United States Patent [19]

Watanabe

[11] **3,734,273**

[45] **May 22, 1973**

[54] **HEAT-SHRINKING PACKAGE USING FOAMED PLASTIC SHEET**

[75] Inventor: **Hiroshi Watanabe,** Suzuka, Japan

[73] Assignee: **Asahi-Dow Limited,** Tokyo, Japan

[22] Filed: **Sept. 14, 1970**

[21] Appl. No.: **71,754**

[30] Foreign Application Priority Data

Sept. 24, 1969 Japan 44/75286

[52] **U.S. Cl.**..........**206/46 FC,** 99/171 LP, 206/46 F, 206/59 A

[51] **Int. Cl.**.....**B65d 85/30,** B65d 85/35, B65d 81/14

[58] **Field of Search**........................206/59 A, 46 FC; 99/171 LP

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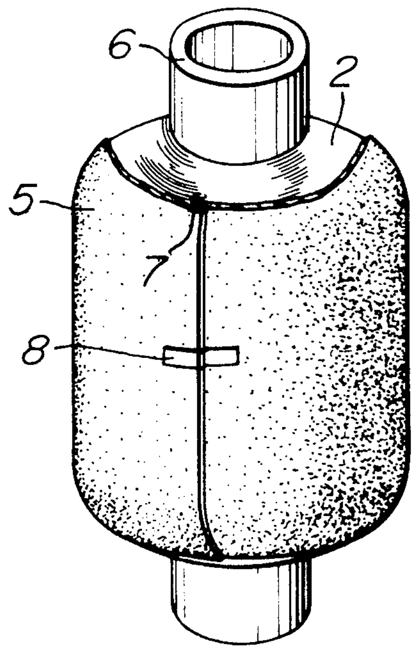
Primary Examiner—Leonard Summer
Attorney—Cushman, Darby & Cushman

[57] **ABSTRACT**

A packaged product of an article, which is liable to be marred on the surface or which is not allowed to form even a slight disorder on the surface, and a process for producing the said packaged product. The packaged product is obtained by use of a relatively soft foamed plastic, which can protect the surface of the packaged article more successfully than in the conventional heat shrinking packaging process using a film or in the conventional packaging process using a foamed plastic without heat-shrinking. The packaging process of the present invention has not only overcome the drawbacks of the said two processes but also provided unexpected effects.

10 Claims, 8 Drawing Figures



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3 Sheets-Sheet 1

FIG. 1

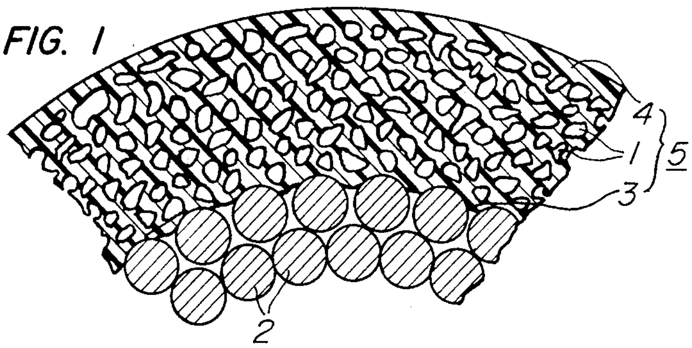


FIG. 2

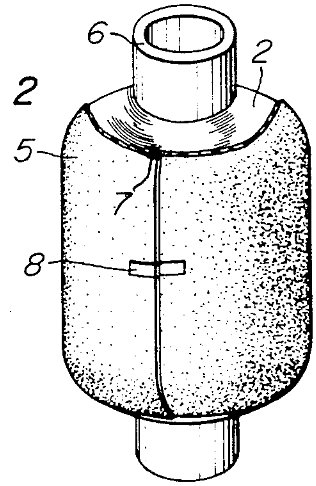
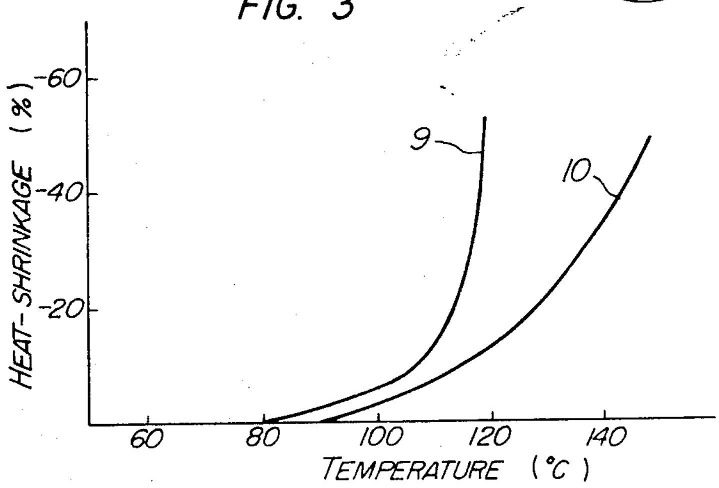


FIG. 3



INVENTOR

Hiroshi Watanabe

BY Cushman, Darby & Cushman
ATTORNEYS

FIG. 4

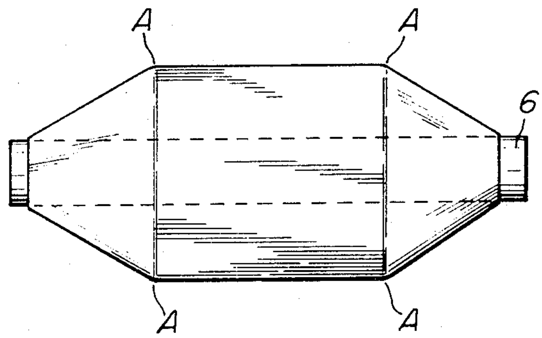
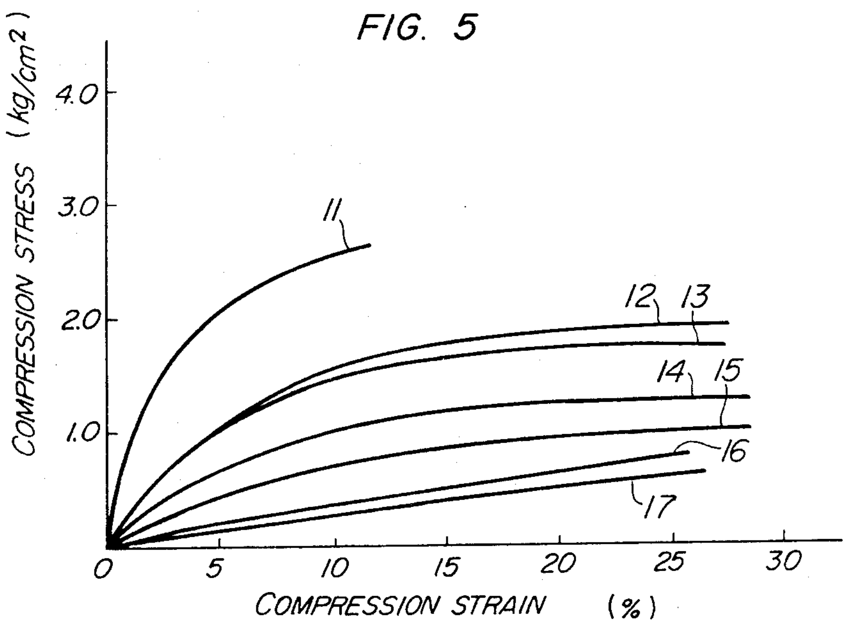


FIG. 5



INVENTOR

Hiroshi Watanabe

BY Cushman, Darby & Cushman

ATTORNEYS

FIG. 6

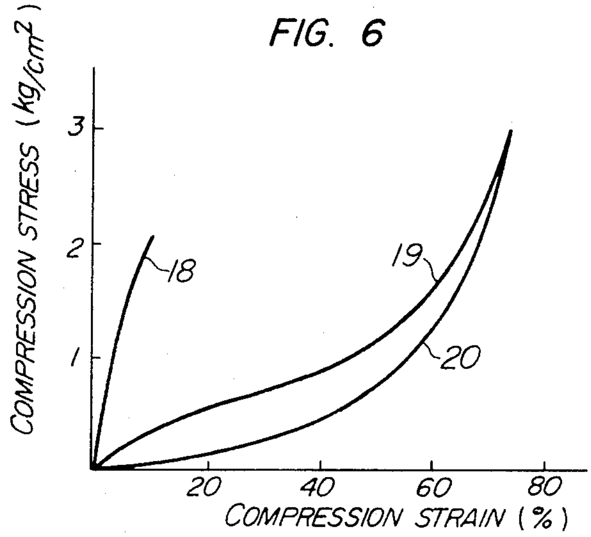


FIG. 7

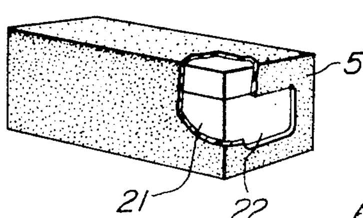
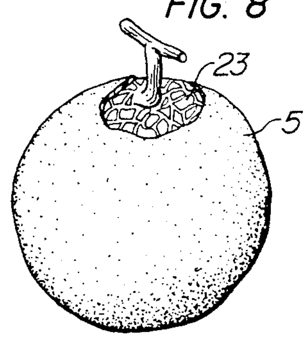


FIG. 8



INVENTOR

Hiroshi Watanabe

BY Cushman, Darby & Cushman

ATTORNEYS

HEAT-SHRINKING PACKAGE USING FOAMED PLASTIC SHEET

This invention relates to the packaging of articles by use of plastics. More particularly, the invention pertains to shrinking-packaging using foamed plastics.

The prior art packaging process using plastic films or sheets has mostly been applied to the cases where articles are required to be stored in a clean state for a long period of time or large members of articles are required to be lumped together. The said process is said to be advantageous since the enhancement in labor productivity can be attained by mechanization. However, there has been proposed a cartoning process in which articles are individually packaged one by one and then several of said articles are lumped together into lots. When this process is taken into consideration together with the subsequent transportation of said articles, the above-mentioned conventional process cannot always be said to be a satisfactory process. This is to say, not only fragile articles but also such articles that even a slight damage on the surfaces thereof brings about a serious loss, e.g., industrial products such as japan, lacquer wares, fiber products wound up into various shapes, damageable fruits and musical instruments, are not allowed to be handled so freely as in the case of ordinary articles. In other words, the protection of surfaces of said articles cannot be accomplished unless there are used packaging forms which required much labor and costs.

As a typical example of such packaging forms, the case of the above-mentioned fiber products will be stated below.

Fiber products, e.g., yarns wound into the form of pirns, are ordinarily transported after packaging them in corrugated cardboard boxes in units of 20 to 30 pieces per box. However, due to vibration during the transportation of said fiber products and to impingement during the loading thereof, the surface yarn layers are disordered or destroyed to bring about, in pre-weaving steps such as warping, beaming and weft spooling which are effected after the transportation, the cutting of filaments in the multifilament yarns, the disorder to yarns due to simultaneous occurrence of local relaxation and contraction of filaments in the multifilament yarns, the formation of fluff, or the cutting of filaments. In such a case, not only much labor and large costs are required for the inspection and removal of such damages but also textiles obtained from such damaged yarns are deprived of commodity values to bring about a great loss.

In order to prevent such damage and loss of the products, the greatest possible care has been taken and a great deal of expense has been required in the packaging of such products. For example, in order that the yarn layers do not contact with the yarn layers of adjacent bobbins, or the yarn layers do not contact with the inner walls of the boxes, there has been adopted a cartoning of such a specific structure that in each corrugated cardboard box, a plate member, which has bosses capable of being inserted in the hollow portions of the bobbins, is placed below the bobbins, and another plate member, which has holes for accommodation of the bobbins, is placed on the bobbins, or there has been adopted such a procedure that foamed articles in the form of flanges which are somewhat greater in diameter than the yarn layer are covered on both ends of the fiber products in the form of cheeses or cones to bring the products into a composite, which is then subjected to shrinking-packaging by use of a heat-shrinkable plastic film.

Generally, foamed plastics as mentioned above have widely been used as packaging materials because of their high impact resistance. The applications of said foams as packaging materials are roughly divided into the following three processes:

1. A process in which granular or fragmentary foams are used as packing materials around an article (U.S. Pat. No. 3,147,321).

2. A process in which unfoamed pellets impregnated with a foaming agent are foamed in a mold having such a shape as to be in conform to the shape of an article to be packed, and then the resulting molded foam is used to pack the article.

3. A process for packaging an article in a corrugated cardboard box or the like external packaging material, wherein cut pieces of a foam are attached to suitable portions inside the packaging material to bring the cut pieces into the form of a construction combined with the external packaging material. (U.S. Pat. No. 3,404,827).

However, such conventional packaging processes using foamed plastics have merely utilized only the buffer properties against impact, and it is clear from the above-mentioned case of the fiber products that there are some cases where no satisfactory packaging can be attained according to the said conventional processes.

On the other hand, shrink packaging processes using various heat-shrinkable plastic films of the vinyl, vinylidene, polypropylene and polyethylene systems, have many advantages such as labor saving due to automatic operation of packaging and improvement in storability of products. According to these processes, however, there are such drawbacks that if articles are shrink packaging with such heat-shrinkable films as mentioned above, no buffer effects against impact can be attained, though the friction between the packaged articles and the shrunk packaging materials can substantially be avoided. For the above reason, the said processes have been obliged to employ, in order to attain the buffer effects, a buffer property-imparting operation which is carried out at the cartoning stage by use of expensive materials and much labor, or to adopt such a procedure that the shrink-packaging is effected by additionally using, in combination with said film, a certain impact-resistance construction.

The present invention provides a novel packaged product and a process for producing said packaged product which have overcome all the above-mentioned drawbacks.

An object of the present invention is to provide novel uses of foamed plastics.

Another object of the invention is to provide a process in which a foamed plastic suitable for application to an article, which is liable to be marred on the surface, is selected by examining the properties thereof under strict conditions, and is used to pack the article with advantages.

A further object of the invention is to provide a packaged product of an expensive article which can be handled more freely than a conventional packaged product.

A still further object of the invention is to provide a packaged product of an article liable to be marred on the surface which can withstand quite unskilled or severe loading conditions.

A further object of the invention is to provide a process in which the packaging of an article having a delicate surface structure, which has heretofore been packaged with much labor, surface be accomplished under such conditions as to be automated.

A further object of the invention is to provide a process in which the packaging of an article, which is required to have such a markedly specific buffer efficiency as not to be attained according to the conventional processes, can be accomplished by use of a material of a commercially advantageous cost.

A further object of the invention is to solve the problems encountered in the packing of a delicate product, which, in spite of requiring transportation for quite a long distance, is now allowed to have even a slight damage or disorder in the surface state thereof after the article has been released from the packaging.

A further object of the invention is to provide a novel and advantageous packaging form of a wound fiber product, as industrial product, a musical instrument or a fruit.

Other objects and advantages of the present invention will become apparent from the following description.

In the first place, the accompanying drawings are explained below.

FIG. **1** is a schematic cross-sectional view showing the state of a foamed plastic which has been brought according to the present process into close contact with the surface of a fiber product.

FIG. **2** is a partially broken perspective view showing a pirn packaged according to the present invention.

FIG. **3** is a graph showing the heat shrinkages of foamed plastic sheets in the present invention.

FIG. **4** is a schematic side view of a pirn according to the warp winding.

FIG. **5** is a graph showing the relation between the compression stress and strain of various foamed plastic sheets.

FIG. **6** is a graph showing the compression stress and strain of foamed polystyrene sheet and foamed polyethylene sheet which have been measured over a wide range of compression strain.

FIG. **7** is a partially broken perspective view showing a music box which has been packaged with a foamed plastic sheet according to the present invention.

FIG. **8** is a perspective view showing a melon which has been packaged with a foamed plastic sheet according to the present invention.

The gist of the present invention resides in (1) a process in which a part or all of the surface of an article to be packaged is wrapped with a soft, elastic, heat-shrinkable foamed plastic sheet, followed by heating to shrink the foamed plastic sheet, and (2) a packaged product obtained according to the said process which has an excellent buffer property for protecting the surface of the packaged article.

The foamed plastic sheet used in the present process is a soft and elastic foamed sheet of a thermoplastic resin, e.g., an aliphatic polyolefin such as low or high density polyethylene, ethylene-vinyl acetate copolymer, a mixture of polyethylene with ethylene-vinyl acetate copolymer or a mixture of polypropylene with polyethylene, or a halogenated polyolefin such as polyvinyl chloride, vinyl chloride-vinylidene chloride copolymer or a chlorinated polyethylene which has been softened by incorporation of a plasticizer. The foamed plastic sheet has preferably been foamed to 10 to 50 times the original volume.

The foamed plastic sheet to be used in the present invention is preferably prepared from ethylene-vinyl acetate copolymer containing up to 20 percent of vinyl acetate, or a mixture of polypropylene or polyethylene with ethylene-vinyl acetate copolymer containing up to 20 percent of vinyl acetate.

That the foamed plastics used in the present invention should be soft and elastic is understood from FIG. **5.** FIG. **5** is a graph showing the compression strain characteristics at 20°C of sheet-like foams (about 2 mm in thickness) of various polymers foamed to 30 times under a pre-compression condition of 2 percent according to the method of ASTM-D-1372. In FIG. **5, 11** is a curve showing the compression strain characteristics with increasing compression stress of a foamed polystyrene, **12** is that of a foamed polypropylene, **13** is that of a foamed high density polyethylene, **14** is that of a foamed high density polyethylene copolymer containing 10 percent of propylene, **15** is that of a foamed low density polyethylene, **16** is that of a foamed plasticized polyvinyl chloride, **17** is that of a foamed sheet comprising a mixture of polyethylene with ethylene-vinyl acetate copolymer. From FIG. **5,** it can be clearly understood that the foamed polystyrene (curve **11**) has specific compression characteristics, that is, six curves other than the curve **11** extend to the right (the rightmost ends of these six curves are not discontinuous, unlike the case of the curve **11,** but have been omitted for convenience), whereas the compression characteristic curve **11** of the foamed polystyrene terminates at a point where the compression stress is 2.6 kg/cm^2 and the compression strain is about 11 percent. This point indicates a point where the foamed polystyrene was so rigid to bring about an unrecoverable strain. Thus, foamed plastic sheets, which are high in stress value required for the strain of unit, are not usable in the present invention. Further, the use of such foams as to form unrecoverable distortion by application of high stress is not preferable. A more concrete explanation of the above-mentioned two points is such that the foamed plastic sheets usable in the present invention should satisfy such conditions that the compression stress bringing about a 10 percent strain should not exceed 2 kg/cm^2 and that no unrecoverable strain should take place by application of a compression stress of about 3 kg/cm^2.

In the next place, the state of compression stress and compression strain, which is to be shown at the right side of FIG. **5** but has not been shown therein, is explained below with reference to FIG. **6.** FIG. **6** shows the state of compression stress and compression strain not only under conditions of increasing compression stress but also under conditions of decreasing compression stress where the compression strain is released. In FIG. **6, 18** is the curve of the aforesaid foamed polystyrene sheet, **19** is a curve showing the state of increasing compression stress when the foamed polyethylene sheet shown in FIG. **5** was compression-distorted to 75 percent, and **20** is a curve showing the relation between compression stress and compression strain in the case where the said sheet, which had been compression-distorted to 75 percent, was gradually released from the compression stress at a rate reverse to the case where the curve **19** was drawn. As is clear from FIG. **6**, the foamed plastics used in the present invention, which are represented by foamed polyethylene and foamed polypropylene, do not form any such permanent set as unrecoverable strain even when a stress of about 3 kg/cm^2 is applied thereto, and substantially recover the compression strain when the compression stress is removed. Such properties of the foamed plastics should be in such ranges as mentioned above, not only before packaging but also after heat shrinking.

The foamed plastic used in the present invention should have a heat-shrinking property in addition to such properties as mentioned above.

The measurement of the heat-shrinking property of the foamed plastic used in the present invention is carried out according to ASTM–D–1204–54. That is, a square test piece wherein each side is 25 cm is inserted between two sheets of paper equal in size to the test piece and is shrunk by allowing to stand for a given period of time in an oven kept at a definite temperature. After cooling, the test piece is measured in longitudinal length and horizontal length to calculate the heat shrinkage thereof according to the following equation:

$$a = [(A' - A)/A[\times 100$$

wherein a is the heat shrinkage, A is the longitudinal or horizontal length of the test piece before heat-shrinking, and A' is the longitudinal or horizontal length of the test piece after heat-shrinking.

In the present invention, however, the heat shrinkage value at a certain specific temperature which is calculated according to the above-mentioned measurement method is of minor importance. This is because, in the present invention, it is meaningless to strictly limit the heating time, the temperature, and the thickness and required heat shrinkage of the foamed plastic sheet which are required to be decided each time, in practice. In the heat shrinking packaging of the present invention, it is proper to decide the heating temperature and time according to the kind and thickness of the foamed plastic sheet used, the kind and shape of the article to be packaged, the heat shrinkage to be possessed by the foamed plastic sheet at each temperature and the required packing speed, taking into consideration according to the kind of the article to be packed the difference in heating temperature and time due to difference in direction of heat shrinking. In the present invention, the heat shrinking degree of the foamed plastic sheet greatly varies locally depending on the shape of the article to be packaged, as is clear from FIGS. **2** and **7**, and the foamed plastic sheet should sufficiently withstand such variations in heat shrinking degree. From FIGS. **2** and **8**, it can be understood that the foamed plastic sheet is required to withstand such uneven shrinking degrees ranging from about 5 percent to about 70 percent. FIG. **3** shows the relation between the temperatures and the heat shrinkages of foamed plastic sheets which brings about such heat shrinking. In FIG. **3**, there are shown the cases of a foamed low density polyethylene (curve **9**) and a foamed polypropylene (curve **10**) as typical examples of the foamed plastic sheets used in the present invention. Such relation between the temperature and heat shrinkages is not only seen in the cases of the above-mentioned foamed plastic sheets but also observed similarly in the cases of all foamed plastic sheets used in the present invention.

The heat shrinkage of the foamed plastic sheet used in the present invention is given at the time when it is placed under such conditions that orientation stress is brought about due to inflation or the like during the course of forming the foamed plastic sheet. The heat shrinkage ability of the foamed plastic used in the present invention may have been given as a result of substantially equal orientation in to the biaxial directions even in the case where the heat shrinking is to be predominantly applied to the monoaxial direction. In practice, however, there are some cases where the direction of heat shrinking should be taken into consideration. A typical example thereof is the case of such a fiber product as sown in FIG. **2.** In this case, it is desirable that the direction, where the heat shrinking of the foamed plastic sheet takes predominantly, coincides with the peripheral direction of a cylindrical member coaxial with the bobbin, around which the fiber has been wound. The packaging process of the present invention is particularly effective for application to fiber products. The reason therefor may be explained with reference to FIGS. **1** and **4.** In FIG. **1, 1** indicates air bubbles possessed by the heat-shrunk foamed plastic sheet **5, 4** is the outer skin of the foamed plastic sheet which becomes the outer layer of the resulting packaged product, and **3** is the layer of the foamed plastic sheet **5** which faces to the packaged fiber **2.** The layer **3** presses the outer-most portion of the fiber **2** in such a modified form as shown in the drawing. At the same time, impact, strain and stress of every direction which come from the direction of the outer skin **4** are absorbed by the soft and elastic foamed plastic, with the result that the fixed state of the layer **3** to the fiber cannot be changed. In the case of such a fiber product as shown in FIG. **1,** the disorder of the yarn tends to take place at the shoulder portions from the part represented by A in FIG. **4** to the bobbin **6.** A fiber product, to which the present invention has been applied, can maintain a surface state which does not differ from the surface state before packaging even when it is been dropped on the floor due to violent handling or even when it has been transported to a long distanced place by a truck through a bad road, in such a state that it has merely been accommodated in a box or the like without using any fillers.

For the production of the heat-shrunk packaged product of the present invention, a foamed plastic sheet having such width and length as conforms to the shape of the article to be packaged is used and, in case the article to be packaged is narrow in surface portion, which is liable to be marred and hence is to be particularly protected, it is at least necessary that the foamed plastic sheet after heat shrinking should sufficiently protect said surface portion. In case a major portion of the surface of the article to be packaged is liable to be marred, it is needless to say that the whole article should be covered with the heat-shrunk foamed plastic sheet. If the thickness of the foamed plastic sheet is insufficient, two or more layers of the foamed plastic sheet may be applied and, if necessary, a heat-shrunk layer of an ordinary heat-shrinkable plastic film may be applied onto the foamed plastic layer.

For temporary maintenance of the form of the packaged product prior to heat shrinking, the foamed plastic sheet used may be fixed at the ends by used of one or more of a yarn, a heat-fusible clasp, an adhesive tape, a bonding agent, a fine alloy wire or heat sealing.

FIG. 2 shows the case where an adhesive tape **8** was used.

In the case of a foamed plastic sheet which has initially been shaped into the form of a tube, the plastic sheet is cut to such a size as to be suitable for protecting an article to be packaged and is subjected to heat-shrinking after inserting the article therein. An example of the resulting packaged product is shown in FIG. **8,** wherein a melon **23** has been protected with a heat-shrunk layer **5** of a foamed plastic sheet.

FIG. 7 is a partially broken perspective view of a lacquered music box packaged with a foamed plastic sheet. In FIG. **7, 5** is the foamed sheet, and **21** is the music box. In the production of such packaged product, there is adopted such a procedure that the sheet, which is sufficiently broader in width than the article to be packaged, is used to cover the four sides of the box, the seam of the covered sheet is heat sealed without covering the remaining two sides, and then the sheet is subjected to heat-shrinking, whereby a packaged product having such a square exposed portion as represented by **22** in FIG. **7** can be obtained.

A pre-packaged product, in which an article has temporarily been packaged with a foamed plastic sheet, is then treated with a suitable heating means to shrink the plastic sheet. As such means, there is used a conventional means for the shrinking-packaging of films. In this case, however, the present invention greatly differs from the conventional process in that the heating conditions are specifically limited. Under such heating conditions that 80 percent of the independent foam cells possessed by the foamed plastic sheet, are destroyed and crushed by heating, it is impossible to attain the effects of the present invention. Thus in the present invention, it is necessary that more than 20 percent of the independent foam cells remain unbroken According to the present invention, favorable results can be obtained in the case where, for example, a foamed polyethylene sheet having a thickness of 1 to 5 mm is heated to temperatures of 90° to 150°C, preferably 110° to 140°C for 20 to 60 seconds.

The present invention will be further illustrated in detail with reference to the following examples.

EXAMPLE 1

In this example there were used three kinds of foamed sheets having a foamed ratio of 32 times and thickness of 2 mm. which had been prepared by using, individually, a foamed polyethylene, a foamed ethylene-vinyl acetate copolymer (containing 5 percent of vinyl acetate) and a foamed resin comprising 70 parts by weight of a low density polyethylene and 30 parts by weight of an ethylene-vinyl acetate copolymer (containing 20 percent of vinyl acetate).

A three-denier, foamed flat yarn of a vinyllidene chloride-vinyl chloride copolymer was wound according to the warp winding around a cylindrical bobbin, while shaping the both ends into conical forms. Around the body of the thus prepared fiber product, each of the aforesaid foamed sheet having a thickness of 2 mm and a cell diameter of 0.3 to 1.5 mm was wound, so that the conical portions of the fiber product could sufficiently be covered with the ends of the foamed sheet, and the seam of the foamed sheet was fixed at three portions by means of an adhesive tape or heat-sealed by contact with a heating member to prepare two kinds of packaged fiber products. Each fiber product was passed through a hot tunnel wherein air temperature was maintained at 135°C and staying time of the product was 40 seconds to shrink the foamed sheet. The hot tunnel was a hollow, cylindridal and horizontal oven having a height of about 40 cm, a width of about 30 cm and a length of about 1 m which had been equipped at the bottom with a belt conveyor capable of being controlled in speed and which had been heat-insulated by suspending at each end two overlapped sheets of canvas curtains of about 7 cm in width. The oven had additionally been equipped externally with an electric heating source capable of being controlled in current and with a fan to circulate the hot air inside the oven. As the result, every foamed sheet tightly covered the surface of the fiber product to form a strained, elastic and beautiful covering.

Packaged fiber products obtained in the above manner were packaged in partitioned corrugated cardboard cases, without being fixed at the top and the bottom of each bobbin, in such a number as 18 per case, and then transported by a truck over a distance of 100 km including 2 times' loadings carried out before and after the transportation. Thereafter, the products were taken out to observe the state thereof. As the result, the yarn layers had not been rubbed since each foamed layer, which had been shrunk, had closely adhered thereto to make the yarn layers unmovable, and there was not observed any disorder of the yarn layers at portions represented by A in FIG. **4,** nor the trace of impact applied.

EXAMPLE 2

Around the body of a double conical cheese prepared by winding up according to the warp winding a 150-denier vinylidene chloride multifilament comprising 15 filaments having a fineness of 10 denier was wound a foamed sheet of a mixed resin comprising 50 percent of polyethylene and 50 percent of an ethylene-vinyl acetate copolymer (containing 16 percent of vinyl acetate) which had a foamed ratio of 27 times, a thickness of 3 mm nd a cell diameter of 0.7 mm, so that the tapered portions at the ends of the cheese were sufficiently covered with he foamed sheet, and then the seam of the foamed sheet was heat-sealed by means of a bar heated to 150°C. The thus treated cheese was passed through the same hot tunnel as in Example 1, in which air temperature was adjusted at 120°C and staying time was 40 seconds, to shrink the foamed sheet, whereby a packaged product was tightly covered with the foamed sheet.

Eighteen packaged samples obtained in the above manner were packed in a corrugated cardboard case having no such construction as to fix the products in the case, and then transported by a truck over a distance of 100 km including 2 times' loadings carried out before and after the transportation. Thereafter, the case was opened, but no damage was observed in the products, despite the fact that the case had been deformed and broken.

EXAMPLE 3

Around the body of a pirn product of a 60-denier nylon multifilament comprising 20 filaments having a fineness of 3 denier was wound a foamed sheet of an ethylene-vinyl acetate copolymer (containing 6 percent of vinyl acetate) which had a cell diameter of 0.5 mm and a thickness of 2 mm, so the all the tapered portions at the both ends of the product were covered with the foamed sheet, and the seam of the foamed sheet was sealed by a fusion technique. The obtained sample was travelled for 30 seconds through the hot tunnel of which type is the same as described in Example 1, but of which air temperature was kept at 140°C to shrink the foamed sheet, whereby a packaged product, in which the foamed sheet tightly covered the yarn layer was obtained.

Packaged products obtained in the above manner were longitudinal packed in a corrugated cardboard case having only a partition, transported in the same manner as in Example 1, and then taken out of the case. As the result, no change was observed in any of the fibers wound into the form of pirn.

EXAMPLE 4

Around a japan coated music box having a width of 120 mm a length of 90 mm and a height of 80 mm was wound, as shown in FIG. **7**, a foamed polypropylene sheet having a thickness of 2 mm, a cell diameter of about 1 mm and a density of 0.04 g/cm^3, so that each 30 mm of the foamed sheet extended over the two ends of the music box, and the seam was heat-sealed while the two end portions were left open. The thus obtained music box was passed for 30 seconds through the hot tunnel of which air was kept at 150°C to shrink the foamed sheet, whereby the foamed sheet became a strained and elastic cover tightly spinned over the surface of the music box. Further, as shown in FIG. **7**, a rectangular exposed portion having each side of about 50 mm was formed at the center of each of both end portions, and the music box was in such a state that only the peripheral portions had been covered with the foamed polypropylene sheet tightly covered therewith.

Twenty-four pieces of packaged products obtained in the above manner were packed in a corrugated cardboard case and then subjected to the same transportation test as in Example 1. Thereafter, the case was opened to investigate the state of the packaged products, but no damage was observed in the packed articles.

EXAMPLE 5

This example is not an embodiment of the present invention in a true sense, but is added for such reason that it is significant to show what change is observed in the surface of an article having a surface liable to be marred, if the article is subjected to such friction as not to be encountered in practice when the foamed plastic sheet used in the present invention is brought into contact with the article.

An acrylonitrile-butadiene-styrene copolymer, which had been colored with a black pigment, was injection-molded to prepare two test pieces of 8 × 5 cm in size which had a smooth surface free from visual scratch. The surface of each test piece was washed with methanol and the test piece was cut to a size of 4 × 5 cm, and then each of a foamed polystyrene sheet having a density of 0.03 g/cc and a thickness of 2 mm and a foamed ethylene-vinyl acetate copolymer (containing 7 percent of vinyl accetate) which had the same density and thickness as above was placed on the test piece. Thereafter, the test piece and the foamed material were rubbed each other for 1 minute at such a rate as 100 reciprocations per minute under a load of 200 g/cm^2. After the rubbing, the surface of each test piece was cleaned with methanol, and the surface state was visually evaluated. As the result, no scratch was observed on the surface of the test piece rubbed with the foamed ethylene-vinyl acetate copolymer, whereas more than several hundred scratches were observed on the surface of the test piece rubbed with the foamed polystyrene sheet. The results indicated that the foamed polystyrene sheet was obviously inferior in surface-protecting property.

What is claimed is:

1. A heat-shrunk package consisting of an article and a heat-shrunk layer of a soft and elastic foamed thermoplastic resin selected from the group consisting of aliphatic polyolefins and halogenated polyolefins, at least a part of the surface of the above article being tightly wrapped in the heat-shrunk layer, said heat-shrunk layer having a thickness of 1 to 5 mm and containing more than 20 percent of independent foam cells in unbroken form.

2. A heat-shrunk package according to claim **1** wherein the aliphatic polyolefin is a member selected from the group consisting of low density polyethylene, high density polyethylene, an ethylene-vinyl acetate copolymer, a mixture of polyethylene with an ethylene-vinyl acetate copolymer, polypropylene, a propylene-ethylene copolymer, a mixture of polypropylene with polyethylene, and a mixture of polypropylene with an ethylene-vinyl acetate copolymer.

3. A heat-shrunk package according to claim **1** wherein the aliphatic polyolefin is a member selected from the group consisting of an ethylene-vinyl acetate copolymer, a mixture of polyethylene with an ethylene-vinyl acetate and a mixture of polypropylene with an ethylene-vinyl acetate copolymer, said member containing less than 20 percent of vinyl acetate.

4. A heat-shrunk package according to claim **1,** wherein the halogenated polyolefin is selected from the group consisting of polyvinyl chloride, a vinylidene chloride-vinyl chloride copolymer and chlorinated polyethylene, which is softened by incorporation of a plasticizer.

5. A heat-shrunk package according to claim **1,** wherein the heat-shrunk layer is of the foamed thermoplastic resin having a softness bringing about a 10 percent strain under a compression stress of up to 2 kg/cm^2 and an elasticity bringing about no unrestorable strain under a compression stress of about 3 kg/cm^2.

6. A heat-shrunk package according to claim **1,** wherein the packaged article has a surface liable to be marred or disordered.

7. A heat-shrunk package according to claim **6,** wherein the packaged article is a fiber wound into the form of pirn.

8. A heat-shrunk package according to claim **6,** wherein the packaged article is a fruit.

9. A heat-shrunk package according to claim **6** wherein the packaged article is lacquer ware.

10. A heat-shrunk package according to claim **6** wherein the packaged article is a musical instrument.

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