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Fradkin

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[54] **PAPERBOARD BLANK WITH CRUSHED OFFSET FLAP EDGES AND METHOD FOR FORMING SAME**

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[51] **Int. Cl.** **B31b 1/14;** B65d 5/20

[58] **Field of Search** .... 93/1 G, 58 R, 58 ST, 58.1, 93/58.2 R, 58.3; 229/16 R, 32, DIG. 2, DIG. 4

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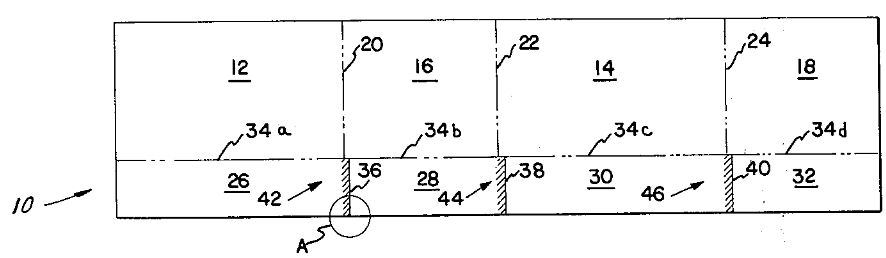
[57] **ABSTRACT**

An improved paperboard blank having offset slits and an adjacent crushed area. A paperboard blank is formed with flaps attached to main panels along fold lines. The flaps are separated from one another by slit lines which are offset from the foldable connections of the main panels. A crush line, which is approximately twice as wide as the amount of offset of the offset slits, extends substantially coextensively with the slit lines. The crush line defines an area which is substantially thinner than the original thickness of the paperboard material. In addition, fold lines adjacent to those flaps which are folded first may be made deeper than other fold lines to aid in easy erection of the blank into a carton. The method for forming the blank is also disclosed.

10 Claims, 4 Drawing Figures



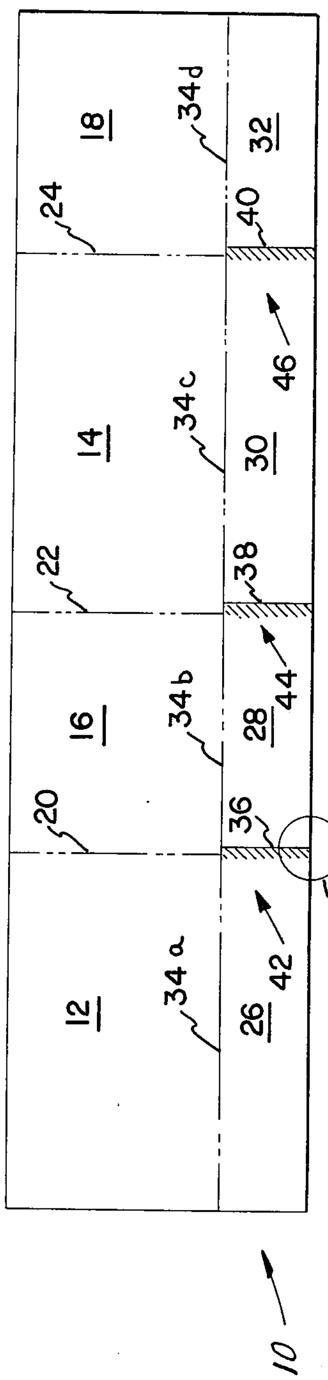


FIG. 1

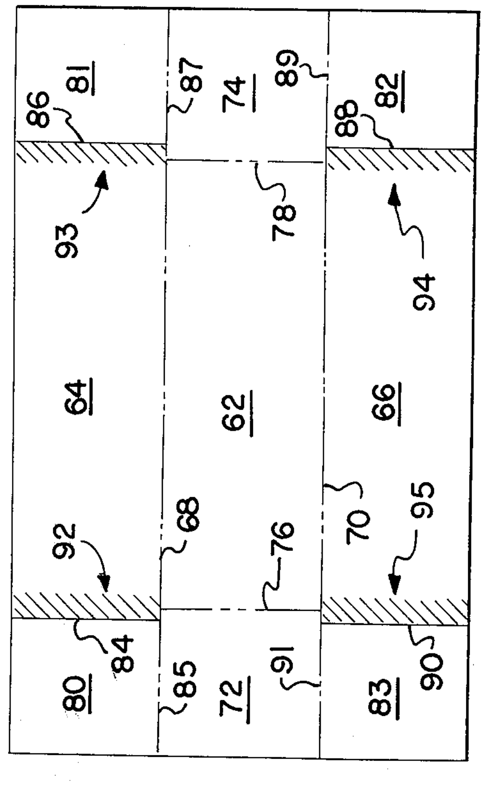


FIG. 4

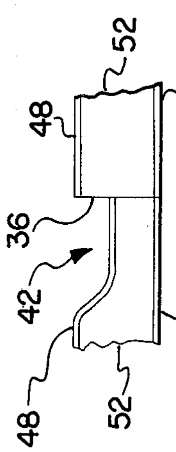


FIG. 2

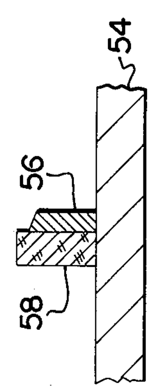


FIG. 3

PAPERBOARD BLANK WITH CRUSHED OFFSET FLAP EDGES AND METHOD FOR FORMING SAME

BACKGROUND OF THE INVENTION

This invention generally relates to paperboard blanks foldable into tubular cartons. More specifically, this invention relates to such blanks having offset slits to separate attached flaps from one another. Most particularly, this invention relates to such blanks having a crush line which is substantially coextensive with each offset slit.

Increasing numbers of cartons are being erected from blanks by automatic machinery. It is extremely important in such machinery that the flaps which form the bottom and/or top closure (or, in the case of open trays, the sidewalls of the tray) pivot freely during the assembly sequence. To allow this, most blanks today are formed with oversized slots which permit free movement of the flaps. While this is quite satisfactory, there are practical operational problems with such slots. During the manufacture of die cut blanks, the material cut to form the slot must be removed from the slot area. Foam rubber is used as a spring around the slot cutting rule to help force the material or "tail," as it is known in the art, out of the slot area. This is not always successful, and the tails must often be removed by hand. In addition, the tails tend to collect around the area of the blank forming machine and present a housekeeping nuisance. Furthermore, it is not uncommon for blanks with the tails still attached to be shipped to the user of the blanks. In the user's plant, these tails can fall out, again creating a nuisance. Worse yet, the tail can remain in place and eventually cause a jam in the automatic erection machinery.

The use of offset slits, rather than slots, to separate the flaps has been known in the art. However, slits have not lent themselves to automatic erection of the blank because the flaps did not have the necessary free pivoting properties provided by slots; the flaps tended to drag on one another. This was satisfactory for manual erection, but jammed automatic machines. Nonetheless, slits would be highly desirable for automatic machinery use because the above enumerated problems of the slot tails would be completely eliminated.

I have found that if an area which is substantially coextensive with a slit line is crushed to approximately half of the original thickness of the paperboard blank, an offset slit will function as well as a slot in automatic erection equipment. The crush line or crushed area should be at least twice as wide as the offset of the offset slit line. Thus, I can form a paperboard blank whose flaps have the free folding properties associated with slots while using slits and obtaining all of the advantages flowing therefrom. In addition, making the fold line for those flaps which are folded first deeper than the other fold lines can also aid in erection on automatic machinery.

SUMMARY OF THE INVENTION

My invention is an improvement in a paperboard blank which may be folded into a tubular configuration. In this blank, flaps are attached to at least one main panel along fold lines. The flaps are separated from one another by offset slit lines which extend from the fold line connecting the flaps to the main panel to the outer marginal edge of the flaps. My improvement is a crush line, substantially coextensive with each of the offset slit lines, which defines an area of the paperboard blank that is substantially thinner than the original thickness of the paperboard blank. The crush line is preferably at least twice as wide as the amount of offset of the offset slit lines. In another aspect of the invention, the fold lines for those flaps which are folded first may be made deeper than the other fold lines in the blank.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a paperboard blank illustrating the present invention;

FIG. 2 is an end view of the circled area designated as A in FIG. 1 on a much enlarged scale;

FIG. 3 is a fragmentary cross-sectional view of a cutting rule and crushing structure to produce the blank of FIG. 1; and

FIG. 4 is a plan view of a paperboard blank for a tray illustrating the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a paperboard blank **10** illustrating the present invention. The blank **10** includes two pairs of opposed sidewall panels **12** and **14** and **16** and **18** respectively connected to one another along fold lines **20, 22** and **24,** which may be formed by scoring or other suitable means. Bottom closure flaps **26, 28, 30** and **32** are integrally and foldably connected to the sidewall panels **12, 14, 16** and **18** along a fold line ***34a***, ***34b***, ***34c*** and ***34d***. The flaps **26, 28, 30** and **32** are separated from one another by offset slit lines **36, 38** and **40.** Offset slit lines such as those shown at **36, 38** and **40** are known in the art of paperboard box construction. These slits are designated as offset slits because they do not align with the foldable connections **20, 22** and **24** which connect together the main sidewall panels. The degree of offset is typically on the order of one-sixteenth to one-fourth of an inch. All of the slit lines extend from the fold line **34** to the outer marginal edges of the flaps **26, 28, 30** and **32.** Again, this is conventional practice. As was previously pointed out, the difficulty with using a blank **10** which utilizes slit lines rather than slots to separate the flaps from one another is that when the blank **10** is folded into a tubular configuration, as is its intended purpose, the flaps **26, 28, 30** and **32** tend to interfere with one another and do not readily fold inwardly into their assigned positions. This particular deficiency is not especially harmful when such cartons are assembled in a hand operation. However, when automatic folding equipment is used to erect the blank **10,** this problem asserts itself in such a fashion as to make cartons utilizing slits rather than slots previously impossible to run on such automatic equipment. The result of attempting to run slitted cartons on such automatic equipment was a series of repetitive jams in the folding operation. In order to overcome this problem and allow the use of slitted cartons with all the attendant advantages previously described, I provide these flaps with crush lines designated in crosshatched area as **42, 44** and **46.** The crush line in all cases is substantially coextensive with its associated offset slit line **36, 38** or **40.** The crush lines **42, 44** and **46** define an area of the paperboard blank that is substantially thinner and is preferably between 20 and 50% thinner than the original thickness of the paperboard blank. In addition, the width of the crushed area is preferably at least twice the amount of offset of its associated offset slit. In the illustration of FIG. 1, all of the crush lines **42, 44** and **46** are on the side of the offset slit **36, 38** or **40** which is toward the foldable connection **20, 22** and **24** from which the slit lines are offset. This particular configuration or positioning of the crush lines is dictated by the folding sequence of the blank **10** in the automatic equipment on which it is run. Some folding sequences could require the crush line to be placed on the opposite side of the slit lines **36, 38** and **40** from that shown in FIG. **1**. This is a simple matter to determine and is well within the ability of one skilled in the art to ascertain once the specific automatic machine and the specific configuration of the blank is known. An additional point to be remembered is that the sidewall panels **12, 14, 16** and **18** should be considered to be main panels in the most general sense. For example, in a paperboard blank for an open-top tray, there is generally only one main panel, which actually forms the bottom of the tray rather than one of the sidewalls. The sidewall panels in such a blank are actually flaps which are attached to the bottom or main panel. However, one can readily see how the present invention could be applied to such a blank. It would not be necessary to slot the various flaps which form the sidewall panels for an open-top tray, but rather these flaps could be slit to distinguish them from one another, with the crush line extending along the slit to enable easy and rapid bending of the flaps into their position as the sidewall panels of the tray. As a final note with respect to the slit lines **36, 38** and **40**, it should be noted that these slit lines run directly into the foldable connection **34**. However, it is also known in the art to angle or bend the portion of the slit line **36, 38** or **40** adjacent to the fold lines **20, 22** and **24** to actually meet with these fold lines. However, this is simply a matter of mechanical strength and may or may not be used, depending upon the circumstances involved and the sensitivity of the blank in this particular area to being torn.

I have also found that making selected fold lines deeper than the other fold lines may also aid in automatic carton erection operations. For example, the fold lines **34***a* and **34***b* may be made with a 0.850 inch scoring rule while all the other fold lines may be made with a 0.830 inch scoring rule. The dimension given, as is the conventional practice, is the height of the rule itself and not the depth of the score. However, the relationship between rule height and score depth or fold line depth is reasonably linear. Therefore, the fold lines **34***a* and **34***b* are about 0.020 inch deeper than the remainder of the fold lines on the blank **10**. By making selected fold lines deeper than others, the flaps connected by the deeper fold lines bend more easily in the carton erection sequence. Thus, one could say as a general statement that the fold lines associated with the flaps that are first folded in a carton erection sequence should be substantially deeper than the remainder of the fold lines in the blank. The deeper fold lines should be from 15 to 35% deeper than the other fold lines.

FIG. **2** illustrates, on a very much enlarged scale, an end view of the section circled in FIG. **1** and designated as A. FIG. **2** is used to illustrate the degree of crushing exhibited along the crush line **42**. As seen in FIG. **2**, the paperboard blank **10** is manufactured of a corrugated paperboard material which has two outer paper layers of liner board **48** and **50** and an inner corrugated layer of corrugating medium board **52**. Note that the crush line **42** is considerably depressed below the original level of the paperboard blank **10** as illustrated by the outer or upper layer **48**. In the use of this invention with corrugated paperboard, it is very difficult to specify a definite depth for the crush line, such as **42**. This is because there are many types of corrugated paperboard used, the more common types being A flute, B flute, C flute and E flute. These designations all indicate specific types of corrugated paperboard having different numbers of corrugated flutes per foot and different overall thicknesses with markedly different crush resistances. Thus, the degree of crushing required for one type of corrugated paperboard might be insufficient for another to allow the flaps to pivot smoothly. Thus, it is far more descriptive of this invention to describe the depth of the crush line **42** as a percentage of the original overall thickness of the paperboard.

Paperboard blanks in commerce today are most commonly formed on either cylindrical type cutters or flat plate type cutters. In these machines, the slots are cut, and additional score lines are placed at right angles to the score lines which were placed on the blank as it was fed from the corrugating machine. In these devices, sponge rubber, having a Shore durometer hardness in the range of from 15 to 24, is normally used around both the scoring rules and the cutting rules to force the blank off of these devices when the blank is being formed. If the sponge rubber were not used, the blank would tend to stick to the cutting rule and would not eject itself from the machine properly. It is understood that there is some small degree of crushing present as a result of the sponge rubber, but this degree of crush is minor and is unacceptable in large amounts because of serious appearance problems. In FIG. **3**, a portion of the die **54** for a flat press type blank die forming machine is shown. Attached to the die **54** is a cutting rule **56** having on one side thereof a piece of cork material **58** having a Shore durometer hardness in the range of **42** to **50**. Note that the cork material **58** extends above the cutting rule **56**. The cutting rule **56** may be used to cut any one of the slit lines **36, 38** and **40**. The purpose of the cork **58** is to produce the crush line **42, 44** or **46**. Thus, the cork **58** should be of a width equivalent to the crush line that is to be produced. Note that cork is given as a specific example of a material to be used because it has a certain degree of resiliency and thus will strip the blank from the cutting rule **56**. However, the cork is much harder than the sponge rubber normally used in the art today and thus will impart a significant degree of crushing to the paperboard blank. While FIG. **3** illustrates a method and apparatus for carrying out the present invention usable on a flat plate type machine, the application and modification necessary to utilize this particular technique on a rotary type blank forming machine should be obvious to those skilled in the art.

FIG. **4** illustrates a paperboard blank **60** for a tray which also incorporates the present invention. As was previously discussed, this type of blank **60** has only one main panel **62** which actually forms the bottom of the completed tray. Sidewall flaps **64** and **66** are separated from the main panel **62** by respective fold lines **68** and **70**. End wall flaps **72** and **74** are separated from the main panel **62** by respective fold lines **76** and **78**. There are also four end closure flaps **80, 81, 82** and **83**. Offset slit lines **84** and **86** separate the flaps **80** and **81** from the sidewall panel **64**. Fold lines **85** and **87** separate the flaps **80** and **81** from the flaps **72** and **74**. Offset slit lines 88 and 90 separate the flaps 82 and 83 from the sidewall panel 66. Fold lines 89 and 91 separate the flaps 82 and 83 from the flaps 72 and 74. As was the case in FIG. 1, areas designated as 92, 93, 94 and 95 are crushed adjacent to the offset slit lines 84, 86, 88 and 90. The crushed areas 92–95 all have a width about twice the amount of the offset of their associated offset slit line from its adjacent fold line. The amount of crushing is from 20 to 50% of the original thickness of the paperboard.

In the case of the blank 60, the fold lines 76, 78, 85, 87, 89 and 91 are all made with a 0.850 inch scoring rule and the fold lines 68 and 70 are made with a 0.830 inch scoring rule. These dimensions have previously been fully explained with respect to FIG. 1. The purpose of this deeper score of from 15 to 35% of selected fold lines is again to aid in the erection sequence. The deeper fold lines have less resistance to bending and thus will fold more easily than the shallower fold lines. The deeper fold lines are adjacent to those flaps which are folded first.

What I claim is:

1. In a paperboard blank particularly adapted for use with an automatic erection machine and foldable into a tubular configuration of the type wherein flaps are connected to at least one main panel along fold lines and wherein said flaps are separated from one another by offset slit lines extending from the fold line connecting said flaps to said main panel to the outer marginal edge of said flaps, the improvement in said blank which comprises:

a crush line, substantially coextensive with said offset slit lines, said crush line defining an area of said paperboard blank that is substantially thinner than the original thickness of said paperboard blank and at least twice as wide as the amount of offset of said offset slit lines.

2. The improvement of claim 1, wherein said crush line defines an area that is between 20 and 50% thinner than the original thickness of said paperboard blank.

3. The improvement of claim 1 which further includes: at least one fold line in said blank that is substantially deeper than the remainder of said fold lines, said one fold line connecting the first of said flaps to be folded by an automatic erection machine to said main panel.

4. The improvement of claim 3, wherein said deeper fold line is from 15 to 35% deeper than the remainder of said fold lines.

5. The improvement of claim 1, wherein said blank comprises:

a plurality of main body panels connected along fold lines and a plurality of end closure flaps connected to the lower marginal edge of said main body panels along fold lines.

6. The improvement of claim 1, wherein said blank comprises:

a single main panel and a plurality of flaps surrounding said main panel and connected thereto along fold lines.

7. In a method for forming a paperboard blank of the type foldable into a tubular configuration, wherein fold lines are impressed into said paperboard to separate flaps from at least one main panel and, wherein offset slit lines are formed in said paperboard to separate said flaps from one another, the improvement in said method which comprises the step of:

crushing said paperboard, along substantially the entire length of each of said offset slit lines, to a thickness that is substantially less than the original thickness of said paperboard in an area at least twice as wide as the amount of offset of said offset slit lines.

8. The improved method of claim 7, wherein said crushing is to a thickness between 80 and 50% of the original thickness of said paperboard blank.

9. The improved method of claim 7, which further includes the step of:

scoring the fold line connecting at least the first of said flaps to be folded to said main panel to a depth greater than the depth to which the remainder of said fold lines are scored.

10. The improved method of claim 9, wherein said scoring is at a depth between 15 and 35% greater than the depth to which the remainder of said fold lines are scored.

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