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TRAY FORMING METHOD AND APPARATUS

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4 Sheets—Sheet 2

FIG. 2

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The present invention relates principally to an "in-line" apparatus and method for forming trays from paperboard blanks.

The apparatus in accordance with the present invention is comprised of a hopper for holding the paperboard blanks, a glue dabling apparatus for applying controlled quantities of adhesive to preselected areas of the blank, a die cavity and a mandrel for removing a blank from the hopper and for forming the blank into the die cavity where it is folded and formed into a tray. The basic principles and structures of the glue dabling apparatus and die cavity are disclosed in my copending application Ser. No. 832,782 filed June 12, 1969, entitled "Glue Dbbing and Tray Forming Method and Apparatus."

The present tray forming apparatus has an "in-line" arrangement in that the mandrel is positioned between the hopper and the die cavity, preferably vertically above the die cavity. Subsequent to the deposition of adhesive on the blank by the glue dabling apparatus, the mandrel removes the glued blank from the hopper and by a combination of rotational and linear movement, moves the glued blank into the die cavity. Both the die cavity and mandrel then come into contact with each other to fold the blank into a finished tray.

Without the "in-line" arrangement of the present invention, the movement of the glue dabling apparatus and mandrel has been mechanically driven and controlled. A mechanical drive generally requires mechanical linkage connections between the glue dabling apparatus and mandrel to permit the proper sequence of operation of these parts. Very heavy moveable supports are usually required to assure proper mandrel operation and somewhat complicated mechanical structures are needed for rotating and moving the mandrel and its support. Such a system is depicted in the embodiment described in my copending application Ser. No. 832,782.

It has now been found that when the mandrel is constructed in an "in-line" arrangement and driven by hydraulic means it is possible to eliminate the heavy moveable mandrel supports and eliminate the complicated mechanical structures needed to move the mandrel between the hopper and die cavity. This results in a large reduction in the cost of the apparatus. The elimination of the heavy supports decreases the inertia load on the apparatus drive system thereby increasing the number of trays that the apparatus can fold from about 20 to about 60 per minute. Both the glue dabling apparatus and mandrel motion are controlled by separate hydraulic cylinders which may be self contained units or units that are fed hydraulic fluid through a plurality of control valves which in turn control the motion of the hydraulic cylinders.

In a preferred embodiment, the mandrel is slidably mounted in a bushing block which is in turn mounted in fixed position on a rotatable shaft. Sliding movement of the mandrel and rotational movement of the mandrel and bushing block is controlled by a second hydraulic cylinder which rotates the shaft to which the bushing block and mandrel are mounted between a first position in which the mandrel is facing the hopper and a second position in which the mandrel is facing the die cavity. Linear movement to the extremes in each of the two positions is controlled by the first hydraulic cylinder.

The use of separate hydraulic cylinders to control the rotation and linear movement of the mandrel makes it possible to position the hopper at an angle to the vertical which is not generally possible with a mechanical drive system. In the mechanical drive systems, the linear movement of the mandrel is generally confined to a vertical path due to a practical design consideration. Placing the hopper at an angle, preferably about 45 degrees from the vertical permits one side of the hopper to act as a support for the blanks, thereby permitting thinner blanks to be stacked within the hopper without danger of the blanks buckling.

The movement of the glue dabling and mandrel may be controlled electrically or by pneumatics instead of hydraulically. However, the cost of electrical apparatus to control dabling and mandrel movement is significantly greater than the simple hydraulic drive means and is therefore not as desirable.

Reverting now to the drawings which depict a preferred embodiment of the invention and in which like numerals refer to like parts:

FIG. 1 is a schematic diagram of a hydraulically operated tray forming apparatus;

FIG. 2 is a partial side view of the apparatus of FIG. 1 taken along line 2—2 thereof in which the components for moving the glue dabling apparatus have been eliminated for the sake of clarity;

FIG. 3 is a partial schematic view of the dabling arrangement of the FIG. 1 embodiment;

FIG. 4 is a sectional view of the glue fountain assembly of FIG. 1;

FIG. 5 is a detail view of the dabling of FIG. 4;

FIGS. 6–8 depict a blank in the various stages of its formation into a tray.

FIG. 9 is a detail view of the preformer plates taken along line 9–9 of FIG. 1.

FIG. 1 is a schematic representation of a hydraulically operated tray former apparatus. 10. A plurality of paperboard blanks 11 which may or may not be varnished are carried in a hopper 12 which has conventional means (not shown) for adjusting its internal dimensions to adapt the hopper for different size blanks.

The first step in the tray forming process performed by the depicted apparatus is the application of adhesive to the blank. 11 at preselected points. The application of adhesive to the blank is achieved by the glue dabling apparatus shown in FIGS. 1–5 in which 13 is a glue tank, 14 is a glue fountain, 15 is a solenoid valve and 16 is a glue spotter.

Glue tank 13 is a conventional type tank having an opening at the top which is closed by removable screw means 13a through which adhesive is added to the tank. Glue tank 13 has a bottom opening 17 to allow adhesive to exit from the tank. The adhesive used is preferably a water based emulsion such as polyvinyl acetate or any of the dextrin family of adhesives. Connected to the opening 17 is a feed line 18 which is in fluid communication with a conventional solenoid valve 15. Adhesive from tank 13 is fed under pressure to the solenoid valve 15 by means of the height differential between the tank 13 and the solenoid valve 15. A feed line 19 is connected...
in fluid communication between the solenoid valve 15 and glue fountain 14 whereby the solenoid valve regulates the flow of adhesive between the glue tank 13 and fountain 14. In place of a height differential between the tank and fountain, a conventional pressure pump may be used to supply adhesive under pressure to the glue fountain.

The solenoid valve 15 is adapted for intermittently allowing the adhesive to flow from tank 13 to fountain 14, and preferably operates to permit flow once for each blank. However, if a continuous flow of adhesive is desired, the solenoid valve may be set to remain continuously open or it may be removed from the system altogether.

Glue fountain 14 (FIG. 4) is comprised of a solid block of metal 20 which has a bore 21 therein. One end of bore 21 is threaded at 22 to receive a complementary threaded nut 23 to which line 19 is connected for the feeding of adhesive from solenoid 15 to the glue fountain. Mounted at the bottom of block 20 is a block of natural sponge or sponge rubber 24 which receives the adhesive and is held in place against block 20 by mask 25. Mask 25 has an annular, inwardly extending flange 26 and an opening 27 therein. The flange 26 is longer than block 20 and sponge 24 and the mask is fixedly mounted on block 20 by conventional screw means 27. Sponge 24 is fed adhesive through bore 21 which preferably deposits the adhesive near the center of sponge 24 to aid in achieving the uniform distribution of adhesive throughout the sponge. Mounted on flange 26 by adhesive or any other suitable means is an annulus of sealing material 28, such as Teflon, the purpose of which will be described below. The block 20 has a bore 29 therein for slidably accepting a shaft 30 on which the glue fountain may be moved closer to or farther from the hopper to control the glue fountain with spotter movement should the position of the spotters be changed.

Spotter 16 (FIG. 5) is comprised of a solid block of material 31 such as steel or hard rubber. Spotter 16 has a raised upper surface 32 which preferably has a cross hatched or etched surface (not shown) for better distribution of adhesive on the surface. Surface 32 is of smaller dimensions than block 31 and its dimensions must be equal to or less than the dimensions of opening 26 in mask 25 (FIG. 4) to permit the raised surface 32 to enter the mask opening 26 and contact the sponge 24. The dimensions of the block 31 must be smaller than the dimensions of opening 26 in mask 25. The difference in dimensions between raised surface 32 and spotter block 31 forms a shoulder 33 at the juncture between the raised surface and the spotter block to which is mounted an annulus of sealing material 34, preferably Teflon. In operation, adhesive is transferred from glue fountain 14 to the surface 32 of the spotter by contacting surface 32 to sponge 24 to slightly compress the sponge to force adhesive to transfer to the raised surface of the spotter. For best results, it is preferred that sealing material 34 be in contact with sealing material 28 on the glue fountain to prevent leakage of adhesive from the sponge along the sides of the spotter during compression of the sponge. The amount of adhesive transferred from the sponge to the spotter is controlled by the amount of adhesive present in the sponge and the amount of compression thereof by the spotter. The raised surface 32 of the spotter may be separate from block 31 and mounted thereon by conventional spring means (not shown). In this manner, the raised surface 32 of the spotter will adjust itself to compensate for any angular irregularity in the position of the fountain or of the blank in the hopper. Alternatively, block 31 may be cut along a line parallel to the spotter to cut portions of block 31 being connected to spring means to permit the whole upper portion of the block 31 to adjust itself to compensate for any such irregularities.

The structure of the spotter and glue fountain permits sealing of the glue fountain by the spotter during periods in which the machine is not operating to prevent the setting of adhesive within the glue fountain. This is achieved by the sealing material 28 of the glue fountain being contacted and pressed by the sealing material 34 carried on shoulder 33 of the spotter. In this manner, air is kept out of the glue fountain. Glue fountain 14 may be constructed without the use of a mask by simply bonding the sponge 24 to the block 20 and the spotter may be constructed without a raised surface or shoulder if the advantages of permitting the machine to remain idle without attendant setting of adhesive in the glue fountain and of preventing flow of adhesive along the sides of the spotters are not wanted or needed.

Hopper 12 is at a 45° angle to the vertical as shown in FIG. 2 to permit the stacking of thin, paperboard therein without buckling. The hopper angle may be set to any angle as long as the blanks carried in the hopper do not buckle.

Referring now to FIGS. 1 and 3, there is shown a preferred manner of moving the spotters between the glue fountains 14 and blank 11. Each of the spotters 16 (four in the particular embodiment of which only two are shown in FIG. 1) is provided with conventional means to shafts 35. Ends 36 ad 37 extend beyond the spotter 16. Rotatably mounted to end 36 is a crank arm 38 which is in turn fixedly mounted to rotateable gear 39. Gear 39 is rotatably mounted to support 40 and is positioned to engage a tooth rack 41. Rack 41 rests on idler roller 42 which assures that the rack is always in engagement with gear 39. Supports 40, gears 39, shafts 35 and spotters 16 are on the same angle as hopper 12.

Rack 41 is fixedly connected by conventional means to a second rack 43 by spacer block 44. The rack 43, in contrast to rack 41, engages the upper surface of its associated gear 39 rather than the lower surface thereof. The reason for this will be explained below. A second glue spotter 16 is mounted and moved by gear 39 between its associated glue fountain and the blank as described hereinbelow.

Spotters 16 must move between glue fountain 14 to pick up adhesive and blank 11 where the adhesive carried by the spotter is deposited on the blank. To achieve this in the embodiment depicted in FIG. 1, the right and left hand spotters must rotate in opposite directions from the position which it contacts the glue fountain. The opposite direction movement of the spotters is achieved by the hydraulic cylinder 45 which has an extensible shaft 46 fixedly connected to rack 41. Hydraulic withdrawal of shaft 46 rightwardly in FIGS. 1 and 3 urges the rack 41 and 43 rightwardly in FIGS. 1 and 3. The rightward movement of rack 41 causes gear 39 which is associated therewith to rotate counterclockwise, thereby rotating the right spotter 16 counterclockwise into contact with its associated glue fountain. Rightward movement of rack 43 causes clockwise movement of the gear 39 associated with rack 43 and consequent clockwise rotation of the left spotter into contact with its associated glue fountain. In reverse, extension of shaft 46 when the spotters are in contact with the glue fountains will cause the spotters to rotate into contact with the blank to apply adhesive thereto at 47 as shown in FIG. 6.

In order to provide controlled rotation of the spotters in crank arm 38 to keep them upright and to provide additional support for the spotters, an extensible member 48 is fixedly connected to extension 37 of both right and left spotters. This assures that the raised surface 32 of the spotters will always be properly oriented in upright position for contact on both the sponge and blank. The rotation of the spotters may be controlled separately by removing spacer block 44 and independently moving each rack by a separate hydraulic cylinder or by conventional means capable of hydraulic operation such
as crank shaft arrangement. Also, each pair of opposed crank arms 58 i.e. the two right or left hand crank arms as seen in FIG. 3 are fixedly connected to each other as by a cross bar not shown whereby only one hydraulic cylinder and one rack and pinion assembly need be utilized instead of two as shown.

Referring now to FIGS. 1 and 2, there is seen a mandrel 49 having a plurality of suction cups 50 therein for removing blanks 11 from hopper 12. Suction cups 50 may be conventional rubber contact cups or simple openings in which a vacuum is induced by conventional mechanical pump or fan means (not shown). Mandrel 49 is fixedly mounted by conventional means (not shown) to extensible hydraulic cylinder shaft 51 which is in turn a part of hydraulic cylinder 52. Hydraulic cylinder 52 is fixedly mounted to a bushing block 53 which has a bore 54 therein through which the shaft 51 slidably extends. Bushing block 53 also has two additional bores 55, 56 therein in which mandrel guide shafts 57, 58 respectively are slidably mounted. Guide shafts 57, 58 are present only for stabilization of the mandrel in its movement as hereinafter described.

Bushing block 53 is fixedly mounted by conventional means to a pair of rotary shafts 59, 60 which are journalled in side frames 61, 62 of the tray former apparatus respectively. Shaft 60 extends through side frame 62 and is fixedly connected in conventional manner to a rotatable toothed gear 63 (FIG. 2). Moveably mounted to side frame 62 is a toothed rack 64 which is supported on a plurality of idler rolls 65. The teeth of rack 64 engage the teeth of gear 63. A hydraulic cylinder 66 is mounted by conventional means to the side frame 62. The cylinder 66 has an extensible shaft 67 which is fixedly connected to rack 64 by conventional means. When the mandrel is in the position shown in FIG. 1, extension of shaft 7 causes leftward movement of rack 64 as seen in FIG. 2 which in turn rotates gear 63 clockwise to thereby rotate mandrel 49 clockwise. In this manner, the mandrel is rotated between a first position in which it faces the hopper 12 and a second position in which it faces die cavity 70 (FIG. 1). A stop 68 is adjustable positioned on side frame 62 and in slot 63 by screw means 69 to limit the movement of rack 64 and thereby the maximum amount of rotation of mandrel 49. Any hydraulically operated means other than described such as a conventional crank and gear arrangement may be used to rotate the shaft 60.

In operation, the glue spotters 16 are rotated into contact with blank 11 in hopper 12 to deposit adhesive on preheat area of the blank (FIG. 6). Spotters 16 are then rotated away from blank 11 and into contact with glue spotters 14 for the twofold purpose of leaving the blank unobstructed and preventing the adhesive from setting in the glue fountain. After the spotters 16 have been rotated away from blank 11, the mandrel 49 is in the position shown in FIG. 1 with the sole exception that at this time, it will not be carrying a blank. Mandrel 49 is rotated in clockwise direction by rightward movement of shaft 67 of hydraulic cylinder 66 (FIG. 2) to rotate gear 63 and shaft 60 until rack 64 contacts stop 68. At this point, the mandrel surface containing suction cups 50 is facing the hopper 12 and is positioned under the just glued blank 11. When the mandrel is in this position, hydraulic cylinder 52 is operated to extend shaft 51 and thereby extend mandrel 49 until it contacts the blank 11 and the suction cups 50 have been compressed sufficiently to hold the blank 11 by suction. The mandrel and blank are then withdrawn from the hopper by operation of hydraulic cylinder 52 to retract shaft 51 and the mandrel and blank are then rotated in counter-clockwise direction to the position just above die cavity 70 as shown in FIG. 1 by retracting of shaft 67 by hydraulic cylinder 66 (FIG. 2). Positioned above die cavity 70 are a pair of preformer plates 71 (FIG. 9) which have a plurality of flanges 72 thereon. Flanges 72 fold flaps 73 (FIG. 6) upwardly as the mandrel 49 pushes blank 11 between the preformer plates. Edges 70a of each of these flaps 80 to less than a vertical position as shown in FIG. 7. A greater amount of folding is given to flaps 73 by preformer plates 71 than to end flaps 80 to prevent contact of adhesive 47 by end flaps 73.

Each preformer plate 71 is fixedly mounted to a bolster 75 which in turn is slidably mounted to a pair of opposed shafts 76 (two of four shown). Bolster 75 is capable of movement towards and away from the die cavity 70 to permit the die cavity to be changed or adjusted for various size trays. Conventional means such as thumb screws (not shown) are used for fixing the bolsters 75 in predetermined position on shafts 76.

Die cavity 70 is positioned inwardly of bolsters 75 and below preformer plates 71 and is comprised of pressure plates 77 which are slidably mounted to shafts 76. For best results, the spacing between pressure plates 77 is made approximately equal to or less than the distance between edges 70a of preformer plates 71 so that the pressure plates 77 will at least hold the degree of fold given to end flaps 80 by the preformer plates 71.

Slidably mounted to pressure plates 77 are two pairs of forming bars 78, 79 which initiate folding of end flaps 74 (FIGS. 6 and 7). Forming bars 78 fold end flaps 74 to an angle of degree angle and forming bars 79 to complete the folding of end flaps 74 to a substantially vertical position. For best results, forming bars 78 are positioned below preformer plates 71 a distance less than the projected vertical length of partially folded flap 73 so that the folding of end flaps 74 will begin while flaps 73 are still in a folded position.

The continuous folding of end flaps 74 alleviates the possibility of the blank ripping during the initiation of folding which may happen if forming bars 78 are set so as to immediately fold end flaps 74 to a vertical position. Positioned between forming bars 79 is an additional forming bar 79x whose function is simply to help retain the degree of fold given to end flaps 74 by forming bar 79. However, only one forming bar may be used if desired. Also, more than two forming bars may be used if more gradual folding is desired.

As mandrel 49 continues its movement into die cavity 70, blank 11 is brought into contact with former plates 81 which fold end flaps 74 an additional amount. Former plates 81 are fixedly mounted to pressure plates 77 and are spaced apart an amount sufficient to permit a clearance of approximately 1/8 inch or greater to remain between end flaps 80 and plates 73 during mandrel movement to prevent flaps 73 from destroying the fidelity of the deposited adhesive 47. To keep the proper separation pressure between former plates 81, conventional springs 82 are provided to urge the former plates outwardly from the die cavity 70 to a position determined by hydraulic pressure cylinders 83 which act as stops for pressure plates 77.

Mandrel 49 urges blank 11 into the die cavity until the edge of each end flap 74 is below strippers 84. Stripper 84 are rotatably mounted to pressure plates 77 in conventional manner and are biased inwardly and into the die cavity by conventional springs 85 (FIG. 2). Stripper means 84 are rotated outwardly out of the die cavity by movement of the blank and mandrel into the die cavity until the edges of end flaps 74 of the blank are below the stripper means. When this occurs, springs 85 urge strippers 84 inwardly over the edge of the flaps for reasons described hereinbelow. At this point, downward movement of the mandrel is stopped and hydraulic cylinders 83 are actuated to urge pressure plates 77 and former plates 81 inwardly to remove the clearance between end flaps 80 and flaps 73 and to press flaps 73 against the mandrel with at least 1000 p.s.i. of pressure for at least 1/2 second and preferably for 1/4 second or more to cause the adhesive 47 to penetrate the substrata of the paperboard. The application of such
high pressures causes the adhesive to assume properties not unlike those of a pressure sensitive adhesive whereby a primary bond between flaps 73 and end flaps 80 is achieved before the adhesive has set. The formed tray is shown in FIG. 8.

After the primary bond has been achieved, hydraulic cylinders 83 are deactivated to permit springs 82 to move pressure plates 77 outwardly. At this point, hydraulic cylinder 52 is operated to withdraw shaft 51 to thereby move the mandrel out of the forming area. Strippers 84 strip the formed tray from the withdrawing mandrel by engaging the upper edges of the formed tray whereby the said formed tray remains in the die cavity 70 where it is held by the bars 79a.

After the mandrel 49 is withdrawn from the die cavity, the steps of applying adhesive to the blank, movement of the blank from hopper to die cavity by the mandrel and the forming of the blank into a tray is repeated. The movement of the mandrel into the die cavity with the next blank pushes the formed tray remaining in the die cavity 70 out of the bottom thereof. Conventional means such as roller belts (not shown) are used to remove the pushed out tray from the vicinity of the apparatus. In the case of a blank which has dust flaps or a hinged cover (not shown) the dust flaps or cover will be supported vertically between the mandrel 49 and either the plates 77 and 81 or the forming bars 78, 79. In such case, means must be provided for removing the folded blank from the die cavity prior to the movement of the next subsequent blank into the die cavity to prevent the mandrel and the blank to be folded from crushing the dust flaps or hinged cover. Such means may take the form of an articulated stripper plate (not shown) which is mounted on the bottom of the mandrel and which is adapted to extend as the mandrel is withdrawn from the die cavity to push the folded tray out of the die cavity. Other means, such as a moveable air or hydraulically operated suction plate (not shown) having means therein for applying suction to the bonded blank may be used by positioning the suction plate under the die cavity and providing means extending and operating the plate to remove the bonded blank from the die cavity after the mandrel has been withdrawn from within the bonded blank. The implementation of such additional removal means is within the skill of the art.

The described embodiment utilizes hydraulics to initiate control and perform the functions of applying adhesive to the blank, linearly moving and rotating the mandrel and forming the blank into a tray. Through the use of hydraulics, many advantages over mechanically driven systems are achieved such as the elimination of large moving masses of metal which are normally required where mechanical drive systems are used. The large metal mass generally required in the mechanical drive system significantly increases the initial and operational cost of the apparatus which has no gain in quality of the finished product. Also, the large inertia forces which are present in such a mechanical system tend to limit production speed to about 20 trays per minute whereas the hydraulic control method permits formation of up to about 60 trays per minute.

The present invention may be used to fold blanks other than the trays described hereinabove. Also, the adhesive need not be deposited in the area shown and may be deposited on the depicted unguled end flaps instead. It is within the ordinary course of the art and in combination with the teaching of this invention to modify the glue dabbing apparatus to spot adhesive at any location and to modify the preformer plates, die cavity and mandrel to form a different type blank or differently glued blank into a tray.

It is therefore intended to cover all changes and modifications of the preferred embodiments of the invention herein chosen for the purpose of illustration which do not constitute a departure from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for folding blanks comprising: a hopper for holding said blanks, a glue dabbing apparatus adapted to apply adhesive to said blanks in the hopper, a mandrel and die cavity, said mandrel having means for removing blanks from said hopper; means for moving and rotating said mandrel between a first position in which said mandrel removes blanks from said hopper and a second position in which said mandrel has pushed said blank into said die cavity, said die cavity having means for folding said blanks as the mandrel pushes the blank into the die cavity, whereby the blank is folded to overlap selected areas of which at least one has an adhesive thereon and means for applying at least 1000 p.s.i. of pressure to said folded blank for at least ½ second to bond said overlapped areas together.

2. An apparatus as specified in claim 1 wherein said mandrel is slidable mounted to a rotatable means, said means for rotating and moving said mandrel between said first and second position comprising first hydraulic cylinder means for rotating said rotatable means to rotate said mandrel between a position in which said mandrel faces said hopper and another position in which the mandrel faces the die cavity and second hydraulic cylinder means for linearly moving said mandrel into contact with said said glued blank when said mandrel is facing said hopper and for pushing said glued blank into said die cavity when said mandrel is facing said die cavity.

3. An apparatus as specified in claim 1 further comprising means for retaining said bonded blank within said die cavity as said mandrel is withdrawn therefrom after said pressure has been released and means for removing said bonded blank from said die cavity.

4. An apparatus as specified in claim 2 wherein said rotatable means is a rotatable shaft, said mandrel being slidable mounted to a bushing block which is in turn fixedly mounted to said rotatable shaft, said second hydraulic cylinder means being fixedly mounted to said bushing block and having an extensible shaft to which said mandrel is mounted whereby rotation of said shaft rotates said mandrel and said second hydraulic cylinder means and extension and retraction of said extensible shaft linearly moves said mandrel.

5. An apparatus as specified in claim 1 wherein said hopper is positioned above said means for moving and rotating said mandrel.

6. An apparatus as specified in claim 5 wherein said hopper is at a 45° angle to the vertical.

7. An apparatus as specified in claim 1 in which said blank is comprised of a plurality of flaps and end flaps, some of the end flaps having adhesive thereon further comprising a plurality of preformer plates positioned above said die cavity for initiating the folding of the flaps and the glued end flaps of the blank which have adhesive thereon to assure that the flaps are positioned inside the glued end flaps which have adhesive thereon before the blank is pushed into the die cavity by the mandrel.

8. An apparatus as specified in claim 1 wherein said die cavity has a plurality of forming bars and a plurality of movable plates, said forming bars being placed transverse to said movable plates, said forming bars being adapted for folding the unguled end flaps of the blank which do not have adhesive thereon to an approximate vertical position as said mandrel pushes said blank into said die cavity, said movable plates being diagonally disposed and initially spaced apart from said end flaps to predetermine a predetermined distance to leave a predetermined clearance among the flaps and the end flaps which have adhesive thereon to prevent the flaps from destroying the fidelity of the adhesive on the end flaps which have adhesive thereon and hydraulic cylinder means for moving said movable plates inwardly to remove said clearance.
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and to apply said at least 1000 p.s.i. of pressure for said at least 1/4 second.

9. An apparatus as specified in claim 3 wherein said means for retaining said bonded blank within said die cavity comprises stripper means, said stripper means being rotatably mounted within said die cavity and biased to normally project into said die cavity, said stripper means being adapted for rotation out of said die cavity by said mandrel as said mandrel pushes said blank into the die cavity and for automatic rotation back into said die cavity when the folded blank has been moved to a position below the said stripper means to strip the folded and bonded blank from the mandrel as the mandrel withdraws from the die cavity.

10. An apparatus as specified in claim 3 wherein said bonded blank is removed from said die cavity by said mandrel when the mandrel is again moved into the die cavity to fold and bond another blank.

11. An apparatus as specified in claim 8 wherein said plurality of forming bars comprises at least two pairs of forming bars, one pair of which is spaced vertically above the other pair, the bars of a vertically higher pair being diagonally spaced from each other a greater distance than the bars of the lower pair to fold the end flaps which do not have adhesive thereon to said vertical position.

12. An apparatus as specified in claim 1 wherein said adhesive is a water based emulsion chosen from the group consisting of a polyvinyl acetate and dextrin.

13. An apparatus as specified in claim 1 wherein said mandrel has suction means to removing the glued blank from the said hopper.

14. An apparatus as specified in claim 13 wherein said suction means is a plurality of rubber cups.

15. A method of folding blanks in an apparatus of the type that includes a hopper for holding blanks positioned above a die cavity in which the blanks are folded to form an open container which comprises the steps of:

(a) applying glue to selected areas of the exposed face on one side of a blank in the hopper;
(b) removing said blank from the hopper;
(c) rotating the blank to bring the unglued face of the second side of the blank into position over the die cavity;
(d) inserting the blank into the die cavity;
(e) folding the blank to bring the selected areas of glue into overlapping relationship with other unglued areas of the blank;
(f) pressing the overlapped areas together under pressure of at least 1000 p.s.i. for at least 1/4 second to bond the overlapped areas together to form the container; and
(g) then removing the container from the die cavity.

16. A method as specified in claim 15 further comprising the step of maintaining a clearance between the selected areas which have glue thereon and the other selected areas of the blank during the step of folding said blank.

17. A method as specified in claim 15 further comprising the step of pressing the overlapped areas together after the step of, folding the blank has been completed and prior to the step of applying said pressure.

18. A method as specified in claim 1 wherein the step of removing the blank from the die cavity further comprises pushing the bonded blank out of said die cavity by again moving the mandrel into the die cavity to fold another blank.

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