March 25, 1958 R. A. LABOMBARDE 2,828,126

SHEET FEEDING APPARATUS AND METHOD

Filed Dec. 16, 1954 5 Sheets-Sheet 1

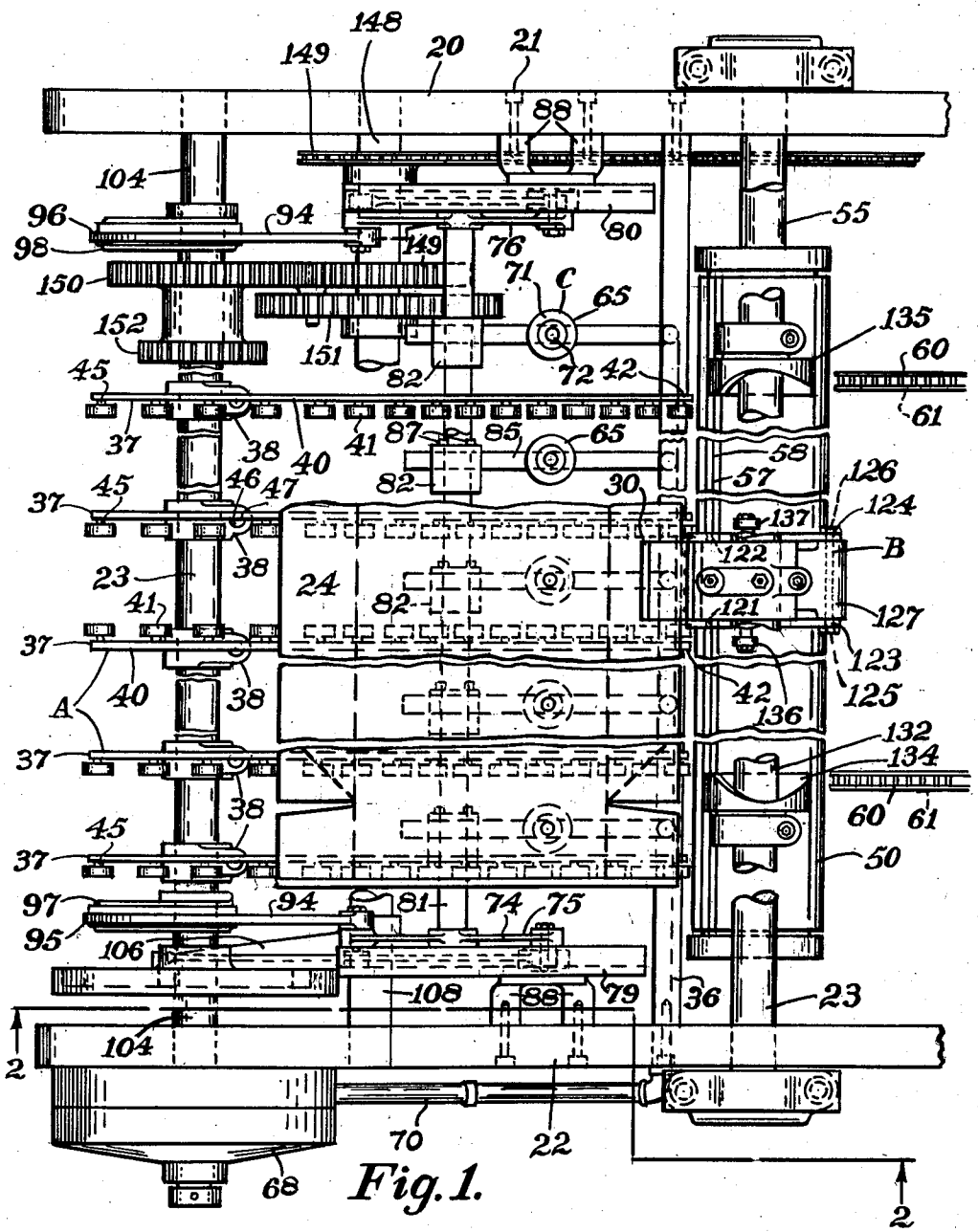

Fig. 1.

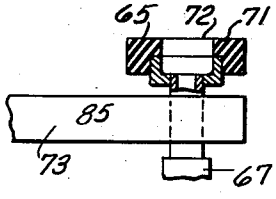

Fig. 1A

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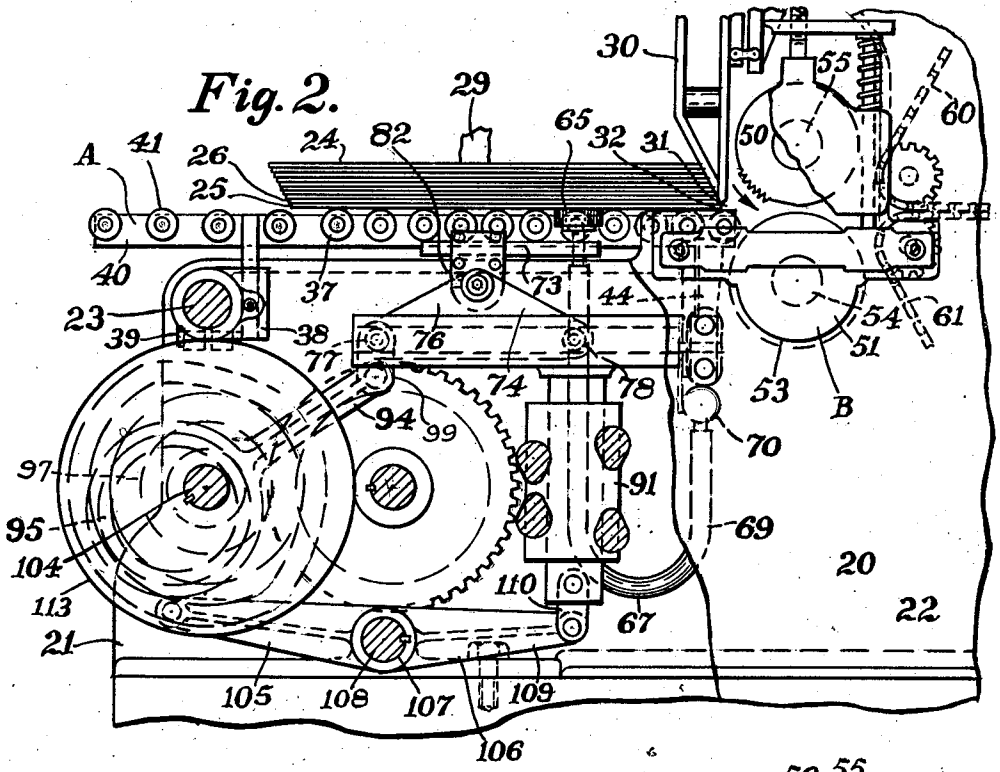
Fig. 2.



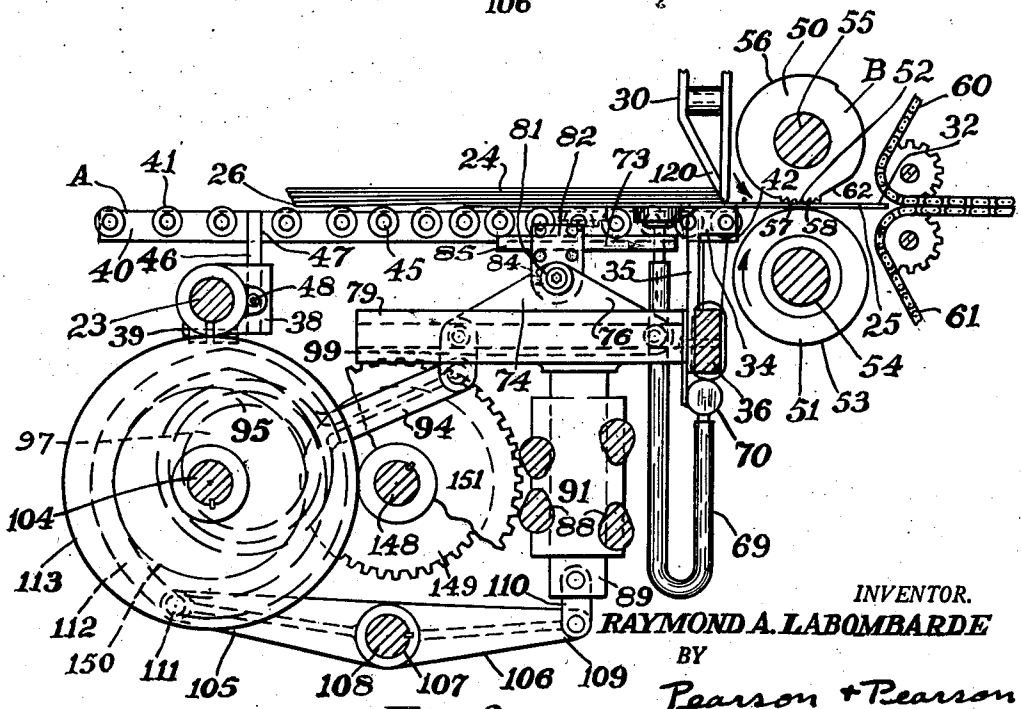


Fig. 3.

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SHEET FEEDING APPARATUS AND METHOD

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Fig. 4.

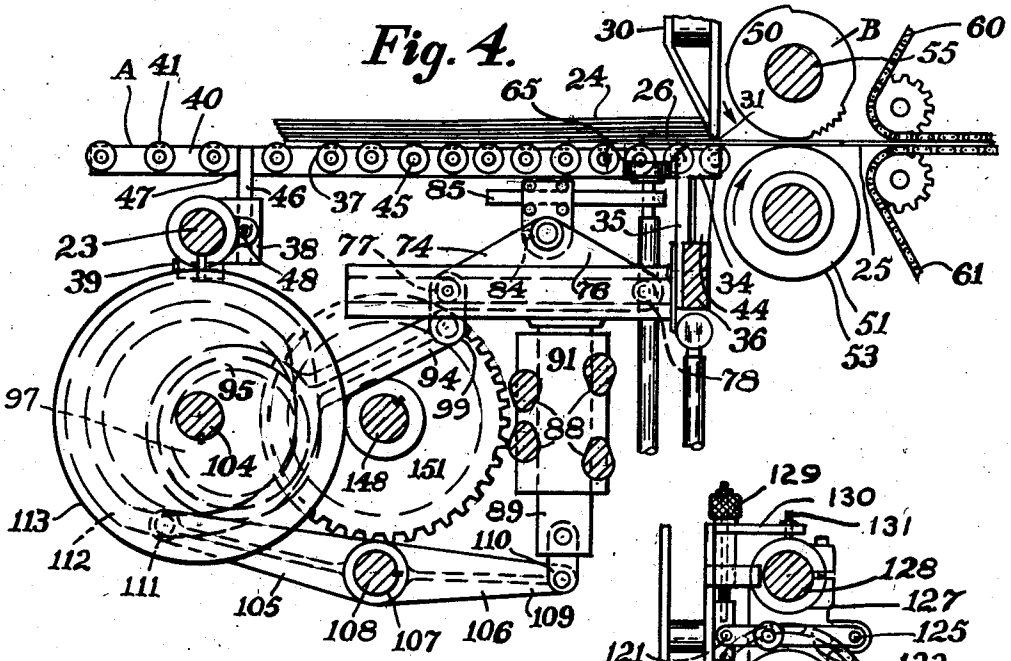
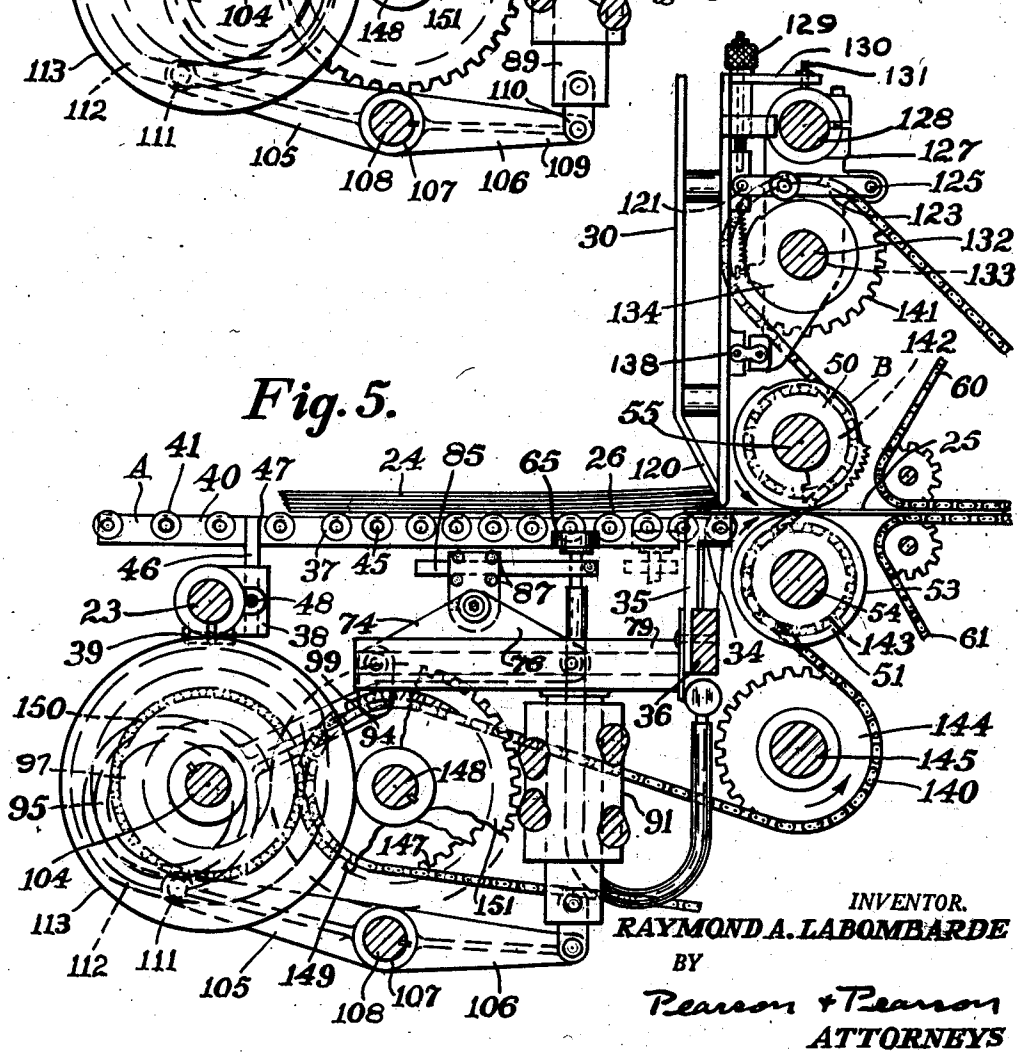


Fig. 5.



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SHEET FEEDING APPARATUS AND METHOD

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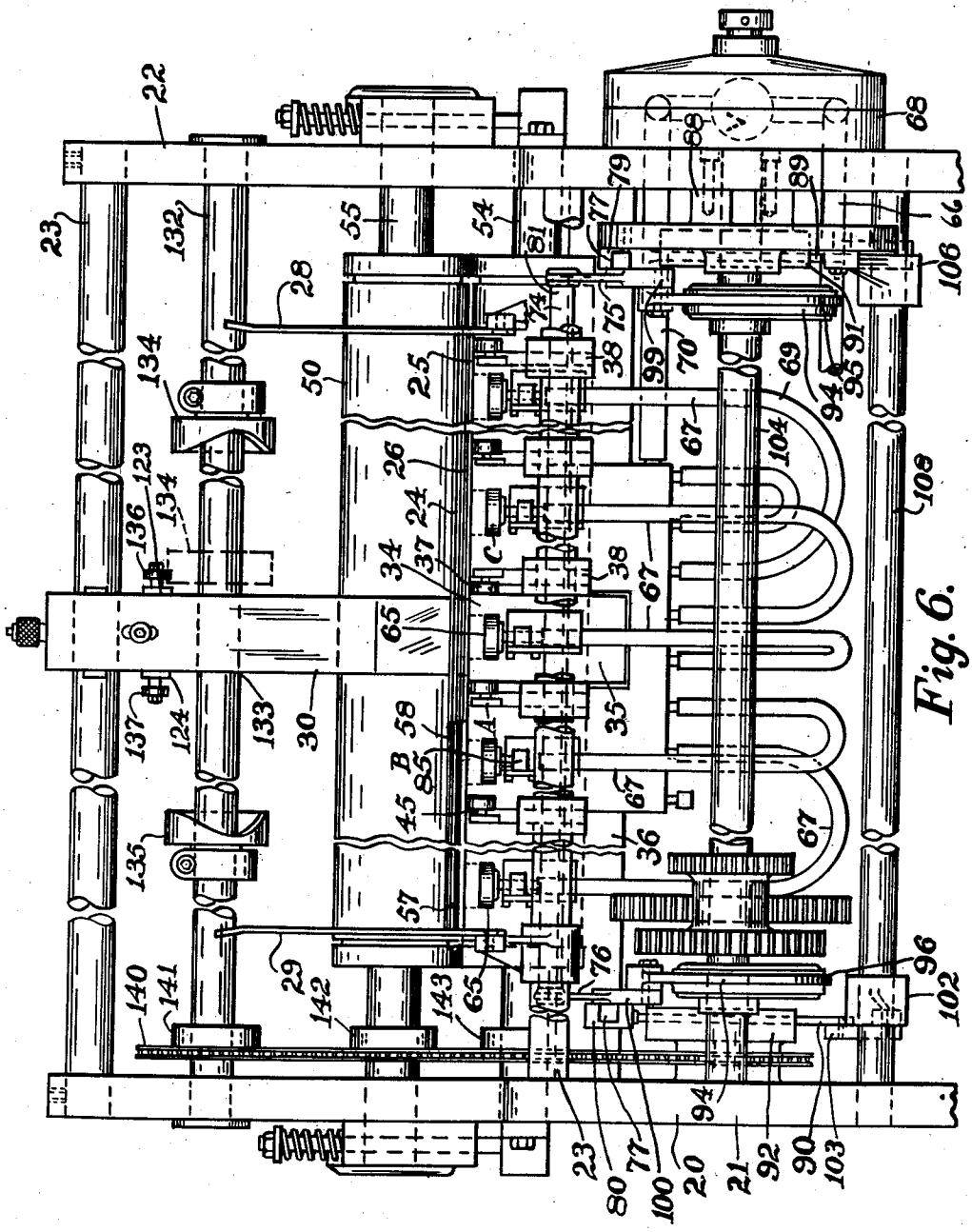

Fig. 6.

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SHEET FEEDING APPARATUS AND METHOD

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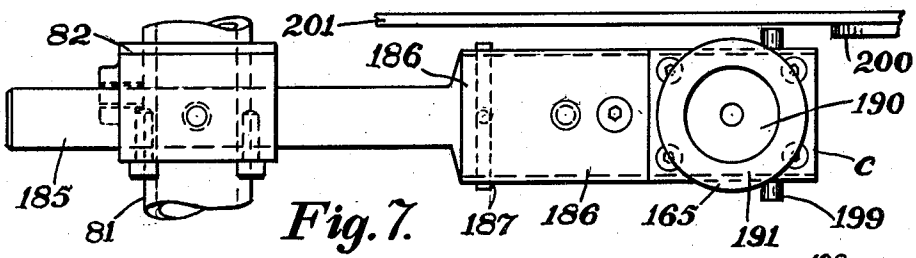

Fig. 7.

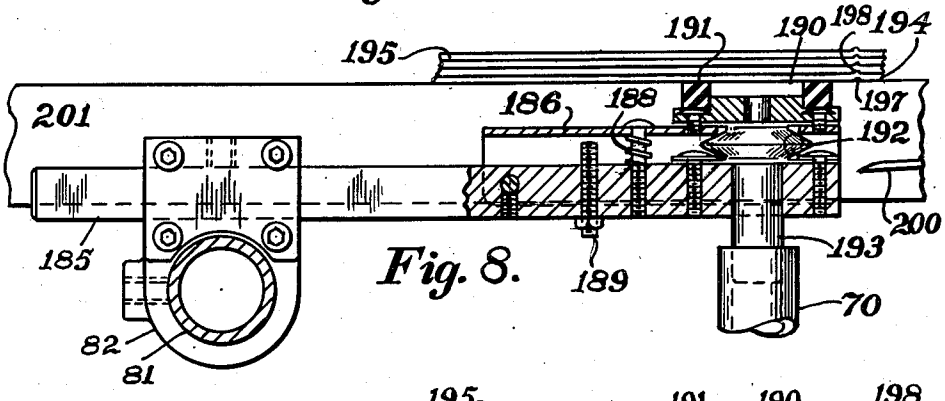

Fig. 8.

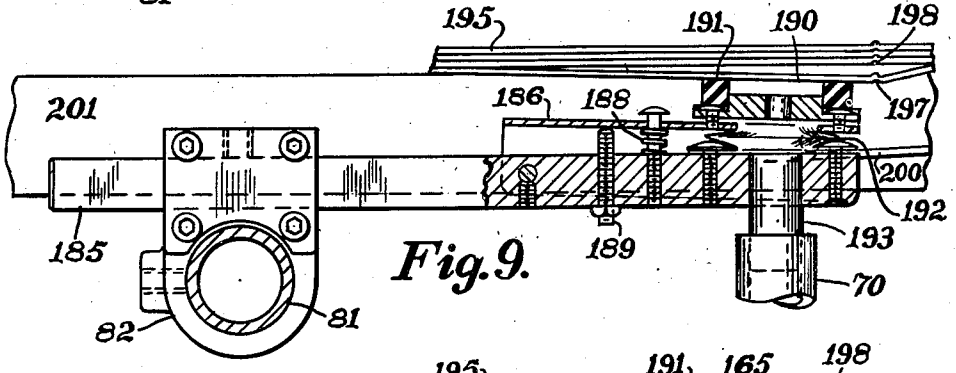

Fig. 9.

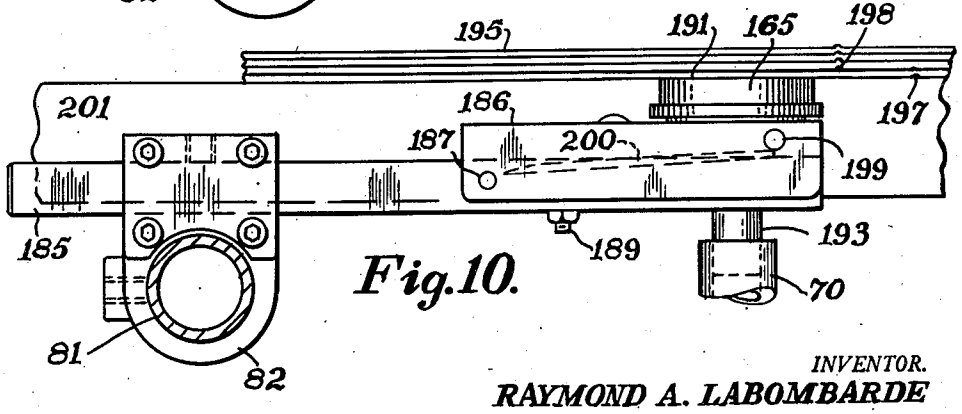

Fig. 10.

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SHEET FEEDING APPARATUS AND METHOD

Raymond A. Labombarde, Nashua, N. H.

Application December 16, 1954, Serial No. 475,804

12 Claims. (Cl. 271—32)

This invention relates to sheet feeding devices for use in paper box folding machines. It especially relates to an improved machine and method for segregating the end blank from a stack of box blanks by the use of an angularly movable friction surface including suction cups.

The principal object of this invention is to provide a moveable friction surface formed by flat, enlarged rims of suction cups; for segregating an end sheet from a stack the surface being moved through a closed angular path rather than in a circular path as has heretofore been proposed.

Another object of the invention is to slideably segregate the end sheets of a stack, individually and successively by causing a friction surface formed by a plurality of suction cups to adhere to the exposed face of each sheet with no sheet advancing component and then causing the adhered cups to advance with the sheet in the same plane as the plane of the sheet. Heretofore, it has been customary to move an adhered cup perpendicularly away from the stack or in a curved line having a perpendicular component since it has been the teaching that an adhered cup moved without a perpendicular component might slip and release the suction. It has been customary to apply friction surfaces tangentially to a sheet for feeding rather than perpendicularly.

A further object of the invention is to provide a novel support and actuating mechanism for such friction faced suction cups which maintains the friction face of the cups in the plane of the end sheet while moving the cups for a considerable distance in a plane parallel to the plane of the sheet and then returns the cups to their original position.

Still another object of the invention is to provide friction and suction sheet segregating mechanism on a bottom feed magazine with the magazine having a fixed, antifriction platform extending across the entire bottom of the magazine for supporting the sheets thus assisting in the slideable segregation of the successive end sheets.

A still further object of the invention is to provide a novel method of applying a friction faced suction cup to a stack for segregating the end sheets thereof, the method including moving the same through a closed substantially angular path which path is preferably rectangular.

Another object of the invention is to provide a sheet feeding element moveable in a straight line for a short distance relative to the size of a sheet to advance a sheet into a gateway together with means for temporarily opening the gateway to accommodate a second sheet until the first sheet has entirely passed therethrough.

Other objects and advantages of the invention will appear in the following description of a specific embodiment of the same, together with the drawings and claims.

In the drawings,

Fig. 1 is a plan view of the invention mounted at the feed end of a paper box folding machine.

Fig. 1A is an enlarged, fragmentary, side view of a friction-rimmed suction cup of the invention.

Fig. 2 is a side elevation of the device in section on line 2—2 of Fig. 1 showing the parts in their respective positions with the flat friction face of the suction cups lifted vertically and adhering to the exposed face of an end blank.

Fig. 3 is a view similar to Fig. 2 showing the suction cups advanced rectilinearly in the plane of the end blank, the end blank having passed through the magazine gateway and been gripped by the blank gripping and advancing mechanism.

Fig. 4 is a view similar to Fig. 2 showing the flat friction face of the suction cups released from adherence to the blank and drawn vertically downwardly out of the plane of the end blank.

Fig. 5 is a view similar to Fig. 2 showing the suction cups retracted rectilinearly in a plane parallel to the plane of an end blank but spaced therebelow and ready to be lifted vertically to engage the next succeeding blank.

Fig. 6 is an end view of the device shown in Fig. 1.

Fig. 7 is a plan view of a preferred form of suction cup and cup support means.

Fig. 8 is a side view of the device shown in Fig. 7 with the friction face thereof coplanar with the paper line and some of the parts sectionalized.

Fig. 9 is a view similar to Fig. 8 showing the friction face retracted slightly below the plane of the paper line and endmost sheet to bow the sheet and

Fig. 10 is a view similar to Fig. 8 showing the friction face being returned to the plane of the paper line after the end sheet has been advanced toward the separator means.

As shown in the drawings, the magazine mechanism is designated A, the sheet gripping and advancing means is designated B and the sheet segregating mechanism is designated C. The paper box folding machine on which the invention is illustrated may be of any well known type and only the feed end thereof is shown. The machine includes a frame **20** having the usual side frame pieces **21** and **22**. The structure of the frame, as is customary, includes a plurality of laterally extending rods such as at **23** which constitute frame pieces but upon which the parts of the machine may be slideably mounted to accommodate blanks of various dimensions. The sheet, or blank, **24** may be of any well known type, depending on the purpose of the machine, and is the end or bottom sheet of a stack **25** of flat blanks all identical to the blank **24**. The next succeeding end blank in the stack is designated **26**.

Magazine mechanism

The magazine mechanism A of the invention when applied to a bottom feed preferably includes a pair of oppositely disposed upstanding side wall guides such as **28** and **29**, a front, or leading edge separator member and guide **30** and may have a rear stack guide not shown. Front guide **30** is in the form of a vertically slideable and adjustable gate which may be fixed in position at a spaced distance from another separator member to form a gateway **31** opposite the leading edge **32** of the end sheet **24**. Gateway **31** is normally of a height equal to the thickness of a single sheet or blank in the magazine, thereby permitting the passage of only one sheet at a time. A stationary platform, or shelf **34**, constituting the other separator member forms the lower edge of gateway **31** and supports the undersurface of the leading edge portions of the sheets in stack **25**. Stationary platform **34** may extend rearwardly from the gateway **31** for one or two inches and is at least co-extensive laterally with the gateway **31**. The platform **34** may be supported in any convenient way as by posts such as **35** extending upwardly from a cross frame piece **36**. Preferably a roller

platform 37 is provided for supporting the weight of the sheets in stack 25. A plurality of brackets such as 38 are fixed on cross rod 23 for lateral positioning by means of set screws 39. Each bracket 38 supports a longitudinally extending bar 40 which bar in turn carries a row of freely revolvable rollers such as 41. The laterally spaced apart rows of rollers 41 extend in the direction of advance of a blank toward gateway 31 and are freely revolvable on axes of rotation such as at 45 which are parallel to, but below the plane of the gateway 31. Each bracket 38 includes a vertical rod 46 fixed to a bar 40 at 47 and vertically positioned at various heights in a suitable bracket slot by means of set screw 48. The forward ends such as 42 of each rod 40 are supported on a transversely extending leg support such as 44. (See Fig. 2.)

Sheet gripping and advancing mechanism

The sheet gripping and advancing mechanism B of the invention is positioned outside the gateway 31 and includes a pair of rotating members 50 and 51 having a nip 52 in the path of a sheet or blank emerging from the gateway 31. Member 51 is preferably a roll having a smooth circumferential surface 53 and revolved in synchronization with the remaining parts of the folding machine by a power shaft 54 in a well known manner. Member 50 may also be a roll oppositely disposed to roll 51 and having a friction insert of any well known type. Member 50 is carried by a power shaft 55, similar to shaft 54, and preferably, however, includes a smooth surface 56 and a toothed or corrugated surface 57. The surface 57 leads surface 56 as member 50 rotates in the direction of the arrows and is formed of a narrow strip of laterally extending sharp teeth, such as 58, which project radially beyond surface 56. Teeth 58 thus make a tight nip at 52 and in cooperation with member 51, grip and positively advance a sheet or blank received therebetween into the conveyor chains or belts 60 and 61. A cut away portion 62 in the circumference of roll 50 permits the leading edge portion of a sheet to be advanced into the nip of the rolls 50 and 51 before the sheet is engaged and advanced by the teeth 58.

Sheet segregating mechanism

The sheet segregating mechanism C of the invention includes a flat friction surface of considerable area formed by suction cups such as 65, each preferably of resilient material such as rubber and each connected by a flexible tube such as 67 to suction means 69. Suction means 69 includes an air suction pipe 70, extending laterally across the machine, and rearwardly to a rotary valve 68 of a type well known in the art and not illustrated in detail. The valve 68 of the suction means is synchronized with the mechanical means of the segregating mechanism to cause air to be exhausted from the cups such as 65 during their advancing motion and to be admitted to the cups during their return motion. This is accomplished by mounting the valve 68 on the same shaft 104 that operates the cams of mechanical means 94 to be described hereinafter. Valve 68 is fed by a pipe 66 leading to a suitable pump and tank of any well known type and therefore not shown. It should be noted that the plane of the flat friction face 71 and the coplanar suction opening 72 of each cup such as 65 is parallel to the flat plane of the bottom blank 24 in stack 25.

Mechanism C includes suction cup support means 73 for supporting and guiding the friction faced suction cups 65 in a closed substantially angular path while retaining the sheet engaging faces 71 thereof in a plane parallel to the plane of bottom blank 24. Means 73 includes a carriage 74 formed by a pair of plates 75 and 76 oppositely disposed on each side of stack 25 but below the same. Each plate such as 75 is provided with rollers such as 77 and 78 and the rollers of each plate are guided and supported in one of a pair of oppositely disposed longitudinally extending tracks 79 and 80. Plates 75 and 76 are joined by a laterally extending shaft 81, upon which collars such as 82 are slidable and adjustable in various lateral positions by set screws such as 84. Each suction cup such as 65 is carried at the forward ends of a bar 85, each bar being longitudinally slidable and adjustable in a collar 82 by set screws such as 87. Thus by means of the collars 82, each suction cup such as 65 may be moved to any desired position under stack 25. When carriage 74 is advanced in tracks 79 and 80, the suction cups 65 also advance parallel to the tracks in an elongated rectilinear component of their closed substantially angular path.

Tracks 79 and 80 are also included in the suction cup support means 73 and extend in a straight line parallel to the direction of advance of a blank for guiding and supporting the carriage 74. The tracks 79 and 80 are each supported by one of a pair of vertically extending rods 89 and 90, the rods 89 and 90 being slidably guided in suitable brackets such as 91 and 92 having lugs such as at 88 for attachment to a frame side piece 21 or 22. Thus while the tracks 79 and 80 guide the carriage 74 in a straight line advancing and retracting path, the rods 89 and 90 guide the tracks in a straight line upward and downward path perpendicular to the direction of advance of a bottom sheet or blank in stack 25. The suction cups 65 are thus guided and supported with their friction and suction faces always parallel to the flat plane of the end blank such as 24, through a closed angular path in a plane perpendicular to the undersurface of the end blank.

Mechanical means 94 is provided for successively actuating the suction cup support means 73 to move a suction cup through its closed angular path. A pair of means 94 includes yoke type cam followers 95 and 96 each encircling one of a pair of eccentric cams 97 and 98 at one end and having its other end connected to a plate 75 or 76 of carriage 74 as by a link 99 or 100. The eccentric cams 97 and 98 are carried at opposite ends of a drive shaft 104 whereby with each rotation of shaft 104 carriage 74 is advanced and retracted in tracks 79 and 80. Means 94 also includes a rocker arm 106 pivotally mounted at 107 to a lateral shaft 108 and having one terminal end 109 pivotally connected to a rod 89 as by a link 110. Arm 106 carries a cam follower 111 at its opposite terminal end 105, follower 111 riding in cam track 112 of a rotating cam 113 mounted on drive shaft 104. A rocker arm 102, similar to arm 106, is fixed to the opposite end of shaft 108 and connected to rod 90 by a link 103 thereby causing both plates 75 and 76 of carriage 74 to rise and fall in unison.

Thus with each rotation of shaft 104, mechanical means 94 causes the carriage 74 to advance toward gateway 31 in a straight line in tracks 79 and 80, then causes the tracks 79 and 80 with carriage 74 to be lowered away from the stack 25, then retracts the carriage 74 in the tracks 79 and 80 and then raises the tracks with the carriage 74 back to their original position, thus completing a cycle.

In operation, the mechanical means 94 causes support means 73 to move the friction face 71 of a suction cup 65 substantially perpendicularly up to the undersurface of the bottom or end sheet 24 of a stack, at which time the suction means 69 exhausts air from the cup and friction face 71 enabling the cup to adhere to the sheet. While still so adhered, means 94 causes support means 73 to move the cup horizontally in a straight line toward gateway 31 sliding the leading edge of bottom blank 24 through the gateway and into the nip of the rotating members 50 and 51. Suction means 69 then admits air to cup 65, thereby enabling the cup to release sheet 24 from its friction face 71 while means 94 draws the cup 65, carriage 74 and tracks 79 and 80 in a straight line downwardly and perpendicularly away from the stack 25. Means 94 then retracts the carriage 74 in tracks 79 and

80 horizontally and in a plane parallel to the plane of bottom blank 24 and then again lifts the cup 65, carriage 74 and tracks 79 and 80 perpendicularly up to the undersurface of the next succeeding bottom blank 26 in stack 25 to repeat the segregation cycle.

While the tracks 79 and 80 move only in a straight line up and down and the carriage 74 moves only in a straight line horizontally relative to the tracks, it will be apparent that the return portion of the closed path of the cups 65, while substantially angular, may include arcuate portions due to the composite paths.

The friction face 71 rimming each suction cup 65 is preferably of considerable area and preferably a comparatively large number of such cups such as five or more are provided in order to increase the frictional engagement with each endmost sheet and thereby avoid slippage. The suction openings 72 of the cups 65 not only tend to adhere to the end sheet but draw the sheet toward the friction surfaces 71 thereby increasing the strength of the grip attained thereby. The surfaces 71 are not only of a friction material such as rubber, but are preferably roughened to increase such friction.

As best shown in Figs. 1 and 5 the separator member 30 while normally stationary and spaced at a fixed distance from platform 34 to allow passage of one sheet at a time, is mounted for vertical movement. Separator 30 includes a tapered lower portion 120 for fanning out the sheets in stack 25 as they approach gateway 31 and is pivotally mounted at 121 and 122 to links such as 123 and 124. Links 123 and 124 are pivoted at 125 and 126 to a bracket 127 depending from cross frame rod 128. A pair of shorter pivoted links such as 138 are provided to limit and guide the movement of the lower end of separator 30. Separator 30 may thus be lifted on its pivot mounting to enlarge gateway 31 but separator 30 falls by gravity back to its initial position established by stop arm 130 and stop pin 131 after such lifting. A shaft 132 extends laterally of frame 20 and is journalled at 133 in bracket 127, shaft 132 carrying a pair of cams such as 134 and 135 arranged to engage a pair of cam followers such as 136 and 137 on links 123 and 124.

Stop pin 131 is threadedly mounted in arm 130 for adjustment to permit passage of single blanks of various thicknesses and a knob and thrust screw 129 is provided for adjusting separator 30 to permit passage of double blanks when followers 136, 137 are at the high point of the cams.

When the cams 134 and 135 are positioned to engage followers 136 and 137 it will be apparent that with each revolution of the cams the separator 30 will be lifted to open the gateway 31 and will then fall to close the gateway to its normal size for admitting one sheet only. The drive chain 140 on shaft 132 and thence around sprockets 142 and 143 on shafts 54 and 55 of the rotating members 50 and 51. Chain 140 is also trained around sprocket 144 on shaft 145, and is then trained around sprocket 147 on shaft 148 for powering and synchronizing the mechanical means 94. A gear 149 on shaft 148 is meshed with a gear 150 on shaft 104 for rotating shaft 104. As shown in Fig. 1 another gear 151 is carried by shaft 148 and another gear 152 is carried by shaft 104 whereby two speeds may be secured for the mechanical means 94 and valve 68 of suction means 69 with relation to the speed of rotation of the rolls 50 and 51.

In the embodiment illustrated, the circumference of the pinch roll 50 is about twelve and one half inches, the forward travel of the cups 65 is about two and one half inches and the distance from the gateway 31 to the nip 52 of rolls 50 and 51 is about two and one quarter inches.

When the gears 149 and 150 are meshed, as shown in Fig. 1, one sheet is fed with each two revolutions of the pinch roll 50. Sheets having a longitudinal length up to fifteen inches may be fed with the gateway 31 constant since a single revolution of pinch roll 50 will clear the trailing end of the sheet from the gateway. Sheets having a longitudinal length from fifteen inches to twenty-five inches may be fed by the use of cams 134 and 135 to periodically lift separator 30. This is because the trailing end of a long sheet would still be in the gateway but advancing with the second revolution of the pinch roll at the same time that the second sheet is entering the gateway 31. The first sheet thus forms a temporary gateway bottom for permitting only a single second sheet to enter the gateway while separator 30 prevents double or triple feeding.

When the gears 151 and 152 are meshed, one sheet is fed with each single revolution of the pinch roll 50. Sheets having a longitudinal length up to eight inches may be fed with the gateway 31 constant since a single revolution of the pinch roll 50 will clear the gateway. Sheets having a length from eight to twelve and one half inches may be fed by using cams 134 and 135 to open the gateway 31 thus permitting the trailing end of one sheet and the leading end of the next succeeding sheet to both occupy the gateway temporarily.

It should be noted that the friction face or surface, formed by the suction cups 65 or otherwise, by reason of the mechanism for angular movement, approaches each endmost sheet substantially perpendicularly while in a flat plane parallel to the flat plane of the sheet and therefore adheres by friction, or friction and suction, simultaneously over a large area of the sheet. There is no component of advancing force in the direction of feed at this time and such component occurs only after a full and complete adhesion has been secured to prevent any slippage. The sheet is thus positively registered for passage through the machine and no further registration is necessary. The contact of the friction surface and the face of the endmost sheet being initially flatwise and then remaining in flatwise engagement for the entire feed travel, unlike a tangential friction feed, causes no lint or other material to build up on the friction surface for eventual slippage. In addition the suction cups tend to remove any foreign material that might build up on the friction surface through their suction tubes. It should also be noted that the friction face is drawn perpendicularly away from the sheet as a complete unit rather than piece meal as in other friction feeds, thereby assuring that the sheet always travels exactly the same distance of feed and then is completely and instantaneously released from the friction surface.

As shown in Figs. 7, 8, 9 and 10 the general perpendicular approach and parallel path of advance of the angularly movable sheet segregating surface of the invention may be retained while varying the parallel path of advance slightly to bow each end sheet downwardly away from the next succeeding sheet in a stack.

The suction cup support means C is unchanged but in place of the bars such as 85 and suction cups such as 63, a bar 185 and a suction cup 165 are provided. Each bar 185 is carried in a collar 82 in the same manner as the bars 85 and may be substituted for the same when desired. An inverted U-shaped housing 186 is pivoted at 187 to bar 185 and normally spaced therefrom by a coil spring 188 and a stop element 189. The suction cup 165 is carried at the terminal end of housing 186 and includes a suction opening 190 and a friction face 191 formed by the rim. A collapsible bellows 192 connects suction cup 165 to the suction tube 193 the tube 193 being in turn connected to the flexible air suction, or air exhaust pipe 70.

It will be apparent that when suction cup 165 is moved perpendicularly up to the face of an endmost blank such as 194 of a stack of blanks 195 and adheres thereto, the bellows 192 will collapse, compressing spring 188 and pivoting housing 186 downwardly on pivot 187. The suction opening 190 and friction face 191 with the forward portion of an end blank 194 will then be downwardly inclined to bow the blank and bend the trans-

verse crease line **197** away from the corresponding crease line **198** of the next succeeding blank.

Upon advancement of the suction cup support means toward the separator means, the outwardly projecting lug **199** on housing **186** travels along an upwardly inclined, fixed track **200** to forcibly lift the suction cup **165** and housing **186** back to its initial level with the faces **191** again coplanar with the plane of the end blank and the paper line. As shown, the track **200** may conveniently be formed in one of the longitudinally extending support bars **201** corresponding to bars **40**, of the magazine.

In Fig. 8 the suction cup **165** is shown at the moment of adherence with an end blank, in Fig. 9 the suction cup and housing are retracted by the suction to bow the blank and in Fig. 10 the cup and housing are shown in an advanced position and back in their normal plane.

The above described device is especially useful with heavy paper stock having deeply defined creases to the extent that the bottom of the crease in one blank nests in the recess of the crease of the next lower blank and prevents sliding movement of the latter.

I claim:

1. Apparatus for automatically and successively sliding and separating each individual flat paper box blank from the bottom of a stack of flat blanks, said apparatus including magazine mechanism for supporting said stack and having a gateway opposite the leading edge of the bottom blank for passing one blank at a time; sheet gripping and advancing mechanism mounted outside the gateway of said magazine and having a pair of rotating members, each positioned on an opposite side of the path of a blank for seizing and advancing the same when presented therebetween through said gateway; and suction sheet segregating mechanism operable upon the exposed face of each bottom blank of the stack, said mechanism including a suction cup having a flat friction face therearound of substantial area extending in a plane parallel to the plane of said bottom blank, suction means for intermittently exhausting air from said cup; suction cup support means for supporting and guiding said friction faced suction cup in a closed substantially angular unidirectional path, while retaining the friction face thereof in said plane, said path having an elongated rectilinear component coinciding with the flat plane of said bottom blank and leading to said gateway and having its remaining components below and spaced from the flat plane of said bottom blank, and mechanical means, synchronized with said suction means, for actuating said suction cup support means to move said friction faced suction cup along said closed angular path.

2. Apparatus as specified in claim 1 wherein said magazine mechanism includes a roller platform formed by at least two spaced apart parallel rows of rollers, each row extending entirely across the bottom of the magazine in the direction of advance of a blank and each roller being freely revolvable on an axis of rotation parallel to, but below the plane of said gateway.

3. Apparatus as specified in claim 1 wherein said magazine mechanism includes a stationary shelf under the leading edge portion of the bottom blank of the stack and a roller platform extending rearwardly therefrom entirely under the middle and trailing portion of said blank, said shelf and platform being in a common flat plane.

4. Apparatus as specified in claim 1 wherein said suction cup support means includes a roller carriage to which said cup is affixed, a straight track extending parallel to the direction of advance of a blank for guiding and slideably supporting said carriage and a straight rod, mounted on said apparatus for sliding movement in a direction perpendicular to the direction of advance of a blank, said rod guiding and supporting said track.

5. Apparatus as specified in claim 1 wherein the mechanical means for actuating the suction cup support means includes yoke follower arm and cam means for moving the same in its horizontal components and roller follower rocker arm and cam means for moving the same in its vertical components, said cams being rotatable with a common shaft.

6. Apparatus as specified in claim 1 wherein said sheet gripping and advancing mechanism is synchronized with said suction sheet segregating mechanism and one of the rotatable members of said sheet gripping and advancing mechanism is provided with a circumferential face having an elongated raised toothed, arcuate section and an elongated depressed, smooth, arcuate section, said raised toothed arcuate section being adapted to grip a blank, and said smooth depressed, arcuate section being adapted to pass a blank in cooperation with the circumferential face of the other rotating member of the pair.

7. Apparatus for automatically and successively slidably segregating each individual flat sheet from the end of a stack of such sheets, said apparatus comprising a suction cup having a flat friction face of substantial area therearound in a plane parallel to the plane of said end sheet; suction means for intermittently exhausting air from said friction faced cup; suction cup support means for supporting and guiding said suction cup in a closed substantially angular uni-directional path while retaining the friction face thereof in a plane substantially parallel to the plane of the end sheet, said path having an elongated component substantially parallel to the plane of the end sheet and having its remaining components all in a plane perpendicular to the plane of said end sheet and mechanical means, synchronized with said friction faced suction means, for successively actuating said suction cup support means to move said suction cup along said closed angular path.

8. A combination as specified in claim 7 plus mechanism forming part of said suction cup support means for drawing the face of said cup slightly away from the plane of an endmost sheet upon initial engagement thereof to bow the sheet and mechanism forming part of said mechanical means for returning the face of said cup to the plane of said endmost sheet during movement along the elongated rectilinear component of said path.

9. In a machine of the character described for feeding flat blanks individually and successively from the end of a stack of such blanks the combination of a suction cup having a flat friction face therearound adapted to frictionally engage a substantial area of the exposed face of a blank; a carriage supporting said suction cup with the flat friction face thereof always parallel to the plane of the end sheet in said stack; a pair of laterally spaced straight tracks slideably supporting said carriage and each extending in a plane parallel to the flat plane of said end sheet; a pair of straight rods each slideably mounted on said machine, each rod supporting one of said tracks and extending in a plane perpendicular to the plane of said end sheet; a pair of connecting arms on said machine each having one terminal end pivotally connected to said carriage and having a yoke cam follower at its other terminal end; a pair of eccentric cams on a cam shaft each for actuating one of said yoke cam followers; a pair of rocker arms on said machine each having one terminal end pivotally connected to one of said rods and at least one said rocker arm having a roller cam follower at its other terminal end; another cam on said cam shaft having a cam track for actuating said roller cam follower, and suction means, including a suction control valve rotatable with said cam shaft for controlling the suction cycle of said cup in cooperation with the travel of said carriage.

10. A machine as specified in claim 9 wherein said carriage includes a shaft extending laterally across said machine; a collar adjustably mounted on said shaft for affixation in various lateral positions, and a bar extending longitudinally of said machine, said bar being adjustably mounted in said collar for affixation in various

longitudinal positions and said suction cup being fixed at one end of said bar.

11. Blank feeding mechanism for use in slideably advancing flat blanks from the end of a stack in a paper box folding machine, said mechanism comprising a magazine for holding a stack of flat blanks; a flat friction face of substantial area formed by spaced apart, flat, rims of a plurality of suction cups, for successively adhering to the exposed face of each successive end blank in said magazine; a carriage for supporting said suction cups; a pair of tracks each mounted on an opposite side of said machine below said magazine and extending rectilinearly parallel to the direction of slideable advance of a blank for slideably supporting and guiding each opposite end of said carriage; a pair of rods, each mounted on an opposite side of said machine below a track and extending rectilinearly perpendicular to said direction of advance of a blank for slideably supporting and guiding one of said tracks; means for continuously raising said tracks perpendicularly toward the exposed face of an end blank, then advancing said carriage in said tracks, parallel to the flat plane of an end blank then lowering said tracks perpendicularly away from the exposed face of said end blank and then retracting said carriage in said tracks parallel to the plane of an end blank, and suction means, cooperable with said means, for creating suction in said cups after engagement of the friction face thereof with the exposed face of a sheet and during the advancing movement of said carriage in said tracks.

12. The method of individually and successively feeding the endmost sheet from a stack of flat sheets which comprises moving a flat friction face, of substantial sheet engaging area, perpendicularly up to a position flatwise against the exposed face of an endmost sheet with no component tending to slideably advance the sheet off the stack, then drawing said sheet face by suction into firm adherence with said friction face, then advancing said friction face in the direction of feeding, while adhered to said endmost sheet a predetermined distance and completely halting said friction face and then releasing said suction adherence and returning said friction face to its initial position by a path removed from said endmost sheet and stack, all while said friction face is parallel to the plane of said endmost sheet.

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