April 18, 1967 T. D. BISHOP 3,314,340

APPARATUS FOR USE IN THE MANUFACTURE OF BOXES AND THE LIKE

Filed Oct. 16, 1964 3 Sheets-Sheet 1

FIG 1

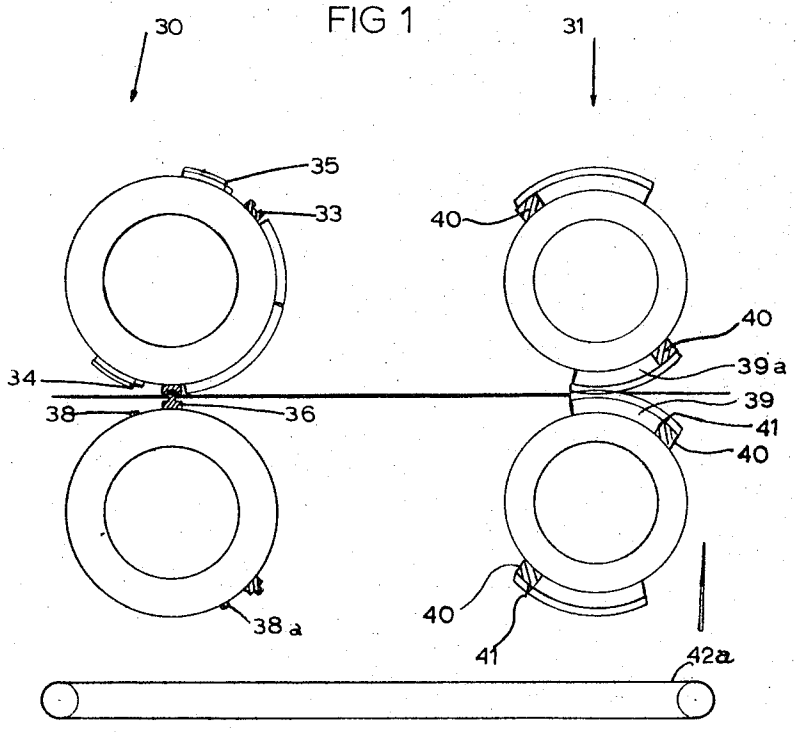

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FIG 2

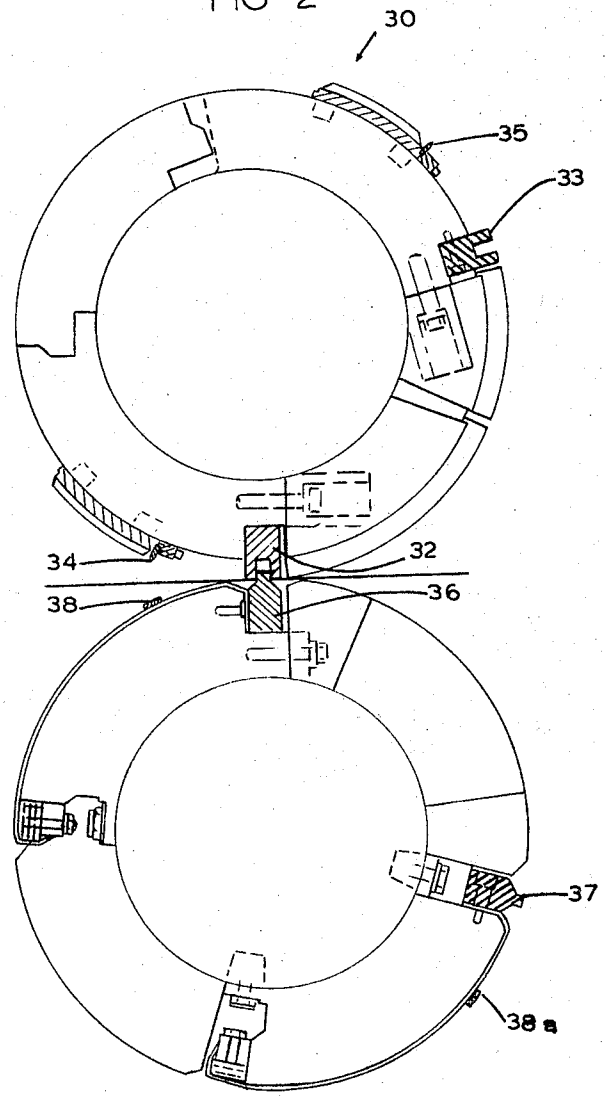

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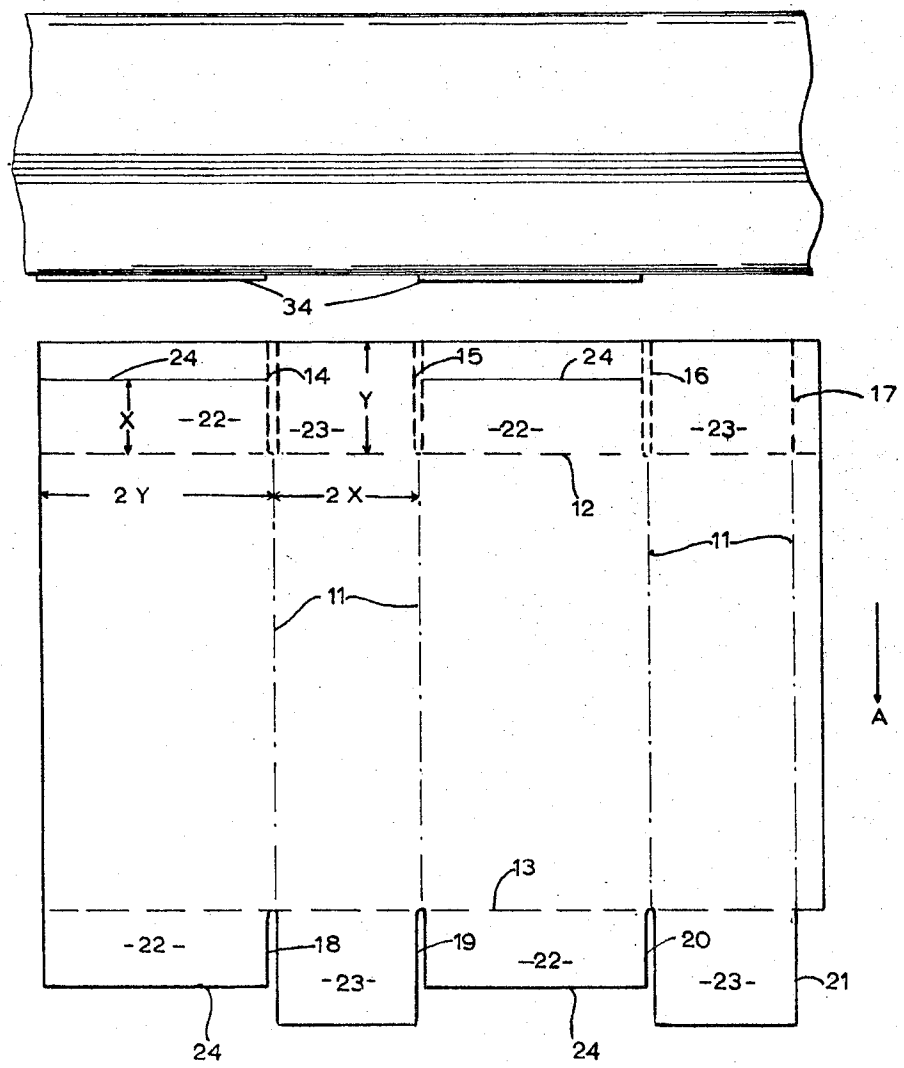
FIG 3



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APPARATUS FOR USE IN THE MANUFACTURE OF BOXES AND THE LIKE

Thomas Desmond Bishop, Solihull, England, assignor to The Deritend Engineering Company Limited, Birmingham, England, a British company

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2 Claims. (Cl. 93—58.2)

This invention relates to appartus for use in the manufacture of boxes and the like particularly from board, i.e. relatively thick cardboard. When erecting a box from a blank consisting essentially of a rectangular piece of board creased and slit appropriately, opposite end edges of the blanks are stitched or otherwise secured together to make a rectangular or square sectioned but open ended box, and then flaps are folded in to form the top and bottom of the box. Maximum strength is achieved when the flaps abut edge-to-edge, but in practice this only occurs when the box is square in plan: otherwise two flaps meet edge-to-edge and the other two (at each end) are either spaced apart or overlap, depending upon the arrangement of the blank.

When maximum strength is required it is usual practice to provide for the flaps to meet edge-to-edge along a line bisecting the shorter dimension of the rectangle and shorten the other flaps so that they too meet in this fashion. This shortening is known in the trade as "butt flap cutting."

Butt flap cutting needs to be carried out with great accuracy to avoid wastage or scrap, since any error in positioning the line of cut transversely of the blank is magnified by a factor of two since two flaps are required to meet together. Moreover the pieces cut off the flaps may interfere with satisfactory operation of the making machine, and it is difficult to dispose of these pieces, particularly in the high speed machinery usually used: for this reason it is usual to butt-flap cut as the last operation, i.e. after the slots separating the flaps one from the next have been cut, all desired creases or bends made, and even after any printing has been effected on the blanks.

In accordance with this invention, apparatus for use in the manufacture of boxes and the like comprises a first roll pair with butt-flap cutting means and bar-bender means for transversely creasing blanks fed through the pair, a second roll pair with slotting means for separating flaps one from the next along the blanks, said second pair being disposed after the said first roll pair, means for carrying out of the plane occupied by the remainder of the blank the cut-off pieces from the but-flaps as the blank proceeds through the apparatus.

Preferably the butt-flap cutting means are provided on the bar-bender rolls in advance of the actual bending (i.e. creasing) mechanism having regard to the synchronisation of the apparatus so that the first operation on each blank is the formation of the cuts separating the pieces to be cut-off from the remainder of the flaps, although the separation does not occur until after the slotting rolls means in the second roll pair have cut in transversely from the edges of the blank, although for some purposes a separate creasing and/or cutting on the blanks may be done prior to the butt-flap cutting stage.

The cutting means may comprise cutting rules held in slotted bars extending along the length of the bar-bending rolls and adjustable thereabout to permit variation in the dimensions between the ends of the blank and the lines of cut: variation in the length of cut may be achieved by substitution of different rules in the slots. Alternatively the rules may be embedded in a plastics pad adjustably mounted on the said rolls. One particularly advantageous

form utilises rules with serrated edged rules adapted to co-operate with hard but resilient pads of for example polyurethane on the co-operating roll, so that these rules cut completely through the board and embed in the pads to ensure thorough cutting. Rubber or like foamed plastics pads may surround the rules to give support to the blanks during feeding between the rolls nip, facilitate extraction from the cuts and prevent the board deflecting during retraction.

The means for carrying the cut-off pieces out of the plane of the blanks may comprise barbed or like spikes disposed adjacent the slotting knives or wheels so that the cut-off pieces are impaled and carried around the slotting rolls, a stripper blade or finger being arranged to strip the pieces from the spikes and allow them to drop, for example on a return conveyor. Hence, separation is definite and positive and there is no risk of the pieces becoming lodged on the blanks, and interfering with subsequent operations; the pieces moreover do not tend to pile up and interfere with the apparatus. In high speed apparatus running for example at 12,000 blanks per hour, this is important to enable continuous running to take place.

Whilst it is more usual and preferred to form blanks in which the individual flaps to be cut and shortened are of equal length so that they butt edge-on on the medium centre line of the erected box, it is possible to leave ones of the flaps uncut and shorten the others appropriately so that they meet offset from the said centre line, and this may enable a simpler apparatus to be used.

The invention will now be more particularly described with reference to the accompanying drawings, wherein:

FIGURE 1 is a diagrammatic view of board treating apparatus in accordance with the invention;

FIGURE 2 is a vertical elevation through one of the roll pairs shown in FIGURE 1; and

FIGURE 3 is a fragmentary plan view of the apparatus and one blank.

Referring first to FIGURE 3, a typical blank **10** for erection into a box is illustrated: prior to being fed through the apparatus the blank is rectangular and is of a length and width in the direction of and transversely of (respectively) arrow A equal to the overall dimensions of the finished blank. This is not essential but the following description is simplified by assuming this to be the case, and such variations as are introduced by using blanks longer in either dimension than the dimension of the finished blank will be obvious to those skilled in the art after reading the following specification.

Prior to delivery to the apparatus, or at an earlier or later stage in the apparatus, the blank is creased along the four parallel chain-dot lines **11**: this may be accomplished by suitable grooving rollers, or by passing the blank transversely of the direction of arrow A through a conventional bar-bender.

In the illustrated apparatus, additional creases are to be formed along the dotted lines **12**, **13**, again transversely of the direction of feed through the apparatus, by bar-bending means, slots are to be cut from the leading and trailing edges of the blank as far as dotted lines **12**, **13**, and along the parallel dotted lines **14–17** (at one end) and along the lines indicated at **18–21** (at the other end): in this respect FIGURE 3 illustrates a blank which is part treated at one end and fully threated (insofar as this invention is concerned) at the other end. The lines **11** represent the lines of folding when the blank is erected into a rectangular sectioned "tube" and the lines **14–21** the lines of separation between side flaps **22** and end flaps **23** which are to be folded to make the base and top of the box. The dimensions of the flaps are related to the dimensions of the box section in the manner shown, i.e. the wider box side-wall is $2y$ wide where y is the dimension of flap **23** from crease **12** to the free edge, so that

on butting the two flaps **23** at that end of the box the edges of these flaps will be in close juxtaposition. Similarly the narrow dimension of the box is $2x$ when x is the dimension of flap **22** from crease to free edge.

This last requirement necessitates cutting of the portion between line **24** and the free edge of the blanks to shorten the flaps **22** so that they will meet as aforesaid without overlap and this cutting operation is "butt-flap cutting."

Hence the other operation carried out in the apparatus is butt-flap cutting.

It is to be realised that the lower part of the blank substantially as shown in FIGURE 3 is not new per se and indeed corresponds to blanks produced in known apparatus by known methods which involve the steps of first rotary creasing to produce creases **11**; secondly bar-bending to produce creases **12, 13**; thirdly slotting along lines **14–21**; and fourthly butt-flap cutting: each of these being accomplished by a separate roll pair and quite frequently with printing rolls interposed between the third and fourth stages so that quite essentially butt-flap cutting was the final stage.

In the present invention the butt flap cutting per se i.e. the cuts along lines **24** is carried out in the same roll pair as performs the creasing of lines **12, 13**, and essentially before the roll pair effecting slotting along lines **14–21**. This not only reduces the number of roll pairs (itself a significant saving in capital cost, running cost, maintenance cost, and space required) but has further advantages in enabling required tolerances or limits of accuracy to be maintained at high speeds: in part this is due to the fact that the dimensions x and y result from creases and cuts made in the same roll pair so that slip or the like between successive roll pairs is eliminated, and in part is due to performing these cuts early in the manufacturing cycle instead of late so that cumulative errors are ineffective. Further, removal of cut-off pieces is more easily possible when the present invention is utilised as will subsequently become clear.

Turning now to FIGURE 1, the apparatus is seen to include, essentially, two roll pairs **30, 31**, the first of which provides butt-flap cutting and bar-bending facilities and the second of which provides slotting and stripping facilities. As best seen in FIGURE 2, the roll pair **30** comprises a pair of cylinders of which the upper carries two female bar-bender tools **32, 33** and two male butt-flap cutting tools, i. e.rules **34, 35**. One bar bender tool is adjustable circumferentially to vary the spacing between creases **12, 13** (FIGURE 3) and each rule **34, 35** is adjustable circumferentially relative to its associated bar-bender tool. The length of each cut **24** and its position along the axis of the roll pair is also adjustable after release of conventional clamping means. Areas of the roll adjacent the tools are covered with rubber blocks which are compresed in the nip and recover resiliently to strip the board blank from the tools.

The lower roll in FIGURE 2 carries male bar-bending tools **36, 37** and cutting pads **38, 38a** which complement the tools **32, 33** and **34, 35** respectively. These are adjustable about the roll axis, in the case of pads **38, 38a**

possibly by securing them with adhesive but in the case of tools **36, 37** by an automatic gear which ensures that as one bar-bending female tool is moved relative to the other, the corresponding male tool is moved equally to maintain their synchronisation. Such automatic gear is well known and is not relevant to this invention and therefore does not need description.

After the leading edge of the blank has passed through the roll pair **30**, and preferably (where possible having regard to the length of the blank and the roll diameters) whilst the trailing end is still engaged in the roll pair **30**, the leading end enters roll pair **31** where slots are cut along lines **14–21**. Again the slotter per se is well known and does not need separate description other than to say that it comprises pairs of male and female knives **39, 39a** which are adjustable about the roll axes to suit the blank requirements. A number of sets of knives will be arranged along the roll axis, one set to cut each slot. Between sets of knives the roll may have blocks or pads **40**, which co-operate to grip between them the pieces which are cut off when the slotter knives cut the edges of the flaps and pass through the butt-flap cut lines **24**. One of each pair of blocks carried (possibly barbed) spikes **41** which pierce the cut-off portions so as to carry them around the roll axis out of the plane of the blanks and over a stripper blade **42** which is fixed in relation to the apparatus and serves to hold the pieces whilst the spikes pull out, the pieces dropping to a conveyor **42a** for removal.

In the event of trimming lengthwise or transversely being required on blanks which are not previouly cut to size, extra rules such as **34** and pads **38** are provided on the first roll pair **30** and/or slotting knives on the second roll pair, the latter extending over the whole of the roll circumference in such case.

I claim:

1. Apparatus for use in the manufacture of boxes and the like comprising a first roll pair with butt-flap cutting means and bar-bender means for transversely creasing blanks fed through the pair, a second roll pair with slotting means for separating flaps one from the next along the blanks, said second roll pair being disposed after the said first roll pair, means for carrying out of the plane occupied by the remainder of the blank the cut-off pieces from the butt-flaps as the blank proceeds through the apparatus.

2. A method of manufacturing boxes from board comprising producing blanks by creasing and cutting the board including the step of butt-flap cutting, characterised in that the butt-flap cutting is carried out before the slotting.

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BERNARD STICKNEY, *Primary Examiner.*