April 2, 1968 A. HONKANEN ET AL 3,375,954

NESTABLE CONTAINER

Filed Oct. 19, 1966

Fig. 1

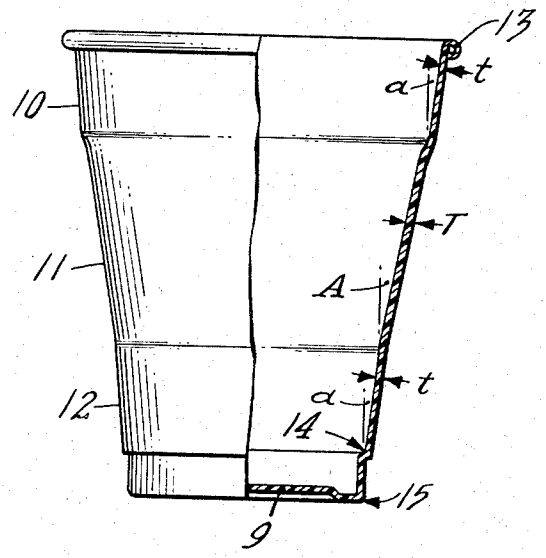


Fig. 3

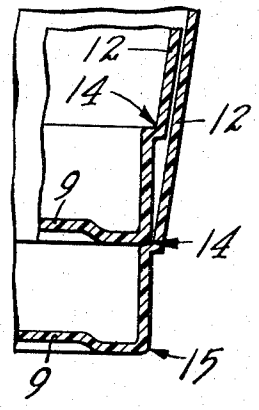
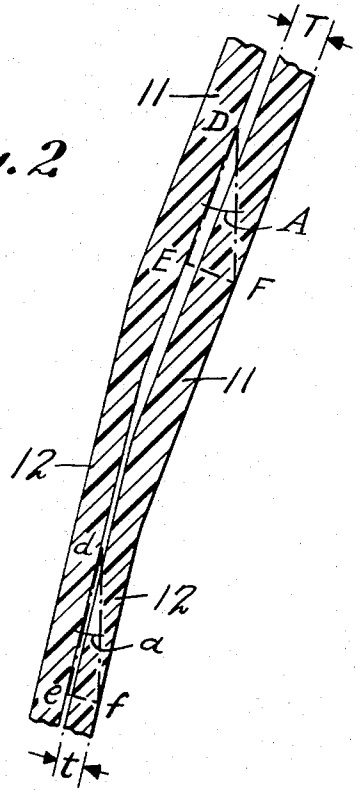


Fig. 2



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NESTABLE CONTAINER

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ABSTRACT OF THE DISCLOSURE

A nestable container adaptable to hold hot beverages has a side wall with a finger-grasping, frusto-conical section and a lower frusto-conical section, the latter section having a smaller cone angle than the former section, whereby the finger-grasping section may be made thicker than the lower section to increase the insulating effect without adversely affecting the axial spacing between nested cups.

This invention relates to containers and particularly to nestable plastic cups which can be used for holding hot beverages.

It is desirable that containers or cups for holding hot beverages, such as coffee, avoid discomfort to people's hands due to heat transfer from the hot beverage to the outside wall surface of the cup. In some known prior art containers, irregularities or protuberances have been formed on sections of the cup side wall to reduce the contact area of a person's fingers or hand and thereby avoid objectionable heat transfer. These constructions required the use of molds and dies having intricate surfaces or configurations, increased the complexity of the manufacturing process, and resulted in higher manufacturing costs. In addition, the irregularities on the outside of the cups prevented or hindered attempts to decorate the outside surface of the container.

Objectionable heat transfer may also be reduced by increasing the cup side-wall thickness to increase the overall insulating effect. This, however, is not always practical because thicker walls tend to increase the cost of the cup. Also, for a given cone angle, thicker walls adversely affect the nesting compactness, more particularly, it increases the nested spacing, i.e. the axial distance between two nested cups. Increased nested spacing is undesirable because a given number of nested cups produce a taller stack height and occupy a larger volume resulting in an increase in the amount of packaging material, storage space, and transportation costs.

Since the angle of the container side wall relative to vertical, i.e. cone angle, is also determinative of nested spacing, it is possible, in a container of given volume and wall thickness to reduce nested spacing by increasing the cone angle. However, there are limitations to this in that while maintaining a given brim diameter, too large a cone angle will result in a small base or bottom with less stability. Thus, it is not always practical to compensate for increased spacing between two nested cups by increasing cone angle, as the latter tends to produce undesirable container geometry.

Accordingly, it is an object of the present invention to provide a plastic cup suitable for dispensing hot beverages without discomfort to a person's fingers or hand, which is adapted to be nested compactly, which requires a minimal amount of plastic material, and which may be easily and economically manufactured.

Another object is to provide a plastic cup for hot beverages having a substantially smooth outer side wall.

A further object is to provide certain improvements in the form, construction, arrangement and material of the several parts whereby the above-named and other objects may effectively be attained.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

The aforesaid objects of the present invention are achieved by providing a container side wall with a frustoconical finger-grasping section having a substantial smooth outer surface and a second, lower frusto-conical section having a thinner wall and a smaller cone angle than the finger-grasping section whereby upon nesting of two such like containers, the perpendicular distance between corresponding side walls will be greater for the finger-grasping sections than for the lower sections, thereby permitting the finger-grasping section to be made thicker to increase the insulating effect thereof without adversely affecting the spacing between two nested cups.

For a better understanding of the present invention, reference should be had to the accompanying drawings wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIGURE 1 is an elevational view, partly broken away and in section, of a cup constructed according to one embodiment of the invention.

FIGURE 2 is an enlarged, fragmentary, sectional view of intermediate portions of two nested cups.

FIGURE 3 is an enlarged, fragmentary, sectional view of the bottom portions of two nested cups.

Referring to the drawings, FIGURE 1 shows a plastic cup adapted to contain a hot beverage such as coffee. The cup has a bottom wall **9**, a side wall made up of three frusto-conical sections **10**, **11**, and **12**, and an upper curl or lip **13**. The cone angle *a* of end sections **10** and **12** are the same but smaller than the cone angle A of intermediate section **11**. Also the wall thickness *t* of end sections **10** and **12** are the same but less than the wall thickness T of intermediate section **11**. By way of example, the end sections **10** and **12** may have a cone angle *a* of 6 degrees and a thickness *t* of 0.025" while the intermediate section **11** may have a cone angle A of 10 degrees and a thickness T of 0.040". The thicknesses and angles may be varied while still maintaining the relationships where T is greater than *t* and angle A is greater than *a*. Thus, the cone angles A and *a* may be varied while maintaining a difference of at least one degree therebetween. The thickness T of intermediate finger-grasping section **11** and the thickness *t* of end sections **10** and **12** may be determined by various factors such as the size of the container and the type of plastic material employed. However, for cups made of foamed polystyrene in the most common sizes (e.g. suitable for vending machines), the thickness T of intermediate section **11** is preferably less than 0.050" and the thickness *t* of end sections **10** and **12** is preferably less than 0.030".

The cup is adapted to be nested in telescopic fashion with like cups. In order to prevent formation of a vacuum between nested cups which would tend to hold them together, suitable means, as will be described, are provided to maintain a slight separation between the side walls of the nested cups.

In the illustrated cup, the larger cone angle A on the intermediate section **11** allows an increased side-wall thickness T on the intermediate section **11** without increasing nested spacing. This is indicated in the enlarged partial view of FIGURE 2 where the cone angles have been proportionately increased and the thicknesses proportionately enlarged for the purposes of illustration. In FIGURE 2, the two longitudinal (vertical as illustrated) lines DF and *df* connect corresponding points on the outside wall surfaces of sections **11** and **12** respectively, of two nested

cups. Since the nested spacing represents the longitudinal or axial distance between corresponding points of two nested cups, lines DF and *ef* represent the nested spacing and are equal. Lines EF and *ef* pass through points F and *f* and are drawn normal to the surfaces of the side walls forming intermediate sections **11** and lower end sections **12** respectively. Thus lines EF and *ef* represent the perpendicular distance between corresponding side walls, said perpendicular distance being made up of the side-wall thickness and the separation between the side walls. Drawing in lines DE and *de* along the outside wall of the inner one of the two nested cups completes two right triangles DEF and *def*. It will be apparent that the two equal lines DF and *df* representing the nested spacing, as previously mentioned, define the hypotenuse of each right triangle. Also the angles A and *a* in each triangle represent the cone angles of intermediate section **11** and lower section **12** respectively. Since angle A is greater than angle *a* and the sine of angle A greater than the sine of angle *a*, then EF/DF must be greater than *ef/df*. Since DF and *df* are equal, as previously described, then EF must necessarily be longer than *ef*. Accordingly, the provision of a larger cone angle A serves to increase the perpendicular distance between the corresponding side walls of intermediate section **11** of two nested cups. It follows, therefore, that intermediate section **11** may be made thicker than lower section **12** without adversely affecting nested spacing. Expressed otherwise, for a given nested spacing, the use of a larger cone angle on intermediate section **11** will permit this latter section to be made thicker.

As previously indicated, a slight separation is maintained between the side walls of two nested cups to preclude formation of a vacuum between the cups which would tend to delay or prevent the bottom cup from falling from a stack when released as in a vending machine. As best shown in FIGURE 3, means for effecting this separation may comprise a shoulder **14** on the lower inside of the cup. This shoulder **14** has an inner diameter smaller than the outer diameter of the bottom edge **15** of the cup so that the shoulder **14** of one cup will support the bottom edge **15** of a nested inner cup slightly higher than would be the case if there were no shoulder and the side walls contacted and rested on one another. By way of example, if allowing the side walls to contact and rest on one another resulted in a nested spacing of 0.250", the shoulder may be located to provide a nested spacing of 0.280" which would provide a slight separation between the side walls. Other arrangements for providing this slight separation may be employed as desired.

It will be apparent that as an alternative arrangement, the upper frusto-conical section **10** may be dispensed with and the frusto-conical section **11** continued upwardly where it is terminated with a lip or top curl. As in the case of the illustrated embodiment, this alternate arrangement would allow an increased thickness of the upper of the two frusto-conical sections without adversely affecting nested spacing.

In the cup shown and described, the outer surfaces of the side walls may be made smooth, thereby facilitating printing or application of decoration thereon. The intermediate section **11** with its thickened side wall is located where the cup is normally grasped and accordingly, defines a finger-grasping section offering a greater insulating effect than other sections of the side wall. In addition, thickened section **11** serves to rigidify the cup, particularly at an intermediate area furthest removed from normally rigidifying parts such as the bottom **9** and upper lip **13**. Also because of the increased rigidity in this finger-grasping area, there is less tendency for the cup to be bent or squashed when it is being manually handled and squeezed. Further, the larger cone angle of the intermediate section **11** affords a steeper surface to a person's fingers so that there is less tendency for a full cup to slide down when grasped.

As described in detail above, the increased side wall thickness at the finger-grasping area does not adversely affect nested spacing. In this regard it is observed that lower nested spacing and resulting stack height are highly desirable because of the many benefits resulting therefrom. For example, considering the packaging for the cups and the large volumes sold because of the fact they are disposable, a slight reduction in stack height can effect a substantial savings on the amount of packaging material required and the overall cost thereof and, of course, on transportation and storage costs.

From the above, it will be apparent that applicants' container is arranged to minimize nested spacing and stack height while providing added insulation where needed most for the user's comfort and presenting a smooth outer surface to facilitate decoration thereof.

The container may be made of foamed polystyrene or any expandable foam or foam laminates and other thermoplastic resins, for example, high impact polystyrene, polyethylene, polypropylene, polyvinyl chloride, and others. The cup may be thermoformed from a flat sheet of plastic material, a method of manufacturing known to those skilled in the art.

It is thought that he invention and many of its attendant advantages will be understood from the foregoing description and it wlil be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. A nestable container adaptable for holding hot beverages comprising a bottom and a side wall, said side wall having a stacking means adjacent the bottom wall to facilitate nesting, a finger-grasping, frusto-conical section of uniform thickness spaced from the bottom wall having a smooth outer surface adapted to be grasped by a person, and a lower frusto-conical section having a thinner wall and a smaller cone angle than the finger-grasping section such that upon nesting of two such like containers, the perpendicular distance between corresponding side walls is greater for the finger-grasping sections than for the lower sections, thereby permitting the finger-grasping section to be made thicker than the lower section to increase the insulating effect and rigidity thereof without adversely affecting the axial spacing between two nested cups.

2. A nestable container as set forth in claim **1** wherein said side wall has an upper frusto-conical section of a different cone angle than that of said finger-grasping section.

3. A nestable container as set forth in claim **2** wherein said upper section has substantially the same wall thickness as said lower section.

4. A nestable container as set forth in claim **2** wherein said upper section has substantially the same cone angle as said lower section.

5. A nestable container as set forth in claim **1** wherein said finger-grasping section has a wall thickness of up to 0.050 inch.

6. A nestable container as set forth in claim **5** wherein said lower frusto-conical section has a wall thickness of up to 0.030 inch.

7. A nestable container as set forth in claim **1** wherein the difference between said cone angles is at least one degree.

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