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[54] **PROCESS FOR HOT BALING ACRYLIC STAPLE**

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[52] **U.S. Cl.** **100/38,** 53/23, 53/24, 53/25, 100/39, 100/92, 100/97

[51] **Int. Cl.** **B30b 9/30,** B30b 15/30

[58] **Field of Search** ..... 100/38, 39, 92, 97; 206/83.5; 19/.56, .58; 34/23, 162; 53/23, 24, 25

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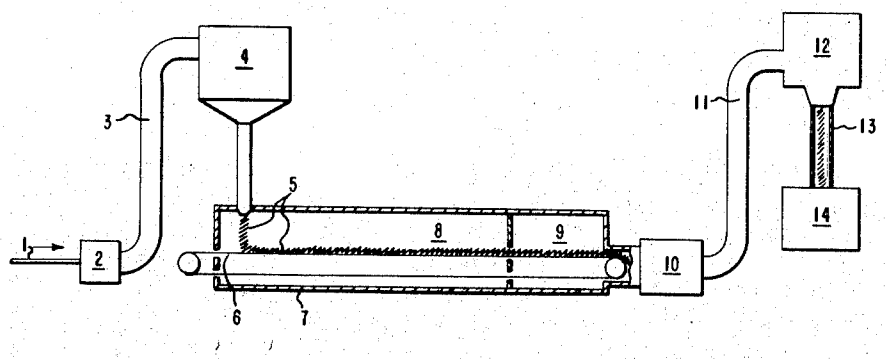
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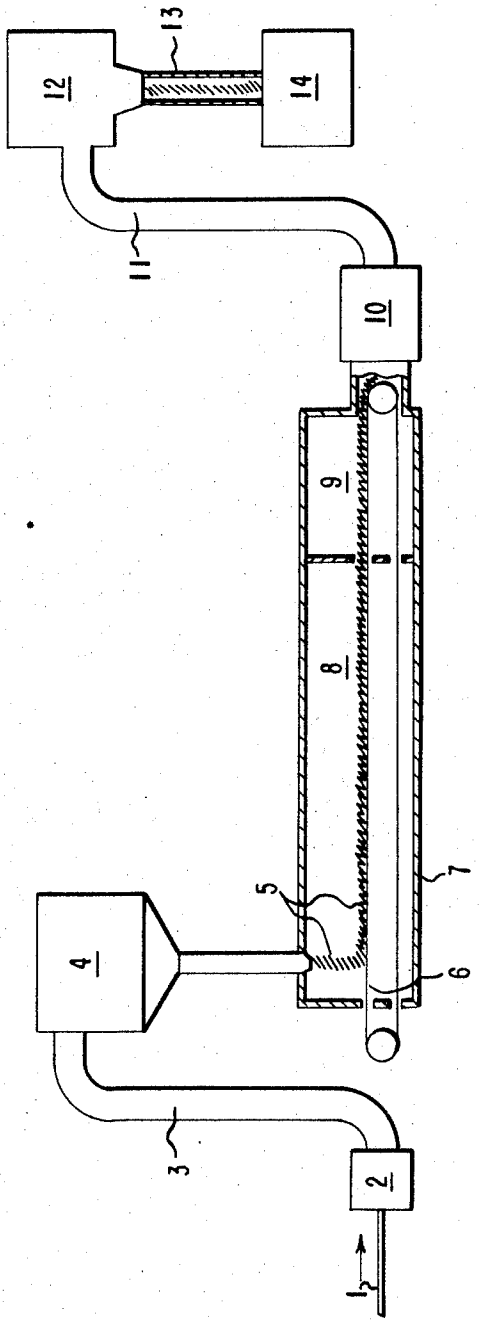
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[57] **ABSTRACT**

An improvement in the process of preparing bales of dry-cut acrylic staple fibers from dried multifilament acrylic tow. The improvement comprises heating the cut fibers to a temperature of 45°–100°C. with heated air after they are cut but just prior to entry into the baler. Such heating provides a bale having a density greater than if the fibers had not been so heated. Thus, more staple fibers can be packed into a bale using this improvement.

6 Claims, 1 Drawing Figure





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PROCESS FOR HOT BALING ACRYLIC STAPLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a process for baling acrylic staple fiber. More particularly, the invention relates to a process for increasing the bale density of dry-cut acrylic staple fibers.

2. Description of the Prior Art

In the manufacture of acrylic staple fibers, the multifilament acrylic tow, from which the staple fibers are prepared, is normally spun and drawn by a process which results in the tow being wet at the conclusion of the drawing step, and the tow is usually also crimped while wet. The tow may subsequently be cut to staple fibers while still wet, or it may be dried and then cut. In commercial practice dry cutting of the tow is usually preferred, since the dried tow may be stored and cut to the exact staple lengths desired, in accordance with commercial demand. Also, the dried tows are readily blended to achieve special effects or to even out differences in fiber properties. The storage life of wet tows is too limited to permit this flexibility.

Acrylic staple fiber cut from dried tows is usually rather fluffy or open, as contrasted with the tendency of acrylic staple fibers cut from wet tows to be in the form of dense clumps or chips. The openness of the staple fiber cut from dried tows is considered desirable from the viewpoint of processing the fiber to yarn in a textile mill, and the yarn produced from the dry-cut fiber is usually more free of neps and other yarn defects. However, in baling the dry-cut staple fibers for shipment to the mill, the openness of the fibers leads to bulky bales of low density, which results in high shipping costs. Accordingly, a method for packing dry-cut acrylic staple fibers in bales of higher density has been greatly desired.

SUMMARY OF THE INVENTION

In the process of preparing bales of dry-cut acrylic staple fibers from dried multifilament acrylic tow, which process comprises the steps of cutting a dry multi-filament acrylic tow into staple fibers, conveying the staple fibers to the bale chamber of a staple fiber baler, compressing the staple fibers into a bale and packaging the resulting bale, the improvement which comprises heating the cut fibers to a temperature between about 45°C. and about 100°C. with heated air immediately prior to entry of the fibers into the bale chamber.

As compared with bales packed by the conventional process at room temperature under the same compression, bales packed in accordance with the process of the invention have a density 20 percent greater, or more.

In a preferred embodiment, the fibers are fed to the baler by a pneumatic conveying duct by a current of heated air. The staple fibers and the air used to convey them may be heated together, or the air may be preheated and employed as the medium to heat the fibers as well as to convey them.

In a highly preferred embodiment of the invention, the fibers are heated to a temperature in the range of 45°–75°C., measured at the baler prior to the compression of the staple into a bale.

DESCRIPTION OF THE DRAWING

The FIGURE is a schematic drawing of a typical operation of cutting tow to staple fibers, heating and conveying the staple fibers to a baler, and baling the staple fibers, in accordance with the invention.

DETAILED DESCRIPTION OF THE INVENTION

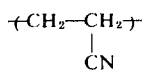
In the FIGURE, multifilament acrylic tow **1** is fed to a cutter **2**, such as a conventional Beria cutter. The fibers are then conveyed pneumatically through a duct **3** into a condenser **4**, such as a cyclone separator equipped with a fan (not shown) to create a vacuum, which induces the flow of the current of air through the duct. The dry staple fibers **5** are discharged onto a driven perforated conveyor belt **6** in an elongated housing **7**, within which heated air is circulated. In the FIGURE, the housing is shown divided into zones **8** and **9**, so that the temperature of the circulating air in each zone may be adjusted for optimum control of fiber heat by heating means not shown. The heated staple fibers, surrounded by heated air, are discharged into fiber opener **10**, such as a rotating drum with teeth. From the end of the fiber opener, hot staple fibers surrounded by heated air are discharged into a pneumatic conveying duct **11**, through which the fibers are delivered into fiber condenser **12**. The fiber condenser is preferably a turning perforated drum so arranged that a fan (not shown) creates a vacuum within the drum which induces the flow of heated air through the pneumatic conveying duct into the condenser. The fibers are discharged by gravity through a chute **13** into the baler **14**. For the purposes of the present invention, the temperature of the fibers is conveniently measured within the fiber condenser **12**.

In actual practice in accordance with the invention, the operation of cutting the dry acrylic tow to dry acrylic staple fibers is carried out in conventional manner. The operation of baling the staple fibers is also carried out upon conventional baling equipment in the conventional steps of delivering the fiber to the bale chamber, compressing the staple fibers into a compact bale under the normal compacting pressure, and packaging the resulting bale in a suitable enclosure, such as corrugated paperboard box, flexible sheets of plastic film, or sheets of spunbonded polypropylene or other spunbonded synthetic fiber. The boxed or wrapped bale is strapped with steel bands, as usual. In accordance with the present improvement, however, the staple fibers are heated after they are cut and are hot when they are delivered to the bale chamber, rather than being at normal room temperature. When delivered to the bale chamber, the staple fibers are at a temperature of 45°–100°C., preferably 45°–75°C. Baling may be carried out at pressures of between 30 and 200 psi. By employing the process of the invention, bales having a density at least 20 percent greater than the density of bales packed in the same way at normal room temperature are readily obtained.

The staple fibers may be heated by any convenient means. If desired, they may be heated in a conventional staple fiber dryer, used in this instance as a heating means rather than as a dryer, since the fibers are already in the dry condition when cut. In the simplest form of the invention, the staple fibers are conveyed from the staple cutter or fiber opener to the baler by means of a pneumatic conveying duct, using air heated to a suitable temperature to heat the fibers to the desired temperature en route.

Ordinarily, atmospheric air is simply heated for use although, if desired, the air can be dried prior to use. Excessively moist air, or steam should be avoided.

As used herein, the term "acrylic" includes any long chain synthetic polymer composed of acrylonitrile units of the formula



in the polymer chain. As is well understood, the term includes the homopolymer of acrylonitrile (i.e., polyacrylonitrile) and copolymers of acrylonitrile and one or more suitable monoethylenically unsaturated monomers copolymerizable with acrylonitrile. Among the typical addition monomers exemplary of those which are copolymerizable with polyacrylonitrile are methyl acrylate, methyl methacrylate, vinyl acetate, styrene, methacrylamide, methacrylonitrile, vinyl chloride, vinylidene chloride, methyl vinyl ketone and the like as well as any of the available vinyl pyridines. The preferred comonomers include methyl acrylate, vinyl acetate, styrene and the vinyl pyridines. Sulfonate comonomers can also be employed, e.g., the sulfonated styrenes, vinyl sulfonate, allyl sulfonate, methallyl sulfonate and their alkali-metal or alkaline-earth-metal salts, and the like; it being necessary only that the compound chosen from this class be copolymerizable with acrylonitrile to the desired extent. The preferred sulfonate comonomers are the sulfonated styrenes.

The comonomers may comprise up to 65 percent by weight of the copolymer but preferably do not comprise more than 15 percent by weight.

The acrylic staple fibers employed in this invention may have any desired cut length, e.g., from about 1 inch or less to about 10 inches or more. Similarly, the denier per filament of the fibers may be any desired number, e.g., from about 1 d.p.f. or less to about 10 d.p.f. or more. The fibers may also be crimped; the crimp level may be at any desired level, e.g., from about 5 to 30 crimps/inch. The fibers may also be acrylic homofibers (single component) or acrylic bicomponent fibers.

The invention is further illustrated by the following example, however, the invention is not intended to be limited thereby.

EXAMPLE

A crimped, dry, 6 d.p.f. multifilament tow of a bicomponent acrylic fiber is cut to staple fibers having a cut length of 3½ inches on a Beria cutter (rotary cutter). The bicomponent staple fibers are comprised of two polymeric components, one side being derived entirely from polyacrylonitrile and the other side from a copolymer of 96.2 percent by weight acrylonitrile and 3.8 percent sodium styrenesulfonate. The dry staple fibers are conveyed through a duct into a cyclone separator (Quickdraft condenser, manufactured by Quickdraft Corp., Canton, Ohio), the air current in the duct being induced by a fan in the cyclone separator, creating a vacuum on the air discharge side of the separator. The fibers are discharged from the cyclone separator and flow by gravity onto the conveyor belt of a conventional staple dryer, used in this instance as a heating means to heat the fibers. Air at 100°C. is recirculated within the first section of the dryer, but the entrance and exhaust fan normally employed when the dryer is used to remove moisture are turned off. Hot staple fibers, surrounded by hot air, are delivered into the second section of the dryer and then from the end of the conveyor belt into a fiber opener equipped with a rotating drum upon which teeth are mounted to open the fibers (Davis-Ferber fiber opener). From the fiber opener, the hot fibers are conveyed through a duct into a fiber condenser (Procter and Schwartz fiber condenser) equipped with a perforated turning drum. A fan mounted above the fiber condenser draws a current of hot air from the fiber opener through the duct, conveying the fibers. The fibers are discharged by gravity into a conventional baler (Beaty Baler). The temperature of the fibers in the baler just after their entry is 48°C. Baling pressure is 43 psi. The fibers are baled into a bale having a weight of 428 pounds and a bale density of 12.3 lbs./ft.^{3}.

In a control test, the fibers are processed through the same equipment, but at normal room temperature. The bale weight in this instance is 385 pounds, and the bale density is only 10.5 lbs./ft.^{3}.

The foregoing detailed description has been given for clearness of understanding only and no unncessary limitations are to be understood therefrom. The invention is not limited to the exact details shown and described for obvious modifications will occur to those skilled in the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In the process of preparing bales of dry-cut arcylic staple fibers from dried multifilament acrylic tow, which process comprises the steps of cutting a dry multi-filament acrylic tow into staple fibers, conveying the staple fibers to the bale chamber of a staple fiber baler, compressing the staple fibers into a bale and packaging the resulting bale, the improvement which comprises heating the cut fibers to a temperature between about 45°C. and about 100°C. with heated air immediately prior to entry of the fibers into the bale chamber.

2. The process of claim **1** wherein the cut fibers are heated to a temperature between about 45°C. and 75°C. immediately prior to entry of the fibers into the bale chamber.

3. The process of claim **2** wherein the acrylic fiber contains at least 85 percent by weight of units derived from acrylonitrile.

4. The process of claim **1** wherein the acrylic fiber contains at least 85 percent by weight of units derived from acrylonitrile.

5. The process of claim **1** wherein the acrylic fiber is a bicomponent fiber.

6. The process of claim **1** wherein the acrylic fiber is a homofiber.

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