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SHOCK-ABSORBING ONE-PIECE TRAY FOR SUPPORTING ELONGATED ARTICLES

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FIG. 1

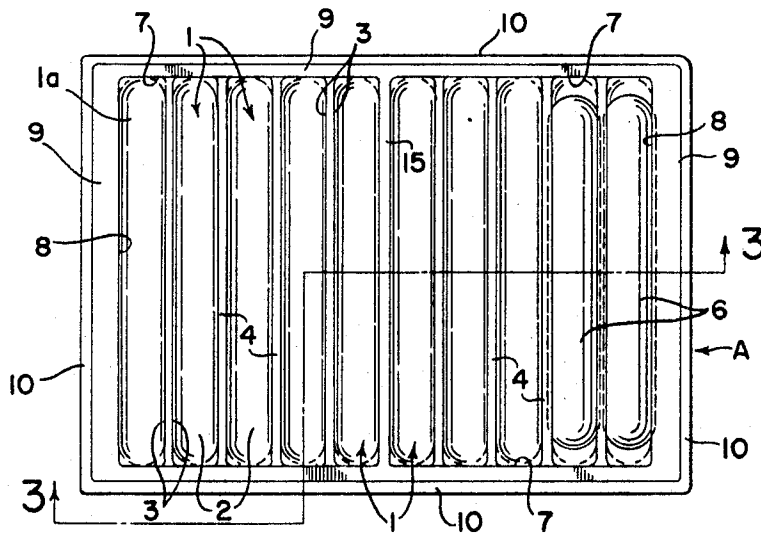
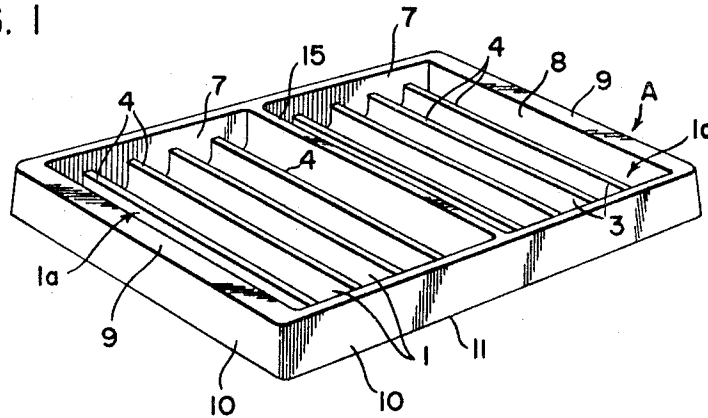


FIG. 2

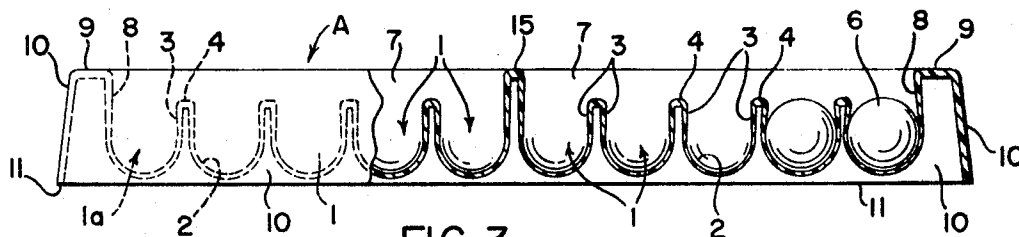


FIG. 3

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**SHOCK-ABSORBING ONE-PIECE TRAY FOR
SUPPORTING ELONGATED ARTICLES**

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7 Claims

ABSTRACT OF THE DISCLOSURE

Trays formed from a single sheet of thermoplastic resin and capable of securely holding and protecting elongated objects such as pens, delicate electronic components and the like, preferably have a shock-absorbing relatively stiff but resilient peripheral flanged portion which surrounds and is spaced from a plurality of elongated article-receiving compartments of generally U-shaped cross section with ribs separating the separate compartments. The lower portions of the walls of the compartments are relatively thin and easily deformable and the vertical walls gradually increase in thickness and terminate in ribs which are of inverted U-shaped section and are thickest in the vicinity of the crest thereof. The downwardly extending legs of the ribs, which are also the upwardly extending or vertical side walls of the said U-shaped compartments are relatively easily deformed or expanded at the lower portions thereof so that objects larger than the openings in the compartments spring apart the side walls at the lower portion of the compartments and are held in the cavities by the stiffness of the ribs and the upper portions of the side walls.

This invention relates to a one-piece molded tray formed from a single sheet of thermoplastic material. It is provided with a plurality of compartments adapted to receive and conform partially to the shape of elongated articles, which may be round or cylindrical objects, and to hold such objects firmly in the cavities. It particularly relates to a tray made from a single thin sheet of stiff, substantially unplasticized polyvinyl chloride having cylinder-receiving compartments with resilient walls of varying thickness, separated by resilient ribs that may be sprung apart when an article is inserted in a cavity and will snap back to firmly hold the article therein.

In order to ship or display and/or to provide for convenient assembly in certain manufacturing operations, it is desirable to have elongated articles, particularly those of round or cylindrical section, supported in such a manner that they will be protected against breakage from contact with each other regardless of the manner in which the package is handled. To accomplish this, various structures have been proposed. These structures have heretofore been made by suitably loosely convoluting a strip of fibrous material to form a laterally compressed, generally sinusoidal or S-shaped member and then cementing or bonding alternate crests of the thus convoluted strip to a separate flat backing sheet. Such structures are shown in one or more of the following patents: Hecker Patents Nos. 2,716,485, 3,270,877 and 3,311,524; Davidson Patent No. 2,747,787; Bossi Patents Nos. 2,767,532 and 2,846,830; and Del Nero Patent 2,833,405.

It is an object of the present invention to provide trays which are formed from a single sheet of thermoplastic material having a plurality of compartments of generally U-shaped cross section suitable for elastically receiving and holding objects of greater diameter than the width of the opening in said compartments.

It is another object of the present invention to provide a tray having a plurality of elongated compartments, each

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adapted to conform to the shape of and to receive and hold an elongated cylindrical object having a diameter greater than the width of the opening of the compartments.

It is a further object of the present invention to provide from a single sheet of thermoplastic material trays for separating and resiliently supporting and holding cylindrical or elongated objects but which permit easy removal and replacement of objects in the cavities thereof.

It is still another object of the present invention to provide relatively stiff trays for protecting objects having a round, transverse cross section and which will receive and resiliently hold the objects by a snap action due to varying rigidity of wall portions of article-receiving compartments.

Other objects will be apparent from the following description of the invention as illustrated by the accompanying drawing, in which:

FIGURE 1 is a perspective view of a tray embodying the present invention;

FIG. 2 is a plan view of a tray embodying the present invention having a cylindrical article disposed in each of two compartments or cavities thereof; and

FIG. 3 is a side elevational view, partly in section, taken on the line 3—3 of FIG. 2, showing a tray of the present invention and articles therein.

Referring more particularly to the drawings, in which like parts are designated by like numerals of reference throughout the several views, the trays A of the present invention, which are formed from a single sheet of thermoplastic resin, preferably a vinyl resin such as unplasticized or substantially unplasticized polyvinyl chloride, have a compartmental portion or article-receiving portion comprising a plurality of side by side disposed elongated compartments 1 of generally U-shaped transverse cross section, as shown in FIGURE 3, and a relatively stiff continuous peripheral flanged portion which surrounds and supports the compartmental portion and which lies in a horizontal plane.

The lower wall portions and bottom 2 of the compartments 1 are preferably of rounded or arcuately shaped cross section and are formed of relatively thin flexible plastic material, such as unplasticized or substantially unplasticized polyvinyl chloride or other vinyl resin. The upper vertically extending portions 3 of the side walls of the compartments 1 are of gradually increasing thickness and merge into the ribs 4, which are generally of inverted U-shaped cross section. Intermediate ribs 4 are formed of a side wall of each of two adjacent cavities joined together at their upper edges by a small laterally extending portion or crest. The downwardly extending legs of the ribs 4 are the upwardly extending vertical wall portions 3 of the adjacent cavities 1.

When the trays are formed of unplasticized or rigid polyvinyl chloride, polystyrene or the like, the wall thickness of the crest of the ribs is usually greater than .005 inch and is preferably about .010 or .015 inch, and the legs generally taper down to $\frac{1}{4}$ or $\frac{1}{2}$ of the maximum wall thickness, preferably to about .003 inch or less at the bottom of the substantially vertical portion 3 of the walls of the cavity. When a cylindrical article, such as a cylinder 6 having a diameter larger than the width of the opening of the U-shaped compartments is inserted into the compartments by springing apart the relatively stiff but resilient ribs 4, the more flexible portion of the compartment walls separate to conform to the shape of the article and the resilience in the ribs 4 causes them to snap back to substantially original shape and hold the article 6 securely in the compartment, even though the trays A are inverted. The separation of the walls of the compartments also raises the bottom of the compartments above the supporting edges 11 of the tray to contribute to shock resistance and protection of fragile articles.

The ends of the ribs 4 and the ends of the side wall portions of the cavities or compartments are fastened to and are integral with the inner side walls 7 which extend along each side of the trays from the end walls of and support for the article-receiving compartments 1. The inner vertical end walls 8 of the tray and of each compartment 1 each are preferably continuous with a side wall of an end compartment or cavity 1a. The side walls 7 are contiguous with and integral with the end walls of the compartments and together with the end walls 8 form a continuous, generally vertical wall that surrounds the article-receiving cavities 1. The height of the inner peripheral walls 7 and 8 is preferably substantially greater than the height of the ribs 4 and the walls of the cavities 1. The inner wall 7 is preferably outwardly inclined so that the cavities or compartments 1 are longer at the upper portions thereof than at the bottom.

The upper edges of the inner walls 7 and 8 terminate in a continuous crest or generally horizontal flange portion 9 which surrounds the article-receiving compartments of the tray. The crest or flange 9 extends around the outer perimeter of the tray and the inner walls 7 and 8 and carries a downwardly extending but outwardly inclined flange 10. The inner walls 7 and 8 cooperate with the downwardly extending flange 10 and the crest 9 to form a generally U-shaped shock-absorbing element. The slope of the wall 10 is preferably slightly outward from the crest 9 so that the projection of the bottom of the trays on a horizontal plane is greater than that of the top, the trays being at the bottom peripheral edges of the wall 10. The lower edges 11 of the outer flange 10, resting on a flat surface or on the edges of a lower tray, support the weight of the articles contained in the cavities 1, particularly when the side walls of the compartment are expanded outwardly so as to raise the bottom of the compartment. The inner wall portions 7 and 8, the crest or flange 9 and the outer wall 10 preferably have a thickness about equal to that of the crest 4 of the ribs separating the cavities or compartments 1.

Preferably, the trays of the present invention are provided with one or more ribs 15 of greater than average height, which function as supports and dividers which may be present to divide the compartmental portion of the tray into groups of article-receiving compartments. The dividers 15 extend parallel to the walls of the compartment and may be of a height such that it extends to the top of the peripheral walls of the tray.

It will be seen that when a package or box containing one or more of the trays A having articles disposed within the compartments thereof is subject to lateral shock, the walls 10 which may bear against the edges of a surrounding box will flex laterally in a springlike action to absorb lateral shock. Bottom walls and side walls of the cavities also deform resiliently to cushion shock in various directions. Even though the package is inverted, articles do not fall out of the tray because of the spring or snap action of the ribs 4 and of the walls of the cavity 1.

Since the trays are molded or vacuum-formed from a single sheet of relatively stiff thermoplastic resin, their manufacture may be automated and production costs may be lower than that of trays preferably formed from fibrous material.

It is also apparent that in accordance with the provisions of the patent statute modifications of the invention may be made without changing the spirit thereof.

Having described my invention, I claim:

1. A one-piece multicompartment tray of flexible thermoplastic resin and suitable for supporting and displaying elongated articles, said tray having an article-receiving portion with a plurality of elongated compartments of generally U-shaped cross section and a peripheral supporting portion generally of inverted U-shaped cross-section, said peripheral portion being formed of an

outer peripheral wall of said tray and an inner peripheral wall, each extending generally vertically and being joined at their upper edges in a continuous crest, located in a single plane, which spaces said inner and outer wall portions of the tray from each other, said article-receiving portion having a plurality of elongated compartments, each generally of U-shaped cross section and disposed side by side, each side wall of a compartment being spaced from a side wall of the next adjacent compartment, adjacent side walls of adjacent compartments being joined at their upper edges by a crest to form ribs of inverted U-shaped cross section separating said adjacent compartments, the intersection of vertical planes parallel to said article-receiving compartments with the crests between said article-receiving compartments being substantially straight lines extending continuously the length of said compartments, said crest and the upper portions of said side walls of said compartments being thicker and stiffer than lower portions of the walls of said compartments, said ribs extending the length of said article-receiving compartments and joined to the inner side walls of the tray.

2. A tray according to claim 1 wherein the outer wall of said tray is inclined outwardly so that the projected area of the bottom edges of the tray on a horizontal plane is greater than that of the top edges thereof, whereby transverse shock may be absorbed by deflection of said inner and outer walls of said tray, and wherein the ribs separating the U-shaped article-receiving compartments extend higher than the radius of the U-shaped bottom portion of said compartments, whereby articles may be held in said compartments even when said trays are inverted.

3. The tray of claim 1 wherein said inner side walls of said tray extend generally vertically but are inclined outwardly toward their upper edges so that said compartments have greater length at the upper edges thereof than at their bottom portions, and wherein the ribs separating the compartments are higher than one-half the spacing between said ribs.

4. A tray according to claim 1 wherein the upper portions of the side walls of said compartments of U-shaped cross section have a gradually increased thickness and are thickest at their upper edge portions where they merge into said crest to form a rib having an inverted U-shaped cross section, and wherein one of said ribs of inverted U-shaped cross section separating said compartments is substantially higher than others, whereby it divides said tray into groups of article-receiving compartments and provides increased support for said tray.

5. A tray according to claim 1 wherein the thermoplastic resin is a rigid polyvinyl chloride.

6. A tray according to claim 1 wherein the thermoplastic resin is polystyrene.

7. A one-piece multicompartment tray of flexible and resilient thermoplastic vinyl resin, said tray comprising a compartmental portion having a plurality of elongated article-receiving compartments and a peripheral supporting portion surrounding and integral with said compartmental portion, said peripheral supporting portion comprising an outer peripheral wall and an inner, generally vertical wall, which also forms end walls of said compartments, the upper edges of which wall terminates in a relatively stiff, flexible but resilient horizontal flange which intersects with said outer peripheral wall, all portions of which flange lie in a single horizontal plane, said article-receiving compartments being disposed side by side, each wall of said adjacent compartments being spaced from a side wall of the next adjacent compartment, adjacent side walls of adjacent compartments being joined at their upper edges by a generally horizontal crest to form with a side wall of each of two adjacent

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compartments ribs of generally inverted U-shaped cross section which separate adjacent compartments, one of said ribs being higher than others and extending substantially to the horizontal plane of said upper edges of said outer peripheral wall, said crest and upper portions of said side walls of said compartments being thicker and stiffer than the lower portions of the walls of said compartments, the intersection of vertical planes parallel to said article-receiving compartments with the crests between said article-receiving compartments being substantially straight lines extending continuously the length of said compartments, said ribs extending the length of said article-receiving compartment and being joined to opposite inner walls of said peripheral supporting portion.

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