NONSLUMPING GLASS FIBER PACKAGE

Inventor: John A. Rolston, Newark, Ohio
Assignee: Owens-Corning Fiberglas Corporation, Toledo, Ohio
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ABSTRACT

Glass fibers coiled in layers into a generally tubularly shaped package, and in which the layer of fibers adjacent one of its generally cylindrical shaped surfaces, is adhered to the surface of a support by a tacky or adhesive material. The degree of tack is such as to hold the layer of coils in position on the support even though the remainder of the layers of coils have been removed, at least to a degree where they no longer support the remaining layer of coiled fibers. The degree of adhesion is such as to allow the adhered fibers to be pulled from the surface of the support without damage to the fibers. The support can be a sheet material, and in the preferred embodiment, is applied to the outside generally cylindrical surface of a tubular package of fibers to form one part of a protective container for the package. Caps may be telescoped over the opposite ends of the package to cooperate with the sheet material and completely incase the package of glass fibers.

3 Claims, 7 Drawing Figures
Continuous filament glass fibers are made by pulling the solidified portions of small flowing streams of glass to attenuate the molten portions of the streams. The pulling action is obtained by wrapping the solidified portions around a revolving drum which also serves the purpose of coiling the fibers into a transportable package. The attenuation of the molten streams tends to be self-limiting, since the surface area of the glass increases per unit volume as the filaments are being attenuated. Since the loss of heat from the glass is a function of the surface area, the streams of glass do not break during the attenuation process, and are attenuated to a diameter that is a function of the speed at which the fibers are coiled upon the pulling drum. A traverse mechanism is used to move the fibers back and forth lengthwise of the pulling drum to produce a generally tubularly shaped package of coiled fibers in which the coiled fibers are superimposed over each other in layers. When the package reaches a generally predetermined diameter, it is removed from the pulling drum and shipped to processors of the fibers who grasp one end of the fibers and uncoil them from the package.

In some instances, the fibers are coiled upon a stiff paper or plastic sleeve which is inserted over the pulling drum and later removed. In other instances, the fibers are wrapped directly upon the drum, which drum is collapsed after the package is formed, and the package slid endwise from the winding drum. In this instance, there is no sleeve or form adjacent the inside cylindrical surface of the package of coiled fibers, and the tension that is built up between the layers of fibers during winding is sufficient to make the package self-supporting. Self-supporting packages can be uncoiled starting either with the outside layer of fibers or starting with the inside layer of fibers, and in many instances, it is convenient to start with the inside layer since when this is done, the package need not be removed from the shipping carton. Self-supporting packages are usually placed in polyethylene bags so that the packages retain a desired amount of moisture which prevents static electricity from being generated when the fibers are pulled through guide surfaces during the uncoiling operation. In some instances, the packages contained in the polyethylene bags, are in turn placed in pasteboard cartons which protect the package from mechanical abuse during shipping. In those instances where the packages are incased in loosely fitting boxes or cartons, it sometimes happens that movement within the carton produces a rubbing action between the outer most fibers of the package and the carton, to cause the fibers at the ends of the package to become abraded. When abrasion of the fibers has occurred, the fibers may break during the uncoiling operation.

A more serious difficulty occurs, however, when the self-supporting packages are uncoiled to a degree where most of the fibers forming the package have been removed. After most of the fibers have been removed, the remaining layers are no longer held in a self-supporting cylinder, and slip downwardly into an entwined heap on the supporting surface. Withdrawal of the fibers from the entwined heap invariably causes several coils to be withdrawn together and a knot formed which breaks the fibers. In many instances, the coils of fibers are so mixed up that it is not economical to untangle the coils, with the result that a sizable percentage of the glass fibers of the original package must be scrapped.

An object of the invention is the provision of new and improved means for preventing the end coils of a package of glass fibers from becoming abraded during shipping.

A further object of the present invention is the provision of a new and improved package of glass fibers which will allow the fibers to be removed therefrom without shift of the coils relative to each other during the unwinding of the package.

Further objects and advantages of the invention will become apparent to those skilled in the art to which the invention relates from the following summary of the invention and description of the preferred embodiments.

Brief Description of the Drawings

Fig. 1 of the drawing is an isometric view of a package of fibers;
Fig. 2 shows the package of Fig. 1 being incased;
Fig. 3 is a telescopic view of the parts of a total package;
Fig. 4 is an isometric view of a total package;
Fig. 5 is a sectional view taken on the line 5-5 of Fig. 4;
Fig. 6 is an isometric view of another embodiment of the invention; and
Fig. 7 is a sectional view taken approximately on the line 7-7 of Fig. 6.

Description of the Preferred Embodiments

According to the present invention, the coils adjacent an exposed surface of a tubular package of glass fibers are caused to adhere to a support or form by means of adhesive which holds the layer in position after the bulk of the coils has been removed to thereby prevent the remaining layer or layers of coils from slumping together into an entwined mass. The adhesive may be applied either to the surface of the fibers, or to the surface of the form that is positioned adjacent the coils forming the surface of the package. In a preferred embodiment of the invention, sheet material having a tacky surface is pressed against the fibers forming the surface of the package. In those instances where the coils are to be removed from the inside cylindrical surface of the package, the sheet material is wrapped around the outside surface of the package with the ends of the sheet material suitably fastened together. The outside layer of sheet material when adhered to the outside layer of coils of glass fibers, not only holds the outside layer in position when the remaining layers have been removed, but forms a protective surface or container for the package. This container is adhered directly to the fibers of the package to prevent relative movement and abrasion of the fibers. In addition, the tacky material or adhesive forms at least a partial vapor barrier, which retards or eliminates vapor transfer to and from the package. By causing end caps or covers to be adhered to each end of the package, a container is provided which totally incases the package of fibers, and which does not allow shifting and abrasion of the
fibers relative to the container. Adhesive may be used to seal the caps relative to the sheet material. In some instances, separate caps may be provided with tapered side walls which can be wedged and sealed against the sheet material forming the outer surface of the container.

While the invention is shown in the drawings as used with a cylindrically shaped package of coiled glass fibers, it will be understood that it is not so limited. Some types of coiled packages of glass fibers have an outer surface whose diameter is greatest midway between the ends of the package and which is tapered or feathered inwardly towards each end of the package. It will be understood that the principles of the present invention are applicable to this type of surface and that the term generally cylindrically shaped surface as used herein is meant to include this type of feathered configuration. The invention is also applicable to an inside cylindrical surface of a tubular package.

The package 10 of glass fibers shown in FIG. 1 has generally parallel inner and outer cylindrical surfaces and generally flat annular end surfaces that are at right angles to the inner and outer surfaces. The package 10 shown in the drawing does not contain a cylindrical form on its inner cylindrical surface. A strip of sheet material 12 is wrapped around the outside cylindrical surface of the package 10 with one end of the strip material 12 overlapping the other end, and with the nonoverlapping portion of the strip material in tight engagement with the outer surface of the package 10. The strip material 12 may be held in tight engagement with the package 10 by some suitable means, and as shown in the drawing, is held in position by a strip of adhesive tape 14. A layer of adhesive or tacky material 16 is caused to be interposed between the structural portion of the sheet material 12 and the package 10 to adhere the outer layer of coils of the package 10 to the structural portion of the sheet material 12. This may be accomplished by applying the layer of adhesive or tacky material to the surface of the package, or may, as in the preferred embodiment shown in the drawing, be a coating on the strip of sheet material 12. The layer 16 when applied to the surface of the strip material 12, automatically adheres to the coils when the strip material 12 is wrapped around and/or pressed against the surface of the package. By adhering the sheet material directly to the outer surface of the package 10, relative movement between the fibers of the package and the sheet material is prevented, as is abrasion of the fibers which otherwise might result. In addition, the layer of adhesive acts as a seal or vapor barrier which greatly reduces transfer of moisture into the package or from the package 10 to the atmosphere.

In the embodiment shown in FIGS. 1-5, caps or covers 18 are slipped over the opposite ends of the package with their side wall portions 20 overlapping the sheet material 12 to cooperate with the sheet material 12 to form an enclosure or container 22. As shown in the drawing, the side wall portions 20 are slightly tapered so that they can be wedged against the sheet material 12 to effect a seal therewith and thereby accommodate packages 10 of slightly different outside diameter. The side wall portions 20 may also contain a layer 24 of adhesive or tacky material to aid in forming a seal with respect to the sheet material 12. The layers of adhesive 16 and 24 shown in the drawing, are obtained by applying a 5.5 percent solution of polyester resin mix in acetone to the surface of the sheet material and caps. The solution can be applied to the sheet material by any suitable means as for example a roller, or spray, etc., and it has been found that a roller is quite satisfactory. Any type of sheet material that can be suitably supported or which is self-supporting can be used, and is preferably one which does not appreciably absorb the adhesive. In the embodiment shown in the drawing, the sheet material 12 is made from a polyethylene-coated cardboard having a total thickness of approximately 20 mils. The polyester resin used was a saturated polyester resin made by reacting one mol of phthalic anhydride, one mol of succinic anhydride and 2.3 mols of propylene glycol to an acid number of approximately 30.

The viscosity of saturated polyester resin changes appreciably with temperature, so that at a temperature of 60°F it may have a viscosity of 5,000 poises, and at 120°F it may have a viscosity of approximately 700 poises. Inasmuch as the fibers will need to be removed from packages at temperatures throughout this range, depending upon weather conditions, the polyester resin preferably includes a viscosity stabilizer, which in the preferred embodiment shown in the drawings is a thixotropic gelling agent. In the preferred embodiment shown in the drawings, the polyester resin mix comprises 5 percent of the polyester resin given above and 0.5 percent of Cabosil (a trademark of the Cabot Corporation for anhydrous and particulate colloidal silica). Alternatively, any suitable thixotropic gelling agent can be used, as for example Thixolin R (a high melting ether of castor oil (Ca 85°C) sold by the Baker Castor Oil Company), refined attapulgite (3MgO·5Al2O3·8SiO2·9H2O), polyacrylamides, etc. The gelling agents will preferably be used in amounts between approximately 2 percent to 15 percent based on the adhesive solids, and most preferably is between 5 and approximately 10 percent. It will further be understood that still other adhesives can be used, as for example dilute contact adhesives, other synthetic resins, natural and/or synthetic gums, etc. which are sufficiently diluted with nonvolatile oils and/or diluents, as for example white oils, etc. to give a viscosity within the above referred to range.

In the embodiment of the invention shown in FIGS. 6 and 7, a tight protective wrapping 30 is formed by a plastic sheet heat shrunk around the package of coiled fibers with an adhesive 16 between the plastic and the exposed outer coils of the package. As previously explained, any suitable adhesive can be used, but the preferred adhesive is the saturated polyester thickened with a thixotropic gelling agent, given above. Saturated polyester is a preferred adhesive since any of the polyester remaining on the fibers is miscible with substantially any resin with which the fibers may later be used. The adhesive 16 can either be applied to the outer surface of the coiled glass fiber package 10, or can be applied to the inner surface of the plastic before it is shrunk into position. In the preferred embodiment shown in the drawings, the polyester is applied to the outer surface of the coiled glass fibers. The package of coiled glass fibers is first sprayed with the adhesive and the bag is then slipped upward over a suspended
package 10. Alternatively the adhesive solution may be applied to the inner surface of the bag and dried before the bag is slipped onto the package. The bag is heat shrunk onto the package by exposure to a temperature of approximately 350°F for ten seconds in a suitable oven. Any suitable heat shrinkable plastic material can be used that has what is called "memory". Plastic materials having "memory" are made by stretching thermoplastic materials that have previously set and which has strained molecules which will return to their set condition when the strain is released by heating. These materials will include heat shrinkable polyethylene, polypropylene, polybutylene, polyvinyl chloride, polyvinylidene chloride, polystyrene, polycarbonates, linear polyester, polyamides, as well as other thermoplastic materials made to have "memory." After heat shrinking onto the package of glass fibers, the plastic sheet takes on a corrugated configuration corresponding to that of the coils of the package and so becomes stiffened to a degree wherein it is self supporting.

The protective wrapping 30 extends across the full width of the bottom of the package 10, but is open at the top of the package 10. Preferably the open end of the bag is folded over the end of the package of coils of glass fibers and is caused to have its edge positioned inwardly of the inner cylindrical surface of the coils of glass fibers prior to heat shrinking. This causes the sheet material to be drawn into position to protect both ends of the package and at the same time provides corrugations to the lip 32 which prevents the strand from whipping around during its removal from the inner cylindrical surface. The lip 32 also provides an inward component to the strand causing it to be lifted away from the fibers, rather than cause the strand to rub against the inner cylindrical surface of the package as it is being removed from the package. These corrugations in the lip have still further advantages in that they do not only stiffen the lip, but also give a rounded edge over which the fibers are drawn.

Alternatively, the sheet material 30 shown in FIGS. 6 and 7 can be produced in situ by coating the exterior surface of the package 10 with a polymeric material that is either elastomeric or resinous. This may be done by dipping the package into a solution of the polymeric material and thereafter drying to remove the solvent, or it may be dipped into a hot thermoplastic material that is cooled to produce the solid sheet material. In still other instances, the polymeric material may be sprayed, brushed, roller coated on, or otherwise applied to the surface of the package 10 either in the form of a molten material or as a solution, and the polymeric material caused to set up in a thin layer of protective sheet material. It will be understood that a coating of adhesive 16 is interpositioned between the sheet material 30 and the fibers of the package 10. It will further be understood that the sheet material 30 that is formed in situ or is heat shrunk into position can be very thin since it takes on the irregular or corrugated configuration of the surface of the coils, and this configuration stiffens a sheet material that would be otherwise nonself supporting.

While the invention has been described in considerable detail, I do not wish to be limited to the particular embodiments shown and described, and it is my intention to cover hereby all novel adaptations, modifications, and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

I claim:
1. A package of glass fibers comprising: a strand of glass fibers coiled in layers into a generally tubularly shaped package having a generally cylindrically shaped outer surface, sheet material extending around said cylindrically shaped surface of said package, and a high viscosity liquid having a viscosity between approximately 700 and approximately 5,000 poises penetrating the space between fibers of the coils of the strand forming at least the outermost layer of coils of the package, said high viscosity liquid extending between said fibers and said sheet material to provide greater resistance to flow in the space between said fibers than in the space between said strand and said sheet material, and whereby the layers of glass fibers can be removed without the coils slumping together.
2. The package of claim 1 wherein the high viscosity liquid includes a viscosity stabilizer.
3. The package of claim 2 wherein the high viscosity liquid is a saturated polyester resin.