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APPARATUS FOR FOLDING BOX BLANKS

Filed April 27, 1951

3 Sheets-Sheet 1

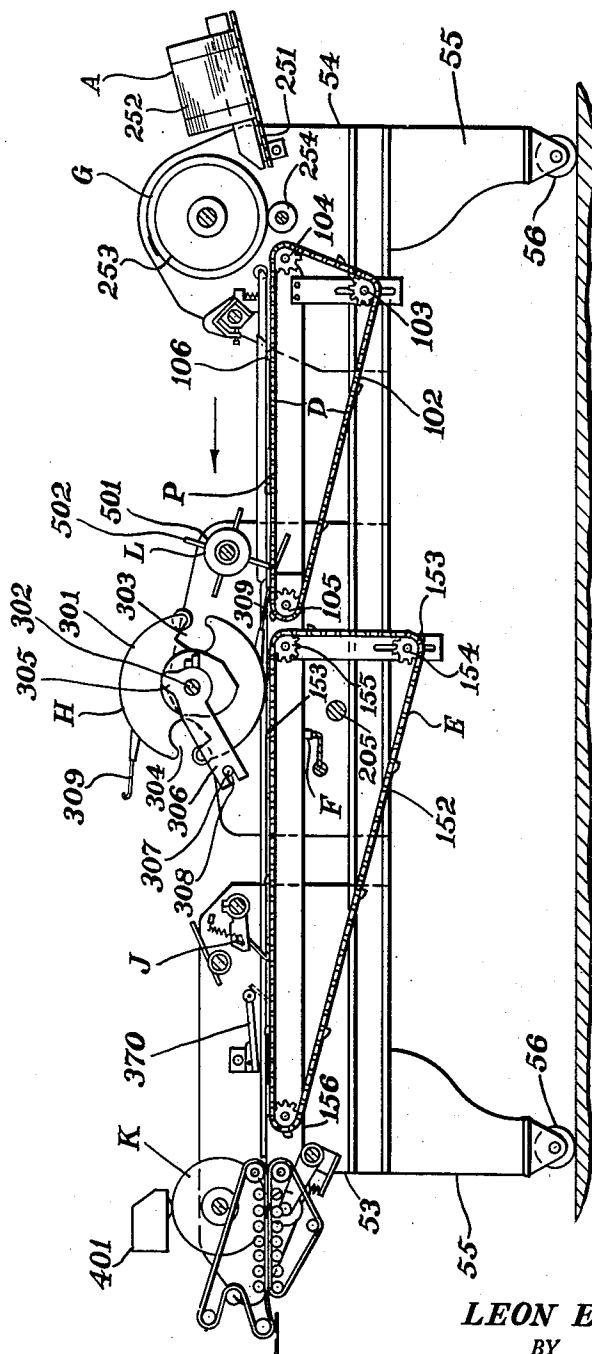


Fig. 1.

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Fig. 2.

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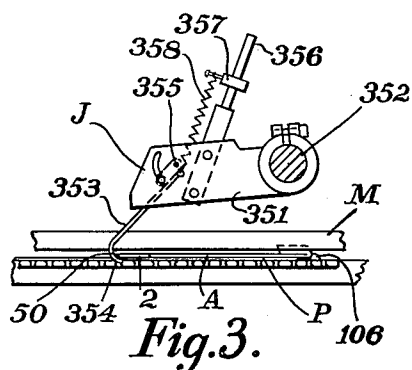
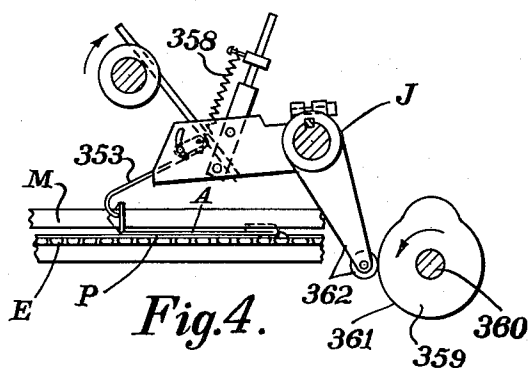
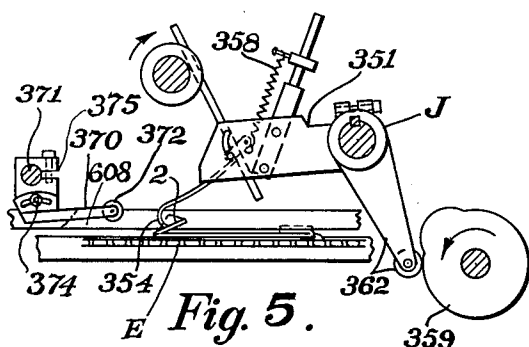
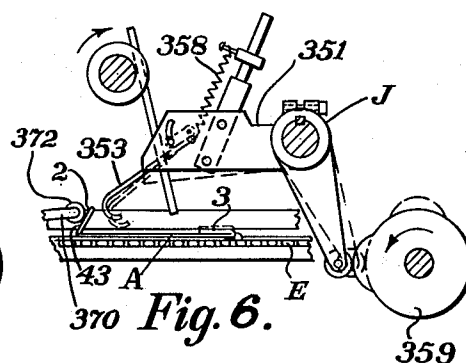
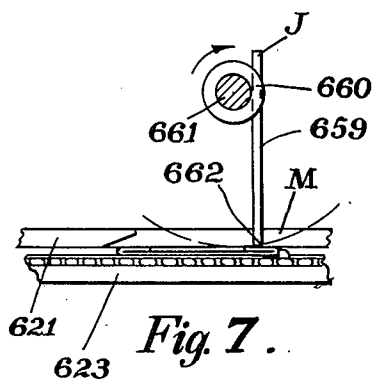
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APPARATUS FOR FOLDING BOX BLANKS

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7 Claims. (Cl. 93—49)

This invention relates to an improved folding machine for use in making boxes of the knock-down, inwardly collapsed type well known in the trade.

The principal object of my invention is to provide improved means for infolding the leading and trailing articulated flaps of the blanks from which such boxes are formed while the blanks travel in a straight line path through the machine.

The means for infolding, or overfolding, the trailing flaps of the blanks is described in detail and claimed in my copending application Serial No. 558,966, filed January 13, 1956, as a continuation in part of this application.

Another object of my invention is to provide such improved infolding mechanism in a compact and light weight form whereby my folding machine may be easily moved about a box factory and up against various other box making machines which perform additional operations on the box.

Another object of my invention is to eliminate certain hold-down elements, used in prior devices to assure the infolding of the flaps on their line of articulation, by providing an infolding finger of such shape, material and angle of operation as to make such hold-down elements unnecessary with a resulting simplification of the operation.

A further object of my invention is the provision of means for temporarily fixing each blank in a position of rest in the machine while the infolding of the trailing flaps takes place thus eliminating infolding mechanism which travels along with the blank, as in prior devices.

Still another object of my device is to provide compactly arranged automatic infolding mechanism made up of easily movable and adjustable parts whereby blanks of a variety of sizes and dimensions may be folded in the machine, and capable of operation at high speed without malfunction.

From a method point of view, I have devised a new flap folding method, which improves over previous methods in that my hooked folding finger contacts a blank flap when the adjacent portions of the blank are in flattened condition, without the rigidity provided by previous blank folds and without hold-down mechanism located opposite, or proximate, the point of folding pressure thereon. My new method provides for progressively applied pressure at the edge of an articulated flap, already weakened at the line of articulation by a crease and preferably a score, during at least one half of the infolding of the flap. It also provides for the main body of the blank to be supported from buckling below the paper line in a direction opposite to the pull of my hooked folding fingers and for the main body of the blank to be held from sliding along the paper line in the direction of pull of the hooked folding fingers.

By my new method, therefore, the pressure of the hooked folding fingers on the edge of an articulated flap will cause a buckle in the blank above the paper line at the line of flap articulation and thereby force the portion of the blank, to which the flap is articulated, to lie flat

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during the folding operation. Continued pressure and motion of the hooked finger in the direction of infolding holds the buckled blank against its support until the flap fold takes place at the weakest point, the creased and scored line of articulation.

My new method of folding a flap, on an already weakened line of articulation can be accomplished with a single hooked element to make a complete infold and does not necessarily require contact with the undersurface of the flap as in prior methods and machines. Folding methods including the step of pushing against the undersurface of an articulated flap require mechanism to prevent the entire blank from lifting during the first half of the infold and such mechanism must then be moved out of the way of completion of the infold, all of which prevents high speed operation.

Other objects of my invention will appear from the following description and drawings and in the claims hereto annexed.

In the drawings:

Fig. 1 is a diagrammatic side elevation of my improved folding machine on line 1—1 of Fig. 2.

Fig. 2 is a diagrammatic plan view of the device shown in Fig. 1.

Fig. 2A is an enlarged plan view of the preferred type of blank used in my machine.

Figs. 3—7 are enlarged fragmentary side elevations of the leading flap infolding mechanism of my device in various stages of operation while the blank is carried along the paper line by a conveyor.

As shown in the drawings the knock-down inwardly collapsed box for which my folding machine is especially suitable is preferably formed from a flat blank A of bendable sheet material such as fibre board, having cuts or slits therein at 23, 29, 30 and 31, underscored crease or fold lines therein at 20, 21, 22 and 23 and diagonal underscored crease or fold lines therein at 24, 25, 26 and 27. The cuts and creases described above divide the flat blank A into a bottom or main body panel 1, side wall panels or flaps 2 and 3, end wall panels, or flaps, 4 and 5, sealing flaps 6, 7, 8 and 9 foldably connected to end wall panels 4 and 5 and triangular tabs 10, 11, 12 and 13 formed in, and foldably connected to side wall panels 2 and 3.

In my folding machine a blank such as A, travels there-through, along the paper line P, with the underscored crease or fold lines 20 and 22 transverse to the path of the blank. During its passages through the machine, blank A is folded into the form shown at B wherein sealing flaps 6, 7 and 8, 9 are infolded toward each other flatwise against end panels 4 and 5, side wall panels, or flaps, 2 and 3 are infolded toward each other and flatwise against bottom panel 1 and triangular tabs 10, 11, 12 and 13 are back folded on the diagonal crease lines 24, 25, 26 and 27 in the opposite direction from that of side wall flaps 2 and 3.

I call side wall panel, or flap, 3 and sealing flaps 7 and 9 the trailing flaps of blank A and I call side wall panel or flap 2 and sealing flaps 8 and 6 the leading flaps of blank A as convenient terms to describe the position of the same in passing along the paper line of my machine.

As shown in Figs. 1 and 2, I provide a frame C having side frame pieces 51 and 52, end frame pieces 53 and 54, four legs such as 55 and rollers on each leg such as 56. Blank feeding mechanism G is located at one end of the machine, blank glueing mechanism K is located at the opposite end thereof and intermediate of the ends are located by trailing flap infolding mechanism H and my leading flap infolding mechanism J.

A first conveyor D, including a pair of endless belts or chains 101 and 102, having spaced upstanding abut-

ments 106 and supported on pulleys such as 103, 104 and 105 is positioned to receive blanks A from feeding mechanism G, convey the blanks along the paper line P and release the same at a position of rest on paper line P at a clamping mechanism F.

A second conveyor E, including a pair of endless belts or chains 151, 152, each chain having a spaced series of upstanding abutments such as 153, 153, and supported on pulleys such as 154, 155 and 156 is synchronized to pick up each blank A as it is released from clamping mechanism F, carry the blank along the paper line P and deliver the blank to the glueing mechanism K.

Feeding mechanism G, includes a chute 251, holding a stack 252 of blanks, such as A, each positioned so that it will travel through the feeding mechanism, and onto paper line P, with its lines of articulation 20 and 22 transverse to the paper line and to the path of travel of the blanks. Flaps 2, 6 and 8 thus become the leading flaps and flaps 3, 7 and 9 become the trailing flaps. A feed roll 253 is provided, together with a suitable friction roll 254, all in a well known manner, and arranged to deliver a succession of blanks such as A, at spaced intervals to conveyor D.

I find it useful to provide tab breaking mechanism L comprising a rotating member 501 with radially projecting elements 502 each synchronized and positioned to contact a triangular tab such as 10, 11, 12 and 13 of blank A and to give a preliminary articulation thereto on the diagonal fold lines 24, 25, 26 and 27. Subsequent folding of the tabs is thus made easier particularly when the sheet material used in blank A is not easily bendable.

I provide a pair of hold-down and folder bars M and N extending longitudinally of the paper line and slightly above the same in order that each blank A may be carried along the paper line P with its lower surface supported on the second conveyor E and its upper surface in contact with the bars M and N. Between feeding mechanism G and clamping mechanism F I also provide longitudinal guides 700 and 702 above paper line P and above conveyor D, together with a centrally located longitudinal guide or support 701 which extends substantially the entire length of the machine, below the paper line P to support the centre of the blanks A and to prevent their buckling downwardly during the folding operation.

The outer and lower longitudinal edge 604 of a hold-down and folder bar, such as M, is longitudinally aligned to contact the upper surface of each blank at one of the opposite sides of the bottom of main body panel 1, just inside of a longitudinal line of articulation such as 23. The inner face 608 of each hold-down and folder bar, such as M, is normally at an angle of about 30° to the paper line for example along hold-down zones 601, 602 and 603 shown in Fig. 2.

Additional hold-down bars such as 620, 621 may be provided above the end flaps 4 and 5 and above flaps 2 and 3 in zones 602 and 603. The end flaps are supported from below by the conveyor E and may also be supported from below by longitudinal support guides such as 623.

Along zone 605, of a bar M or N, where the infolding of the trailing flaps takes place and along zone 606 where the infolding of the leading flaps takes place the angle of the inner surface 608 of the bars gradually increases to 45° and then decreases again to 30°.

The trailing flap infolding mechanism H of my machine comprises one or more rotatable supports 301, revolving on a shaft 302 whereby the portion of the circumference adjacent the paper line P travels in the same direction as the blanks A on the paper line and in close proximity thereto. Each rotatable support 301, is provided with one or more circumferential flap recesses such as 303, 304 and is also provided with a stationary cam member 305, kept from revolving with

shaft 302 by an integral arm 306, having a shaft recess 307, for a shaft 308 by which it is retained and adjusted on frame C.

As explained in detail in my said copending application an elongated, hooked, folding finger 309, of resilient material is associated with each flap recess 303 and pivotally carried by support 301. As each successive blank is halted by clamp F, a finger 309 is rotated into position to engage the trailing edge of a trailing flap bow the blank upwardly until the flap folds on its line of articulation and then release the upfolded flap into a recess 303. Thereupon the recess completes the overfolding of the flap flatwise against the body of the blank and the blank is released to again travel forwardly on the carrier E. Bars M and N serve to backfold any triangular tabs on trailing flaps being overfolded by the mechanism H.

As shown in detail in Figs. 3-7, I provide an oscillatable support 351, mounted on a transverse shaft 352 and having an elongated finger 353 projecting forwardly and downwardly therefrom. Finger 353 has a downwardly extending hook 354, extending into paper line P and mounted for vertical oscillation on a pivot 355 on support 351. A rod 356 is fixed to support 351, having a slidably adjustable sleeve 357, the sleeve being connected to the pivoted end of finger 353, by a coil spring 358 to resiliently hold the same in its downward position.

Cam 359, mounted to rotate on a shaft 360 in synchronization with the other moving elements of my device is provided with a circumferential cam track 361 in contact with a cam follower 362 affixed to support 351. As shown in Fig. 7, cam 359 operates to rotate the support 351 and finger 353 upwardly out of the path of the infolded trailing flaps such as 7, 3 and 9 of blank A immediately after fingers 353 have infolded the leading flaps thereof such as 6, 2 and 8.

In Fig. 3, I show finger 353 extending at a considerable angle of elevation to the paper line P and hook 354 engaging the leading edge 50 of a leading flap such as 2 of a blank A. In Fig. 4, the conveyor E has moved the blank forwardly thereby causing finger 353 to slightly buckle the blank, upfold the flap on line 20 and rise with the flap such as 2 to assume a different angle of elevation to the paper line P. The upward pivoting of finger 353 occurs against the pull of spring 358 and against the resistance of the 45° inner faces of bars M and N in zone 606. As in the case of the infolding of the trailing flaps, triangular tabs 10 and 11 are thus backfolded on their diagonal lines of articulation as the flap such as 2 is infolded.

Further progress of blank A on conveyor E brings the leading flap such as 2 into the position shown in Fig. 5 with the hook 354 having released its contact with the flap and the cam 359 about to raise the oscillatable support 351 and finger 353 out of the way of the infolded trailing flaps 7, 3 and 9.

As best shown in Fig. 7, to prevent the infolded trailing flaps 7, 3 and 9 from rising into the 45° zone 606 of bars M and N in which the infolding of the leading flaps 6, 2 and 8 takes place, I provide hold-down rods such as 659, each mounted on a sleeve 660 rotatably carried by a shaft 661 and having the speed and path of its tip 662 synchronized to contact and hold down each infolded trailing flap as it passes through zone 606 of bars M and N.

As shown in Fig. 6, each leading flap such as 2, after being raised to a substantially upstanding position above paper line P by hooks 354, and after release by hooks 354, is carried forwardly on conveyor E until the undersurface 43 of flap 2 contacts a fixed pusher element 370. Element 370 is adjustably mounted by means of a slot 374 in a split sleeve 375 carried on a shaft 371 and is preferably provided with a roller 372 positioned to engage and positively complete the infolding of flap

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2 and the backfolding of tabs 10 and 11 as they enter the 30° zone 603 of bars M and N.

In passing along the paper line P on conveyor E and in zone 603 of the bars M and N the blank A has assumed the form shown at B and is ready for the glueing operation. I provide suitable glueing mechanism K, having glue pots 401 and glue rolls 402 arranged to transfer a coating of glue 403 to a triangular portion of infolded sealing flaps 6, 7, 8 and 9 corresponding to the area of triangular tabs 10, 11, 12 and 13. The infolding of end flaps 4 and 5 and their infolded sealing flaps to overlie the bottom panel 1 and adhere to the triangular tabs is preferably performed on another machine and may be done in any well known manner.

I claim:

1. Mechanism for infolding an articulated flap of a flat box blank, while simultaneously pressing the main body thereof down on the paper line of a folding machine, said mechanism comprising an oscillating support having first means positioned above the paper line including a hook operable against an edge of said flap, for first bowing the blank and then folding the flap upwardly, on its line of articulation, to a position above said paper line and second means, cooperating with said first means, said second means being positioned above the paper line and operable against the undersurface of said raised flap for completing the infolding of said flap down to said paper line.

2. Mechanism according to claim 1 wherein the first means includes an elongated, hooked finger of resilient material pivotally mounted to engage an edge of said flap at a first predetermined angle of elevation thereto and to bow as it pivots upwardly therewith to a second predetermined angle of elevation thereto.

3. Mechanism for folding a flat flap of a previously cut, flat, box blank, said blank having a weakened line of flap articulation therein, said mechanism comprising a folding finger having a shank of resilient material and a terminal folding hook operable to press against the edge of the flap to be folded in an edgewise direction toward the line of articulation thereof to cause a buckle at the line of articulation during the first part of the fold and operable to press against the underface of the flap to finish the fold and oscillatable finger support means for applying said pressure.

4. A folding device for overfolding a leading flap of a foldable sheet advancing along a path through a fold-

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ing machine, said device comprising a folding finger having a terminal hook adapted to engage the leading edge of a leading flap and having an elongated shank of flexible material adapted to flex into bowed formation when said hook is so engaged, said finger having support means at its opposite terminal end oscillatably mounted on said machine at a spaced vertical distance from the path of said sheet.

5. Mechanism for overfolding a leading flap of a foldable sheet while the sheet is advancing along a path through a folding machine, said mechanism comprising folding finger support means of rigid material mounted on said machine above the path of an advancing sheet; a folding finger having an elongated shank of resilient material pivotally mounted on said finger support means and having a terminal hook adapted to reach below the path of an advancing sheet to hook onto the leading edge of a leading flap thereof and spring means connecting said finger to said support means for normally urging said hook downwardly and rearwardly, but permitting said finger to pivotally yield upwardly and forwardly after said resilient shank has flexed into bowed formation from impact of the leading edge of an advancing sheet.

6. Mechanism as specified in claim 5 wherein said finger support means is oscillatably mounted on said machine and timed means are provided for oscillating said finger support means into and out of operative position in synchronization with the advance of said sheets.

7. Mechanism as specified in claim 5 wherein said finger support means is mounted on said machine to oscillate in a vertical plane and includes a cam arm and a rotating cam operatively connected to said machine for lowering said mechanism in the path of leading flaps and raising said mechanism out of the path of trailing flaps of sheets advancing along said path.

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