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FOLDABLE BOX

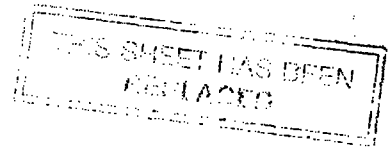
The present invention relates to a foldable box which can be folded to a compact size.

A conventional foldable box, as disclosed in, for example, Japanese Utility Model Laid-Open No. Sho 62-110132, comprises a square tray-like bottom panel, a picture frame-like upper frame formed in substantially the same size as the bottom panel, two swing side panels rotatably pivoted on two opposite sides of the upper frame, and a folding side panel which can be bent into a sidelong V-shaped form and pivotally mounted at the upper and lower ends to the upper frame and the bottom panel. The swing side panels are raised to thereby support the folding side panel upright. When the swing side panels are turned inwardly to a horizontal position, the folding side panel is folded inside the box, so that the box can be folded flat.

Such a foldable box described above is in most cases an injection-molded product of synthetic resin.

The prior art foldable box, however, has the following problems.

Firstly, since a mold for injection molding of synthetic resin is expensive and accordingly the unit price of the box becomes high, and moreover, since there must be prepared as many molds as the number of sizes required, the injection molding is unsuitable for producing many kinds of boxes in small quantities. It is, therefore, impossible to meet every



detail of a customer's need.

Secondly, since the box itself becomes very heavy, a wastefully high transportation cost and much burden in loading and unloading work will be required.

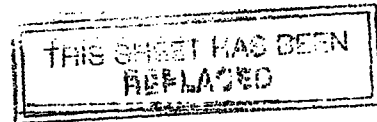
It is therefore an object of the present invention to provide a foldable box which includes the following constitution requirements (1) to (6) for solving all of the above-described problems.

(1) The box 1 comprises at least a bottom panel 2 having a square form in a plan view, two swing side panels 3 located on two opposite sides of the bottom panel 2, and two folding side panels 4 located on the remaining two sides of the bottom panel 2.

(2) Each of the panels 2, 3 and 4 stated above is produced of a corrugated plastics board including a core member 8c of synthetic resin sandwiched between two synthetic resin base panels 8a and 8b.

(3) The bottom panel 2 is made up of vertical fixed panels 9 on both ends provided in a direction intersecting the core member 8c at right angles, and a retaining portion 10 formed on the vertical panel 9.

(4) The swing side panel 3 is produced of the corrugated plastics board used in such a direction that the core member 8c will be vertical. At the lower end a reinforcing band 11 is disposed in a direction intersecting the core member 8c at right angles, and an engaging portion 12 which engages with the



retaining portion 10 of the vertical panel 9 is formed on the reinforcing band 11. At the upper end of the swing side panel 3 is formed a horizontal inward-folding line 14a cut deep except only the base panel 8b of corrugated plastics board. The base panel 8b left uncut serves as a hinge portion to allow the swinging of the swing side panel 3 towards the inside of the box 1.

(5) The folding side panel 4 is produced of the corrugated plastics board used in such a direction that the core member 8c will be vertical, and is provided, in the upper and lower portions, with horizontal inward-folding lines 14b and 14c cut deep except only the base panel 8b of corrugated plastics board, and, at center between the inward-folding lines 14b and 14c cut in the upper and lower portions, with a horizontal outside-folding line 14d cut deep except the base panel 8a of corrugated plastics board, thereby allowing folding into a sidelong V-shaped form.

(6) The swing side panel 3 and the folding side panel 4 are connected in a portion above the uppermost inward-folding lines 14a and 14b.

The swing side panel 3 and the folding side panel 4, produced of the corrugated plastics board which is used in such a direction that the core member 8c will be vertical, has a strength great enough to withstand a vertical force which acts during baggage conveyance and piling up of boxes. Moreover, the reinforcing band 11 is provided at the lower end of the swing side panel 3 to thereby increase rigidity relative to



torsion and lateral pressure added to the swing side panel 3. Furthermore, provided upright at both ends of the bottom panel 2 are vertical panels 9, which engage with the swing side panels 3, thereby improving the strength of the bottom panel 2 itself. In addition, since a load applied to the bottom panel 2 is partly supported by the swing side panels 3, the box can fully withstand even a heavy load.

The above and other objects, features and advantages of the present invention will be more clear from the following description with reference to the accompanying drawings.

Fig. 1 is a perspective view of a box;

Fig. 2 is a perspective view of the box in a folded state;

Fig. 3 is a longitudinal sectional view of the box;

Figs. 4(A) and 4(B) are partly enlarged sectional views of the box;

Fig. 5 is an exploded perspective view of a bottom panel;

Fig. 6 is an exploded perspective view of a swing side panel;

Fig. 7 is an exploded perspective view of a folding side panel;

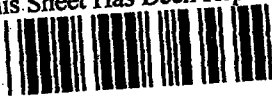
Fig. 8 is a partly sectional view of another embodiment;

Fig. 9 is a partly sectional view of another embodiment;

and

Fig. 10 is an exploded view of another embodiment.

Preferred embodiments of a foldable box according to the



present invention will now be explained with reference to the accompanying drawings. Fig. 1 is a perspective view of the box; Fig. 2 is a perspective view of the box in a folded state; Fig. 3 is a longitudinal sectional view of the box; Figs. 4(A) and 4(B) are partly enlarged sectional views of the box; Fig. 5 is an exploded perspective view of a bottom panel; Fig. 6 is an exploded perspective view of a swing side panel; and Fig. 7 is an exploded perspective view of a folding side panel.

The box 1 includes a rectangular bottom panel 2 in a plan view, two swing side panels 3 located on two opposite sides of the bottom panel 2, two folding side panels 4 located on the remaining two sides of the bottom panel 2, molding members 5a to 5c covering the end portion of the panels 2, 3 and 4, a corner member 6 connecting the side panels 3 and 4 with each other, and a handle member 7 provided on the swing side panel 3.

The bottom panel 2, swing side panels 3, and folding side panels 4 are each produced of a well-known corrugated plastics board where a polypropylene core member 8c is interposed between two polypropylene base panels 8a and 8b in an integral manner.

The bottom panel 2, as shown in Fig. 5, has vertical panels 9 fixedly formed at both end portions intersecting the core member 8c at right angles. The vertical panels 9 formed

by thermally bending both end portions of the bottom panel 2 at right angles, has a groove-like retaining portion 10, and the synthetic resin molding member 5a fitted on the upper edge.

The swing side panel 3, as shown in Fig. 6, is produced of

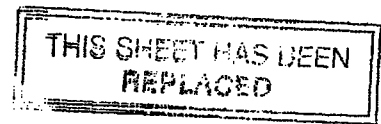


the corrugated plastics board, which is used in such a direction that the core member 8c will be vertically positioned.

On the lower end of the swing side panel 3 is provided a reinforcing band 11 in a direction intersecting the core member 8c at right angles. The reinforcing band 11 in the present embodiment is of such a construction that the lower end of the swing side panel 3 is bent through about 90 degrees by a method similar to the vertical panel 9 of the bottom panel 2, to thereby increase the rigidity of the swing side panel 3. The reinforcing band 11, as shown in Figs. 4(B) and 6, is provided with a lug-like engaging portion 12 to be engaged with the retaining portion 10 of the vertical panel 9.

In the meantime, on the upper end of the swing side panel 3 is folded a folding piece 13, using the outer base panel 8a as a hinge. The synthetic resin molding member 5b is fitted over the folded portion. In the upper end of the swing side panel 3 is formed an inward-folding line 14a cut along the lower edge on the outer side of the molding member 5b, leaving the inner base panel 8b of the corrugated plastics board uncut. The inner base panel 8b serves as a hinge portion so that the swing side panel 3 will swing towards the inside of the box 1.

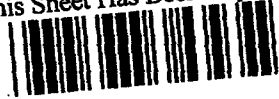
On the upper part of the swing side panel 3 is attached the synthetic resin handle member 7. The handle member 7 has a sectional form of crank as shown in Figs. 4(A) and (B) and is provided, at the upper part, with an invertedly trapezoidal inserting portion 15 and, at the lower part, with a finger engaging portion 17 having inward-facing pawls 16 and 16. The



handle member 7 is securely fastened by fitting the inserting portion 15 into an invertedly trapezoidal recess 18 provided in the folding piece 13 of the swing side panel 3, and further by fitting the molding member 5b thereon.

In the folding side panel 4, as shown in Fig. 7, the corrugated plastics board is used in such a direction that the core member 8c will be vertical; the two folding side panels 4 are connected into one body through a reinforcing panel 19 placed on the bottom panel 2. On the upper edge of the folding side panel 4 is fitted the molding member 5c, along which outer lower edge an inside-folding line 14b is formed. The inside-folding line 14b is cut deep except the inner base panel 8b of the corrugated plastics board. This inner base panel 8b left uncut serves as a hinge portion. An inside-folding line 14c of the same formation as the inside-folding line 14b is provided along a border portion between the folding side panel 4 and the reinforcing panel 19. The folding side panel 4 is further provided with a horizontal outside-folding line 14d cut, except the outer base panel 8a, at the center between the inside-folding lines 14b and 14c.

The folding side panel 4 is designed to be connected to the bottom panel 2 by bonding the reinforcing panel 19 to the upper surface of the bottom panel 2. The swing side panel 3 is disposed on two sides of the bottom panel 2 provided with the vertical panel 9, and is connected by riveting to the folding side panel 4 through the corner member 6 at a corner where the swing side panel 3 and the folding side panel 4 butt against

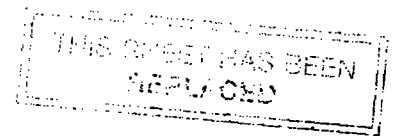


each other. The swing side panel 3 is connected integrally with the folding side panel 4 in a portion above the uppermost inside-folding lines 14a and 14b. A space for holding goods is thus formed in the box 1 by supporting the folding side panels 4 straight with the wing side panels 3 set upright.

Since the engaging portion 12 of the swing side panel 3, in this state, is engaged with the retaining portion 10 of the vertical panel 9 as shown in Fig. 4(B), the load applied to the bottom panel 2 is partly supported by the swing side panels 3; accordingly, the box containing goods will not be broken when raised. The corrugated plastics board, as generally well known, displays a great strength against a force acting in a direction parallel to the core member 8c. The box 1 according to the present invention has the side panels 3 and 4 formed such that the core member 8c will become vertical, and therefore will not collapse under a substantial load. It is, therefore, possible to stack up the box 1 in many layers. And furthermore, the bottom of the box can be substantially increased in strength by using the core member 8c of the reinforcing panel 19 on the bottom panel 2 in an intersectional fashion as in the present embodiment.

Next, a method of using the box 1 will be explained.

To fold the box 1 into a using form as shown in Fig. 1, first the swing side panels 3 are forced to turn inside. Then, the folding side panels 4 lose their support, to be bent by themselves down into a sidelong V-shaped form. Furthermore, when the upper surface of the box 1 is pushed, the pawl 16 of

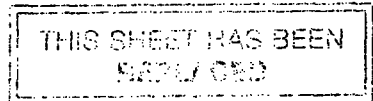


the handle member 7 goes, while deflecting, over the side face of the molding member 5a of the vertical panel 9 into engagement with the retaining portion 10 of the vertical panel 9 as shown in Fig. 4(A), thereby firmly locking a folded form shown in Fig. 2.

Next, to unfold the box 1 into the using form shown in Fig. 1, first the box 1 is spread outside, holding the finger engaging portion 17 of the handle member 7, to thereby release the pawls 16 out of engagement with the retaining portion 10. When, in this state, the handle member 7 is pulled upward, the folding side panel 4 extends slightly with the weight of the bottom panel 2 and the reinforcing panel 19. Subsequently, when the swing side panel 3 is pushed in towards the bottom panel 2, both side edges of the swing side panel 3 press to spread out the inside of the folding side panel 4. Then, when the swing side panel 3 stands almost fully upright to engage the engaging portion 12 with the retaining portion 10 of the vertical panel 9, the folding side panel 4 extends straight upright as indicated by a solid line in Fig. 3, thereby stabilizing in the form shown in Fig. 1.

The embodiment of the foldable box according to the present invention has heretofore been explained. It should be understood, however, that the present invention is not limited thereto.

For example, the engaging portion 12 of the swing side panel 3 and the retaining portion 10 of the vertical panel 9, as shown in Fig. 8, may be of such a construction that their



both edges are engaged by folding both the lower end of the swing side panel 3 and the upper end of the vertical panel 9 together. In this case, the pawl 16 may be set to a size which allows engagement of the pawl 15 with the lower surface of the bottom panel 2 or the lower edge of the molding member 5a, or may be dispensed with if no locking is needed at the time of folding.

Furthermore, the vertical panel 9 may be changed to an L-shaped member 20 of synthetic resin which is riveted to both edges of the bottom panel 2 formed into a flat plate, as shown in Fig. 9.

Furthermore, in the present embodiment, the swing side panel 3 and the folding side panel 4 are formed separately, but they may be produced of a single corrugated plastics board as shown in the exploded view of Fig. 10. In the drawing, the fold line (h) is a portion to be thermally deformed.

The inside- and outside-folding lines cut straight in the swing side panel 3 and the folding side panel 4 are most preferable in the respect of the strength of the hinge portion and such a particular function that the hinge portion bends only in one direction. In some cases, however, the fold lines may be formed in a shape of V-groove. When the V-grooves are adopted, the base panel forming the hinge portion may be used either inside or outside. For example, the hinge portion of the inside-folding line 14a of the swing side panel 3 may be formed of the outer base panel 8a.

The box, if constructed in a foldable manner, has many



movable portions, necessarily decreasing in strength. In the box 1 according to the present invention, therefore, the swing side panel 3 and the folding side panel 4 are provided with the core member 8c of corrugated plastics board directed vertically; the reinforcing band 11 on the lower end of the swing side panel 3; and the vertical panels 9 set upright at both ends of the bottom panel 2 in such a manner as to be engaged with the swing side panel 3. It, therefore, has become possible to provide the foldable box of corrugated plastics board with a substantial strength for practical use.

The foldable box 1 made of corrugated plastics board is superior in the following points to a conventional injection-molded box: firstly, the size of the box 1 can be changed as desired by changing the cutting dimensions of the corrugated plastics board, and moreover, the use of a mold which will increase the cost of the box 1 is not needed, and accordingly, the box is suitable for production of many kinds of boxes in small quantities, meeting every detail of customer's needs; secondly, since the box becomes lighter than the injection-molded box, a transportation cost can be reduced and the load-handling workers' burden can be lessened; and thirdly, since strong hinge portions can be made simply by cutting fold lines in the swing side panels 3 and the folding side panels 4, the box can be manufactured and assembled very easily.

Furthermore, notwithstanding a manufacturing cost a little higher than that of a conventional box of corrugated paper

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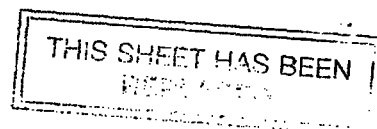
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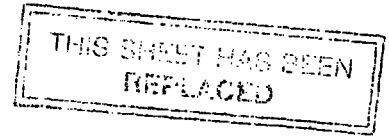
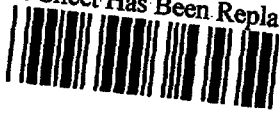
board, which, being non-reusable, wastes resources and moreover is hard to be disposed of after use, the box 1 according to the present invention has such advantages that it is reusable several times and accordingly is more economical than the box of corrugated paper board; furthermore as it is repetitively reusable, wastes to be disposed as well as resource consumption can be held to extremely little volume.



CLAIMS



1. A foldable box comprising:
 - at least a bottom panel of a rectangular or square form in a plan view;
 - 5 two swing side panels positioned on two opposite sides of said bottom panel; and
 - two folding side panels positioned on the remaining two sides of said bottom panel,
 - wherein each of the said panels is produced of corrugated plastics board
 - 10 including a core member of synthetic resin sandwiched between two synthetic resin base panels;
 - said bottom panel having vertical panels fixedly secured on both ends in a direction intersecting said core member at right angles, and a retaining portion formed on said vertical panel,
 - 15 said swing side panel being produced of corrugated plastics board used in such a direction that said core member will be vertically positioned, and having, at the lower end, a reinforcing band disposed in a direction intersecting said core member at right angles, and an engaging portion formed on said reinforcing band and engaged with said retaining portion of said vertical panel,
 - 20 and, at the upper end of said swing side panel, a horizontal inside-folding line cut deep except only said base panel of corrugated plastics board, said base panel 8b left uncut serving as a hinge portion to allow said swing side panel to swing towards the inside of said box,
 - said folding side panel being produced of corrugated plastics board used
 - 25 in such a direction that said core member will be vertically positioned, and being provided, in the upper and lower portions, with horizontal inside-folding lines cut deep except only said base panel of corrugated plastics board, and, at the centre between said inside-folding lines cut in the upper and lower portions, with a horizontal outside-folding line cut deep except said base panel of corrugated
 - 30 plastics board, thereby allowing folding to a sidelong V-shaped form, and
 - wherein said swing side panel and said folding side panel being connected in a portion above the uppermost inside-folding lines.



2. A foldable box comprising:
- at least a bottom panel of a rectangular or square form in a plan view;
- two swing side panels for location on two opposite sides of the bottom
- 5 panel; and
- two folding side panels positioned on the remaining two sides of the bottom panel,
- wherein:
- each of the said panels is produced of corrugated plastics board including
- 10 a core member sandwiched between two face plates;
- the bottom panel has extensions projecting from two opposing edges of the panel on one side thereof, each extension having a retaining portion,
- the swing side panels each have, at an edge which is to lie adjacent one of the said opposing edges of the bottom panel, a reinforcing band with an
- 15 engaging portion formed thereon for engagement with the retaining portion of one of said bottom panel extensions, each swing side panel further having, adjacent an edge thereof opposite to the edge which is to lie adjacent the bottom panel, a horizontal inside-folding line, one of the face plates of the material of the said swing side panel serving as a hinge portion to allow the said swing side panel to
- 20 swing towards the inside of the box,
- the folding side panels each having, at or adjacent a first edge joining it to the bottom panel, and an opposite second edge, respective inside-folding lines and, substantially midway between the said inside-folding lines, an outside-folding line, one or other of the face plates of the material of the panel forming a hinge
- 25 at each of the said folding lines, thereby allowing folding of the panel from a folded configuration in which the first and second edges lie adjacent each other, to a substantially flat unfolded configuration,
- the swing side panels and folding side panels being connected above the inside-folding lines which are remote from the bottom panel in the completed box.



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3. A foldable box according to claim 2, wherein the corrugations of each swing side panel run at right angles to the edge having the reinforcing band, and the corrugations of each folding side panel run at right angles to the said first and
5 second edges.
4. A foldable box according to claim 2 or claim 3, wherein the folding side panels are integrally formed with the bottom panel.
- 10 5. A foldable box constructed and arranged substantially as herein described and shown in the drawings.

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ABSTRACT
FOLDABLE BOX

A light-weight, robust, foldable box which can be folded flat, comprises a bottom panel, swing side panels and folding side panels of corrugated plastics board. The bottom panel has vertical panels on both ends and a retaining portion in the vertical panels. The swing side panels are produced of corrugated plastics board used in such a direction that a core member will be vertically positioned, and are provided with a reinforcing band at the lower end and an engaging portion formed in the reinforcing band to thereby engage with the retaining portion. In the upper end of the swing side panel is formed an inside-folding line which allows the swing of the swing side panel. The folding side panel is used in such a direction that the core member of corrugated plastics board will be vertically positioned, and is provided with inside-folding lines in the upper and lower portions and with an outside-folding line at the center between the inside-folding lines provided in the upper and lower portions, so that the folding side panel may be folded to a sidelong V-shaped form. The swing side panel and the folding side panel are connected in a portion above the uppermost inside-folding line.

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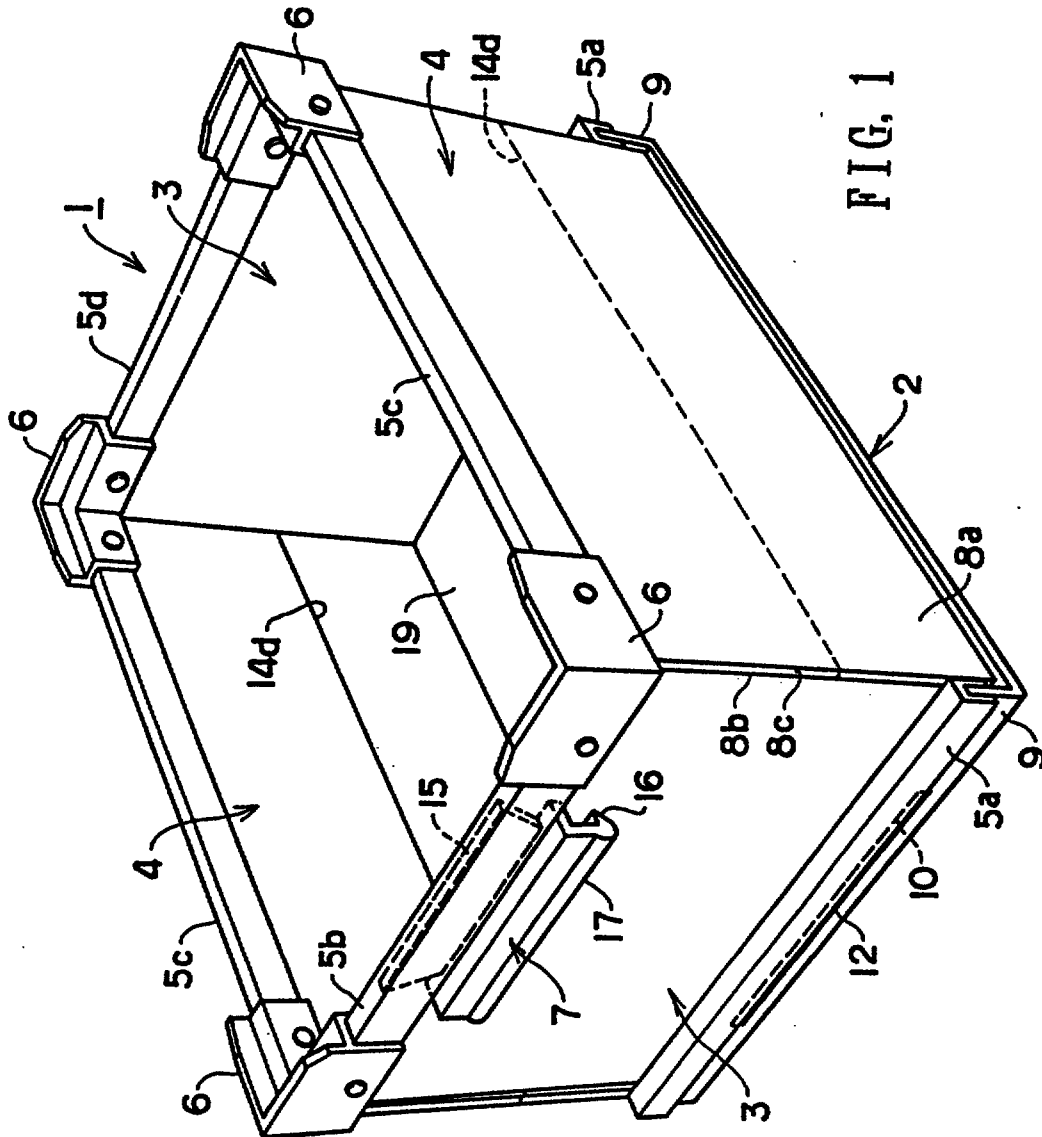
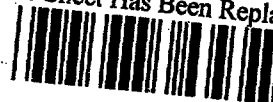


FIG. 1

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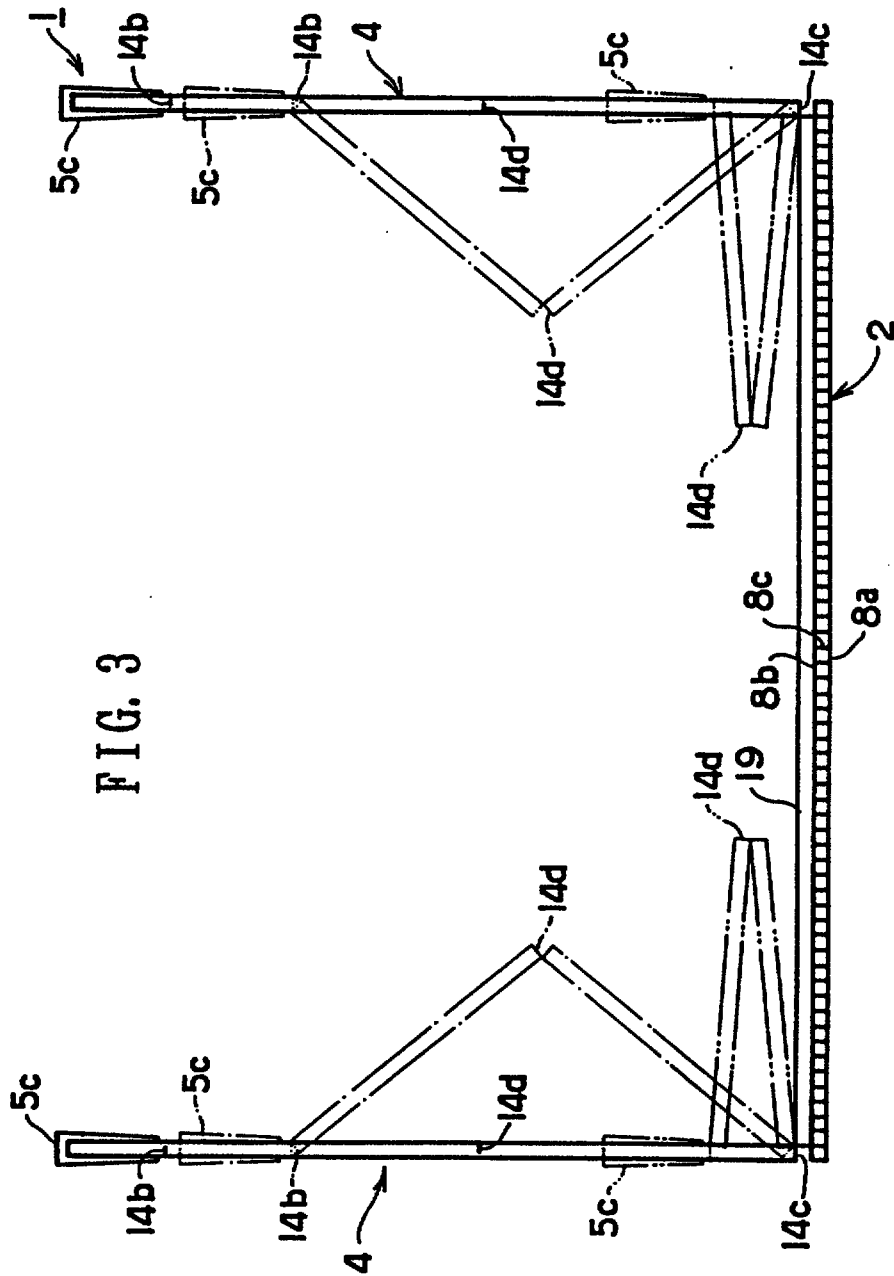


FIG. 4 (b)

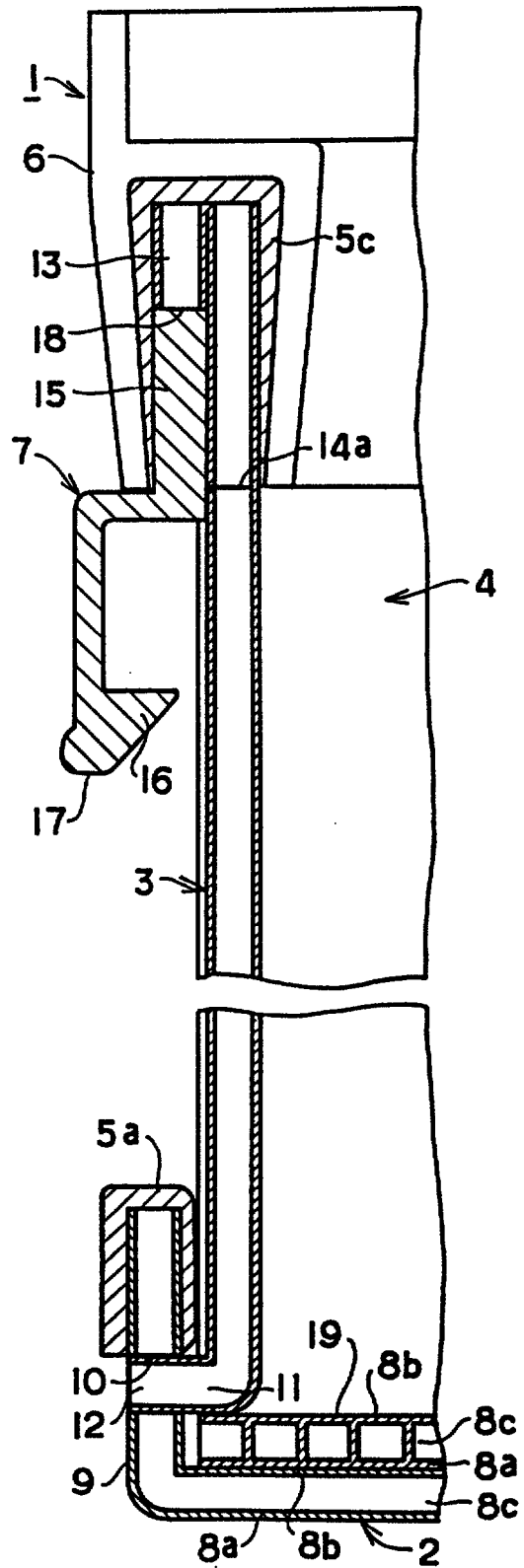
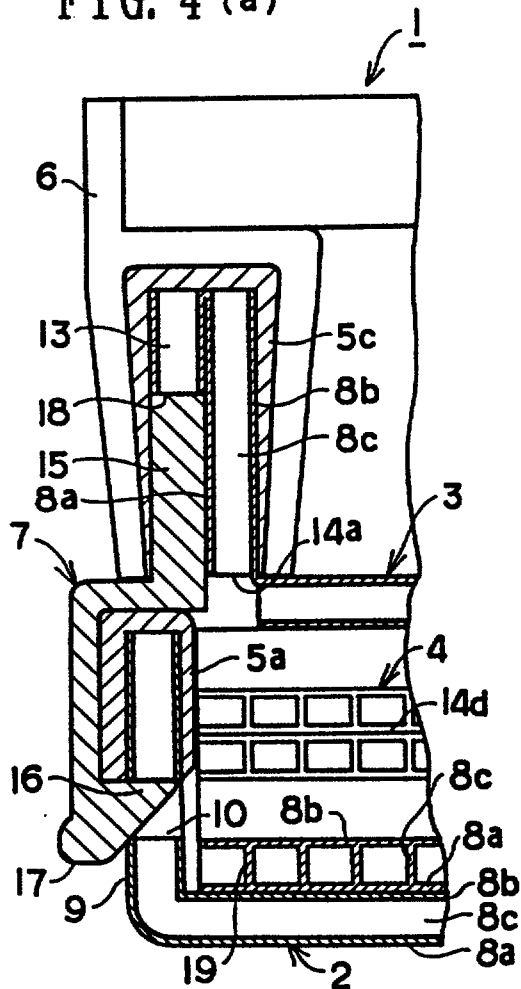


FIG. 4 (a)



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FIG. 5

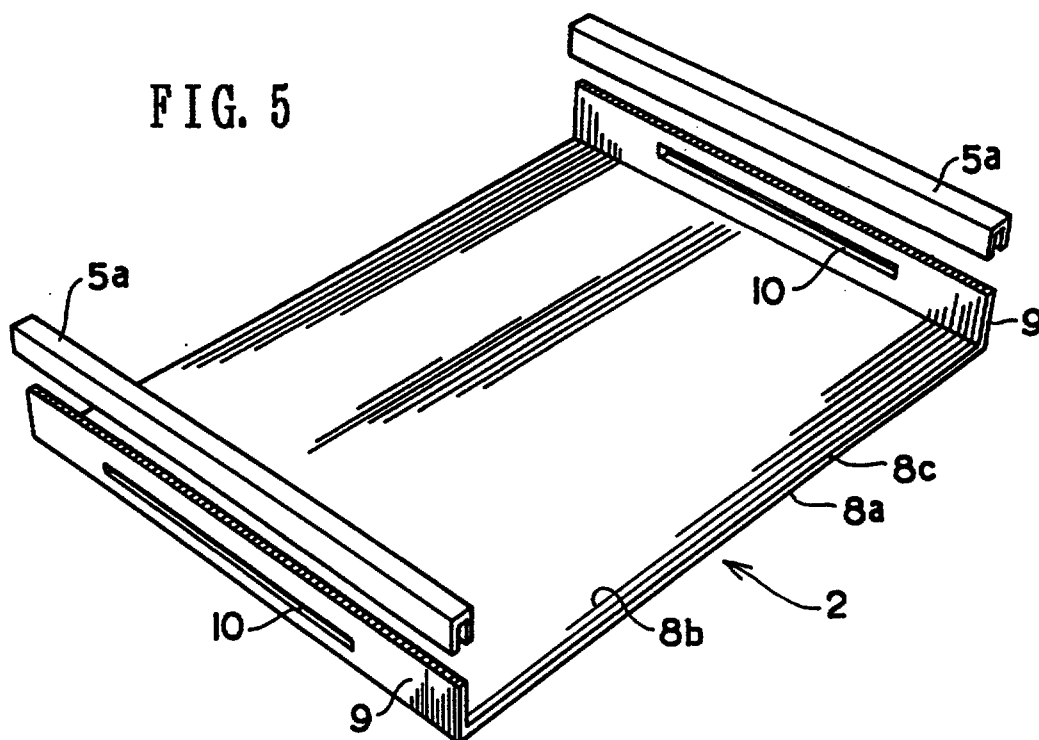
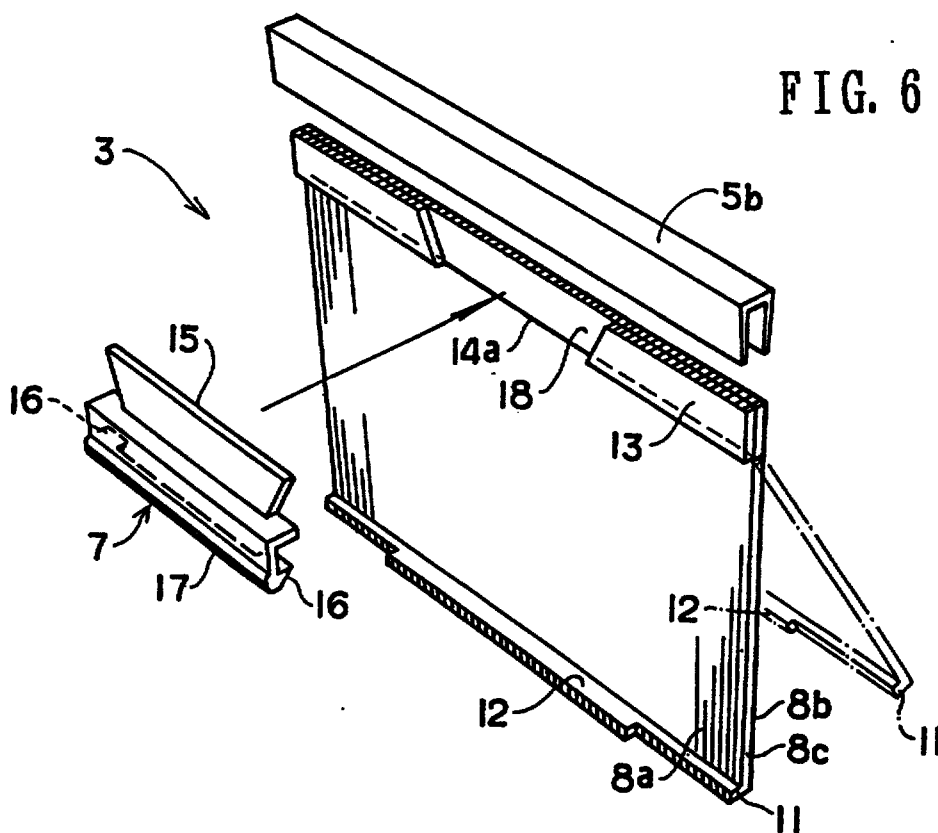
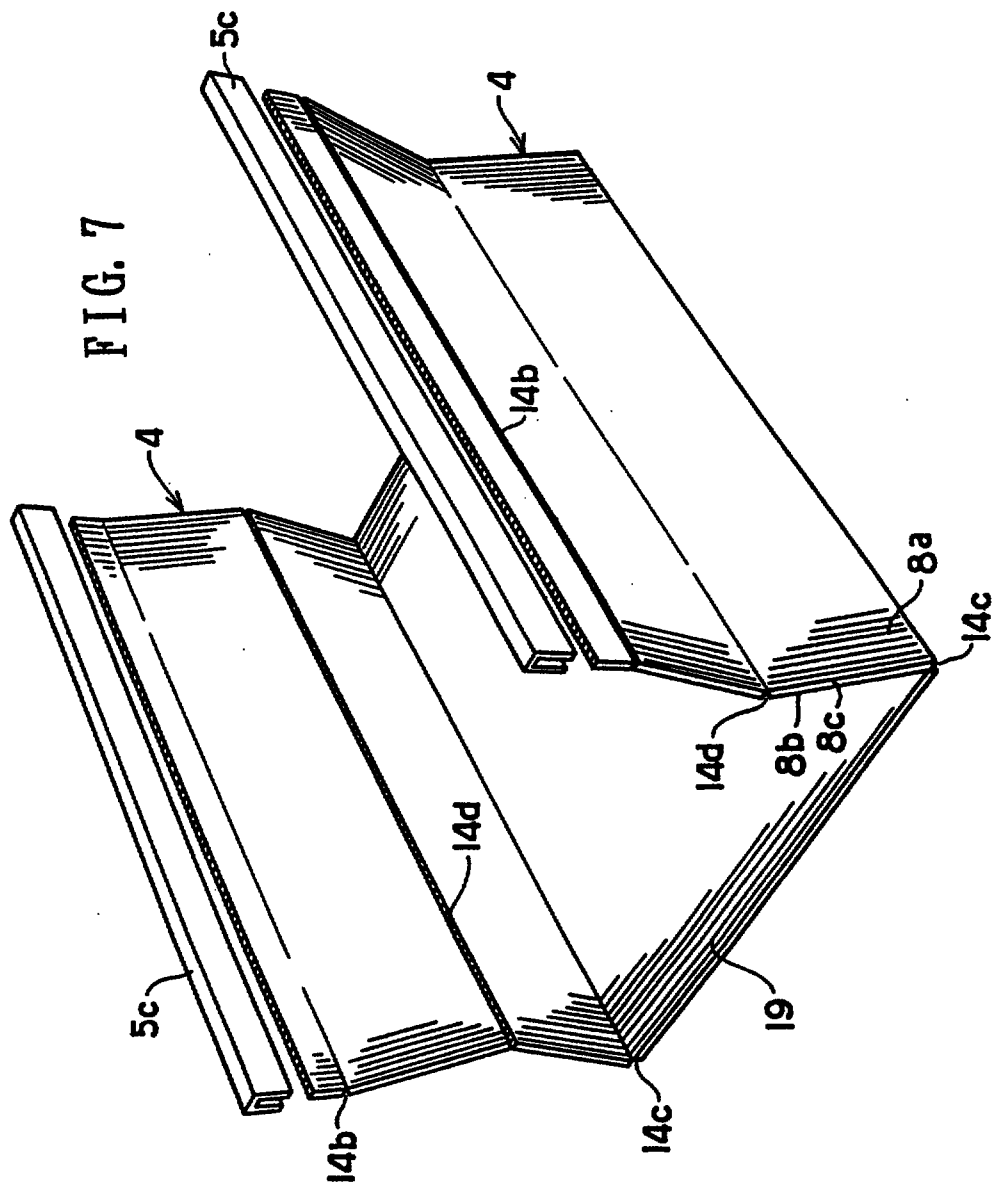


FIG. 6





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FIG. 8

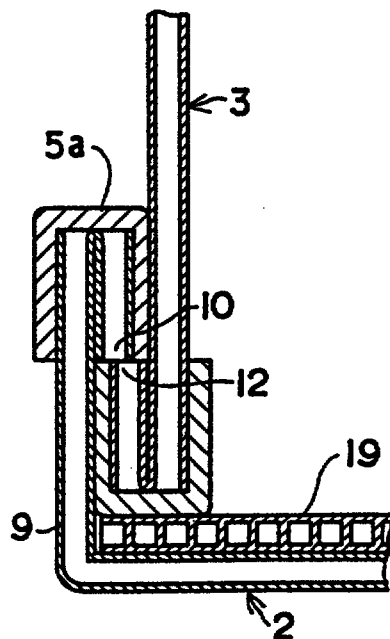
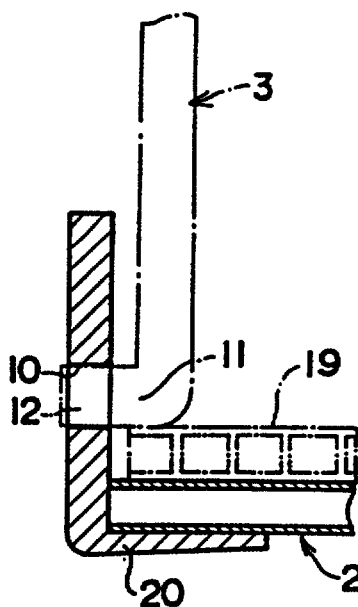


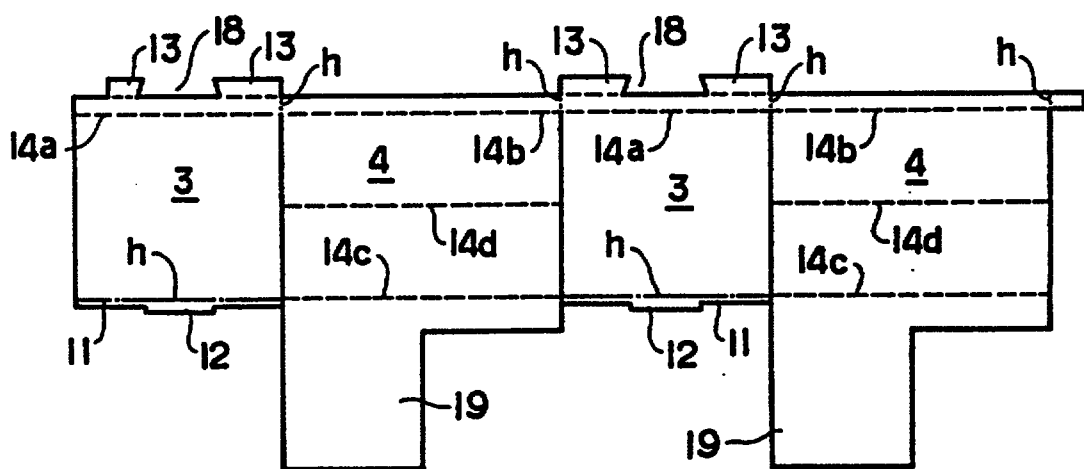
FIG. 9

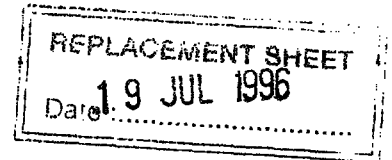
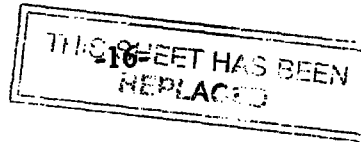


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FIG. 10





ABSTRACT

FOLDABLE BOX

A light-weight, robust, foldable box which can be folded flat, comprises a bottom panel, swing side panels and folding side panels of corrugated plastics board. The bottom panel has vertical panels on both ends and a retaining portion in the vertical panels. The swing side panels are produced of corrugated plastics board used in such a direction that a core member will be vertically positioned, and are provided with a reinforcing band at the lower end and an engaging portion formed in the reinforcing band to thereby engage with the retaining portion. In the upper end of the swing side panel is formed an inside-folding line which allows the swing of the swing side panel. The folding side panel is used in such a direction that the core member of corrugated plastics board will be vertically positioned, and is provided with inside-folding lines in the upper and lower portions and with an outside-folding line at the center between the inside-folding lines provided in the upper and lower portions, so that the folding side panel may be folded to a sidelong V-shaped form. The swing side panel and the folding side panel are connected in a portion above the uppermost inside-folding line.

(FIGURE 1)

FOLDABLE BOX

REPLACEMENT SHEET

Date : 05 NOV 1997

The present invention relates to a foldable box which can be folded to a compact size.

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A conventional foldable box, as disclosed in, for example, Japanese Utility Model Laid-Open No. Sho 62-110132, comprises a square tray-like bottom panel, a picture frame-like upper frame formed to substantially the same size as the bottom panel, two swing side panels rotatably pivoted on two opposite sides of the upper frame, and a
10 folding side panel which can be bent into a sidelong V-shaped form and is pivotally mounted at its upper and lower edges to the upper frame and the bottom panel. The swing side panels are raised thereby to support the folding side panel upright. When the swing side panels are turned inwardly to a horizontal position, the folding side panel is folded inside the box, so that the box can be folded flat.

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Such a foldable box described above is in most cases an injection-molded product of synthetic resin.

The prior art foldable box, however, has the following problems.

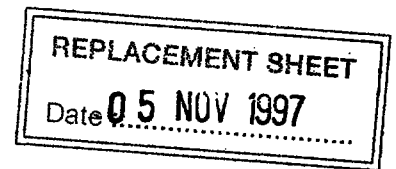
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Firstly, since a mold for injection molding of synthetic resin is expensive, the unit price of the box becomes high and, moreover, since there must be prepared as many molds as the number of sizes required, injection molding is unsuitable for producing many kinds of boxes in small quantities. It is, therefore, impossible to meet every detail of a
25 customer's need.

Secondly, since the box itself becomes very heavy, a wastefully high transportation cost and much burden in loading and unloading work will be required.

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It is, therefore, an object of the present invention to provide a foldable box which at least partly overcomes the above difficulties.



According to a first aspect of this invention, a foldable box comprises: at least a bottom panel of a rectangular or square form in a plan view two swing side panels positioned on two opposite sides of the bottom panel; and two folding side panels positioned on the remaining two sides of the bottom panel, wherein: each of the said panels is produced of corrugated plastics board including a core member of synthetic resin sandwiched between two synthetic resin base panels; the bottom panel has vertical panels fixedly secured on respective opposing sides in a direction intersecting the bottom panel core member at right angles, and a retaining portion formed on each of the said vertical panels; the swing side panels are produced of corrugated plastics board used in such a direction that the core members thereof will be vertically positioned, and each having, at the lower edge, a reinforcing band disposed in a direction intersecting the respective side panel core member at right angles, and an engaging portion formed on the reinforcing band and engagable with the retaining portion of a respective one of the vertical panels, and further, each having at the upper edge, a horizontal inside-folding line cut deep except for one of the base panels of the corrugated plastics board, the said base panel being left uncut and serving as a hinge portion to allow the respective swing side panel to swing towards the inside of the box; each of the said folding side panels is produced of corrugated plastics board used in such a direction that the respective core member will be vertically positioned, and being provided, in its upper and lower portions, with horizontal inside-folding lines cut deep except for one of the base panels of corrugated plastics board, and, at the centre between the said inside-folding lines cut in the upper and lower portions, with a horizontal outside-folding line cut deep except for one of the base panels of the corrugated plastics board, thereby allowing folding to a sidelong V-shaped form; and wherein the swing side panels and the folding side panels are connected in a portion above the uppermost inside-folding lines.

According to a second aspect of the invention, a foldable box comprises: at least a bottom panel of a rectangular or square form in a plan view; two swing side panels for location on two opposite sides of the bottom panel; and two folding side panels positioned on the remaining two sides of the bottom panel; wherein: each of the said panels is

produced of corrugated plastics board including a core member sandwiched between two face plates; the bottom panel has extensions projecting from two opposing edges of the panel on one side thereof, each extension having a retaining portion; the swing side panels each have, at an edge which is to lie adjacent one of the said opposing edges of the bottom panel, a reinforcing band with an engaging portion formed thereon for engagement with the retaining portion of one of said bottom panel extensions, each swing side panel further having, adjacent an edge thereof opposite to the edge which is to lie adjacent the bottom panel, a horizontal inside-folding line, one of the face plates of the material of the said swing side panel serving as a hinge portion to allow the said swing side panel to swing towards the inside of the box; the folding side panels each having, at or adjacent a first edge joining it to the bottom panel, and an opposite second edge, respective inside-folding lines and, substantially midway between the said inside-folding lines, an outside-folding line, one or other of the face plates of the material of the panel forming a hinge at each of the said folding lines, thereby allowing folding of the panel from a folded configuration in which the first and second edges lie adjacent each other, to a substantially flat unfolded configuration; the swing side panels and folding side panels being connected above the inside-folding lines which are remote from the bottom panel in the completed box.

According to a third aspect of the invention, a foldable box comprises: at least a bottom panel of a rectangular or square form in a plan view; two swing side panels for location on two opposite sides of the bottom panel; and two folding side panels positioned on the remaining two sides of the bottom panel; wherein: each of the said panels is produced of corrugated plastics board including a core member sandwiched between two face plates; the bottom panel has extensions projecting from two opposing edges of the panel on one side thereof, each extension having a retaining portion; the swing side panels each have, at an edge which is to lie adjacent one of the said opposing edges of the bottom panel, a reinforcing band with an engaging portion formed thereon for engagement with the retaining portion of one of said bottom panel extensions, each swing side panel further having, adjacent an edge thereof opposite to the edge which is to lie adjacent the bottom panel, a horizontal folding line, one of the face plates of the material of the said swing side panel serving as a hinge portion to allow the said swing side panel to swing

towards the inside of the box; the folding side panels each having, at or adjacent a first edge joining it to the bottom panel, and an opposite second edge, respective first and second folding lines and, substantially midway between the first and second folding lines, a third folding line, one or other of the face plates of the material of the panel forming a hinge at each of the said folding lines, thereby allowing folding of the panel from a folded configuration in which the first and second edges lie adjacent each other, to a substantially flat unfolded configuration; the swing side panels and folding side panels being connected above the folding lines which are remote from the bottom panel in the completed box.

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The swing side panels and the folding side panels may be produced of corrugated plastics board used in such a direction that the core members thereof will be vertical, so as to resist vertical forces which act during baggage conveyance and piling up of boxes. Moreover, reinforcing bands may be provided at the lower end of the swing side panels thereby to increase rigidity relative to torsion and lateral pressure added to the swing side panel. Furthermore, provided upright at the opposing sides of the bottom panel are vertical panels which engage with the swing side panels, thereby improving the strength of the bottom panel. In addition, since a load applied to the bottom panel is partly supported by the swing side panels, the box can fully withstand even a heavy load.

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The invention will now be described by way of example with reference to the accompanying drawings, in which:-

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Fig. 1 is a perspective view of a box in accordance with the invention;

Fig. 2 is a perspective view of the box in a folded state;

Fig. 3 is a transverse cross-section of the box showing different states of folding;

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Figs. 4(a) and 4(b) are detail cross-sections of parts of the box;

Fig. 5 is an exploded perspective view of a bottom panel;

Fig. 6 is an exploded perspective view of a swing side panel;

5 Fig. 7 is an exploded perspective view of folding side panels;

Fig. 8 is a detail cross-section of part of an alternative embodiment of the invention;

10 Fig. 9 is a detail cross-section of part of another alternative embodiment; and

Fig. 10 is an exploded view of yet another embodiment.

Referring to Figs. 1 to 7, a preferred foldable box 1 in accordance with the
15 invention includes a rectangular bottom panel 2 in a plan view, two swing side panels 3 located on two opposite sides of the bottom panel 2, two folding side panels 4 located on the remaining two sides of the bottom panel 2, molding members 5a to 5c covering the edge portions of the panels 2, 3 and 4, corner members 6 connecting the side panels 3 and 4 with each other, and handle members 7 (only one of which is visible in Fig. 1) provided
20 on the swing side panels 3.

The bottom panel 2, swing side panels 3, and folding side panels 4 are each produced of a well-known corrugated plastics board having a polypropylene core member 8c interposed between two polypropylene base panels or face plates 8a and 8b in an integral manner.

25

The bottom panel 2, as shown in Fig. 5, has vertical panels 9 fixedly formed at both end portions, intersecting the bottom panel core member 8c at right angles. The vertical panels 9, which are formed by thermally bending both end portions of the bottom panel 2 at right angles, each have a groove-like retaining portion 10 and a synthetic resin
30 molding member 5a fitted on the upper edge.

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Each swing side panel 3, as shown in Fig. 6, is produced of the corrugated plastics board, which is used in such a direction that the core member 8c will be vertically positioned. On the lower edge of each swing side panel 3 there is provided a reinforcing band 11 extending in a direction intersecting the core member 8c at right angles. The reinforcing band 11 in this embodiment is of such a construction that the lower end of the swing side panel 3 is bent through about 90 degrees by a method similar to that used to form the vertical panel 9 of the bottom panel 2, thereby to increase the rigidity of the swing side panel 3. The reinforcing band 11, as shown in Figs. 4(b) and 6, is provided with a lug-like engaging portion 12 to be engaged with the retaining portion 10 of the vertical panel 9.

Still referring to Figs. 4(b) and 6, on the upper edge of each swing side panel 3 there is a folding piece 13, using the face plate panel 8a of the panel 3 as a hinge. A synthetic resin molding member 5b is fitted over the folded portion. The upper edge portion of the swing side panel 3 is formed with an inward-folding line 14a cut on the outer side along the lower edge of the molding member 5b, leaving the inner face panel 8b of the corrugated plastics board uncut. The inner base panel 8b serves as a hinge portion so that the swing side panel 3 will swing towards the inside of the box 1, as shown in Fig. 6.

On the upper part of each swing side panel 3 there is attached the synthetic resin handle member 7. The handle member 7 has a cranked sectional form as shown in Figs. 4(a), (b) and 6, and is provided with an upper inverted trapezoidal inserting portion 15 and a lower finger engaging portion 17 having inward-facing pawls 16. The handle member 7 is securely fastened by fitting the inserting portion 15 into an inverted trapezoidal recess 18 provided in the folding piece 13 of the swing side panel 3, and further by fitting the molding member 5b thereon.

In the folding side panels 4, as shown in Fig. 7, the corrugated plastics board is used in such a direction that the core member 8c will be vertical and the two panels 4 are connected as one body through a reinforcing panel 19 which is placed on the bottom panel

2. On the upper edge of each folding side panel 4, there is fitted a molding member 5c, along the outer lower edge of which an inside-folding line 14b is formed in the panel. The inside-folding line 14b is cut deep through the panel except for the inner face plate 8b of the corrugated plastics board. This remaining uncut face plate 8b serves as a hinge
5 portion. An inside-folding line 14c of the same formation as the inside-folding line 14b is provided along each border portion between the folding side panels 4 and the reinforcing panel 19. Each folding side panel 4 is further provided with a horizontal outside-folding line 14d cut through the panel, except for the outer face plate 8a, at the center between the inside-folding lines 14b and 14c.

10

The folding side panels 4 are designed to be connected to the bottom panel 2 by bonding the reinforcing panel 19 to the upper surface of the bottom panel 2. The swing side panels 3 are disposed on two sides of the bottom panel 2 provided with the vertical panels 9, and are connected by riveting to the folding side panels 4 through the corner members 6 at the
15 corner where the swing side panels 3 and the folding side panels 4 butt against each other. The swing side panels 3 are connected integrally with the folding side panels 4 above the uppermost inside-folding lines 14a and 14b. A space for holding goods is thus formed in the box 1 by supporting the folding side panels 4 straight with the swing side panels 3 set upright.

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Since the engaging portion 12 of the swing side panel 3, in this state, is engaged with the retaining portion 10 of the vertical panel 9 as shown in Fig. 4(b), the load applied to the bottom panel 2 is partly supported by the swing side panels 3. Accordingly, the box containing goods will not be broken when raised. The corrugated plastics board, as
25 generally well known, displays a great strength against a force acting in a direction parallel to the core member 8c. The box 1 has its side panels 3 and 4 formed such that the core member 8c will be vertical, and therefore will not collapse under a substantial load. It is, therefore, possible to stack boxes 1 in many layers. And, furthermore, the bottom of the box can be substantially increased in strength by using the core member 8c of the
30 reinforcing panel 19 on the bottom panel 2 in an intersecting fashion as in the present embodiment.

Next, a method of using the box 1 will be explained.

To fold the box 1 from its erected form as shown in Fig. 1, first the swing side panels 3 are forced to turn inside. Then, the folding side panels 4 lose their support, to be bent by themselves down into a sidelong V-shaped form. Furthermore, when the upper edges of the box 1 are pushed, the pawls 16 of the handle member 7 moves, while deflecting, over the side face of the molding members 5a of the vertical panels 9 into engagement with the retaining portions 10 of the vertical panels 9 as shown in Fig. 4(a), thereby firmly locking the box 1 in a folded form, as shown in Fig. 2.

10

To unfold the box 1 into the erected form shown in Fig. 1, first the box 1 is pulled outwardly by holding the finger engaging portions 17 of the handle members 7, thereby to release the pawls 16 out of engagement with the retaining portions 10. When, in this state, the handle members 7 are pulled upward, the folding side panels 4 extend slightly with the weight of the bottom panel 2 and the reinforcing panel 19 as shown in Fig. 3. Subsequently, when the swing side panels 3 are pushed in towards the bottom panel 2, both side edges of each swing side panel 3 press to spread out the insides of the folding side panels 4. Then, when the swing side panel 3 stands almost fully upright so that the engaging portion 12 engages the retaining portion 10 of the vertical panel 9, the folding side panel 4 extends straight upright as indicated by a solid line in Fig. 3, thereby stabilizing in the form shown in Fig. 1.

One embodiment of the foldable box in accordance with the invention has been described above. Referring to Fig. 8, in an alternative embodiment, the engaging portion 12 of each swing side panel 3 and the retaining portion 10 of the respective vertical panel 9 may be of such a construction that both of their edges are engaged by folding both the lower end of the swing side panel 3 and the upper end of the vertical panel 9 together. In this case, the pawl 16 may be set to a size which allows engagement with the lower surface of the bottom panel 2 or the lower edge of the molding member 5a, or may be dispensed with if no locking is needed at the time of folding.

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Furthermore, referring to Fig. 9, the vertical panels may be changed to L-shaped members 20 of synthetic resin which are riveted to both edges of the bottom panel 2 formed into a flat plate.

- 5 Furthermore, the swing side panels 4, instead of being formed separately, may be produced from a single corrugated plastics board as shown in the exploded view of Fig. 10. In the drawing, the fold line (h) is a portion to be thermally deformed.

The inside- and outside-folding lines cut straight in the swing side panels 3 and 10 the folding side panels 4 are most preferably in the respect of the strength of the hinge portion and such a particular function that the hinge portion bends only in one direction. In some cases, however, the fold lines may be formed in a shape of V-groove. When V-grooves are adopted, the face plate forming the hinge portion may be used either inside or outside. For example, the hinge portion of the inside-folding line 14a of the swing side 15 panel 3 may be formed of the outer face plate 8a.

The box, if constructed in a foldable manner, has many movable portions, necessarily decreasing in strength. In the box 1 described above, therefore, the swing side panels 3 and the folding side panels 4 are provided with their core members 8c of 20 corrugated plastics board directed vertically, the reinforcing band 11 on the lower end of the swing side panel 3, and the vertical panels 9 set upright at both ends of the bottom panel 2 in such a manner as to be engaged with the swing side panels 3. In this way it is possible to provide the foldable box of corrugated plastics board with substantial strength for practical use.

25

The foldable box 1 made of corrugated plastics board is superior in the following respects to a conventional injection-molded box. Firstly, the size of the box 1 can be changed as desired by changing the cutting dimensions of the corrugated plastics board, and moreover, the use of a mold which will increase the cost of the box 1 is not needed. 30 Accordingly, the box is suitable for production of many kinds of boxes in small quantities, meeting every detail of customer's needs. Secondly, since the box is lighter than an

injection-molded box, transportation cost can be reduced and the load-handling workers' burden can be lessened. Thirdly since strong hinge portions can be made simply by cutting fold lines in the swing side panels 3 and the folding side panels 4, the box can be manufactured and assembled very easily.

5

Furthermore, notwithstanding a manufacturing cost a little higher than that of a conventional box of corrugated paper board, which, being non-reusable, wastes resources and moreover is hard to dispose of after use, the box 1 described above has such advantages that it is reusable several times and accordingly is more economical than the
10 box of corrugated paper board. Furthermore, as it is repetitively reusable, the waste to be disposed as well as resource consumption are very low.



CLAIMS

1. A foldable box comprising:
 - at least a bottom panel of a rectangular or square form in a plan view;
 - 5 two swing side panels positioned on two opposite sides of the bottom panel;
 - and
 - two folding side panels positioned on the remaining two sides of the bottom panel,
 - wherein:
 - 10 each of the said panels is produced of corrugated plastics board including a core member of synthetic resin sandwiched between two synthetic resin base panels;
 - the bottom panel has
 - vertical panels fixedly secured on respective opposing sides in a direction intersecting the bottom panel core member at right angles, and
 - 15 a retaining portion formed on each of the said vertical panels;
 - the swing side panels are produced of corrugated plastics board used in such a direction that the core members thereof will be vertically positioned, and each having, at the lower edge,
 - a reinforcing band disposed in a direction intersecting the respective
 - 20 side panel core member at right angles, and
 - an engaging portion formed on the reinforcing band and engagable with the retaining portion of a respective one of the vertical panels, and further, each having at the upper edge,
 - a horizontal inside-folding line cut deep except for one of the base
 - 25 panels of the corrugated plastics board, the said base panel being left uncut and serving as a hinge portion to allow the respective swing side panel to swing towards the inside of the box;
 - each of the said folding side panels is produced of corrugated plastics board used in such a direction that the respective core member will be vertically positioned,
 - 30 and being provided, in its upper and lower portions, with horizontal inside-folding lines cut deep except for one of the base panels of corrugated plastics board, and, at



the centre between the said inside-folding lines cut in the upper and lower portions, with a horizontal outside-folding line cut deep except for one of the base panels of the corrugated plastics board, thereby allowing folding to a sidelong V-shaped form; and

5 wherein the swing side panels and the folding side panels are connected in a portion above the uppermost inside-folding lines.

2. A foldable box comprising:

at least a bottom panel of a rectangular or square form in a plan view;

10 two swing side panels for location on two opposite sides of the bottom panel; and

two folding side panels positioned on the remaining two sides of the bottom panel;

wherein:

15 each of the said panels is produced of corrugated plastics board including a core member sandwiched between two face plates;

the bottom panel has extensions projecting from two opposing edges of the panel on one side thereof, each extension having a retaining portion;

20 the swing side panels each have, at an edge which is to lie adjacent one of the said opposing edges of the bottom panel, a reinforcing band with an engaging portion formed thereon for engagement with the retaining portion of one of said bottom panel extensions, each swing side panel further having, adjacent an edge thereof opposite to the edge which is to lie adjacent the bottom panel, a horizontal inside-folding line, one of the face plates of the material of the said swing side panel
25 serving as a hinge portion to allow the said swing side panel to swing towards the inside of the box;

the folding side panels each having, at or adjacent a first edge joining it to the bottom panel, and an opposite second edge, respective inside-folding lines and, substantially midway between the said inside-folding lines, an outside-folding line,
30 one or other of the face plates of the material of the panel forming a hinge at each of the said folding lines, thereby allowing folding of the panel from a folded



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configuration in which the first and second edges lie adjacent each other, to a substantially flat unfolded configuration;

the swing side panels and folding side panels being connected above the inside-folding lines which are remote from the bottom panel in the completed box.

5

3. A foldable box comprising:

at least a bottom panel of a rectangular or square form in a plan view;

two swing side panels for location on two opposite sides of the bottom panel;

and

10 two folding side panels positioned on the remaining two sides of the bottom panel;

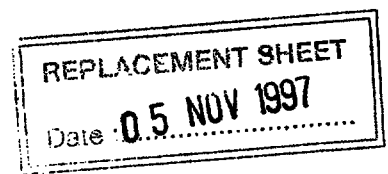
wherein:

each of the said panels is produced of corrugated plastics board including a core member sandwiched between two face plates;

15 the bottom panel has extensions projecting from two opposing edges of the panel on one side thereof, each extension having a retaining portion;

the swing side panels each have, at an edge which is to lie adjacent one of the said opposing edges of the bottom panel, a reinforcing band with an engaging portion formed thereon for engagement with the retaining portion of one of said
20 bottom panel extensions, each swing side panel further having, adjacent an edge thereof opposite to the edge which is to lie adjacent the bottom panel, a horizontal folding line, one of the face plates of the material of the said swing side panel serving as a hinge portion to allow the said swing side panel to swing towards the inside of the box;

25 the folding side panels each having, at or adjacent a first edge joining it to the bottom panel, and an opposite second edge, respective first and second folding lines and, substantially midway between the first and second folding lines, a third folding line, one or other of the face plates of the material of the panel forming a hinge at each of the said folding lines, thereby allowing folding of the panel from a
30 folded configuration in which the first and second edges lie adjacent each other, to a substantially flat unfolded configuration;



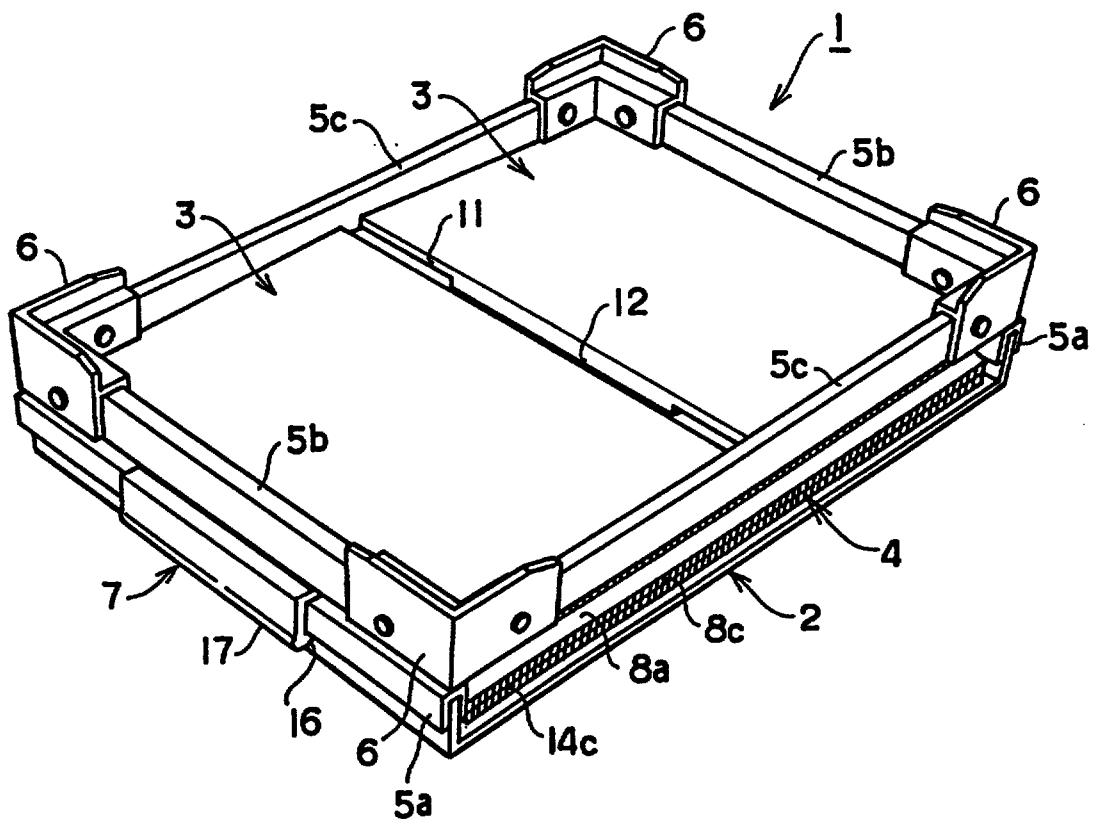
-14-

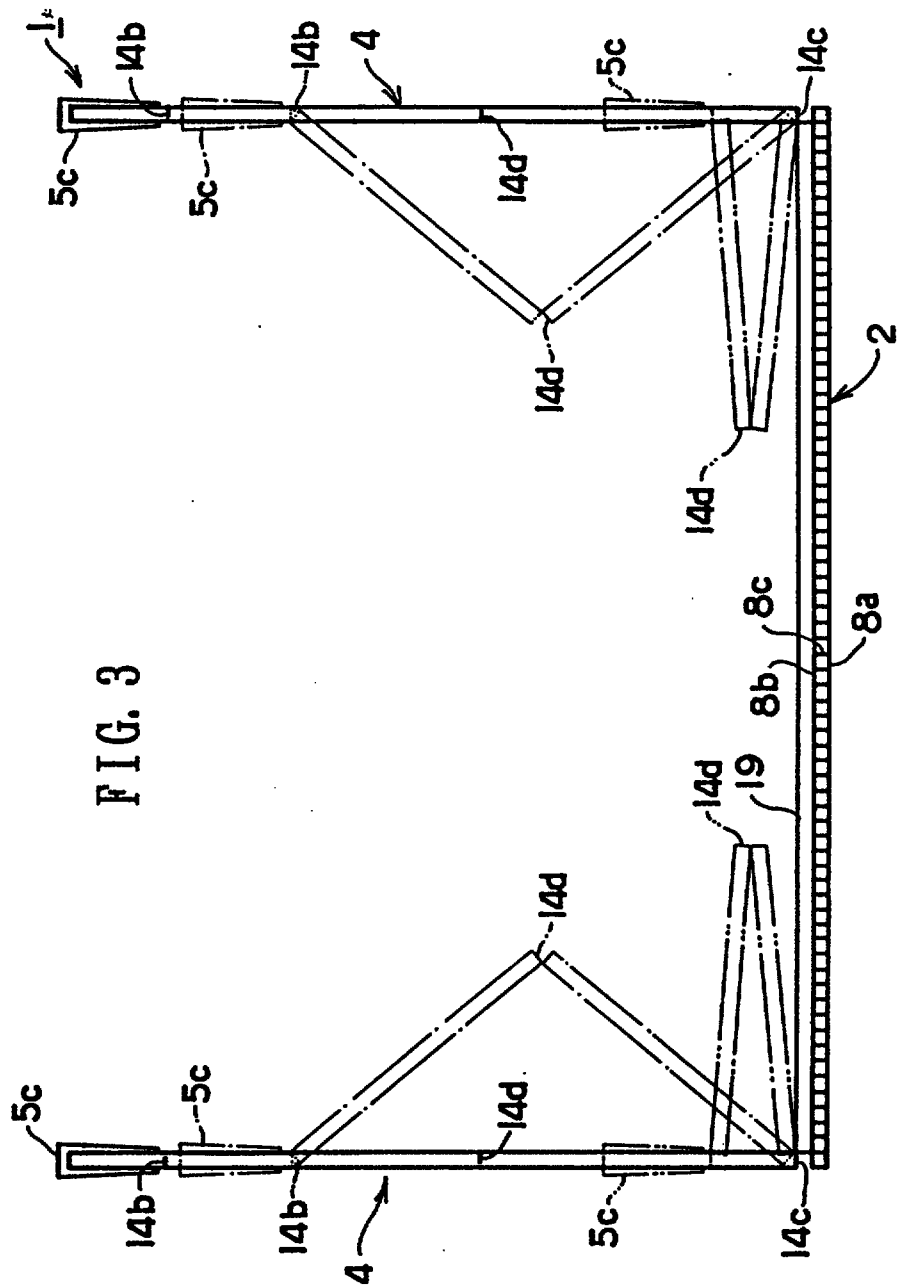
the swing side panels and folding side panels being connected above the folding lines which are remote from the bottom panel in the completed box.

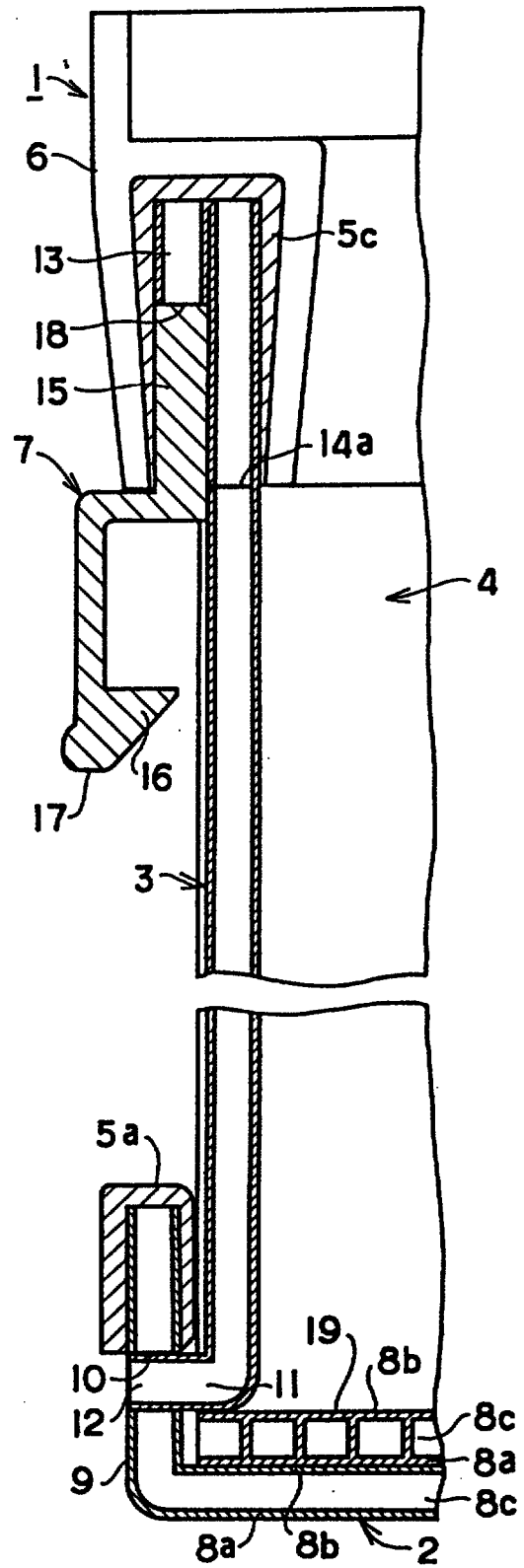
4. A foldable box according to claim 2 or claim 3, wherein the corrugations of
5 each swing side panel run at right angles to the edge having the reinforcing band, and
the corrugations of each folding side panel run at right angles to the said first and
second edges.
5. A foldable box according to any of claims 2 to 4, wherein the folding side
10 panels are integrally formed with the bottom panel.
6. A foldable box constructed and arranged substantially as herein described
with reference to Figures 1 to 7, or any of Figures 8, 9 and 10 of the drawings.



FIG. 2







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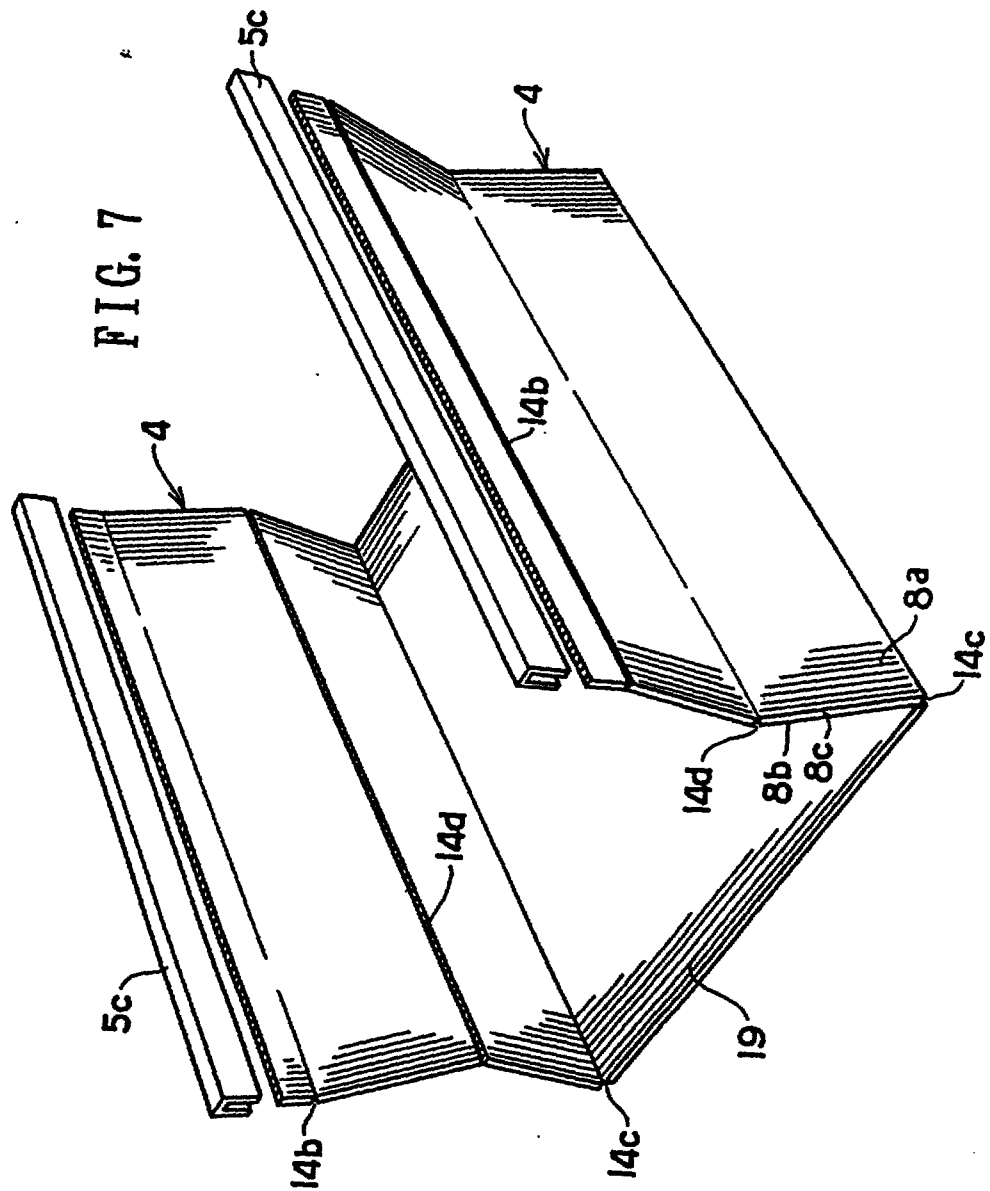


FIG. 8

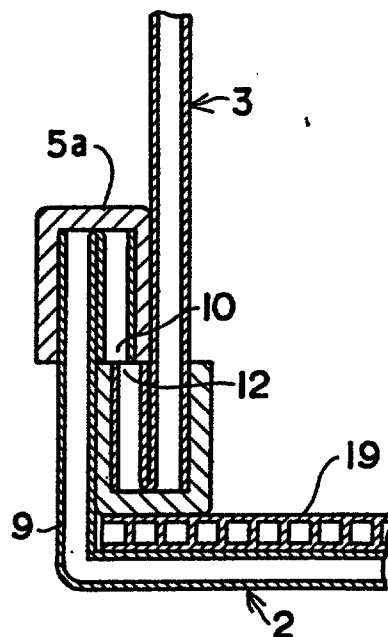


FIG. 9

