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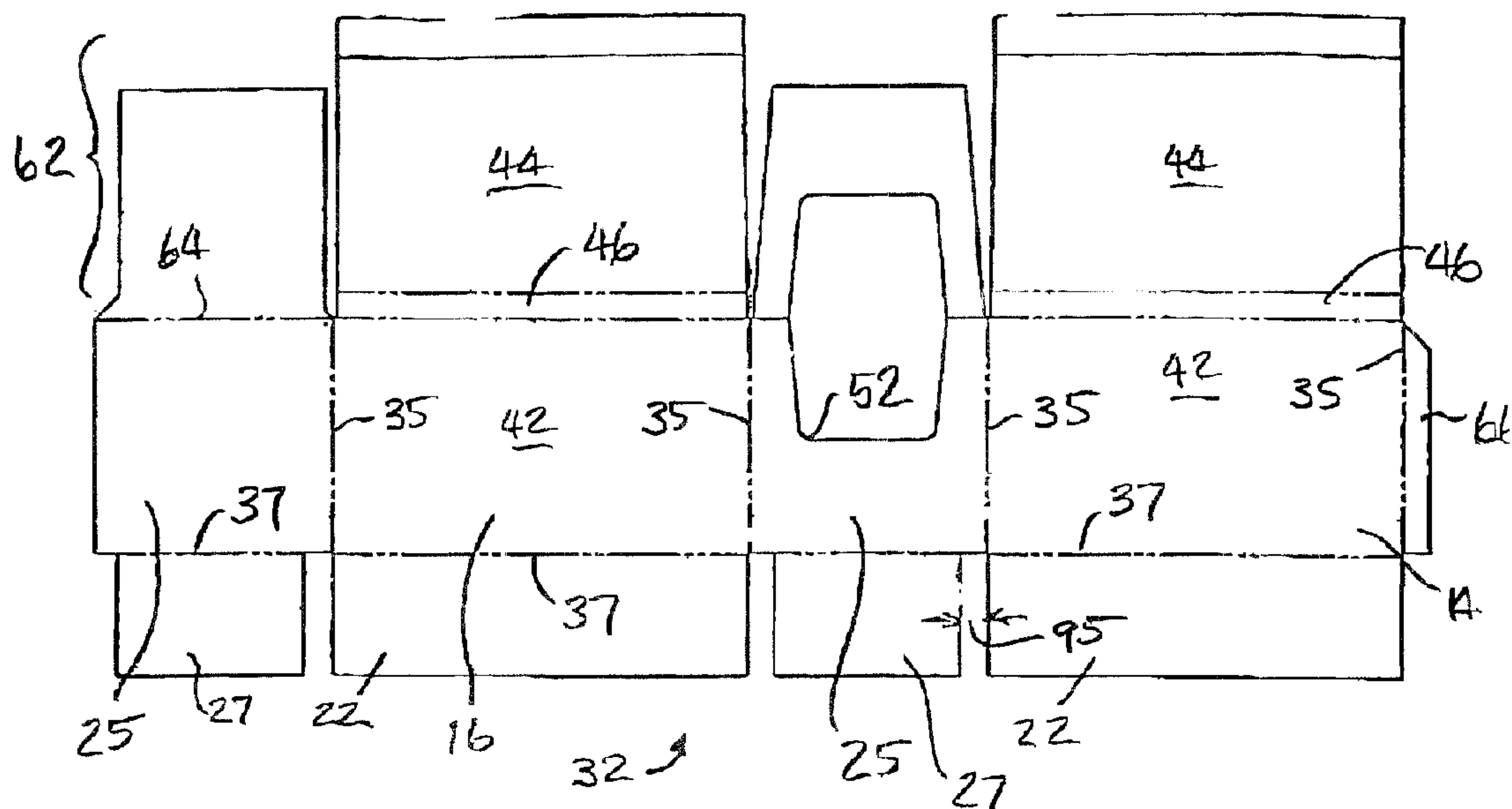
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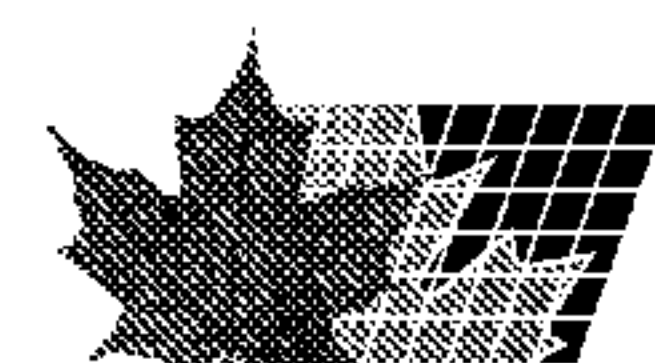
(54) Titre : CONTENANT EN CARTON EQUIPE D'UN PANNEAU REPLIE ET ENGAGE ENTRE DES PAROIS
EXPANSIBLES LORS DU MONTAGE

(54) Title: PAPERBOARD CONTAINER HAVING IN-FOLD PANEL ENGAGED BETWEEN EXPANDING WALLS
DURING ERECTION



(57) Abrégé/Abstract:

A container of paperboard, corrugated craft paper or the like is provided with one or more walls that moves inwardly with erection of the container and bears against an in-fold flap of an adjacent wall, to square up and reinforce the container. In one arrangement, two opposite hollow walls of a rectilinear container expand inwardly against two inner in-fold flaps, during folding of outer in-fold flaps associated with the two hollow walls, into a position in the plane of the container bottom. Embodiments are disclosed with variations including multiple plies, center dividers, integral lid panels and tear-outs. The container preferably is produced in a knocked down flat shape with four sidewall folded flat on one another. The container is erected into a rectangular shape by pressing its diagonally opposite corners toward one another. The inner in-fold flaps first are folded up into the plane of the container bottom, which can be done with ample clearance because the adjacent hollow walls are at first flat and retracted. The outer in-fold flaps have a parallelogram connection with the inner and outer panels of the hollow walls, causing the inner one of the panels to move inwardly against the inner in-fold flaps, eliminating the clearance as the outer in-fold flaps are rotated into the plane of the container bottom.



**PAPERBOARD CONTAINER HAVING IN-FOLD PANEL ENGAGED
BETWEEN EXPANDING WALLS DURING ERECTION**

Abstract of the Disclosure

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10 in-fold flaps associated with the two hollow walls, into a position in the plane of the container bottom. Embodiments are disclosed with variations including multiple plies, center dividers, integral lid panels and tear-outs. The container preferably is produced in a knocked down flat shape with four sidewalls folded flat on one another. The container is erected into a rectangular shape by
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PAPERBOARD CONTAINER HAVING IN-FOLD PANEL ENGAGED BETWEEN EXPANDING WALLS DURING ERECTION

Background of the Invention

1. Field of the Invention

5 [0001] The invention relates to a paperboard, corrugated craft or similarly constituted carton or container, preferably comprising an integral one piece blank having contiguous panels that are folded and/or glued for handling while knocked down flat. The container erects into a rectilinear box. In addition to
10 front, rear and end wall panels, the container has one or more adjacent in-fold panels that close over at least one face, preferably the bottom. An exemplary embodiment for stacking is disclosed, that erects with hollow walls on two sides, each having a wide top edge, and otherwise is open across the top.

[0002] According to an inventive aspect, at least one wall (preferably each of
15 two spaced walls) expands from a flattened to a hollow configuration during erection of the container, thereby reducing a span between two opposed container walls. This can be accomplished in association with erecting in-fold flaps on the hollow wall panels. Additionally, an in-fold flap is provided on one or both ends perpendicular to the hollow walls. This latter in-fold flap (or pair of
20 flaps) is dimensioned to bear against the opposed hollow walls, at the limit of their expansion. This positively squares the erected container.

2. Prior Art

[0003] Corrugated and paperboard cartons, containers, and trays can be made
25 in flat collapsed structures that handled in stacks, and are erected individually shortly before each container is filled with goods. A set of attached panels that are eventually erected to form the container can be cut integrally from a single sheet of stock, with the lines at which the panels are joined being crimped or perforated or scored to permit folding, usually at right angles.

[0004] The dimensions of such containers are widely variable. Typically the container is shaped as a rectilinear box. Four panels that will form the side walls, for example, are delineated by three or four folds on spaced parallel lines. The free ends are overlapped along a line parallel to the fold and are glued,
5 often but not necessarily near a corner.

[0005] The four side wall panels (which might also be considered the front, back and end wall panels) typically have in-fold flaps on their top and bottom edges. Each fold-in flap is joined to one of the side panels (front, rear or end). Each of the side wall panels can have a fold-in flap at one or both of its top and/or
10 bottom edge. The fold-in flaps are joined to the wall panels on fold lines that are perpendicular to the lines between adjacent sidewalls.

[0006] Each of the foregoing folds, whether oriented to vertical or horizontal, typically is folded to a right angle. The result is a set of spaced parallel closed or closeable walls that for a closed container will together define six attached
15 mutually perpendicular and spaced parallel panels. These are a front panel and a parallel back panel spaced from the front, two spaced parallel opposite end panels, and a top and a bottom.

[0007] In a so-called regular slotted carton ("RSC") configuration, the in-fold flaps on opposite walls can each form half of the associated wall structure
20 between the opposite walls. For example flaps attached to the front and back can each form half of the top or bottom. The ends of the opposite flaps abut edge-to-edge, usually along the midline of the container. The opposite flaps can be affixed by a strip of tape along the midline of the container. Usually the top and bottom have similar structures, but it is also possible (and is an aspect
25 of the present invention) that one of the walls (normally the top) is open, and the material that might have been used for in-fold flaps is otherwise employed, e.g., to provide a distinct structure facilitating stacking.

[0008] It is possible to tape either end of such opposite in-fold flaps of the front and back, to the adjacent end wall panels as well. Typically, the end wall
30 panels also have in-fold flaps. The typical end wall in-fold flaps overlap the in-

fold flaps of their adjacent front and rear walls. The in-fold panels of the end walls could be made long enough to meet at a midline of the container (perpendicular to the midline between the front and back walls). Generally the end in-fold flaps are shorter and serve to close any space between the front and rear in-fold flaps versus the two end walls.

[0009] A reinforced container could have any combination of attachments between the in-fold flaps or between particular in-fold flaps and the opposite in-fold flap and/or the adjacent wall. For example, each in-fold flap could extend to the midline and be taped to its opposite counterpart. Either of the front/back or the end in-fold flaps could be on the inside or outside of the other. The overlapping flaps can be glued or stapled together, taped to the adjacent container walls, etc. Normally it is not necessary and is unduly expensive to provide multiple attached layers and redundant structural connections. The object is to provide a sufficient container structure at the minimum cost required to achieve particular packing and shipping needs.

[00010] It will be appreciated that the panels of a container have a number of functions, not the least being to structurally support the container against collapse. For this purpose, the panels of the container are integrally connected or are attached by fasteners, glue or tape, etc. Additionally, to some extent the in-fold flaps hold the shape of the container because they fit between the other walls and are in position to block collapse of the container in certain ways. This function is limited by the degree to which there are clearance gaps between the respective structural parts of the container.

[00011] Assuming that the container bottom, for example, has in-fold flaps hinged on the container end walls and front/back walls, one set of in-fold flaps is outside, and usually is taped, whereas the other set is inside the first set. The inside set of in-fold flaps (usually the flaps on the end walls) reside between the adjacent spaced side walls (usually the front and back walls) having the outer in-fold.

[00012] The inner in-fold flaps typically are sized and shaped to form rectangles that substantially occupy the inside of the bottom of the container when in its correct nominal shape. As a result, the in-fold flaps provide structural support in some instances to maintain the container shape under the influence of force. For example, if a container is dropped diagonally onto a bottom corner, there is a resulting force tending to collapse the container diagonally. A compression force is exerted between diagonally opposite bottom corners of the container, and urges the container to deform from a rectangle in plan view to a parallelogram in plan view. Such deformation is resisted by the in-fold flaps, which were placed and possibly affixed to one another when the container was erected.

[00013] An outer set of opposite in-fold flaps typically extend from the front and back walls, at least on the container bottom, and are taped together along the midline of the bottom. When the edges of these in-fold flaps are abutted and taped, they together define a rectangular shape for the bottom covering panel, attached at least to the front and back wall. The bottom covering panel might resist collapse under diagonal compression force between the corners, except for the fact that there must be some space or clearance left between the edges of the flaps, bridged by the flexible tape, to allow for various tolerances. As a result, the container will admit of some deformation from a precise rectilinear shape toward a parallelogram shape, causing flexing of the midline tape, before the in-fold flaps are caught between and compressed between the opposite container walls (the front and back walls).

[00014] There is a comparable clearance or looseness issue associated with the inner set of in-fold flaps. These inner in-fold flaps, usually being the flaps on the end walls of the container, form an inner set of two opposite flaps aligned perpendicular to the outer set. Typically, there is a substantial space between the edges of the end wall in-fold flaps, which are not taped together and may simply rest on the container bottom.

[00015] The end wall in-fold flaps (namely the inner in-fold flaps) are rectangular, and correspond generally to the nominal rectangular shape of the container bottom between the front and back container walls. If the container is deformed toward a parallelogram, the vertical folds between the ends and the front and back sidewalls define pivot axes. The diagonally opposite corners are deformed from right angles to acute or obtuse angles. The front and rear container walls are displaced toward one another with parallelogram deformation. The end wall inner in-fold flaps are in position between such walls. The in-fold flaps resist compression along their plane. However, there is clearance that permits some displacement before the end wall in-fold flaps come into play to resist compression. This clearance is between the lateral edges of the end wall in-fold flaps and the inside surfaces of the container front wall and rear wall, respectively.

[00016] It is not routinely possible to eliminate clearance between the in-fold flaps and the inside surfaces of the two adjacent walls. It would be conceivable to employ very precise manufacturing processes to produce inner in-fold flaps that are exactly the correct width (i.e., exactly the nominal space between the inside surfaces of correctly constructed front and rear walls), and are exactly placed at the correct position on the end wall relative to the front and rear walls and the corners where they connect at a fold to the end wall. Even if exactly accurate, the result would be in-fold flaps that have an interference fit with the front and rear sidewalls. It would be necessary to hold the container exactly in a rectilinear shape during the process of folding the in-fold flaps inwardly between the spaced opposite container walls, and to force the in-fold flaps into place, possibly bending or damaging them.

[00017] If the lateral width or the position of an edge of the inside in-fold flap (usually the end wall in-fold flap), is the least bit beyond the inside surface of the adjacent sidewall, the in-fold flap will be obstructed and will catch and bend or possibly even crease. A dog-ear or crease in the in-fold flap is highly unacceptable. A resulting bend must be pressed out. Not only does

interference with the in-fold flap retard production, but if any crease has been caused in the in-fold flap, then the compression resistance of the in-fold flap is substantially and permanently reduced.

[00018] As a practical matter, in order to facilitate erection of the container
5 without obstruction to inward folding of the in-fold flap that will reside between the inside surfaces of the adjacent walls, the in-fold flap always is made laterally slightly smaller than the nominal spacing between such inside surfaces. In a typical shipping container, for example of less than a meter on a side, the in-fold flaps may typically have as much as 1cm of clearance on each side. This
10 clearance gap, like the gap between the taped edges of the outside in-fold flaps, permits a conventional container to flex and deform under force, up to a point at which parallelogram deformation consumes the gap.

[00019] Flexing is generally undesirable in a container and is particularly undesirable if the container is to bear the weight of other containers stacked
15 above in tiers. In some containers, which may or may not be intended for stacking, one of the six usual rectilinear walls is omitted, for example to provide a container with an open top or front, etc., for manual access to the contents. This likewise omits the possibility of in-fold flaps at the open wall. In stacking or less-than-six walled container structures, it is desirable to make the container
20 particularly rigid and weight bearing. It would be advantageous to provide such attributes in a container of modest complication and expense.

[00020] Containers are supplied in a collapsed or knocked-down-flat (KDF) state because storage or handling of empty containers is wasteful of space. KDF containers are partly formed, namely with the necessary parts cut
25 out and preliminarily assembled. The blank can be scored or perforated and is folded to subdivided it into side walls and end walls, usually with at least one seam that is glued. The container remains flattened until ready to use. The erector, which might be a person or a mechanism, opens the flattened container body outwardly by pressing it into a three dimensional shape. When there is

sufficient clearance between the respective opposite walls, the in-fold flaps are folded inwardly to occupy the space between the opposite walls.

[00021] It would be advantageous if such erection steps could be accomplished without requiring a great deal of precision on the part of a mechanism, or a great deal of attention if the erector is a person. This normally means providing ample clearance between the in-fold flaps and the inside surfaces of the opposed walls.

[00022] It would also be advantageous if ample clearance for erection could be provided in a structure that is rigidly self-supporting when erected. These are normally inconsistent objects because for maximum rigidity, it is necessary to provide no clearance whatsoever.

Summary of the Invention

[00023] It is an object of the invention to provide a container structure wherein inner in-fold flaps are dimensioned substantially to fill the space between the inside surfaces of adjacent sidewalls.

[00024] It is also an object to provide such a container structure wherein the lack of clearance between the in-fold flaps and the sidewalls does not interfere with container erection.

[00025] These and other objects are provided in a container according to the invention, which is structured such that during erection of the container, moving the outer in-fold flaps into position causes an inward displacement of the inside surfaces of at least one of the adjacent sidewalls, preferably both opposite sidewalls. The inside in-fold flaps are folded into place before the adjacent sidewall surfaces are displaced inwardly to eliminate clearance provided for receiving the inside in-fold flaps. Thus container erection is free of problems with interference and the container need not be held exactly square during erection. When subsequently folding in the outside in-fold flaps, the inward displacement of their inside surfaces causes the sidewalls to engage directly against the inner in-fold flaps. Thus after erection there is no clearance

and no associated slack or looseness. The result is a strong and rigid container that is apt for stacking, is readily strong enough for use if desired without the added support of a lid, and is quick and easy to erect with minimal attention or using even a relatively imprecise erecting device.

5 More particularly, a container of paperboard, corrugated craft paper or the like is provided with opposite hollow walls that expand inwardly during erection of the container and bear against in-fold flaps on the adjacent walls, to square up the container. In an un-erected or semi-erected state, clearance is provided between the in-fold flaps and the adjacent walls. Such clearance can
10 be substantial, for example nearly equal to the width of the ledge atop the hollow side walls.

 The container typically has four wall panels connected along corner folds, namely a front, a rear, and two spaced ends. Other specific structures also are possible. In a rectilinear arrangement, one pair of opposite in-fold
15 flaps, typically on the front and rear, are the outer in-fold flaps. The other pair of in-fold flaps, typically on the container ends, are the inner in-fold flaps, namely the flaps that fold into a position between inner surfaces of the adjacent wall panels, e.g., between the inside surfaces of front and rear walls.

 These front and rear panels are hollow, namely each comprises two
20 parallel panels. The bottom edges of the parallel panels are coupled to the outer in-fold flaps, at a space equal to the thickness of the hollow wall. After the container is first opened from a knocked down flat shape into a rectangular shape by erecting it from a collapsed parallelogram, the inner in-fold flaps are folded between the front and back walls. This operation has ample clearance
25 because the hollow sidewalls remain in a collapsed state. When subsequently folding-in the outer in-fold flaps, the hollow front and back walls each expand in thickness. The parallel panels of each hollow front and back wall become separated, while remaining parallel, because these parallel panels are arranged in a parallelogram with the outer in-fold flap and a top ledge panel.

Thickening of the hollow front and back walls thereby occurs when the bottom in-fold panel and the top ledge panel are brought into a position perpendicular to their wall panels. The inner parallel panels move inwardly against the lateral edges of the inner in-fold flaps. Preferably, the clearance
 5 between the inner perpendicular wall panels and the lateral edges of the inner in-fold flaps is wholly eliminated, but at least such clearance is reduced. The inner hollow wall panels, which are necessarily parallel to the outer hollow wall panels, bear against the inner in-fold flaps and positively square up the container. The container is square and strong, yet can be made and
 10 assembled quickly and easily.

Brief Description of the Drawings

[00026] These and other features and advantages of the invention will be more fully disclosed in or rendered apparent from the following detailed
 15 description of certain preferred embodiments of the invention, and the accompanying drawings, wherein like numbers refer to like parts. In the drawings:

[00027] Fig. 1 is a plan view showing a cut-out blank for a paperboard container according to an exemplary embodiment of the invention.

20 [00028] Fig. 2 is a perspective view of a fully erected open-top container made from the blank shown in Fig. 1, and having in-fold panels on the container end walls, engaged the inside surfaces of sidewalls structured so as to expand inwardly during erection of the container.

[00029] Fig. 3 is a plan view corresponding to Fig. 1, showing areas glued
 25 according to an initial step in changing the blank into a container.

[00030] Fig. 4 is a plan view showing folding and gluing steps.

[00031] Fig. 5 is a plan view of a knocked down flat (KDF) container according to the invention.

30 [00032] Fig. 6 is a partial perspective view showing a corner area of the container during an initial stage of erection.

[00033] Fig. 7 is a section view of a side wall area taken along line 7-7 in Fig. 2.

[00034] Fig. 8 is a plan view of a corresponding blank that makes an alternative embodiment of the inventive container, wherein the container has an attached lid.

[00035] Fig. 9 is a plan view of another alternative embodiment having an internal multiple-ply divider, and wherein the rectangular orientation of the container is changed (i.e., the shorter ends are the sides having expandable hollow walls).

[00036] Fig. 10 is a plan view of still another example, this time corresponding to the rectangular orientation and having a divider as in Fig. 9, and also having a tear-away lid.

Detailed Description of the Preferred Embodiments

[00037] Referring to Figs. 1 and 2, a stackable container 10 is provided, preferably as an open-top container, having a front wall 14 and a back wall 16, each having in-fold flaps 22, and end walls 25, having in-fold flaps 27. Preferably, all the wall panels 14, 16, 25 and all the in-fold flaps 22, 27 that form the bottom 29 of the container, are integrally attached portions of a single sheet 32 of sheet material as shown in Fig. 1. However, it is also possible that certain of the parts can be separate insertable or attachable parts.

[00038] The container 10 can be of any convenient foldable sheet material such as paperboard, cardboard, corrugated craft, plastic sheet, laminate or the like. The container 10 is generally characterized by parallel spaced opposite wall panels for the front and back walls 14, 16, and also the opposite end walls 25. The front/back walls 14, 16 and the end walls 25 are perpendicular to one another and are adjacent to one another at four right angle corner vertically elongated folds 35 in the embodiment shown. The front, back and end walls 14, 16, 25 are also perpendicular to the respective in-fold flaps or panels 22, 27 once the container 10 has been erected as shown in Fig. 2, because the in-fold

flaps or panels reside generally across the bottom 29 of the container 10 as shown. The front/back walls 14, 16 and the end walls 25, are adjacent to one another across vertical fold lines 35 at each corner. The in-fold flaps or panels 22, 27 are adjacent to the front, back and end walls 14, 16, 25, across
 5 horizontal fold lines 37 along the bottom edge or periphery of the container as shown.

[00039] In Fig. 2, the container 10 has been opened from a knocked down flat state, namely to separate and align the front, back and end side walls 14, 16, 25. Also the in-fold flaps 22, 27 have been folded inwardly to a horizontal
 10 orientation across the bottom 29 of container 10. In this way the container 10 is erected and configured so as to contain goods (not shown). In addition to coverage across the bottom 29 and around the four walls 22, 25, the front and back walls 14, 16 are hollow. Specifically, the front and back walls 14, 16 comprise two panels 42, 44 that are parallel and are spaced from one another
 15 by an edge or shelf panel 46 at the top edge of the container 10 and by a connection with a bottom in-fold flap or panel 22 as discussed below.

[00040] The hollow wall front/back wall structure and the horizontal shelf panel 46 thereby provided along the top edges of the opposite front and rear walls 14, 16, facilitate stacking of container 10 with other similar containers.
 20 The shelf panel 46 provides a horizontal supporting surface that has a sufficient area to accommodate an upper container (not shown) that may not be placed precisely in registry with container 10 below it, provided that the upper container is stacked sufficiently closely that at least a part of its bottom aligns with and rests on the top ledge panel 46 on both the front and back of container 10.

25 [00041] The container 10 can be made from one integral piece of sheet material 32 as shown in Fig. 3. In the embodiment shown, the end walls 25 are of double thickness but the two layers of sheet material are simply folded over layers at a 180-degree fold, attached face to face. This attachment can be made using fasteners, adhesive or other means and is represented by in the
 30 drawings by "X" characters showing areas where adhesive could be applied.

[00042] One of the end walls in this embodiment also has a cut-out 52 for manual access to the inside of the container (i.e., an opening through which one can reach into the container). It should be appreciated that the cut-out 52 and the double thickness structures of the end walls 25 are aspects of a preferred embodiment, but are not strictly required. For example, both end walls 25 could cover their entire ends without an access opening 52. One or both of the end walls could be a single thickness. A lid panel or the like (not shown) could be provided over the open top of the container, for example attached at a fold line along the top edge of either or both of the end walls. All such variations are within the scope of the invention. The depicted embodiment, however, is particularly apt because this preferred structure takes substantial advantage of the self squaring and structural reinforced nature of the invention.

[00043] The one-piece cut out blank 32 in Fig. 3 has glue bearing upper counterparts 62 as shown for each of the end walls 25 and the front and back walls 14, 16. The upper counterparts 62 of the front and back walls 14, 16, however, are glued only along strips along their extreme distal or top edges. These panels 62 will form on each of the front and back walls 14, 16, the inner one 44 of the two parallel spaced panels that form each of the front and back hollow walls 14, 16 shown in Fig. 2. The upper counterparts of the end walls 25, on the other hand, are glued over their entire surfaces so that the end walls 25 in the finished container are multi-layer laminates rather than spaced layers forming a hollow wall as with front and back walls 14, 16.

[00044] In order to assemble the one piece blank 32 into an erectable but knocked-down flat container 75, shown in Fig. 5, glue is applied as shown by the X areas in Fig. 3. The upper counterparts 62 of the front, back and end walls 14, 16, 25 are folded down against the main wall panels, which operation is shown in Fig. 4. This fold is made all along a line 64, that will define the top horizontal edge of the ultimate erected container shown in Fig. 2. In addition, a tab panel 66 is provided on one extreme end in Fig. 4, is also glued and is

brought over, overlapped and adhesively attached to the other extreme end 72, so as to close the four container walls into a perimeter. The resulting knocked down flat container 75 is shown in Fig. 5, ready for storage, shipment or erection for use.

5 [00045] Referring again to Fig. 3 and the fold-and-glue operation proceeding from Fig. 3 to Fig. 4, it can be seen that the fold line top edge 64 (corresponding to the upper and outer edge of the front or back hollow wall of the erected container) is not the fold line at the upper one 77 of the two closely spaced fold or score lines 77, 79 in each of the front and rear walls, but instead
10 is at the lower one 79 shown in Fig. 3. The upper fold or score line 77 in Fig. 3 will become the upper and inner edge of the associated front or back hollow container wall 14 or 16. The upper fold line 77 becomes the lower of the two adjacent fold lines 77, 79, when the upward counterparts 62 are folded down and adhesively attached as in Fig. 4.

15 [00046] The blank in Fig. 3 also has lower counterparts 82 for each of the front, back and end wall panels. The lower counterparts 82 become the in-fold flaps 22, 27 that reside at the bottom of the erected container. In addition to closing over the bottom plane of the container, the outer in-fold flaps 22 operate to expand the hollow front and back walls 14, 16 by moving their inner surfaces
20 inwardly toward the longitudinal midline of the container. The inner in-fold flaps 27 are engaged by this expansion, thereby automatically squaring up the container 10, as well as reinforcing its structure when erected.

[00047] As mentioned above, the fold line 77 at the top of the front and back walls shown in Fig. 4 (one of the two closely spaced folds), is the outer top
25 edge of the container front or back wall 14 or 16. The lower one 79 of the fold lines becomes the top inner edge of the front or back wall 14 or 16. In Figs. 4 and 5, the hollow front and back walls 14, 16 are flattened. That is, the inner panel 62 for each of walls 14, 16 and its associated outer panel, lay against one another. In this knocked down flat condition, the top ledge panel 46 is coplanar
30 with the inside panel of the hollow front or back wall 14, 16.

[00048] The bottom of the hollow front or back wall 14, 16 is defined by a strip 84 along the outer in-fold flap 22 adjacent to a fold connection with the outer panel of the front or back wall 14, 16. The outside fold line between the outside panel of the hollow front or back wall and the associated in-fold panel 5 22 is obscured by the inside panel of the hollow front or back wall in Fig. 4, but is at the level shown by an arrow in both Figs. 3 and 4.

[00049] As a result of this structure, the glued strip affixing the extreme edge of the upper counterpart 62 to the outer in-fold flap 22 (i.e., the glue strip at the bottom of the inner panel of wall 14 or 16 as shown in Fig. 4), is moved 10 inboard of the inside panel of the hollow front or back wall when the outer in-fold flap is rotated into the plane of the bottom of container 10 together with the glue strip.

[00050] The glued edge at the top of the front and back inside hollow wall panel in Fig. 3, might alternatively be folded under in Fig. 4 and glued on the 15 other side of the edge, for example manually, but the embodiment shown is apt for assembly in an automated manner using a fold-and-glue production machine. Preferably the container of the invention is produced automatically by a fold-and-glue machine, which machine can optionally be associated with a die cutting machine whereby sheet material is processed into knocked down flat 20 containers.

[00051] A run of containers can be produced and stacked on a pallet or the like (not shown) for storage or shipment in the knocked-down-flat configuration shown in Fig. 5, which is quite compact. The lateral outside edges 92 of the knocked down blank correspond to the diagonally opposite 25 corners of a container 10 when erected. When ready to erect the blank and use the container, a person or machine presses the opposite edges 92 of the blank toward one another to force open the container 10 from the flattened parallelogram state into a rectilinear shape in plan view. In the process, the acute angle between each end 25 and one of the sidewalls 14, 16 at edges 92 30 is increased to a right angle, and a fold is induced between such end 25 and the

other one of the sidewalls 14, 16. Preferably-scored or weakened fold lines are provided at the points where the adjacent coplanar panels are required to fold into a right angle.

[00052] Conventionally, it is necessary to erect such container very
5 precisely into a rectangular shape and to hold it there while the in-fold flaps are folded and optionally attached, or alternatively, the parts can be cut to permit substantial clearance. Unfortunately, the clearance results in structural weakness and, unlike the present invention, fails to contribute to squaring up of the structure. However, according to an inventive aspect the present container
10 need not be precisely rectilinear, yet sufficient clearance is provided for the operation, while subsequent steps during erection and assembly cause the container to square up and structurally to reinforce itself.

[00053] As shown in Fig. 4, the in-fold flaps 27 depending from the end walls 25 are laterally smaller than the width of the end wall 27 to which they are
15 attached. When the container is initially expanded from a flattened parallelogram to an approximate rectangle (in plan view), so long as the hollow front and back walls 14, 16 remain flattened, the space between the inside surfaces of the front and back walls 14, 16 is just less than the lateral dimension of the end wall 25 and is substantially less than the lateral dimension of the in-
20 fold flap 27 that depends from end wall 25. Due to the gaps 95 provided on the lateral sides of the end wall in-fold flap 27, shown in Figs. 3, 4 and 6, there is ample clearance for folding the end wall in-fold flap 27 into position between the inner surfaces of the front and back walls 14, 16, namely up to the plane of the bottom inside of the container 10. Even if the container has not been accurately
25 expanded from a flattened parallelogram into a rectangle, there is clearance to fold the flap 27 into position without contact between the flap 27 and either the front and back wall 14, 16 or their in-fold flaps 22, which have not yet been folded in.

[00054] The end wall in-fold flaps 27 are the inner in-fold flaps in the
30 finished container 10, shown in Fig. 2. That is, the end wall in-fold flaps 27

reside above the front and back wall in-fold flaps 22. Thus the end wall in-fold flaps 27 fit between the inside surfaces of the front and rear walls 14, 16. In contrast, the front and rear wall in-fold flaps 22 cover over the bottom of the container 10, but are not engaged for structural support with other parts.

5 Instead, the outer in-fold flaps 22 can be taped together across their end as shown in Figs. 2 and 7, and/or taped around the bottom to the end walls 25 (not show) and/or attached by glue or staples, for example, to the end wall in-fold flaps 27 or to an inserted panel (not shown), etc.

[00055] According to an inventive aspect, the front and back hollow walls 10 14, 16 expand as parallelograms when their in-fold flaps 22 (the outer in-fold flaps) are folded up into position, thereby moving the inner surfaces of the front and back hollow walls 14, 16 across the gap 95 and against the lateral edges of the end wall in-fold flaps 27. As shown in Fig. 6, in step "A" the end wall in-fold flap is first folded up into position. Clearance is provided due to the gap 95 15 along at least one and preferably both lateral edges of the end wall in-fold flap 27. See also Fig. 7.

[00056] After the end wall in-fold flap 27 is in place between the inside surfaces of the front and back walls 14, 16, then in step "B," the front or rear side wall in-fold flap 22 is folded up. The glued strip 88 at the end of the inner 20 hollow wall panel is affixed to the front or rear in-fold flap 22, at a point that is spaced along the in-fold flap 22 by a distance away from the fold 86 at the lower outside edge of the wall 14 or 16 (i.e., spaced from the fold between the outer hollow wall panel and the associated in-fold flap 22). Therefore, as the front or back in-fold flap 22 rotates around the fold 86 at the lower outside edge of the 25 wall 14 or 16, the inside hollow wall panel is moved inwardly of the container, expanding the thickness of the hollow front or back wall, toward the midline of the container. Specifically, a flattened parallelogram is opened outwardly, that parallelogram being formed by the inner and outer hollow wall panels, the top ledge panel and the strip of the bottom outside in-fold flap that is between the 30 inner and outer hollow wall panels. The outer or lower in-fold panel 22 on said

front or rear wall can be brought up to horizontal as shown in Fig. 7 and attached to the corresponding in-fold panel 22 of the opposite side, for example with a strip of adhesive tape 97 as shown in Figs. 2 and 7.

5 [00057] This operation, shown in a sectional illustration in Fig. 7, results in the erected container shown in Fig. 2. The container is self-squaring. The inside in-fold flaps 27 depending from the end walls, that have the clearance gap 95 described above, are cut parallel to the midline of the container and to the folds between the front and back versus end walls. The inside in-fold flaps 27 are dimensioned to have a lateral width that is precisely equal to the space
10 between the hollow front and rear walls 14, 16, after such hollow walls have been fully expanded by bringing the outer in-fold flaps 22 up into position. The inside surfaces of the expanded hollow walls bear inwardly against the lateral edges of the inside in-fold flaps. The container is forced to become square and is held square by the engagement of its parts.

15 [00058] This structural engagement, which can be as rigid and tight as desired, is achieved without causing corresponding difficulties due to lack of clearance between other parts during assembly (specifically lack of clearance between the lateral edges of the inside in-fold flap and the inner surfaces of the front and back walls.

20 [00059] In this way, the invention enjoys the ease of erection of a container characterized by gaps that would normally reduce structural strength, and the structural stiffness of a container characterized by closely fitting or even stress fitted parts. The hollow container walls 14, 16 expand inwardly with erection of the container and bear against in-fold flaps 27 on the adjacent walls, to square up the container. In an un-erected or semi-erected state, clearance
25 95 is provided between the in-fold flaps and the adjacent walls.

[00060] The container as described has four wall panels connected along corner folds, which are arbitrarily named as the front, rear, and ends. These terms and other terms that might denote a direction (e.g., top, bottom, up,
30 down, etc.) are used only for convenience in the description while referring to

the invention as shown in the drawings. The invention is also applicable to similarly constructed containers in other orientations, or wherein the "front" is arguably on an end or is smaller than the "end" and so forth. The invention is also applicable to container structures with other than four rectilinear walls, such as triangular or other polygonal arrangements, wherein at least one wall panel is arranged to become displaced due to erection of the container, and to bear against a part of another panel or similar structure, for reinforcing, stabilizing or aligning the walls of a container.

[00061] Some examples of additional embodiments that are made possible according to the invention are shown in Figs. 8, 9 and 10. The same reference numbers have been used to identify corresponding structural parts in these additional embodiments, shown in each case as one-piece integral blanks. It will be seen that each of the examples has the same expandable hollow wall for bearing on an inner in-fold flap as the foregoing examples. According to the invention, at least one expandable hollow wall and preferably two opposed hollow walls, expand into engagement with sides of an inner in-fold flap, thereby squaring and supporting the container. Given that structure, however, a variety of containers become possible, and a few examples are shown.

[00062] In Fig. 8, a corresponding blank for the inventive container is provided, wherein the container when erected has an attached lid. For this purpose the end walls 25, which in the previous embodiment had upper extensions that were folded down and glued face to face on the inner side of end walls 25, now define upper in-fold flaps 98. The upper in-fold flaps 98 are folded over to close the top of the container after erection, and can be taped to one another across their adjacent edges and/or taped to the front and back hollow walls. Preferably, the top in-fold flaps 98 are tear-away flaps, being perforated along the fold line with the adjacent end wall part 25 or along the cutout 52 as shown.

[00063] Fig. 9 is a plan view of another alternative embodiment having an internal multiple-ply divider, and wherein the rectangular orientation of the container is changed. In this embodiment, the shorter width side walls are those with panels connected to expand with folding of their in-fold flaps up into the plane of the bottom. The longer width walls carry the inner in-fold flaps with the gaps 95 on either side, which become occupied by the expanding adjacent hollow walls as described above, to support and square the container.

[00064] The embodiment of Fig. 9 also illustrates that the inner in-fold flap need not be a single part. One or both of the inner in-fold flaps on opposite sides (in this case the front and back) can be defined by two flaps 102 (or more), each of which occupies part of the bottom. The sum of the flaps in the embodiment shown substantially fills the area available for the bottom, but it should be appreciated that a shorter in-fold flap, or perhaps an embodiment with just one in-fold flap that occupies all or only part of the bottom, also benefits from the squaring and reinforcing effects of the invention.

[00065] In the embodiment shown, the rear wall is formed in two parts, each part having an attached flap 102, occupying half of what would be the rear side wall in the previous embodiments. The division of the rear side wall into two parts in this manner, permits an end of the flat blank containing three panels 104, 106, 108, to extend across the middle of the container as a partition. The glue flap 66 that was placed in a corner of the erected container in the embodiment of Figs 1 and 8, is placed in the middle of the rear wall in this embodiment.

[00066] During the fold and glue operations, glue is applied to the "X" areas in Fig. 9, except that the glue applied to end tab 110 is applied to the underside of the blank as shown, whereas the other glue areas are facing the viewer in Fig. 9. In addition to the fold-and-glue operations discussed above with respect to the previous embodiments, the upper and lower panels 106, 108 of the partition, are folded downwardly and upwardly, respectively, to attach face-wise against the partition panel 104, forming a multi-ply partition panel.

The partition panel is affixed by tab 110 to the opposite side wall (in this case the front wall), between the cutouts 52.

[00067] In Fig. 9, the front wall and the two-part rear wall are each formed in two plies by folding down and gluing an upper extension flap face-wise against the adjacent wall panel. Fig. 10 is a plan view of still another example. In this embodiment, the front and rear walls are single ply, and the adjacent upper extension flaps function as lid portions. The lid part on the front wall has tear-out parts defined by perforations at cutouts 52, such that the material in the cutouts is removable together with the adjacent flap forming a part of the lid. This arrangement applies the hollow wall squaring aspect as discussed, to partitioned containers, such as the container of US Pat. 5,826,728 – Sheffer, to which reference can be made for other structural aspects.

[00068] A variety of other applications are possible wherein an in-fold flap is engaged, at least on one side, by a wall portion that is movable against the in-fold flap during erection of a container. In the foregoing arrangements, several rectilinear arrangements are discussed, in each case having opposed hollow walls that expand with erection of an outer in-fold flap, and constrict the in-fold flap of an adjacent wall oriented at right angles to the first one. The same inventive concepts are applicable to arrangements in which the respective walls are at angles other than right angles, or where one or more of the walls occupies an outward angle or contains a step, for nested stacking. The examples disclosed also show that arrangements such as multiple ply walls, internal partitions, integrally connected lids, tear-out portions, etc., are all consistent with the disclosed structure for squaring and reinforcing a paperboard or other similar container.

[00069] The invention has been described with reference to certain preferred embodiments and examples, including the example specifically illustrated in the drawings. It should be understood that the invention is not limited to the examples shown in the drawings, and instead is defined by the appended claims. Reference should be made to the following claims rather

than the foregoing examples, to assess the scope of the invention in which exclusive rights are claimed.

What is claimed is:

- 1 1. A container, comprising:
2 a wall panel made of sheet material, bounding an inner volume of the
3 container, wherein said wall panel is movably expandable into the inner volume
4 of the container during a phase of erection of the container;
5 an inside flap made of sheet material, arranged substantially
6 perpendicular to the panel bounding the inner volume, the inside flap extending
7 across at least part of the inner volume;
8 wherein the inside flap initially has clearance relative to the wall panel for
9 insertion of the inside flap, and the wall panel is movable to engage against the
10 inside flap after insertion of the inside panel.

- 1 2. The container of claim 1, wherein the inside flap is integrally
2 coupled to a further wall panel adjacent to said wall panel that is movably
3 expandable.

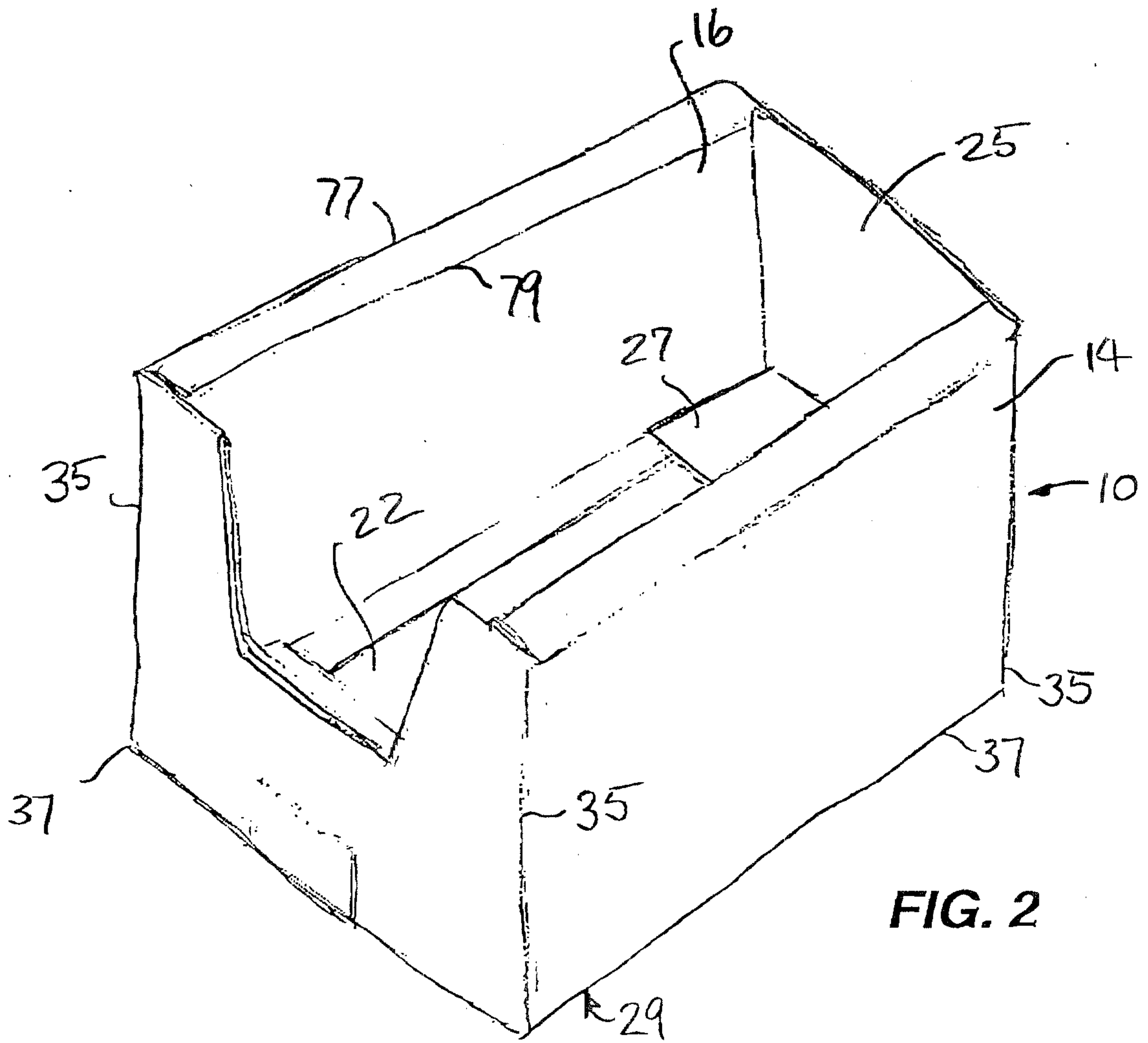
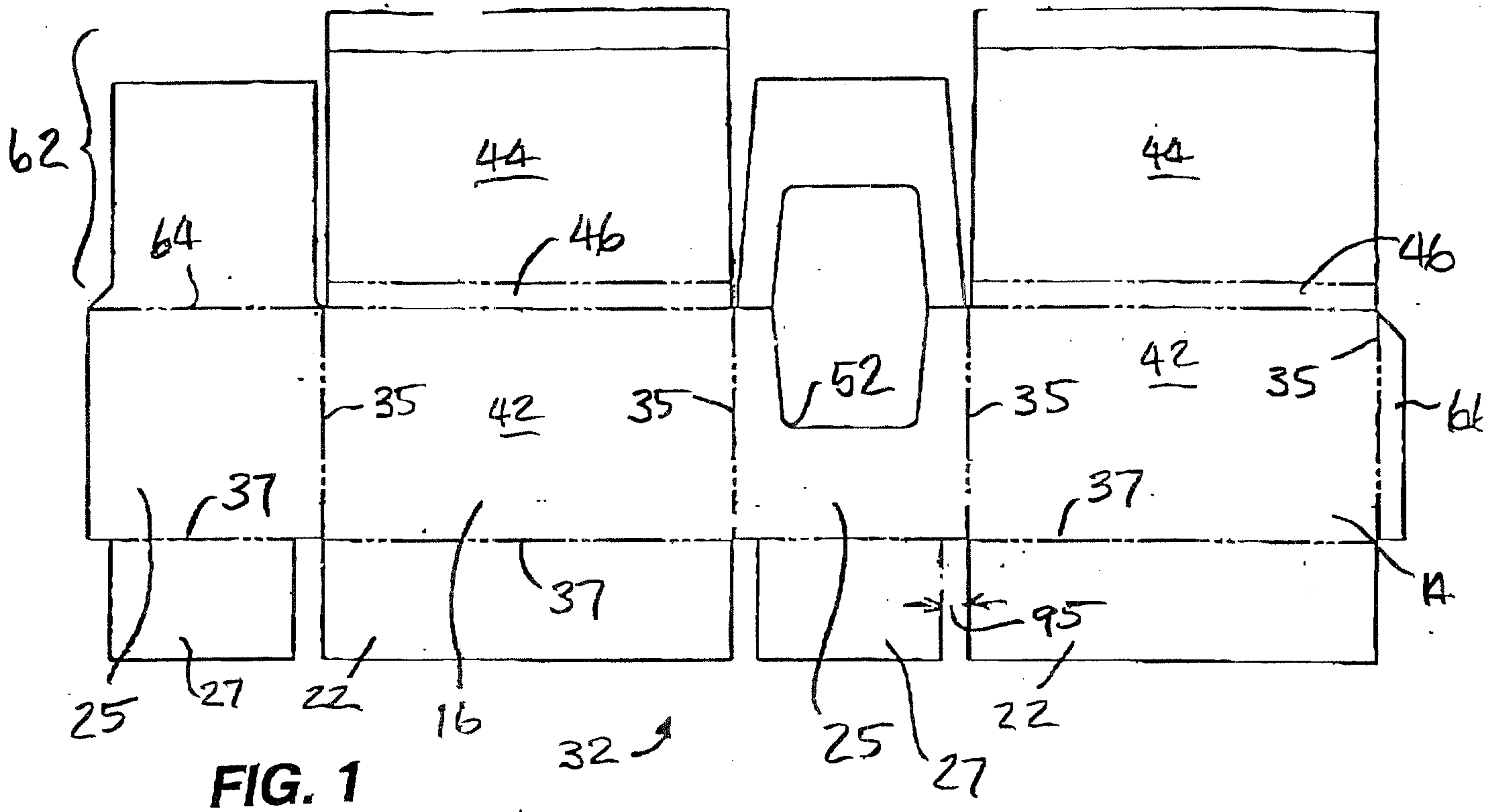
- 1 3. The container of claim 2, comprising a pair of opposite said wall
2 panels, each being movably expandable into the inner volume, and a pair of
3 opposite said inside flaps, each being coupled to one of two said further wall
4 panels that extend between the opposite said wall panels.

- 1 4. The container of claim 1, wherein the wall panel is an inner panel
2 of a hollow wall further comprising an outer panel a top ledge and an in-fold
3 flap.

- 1 5. The container of claim 4, wherein the in-fold flap is an outer in-fold
2 flap, and wherein the outer in-fold flap, the inner and outer panels and the top
3 ledge form a collapsed parallelogram that is opened by folding-in the outer in-
4 fold flap.

1 6. The container of claim 5, wherein the inner panel is an integral
2 extension of at top edge of a sidewall of the container, the outer in-fold flap is
3 an integral extension at a bottom edge of said sidewall, and the inner in-fold flap
4 is an integral extension at a bottom of an adjacent sidewall of the container.

1 7. A container made of sheet material, comprising:
2 a plurality of wall panels connected along corner folds, the wall panels
3 including two pairs of opposite spaced wall panels, one of said two pairs being
4 front and rear wall panels, and the other of said two pairs being opposite
5 spaced end wall panels perpendicular to the front and rear wall panels;
6 two sets of opposite in-fold flaps coupled respectively to an edge of one
7 of the pairs of opposite spaced wall panels, one of said sets of in-fold flaps
8 being outer in-fold flaps and the other of said sets being inner in-fold flaps, the
9 inner in-fold flaps being foldable into a position between inner surfaces of the
10 other of the pairs of opposite spaced wall panels;
11 wherein said other of the pairs of opposite spaced wall panels comprises
12 two spaced panels forming part of a parallelogram with the outer in-fold flaps,
13 whereby folding-in of the outer in-fold flaps separates the two spaced panels to
14 provide an inwardly expanding hollow wall, and wherein an inner surface of the
15 hollow wall bears against the inner in-fold flaps.



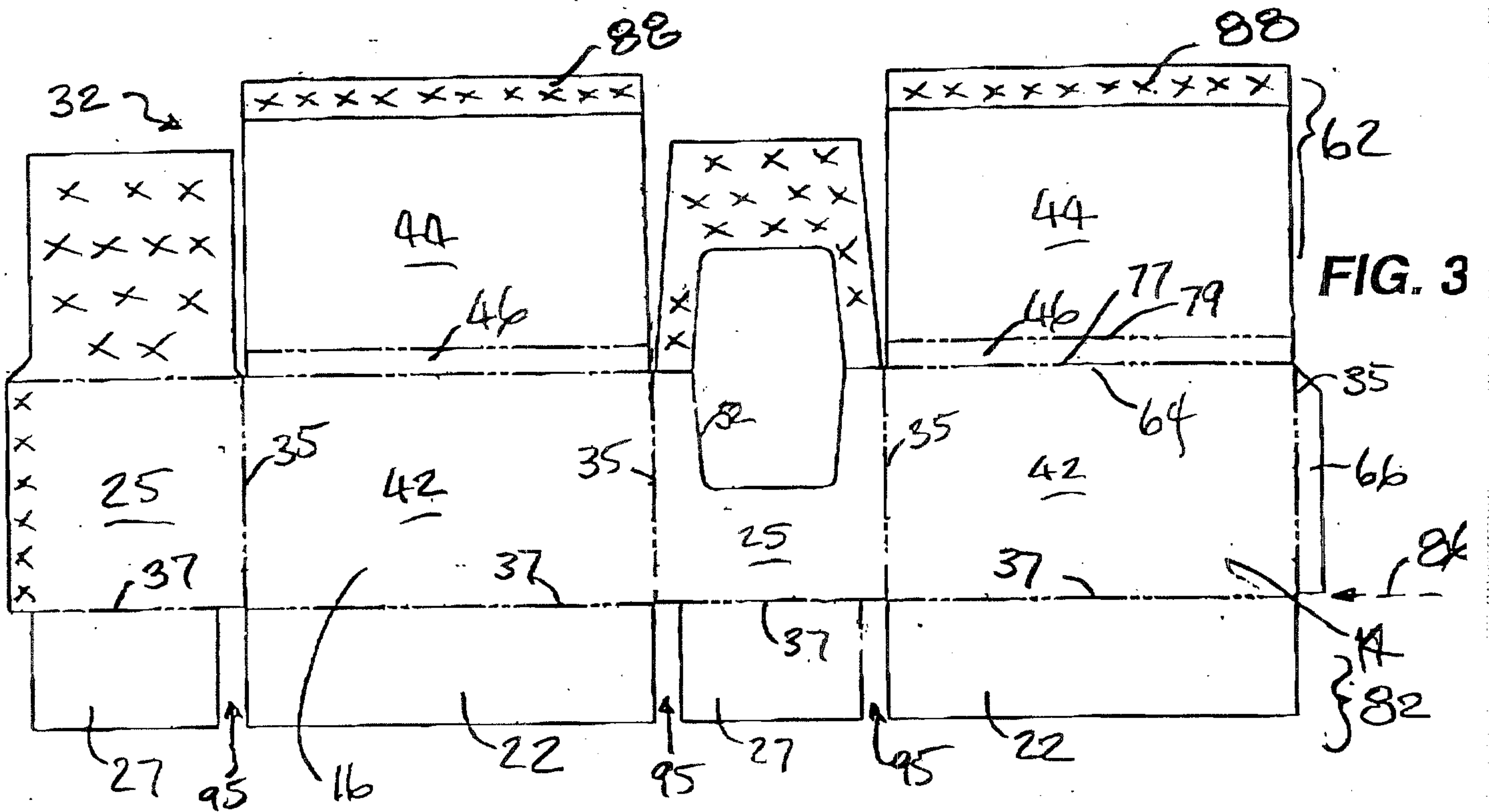


FIG. 3

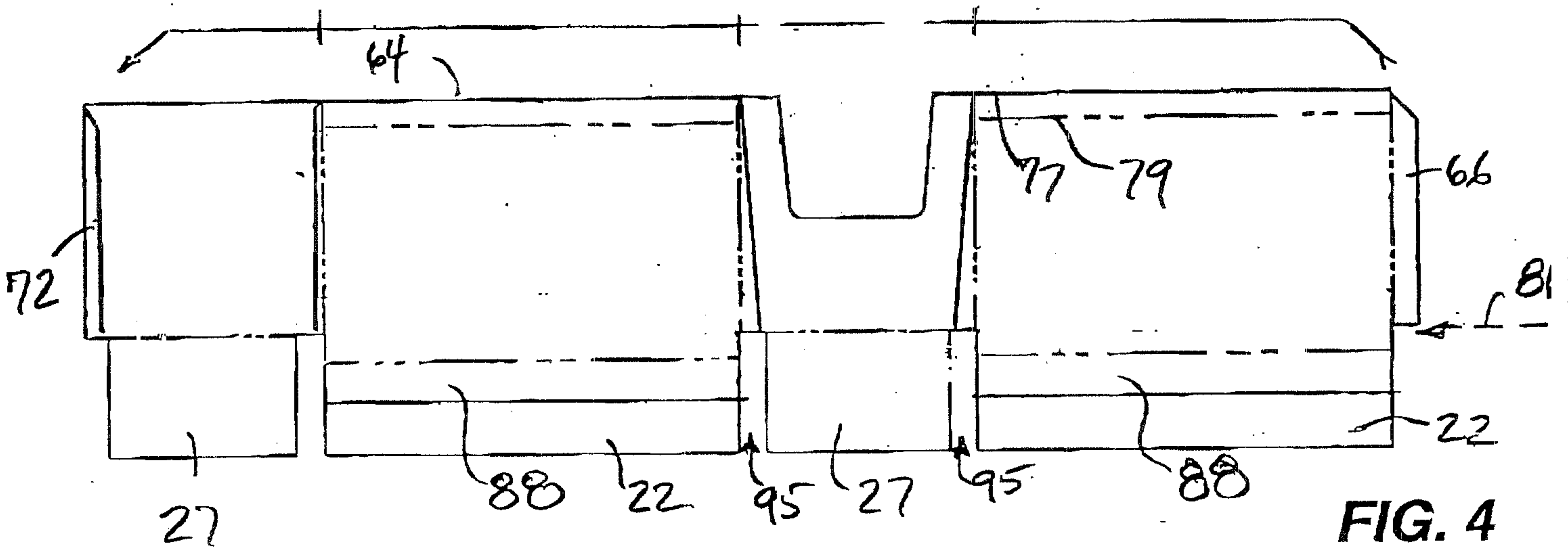


FIG. 4

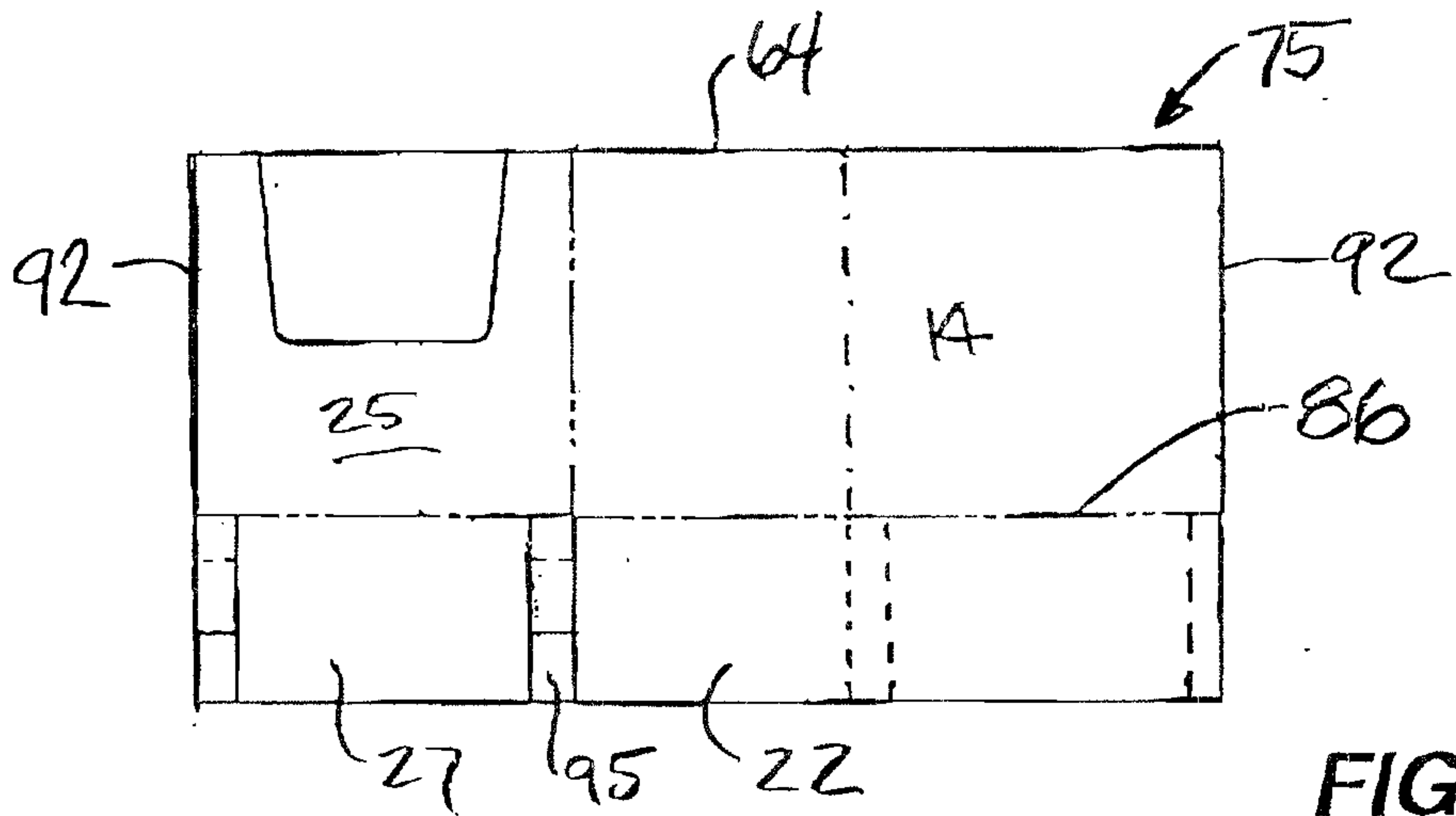
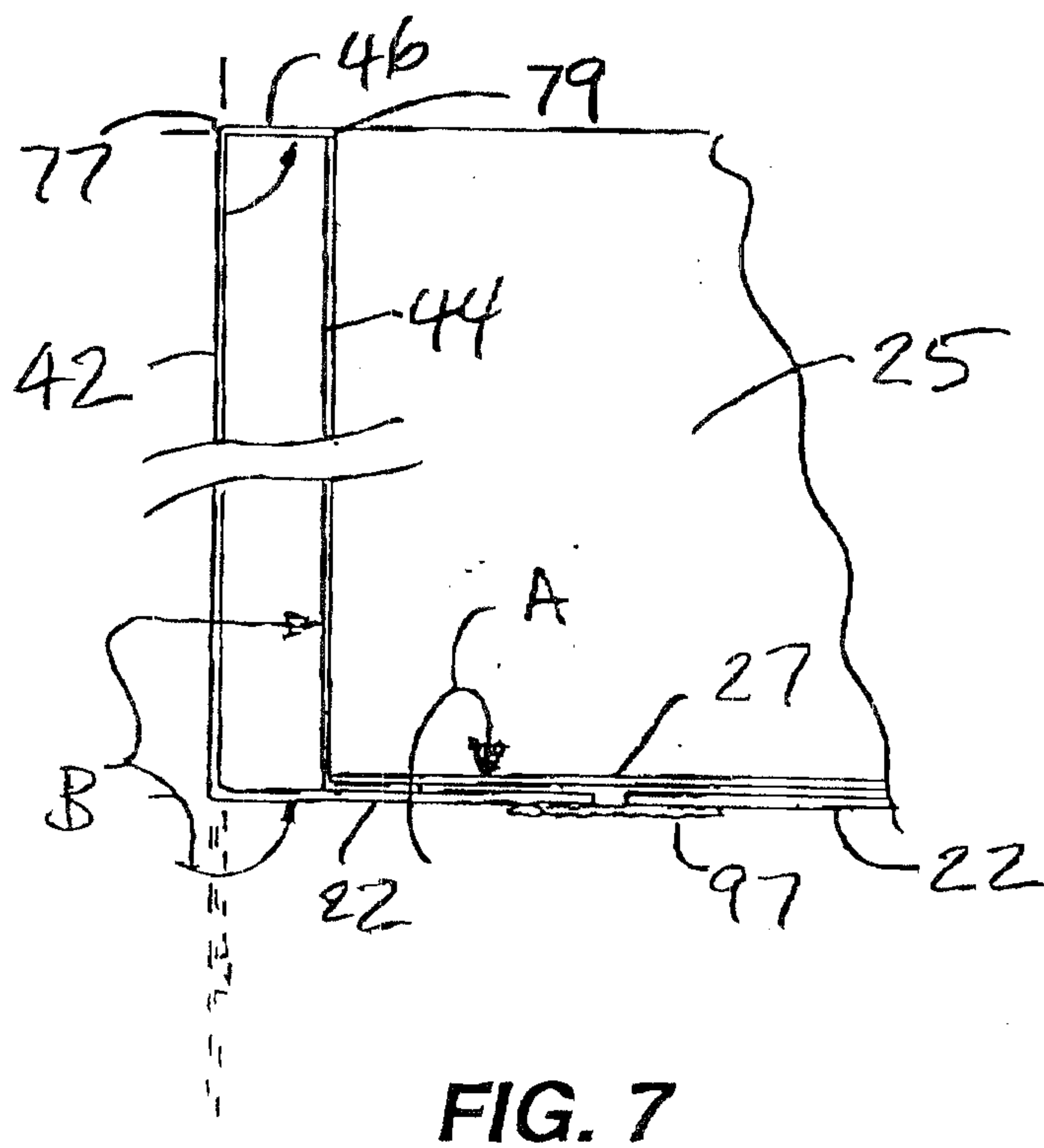
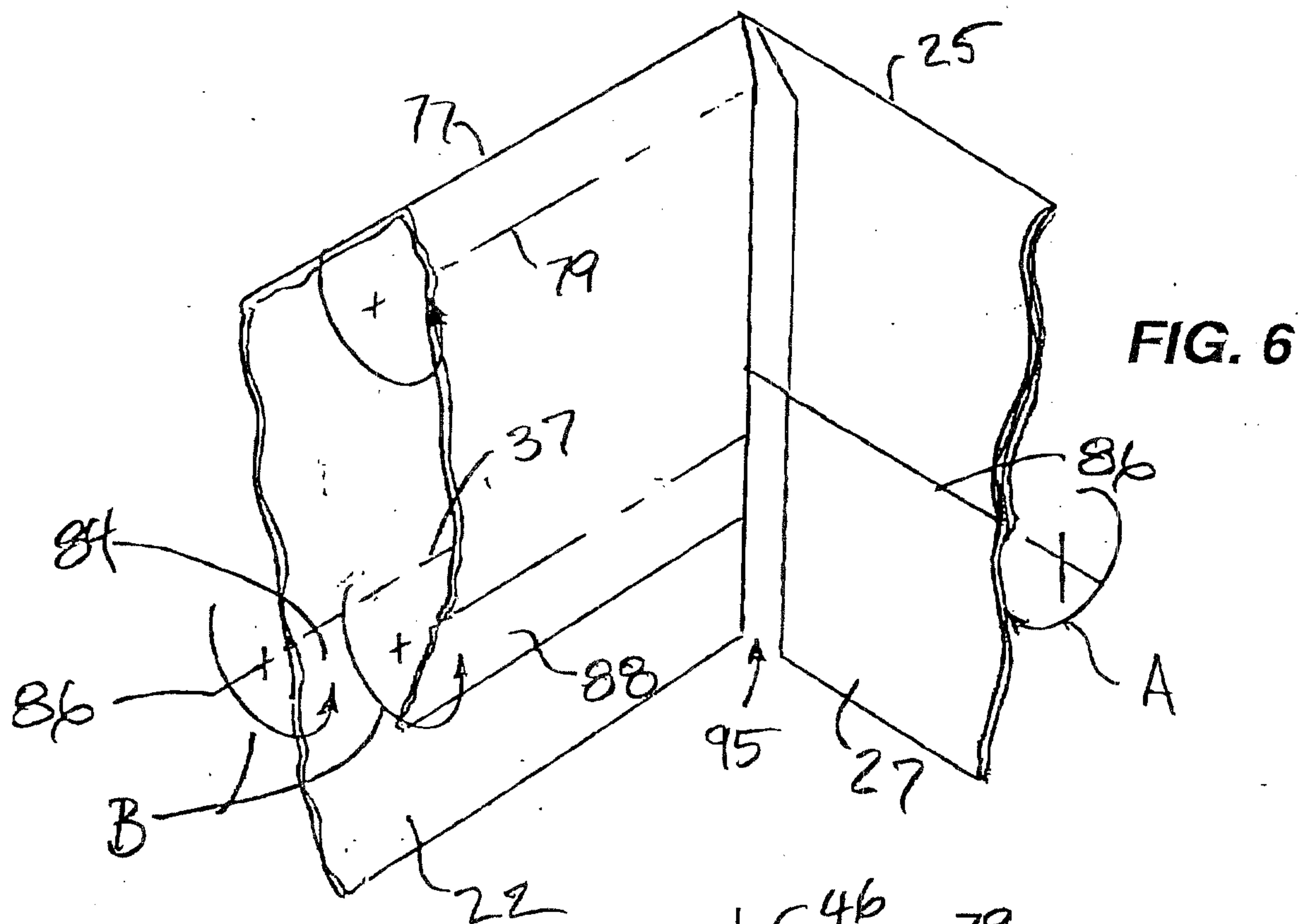


FIG. 5

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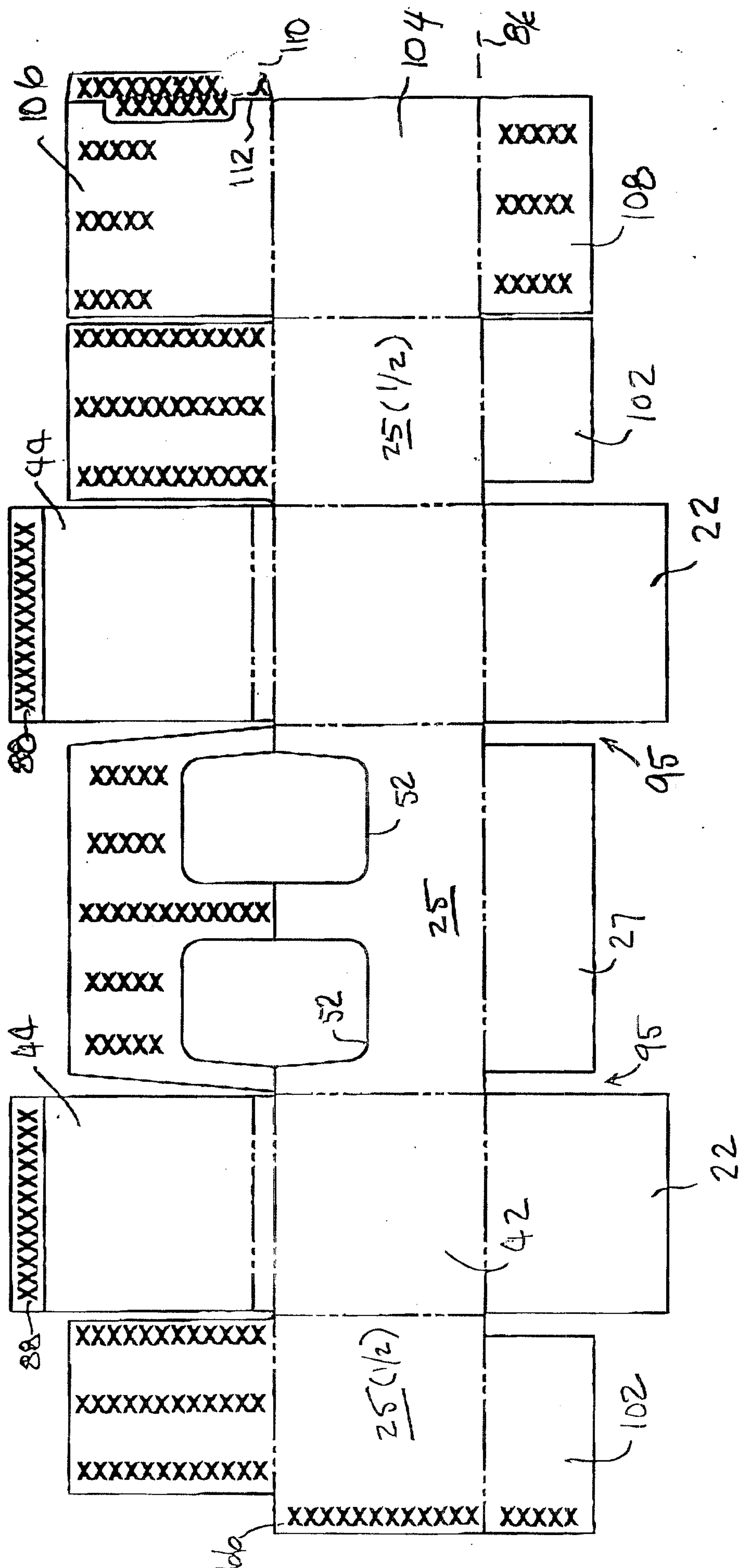


FIG. 9

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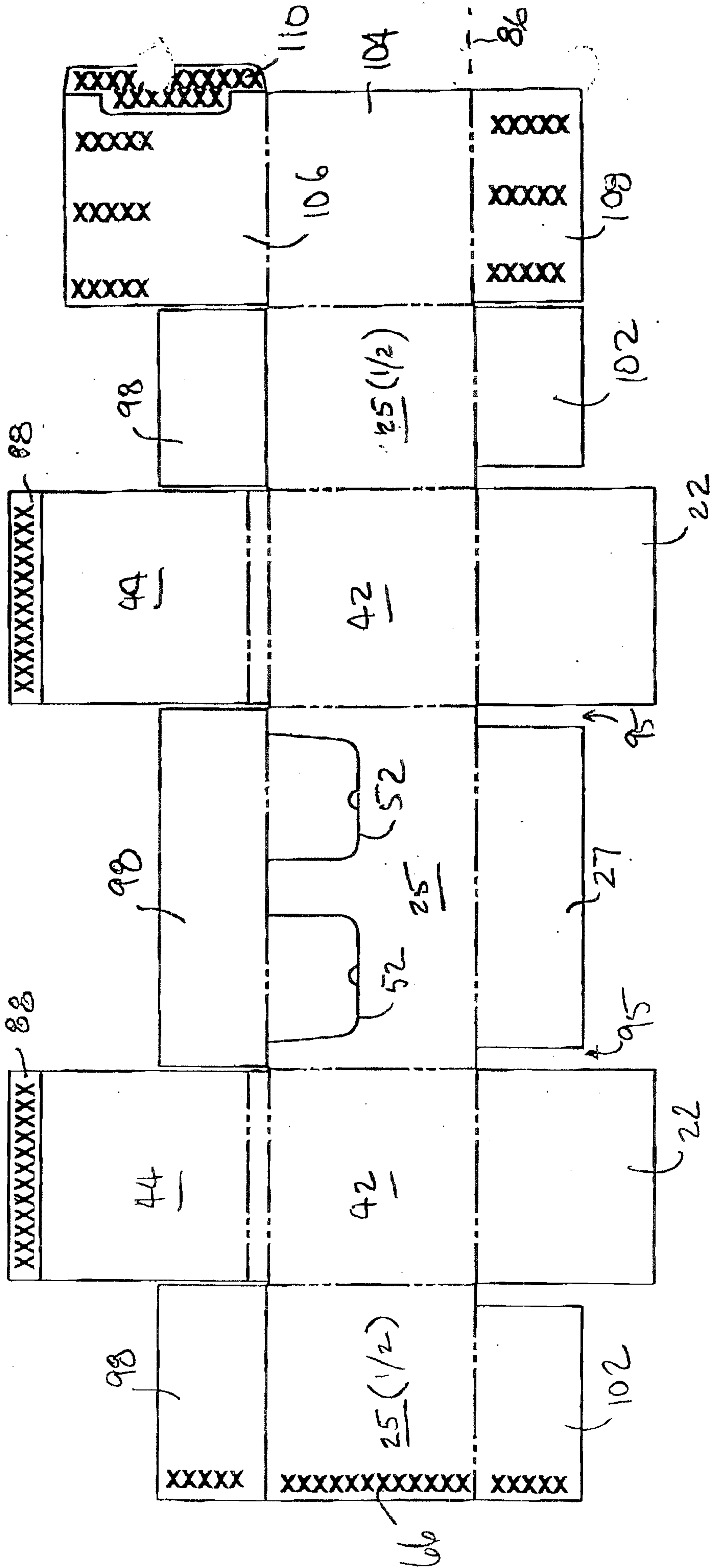


FIG. 10

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