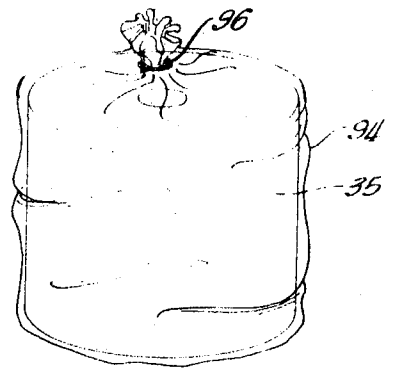
Assistant Examiner—Steven E. Lipman
Attorney, Agent, or Firm—Carl G. Staelin; John W. Overman; Harry O. Ernsberger

[57] **ABSTRACT**

A package of roving of unsized continuous filaments of glass whereby the package is saturated with water maintaining the filaments in group orientation by the water.

8 Claims, 11 Drawing Figures



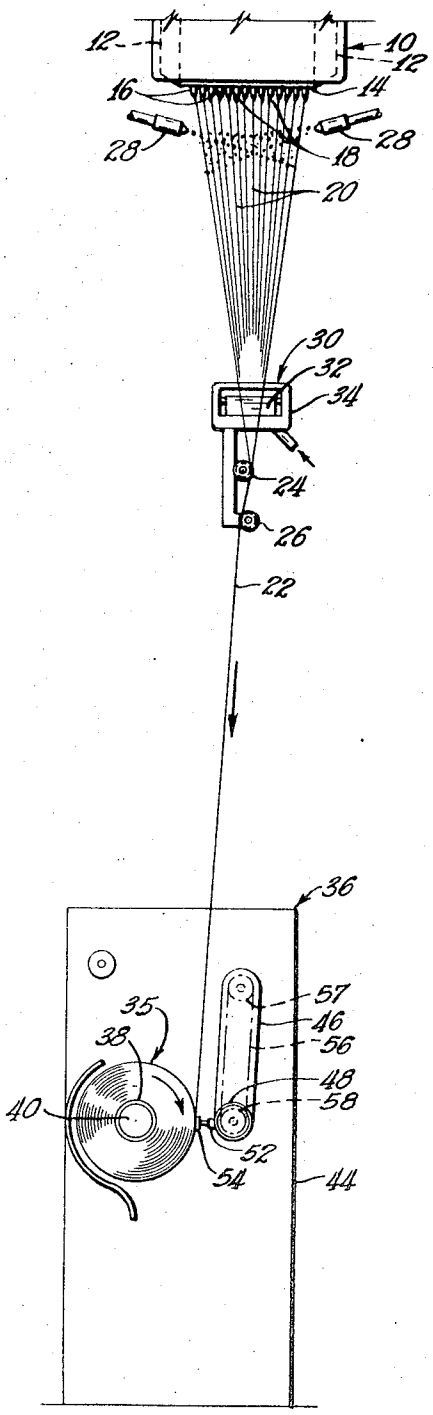

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Fig. 1

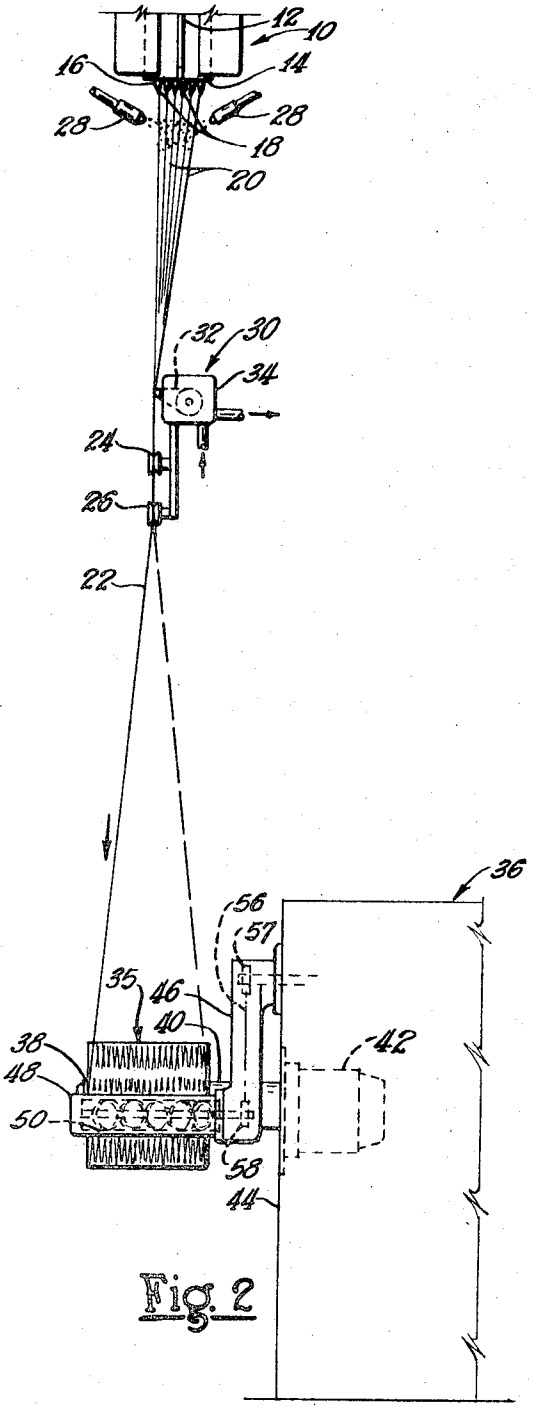
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Fig. 2

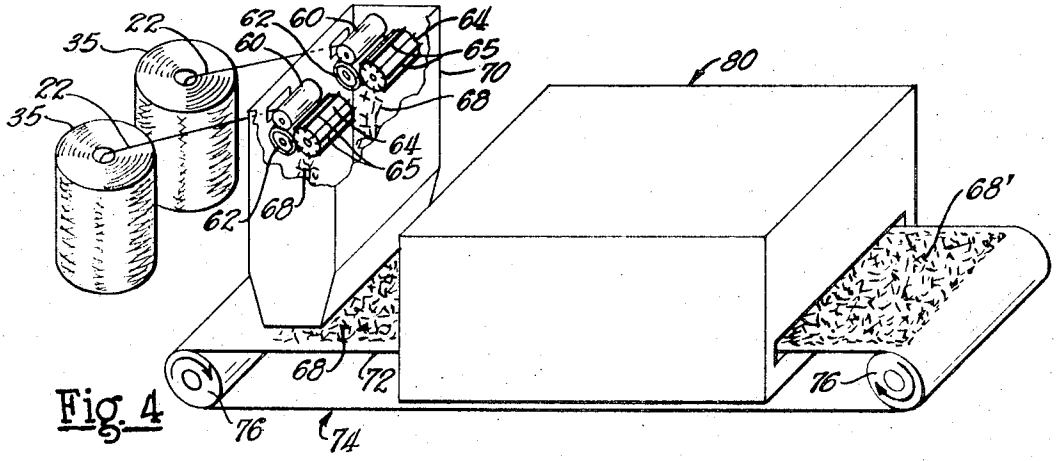

Fig. 4

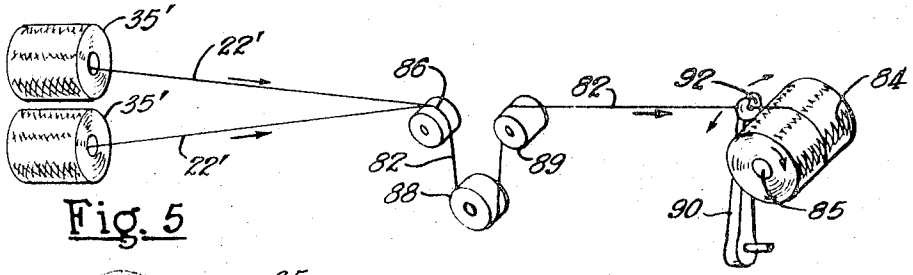

Fig. 5

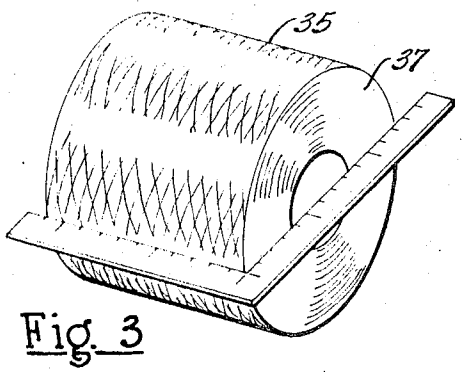

Fig. 3

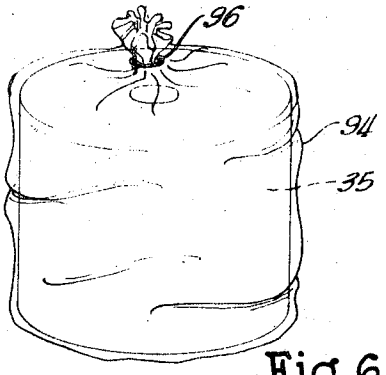

Fig. 6

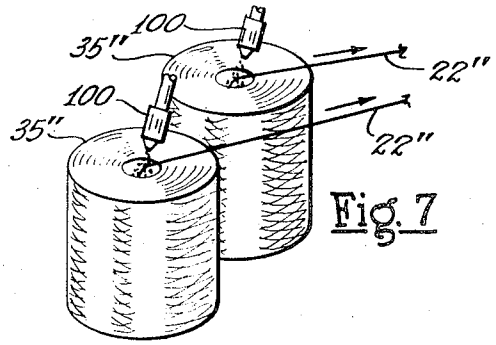

Fig. 7

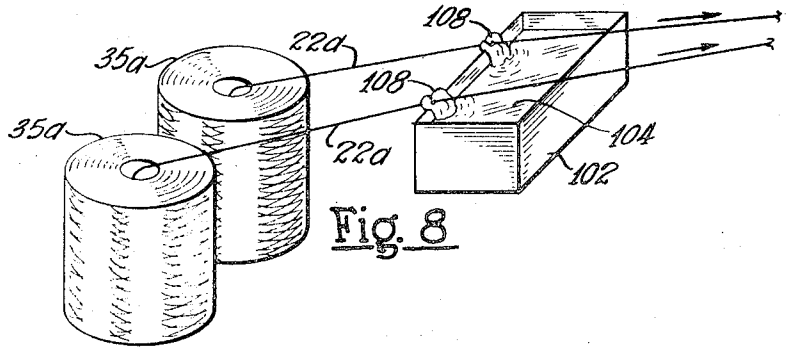

Fig. 8

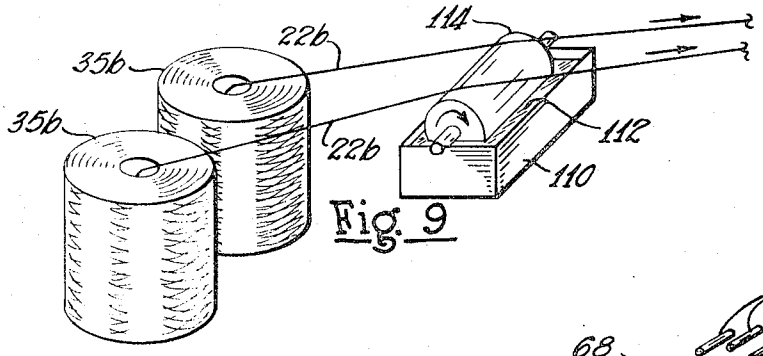

Fig. 9

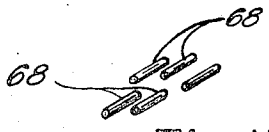

Fig. 11

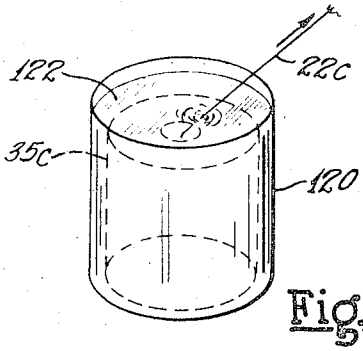

Fig. 10

PACKAGE OF SATURATED UNSIZED GLASS FILAMENTS

This is a continuation of our application, Ser. No. 138,843, filed Apr. 29, 1971, now abandoned which is a continuation of our application, Ser. No. 2,760, filed Jan. 14, 1970, now abandoned which is a division of our application, Ser. No. 493,505, filed Oct. 6, 1965, now U.S. Pat. No. 3,498,770.

This invention relates to method of and apparatus for treating, conditioning and processing roving or bundles of mineral filaments or fibers and more especially to treating, conditioning and processing roving or linear bundles of continuous filaments of glass.

In conventional production and methods of forming and processing roving of glass filaments or fibers it has been a practice to apply a size or bonding material on the filaments as they are formed and gathered into a roving formation to attain some degree of integrity or bonding of the filaments in roving formation. Such bonding materials are usually in the form of emulsions and upon evaporation of the water, the residue solids or bonding agents hold the materials in a group or roving formation.

In sized rovings processed in this manner, it is found that upon further processing and handling, particularly where the roving is severed into short lengths for use in reinforcing plastics or producing molded articles, the filaments of the severed lengths of roving are substantially dispersed during cutting and in a large measure defeat their purpose as reinforcement in plastics. It is found that roving of mineral fibers or filaments in a dried or size-set condition are not adequately held together where several rovings are combined into a single roving probably because of fracture of the size or bond during processing. When a sized roving is fed to a cutting device with the roving in a dry condition, only partial cutting takes place and usually a sbustantial number of the filaments in the roving are not severed because they readily separate when impinged by the cutter or severing device. It is believed that this condition results by reason of fracture of the bond or size under impingement by the cutter and, the bond being dry and hard, destroys any integrity in the filaments to be maintained in a group. When two or more rovings bearing a dry bond or size are combined into a single roving, the handling and the mechanical operation of combining the rovings causes the bond to fracture and the filaments to separate, rendering the combined roving unsatisfactory for further processing because of the lack of integrity of the filaments in the roving. Such condition promotes interabrasion of the filaments and results in frequent filament breakage in combining rovings as well as a high fuzz level.

The present invention embraces a method of moisture-conditioning or treating the roving as the filaments of the roving are formed and wound in a package or treating or conditioning the roving prior to further processing with water or other vaporizable liquid whereby the roving while in wetted condition may be satisfactorily severed into short lengths or combined with other rovings to form a multiple assembly roving or subjected to other processing steps which may be satisfactorily carried out or performed by reason of the wetted condition of the filaments renders them more readily grouped.

An object of the invention resides in packaging or maintaining a package of roving of glass filaments in a wetted condition whereby the water or other vaporizable liquid effects a coherence of the filaments or fibers in the bundle or roving enabling the handling and processing of the roving to attain advantages and results not attainable in the processing of sized roving.

Another object of the invention resides in maintaining a package of roving or bundle of filaments of glass in a wet condition and processing the roving while the package is in a wetted condition.

Another object of the invention resides in forming a roving and conditioning the roving with water, the wetness rendering the filaments more readily grouped and accordingly more easily handable during processing.

Another object of the invention is the provision of a package of roving or a linear bundle of filaments of glass moisture-conditioned or wetted with water or a vaporizable liquid which, when volatilized during subsequent processing operation, does not result in the filaments being in a bonded condition.

Another object of the invention relates to the processing of roving of glass filaments or fibers treated with water prior to severing the roving into short lengths and evaporating the moisture from the severed lengths of roving whereby the filaments of the short lengths of roving are maintained in grouped or integrated condition without bonding providing improved reinforcement for resinous materials in the production of reinforced molded end products.

Another object of the invention resides in processing a linear bundle or roving of unsized filaments of glass wetted with water or other vaporizable or fugitive liquid, rendering the unsized roving or bundle suitable as reinforcement for high temperature plastics and resins by reason of the absence of sizing on the filaments which would be oxidized or otherwise adversely affected during processing at high temperatures.

Another object of the invention resides in water conditioning of a roving or linear bundle of glass filaments to render the filaments of the roving or bundle more readily grouped during processing without bonding by reason of the cohering characteristics or surface tension of moisture on the wetted filaments, providing a bundle or roving of filaments suitable for uses wherein sized filaments cannot be satisfactorily processed or used.

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

FIG. 1 is a semidiagrammatic front elevational view of an apparatus for carrying out the method of forming and packaging roving of continuous filaments of heat-softenable material under conditions providing a moisture saturated package;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1;

FIG. 3 is an isometric view of a cylindrically-shaped square end moisture conditioned packaged formed on the apparatus shown in FIGS. 1 and 2;

FIG. 4 is a semidiagrammatic isometric view illustrating a method of processing the wetted roving;

FIG. 5 is a semidiagrammatic view illustrating the method of processing wetted roving in forming composite or multiple assembly roving;

FIG. 6 illustrates a package of wetted roving enveloped in a moisture impervious closure;

FIG. 7 illustrates a method of wetting roving as it is withdrawn from a package to moisture condition the roving for processing; FIG. 8 illustrates a modified method of moisture conditioning roving preparatory to processing;

FIG. 9 illustrates a further modification of method for wetting roving preparatory to further processing;

FIG. 10 illustrates a method of wetting roving by package immersion; and

FIG. 11 illustrates the group orientation of filaments in severed lengths of wetted roving;

While the method and apparatus of the invention embraces moisture conditioning of a roving or linear bundle of glass filaments in package form, or moisture conditioning a roving or linear bundle as it is withdrawn from a package to facilitate severing the roving or linear bundle into short lengths or combining rovings or linear bundles into a composite multiple assembly roving, it is to be understood that the method of moisture conditioning a roving may be utilized for treating roving preparatory to the performance of other processing operations.

FIGS. 1 and 2 of the drawings illustrates a method and apparatus wherein streams of glass or other heat-softened mineral material are attenuated to continuous filaments under conditions wherein the newly formed filaments are moisture conditioned or wetted with a vaporizable liquid such as water, the filaments gathered into a roving or linear bundle collected in a wound package under conditions wherein the filaments are maintained in a wetted condition during package formation whereby the completed package is substantially saturated with moisture to facilitate further processing operations.

The wetted roving or bundle of filaments of glass is of substantial mass in that the roving comprises filaments or strands of filaments upwards of two thousand or more filaments in a roving or bundle, the package of the roving being preferably wound in cylindrical shape with square ends and containing thirty pounds or more of roving. In FIGS. 1 and 2 there is illustrated a receptacle or stream feeder **10** containing a supply of heat-softened glass or other filament-forming material.

The feeder **10** may be supplied in a conventional manner with prerefined glass in the form of spheres or marbles which are reduced to molten condition either by heating the feeder or in a melter disposed above the feeder. The feeder may be connected with a forehearth (not shown) supplied with molten glass from a melting and refining furnace. The feeder **10** is provided at its end with terminal lugs **12** for connection with a source of electric energy for electrically heating the glass in the receptacle to maintain the glass at a proper temperature and viscosity for attenuation to filaments.

The floor or tip section **14** of the feeder is provided with a large number of depending projections or orificed tips **16** for flowing streams **18** of glass from the feeder, the number of orificed tips being equal to the number of filaments attenuated and converged into a roving or linear bundle, each stream being attenuated into an individual continuous filament. Thus, if two thousand filaments are contained in the roving, the floor section **14** would have two thousand orificed projections.

The individual filaments are of an average diameter of about thirty seven hundred thousandths of an inch, although the filaments may be of greater or lesser size if desired. The large number of filaments making up the roving and the size of the filaments enables attenuation of the streams at a comparatively slow linear speed of about 4,500 feet per minute with a slow traverse for distributing the roving lengthwise of a collector in forming a package.

As shown in FIGS. **1** and **2**, the filaments **20** attenuated from the stream **18** are converged into a roving or linear bundle **22** by gathering shoes or guides **24** and **26** supported in any suitable manner. Nozzles **28** are disposed adjacent the feeder and are adapted to direct sprays of water onto the newly formed filaments. In carrying out the method of the invention, it is desirable that an ample amount of water be delivered onto the filaments so that the filaments are thoroughly wetted or moisture conditioned. An applicator **30,** which may consist of a moving belt **32** acquiring a film of water by immersion in a receptacle **34** amd wetting the filaments by contact, may be employed to assure thorough wetting of the filaments.

The roving **22** is collected into a wound package **35** by a winding apparatus **36,** the roving being wound on a tubular sleeve or collector **38** telescoped onto a rotatable collet **40,** the winding of the roving into a package attenuating the glass streams **18** to filaments **20.**

The winding collect **40** is rotated by an electrically energizable motor **42** contained within the housing **44** of the winding apparatus. The speed of the collet driving motor **42** is progressively reduced by conventional means (not shown) as the package of roving increases in size so as to maintain substantially constant the linear speed of the filaments **20** in order to attenuate filaments of uniform size.

During a package winding operation, the roving is traversed lengthwise of the package being formed to distribute the strand throughout the length of the package. The traverse means illustrated is inclusive of a hollow arm or member **46** swingably supported by the housing **44,** the arm being provided with a tubular horizontal section **48** in which is journally mounted a rotatable traverse actuating member **50.** The member **50** is of cylindrical shape and has its peripheral surface fashioned with a multiple return groove or cam of conventional construction for reciprocating a traverse member **52.**

The axis of the traverse actuator **50** is parallel with the axis of the winding collet **40.** The traverse member **52** cooperates with the multiple return grooves in the member **50** for reciprocating the traverse. The traverse is provided with a guide member **54** normally disposed adjacent the periphery of the package of guiding the roving onto the package. The traverse actuator **50** is driven by means of a chain **56** cooperating with sprockets **57** and **58** driven by the motor **42** to maintain a proper speed ratio between the collet **40** and the traverse actuating member or cam **50.**

The arm **46** supporting the traverse mechanism is arranged for pivotal movement about its journal support under conventional control means (not shown) to accommodate the enlarging package. This method of

forming a package enables the production of a comparatively large package of roving of cylindrical shape having square ends **37** as shown in FIG. **3.** As the roving is supplied with water from the spray nozzles **28** and, if desired additional water supplied to the filaments by the applicator **30,** the filaments of the roving are thus enveloped in moisture or moisture conditioned at the time the roving of filaments is wound into the package.

The package is wound at a comparatively slow speed which is progressively reduced as the packaged increases in size. By reason of the comparatively slow speed winding of the roving into a package, a substantial amount of the water delivered onto the filaments is retained by the roving in the package so that the package is substantially saturated with moisture.

The moisture content of the finished package is usually from ten to twenty percent by weight of the package. Thus the completed package **36** of roving, when removed from the collet **40,** is in a thoroughly wetted condition as the centrifugal forces of rotation of the collet during winding dispel only excess water leaving a substantial amount of water in the package.

It has been a usual practice to apply a size or bonding material to filaments of a roving and, upon drying of a package, the size bonds the filaments of the roving together. When the sized roving is subjected to further processing, such as cutting the roving into short lengths or combining sized rovings to form a composite roving, the cutting or other processing operations fractures the bond so that the filaments of the rovings are not held togehter.

When a dry roving of sized filaments is fed to a severing or cutting device, it is found that only partial cutting takes place and that many of the filaments of the roving remain uncut. It is thought that the impingement of the cutter on the sized filaments fractures the bond causing the filaments to separate to an extent that all of the filaments are not severed.

One of the features of the present invention resides in th method of cutting or processing the roving in a wetted condition. FIG. **4** illustrates the method of processing the wet roving by severing the roving into short lengths. The apparatus is inclusive of pairs of feed rolls **60, 62** adapted to withdraw the roving **22** from two packages **35** of roving in moisture saturated condition, as when removed from the winding machine collet **40.**

Thus in carrying out the roving severing process the moisture saturated packages **35** of roving are conveyed from the winding machine to the position shown in FIG. **4** and th wet roving drawn from the packages by the feed rolls.

Associated with each pair of feed rolls is a rotatable cutting device **64** having severing knives **65** which engage and sever the rovings **22** into short lengths indicated at **68.** The pairs of feed rolls and the cutting devices **64** are rotated at comparatively high speed.

The feed rolls **62** of each pair are preferably fashioned with a peripheral surface of rubber or other yieldable material which cooperates with the cutter **64** to sever the rovings. The severing devices may be of the character shown and described in Stotler U.S. Pat. No. 2,719,336. It is found that the cutters or knives **65** engaging the wet roving effect a complete severing of all of the filaments of the roving.

It is believed that this advantageous result is attained by reason of the cohesion or surface tension of the water or moisture tending to hold the roving or linear bundle of unbonded filaments together during the severing operations. The severed lengths of roving **68** are shown in FIG. **11** to illustrate that the filaments remain in a group formation when the roving is processed in a wetted condition.

In further reference to FIG. **4,** the cutting instrumentalities are contained in an enclosure **70,** the severed lengths of roving, moving downwardly by gravity through the enclosure **70,** are collected on the upper flight **72** of an endless conveyor **74.** The conveyor **74** is supported upon rolls **76** and one of the rolls being driven by motive means (not shown) to move the upper flight **72** of the conveyor in a right-hand direction.

Disposed adjacent the upper flight of the conveyor is a drying oven or drying device **80** for evaporating or volatilizing the moisture on the severed lengths of roving **68** while entrained on the conveyor flight **72.**

The dryer **80** is preferably of a conventional dielectric type as it rapidly evaporates the water from the cut roving. However, radiant heat or other suitable type of dryer for evaporating or dispelling the moisture from the cut roving may be employed. The dried lengths of roving **68'** delivered from the dryer **80** are particularly usable as reinforcement in plastic articles and products, as the bundles of filaments of the cut rovings when mixed with softened plastic retain, at least in part, the filament groupings thereby providing improved reinforcement for plastic moldings.

The wetted or moisture saturated rovings may be processed or combined into a multiple assemblage roving product or composite roving. In combining rovings of sized filaments, the combining operation, necessarily involving flexure of the rovings, engenders fracturing of the size or bond, causing the filaments to separate, resulting in an inferior product and one which cannot be further processed because of the disintegration of the bond and its inability to hold the filaments in group or bundle formation.

FIG. **5** illustrates combining wet rovings into a composite or multiple assembly roving. Packages **35'** of moisture conditioned or wetted rovings are disposed in a position whereby the wetted rovings **22'** may be withdrawn from the packages and converged into a multiple roving assembly or composite roving **82,** the composite roving being wound into a package **84** mounted on a rotating collet **85,** the collet rotated by suitable motive means (not shown) in a conventional manner.

In combining the wet rovings **22',** they are converged into one linear bundle or multiple roving **82** by a guide roll **86,** and directed around idler or tensioning rolls **88** and **89.**

An oscillating traverse member or arm **90,** oscillated by conventional means, is equipped with a guide eye **92** accommodating the composite roving **82** for traversing the combined rovings lengthwise of the package **84** during package formation. In the method of combining of two or more rovings **22'** in the manner illustrated in FIG. **5** utilizing unsized rovings in wetted condition, the water or moisture on the rovings tends to hold the filaments of each roving in a group without bonding, enabling the flexing of the rovings in the combining operation without separation of the filaments. In this manner a multiple roving assembly or composite roving is produced without in any way impairing the high

strength characteristics of each roving in the assemblage.

Through the herein described method of winding a roving or linear bundle of filaments in wetted condition into a package, or combining wetted rovings into a composite or multiple assembly roving, the filaments comprising the rovings, under the cohering characteristics or surface tension of the water or moisture on the filaments, ar maintained in group formation without bonding. This characteristic makes possible the further reprocessing of the packages of roving or composite roving

Thus, the invention enables the handling and reprocessing of rovings or linear bundles of glass filaments without disruption of the groups of filaments and without impairing the strength characteristics of the roving.

In manufacturing processes utilizing the rovings, the severing operations or further processing operations may be carried on by processors at establishments remote from the filament attenuating and roving forming station shown in FIGS. **1** and **2.** Furthermore, considerable time may elapse between the formation of the moisture-conditioned or moisture-saturated package and its further processing, thus necessitating storing the packages for the intervening period of time.

In order to maintain the packages in saturated condition without loss of moisture, the packages may be enveloped in a moisture-impervious bag or envelope **94,** shown in FIG. **6.** The bag of envelope **94** may be fashioned of moisture impervious plastic film of conventional character and the bag closed by heat sealing or ether means such as a securing ring or tie strip **96.** By utilizing a bag or closure of plastic film, such as polyethylene film of one mil or less in thickness, no appreciable weight or size is added to the package by this preparation for storage or shipping. Furthermore, the plastic envelope or container may be fashioned to closely embrace the contour of the package and minimize liability of damage to the package

It has been found that packages of roving of unsized or unbonded glass filaments, which have lost substantial moisture by evaporation, may be successfully severed in the manner illustrated in FIG. **4,** or processed in forming composite rovings as illustrated in FIG. **5,** by wetting or moisture-conditioning the roving prior to severing or processing the roving. FIG. **7** illustrtes one method of wetting a roving of unsized filaments preparatory to severing the roving into short lengths or otherwise processing the same. In the method shown in FIG. **7,** the rovings **22''** are withdrawn from the central regions of the packages **35''.**

Disposed above the hollow central region of each package is a nozzle **100** for delivering sprays of water or other non-residue vaporizable liquids which have the characteristics of wetting the filaments. As the rovings **22''** are withdrawn from th package, the sprays of water or other wetting liquid wets the filaments of the roving to an extent that the cohering characteristics or surface tension of the water or liquid holds the filaments in a group. Rovings moisture-conditioned or wetted in this manner may be successfully severed into short lengths or combined into composite roving in the manner hereinbefore described.

FIG. **8** illustrates another method of moisture conditioning or wetting rovings of unsized filaments withdrawn from packages for processing. The rovings **22***a* drawn from the inside or central regions of the packages **35***a* of roving.

A receptacle or container **102** is provided containing water **104** or other nonresidue vaporizable liquid. Immersed in the water and having portions disposed for engagement with the rovings **22***a* are water saturated bodies or applicators **108,** the roving passing in contact with the saturated bodies **108** to wet the filaments of the rovings.

The bodies **108** may be of any suitable material in which the water or liquid will be dispersed by capillary action such as sponge, wettable fabric or clumps of wettable fibers or other material for transferring water onto the rovings.

FIG. **9** illustrates another means or method of wetting rovings of unsized filaments to moisture condition the rovings for processing operations. Rovings **22***b* are drawn from the central or inside region of the packages **35***b* of roving. A container **110** is adapted to contain water **112** or other non-residue vaporizable liquid. Journally supported by the container **110** is a rotatable roll applicator **114** partially immersed in the water **112** whereby the periphery of the roll continuously acquires a film of water. The rovings **22***b* are drawn tangent to the periphery of the applicator roll **114** and in contact therewith whereby the rovings acquire a film or coating of water. The container **110** is connected with a water supply by conventional means (not shown).

FIG. **10** illustrates a method of wetting or moisture conditioning roving of unsized glass filaments preparatory to cutting operations or other processing operations of the roving. A container **120** is filled with water **122** to a height to cover a package **35***c* of roving.

When it is desired to process a package of dried roving of unsized filaments or a package having a low moisture content, the package is immersed in the water in the container **120** and the roving **22***c* withdrawn from the package. In this manner the roving is thoroughly wetted in preparation for further processing.

The method and apparatus hereinbefore described enables the processing of rovings or linear bundles of unsized filaments of glass treated with water or moisture-conditioned whereby the roving may be handled in a wetted state. The moisture-saturated package may be processed immediately after its removal from the winding apparatus shown in FIGS. **1** and **2** without further water treatment. If moisture-saturated packages of roving are to be stored or shipped, the packages may be enveloped in moisture impervious closures in the manner shown in FIG. **6,** preventing any loss of moisture from the packages.

If packages of roving of unsized filaments have been partially dried because of evaporation in open air in storage without being enclosed in moisture impervious envelopes, the roving may be wetted or moisture conditioned by the methods illustrated in FIGS. **7** through **10.** The roving of unsized glass filaments in wetted condition may be positively sheared or cut up or chopped into short lengths, or the roving subjected to processing operations involving flexure of the roving as there is no size or bonding material on the filaments which may be fractured during handling thus enabling the roving to be processed or reprocessed without impairing the characteristics of the roving because the filaments of the wetted roving are held in a linear bundle or roving formation by the moisture and without bonding.

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.

We claim:

1. A package of roving of unsized continuous filaments of glass, said package being saturated with water whereby the filaments are maintained in group orientation in the roving by the water.

2. A package of roving according to claim **1** including an impervious envelope enclosing the water saturated package of roving.

3. The combination according to claim **2** wherein the impervious envelope is of resinous material.

4. A package of roving of unsized continuous filaments of glass, said package being saturated with a vaporizable liquid whereby the filaments are maintained in group orientation in the roving by the liquid.

5. A package of roving of unsized continuous filaments of glass, said package being of circular cylindrical shape having square ends, said package being saturated with a vaporizable liquid.

6. A water saturated package comprising a linear body of unsized continuous filaments of glass, the linear body being disposed in successive layers in the package, each of said layers extending full length of the package providing square ends for the package.

7. A water saturated package according to claim **6** wherein the convolutions of the linear body are in side-by-side contiguous relation with the convolutions of one layer in crossing relation with the convolutions in an adjacent layer.

8. A package comprising a plurality of rovings, each of said rovings comprising linear bundles of unsized continuous filaments of glass, said package being saturated with water.

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