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[54] **PACKAGING MATERIAL AND PACKAGE; USEFUL IN PACKAGING ORIENTED PLASTIC STRAPPING**
3 Claims, 1 Drawing Fig.

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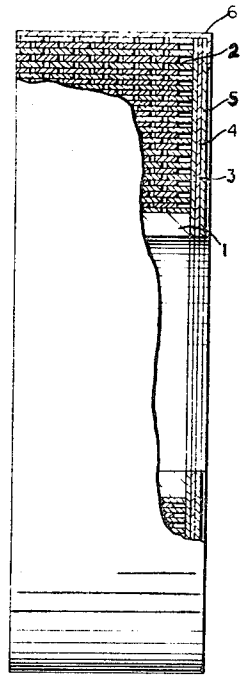
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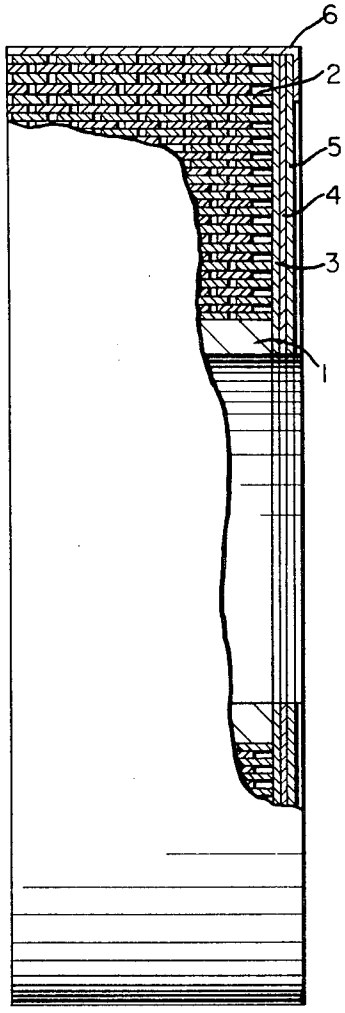
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ABSTRACT: A packaging material consisting essentially of a layer of plasticized polyvinyl butyral resin next to a layer of aluminum foil which is next to a layer of material selected from the class consisting of cellulosic material and polymeric material, and a moisture impregnable and compression fixable package which utilizes the packaging material and is useful in packaging polyamide strapping, leaving no residue on the strapping after the strapping is unreeled.



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PACKAGING MATERIAL AND PACKAGE; USEFUL IN PACKAGING ORIENTED PLASTIC STRAPPING

This invention relates to an improved packaging material. Particularly, this invention relates to a packaging material which is compression fixable without leaving residue after its removal and moisture impregnable. More particularly, this invention relates to a package comprising the improved packaging materials. Even more particularly, this invention relates to a process for packaging polyamide strapping in a package comprising the improved packaging materials. Yet even more particularly, this invention relates to a package comprising the improved packaging material and containing polyamide strapping.

There are many packaging materials known. However, a packaging material which combines the qualities of being compression fixable without leaving residue on the article protected after its removal and of being moisture impregnable has been sought, particularly in the packaging of polyamide strapping where polyethylene foam donut flanges have been attached via four tie straps to the sides of the strapping coils to prevent moisture from contacting the sides of said coils.

A material with the above sought-after properties has been found. It is a packaging material consisting essentially of three layers: a layer of plasticized polyvinyl butyral resin to which there is an immediately adjacent layer of aluminum foil and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the layer of aluminum foil.

Consisting essentially of, as used throughout, means not excluding materials or conditions which do not prevent the advantages of the invention from being realized. That is, the packaging material can have further layers of other materials attached to the layer of cellulosic or polymeric material and still be within the scope of the invention.

As stated above, a material such as the above material has been particularly sought after for use in packaging polyamide strapping. A major problem with the use of polyamide strapping is camber or curvature in the strapping. If the camber is excessive, the use of the strapping in automatic packaging machinery is rendered difficult. To be usable the strapping should have a camber of less than 4 inches in 8 feet.

Some camber is inherent in the strapping due to the processing steps and is termed "in-line." It is usually maintained below 1 inch per 8 feet. This is accomplished through the use of a relaxer which is a device used in the processing of the strapping after the final rolling stage. It allows the tension of the strap to be dropped to a low value while maintaining the strap at an elevated temperature. Suitable relaxers are heated puller rolls, oil baths, convective air baths, or infrared heater. The peak temperature in the relaxer usually varies from 135° C. to 225° C., while the strap usually comes out of the relaxer at a tension of 250 to 1200 p.s.i. The contact time in the relaxer varies from 1 to 12 seconds if the strapping is initially cold or from 0.2 to 12 seconds if it is initially hot.

Additional camber stems from the helical pattern of the wind on the final package. However, the camber produced via winding is kept below the maximum through the use of winding tensions which vary from 0 to 600 p.s.i. and winding temperatures which vary from 40° to 90° C. The strap is laid down on the package with high precision through the use of a print roll so that the surface of the package is flat within 2°.

"Growth camber" or camber which occurs during storage and which can exceed the maximum specification of 4 inches in 8 feet by several fold if uncontrolled, results from the polyamide strapping desorbing or absorbing moisture, depending on the moisture content of the polyamide strapping relative to the equilibrium content at the relative humidity of the surrounding atmosphere. This absorption or desorption of moisture by the strapping while it is attempting to reach equilibrium causes dimensional changes in the strapping with the most significant change being alteration in length. The nature of the wound coil of strapping allows a differential moisture profile to be developed in the strapping in the transverse direction as moisture diffuses into or out of the edges of the coil. The differential moisture leads to differential length, which, in turn, results in camber.

"Growth camber" is lessened if the strapping is to be stored at average environmental conditions, i.e., 50 percent relative humidity, by moisturizing the strapping prior to winding. This is accomplished by continuously dripping a metered quantity of water on a roll whose surface contacts the moving strapping just prior to the print roll at the winding operation. The water is transferred to the strapping surface and is carried into the coil. The water flow is controlled such that the moisture content of the moisturized strapping is about 2 percent by weight. The moisture continuously diffuses throughout the strapping and after approximately 1 month, the strapping has reached a relatively uniform moisture content level. The 2 percent water addition increases the moisture content in the strapping such that it is in the range of the equilibrium content at average environmental conditions, i.e., 50 percent relative humidity. Moisturizing also prevents longitudinal splitting of the strapping.

It was felt that "growth camber" could be lessened further if the sides of the strapping coil could be covered with a moisture-impregnable packaging material such that moisture would not be absorbed by the edges of the strapping if the strapping was at a lower moisture content than equilibrium relative to environmental conditions or desorbed if the strapping was at a higher moisture content than equilibrium relative to environmental conditions. It was also desired that the packaging material be compression fixable without leaving residue on the article protected after its removal, and preferably be structurally self-supporting such that the protection for the sides of the coil would be present even when the coil was in the automatic packaging machines.

A package has been discovered which utilizes a packaging material that fulfills the above requirements. It is a package consisting of an inner cardboard core with a side structure on each end of the core and a layer of polymeric film around the periphery, between, and overlapping the side structures; each of the side structures consisting essentially of a three-layer material which consists of a layer of plasticized polyvinyl butyral resin to which there is an immediately adjacent layer of aluminum foil and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the layer of aluminum foil, the side structures being oriented on the cardboard core such that the plasticized polyvinyl butyral resin layers of the side structures face each other.

The FIGURE is a cross-sectional view of the package. The cardboard core 1 is wound with the matter 2 that is to be protected. The side structures consist of a layer of plasticized polyvinyl butyral resin 3 next to the wound matter 2, a layer of aluminum foil 4 next to the layer of plasticized polyvinyl butyral resin 3, and a layer of cellulosic or polymeric material 5 next to the layer of aluminum foil 4. The polymeric film 6 covers the periphery, is between and overlaps the side structures.

The process for packaging the polyamide strapping comprises: (A) winding said strapping on a cardboard core; (B) compressing a side structure consisting essentially of a layer of plasticized polyvinyl butyral resin to which there is an immediately adjacent layer of aluminum foil and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the layer of aluminum foil on each side of the strapping such that the plasticized polyvinyl butyral resin is immediately adjacent to the strapping and such that the side structures are located at the ends of the cardboard core; and (C) covering the periphery of the strapping with polymeric film such that the film is between and overlapping the side structures.

The package when it contains the polyamide strapping comprises a coil of polyamide strapping wound on a cardboard

core with a side structure on each side of the coil. thus, the side structures are located on the ends of the core, and a layer of polymeric film around the periphery of the coil, extending between and overlapping the side structures; the side structures consisting essentially of a layer of plasticized polyvinyl butyral resin which is immediately adjacent to the strapping, a layer of aluminum foil which is immediately adjacent to the layer of plasticized polyvinyl butyral resin and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the aluminum foil.

The overlapping polymeric film is added to maintain surface stability (keep the strapping from unwinding) and package cleanliness. It may be polyethylene or various other well-known polymeric films which are preferably heat shrinkable.

The thicknesses of the various layers in the packaging material and thickness of the polymeric film are not critical and can vary around 30 mil for the plasticized polyvinyl butyral resin, 1 mil for the aluminum foil, and 10 mil for the polymeric film overwrap. The cellulosic or polymeric material of the layer next to the aluminum foil layer of the packaging material is selected from the class consisting of cardboard, Masonite, pressboard, chipboard, kraft paper, polyethylene foam, polyethylene film and polyurethane foam. The thickness of the cellulosic or polymeric material layer usually varies from about 10 mils to about five-sixteenths inch with one-sixteenths inch to five-thirty seconds inch being the preferred range.

The plasticized polyvinyl butyral layer of the packaging material can be made from any plasticized polyvinyl butyral resin; for example, the resin disclosed in U.S. Pat. No. 2,345,946 to Overbaugh, dated Apr. 4, 1944 in U.S. Pat. No. 2,442,754 issued to Stamatoff on June 24, 1947; and in U.S. Pat. No. 2,946,711 issued to Bragaw et al. on July 26, 1960. Typically, the plasticized polyvinyl butyral resin has a hydroxyl content of 17 to 25 percent, expressed as weight percent of vinyl alcohol in unplasticized polyvinyl butyral and contains a plasticizer in the amount of 20 to 50 parts per 100 parts by weight of the polyvinyl butyral. Preferably, the hydroxyl content is 20 to 24 percent, and the amount of plasticizer is 41 to 48 parts. Typical suitable plasticizers are triethylene glycol di(2-ethylbutyrate); dibutyl sebacate; dibutyl "Cellosolve" adipate and triethylene glycol di(2-ethylhexoate).

The package usually has an outside diameter of 24 inches and is 6 inches thick, although this is not critical. The cardboard core is usually 16 inches in diameter with the thickness of the cardboard being five-sixteenths inch, although neither is critical.

The process variables for the compression fixing of the side structures made of packaging material on the sides of the strapping coil are not critical. The temperature of the hydraulic press used in the compression fixing can vary from about 120° C. to about 130° C., the pressure can vary around 10 p.s.i.g. and the dwell time can vary from about 15 seconds to about 60 seconds. The compression fixing of the side structures bonds the layers of the side structures together as well as attaching them to the strapping coil.

The package is useful in packaging various types of polyamide strapping such as polyhexamethylene adipamide.

The following examples illustrate but do not limit the invention. All percentages are by weight unless otherwise specified.

EXAMPLE I

Several 24-inch outside diameter ×16-inch inside diameter ×6-inch wide coils of 17 mils thick and seven-sixteenths inch wide polyhexamethylene adipamide strapping were equipped with side structures made of a three-layer material consisting of a layer of 30 mil plasticized polyvinyl butyral resin with an immediately adjacent layer of 1 mil aluminum foil and a layer of kraft paper immediately adjacent to the layer of aluminum foil. The layer of plasticized polyvinyl butyral had an hydroxyl content of 22.5 to 23.5 percent, expressed as weight percent of vinyl alcohol in unplasticized polyvinyl butyral, and contained 43 to 47.5 parts of triethylene glycol di(2-ethylbutyrate) per 100 parts by weight of polyvinyl butyral. The side structures were attached such that the plasticized polyvinyl butyral resin face was next to the strapping. The side structures were attached via heated compression by a hydraulic press at 130° C., 10 p.s.i.g. pressure, and 15 seconds dwell time. The periphery of the coils were not covered with the polymeric film, for with the film present it would have not been possible to check the camber.

The side structure bearing coils plus control coils (without side structures but which were packaged in cardboard boxes) were then placed in an environmental room maintained at average conditions of 80° F., 80 percent relative humidity and periodically checked for camber and moisture content. All camber and percent moisture data recorded in the following table were measured 1 inch below the circumferential surface of the coil. As can be seen, the coils with side structures all had camber well below the maximum allowable level of 4 inches in 8 feet while the control coils packaged only in a cardboard box exceeded this 4 inch in 8 feet maximum allowable camber level. Further, no residue was evident on the strapping after unreeling.

COILS WITH SIDE STRUCTURES

	Storage time, weeks	Max. camber in./8 ft.	Max. percent H_2O at edge
Coil No.:			
1	1	1¾	0.29
1	4	¼	0.36
2	2	¾	0.25
2	12	1	0.71
3	12	2½	0.83
4	12	1	0.71
CONTROL—NO SIDE STRUCTURES (IN CARDBOARD BOX ONLY)			
1	1	8½	2.01
1	4	9	2.76
1	2	7	2.73
1	12	5	2.76

Maximum Camber Specification—4 inches/8 feet.
Moisture Content at winding—0.20 percent.

EXAMPLE II

Three coils, each with an outside diameter of 24 inches, an inside diameter of 16 inches, and a width of 6 inches containing polyhexamethylene adipamide strapping (17 mils thick and seven-sixteenths inch wide) were equipped with side structures made of the same material as those in Example I. The side structures were attached to the coils via heated compression by a hydraulic press at 120° C., 10 p.s.i.g. pressure and 30 seconds dwell time. These coils, along with control coils which were without side structures but which were contained in cardboard boxes, were placed in an environmental room under the same conditions as the room in Example I. All camber and percent moisture data in the following table were measured 1 inch below the circumferential surface of the coil. As can be seen, the coils with side structures had camber below the maximum allowable of 4 inches/8 feet, while the control coils packaged in cardboard boxes only exceeded the 4 inch/8 feet maximum allowable camber le level. No residue was evident on the strapping after unreeling.

COILS WITH SIDE STRUCTURES

	Storage time, weeks	Max. camber in./8 ft.	Max. percent H_2O at edge
Coil No.:			
1	1	2½	1.80
2	3	3	1.87
3	6	3	1.82
3	12	3½	1.91
CONTROL—NO SIDE STRUCTURES (IN CARDBOARD BOX ONLY)			
1	1	5½	2.33
2*	3	7	2.42
3	6		
3	12	14	2.80

*Control coil 2 moisture content at winding = 0.20%.
NOTE: Maximum camber specification = 4 inches/8 feet; Moisture content at winding of all coils except control coil 2 = 1.5 percent.

I claim:

1. A package consisting of an inner cardboard core with a side structure on each end of the core and a layer of polymeric film around the periphery, between, and overlapping the side structures; each of the side structures consisting essentially of a three-layer material which consists of a layer of plasticized polyvinyl butyral resin to which there is an immediately adjacent layer of aluminum foil and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the layer of aluminum foil, the side structures being oriented on the cardboard core such that the plasticized polyvinyl butyral resin layers of the side structures face each other.

2. A process for packaging polyamide strapping which comprises: (A) winding said strapping on a cardboard core; (B) compressing a side structure consisting essentially of a layer of plasticized polyvinyl butyral resin to which there is an immediately adjacent layer of aluminum foil and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to

the layer of aluminum foil on each side of the strapping such that the plasticized polyvinyl butyral resin is immediately adjacent to the strapping and such that the side structures are located at the ends of the cardboard core; and (C) covering the periphery of the strapping with polymeric film such that the film is between and overlapping the side structures.

3. A package containing polyamide strapping which comprises a coil of polyamide strapping wound on a cardboard core with a side structure on each side of the coil, thus the side structures are located on the ends of the core, and a layer of polymeric film around the periphery of the coil, extending between and overlapping the side structures; the side structures consisting essentially of a layer of plasticized polyvinyl butyral resin which is immediately adjacent to the strapping, a layer of aluminum foil which is immediately adjacent to the layer of plasticized butyral resin and a layer of material selected from the class consisting of cellulosic material and polymeric material, which is immediately adjacent to the aluminum foil.