Jan. 18, 1966 W. J. HOTTENDORF 3,229,596

BOX MAKING APPARATUS

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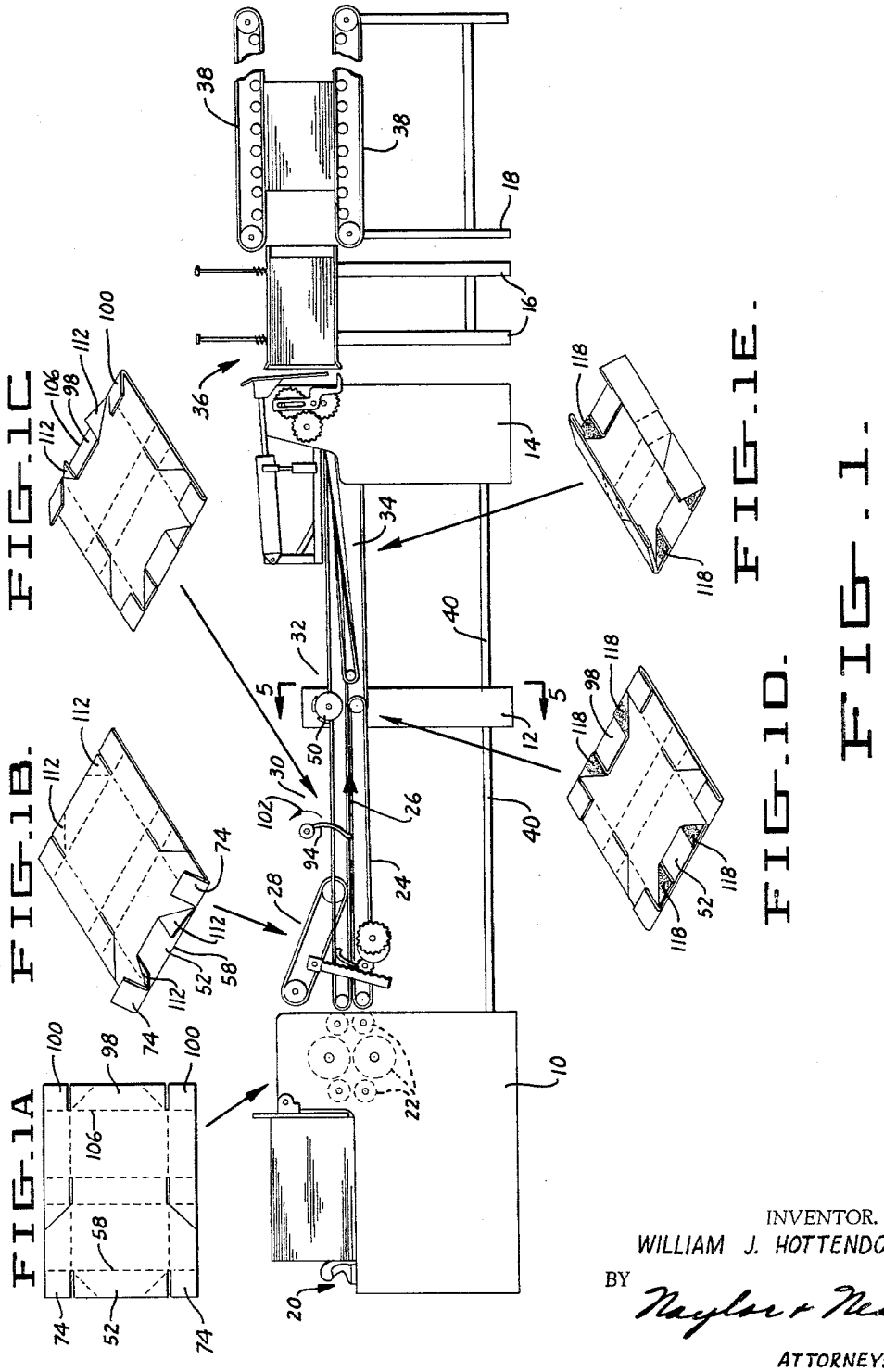

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BOX MAKING APPARATUS

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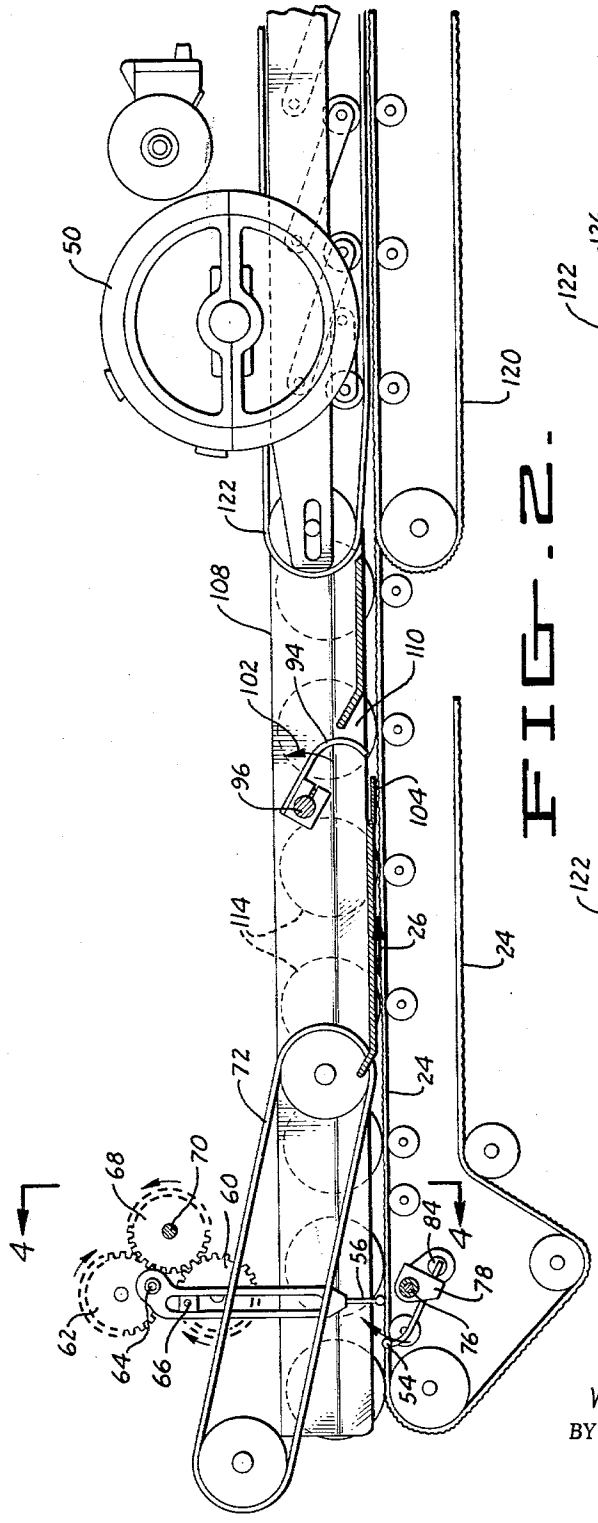

FIG. 2.

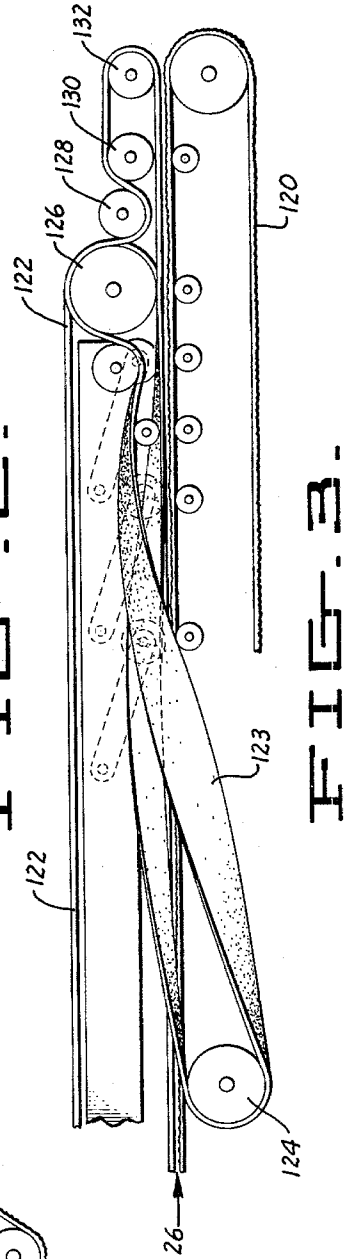

FIG. 3.

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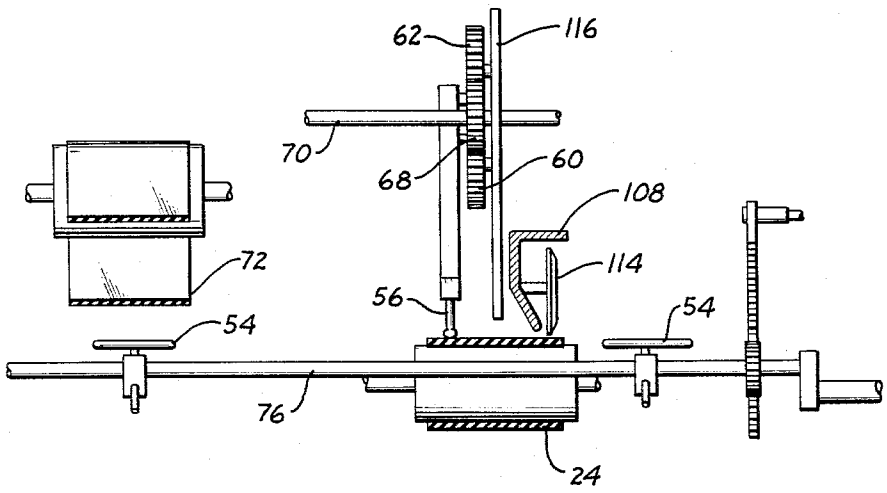

FIG. 4.

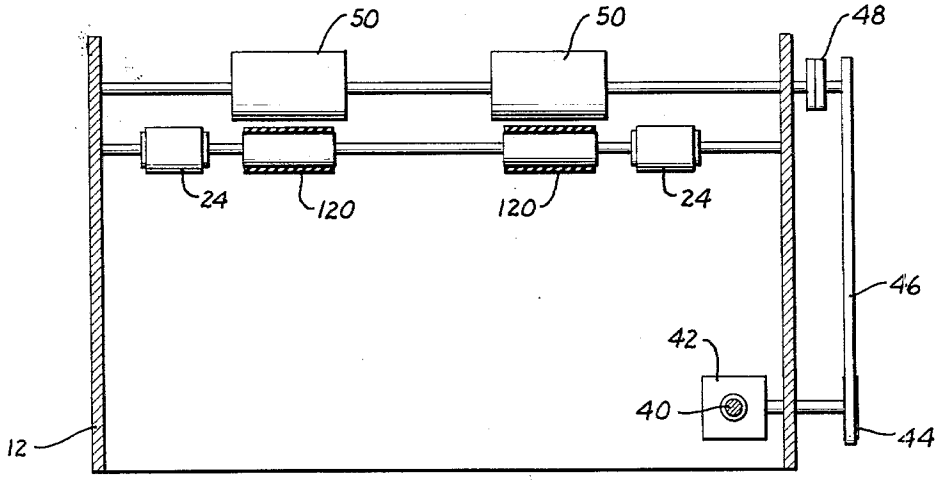

FIG. 5

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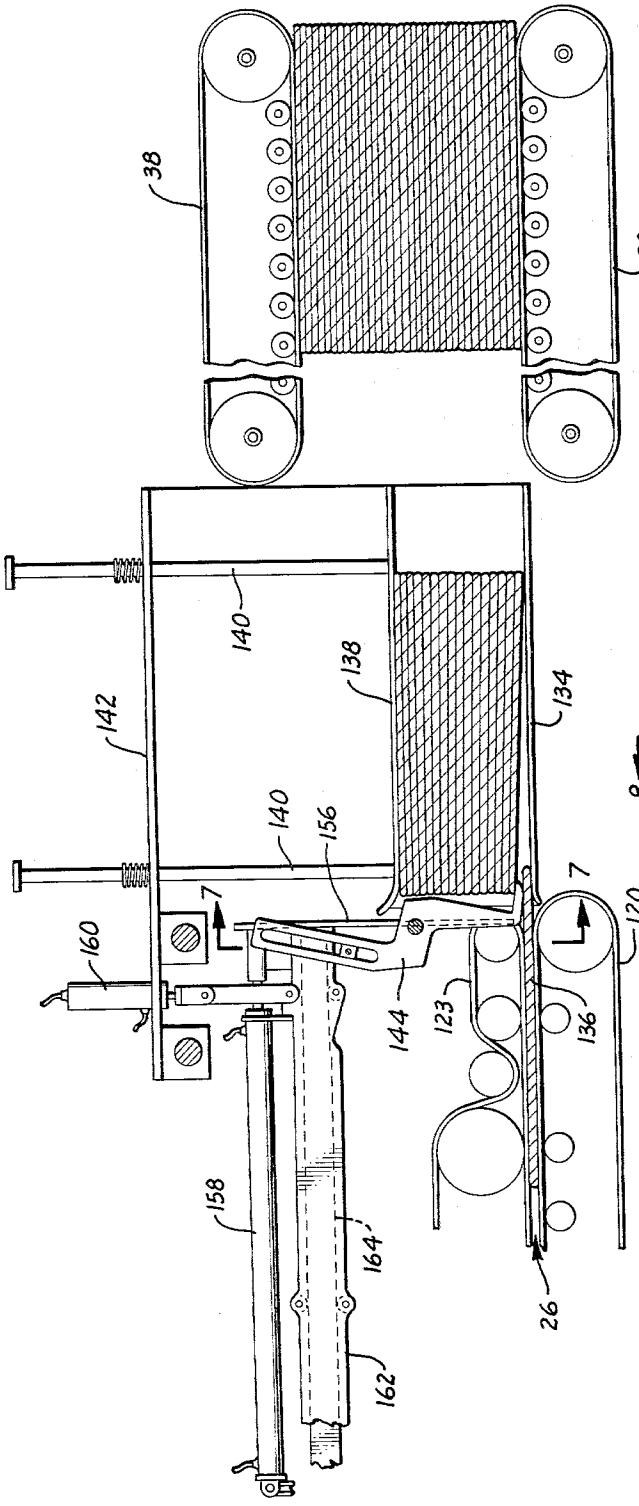

FIG. 6.

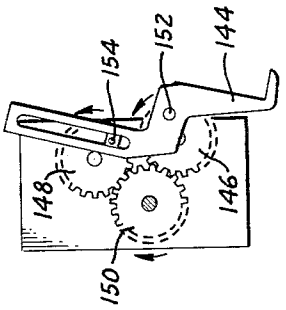

FIG. 8.

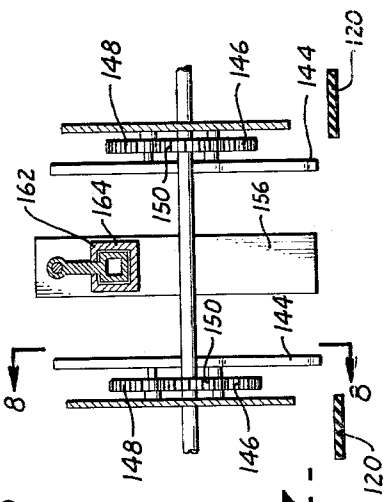

FIG. 7.

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FIG. 9.

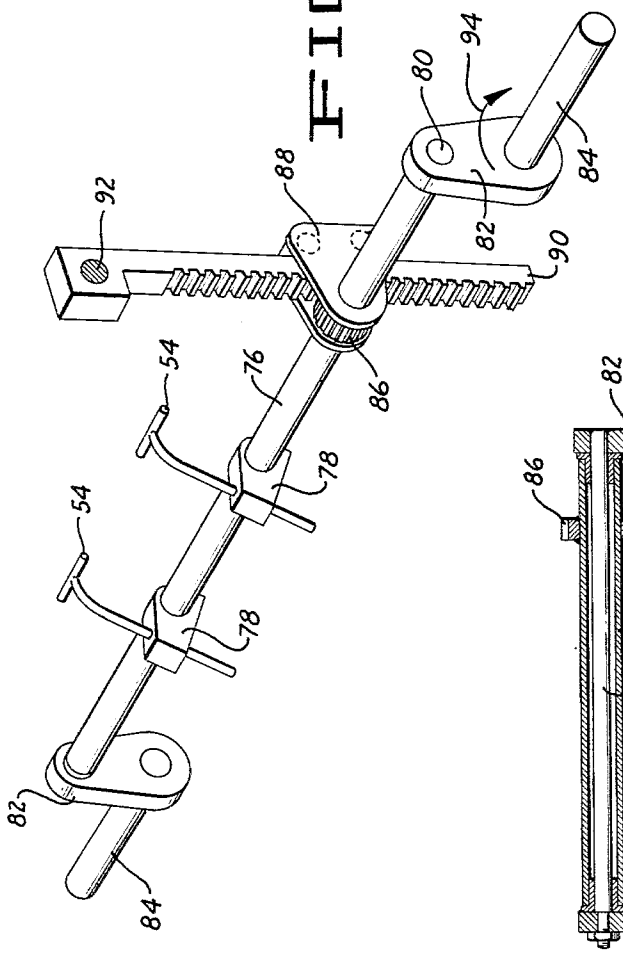
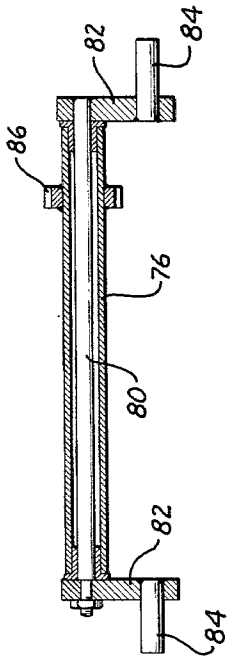


FIG. 10.



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3,229,596

BOX MAKING APPARATUS

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8 Claims. (Cl. 93—49)

This invention relates to paper box making machinery and more particularly to apparatus for folding and gluing box blanks made from corrugated paperboard and the like. The apparatus of the invention is particularly useful in making tray boxes known as the Biers Tray though certain new components of the apparatus have much wider application in making boxes of other types.

The Biers Tray has been known for many years and has been made by machinery for many years from paperboard material known as chip-board and more recently from corrugated paperboard. The machinery for making these tray boxes has involved many disadvantages, however, particularly where the boxes are made from the heavier corrugated paperboard. The basic designs of many of these machines provide inherent operating problems which limit the speed and capacity of the machines, for instance where cam mechanisms on box blank conveyors are used for folding flaps of the boxes and where slow acting stacking and delivery devices are used for discharging boxes made by the machines; the cam mechanisms are subject to large impact shocks where the machines are operated at high speed and these shocks provide serious problems of wear and breakage in parts of the machines, while the slow acting discharge devices require large interruptions in the train of boxes moving through the machine to permit the discharge devices to operate.

The cam folding mechanisms and slow acting discharge devices used heretofore have had certain advantages in facilitating machine design since they provide automatic synchronization between various folding and gluing mechanisms in the machine and since they may use certain types of transverse box blank folding mechanisms which may not be used efficiently on other types of machines, but the speed and capacity problems which these cam mechanisms introduce more than offset the synchronization and folding advantages in many situations.

It is an object of this invention to provide a new apparatus for making tray boxes which may be operated at greater speeds and capacities than such machines used heretofore without causing the operating problems involved in those old machines.

It is another object of the invention to provide a new mechanism for manipulating a box blank moving along a conveyor path with the mechanism moving across and along the path very rapidly to permit box blanks to move freely along the path rapidly and be handled by the manipulating mechanisms in very rapid timed sequences.

It is another object of the invention to provide such manipulating mechanisms which are adapted to use in performing a variety of box blank manipulating functions in machines for making tray boxes and in other box making apparatus.

It is another object of the invention to provide such box blank manipulating means which is particularly useful in folding trailing edge flaps on box blanks about fold lines which extend across the conveying path of the blanks.

It is another and important object of the invention to provide such box blank manipulating mechanisms which may be mounted in fixed position with respect to a conveying path and moved with respect to the path by direct drive means which maintains timed relation between operation of the manipulating mechanisms and the movement of box blanks along the conveyor without employing cam actuators which may limit the speed of the apparatus.

Other objects and advantages of the invention will become apparent from the following description, read in conjunction with the attached drawings, in which:

FIG. 1 is a view in side elevation of a tray box making machine constructed in accordance with the principles of this invention;

FIGS. 1A–1E illustrate sequentially folded positions of a corrugated box blank moving through the apparatus of FIG. 1;

FIGS. 2 and 3 are views in side elevation on an enlarged scale of the box folding and gluing mechanism of the apparatus of FIG. 1;

FIG. 4 is a transverse sectional view of a portion of the trailing flap folding mechanism of the apparatus of FIG. 2 with FIG. 4 taken along the plane indicated at 4—4 in FIG. 2;

FIG. 5 is a vertical sectional view of the apparatus of FIG. 1 taken along the plane indicated at 5—5 in FIG. 1;

FIG. 6 is an enlarged view in side elevation of the discharge mechanism on the apparatus of FIG. 1;

FIG. 7 is a sectional view of the apparatus of FIG. 6 taken along the plane indicated at 7—7 in FIG. 6;

FIG. 8 is a sectional view of apparatus of FIG. 7 taken along the plane indicated at 8—8 in FIG. 7;

FIG. 9 is a perspective view of a portion of the apparatus employed in FIG. 1 for folding the trailing flaps on the box blank; and

FIG. 10 is a sectional view of a portion of the apparatus of FIG. 9.

Referring now in detail to the drawings and particularly to FIG. 1, the machine shown therein includes a plurality of frame bases 10, 12, 14, 16 and 18 which support a feeding mechanism having a kicker 20 and scoring and feed rolls 22 from which tray box blanks are fed to elongated conveyor means 24. The conveyor includes a pair of spaced apart conveyor belts 24 (FIG. 5) which grip the side edges of the box blanks and convey them along an elongated path indicated by arrow 26.

As indicated from FIGS. 1A–1E, the box blank moves along the conveying path sequentially through a trailing flap folding station 28 (FIG. 1B), a leading flap folding station 30 (FIG. 1C), a gluing station 32 (FIG. 1D), a side flap folding station 34 (FIG. 1E), and an ejection station 36 where the folded and glued box blanks are stacked and ejected to a set of compression conveyors 38 from which the stacked boxes are conveyed under compression.

Referring to FIG. 5, it will be noted that an elongated drive shaft 40 extends along the length of the machine adjacent to the floor level, and at each operating station of the machine is connected through a right angle gear box 42 to a sprocket 44 and hence by a chain 46 through a friction clutch 48 to drive the manipulating members (glue rolls 50 in FIG. 5) in synchronization with rotation of the drive shaft 40. The various conveyor means along the length of the machine are also driven from the drive shaft 40 so that the manipulating members move in synchronization with the conveyor, with the provision of friction clutches 48 permitting the timing of the various manipulating members to be adjusted with respect to the conveyor.

TRAILING FLAP FOLDING

Referring to FIG. 2, the trailing flaps 52 (FIG. 1A) of box blanks traveling along the conveyor path 26 are folded upwardly by means of a flap engaging member 54 which engages and lifts the flap while a hold down member 56 engages the box blank in advance of the fold line 58 (FIG. 1A) at which the flap is to be folded. The

hold down member 56 is driven by means of a pair of gears 60 and 62 with member 56 pivotally connected to the gear 62 at 64 and slideably connected to the gear 60 at 66. The two gears 60 and 62 are driven from a common drive gear 68 mounted on a drive shaft 70 with the drive shaft 70 connected to the drive shaft 40 by means similar to the means 42–48 illustrated in FIG. 5. The concurrent rotation of the gears 60 and 62 in synchronization with each other and in synchronization with movement of a box blank along the path 26 causes the lower end of the manipulating member 56 to move very rapidly with respect to the conveyor path to hold the box blank down as the flap 52 is raised and to then move along the length of the path in the direction of travel of the box blank and at a speed greater than the box blank while the manipulating member is raised away from the path to clear the upper edge of the flap 52. An overhead conveyor 72 is mounted centrally between the two conveyor belts 24 and driven at a speed greater than the conveyor belts 24 so that the upper edge of the partially folded flap 52 is engaged by the conveyor 72 and the flap is folded down against the remainder of the blank.

Upward folding of the flap 52 in synchronization with operation of the hold down member 56 is accomplished with a plurality of folding hooks 54 mounted at spaced positions along the width of the path to engage the trailing flap 52 and the two trailing corner flaps 74. The folding hooks 54 are mounted on a support tube 76 by brackets 78, and the tube 76 is mounted for rotation on a shaft 80 (FIG. 10) which is mounted on crank arms 82 which are journaled in the side frame members of the machine for rotation about stub shafts 84. A pinion gear 86 is rigidly mounted on the tube 76 and is held by a bracket 88 in mesh with a rack 90, the rack 90 being pivotally mounted on the frame of the machine at a pivotal axis 92 which lies in a generally vertical plane through the axis of rotation of the stub shafts 84. The stub shafts 84 are driven in rotation in the direction of arrow 94 in FIG. 9 by drive means similar to the drive means 42–48 of FIG. 5.

The mechanism of FIG. 9 operates in synchronization with the hold down members 56 so that the upper ends of the flap engaging members 54 first move upwardly through the path 26 in engagement with the flap to start folding the flap and then move along the direction of movement of box blanks in the path at a speed greater than the box blanks to fold the flap through an angle exceeding 90 degrees; the raising and forward swinging of the flap engaging members 54 are caused jointly by rotation of the stub shafts 84 and rocking of the tube 76 as its pinion 86 moves up rack 90; at the point when the flaps have been folded through an angle exceeding 90 degrees, the flap engaging members 54 hesitate as the pinion 86 reaches its upper point on the rack 90, and the flap engaging members 54 thereafter move rearwardly and downwardly as the tube 76 rotates down around the axis of shafts 84 and rocks rearwardly as pinion 86 moves down rack 90.

LEADING FLAP FOLDING

Referring to FIG. 2, a plurality of leading flap folding hooks 94 are mounted along the width of the conveyor path 26 on a rotatable shaft 96 positioned along the width of the leading edge flap 98 and leading edge corner flaps 100 (FIG. 1A) of the box blanks with the hooks 94 rotating in the direction of arrow 102 and at a speed less than the speed of box blanks moving along path 26 so that the leading edge flaps overrun the hooks 94 and are lifted upwardly as the hooks move up out of the path 26. Spring hold down plates 104 are mounted above the path 26 to hold down the box blanks behind the hinge line 106 (FIG. 1A) about which the leading edge flaps are to be folded. It should be noted that a longitudinal channel 108 extends along the length of the machine at each side thereof in the folding area and is provided with a beveled lower edge portion 110 which engages the diagonal portions 112 (FIG. 1B) of the box blanks and folds them over as the leading and trailing edge flaps are folded. The member 108 also carries a plurality of hold down rollers 114 which hold the box blanks in engagement with the conveyor belt 24, and the member 108 on one side of the machine, a member 116 (FIG. 4) on which gears 60 and 62 are mounted, the brackets 78 and the leading flap folding hooks 94 on one side of the machine are mounted for lateral adjustment along the width of the machine to permit the machine to be adjusted to fold tray boxes of different widths.

GLUING STATION

As indicated in FIGS. 2 and 5, a pair of glue rolls 50 are mounted above the conveyor path 26 to apply glue patches 118 to the diagonal flaps 112 (FIG. 1D). An inner pair of support belts (FIG. 5) are mounted under the glue rolls 50 supporting box blanks against the glue rolls, and an upper central conveyor belt 122 (FIG. 2) engages the box blanks to convey them through the gluing and discharge stations while the side conveyor belts 24 terminate at the glue station and free the side flaps for subsequent folding onto the glued patches 118.

SIDE FLAP FOLDING

Referring to FIG. 3, a side flap folding belt is mounted on each side of the machine with one of its ends extending over a roller 124 and its other end extending over rollers 126, 128, 130, and 132 with the path of each side flap folding belt 123 undergoing a half twist between the rollers 124 and 126 and with the rollers 124 and 126 being positioned on opposite sides of the path 26 so that the side flap folding belt 123 first engage the bottom of the flap, then lift it up and bend it over and press it downwardly on to the glued patches 118. The roller 126 is driven to drive the side flap folding belts 123, and a coaxial roller is provided over which the central belt 122 extends with the belt 123 extending beyond roller 126 to function as the conveying means for the folded box at the discharge end of the conveyor.

DISCHARGE STATION

Referring to FIGS. 6–8, a U-shaped support plate 134 is mounted at the end of the conveyor belts 123 and 120 to receive on its upper surface a folded box blank 136 as illustrated. A hold down plate 138 is mounted above the plate 134 for gravitational movement toward the plate 134 on rods 140 which are slideably received in a flange 142 on the top of the legs of the U-shaped member 134. The folded and glued box blanks have an inherent tendency to unfold, and the hold down plate 138 maintains these boxes in folded and flattened condition as a stack of folded boxes is built up for discharge into the compression conveyors 38.

A pair of lifting hooks 144 are mounted at the discharge end of the conveyor, one at each side of the conveying path, for reaching under the bottom box blank on a stack of blanks on the plate 134 and lifting it off of the plate 134 in synchronization with delivery of another box blank from the conveyors 120 and 123 thereby providing space at the bottom of the stack for insertion of the next box blank as indicated in FIG. 6. The lifting hooks 144 are driven by mechanism which is similar to the drive mechanism which operates the hold down members 56 in FIG. 2. Thus, a pair of gears 146 and 148 are mounted at each side of the conveyor path for rotation about axis which are parallel to each other and to the conveyor path with the two gears 146 and 148 being driven by a gear 150 which is driven by the drive shaft 40 by means of a mechanism similar to the mechanism 42–48 in FIG. 5. The hook 144 is pivotally connected to gear 146 at a pivot point 152 and is slideably connected to the gear 148 at a point 154 with pivot point on gear 146 leading the point

154 on gear 148 by about 90 degrees so that concurrent rotation of the two gears causes the lower lip of the hooks 144 to reach under the bottom box blank on the stack and lift it off of the plate 134 for approximately the period that the pivot point 152 on gear 146 moves from the bottom of gear 146 through the next 90 degrees of rotation of the gear 146.

When a stack of boxes has been built up between the support plate 134 and the hold down plate 138, the stack of boxes is ejected into the compression conveyors 38 by an ejection plate 156 which is driven by a pneumatic ram 158. As illustrated in FIG. 6, the lower edge of the ejection plate 156 is supported above the conveyor path 26 while the boxes are being stacked to permit the boxes to pass under the lower edge of the plate 156. The plate 156 is supported in this position by an overhead ram 160 which is periodically actuated to move the plate 156 downwardly into the path 126 just prior to actuation of the ram 158 to eject the stack of boxes. The ram 160 supports a pair of telescopic tubes 162 and 164 with the tube 162 being pivotally connected at one end to the frame of the machine and at its other end to the ram 160 and with the inner tube 164 being connected to the ejection plate 156.

As indicated above, the feeding mechanism in the machine includes a conventional kicker 20 which starts box blanks along their travel through the machine. The feeding mechanism also employs a conventional counter and box blank lifting mechanism for periodically permitting the kicker to perform an ineffective stroke in which no box blank is delivered to the conveyor 26, that is, the counter provides periodic openings in the train of box blanks which are moving through the machine. The counting mechanism which controls the kicker is connected through conventional control means to actuate the rams 158 and 160 so that the ram 160 is energized to lower the plate 156 into the opening in the train of boxes which has been created by the kicker, and the ram 158 operates to eject the entire stack of boxes during the period when the single box blank opening in the train of box blanks provides no new box blank to be added to the stack of boxes on the plate 134.

While certain specific embodiments of the invention have been illustrated and described in detail herein, it is obvious that many modifications thereof may be made without departing from the spirit and scope of the invention.

I claim:

1. In apparatus for making paperboard boxes having a frame, conveying means on said frame defining an elongated path thereon for the travel of paperboard box blanks along said frame, and box blank manipulating means positioned adjacent to said path for periodically engaging box blanks on said apparatus, the improved drive means for operating said manipulating means to alternately move said manipulating means into proximity with said path and withdraw said manipulating means from operative relation with respect to said path which comprises: first and second discs mounted on said frame adjacent to said path for rotation about axes generally parallel to and transverse of said path with one of said discs mounted between the other disc and said path, means pivotally connecting said manipulating means to said first disc eccentrically of said first disc for movement toward and away from said path responsive to rotation of said first disc, means connecting said manipulating means to said second disc for sliding movement with respect to said second disc eccentrically of said second disc for swinging said manipulating means longitudinally of said path about its point of pivotal connection with said first disc responsive to rotation of said second disc, and means for driving said discs in rotation in synchronization with each other and with movement of a box blank along said path.

2. The apparatus of claim 1 in which said manipulating means comprises means for holding a portion of a box blank in said path while said blank is folded about a fold line extending across said path.

3. The apparatus of claim 1 in which said manipulating means comprises a hook mounted adjacent to said path for reaching into said path to engage a box blank in said path and lift it up out of said path.

4. In apparatus for folding paper boxes having conveying means for moving box blanks along an elongated path with said box blanks having trailing edge flaps to be folded about hinge lines which extend across said path, the improved means for folding said trailing edge flaps which comprises: flap engaging means mounted on one side of said path and drive means for moving said flap engaging means in synchronization with movement of a box blank along said path, (a) to move said flap engaging means simultaneously through said path and along the length of said path in the direction of movement of box blanks moving along said path and at a speed greater than the speed of said box blank along said path, (b) to then stop movement of said flap engaging means with respect to said path, and (c) then to move said flap engaging means back through said path.

5. In apparatus for folding paper boxes having conveying means for moving box blanks along an elongated path with said box blanks having trailing edge flaps to be folded about hinge lines which extend across said path, the improved means for folding said trailing edge flaps which comprises: flap engaging means mounted on one side of said path, box blank holding means mounted on the opposite side of said path, and drive means for moving said flap engaging means and said box blank holding means in synchronization with each other and with movement of a box blank along said path to (a) support said engaging and holding means on opposite sides of said path spaced away from said path while a portion of a box blank passes therebetween, (b) move said holding means into engagement with said blank at a position in advance of said fold line while moving said engaging means through said path in engagment with said flap, (c) move said engaging means and said holding means along said path in the direction of movement of said box blank in said path and at a speed greater than the speed of said box blank to fold said flap through an angle exceeding 90 degrees, (d) stop movement of said engaging means with respect to said path while said folded blank moves away from said engaging means, and (e) to move said holding means away from said path and move said engaging means back through said path to provide space therebetween for the passage of another box blank.

6. The apparatus of claim 5 in which said drive means for said holding means comprises first and second discs mounted on one side of said path for rotation about axes generally parallel to and transverse of said path with one of said discs mounted between the other disc and said path, means pivotally connecting said holding means to said first disc eccentrically of said first disc for movement toward and away from said path responsive to rotation of said first disc, means connecting said holding means to said second disc for sliding movement with respect to said second disc eccentrically of said second disc for swinging said holding means longitudinally of said path about its point of pivotal connection with said first disc responsive to rotation of said second disc, and means for driving said discs in rotation in synchronization with each other and in synchronization with movement of said engaging means.

7. The apparatus of claim 5 in which said drive means for said engaging means comprises: support means extending across the width of said path on the side of said path opposite to said holding means with said engaging means mounted on said support means, means for rotating said support means about an exterior axis parallel to its length to move said support means toward said path and along said path in the direction of movement of box

blanks in said path and then move said support means away from said path and along said path in the opposite direction, and means for rocking said support means about an interior axis responsive to rotation of said support means to rock said support means in the direction of movement of box blanks in said path as said support means approaches said path and rock said support means in the opposite direction as said support means moves away from said path.

8. In apparatus for folding paper boxes having conveying means for moving box blanks along an elongated path with said box blanks having trailing edge flaps to be folded about hinge lines which extend across said path, the improved means for folding said trailing edge flaps which comprise: a support member mounted on one side of said path and extending across the width of said path, a flap engaging member mounted on said support member, means for rotating said support member about an exterior axis parallel to its length to move said support member toward said path and along said path in the direction of movement of box blanks in said path and then

move said support member away from said path and along said path in the opposite direction, and means for rocking said support member about an interior axis responsive to rotation of said support member to rock said support member in the direction of movement of box blanks in said path as said support member approaches said path and rock said support member in the opposite direction as said support member moves away from said path.

References Cited by the Examiner

UNITED STATES PATENTS

2,839,972	6/1958	Labombarde	93—49
2,883,916	4/1959	Labombarde	93—49
2,988,236	6/1961	Shields	214—6
3,039,369	6/1962	Welsh	93—49
3,063,577	11/1962	Shields	214—6

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