Feb. 25, 1964 J. P. LOPEZ 3,122,069

FEEDING AND FOLDING EQUIPMENT

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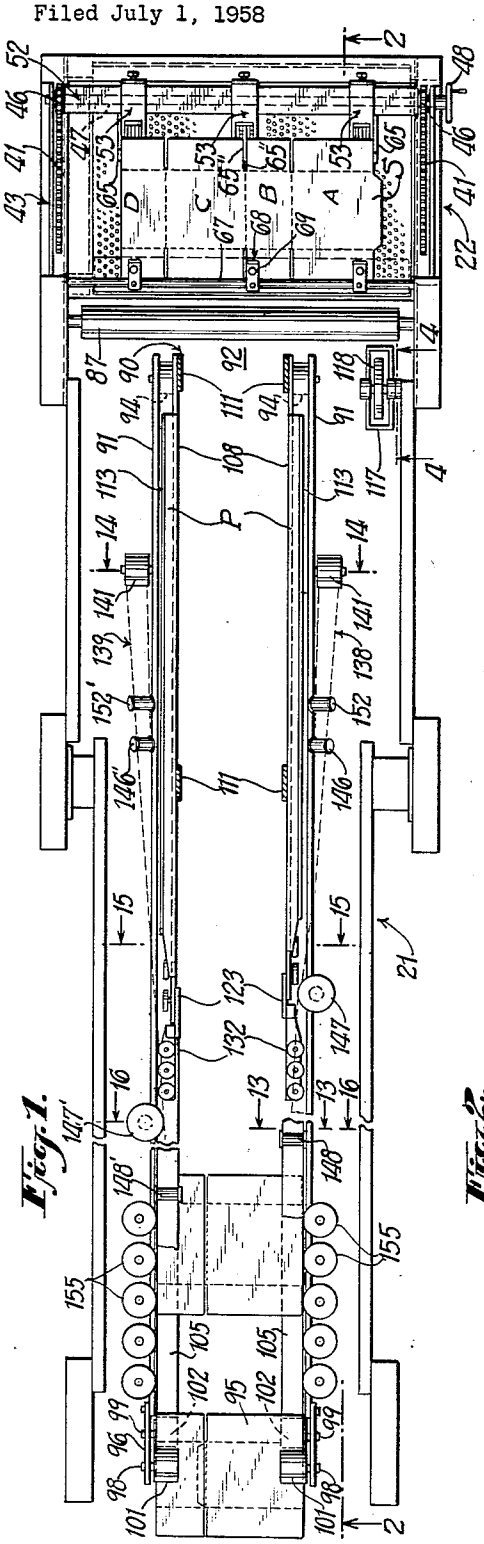


Fig. 1.

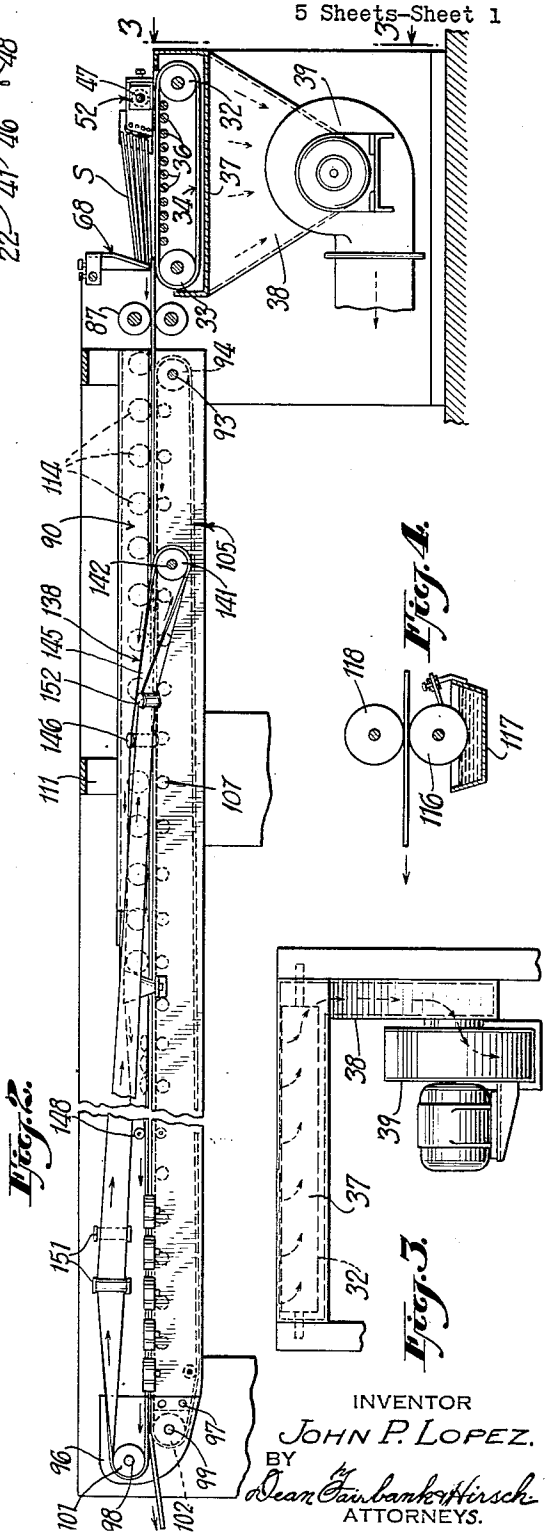


Fig. 2.

Fig. 4.

Fig. 3.

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Fig. 7.

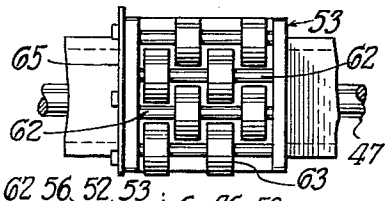


Fig. 5.

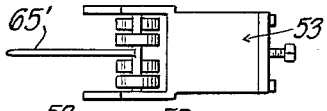


Fig. 6.

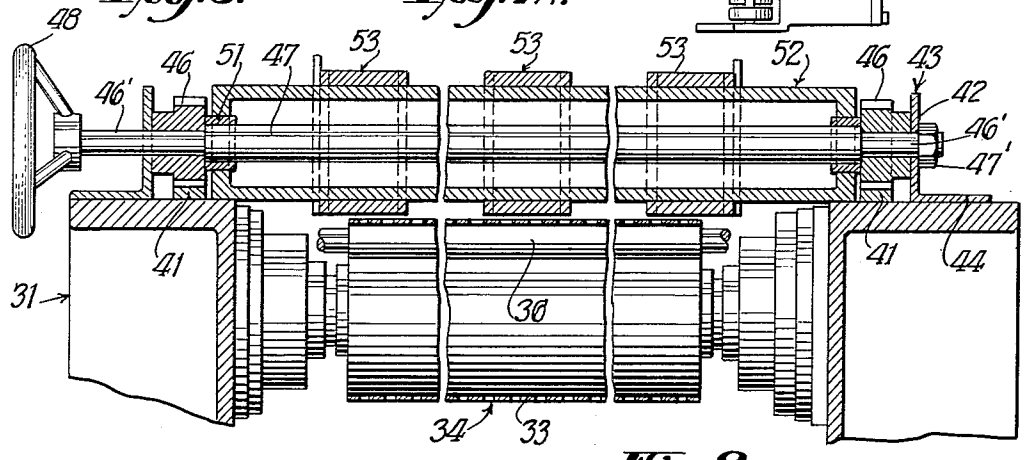


Fig. 7A.

Fig. 9.

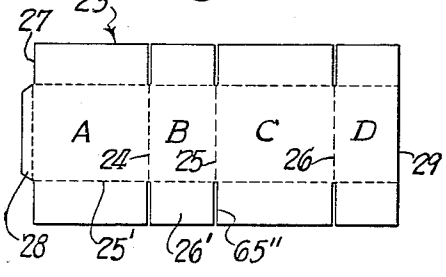


Fig. 10.

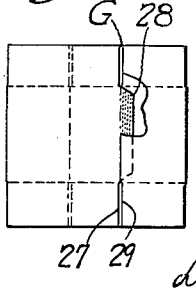
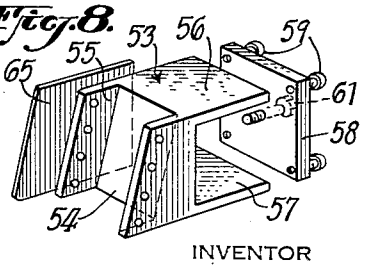


Fig. 8.



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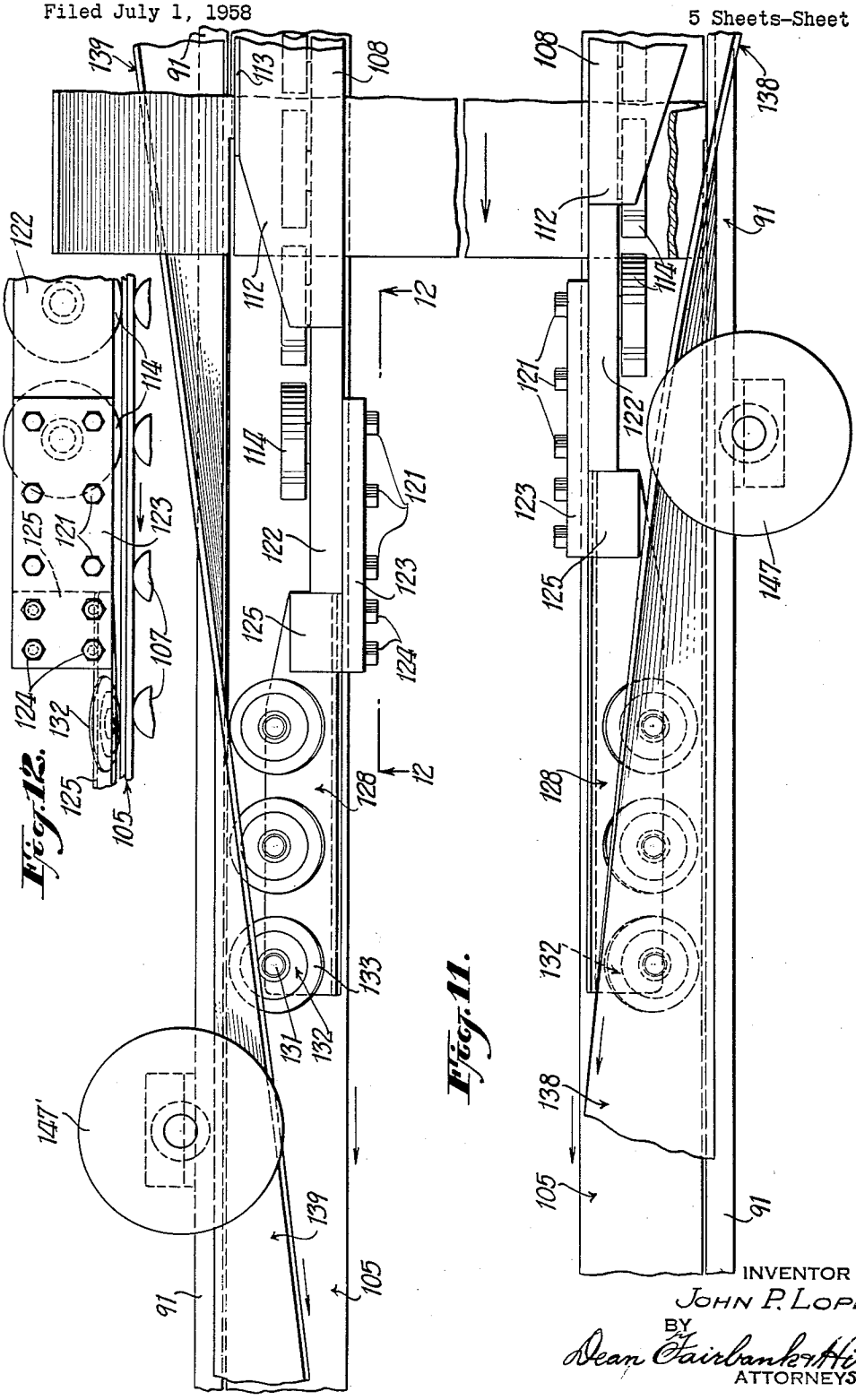


Fig. 12.

Fig. 11.

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Fig. 14.

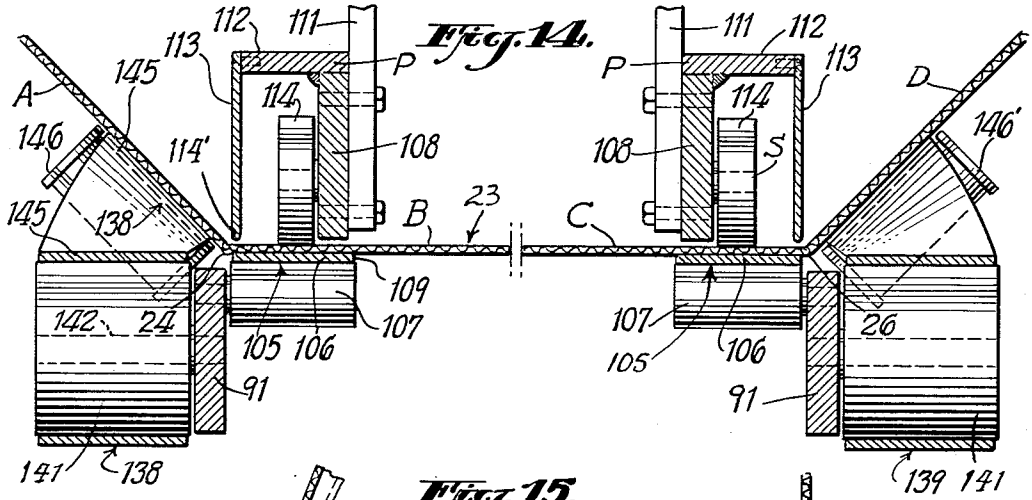


Fig. 15.

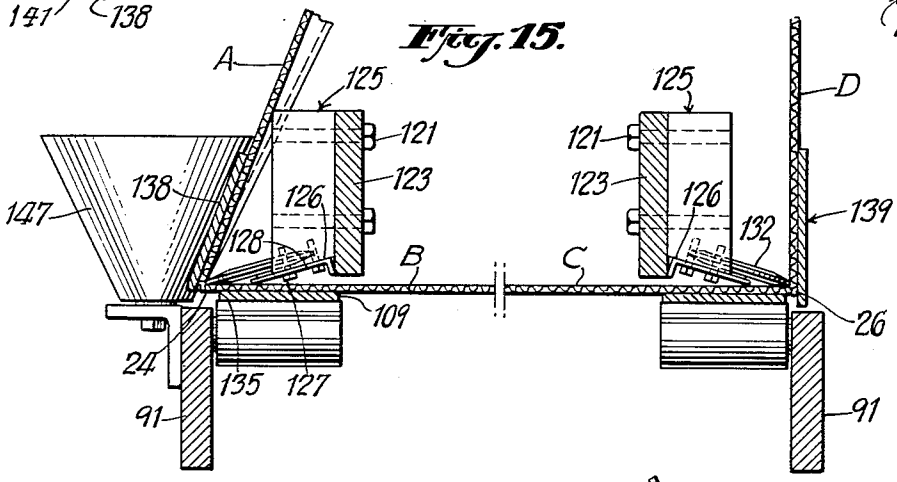


Fig. 16.

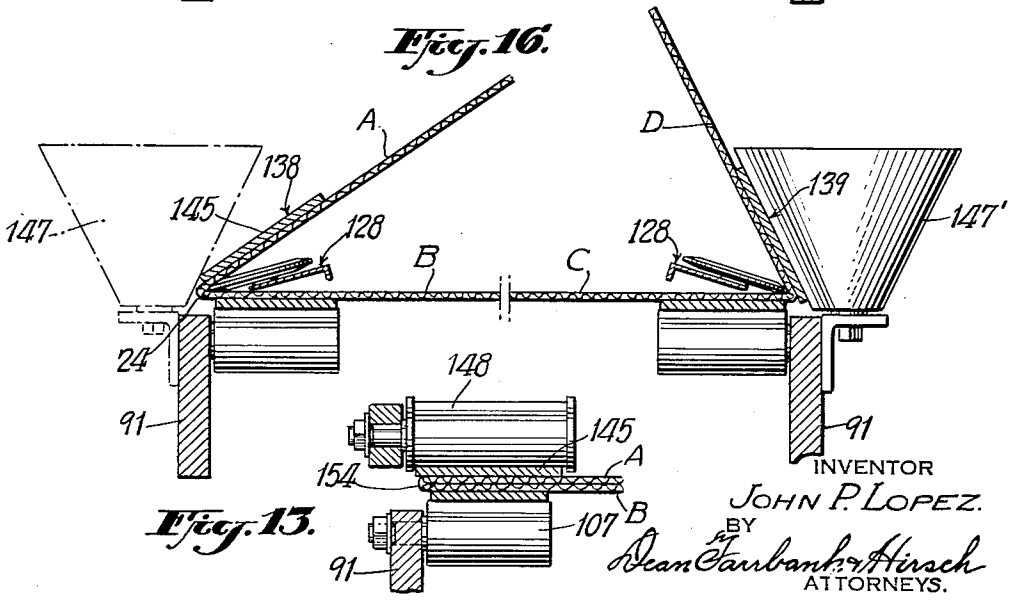


Fig. 13.

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Fig. 17.

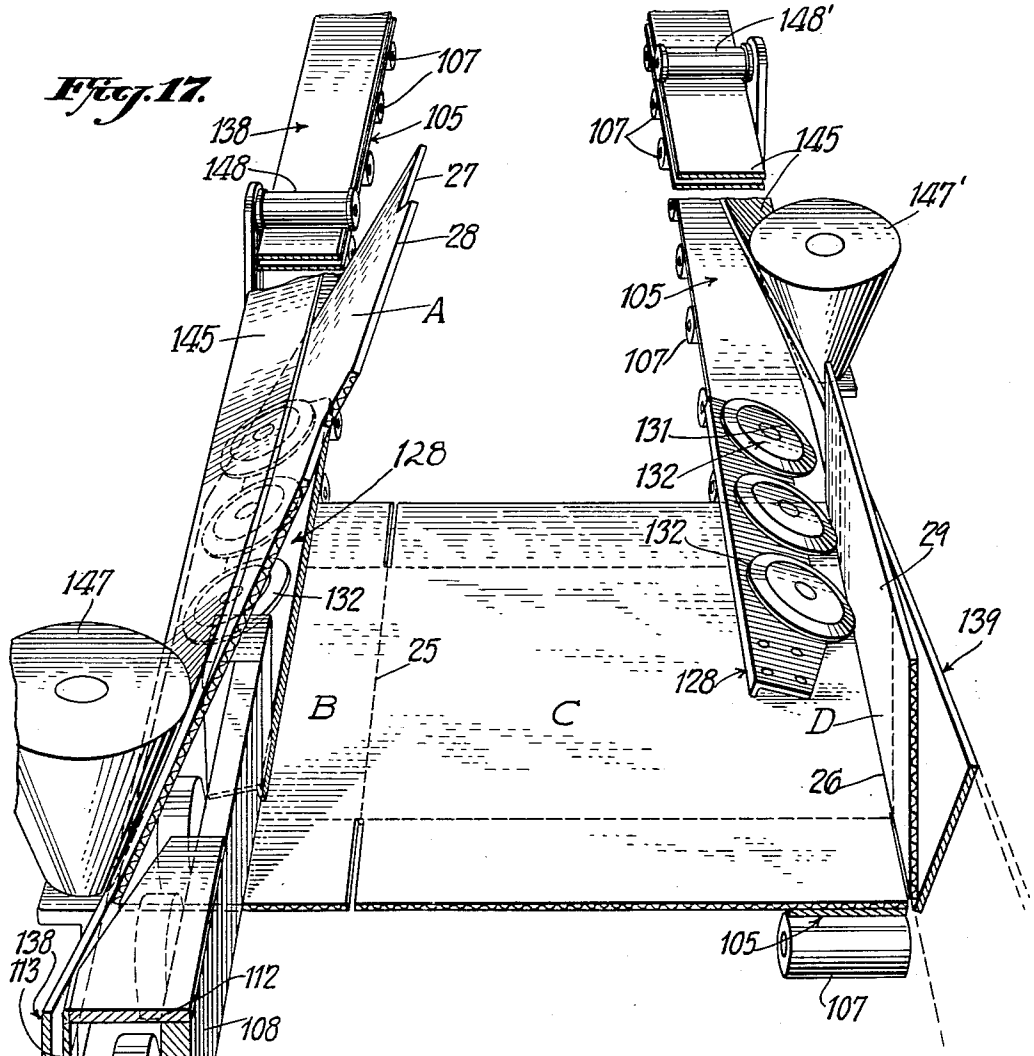
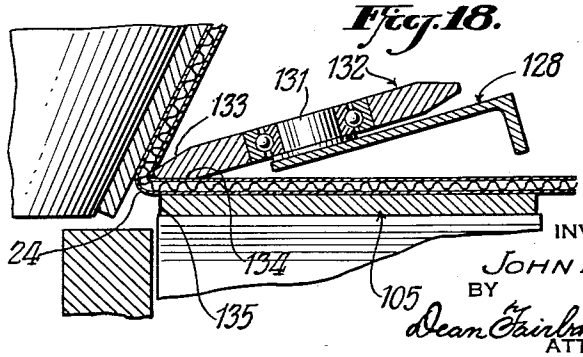


Fig. 18.



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United States Patent Office 3,122,069 Patented Feb. 25, 1964

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FEEDING AND FOLDING EQUIPMENT

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Filed July 1, 1953, Ser. No. 745,979
1 Claim. (Cl. 93—52)

This invention relates to the art of folded box blanks and more particularly to equipment for feeding and folding such box blanks.

As conducive to an understanding of the invention, it is noted that where corrugated box blanks of the type that comprise four panels in side by side relation that have been pre-scored to facilitate folding of the two outer panels into edge to edge juxtaposition, are successively fed to the folding means for such outer panels, if the box blank should skew as it is advanced, it will not fold properly and may cause jamming with resultant stoppage of the equipment for removal of the jammed blanks, with consequent waste thereof.

In addition, if the gap between the juxtaposed edges of the folded outer panels is not maintained at a predetermined amount, the resultant boxes formed may have too wide a gap or if the gap is too small the boxes may not open properly. In either case the box is defective and may have to be discarded with resultant waste.

Furthermore, where the folded box blanks are opened by automatic equipment, if the gap between the juxtaposed edges is too small such automatic equipment will not function properly and frequent stoppages for adjustment would be necessary.

Where, to maintain a gap of predetermined width, a pair of elongated rigid strips is provided over which the outer panels of the box blank are folded and which retain the box blanks against a conveyer for advance of such box blanks, if the strips press the box blanks too tightly against the conveyer, the friction imparted by the fixed strips may cause the box blank to hesitate with resultant jamming of subsequent box blanks or one of the strips may press more tightly than the other with resultant skewing of the box blanks with the difficulties above noted.

If the strips press the box blank too loosely against the conveyer then the blanks will not feed properly or will skew with the objections previously described.

Where the strips are transversely spaced sufficiently to provide a gap of the desired width, the friction imparted by the strips to the folded over outer panels of the box blank may cause hesitation of the blanks as they are advanced with the resultant jamming and if the strips are too close, gap control is lost.

It is accordingly among the objects of the invention to provide an equipment of the above type which will dependably advance open box blanks in sequence at a relatively high rate of speed and will fold the outer panels of such blanks into edge to edge juxtaposition with a gap width between said edges that is maintained at a predetermined amount all without likelihood of skewing of such blanks or hesitation in the successive advance thereof which would cause jamming and destruction of the box blanks, requiring stoppage of the equipment.

In order for the folding equipment to operate at a high rate of speed which is essential for mass production, it is vital that the open box blanks be fed automatically and rapidly in sequence to the folding equipment with substantially no skewing or hesitation in its advance which would cause improper folding of the outer panels of the box blank and jamming of the folding equipment.

Where reciprocating means is used successively to feed the open box blanks, the rate of feed is necessarily slower than it would be with a rotary feed and such reciprocating equipment is more likely to break down.

It is accordingly another object of the invention to provide a box blank feeding equipment which may operate at a high rate of speed dependably to discharge box blanks from the bottom of a stack with assurance that only one box blank will be discharged at a time and with substantially no skewing or hesitation in its advance.

According to one aspect of the invention, a conveyer is provided which successively advances open box blanks in sequence and means are provided as the blanks are advanced to fold the outer panels of the blanks inwardly so that the edges thereof are in juxtaposition. Associated with the folding means and in the path of movement of the box blanks are movable means over which the outer panels are folded as the blanks are advanced, said movable means determining the gap between the juxtaposed edges of the outer panels.

More specifically the movable means are longitudinal rows of transversely aligned discs which press the panel against the conveyer belts for advance of the panel.

According to another aspect of the invention, the box blanks are successively fed from the bottom of a stack by means of a suction type conveyer belt in association with a guide arm or gauge which permits only one blank at a time to pass thereunder.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

FIG. 1 is a top plan view of the equipment,

FIG. 2 is a side elevational view thereof taken along line 2—2 of FIG. 1,

FIG. 3 is an end view taken along line 3—3 of FIG. 2,

FIG. 4 is a detail side elevational view of the glue applying rollers taken along line 4—4 of FIG. 1,

FIG. 5 is a side elevational view of the feeding unit partly in cross section,

FIG. 6 is a view taken along line 6—6 of FIG. 5,

FIG. 7 is a fragmentary detail view of an outer back stop taken along lines 7—7 of FIG. 5,

FIG. 7A is a top plan view of an intermediate back stop,

FIG. 8 is an exploded perspective view of one of the outer back stops,

FIG. 9 is a plan view of a box blank in open condition,

FIG. 10 is a view similar to FIG. 9 of a box blank in folded condition,

FIG. 11 is a fragmentary top plan view on an enlarged scale showing the folding discs,

FIG. 12 is a detail side elevational view taken along line 12—12 of FIG. 11,

FIG. 13 is a detail view of an enlarged scale of one of the folding belt guide rollers taken along line 13—13 of FIG. 1, and

FIGS. 14, 15 and 16 are transverse sectional views taken along lines 14—14, 15—15 and 16—16 of FIG. 1,

FIG. 17 is a fragmentary perspective view of the folding unit, and

FIG. 18 is a sectional view on a greatly enlarged scale showing one of the folding discs.

Referring now to the drawings, the equipment comprises a box blank folding unit 21 and a box blank feeding unit 22 which successively advances the open box blanks to the folding unit.

The open box blank 23 illustratively shown in FIG. 9, is of conventional type and comprises four rectangular panels A, B, C and D defined by score lines 24, 25 and 26; panels A, C and B, D respectively being of the same dimensions, the panels A, D defining the outer panels. The side edges 25' of the panels are suitably scored for

ready folding thereof and each of said edges 25' has a rectangular flap 26' extending laterally therefrom. In addition, the end edge 27 of panel A has a connector flap 28 formed integral therewith to which glue may be applied so that when the blank is folded to the position shown in FIG. 10, the connector flap 28 will be positioned beneath the end edge 29 of panel D and will be secured thereto.

The feeding unit 22 shown in FIGS. 1, 2, 5 and 6 comprises a frame 31 which has a pair of spaced rollers 32 and 33 mounted on a horizontal axis, said rollers carrying a perforated endless belt 34, the upper run 35 of which is supported by a plurality of spaced idler rollers 36. The rollers are encompassed by a suction chamber 37 connected through duct 38 to a suction unit 39 whereby upon creation of suction in the chamber 37 a corresponding suction will be created through the perforations in the belt 34. As shown in FIG. 6, a pair of racks 41 straddle the belt 34 and are secured to the frame 31, said racks being straddled by the vertical legs 42 of elongated L-shaped brackets 43, the horizontal legs 44 of which are secured to the frame 31.

Each of the vertical legs 42 of brackets 43 has an elongated horizontal slot 45 through each of which extends the associated reduced diameter end 46' of a shaft 47 that extends transversely across the belt 34. As shown in FIG. 6, a pinion 46 is secured to each of the reduced diameter ends of the shaft inward of the vertical legs 42 of brackets 43 and adjacent thereto, said pinions engaging the associated rack 41. One end of the shaft has a nut 47' thereon, and the other end mounts a handwheel 48. The shaft 47 extends through bearings 51 in each end of an elongated support 52 that is rectangular in cross section and has its lower ends resting on the frame inwardly of the racks 41 as shown in FIG. 6, said support also extending transversely across the belt 34.

Thus, upon rotation of the handwheel 48, the support 52 will be moved longitudinally of the belt 34, being restrained from rotation by reason of the fact that its ends rest on the frame.

The support serves as a mount for a plurality of box blank guides or back stops 53, each of which, as illustratively shown in FIG. 8, comprises a casting having an inclined front wall 54 with parallel vertical flanges 55 at the side edges extending outwardly from the front wall. Extending rearwardly from the upper and lower ends of the front wall 54 and formed integral therewith are spaced parallel horizontal flanges 56 and 57 adapted to straddle the support 52 and which extend beyond the latter as shown in FIG. 5. A plate 58 is secured as by screws 59 to the free ends of said flanges 56, 57 and by means of a set screw 61 extending through a tapped opening in the plate and reacting against the rear wall of the support 52, the guides 53 may be set to any desired position along the length thereof.

Extending transversely between the parallel vertical flanges 55 are spaced parallel shafts 62 each of which illustratively mounts a pair of rollers 63, the rollers on successive shafts being staggered as shown in FIG. 7, the outer peripheries of said rollers extending beyond the outer edges of flanges 55 to serve as a moving support for the rear edges 64 of the box blanks as will be hereinafter described.

In the illustrative embodiment shown, three guides 53 are provided, the two outer guides having fins 65 secured to the outer flanges 55 thereof, said fins properly positioning the box blanks on the conveyer belt 34.

In the case of a long box blank, the intermediate guide 53 may have a central fin 65' as shown in FIG. 7A which fits into the slot 65'' (FIG. 1) between adjacent flaps 26'. As a result of such fin the long box blank is effectively guided at three points which will prevent skewing thereof as the box blank is deposited on conveyer belt 34.

Extending transversely across the belt 34 and positioned above the latter adjacent the roller 33 and longitudinally spaced from the guides 53 is a hanger rod 67 from which depends a plurality of guide arms or gauges 68, each in the form of an elongated substantially rectangular bar, the lower end of each guide arm 68 being inclined outwardly as shown, to define a deflector portion 68'.

To mount each of the guide arms 68, a substantially rectangular block 69 is provided, which has a transverse bore 71 near one end 72 through which rod 67 extends, a key 73 secured to rod 67 permitting movement of the block along the rod, but preventing rotation thereon. Desirably a set screw 74 is provided to retain the block 69 in a desired position along the rod.

The other end of the block 69 desirably is bifurcated, defining a pair of spaced parallel legs 75 between which the guide arm 68 is positioned. Secured to the upper end 76 of the arm 68 as by screws 77 and extending at right angles thereto, is a bracket 78 which has an opening near its free end through which extends a screw 79 threaded into a correspondingly threaded opening 81 in block 69.

Affixed to the screw 79 as by set screws 82 and straddling the bracket 78 is a pair of collars 83. Thus, upon rotation of the screw 79 by its knob 84, the guide arm 68 may be raised or lowered as desired so that its lower end 85 will be spaced a predetermined distance from conveyer belt 34.

Positioned immediately to the rear of the guide arms 68 is a pair of pull rollers 87 (FIGS. 1 and 2) mounted on vertically aligned horizontal shafts and which serve successively to advance the box blanks to the folding unit 21.

Referring to FIGS. 1 and 14, for example, the folding unit comprises a conveyer 90 including a pair of elongated parallel bars or rails 91, each of the ends of which at the inlet 92 of the conveyer having an inwardly extending shaft 93 (FIG. 2) on which a pulley 94 is mounted. Each of the ends of bars 91 at the outlet end 95 of the conveyer has a plate 96 secured thereto as by screws 97, said plate mounting inwardly extending shafts 98 and 99, each mounting a pulley 101, 102, the horizontal axes of shafts 93 and 99 being in substantially the same plane.

Each of the pairs of pulleys 94 and 102 carries an endless conveyer belt 105, the upper runs 106 of which are supported by idler rollers 107 also mounted on bars 91 (FIG. 14).

Extending parallel to bars 91 are parallel bars 108 which extend in a plane above that of bars 91 and above and along the inner edges 109 of conveyer belts 105, the bars 108 being supported by upright supports 111 suitably mounted so that they are vertically movable.

As shown in FIG. 14 each of the bars 108 has a horizontal elongated plate 112 extending laterally outward from the upper edge thereof, the free edge of each of said plates carrying a depending skirt 113, the lower edge 114' of which is slightly above the plane of the upper run 106 of conveyer belt 105.

Each of the bars 118 has a plurality of rollers 114 mounted on the outer surface thereof and adapted to urge the box blank 23 against the conveyer belts 105 in the manner hereinafter described.

The belts 105 in conjunction with the rollers 114 thus serve as a conveyer successively to advance the open box blanks 23 as they are fed to the inlet 92 of the conveyer.

Positioned laterally of the inlet 92 of the conveyer is a glue roller 116 (FIG. 4) adapted to be vertically aligned with the connector flap 28 of the open box blank. The glue roller illustratively rotates in a glue tank 117 and a pressure roller 118 is positioned directly over the glue roller to urge the connector flap thereagainst to insure application of glue to the undersurface of such flap.

Secured as by screws 121 (FIG. 11) to the inner

sides of each of the ends 122 of the bars 108 is a plate 123 which protrudes beyond such ends 122. Secured as by screws 124 to the protruding ends of each of the plates 123 is a block 125, the undersurface of which is beveled as at 126 (FIG. 15).

Affixed as by screws 127 to the beveled surface of each of the blocks 125 is the end of a rigid elongated strip 128 which extends longitudinally of the associated bars 108.

Each of the strips 128 is thus inclined, and each has a plurality of stud shafts 131 (FIG. 18) rising therefrom and inclined outwardly, said shafts being longitudinally aligned and each carrying a disc 132 rotatably mounted thereon.

As shown in FIG. 18, the top and bottom peripheries of each of the discs 132 is beveled as at 133, the angle of the bevel being such that the undersurface 134 of the outer edge of the disc will be in substantially a horizontal plane, with such outer edge extending slightly beyond the outer edge 135 of the associated conveyor belt 105.

Although any number of discs may be provided, two are desired and illustratively three are provided on each of the strips 128, the discs on the strips 128 being transversely aligned as shown in FIG. 11.

Means are provided to fold the end panels A and D of the box blank inwardly as the blanks are advanced by the conveyor belts 105. To this end, as shown in FIG. 1, a pair of folding belts 138, 139 are associated respectively with the conveyor 90 on each side thereof. Each of the belts rides around a pair of main pulleys 141 and 101, the pulley 141 being mounted on a shaft 142 extending laterally outward from the bar 91 between the inlet 92 and the discs 132 (FIG. 1) and the pulley 101, as previously described, being mounted on shaft 98 extending laterally outward from plate 96 above pulley 102 as is shown in FIG. 2.

The upper run 145 of each of the belts 138, 139 extends from the pulleys 141 over roller 146, 146' which are inclined upwardly, then against cone roller 147, 147', the periphery of each of which is inclined inwardly as shown in FIG. 17, then beneath horizontal rollers 148, 148' (FIG. 17) which thus completes the twisting of belts 138, 139 through angles of 180 degrees so that they are horizontal. The belts then ride around pulley 101; between vertical rollers 151 which twists the belt 90 degrees to vertical position then over inclined rollers 152, 152' and beneath and around the pulley 141.

As such folding belts are well known in the art, no further description thereof is deemed necessary.

In order to have the panel A of the box blank 23 fold inwardly prior to panel D in the manner hereinafter to be described, the cone roller 147 associated with belt 138 is in advance of the cone roller 147' as shown in FIG. 17.

Means are provided to soften the creased folded edges 154 (FIG. 13) of the box blanks 23 so that the box blank may thereafter be squared in any suitable manner such as by equipment of the type shown in patent application Serial No. 620,841, filed November 7, 1956, now Patent No. 2,976,780, issued March 28, 1961.

To this end, as shown in FIGS. 1 and 2, a plurality of adjustable crushing rollers 155 are provided located after the dics 132.

The rollers are suitably mounted on the bars 91 on vertical longitudinally aligned stud shafts so that their inner periphery will be engaged by the folded edges 154 of the box blanks as they are advanced.

Operation

In the operation of the equipment the guides 53 (FIGS. 5–8) with the fins 65 are spaced along the support 52 so that the open box blanks may fit between the fins 65 with but little clearance and the other guide 53, one or more of which may be provided, depending upon the length of the open box blank, is spaced between the outer guides 53 and all the set screws 61 are tightened.

The hand wheel 48 is rotated to position the guides 53 so that when a stack S of open box blanks (FIG. 5) is positioned on the conveyer belt 34 between the outer guides 53, the trailing edges 64 of the blanks will rest on the rollers 63 of the guides and the leading edges 64' of the blanks will rest against the inclined portions 63' of the gauges 68 as shown in FIG. 5.

The blocks 69 carrying the gauges 68 are positioned along the rod 67 so that they will be located between the side edges of the box blanks to be fed and are locked in position by turning screws 74.

The gauges 68 are then lowered by turning screws 79 so that the lower edges 85 of the gauges are spaced from the uper run 35 of belt 34 riding around rollers 32, 33 by a distance just slightly greater than the thickness of the box blank to be fed so that but a single box blank at a time may pass thereunder, the blank immediately thereabove being restrained by the gauge 68.

Suction is applied to the chamber 37 and the conveyer belt 34; and the pull rollers 87, the conveyers 34 and 90 and folding belts 138, 139 are actuated.

As a result of the suction applied to the chamber 37, the leading portion of the lowermost box blank 23' (FIG. 5) will be securely retained against the conveyer belt 34 by reason of suction applied through the perforations thereof.

As the upper run 35 of conveyer belt 34 moves to the left, the leading edge 64' of the lowermost blank 23' will be advanced beneath the lower edges 85 of the gauges 68 and between the nip of the pull rollers 87 which are driven to advance the box blanks in a forward direction.

As the box blank is retained in fixed position by the suction belt 34 and then by the pressure of the pull roller 87, it will remain substantially square, and will not skew.

Referring to FIG. 5, so long as the trailing edge of the lowermost box blank 23' has not passed beneath the gauge 68 the box blank 23'' immediately thereabove cannot be advanced. However, as soon as such trailing edge has passed the front gauge 68 then by reason of the suction imparted through the conveyer belt 34, the leading edge 64' of the next box blank 23'' will be moved downwardly against the belt and be free to be advanced thereby past the front gauge 68. As the leading edges 64' of the box blanks 23 are engaged by said pull rollers which are driven at a higher rate of speed than the drive of the conveyer 34, the successive box blanks will be spaced from each other.

As the leading edge of each box blank is advanced past the pull rollers they will be moved between the upper run 106 of the endless belts 105 and the idler rollers 114 thereabove of conveyer 90 as is clearly shown in FIG. 2. Since the upper bars 108 have been vertically adjusted so that the rollers thereon will effectively press the box blanks 23 against the conveyer belts 105, such box blanks will be securely gripped for advance by said belts 105.

As the box blank 23 is advanced in the above manner, the connector flap 28 thereof will be moved between the glue roller 116 and pressure roller 118, which in conventional manner will apply a coating of glue to the undersurface of such flap. With continued advance of the box blanks 23 by the conveyer 90, the end panels A and D of the box blanks 23, which extend outwardly beyond the skirts 113 (FIG. 14) will be moved into juxtaposition to the folding belts 138 and 139.

Referring to FIGS. 1, 2 and 14, the folding belts 138, 139 due to their incline will cause the panels A and D to fold upwardly about their score lines 24, 26. As the cone roller 147 (FIGS. 1 and 11) is in advance of the cone roller 147' the panel A will be folded inwardly by the belt 138 at a faster rate than the panel D (FIG. 15).

When the leading edge 64' of the box blank 23 is advanced past the cone roller 147, since the blank is be-

neath the bars 108 it will be guided beneath the discs 132 and the undersurface 134 of the discs 132 will press the portions of panels A and D inwardly of the score lines 24, 26 against the conveyer belts 105.

As the conveyer belts 105 are advancing and as the box blanks 23 are urged thereagainst by the discs 132, the discs will rotate so that the forward movement of the box blanks 23 will not be in any way restrained. As a result, the box blank will be advanced without skewing.

With further advance of the box blanks 23, the folding belt 138 (FIG. 17) will have been deflected by the cone roller 147 to bend the panel A inwardly past vertical position and the folding belt 139 will have been deflected by the cone roller 147' to bend the panel D to substantially vertical position.

As the outer peripheries of the discs are substantially aligned with the score lines 24, 26 between panels A, B and C, D, as shown in FIG. 14, the transverse distance between such score lines 24, 26 will be maintained at a desired amount based on the preset transverse spacing between the bars 108.

With the further advance of the blanks, the upper run 145 of the folding belt 138 will first move the panel A to substantially horizontal position and thereafter the upper run 145 of the folding belt 139 will move the panel D to substantially horizontal position so that the glued connector flap 28 of panel A will be engaged by the corresponding portion of panel D adjacent its edge 29 as shown in FIG. 10.

Thereafter the upper runs 145 of folding belts 138, 139 will be moved to horizontal position by rollers 148, 148' to press the folded box blank against belts 105 to advance the folded box blanks past the crushing rollers 155 on each side of the box blank. The rollers reacting against the respective folded edges 24, 26 of the box blanks will crush and soften such edges so that after the box blank is discharged from the outlet 95 of the conveyer 90 of the folding unit, since the glue applied to the connector flap 28 is of the slow setting type, the box blank may readily be squared as by the equipment shown and described in patent application, Serial No. 620,841, filed November 7, 1956, now Patent No. 2,976,780, issued March 28, 1961.

With the equipment above described, by reason of the transversely aligned pairs of discs 132, the gap G shown in FIG. 10 between the juxtaposed edges 27, 29 of panels A and D will be spaced a desired predetermined amount. Thus, the folded and connected box blanks will be uniform in configuration and have no undesirable gap width between the edges 27, 29. In addition, the folded box blanks will readily open without deformation thereof either manually or by automatic equipment.

It is furthermore to be noted that in some cases the score lines 24, 25, 26 in the box blank which define creases to permit folding of the panels, tend to come out during storage of the corrugated box blanks prior to folding thereof.

By reason of the discs 132, as the blanks are advanced, the peripheries of the discs will re-crease the box blanks in the proper place to insure folding of the outer panels to achieve the desired gap width G.

The discs 132 also permit the proper folding of the outer panels of box blanks that have been imperfectly creased by actually re-creasing the blanks at the desired location.

In addition, the discs will crush and soften the blanks to aid in the subsequent crushing by the rollers 155 to permit ready squaring of the folded box blanks.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claim, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

Equipment for folding box blanks of the type having outer panels movable into edge to edge juxtaposition, said equipment comprisinging a conveyor to advance such box blanks in sequence, means in the path of movement of the outer panels of the advancing box blank to effect inward folding movement of said panels to bring their free edges into juxtaposition and rotary means over which said outer panels are folded as the box blank is advanced to determine the width of the gap between the juxtaposed free edges of said inwardly folded outer panels, said rotary means comprising a plurality of rotary discs, the axes of which are arranged in two transversely spaced rows each parallel to the direction of movement of the conveyor, the axes of the discs of the respective rows being inclined so that the outer peripheries of the discs of each row will be closer to the conveyor than the inner peripheries thereof, said outer peripheries being adapted to urge the box blank against said conveyor, said conveyor comprises a pair of spaced parallel bars, a pulley at the end of each of said bars, said pulleys being mounted on horizontal axes, an endless conveyor belt encompassing each of said pairs of pulleys, said belts extending in spaced parallel relation, a second pair of spaced parallel bars lying in a plane above the first bars, each of said bars carrying a plurality of longitudinally spaced rollers vertically spaced from the associated endless belt, said second pair of bars being shorter than the first pair, a strip is carried by the ends of each of said second pair of bars and extends longitudinally thereof, said strips being inclined upwardly and inwardly, said plurality of discs being rotatably mounted on each of said strips, the axes of the discs on each strip being substantially longitudinally aligned and extending at right angles to the surface of the associated strip so that the outer periphery of each of the discs will be closer to the associated conveyor belt than the inner peripheries thereof, said outer peripheries extending beyond the outer edges of the associated strips.

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