

Sept. 11, 1962

M. B. DUNN

3,053,529

BLANK FEEDING APPARATUS FOR BOX ERECTING MACHINE

Filed Feb. 1, 1960

6 Sheets-Sheet 1

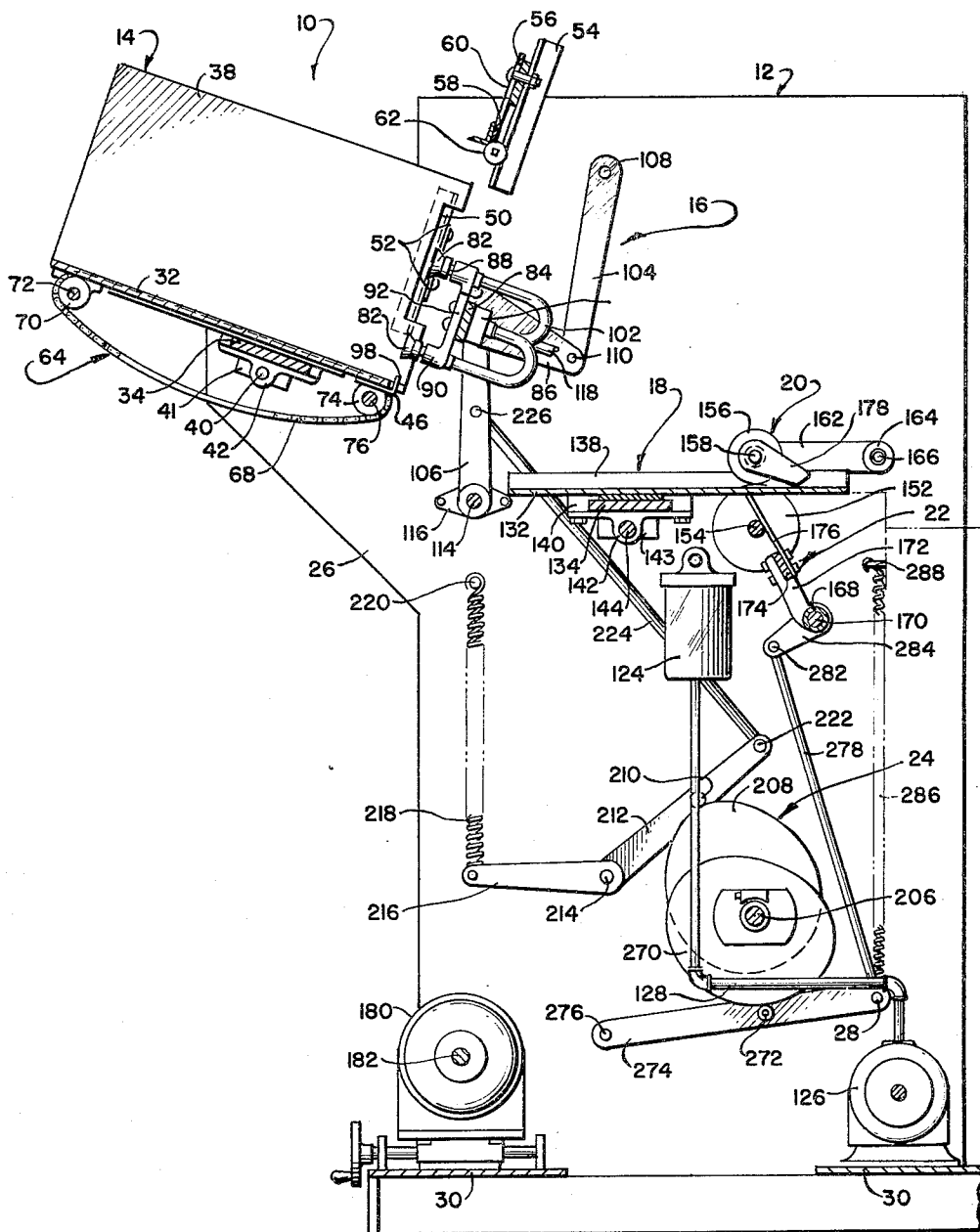


FIG. 1

INVENTOR

MAURICE B. DUNN

BY *Cushman, Parley & Cushman*

ATTORNEY

Sept. 11, 1962

M. B. DUNN

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6 Sheets-Sheet 2

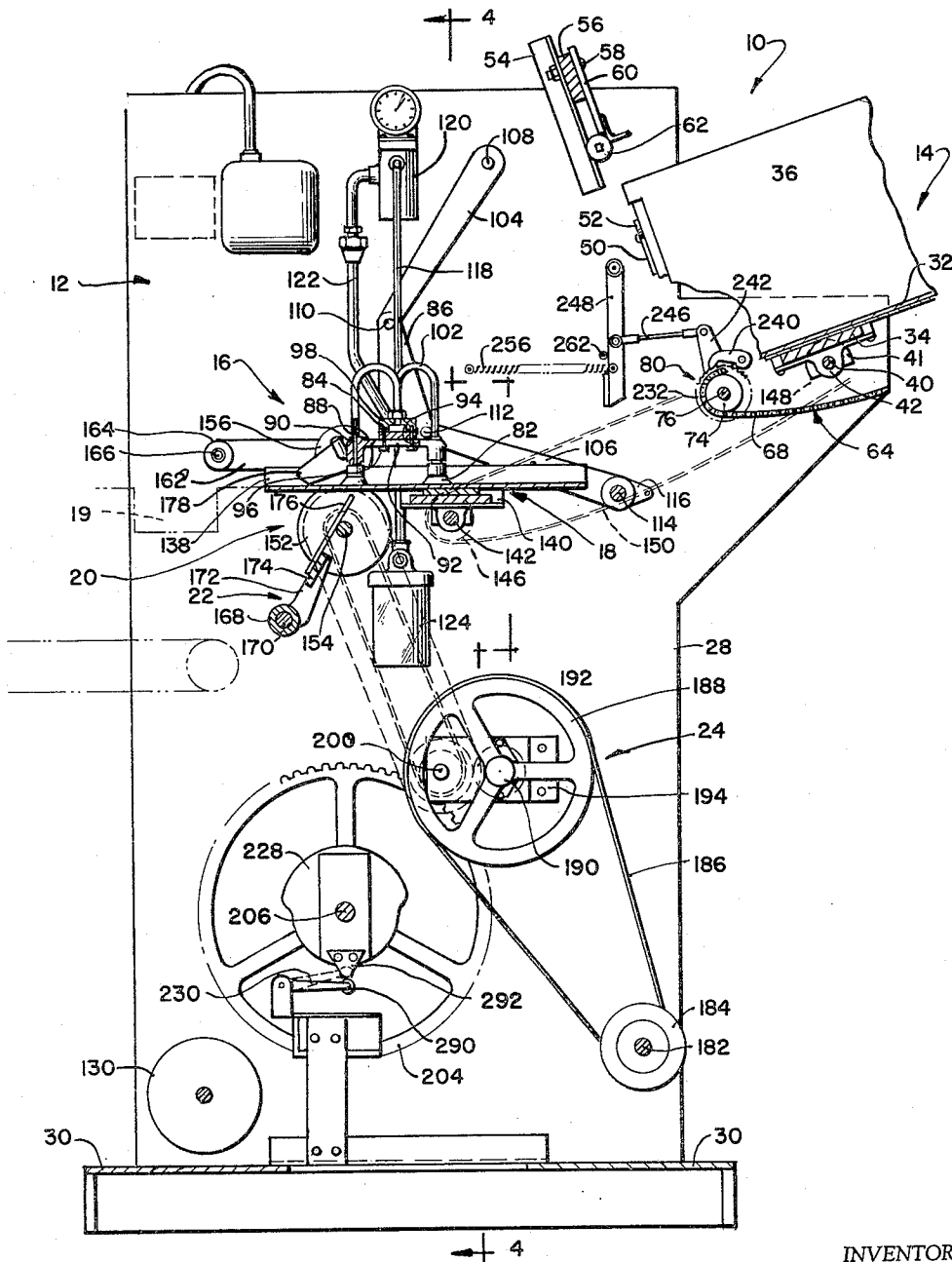


FIG. 2

INVENTOR

MAURICE B. DUNN

BY *Cushman, Parley & Cushman*
ATTORNEY

Sept. 11, 1962

M. B. DUNN

3,053,529

BLANK FEEDING APPARATUS FOR BOX ERECTING MACHINE

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FIG. 3

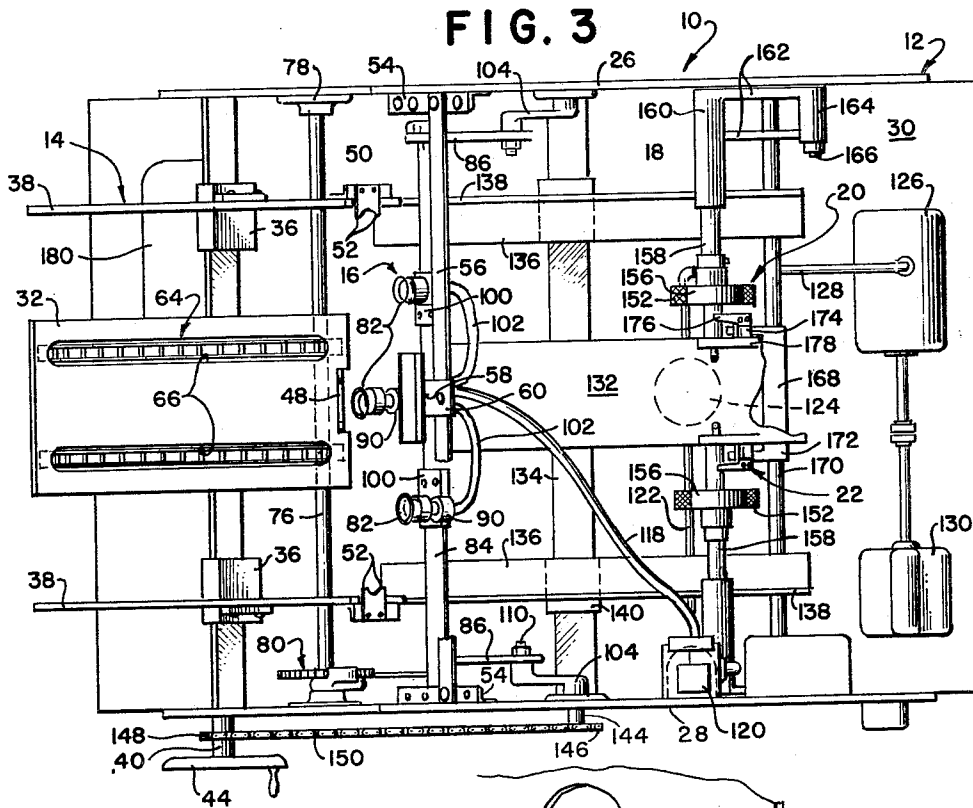
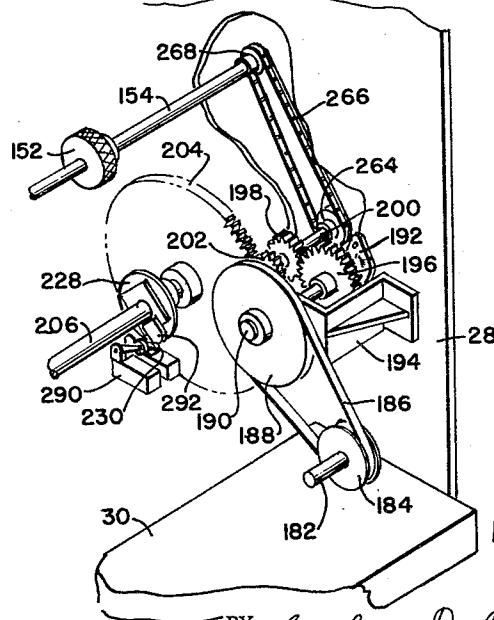


FIG. 5



INVENTOR
MAURICE B. DUNN

BY *Cushman, Darby & Cushman*
ATTORNEYS

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M. B. DUNN

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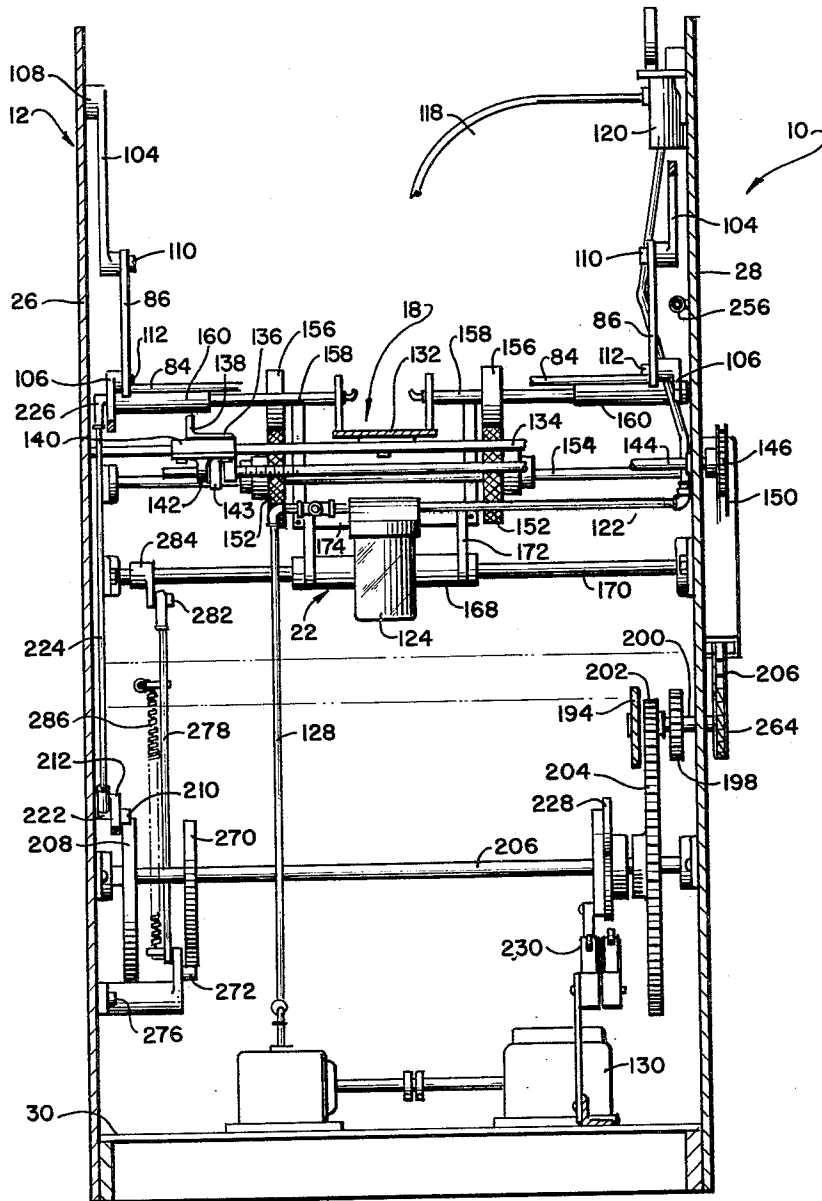


FIG. 4

INVENTOR

MAURICE B. DUNN

BY *Cushman, Parley & Cushman*
ATTORNEYS

ATTORNEY

Sept. 11, 1962

M. B. DUNN

3,053,529

BLANK FEEDING APPARATUS FOR BOX ERECTING MACHINE

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6 Sheets-Sheet 5

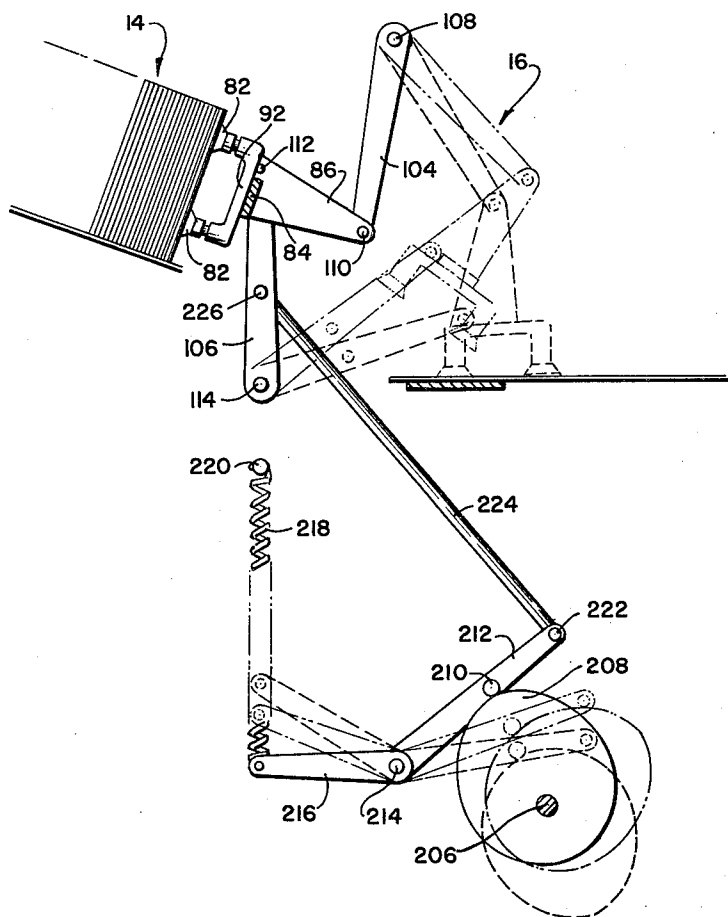


FIG. 6

INVENTOR

MAUDICE B. DUNN

BY *Cushman, Darby & Cushman*
ATTORNEYS

Sept. 11, 1962

M. B. DUNN

3,053,529

BLANK FEEDING APPARATUS FOR BOX ERECTING MACHINE

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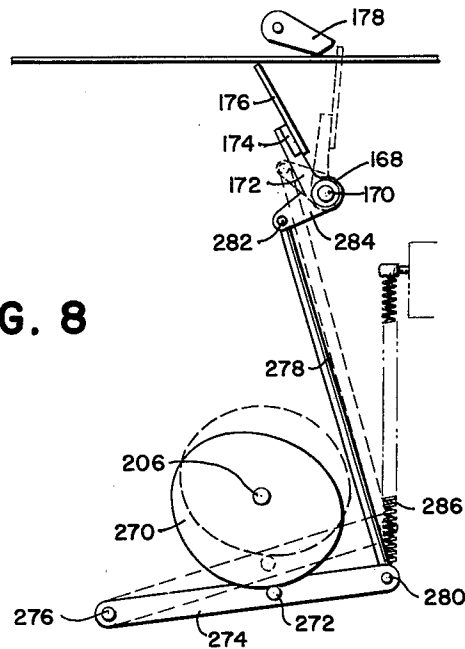
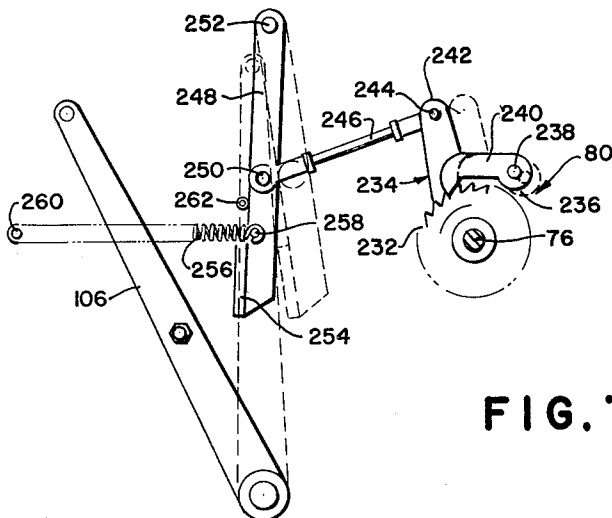


FIG. 7

INVENTOR

MAURICE B. DUNN

BY *Lushman, Darby & Lushman*

ATTORNEYS

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3,053,529

BLANK FEEDING APPARATUS FOR BOX ERECTING MACHINE

Maurice B. Dunn, Charlotte, N.C., assignor to Memco Machinery Corporation, Charlotte, N.C., a corporation of North Carolina

Filed Feb. 1, 1960, Ser. No. 5,819

4 Claims. (Cl. 271-11)

This invention relates to article handling and more particularly to apparatus for retaining a multiplicity of flat box blanks in stack formation and feeding successive box blanks from the stack to an erection station where successive flat box blanks are erected into box formation.

The invention has particular applicability to the erection of box blanks of the type disclosed in my co-pending application Serial No. 819,101, now U.S. Patent No. 3,029,712, which are arranged to be erected or set up into box or tray form by the plunger and die mechanism disclosed in that application. Preferably, such box blanks include a main rectangular bottom panel having side walls and end walls hingedly connected to the edges thereof. Each end of each end wall has hingedly connected thereto an end flap having a tab formed on the outer end thereof arranged to enter suitable cuts formed in the adjacent end portion of the side walls.

The plunger and die mechanism disclosed in my co-pending application includes a stationary die construction providing an upper horizontal surface for supporting the blank in a horizontal position thereabove. Guide rails are provided on the die for engagement with the outer edges of the end walls to transversely position the blank so that the bottom panel thereof is disposed over the central cavity of the die. Suitable stops are provided on the die for engaging the leading edges of the blank to longitudinally position the same so that the bottom panel is over the cavity of the die. When the blank is in proper position, the plunger is reciprocated through the cavity of the die and during the cooperative movement of the plunger through the die the tabs are locked within the associated cuts to erect the blank into tray formation.

An object of the present invention is to provide an apparatus for retaining a multiplicity of flat box blanks in stack formation and for feeding successive blanks from the stack to a suitable mechanism for erecting the same as, for example, the plunger and die mechanism disclosed in my aforesaid application.

Another object of the present invention is the provision of apparatus of the type described having means for supporting a multiplicity of flat box blanks in stack formation, suction cup means for removing successive lowermost blanks from the stack and depositing the same onto a generally horizontally extending guide and support assembly, roller conveyor means for moving successive blanks deposited on the guide and support assembly along the same to an erection station and means for moving successive blanks into proper position in the erection station.

Still another object of the present invention is the provision of an apparatus of the type described having improved means for retaining a multiplicity of flat box blanks in stack formation so that successive lowermost blanks of the stack can be removed for insertion into a suitable box erecting mechanism.

Still another object of the present invention is the provision of apparatus of the type described having a suction cup assembly provided with improved means for effecting movement of the suction cup assembly between a pick-up position inclined slightly with respect to a

vertical plane and a substantially horizontal discharge position.

Still another object of the present invention is the provision of an apparatus of the type described having means for retaining a multiplicity of flat box blanks in stack formation and a guide and support assembly for receiving successive blanks removed from the stack and improved means for transversely adjusting the stack receiving and supporting means of the guide and support assembly to accommodate box blanks of various widths.

Still another object of the present invention is the provision of an apparatus of the type described having improved means for effecting movement of successive flat box blanks along a generally horizontally extending guide and support assembly to an erection station, such means including roller conveyor means for moving the successive blanks into the erection station and means for properly positioning the blank when it reaches the erection station.

Still another object of the present invention is the provision of a flat box blank feeding mechanism which is simple in construction, effective in operation and economical to manufacture and maintain.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with respect to the accompanying drawings, wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a vertical, sectional view looking toward the left hand side of an apparatus embodying the principles of the present invention;

FIGURE 2 is a vertical sectional view looking toward the opposite side of the apparatus with certain parts broken away for purposes of clearer illustration, and the plunger and die assembly of my co-pending application Serial No. 819,101 shown in phantom lines;

FIGURE 3 is a top plan view of the apparatus with the parts of the drive mechanism eliminated for purposes of clearer illustration;

FIGURE 4 is a cross-sectional view taken along the line 4-4 of FIGURE 2 with certain parts broken away for purposes of clearer illustration;

FIGURE 5 is a fragmentary perspective view illustrating the drive mechanism of the apparatus;

FIGURE 6 is a somewhat schematic view of the suction cup assembly of the present apparatus showing the manner in which the same is moved from its vertically inclined pick-up position to its substantially horizontal discharge position;

FIGURE 7 is a schematic view illustrating the manner in which the endless conveyor of the stack receiving and supporting mechanism is advanced; and

FIGURE 8 is a somewhat schematic view illustrating the blank positioning mechanism and the manner in which the same is actuated.

Referring now more particularly to the drawings, there is shown in FIGURES 1-4 an apparatus, generally indicated at 10, embodying the principles of the present invention. In general, the apparatus includes a main frame, generally indicated at 12, having mounted on one end thereof a mechanism, generally indicated at 14, for receiving and supporting a multiplicity of flat box blanks in stack formation with the blanks disposed in a plane inclined slightly with respect to a vertical plane and retained in such stack formation along the edges of the forward surface of the lowermost blank in the stack so that the latter can be readily engaged and removed therefrom. Suitably mounted on the frame adjacent the mechanism 14 is a suction cup assembly, generally in-

licated at 16, which is movable between a first position for engaging the lowermost blank of the stack to retain the same by air suction and a second position wherein the retained box blank removed from the stack can be discharged in substantially horizontal relation. Mounted on the frame 12 in a position to receive the horizontally disposed blanks deposited by the suction cup mechanism 16 is a guide and support assembly generally indicated at 18, which extends generally horizontally from the depositing position of the suction cup assembly to an operation or erection station 19 on the frame (see FIGURE 2) where the flat box blank is erected into box formation by suitable mechanism as, for example, the plunger and die mechanism disclosed in my above-mentioned co-pending application.

Mounted on the frame in cooperating relation to the guide and support assembly 18 is a roller conveyor mechanism, generally indicated at 20, which is operable to effect the movement of successive box blanks deposited on the guide and support assembly by the suction cup assembly into the erecting station. The apparatus of the present invention also provides a blank positioning mechanism, generally indicated at 22, which is operable to effect the proper positioning of successive blanks moved into a position adjacent the erection station by the roller conveyor mechanism 20 to thereby insure that successive box blanks will be properly positioned with respect to the mechanism at the erection station for effecting the erection of the blank into box formation. Finally, the present apparatus also provides drive mechanism generally indicated at 24, for effecting the timed operation of the blank stack receiving and supporting mechanism 14, the suction cup assembly 16, the roller conveyor mechanism 20, and the blank positioning mechanism 22, to effect proper movement of successive box blanks from the stack into proper position at the erection station.

Referring now more particularly to FIGURES 1-4, the frame 12 may be of any suitable construction and, as shown, comprises a pair of vertically extending transversely spaced plates 26 and 28. The plates are rigidly secured in transversely spaced relation by suitable transversely extending frame members such as spaced bottom plates 30 and other elements which form a part of the various component units of the apparatus and will be described in connection with the description of these units.

The stack receiving and supporting mechanism 14 comprises a downwardly inclined bottom plate 32 fixedly secured in a central position between the frame members or plates 26 and 28, as by a bar 34 having its central portion suitably fixed to the lower surface of the plate 32 and its ends suitably fixed to the plates 26 and 28, as by welding or the like. Mounted on the bar 34 on opposite sides of the plate 32 for longitudinal sliding movement thereon is a pair of guide elements 36 each having a vertical rectangular plate 38 rigidly secured thereto and extending upwardly therefrom. The guide elements 36 and the plates 38 carried thereby are moved longitudinally along the bar 34 in and out with respect to the bottom plate 32 by means of a shaft 40 journaled in the frame plates 26 and 28 and having spaced oppositely threaded portions formed on the exterior periphery thereof arranged to engage correspondingly interiorly threaded plates 41 positioned between spaced apertured lugs 42 depending from a plate or the like detachably secured to the guide elements 36 below the bar 34. As best shown in FIGURE 3, the shaft 40 extends outwardly from the frame plate 26 and has a hand wheel 44 fixed to the outer extremity thereof through which the operator may turn the shaft 40 to move the plates 38 into a desired position of adjustment to accommodate the particular box blanks utilized.

It will be noted that the bottom plate 32 and the side plates 38 are arranged to engage the bottom edge and side edges of a multiplicity of box blanks mounted therebetween in stack formation with their surfaces inclined slightly with respect to the vertical. In order to retain the

box blanks in stack formation on the bottom plate 32 and between the side plates 38, means is provided for engaging the leading surface of the lowermost blank of the stack adjacent the peripheral edges thereof. To this end, a plate 46 is longitudinally adjustably secured to the lower surface of the plate 32 adjacent the central lower edge portion thereof. Extending upwardly from the lower end of the plate 46 above the upper surface of the plate 32 is a pair of transversely spaced fingers 48 which are arranged to engage the leading surface of the lowermost blank of the stack adjacent the lower edge thereof. Mounted for longitudinal adjustment adjacent the lower central edge portion of each plate 38 is a similar plate 50 having spaced fingers 52 extending inwardly therefrom beyond the inner surface of the associated plate 38.

Rigidly secured to each frame plate 26 and 28, as by welding or the like, in a position above the lower edge of the associated side plate 38, is an angle iron section 54 having a transversely extending bar 56 adjustably fixed thereto. Mounted on the central portion of the bar 56 for substantial vertical adjustment, as by a pin and slot connection 58, is a bar 60 having a pair of rollers 62 mounted on the lower end thereof. As best shown in FIGURES 1 and 2, by virtue of the adjustment provided by the pin and slot connection 58 and the connection of the bar 56 to the angle iron sections 54, the rollers 62 may be disposed in a position to engage the leading surface of the lowermost blank in the stack adjacent the upper edge portion thereof.

In order to effect movement of the box blanks in the stack supported by the plates 32 and 28 as successive lowermost blanks are removed from the stack, there is provided an endless conveyor, generally indicated at 64. As best shown in FIGURE 3, the bottom plate 32 is provided with a pair of transversely spaced elongated slots 66 arranged to receive therein the upper flights of a pair of endless chains 68. Each chain 68 is trained about an upper sprocket wheel 70 mounted on a shaft 72 suitably mounted below the upper end of the bottom plate 32 and a lower sprocket wheel 74 fixedly mounted on a shaft 76 extending between the frame plates 26 and 28 and suitably journaled therein, as by bearings 78. The shaft 76 is rotated to effect movement of the upper flight of the endless chains 68 in response to the movement of the suction cup assembly 16 through its cycle of movement by a ratchet mechanism, generally indicated at 80, the construction and operation of which will be fully explained in connection with the description of the main drive mechanism 24 hereinafter set forth.

The suction cup assembly 16 comprises a plurality of suction cups 82 carried by a rigid structure including a transversely extending bar 84 having triangular plates 86 rigidly secured to the ends thereof, as by welding or the like. While any suitable number of suction cups 82 may be employed, as shown, there are three such cups, each of which is made of rubber and is mounted on the end of a rigid tube 88. As best shown in FIGURE 2, each tube 88 is longitudinally adjustably fixed to a sleeve 90 formed on the outer end of an arm 92. Each arm is provided with a longitudinally extending slot 94 through which the arm is transversely adjustably secured to the bar 84. The central arm is adjustably secured to the bar 84 by means of a pair of bolts 96 which extend through the associated slot 94, through corresponding openings in the central portion of the bar 84, and threadedly into engagement with a manifold head 98. The arms 92 on opposite sides of the central arm are suitably bolted through their slots 94 to guide elements 100 adjustably mounted on the bar 84 in any desired fixed position of longitudinal adjustment therealong. The tube 88 of each suction cup 82 is connected in parallel with the manifold head 98, by suitable conduits or tubes 102.

Each triangular end plate of the rigid structure which carries the suction cups 82 is movably mounted to the

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adjacent frame plate by a pair of upper and lower arms 104 and 106. One end of each of the upper arms 104 is pivotally mounted to the associated frame plate for pivotal movement about a transverse, horizontal axis common to both, indicated at 108. The opposite end of each arm 104 is connected, as at 110, to the outer end of the associated triangular plate member 86 for pivotal movement about a transverse, horizontal axis common to both. Each triangular plate is also connected, as at 112, at a position spaced from the connection 110 to one end of the associated lower arm 106 for pivotal movement about a common transverse, horizontal axis. The opposite end of each arm 106 is fixedly secured to a shaft 114 extending transversely between the frame plates 26 and 28 and suitably journaled thereon, as by bearings 116.

The manifold head 98 which is connected in parallel with the suction cups 82 is connected by a flexible conduit 118 to a solenoid actuated valve mechanism of conventional construction, generally indicated at 120. The valve mechanism 120 is in turn connected through suitable conduit 122 to a liquid trap 124 which is, in turn, connected with a suitable vacuum source, as for example, a conventional vacuum pump 126, as by conduit 128. Vacuum pump 126 may be mounted on the bottom transverse plate 30 and be driven by a suitable electric motor 130, also mounted on the plate 30.

The guide and support mechanism 18 comprises a central horizontally extending support plate 132 which is mounted between the frame plates 26 and 28 by means of a transversely extending bar 134 having its ends rigidly secured to the end plates, as by welding or the like, and its central portion fixed to the plate 132.

Mounted on opposite sides of the central plate 132 for movement toward and away from the latter is a pair of transversely spaced guide plates 136 of angle iron construction providing upstanding flanges 138 for engaging the lateral edges of the box blanks positioned thereon. The guide plates 136 are mounted for longitudinal sliding movement along the bar 134 by means of suitable guide elements 140, each of which is suitably fixed to the lower surface of the associated guide plate and provided with a downwardly facing groove for receiving the bar 134. Detachably secured to each guide element 140 below the bar 134 is a member having a pair of spaced apertured lugs 142 depending therefrom. Disposed between each pair of lugs 142 is an oppositely interiorly threaded plate 143 to receive the oppositely exteriorly threaded portions of a shaft 144 extending inwardly from the side plate 28 and through the lugs 142.

As best shown in FIGURE 3, the end of the shaft 144 adjacent the end plate 28 extends outwardly thereof and has a sprocket wheel 146 fixedly secured thereon. A second sprocket wheel 148 of comparable size is fixedly secured to the outwardly extending end of the shaft 40 between the wheel 44 and the frame plate 28. An endless chain 150 is trained about the sprocket wheels 146 and 148 so as to transmit the rotary movement imparted to the shaft 40 by the wheel 44 to the shaft 144. In this way, the guide plates 136 are adjustable transversely simultaneously with the transverse adjustment of the plates 38 of the stack receiving and supporting mechanism 14.

The roller conveyor mechanism 20 comprises a pair of rollers 152 which preferably are made of metal and have their outer peripheries suitably knurled. The rollers 152 are suitably fixed to a shaft 154 extending transversely between the frame plates 26 and 28 and suitably journaled therein in a position to dispose the rollers 152 on opposite side of the support plate 132 with their upper peripheries extending slightly above the upper surface of the support plate 132.

Disposed above each of the rollers 152 is a smaller roller 156 which preferably is made of a friction type material such as rubber or the like. Each roller 156 is

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mounted on a central portion of a shaft 158, the outer end of which is fixed within a sleeve 160 having an integral arm 162 extending from the outer extremity thereof. The opposite end of the arm 162 has integrally formed thereon a sleeve 164 which is rotatably mounted on a stub shaft 166 toward and away from the associated knurled roller 152. Since the shaft 166 is disposed in the same general horizontal plane as the axis of the roller 156 when disposed in engagement with the roller 152, the roller 156 will be urged by the weight of the sleeve 160, shaft 158 and roller 156 into engagement with the associated roller 152.

The blank positioning mechanism 22 comprises a sleeve 168 fixedly mounted on the central portion of a shaft 170 extending between the frame plates 26 and 28 and suitably journaled thereon in a position below the end of the guide and support assembly 18 adjacent the erection station. Formed integrally on the sleeve 168 adjacent the ends thereof is a pair of arms 172 which extend outwardly from the sleeve and have their outer ends interconnected by a cross brace 174 forming an integral part of the arms. Longitudinally adjustably mounted on the opposite ends of the cross brace 174 is a pair of elongated fingers or pusher bars 176. As best shown in FIGURES 3 and 4 the pusher bars are spaced on opposite sides of the support plate 132 and are arranged to extend above the upper surface thereof to engage the trailing edge of a blank moving along the guide and support assembly 18.

In order to prevent the blank from moving off of the surface of the support plate 132 and guide plates 136 when the trailing edge of the blank is engaged by the fingers 176, there is provided a hold-down plate 178 rotatably mounted in eccentric relation on the inwardly extending end of each shaft 158. As best shown in FIGURE 1, each hold-down plate 178 extends from the shaft 158 toward the erecting station of the apparatus and the outer end thereof is arranged to engage the upper surface of the support plate 132 adjacent the associated edge thereof. Each hold-down plate is freely pivoted to the shaft 158 and is thus gravitationally urged by its own weight into engagement with the upper surface of the support plate 132 as indicated above.

The drive mechanism 24 of the present apparatus may be of any suitable design and, as shown, there is provided a source of power as, for example, an electric motor 180 suitably mounted on the bottom horizontal plate 30 of the frame opposite that of the vacuum pump 126, as best shown in FIGURE 1. The motor 180 has an output shaft 182 which, as best shown in FIGURE 5, has fixedly mounted on the outer end thereof a sheave or pulley 184. Trained about the pulley 184 is a belt 186 which is also trained about a pulley 188 mounted on the inner end of a shaft 190 journaled in the frame plate 28 as by bearing 192 and Z-shaped bracket 194. Fixed to the shaft 190 intermediate the ends thereof is a large pinion gear 196 which meshes with a smaller pinion gear 198 fixed to a parallel shaft 200 suitably journaled in the frame plate 28 and bracket 194. Fixed to the shaft 200 between the pinion 198 and the bracket 194 is a second small pinion gear 202 which meshes with a large pinion gear 204 fixed to a cam shaft 206 extending between the frame plates 26 and 28 and suitably journaled thereon.

As best shown in FIGURE 6, the suction cup assembly is moved between a first position wherein the suction cups 82 are disposed in an inclined vertical plane to engage and remove the lowermost blank of the stack supported within the mechanism 14 to a second position wherein the suction cups 82 are disposed in a substantially horizontal position to deposit the blank onto the guide and support assembly 18. To this end, a cam 208 is fixedly secured to the cam shaft 206 adjacent the end plate 26. The cam plate 208 engages a cam follower in the form of a roller 210 mounted intermediate the

ends of an arm 212 forming a part of a bell crank lever. The bell crank lever is pivotally mounted on the frame plate 26, as at 214, and includes a second arm 216 which extends outwardly from the pivot 214 in angular relation to the arm 212. The outer end of the arm 216 has the lower end of a vertically extending coil spring 218 connected thereto, the upper end of which is secured to the frame plate 26, as indicated at 220. The outer end of the arm 212 is connected as at 222 to one end of a connecting rod 224, the opposite end of which is connected, as at 226, to the associated lower arm 106 intermediate the ends thereof.

As best shown in FIGURE 6, it can be seen that during one revolution of the cam shaft 206, the cam 208 will effect the pivotal movement of the cam roller carrying arm 212 between the full line position and the dotted line position shown therein, the spring 218 serving to retain the cam roller 210 in peripheral contact with the cam 208. The pivotal movement of the arm 218 will effect a pivotal movement of the arms 106 through the connecting rod 224. The arms 106 adjacent each frame plate will be pivoted in unison, since they are both fixedly secured to the shaft 114 and the upper arms 194 will guide the rigid structure of the suction cup assembly between the first or pick-up position shown in full lines in FIGURE 6, and the second or depositing position shown in dotted lines in FIGURE 6.

The solenoid control valve 120 of the air suction system is actuated to communicate the manifold head 98 with the vacuum pump 126 when the suction cups 82 move into their first or pick-up position, as shown in solid lines in FIGURE 6. To effect the operation of the valve 120 in timed relation to the movement of the suction cup assembly, there is fixedly mounted to the cam shaft 206, a cam 228 which is arranged to engage a conventional switch 230, as, for example, a normally open micro switch arranged to be closed by contact with the cam 228 and electrically connected in series with the solenoid of the valve 120 to actuate the same to communicate the vacuum pump 126 with the manifold head 98 at the proper time, see FIGURES 2 and 5. The valve 120 is operable to maintain the communication of the vacuum pump 126 with the manifold head 98 during the movement of the suction cups from their first or pick-up position to their second or depositing position.

As indicated above, the ratchet mechanism 80 is operable to advance the endless conveyor 64 of the stack receiving and supporting means 14 during each cycle of movement of the suction cup assembly 16. To this end, the ratchet mechanism 80 includes a toothed ratchet wheel 232 which is fixed to the shaft 76 alongside the sprocket wheel 74 adjacent the frame plate 28, as best shown in FIGURES 2 and 7. Rotatably mounted on the shaft 76 is a bell crank lever 234 having an arm 236 pivotally connected, as at 238, at its outer end with a ratchet tooth engaging dog 240. The bell crank lever also includes a second arm 242 which has its outer end pivotally connected, as at 244, with one end of a connecting rod 246. The opposite end of the connecting rod is pivotally connected to a generally vertically disposed actuating arm 248 intermediate the ends thereof, as indicated at 250. The upper end of the actuating arm 248 is pivoted, as at 252, to the frame plate 28 and the lower end is provided with a laterally extending projection 254 which is disposed in the path of movement of the lower mounting arm 106 adjacent the frame plate 28. The actuating arm 248 is maintained in the full line position shown in FIGURE 7, wherein the projection 254 is disposed in the path of movement of the arm 106, by means of a generally horizontally extending coil spring 256 having one end connected to the actuating arm 248, as at 258, and its opposite end connected to the frame plate 28, as at 260, so as to resiliently urge the actuating arm into engagement with a stop element 262 mounted on the frame plate 28 in a position to engage the actuating arm.

As best shown in FIGURE 7, when the adjacent lower mounting arm 106 of the suction cup assembly moves into a position wherein the suction cups pick up the lowermost blank from the stack, the arm 106 will engage the projection 254 and thus move the actuating arm 248 into the dotted line position shown in FIGURE 7. This movement of the actuating arm will move the dog 240 clockwise, as shown in FIGURE 7, into the dotted line position illustrated. When the lower mounting arm 106 begins the return movement of its cycle, it will move out of engagement with the projection 254 of the actuating arm, thus permitting the spring 256 to move the dog 240 in a counterclockwise direction, which, in turn, effects a movement of the ratchet wheel 232, shaft 76 rigid therewith, and sprocket wheels 74 rigid with the shaft. In this way, the endless chains 68 are advanced an incremental distance after each blank is removed from the stack by the suction cup assembly.

The movement of the suction cup assembly from its pick-up position to its discharge position is such that the leading edge of the blank retained by air suction on the suction cups is fed between the rollers 152 and 156. The rollers 152 are continuously driven so as to be operable to move or convey successive blanks fed thereto by the suction cup assembly along the guide and support assembly 18 into the erection station. To this end, the shaft 200 extends outwardly through the frame plate 28 and has a sprocket wheel 264 fixed thereto, as best shown in FIGURE 5. An endless chain 266 is trained about the sprocket wheel 264 and a second sprocket wheel 268 fixed to the outwardly extending end of the roller shaft 154. In this way, the rollers 152 fixed to the shaft 154 are constantly rotated by the electric motor 180 of the drive mechanism 24.

As indicated above, the present apparatus is particularly adapted for use in feeding successive blanks to the plunger and die blank erecting mechanism disclosed in my co-pending application, Serial No. 819,101. The die of this mechanism includes parallel side rails which, when mounted on the frame 12 of the present apparatus, would be aligned with the rails 138 of the guide and support assembly 18. The upper surface of the die is in general horizontal alignment with the support plate 132 so that the rollers 152 will feed successive blanks in cooperation with the rollers 156 horizontally onto the die between the side edge guides thereof. The die is also provided with a stop for engaging the leading edge of the blank so that it will be positioned properly with respect to the die cavity not only transversely but longitudinally as well.

The blank positioning mechanism 22 of the present apparatus insures that successive blanks moving from between the rollers 152 and 156 will be moved onto the die in proper position. The rollers are spaced horizontally from the die so that the blank will move out of contact with the rollers before the same reach the stop on the die. At this time, the positioning mechanism 22 is actuated to move the fingers 176 into engagement with the trailing edge of the blank and thus insure that the leading edge of the blank will advance into engagement with the stop on the die. To effect this movement, the cam shaft 206 has fixed thereto adjacent the cam 208 a second cam 270, the periphery of which engages a cam follower in the form of a roller 272 mounted intermediate the ends of a generally horizontally extending lever arm 274, as best shown in FIGURES 1 and 8. One end of the lever arm is pivotally mounted on the frame plate 26, as indicated at 276, and the opposite end thereof is pivoted to the lower end of a connecting rod 278, as indicated at 280. The upper end of the rod 278 is pivoted, as at 282, to the outer end of an arm 284 fixed to the shaft 170. The roller 272 carried by the lever arm 278 is maintained in engagement with the periphery of the cam 270 by means of a vertically extending coil spring 286, the lower end of which is connected with the outer

end of the lever arm 278 and the upper end of which is connected to the frame plate 26, as indicated at 288.

As best shown in FIGURE 8, it can be seen that the fingers 176 will be moved through the cam roller 72, lever arm 276, connecting rod 278, arm 284 and shaft 170 from the full line position shown into the dotted line position, to engage the trailing edge of the blank and move the same into proper position over the die of the erecting mechanism. The hold-down plates 178 which normally engage the upper surface of the support plate but are movable away from this surface by the movement of a blank therebetween by the roller conveyor mechanism 20, serve to maintain the blank engaged by the fingers 176 in contact with the upper surface of the support plate until the fingers are moved into a substantially vertical position and effect the movement of the trailing edge of the blank past the hold-down plates 178.

It will be understood that when the present apparatus is used in conjunction with the plunger and die mechanism disclosed in my co-pending application, suitable motion transmitting mechanism may be provided between the cam shaft 206 and the plunger to effect the reciprocation of the latter in proper timed relation to the cycle of movement of the suction cup assembly 16 and blank positioning mechanism 22. For example, the motion transmitting mechanism for reciprocating the plunger could be cam actuated by cams similar to the cams 208 and 270 previously described. Preferably the cams would be positively acting to move the plunger upwardly in its reciprocation and a spring would be provided to effect downward movement of the plunger. In this way, if for some reason more than one blank is fed to the die, so that the plunger would not properly move through the die, such movement would not be positively required.

This arrangement lends itself readily to the provision of an automatic cutoff system, as for example, the main power source to the electric motor 180 could be connected through a normally closed microswitch such as switch 290 shown in FIGURE 5 arranged to be momentarily actuated to an open position by a cam element 292 fixed to the cam shaft. The normally closed switch 290 could be connected in parallel with the main lines leading to the electric motor 180 with a second normally open microswitch (not shown) which would be closed by the movement of the plunger through the die. Thus, the cam element 292 would be positioned to open the switch 290 when the second microswitch (not shown) would normally be in a closed position, thus providing a parallel circuit which would maintain the motor energized. However, in the event that the plunger did not pass through the die, the opening of switch 290 would cut off the power to the electric motor 180 when open, since the parallel holding circuit would likewise be open.

Operation

To briefly recapitulate the operation of the present machine, it will be seen that the mechanism 14 is operable to support a multiplicity of flat box blanks in stack formation with their surfaces inclined slightly with respect to the vertical. Elements 48, 52 and 62 serve to engage the surface of the lowermost blank of the stack along the peripheral edges thereof so that the center panel is presented to be engaged by the suction cup assembly. The suction cups 82 of the suction cup assembly 16 are arranged to engage the center panel of the lowermost blank of the stack and at this time the source of air suction is communicated with the suction cups. During the movement of the suction cup assembly from the solid line position shown in FIGURE 6 to the dotted line showing of that figure, the lowermost blank of the stack is stripped away from the retaining elements 48, 52 and 62 by retention of the cups 82 therewith as a result of the air suction applied. During the initial movement of the suction cup assembly away from its pick-up position, conveyor chains 68 are advanced an incremental

distance to insure that the next lowermost blank of the stack will be moved into engagement with the retaining elements 48, 52 and 62.

The suction cup assembly moves the blank retained thereon onto the guide and support assembly 18 and the air suction is released at the same time that the leading edge of the blank is positioned between the rollers 152 and 156 of the roller conveyor assembly 20. The driving rollers 152 in cooperation with the rollers 156 which serve to maintain the blank in contact with rollers 152 move the blank along the guide and support assembly 18 until the trailing end of the blank passes therefrom. At this time, fingers 176 are moved from the solid line position shown in FIGURE 8 to the dotted line position shown therein. During this movement the fingers engage the trailing edge of the blank thus moving the blank into proper stopped relation into the erection station. During this movement the hold-down plates 178 insure that the engagement of the fingers 176 with the trailing edge of the blank will not have the effect of moving the blank off of the surface of the guide and support assembly 18.

The apparatus of the present invention is readily adjustable to accommodate different size box blanks. Where the erecting mechanism constitutes a plunger and die assembly such as disclosed in my co-pending application, a different size plunger and die must be provided for each box blank. Where the box blank varies in size only in the depth of the end panels, the guides on the die which engage the outer edges of the end panels can be adjusted and the present apparatus provides a single wheel 44 which may be turned to simultaneously adjust the guide rails 138 into alignment with the guides of the die, together with the guide plates 38 of the stack retaining and supporting mechanism 14. This same adjustment can also be readily made where a completely different die is utilized as, for example, where the center panel varies. It will also be noted that rollers 62 are readily adjustable to accommodate variations in the size of the blanks being erected as is the position of the three suction cups 82. It is also contemplated that the particular die utilized with the apparatus may be provided with an adjustable stop for engaging the cross brace 174 of the blank positioning mechanism 22 to stop its blank advancing movement at the proper position relative to the particular blank employed. In this regard it will be noted that the spring 286 permits the fingers 176 to be stopped in any desired position between the limits of its movement shown in FIGURE 8.

The manner in which the upper resilient rollers 156 of the roller conveyor mechanism 20 are mounted is significant in that the weight of these elements and associated structure is operable to maintain them in proper contact with the upper surface of the blank moving there-through. However, should a blank become jammed so that it can not enter the erection station, the rollers 156 and hold-down plates 178 will be moved upwardly, thus preventing a positive jamming of the blanks and permitting easy removal of any blanks that have not properly passed on to the erection station.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

What is claimed is:

1. Apparatus for feeding cut and scored flat box blanks to an erecting station where the blanks are set up to form boxes comprising means for receiving and supporting a stack of flat box blanks with the lowermost blank of the stack being retained along its edges in a vertically

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rearwardly and downwardly inclined pick up position, stationarily positioned blank guide and support means extending substantially horizontally to the erecting station, suction cup means movable between said stack receiving and supporting means and said blank guide and support means for removing successive lowermost blanks in said pick up position outwardly from the stack generally in the direction of the extent thereof and depositing the same in substantially horizontal relation onto said guide and support means, roller conveyor means operatively associated with said guide and support means for moving successive blanks deposited on said guide and support means along the same toward said erecting station, and swingable finger means for engaging the trailing edge of successive blanks after they have passed through said roller conveyor means and advancing them substantially horizontally a predetermined amount to a given operation position at said erecting station.

2. Apparatus as defined in claim 1 wherein said suction cup means comprises a transversely extending rigid structure, suction cups carried by said rigid structure, and a pair of arms pivoted to each end of said rigid structure about spaced fixed horizontal transverse axes, each pair of arms being pivotally supported for movement about fixed horizontal transverse axes.

3. Apparatus as defined in claim 1 wherein said stack receiving and supporting means includes transversely spaced vertical plate means for engaging the side edges of the blanks of the stack mounted for movement toward and away from each other, said blank guide and support means includes transversely spaced vertical guide elements for engaging the side edges of the blanks supported thereon, mounted for movement toward and away from each other, and means for simultaneously moving said vertical

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plate means and said guide elements into different positions of transverse adjustment to accommodate different size blanks.

4. Apparatus as defined in claim 1 wherein said roller conveyor means comprises lower driven roller means having the upper periphery thereof disposed in a position to engage blanks supported on said guide and support means and upper idler roller means mounted for biased movement into engagement with the upper periphery of said driven roller means to maintain blanks fed therebetween by said suction cup means in contact with said driven roller means.

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