ABSTRACT

A package of continuous glass filaments coiled into a generally cylindrical tubular shape is provided with a heat shrunk plastic film covering the peripheral and end surfaces of the tubular package. The heat shrunk plastic film protects the filaments from abrasion during shipment and handling. The heat shrunk film also co-operates with the outer layer of the package to support the coils in the outer layer as the filaments are withdrawn from the package thereby preventing the coils from slumping together and becoming entangled. The plastic covering is provided with an opening at one end thereof which acts as a guide for the filaments as they are withdrawn from the package.

3 Claims, 5 Drawing Figures
COVERED TUBULAR PACKAGE OF GLASS ROVING AND METHOD OF MAKING

This is a continuation of application Ser. No. 113,219, filed Feb. 8, 1971.

This invention relates generally to the packaging of filamentary material, particularly strands or rovings of continuous glass fibers, for shipping, handling, and further processing.

Continuous glass filaments are made by flowing molten glass through small orifices in a bushing to form streams of molten glass, attenuating the glass streams into filaments, gathering a plurality of these filaments into a strand or roving, and winding the strand or roving onto a revolving drum. The attenuating force is provided by the revolving drum which also serves to coil the filaments into a transportable package. A traverse mechanism is used to move the strand or roving back and forth along the length of the pulling drum to produce a generally tubularly shaped body of coiled filaments in which the coiled filaments are superimposed over each other in layers. A sizing is usually applied to the filaments as they are formed to give integrity to the strand or roving, and to prevent abrasion of the filaments as they are coiled on the drum. When the tubular body of filaments reaches a generally predetermined diameter it is removed from the drum and prepared for shipment to processors.

When the strand or roving is coiled into a package in this manner, the tension that is built up between the layers of filaments during the winding is sufficient to make the package self-supporting. Free ends of the roving are provided both within the interior of the tubular package and on the exterior surface. Either free end can be pulled to remove roving from the package. However, it is generally found that the processor prefers to withdraw the roving by pulling on the interior free end. This method of withdrawal does not require removal of the package from its container, does not result in ballooning of the strand as it unwinds, and does not result in abrasion of the roving such as occurs when the exterior end is pulled over the edge of the package.

It is also a common practice for the processor to tie the trailing end of roving from one package to the leading end of the next package. This arrangement facilitates transfer from one package to another without interrupting the processor’s operation.

Heretofore it has been the practice to ship roving packages of the type described in loose fitting polyethylene bags, or cardboard cartons or boxes. However, in such containers the roving package is free to move relative to its container during shipment. This movement of the package with respect to the plastic bag or cardboard box may result in abrasion of the filaments on the outer and end surfaces of the package. Consequently, before using such a package the processor must remove the abraded material in the outer layers of the package. The abraded filaments on the package ends cannot be removed except as the roving is being uncoiled. As it is pulled from the package the roving will contain intermittent sections of broken filaments which, if not removed, may cause a continual build-up of fuzz in the processor’s operation.

Another serious problem occurs when the self-supporting roving package is uncoiled. As it is a degree where most of the filaments have been removed. No longer held in a self-supporting cylinder, the outermost layers of filaments slip down into an entwined heap. The coils of filaments become entangled and are withdrawn together. Consequently the processor must interrupt his operation to remove the snarled portion of the rovings. In many instances the coils of filaments are so entangled that it is not economical to untangle them; with the result that a sizeable portion of the package must be scrapped.

In the past various attempts have been made to improve the runout of wound textile packages. One technique consisted of wrapping a moistened, regenerated cellulose sheet around a ball of string. The cellulose wrapper was subsequently dried causing it to shrink tightly around the package. Moistened cardboard was also used in a similar manner. Among other disadvantages, this technique required handling a wetted sheet and the removal of moisture to effect shrinkage.

In another technique, a sheet material such as paper or film was coated with an adhesive and applied to the outer surface of the package. However, in addition to the difficulty in selecting an adhesive which would provide the desired bond under varying environmental conditions, the adhesive bond provided additional resistance to the withdrawal of the textile material. For these and other reasons the prior art practices do not achieve the objectives of the present invention as set forth below.

With these practices and their difficulties in mind, it is an object of the present invention to provide a novel wound package of filamentary material which prevents abrasion of the end and outermost coils of filaments during handling and shipment.

It is a further object of this invention to provide a self-supporting textile package in which the roving or strand can be completely withdrawn without the outermost coils of filaments slumping together and becoming entangled.

It is still a further object of this invention to provide a textile package having a unitary covering provided with an opening at one end which acts as a guide for the filaments as they are withdrawn.

BRIEF SUMMARY OF INVENTION

The above and other objectives are achieved in the present invention by encasing a coiled textile package in a heat shrunk plastic film. The wound package of filaments is inserted into a plastic bag or sleeve and the plastic material is heated. The material is uniformly shrunk until in intimate contact with the outer peripheral surface of the package and taut across the end surfaces of the package.

The intimate contact between the plastic material and the surface of the package is sufficient to prevent the movement of the filaments relative to each other. Similarly abrasion of the filaments in the ends of the package is prevented by tautness of the film protecting that region.

A further feature of the invention results because the heat shrink plastic film supports the outer coils of filaments as the package is unwound. The coils in the outer layers are held in their coiled relationship as the roving or strand is withdrawn thereby preventing them from slumping or collapsing to the supporting surface and becoming entangled. Thus the use of this invention enables the processor of the roving or strand to completely unwind the package, or to transfer from one package to another, without disrupting his operation or scrapping any of the filaments.
A still further feature of the invention results when the shrinkage of the resinous film is controlled to produce a substantially circular opening in the film at one end of the package. This opening serves as a guide for the roving or strand as it is withdrawn from the package. Under the proper conditions the opening is located concentric with the tubular textile package, and causes the roving to be pulled at least partially radially inward as it is being withdrawn. When the roving is withdrawn in at least a partially radial direction it does not rub or abrade adjacent coils of filaments on the interior surface of the package. This opening or guide also cooperates in improving the runout and transfer characteristics of the package. When the package has been depleted down to the last few layers, the inward radial movement of the strand or roving prevents a lateral rubbing or adjacent coils which rubbing could cause them to slump or fall to the bottom of the package and become entangled.

DESCRIPTION OF DRAWINGS

Having thus briefly described the invention, a more detailed description follows with reference to the accompanying drawings forming a part of this specification, of which:

FIG. 1 is an isometric view of a cylindrical package of coiled continuous glass filaments;

FIG. 2 is an isometric view of the package of filaments of FIG. 1 encased in a heat shrunk plastic sheet material;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2 with a portion of the film broken away to show both ends of the filaments more clearly;

FIG. 4 is a schematic view of apparatus used for encasing a package of coiled filaments in a heat shrunk plastic film in accordance with the present invention; and

FIG. 5 is an elevational view of a heat shrinkable plastic bag which is used to encase the package of FIG. 1; the bag has been flattened along a diameter to more clearly show the curvature of its base.

For the purposes of clarity, the following discussion of the invention is limited to its application to glass fibers, and especially continuous glass rovings. However, it will be understood that the inventive concept so exemplified is sufficiently broad to be applicable to other forms of textiles, including filaments, strands, and yarns, as well as both organic and inorganic materials.

The package of glass filaments shown in FIG. 1 consists of a continuous glass roving wound in successive layers of coils to form a generally cylindrical tubular shape. The continuous roving has a free end 12 on the exterior of the wound package 10, and an internally exposed free end 14 which can be pulled to unwind the package from the inside. The package 10 has generally parallel inner 16 and outer 18 cylindrical surfaces.

As shown in FIG. 1, the roving can be wound in successive layers of equal length, with the roving in each layer being in side-by-side relationship, to provide a package having generally flat annular end surfaces perpendicular to the inner and outer surfaces. This square ended cylindrical package is a particularly economical and otherwise suitable configuration for the packaging of continuous glass fibers, especially glass rovings used in the reinforcement of plastics. However, some coiled packages have an outer surface having a gradual taper in one or both axial directions. The inner surface may also have a slight draft to facilitate removal from the winding drum, etc. Similarly in some packages the ends are tapered to reduce sloughing of the outer coils in the package end. It is understood that the present invention is applicable to those additional package configurations, and the term generally cylindric, as hereinafter used, is meant to include these slightly tapered surfaces.

In FIGS. 2 and 3 the roving package 10 is shown encased in a protective covering 20 of a heat shrunk plastic sheet or film. The covering consists of a cylindrical trunk portion 22 and end portions 24 and 26. One end portion 26 of the covering 20 is continuous across the end of the roving package; the other end portion 24 extends radially inward from the trunk 22 and terminates in a circular opening or aperture 30. The opening 30 is smaller in diameter than the inner cylindrical surface 16 of the package. Therefore, the covering 20 fully protects the package ends while the opening 30 serves as a guide for the roving as it is withdrawn; a feature to be discussed later.

The covering 20 is formed from a heat shrinkable plastic material. Heat shrinkable films are stretched during their manufacture to produce a strained orientation of the molecules. When cooled the film retains its strained condition; but upon reheating the molecules revert to their natural orientation causing the film to shrink. Such films find wide use in packaging, and include polyethylene, polypropylene, polybutylene, polyvinyl chloride, polyvinylidene chloride, polystyrene, polycrylates, linear polyester, and polyamides.

One such heat shrinkable film has been found to be particularly satisfactory for use on glass roving packages of the type described. This film is a bi-axially oriented, cross linked polyolefin marketed by the Cryovac Division of W. R. Grace Company under the designation of L900 film. It was found that this film does not stick to itself as it is being shrunk. Consequently, this film does not result in wrinkles in the covering. Such wrinkles, which may result if care is not exercised in using other films, bite into the glass filaments in the package and may cause abrasion of the filaments. Furthermore this film provides a more uniform shrinkage and facilitates forming a smooth, snug free opening 30 in the covering.

In FIG. 4 is shown schematically a method for applying the covering 20 to the wound package 10. A seamless bag 40 of the shrinkable film is placed over the end of the roving package. The package is then placed on a conveyor 50, either in the horizontal position, as shown, or in an upright position, and passed through an oven 52. When the package 10 is conveyed horizontally as shown in FIG. 4, it is rotated slowly to insure a uniform shrinkage of the film. Heat for shrinking the film can be provided by any suitable means such as the electrical resistance heaters 54 shown. Upon emerging from the oven 52, the package is cooled and placed in a carton or on a pallet for shipping.

Although the film is shown in FIG. 4 in the form of a bag 40, the film can be provided in the form of a tubular sleeve open at both ends. The bag form is preferred because it is more readily aligned on the package, and also because it produces a package with a closed end 26 as shown in FIG. 3. It is foreseen that there may be situations in which the processor prefers a package with an opening 30 in both ends. In those cases, a tubular form of plastic material could be used.
The thickness of the film and the dimensions of the bag or sleeve will largely be determined by the type of film and the particular application for which it is used. For example, the roving package of FIG. 1 may be approximately 32 inches in circumference and 10¼ inches in length. The diameter of the inner surface 16 of the package may be approximately 6¼ inches. Successful trials have been conducted by encasing such a package in a heat shrinkable polyolefin film which was 2.2 to 2.6 mils thick before shrinkage. The film was supplied in the form of a bag having a circumference of 34 inches and an overall length of approximately 22 inches. When flattened along one diameter, as shown in FIG. 5, the bag 40 has a curved base with a radius of approximately 11¼ inches.

After shrinking the bag 40 to form the covering 20, the film has been assured to be in the range of 4 to 5 mils thick along the trunk portion 22 and as high as 15 to 20 mils thick in the open end region 24. The shrinkage was controlled to produce an opening 30 having a diameter between 3 and 5¼ inches. It has been observed that exposure of the film to 400°F for about 20 seconds will produce the desired shrinkage.

Referring again to FIGS. 2 and 3, the heat shrunk covering 20 protects the glass filaments from becoming abraded when the roving package comes in contact with another object or is otherwise subjected to external forces. The tightness of the covering 20, after it has been shrunk around the package 10, minimizes movement of the film relative to the glass roving when the film is acted upon by an external force. Consequently, the filaments are not abraded by movement of the film. Furthermore, it has been observed, even when the external force is sufficient to cause some movement of the film, the filaments on the outer and end surfaces of the package are not moved. Therefore, the tight covering 20 also protects the glass roving from self-abrasion due to relative movement of the filaments.

As was mentioned earlier, abrasion of the filaments in the ends of the package is particularly undesirable since the damaged portions cannot be removed except as the roving is being unwound. A feature of the present invention is that additional protection for the package ends is provided. As was discussed previously, when the film has been shrunk it becomes substantially thicker in the end portions 24 and 26. Thus the end portions 24 and 26 become more rigid or taut and provide greater resistance to movement relative to the filaments.

Another significant feature of the covered roving package of FIG. 2 is its improved runout and transfer characteristics. It has been found that the roving from the package can be completely unwound by pulling the free end 14 without the coils of roving on the outer surface 18 slumping together and becoming entangled. Consequently, the processor can use all the roving without any scrap. Furthermore, the processor can tie the trailing end 12 to the leading end of another package for an uninterrupted operation. When shrinking the covering 20 onto the roving package 10, roving end 12 is made accessible through the opening 30.

The mechanism by which the heat shrunk covering 20 works to facilitate the complete runout of the roving is not fully understood. It has been observed that the trunk portion of the film 22 in combination with the outer layer of roving coils maintains the coils of the outer layer in their respective positions until the coils are withdrawn from the package. This result is produced without the necessity of using an adhesive between the covering 20 and the roving package 10. Therefore it is not necessary to overcome an adhesive bond in withdrawing the roving from the covering 20.

It has been observed, when using the polyolefin film described earlier, that the covering 20 is capable of standing independently, after all the roving had been withdrawn, unless disturbed by some external force. It has been observed in some cases that the cylindrical trunk portion 22 of the covering could stand alone without the end portions 24 and 26. However, it is believed that the end portions 24 and 26, which as previously discussed are thicker than the trunk portion 22, contribute to the structural self-support of the covering.

In addition to the support furnished by the trunk portion 22 of the covering 20, the opening 30 in the end 24 is also believed to contribute to the improved runout and transfer properties of the invention. As discussed earlier, the opening 30 is smaller in diameter than the inner cylindrical surface 16 of the textile package. Under the proper process conditions a smooth round, concentric opening is formed during the heat shrinking operation. It is preferred that the opening 30 be concentric with the inner surface 16, but it has been observed that eccentrically located openings occasionally result. However, the packages having eccentric openings are still operable as long as the opening 30 falls with the area of the inner surface 16 so that the end portion 24 of the covering 20 fully protects all the glass roving on the package end.

The opening 30 serves as a guide eye for the roving as it is withdrawn as shown in FIG. 3. As the roving is pulled through the opening 30 it is pulled at least partially radially inward from the surface 16. This radial movement prevents the roving from rubbing adjacent coils on the surface 16 and thereby reduce self-abrasion of the glass filaments. Furthermore, when only the last few coils or layers of coils remain in the package, the radial movement of the roving prevents it from disturbing adjacent coils and causing them to slump or collapse.

In order for the opening 30 to serve as a guide, it must be smooth and free of nags or wrinkles in the material. The opening 30 could of course be manually cut into the end portion 24 of the covering. However, when the plastic film is properly sized and care is used in the shrinking operation, the opening is naturally formed with a smooth edge.

Having thus briefly described one embodiment, numerous other modifications and embodiments of the invention will be apparent to those skilled in the art. It is to be understood that such modifications and embodiments are within the scope of the invention as defined in the accompanying claims.

We claim:

1. A covered tubular package of glass roving from the interior of which roving can be completely withdrawn without interruption, comprising a roving of glass filaments, the roving being wound in successive annular layers of equal axial length to form a cylindrical tube having a pair of generally flat, annular, opposite end surfaces, and a tubular covering longer than the tube of roving, open at one end, and formed of heat-shrinkable resinous film, the tube of roving being disposed endwise in
the tubular covering, a first generally cylindrical portion of the covering being shrunk by heat into a tubular sleeve in intimate contact with an outer layer of the roving, a second generally cylindrical open end portion of the covering being shrunk by heat into a flat, annular, wrinkle-free, taut end portion in contact with the adjacent end surface of the tube of roving and having a smooth, generally circular opening substantially concentric with the tube of roving and of smaller diameter than an inner diameter of the tube, an inner peripheral portion of the flat, annular end portion defining the opening forming a generally planar guiding means for guiding the roving radially inwardly of the tube as the roving is withdrawn from the heat-shrunk covering through the opening, and the heat-shrunk tubular sleeve and the outer layer of the roving forming a structure sufficiently self-supporting, after withdrawal of the inner layers of the roving through the opening, to permit complete withdrawal of the roving of the outer layer through the opening from within the heat-shrunk covering without interruption.

2. A package as claimed in claim 1 wherein the heat-shrunk covering is thicker and more rigid around the opening in the end portion than in the tubular sleeve.

3. A method of making a covered tubular package of glass roving from the interior of which roving can be completely withdrawn without interruption, comprising providing a roving of glass filaments, winding the roving in successive annular layers of equal axial length to form a cylindrical tube having a pair of generally flat, annular, opposite end surfaces, providing a tubular covering longer than the tube of roving, open at one end, and formed of heat-shrinkable resinous film, inserting the tube of roving endwise into the tubular covering through the one open end thereof, shrinking a first generally cylindrical portion of the covering by heat into a tubular sleeve in intimate contact with an outer layer of the roving thereby forming a structure sufficiently self-supporting, after withdrawal of the inner layers of the roving, to permit complete withdrawal of the outer layer of the roving without interruption, and shrinking a second generally cylindrical open end portion of the covering by heat into a flat, annular, wrinkle-free, taut end portion in contact with the adjacent end surface of the tube of roving and having a smooth, generally circular opening through which the roving may be withdrawn, the opening being substantially concentric with the tube of roving and of smaller diameter than an inner diameter of the tube.

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