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SPRUSON & FERGUSON

AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request I/We be granted a patent for the invention disclosed in the accompanying standard complete specification.

[70,71] Applicant(s)/Nominated Person(s):

International Paper Company, incorporated in New York, of 2 Manhattanville Road, Purchase, New York, 10577-2196, UNITED STATES OF AMERICA

[54] Invention Title:

Carton Bottom Sealer

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Details of Basic Application(s):

[31] Appl'n No(s):	[33] Country:	[32] Application Date:
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International Paper Company

By: J. Spruson

Registered Patent Attorney

IRN: 296381 INSTR CODE: 57685

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NOTICE OF ENTITLEMENT

I, John Gordon Hinde, of Spruson & Ferguson, St Martins Tower, 31 Market Street, Sydney, New South Wales 2000, Australia, being the patent attorney for the Applicant(s)/Nominated Person(s) in respect of an application entitled:

Carton Bottom Sealer

state the following:-

The Applicant(s)/Nominated Person(s) has/have entitlement from the actual inventor(s) as follows:-

The Applicant(s)/Nominated Person(s) is/are the assignee(s) of the actual inventor(s).

The Applicant(s)/Nominated Person(s) is/are entitled to rely on the basic application(s) listed on the Patent Request as follows:

The Applicant(s)/Nominated Person(s) is/are the assignee(s) of the basic applicant(s).

The basic application(s) listed on the Patent Request is/are the first application(s) made in a Convention country in respect of the invention.

DATED this FIFTEENTH day of MARCH 1995

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John Gordon Hinde

IRN: 296381 INSTR CODE: 57685

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(54) Title
CARTON BOTTOM SEALER

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(56) Prior Art Documents
US 5029751
US 4991768
US 3998378

(57) Claim

1. A paperboard container comprising four materially integral side walls of thermoplastic film coated paperboard formed about a container axis, said walls being laterally delineated by wall corners that are substantially parallel with each other and said container axis and vertically delineated at one end thereof by substantially coplanar bottom corners, a bottom closure wall formed by a layered folding of bottom panels that are materially integral extensions of said side walls, said bottom closure wall being sealed fluid-tight by a heat fusion of thermoplastic coating respective to adjacent surfaces of said lapped panels and formed to an approximate lenticular geometry that is concave within said bottom corners, said lenticular geometry being a substantially symmetric stepped pyramid of diminishing area step-planes.

6. A method of fabricating a fluid-tight container from an integral sheet of thermoplastic film coated paperboard comprising the steps of:

folding a tubular enclosure having four side walls laterally delineated by substantially parallel corners;

forming a fluid-tight bottom wall that is substantially perpendicular to said tubular enclosure corners with bottom panels that are materially integral extensions of said side walls, by lap folding said bottom panels;

sealing said bottom panels fluid-tight by heat fusing the thermoplastic coating respective to continuous surfaces of said bottom panels; and

embossing said bottom wall to a substantially concave surface shape with a set of embossing dies so that said bottom wall has at least three substantially parallel planar

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areas of concentrically diminishing areal magnitude aligned in a stepped sequence, while allowing the gas created by the embossing step to be vented through an air channel in at least one of said dies.

8. A paperboard container bottom sealing tool comprising a cooperative pair of embossing dies, said pair including convex surface die and a concave surface die, said concave surface die including a plurality of substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence

CARTON BOTTOM SEALER

Background Of The Invention

This invention relates to paperboard containers of the type suitable for liquid food products such as milk and fruit juices, and more particularly relates to a paperboard container for liquid food products which exhibits improved upright standing stability when filled.

Liquid tight containers suitable for distributing consumer quantities of liquid food products are frequently fabricated from paperboard sheets coated with a film of heat sealable, waterproof thermoplastic such as polyethylene, polyvinyl chloride or polypropylene. These plastic coated sheets are cut into blanks which are first folded into four-sided tubes and then closed by a lap fold of bottom panels extending integrally from the four side walls. While the plastic film coating is still hot and tacky, the bottom wall lap panels are fused together by a bottom sealing die.

Paperboard containers for liquid food products have an inherent instability due to the pressure exerted on the walls by the fluid, particularly the bulging effect of the fluid on the bottom. The degree of bulging is a function of the stiffness of the board, i.e., stiffer board exhibits less bulging. Thus, one way to address a bulging problem is to use a stiffer board. However, increasing the stiffness often comes at the cost of other board properties and a stiffer board is generally more difficult to fold and assemble into the erected container. Stiffer boards also tend to be more expensive, which drives up the cost of the container.

These and other problems have limited progress toward achieving an economical carton bottom construction with a minimum of center bulging and improved stability.

It is therefore an object of the present invention to substantially overcome or at least ameliorate the above disadvantages.

SUMMARY OF THE INVENTION

Accordingly, in a first aspect, the present invention provides a paperboard container comprising four materially integral side walls of thermoplastic film coated paperboard formed about a container axis, said walls being laterally delineated by wall corners that are substantially parallel with each other and said container axis and vertically delineated at one end thereof by substantially coplanar bottom corners, a bottom closure wall formed by a layered folding of bottom panels that are materially integral extensions of said side walls, said bottom closure wall being sealed fluid-tight by a heat fusion of thermoplastic coating respective to adjacent surfaces of said lapped panels and formed to an approximate lenticular geometry that is concave within said bottom corners, said lenticular geometry being a substantially symmetric stepped pyramid of diminishing area step-planes.

In a second aspect, the present invention provides a method of fabricating a fluid-tight container from an integral sheet of thermoplastic film coated paperboard comprising the steps of:

folding a tubular enclosure having four side walls laterally delineated by substantially parallel corners;

forming a fluid-tight bottom wall that is substantially perpendicular to said tubular enclosure corners with bottom panels that are materially integral extensions of said side walls, by lap folding said bottom panels;

sealing said bottom panels fluid-tight by heat fusing the thermoplastic coating respective to continuous surfaces of said bottom panels; and

embossing said bottom wall to a substantially concave surface shape with a set of embossing dies so that said bottom wall has at least three substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence, while allowing the gas created by the embossing step to be vented through an air channel in at least one of said dies.

In a third aspect, the present invention provides a A paperboard container bottom sealing tool comprising a cooperative pair of embossing dies, said pair including convex surface die and a concave surface die, said concave surface die including a plurality of substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence.

Brief Description Of The Drawings

The foregoing and other features of the invention will become further known from the following detailed description of preferred embodiments of the present invention in conjunction with the accompanying drawings in which:

Figure 1 is a pictorial illustration of a gable top paperboard beverage container typical of the type to which the present invention relates;

Figure 2 is the lower portion of a paperboard sheet blank appropriate for erecting paperboard beverage containers;

Figures 3, 4 and 5 pictorially illustrate the typical folding sequence for forming a lapped panel bottom wall;

Figure 6 is an interior plan view of a lap folded bottom wall of a paperboard liquid container;

Figure 7 is a sectional elevation of the lapped panel bottom wall illustrated by Figure 6 as viewed along the cutting plane 7-7 of Figure 6;

Figure 8 is an interior plan view of a lapped panel end wall of a paperboard liquid container having an embossed concave exterior surface profile;

Figure 9 is a sectional elevation of the lapped panel bottom wall illustrated by Figure 8 as viewed along the cutting plane 9-9 of Figure 8;

Figure 10 is an elevational view of a concave embossing die suitable for practice of the present invention;

Figure 11 is a top plan view of the concave embossing die of Figure 10;

Figure 12 is a top plan view of a convex embossing die suitable for practice of the present invention;

Figure 13 is an elevational view of the convex embossing die of Figure 12; and

Figure 14 is an external surface bottom plan view of a paperboard fluid container embossed in accordance with the teachings of the present invention.

Description Of The Preferred Embodiment

Referring now to the drawings in which like reference characters designate like or similar parts throughout the several views, Figure 1 illustrates a liquid container 10 of the type contemplated by the present invention. Such a container is folded from a single, continuous blank such as that illustrated by Figure 2 which includes four parallel walls 11, 12, 13 and 14 joined by a longitudinally running lap seam tab 15. This development provides a four-walled tube which is folded to a lapped panel gable closure at the top 18 and to a lapped panel bottom wall 19 at the bottom end.

Although a gable top closure is referenced herein, this is only exemplary of various closure styles. The particular top closure configuration is not germane to the present invention. Some paperboard containers are closed with a flat top wall similar to the bottom.

Since the invention is focused on the bottom closure of a folded paperboard tube, the blank sheet plan of Figure 2 is limited to showing only the fold score lines and lap panels for a surrounding bottom wall edge 19.

It will first be noted that all of the Figure 2 blank is a continuous, integral sheet or board which has been previously coated with one or more continuous films of thermoplastic polymer or otherwise adapted through incorporation of layers, laminants

and/or treatments as may be necessary to confer the properties required for the end use. The lines shown thereon represent fold score lines which are basically creases that have been produced in the board as by passage of the board through the nip of a pair of creasing dies, or placement between creasing plates, for example. No slits or cuts are represented interiorly from the blank periphery.

Accordingly, score line 21 divides the side panel 11 from the bottom panel 26 and becomes a portion of bottom edge 19. Similarly, fold score line 22 divides the side wall 12 from the bottom panel 30 which is further divided into triangular panels 31 and 32 separated by fold lines 33. Fold score 23 separates the side wall 13 from the bottom panel 27. As before, side wall 14 is separated by fold score line 24 from the bottom panel 40 and panel 40 is further divided into triangular panels 41 and 42, each separated by fold lines 43. Fold line 25 separates the lap seam tab 15 from the bottom tab 28 and, in assembly, overlies a portion of the score line 21. Fold lines 21, 22, 23 and 24 together define bottom edge 19, with fold line 25 being tucked into the container upon assembly.

The lap folding sequence of these several bottom panels is illustrated by collective reference to Figures 3, 4 and 5.

Figure 3 shows the open tube with only the side wall corners erected by a heat fused bonding of the lap seam tabs 15 and 28 to the inside surface portions of side wall 11 and bottom panel 26.

A bottom closure sequence is initiated by an inward folding of the triangular panels 41 and 31 about bottom fold lines

22 and 24. Corner panels 32 and 42 simultaneously rotate about score lines 33 and 43, respectively.

As the container bottom wall panels are simultaneously folded upon themselves, end panel 39 is rotated about score line 38 as shown in Figure 4 against the outside surface of bottom panel 26. The end result is seen in Figure 7 which shows the various bottom panels folded flat to form the bottom surface but in an expanded, uncompressed position.

Although paperboard container blanks may be assembled by adhesive, more frequently such paperboard blanks are secured in the erect position by hot fuse bonds between adjacent polymer coatings at the panel lapping interfaces. Such is the material state when the open tube is received over the concave die block 50 illustrated by Figure 10. In that position the end panels are folded down against themselves and against the upper face of the die block shown by Figure 11.

Convex die block 60 is then brought against the exterior face of the lapped panel bottom wall to pressingly engage the several folds in the lapped assembly tightly against themselves between the dies and to fuse the juxtaposed plastic films together.

It will also be noted from Figures 10 and 11 that concave die 50 has its respective area divided into three segments 51, 52 and 53, each corresponding to a respective level in a step tiered sequence separated by surface discontinuity ridges 54 and 55 of progressively deeper rectangular recesses, one within the other, moving inwardly as viewed in Fig. 11.

The corresponding convex die 60 illustrated by Figures 12 and 13 provides concentrically diminishing areas 61, 62 and 63 in a stepped sequence of progressively higher rectangular projections,

one within the other, moving inwardly as viewed in Fig. 12, with riser ridge lines 64 and 65 separating areas 61 and 62 and areas 62 and 63, respectively. The innermost tier surfaces 62 and 63 are vented with an air escape channel 68 between a chevron point 66 and a pair of denticulated fingers 67. This chevron/finger geometry has been found effective to smoothly distribute the sealing pressure as five thicknesses of paperboard are compressed to the dimension of two thickness. As the convex die block 60 advances into the recess of the concave die block 50 air between the folds and within the paperboard compositional matrix is rapidly displaced and forced from the final volume occupied by the bottom wall panel. Vent channel 68 provides an escape route for this sudden rush of gas which would otherwise cause a wave in the overlapping material panels. Without the vent channel 68, the material wave would collapse into a wrinkle in one or more of the bottom forming panels to prevent a fluid tight seal between the several panel faces.

The bottom section profile of Figure 9 illustrates the compacted result of this high pressure die embossment which shows the formation of a stepped platform or pyramid having a rim plane 71, a first step plane 72 and a second step plane 73. Step planes 71 and 72 are separated by an outer embossed relief line 74. Step planes 72 and 73 are separated by an inner embossed relief line 75.

Convex displacement of the bottom wall panel interior area leaves the bottom corners 21, 22, 23 and 24 in the same perimeter plane including the narrow rim surface area 71. The remaining bottom wall surface area approximates a lenticular dish which thrusts the fluid weight of the container contents against the bottom corner walls thereby resisting an external bulging of

the bottom wall profile which contributes to the standing stability of the carton.

Having fully disclosed my invention, I claim:

The claims defining the invention are as follows:

1. A paperboard container comprising four materially integral side walls of thermoplastic film coated paperboard formed about a container axis, said walls being laterally delineated by wall corners that are substantially parallel with each other and said container axis and vertically delineated at one end thereof by substantially coplanar bottom corners, a bottom closure wall formed by a layered folding of bottom panels that are materially integral extensions of said side walls, said bottom closure wall being sealed fluid-tight by a heat fusion of thermoplastic coating respective to adjacent surfaces of said lapped panels and formed to an approximate lenticular geometry that is concave within said bottom corners, said lenticular geometry being a substantially symmetric stepped pyramid of diminishing area step-planes.

2. A paperboard container as defined by claim 1 wherein said bottom closure wall includes, within said bottom corner plane, said bottom corners and a narrow first step-plane adjacent to said corner, and a second step-plane, within the area of said first step-plane that is axially displaced from the plane of said bottom corner plane.

3. A paperboard container as defined by claim 2 wherein said first and second step-planes are delineated by a first line of abrupt surface discontinuity.

4. A paperboard container as defined by claim 3 wherein said second step-plane includes within the area thereof a third step-plane delineated by a second line of abrupt surface discontinuity.

5. A paperboard container as defined by claim 4 wherein said lines of abrupt surface discontinuity are transferred through said lapped bottom panels.

6. A method of fabricating a fluid-tight container from an integral sheet of thermoplastic film coated paperboard comprising the steps of:

folding a tubular enclosure having four side walls laterally delineated by substantially parallel corners;

forming a fluid-tight bottom wall that is substantially perpendicular to said tubular enclosure corners with bottom panels that are materially integral extensions of said side walls, by lap folding said bottom panels;

sealing said bottom panels fluid-tight by heat fusing the thermoplastic coating respective to continuous surfaces of said bottom panels; and

embossing said bottom wall to a substantially concave surface shape with a set of embossing dies so that said bottom wall has at least three substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence, while allowing the gas created by the embossing step to be vented through an air channel in at least one of said dies.

7. A method of fabricating a container as defined by claim 6 wherein said plurality of planar surface areas are disposed in a stepped sequence of planar displacement.

8. A paperboard container bottom sealing tool comprising a cooperative pair of embossing dies, said pair including convex surface die and a concave surface die, said concave surface die including a plurality of substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence.

9. A paperboard container bottom sealing tool as defined by claim 8 wherein said convex surface die includes a plurality of substantially parallel planar areas of concentrically diminishing areal magnitude aligned in a stepped sequence.

10. A paperboard container bottom sealing tool as defined by claim 9 wherein said convex surface die comprises an air venting channel profiled below the surface plane respective to the smallest of said parallel planar areas.

11. A paperboard container bottom sealing tool as defined by claim 8, wherein said convex surface dye is configured to approximate a stepped pyramid.

12. A paperboard container bottom sealing tool as defined by claim 11, wherein an innermost step area of said approximate pyramid is traversed by an air venting channel in the surface profile thereof.

13. A paperboard container substantially as hereinbefore described with reference to Figs. 1 to 9.

14. A method of fabricating a fluid tight container from an integral sheet of thermoplastic film coated paperboard, said method being substantially as hereinbefore described with reference to Figs. 10 to 14.

15. A paperboard container bottom sealing tool substantially as herein before described with reference to Figs. 10 to 14.

DATED this Twenty-ninth Day of January 1998

International Paper Company

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

CARTON BOTTOM SEALER

ABSTRACT

The bottom of a paperboard container of the type suitable for consumer distribution of liquid foods such as milk and fruit juice includes an embossed concavity (72,73) to reinforce the bottom against bulging under content fill pressure for improved free-standing stability.

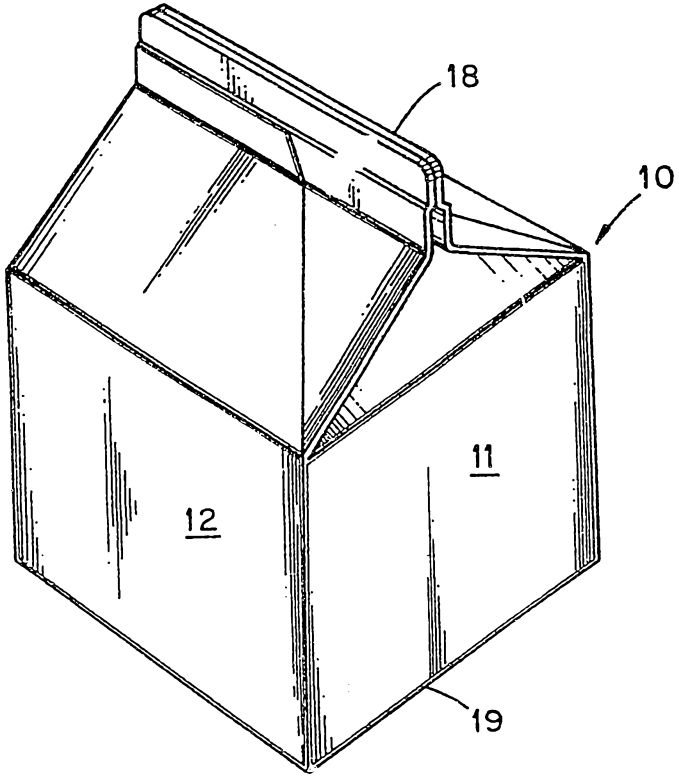


Fig. 1

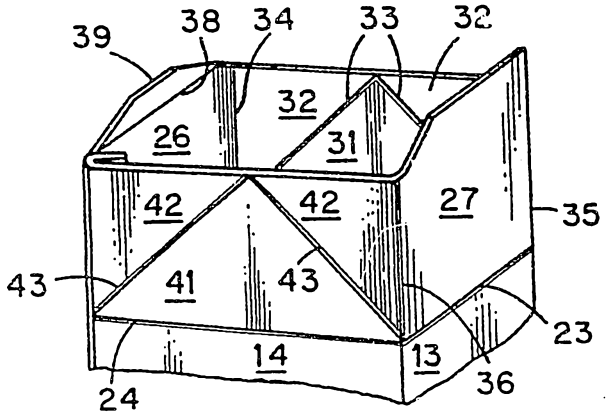


Fig. 3

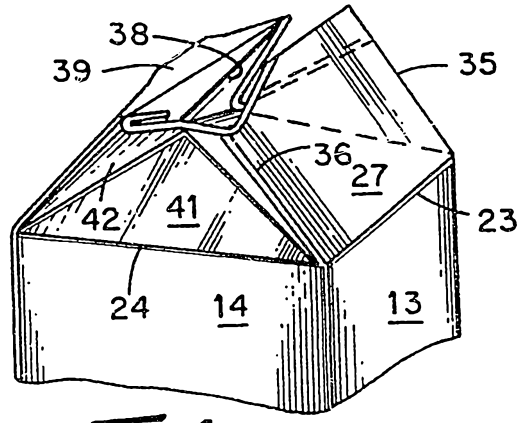


Fig. 4

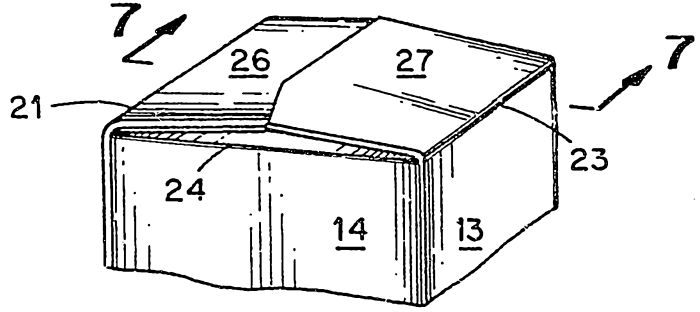
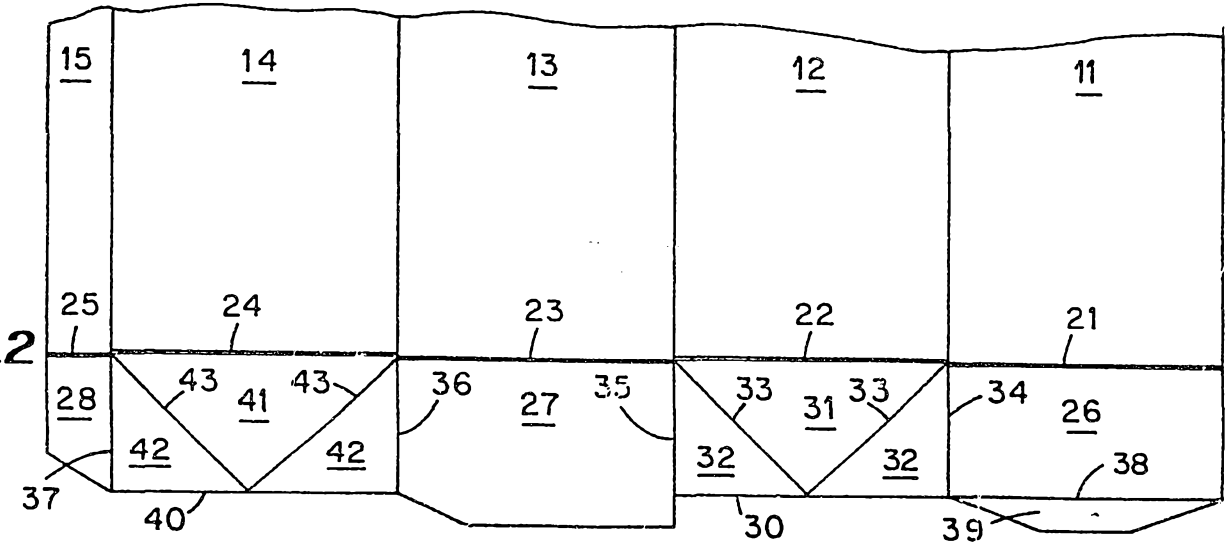


Fig.5

Fig.2



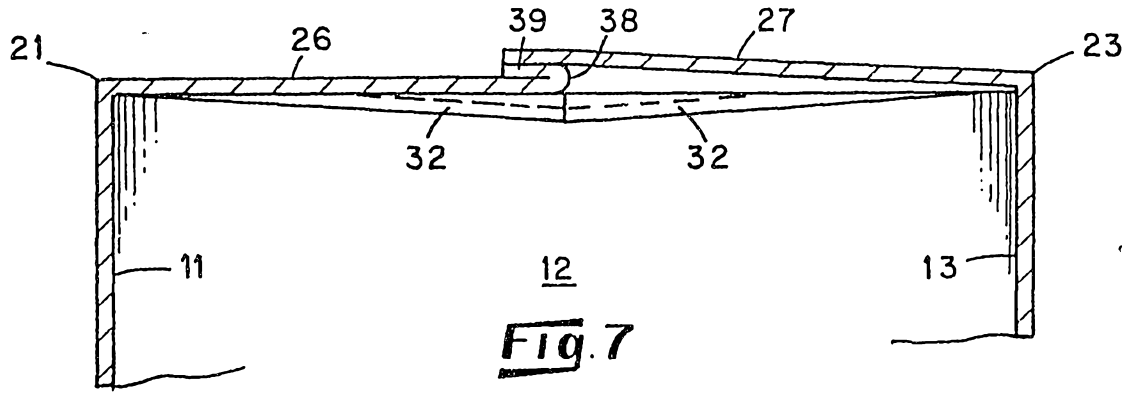

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Fig. 7

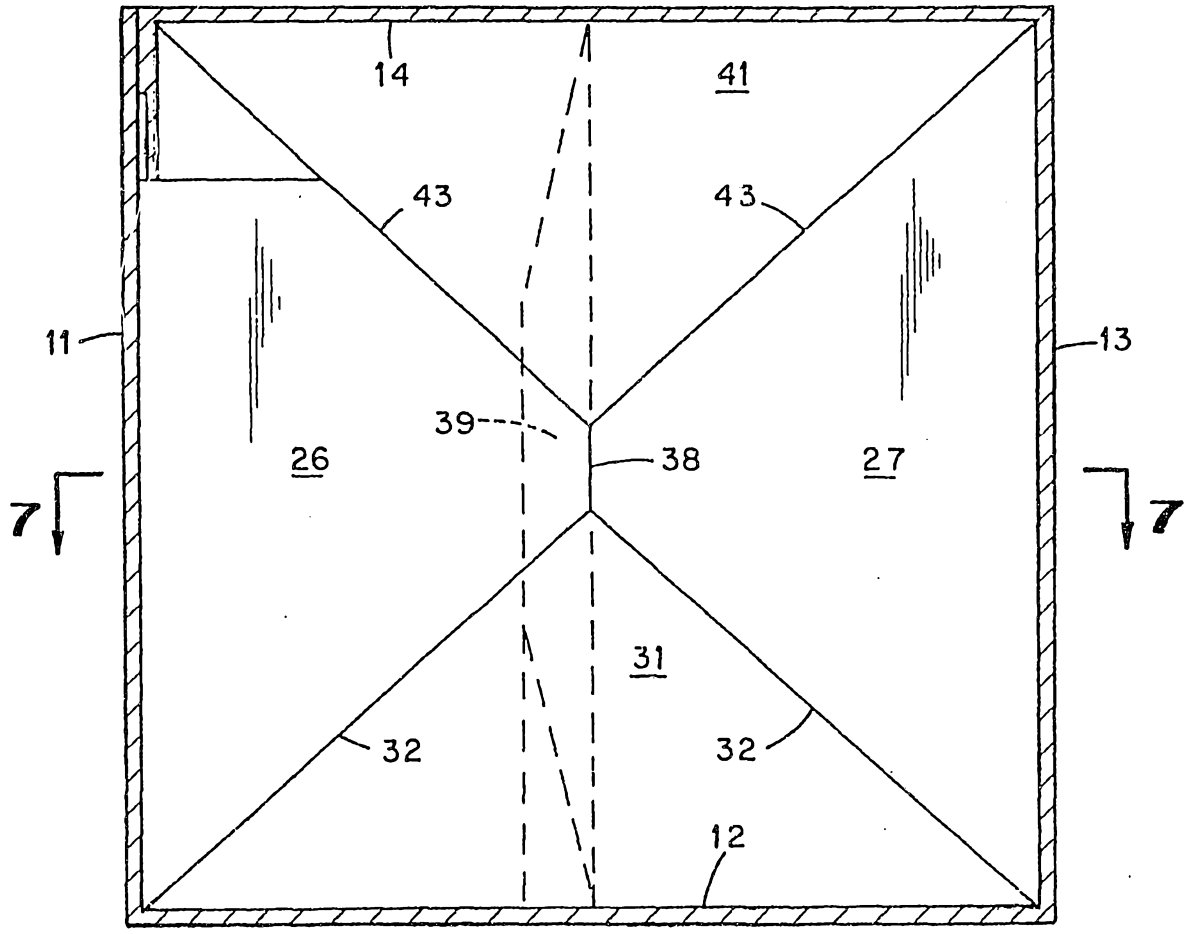
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Fig. 6

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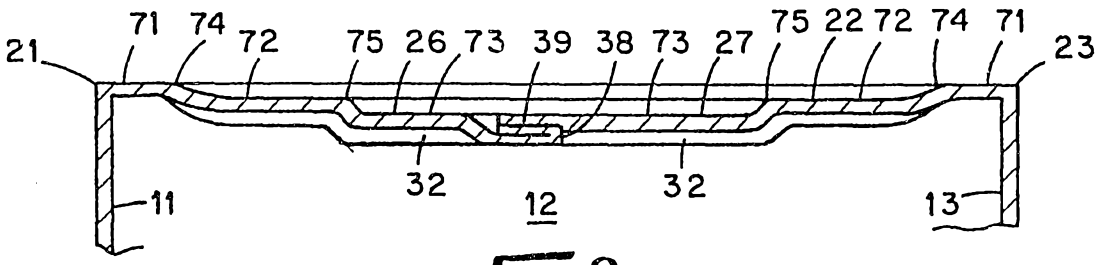

Fig. 9

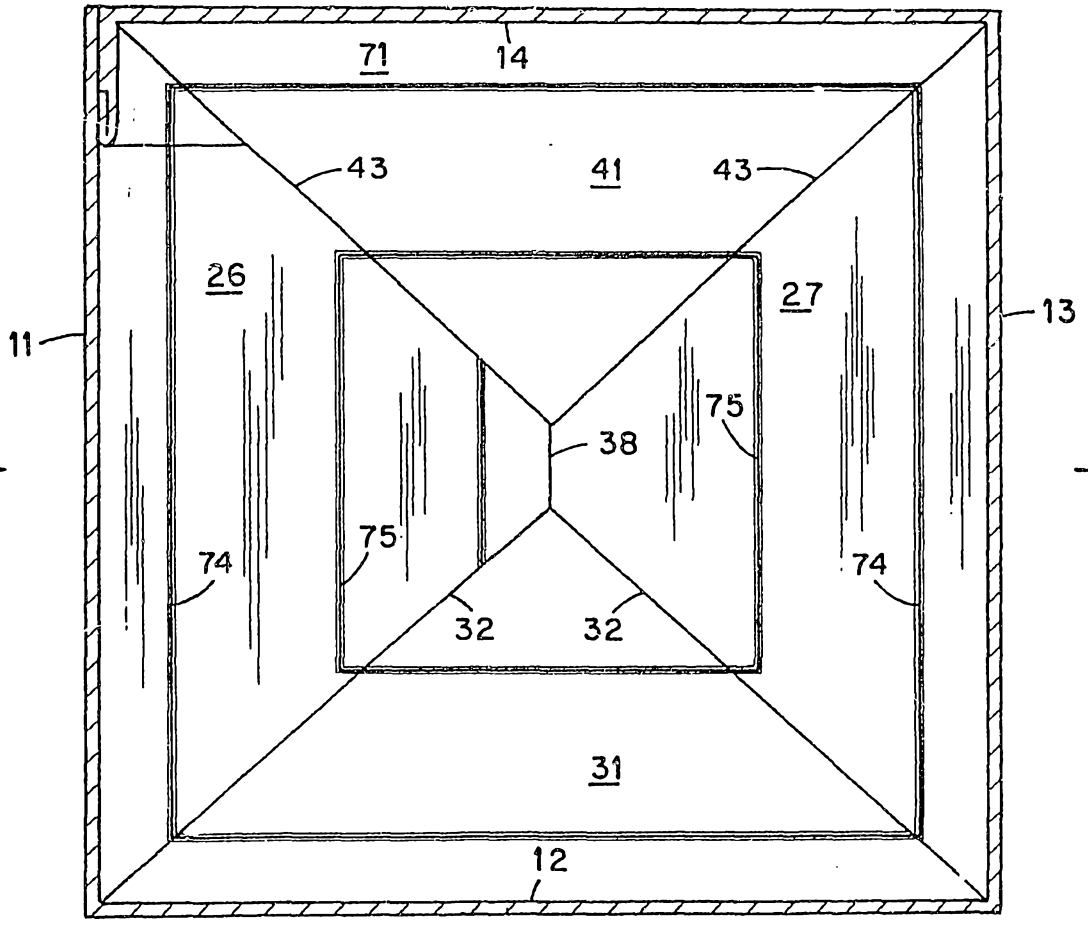

Fig. 8

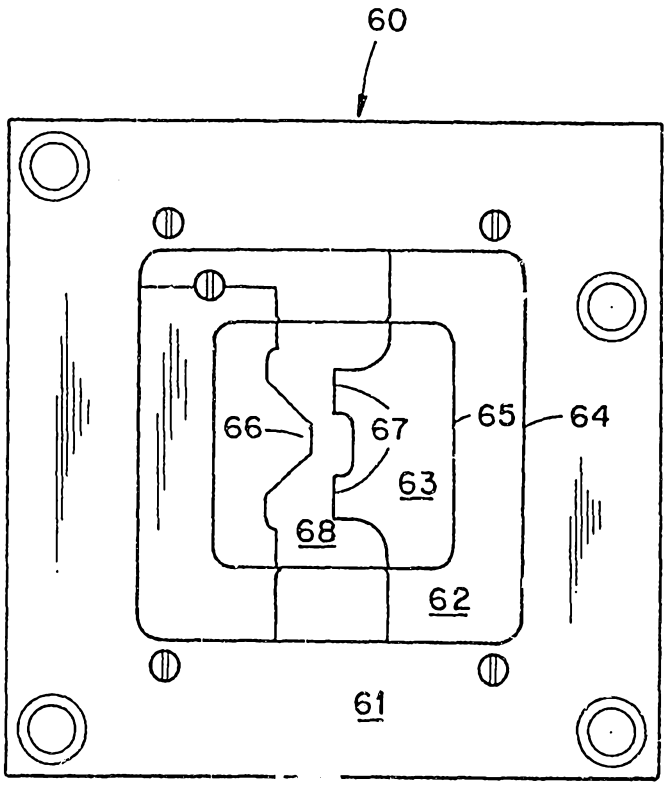

Fig.12

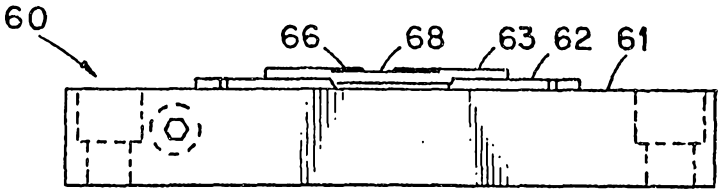

Fig.13

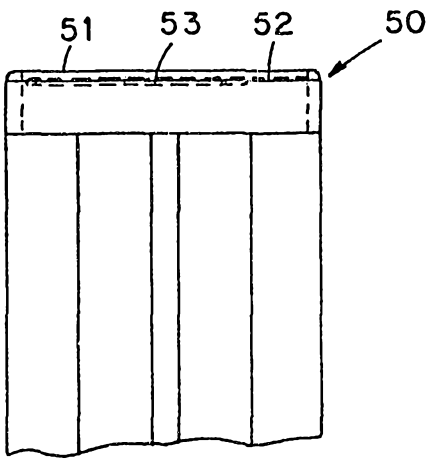

Fig.10

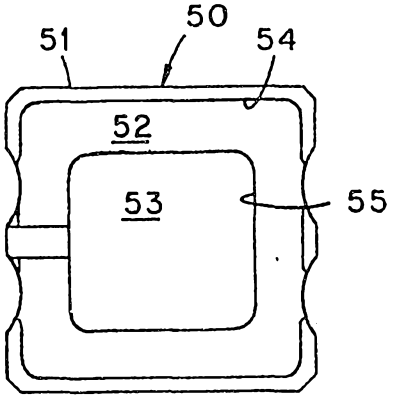

Fig.11

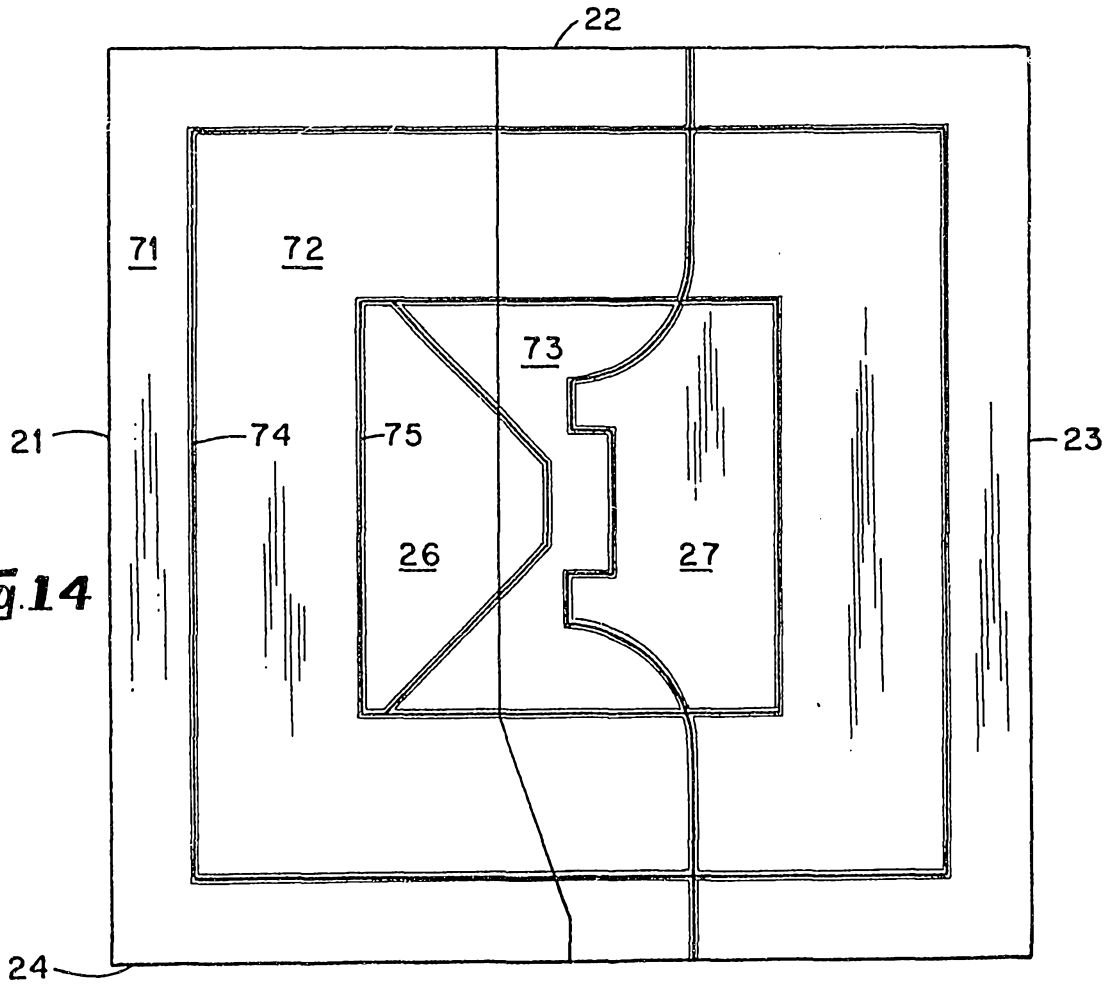

Fig.14