CORRUGATED CARTONS HAVING CRUSH-RELIEVED FLAPS

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This application is a division of my co-pending application Serial No. 805,924, filed April 13, 1959, Patent No. 3,122,976.

My invention relates generally to boxes and cartons formed of corrugated paper board material, and more particularly to triple-ply corrugated cardboard blanks having crush-relieved flaps which are readily bent when erecting the box.

Because of its superior structural and cushioning properties, increased use has been made of three-ply corrugated board for packaging relatively heavy objects or for protecting frail articles in transit. Triple wall board is a development of the Tri-Wall Containers Corporation of New York and is manufactured in accordance with U.S. Patent No. 2,759,523, issued August 21, 1956 to Goldstein et al., the board being identified by the trademark “Tri-Wall Pak.” Containers of “Tri-Wall Pak” board have in many cases replaced boxes made of wood and other packaging materials. Tests have shown that even if a loaded box of triple wall corrugated construction is dropped, it does not shatter like wood but continues to give full protection to its contents.

Corrugated cardboard cartons are ordinarily made from flat blanks which are scored and slotted to define the four side panels and the inner and outer end flaps of the carton. When erecting the carton, the flaps are folded inward along the score lines so as to form the bottom and top walls. Because of the great rigidity and strength of triple wall corrugated board, difficulty is often experienced in forming the flaps, especially in the case of small cartons having narrow flaps. Moreover, the thickness of triple wall board is such that substantial resistance or “fight” is encountered at the corners in erecting the box.

One expedient hereofore used to reduce “fight” has been a broad score line to weaken the flap in the bending zone, thereby to minimize bending resistance. However, this has not afforded a satisfactory solution to the problem, for the bending line is then not clearly defined and the flap tends to break unevenly and unpredictably.

Accordingly, it is the principal object of this invention to provide a box blank of corrugated board so constructed as to facilitate bending of the flaps along sharply defined and predictable lines.

More specifically it is an object of the invention to provide a triple wall box blank in which a zone contiguous to a sharply defined score line for the flap is crush-relieved to minimize forward bending. Also an object of the invention is to provide apparatus for efficiently forming a combined score line and crush-relieved zone in a corrugating machine.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following description to be read in conjunction with the attached drawings wherein like elements in the several figures are identified by like reference numerals.

In the drawings:

FIG. 1 is a plan view of a corrugated board blank having combined score lines and crush-relieved zones in accordance with the invention;

FIG. 2 is a perspective view of the erected carton;

FIG. 3 is a transverse section taken through the blank along the planes of lines 3—3 in FIG. 1;

FIG. 4 is a perspective view of the scoring, crushing and trimming wheels in the output end of the machine;

FIG. 5 is an enlarged detail showing the combined crushing and scoring operation.

Referring first to FIGS. 1 and 3, there is shown a sample blank for a shipping box being made of triple-wall corrugated paper board material. The blank, as best seen in FIG. 3, is formed by three superposed layers or plies of corrugated material consisting, in successive order, of an outer liner 10, a corrugated fluting 11, liner 12, fluting 13, liner 14, fluting 15 and inner liner 16.

As will be evident in FIG. 1, the blank is provided with transverse score lines 17 which define the side panels 18, 19, 20 and 21 of the box. The inner and outer end flaps 24 to 31 of the box are formed by longitudinal score lines 22 and 23 and transverse slots 32. Provided at the upper end of the blank is a narrow stitch flap 33. The box is erected in the usual manner to assume the form shown in FIG. 2 by bending the panels and flaps along the score lines. It will be understood that the dimensions of the side wall panels and the flaps will depend on the size of the box.

Contiguous to longitudinal score line 23 in the area of flaps 24 to 27 is a narrow crushed zone 34 and contiguous to longitudinal score lines 23 is a like narrow crushed zone 35 in the areas of flaps 28 to 31. Thus each flap is crush-relieved at its score line and may be bent inward without difficulty. It must be here noted that triple-wall corrugated board formed with A-A-A fluting is about ¾ of an inch thick, and if made with A-A-C fluting is about 5/16 of an inch thick. This thickness is reduced substantially in the crushed zones to facilitate knuckling. However, since the score line is clearly defined and is of somewhat greater depth than the crushed area, the flap bands exactly along the score lines.

In making up a regular slotted carton from the blank shown in FIG. 1, the blank is first folded on the transverse score lines 17 and flap 35 is stitched to panel 18. Thereafter the bottom is formed by inrolling flaps 24 to 27 as shown in FIG. 2. After the contents are placed in the carton, the top flaps 28 to 31 are inrolled. Since the flaps are crush-relieved, no difficulty is encountered in the inrolling operations.

The web of triple-wall board may be fabricated in a corrugating and combining machine in the manner disclosed in the above-identified Goldstein et al patent. From the drying and cooling sections of the combining machine the composite board 36 (FIG. 5) passes to a scoring, trimming and crushing machine in accordance with the invention. This machine, as shown in FIGS. 4 and 5 comprises a pair of shafts 37 and 38 which are journaled in suitable side plates and are driven by an electric motor.

The width of the blank is determined by the spacing between two sets of trimming rolls 39-40 and 41-42 mounted on shafts 37 and 38, each set being provided with coacting knife edges 39a-40a and 41a-42a which act to shear the edge 43 of the web material.

The longitudinal score lines and contiguous crush zones along the blank are formed by two sets of combined score-crush rollers 43-44 and 45-46 mounted on shafts 37 and 38. The male rolls 43 and 45 are mounted on the upper shaft 37, each roll having a scoring edge 43a and 45a, a cylindrical crushing iron 43b and 45b and a conical beaupier iron 43c and 45c. Thus, as best seen in FIG. 5, the web is scored by edge 43a and crushed.

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in the contiguous area by crushing iron 43b, the crush being feathered by iron 43c to prevent an abrupt step between the crush zone and the adjacent uncushioned area. Experience has shown that the provision of longitudinal score lines and contiguous crush zones facilitates the inward folding of the flaps by reducing the resistance or "flight" of the triple wall board to a folding action. This arrangement also enables the bending line of a flap to be controlled in a precise manner so that the flap folds in an even and predictable manner.

In the transporting and storage of bones, the boxes are normally stacked upon one another in vertically extending rows. In this condition the boxes are subjected to top to bottom compressive loading. This compressive loading can be of an appreciable magnitude in the case of boxes formed from triple wall board since triple wall board is often used in packaging relatively heavy objects. Experience and testing has shown that the longitudinal score lines and contiguous crush zones from which the flaps extend provide the additional important advantage of increasing the top to bottom compressive strength of the box. Thus the invention serves to maintain the general high strength characteristic of a box formed from triple wall board.

While there has been shown what is considered to be a preferred embodiment of the invention, it is to be understood that many changes and modifications may be made therein without departing from the essentially features of the invention.

What is claimed is:

1. A carton formed of triple-wall corrugated paper board material, said carton being formed from a blank having transverse score lines extending along one surface thereof to form the walls of the carton, longitudinal score lines extending along said one surface thereof, transverse slots extending from the longitudinal edges of said blank to said longitudinal score lines to define the flaps of the carton at each of the opposite sides thereof, and a crushed relief zone extending along said one surface contiguous to the side of each longitudinal score line which is adjacent to said flaps to facilitate infolding of said flaps, the portion of the blank contiguous to the other side of said longitudinal score line having a normal thickness of board material, the exposed bottom portion of said crushed relief zone being disposed beneath said one surface of the blank and above the bottom-most portion of said longitudinal score line, said exposed bottom portion being disposed toward said one surface along the area of said crushed relief zone disposed opposite to said longitudinal score line.

2. In a triple-wall corrugated paper board structure wherein a foldable flap is defined by a score line extending along one surface thereof, said structure being crush relieved in a zone extending along said one surface contiguous to the side of said score line which is adjacent to said flap to minimize flight when folding in said flap, the portion of said structure contiguous to the other side of said score line having a normal thickness of paper board, the exposed bottom portion of said crushed-relieved zone being disposed beneath said one surface of the structure and substantially above the bottom-most portion of said longitudinal score line, said exposed bottom portion being disposed toward said one surface along the area of said crushed relieved zone disposed opposite to said score line.

3. A blank of triple-wall corrugated paper board comprising a rectangular composite sheet having spaced transverse score lines extending along one surface thereof to define panels, longitudinal score lines extending along said one surface, transverse slots extending coincidently from said longitudinal score lines to the longitudinal edges of said sheet to form flaps, and longitudinal crushed zones extending along said one surface contiguous to the side of each of said longitudinal score lines which is adjacent to said flaps to facilitate folding in of said flaps, the portion of the sheet contiguous to the other side of said longitudinal score lines having a normal thickness of paper board, the exposed bottom portion of each of said crushed zones being disposed beneath said one surface of the sheet, and substantially above the bottom-most portion of said longitudinal score line, said exposed bottom portion being disposed toward said one surface in the area of said crushed zone disposed opposite to said longitudinal score line.

4. A carton formed from a blank of triple-wall corrugated paper board material, said blank having transverse score lines extending along one surface thereof to form the walls of the carton, longitudinal score lines extending along said one surface of the blank which is adapted to face the interior of the carton, transverse slots extending from the longitudinal edge portions of said blank to said longitudinal score line adjacent thereto for defining the flaps of the carton, and a crushed relief zone extending along said one surface of said flaps contiguous to each of said longitudinal score lines, said crushed relief zone having a base portion with one edge thereof extending adjacent to said longitudinal score line and an additional portion extending adjacent to the edge of said base portion opposite said one edge, the depth of said base portion from said one surface being less than the depth of said longitudinal score line, said additional portion sloping from said base portion to said one surface, whereby said longitudinal score lines and said crushed relief zones adjacent thereto facilitate the folding of said flaps.

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