Sept. 20, 1971 F. BORDERS 3,605,585

APPARATUS FOR THE MANUFACTURE OF BOXES

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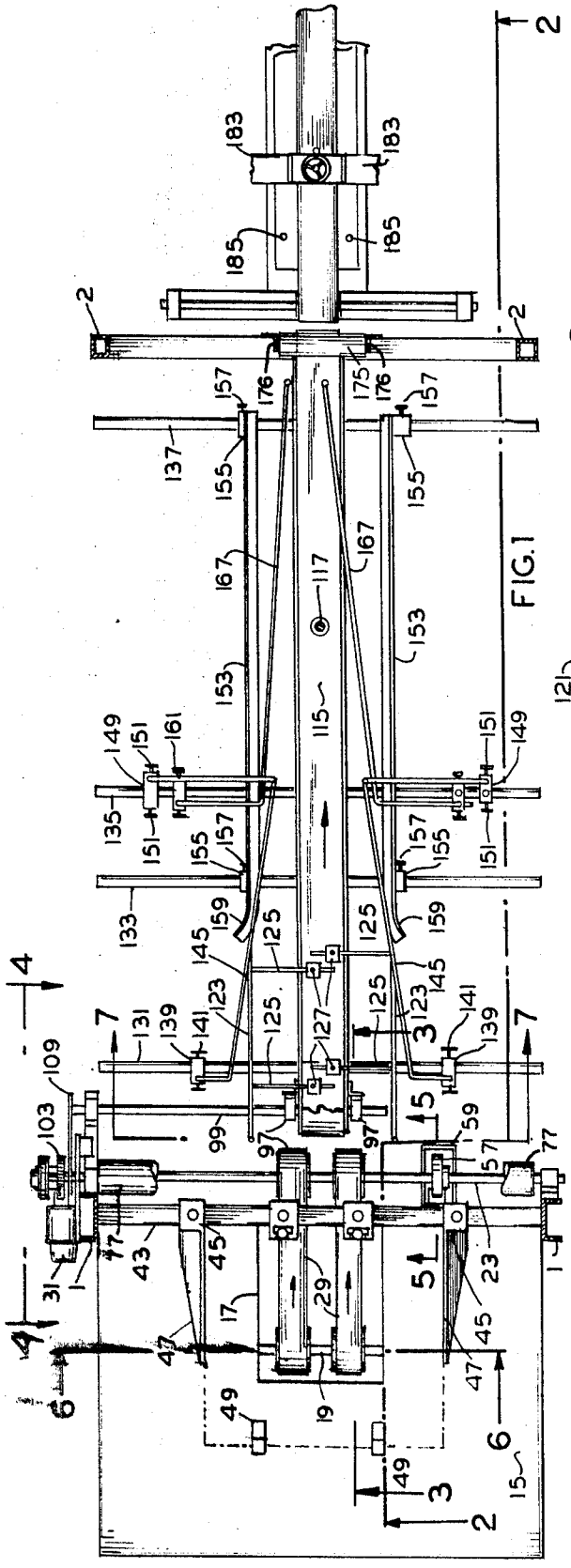


FIG. 1

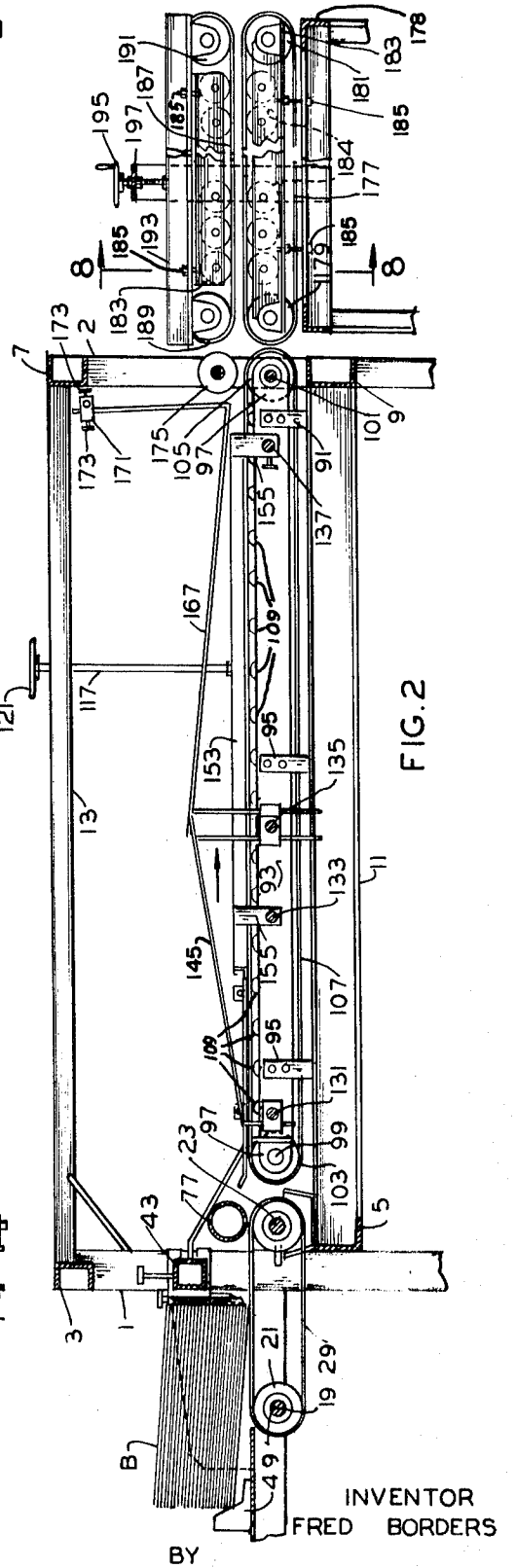


FIG. 2

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APPARATUS FOR THE MANUFACTURE OF BOXES

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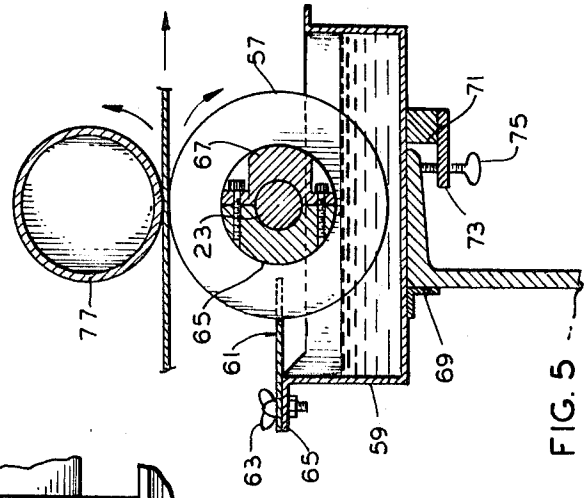


FIG. 5

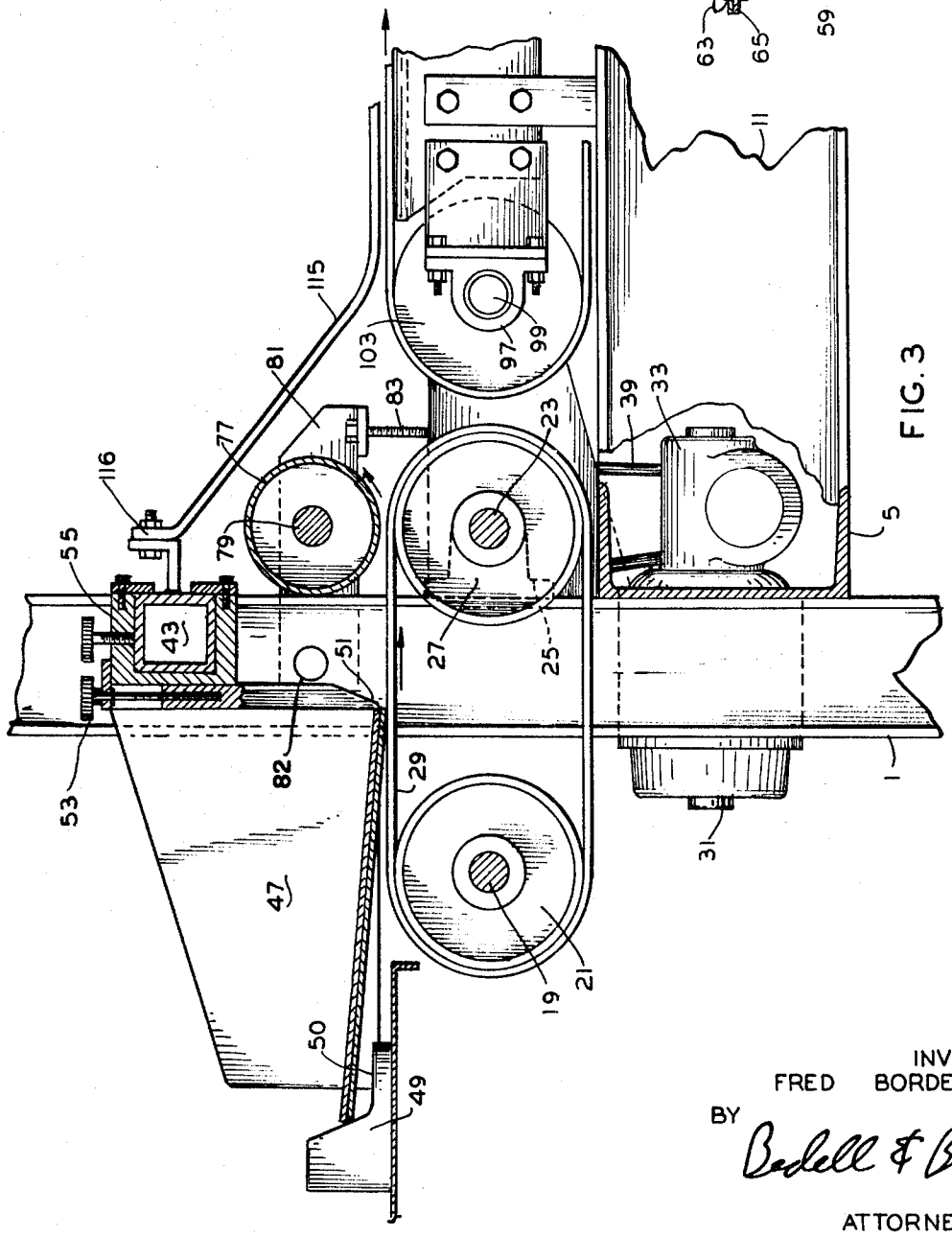


FIG. 3

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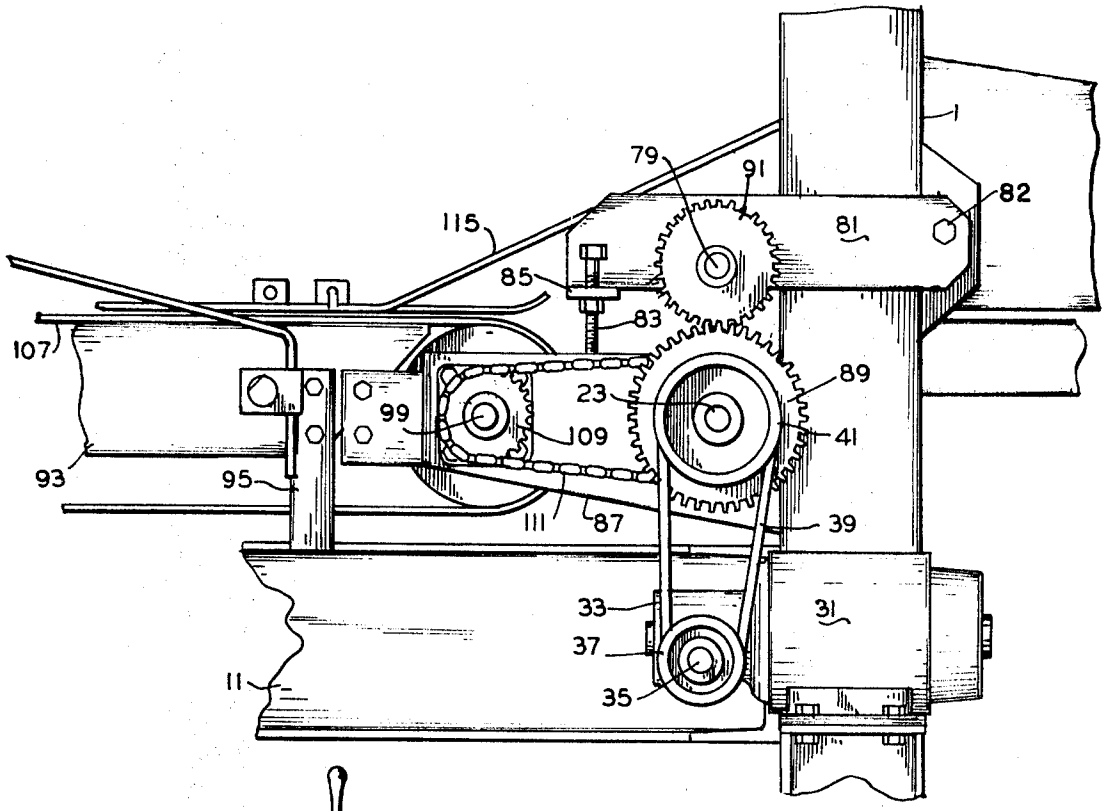


FIG. 4

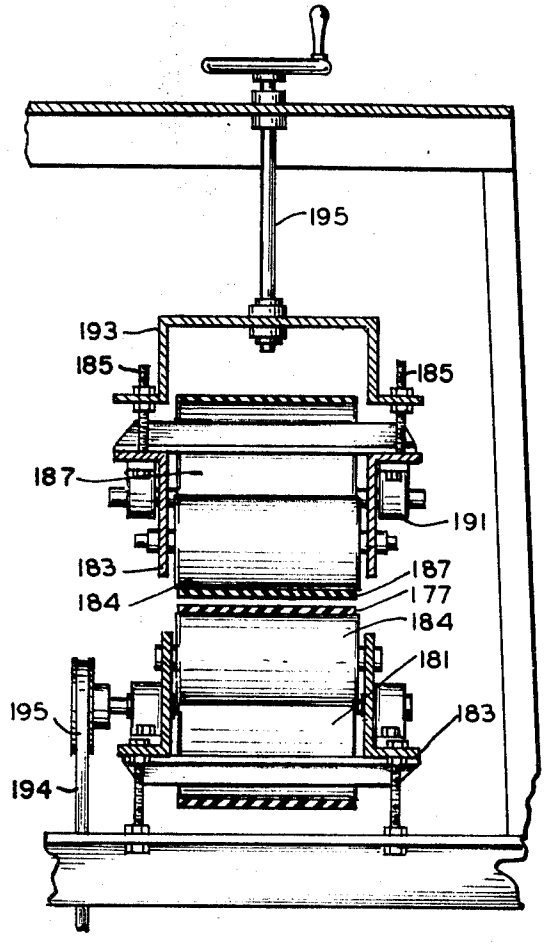


FIG. 8

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APPARATUS FOR THE MANUFACTURE OF BOXES

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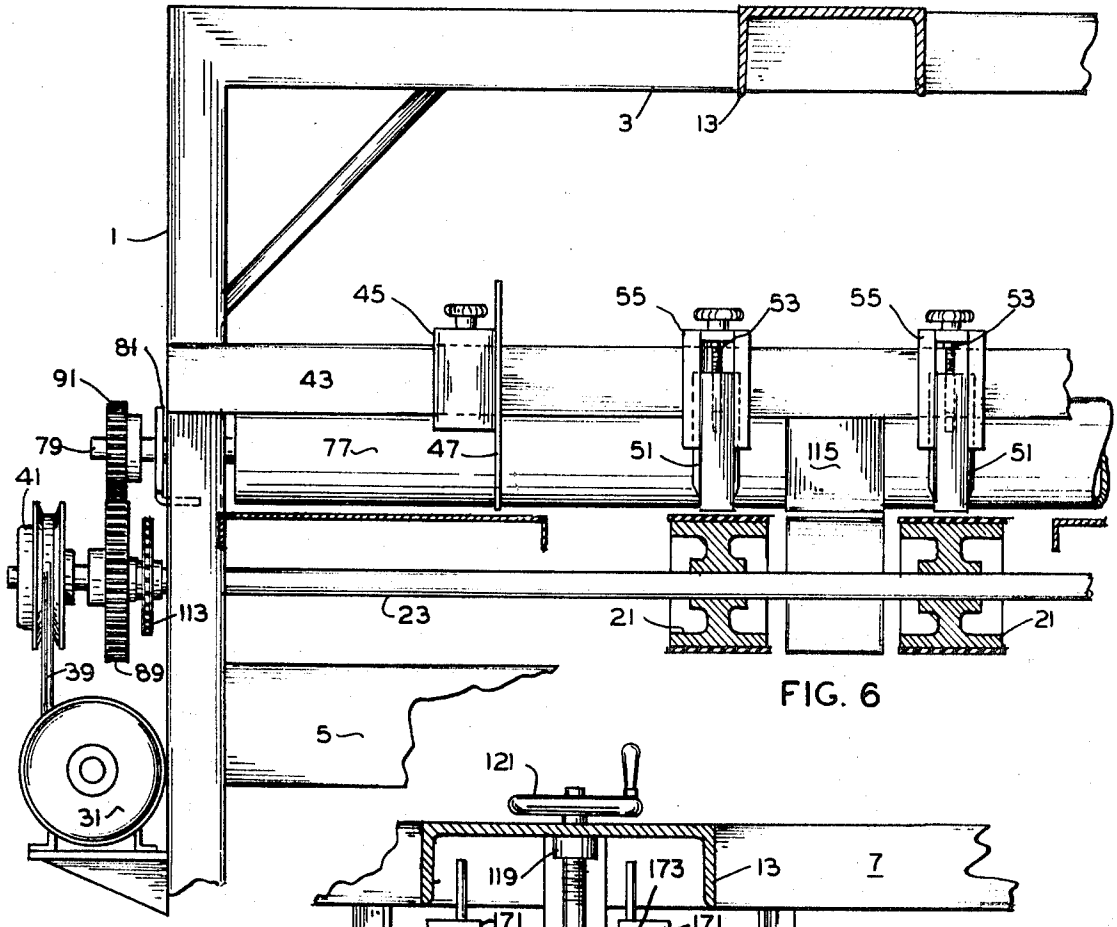


FIG. 6

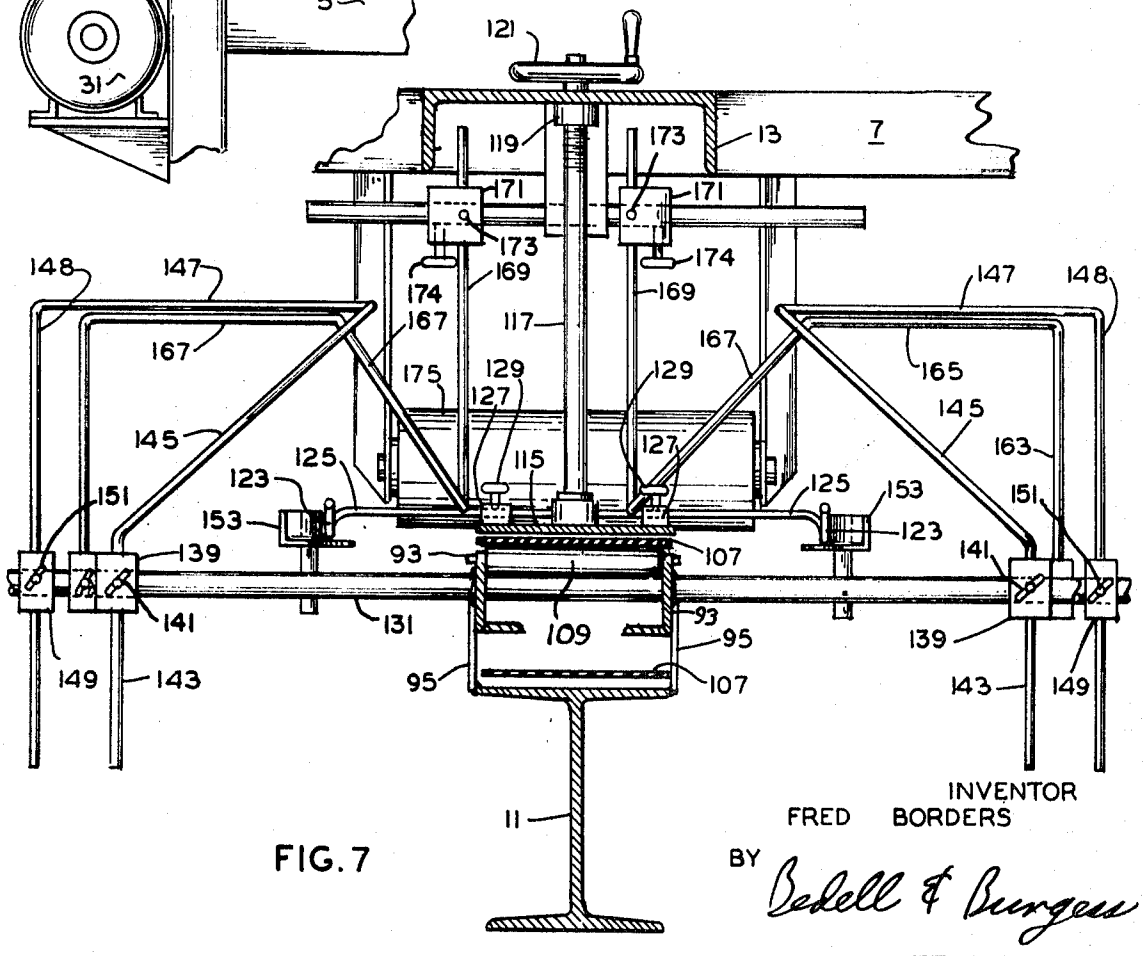


FIG. 7

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APPARATUS FOR THE MANUFACTURE OF BOXES

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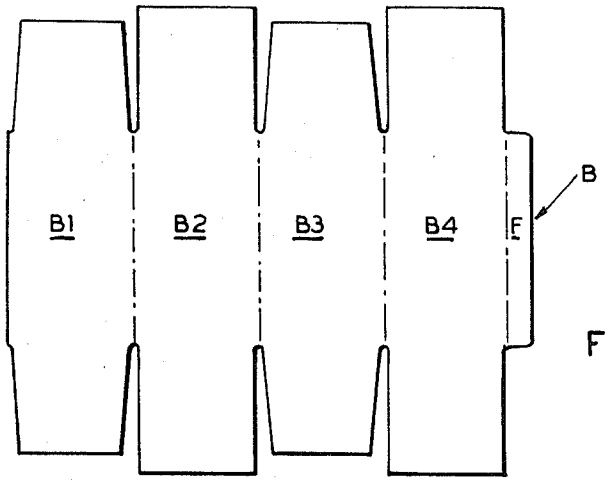


FIG. 9

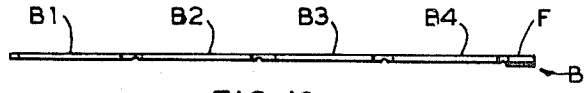


FIG. 10

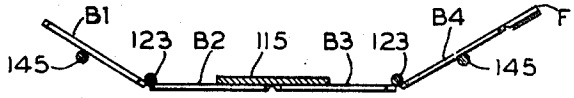


FIG. 11

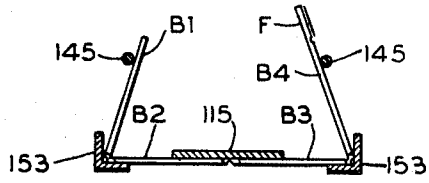


FIG. 12

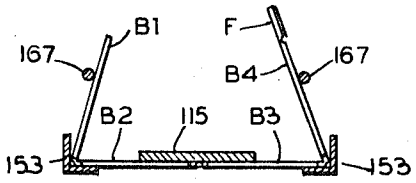


FIG. 12A

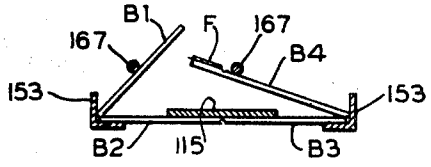
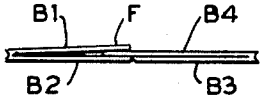


FIG. 13

FIG. 14



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3,605,585

APPARATUS FOR THE MANUFACTURE OF BOXES

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Filed June 11, 1969, Ser. No. 832,060
Int. Cl. B31b 1/36
U.S. Cl. 93—52 6 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for folding and gluing cardboard box blanks of different sizes and of irregular die cut shape as well as those of regular slotted shape, including means for stream feeding the box blanks at a relatively slow speed, applying glue to the flaps, and then feeding the blanks into the folding section at higher speed, the folding section comprising a conveyor belt, a hold-down bar adjustably spaced vertically thereabove to accommodate various flute thicknesses while applying sufficient pressure to the blanks to prevent slipping of the latter on the belt, the folding section also comprising a first pair of upwardly and transversely inwardly sloping folding rods arranged to underlyingly engage the side panels of the box blank to fold them upwardly and a second pair of downwardly and transversely inwardly sloping folding rods to fold the outer panels downwardly against the inner panels, said rods being transversely adjustable to accommodate different sizes of boxes and to provide for sequential downfolding of the glue coated flap and the opposite panel, and a compression section comprising opposing vertically spaced belts supported against the box surfaces by opposing pressure rollers.

SUMMARY OF THE INVENTION

The invention relates to folding and gluing machines particularly adapted to fold and glue box blanks of different sizes and irregular shapes as well as those of regular slotted shape. Prior to my invention, glued boxes of irregular shape had to be folded and glued by hand, a time-consuming and costly operation, and available box folding machines were generally not adaptable to different box sizes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a box gluing and folding machine embodying the invention, with some parts of the frame omitted for the sake of clarity.

FIG. 2 is a longitudinal vertical sectional view along line 2—2 of FIG. 1.

FIG. 3 is an enlarged fragmentary longitudinal vertical sectional view along the feeding section of the machine, taken along line 3—3 of FIG. 1.

FIG. 4 is an enlarged fragmentary side elevational view along line 4—4 of FIG. 1.

FIG. 5 is an enlarged fragmentary vertical sectional view along line 5—5 of FIG. 1, showing the glue applicator.

FIG. 6 is an enlarged fragmentary transverse vertical sectional view along line 6—6 of FIG. 1.

FIG. 7 is an enlarged fragmentary transverse vertical sectional view along line 7—7 of FIG. 1.

FIG. 8 is an enlarged fragmentary transverse vertical sectional view along line 8—8 of FIG. 2 through the compression section of the machine.

FIG. 9 is a plan view of a box blank prior to folding and gluing.

FIGS. 10–13 are end views of the box blank illustrating several steps in the folding operation.

FIG. 14 is an end view of the folded and glued box blank.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The machine comprises a frame having four upright corner posts 1, 1 and 2, 2. Posts 1, 1 are connected at their upper ends by a transverse beam 3 and, at an intermediate level, by a transverse beam 5 to form a first upright end frame, and posts 2, 2 are connected at their upper ends by a transverse beam 7 and, at an intermediate level, by a transverse beam 9 to form a second upright end frame.

At their centers, intermediate level beams 5 and 9 are connected by a longitudinally extending I-beam 11, and top beams 3 and 5 are connected by a longitudinally extending inverted channel beam 13.

Longitudinally outboard of the first upright end frame 1, 3, 5 a horizontal metal feed table 15 is supported at a higher level than transverse beam 5. Adjacent the first upright frame table 15 has an open-end rectangular aperture 17, and adjacent the closed end of aperture 17 a transverse shaft 19 is journaled in the feed table support frame below the table level. A pair of spaced conveyor belt rolls 21 are mounted on shaft 19 below aperture 17, and a second transverse shaft 23 is journaled in brackets 25 on the inboard side of posts 1. A second pair of similarly spaced conveyor belt rolls 27 are mounted on shaft 23 and a pair of endless conveyor belts 29 are mounted on rolls 21 and 27, the upper surface of belts 29 projecting slightly above the table surface.

For driving feed conveyor belts 29, an electric motor 31 is supported on corner post 1 and mounts a right angle drive gear box 33, the output shaft 35 of which mounts pulley 37. A drive belt 39 connects pulley 37 with a pulley 41 on feed conveyor shaft 23.

To accommodate the machine to different sizes of box blanks B, an example of which is illustrated in FIG. 9, a square bar 43 extends between posts 1 at a higher level than table 15 and slidably mounts, by means of screw clamps 45, a pair of transversely spaced guide plates 47, the spacing of which can be adjusted by moving them along bar 43 to conform to the maximum width of the box blanks B being processed. For positioning blanks B lengthwise of the feed table 15 and slightly inclining them downwardly in the direction of movement of the feed conveyor, magnetic blocks 49 are seated on the upper surface of feed table 15, to which they adhere magnetically in selected positions dependent upon the length of the box blanks. Blocks 49 are provided with a step 50 to support the blanks in inclined position on the table, and the surface 52 of the blocks rearwardly of step 50 are slightly inclined rearwardly to accommodate successive blanks in a stack.

For ensuring that the box blanks are fed individually from a stack of blanks placed on the feed table, a pair of vertical stop bars 51 are vertically adjustably secured by thumbscrews 53 to blocks 55 slidably mounted on bar 43, the vertical spacing of bars 51 being adjustable to provide sufficient clearance for the lowermost blank to pass beneath them while preventing the passage of two blanks simultaneously.

For applying glue to the underside of the flap F of each blank B, shaft 23 adjustably mounts a glue roll 57, which extends into a glue sump supported on transverse beam 5. To control the thickness of glue on roll 57 and ultimately on box blank flaps F, a wiper blade 61 is adjustably secured by thumbscrews 63 to the upper outturned flange 65 of sump 59. Wiper blade 61 is recessed at its end to provide surfaces wipingly engaging both the periphery and the sides of glue roll 59. To accommodate box blanks B of different widths and different glue flap F locations, glue roll 57 is movable to selected positions

along shaft **23** and is releasably clamped to shaft **23** by split shoulders **65**, **67**, and sump **59** is similarly movable along beam **5**, being guided therealong by angle flange **69** projecting from the bottom of the sump and engaging the vertical web of beam **5** and flange **71** which engages the edge of the horizontal flange of beam **5**. The latter flange has a horizontal extension **73** underlying the beam flange and is provided with a vertical thumbscrew **75** adapted for clamping engagement with the bottom of the flange of beam **5**.

For maintaining box blank glue flaps F in uniform glue-receiving engagement with glue roll **57** and to hold the blanks B flat against feed conveyor belts **29** preparatory to their transfer to the folding section conveyor, a roller **77** is mounted on a shaft **79** which is journaled at its ends in longitudinally extending arms **81** which are pivoted at **82** on transverse axes to posts **1**, and the height of roller **77** is precisely adjustable in accordance with the thickness of the box blanks being processed, by means of vertical adjusting bolts **83** which pass through brackets **85** on arms **81** and abut the upper surface of elongated brackets **87** which extend longitudinally inwardly from posts **1**. A gear **89** on shaft **23** drives a gear **91** on shaft **79** of roller **77**, the gear ratio being such that the linear speed of the periphery of roller **77** equals the linear speed of belt **29**.

The folding section of the machine follows the feed and glue application section and comprises a pair of parallel transversely spaced inverted longitudinally extending angle irons **93** supported above I-beam **11** in spaced relation thereto by upright brackets **95**. Angle irons **93** are provided at their ends with journal brackets **97**, in which are journaled shafts **99** and **101**, the latter mounting folding conveyor rollers **103** and **105**. A conveyor belt **107**, preferably of rubberized material, is carried by rollers **103** and **105** and its upper surface is coplanar with feed conveyor belts **29** to facilitate receipt therefrom of box blanks to which glue has been applied by glue wheel **57**. Intermediate rollers **103** and **105** a series of small rolls **109**, journaled at their ends in angle irons **93**, underlyingly support conveyor belt **107** throughout its length. At one end conveyor belt roll shaft **99** mounts a sprocket, which is drivingly connected by chain **111** to a larger sprocket **113** on shaft **23** so as to drive shaft **99** and folding section belt **107** at substantially twice the speed of shaft **23** and feed belts **29**. This assures adequate spacing of the box blanks for the folding operation.

For holding the two inner panels B^2 and B^3 of the box blanks flat against the folding conveyor belt **107**, an elongated holddown plate **115** is supported from bar **43** at **116** from which it inclines downwardly over roller **77** and above roller **103** it levels off, after which it is supported in adjustable spaced relation above conveyor belt **107**, in part by a vertical screw **117** rotatably secured at its lower end to plate **115**, and threadably received in a block **119** mounted on top longitudinal beam **13**. A handwheel **121** is provided on screw **117** for operating it to raise and lower holddown plate **115**.

For initially centering and guiding two inner panels B^2 and B^3 of the box blanks as they enter the folding section, and also holding down their outer margins near the creases separating them from outer panels B^1 and B^4, a pair of parallel transversely spaced longitudinally extending holddown rods **123** are supported from holddown plate **115** at the same level as the latter, commencing anterior to the forward end of folding conveyor belt **107**. Rods **123** are both formed with a pair of inwardly directed transverse projections **125** which are transversely slidably received within transversely apertured blocks **127** mounted on holddown plate **115**. Thumbscrews **129** in blocks **127** lock projections **125** in selected transverse positions whereby rods **123** are correspondingly positioned above the outer margins of the inner panels B^2 and B^3 of the box blanks being processed.

For supporting folding and guide means, channel beam **93** mounts a plurality of transversely extending round bars **131**, **133**, **135** and **137**. Bar **131**, near the anterior end of the conveyor, slidably mounts blocks **139** which can be secured in transversely selectable positions on bar **131** by thumbscrews **141**. Blocks **139** are vertically apertured to vertically slidably receive vertical terminals **143** of folding rods **145** which are inwardly and upwardly inclined transversely of the machine and lengthwise in the direction of movement of conveyor belt **107**, the transverse spacing of blocks **139** and folding rod terminals **143** being such that the lower ends of rods **145** will initially underly the outer panels B^1 and B^4 of the box blanks, the outer margins of inner panels B^2 and B^3 of which are overlaid by guide rods **123** so that as the conveyor moves the blanks, the inward and upward inclination of rods **145**, engaging the undersides of the outer panels B^1 and B^4, will bend the latter upwardly and inwardly about the adjacent creases, the innermost ends of rods **145** being positioned transversely inwardly of the outer margins of the inner box blank panels so as to have bent outer panels B^1 and B^4 inwardly past the upright or 90° position. For so positioning the inner ends of rods **145**, they are extended transversely outwardly as at **147** and vertically downwardly as at **148** into vertical apertures in blocks **149** slidably mounted on transverse mounting bar **135** substantially midway between the ends of the folding conveyor. Suitable thumbscrews **151** in blocks **149** lock vertical ends **148** at selected vertical positions in blocks **149**.

For maintaining horizontal inner panels B^2 and B^3 of the box blanks centered transversely of the conveyor, a pair of longitudinally extending angle section bars **153** are mounted at opposite sides of the conveyor, by means of brackets **155** slidably mounted on transverse bars **133** and **137** and locked in selected positions thereon by thumbscrews **157** to permit their transverse adjustment corresponding to various widths of box blanks. The leading ends of bars **153** are positioned substantially midway between the ends of initial upward folding rods **145** and are flared transversely outwardly as at **159** to ensure engagement with the outer margins of box blank inner panels B^2 and B^3.

For folding box blank outer panels B^1 and B^4 downwardly into substantially flattened relation with the inner panels and with glue flap F on the right-hand outer panel B^4 in overlapping relation with the outer margin of the left-hand outer panel B^1, transverse mounting bar **135** mounts a second pair of transversely slidable blocks **161**, in which are vertically slidably received vertical terminal portions **163** of transverse ends **165** of downward folding rods **167**, which are inclined inwardly transversely and downwardly in the direction of movement of the conveyor, the transverse inward inclination of the right-hand rod **167**, being greater than that of the left to cause the right-hand outside panel B^4 with its glue flap F to move to the horizontal flattened position before the left-hand panel reaches this position. The terminals of rods **167** are bent upwardly as at **169** and are vertically slidably received in blocks **171**, so as to be adjustable vertically as well as transversely in accordance with the size and shape of box blanks being processed. Thumbscrews **173** lock rod terminals **169** in selected vertical positions in blocks **171** and thumbscrews **174** lock blocks **171** in selected positions transverse of the machine.

At the outlet end of the folding conveyor, an idler roll **175** journaled at its ends on vertical support legs **176** depending from transverse beam **7** overlies conveyor roller **105** to initiate compression on the folded, glued box blank.

The folding section of the machine is followed by a compression unit comprising supporting framing, an elongated frame consisting of transversely spaced longitudinally extending side rails **183** supported by vertically adjustable screws on framing **178**, an upwardly facing belt **177** supported on spaced rollers **179** and **181** which are

journaled on frame side rails **183** so that the upper surface of belt **177** is substantially coplanar with the upper surface of folding conveyor **107**, and between rolls **179** and **181**. Between side rails **183** are mounted a plurality of closely spaced compression rollers **184** underlyingly engaging the upper section of belt **177** so as to support the latter throughout its length.

For holding the folded box blank in glue-setting compressive relation between the flap and the outer margin of the opposite panel, a downwardly facing compression belt **187** is supported above belt **177** on idler rollers **189** and **191**, journaled on a frame **193**, which is supported at variable height above belt **177** by a vertical screw **195**, threadably mounted in upstanding structure **197** on framing **178**, so as to provide vertical spacing between belts **177** and **187** substantially equal to the maximum thickness of the folded blanks. For maintaining belt **187** in downward compressive engagement, throughout its length, with the blanks, a frame, similar to frame **183** and similarly numbered, is positioned by bolts **185** between upper rollers **189** and **193** and mounts a plurality of compression rollers **184** overlyingly engaging the bottom section of belt **187**.

A motor (not shown) connected by belt **194** to sheave **195** on the shaft of roller **177** drives bottom belt mounting roller **179** at a sufficient speed, with regard to the length of the compression unit, that the glue on each blank completely sets by the time the blanks reach the outlet end of the unit.

Operation of the device can best be understood by reference particularly to FIGS. 10–14, in conjunction with the other views: A stack of blanks B is placed on feed table **15** of the machine, on which guide plates **47** have previously been positioned to engage the outer longitudinal edges of the blanks, and magnetic blocks **49** have been positioned to engage the rear edges of the blanks when the forward edges of the blanks are against stop bars **51**. The frictional engagement of the bottom blank on the stack with feed conveyor belt **29** draws the bottom blank B, beneath stop bars **51**, and roller **77** presses flap F against glue roller **57** to receive a uniform application of glue on its lower surface. Drive roller **77** cooperates with feed conveyor belt **29** to push the blank B forward to the folding conveyor belt **107**, which operates at a higher speed than feed conveyor belt **29**, to insure adequate spacing between successive blanks during the folding operation.

Upon transfer of each blank B to the folding conveyor, blank inner panels B^2 and B^3 are drawn under holddown plate **115** and their outer margins extend beneath holddown rods **123**, and folding rods **145** underly outer panels B^1 and B^4, causing the latter to bend upwardly from their horizontal positions (FIG. 10) through their inclined positions (FIG. 11) to their inwardly inclined positions (FIG. 12A), after which (FIG. 12B) the outer panels are engaged on their outboard sides by downfolding rods **167**, the final ends of which are offset to the left of the folding conveyor, to cause more rapid downfolding of the right-hand panel B^4 and flaps F than of the left-hand panel B^1 (FIG. 13) to insure that the glued surface of flap F, now upwardly facing, will underly the margin of panel B^1 (FIG. 14) wherein the folding has been completed. The folded blanks B then pass under idler roll **175**, which compresses them in the position shown in FIG. 14, and on to the compression unit, through which they are compressed long enough to permit the glue to set.

It will be understood that the shape and proportions of the blank illustrated in FIGS. 9–14 are exemplary and that an infinite variety of shapes and sizes of blanks can be folded and glued on the apparatus by making necessary adjustments provided for in the apparatus.

I claim:

1. Apparatus for the manufacture of boxes and the like from flat blanks having four side-by-side panels foldably related to each other, comprising a folding section having a conveyor belt adapted to underlyingly support and frictionally engage the outer surfaces of the two middle blank panels, holding means overlying said belt and engageable with the upwardly facing inner surfaces of the blanks for holding the latter flat on said belt in frictional engagement therewith, first bending means underlyingly engaging the downwardly facing outer surfaces of the side blank panels for bending the same upwardly and transversely inwardly with respect to the two middle panels, second bending means overlyingly engageable with the outer surfaces of the side panels for bending the same downwardly and transversely inwardly with respect to the two middle panels, said holding means including an elongated plate overlying said conveyor and in vertically adjustable spaced relation thereto in conformity with the thickness of the box blank material and separate elements elongated parallel to said conveyor and supported from said elongated plate at the same level as said plate along the sides thereof and individually selectively positionable transversely with respect to said plate at locations adjacent the longitudinal outer edges of said middle panels, said holding means separate elements having their posterior ends located intermediate the ends of said first bending means, and a transversely spaced pair of longitudinally extending guide means having their anterior ends located in the region of the posterior ends of said holding means separate elements and their posterior ends in the region of the posterior ends of said conveyor, said guide means being selectively positionable transversely of the apparatus independently of each other for slidable engagement with the box blanks outwardly of the intersections between the middle and side panels thereof, said first and second bending means comprising separate elements at both sides of said conveyor individually selectively positionable independently of said guide means vertically and transversely of the apparatus at locations in accordance with the width of the box blanks.

2. Apparatus according to claim **1** wherein said first bending means separate elements are rods with their anterior ends adapted to be selectively positioned transversely outwardly of said holding means separate elements and at a lower level than the top surface of said conveyor, said first bending means rods inclining therefrom upwardly and transversely inwardly in the direction of movement of said conveyor and their posterior ends being adapted for selective positioning transversely inwardly of the outer edges of the box blank middle panels and at a higher level than the latter.

3. Apparatus according to claim **2** wherein said second bending means separate elements are rods with their anterior ends adapted for selective positioning at a higher level than the conveyor and transversely inwardly of the outer edges of the box blank middle panels but transversely outwardly of the posterior ends of said first bending means rods, said second bending means rods being inclined downwardly and transversely inwardly in the direction of movement of said conveyor, their posterior ends being adapted to be selectively positioned transversely inwardly of the outer edges of the box blank middle panels and at a slightly higher level than said conveyor.

4. Apparatus according to claim **1** wherein a roller overlies the posterior end of said conveyor in vertically spaced relation thereto for flattening the folded box blanks.

5. Apparatus according to claim **1** including a feed section anterior to said folding section and having a conveyor at the same level as and in alignment with said folding section conveyor and adapted to receive the unfolded box blanks with their exterior surfaces facing downwardly, said feed section having an upwardly facing surface of magnetizable material at the same level as said feed conveyor, and a magnetized block forming a rear guide for the box blanks and being selectively positioned

on said feed section surface in conformity with the length of the box blanks.

6. Apparatus according to claim 1 including a glue roll adjacent the anterior end of said conveyor, said glue roll being adapted for selective positioning transversely of the apparatus for alignment with a glue flap along one side of the box blanks, the upper surface of said glue roll being at the same level as said conveyor, and an elongated transverse croll above said glue roll and selectively vertically spaceable therefrom in conformity with the thickness of said box blanks, said transverse roll being by its length adapted to press the box blank glue flap against the glue roll irrespective of the width of the box blank and consequent transverse position of the glue roll.

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GRANVILLE Y. CUSTER, JR., Primary Examiner