United States Patent

Cristy et al.

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[54] **PACKAGE FOR FRAGILE ARTICLES**

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[52] **U.S. Cl.**.....**206/62 R,** 206/46 FC, 206/65 F, 206/65 K, 220/23.83, 220/97 C, 229/2.5

[51] **Int. Cl.**.....**B65d 1/34,** B65d 85/30

[58] **Field of Search** ...206/46 FC, 46 FR, 65 R, 65 F, 206/65 K, 62 R; 220/17, 23.83, 97 R, 97 C, 97 D; 229/2.5

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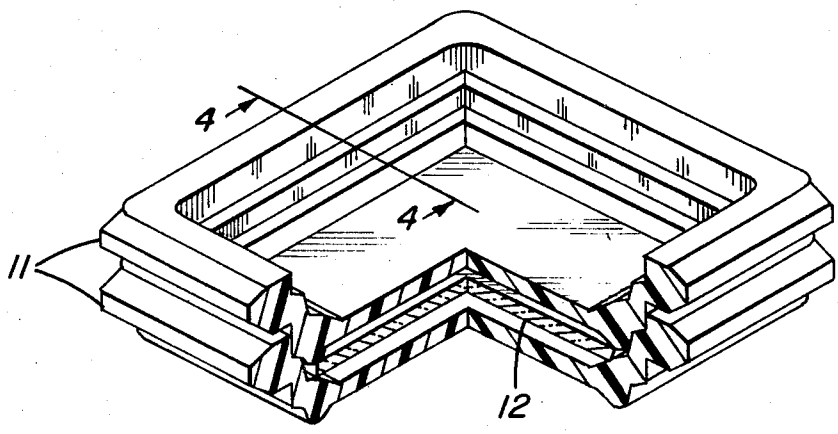
[57] **ABSTRACT**

A protective package for photosensitive glass plates or the like. The package includes a series of similar, nestable trays, adjacent nested trays being adapted to hold therebetween a plate of the type described. Each tray bears a depending ridge and a raised ledge so positioned that the ridge of one tray and the ledge of a similar tray nested therewith cooperate in sealing engagement with the marginal areas of a plate sandwiched therebetween. Contaminant particles present at the plate edges are thus confined and prevented from reaching the central surface areas of the plate. Adjacent nested trays also cooperate to form a labyrinthine light lock to restrict the entry of light rays between the trays. The trays are retained in their nested relationship by frictional engagement.

3 Claims, 5 Drawing Figures



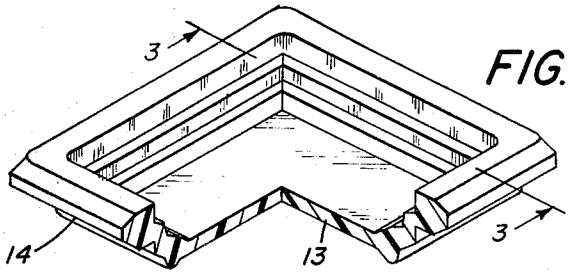


FIG. 1

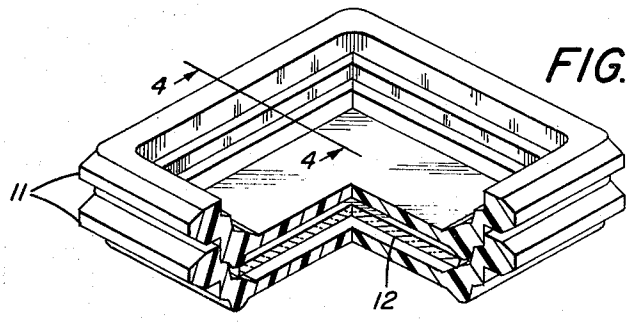


FIG. 2

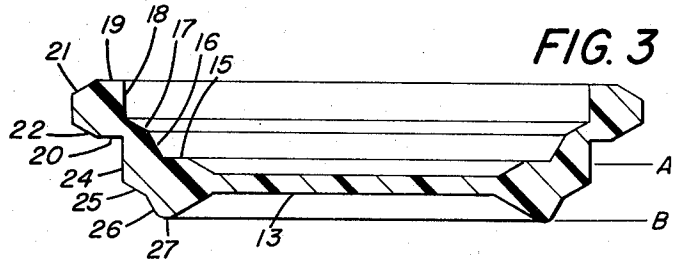


FIG. 3

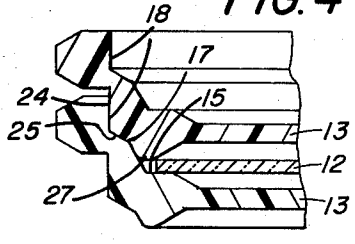


FIG. 4

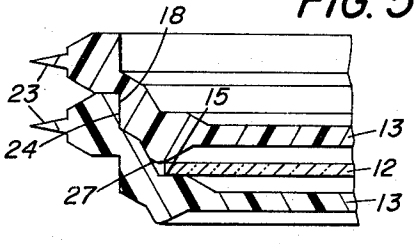


FIG. 5

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PACKAGE FOR FRAGILE ARTICLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the packaging of fragile articles. More specifically, it relates to an improved package for light-sensitive glass plates adapted for use in high resolution photography.

2. Description of the Prior Art

The prior art is replete with packages for fragile and delicate articles, including articles provided with photosensitive coatings. However, the packaging of articles such as high resolution photographic plates poses unique problems which the packages shown in the prior art are not equipped to solve.

A high resolution photographic plate is capable of faithfully recording a microscopic image of a subject. This reduction in scale allows the recording of vast quantities of material on a single photographic plate, but also imposes stringent requirements in the packaging of such plates.

The package must hold the plate securely, but must be in only minimal contact with the planar plate surfaces so as to avoid damage to the delicate coatings borne thereon. Because of the microscopic nature of the image, the plates must be kept free of particulate matter which, although minute, can nonetheless obscure or damage large areas of the recorded material. Although the plates are essentially dust-free when initially packaged, they also must be protected from contaminants generated after packaging. In this regard, the sharp plate edges generate dust particles by abrading those portions of the package in contact therewith. Additionally, minute glass fragments inherently present along the plate edges may become dislodged therefrom and scratch the plate surfaces.

SUMMARY OF THE INVENTION

It is accordingly an object of this invention to provide a package for glass plates, which package is adapted to hold the plates securely while in only minimal contact therewith.

Another object of this invention is to provide a package for glass plates, which package is designed to isolate the plate edges from the planar plate surfaces.

A further object of this invention is to provide a package for such plates, wherein each plate is isolated from adjacent plates.

A still further object is to provide a package for such plates, which package is designed to shield the plates contained therein from light rays.

These and other related objects are attained by providing a series of similar, nestable trays, adjacent nested trays being adapted to hold therebetween a glass plate of the type described. The nested trays form a continuous seal along the marginal areas of both planar surfaces of the plate so that the central areas thereof are effectively isolated from the plate edges. Such trays, when placed in a nested relationship, also cooperate to form a labyrinthine light-lock to restrict the entry of light rays therebetween.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein similar reference numerals indicate corresponding parts in all figures.

FIG. 1 is a partial perspective view of one tray of the package described herein.

FIG. 2 is a partial perspective view of a glass plate sandwiched between two nested trays.

FIG. 3 is an enlarged cross section taken along line 3—3 of FIG. 1.

FIG. 4 is an enlarged cross section taken along line 4—4 of FIG. 2.

FIG. 5 is an enlarged cross section through a modified form of the present invention taken along a line corresponding to line 4—4 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The accompanying FIGS. 1–4 illustrate a package for a plate 12, such as, for example, a glass plate bearing a photosensitive coating and adapted for use in high resolution photography. The package comprises a series of similar, nestable tray members 11, two of such tray members, when in nesting relationship, being adapted to hold therebetween a glass plate of the type described.

The trays 11 may, for reasons hereinafter discussed, advantageously be formed of a compressible material such as, for example, polyurethane foam or polystyrene foam which posseses a type of resiliency such that after being compressed it will exhibit only a partial recovery of its original configuration. The trays may be opaque in nature and can be formed by known processes such as compression molding.

In FIG. 1, there is shown a tray member 11 comprised of a generally planar panel portion 13, forming the bottom end wall of said tray, and sidewalls, shown generally at 14, which extend completely about the periphery of the tray. Sidewalls 14 are attached to end panel 13 and extend generally upwardly and outwardly therefrom toward an upper, open tray end.

Referring now to FIG. 3, there is formed, at the junction of panel 13 and sidewalls 14, an upward-facing ledge 15 spaced above panel 13 in a first reference plane A generally parallel to said panel. Ledge 15 extends completely around the periphery of panel 13 and forms an unbroken surface upon which may be supported a glass plate 12 through spacially continuous contact with the marginal areas of the bottom plate surface.

Adjoining the outer extremity of ledge 15, as seen in FIG. 3, and rising generally upwardly and outwardly therefrom is an inner light lock portion including inclined generally planar surfaces 16 and 17.

Adjoining the upper boundary of surface 17 and rising generally vertically therefrom is a generally planar inner interference surface 18 extending generally to the upper, open tray end. The upper portion of sidewalls 14, part of the inner surface of which is former by inner interference surface 18, forms an outwardly extending flange. This flange facilitates separation of adjacent nested trays from their nested relationship and also increases the dimensional stability and rigidity of the tray. The upper and lower surfaces of flange portion bear, respectively, generally planar surfaces 19 and 20 terminating outwardly in beveled surfaces 21 and 22,

respectively. In an alternate embodiment of the invention depicted in cross section in FIG. 5, the width of the flange is increased to form a relatively thin outward projection, as shown at 23.

A generally planar outer interference surface 24 adjoins the inner boundary of surface 20 and extends generally downward therefrom. Surface 24 is constructed generally coplanar with inner interference surface 18, but is of slightly greater vertical extent in comparison thereto. In the embodiment shown in FIG. 5, however, the inner interference surface 18 and the outer interference surface 24 are of generally equal vertical extent for reasons hereinafter discussed.

Adjoining the lower boundary of outer interference surface 24 and extending generally downwardly and inwardly therefrom is an outer light lock portion including inclined generally planar surfaces 25 and 26. Surface 25 is constructed generally parallel to surface 17 of the inner light lock portion and is of approximately equal extent as measured downslope, while surface 26 is generally parallel to surface 16, but of slightly lesser downslope extent.

The lower boundary of surface 26 terminates in a depending ridge portion 27 the crest of which is disposed in a second reference plane B spaced beneath panel 13 and generally parallel thereto. Ridge 27 extends completely around the periphery of the bottom end of tray member 11. The crest of said ridge thereby forms an unbroken surface adapted to contact throughout its extent the marginal areas of the upper planar surface of a glass plate 12 supported by the ledge of a second, similar tray 11 when the trays are placed in nested relationship with said plate 12 of said similar tray disposed therebetween. The shortened downslope extent of surface 26 allows for the thickness of the glass plate 12 sandwiched between the nested trays. This shortening permits the outer light lock portion of the one tray to closely associate with the inner light lock portion of said similar tray while ridge 27 of said one tray is in contact with said glass plate 12.

OPERATION

In operation, a glass plate 12 may be contained between two nested trays 11, which trays cooperate to hold the plate with minimal contact of the planar plate surfaces and to form spacially continuous seals around the peripheries of said plate surfaces. The edges of a plate so held are thus effectively isolated from the central areas of the plate surfaces. In addition, the respective light lock portions of the nested trays cooperate to restrict the entry of light rays between the trays, which trays are retained in their nested relation by the cooperation of their respective interference surfaces.

Operation of the package and cooperation of the various tray surfaces are best illustrated in FIG. 4, wherein there is depicted a plate 12 contained between two trays 11, the upper tray being essentially received within the lower tray in nested relation therewith.

In FIG. 4 it is seen that glass plate 12 is seated upon ledge 15 of the lower tray 11. The bottom surface of plate 12 is thus in only minimal contact with the lower tray, said contact being confined to the peripheral area of said surface, which area is in spacially continuous contact with said ledge 15. This continuous contact thus forms a seal extending completely around said bottom plate surface, whereby the central area of said surface is effectively isolated from the plate edges.

In like fashion, a seal is formed completely around the upper surface of plate 12 through specially continuous contact of the peripheral area only of said surface by the crest of ridge 27 borne by upper tray 11. Ledge 15 of the lower tray and ridge 27 of the upper tray thus cooperate to seal the central areas of both planar surfaces of plate 12 from the plate edges, whereby particulate matter, including glass chips, present at the plate edges is trapped along said edges and prevented from reaching the central surface areas of the plate.

This sealing action is enhanced by constructing the trays 11 of a somewhat resilient material, such as polystyrene foam or polyurethane foam which, upon being pressed into contact with a plate surface, is compressed or deformed, but exhibits only a partial recovery of its original configuration. Such material possesses sufficient resiliency to maintain sealing engagement with the plate, but also remains slightly deformed so as to mold itself to the contour of the plate surface, thus insuring the formation of at least a line contact therewith.

When two trays 11 are placed in a nested relationship, the inclined surfaces 25 and 26 of the outer light lock portion borne by the upper tray, as seen in FIG. 4, will closely associate with corresponding surfaces 16 and 17, respectively, of the inner light lock portion of the lower tray. These surfaces thus cooperate to form a labyrinthine light lock to restrict the entry of light rays between the nested trays. The light lock, in combination with the opacity of the trays, thereby forms a lightprotective package for the photosensitive plate 12. Additional protection may be achieved by placing the package within a lighttight sleeve or wrapping.

Trays spaced in a nested configuration are retained therein by cooperation of the outer interference surface 24 of the upper tray, as seen in FIG. 4, with the inner interference surface 18 of the lower tray. When the trays are nested together these surfaces lie in abutting relationship and coact to form an interference, or frictional, fit therebetween. The friction generated thereby serves to resist separation of the trays from their nested configuration. From the foregoing it will be apparent that the abutting interference surfaces also form an effective extension of the labyrinthine light lock to further restrict the entry of light rays between the nested trays.

In the embodiment shown in FIG. 4, a slight separation space exists between surface 19 of the lower tray and surface 20 of the upper tray. This space, in connection with bevelled surfaces 21 and 22 provides a convenient notch by means of which the nested trays may be grasped and separated from their nested relation when it is desired to remove plate 12 from therebetween.

FIG. 5 depicts a modification of the embodiment of FIGS. 1 through 4. In this modification, the outer interference surface 24 has a vertical extent approximately equal to that of inner interference surface 18. This construction allows surface 19 of the lower tray, as seen in FIG. 5, to closely associate with or abut surface 20 of the upper tray when said trays are nested together, whereby said surfaces cooperate to form a second effective extension of said labyrinthine light lock. In this

modification, the flange portion of each tray is widened to form a lateral projection as shown at **23**. Adjacent nested trays may thus be grasped by their respective projections and separated from their nested relationship.

From the foregoing it will be apparent that, in accordance with the invention herein described, a plurality to trays **11** may be nested together to form a stacked package for a plurality of glass plates **12**. Adjacent plates are thereby separated by the tray **11** therebetween so that accidental damage to one plate will not result in the spreading of contaminants to adjacent plates. The uppermost and lowermost trays form the respective package ends, which package may then be enclosed in light-tight sleeve or wrapping.

It should be understood that terms referring to orientation, such as, for example, "upper" or "lower" are used herein for illustrative purposes only, and are not intended to restrict the actual operating orientation of the invention.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. A container for generally planar plates, said container comprising a plurality of similar, nested tray members, adjacent tray members adapted to carry therebetween a plate, a given one of said tray members including:

1. a generally planar panel portion forming a closed bottom end wall of said tray;
2. sidewalls laterally bounding said panel and extending generally upwardly and outwardly therefrom toward an open tray end;
3. said given tray having an inner configuration including:
   a. a generally planar inner panel surface formed by said end wall;
   b. ledge means extending completely about the periphery of said panel surface for supporting, in a first reference plane disposed generally parallel to said panel surface and between said panel surface and said open tray end, the bottom surface of a plate by continuous contact confined to the marginal areas of said bottom plate surface; and
   c. an inner interference portion above said first reference plane:
4. said given tray having an outer configuration including:
   a. a generally planar outer panel surface;
   b. ridge means extending completely about the periphery of said outer panel surface for forming, in a second reference plane disposed generally parallel to and subjacent said outer panel surface, at least a continuous line contact with the marginal areas of the upper surface of a plate supported by said ledge means of a similar tray within which said given tray is nested, said ledge means of said similar tray cooperating with said ridge means of said given tray to isolate the marginal surfaces of said plate disposed therebetween from the central surfaces of said plate; and
   c. outer interference portion means frictionally engaging the inner interference portion of said similar tray to retain said trays in nesting relationship.

2. The invention of claim **1** wherein each tray has an outer configuration which includes outwardly projecting flange portion means adjacent said open tray end for facilitating the separation of said trays from nested relationship.

3. A container for photosensitive plates, said container comprising a plurality of similar, nested tray members, adjacent tray members adapted to carry therebetween a photosensitive plate, a given one of said tray members including:

1. a generally planar panel portion forming a closed bottom end wall of said tray;
2. sidewalls laterally bounding said panel and extending generally upwardly and outwardly therefrom toward an open tray end;
3. said given tray having an inner configuration including;
   a. a generally planar inner panel surface formed by said end wall;
   b. ledge means extending completely about the periphery of said panel surface for supporting, in a first reference plane disposed generally parallel to said panel surface and between said panel surface and said open tray end the bottom surface of a photosensitive plate by continuous contact confined to the marginal areas of said bottom plate surface;
   c. an inner light-lock portion adjoining said ledge and extending generally outwardly and upwardly therefrom; and
   d. an inner interference portion adjoining said light-lock portion and extending generally upward therefrom;
4. said given tray having an outer configuration including:
   a. a generally planar outer panel surface;
   b. ridge means extending completely about the periphery of said outer panel surface for forming, in a second reference plane disposed generally parallel to and subjacent said outer panel surface, at least a continuous line contact with the marginal areas of the upper surface of a photosensitive plate supported by said ledge means of a similar tray within which said given tray is nested, said ledge means of said similar tray cooperating with said ridge means of said given tray to isolate the marginal surfaces of said plate disposed therebetween from the central surfaces of said plate;
   c. outer light-lock portion means adjoining said ridge means forming, in cooperation with the inner light-lock portion of said similar tray, a light-lock to restrict the entry of light rays between said trays; and
   d. outer interference portion means frictionally engaging the inner interference portion of said similar tray to retain said trays in nesting relationship.

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