

Jan. 26, 1960

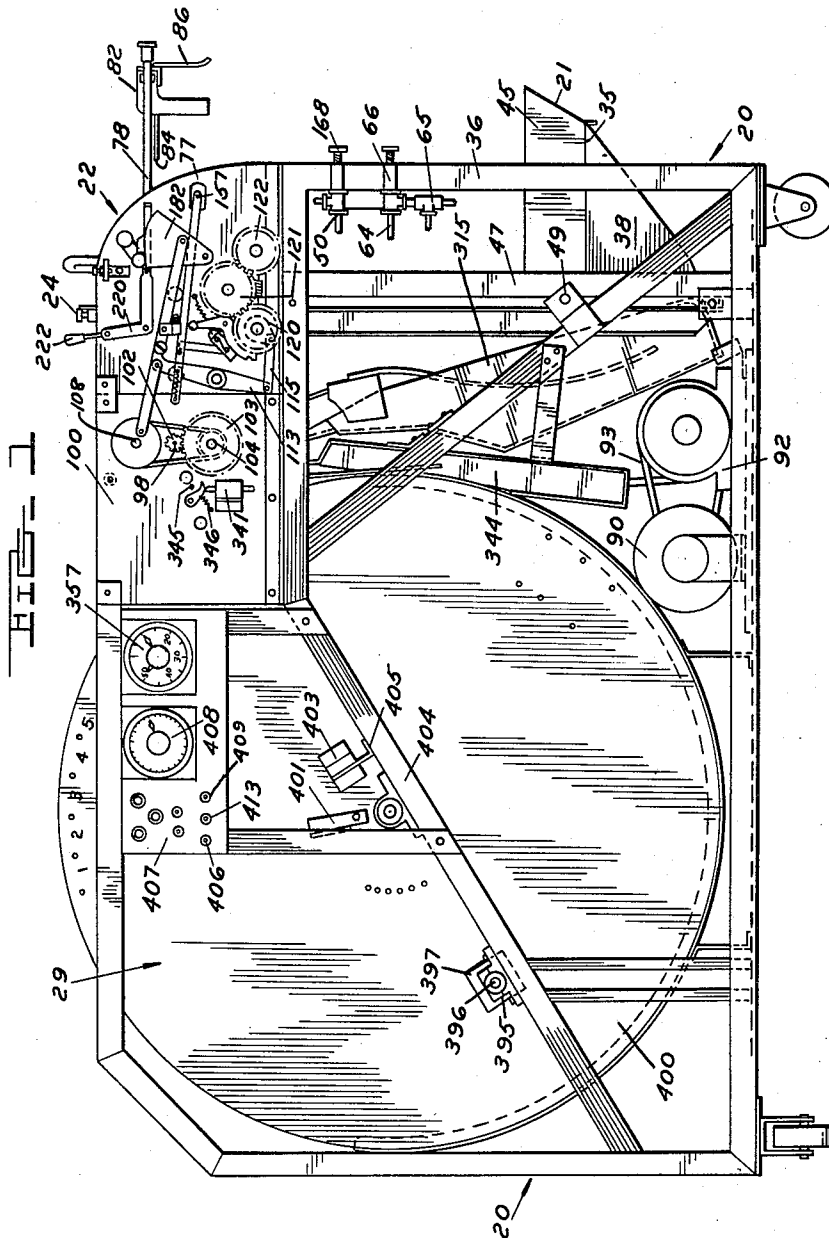
D. E. FORNELL ET AL

2,922,640

COLLATING MACHINE

Filed July 15, 1953

11 Sheets-Sheet 1



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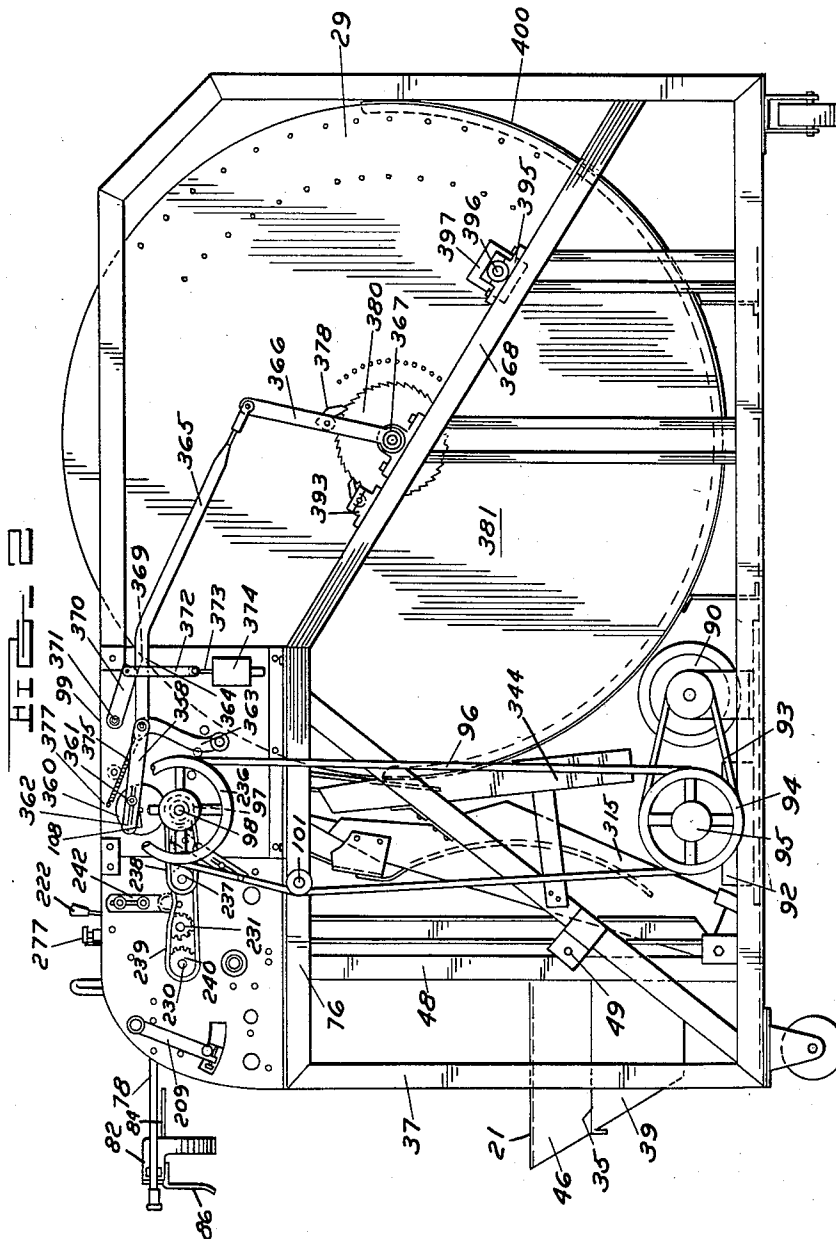
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COLLATING MACHINE

Filed July 15, 1953

11 Sheets-Sheet 2



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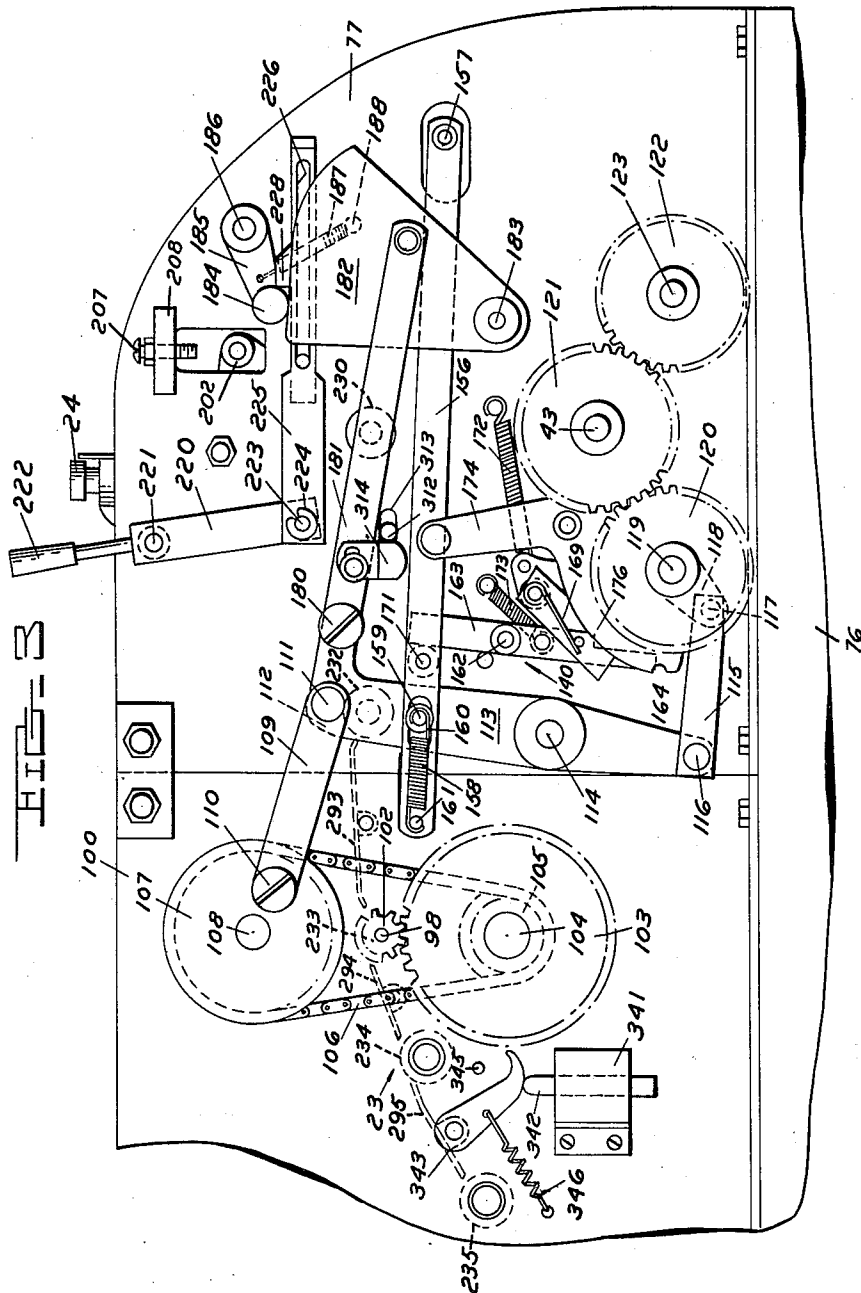
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COLLATING MACHINE

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11 Sheets-Sheet 3



Jan. 26, 1960

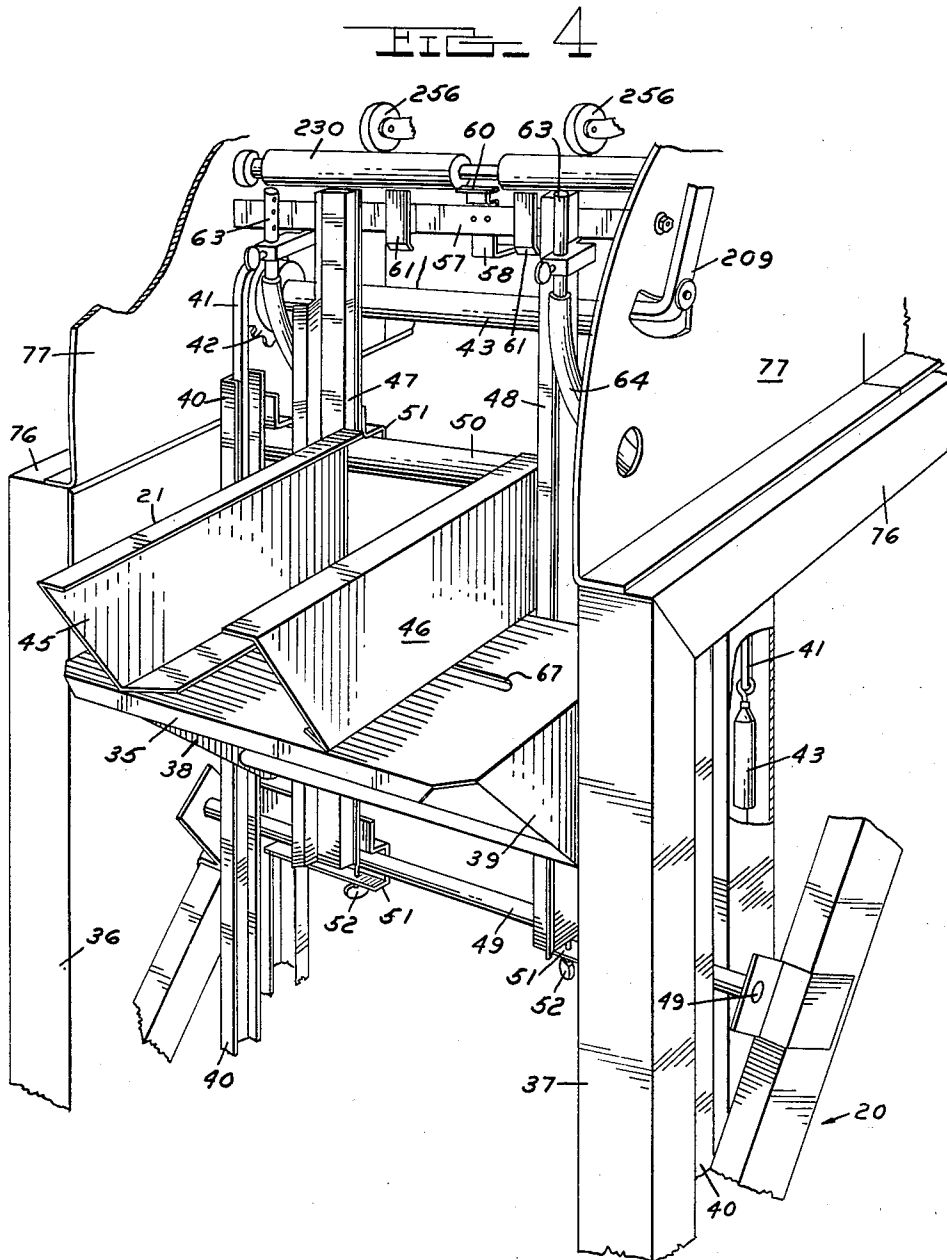
D. E. FORNELL ET AL

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COLLATING MACHINE

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11 Sheets-Sheet 4



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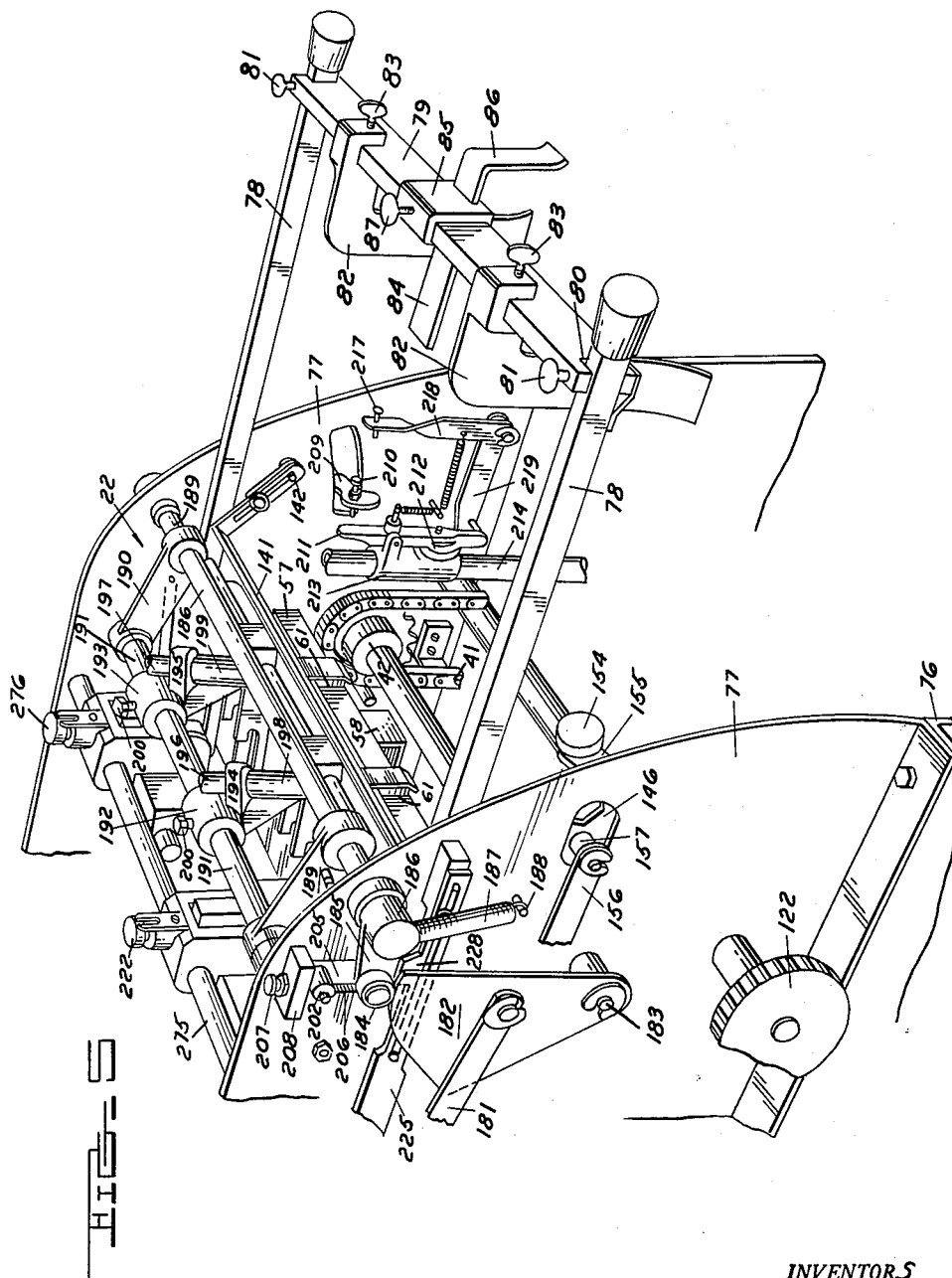
D. E. FORNELL ET AL

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COLLATING MACHINE

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11 Sheets-Sheet 5



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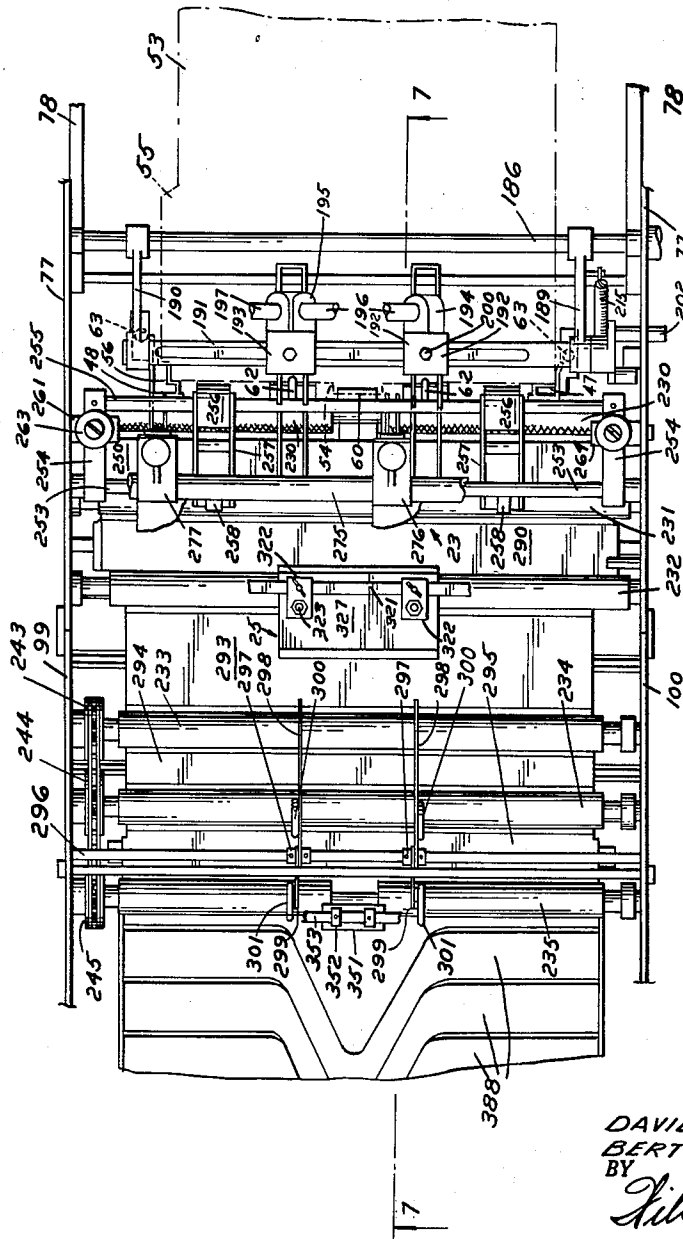
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D. E. FORNELL ET AL
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11 Sheets-Sheet 6



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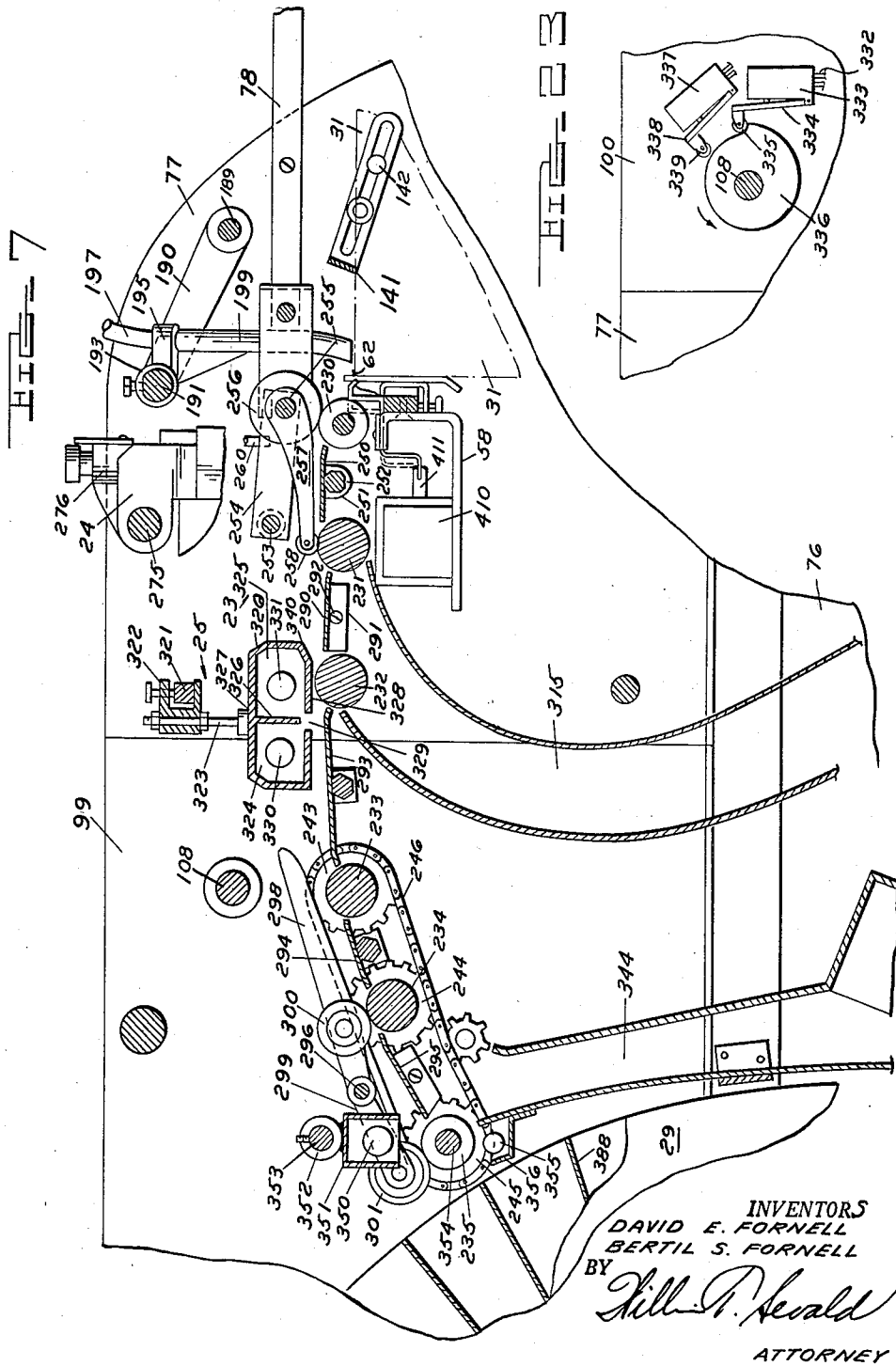
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COLLATING MACHINE

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11 Sheets-Sheet 7



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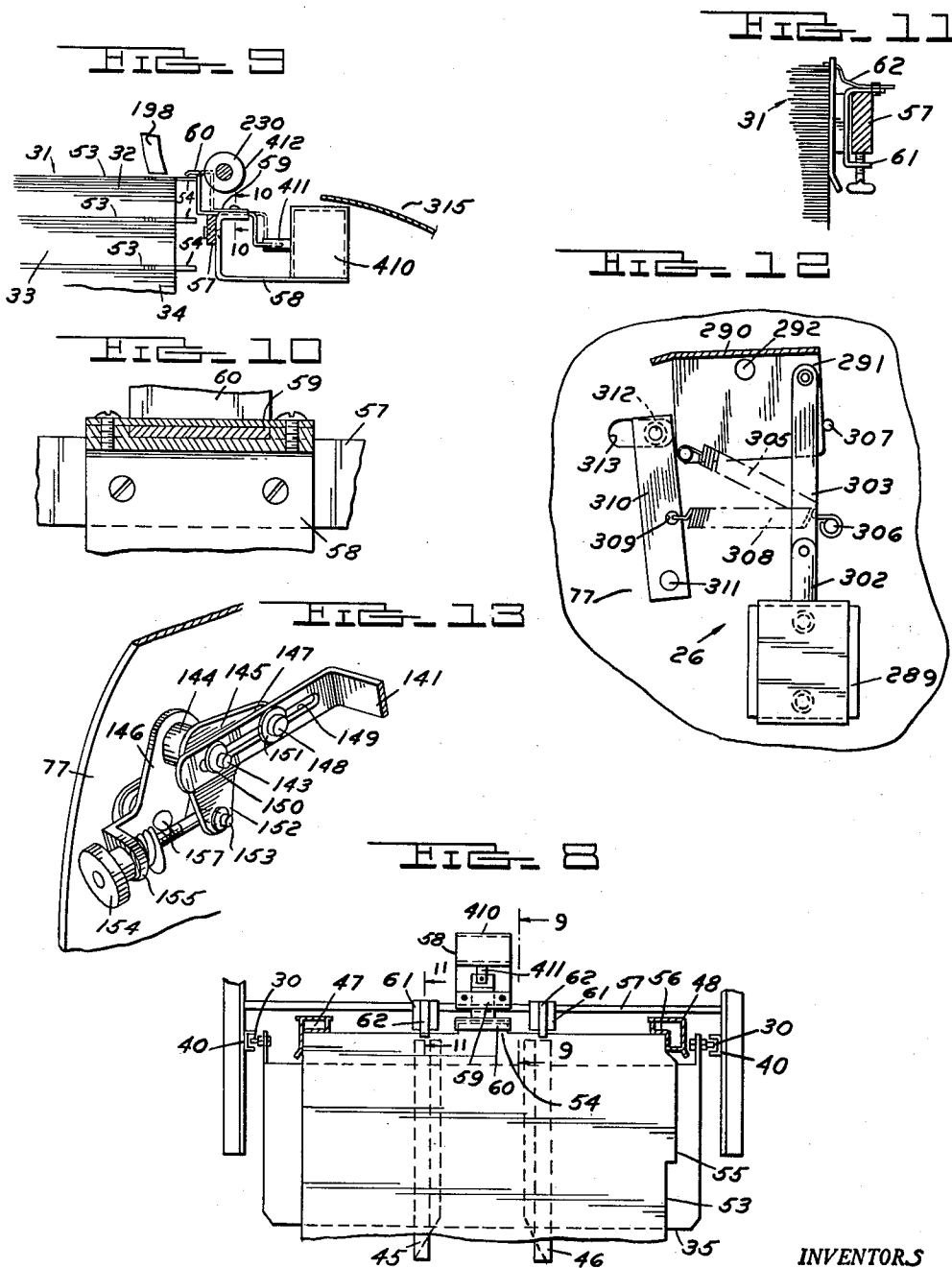
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COLLATING MACHINE

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11 Sheets-Sheet 8



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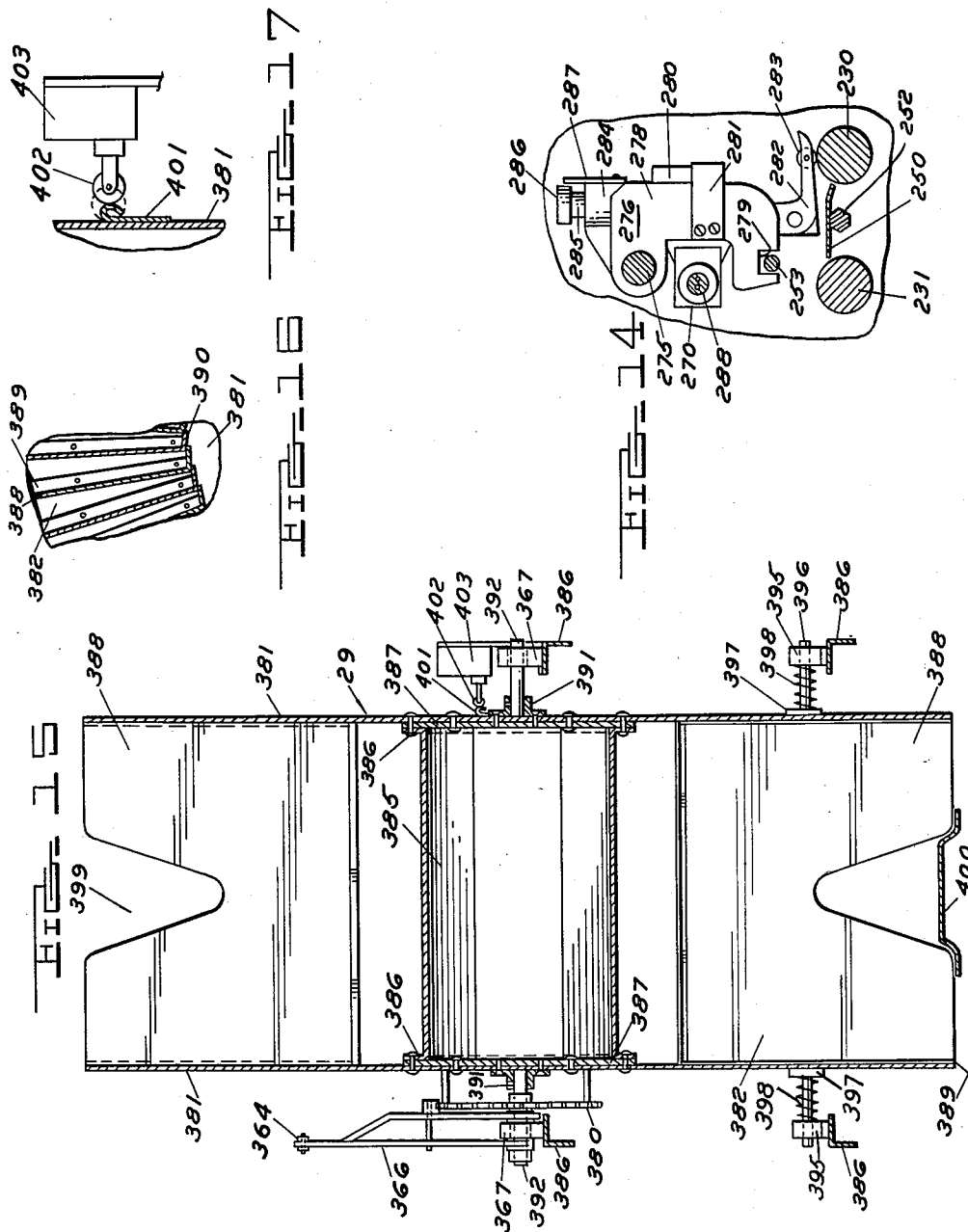
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COLLATING MACHINE

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11 Sheets-Sheet 9



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COLLATING MACHINE

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11 Sheets-Sheet 10

FIG. 18

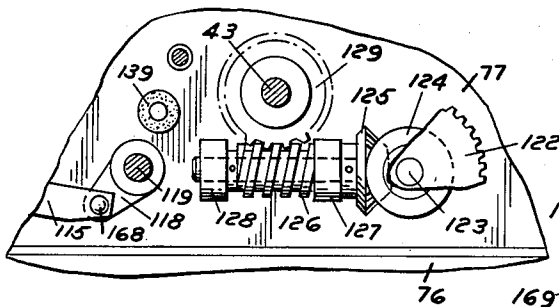


FIG. 19

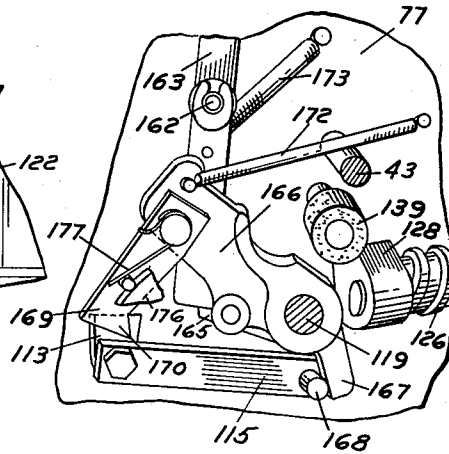


FIG. 20

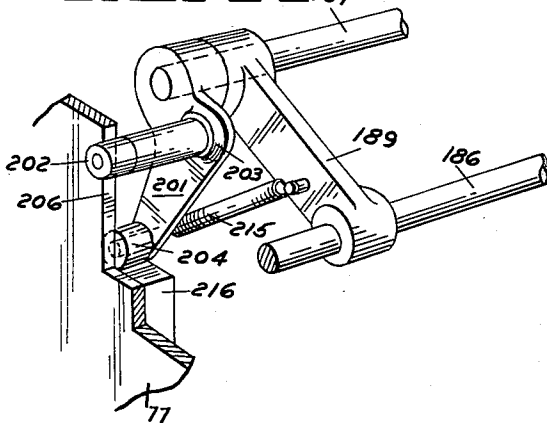


FIG. 21

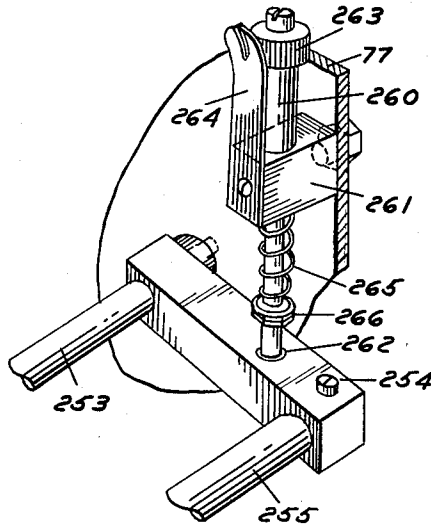
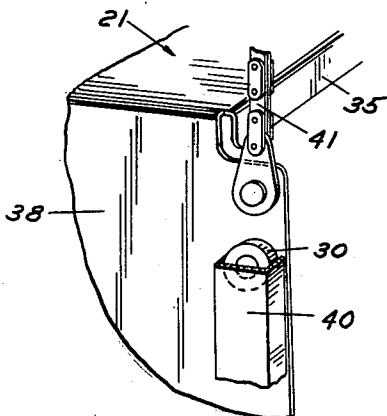


FIG. 22

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COLLATING MACHINE

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11 Sheets-Sheet 11

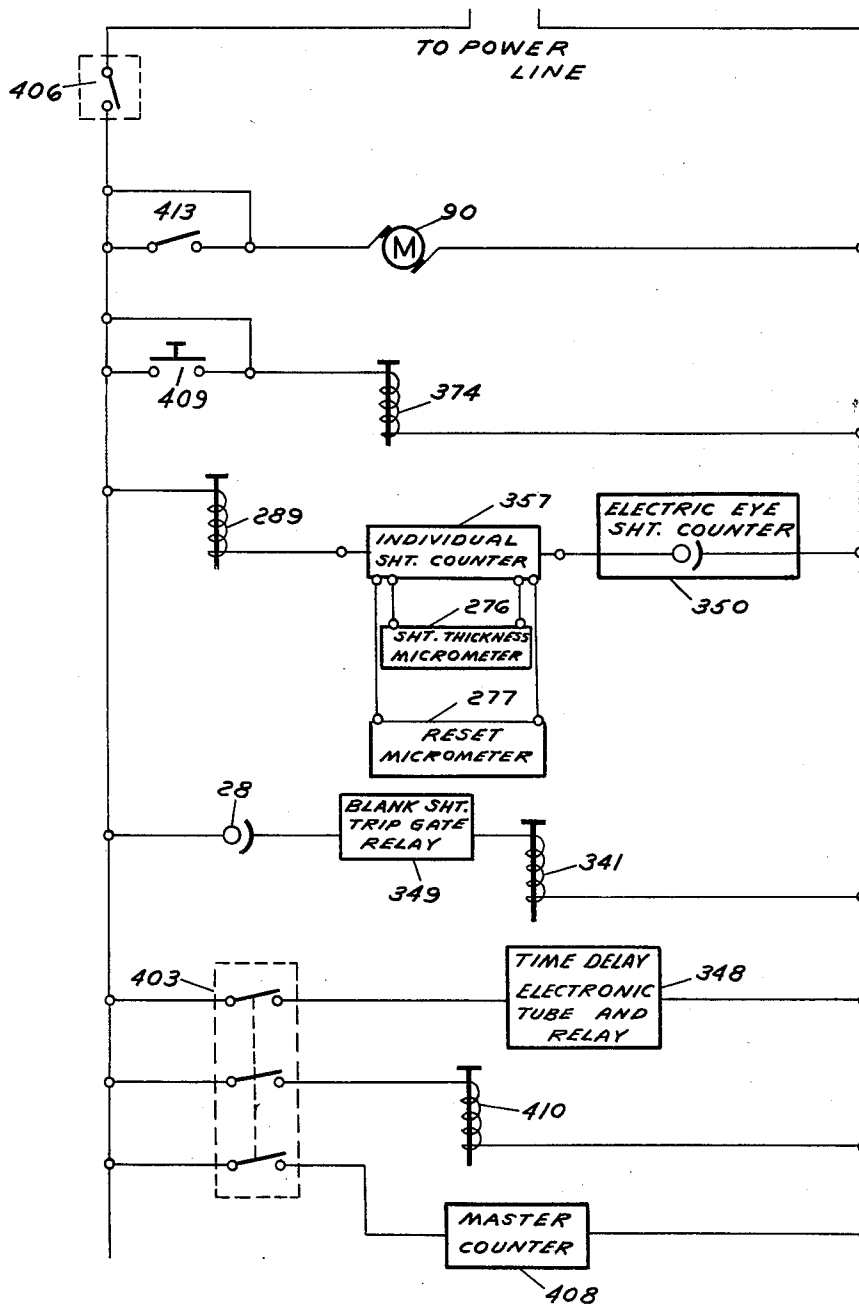


FIG. 24

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COLLATING MACHINE

David E. Fornell and Bertil S. Fornell, Detroit, Mich.

Application July 15, 1953, Serial No. 368,132

14 Claims. (Cl. 270—53)

This invention relates to collating machines and more particularly to a collating machine having a large, variable capacity whose sheet collecting operation is begun from one supply of stock positioned in the machine in a single stack as it comes from the printer and which progresses through completely automatic stages of single sheet gauging and blank sheet scanning until each acceptable sheet is finally collected in a separate bin in a traveling depository in the proper sequence.

Collating machines are well known in the art and their operation has consisted, in the main, of piling stacks of sheets on a plurality of feeding tables from which individual sheets are withdrawn and assembled in a single desired order. Each of these prior art collating machines has its own particular advantages, but they are all subject to the criticism that by the very presence of multiple feeding tables there is a great multiplicity of certain parts such as feeding devices, which multiplicity greatly increases the cost of such collating machines. The use of multiple feeding tables also requires that the machine be of fairly large dimensions, thus taking up a good deal of valuable floor space which might otherwise be used advantageously. The large dimensions of prior art collating machines means that sheets most remote from the assembly station must travel a considerable distance, and, consequently, the machine must have a large number of devices to exert positive control over the sheets in transit.

The collating machine disclosed herein eliminates the objections referred to above by employing but a single feeding table with the result that only a single feeding device need be employed. There being but a single feeding device, there need be but one single sheet gauging device and but one blank sheet rejection device. The use of but a single feeding table permits the size of the instant collating machine to be reduced to the least possible proportions with the beneficial results of savings in floor space and elimination of a majority of the transitory sheet control devices.

Perhaps the greatest disadvantage of prior art collators is the limited capacity thereof. By the term limited capacity is meant the restrictions imposed by the machine upon the size of the sheets which may be used and also the number of sheets which may be assembled. The machines currently in use are usually limited to paper no larger than letter size and the number of these sheets which may be assembled is usually fewer than ten. In the event that a booklet or series of sheets to be collated contains more than this limited number of sheets, a plurality of collating operations must be performed before the job is completed.

In the instant collating machine, however, the size of the paper which may be used can be as large as 17 x 22 inches and the number of sheets which may be collated depends only upon the size of the depository and the capacity of the stock receiving table. The collating machine disclosed herein for illustrative purposes has a fifty-compartment depository and a loading table capacity

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in excess of five thousand sheets permitting the collation of fifty booklets containing one hundred pages each. The range of the illustrative collator therefore, is anywhere from one to fifty booklets containing any number of pages up to one hundred. Furthermore, the sheet size may be as large as 17 x 22 inches, or letter size, or even smaller.

The prior art collating machines have depended mainly upon the principle of withdrawing sheets from multiple stations or positions and conveying them to a stationary destination where they are assembled in a desired order. The instant collating machine withdraws sheets from a single station or position and conveys them to a destination which is movable relatively to the point of discharge of the sheets from the conveying mechanism.

Having the foregoing in mind, therefore, one of the objects of this invention is to provide a collating machine having but a single stock-receiving table from which a single sheet is withdrawn, gauged for single sheet thickness, scanned for blankness, counted and deposited in a selected bin in a traveling depository.

Another object of the invention is to provide a collating machine as described in the above object whose length between the stock-receiving table and the depository is at a minimum for the accomplishment for the desired result.

A further object of the invention is to provide a collating machine wherein each sheet is gauged for thickness and if found too thick, such as in the case of two sheets being withdrawn from the stock pile, rejection means are actuated automatically to reject the gauged sheet.

Another object of the invention is to provide a collating machine wherein each sheet is scanned so that only acceptably printed sheets are collected and the unacceptable sheets are rejected automatically.

Another object of the invention is to provide a collating machine wherein means are provided to set the machine in its initial or starting position prior to the collection of any sheets and wherein further means are provided which operate in conjunction with the first mentioned means enabling an observer to ascertain the extent to which the collecting operation has progressed.

Another object of the invention is to provide limiting means cooperating between the feeding stage of operation and the depositing stage of operation to prevent more than a predetermined number of sheets from being collated.

A further object of the invention is to provide machine regulating means whereby only a selected number of sheets will be collated, the regulating means cooperating with reset means to begin another cycle of collection when the selected number of sheets have been collated.

A further object of the invention is to provide depository actuating means operable to change the position of the depository only after a sheet has been gauged and scanned, found to be acceptable for collection, and deposited therein.

A further object of the invention is to provide a key or separator card positionable between series of sheets in the stock pile which cooperates with the above mentioned regulating means and which actuated the above mentioned reset means.

An additional object of the invention is to provide synchronization means to control the sequential operations of the various elements and groups of elements to produce the desired result.

These and other objects of the invention will be specifically pointed out or will become apparent from the following specification when considered in conjunction with the accompanying drawings in which:

Fig. 1 is an elevational view of the left hand side of the

novel collating machine, the cover being removed to permit an unobstructed view of various elements;

Fig. 2 is an elevational view of the opposite side of the collating machine;

Fig. 3 is an enlarged, fragmentary, elevational view of a left end plate and a portion of the left side plate of the machine as illustrated in Fig. 1;

Fig. 4 is a partial, perspective view of the stock-receiving table and parts associated therewith;

Fig. 5 is a partial, perspective view of a portion of the sheet feeding mechanism;

Fig. 6 is a fragmentary plan view of the collating machine;

Fig. 7 is a cross-sectional view of the collating machine taken on the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary top plan view of the key card positioned on the feeding table showing the relationship between the key card and a part of the machine regulating means;

Fig. 9 is a cross-sectional view taken on the line 9—9 of Fig. 8 illustrating the key card latch in conjunction with a key card;

Fig. 10 is a cross-sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is a cross-sectional view of one of the stripper fingers taken on the line 11—11 of Fig. 8;

Fig. 12 is an enlarged cross-sectional view of one of the trip gates together with its operator embodied in the collating machine;

Fig. 13 is a perspective view of the inside of the left end plate illustrating the stock level bail adjusting means;

Fig. 14 is an elevational view of the single sheet micrometer gauge;

Fig. 15 is a cross-sectional view of the sheet depository or rotating bin drum;

Fig. 16 is a cross-sectional view of several bins illustrating the manner in which the bins are formed;

Fig. 17 is an enlarged view of a cam mounted on the drum side to actuate various switches adjacent thereto;

Fig. 18 is an elevational view of a portion of the left side plate of the machine illustrating a part of the stock table level adjusting means;

Fig. 19 is a partial view of another portion of the stock table level adjusting means;

Fig. 20 is a partial perspective view of the loading table showing the manner in which it is supported;

Fig. 21 is a perspective view of a portion of the sheet feeding mechanism;

Fig. 22 is a perspective view of a pressure regulator for use in a conveyer assembly;

Fig. 23 is an elevational view of the blank sheet trip gate operating mechanism mounted on the inside of the left side plate; and

Fig. 24 is a schematic diagram of the electrical circuit embodied in the machine.

Referring now to the drawings wherein like numerals refer to like and corresponding parts throughout the several views, the embodiment shown therein to illustrate the invention comprises a frame 20 in the rear portion of which is mounted a loading table 21 adapted to support a pile of sheets in a position which enables a suction feeding device 22 to pick up the top sheet and carry it forward to a conveyer assembly 23. Associated with the conveyer assembly 23 is a thickness gauge 24 and a scanning mechanism 25 which respectively gauge and scan the sheet for single sheet thickness and blankness during conveyance. If the sheet is found to be objectionable in either respect, it is rejected by the appropriate rejection mechanism 26 or 27. If the sheet is satisfactory, it passes rejection mechanisms 26 and 27 and is counted by counter 28 which actuates the traveling drum depository or bin 29 causing it to revolve the space of one bin after receiving the sheet therein.

The foregoing brief outline of the collating operation reveals a seven stage cycle: loading, feeding, conveying,

gauging, scanning, counting and depositing, and drum indexing.

Each of these stages will be described in detail, in the order in which they occur.

Loading

The loading table 21 of the collator comprises a platform 35 slidably positioned between side frame members 36, 37 adjacent one end of the machine. Platform 35 has its sides 38, 39 bent vertically downwardly and triangulated inwardly to form side supports for the platform. The upper and lower inner edges of the platform sides 38, 39 are equipped with rollers 30 (Fig. 20) which are received in channels 40 at each side of the platform. Each inner side edge of the platform has secured thereto a chain 41 which extends upwardly in channel 40 and passes over a sprocket wheel 42 fixed to a shaft 43, and to the free end of chain 41 is attached a weight 44 which tensions chain 41 about sprocket wheel 42. Rotation of shaft 43 in one direction will elevate platform 35 whereas rotation in the opposite direction will lower the platform.

To the upper surface of platform 35 is attached a pair of stock supports 45, 46 mounted for lateral adjustability with respect to the platform 35 by means of laterally extending slots 67 so that various widths of stock may be supported thereby at a proper height to the feeding device and to permit ease of loading through the use of a hand truck or the like. The inner edges of stock supports 45, 46 extend beyond the inner edge of platform 35 and fit within stock guides 47, 48. Stock guides 47, 48 are adjustably mounted on frame bars 49, 50 by means of brackets 51 and set screws 52 so that the stock guides may also be adjusted to accommodate various sizes of stock.

Printed sheets 31 are furnished by a printing office with all the sheets of any given number stacked together. That is, all sheets numbered 1 will be in one stack, all sheets numbered 2 will be in another stack, and so on. These sheets will be loaded on the platform 35 with the highest numbered stack on the top and the stack of sheets numbered 1 on bottom. On the very top of the stock is placed a key card 53 as best illustrated in Figures 8 and 9. Between each numbered stack of sheets will be placed another key card 53 in the manner illustrated in Figure 9. The key card is of a width adapted to fit within stock guides 47 and 48 and the inner edge of the key card is provided with a projecting tab 54 which extends beyond the edges of the stock as best shown in Figure 9. Along one side of the key card and fairly close to the inner edge thereof is another tab 55 which projects beyond the sides of the stock 31 as best illustrated in Figure 5. Stock guide 48 is equipped with a filler 56 which is adapted to cooperate with the corner and tab 55 of the key card 53 to properly position the card with respect to the guide.

Mounted on a transversely extending bar 57 secured at each end to the frame 20 is a bracket 58 on which is slidably mounted a solenoid operated latch 59 having a rearwardly bent tongue 60 which is adapted to overlie ear 54 of key card 53. The purpose and operation of latch 59 will be made apparent hereinafter and it will suffice to state here that the tongue 60 is adapted to overlie key card tab 54. Mounted on the same bar 57 by means of brackets 61 is a pair of stripper fingers 62 made of extremely light metal, one finger being disposed on either side of tongue 59 and being adapted to permit only one sheet being picked up at a time by the suction feeding device as is well known in the art.

On each guide 47 and 48 adjacent the upper end thereof is mounted an apertured, cylindrical blower 63 whose lower end is connected to an air hose 64 which is in turn connected to an air line 65 leading to air pump through regulating valve 66. The purpose of blowers 63 is to direct a constant stream of air toward the edges

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of the stock 31 to separate the individual sheets thereof enabling the feeding means to pick up a single sheet as is well understood in the art.

To the upper horizontal frame member 76 on each side of the collator is secured an end plate 77 which provides mounting means for a pair of rearwardly extending arms 78. Arms 78 are spanned by a bar 79 which is provided with a notch 80 at each end adapted to receive arm 78 therein. Bar 79 is slidable forwardly and rearwardly on arms 78 and may be fixed in position by set screws 81 which extend through apertures in bar 79 and engage arms 78.

Bar 79 is provided with a pair of side keepers 82 adapted to be securely positioned on bar 79 by set screws 83 so that the stock on loading table 21 is guided between keepers 82 to maintain the edges of the sheets in alignment. Mounted on bar 79 between side keepers 82 is an end keeper 84 comprising a U-shaped clip 85 straddling bar 79, the free ends of the clip being slotted for reception of an L-shaped strip 86 which is slidable forwardly and rearwardly in the clip 85. The web of the clip 85 is threadedly apertured for reception of set screw 87 which bears against bar 79 to draw the strip 84 against the under side of bar 79 to fix its position against the rear edges of the stock on loading table 21. It will be apparent from the foregoing that the stock will be maintained in proper position on the loading table by the co-operation of guides 47, 48 and keepers 82 and 84 so that each sheet of the stock will be uniformly presented to the suction feeding mechanism 22.

Feeding

The suction feeding mechanism is preferably of the type disclosed in U.S. Patents No. 2,293,046, No. 2,358,560, and No. 2,393,614, and is operated by an electric motor 90 (Fig. 2) connected to a pulley on an air pump 92 by a belt 93. Another pulley 92 is mounted on the air pump shaft 95 and about this pulley is trained a belt 96 which extends upwardly and around a driving pulley 97 mounted on one end of a driving shaft 98 which extends transversely across the machine and is journaled adjacent its ends in right side plate 99 and left side plate 100. An idler 101 may be provided on the upper frame member 76 to maintain proper tension on the belt 96.

Referring to Figs. 1 and 3, the left hand end of driving shaft 98 has secured thereon a pinion 102 which drives a gear 103 mounted on a stub shaft 104 journaled in the left side plate 100. Also mounted on the stub shaft 104 and concentrically with the gear 103 is a sprocket 105 about which is trained a sprocket chain 105 directed upwardly and about a driven sprocket wheel 107 mounted on a shaft 103 extending transversely across the machine and being journaled at its left hand end in left side plate 100.

A link 109 is eccentrically pivoted on sprocket wheel 107 by pin 110 and link 109 is pivotally mounted by pin 111 to the elbow 112 of an L-shaped lever 113 which is rockably mounted on a stud 114 secured to left end plate 77. The lower end of lever 113 has a drag link 115 pivotally secured thereto at one end by means of a pin 116 and secured at the other end by a pin 117 to a lever arm 118 loosely mounted on a shaft 119, lever arm 118 being disposed inwardly of a gear 120 keyed to the same shaft 119.

In mesh with gear 120 is an idler gear 121 loosely carried on shaft 43 which in turn meshes with spur gear 122 mounted on stud shaft 123 journaled in left end plate 77. Also fixed on shaft 123 inwardly of spur gear 122 is a bevel pinion 124. (Fig. 18). Bevel pinion 124 meshes with bevel gear 125 carried on the rear end of a worm 126 which is journaled in a pair of ears 127, 128 protruding from left end plate 77. Worm 126 is in mesh with a worm gear 129 keyed to shaft 43 so that rotation of worm 126 causes rotation of shaft 43 to elevate or lower the loading table by means of the chains 41 to

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locate the stock in proper feeding position. Manual adjustment of the stock is accomplished by cranking shaft 43 by means of a handle (not shown) affixed at the end thereof.

It is not practical to cause rotation of shaft 43 with every swing of lever 113 for the obvious reason that the stock level would be too rapidly elevated. An intermittently operable control mechanism 140, therefore, is provided to prevent elevation of the stock level except when necessary to keep the level at the proper feeding height.

Intermittently operable control mechanism comprises a stock level bail 141 pivotally mounted on right end plate 77 by a stub 142 secured to plate 77 as best shown in Fig. 5. The left end of bail 141 (Fig. 13) is secured to the reduced diameter end 143 of a rock shaft 144 which shaft also connects a pair of bell cranks 145 and 146. Bell crank 145 carries at one end of one arm 147 a stud 148 which extends through a slot 149 in the arm of bail 141. Reduced end 143 and stud 148 are provided with suitable means 150, 151 respectively, to hold the bail arm in adjustable position relative to rock shaft 144. Arm 152 of bell crank 145 is provided with an aperture for reception of the hooked end 153 of an adjusting screw 154 carried by arm 155 of bell crank 146. Advancement of adjusting screw 154 rocks bell crank 145 about shaft 144 to elevate bail 141 and retraction of screw 154 lowers bail 141. Shaft 144 and, consequently, bell cranks 145, 146 are rocked by operation of link 156 (Fig. 3) pinned at one end as at 157 to bell crank 146 and resiliently secured at the other end by a spring 158 having one end fixed to a stud 159 on lever 113 and extending through a lost motion slot 160 in link 156, the other end of spring 158 being secured to a post 161 carried at the end of link 156.

Rockably mounted on left end plate 77 by means of pivot pin 162 is a pawl latch 163 which forms a part of intermittently operable mechanism 140. The lower end of pawl latch 163 is reduced as at 164 to seat in a notch (not shown) in latch plate 165 (Fig. 19) on shaft 119. Fixed to latch plate 165 and also loose on shaft 119 is a lever arm 166 which carries at one end a detent 167 adapted to be engaged by the pin 117 which at the other end of lever arm 166 is pivotally mounted a drive pawl 169 having a tooth 170 at its lower end adapted to be received in a notch in a ratchet wheel (not shown) fixed on shaft 119.

When the level of the stock carried by loading table 21 is below proper feeding height, rocking of lever 113 by eccentrically mounted link 109 will be transmitted by link 156 to bail 141 enabling the latter to make a full throw downwardly. A post 171 carried by link 156 will engage the upper end of pawl latch 163 and unseat its end 164 from the notch in latch plate 165. Removal of pawl latch 163 from the notch in latch plate 165 frees lever 166 enabling a spring 172 secured between end plate 77 and lever 166 to rock lever arm 166 clockwise about shaft 119 to the point where it is stopped by resilient bumper 139. When the lever 113 is rocked in the opposite direction by link 109, the pin 117 carried by link 115 engages detent 167 to rock lever arm 166 in a clockwise direction so that drive pawl 169 whose tooth 170 will have dropped in a ratchet notch can rotate the ratchet and the gear 120 mounted on shaft 119 whereby the train of spur, bevel, and worm gears are actuated to elevate the loading table 21 as previously explained.

When the level of the stock is at the proper height for feeding, the transversely extending portion of bail 141 will contact the top of the pile of stock and thus will be prohibited from making a full throw. The driving action of the lever 113 will be taken up in lost motion slot 160 in link 156 and note that due to the lost motion take up, the stud 171 will not unseat pawl latch 163 from its latch plate where it has again become seated by spring 173 which constantly biases latch 163 into latched position.

To prevent the intermittently operable mechanism from automatically elevating the stock level when elevation thereof is not desired, a release lever 174 is pivoted as at 175 to end plate 77 and release lever 174 carries an arm 176 adapted to engage a stud 177 on drive pawl 169 to remove and hold pawl tooth 170 free of its ratchet wheel.

Referring now to Figs. 3 and 5, the upper end of L-shaped lever 113 is secured by a screw 180 to one end of a drive link 181. The other end of drive link 181 is pivotally secured to a plate cam 182 which is rockably mounted on a stud 183 secured to left end plate 77. Riding atop cam 182 is a cam roller 184 mounted on the end of an arm 185 fixedly secured to the left end of a shaft 186 which extends transversely of the machine and projects through both end plates 77. Arm 185 is normally biased in a counterclockwise direction by a spring 187 secured between a post 188 on left side plate 77 and arm 185 so that the cam roller 184 will follow the contour of the cam.

Inwardly of end plates 77 is a pair of connecting links 189, 199 suitably keyed at one end to shaft 186. The other ends of links 189, 199 carry a pivot rod 191 on which is adjustably secured a pair of suction foot supporting collars 192, 193. Formed as a part of supporting collars 192, 193 is a ring 194, 195 in which air hoses 196, 197 leading from the pump 92 through regulating valve 168 are adapted to be clampingly engaged in communication with suction feet 198, 199. Supporting collars 192, 193 may be slid along pivot rod 191 until the suction feet 198, 199 are in the proper positions to pick up sheets from the stock pile. At those positions the collars 192, 193 may be locked by set screws 200.

Keyed to the left hand end of pivot rod 191 is a cam arm 201 which carries a trip roller 202 at its elbow 203 and a roller 204 at its lower end. Trip roller 202 projects through a slot 205 in left end plate 77 and is adapted to bear against the forward wall 206 thereof.

In the position shown in Fig. 3, the suction feet 198, 199 are in the pick-up position. That is, the tips of the feet are in contact with the uppermost sheet of the stock pile enabling the suction feet operating through the suction created by air pump 92 to pick up the top sheet. Drive link 181 will then pull cam 182 to the position shown in Fig. 5, with the roller 184 riding on cam 182 to rock shaft 186 clockwise. Clockwise rotation of shaft 186 elevates links 189, 199 and, consequently pivot rod 191 is also elevated. Elevation of pivot rod 191 carries with it arm cam 201 with trip roller 202 moving upwardly in slot 205. The upward elevation of arm cam 201 is only sufficient to raise the tips of the suction feet clear of such obstructions as the aforementioned stripper fingers 62 and their associated structure at which time trip roller 202 contacts the lower end of a trip screw 207 mounted in a block 208 fixed to the left end plate 77. The contact of trip roller 202 with trip screw 207 prevents further elevation of roller 202 but since roller 202 is mounted on the offset elbow 203, continued elevation of pivot rod 191 will cause cam arm 201 and pivot rod 191 to be rotated in a clockwise direction, being forced in that direction by the trip screw 207 bearing downwardly against trip roller 202. Clockwise rotation of pivot rod 191 causes the suction feet 198, 199 to be projected forwardly of the machine so as to present the sheet carried by the suction feet to the feed rollers of the conveying system. At the point where the sheet is presented to the feed rollers, an arm 209 (Figs. 2, 4, and 5) mounted on the right hand end of shaft 186 and carrying at its lower end a trip screw 210 will have been rotated with shaft 186 to the point where trip screw 210 bears against valve arm 211 to unseat valve element 212 thereby opening an air valve 213 provided in suction line 214 connecting the suction feet with the pump. Upon the opening of air valve 213, there is no longer any suction in the line

and the suction feet release the sheet carried thereby in a position where it will be picked up by the feed rollers.

By the time the sheet is released by the suction feet, the drive link 181 will be pushing the cam 182 rearwardly toward the position shown in Fig. 3 permitting spring 187 to rock shaft 186 in a counterclockwise manner thereby lowering pivot bar 191. Arm cam 201 and pivot bar 191 will be rocked in a counterclockwise direction by the force of a spring 215 secured between link 189 and the lower end of cam 201 until the point where pivot bar has been lowered sufficiently to enable roller 204 to contact the top of a block 216 secured to the inside of left end plate 77. Shaft 186 will continue to be rotated counterclockwise and pivot bar 191 will continue to be lowered which means that roller 204 will roll forwardly against block 216, rotating pivot bar 191 clockwise to bring suction feet 198, 199 into proper position to pick up another sheet.

During the counterclockwise rotation of shaft 186, the arm 209 will have rocked rearwardly so that trip screw 210 contacts a screw 217 mounted in lever 218 to rock lever 218 to drive a rod 219 against valve element 212 to close the valve opening so that once again a suction is created in suction line 214 to enable the suction feet to pick up another sheet and carry it forwardly to the feed rollers.

Means are provided for ceasing the operation of the suction feeding device without the necessity of shutting down the machine and these means comprise a crank 220 rockably mounted on a stud 221 projecting from the left end plate 77. Crank 220 is provided with a handle 222 at its upper end and at its lower end it is pivotally secured by a pivot pin 223 and a retaining washer 224 to a horizontally extending link 225 which is slotted as at 226 for reception of a post 227 which provides support for the link. The upper surface of link 225 carries a raised cam 228 which is adapted to ride under roller 184 and elevate arm 185 so as to remove roller 184 from contact with plate cam 182. Removal of roller 184 from plate cam 182 ceases the operation of the suction feeding mechanism because shaft 186 will not be rocked so long as roller 184 and arm 185 remain stationary.

Conveying

The conveying mechanism is best illustrated in Figs. 2, 3, 6, and 7 and comprises a plurality of feed rollers and plates arranged in a generally forwardly slope so as to lead a conveyed sheet radially into the rotatable depositary.

The feed rollers consist of a knurled primary feed roller 230, intermediate rollers 231, 232, 233, and 234, and final roller 235 as best seen in Figs. 6 and 7. Intermediate roller 233 constitutes a part of driving shaft 98, previously referred to, and it will be seen in Fig. 2 that the right hand end of roller 233 carries a sprocket wheel 236 keyed thereto externally of right side plate 99. Intermediate roller 232 is equipped with a pair of sprocket wheels 237, one of which is driven by a chain 238 leading from sprocket wheel 236, and the other of which drives intermediate roller 231 and primary roller 230 by a second chain 239 trained around a sprocket wheel 240 fixed on the end of primary roller 230 and also contacting a sprocket wheel 241 fixed on the end on roller 231. Chain 239 is maintained in contact with sprocket wheel 241 by a vertically adjustable chain tensioner 242 as will be understood from Fig. 2.

Intermediate roller 233 is also provided with another sprocket wheel 243 at its right hand end but this sprocket wheel is located on the inside of right side plate 99 as best illustrated in Fig. 7. Intermediate roller 234 and final roller 235 also carry sprocket wheels 244 and 245, respectively, which are driven by a chain 246. All of the sprocket wheels carried by the rollers are the same diameter so that all rollers revolve at the same speed and their speed of rotation is at a fixed ratio to the speed

of the feeding mechanism which is driven by gear 102 fixed at the end of driving shaft 98 of which roller 233 is a part. The synchronization of the conveyor rollers with the feeding mechanism assures the prompt disposal of all sheets presented to the conveyor with no danger of jamming of the sheets due to too slow disposal.

Referring now to Fig. 7, a stationary plate 250 bridges the distance between primary roller 230 and intermediate roller 231 so as to provide support for a sheet and prevent it from curling around the primary feed roller 230 and entering the space between the primary and the intermediate rollers. Stationary plate 250 extends transversely of the machine and is provided at each end with a depending ear 251 through which a bolt 252 extends to secure the plate to the end plates 77.

Slightly above intermediate roller 231 a horizontal, transversely extending mounting bar 253 is secured at each end in end plate 77. Rockably secured to mounting bar 253 adjacent each end thereof is a rearwardly extending link 254 between which is supported a transversely extending bar 255 parallel with mounting bar 254. Bar 255 serves as an axle upon which one or more pressure rollers 256 may be mounted which are adapted to bear against primary feed roller 230 so that a sheet presented to the feed roller will be caught between rollers 250 and 256 and propelled forwardly. To aid in keeping the propelled sheet in contact with the feed rollers, pressure roller 256 may be equipped with a pair of forwardly extending arms 257 which support an auxiliary pressure roller 258 therebetween in contact with intermediate roller 231.

Means are provided at each side of the machine for regulating the pressure exerted by pressure rollers 256 upon primary feed roller 230 and these means comprise (Fig. 22) an adjusting screw 260 extending through a support block 261 secured to end plates 77, the lower end of adjusting screw 260 fitting into a tapped hole 262 in links 254, with a compression spring 265 bearing against the bottom of the block 261 and the top of a fixed washer 266 to resiliently space the links 254 from the blocks 261. The pressure exerted by pressure rollers 256 is set by the adjusting screw 260 which carries a notched head 263 adapted to cooperate with a spring lock clip 264 secured to the block 261 to retain the adjusting screw in the adjusted position. Variation of set screw 260 rocks links 254 and pressure rollers 265 about bar 253 to increase or decrease the pressure exerted on primary roller 230 by pressure rollers 256.

Bridging the space between intermediate rollers 231 and 232 is a transversely extending trip gate 290 whose ends are provided with downwardly turned edges 291 through which extend pivot pins 292 which pivotally secure trip gate 290 to the end plates 77. Trip gate 290 normally lies in a substantially horizontal position as shown in Fig. 7 but is rockable about its pivot pins as will become apparent hereinafter.

Second and third stationary plates 293 and 294, respectively are positioned between intermediate rollers 232 and 233 and between rollers 233 and 234 to provide support for a sheet during conveyance. Between intermediate roller 234 and final roller 235, however, there is a second trip plate 295 which is identical in all respects to trip plate 290 and which normally lies in the position shown in Fig. 7.

Secured to side plates 99 and 100 above trip plate 295 is a transversely extending support rod 296 which provides support for a pair of collars 297. Each collar 297 is equipped with a pair of oppositely extending arms 298, 299 which carry pressure rollers 300 and 301, respectively, which bear against intermediate roller 234 and final roller 235. Arms 298 and 299 are biased downwardly by springs (not shown) so that rollers 300 and 301 will bear against their respective rollers firmly and resiliently to aid in propelling a sheet into the depository. The final portion of the conveyor is curved downwardly as will be seen in Fig. 7 and to prevent a sheet from "sail-

ing" arms 298 project rearwardly from their rollers 300 to provide guides forcing the conveyed sheet to follow the contour of the conveyor.

Ignoring the gauging, scanning, and counting operations for the moment, a sheet picked up from the stock pile 31 by the suction feeding device 22 is presented to the primary feed roller 230 where it is caught between roller 230 and pressure roller 256 and propelled forwardly over the intermediate feed rollers and plates to the final feed roller whence it is projected into the depository.

Double sheet thickness gauging

Referring to Figs. 6, 7, and 14, there is disposed upwardly from mounting bar 253 another mounting bar 275 extending transversely of the machine and providing support for a pair of micrometers 276 and 277 of the type disclosed in U.S. Patent No. 2,393,614. Micrometer 276 constitutes the thickness gauge 24 and comprises a substantially C-shaped body bracket 278 (Fig. 14) having its upper arm apertured for reception of mounting bar 275 and having its lower arm notched as at 279 for reception of mounting bar 253 whereby the body bracket is provided with forward and rearward stability.

Within body bracket 278 is slidably disposed micrometer body 280 positioned between guides 281 secured to the body bracket 278. At the lower end of micrometer body 280 is pivoted a pair of rockable, rearwardly projected L-shaped arms 282 between which is supported a roller 283 adapted to bear against primary roller 230. The upper end of body bracket 278 is provided with a boss 284 through which is threaded an adjusting screw 285 which communicates with micrometer body 280 whereby the arms carrying bearing 283 may be either raised or lowered with respect to primary roller 230. Adjusting screw 285 is equipped with a notched cap 286 which cooperates with a spring clip 287 secured to the boss 284 to retain the set screw and the bearing in the adjusted position.

A switch 270 is secured to the micrometer body and is provided with a socket 288 from which a power line (not shown) leads to trip gate solenoid 289 (Fig. 12) mounted on left side plate 77. The plunger 302 of the solenoid 289 is connected to a trip gate operating link 303 which in turn is pivoted adjacent the rear of the plate turned down edge 291. At the lower front of the turned down edge 291 is a stud 304 to which is connected one end of a spring 305. The other end of the spring 305 is connected to a stud 306 mounted on the left end plate 77 so that the spring biases the trip plate counterclockwise as seen in Fig. 12 or clockwise as seen in Fig. 7. The limit of the biasing effect of the spring 305 on the position of the trip plate is determined by the location of a stop pin 307 which is located so as to position the trip plate in a substantially horizontal position.

Secured to the same stud 306 is one end of a second spring 308 which has its other end hooked into an eye 309 of a rock link 310 journaled on a rod 311 secured to left end plate 77. The upper end of rock link 310 carries a post 312 which projects through a slot 313 in left end plate 77 and which is adapted to be contacted and pushed rearwardly by a dog 314 carried by drive link 181 as illustrated in Fig. 3.

In operation, the position of the thickness micrometer is set by the adjusting screw to be a distance slightly more than the thickness of a single sheet of stock but less than the thickness of two sheets. If a single sheet of stock is presented to the feed roller 230 it passes between the feed roller 230 and the micrometer bearing 283 rocking the arms 282 but insufficiently to close the preset micrometer switch. The trip gate 290 is not actuated, therefore, and the sheet continues on its way over the conveyor. Should two or more sheets be presented to the feed roller, however, the added thickness of the sheets passing between feed roller 230 and micrometer bearing

283 will rock arms 282 sufficiently to close the micrometer switch whereupon the solenoid plunger 302 will be actuated immediately to raise the rearward edge of trip gate 290. Raising of the rearward edge of gate 290 elevates the lower rear of the turned down edge 291 permitting spring 308 to urge rock link 310 under that edge and prop the trip gate in its open position. The multiple sheets, therefore, will be channeled into a chute 315 which is positioned immediately below trip gate 290 and will not be conveyed any further over the conveyor.

As soon as the multiple sheets have passed the micrometer bearing 283, the arms 282 will be rocked to break the micrometer switch contact to de-energize the solenoid 289. Were it not for the propping action of the rock link 310, the trip gate 290 would be restored to its horizontal or closed position at this point with the possible result that the sheets entering the chute 315 would be caught and held by the gate. To prevent such an occurrence, therefore, the restoration of the trip gate to its closed position is delayed a sufficient length of time to assure the rejected sheet clearing the gate. The restoration of the gate is accomplished by the action of the dog 314 on drive link 181 contacting the post 312 on rock link 310 during the drive link's rearward motion to rock the rock link 310 rearwardly moving it from under the turned down edge 291 of trip gate 290 permitting the spring 305 to restore the gate to its closed position. As the drive link 181 moves in its forward direction, it releases the post 312 permitting the spring 303 to return the rock link 310 to its ready position as shown in Fig. 12. In this manner the trip gate will not be returned to its closed position until just before a subsequent sheet is presented to the main feed roller assuring ample time for the rejected sheet to clear the gate.

Blank sheet scanning

The blank sheet rejection means employs an intermittently operable photoelectric sensing device 25 which comprises a case 320 suspended from a transversely extending bar 321 secured to the end plates 77 by suitable brackets 322 and rods 323 which permit the case to be vertically and laterally adjustable.

The case 320 is divided internally into two compartments 324 and 325, the two compartments being separated by a vertical barrier 326 integrally joined to the top wall 327 of the case and terminating short of the case floor 328 as is best shown in Fig. 7. Directly beneath the barrier 326 the floor of the case 320 is provided with a slot 329 extending transversely to the direction of paper travel and which will lie closely adjacent to a sheet traveling over the conveyor. In one of the two case compartments is a socket (not shown) which supports a light bulb 330 and in the other compartment is another socket (not shown) which supports a light sensitive photoelectric cell 331.

Leading from the case 320 is an electrical conduit 332 (Fig. 23) which is connected to a source of power through a switch 333 which is fixed on left side plate 100. Switch 333 carries a spring arm 334 on the free end of which is mounted a cam following roller 335 which is adapted to be engaged by a portion of a cam 336 keyed to shaft 108 to close the switch 333 to energize the photoelectric cell 331.

Above the switch 333 another similar switch 337 is mounted on left side plate 100 and switch 337 also carries a spring arm 338 which carries a cam roller 339 adapted to be engaged by cam 336 to close switch 337. Closing switch 337 energizes a trip relay 349 which is adapted to open trip gate 294 under certain conditions which presently will be described. The cam 336 is so formed that both switches 333 and 337 will be closed for a limited portion of the cam rotation although it will be obvious that switch 333 is closed and opened before corresponding operations of switch 337.

In operation, a sheet of stock which has been conveyed beyond the double sheet rejection means 26 will pass under the case 320 and it will be observed from Fig. 7 that the rear edge of case 320 is slightly upturned as at 340 so as to provide a guide for the leading edge of the sheet. As the sheet passes under the case 320, the cam 336 will close the switch 333 which will energize the photoelectric cell 331 and the light source 330. At this time light from the bulb 330 will pass through the slot 329 in the case floor 328 and be reflected by the sheet passing thereunder back through the slot to the cell 331 on the other side of barrier 326.

The photoelectric cell circuit is so arranged that the intensity of the light reflected from a blank sheet establishes the quiescent condition of the circuit. Whenever any printed matter passes beneath the slot the intensity of the reflected light will be affected and this will cause the voltage values of the circuit to change so as to upset the quiescent condition of the circuit. The change in voltage values will be directed through suitable amplifiers (not shown) from which they are fed to a relay tube (not shown) as a trigger pulse which energizes the relay controlled by the tube.

Further rotation of the cam 336 will close switch 337 which energizes the trip gate relay 349. Because switch 337 is angularly removed from the photoelectric cell switch 333 the trip gate relay will not be energized until a few inches of the leading edge of the conveyed sheet has passed the slot 329. In this manner it is not possible for the trip gate 295 to be opened until after sufficient time has elapsed to permit the top margin of a printed sheet to pass the slot. At the time the trip gate relay is energized by the closing of switch 337 the relay tube will have been energized providing there is printed matter on the sheet. This energized relay will prevent the trip gate relay from opening the trip gate so that the printed sheet will pass over the trip gate 295. If, however, there is no printed matter on the sheet, the relay tube will not have been energized by the time the trip gate mechanism is actuated by the closing of switch 337 and, therefore, the electrical pulse caused by the closing of switch 337 will be directed to the trip gate actuating solenoid 341 (Fig. 3) fixed on the outside of left side plate 100 whose plunger 342 will be moved upwardly to elevate gate arm 343 against a stop 345 to tilt the rear edge of trip gate 295 upwardly so that the blank sheet is channeled into a chute 344 immediately below trip gate 295.

The cam 336 is so constructed that switch 337 will remain closed a sufficient length of time to assure that gate 295 will remain open long enough to permit the blank sheet to clear the gate so that there is no possibility of the sheet being caught in the gate. The gate is closed by the opening of switch 337 which breaks the electrical connection to the solenoid 341 whose plunger returns to its original position permitting a spring 346 to return the gate to its closed position.

Although only a single blank sheet scanning device has been illustrated, it should be understood that as many of the cases 320 may be employed as is desired to assure full sheet width scanning.

Sheet counting and depositing

The sheet counting mechanism is initiated by a photoelectric cell 350 secured in a socket (not shown) in housing 351 which is welded to a pair of supporting collars 352 supported on a transverse rod 353 secured in the machine side plates 99 and 100. In the arrangement illustrated in Fig. 7 the light sensitive cell 350 is supported over the final feed roller 235 whose central diameter is reduced as at 354 so that light from a bulb 355 fixed in a reflector 356 secured to chute 344 will impinge against the photoelectric cell 350. The photoelectric cell 350 is electrically coupled to a relay (not shown) so that every time a sheet interrupts the shaft of light between the bulb 355 and the photoelectric cell

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350, the relay is closed sending an electrical impulse to counter 357, about which more will be said later. The interruption of the light shaft also serves to begin rotation of the drum or depository 29 so that after the counted sheet is deposited in the drum, the latter is moved or rotated one space to receive the next acceptable sheet.

Drum indexing

Earlier in this specification it has been pointed out that shaft 108 is continuously driven by a sprocket chain 106 trained about sprocket 105 fixed on drive shaft 104 and about sprocket 107 fixed to shaft 108. Shaft 108 constitutes the drum drive shaft and extends between side plates 99 and 100 so as to provide mounting means for a disc 360. Disc 360 carries an outwardly projecting eccentrically mounted post 361 which projects through a lost motion slot 362 in one end of a link 358 pivoted to crank 363. Crank 363 is rockably secured at one end to a stud 359 fixed on the side plate and at the other end to one end of a drive link 364 which includes a substantially horizontal portion which terminates in a forwardly and downwardly extending section 365 which is connected at its end to one end of a link 366 rockably journaled at its other end in a housing 367 bolted to frame bar 368. The horizontal portion of drive link 364 is provided with a notch 369 which has a sloping rear portion and an abrupt forward wall and in this notch 369 a stop bar 370 is adapted to seat. Stop bar 370 is fixedly carried on the end of a transversely extending rod 371 rockably mounted in side plates 99 and 100. Connected to the free end of each stop bar 370 is a link 372 which in turn is connected to the plunger 373 of a solenoid 374 secured to its respective side plate.

As long as stop bar 370 is in its slot, the post 361 on disc 360 works back and forth in its lost motion slot and does not impart any motion to crank 363 and drive link 365. When the stop bar 370 is withdrawn from its slot, however, a spring 375 secured to an ear 376 on crank 363 and to a pin 377 on the side plate pulls the crank 364 and consequently the drive link 365 rearwardly so that the forward end of the lost motion slot in link 358 is brought into abutting relation with the eccentrically mounted post 361. Rotation in a forward direction of the disc 360 will drive the link 358 forwardly by the stud 361 and the crank 363 and drive link 364 also will be driven forwardly thereby rocking the link 366. The link 366 carries a pawl 378 pivoted thereon which is adapted to engage a tooth 379 of a toothed disc 380 secured to a wall 381 of the drum 29, to rotate the drum the space of one tooth. While the drum actuating mechanism has been shown and described as being on one side only of the machine, it is obvious that the structure may be duplicated on the other side should it be deemed advisable or expedient.

Returning now to the passage of the sheet through the light shaft directed to the photoelectric cell 350, the passage of the sheet interrupts the shaft of light and actuates a relay in an electrical circuit leading to solenoid 374. The interruption of the shaft of light energizes the solenoid 374 and the plunger, therefore, is projected upwardly, unseating the stop bar 370 from its notch 369 permitting the spring 375 to draw the crank rearwardly whereupon the next revolution of the drum drive shaft 108 will advance the drum the space of one bin so that the next sheet will be deposited in a separate bin 382. As soon as the sheet has passed the photoelectric cell, the solenoid 374 will be deenergized so that on the return stroke of the crank 363 the stop bar 370 will be in a position to arrest the rearward movement of the drive link 364 unless, of course, another sheet has successfully passed the scanning device and is in a position to be deposited in the drum, in which event the stop bar will be retracted prior to its arresting the drive link 364.

The construction of the traveling depository or drum

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29 of this invention is best illustrated in Figs. 15 and 16 wherein a hub 385 of either cylindrical, hexagonal, as shown, or other suitable cross-sectional configuration is provided with flanged edges 386 which are riveted to drum side walls 381 through bearing plates 387 which lend strength and rigidity to the otherwise thin and light weight side walls 381.

Between the side walls 381 are disposed a plurality of leaves 388 which are equipped with right angle flanges 389 along their sides which are riveted to the side walls 381 to provide a plurality of bins 382 within the drum. The leaves 388 are positioned substantially radially within the drum and the bottom flange 390 of each leaf 388 is bent at an angle less than 90 degrees so that bottom flanges 390 overlap each other as shown in Fig. 16 whereby the bottom of each bin 382 is provided with a floor to prevent a sheet from slipping out of the bin.

In the illustrative embodiment of the invention, there are fifty leaves 388 uniformly spaced within the drum providing fifty separate bins. The number of teeth on toothed disc 360 is also fifty so that there is one tooth for every bin. Obviously, more or less bins may be incorporated in the drum as desired, and the toothed disc provided with a corresponding number of teeth.

The drum 29 is provided with bearings 391 secured to the side walls 381 in which are journaled stub axles 392 having their outer ends received in housings 367 fixed on frame bars 386. Also fixed on frame bar 386 is an auxiliary pawl 393 (Fig. 2) whose function it is to prevent the drum from rotating backwardly or counterclockwise as seen in Fig. 2 during the time the drive pawl 378 is being drawn rearwardly by link 366 to obtain a purchase on the next adjacent tooth preparatory to rotating the drum the space of one bin.

To prevent the drum from rotating too far in the forward direction under the combined forces exerted by the driving pawl 378 and gravity due to an unevenly loaded drum, a pair of resilient pressure brake elements 394 are mounted on frame bars 386 radially outwardly of the axles 392. The resilient brake elements 394 comprise blocks 395 bolted to the frame bars 386 which provide support for the brake arms 396, each of which terminates in a foot 397 carrying a friction brake material. Disposed about the brake arms 396 is a compression spring 398 which exerts a force between the blocks 395 and the feet 397 to urge the brake material into resilient engagement with the drum walls 381. The pressure exerted by the brakes is sufficient to prevent the drum from coasting but is not so great that it presents a burden to the bin-by-bin advancement of the drum.

Referring again to Fig. 15, it will be observed that the radially outer edge of each leaf 388 is provided with a generally triangular recess 399. This recess permits the machine attendant to extract the collated sheets in each bin easily and quickly and also permits a retaining band 400 to enter the recess slightly to retain the sheets in those bins which have been rotated beyond a horizontal line through the axis of drum rotation. Retaining band 400 is secured to certain bars of the machine frame 20 and is substantially 180 degrees in length. The material of which the band is made should be non-oxidizing so that no marks will be left on the edges of the sheets within the bins as they are advanced along the band.

As shown in Figs. 1, 15, and 17, one wall of the depository 29 carries an elongated cam 401 positioned radially thereon so as to contact simultaneously three rollers 402, each of which is carried on an arm of a three part switch 403 fixed on frame bar 404 by a suitable bracket 405. Cam 401 is radially in line with the drum bin 70 which is numbered 1 so that as the drum is revolved to position the number 1 bin adjacent the end of the conveyor the cam will trip each switch of the three part switch 403.

The first switch of the three part switch 403 is suitably connected through a time delay electronic tube and re-

lay 348 to a manually depressible drum indexing switch 409 mounted on control panel 407; the second switch is connected to a solenoid 410 whose plunger 411 is attached to key card latch 59 (Figs. 7 and 9); and the third switch is connected to the power source through the master counter 408 mounted on control panel 407. The functioning and purpose of each of these elements will be fully explained in the description of the collating machine operation.

Operation

To begin the collating operation the machine is set to collect the desired number of sheets in as many bins of the drum as is wanted. For example, assume that fifty booklets are to be made, each booklet containing one hundred pages. The pages of the booklet will have been printed and delivered to the collating machine with all pages 1 in one stack, all pages 2 in another stack, and so on up to page 100. The stack of pages 1 will be placed first on the loading table 21 and this stack should contain slightly more than fifty sheets to allow for the possibility of blank sheets and the possibility of more than one sheet being picked up at a time by the feeding mechanism. On top of the stack of sheets numbered 1 will be placed a key card 53 with its end tab 54 facing forwardly and its side tab 55 on the right as shown in Fig. 6. A stack containing a few more than fifty sheets of pages numbered 2 will be placed on top of the key card 53 and on top of this stack another key card 53 is laid. Each stack of different numbered sheets is separated by a key card in this manner until the last stack of sheets (pages numbered 100) is in position and on the top of this stack is laid a final key card 53.

Once the loading table is loaded, it is elevated to a proper feeding height with the forward tab 54 of the uppermost key card lying under the tongue 60 of the key card latch 59 as shown in Figs. 8 and 9, and with the edges of the sheets and the key cards being received in the guides 47 and 48.

To position the drum with its number 1 bin in line with the conveyer, the master switch 406 is turned on and the manually depressible drum rotating switch 409 is depressed. A circuit leads from switch 409 to the stop bar solenoid 374 and depressing switch 409 energizes that solenoid so that stop bar 370 is removed from its notch 369 permitting the drum to be advanced step by step until bin number 1 is in line with the conveyer at which time the cam 401 on the drum side throws all three switches of the three part switch 403. As soon as the first switch of the three part switch is thrown, the time delay electronic tube and relay 348 acts to turn off the power being supplied to the motor for a limited time, usually a few seconds, so that the machine attendant will know that the drum has its number 1 bin in position to begin the collating operation.

At this point the master counter 408 is set for one hundred revolutions of the drum or depository. The setting of the master counter establishes a circuit in the machine which automatically shuts off the machine after the drum has been revolved one hundred times. The number of revolutions is recorded by the closing of switch number 3 of the three part switch 403 mounted on the drum side and which is connected to various relays and solenoids in the master counter. The individual sheet counter 357 is then set at fifty to correspond to the number of sheets to be collected per revolution of the drum and the setting of the counter 357 sets up an electrical circuit which will be discussed hereinafter.

With the drum in its initial position, and the master counter and individual counter set, a starting switch 413 is closed and collating begun. The second switch of the three part switch 403 will have been thrown by the drum being turned to its initial position and this switch, as previously explained is connected to the key card

latch solenoid 410. The closing of the second switch energizes solenoid 410 whose plunger 411 retracts the latch 59 into a recess 412 cut in primary feed roller 230 so as to remove tongue 60 out of engagement with key card tab 54. With the latch 59 retracted, the suction feeding device is able to pick up the key card 53 and carry it forward to the feed rollers where it will be projected forwardly so as to pass under the double sheet rejection micrometer 276. Separator card 53 will be of greater thickness than a single sheet of stock 31 so the micrometer 276 will be actuated to open the trip gate 290 to reject the separator or key card 53. As the key card passes under micrometer 276, the right hand ear 55 passes under reset micrometer 277, and the function of this micrometer will be explained later.

With the top key card rejected, the feeding device picks up the uppermost sheet from the stock 31 and presents it to the feed rollers where it is gauged for thickness and scanned by the scanning device 25. If found satisfactory by those two devices, the sheet passes the photoelectric counter 28 into the number 1 bin of the depository and the sheet passing the photoelectric counter energizes the drum indexing mechanism as explained hereinbefore. The photoelectric counter 28 also is coupled to the individual sheet counter 357 so that passage of a sheet into a drum bin registers a count on the counter 357.

When the drum is rotated one space, as just explained, the cam 401 will release the three part switch 403. The first switch will not be affected because it comes into operation only when the manually depressible drum indexing switch 409 is depressed. The second switch, however, leads to the key card latch solenoid 410 and when the cam releases switch number two, the solenoid 410 is deenergized and the latch 59 released so as to project rearwardly. The rearward projection of the latch 59 does not interfere with the sheets of stock 31, however, as they are maintained in a more rearward position by guides 47 and 48 as shown in Figs. 8 and 9. The release of the third switch of the three part switch 403 sets various relays in the master counter so that it begins its drum revolution count as will be pointed out.

The collating machine continues to operate in a sheet-by-sheet feeding manner, each sheet being individually gauged for single sheet thickness and scanned for blankness, and each sheet being counted as it is deposited in the drum, with the drum being indexed one space after each sheet is deposited. Should more than one sheet be picked up by the feeding device, all of them will be rejected into chute 315 and should any sheet be blank, it will be rejected into chute 344. As the feeding device delivers sheets to the conveying means, the intermittently operable loading table elevating mechanism 140 maintains the stock 31 at proper feeding height as has been explained.

As each acceptable sheet is deposited in the drum, the individual sheet counter 357 will register one count enabling an attendant to ascertain at a glance the extent of the per revolution collation, until the counter is advanced fifty spaces. At this point the electrical circuit which was preset by setting the counter 357 for fifty sheets is actuated and this circuit leads from the counter 357 to the reset micrometer 277. Micrometer 277 is connected to the trip gate actuating solenoid 289 so that when the circuit from the counter 357 to micrometer 277 is closed, the solenoid 289 is energized to hold trip gate 290 in the open position. Trip gate 290 will remain in the open position so that all sheets remaining on top of the second key card 53 will be channeled into chute 315. This operation does not take place until each of the fifty bins has had one sheet deposited therein, however, and if there are only fifty bins in the drum, the drum will have been advanced to its initial position where the three switches are closed by the cam 401.

At the initial position of the drum, the key card latch

59 is retracted. The retraction of the latch 59, however, does not close the trip gate 290 which is held open by the circuit from counter 357 to solenoid 289, so any sheets remaining on top of the second key card are rejected. After the extra sheets have been disposed of through the trip gate 290, the suction feeding device will be able to pick up the second key card which separated sheets numbered 100 from those numbered 99 and present it to the feed rollers. As the key card passes under the micrometers 276 and 277 the thickness of the card causes micrometer 276 to keep the trip gate 290 open and the right hand ear 55 passes under micrometer 277 which is actuated to send a pulse to the individual sheet counter 357 to break the circuit leading to trip gate solenoid 289 and reset the counter at zero, thus breaking the circuit from the counter to solenoid 289. With the solenoid circuit broken, the trip gate 290 will be free to close after the passage of the key card and the operation then continues as before.

Upon each complete revolution of the drum, the closing of the third switch of the three part switch registers one revolution on the master counter 408. At the end of the one hundredth revolution, which was initially set on the master counter, the closing of the third switch completely shuts off the machine. When this occurs, each of the bins will contain one hundred sheets numbered from 1 to 100 in consecutive order so that they may be withdrawn and made into fifty booklets of 100 pages each. At any point during the collation, an attendant can ascertain the progress of the job by checking the master counter with the individual counter.

The operation just described has been confined to a depository containing fifty bins and each of those bins was utilized for the collection of a booklet. The machine is capable of collating a lesser number of booklets, however, and in fact may be used to collate any number of booklets from one to the maximum number of bins. For example, assume that the fifty bin collator described herein is to be used to collect only 40 booklets of 30 pages each. In this situation the master counter 408 will be set to count 40 revolutions, the number of booklets, and the individual sheet counter 357 will be set to count 30 pages per revolution of the drum.

The drum will be rotated to its initial position by the manual switch 409 and at the initial or number 1 bin the time delay tube will be activated by the first switch of the three part switch 403 in the same manner as already described so that the attendant will be aware that the drum is at its initial or starting position. The second switch will retract the key card latch 59 and the third switch will be in readiness to start the master counter 408 to begin its drum revolution count. Between each group of numbered sheets of the stock 31 will be placed a key card 53 just as hereinbefore described. The operation of the machine will be exactly as described in connection with the maximum collection until such time as the thirtieth bin has had a sheet deposited therein.

Upon the sheet being deposited in the thirtieth bin, the individual sheet counter 357 will have reached its preset mark of 30 and thus will energize the solenoid 289 to open trip gate 290 as before described. The drum, however, is not in its initial position but must be rotated through twenty more spaces before the next key card can be picked up and the second sheet of the booklet collected.

To accomplish the desired rotation of the drum, an electrical circuit leading from counter 357 to the photo-electric counting and drum indexing mechanism operated solenoid 374 is closed so as to actuate solenoid 374 whereby the stop bar 370 is withdrawn from its notch and the drum permitted to index space by space by the drum indexing mechanism hereinbefore described. When the drum reaches its number 1 position, the three switches are thrown by the cam 401 whereby the key card latch is retracted permitting the next key card to be picked up

and passed under reset micrometer 277 whereby the counter 357 is reset and 30 more pages are collected and so on until the 40 booklets of 30 pages each are assembled. In this type operation there will be twenty empty bins and 30 bins containing pages. The drum will obviously be overbalanced on one side and it is in this type of operation where the auxiliary pawl 393 and drum brakes 394 prevent the drum from rotating out of order due to the unbalanced weight.

Following the completion of a collating operation the machine is turned off by the master counter mechanism as already described. The only thing which remains to be done is for the attendant to unload the drum and this is a simple matter since he need only reach into the uppermost bins and extract the assembled papers. The manually depressible drum actuating switch 409 may again be used at this point to advance the drum enabling the attendant to extract all the sheets from the drum.

After a collating job has been accomplished, the sheets which have been rejected by the thickness gauge and scanning mechanism may be withdrawn from their respective chutes. Due to the rejection of the key cards after each series of sheets, the various series of rejected sheets in chute 315 will be separated by key cards so that those sheets may quickly be returned to correspondingly numbered piles awaiting collation.

It will be understood that a suitable covering will be placed over the frame to provide safety for the operator and also to present a decorative appearance. The cover has not been illustrated in the drawings, however, in the interest of clarity.

The invention has been shown and described in detail but it is obvious that various modifications and adaptations may be made within the spirit and scope of the appended claims.

We claim:

1. A collating machine comprising a feeding device adapted to feed sheets one at a time to a conveyer, said conveyer having a sheet diverting gate therein, a rotatable multiple bin drum adjacent said conveyer into which sheets are adapted to be deposited from said conveyer, indexing means for rotating said drum from its initial position the space of one bin as each sheet is deposited in said drum so that each sheet is deposited in a separate bin, and regulating means for limiting the number of sheets deposited in said drum per revolution thereof, said regulating means being operable to open said sheet diverting gate when said drum has received the desired number of sheets therein so that additional sheets delivered to said conveyer by said feeding device are diverted from said drum.

2. A collating machine comprising a conveyer, means for feeding sheets to said conveyer, a rotatable multiple bin drum for receiving sheets from said conveyer, indexing means for rotating said drum the space of one bin following the receiving of a sheet in one of said bins whereby each sheet is received in a separate bin, means for limiting the number of sheets received in said drum per revolution thereof, said limiting means operating through said indexing means to divert all sheets away from said drum after the limited number of sheets have been deposited therein.

3. A collating machine as set forth in claim 2 wherein said conveyer assembly is provided with means for gauging each sheet for single sheet thickness.

4. A collating machine as set forth in claim 2 wherein said conveyer assembly is provided with means for scanning each sheet for printed matter.

5. A collating machine having a stock support, a conveyer assembly adjacent said stock support, a rotatable multiple bin depository adjacent said conveyer assembly, means for feeding sheets one at a time from said stock support to said conveyer, means for gauging each sheet for single-sheet thickness, means for scanning each sheet for printed matter, means for indexing said depository

whereby each conveyed sheet is deposited in a separate bin in said depository and by-pass means ahead of said drum operably by said gauging and scanning means adapted to intercept rejected sheets.

6. A collating machine comprising a conveyer, means for feeding sheets to said conveyer, a rotatable multiple bin depository adjacent said conveyer into which conveyed sheets are discharged, means for indexing said depository whereby each conveyed sheet is deposited in a separate bin of said depository, limiting means operating in conjunction with said indexing means for limiting the number of sheets deposited per revolution of said depository, and reset means timed with said depository for beginning another cycle of sheet depositing following the operation of said limiting means.

7. A collating machine comprising a conveyer for delivering sheets individually to a rotatable multiple bin drum, indexing means for rotating said drum from its initial position the space of one bin as each sheet is deposited in a separate bin, and means for limiting the number of sheets deposited in said drum per revolution thereof, said limiting means comprising a counter settable for the desired number of sheets to be deposited, said counter being coupled to said indexing means so that each time said drum is indexed one space said counter is correspondingly indexed, said counter being coupled to a sheet diverting gate, said counter being operable to actuate said gate to divert sheets from said drum when the number of sheets deposited in separate bins in said drum corresponds to the number set on said counter.

8. A collating machine as set forth in claim 7, wherein means is provided for indexing said drum to its initial position after the depositing of said sheets in said drum has been concluded.

9. A collating machine as set forth in claim 8 wherein said means includes a coupling from said counter to said drum indexing means and operated by said counter when the latter is indexed to its preset position to rotate said drum to its initial position following the actuation of said sheet diverting gate.

10. A collating machine as set forth in claim 9 wherein means are provided for reestablishing the depositing of sheets in said drum upon the drum being indexed to its initial position.

11. A collating machine comprising a stock receiving table, feeding means for feeding sheets one at a time from said table to a conveyer, said conveyer delivering said sheets to a rotatable multiple bin drum, indexing means for rotating said drum the space of one bin as

each sheet is delivered thereto so that each sheet is deposited in a separate bin in said drum, means operating said indexing means activated by the passage of a sheet so that said indexing means rotates said drum only upon the delivery of a sheet from said conveyer to said drum and by-pass means ahead of said drum operable by sensing means adapted to intercept rejected sheets.

12. A collating machine as set forth in claim 11 wherein said conveyer is equipped with a gauge to detect the presence of superposed sheets, said conveyer also having means therein operable by said gauge to divert superposed sheets from said drum.

13. A collating machine as set forth in claim 11 wherein said conveyer is equipped with scanning means to detect the presence of blank sheets, said conveyor also having means therein operable by said scanning means to divert blank sheets from said drum.

14. A collating machine having means for feeding sheets one at a time from a stock pile to a rotatable multiple bin drum, means to index said drum from its initial position the space of one bin as each sheet is deposited therein whereby each sheet is deposited in a separate bin, regulating means for regulating the number of sheets deposited in said drum per revolution thereof, said regulating means being operable to divert sheets from said drum when the desired number has been deposited therein, and reset means controlled by the rotation of said drum to begin sheet depositing again when said drum has been rotated to its initial position.

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