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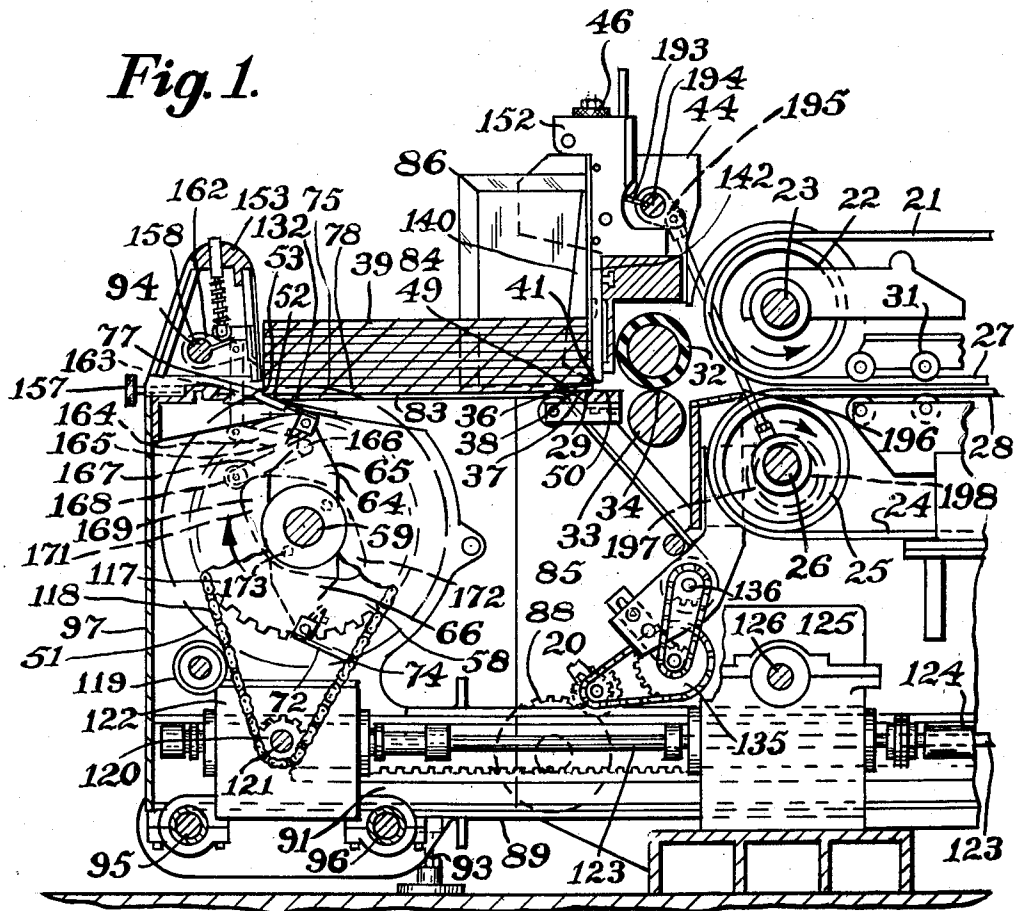
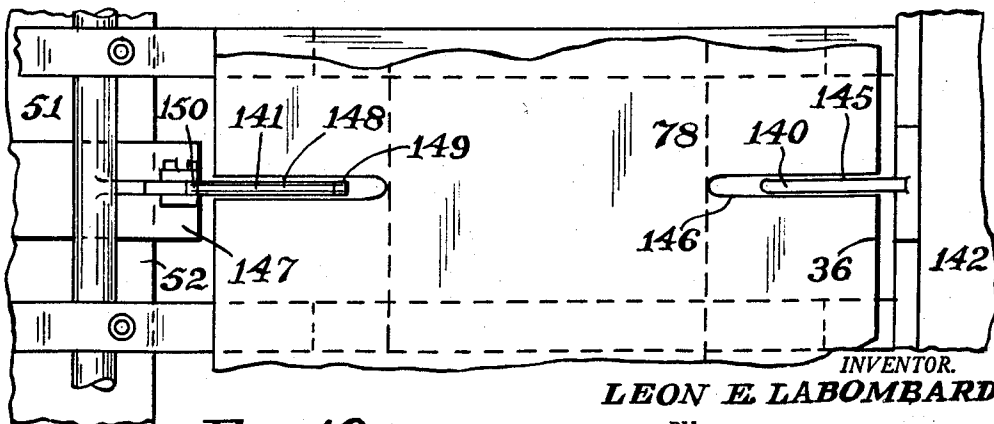
L. E. LA BOMBARD

2,912,239

APPARATUS AND METHOD FOR FEEDING SHEETS

Filed Nov. 25, 1957

7 Sheets-Sheet 1



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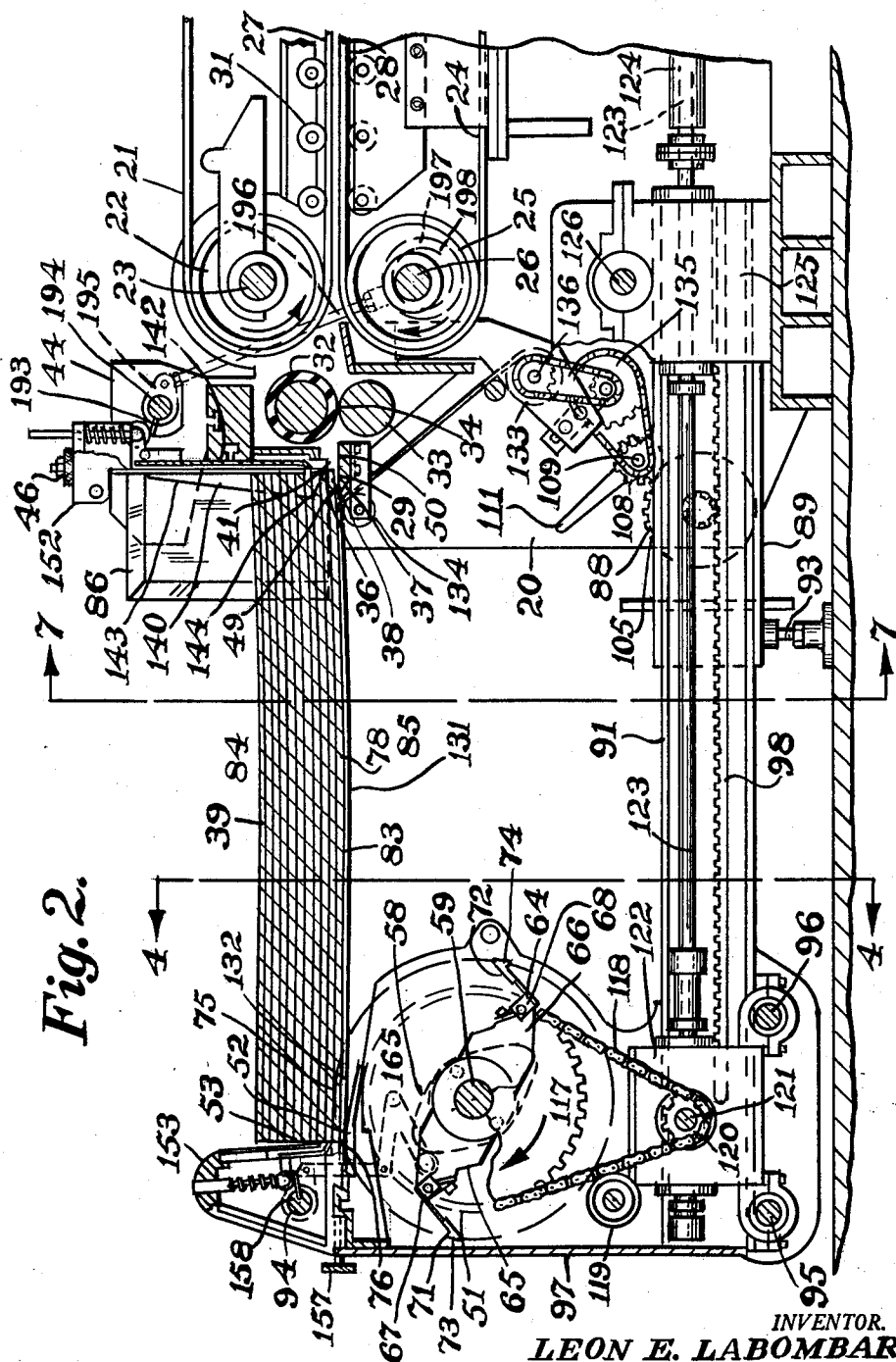
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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 2



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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 3

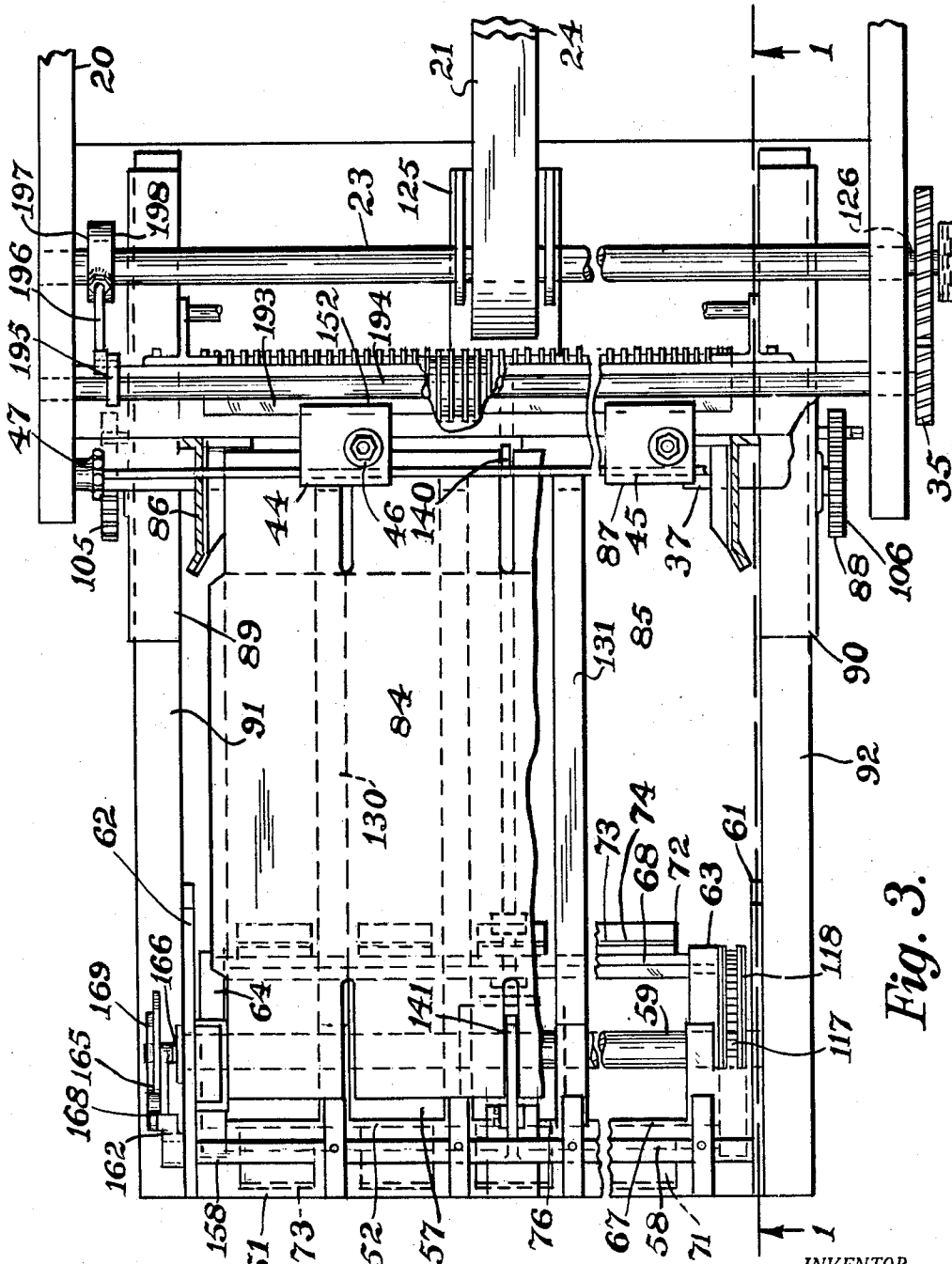


Fig. 3.

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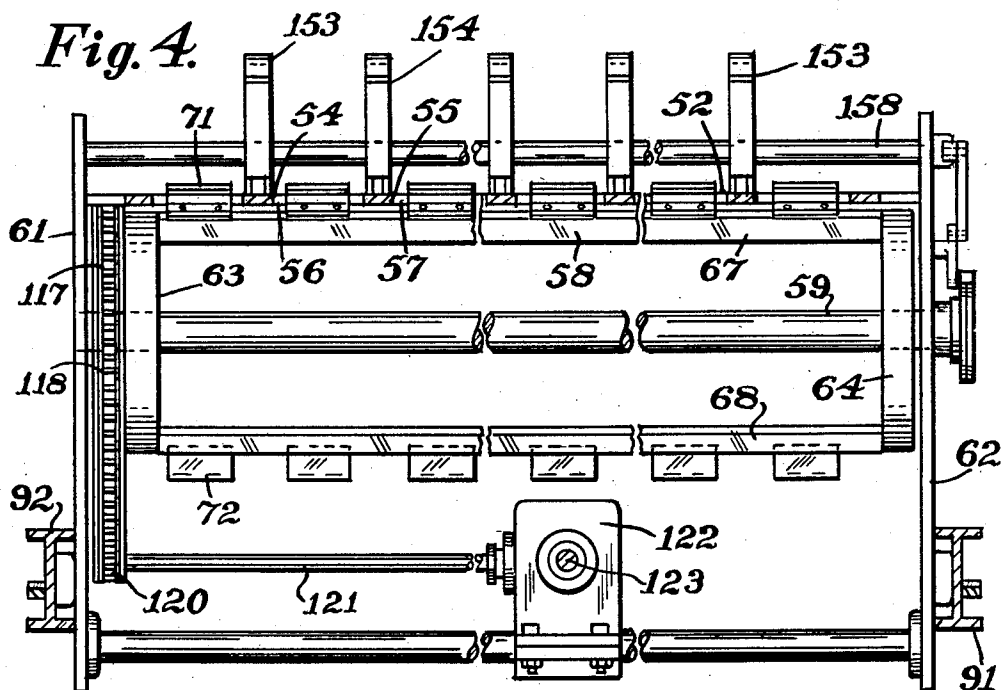
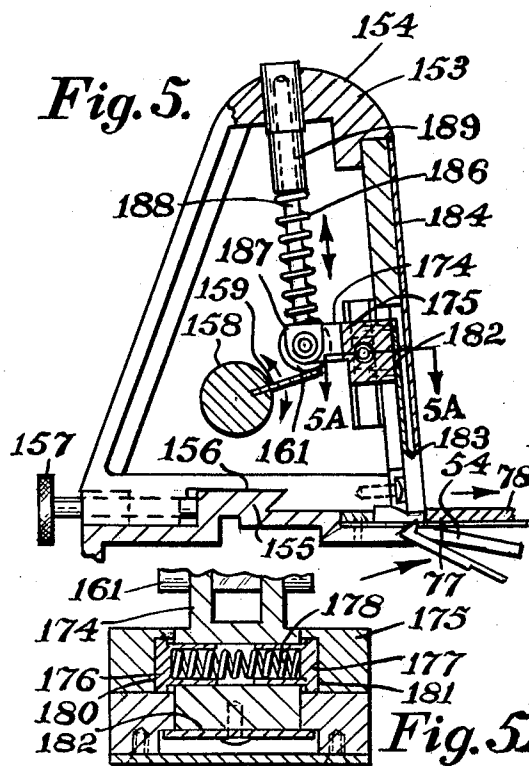
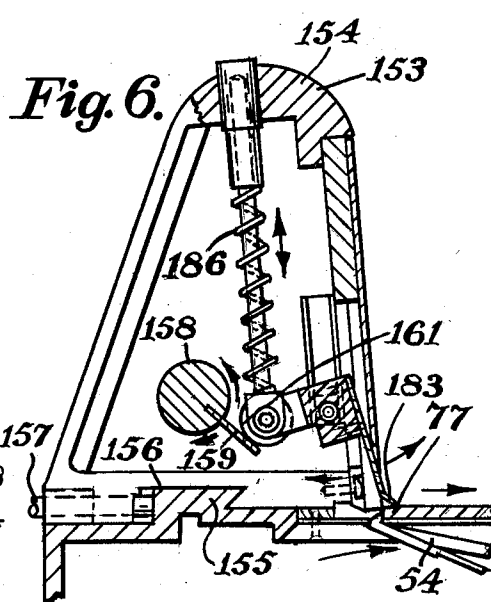
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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 4



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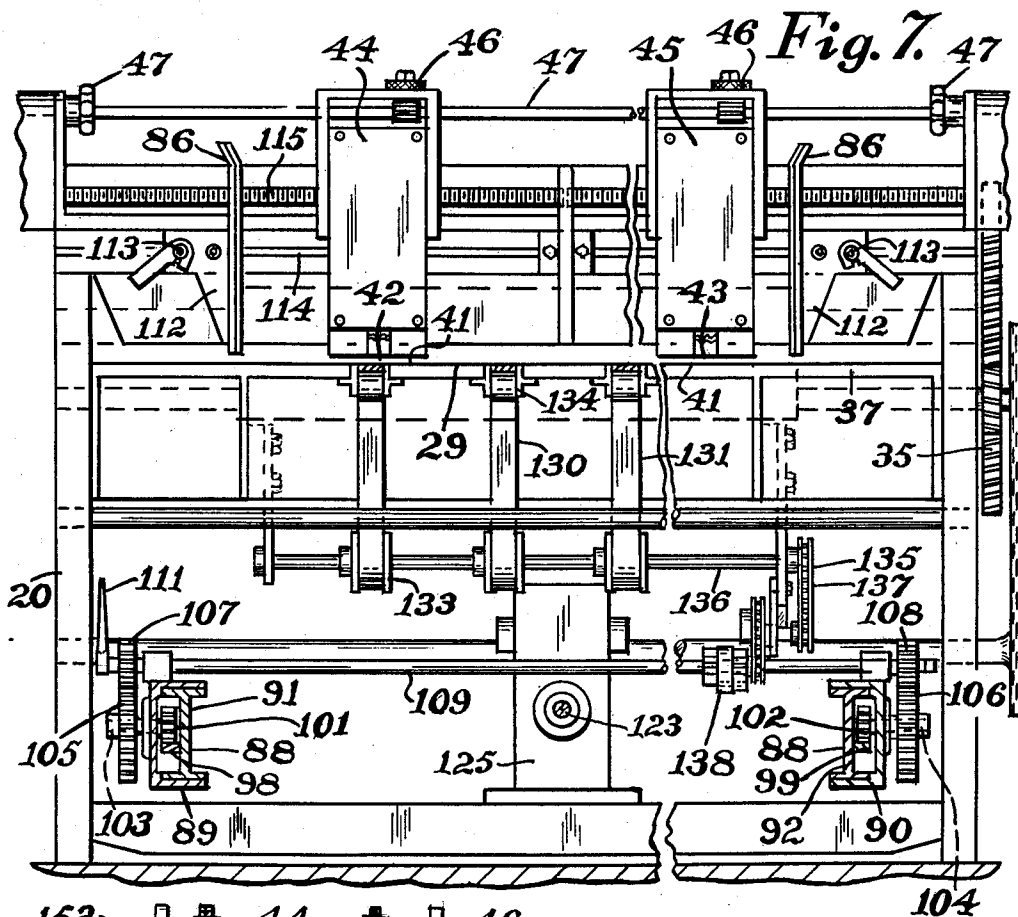
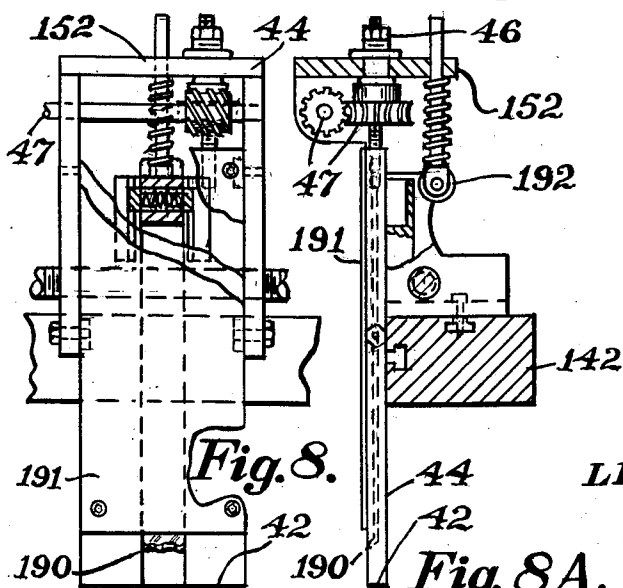
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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 5



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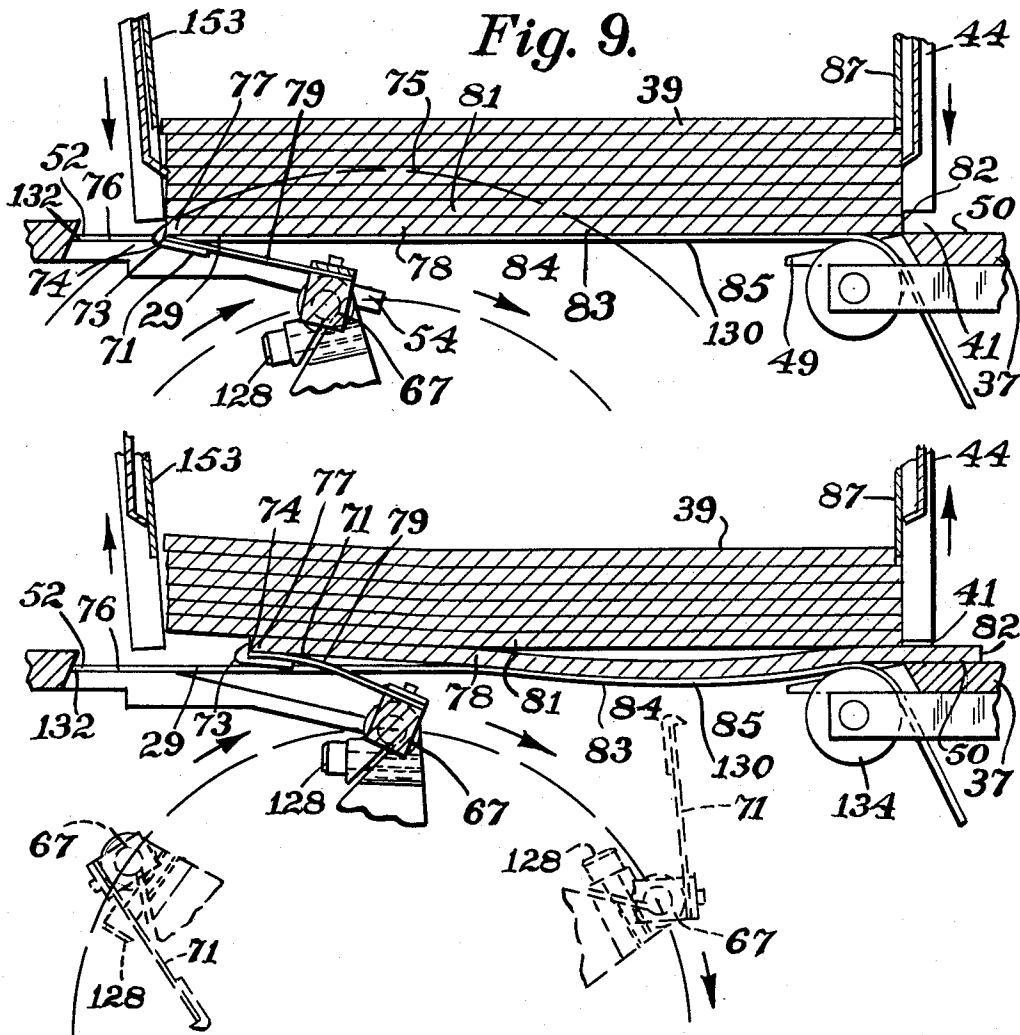
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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 6



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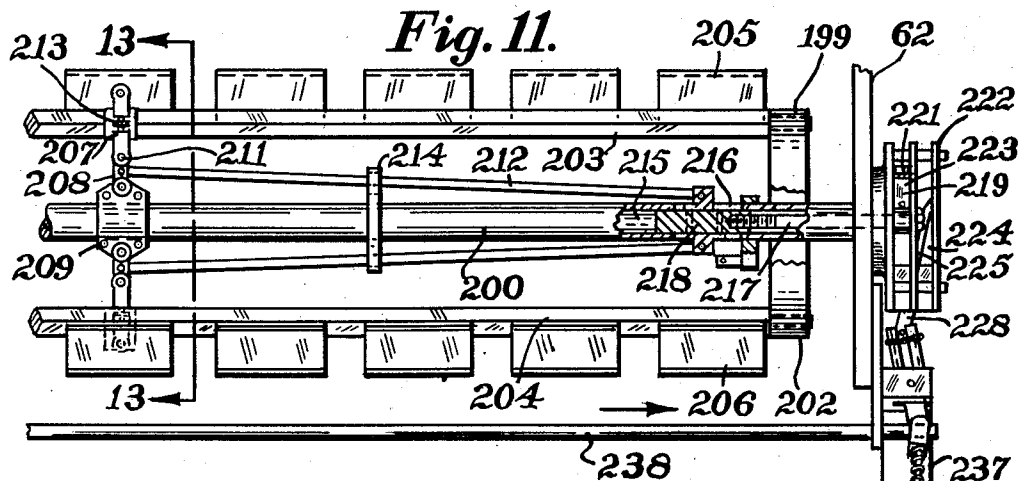
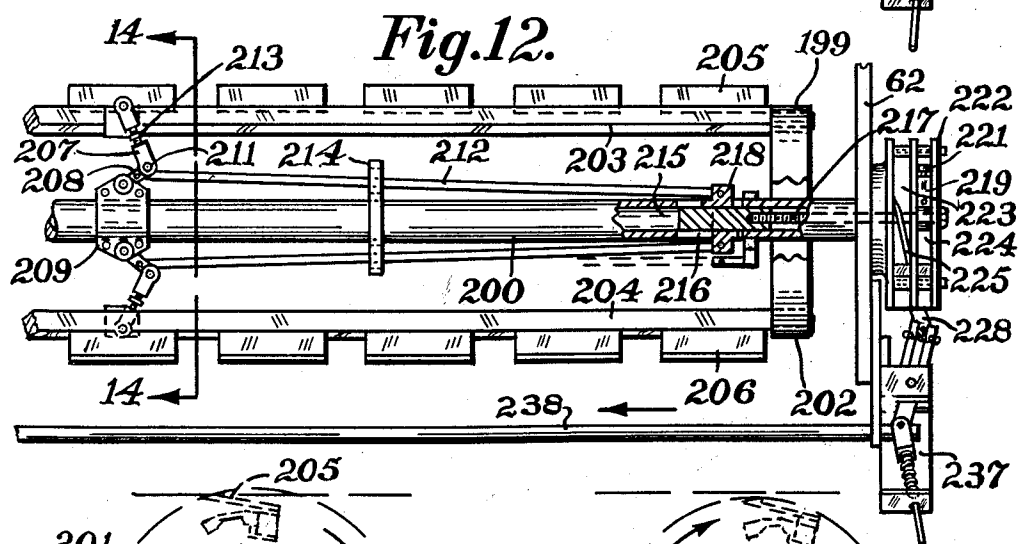
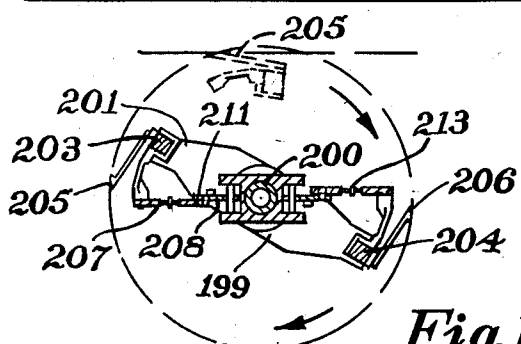
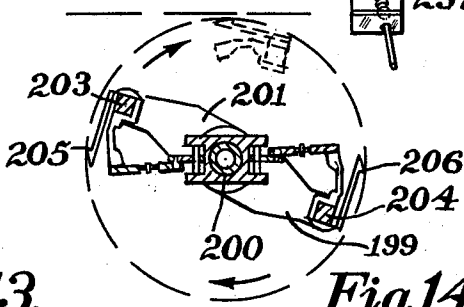
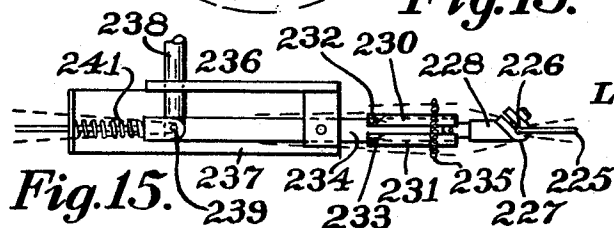
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APPARATUS AND METHOD FOR FEEDING SHEETS

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7 Sheets-Sheet 7



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2,912,239

APPARATUS AND METHOD FOR FEEDING SHEETS

Leon E. La Bombard, Nashua, N.H.

Application November 25, 1957, Serial No. 698,868

32 Claims. (Cl. 271—6)

This invention relates to a method and apparatus for feeding sheets individually and successively from the bottom of a stack of sheets. It relates particularly to the high speed feeding of large box blanks of corrugated paperboard such as are used to make shipping cartons, crates, etc., capable of holding furniture and articles of equivalent size.

It will be understood that box blanks of the size above mentioned have considerable area in contact with each other in a stack, thus raising frictional problems not encountered with smaller blanks when the lowermost blank is slid from the bottom of a stack. Similarly such large area blanks, especially if formed of corrugated material, have an inherent tendency to bow whereby they are difficult to segregate by means of the usual straight passage or gateway in a sheet magazine. A magazine and feed having a limited range of lateral and longitudinal movement for accommodating sheets of various sizes is not satisfactory in the corrugated box art because such boxes vary tremendously in panel dimension in the larger types, some being shallow, some deep, some adapted to enclose a mattress or bicycle, some adapted to enclose a chair or set of books.

In machines of this class, it is most important that a large range of blank sizes be foldable into cartons on a single machine, because the runs are usually short and, unless rapid changeover is possible, hand folding may be less costly.

Small size blanks can be handled more rapidly than large size blanks and the machine of this invention achieves high production by running twice as many small blanks as large blanks in a given period of time. Changeover to various sizes of blanks is accomplished in about three minutes by adjusting the parts and no parts need be removed from the machine.

The machine of this invention makes use of a rotary type feeder, with two sets of blank kickers or pushers thereon, one set being used and the other retracted for large blanks and both sets being used for smaller blanks. The unidirectional feeder tends to continually urge all blanks in the stack toward the gateway rather than imparting a back and forth motion to the blanks as in reciprocating feeds. Thus the third blank from the bottom cannot enter the gateway while the second blank from the bottom is frictionally urged rearwardly as in certain type feeds. Similarly the stack of blanks receives a jogging or up and down loosening motion from the rotary feeder, but otherwise rests undisturbed on the platforms with no forward and then backward travel of the second blank from the bottom.

The capability of moving the entire feed wheel support backward and forward in accordance with the size blank being run on the machine is a particular advantage in that access to the magazine from the rear is the same in all cases. Thus when small blanks are being run, the operator can easily fill the magazine without having to reach over fixed frame pieces or stumble over tracks and the like.

It has heretofore been proposed in U.S. Patent No. 1,680,863 to Ford of August 14, 1928, to support the forward portion of a stack on a platform and to support the rearward portion on the circumference of a rotatable feed wheel having feed fingers thereon for pushing the trailing edge of each bottom sheet through a feed passage. The device can accommodate cards of various lateral dimensions by expanding the magazine side walls but the longitudinal dimension of the cards apparently remains uniform.

In U.S. Patent No. 2,374,698 to Pechy of May 1, 1945 the bottom sheet of the stack is supported on longitudinal rails above the level of the feed line and is drawn down by suction cups into the path of feed fingers on a rotatable feed member. Each bottom sheet of thin metal is thus bowed before it is fed and springs back to flat condition along the feed line. The Pechy device, like that of Ford, appears to be designed to feed sheets having uniform longitudinal dimensions rather than sheets or blanks of continually changing dimensions.

It is the principal object of this invention to provide a method and apparatus for feeding sheets wherein the sheet magazine and sheet feed is expandable and contractable to accommodate a wide range of sizes without malfunction of the feed.

Another object of the invention is to provide feed apparatus capable of feeding large or small sheets of corrugated paperboard even when the coefficient of friction of the faces thereof is relatively high and the sheets are slightly bowed concavely or convexly.

A further object of the invention is to provide novel magazine and feed means for corrugated sheets in which a rear magazine platform and a movable feed member have a fixed relationship but are movable longitudinally relative to a forward magazine platform and sheet passage.

Still another object of the invention is to provide a longitudinally expandable and contractable magazine for a stack of sheets wherein the magazine frame supports are longitudinally telescopic and flexible guides for the lowermost sheet in the stack are also longitudinally expandable and contractable.

A still further object of the invention is to provide novel sheet orienting mechanism for laterally aligning and centering box blanks in a magazine as well as novel forward and rear presser mechanism for flattening bowed sheets in a magazine just prior to passage through a separation gateway.

Other objects and advantages of the method and apparatus of the invention will be apparent from the claims, the description of the drawings, and from the drawings in which:

Fig. 1 is a side elevation, in section on line 1—1 of Fig. 3, of the invention with the parts in position to feed short length sheets or box blanks.

Fig. 2 is a view similar to Fig. 1 showing the parts of the invention in position to feed elongated sheets or box blanks.

Fig. 3 is a plan view of the device shown in Fig. 2.

Fig. 4 is an end view in section on line 4—4 of Fig. 2 showing the sectional rearward magazine platform and the spaced feed fingers of the rotatable feed member.

Fig. 5 is an enlarged fragmentary side elevation of one of the rearward presser mechanisms for flattening bowed sheets.

Fig. 5A is an end view in section on line 5A—5A of Fig. 5.

Fig. 6 is a view similar to Fig. 5 showing the parts in pressing position.

Fig. 7 is an end view in section on line 7—7 of Fig. 2 showing the forward presser mechanisms, the automatic wind-up drums for the flexible guides and the forward

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lateral alignment plate at the longitudinal centre line of the apparatus.

Fig. 8 is an enlarged, fragmentary end view of one of the presser fingers of the invention provided with blunt teeth at the terminal tip thereof.

Fig. 8A is a side view of the device shown in Fig. 8.

Figs. 9 and 9A are somewhat diagrammatic views, similar to Figs. 1 and 2, showing the jogging action of the resilient hooked feed fingers of the invention.

Fig. 10 is an enlarged, fragmentary plan view showing the forward and rearward lateral alignment plates in the superposed slits of a stack of box blanks.

Fig. 11 is a fragmentary rear view of a modified form of rotatable feed member in which the feed fingers are movable from operative to non-operative position while the feed member is continuously rotating.

Fig. 12 is a view similar to Fig. 11 showing the feed fingers in another position.

Fig. 13 is a fragmentary view, in section, on line 13—13 of Fig. 11 showing both sets of feed fingers in operative position.

Fig. 14 is a view in section on line 14—14 of Fig. 12 showing both sets of feed fingers in non-operative position and

Fig. 15 is an enlarged plan view of the blade or switch mechanism of the device.

The magazine and feed apparatus of this invention is useful for feeding single sheets along the feed, or paper line, of sheet treating machines of various types, especially when such sheets are in sizes such as ten feet wide and five feet long. The apparatus is illustrated as applied to a corrugated box folding machine, such machines being sixty or more feet long and ten to fifteen feet wide because the box blanks are large and the panels being folded swing in relatively wide arcs. Only the magazine and feed zone of such a machine is illustrated in detail herein, since the creasing, folding and gluing apparatus forms no part of the present invention.

As shown, 20 is the frame of a sheet treating machine having an upper endless carrier 21, trained around pulley 22 on shaft 23 and a lower endless carrier 24 trained around pulley 25 on shaft 26. The adjacent stretches 27 and 28 of the carriers travel in the direction of the arrows and mutually define the longitudinal feed, or paper line 29 of the machine. Suitable presser rolls 31 are provided and a pair of feed rolls 32 and 33, having a nip 34 at the level of the feed line 29, are also provided. The feed rolls and carrier rolls are driven by the gear train 35, the feed rolls seizing each individual sheet successively entering the nip thereof and advancing the sheet further along the feed line 29 and into the grip of the carriers 21 and 24.

The separation means 36 of the invention is combined with a portion of the magazine means thereof in that it includes the laterally extending, flat forward platform 37 arranged to support the forward edge portion 38 of the stack 39 at the level of feed line 29. Forward platform 37 is straight and horizontal and forms the lower wall of a sheet passage, or gateway, 41 with the terminal tips 42 and 43 of a pair of vertically movable gates 44 and 45 forming the upper wall of the passage. The gates 44 and 45 may be raised and lowered independently by turn knobs such as 46 or jointly from either side of the apparatus by shaft, worm gear and turn wheel mechanism, such as 47, to vary the height of the passage 41 in accordance with the thickness of the sheets and thereby pass only a single sheet at a time. The forward platform 37 tapers downwardly at its rearward edge 49 and the horizontal portion 50 extends longitudinally only enough to offer support to the stack along the forward edge of the sheets, or box blanks therein.

The feed means 51 of the invention is also combined with a portion of the magazine means in that it includes the laterally extending, flat, rearward platform 52 arranged to support the rearward edge portions 53 of the

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stack 39 at the level of feed line 29. Like platform 37, platform 52 is horizontal under the edge of the stack and preferably tapers downwardly at its forward edge. Platform 52 is formed of laterally spaced individual sections such as 54 and 55 having spaces such as 56 and 57 therebetween. Feed means 51 includes a rotatable feed member 58 revoluble on the lateral shaft 59 journaled in the side frame plates 61 and 62. Member 58 is preferably formed by a pair of spiders 63 and 64, each at an opposite end of shaft 59 and each having radial arms such as 65 and 66. A pair of laterally extending bars 67 and 68 connect the opposite ends of the arms 65 and 66 and extend substantially the full width of the apparatus.

A plurality of identical feed fingers such as 71 and 72 are laterally spaced along each bar 67 and 68 for substantially the full width thereof, with each finger following a circular path which passes through one of the spaces such as 56 and 57 between platform sections such as 54 and 55. The tips 73 of each feed finger are hooked as at 74 and the upper arc, or sector, of the circular path thereof at 75 reaches above the level of the feed line 29, as best shown in Fig. 9. It should be noted that the shaft 59 is in advance of the rearward portion 76 of rearward platform 52 and the hooks 74 of the feed fingers engage the trailing edge 77 of each successive lowermost sheet 78 at the level of feed line 29. The resilient shanks 79 of each feed finger then yield downwardly under the weight of the stack 39 to permit the hooks to advance in a straight, horizontal line until the hooks disappear below feed line 29. Although the fingers are resilient and yield, they tend to assume some of the weight of the stack and at high speed have a jogging effect which assists in reducing the frictional contact between the lowermost sheet 78 and the next sheet 81. Unlike reciprocating feed fingers or plates of the prior art the rotatable feed fingers of this invention impart a sudden impact on the trailing edge 77 to slide the leading edge 82 through passage 41 while the major portion of the bottom of the stack 39 is unsupported, and while also imparting a slight upward jog to the rearward portion of the stack. The trailing portion of the lowermost sheet 78 thus tends to flex slightly downwardly away from the stack to permit air to enter therebetween at the same time that the remainder of the stack tends to jog upwardly away from the lowermost sheet (see Fig. 9A).

The bottom 83 of magazine 84 of this invention is thus formed by the rearward platform 52 and the forward platform 37 with a central lateral opening 85 therebetween which permits each successive lowermost sheet 78 to be flexed downwardly therein when fed forwardly from under the stack 39. The forward wall 87 of the magazine 84 is formed by the upstanding gates 44 and 45, the side walls may be formed by side stack plates such as at 86 and the rearward wall may be any convenient upstanding guide attached to the feed means 51.

The feed means 51 is movable longitudinally toward and away from the separation means 36 by translation mechanism 88 in order to expand and contract the magazine 84 to accommodate sheets of various longitudinal dimensions. As shown, the frame 20 includes a pair of fixed, opposite, rearwardly extending frame supports 89 and 90 of channel cross section and feed means 51 includes a pair of movable, opposite, forwardly extending frame supports 91 and 92 of I cross section longitudinally telescopic therein. A threaded post such as at 93 supports the free end of each frame support such as 89 and 90 on the floor but the feed means 51 is not supported on the floor at all but only on the frame 20. Thus, regardless of the longitudinal position of feed means 51, it remains laterally and vertically aligned with the separation means 36. The side frame plates 61 and 62 of feed means 51 are joined by lateral rods 94, 95 and 96 and an end plate 97 is also provided for rigidity. Because of the cantilever type support of feed means 51 the operator

can reach the magazine 84 without interference by a fixed feed platform and without stumbling over fixed floor tracks regardless of the longitudinal position of the feed means. Gear racks 98 and 99 are fixed along the outside of each movable frame support 91 and 92 (Fig. 7) and meshed with gears 101 and 102 carried by stub shafts 103 and 104 journaled in the fixed frame supports 89 and 90. Each shaft 103 and 104 carries a gear 105 or 106 meshed with spur gear 107 or 108 rotatable with lateral shaft 109. Handle 111 is connected by suitable ratchet mechanism to shaft 109 whereby turning the shaft causes gears 101 and 102 to advance or retract feed means 51 relative to separation means 36 to expand and contract the magazine 84 longitudinally.

The magazine side plates 86 are supported by brackets such as 112, having bolts 113 laterally tightenable in a laterally extending slot 114 for lateral expansion and contraction of the magazine. Similarly the gates 44 and 45 are threadedly mounted on the lateral threaded shafts such as 115 whereby turning the shafts moves each gate an equal distance laterally toward or away from the longitudinal centre line of the device.

The drive mechanism for the rotatable feed member 58 includes the sprocket 117 fixed to shaft 59, the chain 118, tension pulley 119 and sprocket 120, sprocket 120 being driven by shaft 121 of gear reducer 122. Reducer 122 is driven by longitudinal shaft 123 which is longitudinally telescopic within the hollow main drive shaft 124 of gear reducer 125. Main shaft 124 is driven by an electric motor not shown, and the lateral shaft 126 of reducer 125 provides power for the gear train 35 driving the feed rolls 32 and 33 and the carrier rolls 22 and 25. Regardless of the longitudinal position of feed means 51, the longitudinally telescopic drive mechanism assures that the rotatable feed member 58 will be in synchronism with the feed rolls and carrier pulleys. For example, each successive lowermost sheet 78 in magazine 84, which may be fifty inches long, will be advanced about six inches by the impact of fingers 71, with each revolution of member 58, whereupon it will enter nip 34 and be completely drawn through passage 41. A distance of about six inches will be maintained between sheets because the circumferential length of the circular finger path is greater than the length of the sheet and the surface speed of the feed rolls and feed fingers is approximately the same.

The lateral bars 67 and 68 are each rotatably mounted in the arms 65 and 66 with a removable pin such as 128 arranged to lock the fingers in the operative position shown or in a radially inward inoperative position. With sheets of shorter lengths, such as twenty-five inches or less, the fingers on both bars may be used to provide two feeds with each revolution (see Fig. 9A).

Preferably the apparatus of the invention includes a plurality of laterally spaced, flexible yieldable guides such as 130 and 131 extending longitudinally across the bottom opening 85 of magazine 84 from rearward platform 52 to forward platform 37. Guides 130 and 131 offer only insubstantial yieldable support to the stack 39 and serve mainly to support and guide the trailing portion of each successive lowermost sheet along the feed line 29 after it has been advanced by fingers 71 and while the sheet is advanced from under the stack by feed rolls 32 and 33. The sudden forward and slightly upward impact of fingers 71 on the trailing edge 77 of each sheet 78 first dislodges the trailing edge from the rearward portion 76 of rearward platform 52 and then urges the trailing edge 77 into bottom opening 85. The vertical separation of the lowermost sheet from the next successive sheet reduces frictional contact therebetween and is permitted by the yieldable guides such as 130 and 131 which assume a predetermined sag below the level of the feed line 29. The guides 130 and 131 are metal tapes fixed at one end 132 to platform 52 and wound on rotatable drums such as 133 after passing over rotatable drums

such as 134 proximate forward platform 37. The winding means 135 of the invention comprises the lateral shaft 136 upon which the laterally spaced wind-up drums 133 are mounted, shaft 136 being rotated by a sprocket and chain train 137 actuated by the lateral shaft 109 of the translation mechanism (Fig. 1). Thus as the feed means 51 is moved toward and away from separation means 36 by handle 111, the flexible bottom guides 130 and 131 are correspondingly wound and unwound to maintain the predetermined tension and yieldability to a sag therein. As best shown in Fig. 7 a constant take-up spring 138 is mounted on shaft 109 to maintain predetermined tension on the guides 130 and 131 at all times.

When the sheets to be fed in the apparatus of this invention are box blanks of corrugated paperboard, novel lateral alignment means is provided. As best shown in Figs. 1, 3, and 10, a forward alignment plate 140 forms part of separation means 36 and a rearward alignment plate 141 forms part of movable feed means 51. The forward alignment plate 140 is mounted vertically on the lateral frame piece 142 of frame 20, proximate the longitudinal centre line of the apparatus and extends longitudinally and rearwardly therefrom. Plate 140 tapers rearwardly and downwardly at 143 and then forwardly and downwardly at 144 to terminate at the level of the top of sheet passage 41. The vertical slot 145 formed by the superposed slits 146 between the leading flaps of the sheets or box blanks 78, at the centre crease line thereof fit around the plate 140 and assure that each blank in the magazine is properly centered. The rearward alignment plate 141 is mounted vertically on a bracket 147 carried by the platform 52 proximate the longitudinal central line of the apparatus and also fits within the adjacent slits of the blanks. At least one of the plates 140 or 141, and preferably the rearward plate 141, includes a freely revoluble roller 148 mounted at the top thereof in journals 149 and 150 to revolve around a longitudinally extending horizontal axis. The operator is thus enabled to first align the forward slits of a pile of blanks on the plate 140 and then permit the rearward slits of the pile to fall down plate 141 with the assistance of roller 148. Plates 140 and 141 also serve as side guides for the magazine 84 located intermediate of the blanks rather than along the side edges thereof.

It is thus possible to completely eliminate the side guides 86 of magazine 84 and depend entirely on the plates 140 and 141 for alignment. The carriers 21 and 24 are preferably aligned with the centre slits of the blanks to assure accurate alignment through the next succeeding zone of the machine. It will be understood that the glue flaps of large blanks of corrugated paperboard sometimes vary in width and that large blanks of any type paperboard may also vary in width. The elimination of side magazine walls, such as 86, prevents misalignment due to such variations in width and the plates 140, 141 assure the exact alignment of the centre slits of the blanks with the carriers.

As best shown in Figs. 5, 6, 8 and 8A forward presser mechanism 152 and rearward presser mechanism 153 is provided to flatten the forward and rearward edges of the sheets or blanks in the stack 39 into a horizontal plane just prior to feeding. As shown in Fig. 4 preferably there are a plurality of rearward presser mechanisms such as 153 each positioned above one of the individual platform sections 54 or 55 of the rearward platform 52. Each presser mechanism 153 includes a sub frame 154 laterally slideable on a lateral tongue element 155 of frame 20 by means of the lateral groove 156 and fixed in position therealong by a set screw 157. A lateral cam shaft 158 extends through all of the mechanisms 153 and carries a cam plate 159 arranged to lift the roller cam follower 161 with each oscillation of shaft 158. As shown in Fig. 1, cam shaft 158 is journaled in the side frame plates 61 and 62 and includes a crank arm 162 connected by a link 163 to one arm 164 of a lever 165

pivoted at 166 to side plate 62. The other arm 167 of lever 165 carries a roller cam follower 168 which is actuated by a cam 169 rotated by shaft 59. Cam 169 is doubled so that the two parts 171 and 172 may overlie each other when only one set of feed fingers is used or part 172 may be turned through 180° and locked by pin 173 when both sets of feed fingers are used, thereby actuating the presser mechanism twice with each revolution of feed member 58.

Roller follower 161 is rotatably mounted on an arm 174 of a block 175, the block 175 having a pair of opposite nylon guides 176 and 177 pressed outwardly by a spring 178 into the opposite channelled tracks 180 and 181. A presser finger 182 is fixed to the block 175 and includes an arcuate terminal tip 183 curved inwardly toward the adjacent sheet edges in the magazine 84. A cover plate 184, on sub frame 154 prevents the tip 183 from engaging the sheets when the block 175 is in the upward position shown in Fig. 5 but enables the tip 183 to engage and press down on the sheet edges when in the downward position shown in Fig. 6. A coil spring 186 having a yoke 187, rod 188 and threaded adjusting sleeve 189 connects the arm 174 to the sub frame 154 and serves as a return spring to urge the block 175 downwardly and the tip 183 forwardly under uniform pressure after the cam lift mechanism has operated.

The rearward presser mechanisms 153 are timed to exert a downward pressure on the bottom three or four sheets in the magazine 84 to press flat any bows in the lowermost sheet 78 and create a true horizontal trailing edge 77 resting on rearward platform 52 just as the feed fingers 71 or 72 strike the trailing edge in their circular paths. The presser fingers then move outwardly away from the stack as they are lifted by cam plate 159 to the position of Fig. 5. Upon being released by the cam lift mechanism, the coil spring 186 moves the presser fingers downwardly and longitudinally to secure a new grip on the trailing edge portions of the sheets.

Each forward presser mechanism 152 operates in a similar manner and includes the forward presser finger 190, cover plate 191, roller cam follower 192 and other parts substantially identical in operation with that of presser mechanism 154 and not shown in detail. Preferably a finger 190 is located centrally of each gate 44 and 45 in order to press flatwise that portion of the sheet about to pass through the passage, or gateway 41. The forward presser mechanisms are actuated by the lateral cam plate 193 of lateral cam shaft 194, shaft 194 having a crank arm 195 connected by the link 196 to the yoke cam follower 197 and eccentric cam 198 on shaft 26 of lower carrier pulley 25. Thus the forward presser mechanism 152 is timed to press the leading edges of the sheets or blanks in the magazine 84, flatwise against the horizontal portion 50 of forward platform 37 to remove any bows in the sheets just prior to the impact on the sheet of the feed fingers 71.

As shown in Figs. 11-15 a rotatable feed member 199 may be provided which is similar to feed member 53 except that the feed fingers are selectively movable during the rotation of the member from operative to non-operative position and vice versa. The feed member 199 includes a pair of spiders 201 and 202 fast to the lateral shaft 200, the shaft 200 being journaled in the side frame plates 61 and 62. A pair of laterally extending bars 203 and 204, similar to bars 67 and 68 are journaled at each opposite end in the spiders 201 and 202 and each carries at least one feed finger such as 205 and 206, similar to feed fingers 71 and 72.

Each bar such as 203 is connected by a pair of toggle links 207 and 208 to a bracket 209 on shaft 200, the central pivot 211 of the toggle links being connected to an axially extending rod 212. Link 207 includes a turn-buckle 213 for adjusting its length and rod 212 is guided in a plate 214 on shaft 200. Shaft 200 includes an axial bore 215 and an axial slot 216, there being an axially

slideable rod 217 in bore 215 threaded in a collar block 218 extending through slot 216 and connected to the rods such as 212. The outer end of rod 217 includes a radial arm 219 having a rotatable cam follower 221 at its terminal end.

A cam 222 is fixed to side frame piece 62 to encircle the path of follower 221 and includes an inner path 223 and an outer path 224 as well as a movable blade, or switch 225. When blade 225 is in the position shown in Fig. 1 the follower 221 is guided into, and retained in, the inner path 223 thereby straightening the toggle links 207 and 208 and causing the feed fingers 205 and 206 to reach above the paper line and feed the sheets.

When blade 225 is moved to the position of Fig. 2, cam follower 221 is guided into, and retained in, outer path 224 thereby retracting the feed fingers to below the paper line and halting the feed while the member 199 continues to rotate and the machine continues to run off the sheets already fed.

Blade 225 is pivotally mounted at 226, and adjustable on the pivot mounting by means of the threaded split clamp 227. As best shown in Fig. 15, blade 225 is yieldably and resiliently mounted to prevent dead centres and prevent jamming. The operating arm 228 of the blade 225 is pivotally clamped between a pair of parallel bars 230 and 231 each bar being pivoted at its opposite end 232 and 233 to the lever 234, and encircled by a coil spring 235.

Lever 234 is pivoted at 236 to a frame piece 237 of the machine and an operating handle 238 extends laterally across the entire rear of the machine for ready access by the operator. Handle 238 is laterally slidable in the frame piece 237 and is pivotally connected at 239 to lever 234. A toggle spring 241 is provided for spring urging the handle 238 from dead centre into the operative or the nonoperative positions.

The coil spring 235 and bars 230 and 231, as shown in dotted lines in Fig. 15, permit the handle 238 to be shifted from one position to the other, without a rigid resulting switching of the blade 225 which might cause breakage. The blade 225 under such circumstances merely bears resiliently against follower 221 until the follower revolves out of the way and then the blade springs into the desired switch position.

I claim:

1. Sheet feeding apparatus for feeding sheets individually and successively along the longitudinal feed line of a sheet treating machine, said apparatus comprising combined sheet magazine and separation means including a pair of power driven sheet advancing rolls, forward magazine wall, a horizontal forward magazine platform supporting only the forward end of a stack of sheets with the lowermost sheet at the level of said feed line and a forward sheet gateway, above said platform, adapted to pass only a single lowermost sheet of said stack at a time; combined magazine and feed means, including a horizontal rearward magazine platform supporting only the rearward end of said stack with the lowermost sheet therein at substantially the level of said feed line, a rotatable feed member below said rearward platform and at a spaced distance below said feed line, said member having a plurality of elastomeric, downwardly yieldable, hooked feed fingers thereon reaching above said platform to engage behind the trailing edge of each successive lowermost sheet supported on said rearward platform for advancing at least one sheet through said passage with each revolution thereof; drive mechanism for rotating said member in synchronization with said sheet advancing rolls and cantilever support mechanism for translating said magazine and feed means longitudinally relative to said magazine and separation means for expanding and contracting the magazine of said apparatus to accommodate sheets of various lengths.

2. A combination as specified in claim 1 wherein said rotatable feed member comprises a spider proximate each

opposite end of a rotatable shaft coextensive laterally with the maximum area sheet to be fed by said apparatus, the free ends of the arms of said spiders being connected by laterally extending bars and said feed fingers are spaced along said bars from one spider to the other whereby the full width of the trailing edge of a maximum area sheet may be engaged by said elastomeric, hooked feed fingers even when said sheets are slightly warped.

3. A combination as specified in claim 1 wherein said rearward platform is formed of individual sections uniformly spaced apart laterally, each section terminating in a downwardly tapered forward edge portion and said feed fingers are laterally spaced along said rotatable feed member to rotate in paths passing through the spaces between said platform sections.

4. A combination as specified in claim 1 wherein said feed fingers are of resilient, flexible sheet material having one end fixed to said rotatable member and having a hook at the other end, said hooked end being adapted to trail said fixed end outside the circular path thereof, hook onto the trailing edge of a lowermost sheet in said stack and flex downwardly while advancing said sheet in a straight horizontal path along said feed line.

5. A combination as specified in claim 1 wherein said sheet magazine and separation means is stationary, said sheet magazine and feed means is longitudinally movable and said cantilever support mechanism includes longitudinally telescopic frame supports connecting said means together.

6. A combination as specified in claim 1 wherein said drive mechanism includes a longitudinally telescopic drive shaft for synchronizing the timing of said apparatus while permitting longitudinal translation of the magazine thereof.

7. A combination as specified in claim 1 plus a longitudinally expandable bottom guide of flexible material extending between said forward platform and said rearward platform for guiding the trailing portion of each lowermost sheet along said feed line, while yieldably supporting said blanks.

8. A combination as specified in claim 7 wherein said guide comprises a plurality of longitudinally extending, laterally spaced tapes each having one end fixed to said rearward platform and the other end thereof wound on a rotatable drum proximate said forward platform.

9. A combination as specified in claim 7 wherein said guide comprises a plurality of laterally spaced tapes wound on rotatable drums and means for winding said drums in synchronization with the movements of said cantilever support mechanism.

10. A combination as specified in claim 1 plus forward presser mechanism on said sheet magazine and separation means adapted to flatten the leading edge of each successive lowermost sheet against said forward platform for free travel through said passage and rearward presser mechanism on said sheet magazine and feed means adapted to flatten the trailing edge of each said lowermost sheet against said rearward platform for firm, full width engagement thereof by said feed fingers.

11. A combination as specified in claim 10 wherein said forward and rearward presser mechanisms each comprise a sub frame laterally slideable on said apparatus above the said feed line, a presser finger mounted on said sub frame to slide up and down in an arcuate path, cam lifting and spring return mechanism for actuating said finger and means, connected to said rotatable member, for timed driving of said cam lifting mechanism in synchronization therewith.

12. Blank feeding apparatus for feeding box blanks individually and successively along the paper line of a box folding machine, said apparatus comprising blank separation means including power driven blank advancing rolls, a forward platform at the level of said paper line and a forward feed gate thereabove, said platform and gate jointly defining a passage above the level of said

paper line for passing only the lowermost blank of a stack of blanks supported on said platform into the nip of said rolls; blank feed means including a rearward platform at the level of said paper line and a rotatable feed member therebelow, said feed member having feed elements thereon reaching above said paper line in the upper arc of their path thereon for engaging the trailing edge of the lowermost blank of said stack also supported on said rearward platform, longitudinally telescopic frame supports in said apparatus connecting said feed means to said separation means for increasing and decreasing the longitudinal space between said means to accommodate blanks of various lengths and longitudinally telescopic drive mechanism in said apparatus connecting said rotatable member to said power driven rolls for timed driving of said member in synchronization therewith.

13. A combination as specified in claim 12 wherein said blank separation means and said blank feed means each include a longitudinally extending, vertical, alignment plate mounted above said paper line proximate the longitudinal centre line of said apparatus, each said plate fitting within the vertical slot formed by the superposed longitudinally extending flap slits of a stack supported on said platforms for centring and aligning the blanks in said stack.

14. A combination as specified in claim 13 plus a cylindrical roll mounted at the top of at least one said plate, said roll being freely rotatable on a horizontal, longitudinal axis within the confines of said slot and slits to guide blanks down onto said plate.

15. A combination as specified in claim 12 plus a longitudinally expandable and contractable guide of flexible material extending from said rearward platform to said forward platform for guiding each lowermost blank of a stack along said paper line and means for maintaining uniform tension on said guide at various spacings of said feed means from said separation means.

16. The method of feeding box blanks of corrugated paperboard individually and successively from the bottom of a stack which comprises the steps of rigidly supporting only the forward and rearward portion of said stack while yieldably supporting the central portion thereof said step being independent of any frictional force tending to move the lowermost sheet forwardly in the direction of feeding; retaining the forward edges of all of the sheets in said stack, except each successive lowermost sheet, against movement in a forward direction and imparting a sudden forward impact along spaced zones of the full width of the trailing edge of each successive lowermost sheet, while yieldably lifting and then lowering the rearward portion of said stack to jog the same.

17. A method as specified in claim 16 plus the steps of flattening each successive lowermost sheet into a horizontal plane at the forward edge portion and at the rearward edge portion thereof just prior to applying said sudden impact to the trailing edge of said sheet.

18. A method as specified in claim 16 plus the step of resiliently supporting the trailing portion of each successive lowermost sheet as it moves forwardly below said stack under said impact.

19. In sheet feeding apparatus the combination of a longitudinally expandable and contractable magazine for holding a stack of sheets, said magazine having a central, lateral opening in the bottom thereof adapted to permit each successive lowermost sheet to flex downwardly thereinto when fed forwardly therefrom; presser mechanism along the front and rear of said magazine adapted to flatten each successive lowermost sheet in said stack into a horizontal plane; flexible, yieldable guides extending longitudinally across the opening in said magazine bottom for guiding the trailing portion of each successive lowermost sheet in said stack along the plane of said magazine bottom, a rotatable feed member at the rear of said magazine, said member having a plurality of spaced resilient, hooked feed fingers adapted to engage

along the full width of the trailing edge of each successive lowermost sheet and impart a sudden forward impact thereto and timed drive mechanism for actuating said rotatable member and said presser means in synchronism.

20. Presser mechanism for flattening sheets of paper-board prior to feeding the same from the bottom of a sheet magazine, said presser mechanism comprising a frame adapted to be mounted along the leading or trailing edge of said magazine, a presser finger mounted to slide up and down in said frame, said finger having a lower terminal tip curved inwardly toward the sheets in said magazine, a finger track in said frame adapted to guide said finger tip horizontally toward the sheets in said magazine during downward travel and horizontally away therefrom during upward travel, cam lifting mechanism in said frame for raising said finger in said finger track and spring return mechanism, operably connected thereto, for lowering said finger in said finger track, under uniform spring pressure, for engaging and flattening the adjacent edge portions of the lowermost sheets in said magazine.

21. Presser means as specified in claim 20 wherein the terminal edge of the terminal tip of said presser finger is serrated with blunt teeth to secure a firm grip on the adjacent edge portions of the sheets in said magazine.

22. Apparatus for feeding box blanks individually and successively from the end of a stack of blanks, said apparatus comprising blank separation means having a blank passage adapted to pass only a single endmost blank at a time in the direction of feeding; rotary blank segregation means having a plurality of elastomeric, downwardly yieldable, hooked feed fingers arranged to hook onto the trailing edge of each successive endmost blank to push said blank through said passage, said segregation means being telescopably supported on said apparatus for translation toward and away from said passage and telescopable drive mechanism for actuating said segregation means in synchronism with said apparatus in various positions of translation.

23. A combination as specified in claim 22 plus presser mechanism at said blank passage applying downward pressure on the leading edge portions of the lower blanks of said stack to flatten the same for travel through said passage.

24. A combination as specified in claim 22 plus forward and rearward presser mechanisms, synchronized with said drive mechanism for flattening the leading and trailing edge portions of each successive endmost blank just prior to feeding thereof through said passage.

25. A combination as specified in claim 22 plus a forward, upstanding, alignment plate proximate the longitudinal center line of said separation means and fitting within the centre slots of said stack of blanks for aligning the same prior to feeding.

26. A combination as specified in claim 22 wherein said segregation means includes a rigid, immovable platform supporting the trailing portion of said stack and having feed finger openings therealong, whereby said feed fingers periodically impart a sudden impact to the trail-

ing edge of each successive endmost blank in the direction of feeding without imparting any rearward movement to said blanks.

27. A combination as specified in claim 22 plus a plurality of self adjusting yieldable members extending along the bottom of said stack from said separation means to said segregation means for yieldably supporting the trailing portion of each lowermost blank fed through said passage, said members being automatically extensible and contractable during translation of said blank segregation means.

28. A combination as specified in claim 22 plus presser means at the forward and rearward edges of said stack, slot guide means at the centre of said stack and self adjusting extensible and contractable members along the bottom of said stack whereby the feeding action of said translatable segregation means is accurate in any position of translation.

29. A combination as specified in claim 27 wherein said self-adjusting, yieldable members comprise a plurality of laterally spaced flexible tapes wound on drums adapted to wind and unwind during said translation to maintain uniform tension therein.

30. A combination as specified in claim 1 plus mechanism selectively operable during the rotation of said feed member for moving said feed fingers from sheet engaging position to non-sheet engaging position at the feed line of said apparatus.

31. A combination as specified in claim 12 wherein said blank feed means includes cam mechanism operably connected to the feed elements of said rotatable feed member and adapted to retract said elements below said paper line during the rotation of said member.

32. In sheet feeding apparatus for feeding each successive endmost sheet from a stack of sheets, the combination of means for retaining the stack of sheets; gate means along the leading edge of each said endmost sheet and having a passage for passing only one sheet at a time; a rotating feed member proximate the trailing edge of each said endmost sheet, said member having hooked, resilient, feed fingers therearound arranged to engage the trailing edge of each endmost blank and push the same into said gate passage and cam mechanism associated with said feed member for selectively advancing and retracting said fingers during rotation thereof and maintaining said fingers in advanced or retracted position around the entire circular path of said rotating feed member.

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