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Ploetz et al.

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[54] METHOD OF LABELING CONTAINERS

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **B31f 1/00**

[58] **Field of Search** 40/310; 156/196

[56] **References Cited**

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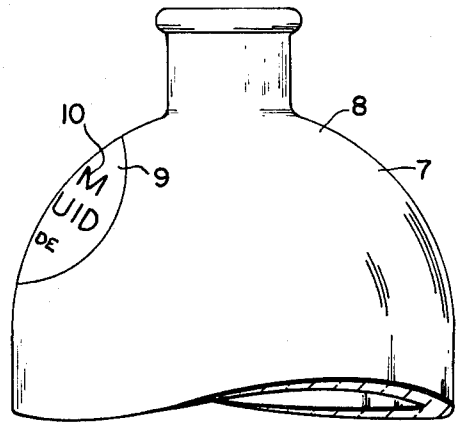
[57] **ABSTRACT**

Labels of polyethylene are made from flat, thin sheet stock by imprinting one face of the sheet with a mirror image of the desired indicia, molding the sheet stock until the printed face assumes the three-dimensionally curved, concave shape of a one-way bottle or similar non-developable surface of a container, maintaining the molded shape while applying the printed face to the conforming bottle surface, and adhesively fastening the label to the surface. The indicia are visible through the transparent plastic and are protected by the same.

6 Claims, 2 Drawing Figures



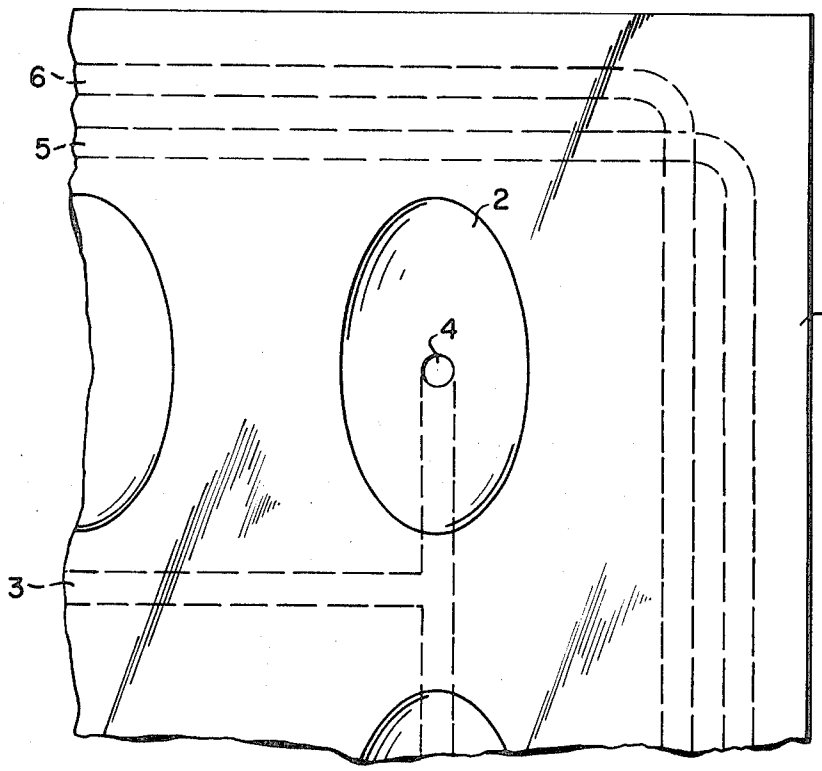


FIG.1

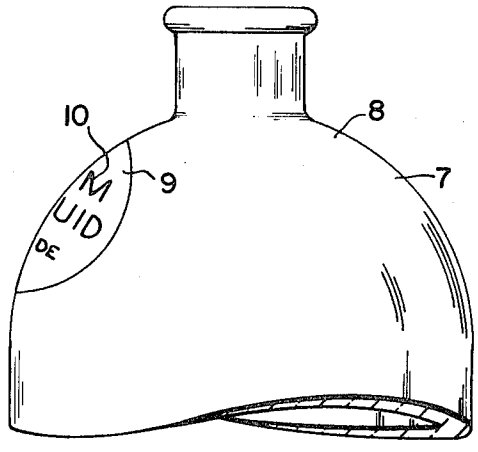


FIG.2

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METHOD OF LABELING CONTAINERS

This invention applies to the labeling of containers, and particularly to a method of applying labels of sheet material to a surface portion of a container which is non-developable, and particularly arcuate in three planes perpendicular to each other.

In one of its more specific aspects, this invention is concerned with the labeling of one-way glass bottles whose wall thickness is small, and which are normally given a non-cylindrical shape without avoidable flat surfaces in order to achieve greatest mechanical strength at minimum weight. The sole flat surface of such a bottle, if any, is the bottom, not suited for displaying a label, and much of the bottle surface approximates an ellipsoid of rotation or is ovoid so as to be circularly arcuate in all planes perpendicular to the bottle axis, and also arcuate in all planes parallel to the bottle axis, the curvature of the arcs in planes parallel to the axis being different from the curvature of the circular arcs in planes perpendicular to the bottle axis.

It is difficult to affix conventional labels to the three-dimensionally curved bottle surfaces. The known labels are made from pliable sheet material capable of being rolled out or developed in a plane. Such material may be wrapped conformingly about a cylindrical or conical surface without generating internal stresses in the material, but not about a surface which is arcuate in three planes perpendicular to each other. While the label may be pleated and stretched locally by a skilled operator to make it conform to the non-developable bottle surface, machinery capable of duplicating the manually produced effects is not available. Yet, manual labeling of bottles is not economically feasible in most cases.

It has therefore been proposed heretofore to provide an otherwise three-dimensionally curved bottle with an attachment having a cylindrically curved surface capable of receiving a conventional, initially flat label (The Glass Industry, Oct. 1968, page 551). It has also been proposed to soak a paper label in enough water to make it plastically deformable under the pressure with which the label is applied to the curved bottle surface (German Pat. No. 1,008,195).

The first-mentioned known solution to the instant problem is obviously impractical in many instances. The second proposal has not been found practical because the deformation achieved in the very wet paper causes stresses to be generated after drying, whereby the label edges tend to be lifted from the convex bottle surface. Moreover, a relatively long drying period is required for removing the water before the labeled bottle can be handled in a normal manner, and the output of a labeling machine is limited by this fact.

The primary object of the invention is the provision of a method of applying labels to non-developable container surfaces which permits labels to be applied firmly and permanently at the high speeds now expected from automatic bottle labeling equipment.

With the object and others in view, as will hereinafter become apparent, the sheet material of the label is deformed, while remote from the container, until one face of the material assumes a shape, mostly concave, conforming to the surface portion of the container to which it is to be applied, and which is arcuate in three planes perpendicular to each other or otherwise non-developable. The deformation is performed under such conditions that the molded shape of the label face can be maintained without significant stress in the label while the afore-mentioned face is applied to the container surface and is fixedly fastened to the same.

An embodiment of the invention is illustrated in the appended drawing in which:

FIG. 1 is a fragmentary top plan view of a mold for deforming sheet material for the purpose of this invention; and

FIG. 2 shows a bottle carrying a label applied according to the invention in an elevational view.

FIG. 1 shows a female mold 1 having multiple cavities 2 about two inches deep and of ovoid contour. The mold is provided with a vacuum duct 3 having an orifice 4 in each mold and with heating and cooling ducts 5, 6 in its thermally conductive walls.

FIG. 2 illustrates a bottle 7 whose shoulder portion 8 is curved ovoidally to conform to the bottom wall of each mold cavity 2. A label 9 carrying an imprint 10 is affixed to the shoulder portion 8.

The label was prepared and attached as follows:

One face of a polyethylene sheet, 3 mils thick, which had been pretreated by corona discharge to make it receptive to ink and adhesive was imprinted with the mirror image of a label text in a repeating pattern by conventional flexographic printing techniques. The printed sheet was then shaped by vacuum forming in the mold 1 which was heated well beyond the softening point of the sheet material while the individual printed surface portions were drawn by vacuum into the respective cavities 2. The mold was then cooled so that the deformed sheet sections were stabilized and retained their shape against the force of gravity when removed from the mold.

The shaped sheet was cut into individual pieces, and the pieces were trimmed to a label size of approximately 6 inches by 4 inches. The convex, printed face of each label 9 so produced closely duplicated the shape of the shoulder portion 8.

The printed label surface was coated with a commercially available adhesive for polyethylene (an aqueous dispersion of polyvinylisobutyl ether and acrylic acid esters), and the coated surface was superimposed on the conforming, clean glass surface of the bottle 7 without stressing the label in the direction of its length and width. Little pressure in the direction of label thickness was needed to expel air from the interface of the label 9 and the bottle 7 and did not cause internal stresses in the label.

In the finished product, the imprint 10 on the label is visible through clear polyethylene film, but protected by the latter against abrasion and other effects of the environment. The adhesive bond was not subjected to destructive stresses at elevated temperature which would tend to release internal stresses in the plastic film, since the film had been formed well above its softening temperature.

Obviously, the method of the invention is not limited to polyethylene film, nor is it necessary that the imprint be formed on the face of the film which is directed toward the container surface. It is generally more advantageous to print on flat stock, and it is therefore preferred to form the imprint prior to molding, but the label may be printed after molding, or even after application to the container if made receptive to the printing ink.

Good labels of the invention have been prepared from synthetic resin compositions made opaque either by imprints covering their entire exposed faces, or containing pigments and other fillers in a manner conventional in itself, and providing a good substrate for indicia additionally applied in printing ink because of the filler present.

It has also been found that laminates of paper and plastic film, whose mechanical properties are controlled by the plastic component, may be employed for making and applying labels according to the invention. A very thin layer of paper does not significantly interfere with the shaping of the plastic by vacuum or other conventional sheet forming techniques, and may carry the desired indicia which are protected against mechanical damage and spilled liquid by the plastic. Another sheet material which is suitable for the labels of the invention consists of a web made on a paper machine from cellulose fibers and fibers of thermoplastic synthetic resins and resembling a non-woven fabric.

If the surface which it is desired to cover with a label does not deviate greatly from the shape of a cylinder or other developable surface, the label of the invention may be made from paper prepared by the method of Cluett U.S. Pat. No. 2,624,245, under conditions which permit the label to be free from internal stress when superimposed on the non-developable bottle surface.

While reference has been had in the Example to the forming of label material by vacuum molding, other methods of plastic sheet forming may be employed in practicing this invention,

and will be chosen by those skilled in this art to suit the required depth of curvature and general shape of the label. Straight vacuum forming or drape forming over a male mold, drape molding in a female cavity, plug assist and plug forming with a vacuum, plug and ring forming with and without vacuum, and many other procedures commonly employed in the shaping of plastic sheet material may be resorted to.

Depending on specific service conditions and economic consideration, plastic materials more costly than polyethylene may be employed singly, in laminar structures, or in mixtures such as the fibrous web referred to above. Thus, flexible vinyl film, cast acrylic sheet material, and the several cellulose ester materials commonly used as thermoplastics are useful in this method. Polystyrene and copolymers thereof (ABS) and polyester films may find applications in the labeling procedure outlined above and require modifications of operating conditions which will readily suggest themselves to those skilled in the art.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not limited thereto, but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. In a method of applying a label of sheet material to a portion of a container having a surface which is non-developable, the improvement which comprises:

a. deforming said sheet material while remote from said container until one face of said material assumes a shape conforming to said surface portion;

b. maintaining said shape of said one face while conformingly superimposing said one face on said surface; and

c. fixedly fastening said one face to said surface.

2. In a method as set forth in claim 1, said non-developable surface being arcuate in three planes perpendicular to each other.

3. In a method as set forth in claim 2, the curvature of a first arc defined by said surface in one of said planes being circular, and the curvature of a second arc defined by said surface in another of said planes being different from the curvature of said first arc.

4. In a method as set forth in claim 1, said sheet material consisting essentially of thermoplastic resin composition and being deformed under pressure and at a temperature higher than the softening temperature thereof.

5. In a method as set forth in claim 1, indicia being imprinted on said one face prior to said superimposing, said material being permeable to light.

6. In a method as set forth in claim 1, indicia being imprinted on said one face prior to said deforming, said material being permeable to light.

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