United States Patent [19]

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[54] **CARDBOARD BOX BLANK AND APPARATUS FOR MAKING THE SAME**

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[52] **U.S. Cl.** ..... **93/58.2 R**

[51] **Int. Cl.** **B31b 1/14**

[58] **Field of Search** 93/58.2

[56] **References Cited**

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Assistant Examiner—Leon Gilden
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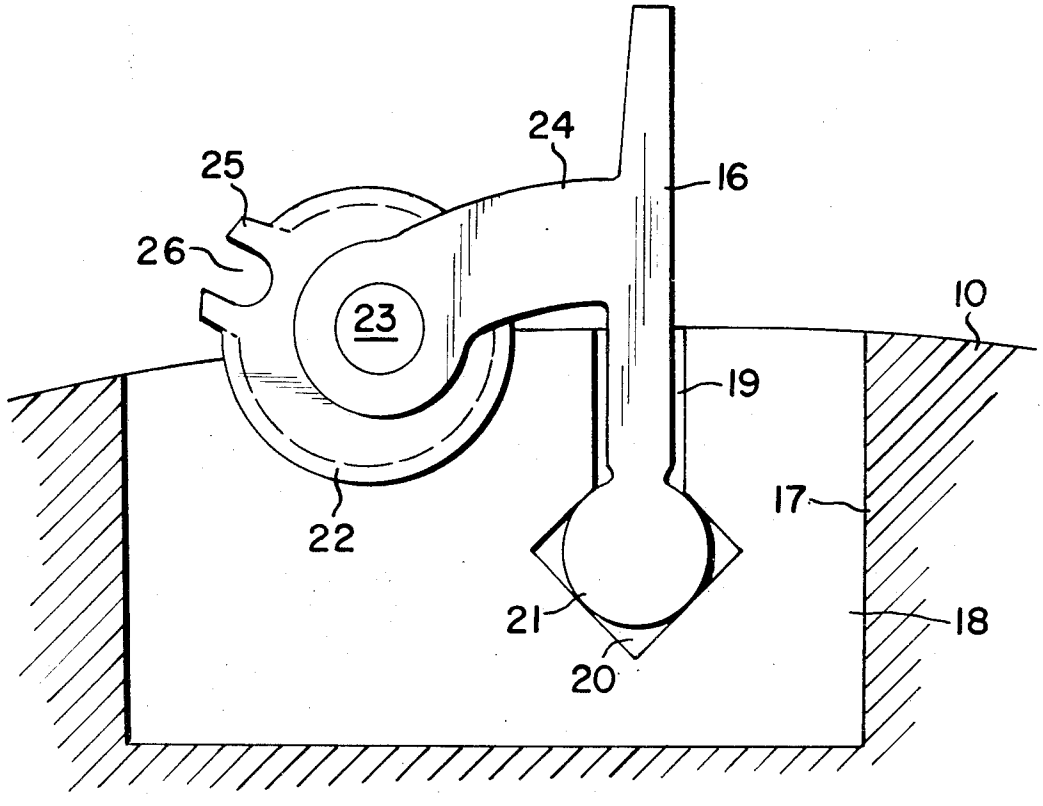
[57] **ABSTRACT**

A cardboard blank for a box is approximately rectangular, has two rows of crease sections elongated spacedly parallel to the long edges of the rectangle, and two groups of three slots extending inward of each edge to the nearer row of crease sections. The crease sections are longitudinally consecutive, but transversely offset from each other by about the thickness of the blank so that the flap portions of the blank may be folded over each other in making the box without interfering with each other. The apparatus employed for making the blank has paired rollers, one roller of each pair carrying circumferential cutting blades and an axial row of creasing blades axially interposed between the cutting blades and circumferentially adjustable to produce the desired offset of the crease sections.

5 Claims, 6 Drawing Figures



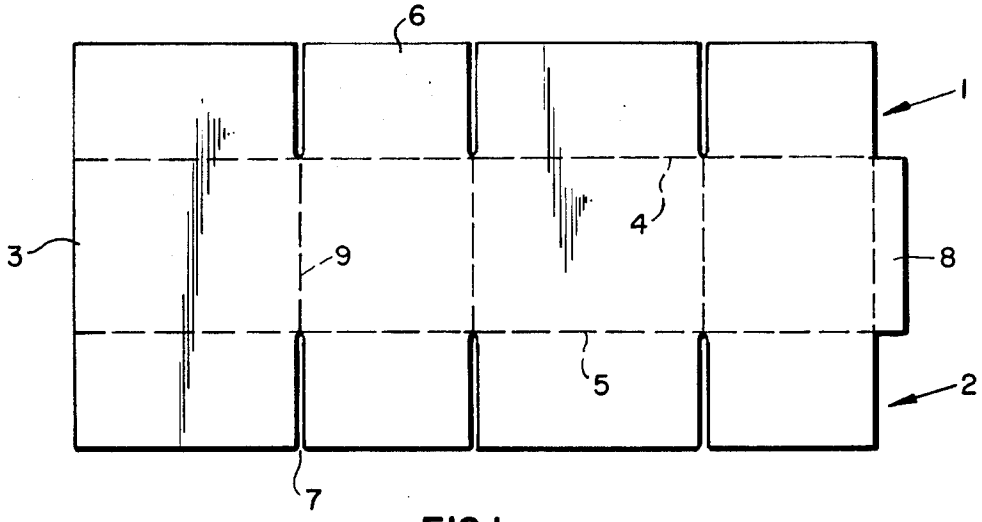


FIG.1 PRIOR ART

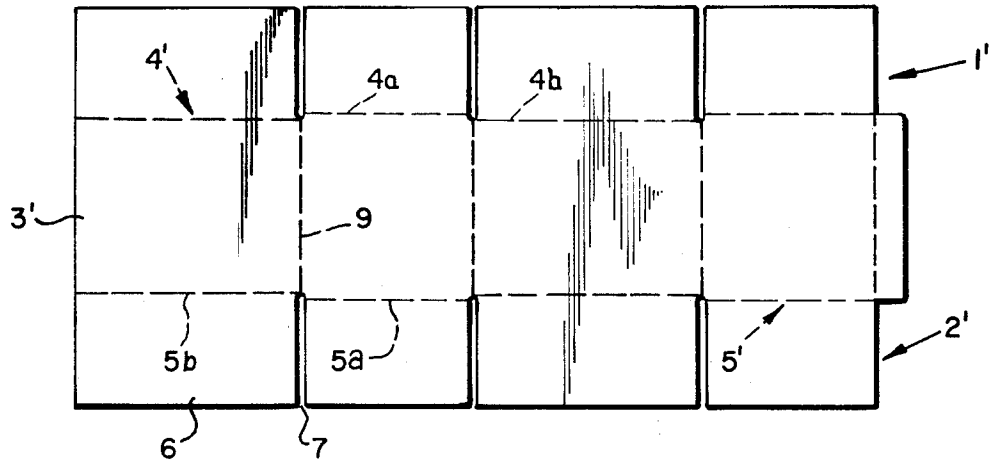


FIG.3

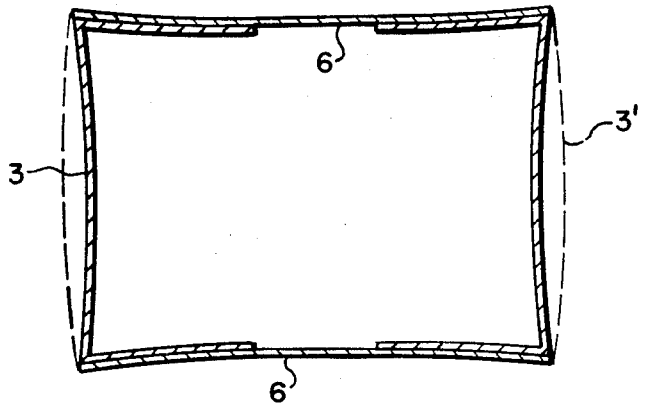


FIG.2 PRIOR ART

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FIG. 4

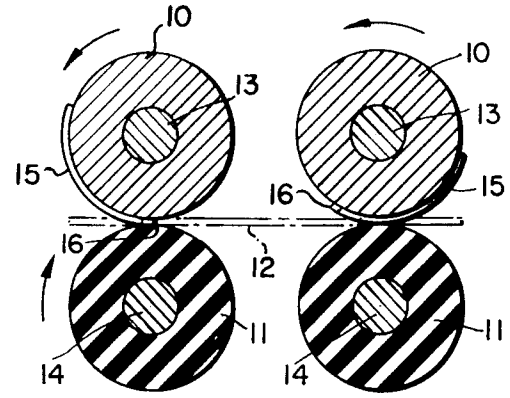
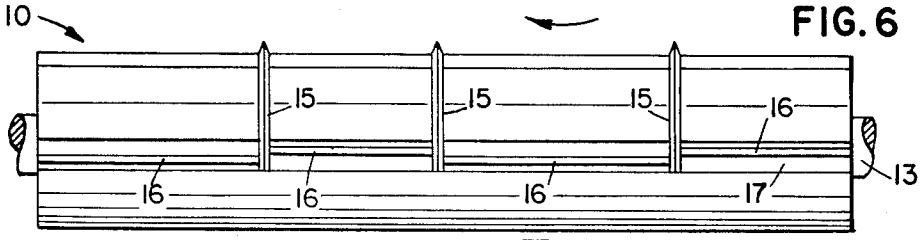


FIG. 6



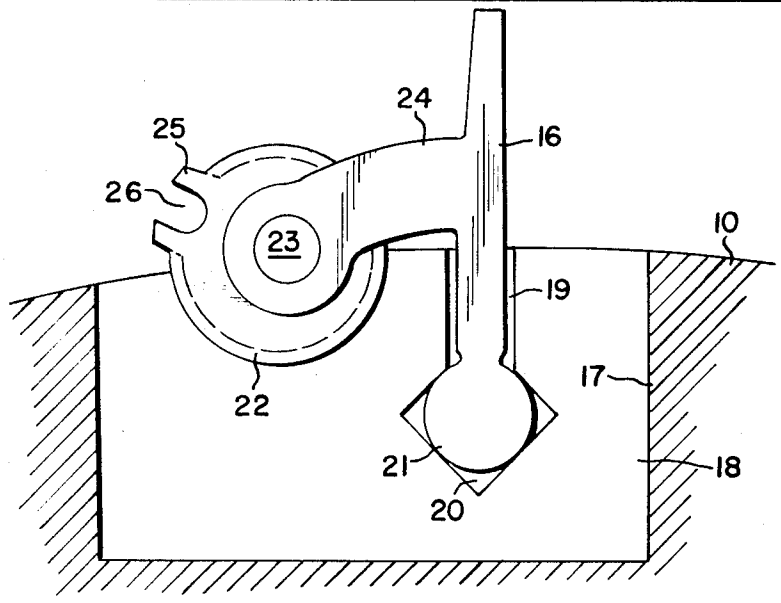


FIG. 5

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CARDBOARD BOX BLANK AND APPARATUS FOR MAKING THE SAME

This invention relates to the production of cardboard boxes, and particularly to an improved blank for such boxes, and to apparatus for shaping the blank.

It is common practice to crease and slot a sheet of cardboard, corrugated or otherwise, to produce a blank which is later folded along the initially produced crease lines and glued, stapled, or otherwise secured in the folded condition in which it constitutes a box.

It is difficult or even impossible to produce a box closely approximating a precisely rectangular shape from the slotted and creased blanks now in commercial production, and the difficulties increase as the ratio between the major dimensions of the blank, that is, its length and width, and the blank thickness decreases. Boxes of heavy corrugated cardboard that are small relative to the cardboard thickness, as are required for packing heavy and relatively small metal objects, are frequently found to deviate sufficiently from a rectangular shape to make stacking difficult unless very complex blank configurations are resorted to.

It is an object of the present invention to provide cardboard blanks of simple configuration from which boxes of adequately precise rectangular shape can be prepared.

A concomitant object is the provision of apparatus for making such blanks in a simple and inexpensive manner.

With these objects and others in view, as will hereinafter become apparent, the invention in one of its aspects provides a cardboard box blank which has two edges and is formed with two rows of crease sections spacedly interposed between the two edges, the edges and rows being elongated in a common direction, so that each row is near one edge and remote from the other. Each row consists of longitudinally consecutive crease sections elongated in the afore-mentioned common direction. Each section is transversely offset in the same direction from the two longitudinally adjacent sections. The groups of slots are formed in the blank and elongated transversely of the common direction of elongation of the edges and the rows of crease sections. The slots of the two groups extend from respective ones of the edges to the near rows of crease sections, and each slot terminates between two of the transversely offset, longitudinally consecutive crease sections.

The amount of transverse offset between longitudinally consecutive crease sections should best be approximately equal to the thickness of the blank.

Each slot of one group is longitudinally aligned with a slot in the other group and connected with the aligned slot by a crease transverse to the first-mentioned rows of crease sections. The edges, crease sections, and slots are symmetrical in a preferred, particularly simple and effective blank of the invention.

The invention is also concerned with apparatus for producing the afore-described blank, and such apparatus may include a pair of rollers defining a nip therebetween, at least one of the rollers being driven for rotation about its axis. Cutting blades mounted on the driven roller are elongated circumferentially relative to the roller and are axially spaced from each other for simultaneous movement through the nip in cutting cooperation with the other. Axially elongated creasing blades of somewhat smaller radial height than the cutting blades are interposed on the driven roller between

respective pairs of axially adjacent cutting blades. An adjusting device permits each creasing blade to be moved circumferentially relative to the driven roller toward and away from a position of axial alignment with an axially adjacent other creasing blade.

The creasing blades can be adjusted for blank thickness in a particularly simple and reliable manner when they are pivotally mounted on the driven roller for movement about a pivot axis extending in the direction of the axis of roller rotation.

Additional features, further objects, and many of the attendant advantages of this invention will readily become apparent from the following detailed description of preferred embodiments and comparison with the prior art when considered in connection with the appended drawing in which:

FIG. 1 shows a cardboard blank of the prior art for a box in semicircular view; arm

FIG. 2 shows a box made from the blank of FIG. 1 in elevational section;

FIG. 3 illustrates a corresponding blank of the invention in a view corresponding to that of FIG. 1;

FIG. 4 shows apparatus for preparing the blank of FIG. 3 in fragmentary side-elevational section;

FIG. 5 illustrates a portion of the apparatus of FIG. 4 in greatly enlarged, side-elevational section; and

FIG. 6 shows an element of the apparatus of FIG. 4 in front elevation in a different angular position.

Referring now to the drawing in detail, and initially to FIG. 1, there is shown a conventional blank of corrugated cardboard having the general shape of an elongated rectangle divided into three parts 1, 2, 3 by two longitudinal crease lines 4, 5. The two outer parts 1, 2 are further divided into four flaps 6 each by groups of three slots 7 extending in each outer part 1, 2 inward of the free edge thereof, the slots being perpendicular to the crease lines 4, 5, and the three slots in each group being longitudinally aligned with corresponding slots in the other group. The central part 3 of the blank between the crease lines 4, 5 longitudinally projects beyond the side parts 1, 2 to form a gluing strip 8. Transverse crease lines 9 in the central part 3 of the blank connect each pair of aligned slots 7 and separate the strip 8 from the remainder of the central part 3.

The blank shown in FIG. 1 is made into a box by bending the central part 3 through 90° along each transverse crease 9 and gluing the strip 8 to the portion of the central part 3 which is farthest from the strip in the flat blank, as shown in FIG. 1. The flaps 6 are then folded inward of the rectangular tube so obtained, and there is obtained a box of the elevationally sectional configuration seen in FIG. 2. Because the longitudinal creases 4, 5 of the blank extend along straight, continuous lines, the flaps 6 which respectively form the top and bottom of the box interfere with each other at the corners of the box so that the side walls of the box, formed by respective sections of the central blank part 3, bulge either inward of the box cavity, as is indicated in fully drawn lines, or outward as indicated by broken lines 3', the extent of curvature being exaggerated somewhat in FIG. 2 for the sake of clarity.

It has now been found that a box more closely approximating a precisely rectangular configuration and having the same capacity can be prepared from slightly less material when the original blank is creased in the manner illustrated in FIG. 3.

The outer parts 1', 2' of the modified blank are separated from the central part 3' by longitudinal rows 4', 5' of respective longitudinal sections 4*a*, 5*a* slightly farther from the longitudinal line of symmetry of the blank than sections 4*b*, 5*b* with which the sections 4*a*, 5*a* alternate, the crease lines 4', 5' and slots 7 bounding flaps 6 not significantly different from the correspondingly numbered elements of the blank shown in FIG. 1. Each slot 7 terminates between two transversely offset crease sections. The lateral offset of the sections 4*a* from the sections 4*b*, and the corresponding offset of the sections 5*a* from the sections 5*b* is approximately equal to the thickness of the cardboard employed so that the flaps 6, when folded along the associated creases, smoothly fit over each other without interference at the edges and corners of the box.

Apparatus for slotting and creasing substantially planar pieces of cardboard in making the blank shown in FIG. 3 is illustrated in FIGS. 4 to 6 to the extent needed for an understanding of the invention.

Two pairs of cylindrical rollers 10, 11 are arranged in tandem to pass a cardboard sheet 12 through the nip between the rollers of each pair when the rollers are turned by their drive shafts 13, 14 as indicated by curved arrows, the shafts being coupled in a conventional manner, not shown, to rotate the four rollers at identical circumferential speeds. As is partly shown in FIG. 6, the roller 10 of each pair consists of steel and is provided with a set of axially spaced, circumferentially elongated cutting blades 15 and with an axially elongated creasing blade 16 between each pair of axially adjacent cutting blades, the cutting blades of the two rollers 10 being arranged in common radial planes through the parallel axes of roller rotation. The cooperating rollers 11 have a surface layer of wear resistant synthetic rubber or moderately resilient plastic, and a smoothly cylindrical surface. Whily only one cutting blade 15 and one creasing blade 16 are visible on each roller 10 in FIG. 4, the disposition of the several blades on the roller 10 is evident from FIG. 3 which, in effect, provides a composite developed view of the blades on each roller, the cutting blades on the rollers 10 being represented by respective groups of slots 7, and the creasing blades the creases 9 representing creasing blades on a non-illustrated third pair of rollers, as will presently become apparent 16 by respective rows 4', 5'.

The circumferentially elongated cutting blades 15 are conventional in themselves and do not require more detailed description. The several radially lower creasing blades 16 of each roller 10 are mounted in a common axial groove 17 of the roller 10, as is shown in more detail in FIG. 5. Mounting blocks 18 are arranged near the axial ends of each creasing blade 16 and fastened in the groove in a manner not shown. An approximately radial slot 19 in each block 18 is open in a radially outward direction and in both axial directions, its radially inner end 20 being enlarged into a square, cross sectional shape to receive a cylindrically enlarged pivot portion 21 of the blade 16 in a manner to permit limited angular movement of the blade 16 about the pivot axis of its cylindrical portion 21.

A notch in the outer face of the block 18 which is of approximately semicicular cross section conformingly receives a flanged adjusting disc 22 provided with an eccentric pin 23. The pin is movably received in one end of a motion transmitting are 24 whose other end is integrally fastened to the blade 16. Two integral abutments 25 project radially outward from the circumference of the disc 22 and bound a recess 26 therebetween.

During operation of the apparatus, a cardboard sheet 12 having the overall shape of the blanks shown in FIGS. 1 or 3 is fed to the nip of the first pair of rollers 10, 11 sideways, that is, in such a position that the sheet is elongated in the direction of the roller axes. The leading outer part of the sheet passes between the first pair of rollers without being engaged by the blades 15, 16, and the trailing outer part is creased by the blades 16 and slotted by the blades 15. The leading outer part is similarly creased and thereafter slotted by the blades 15, 16 on the second roller 10 in cooperation with the associated resilient roller 11.

The length of the several slots 7 formed by the blades 15 can be varied by changing the angular position of the rollers 10 relative to each other and by suitably feeding the sheets 12 to the nip of the first pair of rollers. The positions of the several longitudinally consecutive crease sections 4*a*, 4*b*, 5*a*, 5*b* may be shifted transversely toward and away from longitudinal alignment by turning the discs 22 associated with the corresponding creasing blades 16, and thereby pivoting the blades 16 through the small angles required for making the free creasing edges of the blades move a distance equal to the thickness of the processed cardboard. The eccentricity of the pin 23 is preferably chosen in such a manner that one abutment 25 abuts against the surface of a block 18 in the position of the blades 16 producing the sections 4*a*, 5*a*, and the other abutment 25 abuts against the block surface for producing crease sections 4*b*, 5*b*, the two positions of the disc 22 being angularly offset about 320°, or less than one revolution.

The transverse creases 9 are formed separately between a third pair of rollers whose configuration is evident from FIG. 3, but the cutting blades 15 may be extended circumferentially, and the extensions reduced in radial height to score the creases 9 in the same operation.

While the blank of the invention and the apparatus employed for carrying out an essential part of the blank-forming process have been illustrated and described with reference to the manufacture of a very simple rectangular cardboard box, the invention is not directly concerned with the ultimate product, and may be modified to produce blanks having a shape entirely different from that illustrated in FIG. 2.

It should be understood, therefore, that the invention is not limited to the specific embodiments chosen for the purpose of the disclosure, but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. An apparatus for shaping a cardboard blank which comprises:

a. a pair of rollers defining a nip therebetween;

b. drive means for rotating one of said rollers about the axis thereof;

c. a plurality of cutting blades mounted on said one roller, said blades being elongated circumferentially relative to said one roller and axially spaced from each other for simultaneous movement through said nip in cutting cooperation with the other roller;

d. a plurality of axially elongated creasing blades interposed on said one roller between respective pairs of axially adjacent cutting blades; and

e. adjusting means for moving each of said creasing blades circumferentially relative to said one roller toward and away from a position of axial alignment with an axially adjacent other creasing blade.

2. An apparatus as set forth in claim **1,** further comprising pivot means securing each of said creasing blades to said one roller and having a pivot axis extending in a common direction with the axis of rotation of said one roller, said adjusting means including means for pivotally moving each creasing blade about the pivot axis of the associated pivot means.

3. An apparatus as set forth in claim **2,** wherein said adjusting means for each creasing blade include an adjusting member mounted on said one roller for angular movement about an axis extending in said common direction and spaced from said pivot axis, and motion transmitting means interposed between said adjusting member and said creasing blade for pivotally moving said creasing blade in response to the angular movement of the associated adjusting member.

4. An apparatus as set forth in claim **3,** wherein said motion transmitting means include an eccentric pin on said adjusting member and an arm on said creasing blade hingedly engaging said pin.

5. An apparatus as set forth in claim **3,** further comprising abutment means on said one roller for limiting said angular movement of said adjusting member to less than a full revolution.

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