March 8, 1960 H. J. GOSS 2,927,792

RECIPROCATING SHEET FEED APPARATUS

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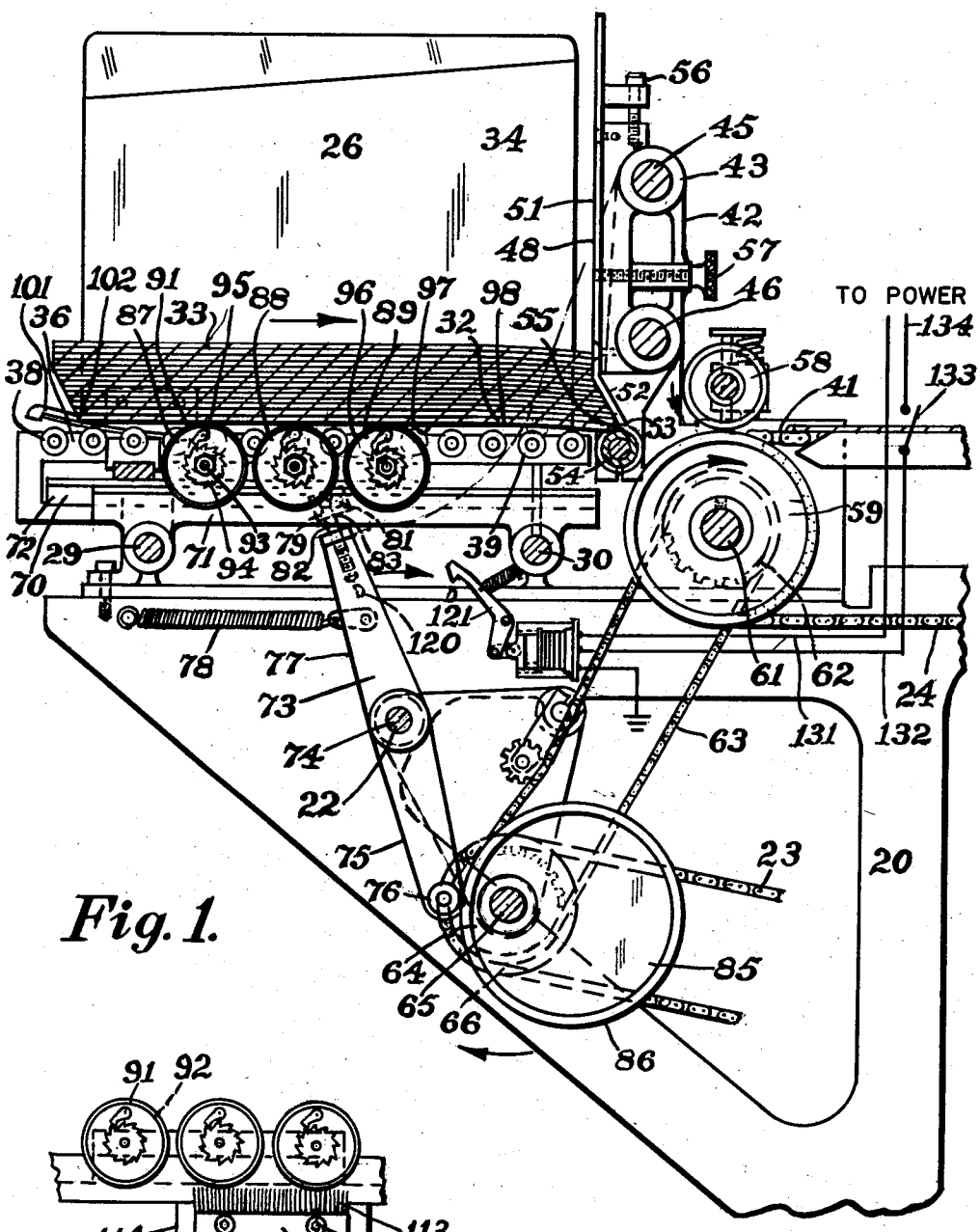

Fig. 1.

Fig. 2.

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RECIPROCATING SHEET FEED APPARATUS

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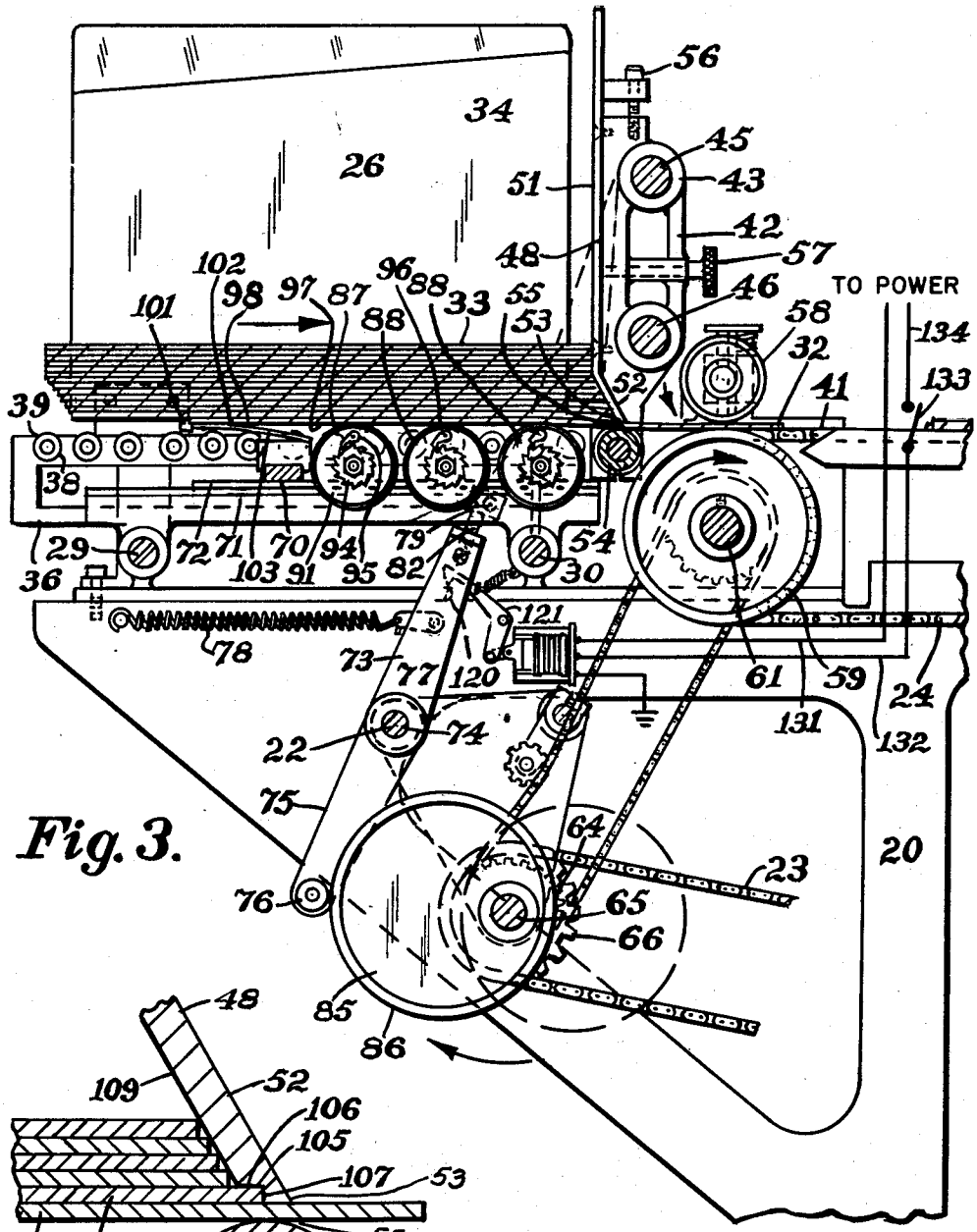

Fig. 3.

Fig. 4.

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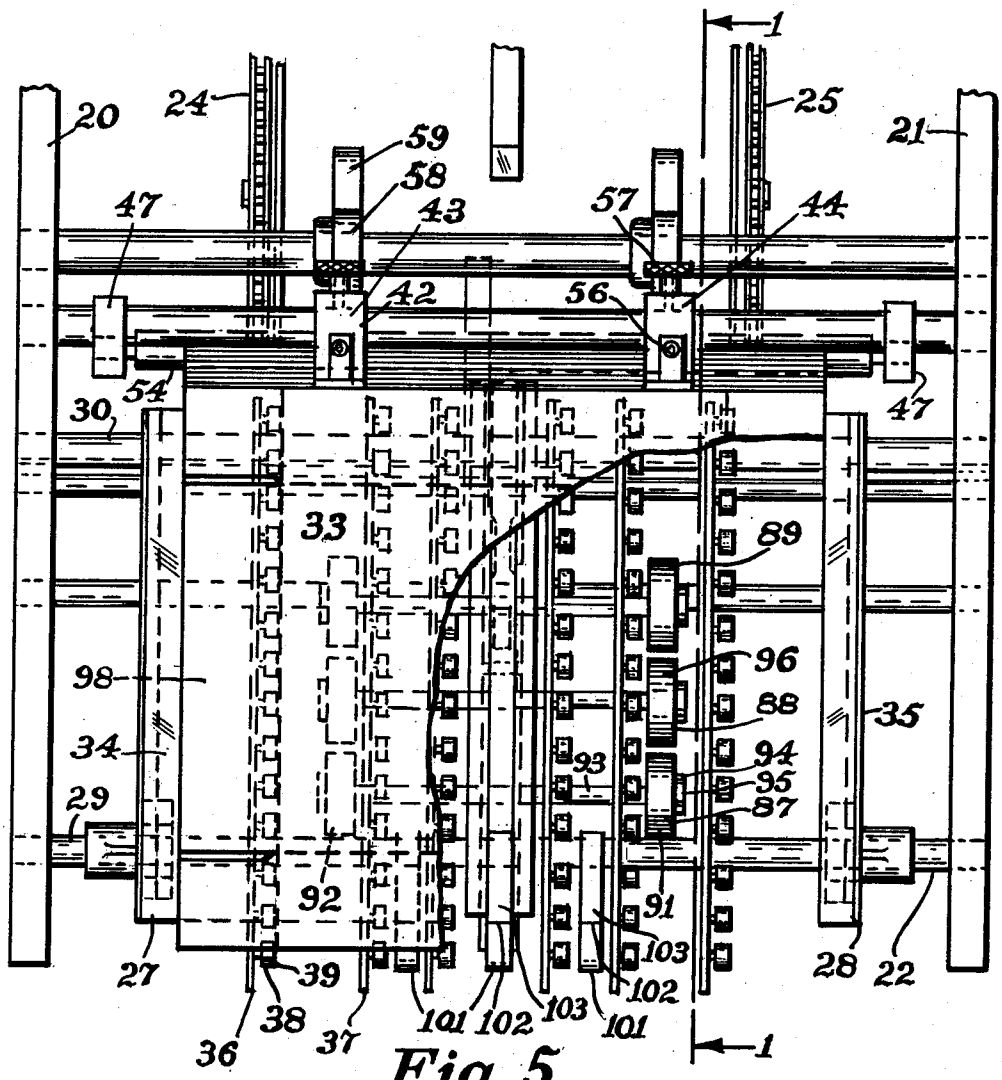

Fig. 5.

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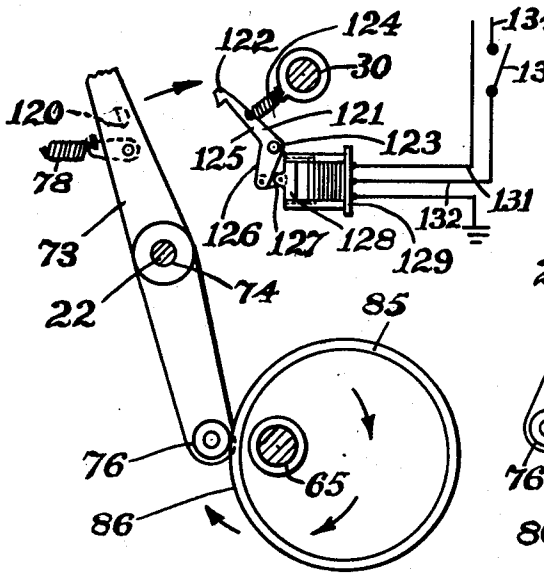

Fig. 6.

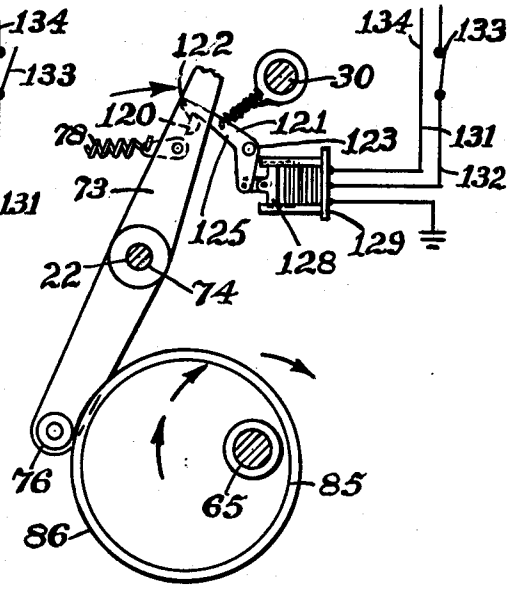

Fig. 7.

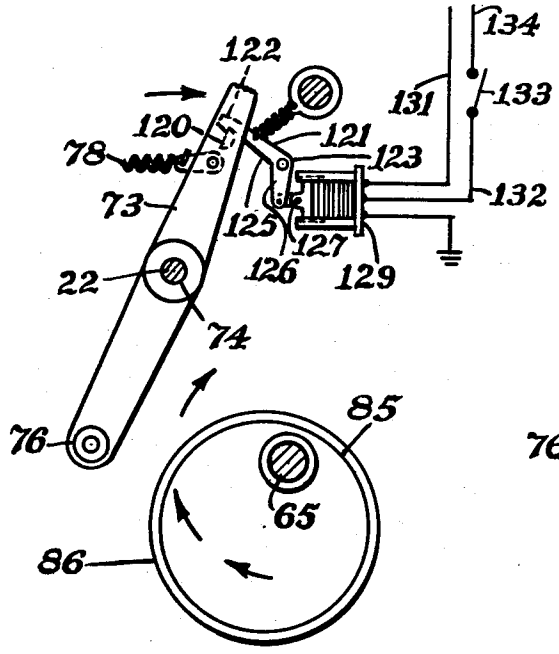

Fig. 8.

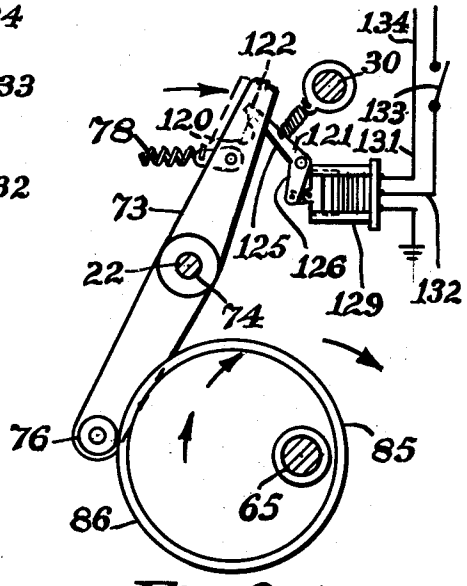

Fig. 9.

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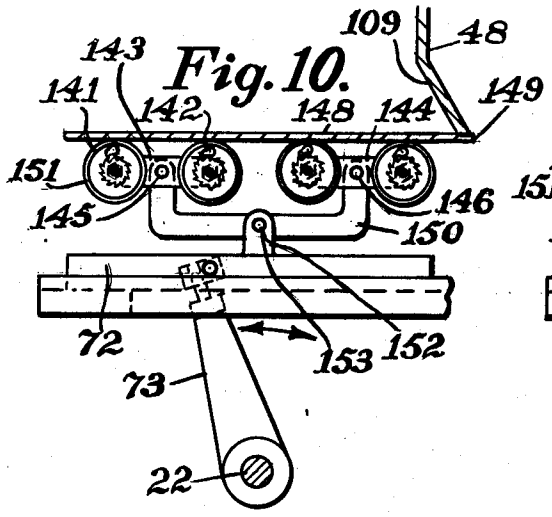

Fig. 10.

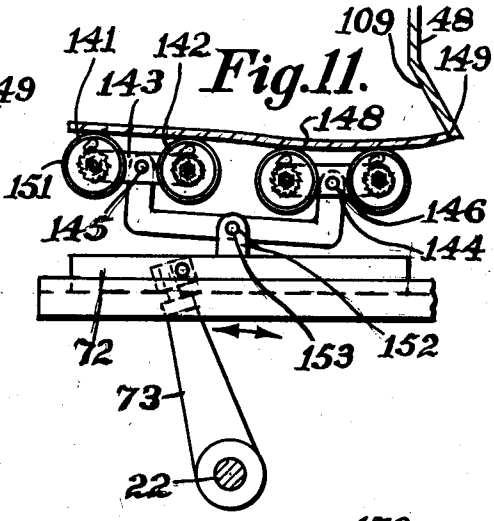

Fig. 11.

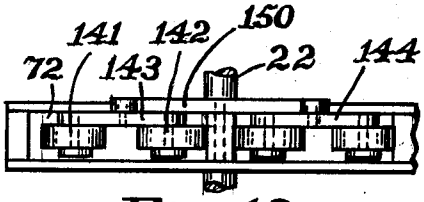

Fig. 12.

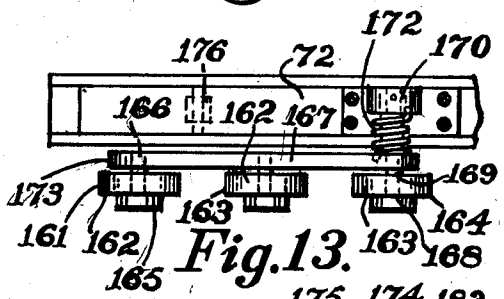

Fig. 13.

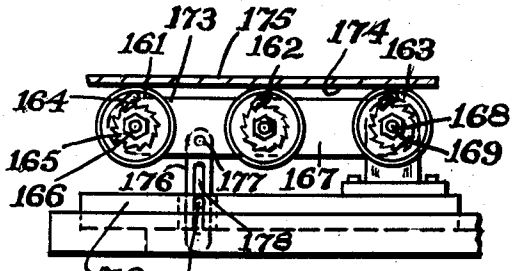

Fig. 14.

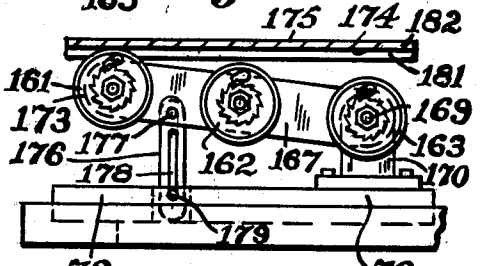

Fig. 15.

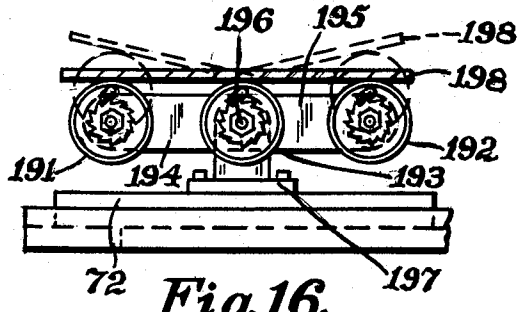

Fig. 16.

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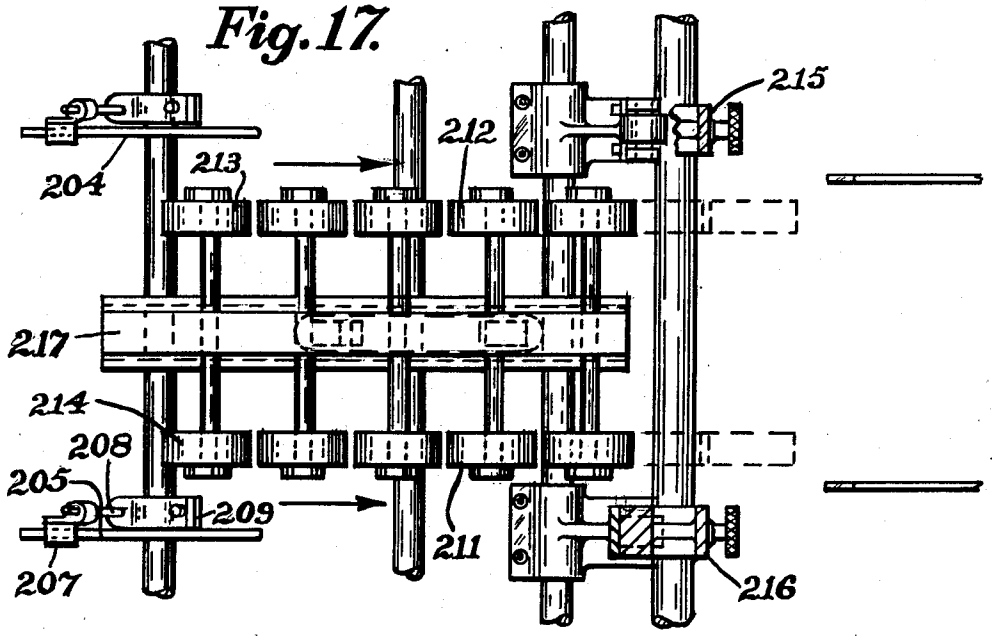
Fig. 17.



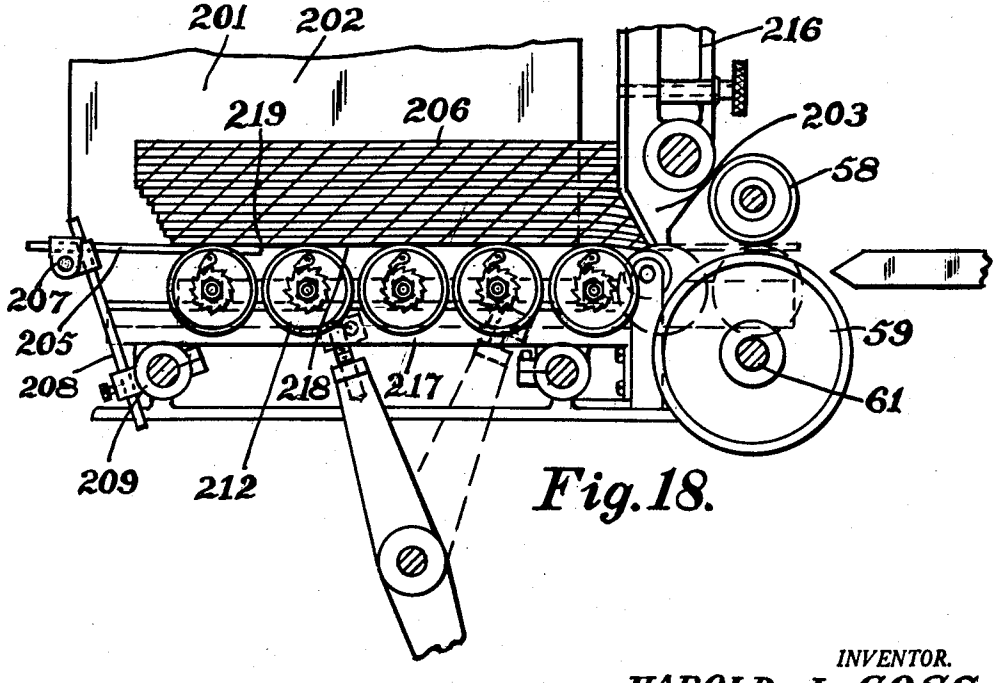


Fig. 18.

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United States Patent Office 2,927,792 Patented Mar. 8, 1960

2,927,792

RECIPROCATING SHEET FEED APPARATUS

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Application July 23, 1957, Serial No. 673,641

5 Claims. (Cl. 271—44)

This invention relates to sheet feeding apparatus and especially to such apparatus for use with folding box blanks of corrugated paper board.

It is customary in the paper box and envelope arts to provide a magazine for holding a stack of flat box blanks and to provide an adjustable gate at the outlet of the magazine for passing only one sheet at a time. The mechanism for feeding each successive endmost sheet through the gateway at the outlet has been of various types, for example, a feed wheel having friction inserts, a reciprocating slide having an abutment for engaging the trailing edge of a blank, suction cups moving in various paths, and the like.

The feeding of sheets of corrugated paper board at high speed presents difficulties not ordinarily encountered with ordinary box board. Corrugated paper board usually has a relatively rough surface tending to increase the adhesion of the sheets to each other and also tends to bow rather than to lie flat. In addition the trailing edge of corrugated paper board may crumple when engaged by feeding fingers, or by the abutment of a slide since the trailing edge is not of solid material as in paper board.

It is the principal object of this invention to provide improved sheet feeding apparatus, especially useful with corrugated paper board, wherein a reciprocating feed member includes unidirectionally rotatable, friction feed rollers movable normal to, and having their friction faces continually in contact with the exposed face of each successive endmost sheet in a magazine for feeding only during the forward stroke and not during the rearward stroke.

Another object of the invention is to provide a pair of friction feed elements, oppositely movable in directions normal to, and operable on the exposed face of, the end sheet of a stack, each element of the pair being rotatable but the rotation of said element being halted during forward translation.

A further object of the invention is to provide unidirectionally rotatable rollers, mounted to rock on arms pivoted to a slideable feed support for friction feeding of the end sheets of a stack, the mounting enabling the rollers to conform to any bow in the sheets of the stack.

Still another object of the invention is to provide friction faced, unidirectionally rotatable rollers for slideably advancing sheets from a stack together with brush means for continuously cleaning the friction faces thereof of lint or other foreign matter.

Other objects and advantages 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 of the invention, in section on line 1—1 of Fig. 5.

Fig. 2 is a fragmentary view, similar to Fig. 1 of the brush means of the invention.

Fig. 3 is a view similar to Fig. 1 but showing the feed mechanism in another position.

Fig. 4 is an enlarged fragmentary side elevation of the improved gate of this invention.

Fig. 5 is a plan view of the device shown in Fig. 1 with part of the stack broken away.

Figs. 6 to 9 are diagrammatic side elevations showing the latching mechanism of the invention in various stages.

Figs. 10 and 11 are fragmentary side elevations similar to Fig. 1 showing the rotatable feed elements of the invention rockably mounted in the preferred manner.

Fig. 12 is a plan view of the device shown in Fig. 10 and Fig. 11.

Fig. 13 is a plan view and Figs. 14 and 15 are side elevations of a resilient mounting for the rotatable feed elements of the invention.

Fig. 16 is a modified form of the mounting shown in Figs. 10, 11 and 12.

Fig. 17 is a plan view similar to Fig. 5 of still another modification and

Fig. 18 is a side view of the device shown in Fig. 17.

The feeding apparatus of this invention may be used in feeding sheets from a stack in many different types of machines and only the feed zone of a typical machine is illustrated. **20** and **21** designate the side frame pieces of the machine, there being the usual cross frame members such as **22** and a chain **23** forming part of the power train of the machine. Carrier chains or belts such as at **24** and **25** carry the sheets individually and successively away from the feed zone and through the treatment or folding zones of the machine in a well known manner forming no part of this invention.

Sheet magazine means **26** includes the sub frame pieces **27** and **28** slideably mounted on cross rods **29** and **30** for lateral adjustment to the width of the sheets such as **32** in the stack **33**. Upstanding side magazine guides **34** and **35** are carried on sub frame pieces **27** and **28** and a plurality of longitudinally extending bottom supports such as **36** and **37** are laterally slideable on the rods **29** and **30**. Each bottom support such as **36** carries a longitudinally extending row **38** of freely revoluble rollers such as **39**, the rollers forming a relatively frictionless bottom for stack **33** at the level of the paper line **41**.

Sheet separator means **42** includes at least one, and preferably two, gate mechanisms such as **43** and **44** which form the forward wall of the magazine means as well as the outlet therefor. Each gate mechanism such as **44** is slideable laterally on cross rods such as **45** and **46**, the cross rods being supported on sub frame pieces such as **47**. The gate **48** thereof is preferably vertical in its upper portion **51** but forwardly inclined in its lower terminal portion **52** to cause the sheets in stack **33** to fan out in a well known manner, thus assisting in the segregation of the same. The lower terminal tip **53** of each gate **48** is spaced above a laterally extending roll **54** a distance equal to the thickness of a single sheet such as **32** in order to form a sheet passage **55** for passing only a single sheet at a time. The width of passage **55** is adjustable by set screw **56** and the lateral position of the gate mechanism **44** is adjustable by set screw **57**.

The usual sheet advancing pressure rolls such as **58** and **59** are located beyond the passage **55** in order to pick up each successive sheet moved through the gateway or passage and advance the same to the carriers **24** and **25** all in a well known manner. The lower roll **59** is mounted on a shaft **61** and turned in the direction of the arrow by a sprocket **62**, chain **63** and a sprocket **64** carried on a shaft **65**. Shaft **65** is turned by a sprocket **66** turned by chain **23**.

The sheet feeding mechanism **70** of the invention includes a longitudinally extending track or way **71** slideable laterally on the cross rods **29** and **30** and preferably positioned at the longitudinal central line of the magazine bottom at a spaced distance therebelow. A support **72** is slideably mounted on track **71** and arranged to be moved longitudinally along the magazine bottom, in the

space between the rows such as 38 of rollers 39, toward and away from the magazine outlet formed by the sheet passage 55. An actuating arm 73 is centrally pivoted at 74 on cross rod 22 and includes a lower arm 75 carrying a roller cam follower 76, an upper arm 77 and a return spring 78. Upper arm 77 carries a block 79 pivotally connected by pivot pin 81 to support 72, the block 79 having a recess 83 slideable on a pin 82 mounted on the upper arm 77. An eccentric cam 85 revolubly mounted on shaft 65 is arranged to move cam follower 76 toward the rear of magazine means 26 with each revolution thereof, thereby moving support 72 on its forward stroke of reciprocation. Spring 78 maintains the cam follower 76 in contact with the peripheral face 86 of cam 85 and also returns the support 72 on its rearward stroke of reciprocation. It will be apparent that the support 72 continuously reciprocates longitudinally along the magazine bottom, toward and away from passage 55 so long as shaft 65 is turned by chain 23.

The sheet feeding mechanism 70 also includes at least one unidirectionally rotatable member having a friction face and carried by the support 72. Preferably a plurality of such members are provided on each opposite side of the longitudinal centre line of the magazine bottom, each row being aligned with one of a pair of gate mechanisms such as 44 and 45. As shown there are three pairs of such members, 87, 88 and 89, each roll 91 and 92 of each pair such as 87 being mounted on a single lateral shaft such as 93 fixed to support 72 and each roll 91 and 92 being on an opposite side of the said longitudinal centre line. Each rotatable member, or roll, such as 91 is connected to its shaft by a ratchet 94 and pawl 95 to prevent rotation thereof on the forward stroke of reciprocation of support 72, but to permit rotation on the rearward stroke of reciprocation. The particular rotatable members shown are of rigid material and revoluble on rigid shafts but such members could be mounted on shafts of resilient material or could be of resilient material for example, structures of the balloon tire type or of the rollable bag type. The peripheral or sheet contacting face 96 of each rotatable member such as 91 is of friction material such as rubber, in order to frictionally engage the exposed underface 97 of each successive bottom sheet 98 of stack 33. The unidirectionally rotatable members such as 91 and 92 are preferably mounted on to support 72 to enable the uppermost portions thereof to reach above the level of the bottom of the magazine means defined by the corresponding portions of the rollers 39. Thus perfectly flat sheets will normally rest entirely on the rotatable members 91 and 92 and upwardly bowed sheets will also be firmly engaged by the said members.

In operation, the forward movement of support 72 will cause the rotatable members such as 91 and 92 to frictionally advance the endmost sheet in the stack through passage 55 and into the nip of rolls 58 and 59. The ratchet and pawl mechanism prevents rotation of the members during the advancing movement. Upon the return stroke of reciprocation the rotatable members merely rollably engage the exposed face of the sheet being fed and that of the next successive sheet with no tendency to move either sheet rearwardly. Usually the rolls 58 and 59 pull the sheets away from the stack at high speed and the members 91 and 92 do not tend to tear the sheet because they rotate freely as the fed sheet is so pulled.

Feeding mechanism 70 may also include a plurality of laterally spaced, resilient feed fingers such as 101 mounted along the rear edge of support 72. Each finger such as 101 is provided with an upstanding abutment 102 arranged to engage the trailing edge of each bottom sheet and carry the sheet forwardly with the support toward passage 55. The resilient fingers 101 include a curved trailing edge 103 for sliding along the bottom sheets on the return stroke and are especially useful in case of an extreme bow in the sheets since they spring upwardly to accommodate themselves to the shape of any such bow. Because of the difficulty in feeding corrugated sheets, it is desirable that the stack be fanned out, and resilient fingers such as 101 used, in addition to the unidirectionally rotatable friction feed members such as 91 and 92, thus assuring an efficient segregation of the sheets without likelihood of jamming at the gate, double feeds or crumpling of the sheets.

As shown in Fig. 4, it is also preferred that the inclined lower portion 52 of each gate such as 48 be provided with a notch, or recess, 105 at the terminal tip 53. Notch 105 is substantially right angular to provide a horizontal upper wall 106 and a vertical forward wall 107, the wall 107 constituting a vertical barrier for the each successive sheet 108 next to the bottom sheet 98. The inclined rear face 109 of the portion 52 permits the stack 33 to fan out which is desirable for segragtion purposes but also tends to press, or guide, downwardly the leading edges of the sheets. By reason of notch 105 there is reduced pressure on the sheets 108 tending to urge the same into the passage 55 and the advance of the sheet 108 is positively halted against wall 107 until the end, or bottom, sheet 98 has entirely cleared passage 55. The roll 54 forms the opposite side of passage 55 in the usual manner.

As shown in Fig. 2, the unidirectional friction faced, rotatable members of the invention, such as the rolls 91 and 92 may be provided with brush means for continually cleaning the friction faces thereof of lint or other foreign material. Brushes such as 112 having upstanding bristles 113 are fixed in the path of reciprocation of the members 91 and 92 to clean the faces thereof on both the forward and rearward stroke of the support 72. The brushes 112 are fixed to a cross frame piece 114 by set screws 115.

As best shown in Figs. 6–9, the oscillatable actuating arm 73 is provided with a laterally projecting stud 120.

A latch 121, having a hooked portion 122 for engaging the stud, is pivoted at 123 to frame 20. Latch 121 is of bell crank shape with a spring 124 on its longer arm 125 and the shorter arm 126 thereof is pivoted at 127 to the armature 128 of a solenoid 129. Solenoid 129 is connected by conductors 131 and 132 to a switch 133 and a suitable electric power source 134 whereby closing of the switch 133, energizes the solenoid to pivot latch 121 into stud engaging position.

Normally the latch 121 is in raised position as shown in Fig. 6 with the switch 133 open. When as sometimes occurs, it is desirable to stop the feeding of sheets while the machine completes its operations on sheets already fed, the switch 133 may be closed to cause latch 121 to engage stud 120. The arm 73 is thus held with its cam follower 76 out of contact with the continuously rotating cam face 86 of cam 85 and sheet feeding ceases all as illustrated in Fig. 7. When it is desired to resume feeding, the switch 133 is opened thereby de-energizing solenoid 129 but as shown in Fig. 8, the hooked portion 22 does not immediately release stud 120 because of friction therebetween. However, as shown in Fig. 9 the cam face 86 upon engaging follower 78 moves the stud 78 slightly with each revolution thereof and such movement frees latch 121 to return to its normal position by means of spring 124.

As shown in Figs. 10, 11 and 12 it is preferred that, instead of rigidly mounted rotatable members such as 91 and 92, similar members such as 141 and 142 be mounted for unidirectional rotation on rocker arms such as 143 and 144, the rocker arms being pivotally mounted at 145 and 146 on a rocker arm 150 which is pivoted at 152 of bracket 153 mounted on slideable member 72. The sheets 148 shown, may have a considerable bow but the leading edges 149 thereof are constantly urged downward by the inclined face 109 of the

gate 48 thereby inclining the successive sheets downwardly. The rockable members 141 and 142 are thus caused to tilt accordingly until each member is firmly in contact with the underface of the end, or bottom, sheet and enabled to frictionally advance the same. The rotatable members 141 and 142 may be entirely of rubber or similar yieldable, friction material or may be rolls of rigid material such as metal with a circumferential covering 151 of yieldable, friction, resilient material such as sponge rubber, foam rubber or the equivalent. Each pair of friction rolls is thus mounted to tilt or rock oppositely in a direction normal to the plane of the end sheet, thereby conforming to any bow therein.

As shown in Figs. 13, 14 and 15, instead of rigidly mounted or rockably mounted members such as 91 or 141, similar members 161, 162 and 163 may be resiliently mounted relative to the slide 72, to rock as a unit. Each member such as 161 is unidirectionally rotatable by means of the pawl 164, ratchet 165 and stub shaft 166 on an arm 167 pivoted at 168 to a shaft 169 carried by bracket 170. A coil spring 172 encircles shaft 169 and is arranged to continually urge the free end 173 of arm 167 upwardly toward the underface 174 of a sheet 175 in the magazine. A strip 176 is pivoted at 177 to arm 167 and slotted at 178 to receive a pin 179 on slide 72 in order to serve as a limit stop as well as a guide for arm 167. In Fig. 14 the arm 167 is shown horizontal when the sheets 175 are flat and unbowed but in Fig. 15 the arm 167 has pivoted upwardly by spring pressure to engage the underface 181 of a bowed sheet 182 with at least one rotatable friction feed element.

In Fig. 16 resiliently mounted friction feed members 191 and 192 are shown associated with a rigidly mounted member 193, all similar to the elements 91, 141 and 161. A pair of oppositely disposed arms 194 and 195 are spring pivoted on a shaft 196, of a bracket 197 carried by the slide 72, each carrying a member 191 or 192 at its free end. The member 193 is rotatable on shaft 196 but does not yield or rock thereon. As shown, the members 191, 192 and 193 accommodate themselves to a convex or concave bow in a sheet 198, by rocking or tilting in a vertical plane on the arm 195, to assure a good grip thereon.

As shown in Figs. 17 and 18, sheet magazine means 201 may be provided having side plates such as 202, a forward wall formed by sheet separating means 203 similar to means 42 and a pair of horizontally extending rods 204 and 205 for supporting the rear edge portion of a stack of blanks 206. Each rod 204 is slideably adjustable in a bracket 207, the bracket 207 being slideably adjustable on a rod such as 208 which in turn is slideably and angularly adjustable in a bracket 209. Thus the rods 204 and 205 are universally adjustable to support various sizes of blanks. The remainder of the bottom of the magazine means 201 is formed by a pair of lines 211 and 212 of unidirectional, rotatable feeding members such as 213 and 214 similar to members 41.

Instead of aligning the lines 211 and 212 with the gate mechanisms 215 and 216 of sheet separator means 203 as in the embodiment of Figs. 1–5, the gate mechanisms 215 and 216 are spread apart to permit the slide 217 corresponding to slide 72, to pass therebetween. It is thus possible to have the underface 218 of each successive endmost sheet 219 frictionally engaged at spaced zones for the full length thereof to secure an especially firm grip thereon. In addition, the entire weight of the stack is supported by the friction feed members, except for the rear edge portion and there is no tendency for the blank being fed to crumple at the gateway or at the feed rolls 58 and 59. It should be noted that the rotatable members frictionally advance the sheets not only through the gateway, but also travel beyond the nip of the feed rolls, this being possible because the rotatable members revolve freely as the feed rolls pull the sheet forwardly.

I claim:

1. In sheet feeding apparatus of the type having a bottom feed magazine, sheet separator means at the outlet of said magazine and a support continuously reciprocating longitudinally along the magazine bottom toward and away from said magazine outlet the combination of a rocker arm on said support; at least two rotatable members carried by said arm and adapted to reciprocate along said magazine bottom with said support, each said member having a friction face adapted to rollably engage the exposed face of each successive bottom sheet in said magazine and unidirectional mechanism, connecting each said member to said rocker arm and adapted to prevent rotation of said member during movement toward said outlet but to permit free rotation thereof during movement away from said outlet.

2. In sheet feeding apparatus the combination of a magazine having a bottom adapted to support a vertical stack of sheets; an inclined sheet separator gate adapted to fan out the lowermost sheets in said magazine and form a passage for one sheet at a time out of said magazine; a support slideably mounted below said magazine for rectilinear movement toward and away from said passage; at least two unidirectionally, rotatable, friction rollers mounted to move oppositely up and down on said support, said rollers being adapted to engage each successive bottom sheet in said magazine and move said sheet into said passage; an oscillatable actuating arm having one end pivoted below said magazine and the other end pivotally connected to said support for slideably moving said support; rotating cam means operably connected to said actuating arm for oscillating the arm in one direction; spring means operably connected to said actuating arm for oscillating the arm in the opposite direction and urging said arm into contact with said cam means and a pivoted latch at the end of the path of oscillation of said actuating arm by said cam means, said latch being adapted to selectively hold said arm out of contact with said cam means, and thereby halt the feed of said sheets, while said cam means continues to rotate.

3. A combination as specified in claim 2 wherein said inclined sheet separator gate includes a notch adjacent the passage formed thereby, said notch having a vertical wall in the path of the leading edge of each successive second sheet from the bottom in said stack for barring the advance of said sheet into said passage during feeding of the lowermost sheets therethrough.

4. Sheet feeding apparatus comprising a magazine for holding a stack of flat sheets, sheet separator means including a gate, at the outlet of said magazine for passing one said sheet at a time, sheet feeding mechanism reciprocating toward and away from said outlet in a plane parallel to the plane of, and opposite, the endmost sheet of said stack; a rocker arm pivotally mounted on said sheet feeding mechanism to oscillate in a vertical plane, a plurality of friction faced rollers rotatably mounted on said rocker arm for reciprocation therewith, the friction faces of said rollers being in rolling engagement with the under face of each successive endmost sheet in said stack and means for preventing rotation of said rollers when said sheet feeding mechanism is moving toward said outlet and gate.

5. A combination as specified in claim 4 wherein said sheet feeding mechanism includes a plurality of resilient feed fingers; each finger having an upstanding abutment thereon for engaging the trailing edge of each successive endmost sheet in said stack and sliding the same toward said outlet in cooperation with said friction faced rollers.

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