

June 17, 1969

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3,450,330

CONSTRUCTION OF A FOLDING BOX CORNER, AND METHOD OF ASSEMBLY

Filed Dec. 21, 1967

Sheet 1 of 4

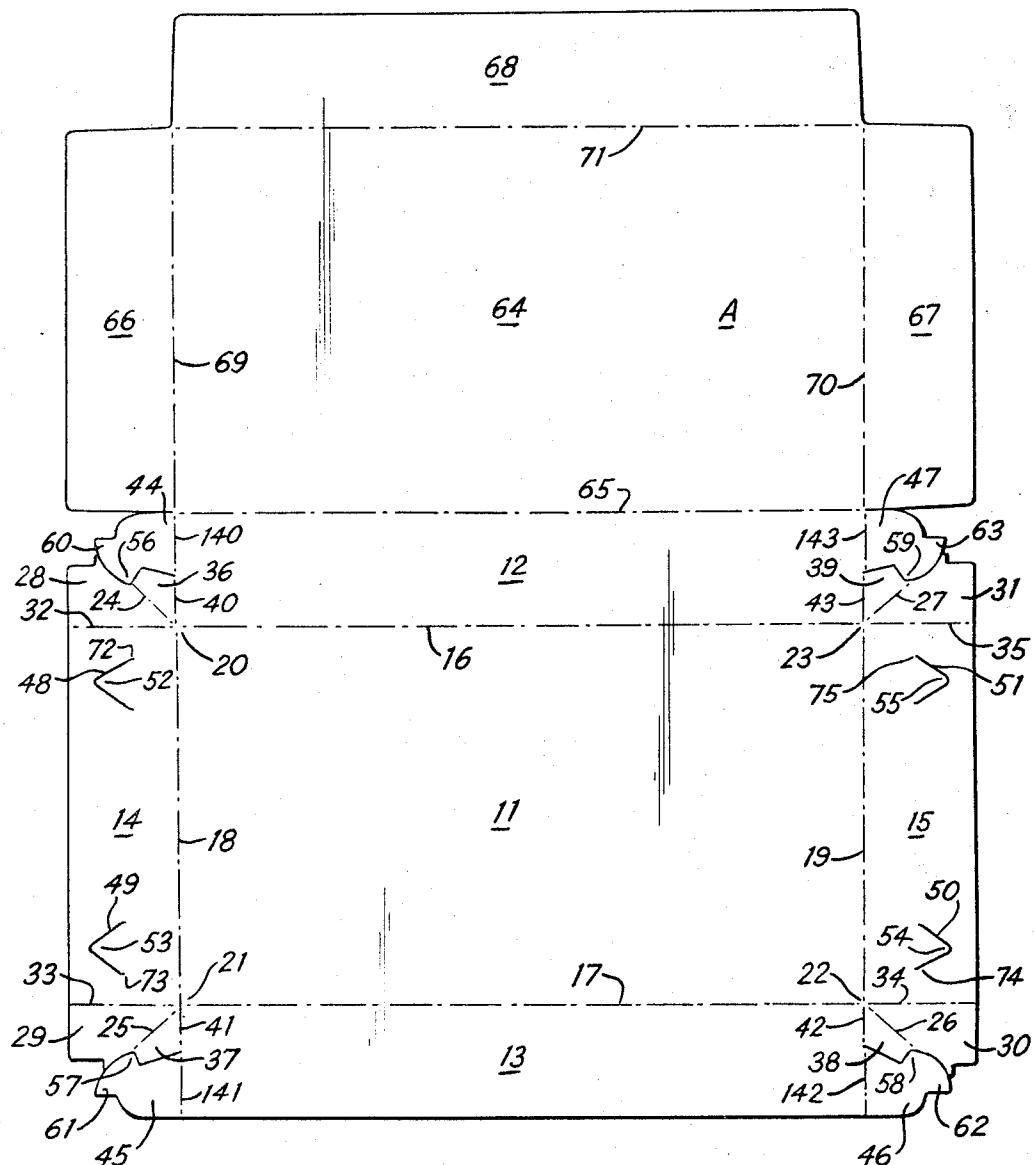


Fig. 1

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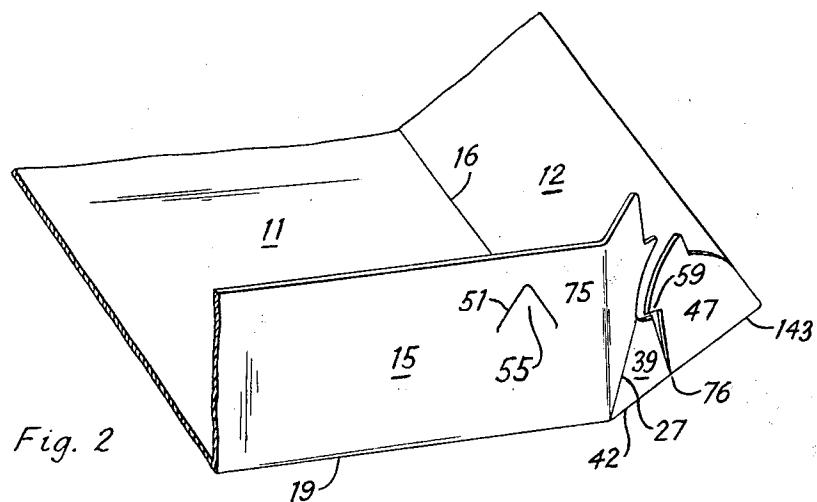


Fig. 2

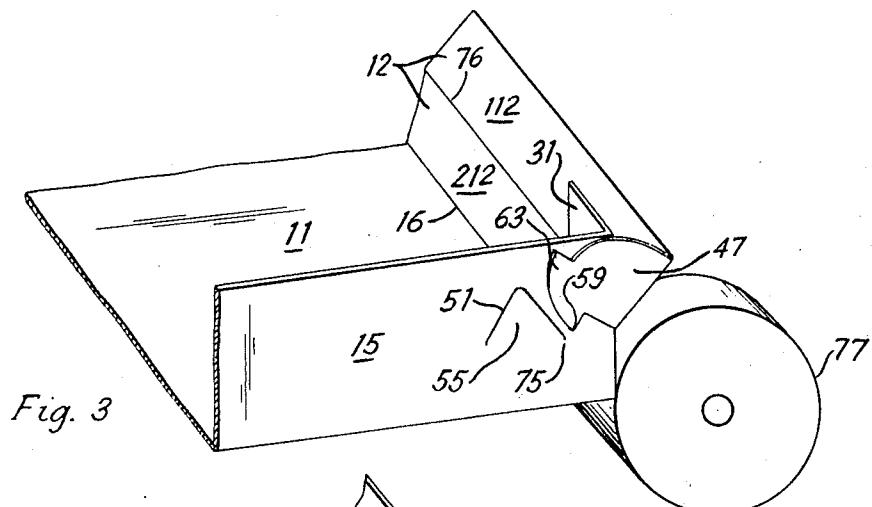


Fig. 3

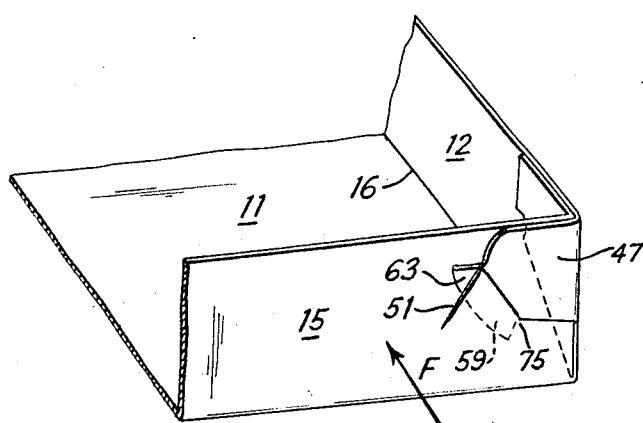


Fig. 4

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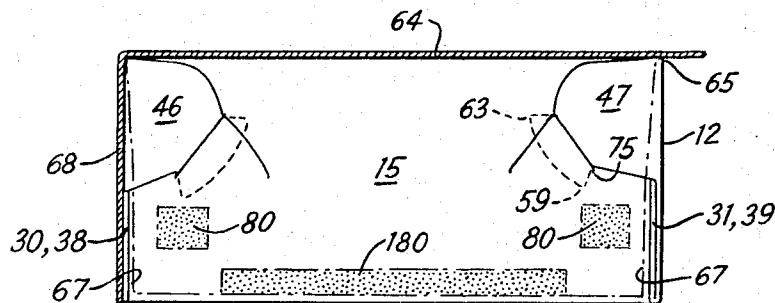


Fig. 5

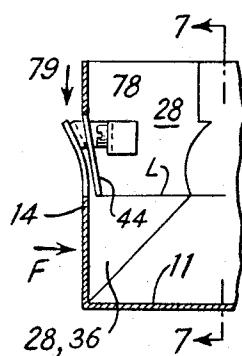


Fig. 6

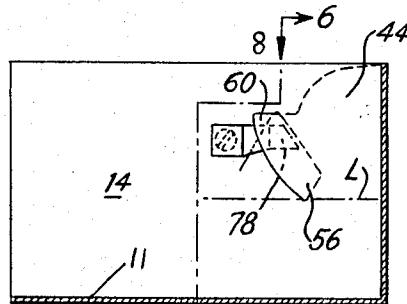


Fig. 7

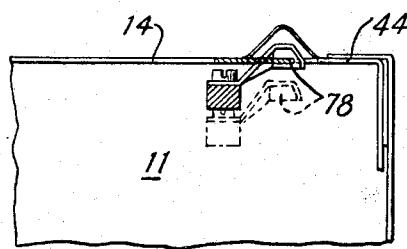


Fig. 8

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Sheet 4 of 4

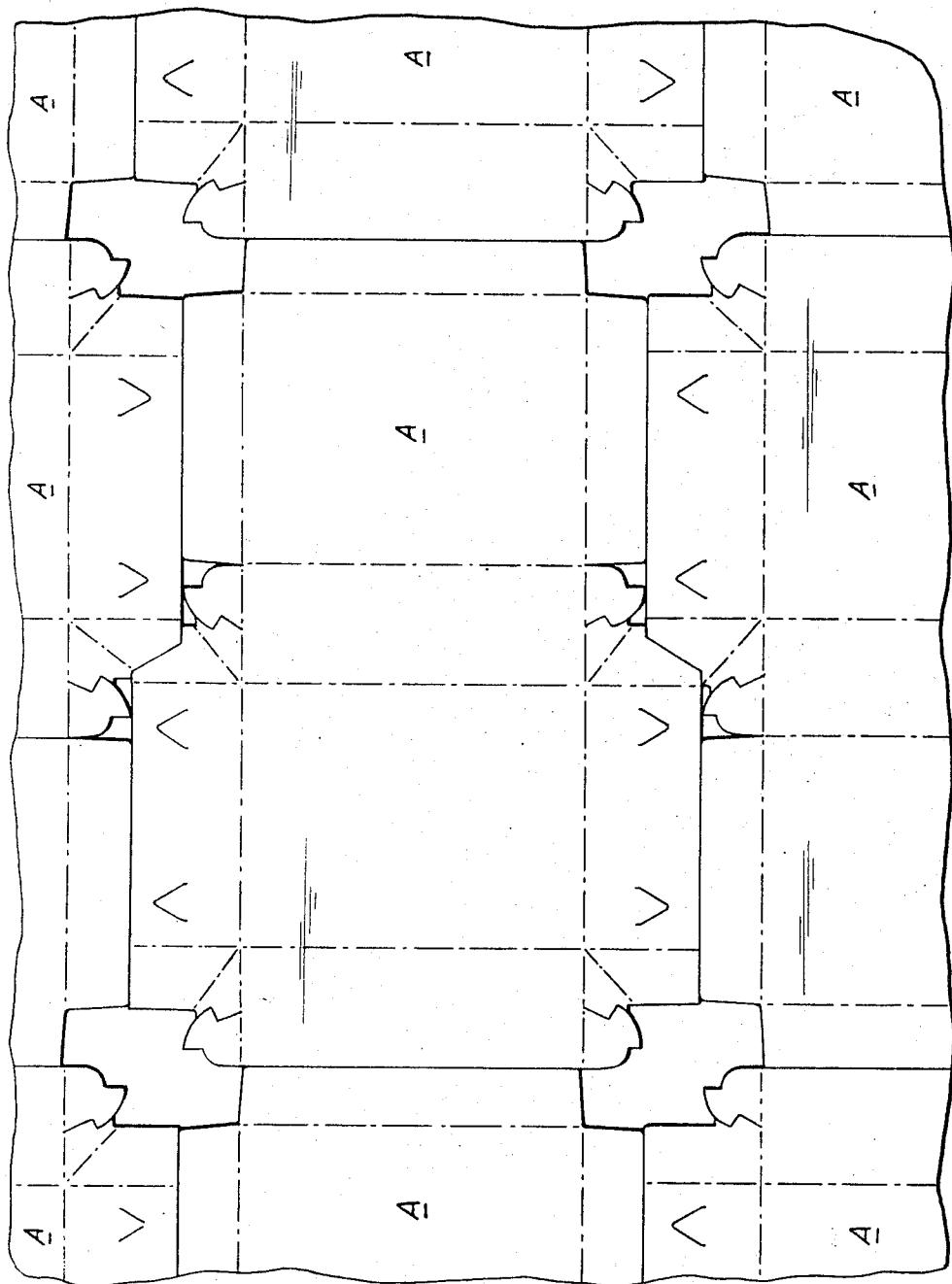


Fig. 9

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## CONSTRUCTION OF A FOLDING BOX CORNER, AND METHOD OF ASSEMBLY

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Filed Dec. 21, 1967, Ser. No. 692,570

Int. Cl. B65d 5/26, 5/22, 5/42

U.S. Cl. 229—33

6 Claims

### ABSTRACT OF THE DISCLOSURE

The present improvements provide a folding box corner construction capable of glueless assembly and provided with an interior corner gusset for liquid proofness and increased mechanical rigidity and resistance, particularly to inwardly directed compressive force exerted, for example, during the gluing to the box body walls of flaps on the cover. The box body walls are locked together by an exteriorly disposed lock flap articulated to one wall panel and partially inserted in a slot in the other wall panel. The lock flap has a hook formed in it which is of such configuration in relation to the slot that its tip fails to clear the slot unless the upper portion of the wall panel from which it extends is flexed into an angular position with respect to the lower wall portion, thereby raising the tip sufficiently high to clear the slot. A tab on the lock flap pointing in a general direction opposite to the hook tip is resiliently snapped past an edge of the slot and acts as a safety catch for the hook preventing disengagement of hook and slot even under conditions under which the wall panel is flexed.

### SPECIFICATION

The present invention is directed to improvements in the corner construction of gluelessly assembled folding boxes, more particularly boxes for the packaging of frozen foods, in which a corner gusset is provided to impart liquid proofness to the box body up to a certain level and in which a lock flap is provided above the corner gusset for locking the respective wall panels together.

Frozen food boxes are generally made from paper-board having a coating of thermoplastic material thereon which makes the board non-absorbent to liquid and even permits heat sealing of the filled box without application of additional adhesive, provided appropriate techniques are employed in adhering flaps on the box cover to the sides of the box body.

The reliability of the heat seal depends in a large measure on the ability of the box body to resist caving-in under the sealing pressure exerted on the cover side flaps from the outside, particularly at the corners.

Interiorly disposed gusset panels provide the required strength and rigidity at the box corners.

A lock flap is provided at each of the corners above the level to which the gusset panels extend. The lock flap is of hook-shaped configuration and is insertable into a slot in the other wall panel. According to the present invention the lock flap hook and the slot are so contoured and dimensioned that the hook tip can neither be inserted into the slot nor be withdrawn therefrom unless the wall panel portion from which the flap extends is flexed with respect to the portion of the same wall panel which lies adjacent the gusset panels. Such flexing, which must be deliberate, then raises the hook tip sufficiently to clear the slot.

A further safety catch tab may be provided on the lock flap, which tab is resiliently snapped past one edge of the slot and extends in a direction generally opposite to the direction of the hook. The tab prevents disengagement of the lock flap from the slot even under conditions of deliberate flexing of the wall panel once the lock is engaged and the safety tab is set.

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The security of the lock is of great importance in the automatic packaging of frozen foods where supervising personnel occasionally handle filled, but still open boxes by the upstanding cover panel while the boxes are moving through the machinery. This puts a severe strain on the rearward corner locks, and also causes considerable distortion of box panels. The corner locks must not come apart under such conditions, as disengagement of the locks would result in spillage of contents on the machine and necessitate shutdown of the entire packaging line from the box former to the box closer and sealer.

Box corner constructions comprising an interiorly disposed pair of gusset panels between adjacent wall panels and an exteriorly disposed lock flap of hook-shaped configuration on one of the wall panels and insertable in a slot in the other wall panel are basically known as applied to re-collapsible open trays. In the known construction the engagement of the hook with the slot depends solely on the depth of insertion of the hook. The danger of disengagement of the corner lock is considerable, if the trays are picked up or otherwise handled by the wall panel from which the lock flap extends. Rivets and staples are provided in the known tray construction for the purpose of maintaining certain gusset portions in a prefolded condition, but these rivets or staples do not prevent disengagement of the hook.

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In the following description and in the claims various details will be identified by specific names for convenience. The names, however, are intended to be generic in their application. Corresponding reference characters re-

fer to corresponding parts in the several figures of the drawings.

The drawings accompanying, and forming part of, this specification disclose certain specific details of construction for the purpose of explanation of broader aspects of the invention, but it should be understood that structural details may be modified in various respects without departure from the principles of the invention and that the invention may be incorporated in other structural forms than shown.

The blank A shown in FIG. 1 may be cut and scored in multiple from large sheets or rolls of paperboard, preferably board bearing a coating of a thermoplastic substance at least on the surface which becomes the inside of the box in order to impart moisture resistance to the board. When applying suitable techniques, such coatings permit heat sealing of portions of the box cover to portions of the box body after filling and closing of the box.

*Design of a representative blank A*

The blank A comprises a bottom panel 11 to which side wall panels 12, 13 and end wall panels 14, 15 are articulated along bottom fold lines 16, 17, 18 and 19, which intersect at corner points 20, 21, 22 and 23.

The wall panels are interconnected at the corners by 25 pairs of gusset panels which are foldable along diagonal gusset fold lines 24, 25, 26 and 27.

Each pair of gusset panels comprises a tall gusset panel 28, 29, 30 and 31 articulated to the end wall panels along corner edge lines 32, 33, 34 and 35, and a low gusset panel 36, 37, 38 and 39 articulated to the side wall panels 12, 13 along corner edge lines 40, 41, 42 and 43.

It is thus seen that the corner gussets lie adjacent the four corner points. Remote from the corner points, and adjacent the upper or top edges of the side wall panels, lock flaps 44, 45, 46 and 47 are articulated to the side wall panels along corner edge lines which are preferably slightly offset in the direction of the lock flaps and are identified as lines 140, 141, 142 and 143, respectively.

Internal cuts 48, 49, 50 and 51 form slots in the end wall panels into which the lock flaps 44, 45, 46 and 47 may be inserted. In order to facilitate such insertion, the internal cuts are preferably made angular, thus defining deflectable tongues 52, 53, 54 and 55 in the end wall panels.

The end portions of the lock flaps are contoured to provide a hook tab portion for hooking into the end of the respective end wall slot or otherwise engaging the slot. The hook tab portions are numbered 56, 57, 58 and 59.

The dimensions and disposition of the lock flap end portions in relation to the internal slots in the end walls are such that the distance from the corner point (for example 20) to the hook tip (for example 56) is less than the distance from the corner point 20 to the end of the respective internal cut or slot (for example 48), considering that end 72 which is nearest the corner point. In FIG. 1 the respective ends are numbered 72, 73, 74 and 75.

If, therefore, the wall panels 12 and 14 are folded into upright position with respect to the bottom panel 11 and the lock flap 44 is folded over the outside of the end wall panel 14, and if an attempt were made to insert the lock flap into the slot, it would be found that the hook tab tip 56 fails to clear the cut 48, therefore resisting insertion.

If, on the other hand, it were assumed that by some technique the end of the lock flap 44 were fully inserted in the slot 48, the hook tab 56 would then resist withdrawal of the lock flap because of insufficient clearance for it to slip out of the slot 48.

The hook tab is preferably so oriented as to point towards the main panel of the box, considering the box in set up condition.

Preferably—even though not necessarily—the lock flaps are provided with a further tab portion which extends beyond the confines of the internal cut or slot, con-

sidering the corner structure assembled. This further tab portion may be termed a safety catch tab and preferably points in a direction at right angles, or opposite, to the direction in which the hook tab points.

Such safety catch tab portions are shown at 60, 61, 62 and 63 and their significance will become further apparent from FIGS. 5 to 8 later to be described.

A cover panel 64 is articulated to the side wall panel 12 along a cover hinge fold line 65 and cover flaps 66, 67, and 68 extend from the cover panel along cover flap fold lines 69, 70 and 71.

For the sake of simplification of FIGS. 2 to 4 and 6 to 8, the cover panel and its flaps are omitted in these figures.

*Assembly of blank A into box form*

Blank A lends itself to assembly into box form and to locking of the box corners by a device of the plunger-and-die type in which a plunger forces the flat blank into and through a die. During the passage into and through the die the corners are formed and locked.

FIG. 2 and the subsequent figures illustrate the assembly of only one box corner, it being understood that the other three corners are assembled in the same manner, preferably simultaneously with the one corner. It will therefore suffice to describe one corner only, which proceeds as follows:

The end wall panel 15 is folded into substantially upright position with respect to the bottom panel 11 along main fold line 19. Simultaneously, or slightly later, the wall panel 12 is folded towards an upright position. Such folding causes the corner gusset panels to crease along the diagonal fold line 27 and move towards the inside of the box as shown in FIG. 2. Substantially simultaneously the lock flap 47 is folded into a position at right angles to the wall panel 12.

Due to the presence of the corner gussets and the lock flap 47, the wall panel 12 develops increasing rigidity and resistance to flexing. There remains, however, a line of weakness 76 which lies between the top of the gusset panel 39 and the bottom of the lock flap 47 and extends across the entire panel 12 to the corresponding point at the opposite corner. This line of weakness permits flexing of the panel so as to move its upper panel portion 112 into an angular position with respect to its lower panel portion 212 about the normally unscored line or axis of flexure 76 (see FIG. 3).

In the state shown in FIG. 3, the panel 15 is fully erected, the gussets are fully folded, the panel 31 has assumed a right-angular position with respect to panel 15 and the lock flap 47 is folded over the outside of the wall panel 15.

The lack of resistance of the panel 12 to flexing along line 76 is taken advantage of in order to swing the tip of the hook tab 59 into an elevated position, sufficiently elevated to clear the end point 75 of the slot 51.

During flexure the tip 59 may be considered as moving on an arc about the axis of flexure 76.

At about this moment the internal tongue 55 is flexed outwardly by suitable manipulation (see FIGS. 6 and 8) permitting the end of the lock flap 47 to enter the slot 51 as the panel 12 is gradually being flattened out, for example by movement past pressure rollers 77.

The entire end portion of the lock flap 47 enters the slot except in a case where a safety catch tab is provided on the lock flap.

As seen in FIG. 4 the safety catch tab 63 extends beyond the confines of the internal slot 51. The tab 63 is of such size that it may be forced to the inside of the corner by appropriate flexing of the portion of the lock flap from which it extends. Mechanism for this operation is illustrated in FIGS. 6, 7 and 8.

The plunger which moves the blank through the folding die may be equipped in a manner known per se with hook-like extensions or blades 78, one for each corner. These

blades are actuated in dependence on the plunger stroke from a normally extended position indicated in solid lines to a retracted position shown in dash-dot lines. In projected position the blade 78 bears against the internal tongue 55 and deflects it toward the outside, thus opening a slot into which the lock flap may be inserted into a position inwardly of the blade (arrow 79).

Towards the end of the plunger stroke the extended blades are retracted, thus pulling the safety catch tab 63 to the inside of the box. In this position (FIG. 5) not only the hook tip 59 but also the remainder of the end of the lock flap 47 lies on the inside of the box, and the assembly of the corner is completed.

The box is then filled and is closed by folding the cover panel 64 down on the box body and folding the cover flaps 66, 67 and 68 over, and bonding them to the walls of the box body.

The sealing procedure entails the application of a sealing force on the cover flaps directed to the inside of the box. It is readily seen that the panel 15 would tend to cave in under an application of a force  $F$  (FIGS. 4 and 6) if it were not for the presence of the gusset panels (28, 36 in FIG. 6) which stiffen the box walls and, in addition, provide leak proofness up to a level  $L$ .

FIG. 5 illustrates a preferred pattern for adhering the cover flap 67 to the box body wall 15 along areas 80 and 180 outlined in dash-dot lines. It is readily seen that the rigidity of the areas 80 exists by reason of the gusset panels and that the rigidity of the area 180 exists because of its proximity to the main fold line 19 along which the bottom panel backs up the wall panel 15.

FIG. 9 illustrates a layout of blanks A in multiple in a sheet 81 in which the individual blanks are staggered and dovetailed so as to leave a minimum of waste material between blanks. This layout is brought about by reducing the height of the cover flaps to one-half the height of the box.

The height reduction is quite satisfactory, particularly in view of the liquid- and dust-tightness of the box body due to the corner gussets.

The slots above the level  $L$  through which dust could enter, were it not for the presence of the cover flaps, are sealed by the cover flaps even though their height is reduced.

What is claimed is:

1. Corner construction of a folding box which comprises a bottom panel, two wall panels articulated to said bottom panel along bottom fold lines intersecting at a corner point, said wall panels being interconnected by a pair of interior gusset panels adjacent said corner point, one wall panel having an exterior lock flap articulated thereto adjacent its terminal edge and above the respective gusset panel, said lock flap being foldable over, and insertable in, an internal slot in the other wall panel and comprising a hook portion, the point of which is directed towards the bottom panel when the hook portion is inserted in said slot, characterized in that the distance of the hook tip from the corner point is less than the distance from that end of the internal cut which is nearest the corner point to the corner point, and that the upper portion of said one wall panel, to which upper portion said lock flaps are articulated, is flexible relatively to the lower portion of said one wall panel about a line of flexure extending across said first wall panel from approximately the terminal edge of the gusset panel articulated to said first wall panel, the arrangement resulting in failure of the hook tip to clear the end of the slot when said one panel is swung into corner forming position about its bottom fold line in flat condition, and in freedom of the hook tip to clear the end of the internal slot when the upper portion of said one wall panel is flexed relatively to said lower portion to raise the hook point, causing it to travel on an arc of a radius larger than the distance of

the end of the slot from the corner point while said one wall panel is in flexed condition.

2. Corner construction according to claim 1 in which the lock flap comprises a tab portion which extends beyond said internal slot, prevents that portion of the lock flap on which it is formed from passing through said slot when inserted therein, said tab being of a dimension sufficiently small to pass through said slot to the inside of the corner without permanent creasing of the board when forced past the edge of the slot by a force exerted in a direction substantially normal to the surface of said tab.

3. Corner construction according to claim 1 in which the lock flap comprises a tab portion which extends beyond said internal slot and is capable of being snapped from a position overlying the said other panel, past an edge of the slot, into a position underlying said other panel, said tab portion pointing in a direction substantially opposite to said hook portion.

4. A hinge cover folding box comprising a box body and a hinge cover articulated to said box body, said box body comprising a main bottom panel, four wall panels articulated thereto, and incorporating at each of its four corners the corner construction as defined in claim 1; the hinge cover comprising a cover panel articulated to one of the box body wall panels, and three cover flaps articulated to said cover panel to overlie the box body wall panels exclusive of said one of the box body wall panels, the height of said cover flaps being approximately one-half the height of the box body wall panels, considering the box in closed position.

5. A hinge cover folding box as claimed in claim 4 in which the height of each of the corner gusset panels, considering the gusset panels in corner forming position, is approximately one-half of the height of the box body wall panels which dimensioning makes the blank of the box fully dovetailing in a sheet of paperboard in which blanks are laid out in multiple.

6. In the method of forming an interlocked corner of a folding box, which box comprises a first and a second wall panel articulated to a bottom panel along bottom fold lines intersecting at a corner point, the wall panels being interconnected by a pair of gusset panels adjacent the corner point, one wall panel having a lock flap articulated thereto along its lateral edge which is to become the edge of the corner, said lock flap being foldable over, and insertable in an internal slot in, the other wall panel and comprising a hook portion the point of which is directed toward the bottom panel, considering the corner in assembled condition, the length of the hook portion being so great that the tip of the hook portion fails to clear the internal cut when the one wall panel is folded in flat condition into upright position with respect to said bottom panel, the steps of (a) flexing said one wall panel transversely, so as to cause its upper portion to which the lock flap is articulated to assume temporarily an angular disposition with respect to the lower portion to which the gusset panels are articulated, said flexing being of a degree sufficient for the hook tip to clear the internal slot to pass the corner inside, and then (b) flattening out said one wall panel so as to cause its upper and lower portion to lie in substantially the same plane in which flattened condition the hook tip fails to clear the internal slot.

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