Oct. 30, 1962 R. L. DREYFUS 3,060,655

PACKAGING

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FIG. 1.

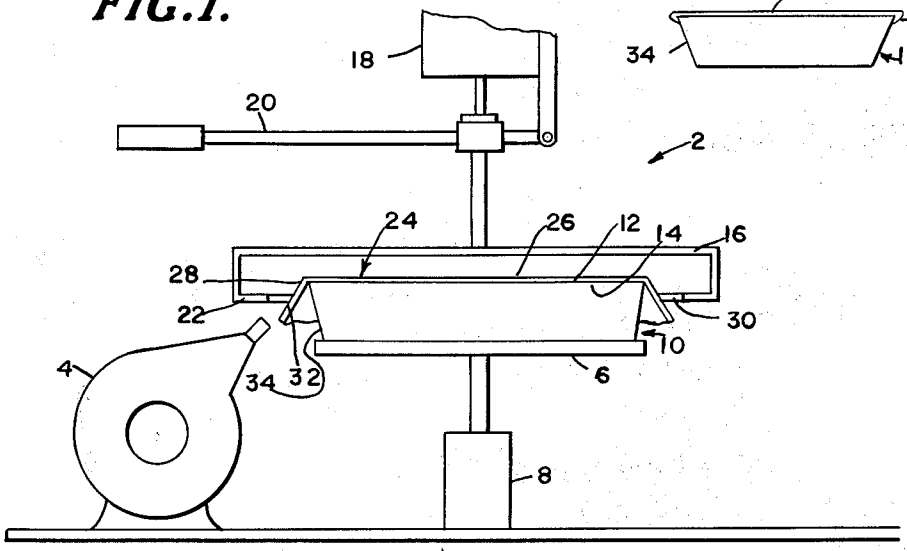


FIG. 18.

FIG. 2.

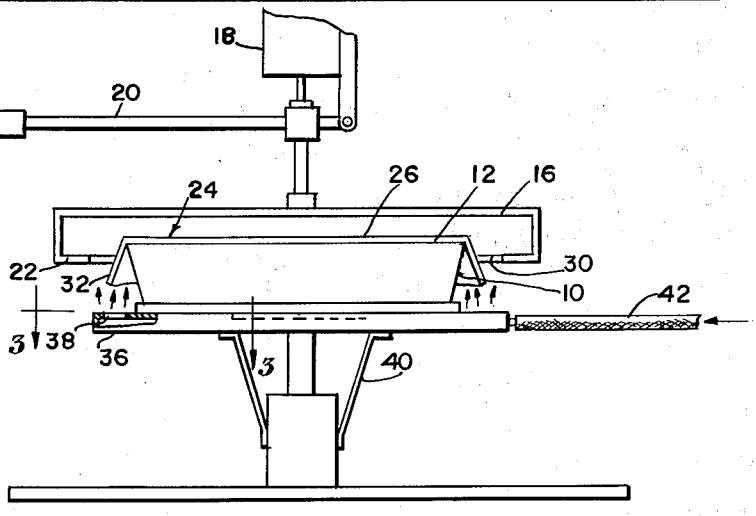
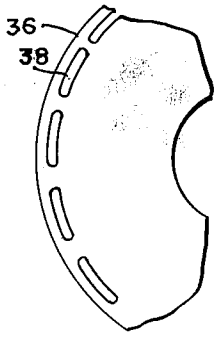


FIG. 3.



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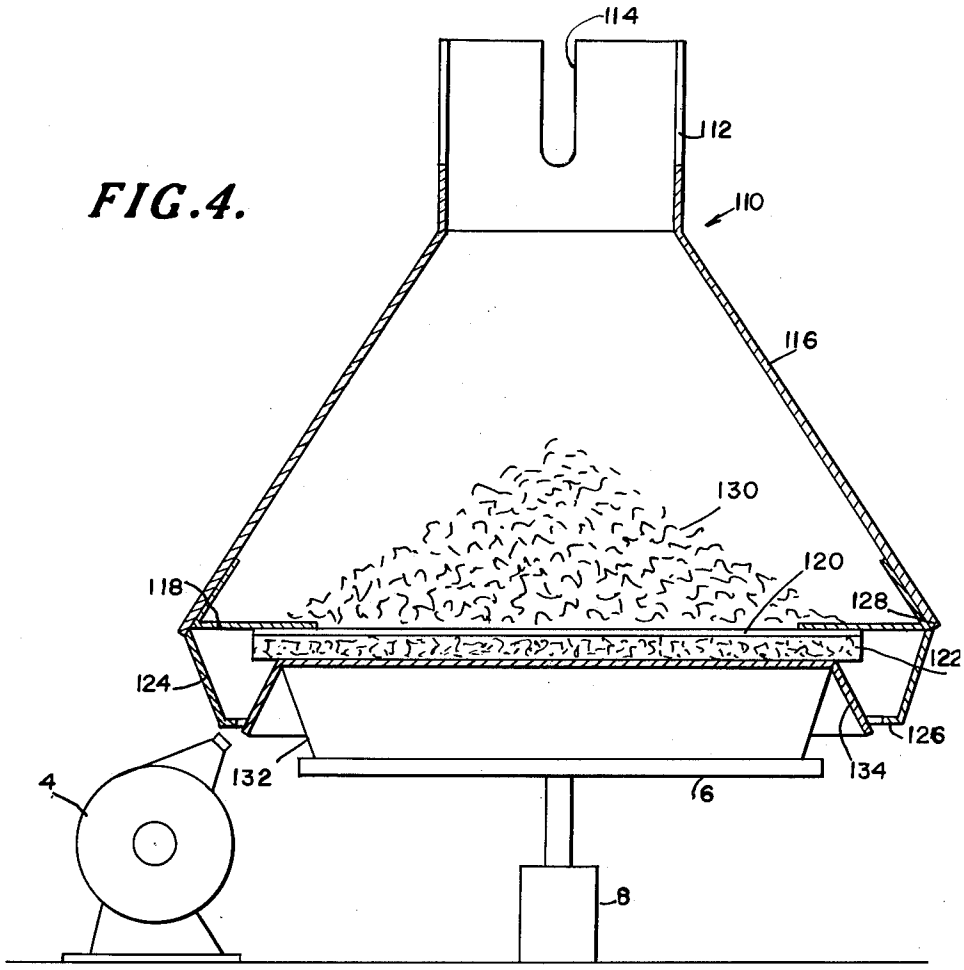
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FIG. 4.



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FIG. 5.

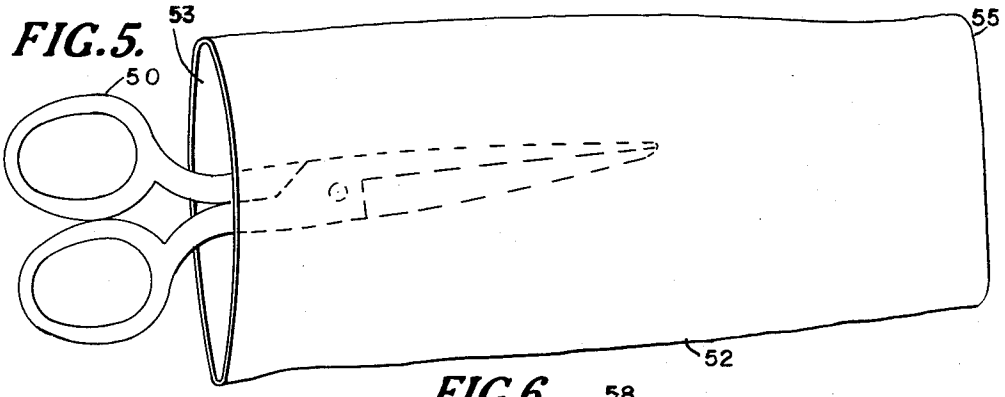


FIG. 6.

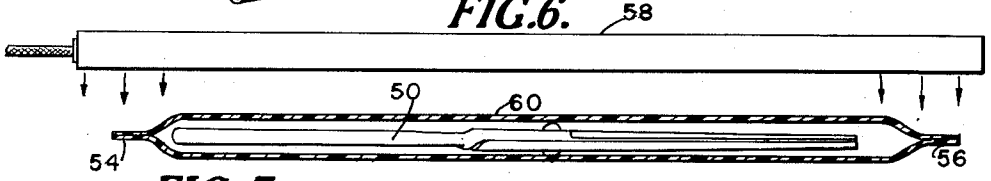


FIG. 7.

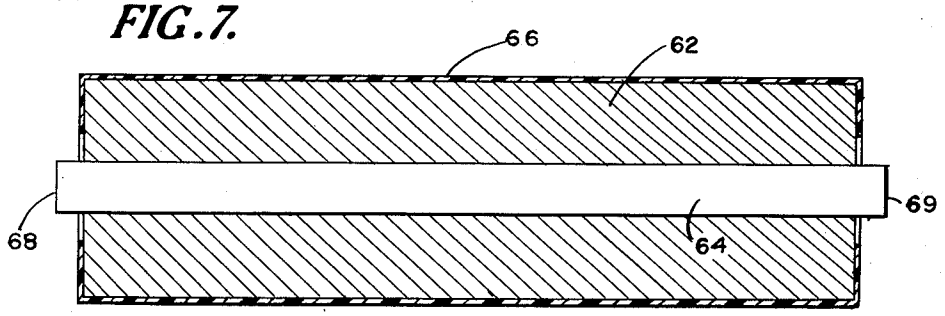
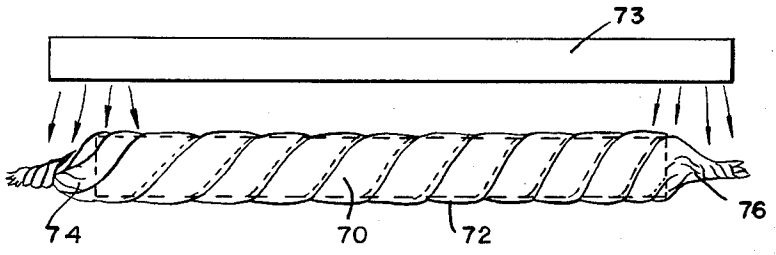


FIG. 8.



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FIG. 9.

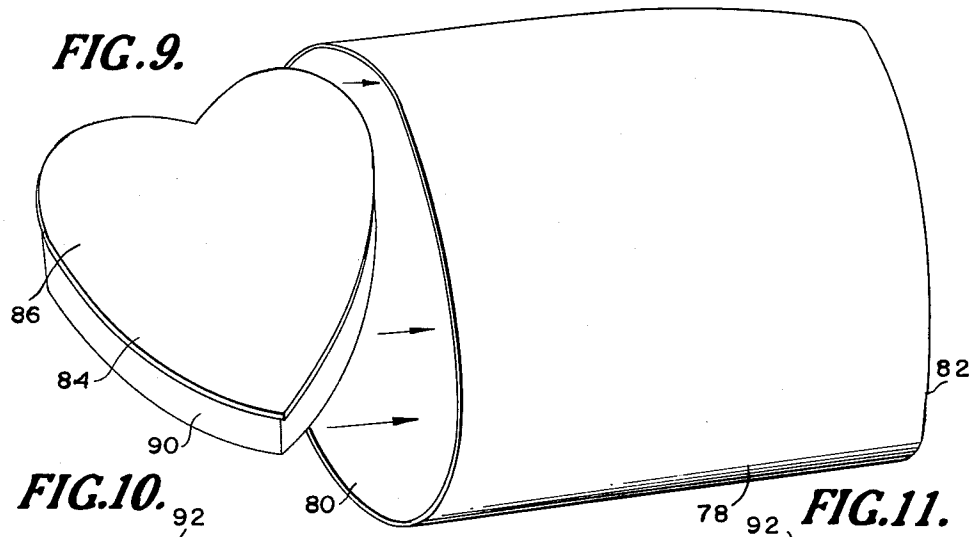


FIG. 10.

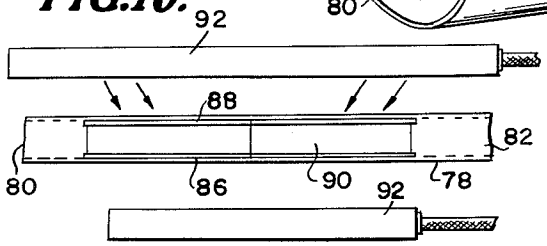


FIG. 11.

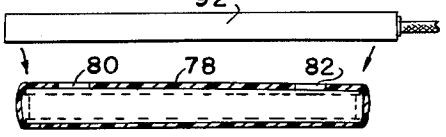


FIG. 12.

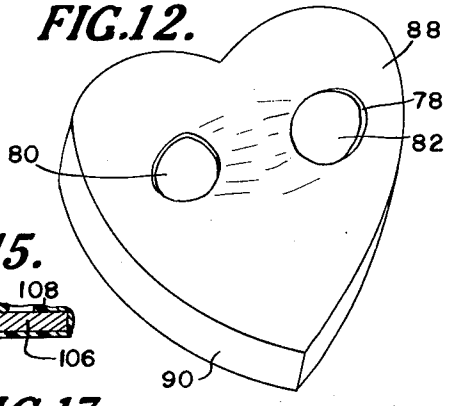


FIG. 13.

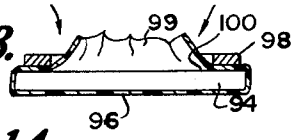


FIG. 14.



FIG. 15.

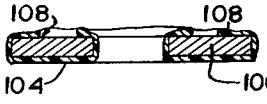


FIG. 16.

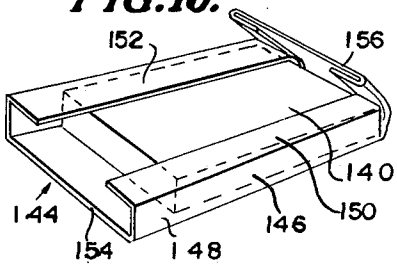
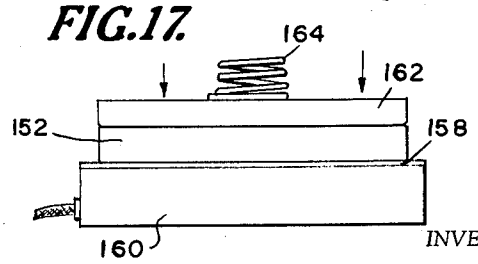


FIG. 17.



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United States Patent Office 3,060,655 Patented Oct. 30, 1962

3,060,655

PACKAGING

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Filed Nov. 7, 1958, Ser. No. 772,471
4 Claims. (Cl. 53—30)

This invention relates to a novel method and apparatus for shrinking a biaxially oriented olefin polymer and to goods contained in or confined by such polymer.

It is an object of the present invention to provide a method for applying a protective cover over the open side of a container.

Another object is to provide an apparatus suitable for forming a shrinkable polymer film into a cover for a container, folding the edges against the sides of the container and shrinking portions of the polymer film to form the cover.

A further object is to form an elastic edged cover for dishes and the like, said cover being thickened in the edge portion.

An additional object is to provide a cover from a plastic film which will have a tab to assist in removing the cover.

Yet another object is to improve the bond of shrinkable irradiated polyethylene covers to containers made of glass, paper or thermosetting plastic.

A still further object is to provide complete encapsulation of objects utilizing a shrinkable irradiated polyolefin tubing.

An additional object is to partially encapsulate objects using shrinkable irradiated polyolefin tubing or sheet film.

A further object is to control the shrink around an object of a tube of shrinkable polymer so that the open ends of the tube can be directed to the back of the object.

Additionally, it is an object of the present invention to reduce the amount of material required in an overwrap package.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

These objects are attained in the manner subsequently described utilizing heat shrinkable irradiated polyolefins, more particularly, heat shrinkable, irradiated polyethylene and heat shrinkable irradiated polypropylene.

Referring to the drawings:

FIGURE 1 is a side elevation of a preferred apparatus for heat shrinking a cover on a container;

FIGURE 2 is a side elevation of an alternative device for heat shrinking a cover on a container;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a side elevation of another device suitable for heat shrinking a cover on a container;

FIGURE 5 is a perspective view showing the encapsulation of a pair of scissors;

FIGURE 6 is a side elevation partially in section taken during a later stage of the encapsulation;

FIGURE 7 is a vertical section showing the partial encapsulation of a roll of paper;

FIGURE 8 is a top elevation of a cylindrical container spirally wrapped with the shrinkable polyolefin;

FIGURE 9 is a perspective view of a box of candy being placed in a tube of heat shrinkable, irradiated polyethylene;

FIGURE 10 is a side elevation of the candy box showing a subsequent stage utilizing localized heating;

FIGURE 11 is a vertical section of the encapsulated candy box near the end of the shrinking process;

FIGURE 12 is a bottom plan view of the encapsulated candy box;

FIGURE 13 is a sectional view of an alternative method of forming a cover around a container;

FIGURE 14 is a sectional view of the cover at the completion of the process in FIGURE 13;

FIGURE 15 a vertical section showing the partial encapsulation of a ring gasket;

FIGURE 16 is a plan view showing the formation of an overwrap;

FIGURE 17 is a side elevation showing the sealing of the overwrap of FIGURE 16; and

FIGURE 18 is a vertical section of a container having a heat shrunk cover thereon.

In the specific examples below there was employed heat shrinkable irradiated, biaxially oriented polyethylene, specifically Alathon 14, molecular weight of 20,000 and density of 0.916, which had been irradiated to an extent of about 12 megarad and then biaxially stretched 350% longitudinally and 350% laterally. The irradiated polyethylene had a shrink energy of about 150 p.s.i. in both directions.

Referring more specifically to FIGURE 1 of the drawings, there is provided an apparatus 2 for selectively shrinking irradiated polyethylene film to provide an elastic edged cover for dishes. In providing such covers there is the problem of holding the cover film in place and folding the edges down evenly against the sides of the container and then shrinking them in that position. To even out any wrinkles, the cover film can be finally heated slightly, if desired. The apparatus of FIGURES 1 and 2 are eminently suited to solve the problem outlined above.

The apparatus 2 comprises a hot air blower 4 and a turntable 6 mounted for rotation on support 8. A truncated conical container 10, e.g., a wax coated paper container filled with cheese, is positioned on the turnable and an approximately circular film 12 of the irradiated biaxially oriented polyethylene of somewhat larger diameter than the open end 14 of the container was positioned over the opening.

Above the turntable 6 is positioned a diaphragm holder 16 of larger diameter than the container. The diaphragm holder is mounted for rotation concentrically with turntable 6 on support 18.

The diaphragm also is connected to lever 20 which can raise or lower the diaphragm holder to the idle or working condition as is required. The diaphragm holder is cylindrical and has an inner flange 22 at its lower end. Secured to the diaphragm holder is a diaphragm or sponge pad 24 which is flat in the non-compressed state. The diaphragm has a flat horizontal upper section 26, a middle section 28 extending outwardly and downwardly and of a conical shape and an outwardly extending lower portion 30 which is connected to the inner flange 22.

In operating according to the invention the container 10 is positioned on the turntable 6. The film 12 of irradiated biaxially oriented polyethylene from 0.5 to 5 mils, e.g., of 3 mil thickness, is then positioned over the top of the container. The lever 20 is then lowered until the upper portion 26 of diaphragm 24 engages the film. The diaphragm not only holds the film in place but it also evenly bends down the overlying edges 32 of the film. The hot air blower is then started as is the turntable. The hot air forces the film in place against the sides 34 of the

container while at the same time the hot air also shrinks the film. As a result the film forms a thickened edge or bead **37** as shown in FIGURE 18 around the lip of the container. This thickened edge is usually about 5 to 10 times as thick as the film itself. As a result, an elastic edged cover for the container is formed. The cover can be removed to open the container and then can be again applied as a cover for the container due to its elasticity.

In order to even out any wrinkles formed in the cover film, it can be heated slightly while on the turntable.

The use of the turntable insures that the cover is evenly heated and consequently that there will be uniform shrinkage to form a smooth and attractive sealing edge on the film.

In FIGURE 4 there is shown a special nozzle **110** which has been successfully employed for sealing the irradiated biaxially oriented polyethylene over the top of pie plates, cheese tubs, glasses, cups and the like. The nozzle of FIGURE 4 can be used with any commercially available hot air source. The nozzle **110** comprises a cylindrical neck **112** which can be split as at **114** to pinch-fit a flameless blow torch. The neck **112** ends in a metal cone **116**. At the lower end of the cone there are four narrow supports **118** for metal disc **120**. Adhered to the metal disc **120** is a soft silicone or other heat resistant sponge **122**. The sponge preferably has a 30 durometer hardness and is a polydimethylsiloxane, although other silicone sponges can be employed. A metal inverted truncated cone **124** terminating in an inner flange **126** also depends from the lower end **128** of the cone **116**. Above the metal disc **120** there is provided a foamglass insulator **130** to protect against undesired heating of the container **132** to which is applied the irradiated biaxially oriented polyethylene film **134**. The container **132** is supported on stand **136**. The film is shaped to the desired cover contour as described in connection with FIGURE 1. Heating is accomplished, however, by the hot air which passes through the nozzle and emerges at the lower end **128** of the cone along the periphery thereof and thence to inverted cone **124** where it contacts the formed cover and shrink seals it to the container. This unit has been employed satisfactorily at a gas temperature of 500° F. although other temperatures can be employed so long as they are high enough to shrink the polyethylene.

In place of the turntable and single position blower there can be used other devices to insure uniform heating. For example, as shown in FIGURES 2 and 3, the blower and turntable can be supplanted by an annular ring **36** supported on frame **40** and having a series of openings **38** placed to direct heated air introduced via line **42** upward to be reflected from the diaphragm in a manner to push the film against the container sides while shrinking the edges to form the finished cover shown in FIGURE 4. It will be appreciated that instead of heated air there could be employed steam, hot water or other heated fluid.

The diaphragm and associated heating apparatus can be placed on a conveyor to either travel with the product during the application of heat or to have the conveyor index under a fixed application point.

In a continuous process, for example, a dispensing device can be provided over the conveyor in advance of the unit to place a circular disc or square of film over each container as it passes under the dispenser. A small traveling band of tape or an air curtain can be used to hold the film in place as the conveyor travels ahead. After shrinking the film to form the bead, either hot air from the annular ring (or rectangle) as it rises from contact or from a separate hot air blower can be used to eliminate any wrinkles from the surface of the package. While the film which forms the thickened edge is substantially completely shrunk, there is virtually no shrinkage of the protective film over the opening **14** of the container.

The process can be carried out utilizing a substantially inverted apparatus wherein hot air from orifices in a table top blow the film upward and inward to effect the seal. Alternatively, the film and inverted dish can be placed on a depressable pad and pushed downward into a chamber of heated fluid which would float the film upward and inward. In this procedure preferably the immersion is controlled so as not to let the heated liquid flow over the edge of the film until shrinkage is accomplished.

The film cover pressure pad **24** can be applied to the film in a chamber which has been filled with an inert gas, e.g. helium, argon or nitrogen, or in a vacuum chamber. Shrinking and sealing can then be accomplished to maintain this controlled atmosphere within the container being sealed.

When a square of film is positioned on a round container opening the subsequent shrinking provides small, unobtrusive tabs which aid in removing or reapplying the cap.

The cap or cover has been found to seal tightly by its own tension in most cases. An especially good bond can be obtained by coating the outside of the container in the sealing area with wax or with other thermoplastic material.

The apparatus shown in FIGURES 1–4 is particularly useful in preparing closures, e.g. milk bottle hoods, covers for pie plates, trays, meat pie plates, TV dinner trays, jars, cans or jelly tumblers, particularly those having a flared or lip-type top edge. It is likewise useful in covering containers for ice cream, potato salad, cottage cheese or other foods in plastic or coated paper or metal, e.g., aluminum, containers.

The present invention is also useful in the complete encapsulation of objects using tubing or partial encapsulation using tubing or sheet film as well as in the formation of lids or covers as previously set forth.

To completely encapsulate an object, e.g., a scissors **50** in FIGURE 5, it is placed in a slightly over-size tube **52** of the irradiated high shrink energy polyethylene. The tube should be about 4 to 6″ longer than the overall scissors length. Then, first one open end **53** of the tube is heated and shrunk back to tape dimensions at **54** and then the other open end **55** is shrunk back to tape dimensions at **56**. The heating can be accomplished with radiant heater **58**, FIGURE 6, or with hot air as by drier **4**, FIGURE 1, or by nozzle type drier **110** of FIGURE 4. Then heat is applied over the entire tube to shrink the same as at **60** and to force out most of the air. The ends are reheated and when hot are pinched off to form a seal. Then the package is cooled to give a completely encapsulated scissor.

Partial encapsulation can be accomplished, for example, by placing a roll of paper **62** on a core **64** within a tube **66** of irradiated high shrink energy polyethylene. The ends of the polyethylene are folded down and shrunk and heat subsequently applied to the rest of the package, e.g., with a hot air drier to encapsulate the roll of paper while the ends **68** and **69** of the core stick out as shown in FIGURE 7.

Using a sheet of irradiated high shrink energy polyethylene rather than a tube, it is also possible to encapsulate objects as is shown in FIGURE 8. A sheet **70** of the polyethylene is spirally wrapped around cylindrical container **72**. Opposite ends **74** and **76** of the sheet are heated, e.g., with the aid of radiant heater **73**, and thus shrunk to secure the package. Then the remaining surfaces of the polyethylene sheet are heat shrunk around the cylinder to complete the encapsulation procedure. The application of heat will partially seal the overlap.

It is possible to control the application of heat in the shrinking of irradiated high shrink energy polyethylene tubing so that the open ends of the tube can be directed to the back or any other desired part of the container so that they are in effect concealed and do not depart from the attractiveness of the packaged product. This form of the invention is illustrated in FIGURES 9–12 wherein heat is selectively applied to direct the open ends of the

tube to the back of the package. Referring more specifically to FIGURES 9–12, there is provided a tube **78** of irradiated high shrink energy polyethylene having open ends **80** and **82**. A heart-shaped candy package **84** is inserted in the tube **78**. The candy package has a top **86**, bottom or back **88**, and sides **90**. Heat is then concentrated on the back **88** rather than on the entire package with the aid of hot air heater **92**. As a result, shrinkage occurs primarily in the back with the net result that the film is relatively thick on the back and relatively thin in the front. Additionally, as shown in FIGURES 11 and 12, the original openings in the tube end up on the back of the package in relatively close-spaced relation compared to their original positions and the openings can be covered by a label. Due to the shrinkage in the tubing a tight fit over the package results. If there are any wrinkles in the front or top of the package, they can be removed by briefly passing the hot air heater over the front of the package. The end result is an attractive package in which the original open ends of the tubing are effectively concealed. In fact, anyone who is not familiar with the manner of applying the polyethylene cover would not realize that the candy box had been covered with tubing.

As previously set forth, the present invention is especially adapted to place a protective polyethylene film on lids or covers. This form of the invention is also illustrated in FIGURES 13 and 14. Thus, a form or ring **94** for making a lid or cover is placed top side down on a piece of irradiated high shrink energy polyethylene film **96**. The edges of the lid **94** and the corresponding area of the polyethylene film are restrained by means of ring **98**. The free polyethylene film **99** on the back **100** of the lid is heated with hot air heater **92** to shrink and thicken the polyethylene at **102** as shown in FIGURE 14. The restraining ring acts to control the shrinkage since shrinkage does not take place under it or beyond. In order to remove wrinkles from the polyethylene film, the front of the lid can be heated briefly as can the sides and the area under the ring. In similar fashion the polyethylene film **104** can be shrunk around gasket **106** to form a thickened sealing area **108** at the back as shown in FIGURE 15.

The present invention can likewise be used to cover only one surface and the sides of a package, the back surface being sealed only at the four corners as is illustrated in FIGURES 16 and 17. As an illustration of this procedure a box 5" x 8" x 1¼" was packaged using an irradiated high shrink energy polyethylene film 9½" wide by 12½" long. These dimensions were obtained by utilizing as the width the box width+2 times the box height+2 inches, and as the length, the box length+2 times the box height+2 inches.

The box **140**, top side **142** down, was centered on the polyethylene film **144** with the long side **146** of the box parallel to the long side of the film. One opposite pair of film edges, e.g. the two long edges **150** and **152**, were folded over the box.

Then the second pair of film edges, namely the short edges **154** and **156**, were folded over the box. At the four corners these edges overlapped. The box **140** was then inverted on Teflon 158 (polytetrafluoroethylene) covered hot plate **160**. The hot plate was set at about 300–325° F. and weight **162**, biased by spring **164**, was pressed down firmly on the overlapping edges to heat the film uniformly. The film sealed at the four corners and shrunk along the borders with a resultant increase in gage and tightness. The film should be cooled while the film is still being restrained.

Normal overwrapping, e.g. the diaper wrap, requires 14" x 14" (196 sq. in.) or larger of polyethylene film. The present procedure thus results in a saving of 40% or better in material required.

In general, there is employed in the invention polyethylene film or tubing which has been irradiated to an extent of 2 to 100 megarad, preferably 6 to 20 megarad. The irradiation can be accomplished in conventional fashion, e.g. by the use of a high voltage resonant transformer, such as the 2,000,000 volt General Electric transformer, or similar transformers of 50,000 to 50,000,000 volts or a Van de Graaff electron generator. In addition to the use of electrons there can be employed beta rays, gamma rays, e.g. by employing cobalt 60, etc. There can be employed any of the irradiation procedures disclosed in Baird application, Serial No. 713,848, filed February 7, 1958, now Patent 3,022,543, issued February 27, 1962, for example. The entire disclosure of the Baird application is hereby incorporated by reference.

The biaxial orientation is normally carried out to an extent of 100 to 700% longitudinally and 100 to 900% laterally. The biaxially stretching can be carried out by blowing irradiated polyethylene tubing as disclosed in the Baird application. The irradiated biaxially oriented polyethylene prepared by such a procedure has a high shrink energy, e.g. 100 to 500 p.s.i.

There can be employed as the starting polyethylene for the irradiation procedure high, low or medium density polyethylene prepared by low or high pressure technique. The starting polyethylene can have a molecular weight of 7,000 or 12,000 or 19,000 or 21,000 or 24,000 or 35,000 or even higher.

In place of irradiated polyethylene there can be employed irradiated polypropylene.

What is claimed as new is:

1. The method of encapsulating a container having a front and a back in a single thickness, preformed tubing of irradiated, biaxially oriented, high shrink energy polyethylene comprising placing said container in said tubing, selectively heating the portion of the side wall of the tubing adjacent the back of the container to shrink said portion of the tubing only and to force the open ends of the tubing to the back of said container.

2. A method according to claim 1 wherein the front of the container is heated briefly to remove wrinkles in the tubing.

3. A method according to claim 1 wherein the contained is a heart-shaped box having sides containing candy, the box is placed in the tubing sidewise and the selective heating is sufficient that the ends of the tubing are in relatively much closer spaced relation than their original spaced relationship prior to shrinking.

4. The method of encapsulating an object in a tubing of a high shrink energy plastic, said object being three-dimensional and having at least one substantially flat surface comprising positioning the object in the tubing, selectively heating substantially only the portion of the side wall of the tubing covering said substantially flat surface to shrink said portion thereof only and to force the open ends of the tubing to desired closer position that the original spacing of such open ends, said position being on said flat surface.

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