

Feb. 17, 1970

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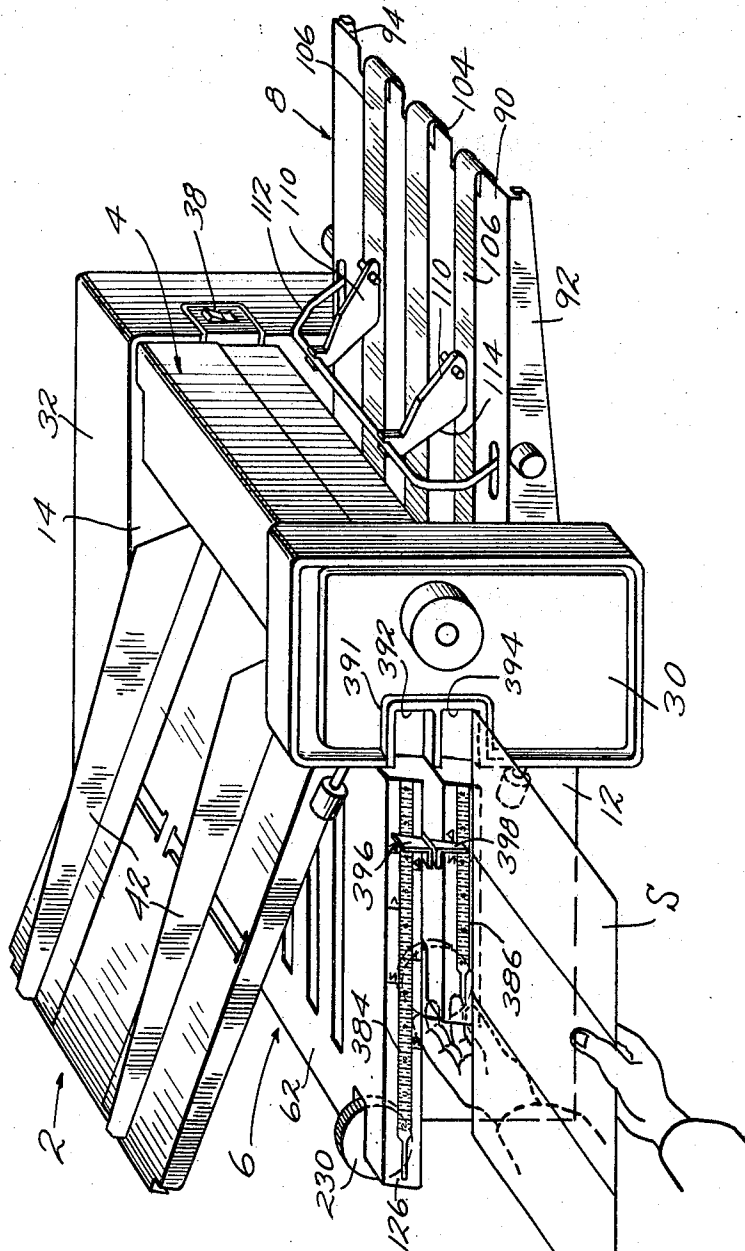
3,495,818

SHEET FOLDING APPARATUS

Filed May 18, 1967

7 Sheets-Sheet 1

FIG. 1



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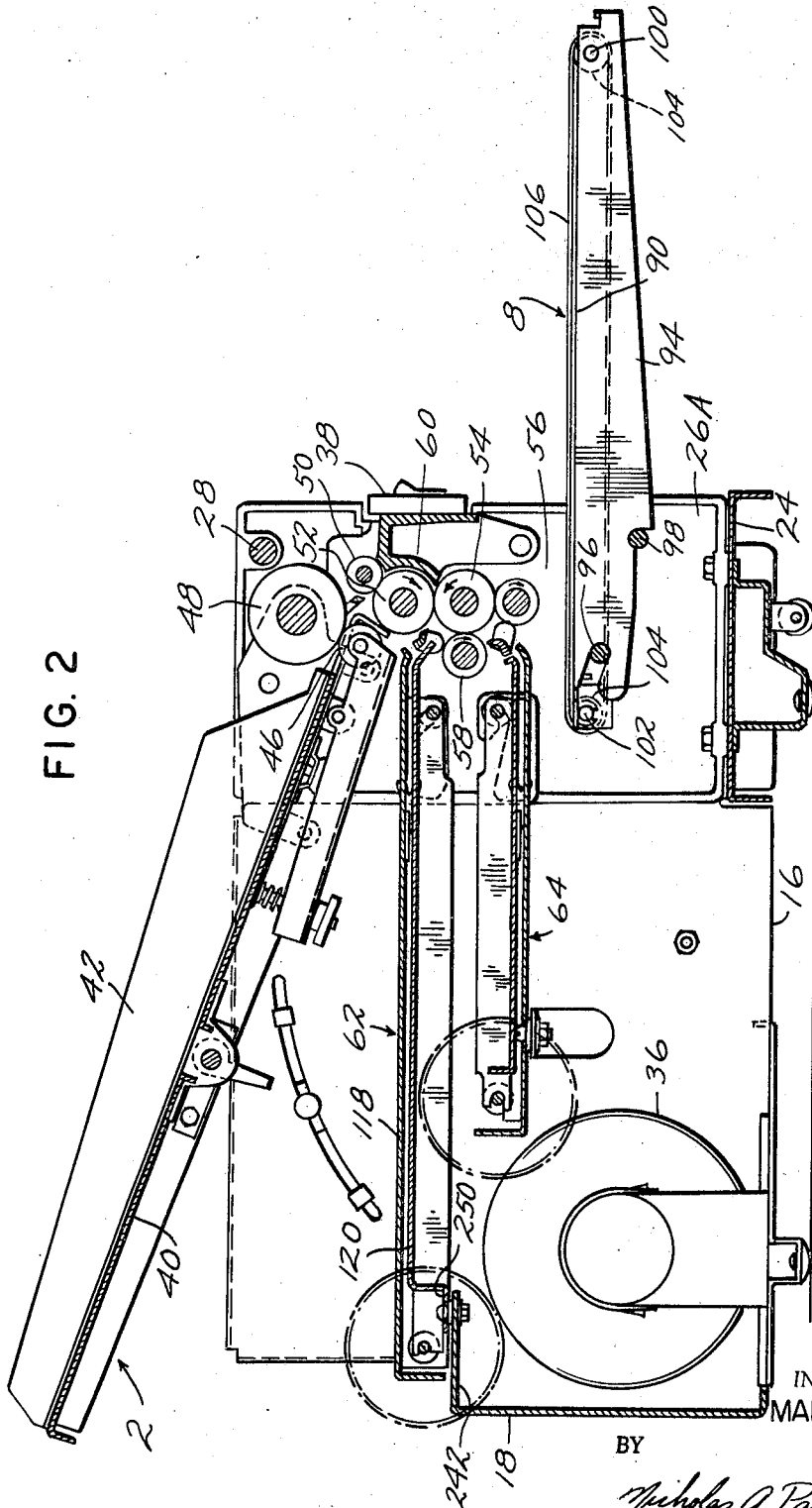
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SHEET FOLDING APPARATUS

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7 Sheets-Sheet 2



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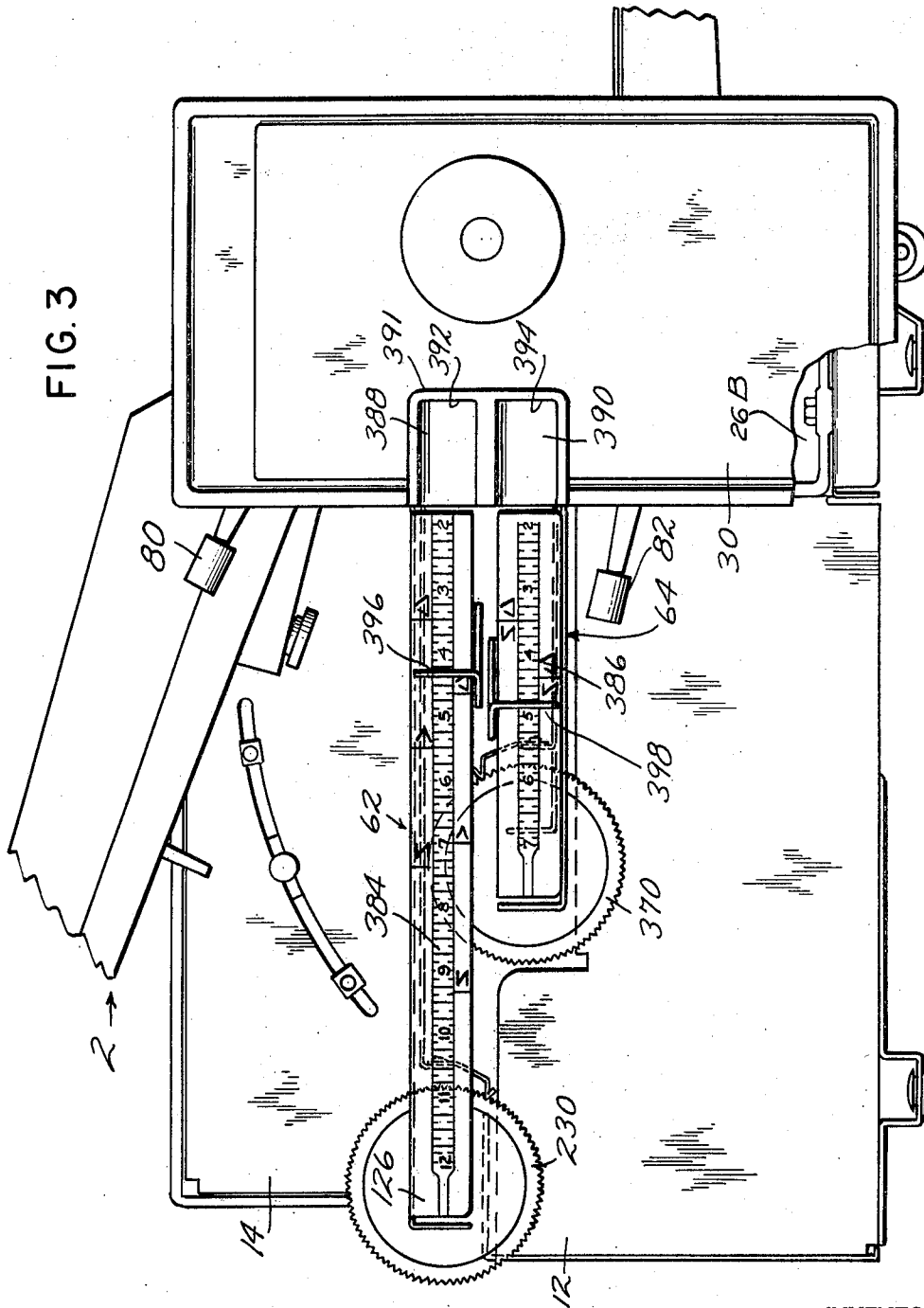
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SHEET FOLDING APPARATUS

7 Sheets-Sheet 3



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SHEET FOLDING APPARATUS

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7 Sheets-Sheet 4

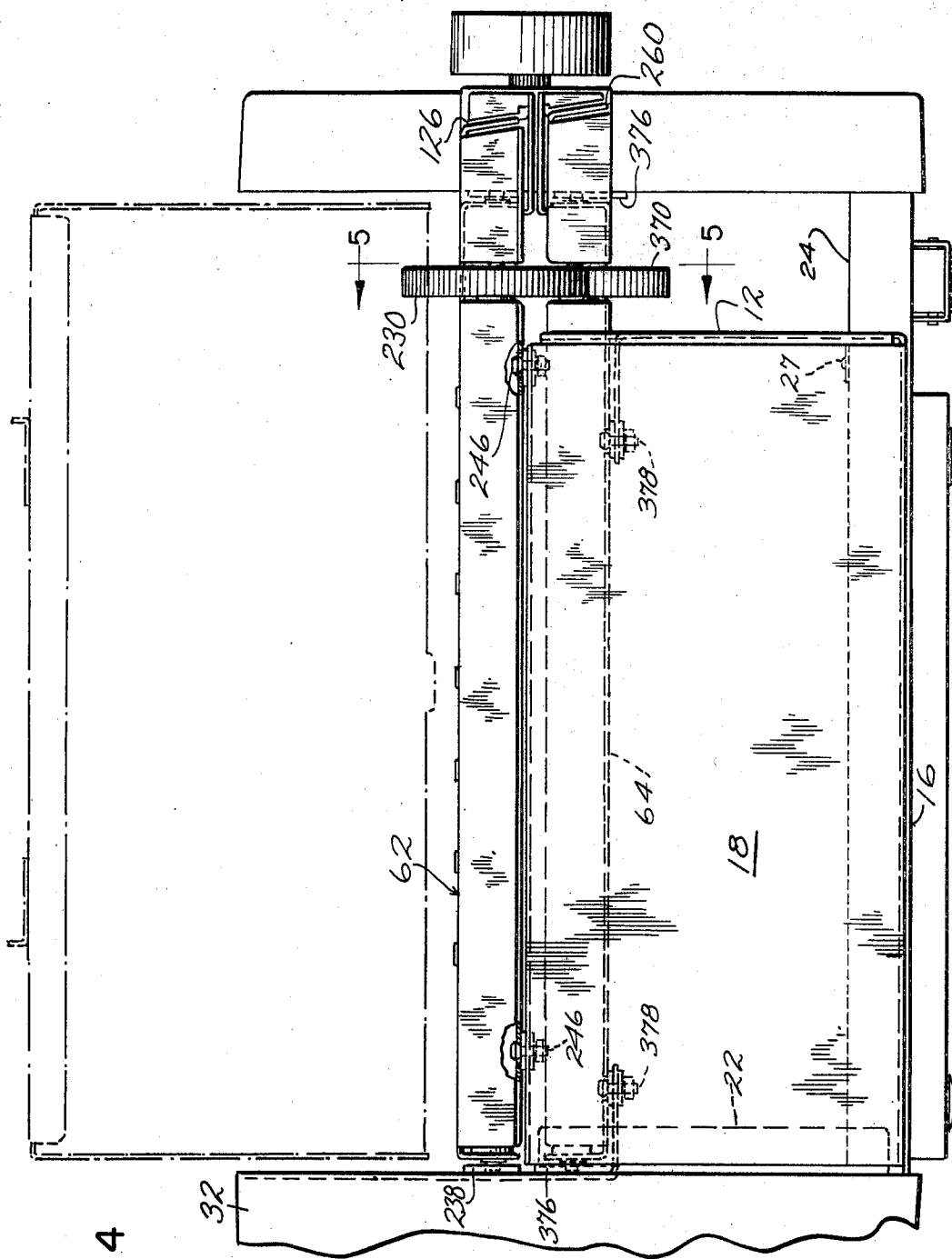


FIG. 4

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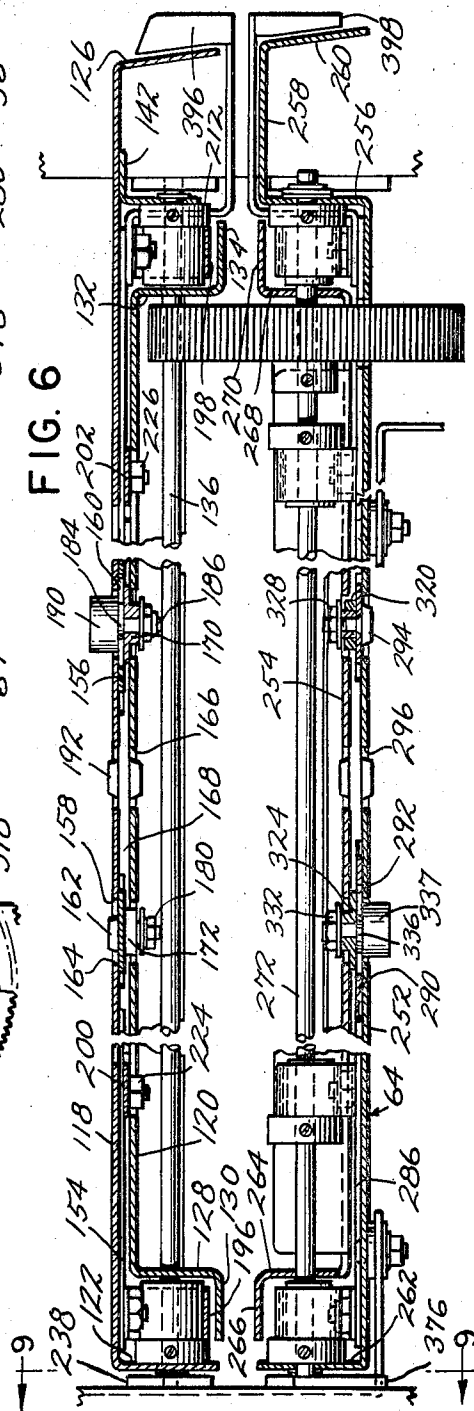
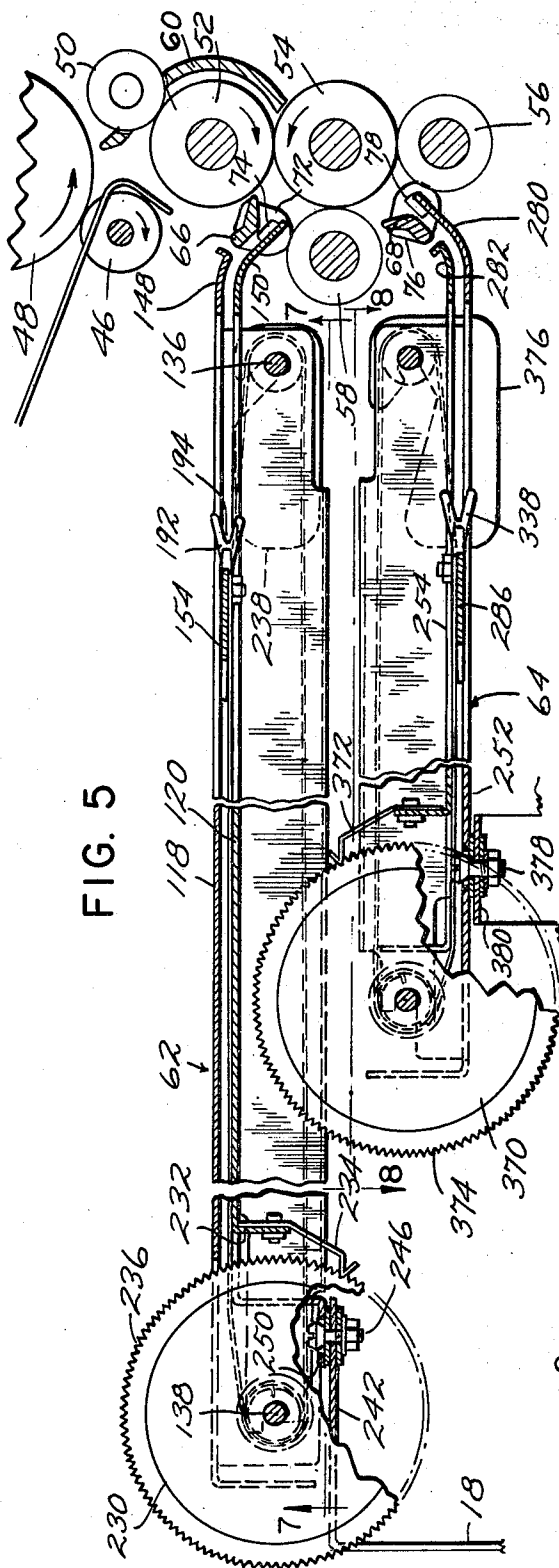
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SHEET FOLDING APPARATUS

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7 Sheets-Sheet 5



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SHEET FOLDING APPARATUS

Filed May 18, 1967

7 Sheets-Sheet 6

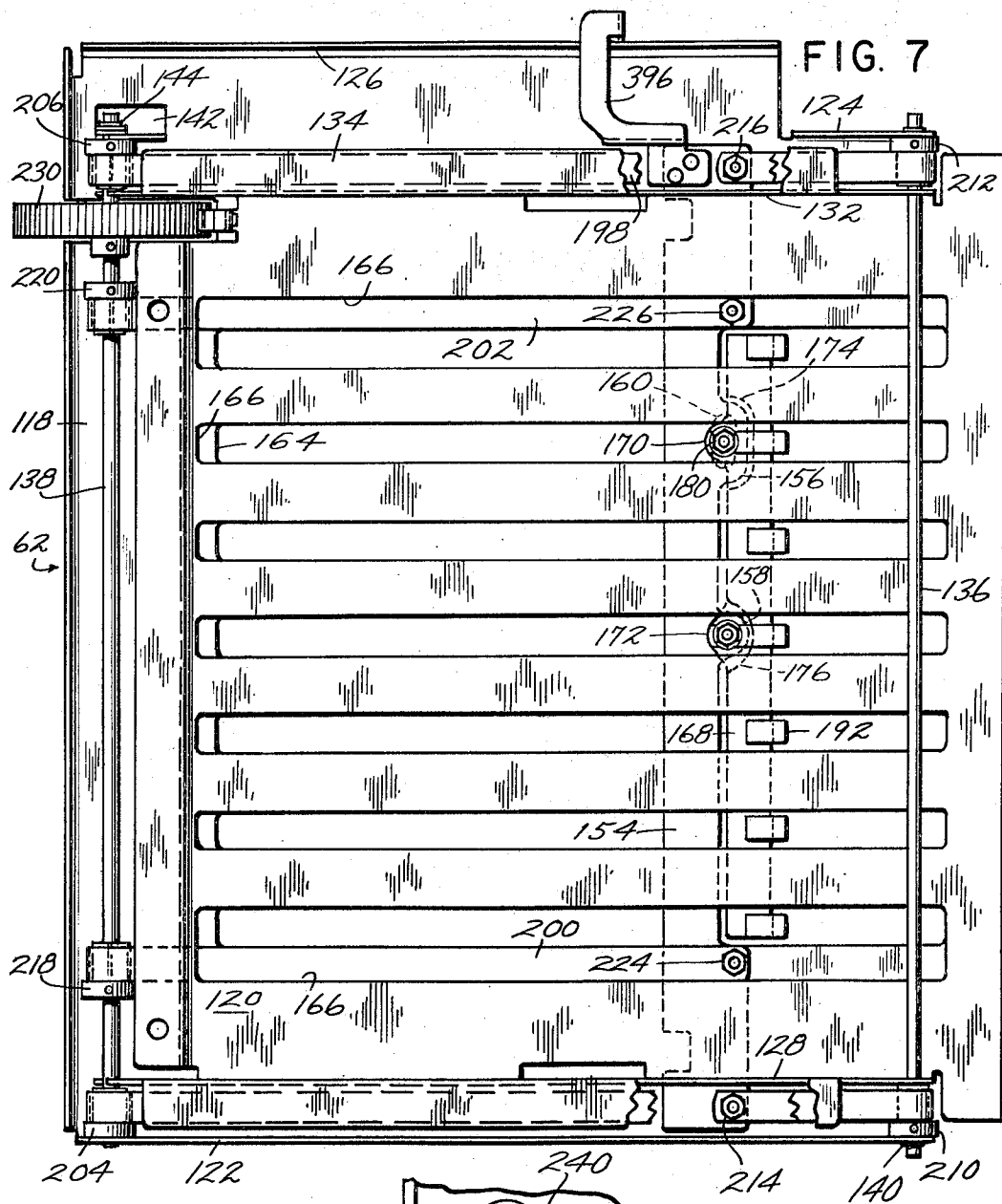
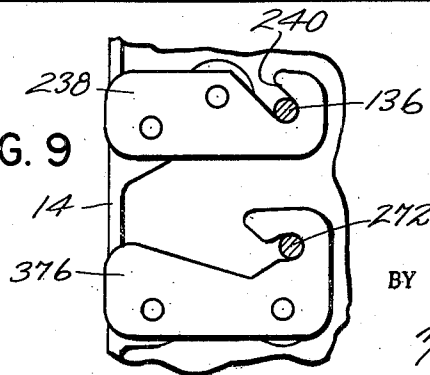


FIG. 9



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SHEET FOLDING APPARATUS

Filed May 18, 1967

7 Sheets-Sheet 7

FIG. 8

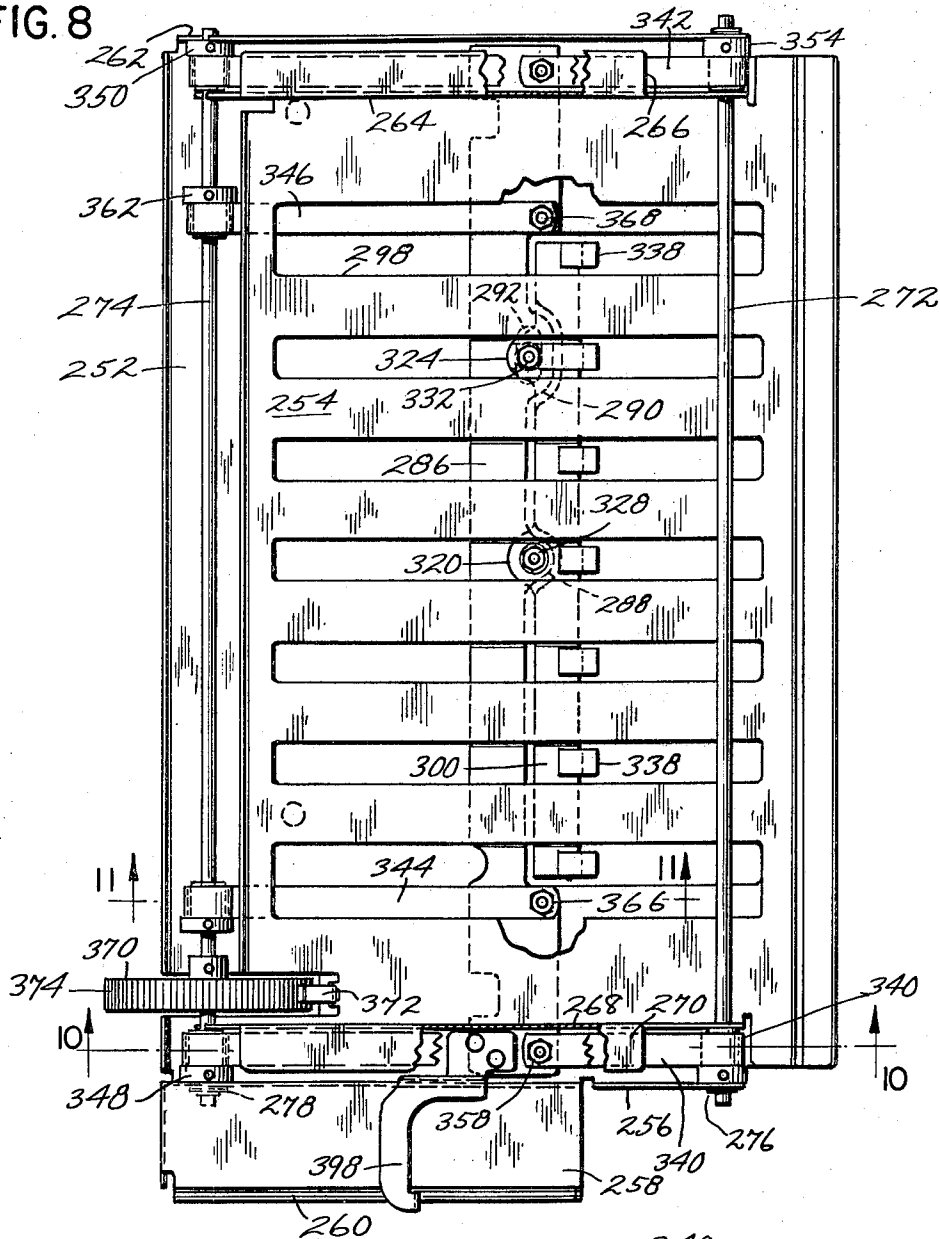


FIG. 10

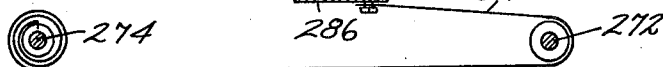
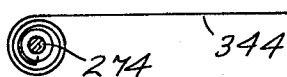


FIG. 11



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3,495,818

SHEET FOLDING APPARATUS

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Filed May 18, 1967, Ser. No. 639,411

Int. Cl. B65h 45/14

U.S. Cl. 270—68

19 Claims

ABSTRACT OF THE DISCLOSURE

This patent specification describes a sheet folding machine comprising a new compact buckle chute arrangement wherein the setting of each buckle chute can be adjusted without removing it from the machine. The machine also includes means for selectively rendering each buckle chute inoperative.

This invention relates to buckle-type sheet folding machines and more particularly to an improved buckle chute mechanism.

Buckle-type sheet folding machines generally include a feeding unit, a folding unit, and a delivery unit. The folding unit receives sheets from the feeding unit and comprises means for producing a buckling action thereon as they are fed and means for creasing the buckled sheets. The buckling action is produced by directing each sheet into a buckle chute where it engages a stop member. Continued feeding of the sheet causes it to buckle and the buckled portion is picked up by a pair of rollers that crease it and deliver it to the delivery unit either directly or via another buckle chute where another folding operation is performed. Machines of this general type are well known as exemplified by U.S. Patents 3,150,871, 3,178,161, 2,766,569, 2,766,040, 2,703,237, and 2,589,436.

The primary object of this invention is to provide a new buckle chute mechanism that is improved in many respects relative to prior art mechanisms including greater ease of adjustment.

A more specific object is to provide a novel buckle chute mechanism that is adapted to be inserted in and removed from the folding machine without tools and without the need for disassembling other operative units of the machine.

A further specific object is to provide a compact sheet folding unit that comprises two or more buckle chutes of simple yet rugged construction that are adapted to be disposed in parallel stacked relation to each other and which embody adjustable fold-controlling sheet stops and improved means for adjusting the setting of the sheet stop without dismantling the buckle chutes.

Still another specific object is to provide in a sheet folding machine one or more buckle chutes each embodying a sheet stop assembly that can be moved with a minimum of operator effort and comprises a stop element and means for pivoting said stop element so that it is square with the leading edge of delivered sheets.

These and other objects of the invention which are apparent from the following detailed description of a preferred embodiment are achieved by providing a detachable buckle chute comprising a pair of parallel plates spaced so as to define a space therebetween with a sheet entrance opening at one end, a movable sheet stop assembly mounted in said space and moveable toward and away from said entrance opening, and means including first and second uncoilable spring means for moving the stop assembly in its own plane. The uncoilable spring means are connected to the stop assembly in opposing force-balancing relation to each other. The stop assembly comprises a bar to which the spring means

are directly connected and a stop member secured to said bar. The stop member can pivot relative to said bar so as to make it square with, i.e. parallel to, the leading edges of the fed sheets, and means are provided for locking the stop member after it has been satisfactorily positioned relative to the bar. One or more of these buckle chutes can be mounted in a machine with each chute in parallel closely stacked relation to the other chutes. Further features of the invention are presented on the following detailed description which is to be considered together with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a sheet folding machine embodying two buckle chutes constructed and disposed in accordance with the present invention;

FIG. 2 is a longitudinal sectional view in elevation of the same machine;

FIG. 3 is an enlarged fragmentary side elevation of the same machine;

FIG. 4 is a rear elevational view, partly in section, showing the disposition of the two buckle chutes;

FIG. 5 is an enlarged longitudinal sectional view taken substantially along line 5—5 in FIG. 4 showing details of the two buckle chutes and the feeding and folding rolls assembly;

FIG. 6 is a cross-sectional view of the two buckle chutes;

FIG. 7 is taken along line 7—7 in FIG. 5 and is a bottom plan view of the upper buckle chute;

FIG. 8 is taken along line 8—8 in FIG. 5 and is a top plan view of the lower buckle chute;

FIG. 9 is an enlarged fragmentary sectional view taken along line 9—9 in FIG. 6 showing how the front ends of the two buckle chutes are detachably supported; and

FIGS. 10 and 11 are fragmentary sectional views, taken along lines 10—10 and 11—11 in FIG. 8, showing how the uncoilable spring means are connected to the sheet stop assembly in force-balancing relation to each other.

Turning now to FIGS. 1 and 2, there is shown a folding machine corresponding generally to the folding machine disclosed and claimed in the copending application of Thomas J. Gavaghan, Ser. No. 716,044, filed Mar. 26, 1968, for "Sheet Folding Machine." The illustrated folding machine comprises a feed table assembly 2, a feeding and folding roll section 4, a buckle chute section 6, and a delivery unit 8. The end where the buckle chute action is disposed is considered to be the rear end of the machine and the opposite end where the delivery unit is located is the front end. The particular embodiment illustrated in the drawings is designed to make two folds in each sheet of paper as it moves forward from the feed unit through the folding unit to the delivery unit. However, adjustable deflector means are provided whereby either of the two buckle chutes may be isolated so that only one fold is made in each sheet.

The housing of the machine comprises a number of structural members, some of which are omitted to facilitate illustration of the significant aspects of the invention. The main structural members of the housing which is formed of sheet metal stock are vertical side walls 12 and 14 (see FIGS. 1-4) which are secured to a horizontal floor member 16 and a rear vertical wall 18. The front end of wall 14 has an intumed flange 22 (see FIG. 4) to which is secured an auxiliary bottom floor member 24. Bolted to the latter at its opposite sides are two plates 26A and 26B (see FIGS. 2 and 3). The front end of wall 14 is secured to plate 26A. A portion of wall 12 extends forward inside of plate 26B and has a flange that is secured to auxiliary floor member 24 as shown in phantom at 27 in FIG. 4. The plates 26A and 26B are held in parallel spaced relationship by virtue of their

connection to auxiliary floor member 24 and also by a tie rod 28 (FIG. 2), as well as by various transversely extending operating members such as feeding and folding rolls, etc. whose shafts are rotatably mounted therein. These plates as well as side wall 14 are covered by removeable guards 30 and 32 (FIG. 1) which conceal the drive train (not shown) for the various operating members. The drive train is powered by an electric motor 34 (FIG. 2) that is mounted on floor member 16 and is rendered operative by an on-off switch 38 located at the front end of the machine. Although not shown, it is to be understood that switch 38 and motor 34 are connected electrically and that the power circuit for the motor includes a flexible line cord adapted to be plugged into a power outlet.

As shown in FIGS. 1 and 2, the feed table assembly 2 comprises a downwardly and forwardly inclined feed table 40 that is secured to the two side plates 26 and is provided with laterally adjustable paper guide rails 42. Except to the extent described below, a more detailed description of the feed table assembly is not believed to be necessary since it is conventional and its specific construction is not critical to the invention. The forward end of the feed table assembly carries a retarder roller 46 that is positioned adjacent to a main feed roll 48 that forms part of feeding and folding roll section 4. Such retarder-feed roll combinations are well known in the art and are employed as in the present case to fan out a pile of sheets on the feed table so that successive sheets can be fed one at a time by the main feed roll. The fanning or separation of the sheets is due to the fact that the curved surface of the retarder is offset rearwardly relative to the periphery of the main feed roll.

In addition to main feed roll 48, the feeding and folding roll section 4 comprises a plurality of cooperating feeding and folding rolls 50, 52, 54, 56 and 58, a fixed paper guide member 60, a pair of parallel buckle chutes 62 and 64, and a pair of moveable deflector members 66 and 68. The feeding and folding rolls 52, 54 and 56 are located in a common vertical plane just forward of the axis of rotation of main feed roll 48. The feeding and folding roll 58 is located just behind roll 54 with the axes of both rolls lying in a common horizontal plane. The drive train coupling motor 36 to the operating mechanisms of the machine includes intermediate gearing (not shown) arranged so that (as seen in FIGS. 2 and 5) rolls 48, 50 and 54 rotate counterclockwise and rolls 52, 56, and 58 rotate clockwise. The rolls are driven at selected surface speeds. The fixed paper guide member 60 extends between and is secured to the two side plates 26. It is slotted to accommodate roll 50 and is formed so as to extend around the front of roll 52, with its upper rear edge almost engaging main feed roll 48 and its lower rear edge almost engaging roll 54. As a result guide member 60 directs sheets fed by the main feed roll around roll 52 into the nip between rolls 52 and 54.

The two buckle chutes 62 and 64 are located one above the other, with chute 62 located behind roll 52 and chute 64 located behind roll 56. The two deflector members 66 and 68 are located just in front of chutes 62 and 64 respectively. The deflector members extend between the two side plates 26A and 26B. The opposite ends of deflector 66 are provided with ears 72 (one of which is shown in FIG. 5) that are secured to stub shafts 74 which are rotatably mounted in side plates 26. The opposite ends of deflector 68 are provided with like ears 76 that are secured to like stub shafts 78 which also are rotatably mounted in side plates 26. Attached to one of the stub shafts 74 is a handle 80 (FIG. 3) that is used by the operator to rotate deflector 66. A like handle 82 is attached to one of the stub shafts 78. If the machine is to perform two folding operations per sheet, the deflector members are positioned as shown in FIGS. 2 and 5, with the leading edges of deflectors 66 and 68 almost touching rolls 52 and 58. When so positioned the deflectors will

direct fed sheets into the two buckle chutes and prevent them from wrapping themselves around rolls 52 and 58. When it is desired to isolate or immobilize chute 62, handle 80 is moved so that the leading edge of the deflector 66 points down toward roll 58 and its trailing edge (the rear edge as shown in FIG. 5) points toward and almost touches roll 52. When it is desired to isolate chute 64, handle 82 is moved so that the leading edge of deflector 68 points toward roll 56 and its trailing edge (the bottom edge as shown in FIG. 5) points toward and is closely spaced from roll 58. In this connection it is to be noted that the deflectors are almost arcuate in cross-section. This is to facilitate deflection of fed sheets when the deflectors are in chute isolating position. When deflector 66 is pivoted to its chute isolating position, it deflects sheets fed by rolls 52 and 54 away from chute 62 and down into the nip formed by rolls 54 and 58. When deflector 68 is in chute isolating position, it deflects sheets fed by rolls 54 and 58 away from chute 64 forward into the nip formed by rolls 54 and 56.

Further details of the buckle chutes and how they coact with rolls 52-58 to effect folding of fed sheets are described below. At this point it is pertinent to note that the folded sheets are delivered by rolls 54 and 56 to sheet delivery unit 8. As seen in FIGS. 1 and 2, the latter comprises a sheet metal plate 90 whose sides 92 and 94 interlock with and are supported by tie rods 96 and 98 that extend between side plates 26. Attached to the underside of plate 90 at its front and rear ends are two rotatable shafts 100 and 102, each of which carries a plurality of pulleys 104 on which are mounted a like plurality of conveyor belts 106. The rear shaft 102 is coupled to and driven by the gear train (not shown) that drives rolls 48 and 52-58. The direction of movement of shaft 102 is clockwise as seen in FIG. 2 so that the upper runs of belts 106 move forwardly away from rolls 54 and 56. The sheet delivery unit also includes a pair of guide members 110 that are hinged at their upper ends to a wire rod support member 112. The rear surfaces 114 of guides 110 are inclined rearwardly. Hence as each sheet is delivered by rolls 54 and 56, it engages and is directed downward by the rear surfaces 114 onto the belts 106 which carry it beneath guides 110 to the operator or to a receiving hopper (not shown) or to some other machine such as an envelope stuffer.

The two buckle chutes 62 and 64 are substantially the same but differ in length and in certain other particulars noted below. Referring now to FIGS. 2 and 4-7, the upper buckle chute is made up of two plates 118 and 120. The left hand edge of plate 118 is straight and is formed with a vertically depending side wall 122. At its right hand side plate 118 is cut back for a short distance and this cut-back portion is formed with a short vertically depending side wall 124. Along the rest of its right hand edge plate 118 is formed with a depending flange 126 that is not exactly vertical but is inclined slightly as shown in FIG. 6. The lower plate 120 is slightly smaller in width than plate 118. The left hand side of plate 120 is formed with a vertically depending wall 128 having a right angle flange 130 at its bottom edge. The right hand side of plate 120 has a like vertically depending wall 132 with a similar flange 134. The two plates are secured in parallel relation to each other by a pair of rotatable shafts 136 and 138. The opposite ends of the front shaft 136 extend through aligned holes formed in side walls 128 and 132 of plate 120 and side walls 122 and the 124 of plate 118. The ends of the shaft are fitted with snap type retainer rings as shown at 140 to prevent it from moving axially. The opposite ends of shaft 138 also extend through aligned holes in side walls 128 and 132. One end of shaft 138 also extends through a hole in side wall 122 of plate 118, but the other end extends through a hole formed in a bracket 142 welded to the underside of plate 118. Snap type retainer rings 144 are attached to the ends of shaft 138 to prevent axial movement.

The front end of plate 118 has a slight downward bend as shown at 148 (see FIG. 5). The corresponding end of plate 120 is bent at about the same angle but extends beyond the front end of plate 118 by a substantial amount as shown at 150 in FIG. 5. These bent forward ends define an entrance opening whereby sheets fed by rolls 52 and 54 may enter the space between plates 118 and 120. Disposed in this space is a stop assembly comprising a bar 154 whose length is slightly less than the distance between side walls 122 and 124 of plate 118.

The forward edge of bar 154 is formed with two projecting portions or ears 156 and 158. The former is formed with a cam slot 160 (see FIG. 7) while the latter is formed with a hole to receive a pivot pin in the form of a screw 162. In this connection it is to be noted that plate 118 is formed with a series of parallel slots 164 that extend at right angles to shafts 136 and 138 and plate 120 is formed with a like number of parallel slots 166, each of the latter being aligned with one of the slots 164. The projections 156 and 158 of bar 154 are each aligned with a pair of slots 164 and 166.

Also joining part of the stop assembly is a second bar 168 located in front of bar 154. Bar 168 is formed with two ears 170 and 172 at its rear edge. Ear 170 underlies ear 156 of bar 154. Ear 172 underlies ear 158 of bar 154. In this connection it is to be noted that bar 168 is thicker than bar 154 and is provided with recesses 174 and 176 (FIG. 7) to accommodate ears 156 and 158. Ear 172 is formed with a hole to receive the pivot screw 162. The latter is held in place by a nut 180. To the extent described bar 168 is capable of pivoting in its own plane to a limited extent relative to bar 154. However, bar 168 cannot pivot freely but only under the influence of a cam 184 that is affixed to the shank of a threaded pin 186. Cam 184 is situated in cam slot 160 and is shaped so that when rotated by pin 186 it forces bar 168 to pivot in one direction or the other depending upon the direction of rotation of pin 186. The latter is fitted with a knob 190 whereby it may be rotated by the operator. The cam is shaped so that when rotated 360 degrees it will cause bar 168 to pivot first clockwise and then counterclockwise with the bar reversing direction just short of engaging the ends of bar 154.

Bar 168 is formed at its leading edge with a plurality of like sheet stop members 192 which project into the slots 164 and 166 of plates 118 and 120. As seen best in FIG. 5, these sheet stop members are bifurcated at their front ends, each having a V-shaped groove 194 for receiving the leading edges of sheets to be folded.

Still referring to FIGS. 5-7, the stop assembly is positioned by a dual balanced spring mechanism. The latter comprises four negator springs 196, 198, 200 and 202. Negator springs, well known in the art, are flat coiled springs that provide a substantially constant spring load regardless of the amount of extension. Springs 196 and 198 are wound on hubs 204 and 206 that are affixed to shaft 138 adjacent its opposite ends. Spring 196 extends along and just above flange 130, passes about a pulley 210 mounted on shaft 136, and is connected to one end of bar 154 as shown at 214. Spring 198 follows a similar path, passing above flange 134, around a pulley 212 and then back to bar 154 where it is secured as shown at 216. Springs 200 and 202 are wound on hubs 218 and 220 respectively mounted on shaft 138. They are wound oppositely to springs 196 and 198. They extend between plate 118 and 120 and are connected to bar 154 by screws and nuts as shown at 224 and 226, respectively. The end slots 166 in plate 120 are made wider than the rest to allow the screws and nuts shown at 224 and 226 to move back and forth unimpeded. With this arrangement springs 196 and 198 oppose springs 200 and 202 so that their forces are effectively balanced. Hence in the absence of an applied overriding force, the four springs tend to hold the stop assembly stationary.

Application of an overriding force to move the stop as-

sembly toward or away from the entrance opening defined by the curved ends 148 and 150 of plates 118 and 120 is achieved by means of a large thumb wheel 230 attached to shaft 138. Plates 118 and 120 are slotted to accommodate the thumb wheel and plate 120 has a downturned extension 232 to which is attached a resilient pawl 234. The latter engages teeth 236 formed in the periphery of wheel 230 and this provides a detent action that restrains the wheel against movement until it is overridden by the operator.

The buckle chute 62 just described is attached to the machine by a releasable connection. The latter is provided in part by a pair of brackets 238 (only one of which is shown in FIG. 5) that are attached to side walls 12 and 14. As shown in FIG. 9, each of the brackets 238 has a slot 240 that extends downwardly and forwardly from its top edge and is just wide enough to accommodate the end of shaft 136 located at the front end of the buckle chute. The rear end of the buckle chute is supported on a horizontal extension 242 of the rear wall. This extension carries two studs 246 whose heads are slightly elevated and are tapered as shown. The rear end of plate 120 of the buckle chute is offset so as to provide a horizontal flange 250. This flange 250 has a hole for each stud 246. Each hole is just large enough to accommodate the head of the stud so that the latter can hold the buckle chute in place. Brackets 238 and studs 246 are located so as to position the chute's front end next to deflector member 66 as illustrated. Removal of the buckle chute is effected by lifting its rear end clear of studs 246 and pulling it upward and rearward until the ends of shaft 136 have cleared slots 240.

Referring now to FIGS. 5, 6 and 8, the bottom buckle chute 64 is similar in construction to chute 62, comprising a lower plate 252 and an upper plate 254. The right hand edge of plate 252 is formed with an upstanding vertical wall 256. Formed integral with the top wall of 256 and extending from the rear end thereof for about $\frac{3}{8}$ of its length is a horizontally extending flange 258. The right hand edge of the latter has a depending flange 260 that is inclined at about the same angle as flange 126 of the upper buckle chute. The left hand edge of plate 252 is formed with an upstanding vertical wall 262. The upper plate 254 is shorter than plate 252. Its left hand side is formed with an upstanding vertical wall 264 having a right angle flange 266 at its top edge. The right hand side of plate 254 has a like upstanding vertical wall 268 with a similar flange 270. The two plates are secured in parallel relation to each other by a pair of rotatable shafts 272 and 274. The opposite ends of shaft 272 extend through aligned holes formed in the forward ends of side walls 264 and 268 of plate 254 and side walls 256 and 262 of plate 252. The ends of these shafts are fitted with snap type retainer rings as shown at 276 (FIG. 8) to prevent them from moving axially. The opposite ends of shaft 274 also extend through aligned holes formed in the rear ends of side walls 256, 262, 264 and 268. Additional snap type retainer rings 278 (FIG. 8) are attached to the ends of shaft 274 to prevent axial movement thereof.

The front end of lower plate 252 has a slight upward bend as shown at 280 (see FIG. 5). The corresponding end 282 of upper plate 254 is bent at about the same angle but does not extend as far as the front end of plate 252. These bent ends define an entrance opening whereby sheets fed by rolls 54 and 58 may enter the space between plates 252 and 254. Disposed in this space is a stop assembly comprising a bar 286 whose length is slightly less than the distance between side walls 264 and 268 of plate 254. Bar 286 is formed with two ears 288 and 290 at its forward edge. Ear 290 has a cam slot 292 (FIG. 8) while ear 288 has a hole to receive a pivot pin in the form of a screw 294. Plates 252 and 254 have a series of parallel slots 296 and 298 respectively, like the slots 164 and 166 formed in the plates of the upper

buckle chute, and each of the ears 288 and 290 is aligned with a pair of the slots 296 and 298.

The stop assembly for chute 64 also includes a second bar 300 located in front of bar 286. Bar 300 has two ears 320 and 324 projecting from its rear edge and overlying the ears 288 and 290 respectively of bar 286. Ear 320 is formed with a hole to receive pivot screw 294 which is secured in place by a nut 328. Ear 324 has a hole to accommodate a threaded pin 330 that also extends through ear 290 and is secured in place by a nut 332. Affixed to the shank of threaded pin 330 is a cam 336 that is situated in cam slot 292. Cam 336 and its slot 292 are shaped like cam 184 and slot 160, so that rotation of cam 336 will cause bar 300 to pivot relative to the bar 286. Threaded pin 330 is provided with a knob 337 similar to knob 190 to facilitate rotation of cam 336. The leading edge of bar 300 has a plurality of sheet stop members 338 identical to stop members 192 described above.

Movement and positioning of the stop assembly for buckle chute 64 is achieved by a dual balanced spring assembly substantially the same as that embodied in chute 62. More specifically, it comprises four negator springs 340, 342, 344 and 346. Springs 340 and 344 are wound on hubs 348 and 350 attached to shaft 274 near its ends. Springs 340 and 342 extend along and just below flanges 266 and 270, pass about pulleys 352 and 354 mounted on shaft 272, and are connected to the ends of bar 286 by screws and nuts as shown at 356 and 358 respectively. Springs 344 and 346 are wound on hubs 360 and 362 respectively affixed to shaft 274. These springs are wound opposite to springs 340 and 342. They extend between plates 252 and 254 and are connected to bar 286 by screws and nuts as shown at 366 and 368 respectively. The end slots 298 in plate 254 are made wider than the rest to allow the screws and nuts shown at 366 and 368 to move unimpeded.

The two pairs of springs substantially balance each other so that the stop assembly will remain at rest until an overriding or unbalancing force is applied by the operator by means of a thumb wheel 370 affixed to shaft 274. Plates 252 and 254 are slotted to accommodate the thumb wheel. A resilient pawl 372 affixed to plate 254 coacts with teeth 374 formed in the periphery of wheel 370 to prevent the latter from rotating freely.

Buckle chute 64 is detachably connected to the machine in essentially the same manner as chute 62. A second pair of brackets 376 somewhat similar to brackets 238 are attached to side walls 12 and 14 in position to receive the ends of shaft 272; and the rear end of plate 252 is provided with a pair of holes positioned to receive a pair of studs 378 whose heads are tapered to make a snap fit with plate 252. Studs 378 are supported by a horizontally extending bracket 380 formed by bending out sections of the machine's side walls 12 and 14. Brackets 376 have like slots 382 which are shaped as shown to limit vertical and forward movement of shaft 272. Removal of buckle chute 64 is effected by lifting its rear end upward clear of studs 378 and then pulling it rearward until shaft 272 is clear of brackets 376.

It is to be noted that the two buckle chutes can be inserted or removed without dismantling any other part of the machine. The lower chute is inserted first and removed last. It is to be noted also that the two stop assemblies may be adjusted independently and without removing the chutes from the machine. The two thumb wheels are spaced one behind the other and at different levels so that they are easily accessible to the operator.

The machine illustrated in the drawings also embodies indicators means for facilitating setting of the two stop assemblies. These indicator means form no part of this invention but are described below to better demonstrate the mode of operation of the machine. Referring now to FIGS. 1, 3, 6, 7 and 8, the inclined flange 126 at the right edge of plate 118 of the upper buckle chute is provided

with a scale 384 graduated in inches and fractions thereof. A second scale 386 graduated in inches and fractions thereof is provided on flange 260 of plate 252 of the lower buckle chute. Associated with these scales are two elongate slots 388 and 390 formed in a member 391 attached to side plate 26B. The side covers plate 30 is recessed to accommodate member 391. These slots are aligned with the scales and their end surfaces 392 and 394 serve as reference points for scales 384 and 386 respectively as described below. Cooperating with these scales are two indicator members 396 and 398. Indicator member 396 is attached to and moveable with plate 154, while indicator member 398 is attached to and moveable with plate 286. The position of these indicators relative to scales 384 and 386 indicate the length of the folds that will be made in a sheet by the two buckle chutes as a result of the particular settings of their respective stop assemblies.

Operation of the machine will now be described. Assume that a supply of sheets are to be folded twice in overlapping style with the lengths of the folds corresponding to those previously made in a specimen sheet S. The operator unfolds the specimen sheet and positions one side edge along scale 384 so that one end edge engages surface 392. Then the operator rotates wheel 230 until indicator 396 is set even with the first fold line. Then the operator reverses the sheet, puts its other edge against surface 394, and turns wheel 374 until indicator 398 is even with the other fold line. The foregoing procedure of setting the two buckle chutes is demonstrated in FIG. 1 where the specimen sheet S is held against scale 386 while the operator is adjusting indicator 398. Then the supply of sheets are placed in the feed tray 2 and switch 38 is closed to energize motor 36. Immediately feed roll 48 commences feeding sheets one at a time from the feed tray. Each sheet passes first between rolls 50 and 52 and then between rolls 52 and 54. The latter delivers the sheet into buckle chute 62. The leading edge of the sheet will stop when it engages stop members 192 and the will buckle as its trailing end continues to be propelled. The buckled portion of the sheet will pass between rolls 54 and 58 where it is folded flat. This folded portion then passes into buckle chute 64 and stops when it engages stop members 338, whereupon its trailing section will buckle under the driving force of rolls 54 and 58. This newly buckled portion will pass between rolls 54 and 56 where it will be folded flat. The fully folded sheets fall onto conveyor belts 106 which deliver them to the operator or to some associated piece of equipment. The folds may be of the overlapping or accordin type, depending upon the settings of the buckle chute stop assemblies.

It is believed to be apparent that the invention above described and illustrated offers a number of advantages. The buckle chutes are simple to make and operate, and are easily inserted and removed. The folding section is compact since the buckle chutes are stacked one upon the other. The construction and arrangement of the chutes makes it possible to provide more than two chutes in one machine, with the extra chutes located in parallel stacked relation to the ones shown in the drawings. Of course, if more than two chutes are provided, extra folding and feeding rolls also are required to convey the sheets of paper to and from the extra chutes.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts specifically described or illustrated, and that within the scope of the appended claims, it may be practiced otherwise than as specifically described or illustrated.

What is claimed is:

1. In a sheet folding machine having a plurality of sheet feeding rollers,
a buckle chute with an adjustable fold-controlling stop assembly,

said chute comprising a pair of parallel spaced plates defining a space therebetween having an entrance opening adjacent said feed rollers,
 said fold-controlling stop assembly disposed in said space and moveable toward and away from said entrance opening,
 said fold-controlling stop assembly comprising an elongate bar extending at right angles to the path of movement of said stop assembly,
 first and second shafts each disposed parallel to said elongate bar,
 means rotatably mounting said shafts in spaced relationship with each other,
 a pair of pulleys on said first shaft,
 a first pair of negator springs mounted on said second shaft, said first springs extending around said pulleys and connected to said elongate bar,
 a second pair of negator springs mounted on said second shaft, said second springs connected to said elongate bar so as to oppose the forces exerted thereon by said first springs, and
 means for rotating said second shaft so as to cause movement of said stop assembly under the influence of said springs with one pair of springs pulling said elongate bar in one direction against the restraining forces exerted by the other pair of springs.

2. The combination of claim 1 wherein
 said stop assembly includes a second bar carrying means for intercepting and stopping a sheet, and further including
 means for adjustably moving said second bar angularly with respect to said first bar so as to facilitate aligning said sheet intercepting and stopping means with the leading edges of sheets fed by said rollers.

3. The combination of claim 1 wherein
 said stop assembly includes a second bar located adjacent to said elongate bar on the side thereof nearest to said entrance opening,
 said second bar having means for stopping a sheet delivered by said rollers,
 means pivotally connecting said elongate bar and said second bar so that said second bar can pivot relative to said elongate bar, and
 means for locking said second bar against pivoted movement relative to said elongate bar.

4. The combination of claim 3 wherein
 said last-mentioned means also is adapted to pivot said second bar relative to said elongate bar.

5. The combination of claim 3 wherein
 said parallel spaced plates are each provided with a plurality of slots extending parallel to the direction of movement of said stop assembly, with the slots in one plate aligned with the slots in the other plate, and further wherein
 said sheet stopping means comprises a plurality of spaced elements along one edge of said second bar, said spaced elements projecting into said slots.

6. The combination of claim 1 wherein
 said means for rotating said second shaft comprises a thumb wheel attached to said second shaft.

7. The combination of claim 6 further including
 means for releasably locking said thumb wheel so as to prevent movement of said stop assembly.

8. The combination of claim 1 wherein
 said means for rotating said second shaft comprises a thumb wheel attached to said second shaft, said thumb wheel including a toothed cylindrical surface, and further including
 a pawl cooperating with the teeth of said thumb wheel to retard rotation of said second shaft.

9. The combination of claim 1 further including
 detent means opposing movement of said stop assembly.

10. The combination of claim 1 wherein

said machine includes fixed members located at opposite sides of said buckle chute, and further including
 means detachably connecting said buckle chute to said fixed members.

11. The combination of claim 1 further including
 a second buckle chute with a second adjustable fold-controlling stop assembly,
 said second buckle chute and its stop assembly being substantially the same as the first-mentioned buckle chute,
 said second buckle chute being disposed in spaced parallel relation to said first mentioned buckle chute and having its entrance opening located adjacent to said feed rollers in position so that sheets delivered by said feed rollers undergo a first folding operation in said first-mentioned buckle chute and a second folding operation in said second buckle chute with the lengths of the folds determined by the position of the stop assemblies of the two buckle chutes.

12. The combination of claim 1 wherein
 the opposite ends of said shafts project beyond the sides of said plates, and further including
 fixed buckle chute supports adapted to support said chute by the ends of said shafts,
 said fixed supports having slots into which said shafts may be inserted for engagement therewith.
 said slots being shaped so as to oppose movement of said shafts toward or away from said entrance opening while permitting said shafts to be lifted out of disengagement with said supports.

13. A buckle chute adapted for attachment to a sheet folding machine comprising
 parallel spaced means defining a space therebetween with a sheet entrance opening at one end thereof,
 a fold controlling stop assembly disposed in said space and moveable toward and away from said sheet entrance opening,
 first spring means coupled to said stop assembly and urging said stop assembly away from said sheet entrance opening,
 second spring means coupled to said stop assembly and urging said stop assembly toward said sheet entrance opening,
 said first and second springs substantially balancing each other so that in the absence of an applied overriding force said stop assembly tends to remain at rest, and
 force-applying means for overriding said springs so as to effect movement of said stop assembly.

14. A buckle chute as defined by claim 13 wherein
 said first and second spring means comprise coiled springs of the type which provide a substantially constant spring load regardless of the amount of extension thereof.

15. A buckle chute as defined by claim 13 wherein
 said stop assembly comprises a bar extending across said space substantially parallel to said sheet entrance opening, and further wherein
 said first and second spring means are connected to said bar.

16. A buckle chute as defined by claim 15 wherein
 said spring means are connected to said bar adjacent the ends thereof.

17. A buckle chute as defined by claim 15 wherein
 said stop assembly also comprises an elongate sheet stopping member,
 means pivotally securing said sheet stopping member to said bar so that said sheet stopping member can pivot relative to said bar in a plane common to said bar and sheet stopping member, and

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means connected to said bar and sheet stopping member for pivoting said sheet stopping member and holding it in a predetermined angular position relative to said bar.

18. A buckle chute as defined by claim 17 wherein said last-mentioned means comprises a rotatable cam. 5

19. A buckle chute as defined by claim 17 farther including means for rotating said cam.

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