

Dec. 25, 1951

R. B. MELLER

2,580,180

METHOD OF FOLDING CARTONS

Filed June 23, 1947

3 Sheets-Sheet 1

Fig. 1

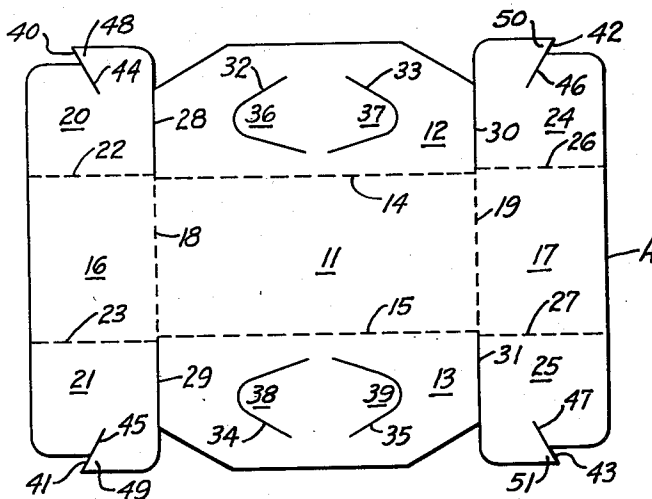


Fig. 2

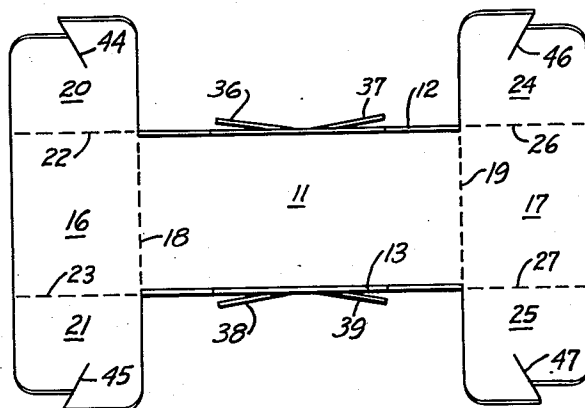
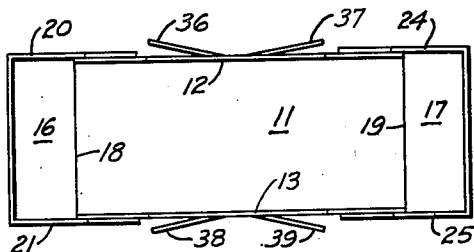


Fig. 3

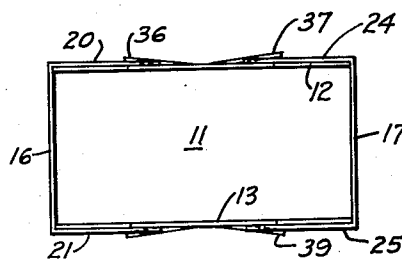


Fig. 4

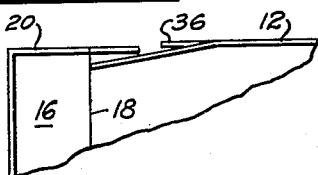


Fig. 3A

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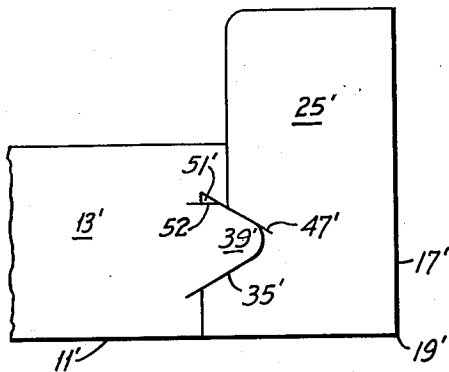


Fig. 6

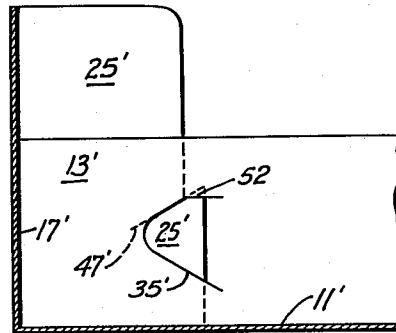


Fig. 7

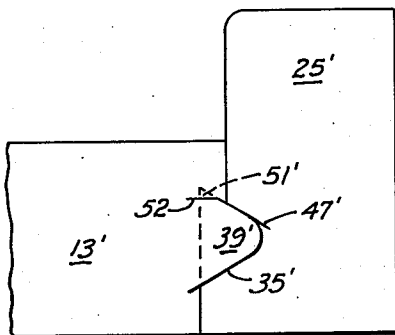


Fig. 8

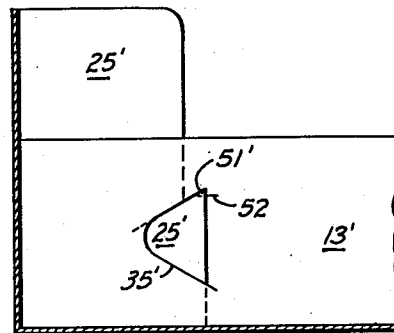


Fig. 9

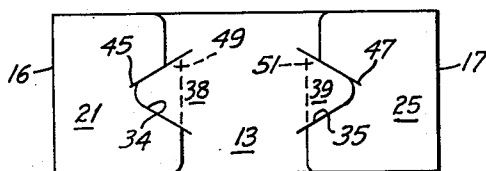


Fig. 5

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Fig. 10

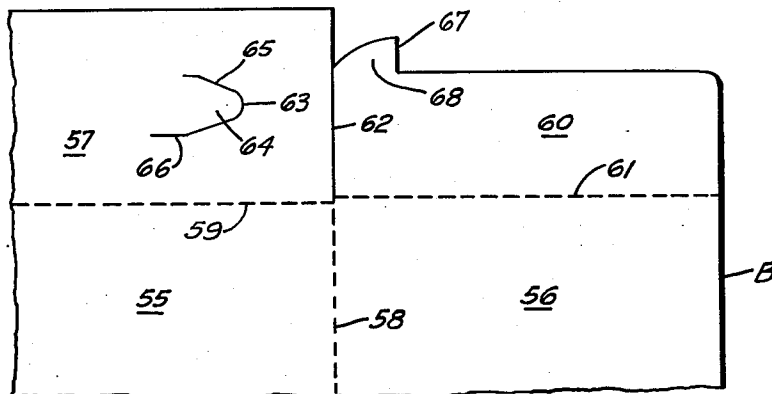


Fig. 11

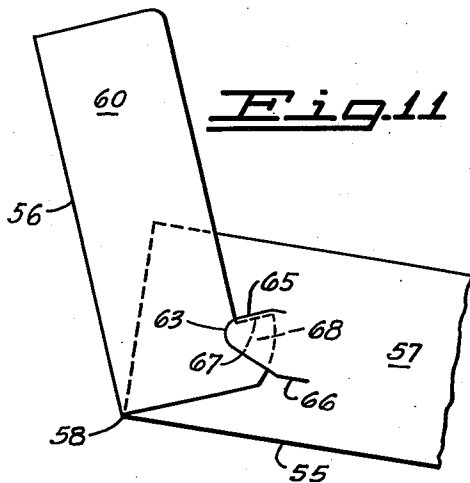
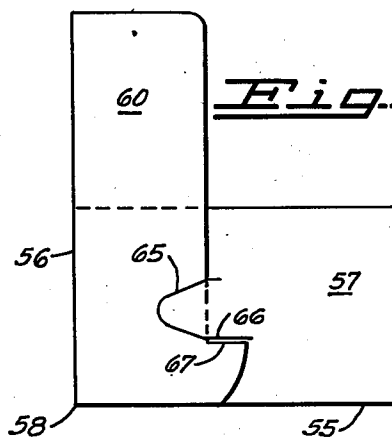


Fig. 12



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METHOD OF FOLDING CARTONS

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Application June 23, 1947, Serial No. 756,452

2 Claims. (Cl. 93—49)

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This invention provides a method of securing together panels of cartons, boxes, trays, or other structures formed from cardboard or paper-board blanks, hereinafter collectively referred to as "boxes" or "folding boxes."

The making of a folding box generally comprises folding of a scored and cut blank into hollow box form and securing certain portions or panels of the blank together in order to maintain the several portions of the blank in a definite folded position or relationship.

The majority of the presently used boxes are glued, that is, panels of the boxes are secured together by adhesive compositions which are generally applied during the folding process, and the folding and gluing operations are commonly performed on an automatic folding and gluing machine. Such machines are relatively complicated, expensive, require much floor space and are usually inflexible with regard to output, that is to say, a folding and gluing machine must generally be run at a pre-determined critical rate. This rate is so selected, among other factors, that glued portions of the box are maintained under pressure in the machine for a certain length of time until the glue sets. Speeding up of the machine ordinarily results in imperfect glue seams and other difficulties and reduction of the rate below the normal rate is uneconomical and frequently also results in imperfectly formed boxes. Starting and stopping of automatic gluing machines causes an appreciable waste of boxes and is, for this reason, avoided as much as possible.

For industries where the demand for folding boxes undergoes fluctuations a glued box is not the best suited box. Without attempting to exhaust all the reasons which make a glued box relatively undesirable in such instances, it may be mentioned that an automatic folding and glue machine cannot be operated economically unless it is operated continuously. If the demand for boxes drops, it becomes necessary to store empty boxes requiring a great amount of space. Also, where boxes are manufactured at a plant remote from that of the user of the box, for example the product manufacturer or distributor, hollow boxes must be shipped, which is comparatively uneconomical since most of the shipping space is occupied by air.

A relatively small percentage of presently used boxes are assembled by securing box panels together by rivets or staples. Riveted or stapled boxes have limitations which result in a correspondingly limited use of this type of box,

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In order to supply the demand of a trade where quantity requirements vary, for example, for the retail trade, boxes have been proposed and are in use in which panels are connected together by a so-called hook-lock, that is, by panels of certain configuration which can readily be hooked together after folding. Such hook locks are ordinarily weak, since the strength of the carton depends on the tear strength of the board at the hook lock, resulting in a box which is considerably weaker than a glued box made from the same kind of board.

The manual assembly of hook locks is time consuming and for this reason not suited for the production of boxes in considerable quantities. There have been proposed machines for the automatic assembly of hook lock boxes. Such machines, while increasing the numerical output of boxes do not produce a box which is any stronger than one assembled by hand and it is necessary to resort to the use of high grade board or to a thicker board than would be necessary if the box were glued.

This invention provides a novel method of interlocking panels of the folding box without the use of adhesive, staples or rivets and is particularly suited for the securing together of box panels at a box corner. However, the invention is not limited to such application, but may be employed wherever it is desired to interlock two panels of a folding box in overlapping relationship against movement about a hinge axis extending at an angle with respect to the surface of the panels.

The invention therefore lends itself to the interlocking of a panel connected to a box cover with a panel connected to a box bottom, as well as to the more common application calling for the interlock between a panel hinged to either the bottom or the top of a box with a panel hinged to a side wall of the box, as is the case in the formation of a box corner.

The interlock formed according to the present invention is particularly strong in that it does not subject the board to tearing, but employs, in distinction, an edge-to-edge interlock in which one cut edge on one panel engages a cut edge on the other panel along a substantial length, whereby the board is subjected to compression at the interlock rather than tearing. This is an important feature of the invention which makes the invention particularly valuable for boxes subject to moisture which, as well known, reduces the tear strength of the board considerably. The strength of interlocks formed according to the

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present invention is found to be far less affected by moisture than the conventional hook-lock.

The present invention utilizes the inherent stiffness of the board both in the forming of the interlock so that the stiffness of the board causes the interlocking portions of the blank to snap into engagement, as well as in the completed interlock in which the stiffness of the board tends to maintain the interengaging portions of the panel in interlocked position. This is a further advance over the conventional hook lock.

The various objects, features, and advantages of this invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, an application of the novel method to various forms of blanks. The invention also consists in certain new and original steps and combination of steps hereinafter set forth and claimed.

Although the characteristic features of this invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:

Figure 1 is a plan view of a flat blank prepared to be set up into box form according to the invention, the inside surface of the blank facing the observer;

Figure 2 is a plan view of the blank shown in Figure 1 in the process of assembly, the side walls being upright, and other panels being in partially folded position;

Figure 3 is a plan view of the blank of Figure 2 at a further advanced stage of assembly, shortly prior to the formation of interlocks between the several panels;

Figure 3a is a fragmentary view illustrating an alternative way of flexing certain panels and panel portions in forming the interlock;

Figure 4 is a plan view of the assembled box;

Figure 5 is a side view of the assembled box;

Figure 6 is an outside view of a corner portion of a folding box embodying the invention, the box panels being shown in semi-assembled position prior to the performance of a final step in locking the panels together;

Figure 7 is an inside view, partly in section, of the corner portion shown in Figure 6;

Figure 8 is an outside view of the corner portion shown in Figure 6 after performance of a final step of locking the panels together;

Figure 9 is an inside view, partly in section, of the corner portion shown in Figure 8; and

Figures 10, 11 and 12 illustrate in plan view and side views, respectively, an application of the invention to the forming of a corner portion of a box. Figures 10, 11 and 12 illustrating successive steps in the assembly.

In the following description and in the claims, various details of structure and method will be identified by specific names for convenience. The names, however, are intended to be as generic in their application as the art will permit. Like reference characters refer to like parts in the several figures of the drawings.

In the drawings accompanying, and forming part of, this specification, certain specific disclosure of the invention is made for the purpose of explanation of broader aspects of the invention, but it is understood that details may be

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modified in various respects without departure from the principles of the invention, that the several steps of the method may be modified, and that the invention may be applied to the forming of other kinds of box structures than the ones shown.

A blank A shown in Figure 1 is substantially rectangular in outline resulting in a minimum waste of material. The blank may be cut from a large sheet or roll of paperboard or other suitable, foldable material and scored, in multiple, on an automatic cutting and scoring machine. Only one side of the blank need be decoratively finished or imprinted since only one side of the blank appears as the outside of the finished box.

The blank A is subdivided by several scored fold lines to provide a bottom panel 11 to which side wall panels 12 and 13 are hinged along fold lines 14 and 15. End panels 16 and 17 are hingedly connected to the bottom panel 11 along fold lines 18 and 19, respectively. Lock panels 20 and 21 are hingedly connected to the end panel 16 along side fold lines 22 and 23, respectively. The fold lines 22 and 23 are either aligned with, or parallel and slightly offset with respect to, the bottom fold lines 14 and 15 to compensate for the thickness of the board in the succeeding folding operations, as is customary in the art.

Lock panels 24 and 25 are hingedly connected to the end panel 17 along side fold lines 26 and 27 in a similar manner as just described. The lock panels 20, 21, 24 and 25 are separated from the side panels 12 and 13 by cuts 28, 29, 30 and 31, respectively, each of the cuts extending to the intersections of fold lines 14 and 15 with the fold lines 18 and 19.

According to the present invention the side panels 12 and 13 are internally severed by cut lines 32, 33, 34 and 35, whereby internal tongues 36, 37, 38 and 39 are formed in the panels, each tongue being resiliently deflectable with respect to the remainder of the panel from which it is cut.

Cut edges 40, 41, 42 and 43 are formed on the lock panels 20, 21, 24 and 25 by external cuts 44, 45, 46, and 47 extending into the body of the lock panels from outer edges. The orientation, length and shape of the cuts 44, 45, 46 and 47 is such that the cut edges formed thereby will upon assembly of the blank into box form move into alignment with portions of the internal cuts 32, 33, 34 and 35, so that an edge to edge engagement will result therebetween as will hereinafter become apparent. The portions of the panels 20, 21, 24 and 25 lying to either side of the cuts 44, 45, 46 and 47, respectively, are also deflectable with respect to each other.

The formation of a box from the blank A may proceed as follows:

The side panels 12 and 13 are first folded about their respective bottom fold lines 14 and 15 into substantially upright position with respect to the bottom panel 11, as shown in Figure 2. The end panels 16 and 17 are also folded about their respective fold lines 18 and 19 towards their ultimate upright position, and substantially simultaneously the lock panels 20 and 21 and the lock panels 24 and 25 are folded with respect to the end panels 16 and 17 to which they are hinged along the side fold lines 22, 23, and 26, 27, respectively, until they lie face to face with the side wall panels 12 and 13 as indicated in Figure 3.

The internal tongues 36, 37, 38 and 39 are flexed with respect to the remainder of the wall panels 12 and 13 in which they are formed, as

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illustrated in Figure 3, or the end portion of the wall panels 12 and 13 are flexed with respect to the internal tongue, as shown in Figure 3a, whereby wedge-shaped spaces are formed between the internal tongues and the side wall panels into which the lock panels 20, 21, 24 and 25 may be moved. Such movement in the illustrated form of box involves swinging movement of the lock panels 20, 21, 24 and 25, together with the end wall panels 16 and 17 about the fold lines 18 and 19 as a hinge axis, so that the lock panels 20, 21, 24 and 25 enter the wedge-shaped spaces bottom edge first, the bottom edge being formed by the cuts 28, 29, 30 and 31.

As soon as the lock panels have entered the wedge-shaped spaces formed by the internal tongues 36, 37, 38 and 39 and the remainder of the side wall panels 12 and 13, the internal tongues are released permitting the tongues, by reason of the resiliency inherent in the board, to return towards the planes of the respective side wall panels in which they are formed.

The resiliency causes the internal tongues to bear down upon the respective lock panels. When the end panels 16 and 17 reach a position upright with respect to the bottom panel 11, the external cuts 44, 45, 46 and 47 move into alignment with portions of the internal cuts 32, 33, 34 and 35, as shown in Figure 5. The internal cuts 32, 33, 34 and 35 are each respectively at an angle of 90° to each of the cuts 44, 45, 46 and 47 and the respective panels each stand at an angle of 90° with respect to bottom panel 11. When the side and end panels are to be in other than a 90° relationship, the respective cuts are provided in the panels in such angular relationship to one another to permit the desired relationship to be established when the cuts are interengaged.

In the interengaged position, the cut edges are so disposed that the one end of the internal cut lies to one side of the portion of interlock and that the end of the interengaged external cut closest to the body of the other panel lies on the other side of the portion of interlock. This particular disposition of the cuts results in deflection of portions of the side wall panel as well as portions of the lock panels. Referring briefly to Figure 1, it is easily apparent that the internal tongue 38 will exert least resistance to a force tending to deflect it with respect to the remainder of the side wall 13, if the force is applied near the tip of the tongue 38, than if it were applied near the root of the tongue, that is, near the ends of the cut 34. Similarly, it is quite apparent that the two portions of the lock panel 21 lying to either side of the external cut 45 are more easily deflected by a force applied near the outer end of the cut, than if the same force were applied near the inner end of the cut 45 where the cut ends in the body of the panel 21.

The interlock produced according to the present invention has the peculiar feature that the portion of the internal tongue near the tip of the tongue, where it is most easily deflected lies next to a portion of the lock panel adjacent the inner end of the cut where the portions of the lock panel offer much resistance to deflection. More particularly, the portion of the internal tongue 38 near the tip of the tongue, where it is most easily deflected, lies next to a portion of the lock panel 21 adjacent the inner end of the cut 45, where the portions of the lock panel offer much resistance to deflection. Similarly, the root of the tongue 38 lies adjacent to the end portion

49 of the lock panel 21, where the lock panel is most easily deflected.

In interlocked position, each lock panel overlies the respective side wall panel, but is threaded through the respective internal cut and therefore underlies partly the internal tongue formed by the internal cut. This causes the end portions 48, 49, 50 and 51 of the lock panels 20, 21, 24 and 25 to be deflected into the plane of the respective side wall panels 12 and 13. More specifically, the end portion 49 of the lock panel 21 is deflected into the plane of the side wall panel 13 and the tip portion of the tongue 38 is deflected into the plane of the lock panel 21 whereby a full edge to edge engagement is formed between the side wall and the lock panel 21.

The inherent resiliency of the stock is thus utilized causing cut edges of the side wall panels to snap into engagement with cut edges on the lock panel and the resiliency of the stock is further utilized in maintaining the edges in engagement.

The resultant interlock is positive, substantially free from play or lost motion, and is extremely resistant to re-opening caused by pressure of the box contents bearing against its side and end walls. The pressure of the contents against the box walls merely results in an increased edge-to-edge pressure along the portion of interlock in a direction in which the board is most resistant to force. The interconnection produced between carton panels according to this invention is comparable in strength to a glue connection between the interlock panels.

Figures 6, 7, 8 and 9 illustrate a modification of the present invention. Briefly, the modification comprises the steps hereinbefore described in connection with the blank and box shown in Figures 1 to 5 and comprises, in addition, further steps resulting in an additional lock or interconnection.

Because of the similarity of the box structure of Figures 6 to 9 with the box structure of Figures 1 to 5 and because of the similarity of the method steps employed setting up the box, primed reference numerals are used in Figures 6 to 9 corresponding, except for the primes, to the reference numerals used in Figures 1 to 5. For reasons of simplicity, only one corner of the box is shown.

The structure shown in Figure 6 comprises a bottom wall 11' to which an end panel 17' is hinged along a bottom fold line 19'. The lock panel 25' has an external cut 47' therein, the protruding end portion of the lock panel being visible at 51'. The side wall panel 13' has an internal cut 35' therein forming an internal tongue 39'. In the position shown in Figure 6, the lock panel 25' overlies the side wall panel 13' to either side of the internal tongue 39' and underlies the internal tongue 39'.

The configuration of the internal cut 35' differs from that shown in Figures 1 to 5 in that one end of the internal cut extends at an angle at 52. As a result, the end portion 51' of the lock panel 25' forms a tab portion which extends slightly beyond the confines of the tongue 39' and overlies the outside surface of the side wall panel 13' after performance of steps previously described in connection with the box shown in Figures 1 to 5.

As a final step the tab 51' is forced from the position in which it overlies the side wall panel 13' as shown in Figures 6 and 7 through the internal cut 35' into a position in which the tab 51'

underlies the side wall panel 13' as shown in Figures 8 and 9. In this position, the tab portion 51' positively, and without the assistance of resiliency of the boxboard maintains a portion of the lock panel 25' deflected into the plane of the side wall panel 13' whereby an edge-to-edge engagement between the side wall 13' and the lock panel 25' is securely maintained. The interconnection shown in Figures 6 to 9 is particularly suited for low grade board, such as chipboard.

Figures 10 to 12 illustrate a further modification of the present method by which an interlock is formed between two overlapping panels in which two successive edge-to-edge interlocks are formed as one panel is moved with respect to the other panel about a hinge axis. For the sake of brevity, only sufficient structure of the blank is shown as is necessary for forming a box corner. The blank B shown in Figure 10 comprises a bottom panel 55 to which an end panel 56 and a side wall panel 57 are hinged along bottom fold lines 58 and 59. The end panel 56 has a lock panel 60 hingably connected to it along a side fold line 61. The lock panel is separated from the side panel 57 by a cut 62 extending to the intersection of the bottom fold line 58 with the side fold line 61. An internal cut 63 forms an internal tongue 64 in the side wall panel 57. Two portions of the internal cut 63 are identified as 65 and 66 for reasons which will become apparent hereinafter. A cut edge 67 is formed on the lock panel 60 as an outside edge on the blank. The cut edge 67 forms a border of the projecting external tongue 68.

The blank B is assembled by folding the several panels about their respective fold lines 58, 59 and 60 and by insertion of the external tongues 68 underneath the internal tongue 64, which is being deflected with respect to the remainder of the side wall panel 57.

After threading of the external tongue 68 through the internal cut 63, the internal tongue 64 is being released, causing the internal tongue 64 to bear resiliently upon the external tongue 68. The resiliency of the board causes the lock panel to snap into edge to edge engagement with the side wall panel 57 when the edge 67 on the external tongue 68 moves past the portion 65 of the internal cut 64. This position is shown in Figure 11. The intermediate stage of assembly of the blank thus arrived at, permits convenient filling of the box with merchandise whereafter the lock is finally completed by further swinging the end panel about the fold line 58 until the edge 67 snaps into edge-to-edge engagement with the portion 66 of the internal cut 63. The final interlock is shown in Figure 12.

The invention thus provides a convenient, inexpensive and secure interlock between carton panels which, with respect to rigidity and reliability is comparable to a glued connection. The interlock is formed solely by the board itself from which the box is formed, advantage being taken of the stiffness and the resiliency of the board in forming and maintaining the interlock. The invention is adapted to boxes designed for manual assembly as well as to boxes designed for automatic assembly at a rapid rate.

The present invention may be practiced on simple and relatively inexpensive automatic machinery which may be operated at low as well as at extremely high rates of speed. The equipment may be started and stopped, accelerated or slowed according to requirements without affecting the quality and reliability of the interlock. Because of these features, the invention lends itself ad-

mirably to the mass production of boxes with relatively inexpensive equipment and thus fills a need which has long existed, but never before been supplied.

Obviously, the present invention is not restricted to the specific forms of blanks illustrated and described, nor is it restricted to the specific steps or the sequence of steps disclosed.

Whereas the present invention has been explained by reference to boxes in which the wall panels form ninety degree angles with respect to one another, it should be apparent that the invention may also be applied to the manufacture of boxes in which the angle between panels is greater or less than ninety degrees. Also, it is obvious that instead of providing the end panel of a box with a lock panel which is interlocked with a side wall, the lock panel may be hinged to the side wall and locked to the end wall, or quite generally be hinged to any wall and locked to another wall which lies face to face with the lock panel. Such applications are evident to persons skilled in the art after becoming acquainted with the principles of the present invention.

Thus, various additions, omissions, modifications, substitutions and other changes may be made without departing from the spirit and from the essence of this invention.

I claim:

1. The method of assembling, without the use of extraneous means, such as staples or adhesive, in rigid corner forming relationship the corner portion of a flat box blank including, a main panel, two wall panels integral with, and hinged to, said main panel along fold lines forming an angle with each other, and a lock flap integral with, and hinged to, one of said wall panels along a side edge of said panel, the method comprising, severing the other panel by an internal cut of bent outline to form an internal tongue in said other panel extending towards the corner in the assembled blank, the tongue being resiliently deflectable with respect to the remainder of the other panel; cutting said flap by an external cut extending into the body of the flap from an outer edge of the flap, said external cut coinciding in the assembled corner with a portion of said internal cut, said external cut forming an external deflectable portion on said flap; deflecting said tongue relatively to the remainder of said other panel to form a wedge-shaped slit in said other panel; folding said wall panels towards an upright position with respect to said main panel and folding said flaps sufficiently close to said other panel to move into the opened cut in a direction toward the main panel in substantially face to face position with said other panel until a portion of said internal cut is in register with a portion of the external cut, in a position in which the deflectable flap portion underlies said tongue and the remainder of the flap overlies said other panel beyond the confines of said tongue, in which position also the one end of the internal cut closest to the portion of register lies to one side of the portion of register and the inner end of said external cut lies on the other side of the portion of register; and then releasing said tongue resiliently to bear against the underlying portion of said flap urging said flap edge into edge to edge interlocking engagement with the internal cut, whereby a multiple interlock is formed holding the panels in rigid corner forming position, the interlock including an edge to edge engagement sustaining compressive stress, and an interlacing engagement re-

sisting separation of the flap and the other panel lying face to face with the flap, the inherent stiffness of the stock being utilized for automatically maintaining the interlock in edge to edge engaging position.

2. The method of assembling, without the use of extraneous means, such as staples or adhesive, in rigid corner forming relationship the corner portion of a flat box blank including, a main panel, two wall panels integral with, and hinged to, said main panel along foldlines forming an angle with each other, and a lock flap integral with, and hinged to, one of said wall panels along a side edge of said panel, the method comprising, severing the other panel by an integral cut of bent outline to form an integral tongue in said other panel extending towards the corner in the assembled blank, the tongue being resiliently deflectable with respect to the remainder of the other panel; cutting said flap by an external cut extending into the body of the flap from an outer edge of the flap, the external cut coinciding in the assembled corner with a portion of said internal cut and forming an external tongue on said flap deflectable with respect to the remainder of the flap and including a tab portion extending beyond the confines of said tongue to overlie a portion of the said remainder of the other panel if the flap is placed face to face over said other panel in the position in which the flap is to be interlocked with the other panel; deflecting said tongue relatively to the remainder of said other panel to form a wedge shaped slit in said other panel; folding said wall panels towards an upright position with respect to said main panel and folding said flap sufficiently close to said other panel to move into the opened cut in substantially face to face position with said other

panel in a direction toward said main panel until a portion of said internal cut is in register with a portion of the internal cut, in a position in which the external tongue underlies said internal tongue and the remainder of the flap overlies said other panel beyond the confines of said tongue, said tab portion also overlying said other panel; then releasing said tongue resiliently to bear against the underlying portion of said flap, and then forcing said tab from the position overlying said other panel, through said internal cut, into a position in which the tab underlies said other panel, while maintaining said cuts in register, thereby urging said flap edge into edge to edge interlocking engagement with the internal cut, whereby a multiple interlock is formed holding the panels in rigid corner forming position the interlock including an edge to edge engagement sustaining compressive stress, and an interlacing engagement resisting separation of the flap and the other panel lying face to face with the flap, the inherent stiffness of the stock being utilized for automatically maintaining the interlock in edge to edge engaging position.

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