June 14, 1966 K. T. BUTTERY 3,255,649

SEVERANCE LINE CONSTRUCTION FOR CARTONS AND THE LIKE

Original Filed Nov. 16, 1964

Fig. 1.

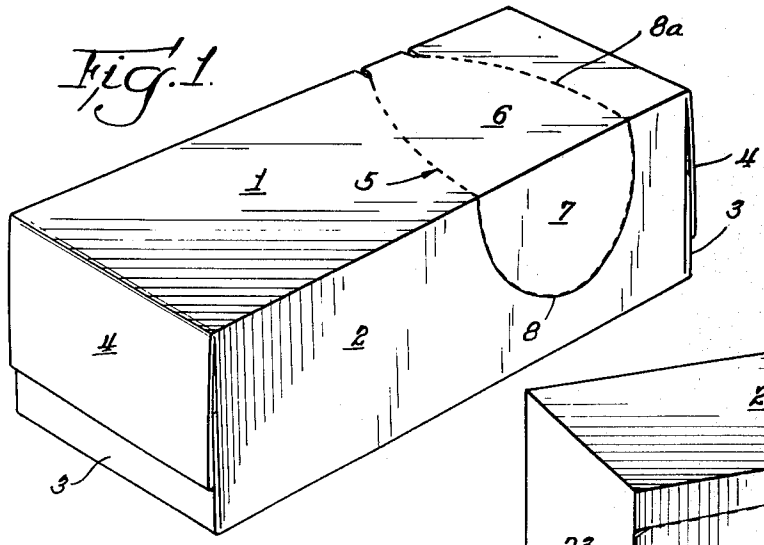


Fig. 7

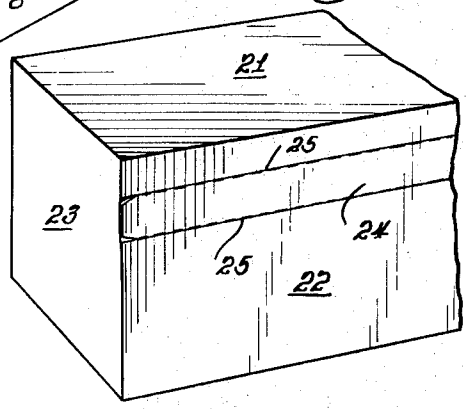


Fig. 3.

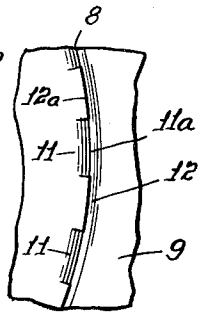


Fig. 4

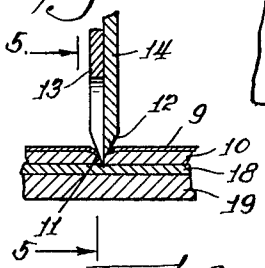


Fig. 2.

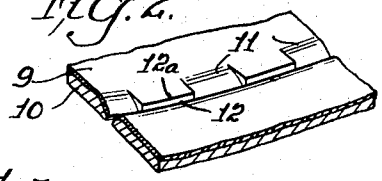


Fig. 6

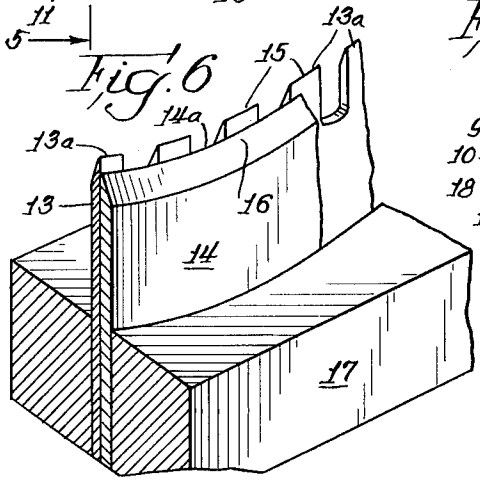
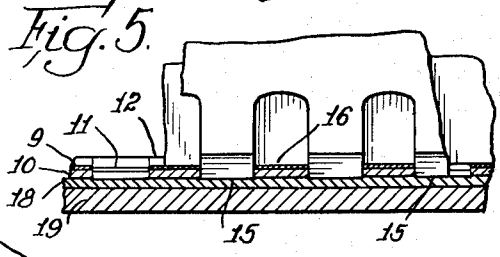


Fig. 5.



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SEVERANCE LINE CONSTRUCTION FOR CARTONS AND THE LIKE

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3 Claims. (Cl. 83—9)

This is a division of application Serial No. 411,310, filed November 16, 1964.

The present invention relates to fabricated paperboard products, and is more particularly concerned with a means and method for forming novel weakened severance lines in such products, and with the products formed thereby.

Paperboard products having weakened severance lines which may be readily torn apart are in widespread use. To form such severance lines, a cutting tool is generally used having an interrupted cutting edge. When the tool is applied to a sheet of paperboard, a series of short, aligned, spaced-apart slits or cuts passing through the paperboard are formed. The paperboard may be subsequently torn along the weakened severance line and the tear-out panel defined by the line of cuts removed. Although the type of severance line described is satisfactory for use in many applications, its use presents numerous problems when certain types of paperboard are used, or where the severance line must have a high degree of curvature. When a cylinder type paperboard (cylinder board) is used having a strong outer surface layer which is tougher than the remainder of the thickness of the paperboard, some of the fibers may be oriented transversely with respect to the line of the perforations and in the spaces therebetween. Consequently, this may cause surface portions of the paperboard to peel even in those areas which must remain intact after removal of the parts to be discarded. Moreover, when the severance line has a high degree of curvature, danger from peeling and anomalous tearing is considerably aggravated. This danger is generally present even in relatively thin paperboard formed on a Fourdrinier machine. To avoid the difficulty described, it has been proposed to provide a severance line comprised of a series of short primary cuts formed to define the line of severance, which cuts extend completely through the paperboard, and additional short, spaced cuts formed intermediate the primary cuts and on the exterior surface of the board, which cuts pass only part way through the paperboard and are aligned with the primary cuts. This type of severance line has proven to be superior to the type previously described comprised solely of spaced primary cuts. However, great difficulty has been experienced in providing the improved type of severance line on a mass production scale. A compound severance line of the type described must be provided by means of a single cutting tool having a series of extended spaced blade elements with recessed blade elements interspersed therebetween in alignment with the extended blade elements. Such a cutting tool is difficult and expensive to fabricate. Moreover, during even a short production run the blade dulls quickly and must be sharpened. It has been found extremely difficult to sharpen a blade of the type described, particularly the recessed blade elements.

It is an object of the invention to provide a novel severance line structure for panels formed of a frangible material such as paperboard, which severance line structure remains intact during the normal physical stresses to which the severance line may be subjected during assembly of the products such as cartons to which it is applied, packaging of contents, and transportation, until the

products are ready to be opened. It is a further object to provide a severance line of the type described which may be readily parted to allow the tear-out panel defined by the severance line to be readily removed without any shredding, peeling, or tearing along the severed edges. It is an additional object to provide a severance line structure which may be used to define tear-out panels having edges of high curvature, which panels may be readily torn out without danger of shredding, peeling, or tearing. It is still further an object to provide a severance line structure having the properties described, which may be formed by relatively simple cutting apparatus. It is still another object to provide a novel cutting apparatus for providing the severance line structure described, and a novel method for forming the severance line structure. The accomplishment of the foregoing and additional objects will become more fully apparent hereinafter.

The invention in its preferred embodiment is illustrated by the accompanying drawings in which:

FIG. 1 is a perspective view of a paperboard carton having a tear-out panel defined by the novel severance line structure of the invention.

FIG. 2 is an enlarged fragmentary perspective view showing the severance line structure in greater detail.

FIG. 3 is an enlarged fragmentary plan view of the severance line structure.

FIG. 4 is a fragmentary cross-sectional view showing the knife blades inserted in a portion of paperboard to produce the severance line structure.

FIG. 5 is a fragmentary vertical section taken at the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary perspective view of the cutting apparatus according to the invention; and

FIG. 7 is a perspective view of a carton having a tear-strip formed by severance lines formed according to the invention.

Reference is now made to the accompanying drawings for a better understanding of the invention, wherein all the parts are numbered and wherein the same numbers are used to refer to corresponding parts throughout.

Referring to FIG. 1, a representative paperboard carton in erected and sealed form is shown comprising a top panel **1**, a front panel **2**, inner end panels **3**, outer end panels **4**, and a rear panel and bottom panel (not shown). A tear-out panel **5** having a top panel portion **6** and a front panel portion **7** is defined by severance lines **8** and **8***a*. The severance line **8** has a relatively high degree of curvature and is formed according to the structure of the invention. The severance line **8***a* has a relatively low degree of curvature and may consist of the traditional prior art single row of spaced-apart cuts.

In FIG. 2 there is illustrated the structure of a cylinder type of paperboard for which the present invention is particularly suitable, which paperboard comprises a facing layer or liner **9** comprising a relatively dense, tough covering, and a softer body layer **10**. As shown in FIGS. 2 and 3, the severance line structure comprises a plurality of elongated, spaced-apart aligned primary cuts **11** and a continuous secondary cut score **12** in side-by-side relationship. The primary cuts extend through the entire thickness of the paperboard. The secondary cut score **11** extends only partially through the thickness of the paperboard. The upper portions of the primary cuts communicate with the secondary cut score. As shown in FIG. 3, the inner side wall **12***a* of the secondary cut score is substantially coplanar with the remaining adjacent side wall **11***a* of the primary cuts at the lower portion thereof. The linear area defined by the secondary cut score is substantially external to the linear area defined by the primary cuts and their interstices. It is, of course, obvious that where the severance line is curved, the plane defining the side walls **11***a* and **12***a* is a curved plane, as in FIG. 2. As

the term "interstices" is used herein with reference to the primary cuts forming the severance line, it refers to the uncut spaces or areas of the paperboard between successive primary cuts **11**.

The cutting tool of the invention, as shown in FIGS. 4, 5 and 6, comprises a primary blade **13** and a secondary blade **14**. The cutting edge of each blade is formed by a beveled edge (i.e., flush bevel) cooperating with an opposite face (i.e., side face). The cutting edge of the primary blade milled or machined by any other suitable process to provide a plurality of spaced-apart primary blade sections **15**. The secondary blade **14** is continuous and is provided with a continuous bevel **16**. The relative size of the blade sections and spacings therebetween of the primary blade may be chosen according to the configuration desired in the severance line structure. In the preferred embodiment as shown in the drawing the primary blade is so cut that the cutting edges and their interstices are of substantially equal lengths.

In order to provide a clean cut, the paperboard is placed on a backing **18** of a material such as pressed fiberboard which in turn is supported on a steel platen **19**. In preparing the cutting tool for cutting severance lines in paperboard, the primary and secondary blades are arranged in face-to-face contact engagement, that is, with their flat face surfaces in engagement and beveled edges externally positioned. In this position the cutting edges of the two blades are substantially coplanar. As the term "interstices" is used with respect to the cutting tool, it refers to the cut out spaces between successive primary blade sections **15**.

As can be seen in FIG. 6, the cutting edges **13***a* and **14***a* lie substantially in a vertical plane, the plane being curved in the embodiment of FIG. 6 since the severance line is also curved. Moreover, the secondary blade is recessed transversely so that the primary blade sections protrude beyond the cutting edge of the secondary blade, thus enabling the primary blade sections to penetrate the paperboard completely while the secondary blade section penetrates only partially. The blades may be placed in the slot of a supporting means such as a jig **17**, or any other type of blade holding device commonly used in the art, as for example locked in a chase including complementary plywood or wood blocks or strips, or embedded in molding material. In fabricating the cutting tool, the relative heights of the blades may be so provided that the cutting edges of the primary and secondary blades have the proper relative vertical position when the bottom edges of both blades are flush mounted.

In FIGS. 4 and 5 the cutting tool is shown at the end of the cutting stroke embedded in a portion of paperboard. As can be seen, the primary blade sections have penetrated completely through the paperboard, while the secondary blade section has penetrated only through about one-half the thickness of the paperboard.

The embodiment shown in FIG. 7 comprises a carton having a top panel **21**, a front panel **22**, and an end panel **23**. A tear-strip **24** is formed in the front panel by means of parallel spaced apart severance lines **25**. The severance line of the present invention tears with such precision that it may be used for forming tear strips in place of the commonly used V-shaped slits which are considerably more expensive to produce.

Illustratively, it has been found that a suitable severance line structure can be provided if the primary cuts are made about $\frac{1}{16}$ of an inch long. However, other lengths may be used.

It has further been found that primary and secondary cutting blade edge heights of .937 inch and .927 inch, respectively, are highly satisfactory for use with 22 point board (.022 inch thickness). The .937 inch blade, under normal press settings, is the one used to cut through the entire board thickness or substantially through the entire board thickness (as where a moisture-proof inner liner is present). The second blade, which should not cut entirely through the board thickness, is variable depending on other circumstances, e.g., thickness of the board. It will, of course, be obvious that the blade heights and relative heights may be varied depending upon the type and length and relative lengths of the cuts desired and with the type and thickness of the paperboard utilized.

Because of the nature of the present severance line, it is much more readily and much more cleanly torn apart than prior art severance lines, for example those having secondary cuts aligned with the centers of the primary cuts, and yet it remains strong and unimpaired during normal usage prior to tearing. Due to the continuity of the secondary score line and the coplanar nature of the cuts, the severance line of the invention is far superior to other known severance line constructions.

The present severance line structure is also suitable for use in preparing pour spouts or other tear-out panels in cartons such as those commonly employed to contain laundry detergents, even those wherein the carton material is so constructed that an inner moisture-proof or relatively moisture-proof liner is present which must remain intact even after the severance line is formed. In this embodiment the cutting tool is so arranged that the primary blade cutting edges stop short of the inner moisture-proof layer as they cut through the paperboard, leaving the moisture-proof liner intact. As a result of the unique structure of the present severance line, the tear-out panels may be readily removed even though the primary cuts extend substantially but not completely through the thickness of the paperboard.

The severance line structure of the present invention has a number of advantages over many types of severance lines such as spaced-apart perforation lines. It enables a tear-out panel to be removed with greater precision and with less danger of shredding or tearing the paperboard at the severance lines. It also enables cylinder-type paperboard to be utilized without risk of the dangers described. So precise and free from anomalous tearing is the present severance line that it may be used to provide tear strips formed by parallel spaced-apart severance lines. For example, it was discovered in the prior art that the well known spaced-apart perforation slits were not suitable for use in preparing such tear strips, since the tearing process often resulted in excursions into the major portion of the panel containing the tear strip. To avoid this problem, it has become customary to use a V-shaped slit for the preparation of tear strips comprising a portion parallel to the line of tear and another portion connected thereto diverging from the direction of tear. This type of tear strip configuration requires expensive cutting tools. With the prseent severance line configuration, tear strips may be provided on much simpler cutting equipment.

It is to be understood that the invention is not limited to the exact details of construction, operation, or exact materials or embodiments shown and described, as obvious modifications and equivalents will be apparent to one skilled in the art, and the invention is therefore to be limited only by the scope of the appended claims.

I claim:

1. A cutting tool for providing a severance line in a paperboard sheet which comprises a primary blade having a plurality of elongated, spaced-apart, aligned cutting edges and a secondary blade having a single continuous cutting edge positioned in side-by-side engagement with said primary blade, the cutting edge of said secondary blade being recessed below the cutting edges of said primary blade but extending above the bottom of the spaces intermediate the cutting edges of said primary blade, and means securing said primary and secondary blades in fixed relationship to each other and supporting said blades in position.

2. A cutting tool according to claim **1** wherein said primary and secondary cutting edges are substantially coplanar.

3. A cutting tool according to claim **1** wherein the

cutting edges of each blade are defined by a beveled edge cooperating with a face surface, the face surfaces of the primary and secondary blades being in engagement, and the beveled edges being outwardly positioned.

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