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[54] **PLASTIC TRAY AND METHOD OF MAKING SAME**

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[52] **U.S. Cl.** **220/66;** 220/72; 206/503; 264/231

[51] **Int. Cl.²** **B65D 7/32;** B65D 1/34

[58] **Field of Search** 220/66, 72, 74; 206/503, 206/515, 518, 519, 520

[56] **References Cited**

UNITED STATES PATENTS

3,351,228	11/1967	Huisman	220/66
3,434,625	3/1969	Embry	220/72
3,494,502	2/1970	Roush	220/66
3,648,883	3/1972	Briedenstein	220/66
3,727,791	4/1973	Fraser	220/66

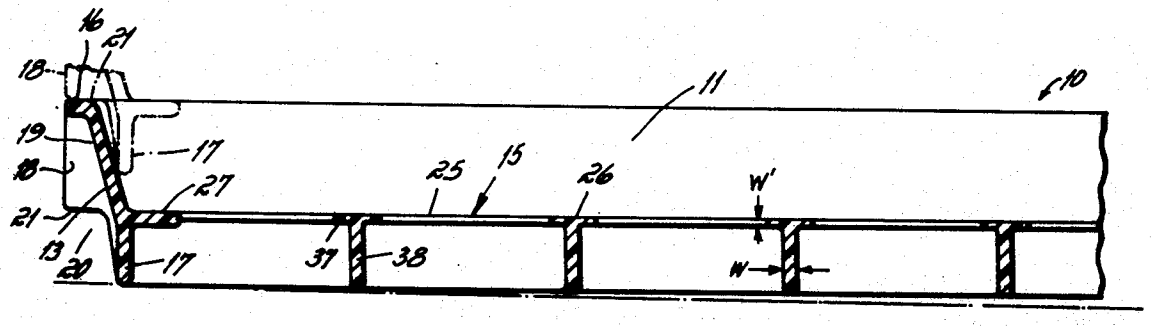
Primary Examiner—George E. Lowrance

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[57] **ABSTRACT**

An open top tray having side walls and a bottom wall. The bottom wall is made from a matrix of interconnecting struts which are so configurated and sized that in the course of being molded they are prestressed into an upwardly bowed condition. This prestressing rigidifies the bottom of the tray as well as enables it to be maintained in an upwardly bowed condition from which it is deformed into a flat condition only when the tray is fully loaded. The side walls of the tray terminate in a horizontal flange which is reinforced by vertical ribs which extend between the side walls and the horizontal flange.

5 Claims, 5 Drawing Figures



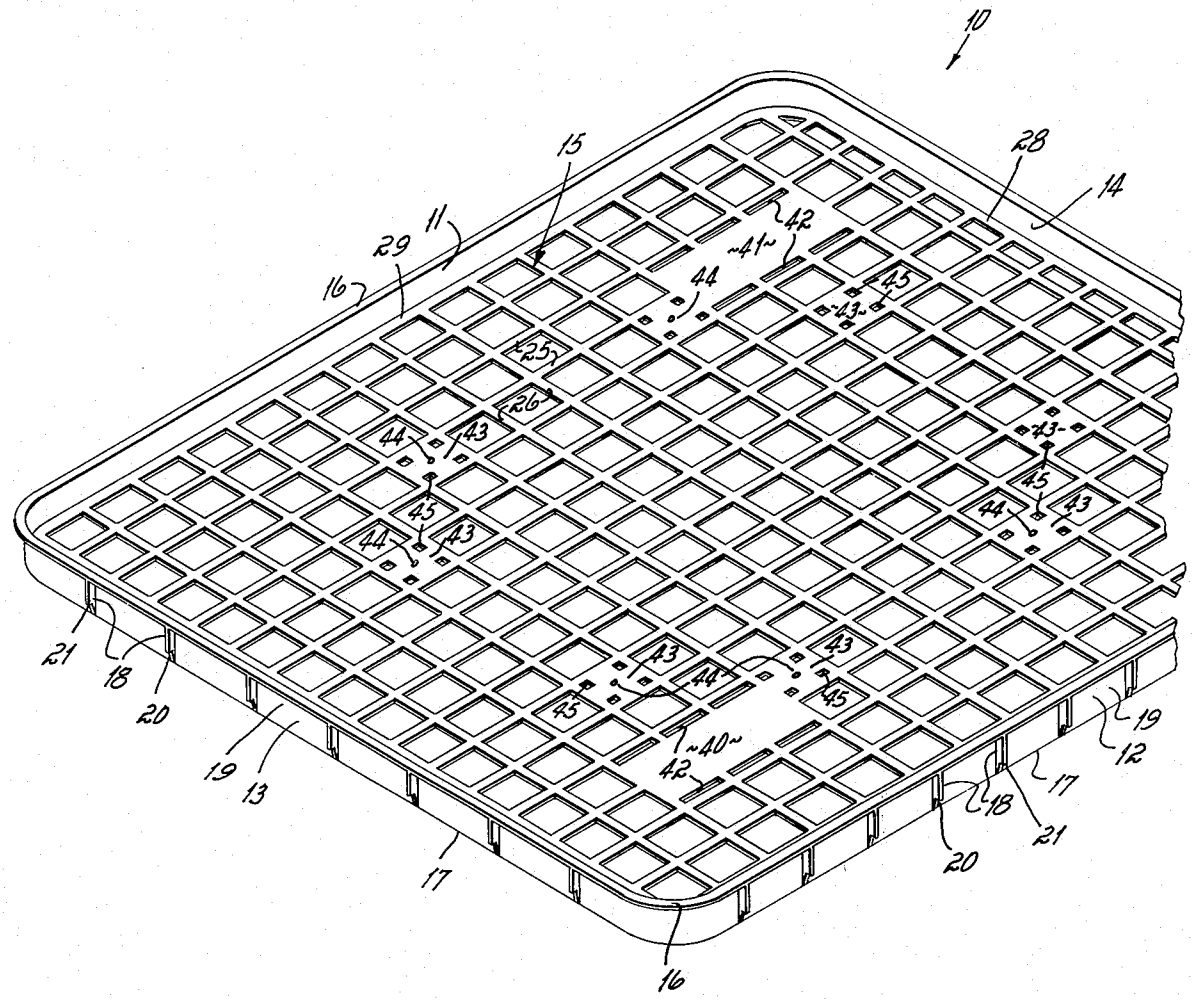


Fig. 1

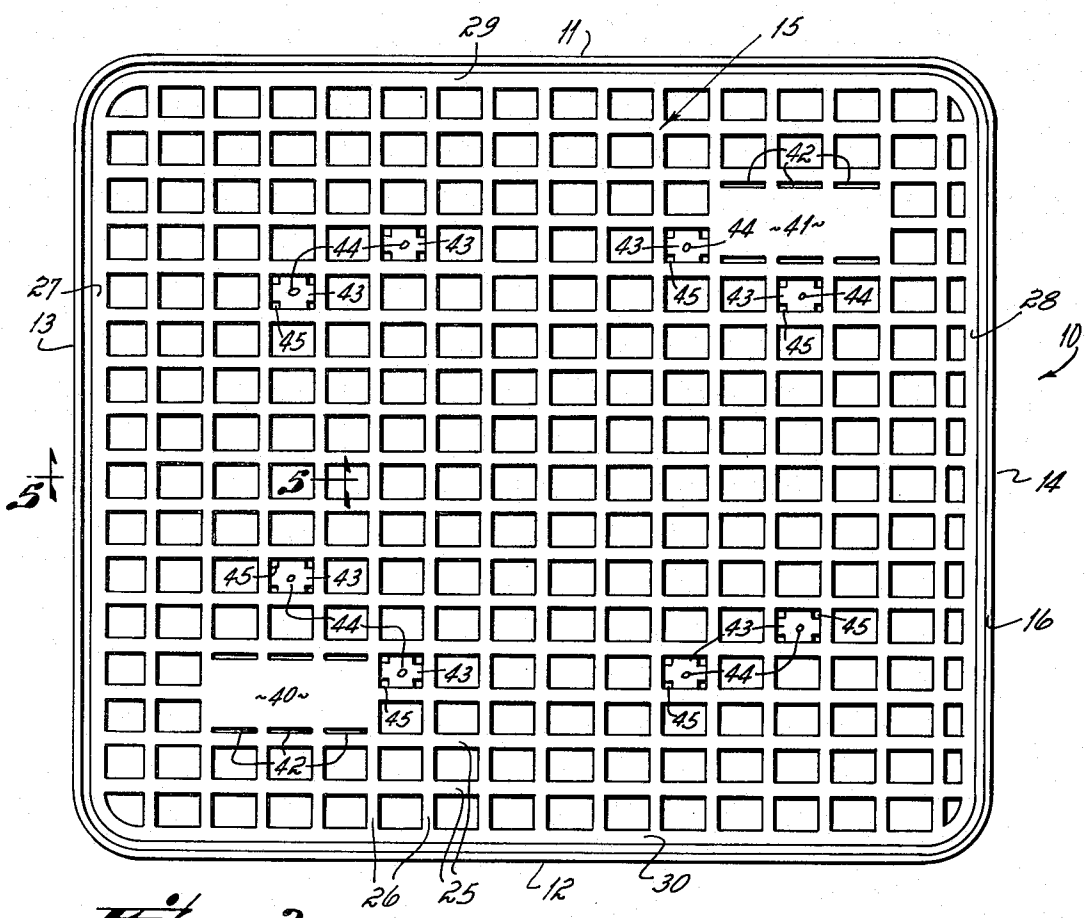


Fig. 2

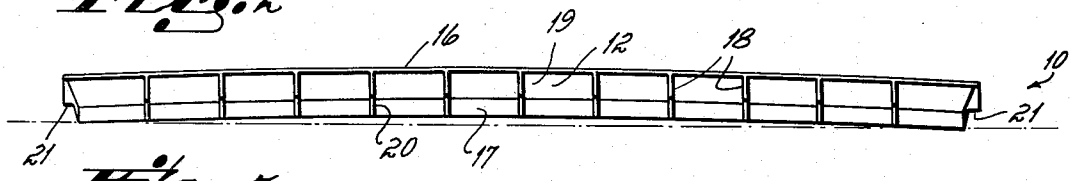


Fig. 3

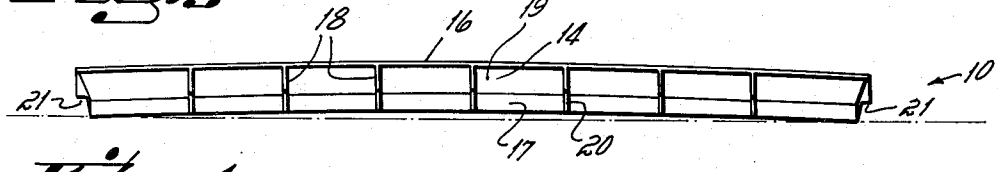


Fig. 4

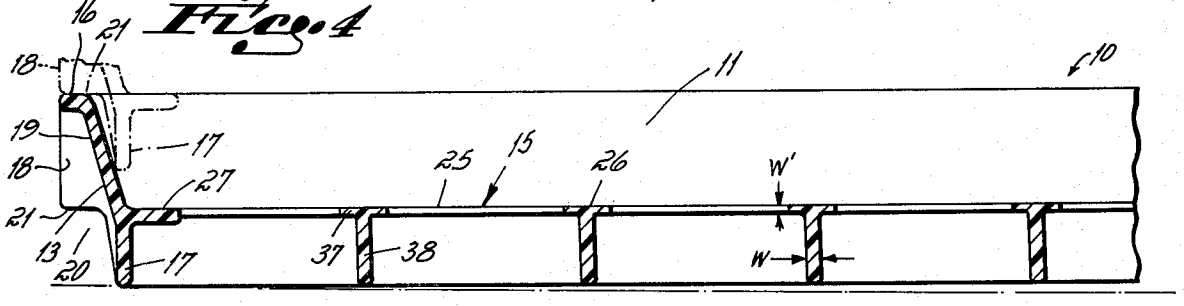


Fig. 5

PLASTIC TRAY AND METHOD OF MAKING SAME

This invention relates to molded plastic trays and particularly to low profile trays or shallow plastic trays which have relatively little vertical rigidity imparted to the bottom by the side walls.

Molded plastic trays are utilized for a large number of commercial applications, each one of which usually requires a specific shape and configuration; some are relatively small with deep botom areas and high side walls and others are large with shallow side walls. Between these two extremes there are all kinds of variations in both size and shape. Irrespective of the configuration and/or application, an attempt is usually made in the course of tray design to minimize the cost of the tray by minimizing the quantity of plastic material employed in it. Reduction or minimization in the quantity of material employed in the tray, though, usually results in a sacrifice of tray rigidity and load capacity, particularly if the minimization occurs in the bottom of the tray. In the case of large trays with minimum height profiles, the bottom is often very flexible because of a minimal quantity of plastic employed in forming the bottom. Generally, flexibility of the bottom of the tray, particularly in the case of large trays, is undesirable because the bottom tends to bow or sag when the tray is fully loaded.

One common expedient employed to minimize the quantity of plasic employed in a tray is that of forming the bottom of an open gridwork of plastic struts. Such gridwork type plastic bottom trays are employed for numerous applications, as for example, beverage cases, bottle case, tote boxes, etc.; but they are almost always employed in trays used in the bakery industry. Not only is the open gridwork bottom less expensive in terms of material costs, but it also has the inherent advantage of draining and preventing collection of moisture in the bottom of the tray. Consequently, in the bakery industry where trays require frequent cleaning and where moisture is detrimental to the product carried in the tray, nearly all trays have some form of open gridwork bottom structure.

It has been an objective of this invention to provide a molded plastic tray or pallet and a method of making the tray which results in a very rigid bottom structure without a corresponding increase in the quantity of material employed in the manufacture of the tray. This objective has been accomplished and one aspect of this invention is predicated upon the concept of prestressing the bottom during its formation so that it is rigidified without a corresponding increase in the quantity of material utilized in the manufacture of the tray.

Still another objective of this invention has been to provide an approved method of manufacturing molded plastic trays which results in the bottom of the tray being rigidified as a consequence of its being prestressed in the molding process. This prestressing is derived from a bottom configuration which causes some portions to solidify more quickly than others with the result that the last portions to solidify, shrink and prestress the earlier solidified portions.

Still another objective of this invention has been to provide a low profile or shallow tray in which the bottom of the tray is bowed upwardly. Particularly in shallow or low profile trays (sometimes referred to as "pallets"), there is a problem with the natural sag of the bottom when the tray is fully loaded. These low profile or shallow trays derive very little rigidity from the sides so that sag is particularly acute in this type of tray. To minimize this sagging, the tray of this application is prestressed into an upwardly bowed condition during the molding process. Consequently, when the tray is fully loaded, the bottom is only forced into a horizontal plane and is not permitted to sag or droop in the center.

The tray which accomplishes these objectives is a shallow molded plastic tray in which the bottom is formed by intersecting struts. Each of the struts is T-shaped in cross section and has the cross bar portion of the T forming the inside bottom surface of the tray. The vertical bar of the T extends downwardly from the cross bar and is much heavier or thicker than the cross bar section with the result that it is the last portion to solidify in the mold. Because of these differentials in thickness and because the plastic material of which the struts are formed shrinks during solidification, the struts are prestressed into an upwardly bowed condition during formation. Consequently, the bottom is very rigid in addition to its being bowed upwardly.

The preferred embodiment of the tray of this invention has shallow side walls which terminate in a horizontal flange. This flange is reinforced by vertical ribs located around the periphery of the tray which extend between the horizontal flange and the side walls. This horizontal flange is advantageous, particularly in bakery trays, because it eliminates recesses or cavities which are potential moisture traps. Heretofore, the common practice has been to form a flange on the edge of the tray but to have the flange generally hook shaped with the result that the inside surface of the hook could and did retain moisture. The side edge and top flange construction of this preferred embodiment of the tray eliminates that moisture retaining recess from the side wall of the tray.

These and other objects and advantages of this tray will become more apparent from the following description of the drawings in which:

FIG. **1** is a perspective view of a tray incorporating the invention of this application.

FIG. **2** is a top plan view of the tray of FIG. **1.**

FIG. **3** is a side elevational view of the tray of FIG. **1.**

FIG. **4** is an end elevational view of the tray of FIG. **1.**

FIG. **5** is a cross sectional view taken along line **5—5** of FIG. **2.**

A preferred embodiment of a stackable tray **10** incorporating the invention of this application is illustrated in FIGS. **1–5.** This tray **10** is generally rectangular in configuration and comprises a pair of side walls **11, 12** and a pair of end walls **13** and **14** interconnected by a bottom wall **15.**

As may be seen most clearly in FIG. **5,** the side walls and end walls of this tray taper upwardly and outwardly from the bottom wall **15** and terminate at their upper end in a horizontal flange **16.** A vertical lip **17** extends downwardly from each of the side and end walls beneath the horizontal plane of the bottom wall **15.**

To reinforce the side and end walls of the tray, there are a plurality of vertical ribs **18** which extend between the underside of the horizontal flange **16** and the outer surface **19** of the side and end walls. These ribs **18** each have recesses **20** formed in them to facilitate stacking of the trays. This stacking relationship is illustrated in FIG. **5.**

When the trays are stacked, the recess **20** enables the bottom flange **17** of the side wall of the uppermost of two stacked trays to be received within the open top of

the lowermost tray. In that stacked relationship a horizontal surface **21** of the recess **20** of the uppermost tray rests upon the top surface of the horizontal flange **16** of the lowermost tray.

Referring now to FIGS. **2** and **5**, it will be seen that the bottom of the tray is formed from a plurality of intersecting longitudinal struts **25** and transverse struts **26.** The longitudinal struts **25** are equidistantly spaced across the bottom of the tray and extend from a horizontal ledge **27** at one end of the tray to a horizontal ledge **28** at the opposite end. Similarly, the transverse struts **26** are equidistantly spaced between the ends of the tray and extend between a horizontal ledge **29** along one side **12** of the tray to a horizontal ledge **30** at the opposite side of the tray.

All of the struts **25** and **26** are identical in cross sectional configuration and comprise a horizontal cross bar section **37** and a vertical rib **38.** The top surface of the cross bars **37** form the inside surface of the bottom of the tray.

As may be seen most clearly in FIG. **5**, the vertical ribs of the tray are all substantially wider or have a width or thickness W substantially greater than the cross sectional width or thickness W' of the cross bars. In fact, in the preferred embodiment of the invention, the thickness of the vertical ribs is approximately twice that of the cross bars. The purpose of this difference in width is to prestress the bottom of the tray during the molding process.

The plastic tray of this invention is manufactured in a closed mold in which there is a cavity which conforms to the configuration of the tray. Molten thermoplastic material, as for example, fiber glass reinforced high density polyethylene, is poured into the mold where it cools and sets or solidifies. In the course of solidification, the material shrinks anywhere from .002 inch to .050 inch per inch of length. In the preferred embodiment in which the tray is molded from fiber glass reinforced high density polyethylene, this shrinkage is approximately .005 inch to .008 inch per inch. Because of the relative differences in thicknesses, the cross bar sections **37** of the struts solidify before the vertical ribs **38.** After the cross bars have solidified or "set," continued solidification of the vertical ribs causes further shrinkage of the ribs with the result that the previously solidified cross bars **37** are prestressed. In the preferred embodiment of this invention, this prestressing of the struts **25, 26** causes the bottom of the tray to bow upwardly as illustrated in FIGS. **3, 4** and **5.**

In the absence of the differential in thickness between the two sections, the struts would all shrink at the same rate and stress to the same degree. The bottom of the resulting tray would then be located in a perfectly horizontal plane.

The differential degree of prestress imparted to the cross bar and vertical sections of the struts by their differential in thickness results in the tray bottom being more rigid in a vertical plane and in addition to its being bowed upwardly at the center. This is desirable, particularly in the case of shallow or low profile trays because the bottoms of these trays are generally so flexible that they sag out of the horizontal plane when the trays are loaded. By being differentially prestressed and bowed upwardly, the tray of this application only "sags" into a horizontal plane from the bowed condition illustrated in the drawings when the tray is fully loaded.

In the preferred embodiment of the invention, there are two pads **40, 41** located in the plane of the cross bars **37** of the tray. These pads are provided as surfaces upon which manufacturers may place identifying data, as for example, the name of the manufacturer or trademarks, etc. As may be seen most clearly in FIGS. **1** and **2,** these pads **40, 41** each have drain holes **42** located around the periphery of the pad so as to permit drainage of water through the bottom of the tray.

In addition to the pads **40, 41,** there are also eight pads or forming gates **43** located around the bottom of the tray which fill the space defined between a pair of adjacent transverse struts and a pair of adjacent longitudinal struts. These pads **43** are molding gates into which liquid plastic flows during the molding process and from which molding sprues **44** are cut after the molding process is completed. Each of these pads has corner holes **45** formed in it at the corners through which water may freely drain.

The primary advantage of the upwardly bowed tray of this invention is that it enables the tray to carry products without the products forcing the tray to sag to an undesirable extent. In other words, the prestress imparted by the practice described hereinabove results in the tray being capable of supporting a much greater load while the bottom of the tray is maintained in a horizontal plane.

Another advantage of this tray resides in its having no pockets or recesses to catch and hold moisture. Particularly in the case of trays used in the bakery industry, this is a very desirable feature and one which has not been characteristic of bakery trays. Heretofore, the practice has been to form the flange **16** into the shape of a hook which did catch and hold moisture particularly when the trays were inverted.

While I have described only a single preferred embodiment of my invention, persons skilled in the art to which it pertains will readily appreciate numerous changes and modifications which may be made without departing from the spirit of my invention. For example, the tray may be made from other materials, such as polypropylene, which have approximately the same molding, shrinkage and flexibility characteristics. Therefore, I do not intend to be limited except by the scope of the following appended claims.

Having described my invention, I claim:

1. A molded plastic tray comprising

side walls and a bottom wall,

said bottom wall comprising an open gridwork of intersecting struts, at least some of said struts being T-shaped in cross section, said T-shaped struts having intersecting horizontal cross bars and vertical ribs, the cross bars of the T-shaped struts being located above the vertical ribs and forming the inside bottom surface of the tray, and

the vertical ribs of said struts being approximately twice the thickness in cross section of said horizontal cross bars and being substantially greater in height than the width of said cross bars so that during molding of the tray, the cross bars solidify before the vertical ribs and cause the struts to be prestressed into a rigid condition which effectively resists vertical deflection of the bottom.

2. The molded plastic tray of claim **1** in which the side walls as well as the bottom wall are bowed upwardly as a result of the prestressed condition of the struts.

3. The plastic tray of claim 1 which further includes a flange located along the upper edge of each of said side walls, said flange being completely located in a substantially horizontal plane.

4. The plastic tray of claim 3 which further includes vertical ribs extending between said substantially horizontal flange and said side walls, said vertical ribs being operable to reinforce said substantially horizontal flange.

5. The plastic tray of claim 4 in which said substantially horizontal flange defines an included angle of approximately 105° with said side walls.

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