

Aug. 30, 1966

R. L. DREYFUS ET AL

3,270,104

VACUUM FORMING OF PLASTIC MATERIAL

Original Filed May 21, 1959

FIG. 1.

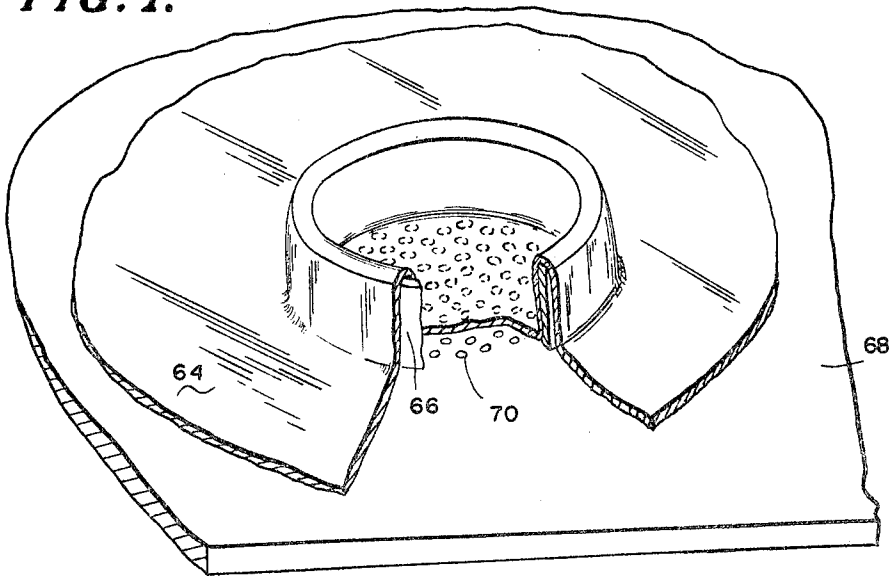


FIG. 2.



FIG. 3.

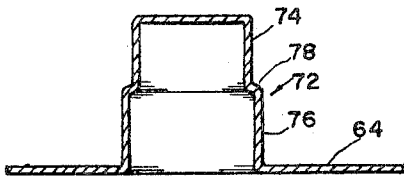


FIG. 4.

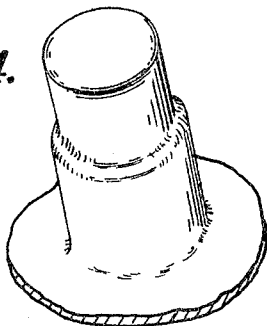


FIG. 5.

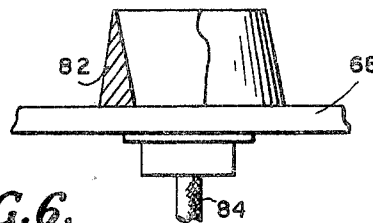
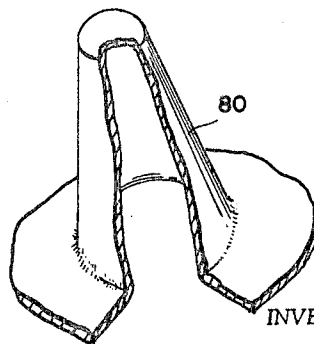


FIG. 6.



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VACUUM FORMING OF PLASTIC MATERIAL

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Original application May 21, 1959, Ser. No. 814,801, now Patent No. 3,022,614, dated Feb. 27, 1962. Divided and this application Dec. 12, 1961, Ser. No. 158,752
3 Claims. (Cl. 264-92)

This application is a division of application Serial No. 814,801, filed May 21, 1959, now Patent No. 3,022,614, February 27, 1962.

This invention relates to the vacuum forming of objects from orientable films, more particularly irradiated polyolefins, such as irradiated polyethylene and irradiated polypropylene.

An object is to develop new uses for irradiated polyethylene and polypropylene.

Another object is to develop an improved vacuum drawing technique.

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.

It has now been found that these objects can be attained by vacuum drawing irradiated polyethylene or polypropylene in accordance with the disclosure hereinafter.

Certain of the presently preferred embodiments of the invention are illustrated in the accompanying drawings wherein:

FIGURE 1 is a perspective view partially broken away illustrating another aspect of the vacuum drawing operation;

FIGURE 2 is a sectional elevation of the initial vacuum drawn article of FIGURE 1;

FIGURE 3 is a sectional elevation of the article of FIGURE 2 after it has been pushed out;

FIGURE 4 is a perspective view of the article of FIGURE 3;

FIGURE 5 is a side elevation illustrating the vacuum drawing of a conical article; and

FIGURE 6 is a perspective view partially broken away in section of the finished article of FIGURE 5 after it has been pushed out.

In the illustrative examples in describing the invention in connection with the drawings there was employed Alathon 14 film (polyethylene, molecular weight about 20,000, density 0.916) which had been irradiated to an extent of 12 megarad.

FIGURES 1-6 illustrate a procedure for obtaining a deeper draw without rendering the oriented film too thin.

As shown in FIGURE 1, 10 mil thick irradiated un-oriented polyethylene film 64 was preheated, draped over mold 66 and vacuum drawn. The mold 66 was positioned on a vacuum plate 68 having a plurality of small holes 70 connected to a vacuum pump (not shown). The mold 66 was a 4 inch deep cardboard core having a diameter of 3½ inches. The vacuum drawn film 64 was removed from the mold and pushed out to form the article 72

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of FIGURES 3 and 4. Due to the rigidity of the irradiated polyethylene, it retained this new shape. The article 72 has a relatively narrow upper sidewall 74 and a relatively wide lower sidewall 76 joined together by connecting flange 78.

Using the procedure described in connection with FIGURES 1-4, an article 80 (FIGURE 6) can be formed with the aid of hollow conical mold 82 (FIGURE 5). Article 80 has a smooth conical sidewall. Irradiated polyethylene film is preheated and then draped over the mold 82 positioned on vacuum plate 68 connected via line 84 to a vacuum pump (not shown). When the drawn film is pushed or snapped out in the manner previously set forth, the conical article 80 is formed having a height double that of the mold 82. Because of the conical design, the sidewall of the article 80 is smooth in the form of a truncated cone and there is no flange connecting the top and bottom portion of the sidewall.

In general, there is employed in the invention polyethylene film 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 Resonant Transformer, or high energy particle generators 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 known irradiation procedures which will produce a dosage of at least 2 megarad.

There can be employed as the starting polyethylene for the irradiation procedure high, low or medium density polyethylene prepared by low or high pressure techniques. 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 similarly irradiated polypropylene. Polyethylene and polypropylene are polymers of an olefin having two to three carbon atoms.

In many instances there can be employed other heat softening plastic films which can be vacuum drawn rather than the specific polymers recited above.

Obviously, in the foregoing disclosure the orientable film may be partially oriented or partially stretched and further oriented or stretched during the vacuum-forming operation. Some films, particularly irradiated polyethylene, have the ability to be partially oriented and then further oriented in steps or stages.

In this specification, the reference to vacuum-forming or vacuum-drawing is equally applicable to pressure forming or the combination of vacuum and pressure forming to force the film into intimate contact with the surface of the mold. Pressure forming makes it possible to obtain greater pressure and therefore results in greater detail in the molded piece, but such a process requires heavier and more expensive equipment.

What is claimed is:

1. A process comprising heating an orientable plastic film, positioning the film across the core of a hollow mold, applying vacuum to biaxially stretch orient the film on both the inside and outside of said core and applying pressure to the film formed inside said core to position said inside film above said outside film.

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2. A process according to claim 1 wherein the plastic film is irradiated polyethylene.

3. A method according to claim 2 wherein the core is conical and pressure is applied to force the film inside said core upward and form an article having a smooth, conical sidewall. 5

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