US 20240101302A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0101302 A1**

Castle (43) **Pub. Date: Mar. 28, 2024**

(54) **SKIP SLOT BOX BLANKS, BOXES AND METHODS OF FORMING THE SAME**

(71) Applicant: **Georgia-Pacific Corrugated LLC**, Atlanta, GA (US)

(72) Inventor: **Matthew David Castle**, Chillicothe, OH (US)

(21) Appl. No.: **18/371,470**

(22) Filed: **Sep. 22, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/409,902, filed on Sep. 26, 2022.

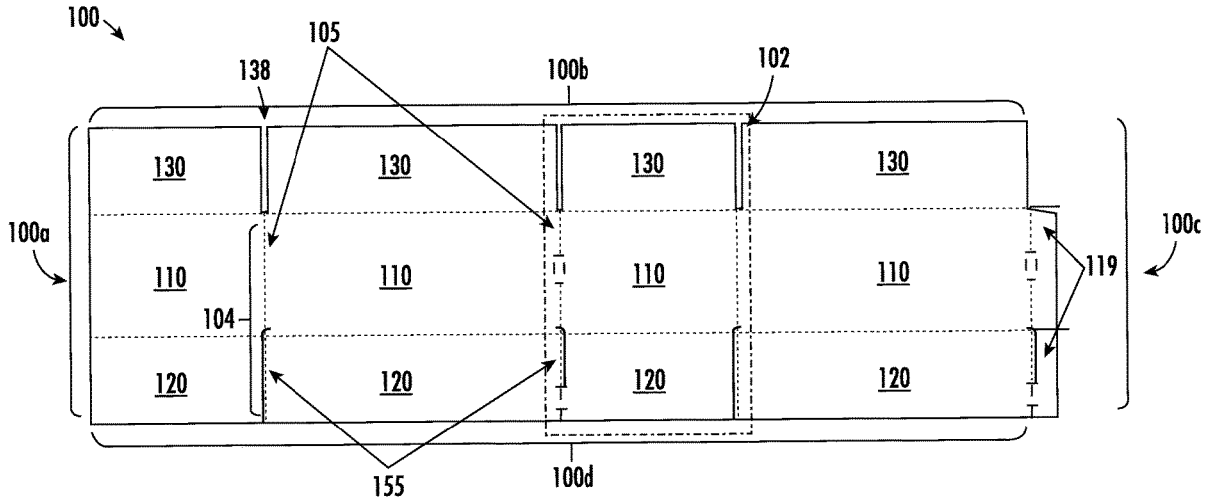
Publication Classification

(51) **Int. Cl.**
B65D 5/42 (2006.01)

(52) **U.S. Cl.**
CPC ***B65D 5/4266*** (2013.01); ***B65D 5/4279*** (2013.01)

(57) **ABSTRACT**

Box blanks, boxes, and corresponding methods of forming the same are provided herein. The box blank comprises a plurality of panels and flaps. Each of the plurality of panels are connected along a foldable panel score line portion, and each of the plurality of flaps are connected along a foldable flap score line portion. The plurality of flaps are connected to the plurality of panels. The box blank further comprises a first cross-cut and a second cross-cut spaced apart from the first cross-cut to define an uncut portion therebetween. Each cross-cut extends across the flap score line portion. The box blank further comprises a first cut extending from the first cross-cut at least a portion of a distance to the plurality of panels, and a second cut extending from the second cross-cut at least a portion of a second distance leading towards an edge of the plurality of flaps.



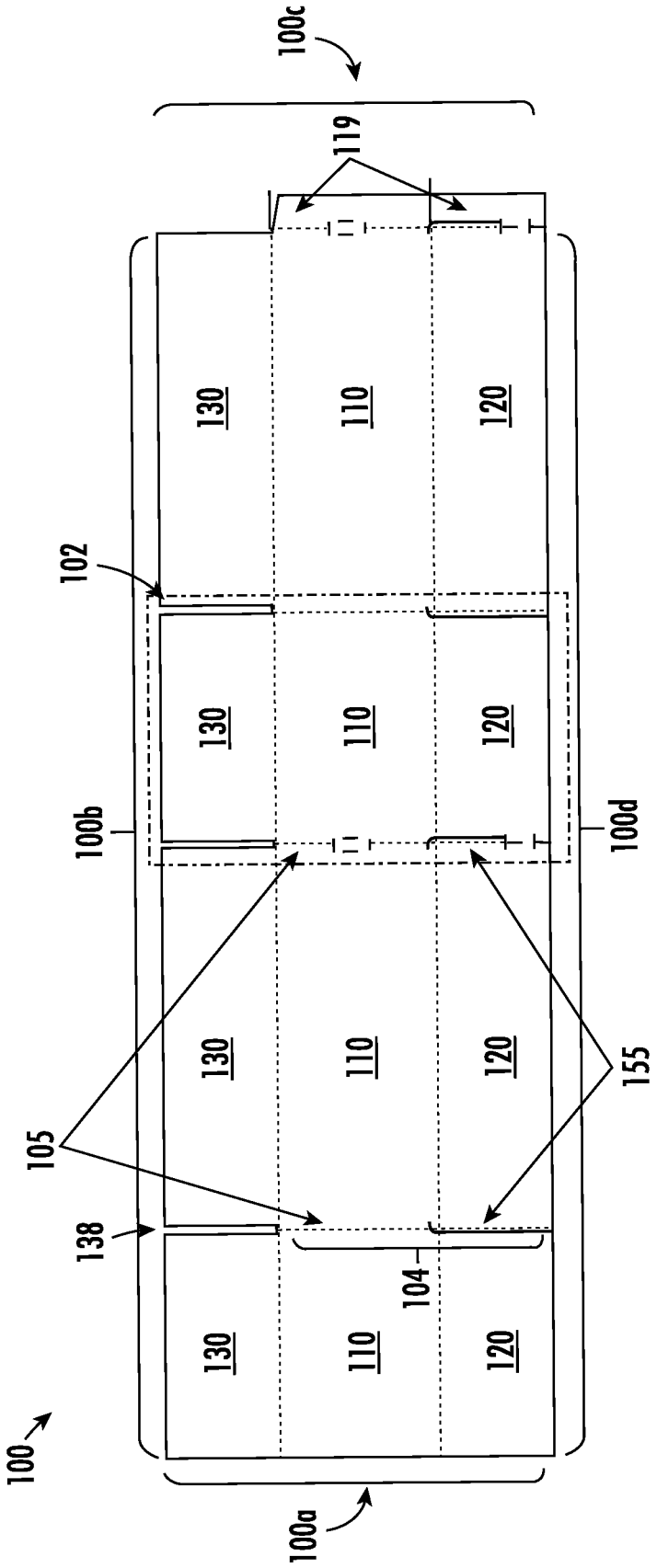


FIG. 1A

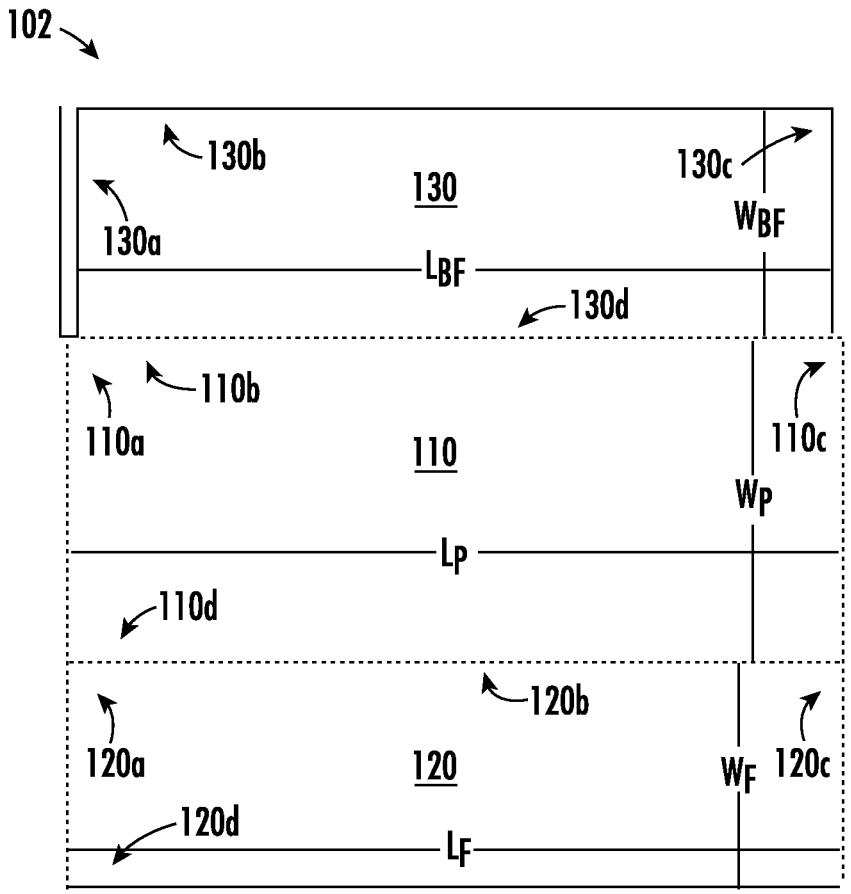

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FIG. 1B

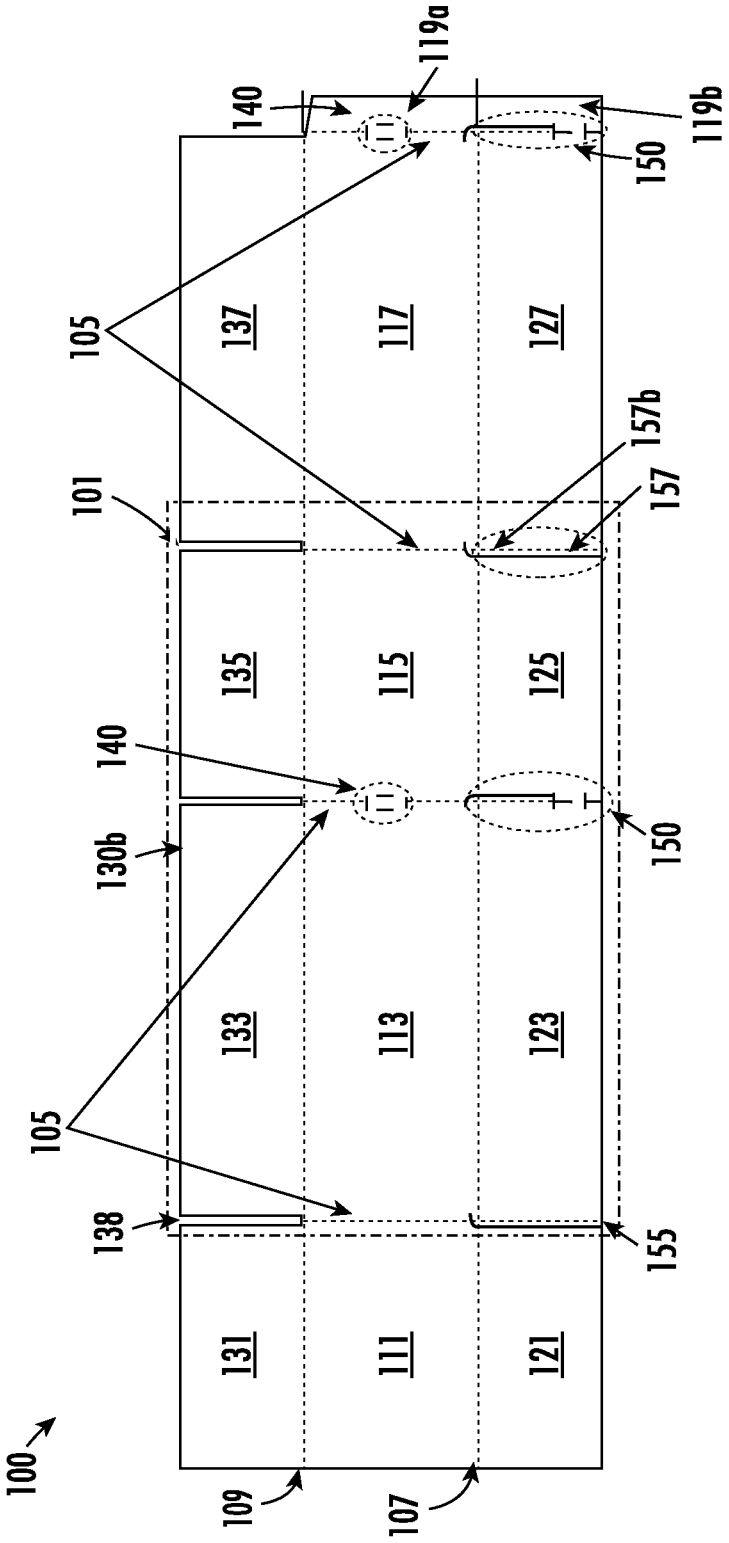
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FIG. 2A

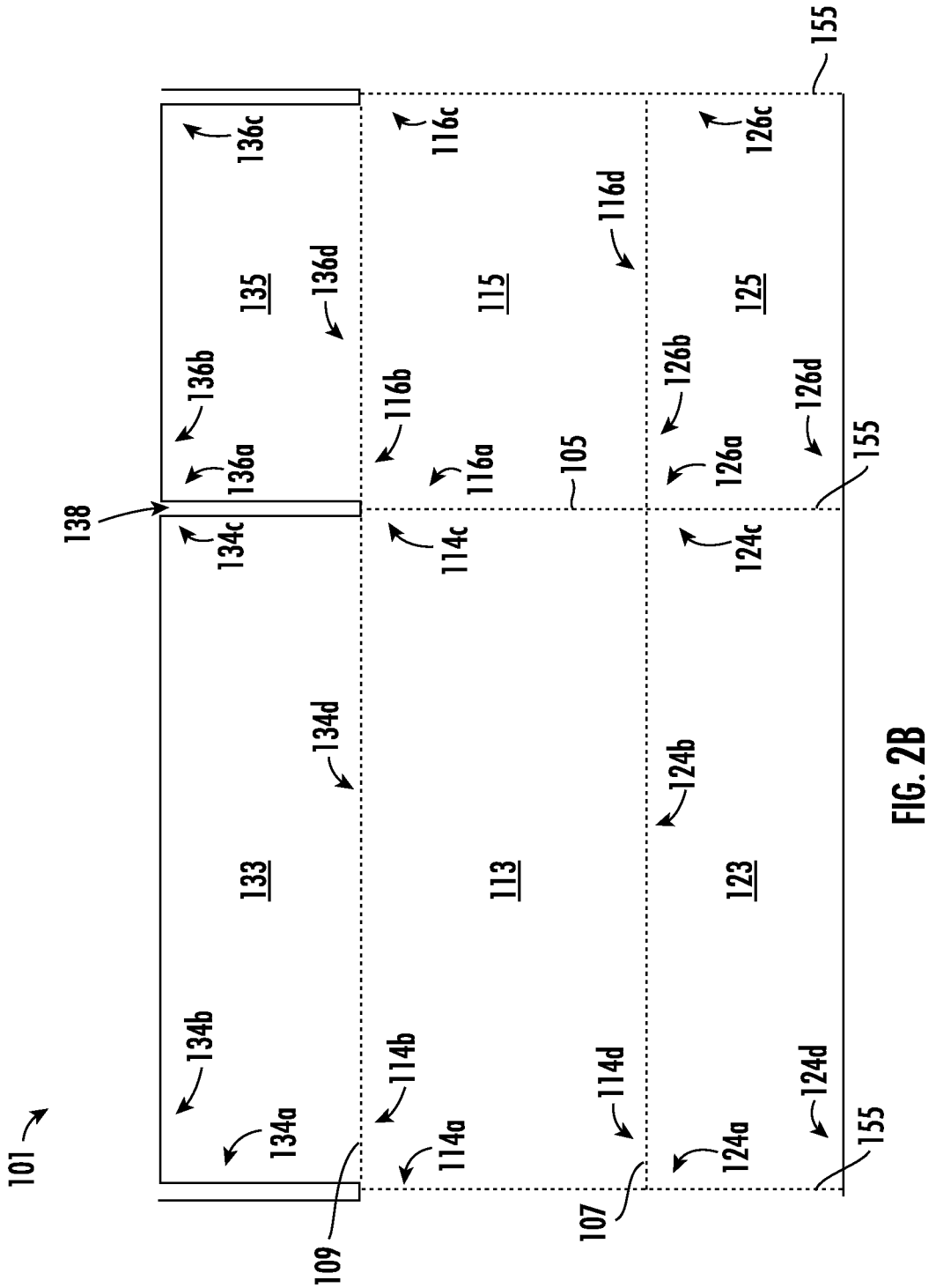
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FIG. 2B

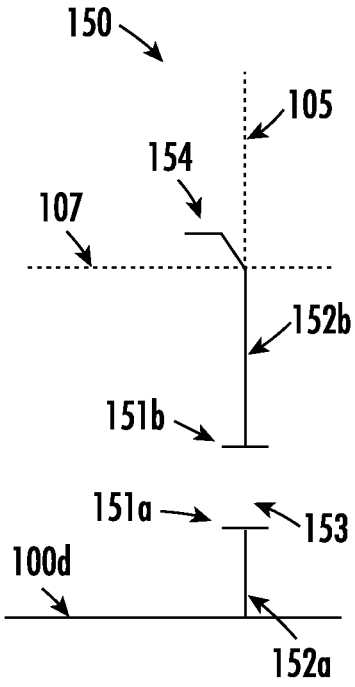

FIG. 3A

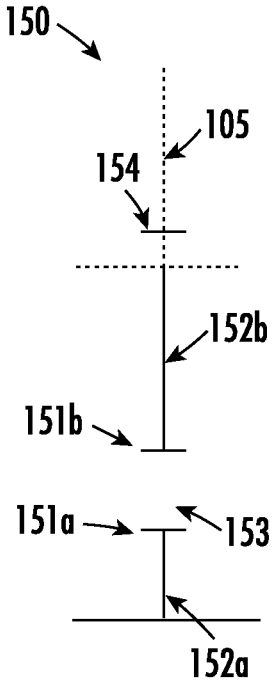

FIG. 3B

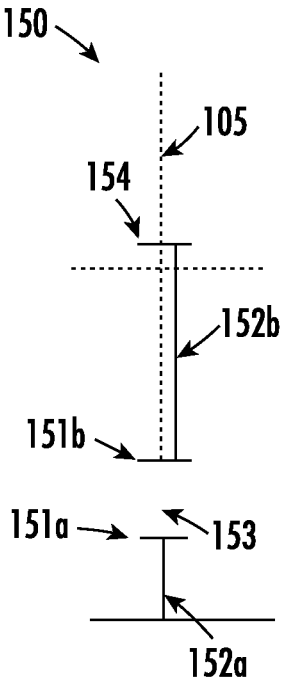

FIG. 3C

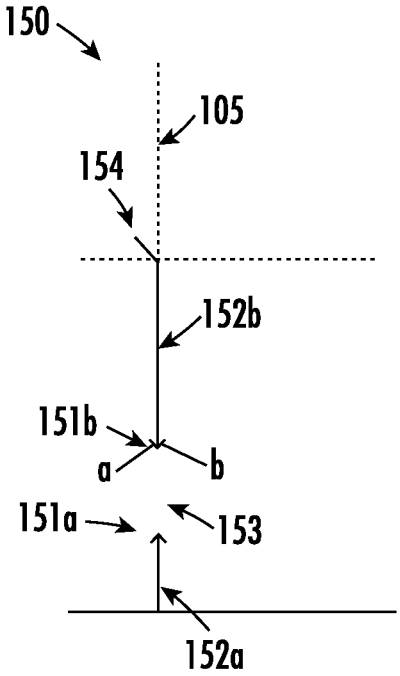

FIG. 3D

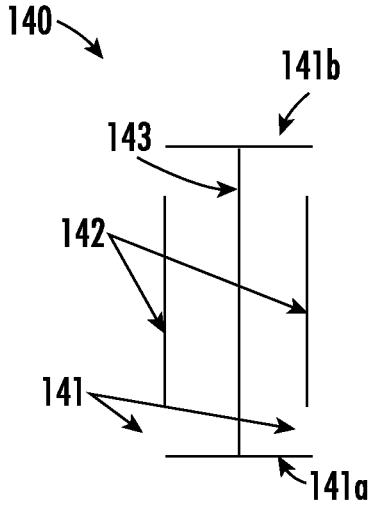

FIG. 4A

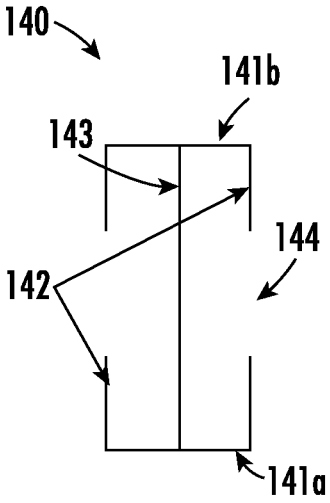

FIG. 4B

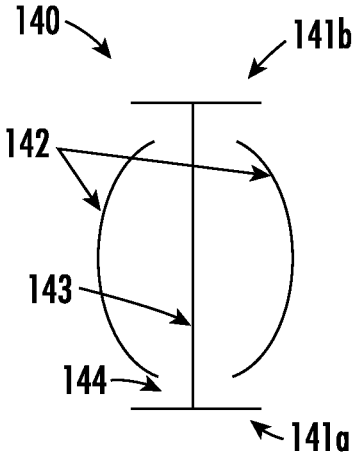

FIG. 4C

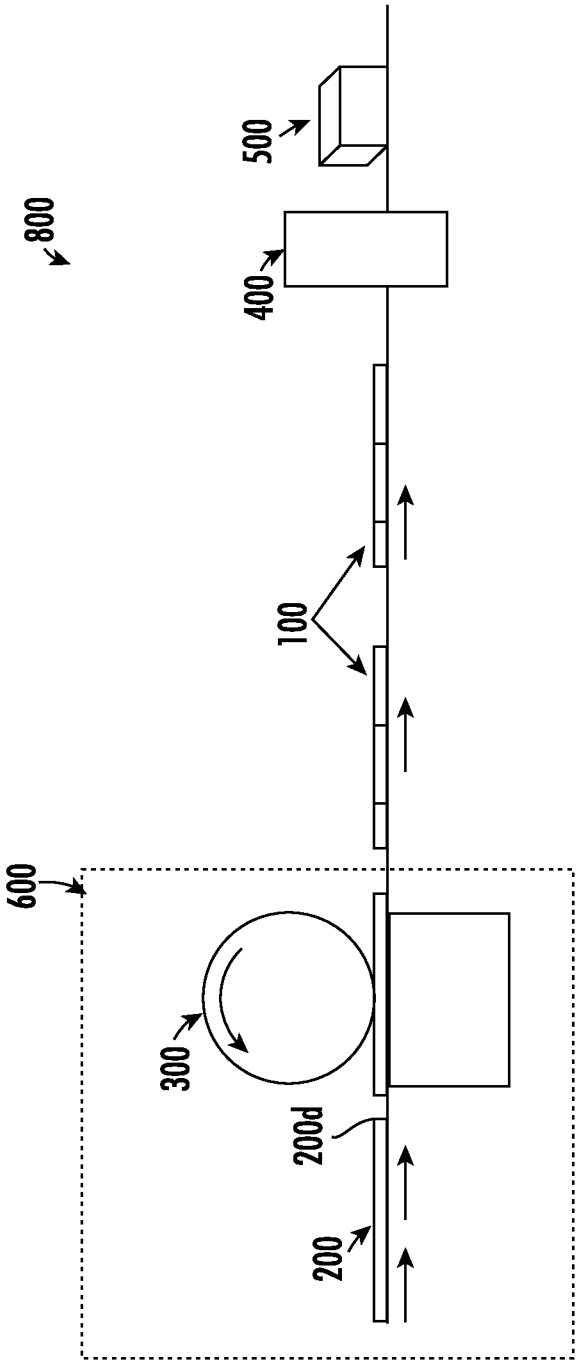

FIG. 5A

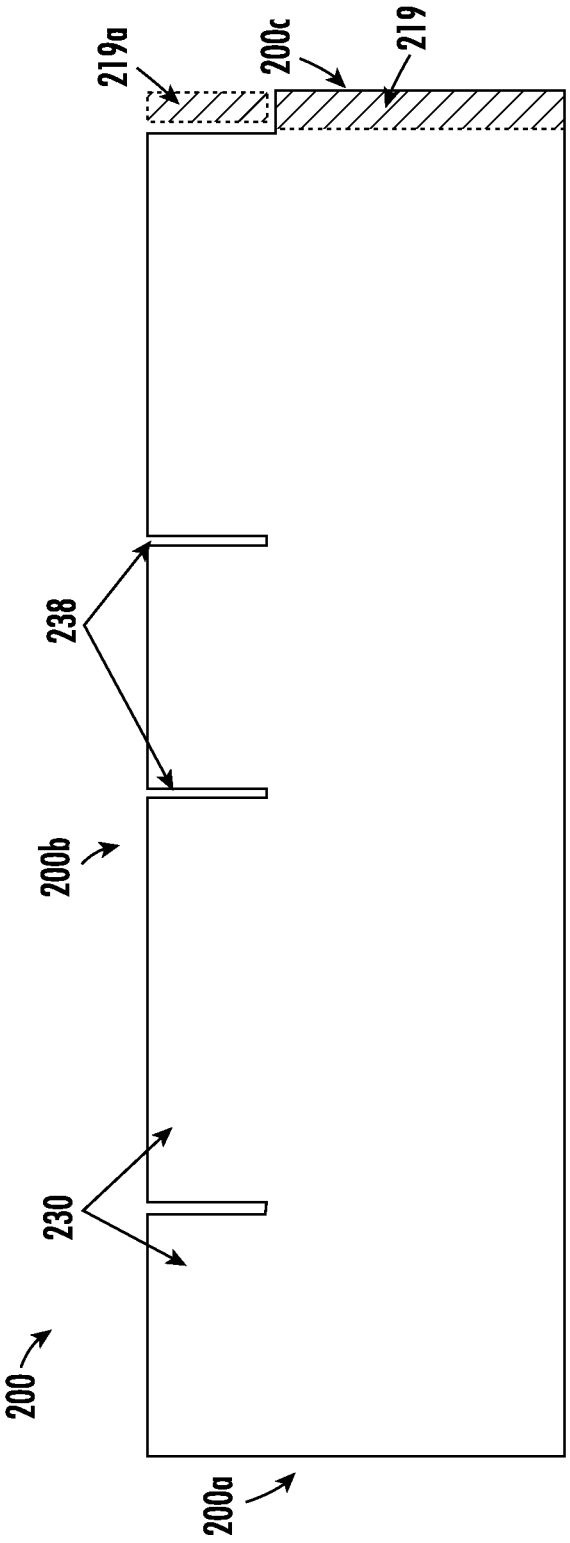

FIG. 5B

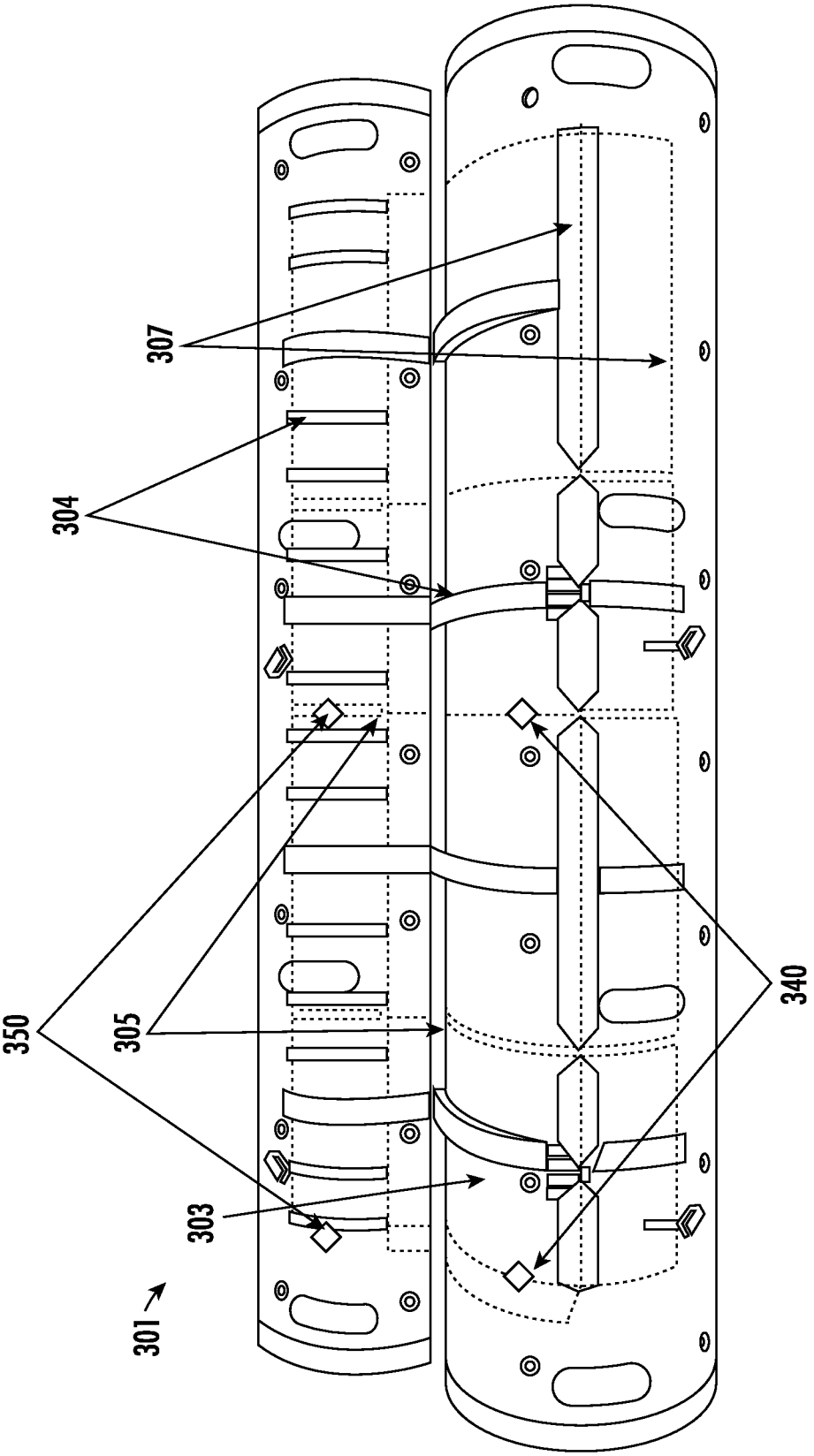

FIG. 5C

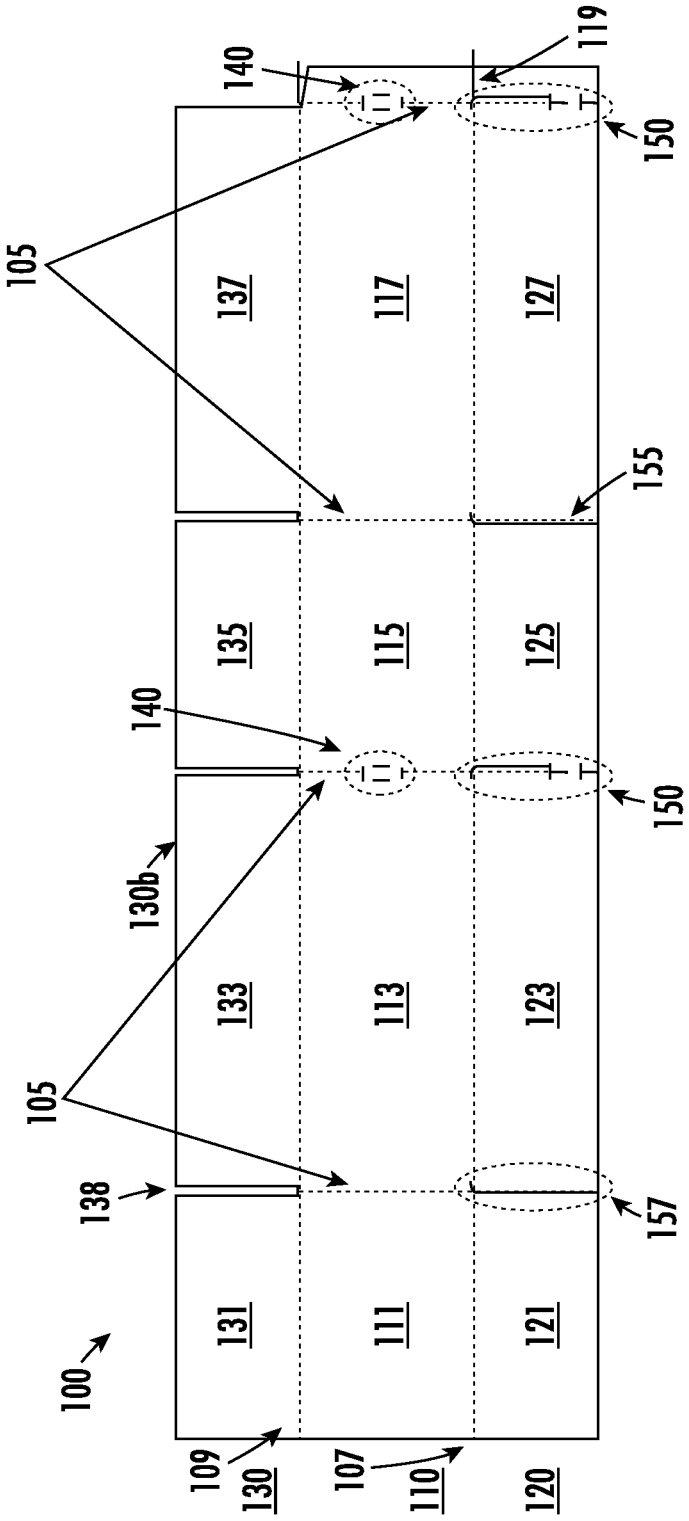
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FIG. 5D

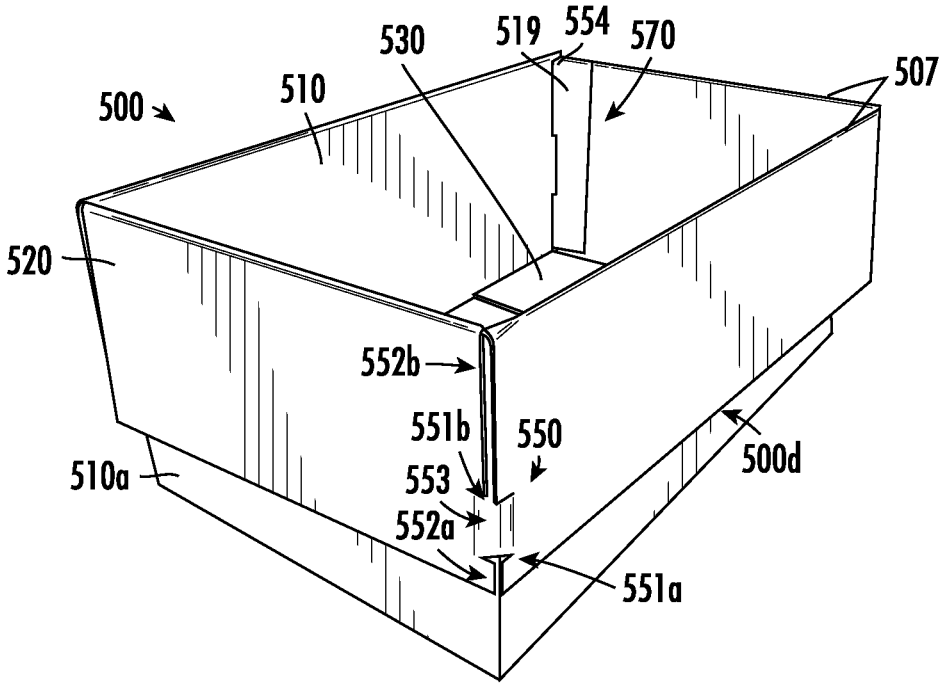
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FIG. 6A

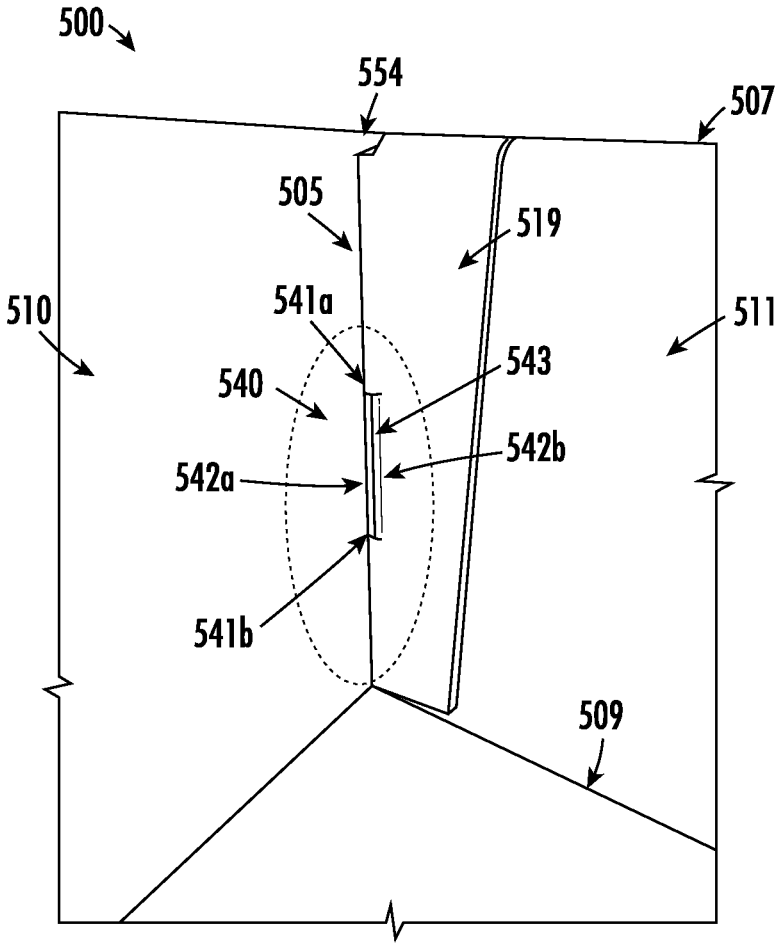
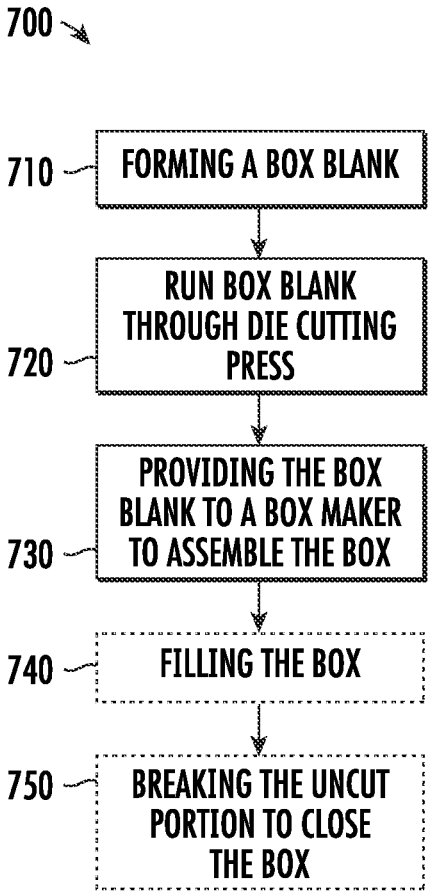


FIG. 6B


700
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FORMING A BOX BLANK
720
RUN BOX BLANK THROUGH DIE CUTTING PRESS
730
PROVIDING THE BOX BLANK TO A BOX MAKER TO ASSEMBLE THE BOX
740
FILLING THE BOX
750
BREAKING THE UNCUT PORTION TO CLOSE THE BOX

FIG. 7

SKIP SLOT BOX BLANKS, BOXES AND METHODS OF FORMING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to U.S. Provisional Application No. 63/409,902, entitled "Skip Slot Box Blanks, Boxes and Methods of Forming the Same", filed Sep. 26, 2022; the contents of which is incorporated by reference herein in its entirety.

BACKGROUND

[0002] Corrugate box blanks may be formed from a web of corrugate that may be formed in, for example, a corrugator. The box blank comprises various cuts, cut outs, scores and compressions increasing the ease of folding and erecting a box therefrom. The box blank may include thinning of areas including creases, slits, compressions, perforations, and cuts. A box may be assembled by a user or with a box maker (e.g., a case erector).

[0003] The box blank may be formed with a die cut positioned on a machine (e.g., a die cutting press). A user assembles the die cut onto the press and may be required to set up additional features needed for the die cut, including any knives, pins, and patterns that are unable to stay on the die cut. The time spent assembling and dissembling the die cut from the press may reduce the amount of available run time, and thus reduce the efficiency of the die cutting press. Additionally, when the die cut pattern requires holes in the corrugate box blank, the scrap corrugate resulting from the cut may remain in the die cut or press itself rather than being ejected. The un-ejected scrap corrugate must be manually removed, and adjustments may need to be made to the die cut, thereby increasing down time. Further, in addition to assembly and disassembly, any down time to repair or adjust the die cuts (e.g., due to scrap corrugate) may reduce efficiency. Thus, there is a need for a box blank which may be produced at a high efficiency and may reduce the amount of down time needed on the press when forming the box blank.

BRIEF SUMMARY

[0004] Embodiments of the present invention are directed to corrugate box blanks that are designed to reduce the amount of scrap corrugate, and reduce downtime of the die cutting press, and therefore increase efficiency and throughput. Importantly, rather than include multiple cut outs within the box blank, the box blank includes a plurality of scores that may be arranged in score lines (which may be referred to as, for example, crease lines, lines of weakness, etc.) and/or cuts arranged so the box blank is pliable, while not creating scrap of corrugate material. Thus, when the corrugate box blank is erected into a box, the resulting box flaps are secured to one another along the outer surface of the walls to secure the flaps in an open configuration, while allowing a user to easily position the flaps into a closed position after filling the box. Such box blanks, as noted above, are produced without certain scrap—thereby enabling them to be formed in high throughput presses and, in some cases, even in a 2-up scheme (e.g., two box blanks may be formed from a single rotation of a die cut).

[0005] In this regard, embodiments of the present invention are directed towards a box blank comprising a series of cross cuts, and parallel cuts, to afford easy manufacturing of boxes, while creating less scrap, and thus, improving efficiency and productivity. Some embodiments of the present invention are directed to corresponding boxes and methods for forming the box blanks and boxes.

[0006] In an example embodiment a box blank for a corrugated box is provided. The box blank comprises a plurality of panels including at least a first panel and a second panel. The first panel defines a first edge, a second edge, a third edge, and a fourth edge, and the second panel defines a first edge, a second edge, a third edge, and a fourth edge. The third edge of the first panel is connected to the first edge of the second panel along a panel score line portion, and the panel score line portion is foldable. The box blank further comprises a plurality of flaps including at least a first flap and a second flap. The first flap defines a first edge, a second edge, a third edge, and a fourth edge, and the second flap defines a first edge, a second edge, a third edge, and a fourth edge. The second edge of the first flap is connected to the fourth edge of the first panel, and the second edge of the second flap is connected to the fourth edge of the second panel. The third edge of first flap is connected to the first edge of the second flap along a flap score line portion, and the flap score line portion is foldable. The box blank further comprises a first cross-cut extending across the flap score line portion between the first flap and the second flap, and a second cross-cut extending across the flap score line portion between the first flap and the second flap. The second cross-cut is spaced apart from the first cross cut so as to define an uncut portion of the flap score line portion therebetween. The box blank further comprises a first cut extending from the first cross-cut at least a portion of a first distance leading to the fourth edge of the first flap or the fourth edge of the second flap, and a second cut extending from the second cross-cut at least a portion of a second distance leading to the second edge of the first flap or the second edge of the second flap.

[0007] In some embodiments, the second cut may comprise a tail portion and the tail portion may extend beyond the fourth edge of either the first panel or the second panel. In some embodiments, the tail portion may extend away from the panel score line portion. In some embodiments, the first cut may extend to the fourth edge of the first flap or the fourth edge of the second flap. In some embodiments, the uncut portion may be between 1-1.5 inches. In some embodiments, the flap score line may be a line of weakness. In some embodiments, the second cut may be parallel to the flap score line portion.

[0008] In some embodiments, the first cross-cut and the second cross-cut may extend non-linearly across the flap score line portion. In some embodiments, the first cross-cut of the second cross-cut may comprise a first portion extending in a first direction from the flap score line portion and a second portion extending in a second direction from the flap score line portion. In some embodiments, the first direction and the second direction may be different.

[0009] In some embodiments, the box blank may further comprise a panel pattern cut about the panel score line portion between the first panel and the second panel. In some embodiments, the panel pattern cut may comprise a first panel score line cross-cut extending across the panel score line portion between the first panel and the second panel, and a second panel score line cross-cut extending across the panel score line portion between the first panel and the

second panel. In some embodiments, the second panel score line cross-cut may be spaced apart a distance from the first panel cross-cut. In some embodiments, the panel pattern cut may further comprise at least one panel cut or line of weakness extending at least partially between the first panel cross-cut and the second panel cross-cut. In some embodiments, the at least one panel cut or line of weakness is spaced apart from the panel score line between the first panel and the second panel. In some embodiments, the length of the uncut portion may be smaller than the distance between the first panel score line cross-cut and the second panel soccer line cross-cut.

[0010] In some embodiments, the box blank may further comprise a plurality of bottom flaps, including at least a first bottom flap and a second bottom flap. In some embodiments, the first bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, and the second bottom flap defines a first edge, a second edge, a third edge, and a fourth edge. In some embodiments, the fourth edge of the first bottom flap is connected to the second edge of the first panel, and the fourth edge of the second bottom flap is connected to the second edge of the second panel. In some embodiments, the third edge of the first bottom flap may be spaced apart from the first edge of the second bottom flap.

[0011] In some embodiments, the first bottom flap and the second bottom flap may be foldable about a bottom score line. The bottom score line may abut the fourth edge of the first bottom flap and the fourth edge of the second bottom flap and the second edge of the first panel and the second edge of the second panel.

[0012] In some embodiments, the plurality of panels of the box blank may further comprise a third panel and a fourth panel. In some embodiments, the third panel defines a first edge, a second edge, a third edge, and a fourth edge. In some embodiments, the first edge of the third panel is connected to the third edge of the second panel along a second panel score line portion. In some embodiments, the fourth panel defines a first edge, a second edge, a third edge, and a fourth edge. In some embodiments, the third edge of the fourth panel is connected to the first edge of the first panel along a third panel score line portion. In some embodiments, the plurality of flaps of the box blank may further comprise a third flap and a fourth flap. In some embodiments, the third flap defines a first edge, a second edge, a third edge, and a fourth edge, and the fourth flap defines a first edge, a second edge, a third edge, and a fourth edge. In some embodiments, the second edge of the third flap is connected to the fourth edge of the third panel, and the second edge of the fourth flap is connected to the fourth edge of the fourth panel. In some embodiments, the first edge of the third flap is connected to the third edge of the second flap along a second flap score line portion, and the second flap score line portion may be foldable. In some embodiments, the first edge of first flap is connected to the third edge of the fourth flap along a third flap score line portion, and the third flap score line portion may be foldable.

[0013] In some embodiments, the box blank may further comprise a connector tab comprising at least a connector panel, connected to either the third side of the third panel or the first side of the fourth panel along a fourth panel score line portion. In some embodiments, the connector tab may further comprise a connector flap connected to either the third side of the third flap or the first side of the fourth flap along a fourth flap score line portion. In some embodiments, the box blank may further comprise a third cross-cut extending across the fourth flap score line portion, and a fourth cross-cut extending across the fourth flap score line portion. In some embodiments, the fourth cross-cut may be spaced apart from the third cross-cut so as to define a second uncut portion of the fourth flap score line therebetween. In some embodiments, the box blank may further comprise a third cut extending from the third cross-cut at least a portion of a first distance leading to the fourth edge of the third flap or the fourth edge of the fourth flap, and a fourth cross-cut extending from the fourth cross-cut at least a portion of a second distance leading to the second edge of the third flap or the second edge of the fourth flap.

[0014] In some embodiments, the box blank may further comprise a third bottom flap and a fourth bottom flap. In some embodiments, the third bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, and the fourth bottom flap defines a first edge, a second edge, a third edge, and a fourth edge. In some embodiments, the fourth edge of the third bottom flap is connected to the second edge of the third panel, and the fourth edge of the fourth bottom flap is connected to the second edge of the fourth panel. In some embodiments, the first edge of the third bottom flap is spaced apart from the third edge of the second bottom flap, and the third edge of the third bottom flap is spaced apart from the first edge of the second bottom flap.

[0015] In another example embodiment of the present invention a method of forming a box is provided. The method comprises providing a blank. The blank comprises a sheet of corrugate defining a first outer edge, a second outer edge, a third outer edge and a fourth outer edge. The fourth outer edge is parallel to the second outer edge, and the fourth outer edge is perpendicular to the first outer edge, and the first outer edge is parallel to the third outer edge.

[0016] The method further comprises running the blank through a blank die to form a box blank. The box blank comprises a plurality of panels including at least a first panel and a second panel. The first panel defines a first edge, a second edge, a third edge, and a fourth edge, and the second panel defines a first edge, a second edge, a third edge, and a fourth edge. The third edge of the first panel is connected to the first edge of the second panel along a panel score line portion, and the panel score line portion is foldable. The box blank further comprises a plurality of flaps including at least a first flap and a second flap. The first flap defines a first edge, a second edge, a third edge, and a fourth edge, and the second flap defines a first edge, a second edge, a third edge, and a fourth edge. The second edge of the first flap is connected to the fourth edge of the first panel, and the second edge of the second flap is connected to the fourth edge of the second panel. The third edge of first flap is connected to the first edge of the second flap along a flap score line portion, and the flap score line portion is foldable. The box blank further comprises a connection tab extending from one of the plurality of panels and a corresponding one of the plurality of flaps. The connection tab is defined by a connection tab score line. The box blank further comprises a first cross-cut extending across the flap score line between the first flap and the second flap, and a second cross-cut extending across the flap score line between the first flap and the second flap. The second cross-cut is spaced apart from the first cross cut so as to define an uncut portion of the flap score line portion therebetween. The box blank further comprises a first cut extending from the first cross-cut at

least a portion of a first distance leading to the fourth edge of the first flap or the fourth edge of the second flap, and a second cut extending from the second cross-cut at least a portion of a second distance leading to the second edge of the first flap or the second edge of the second flap.

[0017] The method further comprises providing the box blank to a box maker. The box maker is configured to fold the plurality of flaps such that an outer surface of the plurality of flaps abuts an outer surface of the plurality of panels. The box make is further configured to fold the plurality of panels along the plurality of panel score line portions. The box maker is further configured to adhere the connection tab to one of the plurality of panels and the corresponding one of the plurality of flaps, and adhere the plurality of bottom flaps to form a bottom surface.

[0018] In some embodiments, the blank die may be configured to penetrate a thickness of the blank without removing material from the blank.

[0019] In yet another example embodiment a box formed from a corrugated box blank is provided. In some embodiments, the box comprises a plurality of walls including at least a first wall, a second wall, a third wall, and a fourth wall, wherein each wall is connected to the adjacent wall at a foldable score line portion. In some embodiments, the box comprises a plurality of flaps, including at least a first flap, a second flap, a third flap and a fourth flap. Each of the plurality of flaps extend from the corresponding wall of the plurality of walls, and each of the plurality of flaps are folded such that at least a portion of an outer surface of the plurality of walls abuts at least a portion of an outer surface of the plurality of flaps. The plurality of flaps comprises a first uncut portion between the first flap and a second flap and a second uncut portion between the third flap and the fourth flap. The box further comprises a plurality of bottom flaps. Each of the plurality of bottom flaps extend from the plurality of walls opposite the plurality of walls, and the plurality of bottom flaps are adhered to form a bottom, wherein the bottom is perpendicular to the plurality of walls. The box further comprises a connector tab extends from either the first wall and the first flap or the fourth wall and the fourth flap. The connector tab is adhered to either the first wall and the first flap or the fourth wall and the fourth flap.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0020] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0021] FIG. **1**A illustrates an example corrugated box blank, in accordance with some embodiments discussed herein;

[0022] FIG. **1**B illustrates an example section of the corrugated box blank shown in FIG. **1**, in accordance with some embodiments discussed herein;

[0023] FIG. **2**A illustrates an example corrugated box blank, in accordance with some embodiments discussed herein;

[0024] FIG. **2**B illustrates a portion of the corrugated box blank shown in FIG. **2**A, in accordance with some embodiments discussed herein

[0025] FIGS. **3**A-D illustrate various configurations of example tab cuts, in accordance with some embodiments discussed herein;

[0026] FIGS. **4**A-C illustrate various configurations of example pattern cuts, in accordance with some embodiments discussed herein;

[0027] FIG. **5**A illustrates an example process of forming an example box, in accordance with some embodiments discussed herein;

[0028] FIG. **5**B illustrates an example corrugate sheet, in accordance with some embodiments discussed herein;

[0029] FIG. **5**C illustrates an example die cut, in accordance with some embodiments discussed herein;

[0030] FIG. **5**D illustrates an example box blank formed from the example die cut, in accordance with some embodiments discussed herein;

[0031] FIG. **6**A is a perspective view of an example box, formed from the example box blank shown in FIG. **1**, in accordance with some embodiments discussed herein;

[0032] FIG. **6**B is a close-up view of an interior portion of the example box shown in FIG. **6**A, in accordance with some embodiments discussed herein; and

[0033] FIG. **7** illustrates a flowchart of an example method of forming a blank, and forming a box from the blank, in accordance with some embodiments discussed herein.

DETAILED DESCRIPTION

[0034] Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments are shown. Indeed, the examples described and pictured herein should not be construed as being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout.

[0035] Notably, while some embodiments describe various positional qualifiers for various features, such as "top", "bottom", "front", "back", "side", etc. embodiments described herein are not meant to be limited to such qualifiers unless otherwise stated. Directional qualifiers herein are generally used to aid in describing the invention in the context of the drawings and/or description but are not otherwise intended to be limiting.

[0036] While some embodiments describe a "user", use of such a term herein is not meant to be limited to a person or a single person, as the "user" may be an end user, a consumer, a manufacturer, among other types of users along a supply chain in relation to the box design. Further, when utilizing the word "user", the actor(s) may be operating one or more machines/system that cause the intended function (e.g., forming the box blank or converting the box blank to a box).

[0037] An example box blank **100** is shown in FIG. **1**A. With reference to FIGS. **1**A-**2**B, the corrugated box blank **100** is formed of a plurality of panels **110**, a plurality of flaps **120**, and a plurality of bottom flaps **130** and a connector tab **119**. The box blank **100** may comprise a first outer edge **100***a*, a second outer edge **100***b* (also referred to as a "trailing edge"), a third outer edge **100***c*, and a fourth outer edge **100***d* (also referred to as a "leading edge") defining an outer periphery of the box blank **100**. In some embodiments, the fourth outer edge **100***d* may be parallel to the second outer edge **100***d* and may be perpendicular to both the first outer edge **100***a* and the third outer edge **100***c*. In some embodiments, the second outer edge **100***b* may comprise a

plurality of gaps **138** such that in some embodiments the second outer edge **100***b* may not be continuous. Additionally, in some embodiments, the connector tab **119** may define a portion of the third outer edge **100***c* and may not extend from the fourth outer edge **100***d* to the second outer edge **100***b*. Thus, in some embodiments, the third outer edge **100***c* may comprise multiple sections.

[0038] Notably, in some embodiments, the box blank **100** may be processed through one or more manufacturing systems at various stages, such as described herein. For example, in some embodiments, the box blank **100** may be formed from a web of corrugated material which may be cut into the box blank **100**, the box blank **100** may be further processed through a die cut to form desired cuts, scores, or impressions thereon, and/or the box blank **100** may be passed through a box maker to form the box therein. In this regard, use of the term leading edge versus trailing edge may relate to the machine direction in which the box blank passes. However, other edges may be a leading edge or a trailing edge. Likewise, the leading edge and the trailing edge may be opposite than described in the illustrated embodiment.

[0039] In some embodiments, the box blank **100** may comprise multiple adjacent sections **102**, each comprising one of the plurality of panels **110**, one of the plurality of flaps **120** and one of the plurality of bottom flaps **130**. In some embodiments, adjacent sections **102** may be connected via a section score line **104**. In some embodiments, each section score line may comprise a panel score line portion **105** between adjacent panels and via a flap score line portion **155** between adjacent flaps. In this regard the section score line **104** may be continuous between the second outer edge **100***b* and the fourth outer edge **100***d*. In some embodiments, the term "score" may be used to describe a compression of the internal support system of the blank without creating a cut therethrough. In some embodiments, the sections **102** of the box blank **100** may be foldable about the section score line **104**.

[0040] FIG. **1**B illustrates an example section **102** of the box blank **100**. Each section **102** of the box blank comprises one of the plurality of panels **110**, one of the plurality of flaps **120** and one of the pluralities of bottom flaps **130**. In some embodiments, each of the plurality of panels **110** comprises a first edge **110***a*, a second edge **110***b*, a third edge **110***c*, and a fourth edge **110***d*. In some embodiments, the first edge **110***a* and the third edge **110***c* are parallel, and the first edge **110***a* is perpendicular to each of the second edge **110***b* and the fourth edge **110***d*. Similarly, each of the plurality of flaps **120** comprises a first edge **120***a*, a second edge **120***b*, a third edge **120***c*, and a fourth edge **120***d*. In some embodiments, the first edge **120***a* and the third edge **120***c* are parallel, and the first edge **120***a* is perpendicular to each of the second edge **120***b* and the fourth edge **120***d*. Likewise, the plurality of bottom flaps **130** each comprise a first edge **130***a*, a second edge **130***b*, a third edge **130***c*, and a fourth edge **130***d* and the first edge **130***a* and the third edge **130***c* are parallel, while the first edge **130***a* is perpendicular to each of the second edge **130***b* and the fourth edge **130***d*.

[0041] As illustrated, the second edge **120***b* of one of the plurality of flaps **120** may extend from the fourth edge **110***d* of one of the plurality of panels **110**. Similarly, the fourth edge **130***d* of one of the plurality of bottom flaps **130** may extend from the second edge **110***b* of one of the plurality of panels **110**. Said differently the box blank **100** may comprise a continuous piece of corrugated material comprising a bottom flap, a panel and a flap.

[0042] In some embodiments, each of the plurality of panels **110** defines a panel length L_P, wherein the panel length L_P extends between the first edge **110***a* and the third edge **110***c*. In some embodiments, the panel length L_P is between 8-20 in, 9-19 in, or 10-18 in. In some embodiments, each of the plurality of panels **110** defines a panel width W_P extending between the second edge **110***b* and the fourth edge **110***d* of the panel. In some embodiments, the panel width W_P is between 5-10 in, between 6-9 in, or between 7-8 in. In some embodiments, each of the plurality of panels **110** defines the same panel width W_P. In some embodiments, each of the plurality of panels **110** defines the same panel length L_P, while in other embodiments the plurality of panels **110** may alternate panel lengths L_P. For example, in an example embodiment, adjacent panels may define different panel lengths L_P, while alternating panels may define the same panel lengths L_P.

[0043] In some embodiments, each of the plurality of flaps **120** defines a flap length L_F, wherein the flap length L_F extends from the first edge **120***a* to the third edge **120***c*. In some embodiments, the flap length L_F is between 8-20 in, 9-19 in, or 10-18 in. In some embodiments, the flap length L_F is equal to the panel length L_P of the corresponding panel of the plurality of panels **110**. In some embodiments, each of the plurality of flaps **120** defines a flap width W_F, wherein the flap width W_F extends between the second edge **120***b* and the fourth edge **120***d*. In some embodiments, the flap width W_F is between 3-8 in, between 4-7 in, or between 5-6 in. In some embodiments, the flap width W_F may be equal for the plurality of flaps **120**, while the flap length L_F may change across the plurality of flaps **120** corresponding to the panel length L_P of the corresponding panel of the plurality of panels **110**.

[0044] In some embodiments, each of the plurality of bottom flaps **130** defines a bottom flap length L_{BF}, wherein the bottom flap length L_{BF} extends between the first edge **130***a* and the third edge **130***c*. In some embodiments, the bottom flap length L_{BF} is between 8-20 in, 9-19 in, or 10-18 in. In some embodiments, the bottom flap length L_{BF} is equal to the panel length L_P, while in other embodiment the bottom flap length L_{BF} is smaller than the panel length L_P. In this regard, the gap **138** between the plurality of flaps **130** comprises the difference in length between the bottom flap length L_{BF} and the panel length L_P. In some embodiments, the gap **138** is between 1/32-1/8 in, more particularly between 1/16-1/8 in, while in some embodiments, the gap **138** may be negligible.

[0045] In some embodiments, each of the plurality of bottom flaps **130** defines a bottom flap width W_{BF}, extending between the second edge **130***b* and the fourth edge **130***d*. In some embodiments, the bottom flap width W_{BF} is between 3-8 in, between 4-7 in, or between 5-6 in. In some embodiments, each of the plurality of bottom flaps **130** defines an equal bottom flap width W_{BF}, while the bottom flap length L_{BF} changes across the plurality of bottom flaps **130** corresponding to the panel length L_P of the corresponding panel of the plurality of panels **110**.

[0046] In some embodiments, such as illustrated in FIG. **2**A, the plurality of panels **110** may comprise a first panel **113**, a second panel **115**, a third panel **117**, and a fourth panel **111** (corresponding walls can be seen in the box form **500** illustrated in FIGS. **6**A-B). In this regard, the term "panels"

may be used when in a box blank form and the term "walls" may be used when in the erected/formed box form, although such differentiation in terminology is not required for an understanding of what is being described or claimed.

[0047] In some embodiments, each of the plurality of panels **110** are connected to one of the plurality of flaps **120** via a juncture score line **107** at the respective position. For example, the first panel **113** is connected to a first flap **123**, the second panel **115** is connected to a second flap **125**, the third panel **117** is connected to a third flap **127** and the fourth panel **111** is connected to a fourth flap **121**. In this regard, the juncture score line **107** may be a single score line extending along the box blank **100**, from the first outer edge (e.g., **100***a* FIG. **1**A) to the third outer edge (e.g., **100***c* FIG. **1**A). In some embodiments, the plurality of panels **110** and the plurality of flaps **120** are foldable about the juncture score line **107**.

[0048] In some embodiments, the plurality of panels **110** are connected to the plurality of bottom flaps **130** via a bottom score line **109**. For example, the first panel **113** is connected to a first bottom flap **133**, the second panel **115** is connected to a second bottom flap **135**, the third panel **117** is connected to a third bottom flap **137**, and the fourth panel **111** is connected to a fourth bottom flap **131**. In some embodiments, the plurality of panels **110** and the plurality of bottom flaps **130** are foldable about the bottom score line **109**. In this regard the bottom score line **109** may be one continuous score extending across the box blank **100**, from the first outer edge (e.g., **100***a* FIG. **1**A) to the third outer edge (e.g., **100***c* FIG. **1**A).

[0049] In some embodiments, one or more of the panel score line portions **105** may comprise a panel pattern cut **140**, disposed about the panel score line portion **105** and the adjacent panels. For example, in the illustrated embodiment the panel pattern cut **140** may extend between the first panel **113** and the second panel **115** and may be bound between the juncture score line **107** and the bottom score line **109**. Additionally, another panel pattern cut **140** may extend between the third panel **117** and a connector first portion **119***a*. Notably, the connector tab **119** may, thus, be formed of one or more sections, such as the connector first portion **119***a* (e.g., a connector panel) and/or a connector second portion **119***b* (e.g., a connector flap). In some embodiments, the connector tab **119** may extend from one of the plurality of panels **110**, and/or one of the plurality of flaps **120** (e.g., the fourth panel **111** and/or the fourth flap **121**). In this regard, in some embodiments the connector tab **119** only extends from one of the plurality of panels **110**; in some embodiments the connector tab **119** only extends from one of the plurality of flaps **120**; and in other embodiments the connector tab **119** extends from both the one of the plurality of panels **110** and one of the plurality of flaps **120**. Further, in some embodiments, the connector tab **119** may optionally extend from one of the plurality of bottom flaps **130**.

[0050] In some embodiments, the flap score line portion **155** may comprise a cut, perforations, line of weakness, compression and/or other weakness. In some embodiments, the flap score line portion **155** extending between adjacent flaps may comprise different configurations depending on the placement of the flap score line portion **155**. For example, the flap score line portion **155** may define a flap pattern cut **150** when positioned along the score defining a panel pattern cut **140**, while the flap score line portion **155** extending from a panel score line portion **105** without a panel pattern cut **140** (e.g., between the second panel **115** and the third panel **117**) may define a flap score line cut **157** adjacent to or in conjunction with the flap score line portion **155**. In some embodiments, the flap score line cut **157** may be formed by a box maker, rather than with the die cut, such as the case erector **400** shown and described with respect to FIG. **5**A.

[0051] In some embodiments, each of the plurality of bottom flaps **130** may be separated by the bottom gap **138** extending from the second outer edge (e.g., **100***b* FIG. **1**A) of the box blank **100** to the juncture score line **107**. In some embodiments, each gap **138** may be cut out of the corrugate material (e.g., sheet or web) prior to die cutting. In some embodiments, each gap **138** may be a cut between adjacent flaps of the plurality of bottom flaps **130**.

[0052] FIG. **2**B illustrates a portion **101** of the box blank **100** illustrated in FIG. **2**A. In some embodiments, the portion **101** may comprise the first panel **113** and the second panel **115**. In some embodiments, the first panel **113** may comprise a first edge **114***a*, a second edge **114***b*, a third edge **114***c*, and a fourth edge **114***d*. In some embodiments, the first edge **114***a* and the third edge **114***c* may be parallel, and the first edge **114***a* may be perpendicular to each of the second edge **114***b* and the fourth edge **114***d*.

[0053] In some embodiments, the second panel **115** may comprise a first edge **116***a*, a second edge **116***b*, a third edge **116***c* and a fourth edge **116***d*. In some embodiments, the first edge **116***a* and the third edge **116***c* may be parallel, and the first edge **116***a* may be perpendicular to each of the second edge **116***b* and the fourth edge **116***d*. In some embodiments, the third edge **114***c* of the first panel **113** may be connected to the first edge **116***a* of the second panel **115** at the panel score line portion **105**. In some embodiments, the panel score line portion **105** may be foldable. In some embodiments, the panel score line portion **105** may be configured as a compression within the corrugate material.

[0054] In some embodiments, the portion **101** of the box blank **100** may comprise a first flap **123**, and a second flap **125**. In some embodiments, the first flap **123** may define a first edge **124***a*, a second edge **124***b*, a third edge **124***c*, and a fourth edge **124***d*. In some embodiments, the first edge **124***a* may be parallel to the third edge **124***c*, and the first edge **124***a* may be perpendicular to both the second edge **124***b* and the fourth edge **124***d*. In some embodiments, the second flap **125** may define a first edge **126***a*, a second edge **126***b*, a third edge **126***c*, and a fourth edge **126***d*. In some embodiments, the first edge **126***a* may be parallel to the third edge **126***c*, and the first edge **126***a* may be perpendicular to both the second edge **126***b* and the fourth edge **126***d*. In some embodiments, the fourth edge **124***d* of the first flap **123** and the fourth edge **126***d* of the second flap **125** define the fourth outer edge (e.g., **100***d* FIG. **1**A) of the box blank (e.g., **100** FIG. **1**A).

[0055] In some embodiments, the third edge **124***c* of the first flap **123** and the first edge **126***a* of the second flap **125** may be connected along the flap score line portion **155**. In some embodiments, the flap score line portion **155** may be foldable, while in other embodiments the flap score line portion **155** may further define a cut, a line of weakness, perforations, or other similar feature.

[0056] As discussed, in some embodiments, the second edge **124***b* of the first flap **123** may be connected to the fourth edge **114***d* of the first panel **113** along the juncture score line **107**. Similarly, the second edge **126***b* of the second

flap **124** may be connected to the fourth edge **116***d* of the second panel **115** along the juncture score line **107**. In some embodiments, the first flap **123** and the second flap **125** may be foldable along the juncture score line **107**. In some embodiments, the juncture score line **107** may be configured such that the first flap **123** and the second flap **125** may be foldable.

[0057] In some embodiments, the plurality of bottom flaps **130** may comprise at least a first bottom flap **133** and a second bottom flap **135**. The first bottom flap **133** may comprise a first edge **134***a*, a second edge **134***b*, a third edge **134***c*, and a fourth edge **134***d*. In some embodiments, the first edge **134***a* may be parallel to the third edge **134***c*, and the first edge **134***a* may be perpendicular to both the second edge **134***b* and the fourth edge **134***d*. The second bottom flap **135** may comprise a first edge **136***a*, a second edge **136***b*, a third edge **136***c*, and a fourth edge **136***d*. In some embodiments, the first edge **136***a* may be parallel to the third edge **136***c*, and the first edge **136***a* may be perpendicular to both the second edge **136***b* and the fourth edge **136***d*.

[0058] In some embodiments, the fourth edge **134***d* of the first bottom flap **133** may be connected to the second edge **114***b* of the first panel **113** along the bottom score line **109**. Similarly, the fourth edge **136***d* second bottom flap **135** may be connected to the second edge **116***b* of the second panel **115**. In some embodiments, the second edge **134***b* of the first bottom flap **133** and the second edge **136***b* of the second bottom flap **135** may be considered as the second outer edge (e.g., **100***b* FIG. **1**A) of the box blank (e.g., **100** FIG. **1**).

[0059] Returning briefly to FIG. **2**A, as discussed, the box blank **100** may comprise at least one flap pattern cut **150** and at least one panel pattern cut **140**. In some embodiments, the number of flap pattern cuts **150**, is equal to the number of panel pattern cuts **140**. In some embodiments, there may be two flap pattern cuts **150**, and two panel pattern cuts **140**. In some embodiments, the box blank may include only one or more flap pattern cuts **150** and no panel pattern cuts **140**. Alternatively, in some embodiments, the box blank may include only one or more panel pattern cuts **140** and no flap pattern cuts **150**.

[0060] In some embodiments, with reference to FIG. **2**A, the flap score line portion **155** may comprise the flap score line cut **157**. In some embodiments, the flap score line cut **157** may extend from the leading edge (e.g., **100***d* FIG. **1**A) of the box blank **100** into one of the plurality of panels **110**. In some embodiments, the flap score line cut **157** may be parallel to the flap score line portion **155**, while in other embodiments the flap score line cut **157** may be positioned within the flap score line portion **155**. In this regard, the flap score line cut **157** may comprise a series of perforations, or points of weakness formed within the flap score line portion **155** such that the adjacent flaps may be easily separable. In some embodiments, the flap score line cut **157** may include an end portion **157***b* which may extend along the juncture score line **107**, for example, as illustrated in FIG. **2**A the end portion **157***b* extends into the third panel **117**. In some embodiments, the end portion **157***b* may be parallel to the juncture score line **107**, while in other embodiments, the end portion **157***b* may extend at an angle from the juncture score line **107**.

[0061] As discussed above, the flap score line portions **155** may comprise a flap score line cut **157** or a flap pattern cut **150**. FIGS. **3**A-D illustrate configurations of example flap pattern cuts **150**. In some embodiments, each of the flap pattern cuts **150** may extend in a corresponding manner with a flap score line portion **155**. In some embodiments, the flap pattern cut **150** may be configured to interact with the panel pattern cut **140** when the box blank is formed into a box, while in other embodiments, the panel pattern cut **140** may be omitted.

[0062] In some embodiments, each flap pattern cut **150** may include a first cross-cut **151***a* and a spaced apart second cross-cut **151***b*, each extending across the flap score line portion (e.g., **155**, FIG. **2**A). In some embodiments, a first cut **152***a* may extend from the first cross-cut **151***a* towards the leading edge **100***d*. In some embodiments, the first cut **152***a* may extend from the first cross-cut **151***a* all the way to the leading edge **100***d*, while in other embodiments, the first cut **152***a* may end prior to reaching the leading edge **100***d*. In some embodiments, the first cut **152***a* may be along the flap score line portion **155**, while in other embodiments, the first cut **152***a* may be parallel to, but spaced apart from the flap score line portion **155**.

[0063] In some embodiments, a second cut **152***b* may extend from the second cross-cut **151***b* towards the juncture score line **107** between the plurality of flaps **120** and plurality of panels **110**. In some embodiments, the second cut **152***b* may extend through the juncture score line **107**, while in other embodiments, the second cut **152***b* may extend to the juncture score line **107**. In some embodiments, the second cut **152***b* may be along the flap score line portion **155**, while in other embodiments, as illustrated in FIG. **3**C, the second cut **152***b* may be parallel to, but spaced apart from the flap score line portion **155**. In some embodiments, the first cross-cut **151***a* and the second cross-cut **151***b* may define the same orientation and shape, while in other embodiments the first cross-cut **151***a* and the second cross-cut **151***b* may define different orientations and/or shapes (e.g., a linear cross-cut, and a non-linear cross-cut).

[0064] In some embodiments, such as illustrated in FIGS. **3**A-C, the first cross-cut **151***a* and the second cross cut **151***b* may extend linearly across the flap score line portion (e.g., **155** FIG. **2**A) between two of the plurality of flaps (e.g., the first flap **123** and the second flap **125** FIG. **2**A), while in other embodiments, the first cross-cut **151***a* and the second cross-cut **151***b*, such as illustrated in FIG. **3**D, may extend non linearly across the flap score line portion (e.g., **155** FIG. **2**A) between two of the plurality of flaps (e.g., the first flap **123** and the second flap **125** FIG. **2**A). To explain further, as illustrated in FIG. **3**D the first cross-cut **151***a* and the second cross-cut **151***b* each contain a first portion (a) and a second portion (b) which are formed into an arrow tip shape. Thus, the first portion (a) extends away from the flap score line portion **155** in a first direction, and the second portion (b) extends away from the flap score line portion **155** in a second direction. Although the first portion (a) and the second portion (b) are illustrated as an arrow tip shape, the first portion (a) and the second portion (b) may be arranged in any configuration where stress will be shifted away from the uncut portion **153**, such that an uncut portion **153** does not fracture, break or otherwise rupture before desired.

[0065] In some embodiments, the first cross-cut **151***a* and the second cross-cut **151***b* may be spaced apart so as to define the uncut portion **153** of the flap score line portion **155** therebetween. In some embodiments, the uncut portion **153**, extends between 0.5-2.5 in, between 0.75-2.0 in, or between 1-1.5 in. In some embodiments, the uncut portion **153** is configured to retain two adjacent flaps (e.g., the first

flap **123** and the second flap **125** FIG. **2**B) of the plurality of flaps **120** in an open position (see e.g., **533**, FIG. **6**A) after the box blank **100** is formed into a box. In some embodiments, the uncut portion **153** may be positioned closer to the fourth outer edge **100***d* of the box blank **100**, while in other embodiments the uncut portion **153** may be positioned closer to the junction score line **107**. In some embodiments, the uncut portion **153** may be centered between the first cut **152***a* and the second cut **152***b*. In some embodiments, the length of the uncut portion **153** may be equal to the length of the first cut **152***a*, while in other embodiments, the length of the uncut portion **153** may be greater than the length of the first cut **152***a*.

[0066] In some embodiments, the second cut **152***b* may comprise a tail end **154** extending therefrom. In some embodiments, the tail end **154** may cross the juncture score line **107** into one of the plurality of panels **110**, such as illustrated in FIG. **3**A. In some embodiments, the tail end **154** may be shaped to relieve stress from the box blank during formation into a box, such as to provide relief points and foldable positions. In some embodiments, the tail end **154** may be configured as a line of weakness, a series of perforations, and/or a through cut. In some embodiments, the tail end **154** may be parallel to the juncture score line **107**, such as illustrated for example in FIGS. **3**B-C, while in other embodiments, the tail end **154** may be formed at an angle between the juncture score line **107** and the panel score line portion **105**, such as illustrated for example in FIG. **3**D. In some embodiments, the tail end **154** may be formed as a cross-cut of the panel score line portion **105**, such as illustrated for example in FIGS. **3**B-C, while in other embodiments, the tail end **154** may extend away from the panel score line portion **105**, such as illustrated for example in FIGS. **3**A and **3**D. In some embodiments, the tail end **154** may be configured to minimize continual cutting or tearing. For example, if the second cut **152***b* ended along the panel score line portion **105**, it may be more likely during box formation, packaging, and/or traveling, that the panel score line portion **105** may rupture as the second cut **152***b* may bias the panel score line portion **105** towards rupturing.

[0067] As mentioned, in some embodiments, the box blank may comprise a panel pattern cut **140** extending across the panel score line portion **105**, and within adjacent panels of the plurality of panels **110**. The panel pattern cut **140** illustrated in FIGS. **4**A-C may comprise different cut portions and shapes within the panel pattern cut **140**. In some embodiments, the panel pattern cut **140** may include a first panel score line cross-cut **141***a* and a second panel score line cross-cut **141***b*. Each of the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b* may extend between adjacent panels (see e.g., FIG. **2**A). In some embodiments, the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b* may be spaced a distance apart. In some embodiments, the distance between the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b* may be equal to the length of the uncut portion **153**, while in other embodiments the distance between the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b* may be larger than the length of the uncut portion **153** or smaller than the length of the uncut portion **153**.

[0068] In some embodiments, a panel score line cut **143** may extend at least partially between the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b*. The panel score line cut **143** may be configured as a series of perforations, a cut, a line of weakness, or other weakness such that the panel score line cut **143**, may partially fracture, or at least bend during formation of the box from the box blank. In some embodiments, the panel score line cut **143** may be positioned on the panel score line portion **105**, while in other embodiments, the panel score line cut **143** may be spaced apart from the panel score line portion **105**.

[0069] In some embodiments, at least one panel cut **142** may extend at least partially between the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b*. In some embodiments, the at least one panel cut **142** may be configured as a line of weakness rather than a cut. In some embodiments, the at least one panel cut **142** may provide stress relief with the panel pattern cut **140** during formation to allow the corrugate within the panel pattern cut **140** to fold accordingly. As illustrated in FIG. **4**A, in some embodiments, the at least one panel cut **142** may extend between the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b*, while defining an intact portion **144** extending between the first panel score line cross-cut **141***a* and the at least one panel cut **142**, and between the second panel score line cross-cut **141***b* and the at least one panel cut **142**. In some embodiments, the intact portion **144** may be sized so as to retain the corrugate within the panel pattern cut **140** within the box blank **100**, thereby preventing any scrap corrugate, during die cutting, thus, improving run time.

[0070] In some embodiments, such as illustrated in FIG. **4**B, the at least one panel cut **142** may extend from one and/or both sides of the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b*, such that the intact portion **144** may be positioned in between the at least one panel cuts **142**.

[0071] In some embodiments, such as illustrated in FIG. **4**C, the at least one panel cuts **142** may be spaced apart from the panel score line cut **143**, but not parallel to the panel score line cut **143**. Thus, in some embodiments, the at least one panel cut **142** may be curved.

[0072] In some embodiments, the at least one panel cut **142** is designed to create a weakness within the plurality of panels **110** to allow the panel pattern cut **140** to receive the flap pattern cut **150** therein (e.g., after the box is formed). To explain, when the blank **100** is erected into a box, the panel pattern cut **140** and the flap pattern cut **150** may be configured to align such that the uncut portion **153** of the flap pattern cut **150** aligns with the intact portion **144** of the panel pattern cut **140**. Thus, as the box is erected a portion of the panel pattern cut **140** may shift inward (e.g., towards the interior of the box) such that the first panel score line cross-cut **141***a* and the second panel score line cross-cut **141***b* may be exposed and configured to receive at least a portion of the uncut portion **153** of the flap pattern cut **150**. Thus, the interaction may be configured to hold the plurality of flaps **120** in an open position to the exterior of the box, when erected, such that the box may be filled without interference, and then the user may rupture the uncut portion **153** to allow the plurality of flaps **120** to be formed into a top side of a box in a closed position. Notably, in some embodiments, the panel pattern cut **140** may not be required to still enable the uncut portion **153** from the flap pattern cut **150** to

hold the plurality of flaps **120** in an open position to the exterior of the box, when erected, such that the box may be filled without interference.

[0073] Returning to FIG. **2**A, in some embodiments, the box blank **100** may comprise two flap pattern cuts **150**, separated by at least one flap, such that the flap pattern cuts **150** are not positioned on the same flap. For example, the first edge (see e.g., **120***a* FIG. **1**B) and the third edge (see e.g., **120***c* FIG. **1**B) of the same section (e.g., **102** FIG. **1**B). In the illustrated embodiment, one flap pattern cut **150** may be positioned between the first flap **123** and the second flap **125** and a second flap pattern cut **150** may be positioned between the third flap **127** and the connector tab **119**. Alternatively, in some embodiments, one flap pattern cut **150** may be positioned between the fourth flap **121** and the first flap **123**, and one flap pattern cut **150** may be positioned between the second flap **125** and the third flap **125**.

[0074] In some embodiments, the panel pattern cut **140** may be formed between sections (e.g., **102**) of the box blank comprising the flap pattern cut **150**. To explain, at least one of the flap pattern cuts **150** may be formed between the first flap **123** and the second flap **125**. Thus, for a flap pattern cut to be formed between the same sections (e.g., first section and second section), the panel pattern cut **140** is formed about the panel score line portion between the first panel **113** and the second panel **115**. Alternatively, in some embodiments, the box blank **100** may comprise no panel pattern cuts **140** and may comprise only the flap pattern cuts **150** and the flap score line cuts **157**.

Example Processes

[0075] Embodiments of the present invention provide processes and systems for forming a corrugated box blank, and in some embodiments for forming the corrugated box blank into a box, according to various embodiments described herein. In this regard, associated system and method for manufacturing, shipping, and forming example box blanks and converting into corresponding shipping boxes described herein are contemplated by some embodiments of the present invention. Such systems and methods may include various machines and devices, including for example box forming devices (e.g., for folding, gluing, and/or taping boxes, among other things), die cutters, and/or corrugators. In this regard, known corrugators utilize web product (e.g., liner) and flute medium to form corrugated web product (which may be formed into any number of layered corrugate, such as conventional corrugate (liner, flute medium, liner) or double-walled corrugate (liner, flute medium, liner, flute medium, and liner)). The formed corrugated web product may then be scored and/or cut (e.g., sliced, perforated, etc.) as needed to form a box blank of the desired box (e.g., any of the box designs described herein).

[0076] Various examples of the steps performed in accordance with some embodiments of the present invention will now be provided with reference to FIG. **5**A-D. In this regard, FIG. **5**A illustrates a process flow diagram according to an example method for cutting a box blank and forming the box blank into a box according to an example embodiment 800.

[0077] In some embodiments, a corrugated sheet **200** may be formed within a corrugator **600** or similar machine that processes corrugate web product into desired products, such as box blanks. As illustrated, the corrugator may include a die cutting press **300**. In some embodiments, the die cutting press **300** may be separate from the corrugator. Further, while a sheet (e.g., a cut portion of the web) is shown entering the die cutting press **300**, in some embodiments, corrugate web may enter the die cutting press **300** and the box blanks may be cut and formed into sheets thereafter.

[0078] The corrugated sheet **200** may be positioned with a leading edge **200***d* (e.g., the fourth outer edge **100***d* FIG. **1**A) configured to enter into a die cutting press **300**. The corrugated sheet **200**, illustrated in FIG. **5**B, may define the leading edge **200***d*, a trailing edge **200***b* (e.g., the second outer edge **100***b* FIG. **1**A) opposite and parallel to the leading edge **200***d*, a first outer edge **200***a*, and a third outer edge **200***c* parallel to the first outer edge **200***a* and perpendicular to the leading edge **200***d*. In some embodiments, the trailing edge **200***b* may define a plurality of bottom flaps **230**, wherein each of the plurality of flaps **230** is separated by a gap **238** preformed in the corrugated sheet **200**.

[0079] In some embodiments, the third outer edge **200***c* may define a connection flap **219**. In some embodiments, the connection flap **219** may extend from the leading edge **200***d* to the trailing edge **200***b*, thereby defining a bottom connection flap portion **219***a*. In some embodiments, the connection flap **219** may not include the bottom connection flap portion **219***a*, rather the third outer side edge **200***c* may be nonlinear between the leading edge **200***d* and the trailing edge **200***b*. In this regard, the length of the leading edge **200***d* may be larger than the length of the trailing edge **200***b*.

[0080] Returning to FIG. **5**A, the corrugated sheet **200** is positioned such that the leading end **200***d* of the corrugated sheet enters into the die cutting press **300** to be formed into the box blank **100**. FIG. **5**C illustrates an example die cut **301**, separated into two pieces, used to on the die cutting press (e.g., **300** FIG. **5**A) to form the box blank **100**. In some embodiments, the die cut **301** may include one or more raised portions **304** positioned on a base **303** of the die cut **301** to align the corrugate sheet within the die cut **301**. In some embodiments, the die cut **301** may be a cylindrical object which rotates as the corrugated sheet **200** moves through the die cutting press (**300** FIG. **5**A).

[0081] As illustrated, in some embodiments, the base **303** of the die cut **301** may include a series of latitudinal perforations **305**, and a series of longitudinal perforations **307**, with respect to the cylindrical shape. In some embodiments, the latitudinal perforations **305** may correspond to the section score line (e.g., the panel score line portion **105**, FIG. **1** and the flap score line portion **155** FIG. **1**), and the longitudinal perforations **307** may correspond to the juncture score line (e.g., **107** FIG. **1**), and the bottom score line (e.g., **109** FIG. **1**).

[0082] In some embodiments, latitudinal perforations **305** may comprise pattern die **350**, **340**. In some embodiments, a first pattern die **350** may be configured to create the flap pattern cuts (e.g., **150** FIG. **1**), and a second pattern die **340** may be configured to create the panel pattern cut (e.g., **140** FIG. **1**). In some embodiments, the first pattern die **350** and the second pattern die **340**, although illustrated as diamonds, may be configured in an orientation to form the flap pattern cuts **150** illustrated in FIGS. **3**A-D, and the panel pattern cuts **140** illustrated in FIGS. **4**A-C.

[0083] In some embodiments, each of the latitudinal perforations **305**, and the longitudinal perforations **307** may comprise cut knives and/or patterns to interact with the corrugate sheet to form the section score line (e.g., the panel score line portion, and the flap score line portion), juncture score line, and bottom score line (e.g., **105**, **155**, **107**, **109** of

FIG. **1**). In some embodiments, such as illustrated in FIG. **5**D, the box blank **100** may be formed after the sheet of corrugate **200** exits the die cutting press **300**.

[0084] In some embodiments, the die cutting press **300** may run up to 250 revolutions a minute, up to 300 revolutions a minute, 350 revolutions a minute or even up to 400 revolutions a minute. In some embodiments, the die cut may be formed such that both a first half and second half of the roller each define the necessary features to form a box blank as desired—thereby allowing 2-UP box blank formation. In some embodiments, the die cutting press **300** may run two sheets of corrugate **200** at a time. In some embodiments, the die cutting press **300** may run up to 1 million sheets of corrugate before changed, up to 1.5 million sheets of corrugate before being changes, or even up to 2 million sheets of corrugate before being changed.

[0085] In contrast to other die cuts for corrugate which may routinely create scrap and cause scrap to be maintained on the die, and/or in the blank, the present die cut **301** does not create cut-outs, and thus, does not create scrap corrugate. As such the die cut **301** may not need to use pins to remove scrap, and in turn may not be clogged as easily from the scrap not being removed. To explain some current machines require placement of pins to help in removal of scrap during cutting. However, at some desired throughput speeds, such a solution is impractical and scraps are often dropped into the machinery, which can create issues that need to be resolved—thereby negatively affecting down time.

[0086] Returning to FIG. **5**A, in some embodiments, the box blank **100** may be piled and packaged to be sent to the customer, where the boxes may be assembled on site by the customer. In other embodiments the box blank **100** may be erected into a box **500** via a box erector **400**. In some embodiments, the flap score line cut (e.g., **157** FIG. **1**) may be formed by the box erector **400**, while in other embodiments, as discussed above, the score lines may be formed by the die cut **301**. As illustrated in FIG. **5**D, to form the box **500** shown in FIGS. **6**A-B, the connector tab **119** may be attached, such as using an adhesive (although additional or alternative attachment means can be utilized, such as tape, staples, etc.) to the fourth panel **111**, and in some embodiments, to the fourth flap **121**. In some embodiments, the plurality of flaps **120** may be folded towards an exterior of the plurality of panels **110**, and the plurality of bottom flaps **130** may be folded towards an interior of the box and attached to one another. In some embodiments, the fourth bottom flap **131** may be attached to both the first bottom flap **133** and the third bottom flap **137**, and the second bottom flap **135** may be attached to both the first bottom flap **133** and the third bottom flap **137**. In this regard, in some embodiments, the fourth bottom flap **131** and the second bottom flap **135** may be folded inward, and the first bottom flap **133** and the third bottom flap **137** may be folded in second, such that an interior surface of the first bottom flap **133** and third bottom flap **137** may be attached to an exterior surface of the fourth bottom flap **131** and the second bottom flap **135**.

[0087] The operations illustrated in and described with respect to FIGS. **5**A-D may, for example, be performed by, with the assistance of, and/or under the control of one or more of a user or a machine for performing the operation (e.g., a corrugator for forming the corrugated blanks, a die cutting press for forming the box blank, a box maker for forming the box or portions thereof, etc.).

Example Box

[0088] FIGS. **6**A-B illustrate an example formed box **500**. FIG. **6**A illustrates a perspective view of the example box **500**. The box **500** may comprise a plurality of walls **510**, a plurality of flaps **520**, and a bottom surface **530**.

[0089] In some embodiments, a connector tab **519** may be attached to one of the plurality of walls **510** to retain the box shape of the box **500**. Similarly, the bottom surface **530** may comprise a plurality of attached bottom flaps (e.g., **130** FIG. **1**). In some embodiments, the plurality of flaps **520** may be folded to the outside of the box **500** along a juncture score line **507** thereby defining an opening **570** of the box **500**. In this regard, the plurality of flaps **520** may be folded such that the plurality of flaps contact an exterior surface **510***a* of the plurality of walls **510**.

[0090] In some embodiments, the plurality of flaps **520** may maintain position on the exterior of the box **500** through a flap pattern cut **550**. To explain, a first flap pattern cut **550** and a second flap pattern cut **550** may be configured in catty corner to one another (e.g., diagonal corners of the box **500**), thus, each of the flap pattern cuts **550** may be configured to hold two of the plurality of flaps **520** against the exterior surface **510***a* of the plurality of walls **510**.

[0091] In some embodiments, the flap pattern cut **550** comprises a first cut **552***a* and a second cut **552***b*, the first cut **552***a* extending from a leading edge **500***d* of the plurality of flaps **520** to a first cross-cut **551***a*, and the second cut **552***b* extending from a second cross-cut **551***b* through the juncture score line **507**. In the illustrated embodiment, the first cross-cut **551***a* and the second cross-cut **552***b* define an uncut portion **553** therebetween.

[0092] In some embodiments, the flex of the corrugate material within the plurality of flaps **520** may cause the plurality of flaps **520** to be biased slightly off of the exterior surface **510***a* of the plurality of walls **510**. Thus, the first cross-cut **551***a* and the second cross-cut **522***b* help with retention of the uncut portion **553** (e.g., in a flap pattern cut on a flap score line between the underneath walls) such that two adjacent flaps of the plurality of flaps **520** remain in an open position, wherein, in the open position, the plurality of flaps **520** are adjacent and/or near the exterior surface **510***a* of the plurality of walls **510**.

[0093] FIG. **6**B illustrates an interior perspective of the box **500**. In some embodiments, each of the flap pattern cuts **550** comprise a tail portion **554**. In some embodiments, the tail portion **554** (e.g., **154** FIG. **3**) may extend into the adjacent one of the plurality of walls **510**. Thus, the tail portion **554** may be configured to prevent the second parallel cut **522***b* from continuing into a panel score line **505** between one of the plurality of walls **510** and the connection flap **519**.

[0094] In some embodiments, the panel score line **505** between the plurality of walls **510** may comprise a panel pattern cut **540**. In some embodiments, the panel pattern cut **540** may be configured as the panel pattern cut **140** (shown in FIGS. **4**A-C). In some embodiments, the panel pattern cut **540** may comprise a first panel score line cross-cut **541***a* and a second panel score line cross-cut **541***b*. In some embodiments, the panel pattern cut **540** may comprise a line of weakness **543** (e.g., the panel score line cut **143** FIGS. **4**A-C) extending between the first panel score line cross-cut **541***a* and the second panel score line cross-cut **541***b*. In some embodiments, the line of weakness **543** may be configured to cause a portion of the corrugate to collapse

into itself when the box **500** is erected. In some embodiments, the panel pattern cut **540** may further comprise a first panel cut **542***a* and a second panel cut **542***b* each spaced apart from the line of weakness **543**. In some embodiments, the panel pattern cut **540** may be formed as illustrated in one of FIGS. **4**A-C. In some embodiments, the line of weakness **543** allows the box **500** to be erected easier. For example the line of weakness forces the box to have a weak spot to collapse into when erected.

Example Flowchart(s)

[0095] Various examples of the operations performed in accordance with some embodiments of the present invention will now be provided with reference to FIG. **7**. In this regard, FIG. **7** illustrates a flowchart according to an example method for forming a box blank and forming a box therefrom according to an example embodiment 700. The operations illustrated in and described with respect to FIG. **7** may, for example, be performed by, with the assistance of, and/or under the control of one or more of a user or a machine for performing the operation (e.g., a corrugator for forming the corrugated box blanks, a die cut for scoring and cutting the corrugated box blanks, a box maker for forming the box or portions thereof, etc.).

[0096] Operation **710** may comprise forming a box blank, and operation **720** may comprise running the box blank through a die cutting press to form the box blank with appropriate scores and cuts, such as described herein.

[0097] Operation **730** may comprise providing the box blank to a box maker to assemble the box (although box formation may, in some embodiments, occur manually).

[0098] Then, such as upon arrival at the final destination, operation **740** may comprise filling the box with goods, and operation **750** may optionally comprise breaking the uncut portion to attach the plurality of flaps to one another to close the box. This may be performed using a machine/device and/or via a user.

CONCLUSION

[0099] Many modifications and other embodiments of the inventions set forth herein may come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the embodiments of the invention are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the invention. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments in the context of certain example combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the invention. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated within the scope of the invention. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

1. A box blank for a corrugated box, the box blank comprising:

a plurality of panels including at least a first panel and a second panel, wherein the first panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the third edge of the first panel is connected to the first edge of the second panel along a panel score line portion, wherein the panel score line portion is foldable;

a plurality of flaps including at least a first flap and a second flap, wherein the first flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second edge of the first flap is connected to the fourth edge of the first panel, wherein the second edge of the second flap is connected to the fourth edge of the second panel, wherein the third edge of first flap is connected to the first edge of the second flap along a flap score line portion, wherein the flap score line portion is foldable;

a first cross-cut extending across the flap score line portion between the first flap and the second flap;

a second cross-cut extending across the flap score line portion between the first flap and the second flap, wherein the second cross-cut is spaced apart from the first cross cut so as to define an uncut portion of the flap score line portion therebetween;

a first cut extending from the first cross-cut at least a portion of a first distance leading to the fourth edge of the first flap or the fourth edge of the second flap; and

a second cut extending from the second cross-cut at least a portion of a second distance leading to the second edge of the first flap or the second edge of the second flap.

2. The box blank of claim **1**, wherein the second cut comprises a tail portion and the tail portion extends beyond the fourth edge of either the first panel or the second panel.

3. The box blank of claim **2**, wherein the tail portion extends away from the panel score line portion.

4. The box blank of claim **1**, wherein the first cut extends to the fourth edge of the first flap or the fourth edge of the second flap.

5. The box blank of claim **1**, wherein the uncut portion is between 1-1.5 inches.

6. The box blank of claim **1**, wherein the flap score line portion is a line of weakness.

7. The box blank of claim **1**, wherein the second cut is parallel to the flap score line portion.

8. The box blank of claim **1**, wherein the first cut is on the flap score line portion.

9. The box blank of claim **1**, wherein the first cross-cut and the second cross-cut extend non-linearly across the flap score line portion.

10. The box blank of claim **1**, wherein the first cross-cut or the second cross-cut comprises a first portion extending in a first direction from the flap score line portion and a second portion extending in a second direction from the flap score line portion, wherein the first direction and the second direction are different.

11. The box blank of claim **1**, further comprising:

a panel pattern cut about the panel score line portion between the first panel and the second panel, the panel pattern cut comprising:

a first panel score line cross-cut extending across the panel score line portion between the first panel and the second panel; and

a second panel score line cross-cut extending across the panel score line portion between the first panel and the second panel, wherein the second panel score line cross-cut is spaced apart a distance from the first panel score line cross-cut.

12. The box blank of claim **11**, wherein the panel pattern cut further comprises:

at least one panel cut or line of weakness extending at least partially between the first panel cross-cut and the second panel cross-cut, wherein the at least one panel cut or line of weakness is spaced apart from the panel score line portion between the first panel and the second panel.

13. The box blank of claim **11**, wherein a length of the uncut portion is smaller than the distance between the first panel score line cross-cut and the second panel score line cross-cut.

14. The box blank of claim **1**, further comprising a plurality of bottom flaps, including at least a first bottom flap and a second bottom flap, wherein the first bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the fourth edge of the first bottom flap is connected to the second edge of the first panel, wherein the fourth edge of the second bottom flap is connected to the second edge of the second panel, and wherein the third edge of the first bottom flap is spaced apart from the first edge of the second bottom flap.

15. The box blank of claim **14**, wherein the first bottom flap and the second bottom flap are foldable about a bottom score line, wherein the bottom score line abuts the fourth edge of the first bottom flap and the fourth edge of the second bottom flap and the second edge of the first panel and the second edge of the second panel.

16. The box blank of claim **1**, wherein the plurality of panels further comprises a third panel and a fourth panel, wherein the third panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the first edge of the third panel is connected to the third edge of the second panel along a second panel score line portion, wherein the fourth panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the third edge of the fourth panel is connected to the first edge of the first panel along a third panel score line portion; and

wherein the plurality of flaps further comprises a third flap and a fourth flap, wherein the third flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the fourth flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second edge of the third flap is connected to the fourth edge of the third panel, wherein the second edge of the fourth flap is connected to the fourth edge of the fourth panel, wherein the first edge of the third flap is connected to the third edge of the second flap along a second flap score line portion, wherein the second flap score line portion is foldable, wherein the first edge of first flap is connected to the third edge of the fourth flap along a third flap score line portion, wherein the third flap score line portion is foldable.

17. The box blank of claim **16** further comprising:

a connector tab comprising a connector panel and a connector flap, wherein the connector panel is connected to either the third side of the third panel or the first side of the fourth panel along a fourth panel score line portion, and the connector flap is connected to either the third side of the third flap or the first side of the fourth flap along a fourth flap score line portion;

a third cross-cut extending across the fourth flap score line portion;

a fourth cross-cut extending across the fourth flap score line portion, wherein the fourth cross-cut is spaced apart from the third cross-cut so as to define a second uncut portion of the fourth flap score line portion therebetween;

a third cut extending from the third cross-cut at least a portion of a first distance leading to the fourth edge of the third flap or the fourth edge of the fourth flap; and

a fourth cut extending from the fourth cross-cut at least a portion of a second distance leading to the second edge of the third flap or the second edge of the fourth flap.

18. The box blank of claim **16**, further comprising a third bottom flap and a fourth bottom flap, wherein the third bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the fourth bottom flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the fourth edge of the third bottom flap is connected to the second edge of the third panel, wherein the fourth edge of the fourth bottom flap is connected to the second edge of the fourth panel, wherein the first edge of the third bottom flap is spaced apart from the third edge of the second bottom flap, and wherein the third edge of the third bottom flap is spaced apart from the first edge of the second bottom flap.

19. A method of forming a box, the method comprising:

providing a blank, the blank comprising:

a sheet of corrugate defining a first outer edge, a second outer edge, a third outer edge and a fourth outer edge, wherein the fourth outer edge is parallel to the second outer edge, wherein the fourth outer edge is perpendicular to the first outer edge, wherein the first outer edge is parallel to the third outer edge;

running the blank through a blank die to form a box blank, the box blank comprising:

a plurality of panels adjacent the plurality of bottom flaps, wherein the plurality of panels includes at least a first panel and a second panel, wherein the first panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second panel defines a first edge, a second edge, a third edge, and a fourth edge, wherein the third edge of the first panel is connected to the first edge of the second panel along a panel score line portion, wherein the panel score line portion is foldable;

a plurality of flaps including at least a first flap and a second flap, wherein the first flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second flap defines a first edge, a second edge, a third edge, and a fourth edge, wherein the second edge of the first flap is connected to the fourth edge of the first panel, wherein the second edge of the second flap is connected to the fourth edge of the second panel, wherein the third edge of first flap is connected to the first edge of the second flap along a flap score line portion, wherein the flap score line portion is foldable;

a connection tab extending from one of the plurality of panels and a corresponding one of the plurality of flaps, wherein the connection tab is defined by a connection tab score line portion;

a first cross-cut extending across the flap score line portion between the first flap and the second flap;

a second cross-cut extending across the flap score line portion between the first flap and the second flap, wherein the second cross-cut is spaced apart from the first cross-cut so as to define an uncut portion of the flap score line portion therebetween;

a first cut extending from the first cross-cut at least a portion of a first distance leading to the fourth edge of the first flap or the fourth edge of the second flap; and

a second cut extending from the second cross-cut at least a portion of a second distance leading to the second edge of the first flap or the second edge of the second flap;

providing the box blank to a box maker, wherein the box maker is configured to:

fold the plurality of flaps such that an outer surface of the plurality of flaps abuts an outer surface of the plurality of panels;

fold the plurality of panels along the plurality of panel score line portions;

adhere the connection tab to one of the plurality of panels and the corresponding one of the plurality of flaps; and

adhere the plurality bottom flaps to form a bottom surface.

20. The method of claim **19**, wherein the blank die is configured to penetrate a thickness of the blank without removing material from the blank.

21. A box formed from a corrugated box blank, the box comprising:

a plurality of walls, including at least a first wall, a second wall, a third wall, and a fourth wall, wherein each wall is connected to the adjacent wall at a foldable score line portion;

a plurality of flaps, including at least a first flap, a second flap, a third flap and a fourth flap, wherein each of the plurality of flaps extend from the corresponding wall of the plurality of walls, wherein each of the plurality of flaps are folded such that at least a portion of an outer surface of the plurality of walls abuts at least a portion of an outer surface of the plurality of flaps, wherein the plurality of flaps comprise a first uncut portion between the first flap and a second flap and a second uncut portion between the third flap and the fourth flap;

a plurality of bottom flaps, wherein the plurality of bottom flaps extend from the plurality of walls opposite the plurality of walls, wherein the plurality of bottom flaps are adhered to form a bottom, wherein the bottom is perpendicular to the plurality of walls; and

a connector tab extending from either the first wall and first flap or the fourth wall and the fourth flap, wherein the connector tab is adhered to either the first wall and first flap or the fourth wall and the fourth flap.

* * * * *