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SIMULTANEOUS MANUFACTURE OF CONTAINERS AND CLOSURES

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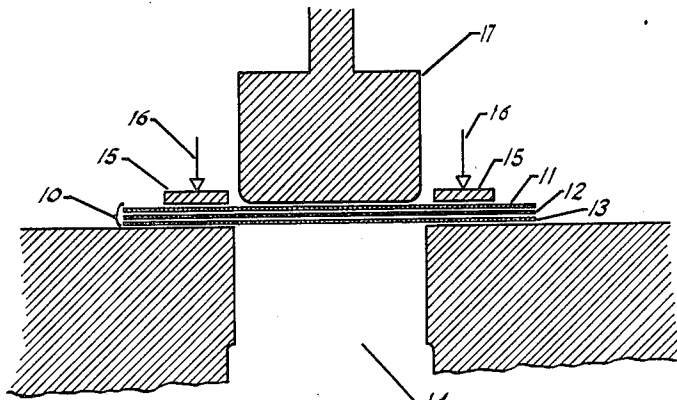


FIG. 1

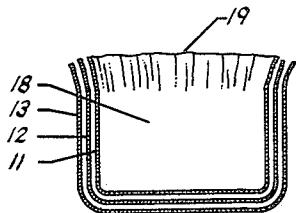


FIG. 2

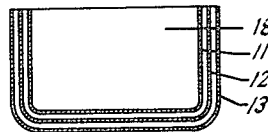


FIG. 3

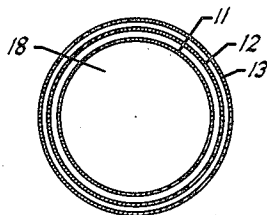


FIG. 4

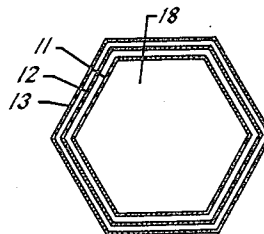


FIG. 5

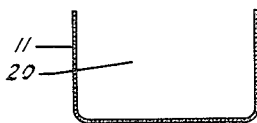


FIG. 6

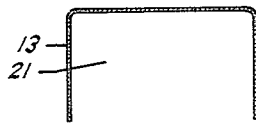


FIG. 7



FIG. 8

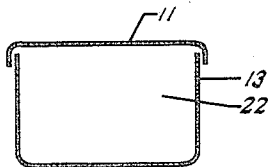


FIG. 9

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## UNITED STATES PATENT OFFICE

2,270,185

## SIMULTANEOUS MANUFACTURE OF CONTAINERS AND CLOSURES

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6 Claims. (Cl. 113—120)

The present invention relates to a method for the simultaneous manufacture of thermoplastic containers and of caps to serve as closures therefor. It relates in particular to a method whereby the body and the closely fitting cap portion of containers may be formed in a single operation.

The containers to which the invention relates are usually of a type having a substantially flat bottom and top and vertical walls, though the top and bottom may be concave or convex if desired. In horizontal cross-section the containers may be circular, elliptical, rectangular, or any polyhedral shape desired. The containers here concerned are made of thermoplastic sheet material which is capable of being drawn to shape, as hereinafter described, and have a close fitting or "friction" cap of the same cross-sectional shape as the container, but just enough larger in each horizontal dimension to fit over the vertical walls of the container.

It is the principal object of the invention to provide a method whereby containers and caps therefor, as aforesaid, may be formed simultaneously and substantially in a single working operation. Other objects may appear from the following description.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the method hereinafter fully described and particularly pointed out in the claims, the annexed drawing and following description setting forth in detail certain modes of carrying out the invention, such disclosed modes illustrating, however, but some of the various ways in which the principle of the invention may be used.

In the single sheet of annexed drawings:

Fig. 1 represents a vertical section through a drawing device, whereby one step of the invention may be carried out, ready for operation;

Fig. 2 illustrates a nest of a plurality of drawn sheets from which the containers are made;

Fig. 3 shows the same nest with the ruffled surplus edge removed;

Figs. 4 and 5 are plan views showing various cross-sectional shapes which the nested drawn bodies may take;

Figs. 6 and 7 represent a pair of alternate members of a nest, that in Fig. 6 being the smaller and that in Fig. 7 being the larger member of the pair;

Fig. 8 shows the same member as in Fig. 7, further trimmed to reduce the height of its wall; and,

Fig. 9 represents an assembled container.

In Figs. 2-5 and 9, the spacing between the formed members is shown in a greatly exaggerated scale for purposes of illustration.

According to the invention, a container and its cover, of the type described above, may be made from organic thermoplastic sheet material by subjecting a stack of sheets, at least the alternate members of which are of the desired thermoplastic, to a drawing operation, suitably in a conventional press containing a male ram and female die of the same cross-sectional contour as the desired container, thereby to form concurrently a plurality of nested members having the desired shape, trimming any excess or irregular edge or ruffle from the so-formed vertical-walled bodies, separating the nested members, pairing off alternate members of the drawn shapes, and utilizing the member of said pair which is of smaller cross-sectional area as the container body and the other member, of larger cross-sectional area, as the cap for said container.

A preferred method of carrying out the invention will now be described with reference to the accompanying drawing, in the several figures of which like parts bear like numerals. A stack 10, consisting of thermoplastic sheets 11 and 13, separated by a spacer sheet 12, is placed over the opening of a female die member 14 of a drawing press. The stack of sheets 10 is clamped in position by means of clamping ring 15, suitable tension being maintained thereon, as indicated diagrammatically, by means 16. A ram or plunger 17, of the same cross-sectional contour but somewhat smaller than the die cavity 14, is driven, by means not shown, into the said die cavity, distorting the stack 10 and drawing it to the shape of the die. The plunger 17 is withdrawn, tension released from the ring 15 and the nest 18 of drawn sheets is removed from the press. The nest 18 has a ruffled or fluted edge 19 of excess sheet material, which is trimmed off to leave each of the nested members with a vertical wall of substantially uniform height around its perimeter, as illustrated in Fig. 3. The various formed sheets of which the nest 18 is composed are separated one from the other, and alternate members, such as those produced from sheets 11 and 13 are paired off to form, respectively, the base or container portion 20 and the cap or closure portion 21 of a thermoplastic container 22. Commonly the vertical wall of the cover member 21 is trimmed to reduce its height as illustrated in Fig. 8. It is seen from the foregoing that, in a single drawing operation applied to a plurality of sheets, the two perfectly fitting

members of a thermoplastic container 22 are formed simultaneously.

The invention has been illustrated with reference to operations carried out on a stack 10 composed of three sheets, the intermediate sheet 12 being merely a spacer to ensure sufficient clearance between sheets 11 and 13, when drawn to form the members 20 and 21, respectively, so that the cap 21, while fitting closely, is still large enough to slip over the upper rim of the body member 20. The particular conditions illustrated result in the formation of the necessary parts for a single container 22, the spacer member formed from sheet 12 being discarded. In another form of the invention, the stack 10 of sheets operated on may consist of four or more thermoplastic sheets, which, when drawn to form a nest, trimmed, separated into pairs of alternate members, and assembled as above described, forms two or more containers.

When a single container is formed from three sheets, as previously described, the upper sheet 11 and lower sheet 13 are of a thermoplastic material of sufficient thickness to provide the required strength and rigidity in the subsequently fabricated container, allowance being made for thickness reduction during the drawing operation. The spacer sheet 12 may be of the same thickness as the sheets which it separates, or, if desired, it may be thinner than these sheets, or in certain instances somewhat thicker. The spacer sheet itself is preferably thermoplastic and may be of the same or different composition employed in the sheets which it separates. The spacer sheet may also, though less favorably, be a non-plastic material such as paper or Cellophane. Non-thermoplastic spacers sometimes tend to rupture under the stress of the drawing operation.

When it is intended to draw more than three sheets simultaneously, it is generally preferable that all of them should be thermoplastic, and all of a thickness suitable for making containers. Within the stack 10, in such a case, each sheet is shaped for use in making a container part, and each serves as the spacer for the sheets which it separates, providing a clearance between alternate members sufficient to enable them to slide together in a satisfactory cap and container relationship.

The thermoplastic sheets employed in a single stack, and subjected to simultaneous drawing, may be transparent, if the material of construction permits of transparency, or they may be opaque. When using colored sheets, they may all be of a single color, or they may individually be of different colors. The latter arrangement makes possible the fabrication of boxes or containers of striking color combinations. Because of the intimate relation between the component elements of the "nest" following the drawing operation, a closely fitting yet easily removable cover is assured for each container body.

The films or sheets employed should ordinarily be lubricated before drawing to prevent wrinkling and local overstrain during drawing. Soap, or sodium salts of higher alkyl acid sulphates may be used as the lubricant, and may be deposited on the film from a dilute aqueous solution of the lubricant. Such lubrication tends to prevent sticking together of the sheets.

The material of which the containers are to be made may be any organic thermoplastic which is available as, or capable of being made into, strong flexible sheets and which is not too

brittle to be drawn. Because of its high inherent flexibility and toughness, organo-soluble ethyl cellulose is a preferred material for the purpose. The other cellulose derivatives may be employed, as may such polymer products as vinylidene chloride co-polymers, vinylite, plexiglas, or the like. Suitable sheet thicknesses are from 0.005 to 0.040 inch, and the spacers may be of from 0.001 to 0.015 inch for most satisfactory results.

The drawing operation may be performed at room temperature, or at a moderately higher temperature, but should not be carried out as high as the softening point of the plastic employed. The method described, using a ram or plunger to force the sheets into shape in the female die, is satisfactory, and is usually preferred. Distorting or shaping influences other than a ram may be employed in some cases if desired. Included in such shaping means are directly applied hydraulic pressure or air pressure, either of which may act to stretch the thermoplastic sheets and to shape them to the walls of the female die.

Containers as herein described have been made in sizes varying from less than 0.5 to over 2 inches deep, and from 1 to 6 inches or more in diameter. They have been made in circular, square, oval, and hexagonal cross-section, and with flat and slightly dished tops and bottoms. Other sizes and shapes are possible, being limited chiefly by the drawing equipment available, the drawing characteristics of the plastic employed, and by the requirement that the container have substantially vertical walls and be symmetrical in vertical section. They may be employed for a variety of useful and decorative purposes. For example, containers as herein described are employed as powder, cosmetics or "vanity" boxes, as well as for packaging and displaying numerous small and fragile or easily soiled articles. For the latter purpose an opaque body and transparent cover therefor are especially suited. A particularly advantageous adaptation of the invention is the manufacture of capsules of varying sizes for measuring, holding or administering medicinals, or for displaying relatively small quantities of material, the plastic being selected according to the purpose in mind, water-soluble or acid-soluble plastics being most generally used for medicinal capsules.

I claim:

1. In a method of making a container of organic plastic material, the steps which consist in drawing simultaneously a stack of flat sheets to the desired cross-sectional contour, thus forming a nest of the shaped sheets, at least the alternate members of which are of the desired plastic, separating the nested members, and, after suitable trimming of the vertical walls thereof, employing a plastic member, other than the outermost member of the nest, as a container body, and another plastic member of the nest, of larger diameter, as a cap therefor.

2. In a method of making a container of organic plastic material, the steps which consist in drawing simultaneously a stack of sheets to the desired cross-sectional contour, thus forming a nest of the shaped sheets, at least the alternate members of which are of the desired plastic, separating the nested members, pairing off alternate members of the drawn shapes, and, after suitable trimming of the vertical walls thereof, utilizing the member of a pair which is of smaller cross-sectional area as the container body and

the other member, of larger cross-sectional area, as the cap for said container.

3. In a method of making a container of organic plastic material, the steps which consist in drawing simultaneously a stack of three sheets to the desired cross-sectional contour, thus forming a nest of the said sheets, at least the inner and outer members of the nest being of the desired plastic, separating the nested members, and, after suitable trimming of the vertical walls thereof, utilizing the smallest, inner member as the container body, and the largest, outer member as the cap for said container.

4. In a method of making a container of organic plastic material, the steps which consist in drawing simultaneously a stack of four sheets of the desired plastic to the desired cross-sectional contour, thus forming a nest of the said sheets, separating the nested members, pairing off alternate members of the drawn shapes, and, after suitable trimming of the vertical walls thereof, utilizing the member of each pair which is of smaller cross-sectional area as a container body and the other member of the pair, of larger cross-sectional area, as the cap for said container.

5. In a method of making a container of organic plastic material, the steps which consist in forming a stack of a plurality of sheets of the said material of sufficient thickness to provide the required strength and rigidity in the subse-

quently fabricated container, interposing a plastic spacer sheet between pairs of said sheets, subjecting the stack, including spacers, to simultaneous drawing to the desired cross-sectional contour, trimming the ruffled excess from the so-formed nest of shaped sheets, separating the members of the nest, pairing off alternate members of the drawn shapes, and, after suitable trimming of the vertical walls thereof to provide members of the desired depth, utilizing the member of a pair which is of smaller cross-sectional area as the container body, and the other member, of larger cross-sectional area, as the cap for the said container.

6. In a method of making a container of organic plastic material, the steps which consist in drawing simultaneously a stack of sheets to the desired cross-sectional contour, thus forming a nest of the shaped sheets, at least the alternate members of which are of the desired plastic, separating the nested members, pairing off alternate members of the drawn shapes, trimming the vertical wall of the member of greater cross-sectional area to a lesser height than the wall of the member of lesser cross-sectional area, and utilizing the member of lesser area and greater height as the container body and the other member of greater area and lesser height as the cap for said container.

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