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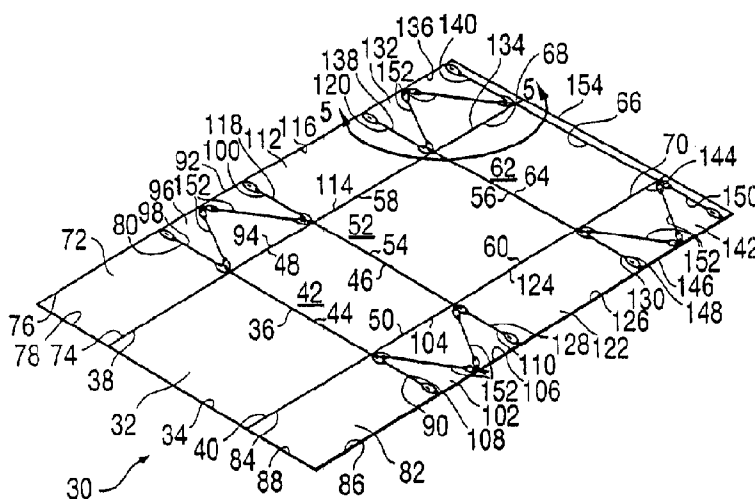
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(54) Title: CARTON, BLANK, METHODS AND APPARATUS FOR MAKING A CARTON



(57) Abstract: A blank for erecting a carton has 180° fold lines with a compressed area (156) at each end and a slit (158) joining the compressed areas (156). A carton is erected by moving the blank in a first direction against a stop (172) to form a first set of 90° folds, holding the blank stationary with a suction while pushing the blank in a second direction to form a second set of 90° folds, erecting the carton. A filled carton is closed by advancing it through the central opening of a V-shaped member (188) to increasingly fold the carton top panels. The closed carton (100) is sealed by advancing it through a second V-shaped member (198) and into contact with a pivotally supported sealing device (192).

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## Carton, Blank, Method and Apparatus For Making a Carton

TECHNICAL FIELD

The present invention pertains to a carton, a blank for producing a carton, and methods and apparatuses for erecting, closing and sealing a carton. More particularly, the present invention pertains to a carton which can be rapidly and automatically erected and, after filling, automatically and rapidly closed and sealed. The present invention further pertains to methods and apparatuses for erecting, closing, and sealing cartons of different sizes without adjustment of the apparatuses to accommodate the different sizes. The present invention is particularly suited for, but not limited to, corrugated cartons. Thus, while the following description and drawings make reference to corrugated cartons, the invention is applicable to cartons of other materials.

BACKGROUND ART

Numerous businesses need to ship large quantities of goods and utilize cartons, particularly corrugated cartons, to hold the goods during shipment. Consequently, such businesses desire to be able to rapidly erect, fill, close, and seal their shipping cartons. Figure 1 illustrates a typical prior art carton 10 having side surfaces 12 and end surfaces 14. Carton 10 also includes a bottom surface (not shown). Closure panels 16 extend upwardly from side surfaces 12, while closure panels 18 extend upwardly from end surfaces 14. Figure 2 depicts a carton blank 20 from which a carton 10 might be erected. Carton blank 20 includes the panels 12-18 shown in Figure 1 and also bottom panels 22 and 24 which correspond, respectively, with the top panels 16 and 18. Preferably, carton blank 20 also includes a sealing strip 26 which extends from one panel, such as the outermost end panel 14 as illustrated in Figure 2, so that when the carton is erected, strip 26 can be sealed to the adjacent side panel 12, as illustrated in Figure 1. To enable the necessary folds, panels 16 and 18 must be separated by slots 19, and likewise panels 22 and 24 must be separated by slots 25. Consequently, it is time consuming and expensive to form blank 20.

Erecting carton 10 from blank 20 requires folding panels 22 and 24 inwardly 90°, making 90° folds at the junctions of the panels 12 and 14, sealing the junction of the two bottom panels 22, and sealing the sealing strip 26 to the adjacent panel. The several folds must be performed in sequence, and so require significant time.

Once carton 10 is filled with goods, panels 18 are folded inwardly to overlie those goods, and then panels 16 are folded over panels 18 and the goods to close the carton. The carton then might be sealed, for example by applying a tape along the junction of the two panels 16. Figure 3 depicts the resulting closed carton 10. The four separate closure panels 16, 18 must be separately folded, with panels 18 folded before panels 16. Consequently, a significant time is required to close carton 10. The junction of the two top panels 16 must then be sealed.

While these various operations might be mechanized, still the large number of steps results in the operations being time consuming. In addition, different sizes of cartons require different equipment sizes in order to perform the operations mechanically. This requires either different apparatuses for different carton sizes, or an apparatus which is adjustable in size, then necessitating the adjustment of the size each time the carton size changes. In addition to being time consuming, these approaches are expensive.

Figure 9 depicts a carton 162 having side panels 32, 52 and end panels 42, 62 which bridge the side panels. First and second top panels 72, 112 extend upwardly from side panels 32, 52, while first and second fold-in panels 92, 132 extend upwardly from end panels 42, 62 and bridge the top panels. Panels 72, 92, 112 and 132 are joined to their respective side panels and end panels 32, 42, 52, 62 by 90° fold lines 74, 94, 114, and 134. Each fold-in panel 92, 132 has a pair of fold lines 152 which extend from a point substantially at the center of the panel upper edge opposite fold line 94, 134 to the corners of the panel 92, 132 at the ends of fold line 94, 134. Pressure on any panel 72, 92, 112 or 132 can cause the fold-in panels 92, 132 to be folded inwardly on the fold lines 94, 134, forming a 180° fold at each fold line 152 and causing top panels 72, 112 to fold over the top of carton 162, as depicted in Figures 10 and 11. Continued such pressure will bring carton 162 to its closed condition, depicted in Figure 12.

The necessity to make a 180° fold in each fold line 152 has limited the applicability of this type of carton. By way of example, United States Patent No. 2,439,435 shows such a carton used for

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moisture-proof packaging. However, to permit the 180° folds that are necessary, the carton of this patent is made of paper board. United States Patent No. 5,143,281 shows such a carton made of cardboard having a foil to provide a liquid-tight package. United States Patent No. 5,078,315 likewise shows a liquid containing package having 180° folds.

5 This package is formed of a laminate of paper, thermal plastic and possibly aluminum foil. United States Patent No. 2,810,506 shows a carton with 180° folds which is made of a sheet material. United States Patent No. 5,056,707 similarly shows a carton made of a sheet material coated with thermoplastics to permit containing of liquids. All of thin material can readily be folded 180°. However, cartons made of such thin materials are

10 unsuitable for heavy duty cartons used for shipping.

United States Patent No. 915,579 shows a shipping container made of a corrugated material and utilising 180° folds on end flaps. However, the end flaps are first crushed to permit such folding. This, of course, destroys the corrugations and weakens the materials. United States Patent No. 2,926,777 also shows a shipping container made of a corrugated

15 material and having 180° folds. However, to permit such folds in the corrugated material, the fold lines are scored. This severs the corrugation and weakens the material.

#### DISCLOSURE OF THE INVENTION

According to the present invention there is provided a blank for producing a carton,

20 said blank comprising:

a first side panel having substantially parallel first and second end edges and substantially parallel top and bottom edges extending substantially perpendicular to the end edges;

a first end panel having first and second side edges substantially parallel with the

25 first side panel end edges and having substantially parallel top and bottom edges, said first end panel extending from said first side panel with the first end panel first side edge joined to the first side panel second end edge to define a first 90° fold line and with the first end panel top and bottom edges being extensions of the first side panel top and bottom edges respectively;

30 a second side panel having first and second end edges substantially parallel with the

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first side panel end edges and having substantially parallel top and bottom edges, said second side panel extending from said first end panel with the second side panel first end edge joined to the first end panel second side edge to define a first 180° fold line parallel with the first 90° fold line and with the second side panel top and bottom edges being extensions of the first end panel top and bottom edges respectively;

a second end panel having first and second side edges substantially parallel with the first side panel end edges and having substantially parallel top and bottom edges, said second end panel extending from said second side panel with the second end panel first side edge joined to the second side panel second end edge to define a second 90° fold line and with the second end panel top and bottom edges being extensions of the second side panel top and bottom edges respectively;

a first top panel having first and second side edges substantially parallel with the first side panel top edge and having substantially parallel first and second end edges, said first top panel extending from said first side panel with the first top panel first side edge joined to the first side panel top edge to define a third 90° fold line and with the first top panel first and second end edges being extensions of the first side panel first and second end edges respectively;

a first bottom panel having first and second side edges substantially parallel with the first side panel bottom edge and having substantially parallel first and second end edges, said first bottom panel extending from said first side panel with the first bottom panel first side edge joined to the first side panel bottom edge to define a fourth 90° fold line and with the first bottom panel first and second end edges being extensions of the first side panel first and second end edges respectively;

a first fold-in panel having first and second end edges substantially parallel with the first end panel top edge and having substantially parallel first and second side edges, said first fold-in panel extending from said first end panel with the first fold-in panel first end edge joined to the first end panel top edge to define a fifth 90° fold line, with the first fold-in panel side edges being extensions of the first end panel first and second side edges respectively and with the first fold-in panel first side edge joined to the first top panel second end edge to define a second 180° fold line;

a second fold-in panel having first and second end edges substantially parallel with

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the first end panel bottom edge and having substantially parallel first and second side edges, said second fold-in panel extending from said first end panel with the second fold-in panel first end edge joined to the first end panel bottom edge to define a sixth 90° fold line, with the second fold-in panel first and second side edges being extensions of the first end panel first and second side edges respectively and with the second fold-in panel first side edge joined to the first bottom panel second end edge to define a third 180° fold line;

a second top panel having first and second side edges substantially parallel with the second side panel top edge and having substantially parallel first and second end edges, said second top panel extending from said second side panel with the second top panel first side edge joined to the second side panel top edge to define a seventh 90° fold line, with the second top panel first and second end edges being extensions of the second side panel first and second end edges respectively, and with the second top panel first end edge joined to the first fold-in panel second side edge to define a fourth 180° fold line;

a second bottom panel having first and second side edges substantially parallel with the second side panel bottom edge and having substantially parallel first and second end edges, said second bottom panel extending from said second side panel with the second bottom panel first side edge joined to the second side panel bottom edge to define an eighth 90° fold line, with the second bottom panel first and second end edges being extensions of the second side panel first and second end edges respectively, and with the second bottom panel first end edge joined to the second fold-in panel second side edge to define a fifth 180° fold line;

a third fold-in panel having first and second end edges substantially parallel with the second end panel top edge and having substantially parallel first and second side edges, said third fold-in panel extending from said second end panel with the third fold-in panel first end edge joined to the second end panel top edge to define a ninth 90° fold line, with the third fold-in panel first and second side edges being extensions of the second end panel first and second side edges respectively and with the third fold-in panel first side edge joined to the second top panel second end edge to define a sixth 180° fold line; and

a fourth fold-in panel having first and second end edges substantially parallel with the second end panel bottom edge and having substantially parallel first and second side edges, said fourth fold-in panel extending from said second end panel with the fourth fold-



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in panel first end edge joined to the second end panel bottom edge to define a tenth  $90^\circ$  fold line, with the fourth fold-in panel first and second side edges being extensions of the second bottom panel first and second side edges respectively and with the fourth fold-in panel first side edge joined to the second bottom panel second end edge to define a seventh  
 5  $180^\circ$  fold line;

each fold-in panel having  $180^\circ$  fold lines extending from a point on the second end edge of such panel substantially midway between the first and second side edges thereof to points at the intersections of the first end edge thereof and the first and second side edges thereof,

10 wherein each  $180^\circ$  fold line comprises a first compressed area extending from a first end of the  $180^\circ$  fold line, a second compressed area extending from a second end of the  $180^\circ$  fold line and a slit joining the first and second compressed areas.

The invention also provides a blank for producing a carton when joined with a like blank, said blank comprising:

15 a side panel having substantially parallel first and second end edges and substantially parallel top and bottom edges extending substantially perpendicular to the end edges;

an end panel having first and second side edges substantially parallel with the side panel end edges and having substantially parallel top and bottom edges, said end panel  
 20 extending from said side panel with the end panel first side edge joined to the side panel second end edge to define a first  $90^\circ$  fold line and with the end panel top and bottom edges being extensions of the side panel top and bottom edges respectively;

a top panel having first and second side edges substantially parallel with the side panel top edge and having substantially parallel first and second end edges, said top panel  
 25 extending from said side panel with the top panel first side edge joined to the side panel top edge to define a second  $90^\circ$  fold line and with the top panel first and second end edges being extensions of the side panel first and second end edges respectively;

a bottom panel having first and second side edges substantially parallel with the side panel bottom edge and having substantially parallel first and second end edges, said  
 30 bottom panel extending from said side panel with the bottom panel first side edge joined to the side panel bottom edge to define a third  $90^\circ$  fold line and with the bottom panel first

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and second end edges being extensions of the side panel first and second end edges respectively;

5 a first fold-in panel having first and second end edges substantially parallel with the end panel top edge and having substantially parallel first and second side edges, said first fold-in panel extending from said end panel with the first fold-in panel first end edge joined to the end panel top edge to define a fourth 90° fold line, with the first fold-in panel first and second side edges being extensions of the end panel first and second side edges respectively and with the first fold-in panel first side edge joined to the top panel second end edge to define a first 180° fold line;

10 a second fold-in panel having first and second end edges substantially parallel with the end panel bottom edge and substantially parallel first and second side edges, said second fold-in panel extending from said end panel with the second fold-in panel first end edge joined to the end panel bottom edge to define a fifth 90° fold line, with the second fold-in panel first and second side edges being extensions of the end panel first and second side edges respectively and with the second fold-in panel first side edge joined to the bottom panel second end edge to define a second 180° fold line;

15 each fold-in panel having 180° fold lines extending from a point on the second end edge of such panel substantially midway between the first and second side edges thereof to points at the intersections of the first end edge thereof and the first and second side edges thereof,

20 wherein each 180° fold line comprises a first compressed area extending from a first end of the 180° fold line, a second compressed area extending from a second end of the 180° fold line and a slit joining the first and second compressed areas.

The invention also provides a method of closing a carton made from a blank as defined above wherein there are two of said side panels, two of said end panels and two of said top panels, said method including the steps of:

25 providing a movement path beneath the central opening of a substantially V shaped centering member having two arms, each arm having a first end and a second end, the first arm ends being spaced apart to form the wide end of the V shape and the second arm ends being connected together to form the point of the V shape, with the centering member 30 central opening between the arms, the centering member wide end being pivotally mounted

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above the movement path and the centering member point hanging down toward the movement path; and

advancing the carton along the movement path and through the central opening of the centering member from the wide end toward the narrow end to cause the arms to  
 5 contact the carton top panels and fold the top panels over the carton, with the carton fold-in panels folding inwardly beneath the top panels, thereby closing the carton.

The invention also provides apparatus for closing a carton made from a blank as defined above wherein there are two of said side panels, two of said end panels and two of said top panels, said apparatus comprising:

10 means defining a movement path;

a substantially V shaped centering member having two arms, each arm having a first end and a second end, the first arm ends being spaced apart to form the wide end of the V shape and the second arm ends being connected together to form the point of the V shape with a central opening between the arms; and

15 means pivotally mounting the centering member wide end above the movement path with the centering member point hanging down toward the movement path.

The invention also provides a method of erecting a carton from a pair of blanks, each blank as defined above, said method comprising:

positioning the blanks on an erecting surface with a stop member adjacent the end  
 20 panel of one of the blanks;

advancing the blanks in a first direction against the stop member to cause the blanks to form 90° folds on the first 90° fold line, the first and second 180° fold lines and the further 180° fold lines;

applying suction beneath one of the top panel and the bottom panel of the  
 25 underlying one of the blanks;

advancing the blanks in a direction perpendicular to the first direction with the suction maintaining the one panel substantially stationary to cause the blanks to form 90° folds on the second and third 90° fold lines and to form 180° folds on the 180° fold lines of the second and fourth fold-in panels and on the fold lines joining the fold-in panels to the  
 30 top and bottom panels; and

sealing the bottom panels of the two blanks together.

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The invention also provides apparatus for erecting a carton from a pair of blanks, each blank as defined above, said apparatus comprising:

an erecting surface for supporting the blanks with the end panel of one blank overlying a portion of and joined to the side panel of the other blank and the fold-in panels  
5 of the one blank overlying portions of and joined to the top and bottom panels of the other blank, the joined panels defining further 180° fold lines;

a stop member on said erecting surface;

a first actuator for advancing the blanks in a first direction against the stop member to cause the blanks to form 90° folds on the first 90° fold line, the first and second 180°  
10 fold lines and the further 180° fold lines;

a vacuum source for applying suction beneath one of the top panel and the bottom panel of the underlying one of the blanks;

a second actuator for advancing the blanks in a direction perpendicular to the first direction while suction from the vacuum source maintains the one panel substantially  
15 stationary to cause the blanks to form 90° folds on the second and third 90° fold lines and to form 180° folds on the 180° fold lines of the fold-in panels and on the fold lines joining the fold-in panels to the top and bottom panels; and

a sealing mechanism for sealing the bottom panels of the two blanks together.

The carton can be erected, closed and sealed by hand, if desired, and such manual  
20 operations are

more readily done with the carton of the present invention than with the prior art carton of Figure 1. All the panels that close the carton can be folded into place at the same time by simply pressing on any one of the panels.

### BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the present invention are more apparent from the following detailed description and claims, particularly when considered in conjunction with the accompanying drawings in which like parts bear like reference numerals: In the drawings:

Figure 1 depicts an open prior art carton;

Figure 2 depicts a carton blank from which the carton of Figure 1 can be erected;

Figure 3 depicts the carton of Figure 1 closed;

Figure 4 depicts a first preferred embodiment of a carton blank in accordance with the present invention;

Figure 5 is an enlarged fragmentary view of area 5-5 of Figure 4;

Figure 6 is a sectional view taken on line 6-6 of Figure 5;

Figure 7 is a sectional view taken on line 7-7 of Figure 5;

Figure 8 is a fragmentary view of a 180° fold as made in a carton blank in accordance with the present invention;

Figures 9-13 depict a carton in accordance with the present invention in various degrees of closing;

Figures 14-21 illustrate preferred embodiments of a method of and an apparatus for erecting a carton in accordance with the present invention;

Figure 22 depicts a second preferred embodiment of a carton blank in accordance with the present invention;

Figures 23-28 illustrate preferred embodiments of methods and apparatuses for closing and sealing a carton in accordance with the present invention; and

Figure 29 depicts an alternative embodiment of a carton in accordance with the present invention.

### BEST MODE FOR CARRYING OUT THE INVENTION

Figure 4 depicts a preferred embodiment of a carton blank 30 from which a carton in accordance with the present invention can be erected. Blank 30 includes a first side panel 32 having a first end edge 34, a second end edge 36, a top edge 38 and a bottom edge 40. End edges 34 and 36 are substantially parallel with each other, while top edge 38 and bottom edge 40 are substantially parallel with each other and substantially perpendicular to edges 34 and 36. Blank 30 further includes a first end panel 42 having a first side edge 44, a second side edge 46, a top edge 48, and a bottom edge 50. Carton blank 30 also includes a second side panel 52 having a first end edge 54, a second end edge 56, a top edge 58, and a bottom edge 60. Carton 30 further includes a second end panel 62 having a first side edge 64, a second side edge 66, a top edge 68, and a bottom edge 70. Edges 46, 54, 56, 64 and 66 are substantially parallel with edge 34, while edges 48, 58, and 68 are extensions of edge 38, and edges 50, 60, and 70 are extensions of edge 40.

Carton blank 30 also includes a first top panel 72 having a first side edge 74, a second side edge 76, a first end edge 78, and a second end edge 80. Edges 74 and 76 are substantially parallel with edge 38, and edges 78 and 80 are extensions of edges 34 and 36, respectively. Carton blank 30 includes a first bottom panel 82 having a first side edge 84, a second side edge 86, a first end edge 88, and a second end edge 90. Edges 84 and 86 are substantially parallel with edge 38, while edges 88 and 90 are extensions of edges 34 and 36, respectively. Carton blank 30 also includes a first fold-in panel 92 having a first end edge 94, a second end edge 96, a first side edge 98, and a second side edge 100. Edges 94 and 96 are extensions of edges 74 and 76, respectively, while edges 98 and 100 are extensions of edges 44 and 46, respectively. Carton blank 30 has a second fold-in panel 102 having a first end edge 104, a second end edge 106, a first side edge 108, and a second side edge 110. Edges 104 and 106 are extensions of edges 84 and 86 respectively, while edges 108 and 110 are extensions of edges 44 and 46, respectively. Carton blank 30 includes a second top panel 112 having a first side edge 114, a second side edge 116, a first end edge 118, and a second end edge 120. Edges 114 and 116 are extensions of edges 94 and 96, respectively, while edges 118 and 120 are extensions of edges 54 and 56, respectively. Carton blank 30 includes a second bottom panel 122 having a first side edge 124, a second side edge 126, a first end edge

128, and a second end edge 130. Edges 124 and 126 are extensions of edges 104 and 106, respectively, while edges 128 and 130 are extensions of edges 54 and 56, respectively. Carton blank additionally includes a third fold-in panel 132 having a first end edge 134, a second end edge 136, a first side edge 138, and a second side edge 140. Edges 134 and 136 are extensions of edges 114 and 116, respectively, while edges 138 and 140 are extensions of edges 64 and 66, respectively. Carton blank 30 includes a fourth fold-in panel 142 having a first end edge 144, a second end edge 146, a first side edge 148 and a second side edge 150. Edges 144 and 146 are extensions of edges 124 and 126, respectively, while edges 148 and 150 are extensions of edges 64 and 66, respectively.

First end panel 42 extends from first side panel 32, with first side edge 44 of first end panel 42 joined to second side edge 36 of first side panel 32 to define a 90° fold line. Second side panel 52 extends from first end panel 42, with first end edge 54 joined to second side edge 46 to define a 180° fold line. Second end panel 62 extends from second side panel 52, with first side edge 64 joined to second end edge 56 to define a 90° fold line. First top panel 72 extends from first side panel 32, with first side edge 74 joined to top edge 38 to define a 90° fold line. First bottom panel 82 extends from first side panel 32, with first side edge 84 joined to bottom edge 40 to define a 90° fold line. First fold-in panel 92 extends from first end panel 42, with first end edge 94 joined to top edge 48 to define a 90° fold line and with first side edge 98 joined to second end edge 80 to define a 180° fold line. Second fold-in panel 102 extends from first end panel 42, with first end edge 104 joined to bottom edge 50 to define a 90° fold line and with first side edge 108 joined to second end edge 90 to define a 180° fold line. Second top panel 112 extends from second side panel 52, with first side edge 114 joined to top edge 58 to define a 90° fold line and with first end edge 118 joined to second side edge 100 of first fold-in panel 92 to define a 180° fold line. Second bottom panel 122 extends from second side panel 52, with first side edge 124 joined to bottom edge 60 to define a 90° fold line and with first end edge 128 joined to second side edge 110 of second fold-in panel 102 to define a 180° fold line. Third fold-in panel 132 extends from second end panel 62, with first end edge 134 joined to top edge 68 to define a 90° fold line and with first side edge 138 joined to second end edge 120 of top panel 112 to define a 180° fold line. Fourth fold-in panel 142 extends from second end panel 62, with first end edge 144 joined to bottom edge 70 to define a 90° fold

line and with first side edge 148 joined to second end edge 130 of bottom panel 122 to define a 180° fold line.

Each fold-in panel 92, 102, 132, and 142 includes a pair of 180° fold lines 152 which extend from a point on the second end edge 96, 106, 136, 146, of the respective panel substantially midway between the first and second side edges of such panel to points at the intersections of the first end edge 94, 104, 134, 144 of the respective panel to points at the intersections of that first end edge and the first and second side edges of such panel.

Preferably, carton blank 30 also includes a sealing strip 154, for example extending from third fold-in panel 132, second end panel 62, and fourth fold-in panel 142 as depicted in Figure 4. Sealing strip 154 includes fold lines which are extensions of the 90° fold lines defined by edges 68 and 134 and edges 70 and 144. After carton blank 30 has been manufactured, it is folded 180° on the fold line defined by edges 46, 54, 100, 110, 118, and 128, and sealing strip 154 is sealed to panels 72, 32, and 82, forming the folded carton blank as depicted in Figure 15. Alternatively, sealing strip 154 can be omitted, and panels 132, 62, and 142 sealed to panels 72, 32, and 82 by other means such as a sealing tape. Further, instead of making folded carton blank in one piece, it can be made in two pieces which are then sealed together, as discussed below with regard to Figure 22.

Figures 5-8 show the form of the 180° fold lines. Each 180° fold line includes first and second compressed areas 156 which extend from opposite ends of the 180° fold line for a distance in the order of about two inches and which are joined by a slit 158. Each compressed area 156 is preferably oval in shape with a maximum width in the order of from about  $\frac{3}{8}$  inch to about  $\frac{1}{2}$  inch for standard packing carton corrugated panels. As can be seen in Figure 6, each compressed area 156 extends into the material of carton blank 30 a substantial distance, while leaving the adjacent panel portions joined. Preferably, a protrusion 160 extends from the undersurface of carton blank 30, substantially along the center line of each compressed area 156 to define a fold line. As can be seen in Figure 7, each slit 158 extends through carton blank 30.

Figure 8 illustrate the manner in which carton blank 30 can be folded 180° as a result of the 180° fold lines formed by compressed areas 156 and slits 158. As can be seen in Figure 8, as a result of



compressed areas 156, the 180° fold is readily made without unduly stressing the carton blank material.

Figures 9-13 illustrate the manner in which a carton 162 formed from carton blank 30 can be closed after the carton has been erected and filled. In Figure 9, carton 162 is illustrated with top panels 72 and 112 and first and second fold-in panels 92 and 132 extending upwardly from their corresponding side panels and end panels. Figure 10 illustrates carton 162 when fold-in panels 92 and 132 are initially folded in on 180° fold lines 152. Top panels 72 and 112 are folded partially together. Figure 11 depicts carton 162 with the fold-in panels 152 further folded in and with top panels 72 and 112 folded closer together. Figure 12 illustrates carton 162 full closed. Figure 13 shows the closed carton 162 with top panels 72 and 112 sealed together, for example by a sealing tape 164. Carton 162 can be closed and sealed with the method and apparatus of the present invention. Alternatively, if desired, carton 162 can be closed and sealed, as well as erected, manually. Manual erecting and closing of carton 162 can be done rapidly by simply pressing on any one of the bottom panels to erect the carton and any one of the top panels to close the carton. Pressing on any one of the bottom panels or of the top panels causes all of the bottom panels or the top panels to fold inwardly, closing the bottom or the top.

Figures 14-21 illustrate an apparatus 166 for erecting carton 162 from carton blank 30 in accordance with a preferred embodiment of the present invention. Apparatus 166 includes an erecting surface 168. A number of carton blanks 30 are provided adjacent one end of erecting surface 168, preferably standing on edge as illustrated in Figure 14. When a carton 162 is to be erected, one of the carton blanks 30 is released from the stack and falls onto erecting surface 168 as depicted in Figure 15. Carton blank 30 is then supported on erecting surface 168 with end panel 62 overlying a portion of side panel 32, with third and fourth fold-in panels 132 and 142 overlying portions of first top panel 72 and first bottom panel 82 respectively, and with sealing strip 154 sealed to side panel 32, top panel 72 and bottom panel 82. If desired, rather than the single piece carton blank 30 of Figure 4, the carton blank could be formed of two blanks 169 as illustrated in Figure 22. The two blanks 169 are then positioned one over the other, with one rotated 180° with respect to the other, and the sealing strip of each blank is sealed to the other blank. This construction provides a carton blank 30 just as illustrated in Figure 15.

A first actuator 170 is provided adjacent one end of erecting surface 168, and a second actuator

174 is provided adjacent one side of the erecting surface, as depicted in Figure 14. A vacuum belt 175 having a number of openings 176 defines an erecting position adjacent the corner of erecting surface 168 remote from actuators 170 and 174. Openings 176 are connected to a vacuum source (not shown). As illustrated in Figure 16, first actuator 170 advances the carton blank 30 until the joined edges 34 and 66 abut against a stop member 172 adjacent the end of erecting surface 168 opposite actuator 170. Second actuator 174 then advances the blank 30 in a direction perpendicular to that of actuator 170 so that one corner of blank 170 overlies the openings 176 at a portion of vacuum belt 175, as depicts in Figure 17. Suction is then applied through openings 174, firmly holding in place bottom panel 82, which is beneath fourth fold-in panel 142. First actuator 170 advances further, causing the carton blank to fold 90° on the fold lines defined by the respective joined edges 36-42, 80-98, 90-108, 46-54, 100-118, 110-128, 56-64, 120-138, and 130-148, bringing the partially erected carton to the position depicted in Figure 18. As illustrated in Figure 19, second actuator 174 then advances the carton blank in its direction of travel while suction is continued through openings 176, causing the carton blank to fold 90° on the fold lines defined by the respective joined edges 38-74, 40-84, 48-94, 50-104, 58-114, 60-124, 68-134, and 70-144. This erects the carton 162 and positions it over several of the openings 176 of vacuum belt 175, as depicted in Figure 19. Figure 20 illustrates vacuum belt 175 moving carton 162 over a sealing unit 178, for example a tape sealing unit, which seals bottom panels 82 and 122 together, completing the erection of carton 162. Figure 21 then depicts the erected carton 162 being conveyed for filling while a second carton blank 30 is released onto erecting surface 168.

Figures 23-28 illustrate the closing of the filled carton 162 in accordance with preferred embodiments of the present invention. Filled cartons are conveyed by a first conveyor 180 to a conveyor 182 of carton closing apparatus 184. A pair of upwardly extending frame member 186 pivotally support a V-shaped centering member 188 above conveyor 182. As seen in Figure 24, centering member 188 includes a pair of arms 190 which have their upper ends pivotally mounted to the upper ends of frame members 186. The lower ends of arms 190 are connected together at a point above substantially the center of conveyor 182. As the filled container 162 progresses on conveyor 182, it enters the central opening between arms 190 of centering member 188. As container 162 progresses further, arms 190

contact the top panels 72 and 112 of carton 162. The initial contact assures that carton 162 is substantially centered on conveyor 182. Further movement of container 162 on conveyor 182 brings carton 162 into a more narrow portion of the central opening of centering member 188, as depicted in Figure 25. This causes arms 190 to force top panels 72 and 112 to fold, resulting in fold-in panels 92 and 132 folding progressively inwardly as depicted in Figures 10, 11 and 26. Continued movement of carton 162 on conveyor 182 results in full closing of top panel 72 and 112 over the carton as depicted in Figures 27 and 28, providing the closed carton of Figure 12.

The V-shaped form of centering member 188 allows carton closing apparatus 184 to be used with cartons of various sizes. Regardless of the height or width of the carton, its top panels 72 and 112 will contact arms 190 and be closed as the carton progresses on conveyor 182.

Once the carton 162 is fully closed, as depicted in Figure 27, the carton can be sealed by sealing apparatus 192. As depicted in Figure 23, sealing apparatus 192 includes a conveyor 194 to which the closed cartons are transferred from conveyor 182. Figure 23 depicts a closed carton 162a on conveyor 194. Closing apparatus 192 includes a pair of frame members 196 which pivotally support a centering member 198, similar to centering member 188. Again, centering member 198 assures that carton 162a is substantially centered on conveyor 194. Support members 196 further pivotally support sealing arm 200 above the central opening of centering member 198. Sealing arm 200 rotatably supports a reel 202 of tape or other suitable sealing material. Sealing arm 200 terminates in a first sealing roller 204 and pivotally supports an arm 206 which supports a second sealing roller 208. Tape 210 from reel 202 wraps around rollers 208 and 204 and onto the leading end panel 62 of carton 162a, as depicted in Figure 23. As carton 162a progresses on conveyor 194, sealing arm 200 pivots upwardly, bringing sealing rollers 204 and 208 onto the top surface of the closed carton 162. This applies tape along the junction of top panels 72 and 112 of carton 162a, as illustrated in Figure 25. Further movement of carton 162a on conveyor 194 results in rollers 204 and 208 progressing down the second end panel 42 of carton 162a, as depicted in Figure 27. The sealing mechanism can include a blade or other suitable means which is actuated by movement of the arm 206 to the position of Figure 27 to cut the tape once carton 162a is fully sealed.

Figure 29 depicts an alternative embodiment of carton 162b having a strip 212 of sealing tape

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affixed to top panel 112 so that when top panels 72 and 112 are closed, the strip will adhere to panel 72, sealing the carton. With this embodiment, sealing apparatus 192 is not necessary.

5 The present invention is thus seen to provide an improved carton blank that can be readily erected closed, and sealed, and improved methods of and apparatuses for erecting, closing and sealing cartons. Although the invention has been described with reference to preferred embodiments, rearrangements, alterations, and substitutions can be made, and still the result will be within the scope of the invention.

10 The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

15 Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

CLAIMS

What is claimed is:

1. A blank for producing a carton, said blank comprising:

a first side panel having substantially parallel first and second end edges and substantially parallel top and bottom edges extending substantially perpendicular to the end edges;

a first end panel having first and second side edges substantially parallel with the first side panel end edges, and having substantially parallel top and bottom edges, said first end panel extending from said first side panel with the first end panel first side edge joined to the first side panel second end edge to define a first 90° fold line and with the first end panel top and bottom edges being extensions of the first side panel top and bottom edges respectively;

a second side panel having first and second end edges substantially parallel with the first side panel end edges, and having substantially parallel top and bottom edges, said second side panel extending from said first end panel with the second side panel first end edge joined to the first end panel second side edge to define a first 180 ° fold line parallel with the first 90° fold line and with the second side panel top and bottom edges being extensions of the first end panel top and bottom edges respectively;

a second end panel having first and second side edges substantially parallel with the first side panel end edges, and having substantially parallel top and bottom edges, said second end panel extending from said second side panel with the second end panel first side edge joined to the second side panel second end edge to define a second 90° fold line and with the second end panel top and bottom edges being extensions of the second side panel top and bottom edges respectively;

a first top panel having first and second side edges substantially parallel with the first side panel top edge, and having substantially parallel first and second end edges, said first top panel extending from said first side panel with the first top panel first side edge joined to the first side panel top edge to define a third 90° fold line and with the first top panel first and second end edges being extensions of the first side panel first and second end edges respectively;

a first bottom panel having first and second side edges substantially parallel with the first side panel bottom edge, and having substantially parallel first and second end edges, said first bottom panel

extending from said first side panel with the first bottom panel first side edge joined to the first side panel bottom edge to define a fourth 90° fold line and with the first bottom panel first and second end edges being extensions of the first side panel first and second end edges respectively;

a first fold-in panel having first and second end edges substantially parallel with the first end panel top edge, and having substantially parallel first and second side edges, said first fold-in panel extending from said first end panel with the first fold-in panel first end edge joined to the first end panel top edge to define a fifth 90° fold line, with the first fold-in panel side edges being extensions of the first end panel first and second side edges respectively, and with the first fold-in panel first side edge joined to the first top panel second end edge to define a second 180° fold line;

a second fold-in panel having first and second end edges substantially parallel with the first end panel bottom edge, and having substantially parallel first and second side edges, said second fold-in panel extending from said first end panel with the second fold-in panel first end edge joined to the first end panel bottom edge to define a sixth 90° fold line, with the second fold-in panel first and second side edges being extensions of the first end panel first and second side edges respectively, and with the second fold-in panel first side edge joined to the first bottom panel second end edge to define a third 180° fold line;

a second top panel having first and second side edges substantially parallel with the second side panel top edge, and having substantially parallel first and second end edges, said second top panel extending from said second side panel with the second top panel first side edge joined to the second side panel top edge to define a seventh 90° fold line, with the second top panel first and second end edges being extensions of the second side panel first and second end edges respectively, and with the second top panel first end edge joined to the first fold-in panel second side edge to define a fourth 180° fold line;

a second bottom panel having first and second side edges substantially parallel with the second side panel bottom edge, and having substantially parallel first and second end edges, said second bottom panel extending from said second side panel with the second bottom panel first side edge joined to the second side panel bottom edge to define an eighth 90° fold line, with the second bottom panel first and second end edges being extensions of the second side panel first and second end edges respectively, and with the second bottom panel first end edge joined to the second fold-in panel second side edge to define

a fifth 180° fold line;

a third fold-in panel having first and second end edges substantially parallel with the second end panel top edge, and having substantially parallel first and second side edges, said third fold-in panel extending from said second end panel with the third fold-in panel first end edge joined to the second end panel top edge to define a ninth 90° fold line, with the third fold-in panel first and second side edges being extensions of the second end panel first and second side edges respectively, and with the third fold-in panel first side edge joined to the second top panel second end edge to define a sixth 180° fold line; and

a fourth fold-in panel having first and second end edges substantially parallel with the second end panel bottom edge, and having substantially parallel first and second side edges, said fourth fold-in panel extending from said second end panel with the fourth fold-in panel first end edge joined to the second end panel bottom edge to define a tenth 90° fold line, with the fourth fold-in panel first and second side edges being extensions of the second bottom panel first and second side edges respectively, and with the fourth fold-in panel first side edge joined to the second bottom panel second end edge to define a seventh 180° fold line;

each fold-in panel having 180° fold lines extending from a point on the second end edge of such panel substantially midway between the first and second side edges thereof to points at the intersections of the first end edge thereof and the first and second side edges thereof,

wherein each 180° fold line comprises a first compressed area extending from a first end of the 180° fold line, a second compressed area extending from a second end of the 180° fold line, and a slit joining the first and second compressed areas.

2. A blank as claimed in claim 1, further comprising a sealing strip for sealing the blank as a carton.

3. A blank as claimed in claim 1, wherein each compressed area provides a protrusion extending from the surface of the blank opposite the compressed area to define the fold line.

4. A blank as claimed in claim 1, wherein each compressed area is oval in shape.
5. A blank as claimed in claim 1, wherein the blank is corrugated.
6. A carton erected from the blank of claim 1.
7. A blank for producing a carton when joined with a like blank, said blank comprising:
  - a side panel having substantially parallel first and second end edges and substantially parallel top and bottom edges extending substantially perpendicular to the end edges;  
an end panel having first and second side edges substantially parallel with the side panel end edges, and having substantially parallel top and bottom edges, said end panel extending from said side panel with the end panel first side edge joined to the side panel second end edge to define a first 90° fold line and with the end panel top and bottom edges being extensions of the side panel top and bottom edges respectively;
  - a top panel having first and second side edges substantially parallel with the side panel top edge, and having substantially parallel first and second end edges, said top panel extending from said side panel with the top panel first side edge joined to the side panel top edge to define a second 90° fold line and with the top panel first and second end edges being extensions of the side panel first and second end edges respectively;
  - a bottom panel having first and second side edges substantially parallel with the side panel bottom edge, and having substantially parallel first and second end edges, said bottom panel extending from said side panel with the bottom panel first side edge joined to the side panel bottom edge to define a third 90° fold line and with the bottom panel first and second end edges being extensions of the side panel first and second end edges respectively;
  - a first fold-in panel having first and second end edges substantially parallel with the end panel top edge, and having substantially parallel first and second side edges, said first fold-in panel extending from said end panel with the first fold-in panel first end edge joined to the end panel top edge to define a



fourth 90° fold line, with the first fold-in panel first and second side edges being extensions of the end panel first and second side edges respectively, and with the first fold-in panel first side edge joined to the top panel second end edge to define a first 180° fold line;

a second fold-in panel having first and second end edges substantially parallel with the end panel bottom edge and substantially parallel first and second side edges, said second fold-in panel extending from said end panel with the second fold-in panel first end edge joined to the end panel bottom edge to define a fifth 90° fold line, with the second fold-in panel first and second side edges being extensions of the end panel first and second side edges respectively, and with the second fold-in panel first side edge joined to the bottom panel second end edge to define a second 180° fold line;

each fold-in panel having 180° fold lines extending from a point on the second end edge of such panel substantially midway between the first and second side edges thereof to points at the intersections of the first end edge thereof and the first and second side edges thereof,

wherein each 180° fold line comprises a first compressed area extending from a first end of the 180° fold line, a second compressed area extending from a second end of the 180° fold line, and a slit joining the first and second compressed areas.

8. A blank as claimed in claim 7, further comprising a sealing strip for sealing the blank as a carton.

9. A blank as claimed in claim 7, wherein each compressed area provides a protrusion extending from the surface of the blank opposite the compressed area to define the fold line.

10. A blank as claimed in claim 7, wherein each compressed area is oval in shape.

11. A blank as claimed in claim 7, wherein the blank is corrugated.

12. A carton erected from a pair of the blanks of claim 7.

13. A method of closing a carton made from a blank as claimed in any one of claims 7 to 12 wherein there are two of said side panels, two of said end panels and two of said top panels, said method including the steps of:

providing a movement path beneath the central opening of a substantially V shaped centering member having two arms, each arm having a first end and a second end, the first arm ends being spaced apart to form the wide end of the V shape and the second arm ends being connected together to form the point of the V shape, with the centering member central opening between the arms, the centering member wide end being pivotally mounted above the movement path and the centering member point hanging down toward the movement path; and

advancing the carton along the movement path and through the central opening of the centering member from the wide end toward the narrow end to cause the arms to contact the carton top panels and fold the top panels over the carton, with the carton fold-in panels folding inwardly beneath the top panels, thereby closing the carton.

14. A method as claimed in claim 13, wherein the movement path extends beneath the central opening of a second substantially V shaped centering member having two arms, each arm of the second centering member having a first end and a second end, the first arm ends of the second centering member being spaced apart to form the wide end of the V shape of the second centering member and the second arm ends of the second centering member being connected together to form the point of the V shape of the second centering member, with the second centering member central opening between the arms of the second centering member, the second centering member wide end being pivotally mounted above the extended movement path and the second centering member point hanging down toward the extended movement path, the second centering member further having a sealing arm with a first end pivotally mounted above the central opening of the second centering member and a second end hanging down toward the movement path and having a seal dispenser thereon, said method further comprising:

advancing the closed carton along the extended movement path and through the central opening of the second centering member to cause the seal dispenser to dispense a sealing material onto adjacent edges of the top panels, sealing the top panels together to

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seal the closed carton.

15. Apparatus for closing a carton made from a blank as claimed in any one of claims 7 to 12 wherein there are two of said side panels, two of said end panels and two of said top  
5 panels, said apparatus comprising:

means defining a movement path;

- a substantially V shaped centering member having two arms, each arm having a first end and a second end, the first arm ends being spaced apart to form the wide end of the V shape and the second arm ends being connected together to form the point of the V  
10 shape with a central opening between the arms; and

means pivotally mounting the centering member wide end above the movement path with the centering member point hanging down toward the movement path.

16. Apparatus as claimed in claim 15, further comprising:  
15 a second substantially V shaped centering member having two arms, each arm of the second centering member having a first end and a second end, the first arm ends of the second centering member being spaced apart to form the wide end of the V shape of the second centering member and the second arm ends of the second centering member being connected together to form the point of the V shape of the second centering member, with  
20 a central opening between the arms of the second centering member;

means pivotally mounting the second centering member wide end above the movement path with the second centering member point hanging down toward the movement path;

a sealing arm;

- 25 means pivotally mounting the first end of the sealing arm above the central opening of the second centering member with the second end of the sealing member hanging down toward the movement path; and

a seal dispenser mounted on the second end of the sealing arm.

- 30 17. A method of erecting a carton from a pair of blanks, each blank being as defined in any one of claims 7 to 12, said method comprising:

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positioning the blanks on an erecting surface with a stop member adjacent the end panel of one of the blanks;

advancing the blanks in a first direction against the stop member to cause the blanks to form 90° folds on the first 90° fold line, the first and second 180° fold lines and  
5 the further 180° fold lines;

applying suction beneath one of the top panel and the bottom panel of the underlying one of the blanks;

advancing the blanks in a direction perpendicular to the first direction with the suction maintaining the one panel substantially stationary to cause the blanks to form 90°  
10 folds on the second and third 90° fold lines and to form 180° folds on the 180° fold lines of the second and fourth fold-in panels and on the fold lines joining the fold-in panels to the top and bottom panels; and

sealing the bottom panels of the two blanks together.

15 18. Apparatus for erecting a carton from a pair of blanks, each blank being as defined in any one of claims 7 to 12, said apparatus comprising:

an erecting surface for supporting the blanks with the end panel of one blank overlying a portion of and joined to the side panel of the other blank and the fold-in panels of the one blank overlying portions of and joined to the top and bottom panels of the other  
20 blank, the joined panels defining further 180° fold lines;

a stop member on said erecting surface;

a first actuator for advancing the blanks in a first direction against the stop member to cause the blanks to form 90° folds on the first 90° fold line, the first and second 180° fold lines and the further 180° fold lines;

25 a vacuum source for applying suction beneath one of the top panel and the bottom panel of the underlying one of the blanks;

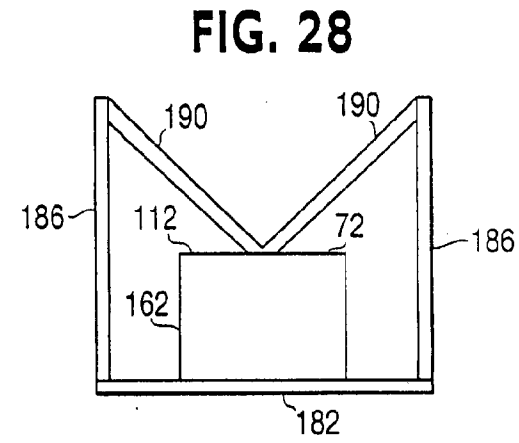
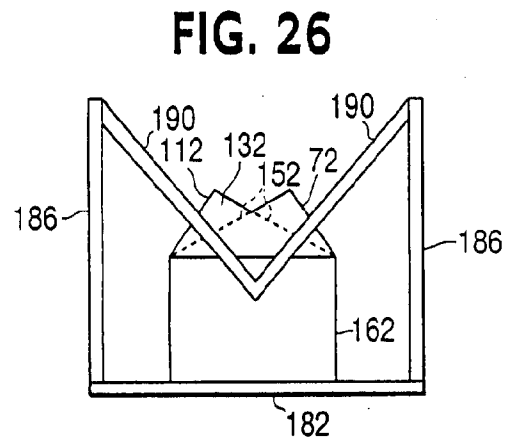
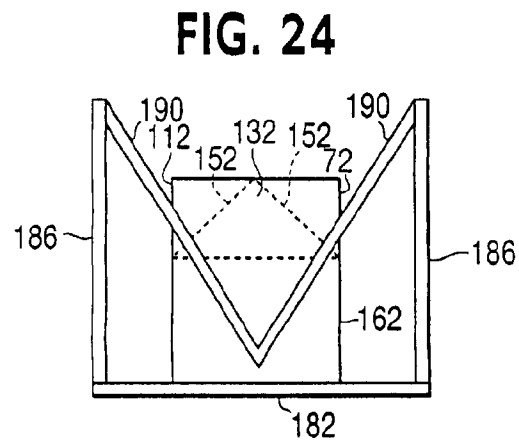
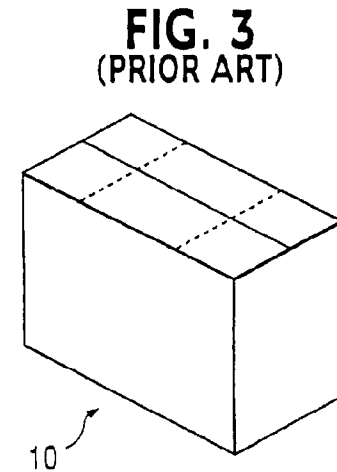
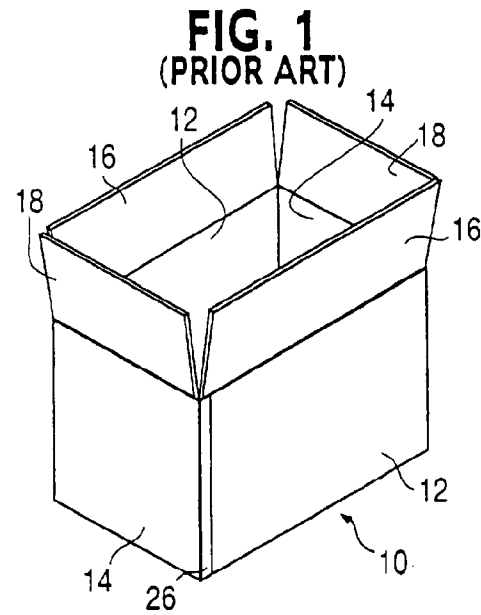
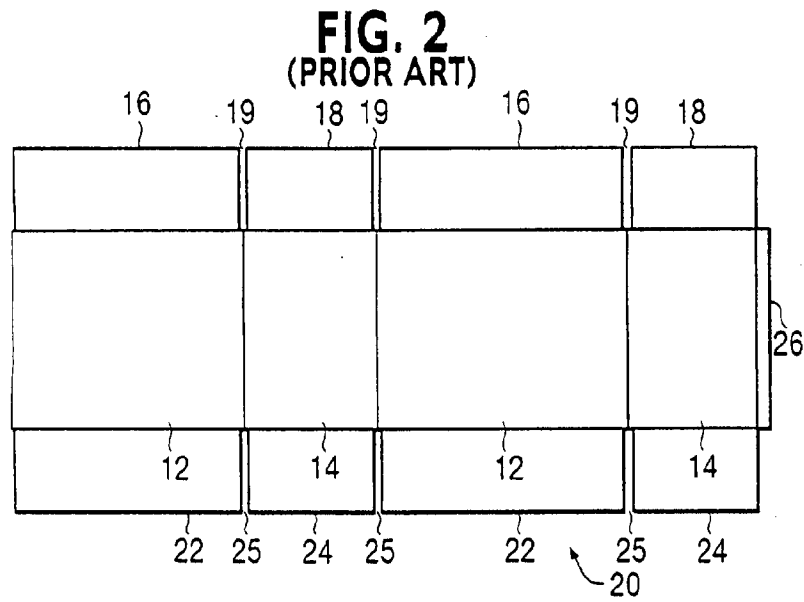
a second actuator for advancing the blanks in a direction perpendicular to the first direction while suction from the vacuum source maintains the one panel substantially stationary to cause the blanks to form 90° folds on the second and third 90° fold lines and  
30 to form 180° folds on the 180° fold lines of the fold-in panels and on the fold lines joining the fold-in panels to the top and bottom panels; and

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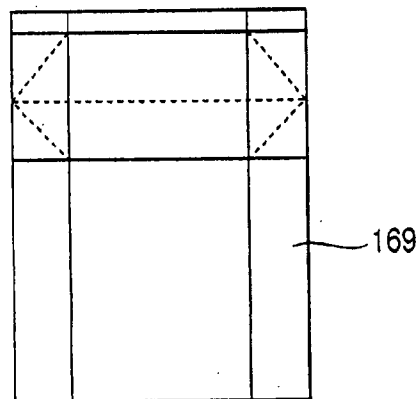
a sealing mechanism for sealing the bottom panels of the two blanks together.

19. A blank for producing a carton, a method of closing a carton or apparatus for closing a carton made from a blank substantially as hereinbefore described with reference  
5 to Figures 4 to 29 of the accompanying drawings.

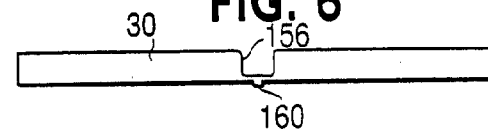
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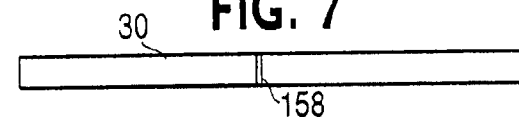
**FIG. 22**



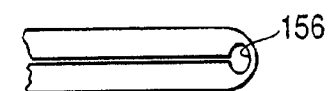
**FIG. 6**



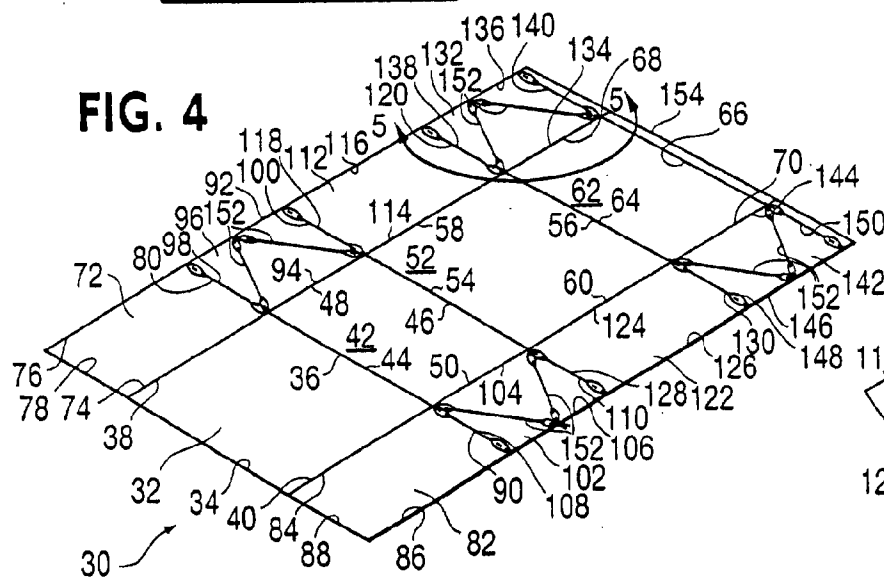
**FIG. 7**



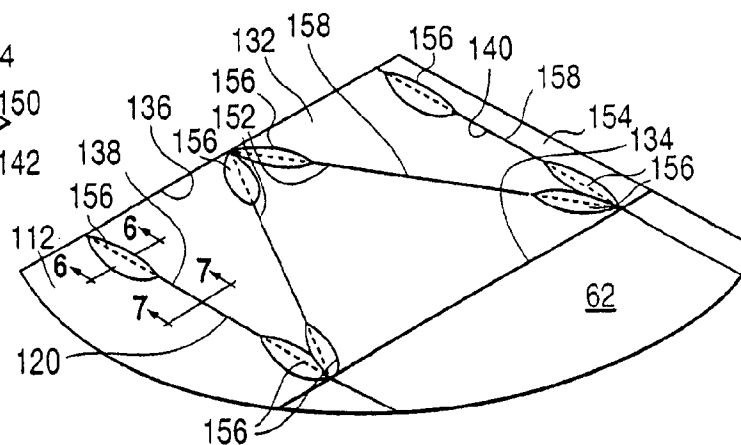
**FIG. 8**



**FIG. 4**



**FIG. 5**



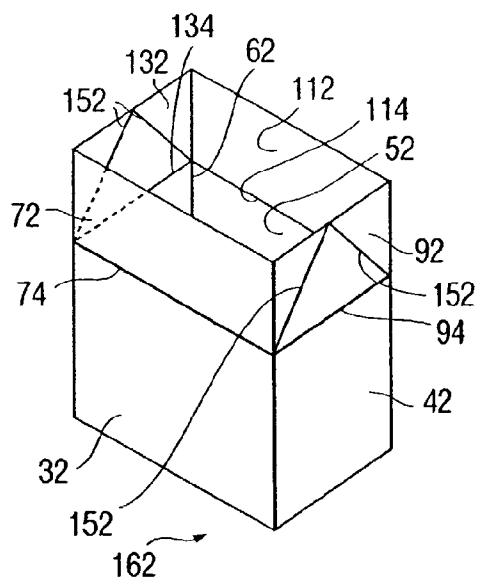
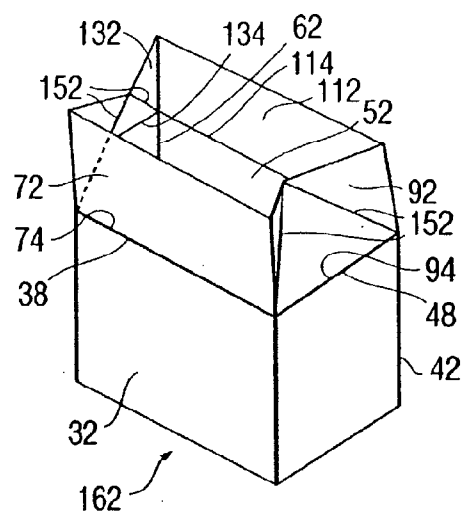
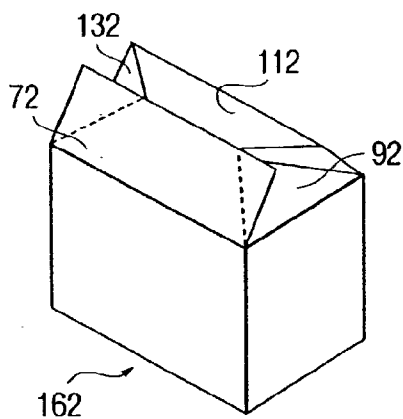
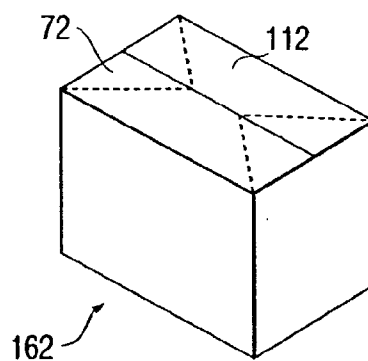
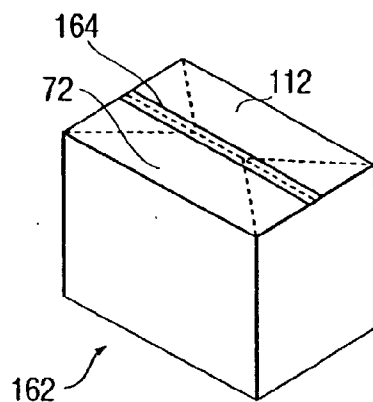
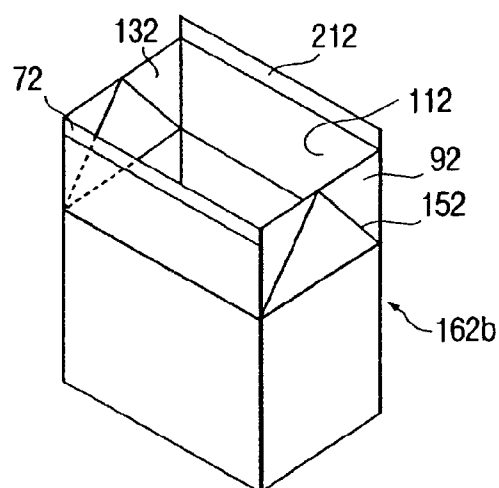
**FIG. 9****FIG. 10****FIG. 11****FIG. 12****FIG. 13****FIG. 29**



FIG. 14

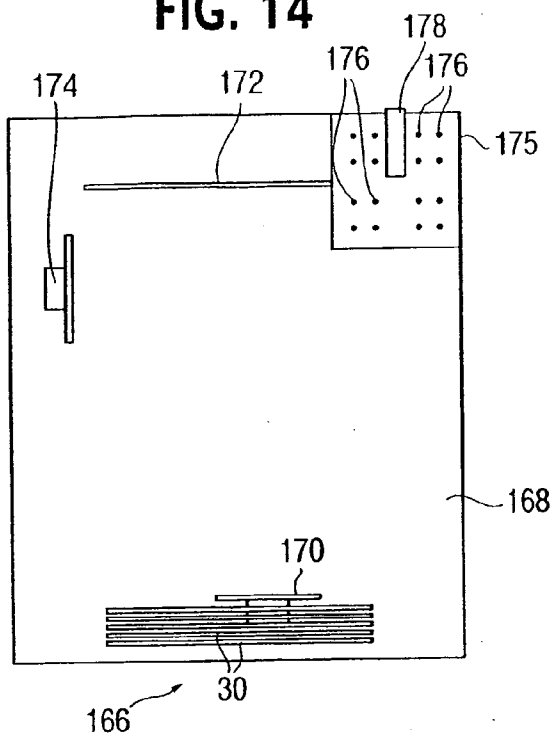


FIG. 15

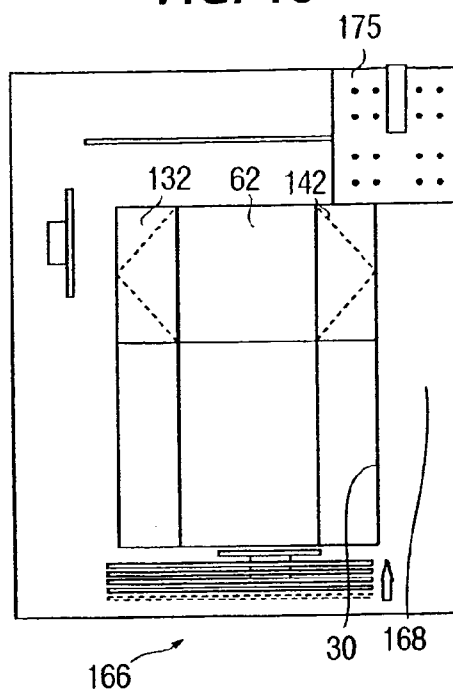


FIG. 16

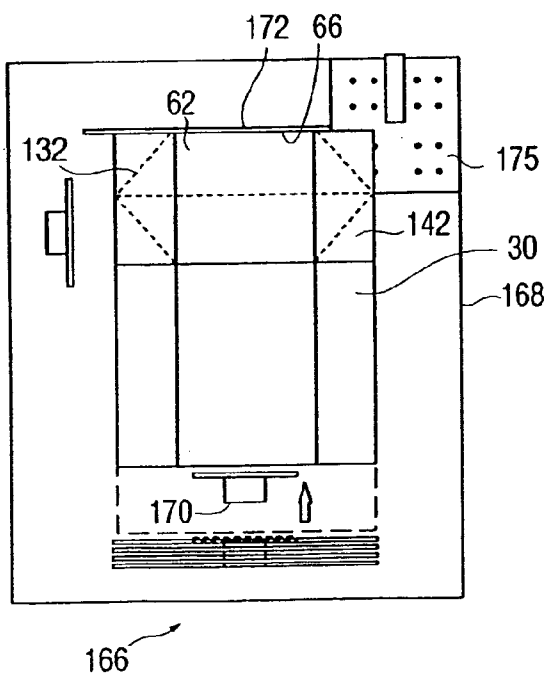
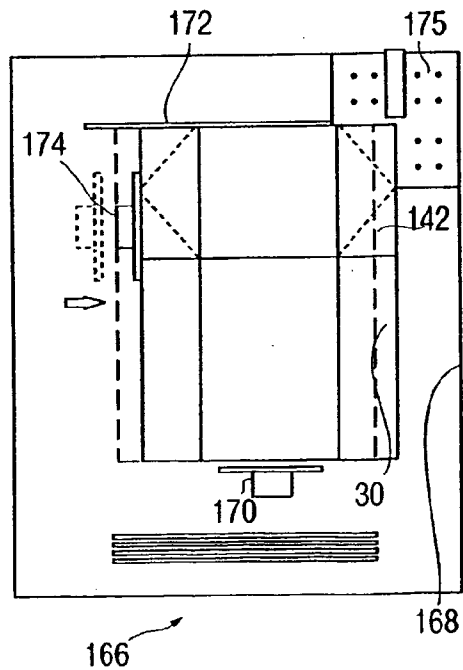
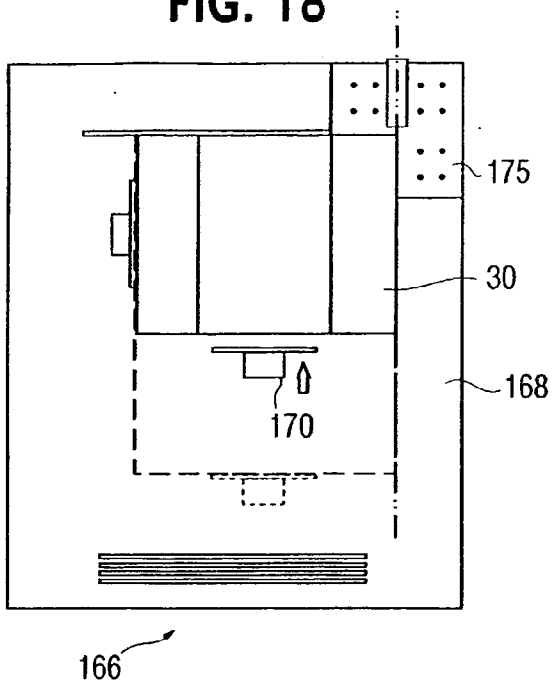


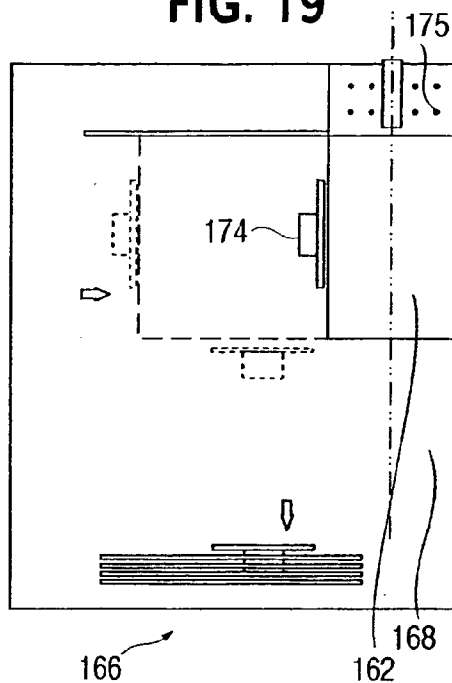
FIG. 17



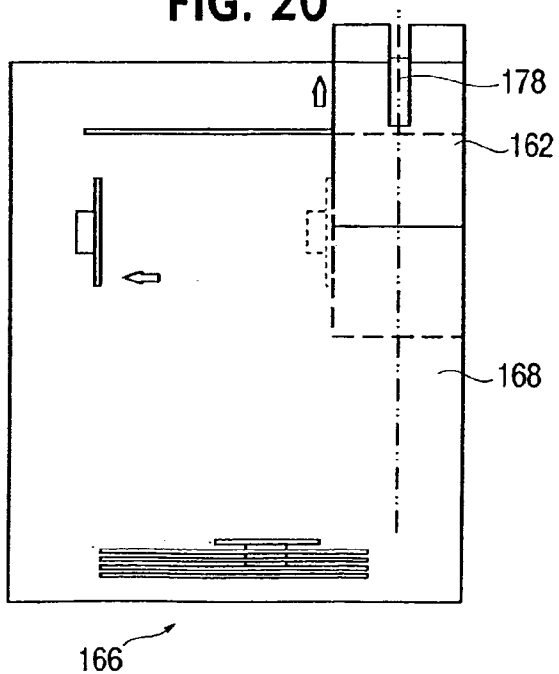
**FIG. 18**



**FIG. 19**



**FIG. 20**



**FIG. 21**

