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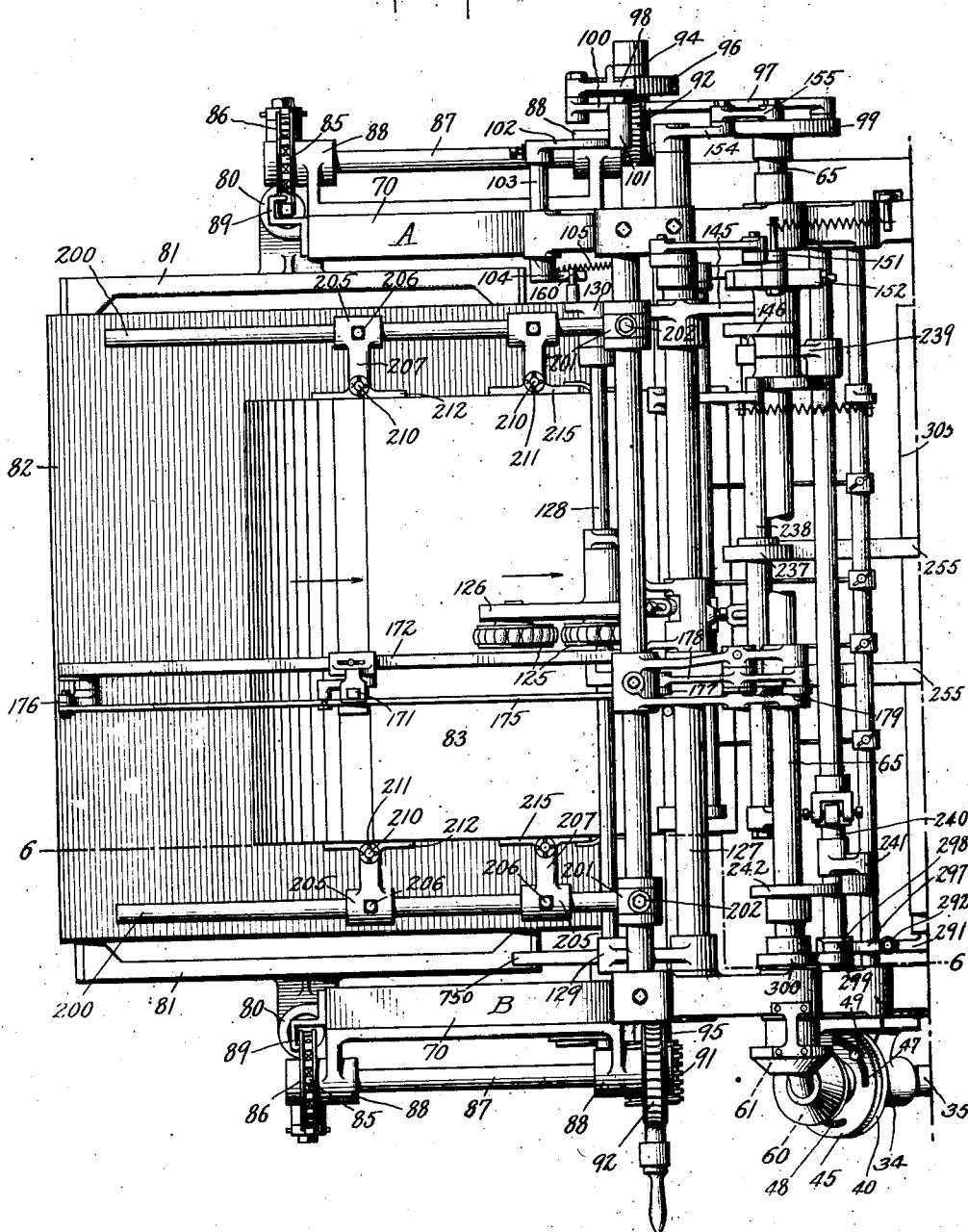
E. D. RADER
PAPER FOLDING MACHINE

1,746,444

Filed Aug. 10, 1923

22 Sheets-Sheet 1

Fig. 1.



Inventor
Earl D. Rader
By *Knight & Co.* Attorney's

Feb. 11, 1930.

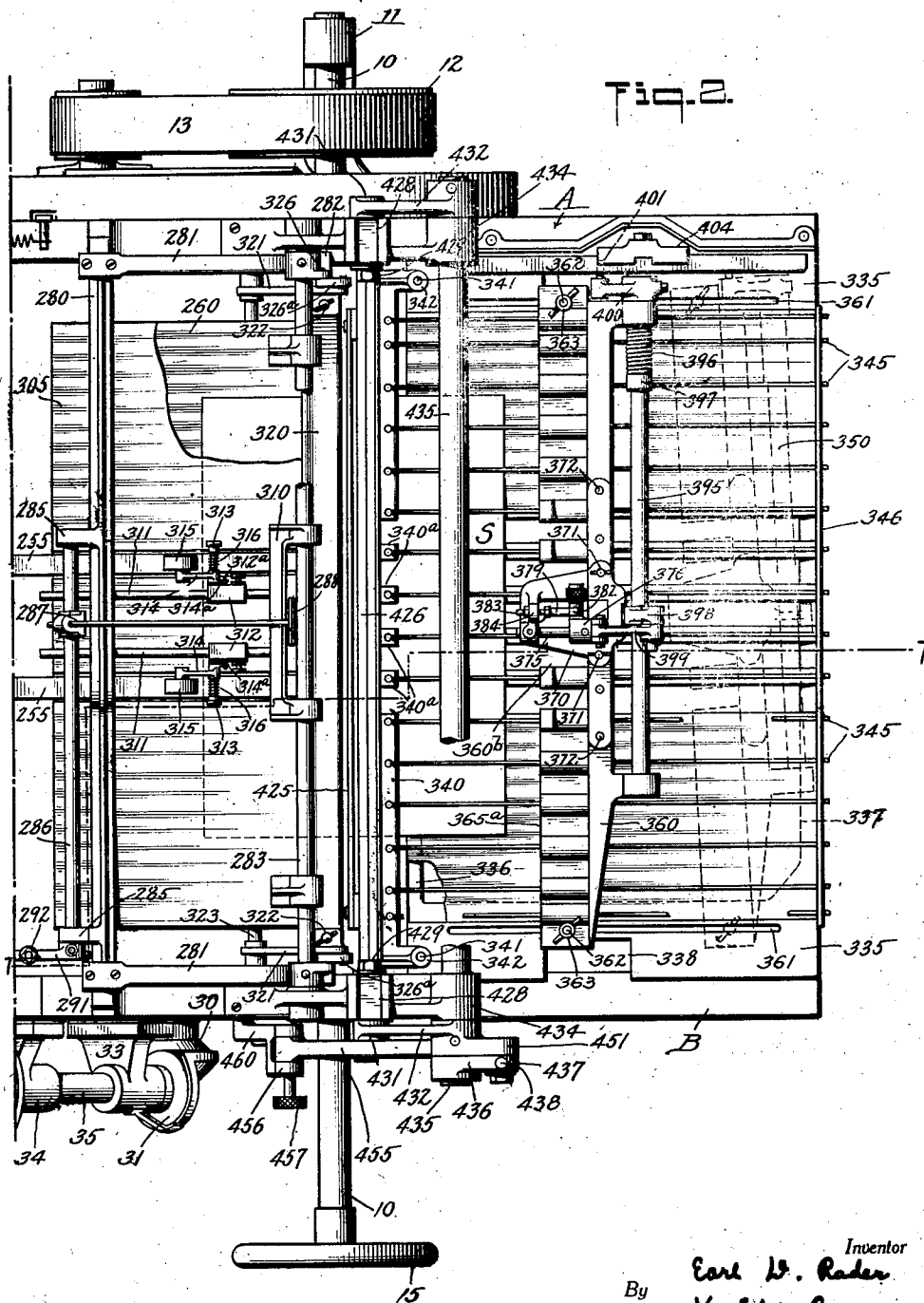
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1,746,444

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22 Sheets-Sheet 2



Inventor
E. D. Rader
By
Knight & Co.
Attorneys

Feb. 11, 1930.

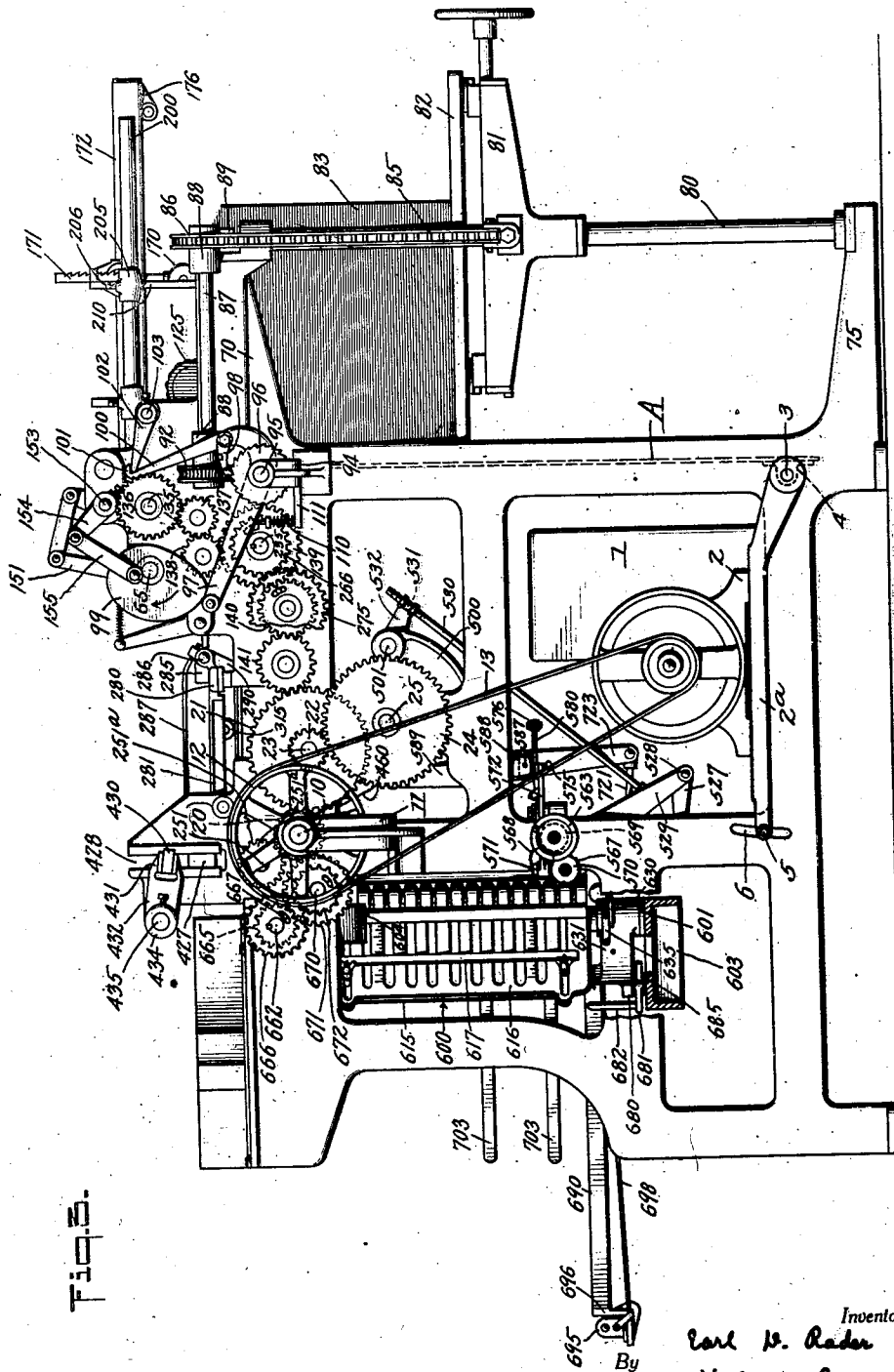
E. D. RADER

1,746,444

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22 Sheets-Sheet 3



Inventor

Earl W. Rader

Knight Bros
Atto

Attorney

Feb. 11, 1930.

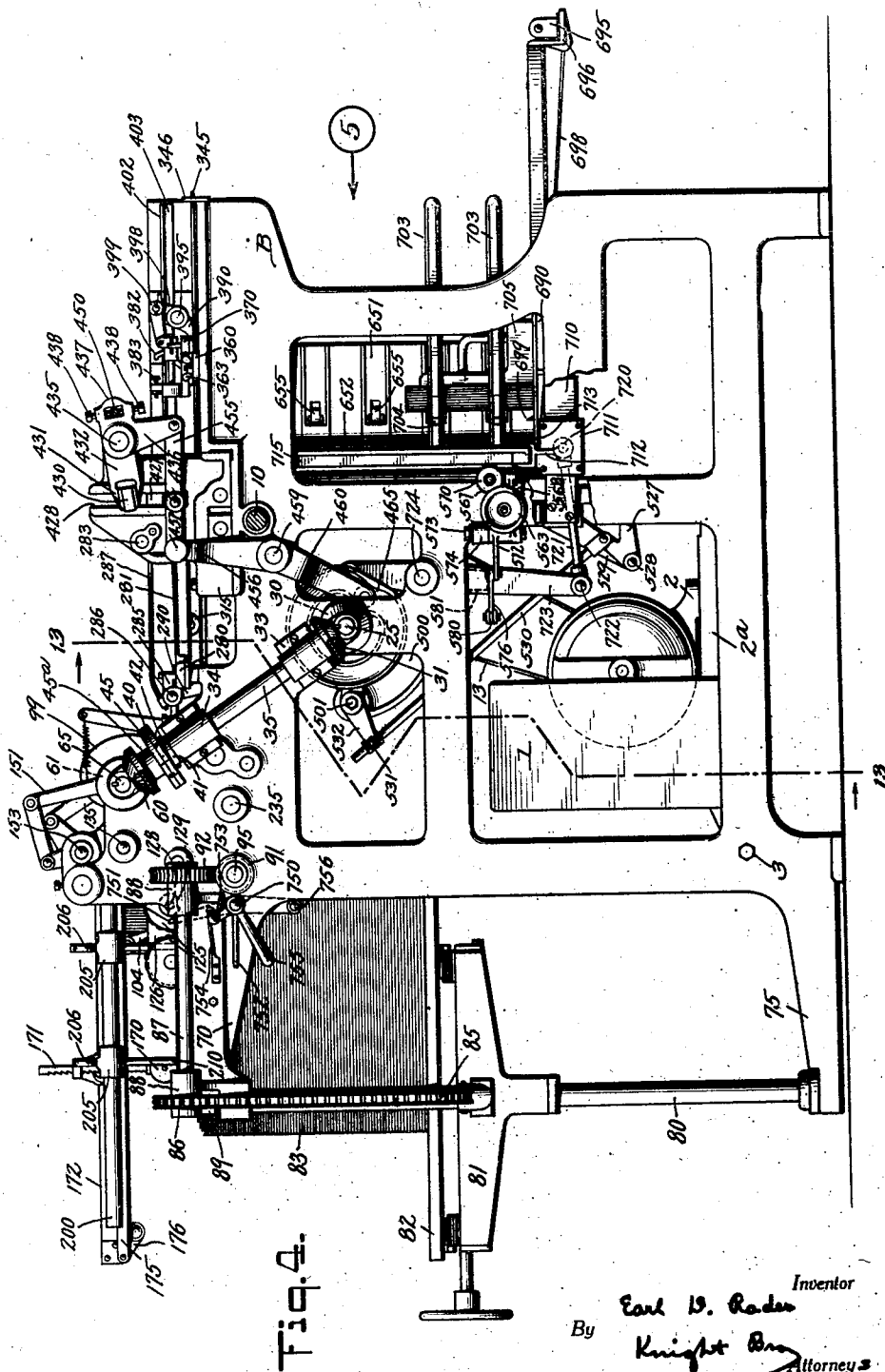
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22 Sheets-Sheet 4



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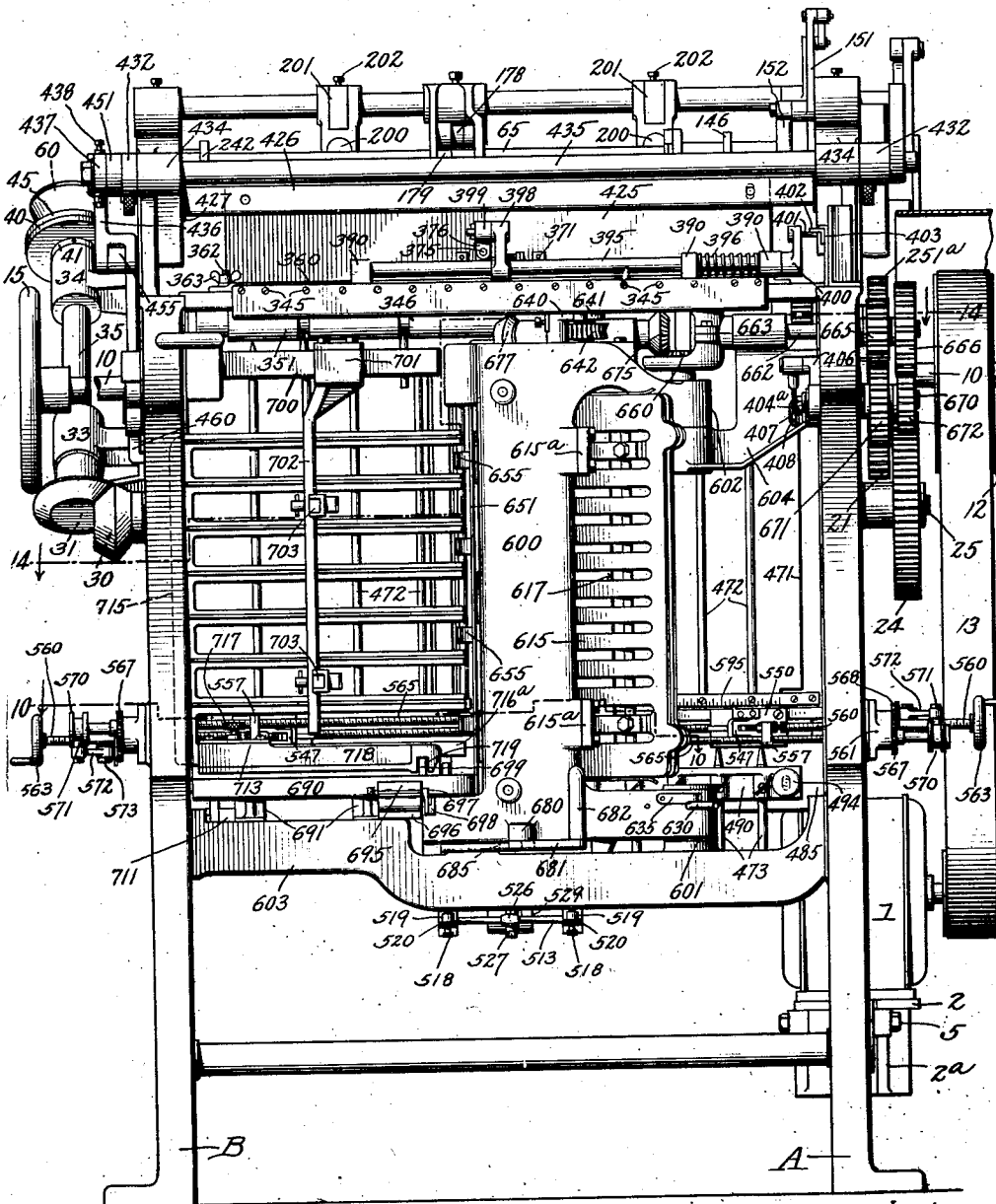
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PAPER FOLDING MACHINE

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22 Sheets-Sheet 5

Fig. 5.



Inventor
By *Carl W. Rader*
Knight & Co. Attorney &

Feb. 11, 1930.

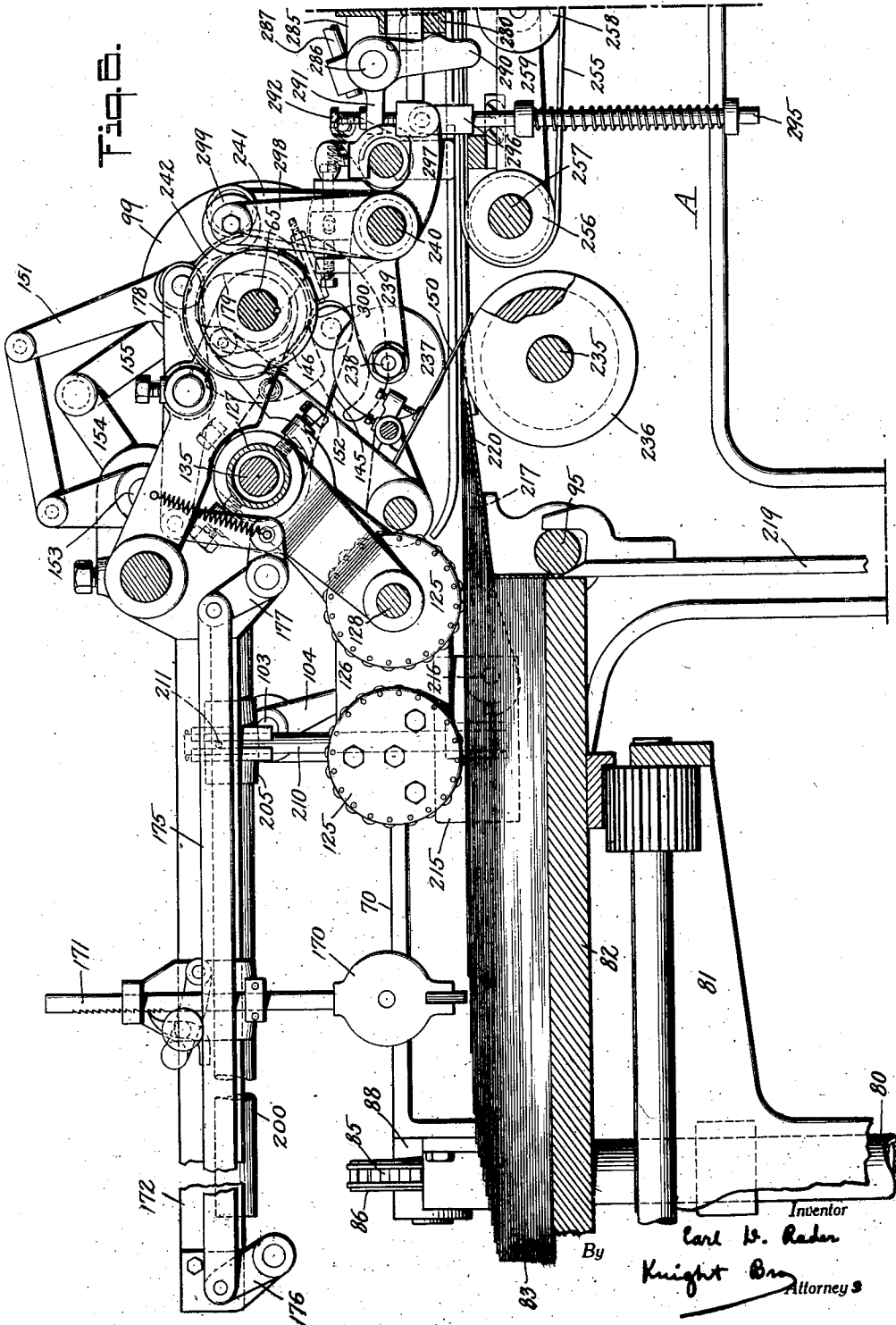
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22 Sheets-Sheet 6



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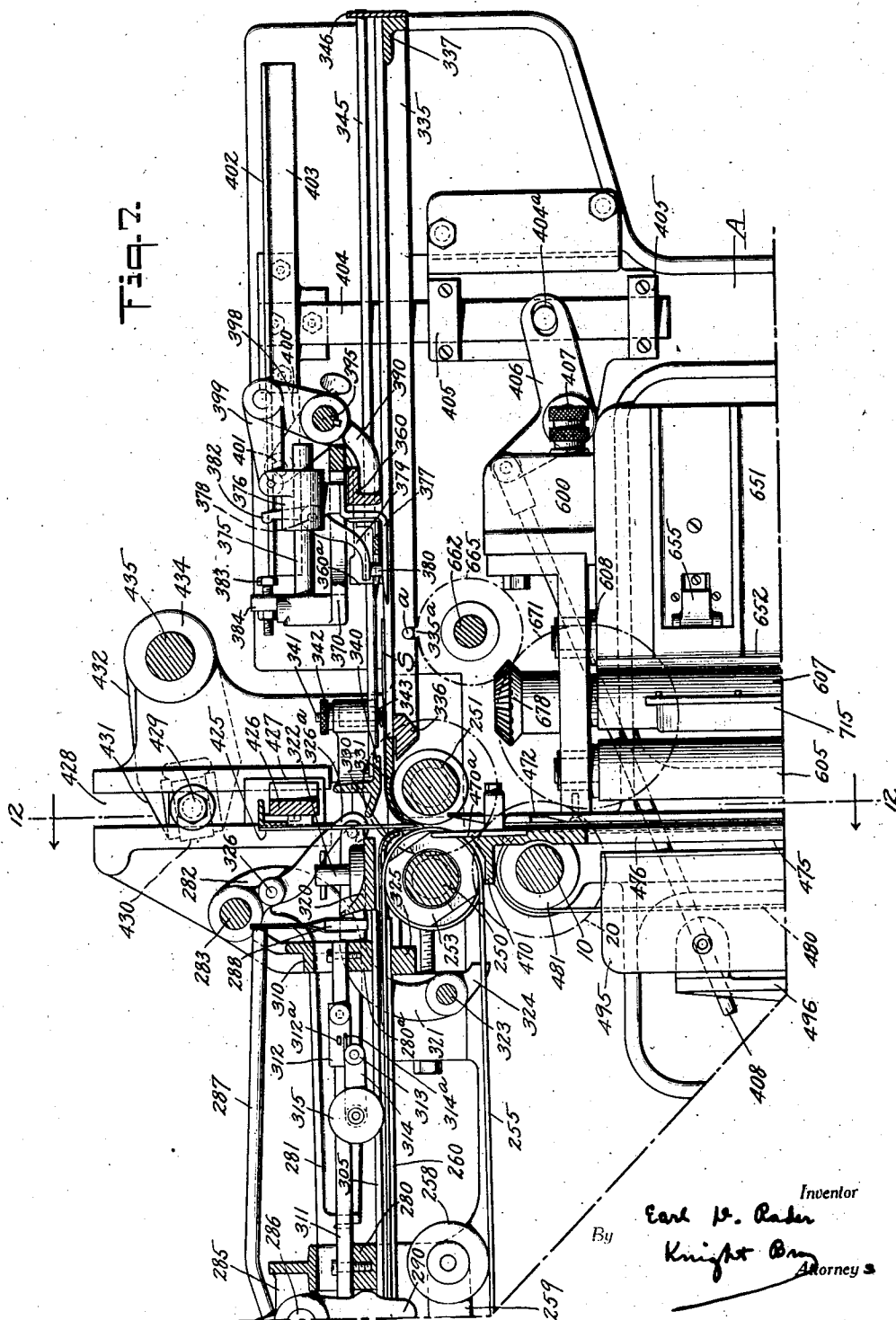
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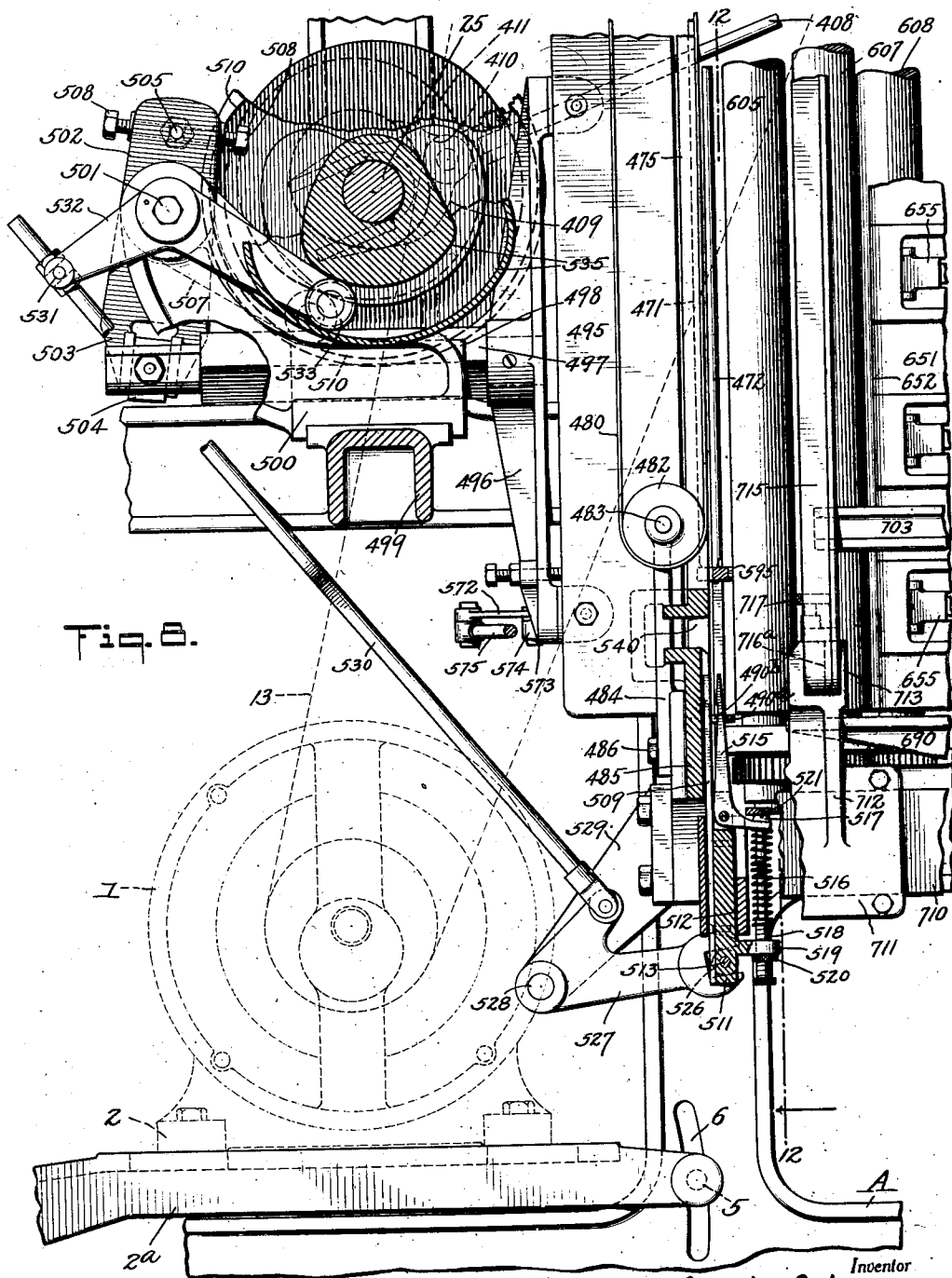
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Filed Aug. 10, 1923

22 Sheets-Sheet 8



Inventor
Earl D. Rader
By
Knight & Bay
Attorneys

Feb. 11, 1930.

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PAPER FOLDING MACHINE

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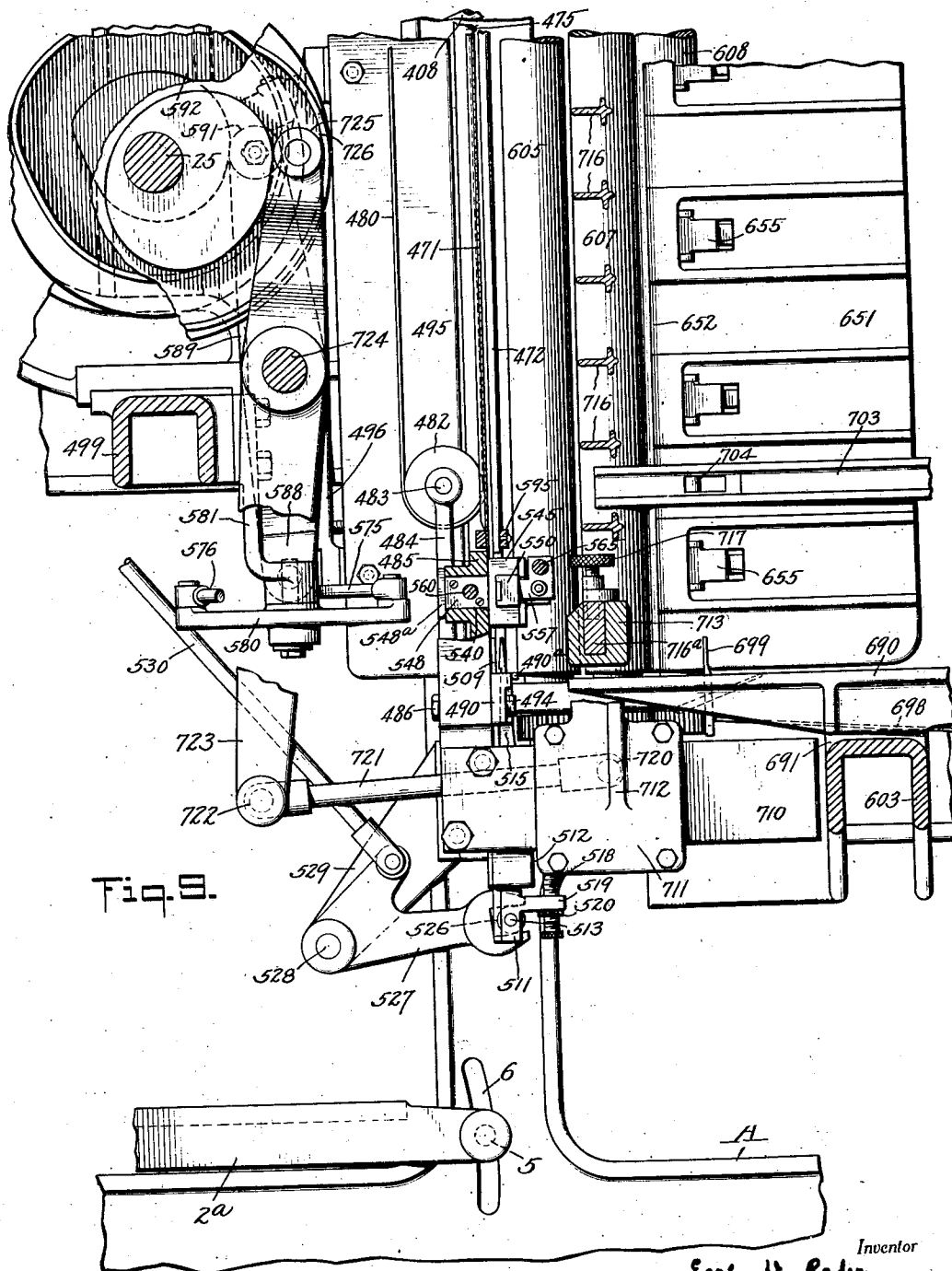


Fig. 8.

Inventor
Earl W. Rader
By
Knight Bros.
Attorneys

Feb. 11, 1930.

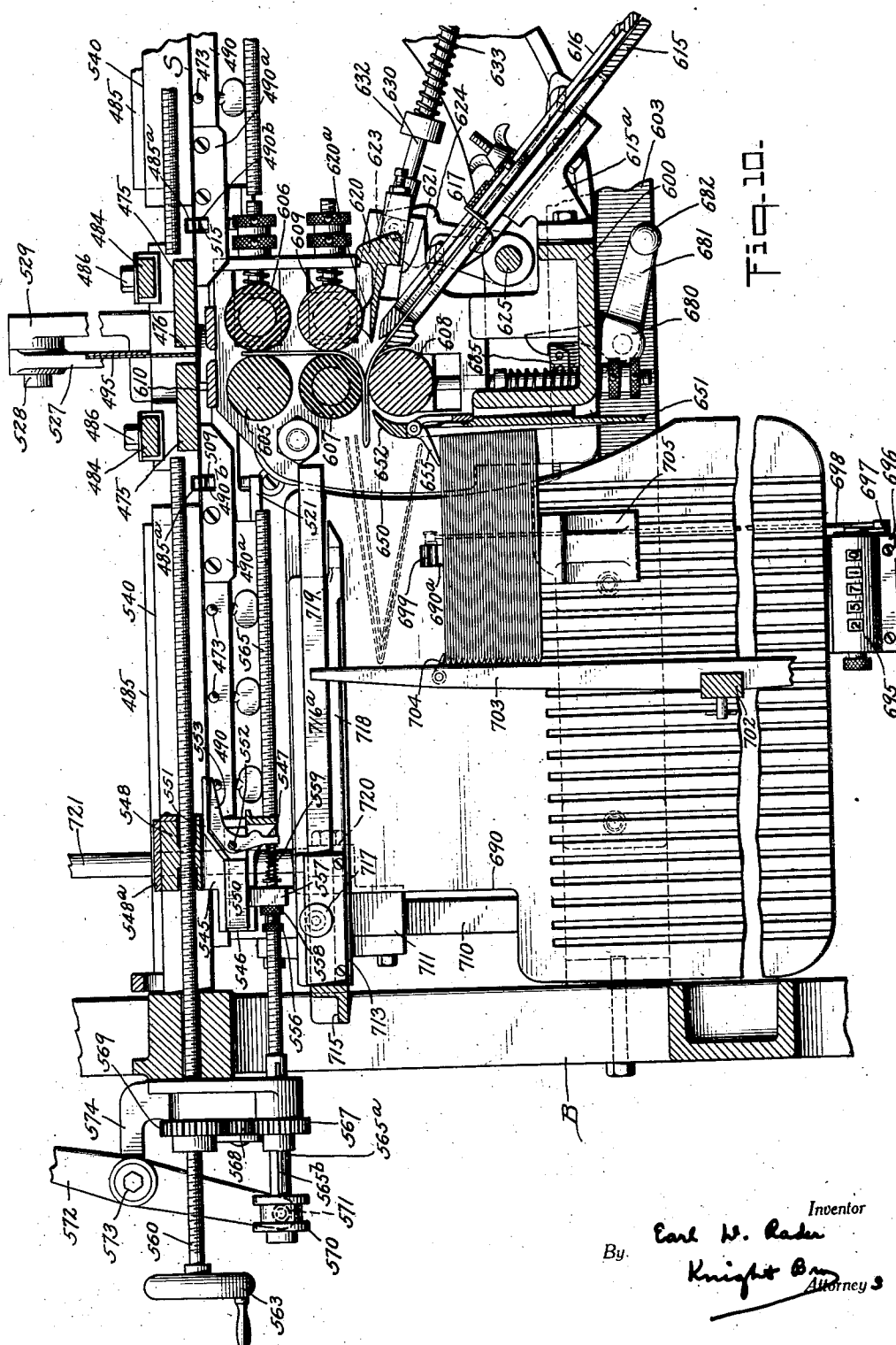
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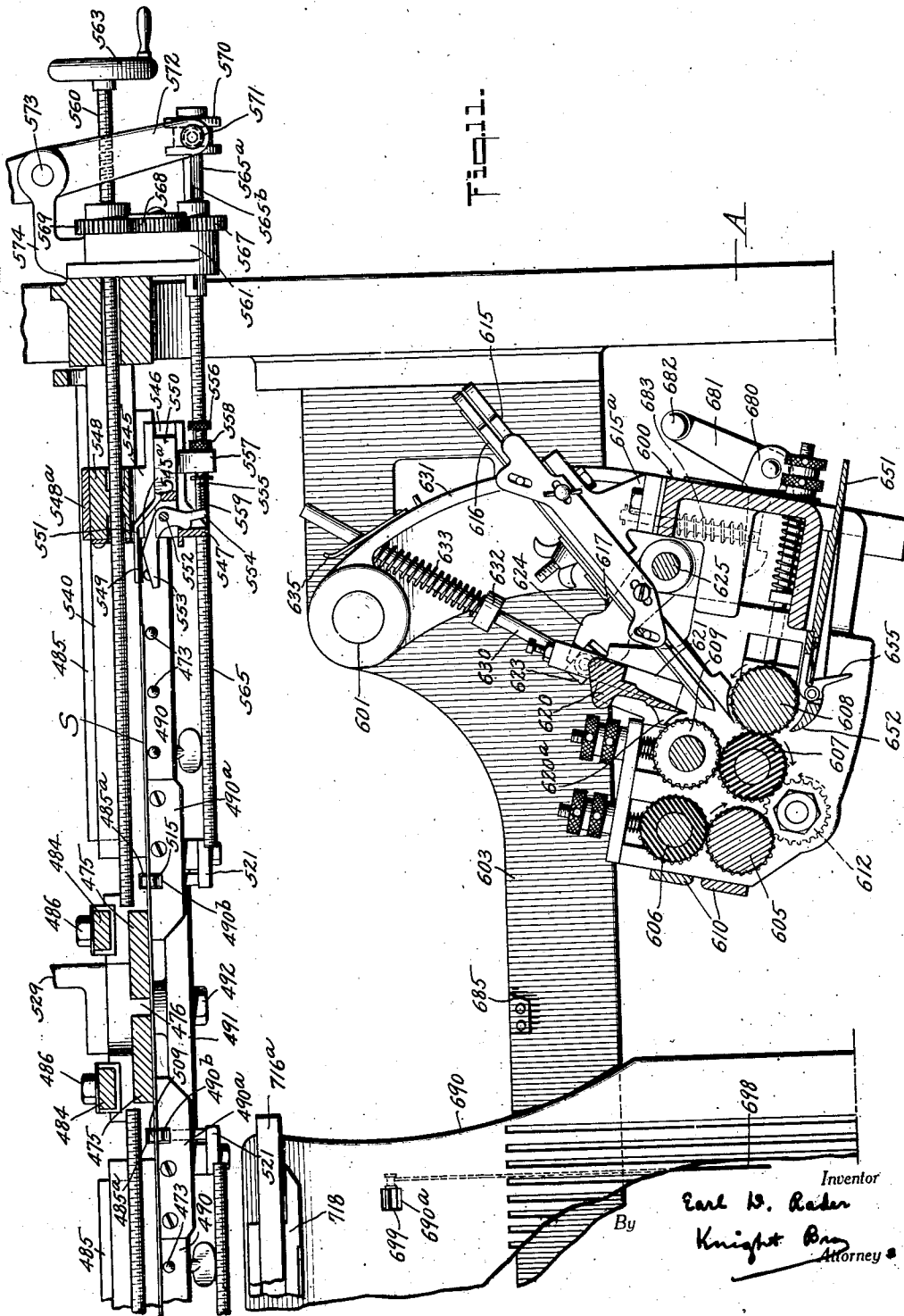
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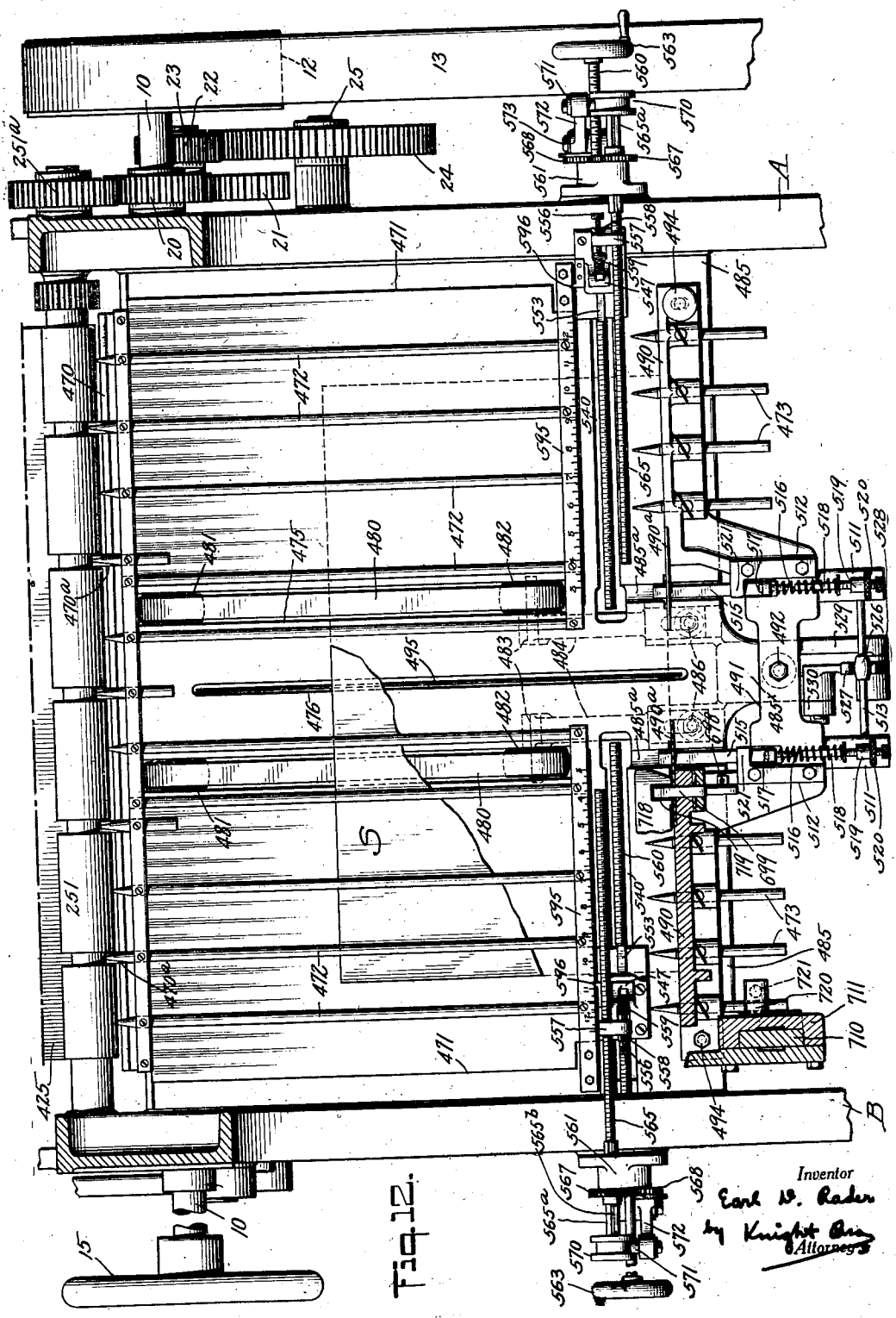


Fig. 12.

Inventor
Earl W. Radler
by Knight & Co.
Attorneys

Feb. 11, 1930.

E. D. RADER

1,746,444

PAPER FOLDING MACHINE

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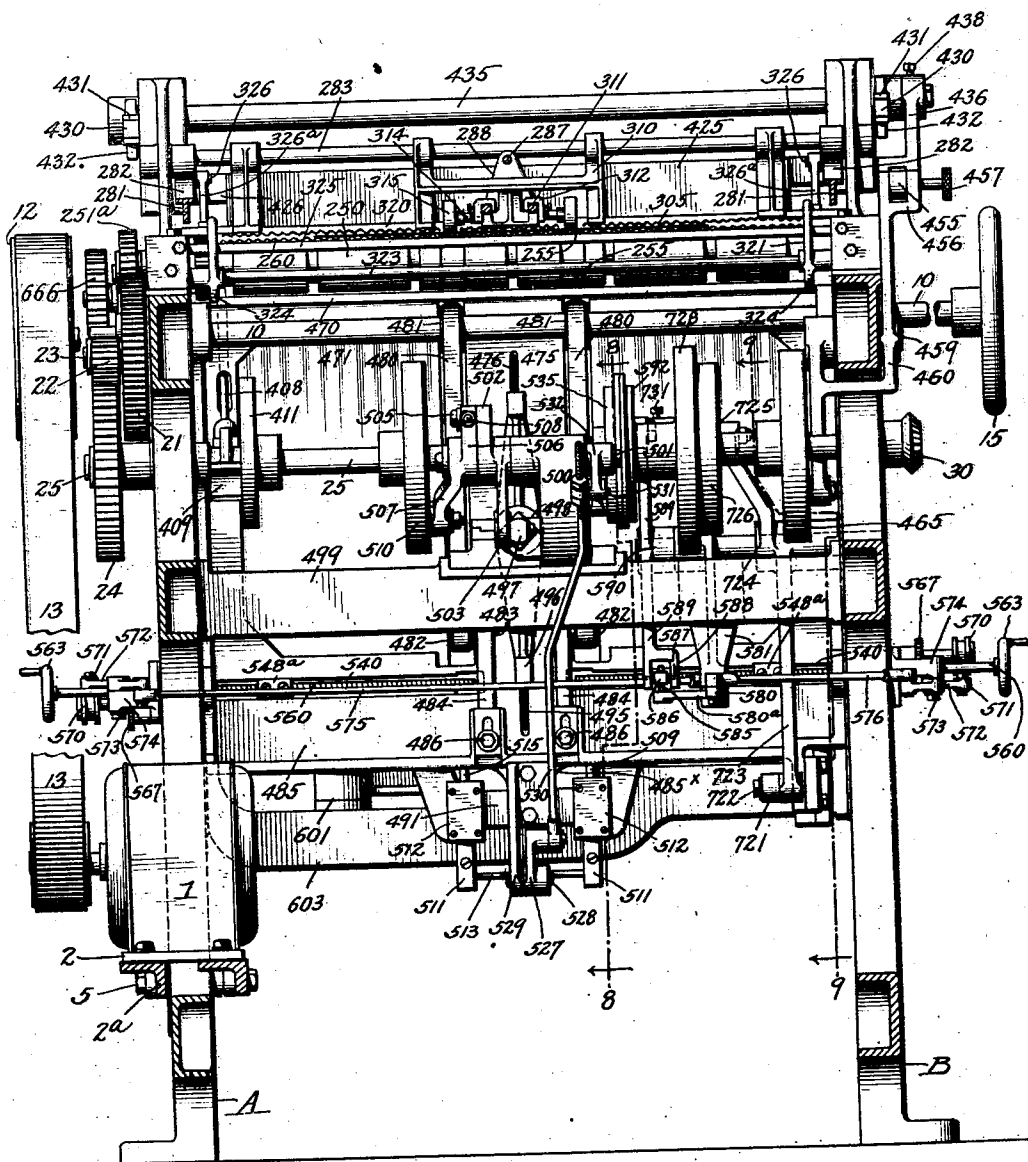


Fig. 13.

Inventor
Earl W. Rader
By
Knight & Co.
Attorney

Feb. 11, 1930.

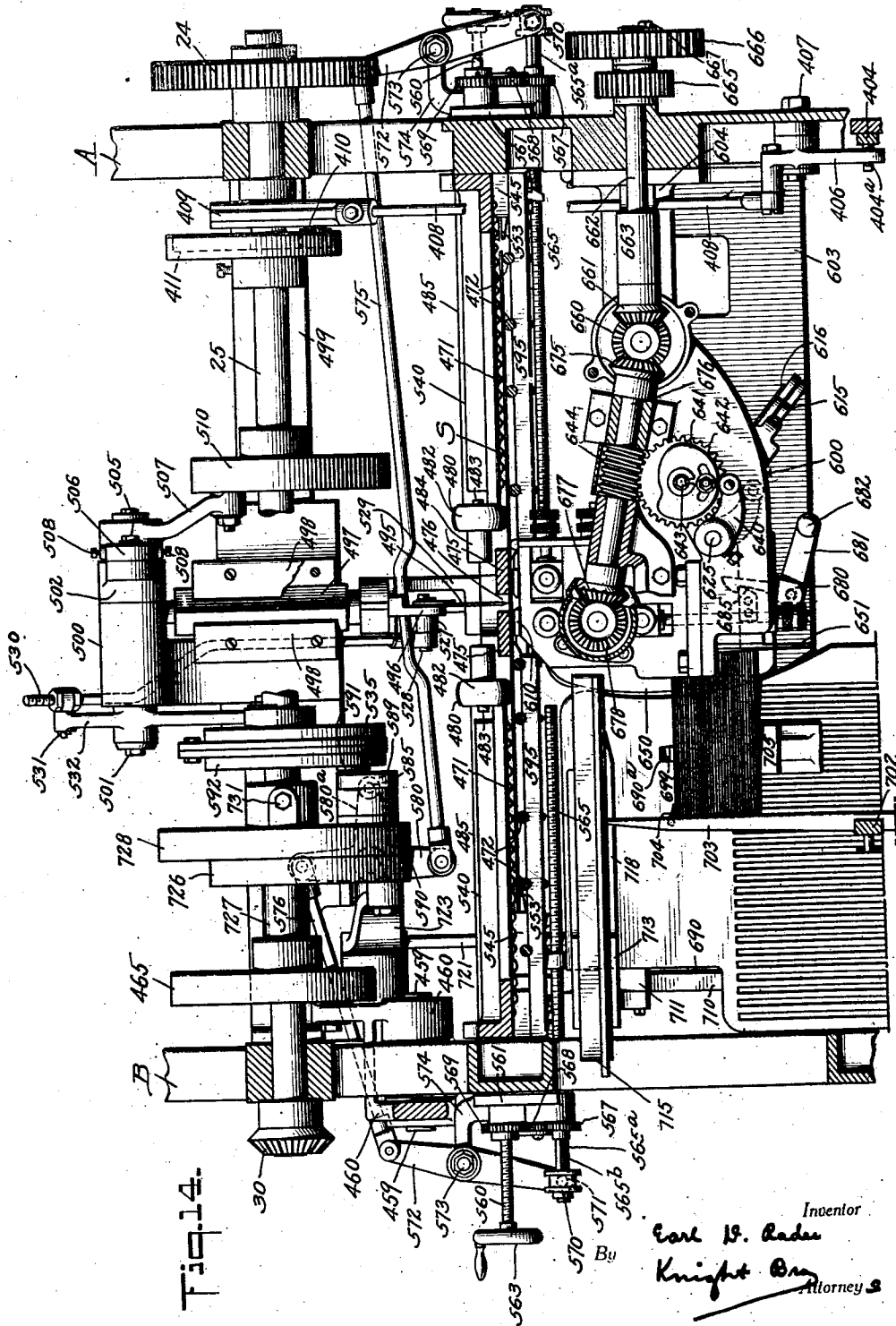
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Feb. 11, 1930.

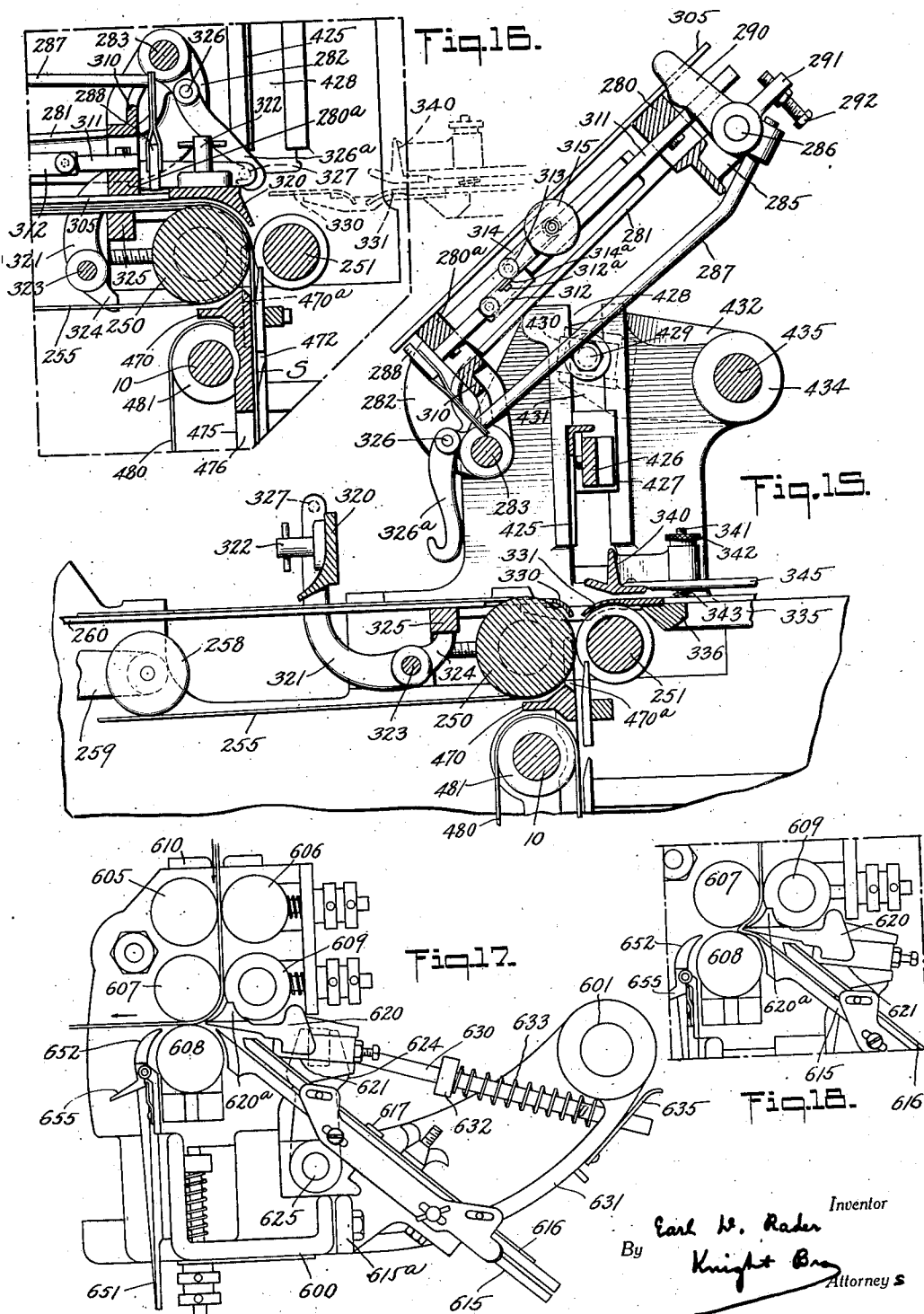
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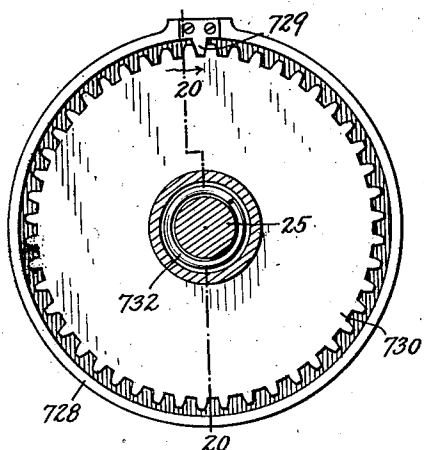


Fig. 19.

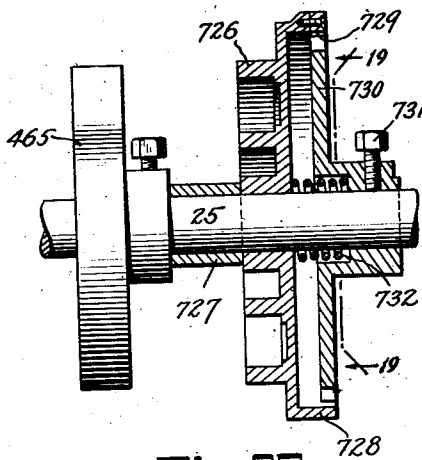


Fig. 20.

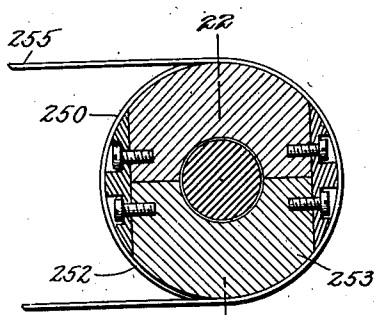


Fig. 21.

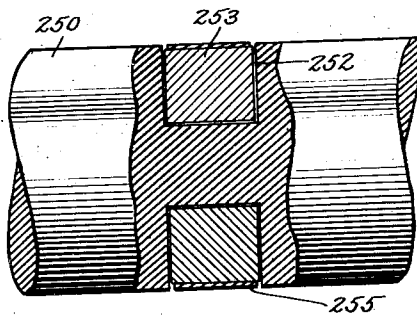


Fig. 22.

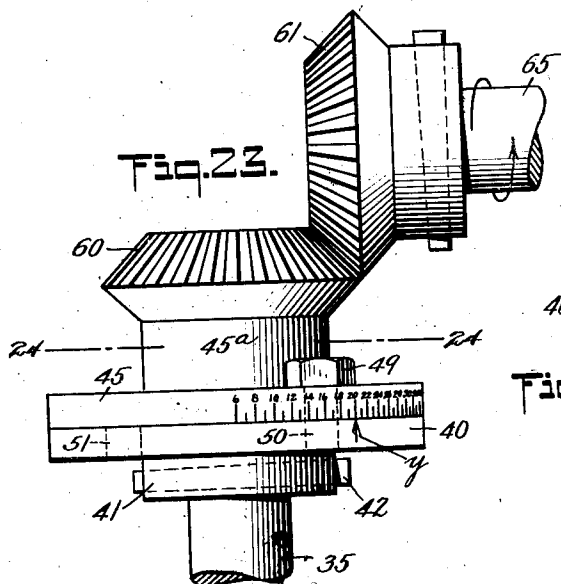


Fig. 23.

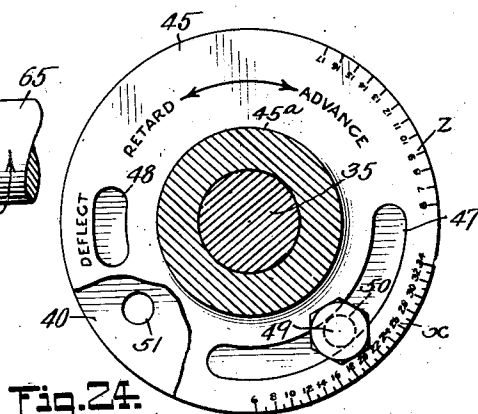


Fig. 24.

Inventor
Carl W. Rader
By Knight Bros. Attorneys

Feb. 11, 1930.

E. D. RADER

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PAPER FOLDING MACHINE

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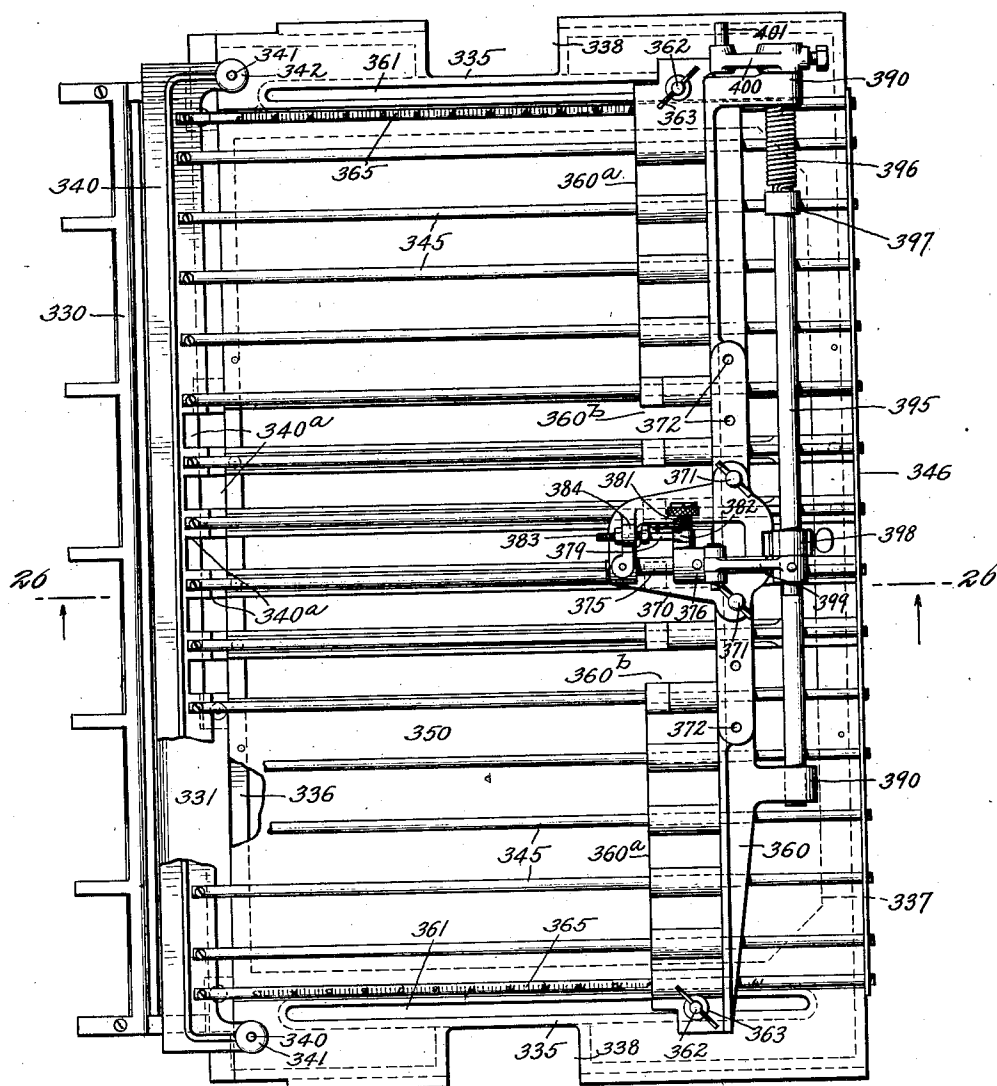


Fig. 25.

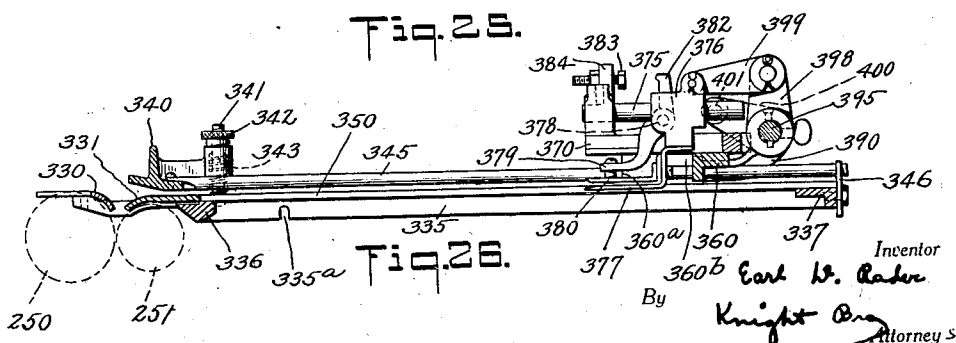


Fig. 26.

Inventor
E. D. Rader
By
Knight & Co.
Attorneys

Feb. 11, 1930.

E. D. RADER
PAPER FOLDING MACHINE
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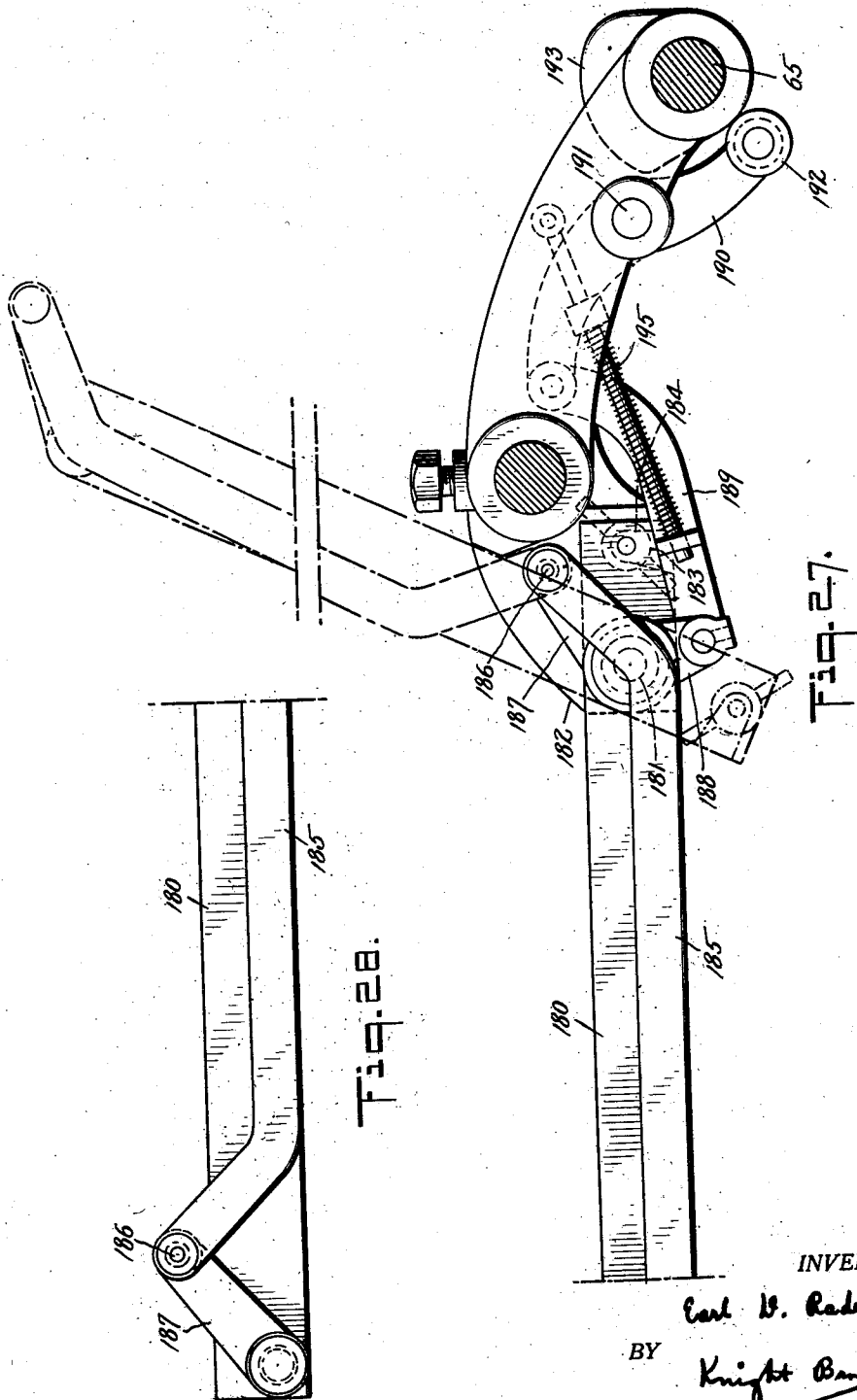


Fig. 27.

Fig. 28.

INVENTOR

Carl B. Rader

BY

Knight & Co.

ATTORNEYS

Feb. 11, 1930.

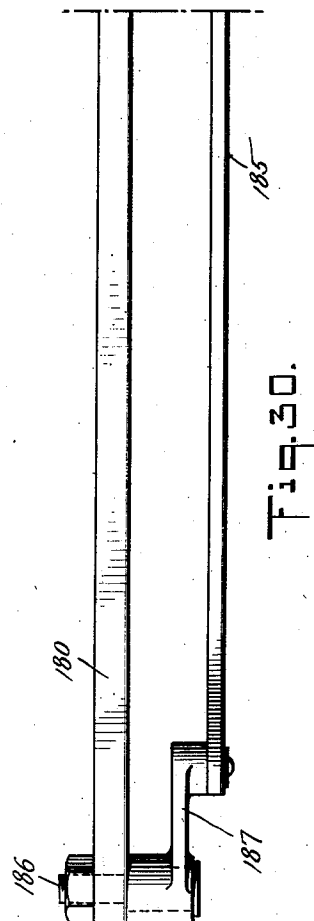
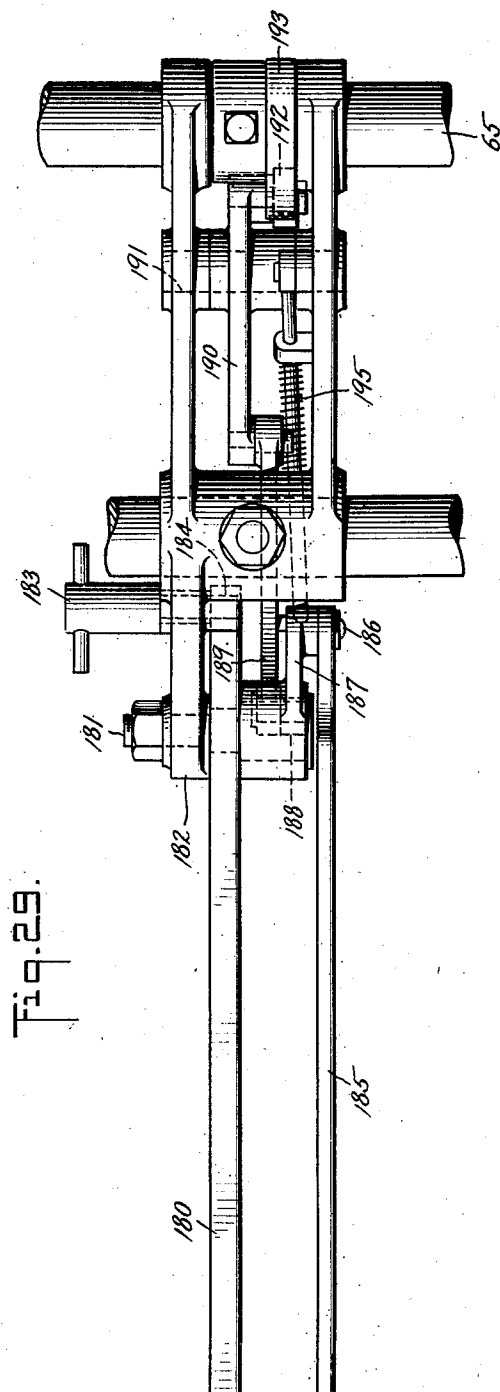
E. D. RADER

1,746,444

PAPER FOLDING MACHINE

Filed Aug. 10, 1923

22 Sheets-Sheet 19



INVENTOR
Earl B. Rader
BY
Knight Bros
ATTORNEYS

Feb. 11, 1930.

E. D. RADER

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Filed Aug. 10, 1923

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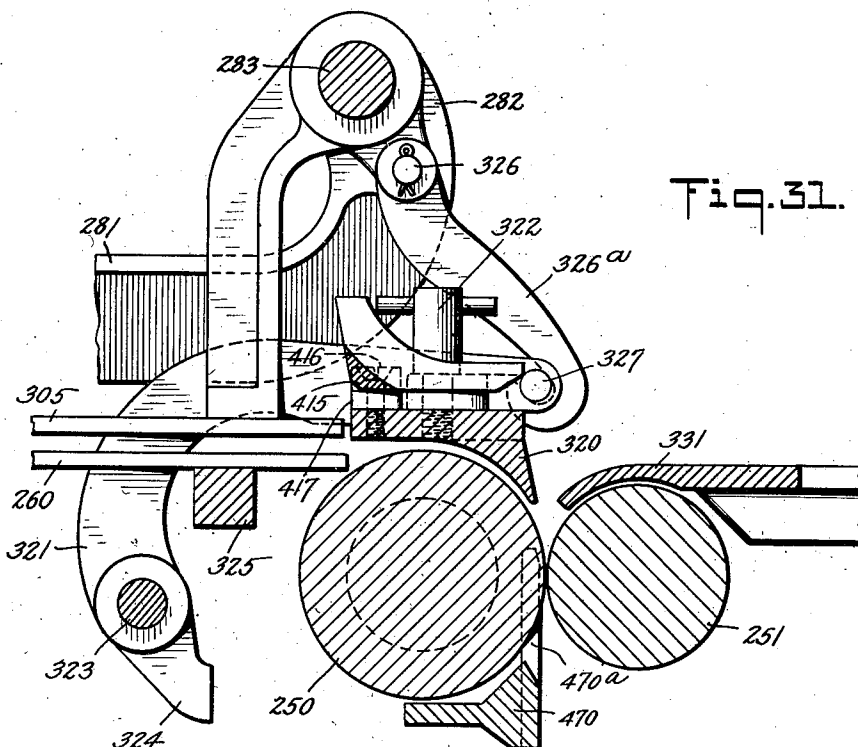


Fig. 31.

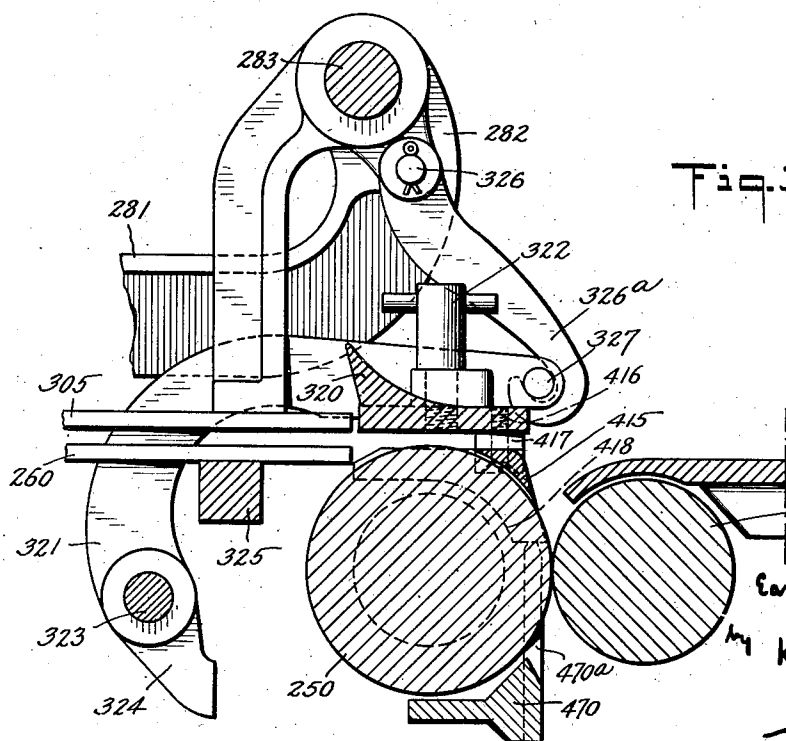


Fig. 32.

INVENTOR

Earl W. Rader

by Knight Bros
ATTORNEYS

Feb. 11, 1930.

E. D. RADER

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PAPER FOLDING MACHINE

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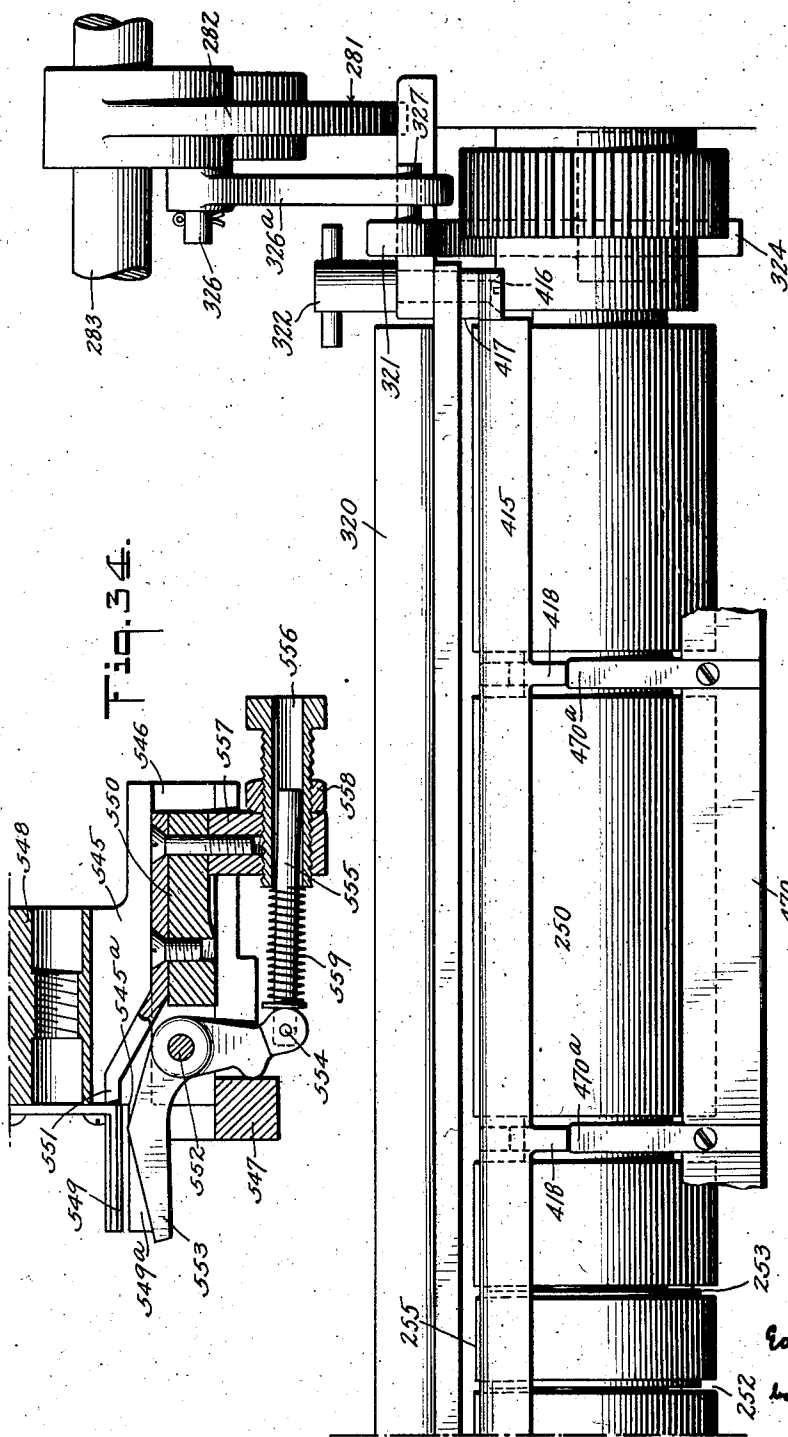


Fig. 33.

Fig. 34.

INVENTOR

Earl W. Rader

by *Knight & Co.*
ATTORNEYS

Feb. 11, 1930.

E. D. RADER

1,746,444

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22 Sheets-Sheet 22

Fig. 35.

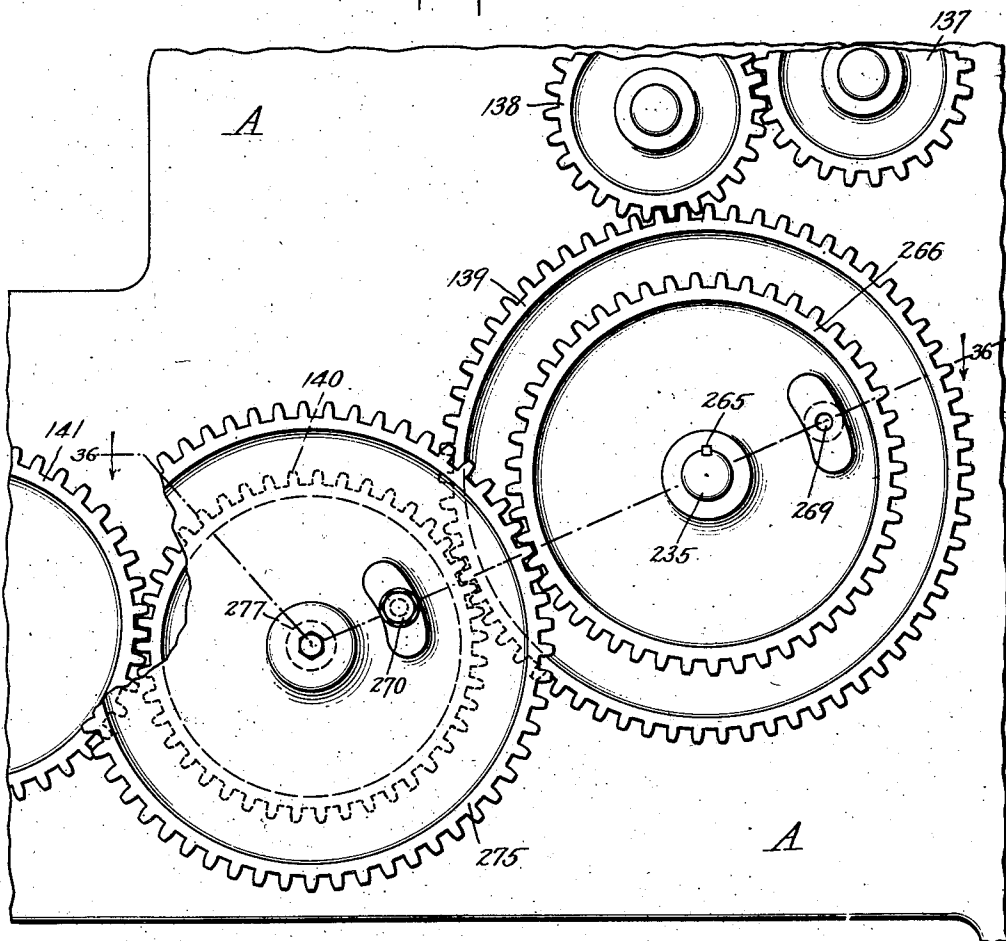
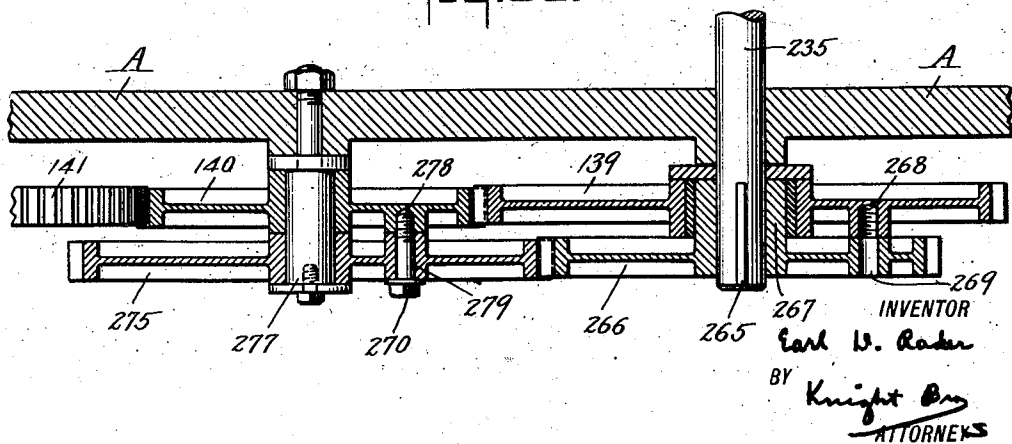


Fig. 36.



UNITED STATES PATENT OFFICE

EARL D. RADER, OF BEDFORD TOWNSHIP, WESTCHESTER COUNTY, NEW YORK, ASSIGNOR TO DEXTER FOLDER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

PAPER-FOLDING MACHINE

Application filed August 10, 1923. Serial No. 656,734.

The present invention comprises a sheet folding machine combined with an automatic pile feeding mechanism, built into a unitary structure with their operating parts correlated through suitable adjustable mechanism for automatically producing various styles and sizes of folded products from sheets.

In the preferred embodiment of the present invention, the folding machine comprises first, second and third fold mechanisms with the second and third of said mechanisms arranged in parallel vertical planes beneath and at right-angles to the first fold mechanism. The first and second fold mechanisms are preferably of the blade and roller type, while the third fold mechanism is preferably in the form of a combined blade and loop folding mechanism, so arranged that the third fold may be formed either as a loop fold or as a blade fold. The second and third fold rollers are further mounted upon a vertically pivoted swinging frame having their operating mechanism in the form of a train of gears, including one gear which rotates upon the pivot center of the supporting frame so that the second and third fold rollers can be moved into and out of operative position without disarrangement of their operative relation with the rest of the machine. The movement of the second and third fold rollers into inoperative position is for the purpose of giving access to the interior of the machine for the ready removal of misfed sheets.

The first and second fold mechanisms are provided with adjustable pull-up and side registry gauges of novel construction designed with a view to economy in manufacture and simplicity and convenience of adjustment and operation.

Sheets are passed from the automatic feeding machine to the first fold mechanism beneath two removable guide frames or grids, which separate in the vertical plane of the first fold rollers. The grid on the feeding-in side of the first fold mechanism comprises a hinged frame carrying the slow-down and feed-up mechanisms and a hook which engages a pivoted frame upon which is mounted a reversible top guide and deflector plate, so

that when the grid is raised away from the sheet path the slow-down and feed-up devices, as well as the combined top guide and deflector plate will be raised to permit free access to the sheet path for the removal of improperly fed sheets. When the combined top guide and deflector plate is thus raised it can be reversed in position upon its supporting frame to act either as a top guide when the first fold mechanism is in operation, or as a deflector plate when the sheets are deflected through the first fold rollers without folding. The first fold folder bars are arranged for convenient removal with other parts. These folder bars may both be mounted upon the rear removable grid, or one may be mounted upon said rear grid and the other attached to the top guide and deflector plate to be moved into and out of position by the manipulation of said parts just described. In either form the first fold folder bars are readily moved into and out of position. When the folder bars are moved away from their normal position above the first fold rollers, these rollers are entirely exposed and freed for convenient removal of choke-ups.

The rear removable grid also supports the adjustable first fold gauge and pull-up gripper mechanism, the operation of the pull-up gripper being through a rock shaft carrying a rock arm that normally engages a vertically reciprocating flanged plate. This rear grid can be bodily removed from its position upon the machine without disarranging any of the mechanisms by disengaging the gripper operating rock arm from beneath the flange of the operating plate.

The automatic pile feeder, which is built into the folding machine for supplying sheets, may be of any suitable type of automatic feeder, but in the preferred embodiment as shown is of the sheet combing type illustrated in the Christophel Patent No. 1,410,996 dated March 28th, 1922. The improvements in this part of the mechanism relates to the sheet gauging and controlling devices.

Sheets delivered by the automatic feeder pass over a corrugated metal bed plate and are carried into position above the first fold rollers by two or more endless feed tapes

or bands driven by the feeder mechanism and operating upon rollers freely journaled in annular recesses of one of the first fold rollers.

An important feature of the improved folding machine is the provision for adjusting the speed relation between the sheet feeding mechanism and the folding mechanism, as well as the speed relation between the first fold mechanism and the second and third fold mechanisms.

The speed of operation of sheet folding machinery is limited mainly by the character of the paper stock and the size of sheets operated upon. Even with large sheets of paper the speed of feeding is limited by the strength and thickness of the stock, which, if moved too rapidly will be injured. Ordinarily it is possible with a given grade of stock to increase the speed of operation of the folding machine in proportion to the decrease in the size of sheets.

In the manufacture of folding machines of the type having timed operating mechanisms, such as the folding knife, feed-off drop rollers and registering gauges, the sheet conveyor is designed to operate at a certain speed with relation to these timed mechanisms, said conveyor speed being dependent upon the speed with which the maximum size of sheets of the average character of stock can be properly fed. In other words, the design of the ordinary folding machine of today calls for a maximum speed of operation suitable for the maximum size of sheets that can be folded upon the particular machine. This maximum size of sheets can be economically folded upon the particular machine, but when using that design of machine for folding smaller sizes of sheets, the machine can run no faster than its maximum speed because of the limitation referred to in the speed of conveying paper sheets, with the result that the machine is incapable of folding more of the smaller sheets per hour than of the larger sizes. It is clear from this difficulty that it is not economical to fold small sheets upon a folding machine designed for operating upon large sheets.

It will further be understood that, when a folding machine of any of the well known designs is operating upon its maximum size of sheets with its conveyor operating at the highest speed that is safe for the particular paper stock, practically all of the available sheet supporting surface of the conveyor will be in use, a proper spacing between sheets being necessary to permit the functioning of the sheet gauging devices. When this same machine is used for folding smaller sheets, the end gauges will be set closer to the plane of action of the folding knife and such smaller sheets will project the same distance upon the feeding-in side of the knife plane; the smaller sheets, therefore, will have a shorter distance to travel to the end gauges and will cover a

smaller amount of surface of the sheet conveyor. The timed feed-off devices, (drop rollers) folding knife and side registering gauges acting at the maximum speed fixed for large sheets, and the feed of the conveyor remaining relatively the same, it will be clear that there will be a greater spacing between successive small sheets upon the conveyor. In other words, there will be a greater amount of unused conveying surface when the machine referred to is acting upon small sheets.

One of the purposes of the present invention is to obviate this economic waste in the operation of sheet folding machinery and to this end one of the features of the invention consists in providing means for changing the speed relation between the sheet conveying mechanism and the timed mechanisms of the folding machine, whereby it will be possible to utilize substantially the same extent of feeding surface of the conveyor in handling small sheets as is used in handling large sheets, so that by increasing the speed of operation of the timed mechanisms with relation to the speed of the conveyor, the machine will, thereby, be able to fold in a given time a greater number of small sheets than of large sheets. In obtaining this result the folding mechanism is caused to operate more frequently upon small sheets (by speeding the driving motor) while the conveyor is caused to operate at approximately the same speed for smaller sheets as for large sheets, but, because of the relatively faster operation of the feed-off devices (drop rollers), a greater number of small sheets is supplied to the surface of the conveyor. This speed relationship is obtained through a proper arrangement of adjustable gearing, whereby the maximum conveyor speed may be utilized with the rapid operation of gauging and folding mechanisms upon small sheets, or with the necessarily slower operations of such timed mechanisms upon large sheets. The machine as a whole is driven by motor provided with the usual controller which regulates the speed of the main driving shaft, from which all parts of the machine are operated. The aggregate length of sheets upon the same length of acting conveyor surface during any feeding period will be approximately the same whether the sheets are large or small, the difference in output of the folded product being due to the relatively increased rapidity of operation of the timed mechanisms upon smaller sheet units.

This adjustment of speed relationship between the several mechanisms is of importance in facilitating the accurate action of the several parts of the machine to suit the particular size of sheets that are operated upon. This adjustable speed relationship, which recognizes the critical maximum speed of successfully feeding large size sheets, permits the operator to so adjust the relationship

of the mechanisms that the machine will be capable of a larger output of small folded sheet products than of large folded sheet products, whereas all folding machines have heretofore been limited in output by the maximum speed for which the machines have been designed for handling large sheets. This feature of the invention takes advantage of the fact that in feeding small sheets the required distance of travel into registered position and the amount of conveyor surface covered by each sheet are proportionately less than when feeding large sheets.

In addition to the adjustment of speed relationship between the several mechanisms, means are provided for conveniently adjusting the time relation between the automatic feeder and folding mechanism, to accurately feed sheets in register time, and also to facilitate the adjustment of the machine from its condition in which the first fold mechanism is in operation into the condition in which said first fold mechanism is out of operation and sheets are deflected through the first fold rollers without folding.

The present invention also includes other novel features of construction designed to improve the general operation of the machine and the economic production of the various sizes and styles of folded products of the machine.

In order that the invention may be fully understood, it will first be described with reference to the accompanying drawings and afterwards more particularly pointed out in the annexed claims.

In said drawings:

Figure 1 is a top plan view of the feeder end of the machine.

Figure 2 is a similar view of the folder end of the machine.

Figures 1 and 2 taken together represent a top plan view of the entire machine.

Figure 3 is a side elevation of the machine showing the power driving mechanism, part of the machine frame being broken away to show the pivotal mounting of the second and third fold mechanisms.

Figure 4 is a side elevation of the machine looking at the opposite side from that shown in Figure 3, parts of the machine frame being broken away and the main driving shaft being shown in section.

Figure 5 is a rear end elevation of the machine indicated by arrow 5 in Figure 4.

Figure 6 is a partial vertical longitudinal sectional view of the feeder end of the machine, taken on the section line 6—6 of Figure 1.

Figure 7 is a similar view of the folder end of the machine, taken on the section line 7—7 of Figure 2.

Figure 8 is an enlarged detail side elevation of parts of the second and third fold mechanisms and the packer pusher, the frame be-

ing broken away and the main cam shaft shown in section to more clearly illustrate the cams and other parts.

Figure 9 is a similar view showing particularly parts of the second fold side register, the packer pusher and their operating cams. This view is a companion to Figure 8, including sectional view of parts a little further away from the vertical plane of the second fold knife and parts being omitted for the sake of clearness.

Figure 10 is an enlarged detail horizontal sectional view taken on the line 10—10 of Figure 5 through the second and third fold mechanisms in the plane of the second fold side registering grippers, parts of the mechanisms being broken away.

Figure 11 is a view similar to Figure 10 taken in the same general plane illustrating the opposite side of the machine with the second and third fold mechanisms upon their pivoted frame moved outwardly into inoperative position and the third fold knife locked back out of action.

Figure 12 is an enlarged detail vertical transverse sectional view taken on the line 12—12 of Figures 7 and 8 in a plane just in rear of the vertical guide rods which support the sheets in front of the second fold rollers, parts being omitted for clearness.

Figure 13 is a vertical transverse sectional view taken on the line 13—13 of Figure 4 and looking toward the rear of the machine as indicated by the arrows.

Figure 14 is an enlarged detail horizontal sectional view taken on the line 14—14 of Figure 5, the operating mechanism for the second and third fold mechanisms being shown in top elevation.

Figure 15 is an enlarged detail vertical longitudinal sectional view taken in the same plane as Figure 7 and illustrating the hinged grid raised and thrown back upon the first fold knife guide brackets and the combined top guide and deflector plate raised in position for convenient removal and reversal.

Figure 16 is a similar detail sectional view showing the parts put back in operative position with the combined top guide and deflector plate reversed to act as a deflector for eliminating first folds.

Figure 17 is a diagrammatic view of parts of the second and third fold mechanisms illustrating the use of the third fold knife as a deflector when it is desired to eliminate the third fold operation.

Figure 18 is a similar detail diagrammatic view illustrating the action of the third fold knife in folding a sheet into the bite of the final third fold delivery rollers, this blade fold at the third fold station being employed upon certain stock to effect a more positive folding of the sheet.

Figure 19 is a transverse sectional view taken on the line 19—19 of Figure 20 illus-

trating the adjustable cam for operating the packer mechanism.

Figure 20 is a vertical sectional view of the same taken at right-angles to the view shown in Figure 19 on the line 20—20 of Figure 19.

Figure 21 is a transverse sectional view of one of the sectional feed pulleys, which are mounted in the annular recesses of one of the first fold rollers.

Figure 22 is a detail view of a first fold roller showing an interior section taken on the line 22—22 to illustrate a tape pulley upon the roller.

Figure 23 is an enlarged detail side elevation of the adjustable timing coupling between the drive shaft and the feeder cam shaft.

Figure 24 is a transverse sectional view taken on the line 24—24 of Figure 23.

Figure 25 is a plan view of the rear removable grid carrying the first fold gauge and pull-up gripper mechanism.

Figure 26 is a vertical longitudinal sectional view of the same taken on the line 26—26 of Figure 25.

Figure 27 is an enlarged detail elevation of a modified form of the supporting and operating mechanism for feeder tail grip.

Figure 28 is a similar view of the end portion of the same.

Figure 29 is a top plan view of the mechanism shown in Figure 27.

Figure 30 is a top plan view of the parts shown in Figure 28.

Figures 31 and 32 are enlarged detail longitudinal sectional views illustrating a modified form of a reversible top guide and deflector bar combined with a folding bar, these two views showing the parts in reversed positions.

Figure 33 is an enlarged detail view of the same mechanism.

Figure 34 is a longitudinal sectional view of a side registering gripper.

Figure 35 is an enlarged detail face view of the adjustable driving gears shown in driving train of Figure 3.

Figure 36 is a sectional view of the same taken on the lines 36—36 of Figure 35.

The improved machine, including folding mechanisms, gauging devices, automatic feeder and driving motor, is built as a unitary structure upon a suitable framework of which A and B are the main side frames braced by suitable cross-bars and tie-rods and the shafts of the operating mechanisms.

Electric driving motor 1 is mounted upon a platform 2 carried by arms 2^a pivoted at 3 in the brackets 4 carried by the main side frame A. The rear ends of platform arms 2^a straddle part of the frame A and carry a clamping bolt 5 which passes through curved slot 6 in frame A to permit the vertical adjustment of platform 2 in the machine frame. The frame can be clamped in the desired po-

sition to suit the location of the motor to the main driving pulley and thereby tighten or loosen the driving belt leading from the motor to the driving pulley.

10 is the main driving shaft extending from side to side of the machine and suitably journaled in the side frames and in an external bearing bracket 11 mounted upon the side frame A. This main drive shaft 10 carries, between frame A and the bracket 11, a driving pulley 12 over which the driving belt 13 passes from the pulley of the motor 1. This arrangement is clearly illustrated in Figures 2 and 3 of the drawings.

It will be understood that electric current is supplied to the motor 1 through any of the usual forms of controllers or starting boxes (not shown) by which the motor is controlled; and by such control of the motor the speed of the main driving shaft 10 is determined. The speeds of operation of all of the relatively timed mechanisms are relative to or dependent upon the speed of said driving shaft 10.

Driving shaft 10 carries upon the end opposite to the driving pulley 12 a hand wheel 15 for conveniently turning over the machine by hand. Between the pulley 12 and the main side frame A shaft 10 has secured to it a main driving pinion 20, which operates the spur gear 21 carrying a pinion 22, which is mounted upon stub shaft 23, meshing with and driving spur gear 24 mounted upon the end of the main cam shaft 25. This cam shaft 25 carries the main operating cams for the folding mechanisms and sheet positioning devices therefor, as will be hereinafter pointed out.

Upon the opposite end of the cam shaft 25 from gear 24 just outside the side frame B is mounted a driving beveled pinion 30 meshing with a similar beveled pinion 31 carried upon the lower end of an inclined auxiliary shaft 35 mounted in bearing brackets 33 and 34 suitably secured to the side frame B. This inclined shaft 35 carries at its upper end an adjustable timing coupling illustrated particularly in Figures 23 and 24 of the drawings. This coupling comprises a circular plate or flange 40 having an integral hub or collar 41 keyed to shaft 35 by removable pin or key 42, and a second plate or flange 45 adjustably mounted upon the end of shaft 35 and formed with two spaced curved slots 47 and 48, through one of which passes a removable bolt 49 which may be threaded into either one of the threaded openings 50 or 51 drilled through the lower fixed plate or flange 40.

As shown in Figures 23 and 24 this clamping bolt 49 is in position in the slot 47 of upper flange 45 and threaded opening 50 of lower flange 40. The upper flange 45 has upon it two indicator scales α and β with which an indicator arrow γ on the lower

flange 40 is adapted to register for indicating certain positions and adjustments. The short slot 48 in the upper flange 45 is marked with the word "Deflect" to indicate that the clamping bolt 49 passes through the slot 48 and engages the threaded opening 51 of the lower flange, when the action of the automatic feeder is retarded because the sheets are deflected through the first fold mechanism without receiving a fold. Under this "deflect" operation there is no necessity for varying the coupling adjustment for different sheet sizes since the second fold gauge remains in the same position for all sizes of sheets. When the machine is operating normally, (including the action of the first fold mechanism) upon large sheets with the conveyor operating at its maximum relative speed, the coupling is adjusted to the desired position for the particular sheet size as indicated by the arrow y upon the first scale x , the clamping bolt 49 in this normal operation being passed through the slot 47 and engaged in the threaded opening 50. When the machine is operating normally upon small sheets (one-half of the maximum or less) with the sheet conveyor operating at a relative slow speed, the coupling is adjusted to bring slot 47 in registry with opening 51 to receive bolt 49, the exact position for the size of sheets operated upon being then indicated by the arrow y upon the second scale z . The numerals employed in scales x and z correspond with sheet lengths whereby an operator can accurately and quickly time the action of the feeder to suit the sheet size of any job placed in the machine. Upper coupling member 45 carries a double arrow between the words "Retard" and "Advance" to indicate the directions for adjustment to either retard or advance the action of the feeder with reference to the folder gauges.

While the adjustable retiming coupling 40, 45 is of use in the several operations just referred to, its greatest importance is to enable the operator to quickly and properly time the action of the feeding mechanism to correspond with the folding machine sheet-registering devices for any size of sheets. This retiming coupling adjusts the action of the feeder upon a particular size of sheets so accurately with reference to the pull-up grippers of the folder front gauge that the rebound of sheets is prevented by said grippers without the assistance of the usual slow-down devices.

The upper coupling plate or member 45 is formed integral with the hub 45^a carrying a beveled pinion 60, which meshes with and drives a similar pinion 61 pinned to the projecting end of the feeder cam shaft 65, which extends from side to side of the machine and is suitably journaled in the main side frames A and B. This cam shaft 65 carries the op-

erating cams of the automatic feeder as will be more fully hereinafter explained.

It will be observed that the folder cam shaft 25 and feeder cam shaft 65 are operated in unison through the auxiliary coupling shaft 35, while the adjustable coupling between these cam shafts enables the operator to properly time the mechanisms of the two parts of the machine to suit the desired result.

The side frames A and B are formed with upper and lower forwardly extending bracket arms 70, 75 carrying the vertical hollow guide posts or standards 80 on which is mounted vertically movable frame 81, carrying the platform 82 on which is mounted a pile of sheets 83. This frame 81 is suspended at its opposite sides from the sprocket chains 85, which pass over sprocket wheels 86 mounted upon shafts 87 journaled in brackets 88 secured to the side frames A and B. The free ends of the sprocket chains 85 pass downwardly from the sprocket wheels 86 into the hollow posts or standards 80, suitable angular deflector plates 89 being mounted upon the frame brackets 70 in position to engage the sprocket chains tangentially of the sprocket wheels to accurately strip the chains from the sprocket wheels and guide them downwardly into the posts 80.

Each of the shafts 87 carries a worm gear 92 meshing with a worm pinion 91, the pinions 91 being keyed to the opposite ends of shaft 95, which passes from side to side of the machine and is suitably journaled in the side frames A and B. The shaft 95 at the motor side of the machine is also journaled in a bracket 94 secured to the side frame A. A ratchet wheel 96 is keyed to shaft 95 between bracket 94 and side frame A and freely journaled upon shaft 95 between ratchet 96 and frame A is a curved lever 97 carrying a dog or pawl 98 which operates upon the ratchet wheel 96. This lever 97 extends rearwardly into engagement with cam 99 mounted upon the feeder cam shaft 65 outside of the side frame A. The lever 97 is extended upwardly at its forward end into a controlling arm 100 formed at its upper end with an inwardly presented angular latching hook 101, which is normally engaged by a latch member 102 projecting from a rock shaft 103 journaled in the side frame A and carrying on its inner end a downwardly presented arm 104 to which is attached one end of a spring 105 extending from a pin of the machine frame to hold the arms 102 normally in position for engagement with the angular plate or hook 101 of arm 100, and the arm 104 in the path of its actuating member 160 presently referred to. A spring device 110 is mounted between a frame bracket 111 and the lever 97 for causing the lever 97 to follow the cam 99 when released by the latching finger 102 in the manner presently to be explained.

The automatic sheet feeding mechanism of the improved machine may be of any desired construction. The form of sheet feeding machine set forth in U. S. Patent No. 1,410,996 dated March 28th, 1922, has been illustrated in the accompanying drawings. This feeding mechanism will be described only in a general way to make clear the cooperation of the feeding mechanism with the rest of the machine. The sheet separating devices in this form of feeder are of the sheet combining type, in which tandem combining wheels 125 are suitably journaled upon a rocking frame 126 adjustably mounted upon a tubular rock shaft 127 suitably journaled in the side frames A and B. A rotary shaft 128 journaled at its ends in frame members 129 and 130 (extending from the tubular shaft 127) passes through the hub of one of the combing wheels 125 and is suitably geared to rapidly rotate the combing wheels in unison. The frame member 130 is in the form of a housing containing a train of gears for driving the shaft 128 from the shaft 135, which is housed in the hollow rock shaft 127 and is driven by a train of gears 136, 137, 138, 139, 140 and 141 indicated in Figure 3. The train is driven from the spur gear 21 above referred to.

The rocking frame carrying the combing wheels is periodically raised and lowered by means of the rock arm 145 operating upon the cam 146 mounted upon shaft 65 above referred to. In addition to this periodic raising and lowering, the combing wheels are automatically raised out of action by a sheet controlled trip as set forth in the above named patent, not specifically described herein. 150 is the sheet actuated trip for said automatic comb control. 151 is a part of the lever mounted upon the oscillating controlling cam 152 and connected with the reciprocating rack bar (not shown), while 153 is a rock shaft driven by rock arm 154 and pitman 155 engaging the crank pin upon cam 99 above referred to. These parts are only referred to incidentally to clearly connect up the illustrated mechanism with the disclosures in the above named patent, which is relied upon for a more complete understanding of the specified mechanism.

The member 130 of said rocking frame, which carries the sheet separating comb wheels 125, is provided with a laterally projecting pin 160 which engages the arm 104 when the rocking frame is in lowered position. This action moves the latch 102 out of the path of the angular plate or hook 101, so that the lever 97 and its arm 100 will be permitted to rock rearwardly under the action of a spring 110 controlled by the cam 99. The action of cam 99 is so timed as to cause this movement of lever 97 immediately after each periodic dropping of the combing wheels into action, so that in case the comb wheels re-

main in action more than their normal momentary period, the lever carrying the dog 98 will be moved to the rear preparatory to a movement of the pile elevating mechanism. In the normal combing operation, however, the period of action of the combing wheels is so short that the automatic rise of the rocking frame permits the reengagement of latch finger 102 with angular plate 101 before the ratchet operating lever 97 can move rearwardly. This automatic table elevator control, therefore, depends upon the period of time that the combing feeding devices remain in action, the principle being the same as in the control of the feed of the bank of sheets set forth in the above named Patent No. 1,410,996.

The automatic feeder is further provided with an automatically operating tail clamp; which is shown in Figures 1, 3, 4 and 6, of the same general construction as that set forth in the above named patent. In these figures 170 is the tail clamp carried by a vertical ratchet bar 171, mounted on supporting bar 172 and operated through the cam bar 175 pivotally mounted on parallel links 176, 177 operated through a rocking lever 178 and cam 179. In this form of tail clamp the supporting bar 172 is rigidly mounted upon a tie bar of the machine frame to project horizontally above the pile of sheets. It is preferred to construct this tail clamp mechanism so that it can be moved away from the pile to afford free access to the pile support and pile. To this end the tail clamp is mounted upon a hinged supporting bar and operated by a slightly different design of cam bar, as shown in Figures 27, 28, 29 and 30 of the drawings. In these figures of the drawings the supporting bar 180 is pivotally mounted at 181 upon a bracket arm 182 and clamped in horizontal position by means of a shouldered setscrew 183 threaded into the inner end of bar 180 and resting in the downwardly presented notch 184 of the bracket 182. The cam bar 185 is formed with upwardly presented front and rear ends which are pivotally mounted at 186 upon the parallel links 187 journaled upon the track bar 180. The inner link 187 is journaled upon the pivot 181 of the track bar and has formed integral with it or otherwise attached to it an operating rock arm 188 connected through curved link 189 with a lever 190 pivoted at 191 and carrying an anti-friction roller 192, which operates in peripheral engagement with cam 193. A spring device 195 is arranged between the link 189 and one of the bracket arms to hold the cam bar and its operating lever in normal operative relation to cam 193.

The tail clamp 170 and its adjustable supporting block has been omitted from Figures 27 and 30, but it will be understood that these parts, shown in other figures of the drawings referred to, are intended to be mounted upon

the supporting bar 180 and operating cam bar substantially as shown in the other figures. The advantage of the improved construction for mounting the tail clamp is the provision for moving the track bar and cam bar with the tail clamp into elevated position as indicated by dotted lines in Figure 27, the parts moving around the pivot 181 until they rest in the raised rearwardly inclined position out of the way of the operator who desires to work upon the pile or its supporting mechanism.

It is preferred to provide adjustable side guides for the upper portion of the pile of sheets. These side guides are clearly shown in Figures 1, 3, 4 and 6. At each side of the machine a horizontal bar 200 projects from a supporting hub or collar 201, which is rotatably mounted upon a machine stay bar and secured in the desired adjusted position by means of a set screw 202. Adjustably mounted upon these bars 200 are the brackets 205 held in the desired adjusted position by set screws 206, each bracket being formed with an inwardly presented socketed bracket arm 207 in the vertical sockets of which are mounted the reversible and interchangeable pile side guides. The sockets of each of the bracket arms 207 are in the form of vertical cylindrical channels having diametrically opposite vertical slots, while the vertical rods 210 of the side guides 212 or 215 are formed with radially projecting pins 211, which engage the lateral slots of said sockets to hold the side guiding plates in accurate longitudinal alignment. It will be observed that with this construction, the pile guides can be removed and interchanged from side to side and that their supporting bars and bracket arms can be adjusted to the desired position for accurately gauging the pile of any size of sheets.

The forward pile side guides, shown particularly in Figures 1 and 6 of the drawings, comprise the main gauge plates 215 mounted at the lower end of supporting rods 210 and having pivoted at 216 the forward tapered extension guides 217, which normally project over the inclined delivery plate 220 at the delivery end of the feeder above the front piling guides 219. Engaging shoulders are formed between the gauge plates 215 and their extensions 217 to limit the movement of the extensions upon their supporting gauge plate. By loosening the set screws 202 the bars 200 carrying with them the pile side guides can be swung upwardly to the rear and entirely remove all obstructions from above the pile and support.

At the delivery end of the automatic feeder adjacent to the inclined delivery plate 220 is located a transverse under feed shaft 235, which is suitably journaled in the side frames A and B and carries centrally of the machine an under feed roller 236 with which cooperate the usual drop rollers 237 mounted upon

shaft 238 freely journaled in the rocking frame 239, pivotally mounted upon the transverse tie rod 240 controlled by the rock arm 241 operating upon the cam 242 on cam shaft 65.

250 and 251 are the first fold rollers journaled at their ends in the usual manner in the side frames A and B and operated by suitable gearing hereinafter referred to. The first fold roller 250 presented nearest the automatic feeder is formed with two deeply cut annular channels 252, clearly illustrated in figures 21 and 22 of the drawings, to receive the sectional tape pulleys 253, which are freely journaled upon the reduced axis of roller 250 and formed of slightly reduced diameter, so as to carry the feed tapes around the first fold roller within the circumference of said roller. Two endless parallel feed tapes 255 pass around the sectional pulleys 253 referred to from the guiding and driving pulleys 256, which may be mounted upon the shaft 235 or as shown in Figure 6 upon a parallel shaft 257, which is geared to shaft 235 through an intermediate idler gear to operate in unison therewith. 258 are belt tightening rollers mounted upon arms 259 journaled upon the shaft 257 and resting upon the lower runs of the feed tapes 255.

A suitable under guide for sheets is provided between the delivery of the automatic feeder and the first fold rollers. This under guide is preferably formed of a corrugated metal sheet 260, best shown in Figure 2 of the drawings, although it will be understood that the usual under guide rods employed in folding machinery may be used. This corrugated metal plate 260 is cut out in the longitudinal planes of the feed tapes 255 to permit the operation of the tapes upon the sheets.

Referring particularly to Figures 3, 35 and 36 of the drawings, it will be observed that the end of under feed shaft 235 projects beyond the side frame A and has splined to it at 265 a spur gear 266 formed with an inwardly extended hub 267 upon which is freely journaled spur gear 139 above referred to. This gear 139 is formed with a threaded socket 268 adapted to be brought into registry with a smooth socket 269 formed through a reinforced web portion of the gear 266. A removable threaded bolt 270 is passed through the socket 269 and screwed tightly into the threaded socket 268 for rigidly coupling together the spur gears 139 and 266 to thereby cause the shaft 235 to be driven at the speed of gear 139, which operates in the train above referred to.

The spur gear 266 is in constant mesh with a larger spur gear 275 which is freely journaled upon a stub shaft 277 alongside of the spur gear 140 referred to. The gear 140 is formed with a threaded socket 278 adapted to register with a smooth socket 279 formed through a reinforced web portion of the gear

275 to receive removable bolt 270, which is designed to rigidly couple the spur gears 140 and 275. It will be understood that the pin 270 is used for coupling either the gears 140 and 275, or the gears 139 and 266, only one of said named pairs being coupled at one time. When gears 140 and 275 are coupled it will be understood that the under feed shaft 235 will be driven through gears 141, 140, 275 and 266, while the gear 139 continues to function as an idler in the train for driving the sheet combing wheels. When the bolt 270 is removed from gears 140 and 275 and mounted in sockets 269 and 268 for coupling gears 139 and 266, the under feed shaft 235 will be driven through gears 141, 140, 139 and 266, in which case the gear 275 will rotate idly. The purpose of this change gear mechanism is to adjust the speed of the feed mechanism to suit particular conditions as hereinafter more particularly explained. With the gearing shown the speed of the feed shaft 235 will be twice as fast when the gears 140 and 275 are coupled as it will be when gears 139 and 266 are coupled.

Mounted above the path of sheets at the feeding in side of the first fold mechanism is a rectangular frame comprising main cross-bars 280, 280^a mounted upon side bars 281 formed with upwardly curved ends 282, which are freely journaled upon a transverse rod or bar 283 mounted upon upward extensions of the main frames A and B. The cross-bar 280 of said rectangular frame is formed with rearwardly presented brackets 285 in which is journaled a rock shaft 286 carrying a forwardly extending arm 287 on the end of which is mounted a sheet engaging slow-down member 288. The rock shaft 286 has secured to it a downwardly presented weighted counter-balance arm 290 adapted to engage cross-bar 280 to limit the movement of shaft 286 in raising the slow-down 288 away from the path of sheets. The counter-balance arm normally holds the slow-down 288 raised slightly from the path of sheets.

A spring device tends to rock the shaft 286 under the control of a cam. 295 is a spring actuated rod carrying at its upper end a yoke 296 pivotally connected to a rock arm 297, extending from a rock arm 298 mounted upon rod 240 and carrying an antifriction roller 299 running in peripheral engagement with the controlling cam 300 keyed to the feeder cam shaft 65. An arm 291 projects from rock shaft 286 and carries an adjustable screw tappet 292 passing through arm 291 and engaging the yoke 296 above referred to. The action of this cam control slow-down 288 is to momentarily engage the passing sheet as it moves toward the front gauge of the first fold folding mechanism.

This pivotally mounted frame 280, 280^a, 281 also carries a top sheet guide in the form of a corrugated metal plate 305, which is

supported in spaced relation to the bottom plate 260 above referred to.

A bracket 310 mounted upon the bar 283 carries the rearwardly presented rods 311 supported at their rear ends on cross-bar 280. Adjustably mounted upon rods 311 are the sliding blocks 312 having laterally presented pins 313 upon which are mounted the arms 314 carrying the feed-up rollers 315, which operate upon the upper runs of endless feed tapes 255 above referred to. Adjustable tension springs 316 are carried by pins 313 to apply tension to the roller carrying arms 314. The arms 314 are preferably formed with heels 314^a adapted to engage pins 312^a on blocks 312, when the frame 280, 280^a, 281 is lifted so as to prevent the unwinding of tension springs 316.

Referring particularly to Figures 2, 7, 15 and 16, 320 is the combined top guide and tip-in guide operating above the first fold roller 250. This bar 320 is removably secured to two curved arms 321 by means of T-screws 322. Arms 321 are freely pivoted upon cross-rod 323 and are provided with extension heels 324 adapted to engage a cross-bar 325 of the frame for supporting the arms 321 in raised position. The combined top guide and tip-in plate 320 is adapted to act as a top guide, as shown in Figure 7, when sheets are passed into position to be folded through the first fold rollers 250, 251. The plate 320 can be reversed upon its supporting arms 321 to present its curved tip-in face above the first fold roller 250, as shown in Figure 16, when sheets are deflected through the first fold rollers without folding. The arms 321 can be moved from position shown in Figure 16 to the position shown in Figure 15 for the purpose of giving access to the first fold rollers and also for the purpose of presenting the plate 320 in convenient position for removal of screws 322 and the reversal of the plate upon its supporting arms.

The frame 280, 280^a, 281, above referred to, is adapted to be raised from its horizontal position, as shown in Figures 2, 7 and 16, into the position shown in Figure 15, in which the side bars 281 of said frame rest upon the upper guide extensions of the main side frames A and B. When this frame is so elevated the slow-down 288, feed-up wheels 315 and top guide plate 305 are raised away from the path of sheets to facilitate the removal of a choke-up. The side bars 281 have pivotally connected to them at 326 hooks 326^a, which normally rest in engagement with pins 327 projecting laterally from the ends of pivot arms 321, as clearly shown in Figures 7 and 15. When the frame 280, 280^a, 281 is elevated into the position shown in Figure 15, these hooks 326^a will move the reversible plate 320 and arms 321 from the position shown in Figure 16, into the position shown in Figure 15.

It will be observed that in Figure 15 the folding bars hereinafter referred to are shown in position above the first fold rollers 250 and 251, while in Figure 16 these bars are indicated in dotted lines as shifted out of place to indicate their removability. One of the features of the present invention is the provision for removably mounting these first fold folder bars. This is accomplished in the form of mechanism illustrated in Figures 2, 7, 15, 16, 25 and 26 by mounting the said folder bars 330, 331 upon a removable rectangular grid or skeleton frame, comprising flanged side bars 335 and cross-bars 336, 337. This removable grid is formed with hand-hold recesses 338, in its side bars for convenience in taking hold of it for mounting and removing. The removable grid rests upon suitable flanges of the main machine frame, it being preferable to provide the side bars 335 with notches 335^a to fit over inwardly presented pins *a* upon the machine frame (see Figure 7) to accurately locate the removable grid when it is put into position. The curved folder plates or bars 330, 331 are secured upon said grid, so as to be presented directly above the first fold rollers 250, 251, when the grid is put in place. At the inner end of this removable grid a flanged cross-bar 340 is adjustably and yieldingly mounted upon the removable grid by means of screws 341, nuts 342 and confined springs 343. Top guide rods 345 are mounted at one end upon the cross-bar 340 and at their rear end upon a plate 346, secured to the rear cross-bar 337. Guide rods 345 are spaced above the sheet metal underguide plate 350 carried by the removable grid or frame referred to. It will be understood that the path of sheets above the first fold rollers lies between top rods 345 and the plate 350 just referred to.

360 is an adjustable frame carrying the first fold front gauge and pull-up gripper that cooperates therewith. This frame 360 is channeled to fit upon top guide rods 345, so as to be adjustable forward and backward thereon. The ends of the frame 360 rest above the side bars 335 of the removable grid, said side bars being formed with slots 361 through which pass headed bolts 362 that extend up through openings in the member 360 and receive the butterfly nuts 363. The top guide rods 345 at the outer edges of the removable grid are preferably marked with scales 365, with which the front edge 360^a of the member 360 can register for assisting in the proper adjustment of said member. This front edge 360^a constitutes the first fold front gauge.

370 is an auxiliary frame secured in the desired adjustable position transversely of the machine by means of T-screws 371 passing through openings in the frame 370 and engaging the desired perforations 372 of the flattened surface of frame 360. By this

means the pull-up gripper carried by the frame 370 can be presented either in the longitudinal center of the machine, or adjacent to one or the other side. This auxiliary frame 370 carries a track bar 375 upon which slides a block 376 supporting the lower fixed gripper member 377, just beneath the path of sheets. Pivoted at 378 is the upper movable gripper member 379 carrying a downwardly presented block 380 that is adapted to engage a sheet against the lower gripper member 377. This movable gripper member 379 is actuated by an adjustable spring 381 acting upon its pivot in the usual manner, so as to give the movable gripper member a normal closing tendency. Arm 382 projects upwardly from the gripper member 379 in position to engage an adjustable tappet 383 carried by a bracket arm 384 of auxiliary frame 370. When the block 376 is moved against tappet 383 the gripper is opened and when it is moved away from the tappet the gripper is closed by the action of its spring.

Frame 360 is formed with rearwardly presented lugs 390 in which is freely journaled a rock shaft 395 having a coil spring 396 mounted upon it and engaging at its opposite ends with one of the brackets 390 and an adjustable collar 397 secured to shaft 395. 398 is a rock arm adjustably secured to rock shaft 395 and connected through the link 399 with the reciprocating block 376 above referred to. The end of rock shaft 395 carries a rock arm 400 having a lateral pin 401, which rests normally beneath the horizontal flange 402 of a vertically reciprocating angular cam plate 403 mounted upon the upper end of a reciprocating bar 404 mounted in guides 405 secured to the inner face of the side frame A.

A bell-crank lever 406, having pin and slot connection 404^a with bar 404, is pivoted to the side frame A at 407 and connected through rod 408 with yoke 409 straddling main cam shaft 25 and carrying an antifric-tion roller 410 operating upon the internal cam 411. The frame 360 has in its central portion a series of forwardly presented recesses 360^b in one of which the gripper 377, 379 can be presented for operation. The bar 340 above referred to is similarly provided with series of rearwardly presented recesses 340^a to permit the close approach of the gripper to the line of first fold, when operating upon short sheets or when folding a short distance from the leading edge of a sheet.

By the described mechanism the gripper 377, 379 is caused to move forwardly and grip the leading edge of the sheet and pull it up into registry with the front gauge 360^a, and slide off of the sheet.

The opposite ends of the frame 360 can be adjusted independently to correctly register any sheets according to their peculiarities. This adjustment is represented in an exag-

gerated position by the dotted lines in Figure 2 of the drawings.

The grid or frame 335, 336, 337 carrying with it the pull-up registry mechanism and other parts described is readily removed from the machine, when it is desired to have access to the inner parts of the mechanism. When this grid is removed it is lifted by taking hold of the recessed handhold portions 338 of side frames 335 and lifting the frame upwardly and laterally to disengage the pin 401 of rock arm 400 from beneath the actuating flange 402 of the reciprocating cam plate.

In Figures 31, 32 and 33 of the drawings, I have shown a modification of removable folder bars in which the innermost first fold bar is attached to the reversible top guide and deflecting plate 320. In this form of mechanism the inner folding bar is shown in the form of a member 415 having a concave face to fit around the first fold roller 250 and a rounded angular face for acting as a folder bar. This folder bar 415 is attached at its ends to one edge of the flattened face of the combination plate 320 by means of screws 416 passing through the folder bar and plate and having spacing washers 417 interposed to properly space folder bar 415 from the plate 320 to permit free passage of sheets, when the sheets are to be folded through the first fold mechanism. Curved guide fingers 418 are secured at intervals beneath the folder bar 415 to extend into the annular grooves of the first fold roller 250, in which position said fingers rest upon the upper ends of the vertical guides arranged beneath the first fold rollers as hereinafter more fully explained. The horizontal portions of said fingers 418 are presented to act as continuations of the underguide for sheets passing over the first fold rollers. Figures 31 and 32 show the combined top guide, tip-in deflector and folder bar as shown in its two positions, it being understood that to change from the position shown in one of these figures to that shown in the other, the screws 322 are removed and the combined bar reversed and fastened upon links 321 in the new position.

425 is the first fold knife adjustably mounted upon the cross-head 426 secured at its ends to blocks 427, sliding in the vertical guideways 428 formed in the upward extensions of side frames A and B. Heavy bolts 429 pass through the slide blocks 427 and have swivelled upon them trunnion blocks 430 with which engage the forked ends 431 of rock arms 432 keyed to the opposite ends of the rock shaft 435, which is journaled in the bracket bearings 434 of the upward extensions of side frames A and B. A rock arm 436 is mounted upon one end of the rock shaft 435 and formed with a rear heel 437 carrying adjustment screws 438, which oppositely engage the pin 450 projecting laterally from

an arm 451 formed integral with one of the rock arms 432 above referred to.

The adjustment screws are for the purpose of adjusting the connection between rock arm 436 and rock shaft 435. A link 455 pivoted to the lower end of rock arm 436 is detachably pivoted at its opposite ends to the yoke 456 formed in the upper end of heavy operating lever 460 pivoted to the machine frame at 459. The pivoted connection between link 455 and lever 460 is by means of a removable pivot pin 457, which in case the first fold mechanism is not operating, can be removed from the yoke 456 and inserted in a suitable socket in the machine frame to support link 455 and knife 425 raised out of action while the lever 460 rocks idly. The lever 460 has its lower arm presented through an opening in the side frame in position to operatively engage an internal cam 465 upon cam shaft 25 above referred to.

Sheets passing through the first fold rollers 250, 251, whether folded by the knife 425 or deflected into the bite of these rollers by the member 320 without folding are deposited into the vertical guide frame 470 carrying the centrally separated corrugated guide plates 471 and a series of guide rods 472, properly spaced from plates 471. The lower ends of guide rods 472 are attached to the scale plates 595, hereinafter referred to, just above the transverse channels for the side registering gauges. Short pointed rods 473 are adjustably mounted in sockets of the second fold end gauge 490 and project upwardly from said gauge to guide and confine the leading edge of the sheet in contact with the gauge, see Figures 9 and 12.

Arranged centrally between the corrugated guide plates 471 and in the same vertical plane therewith, is the vertical plate 475 having the knife slot 476. Between the plate 475 and the corrugated guide plates 471 are two endless feed tapes 480 mounted at top upon pulleys 481 carried by main drive shaft 10, and at bottom by pulleys 482 journaled at 483 upon bracket arms 484 adjustably secured to the transverse machine frame girder 485 by means of set screws 486. These vertical feed belts 480 are presented with their feed surfaces in the vertical plane of the guide plates 471 and slotted plates 475 to assist in carrying the sheets downwardly to the second fold end gauge 490. Feed-up rollers (not shown) may cooperate with belts 480.

495 is the second fold knife adjustably mounted upon a reciprocating head 496 carried upon one end of the slide bar 497, (angular in cross-section) which reciprocates in the guideway 498 mounted upon the cross-girder 499 of the machine frame. A bracket 500 mounted upon the girder 499 supports the fixed bearing shaft 501 upon which is journaled a rock arm 502 formed with a lower

forked end 503, which has sliding engagement with a trunnion block 504 journalled upon the reduced end of the slide bar 497. The rock arm 502 carries a laterally projecting pin 505 which is presented in a suitable opening formed in an arm 506 projecting from a rock arm 507, which is also journalled upon the bearing shaft 501. Set screws 508 mounted in the arm 506 engage the opposite sides of the pin 505 for adjusting the connection between rock arms 502 and 507. The rock arm 507 carries an antifriction roller operating in an internal cam 510 upon the main cam shaft 25, by which the second fold knife 495 is reciprocated.

Prior to receiving the second fold, the once folded sheets or sheets tipped through the first fold rollers without folding, are acted upon by suitable pull-up gripper mechanism to insure rapid and accurate registry with the second fold front gauge 490, and also side register mechanism to insure the accurate placing of the second fold. These mechanisms will now be described.

Referring particularly to Figures 11 and 12 of the drawings, it will be observed that the second fold gauge 490 comprises two centrally spaced gauge arms or plates rigidly connected by the downwardly arched supporting cross-bar 491 centrally pivoted for adjustment at 492 upon a central downwardly presented extension 485* of the transverse girder or frame member 485. Bridge plates 490^a project inwardly from gauge arms in the same plane as their gauging faces and are formed with notches 490^b registering with recesses 485^a for the pull up grippers 509, 515 to operate in. The outer ends of gauge 490 are formed with short vertical slots to receive set screws 494 that pass through said slots and are threaded into the girder 485. The pull-up grippers, presently to be described, are mounted upon the downwardly arched cross-bar 491 of the second fold gauge, so that by loosening screws 494 the unitary structure can be readily adjusted upon pivot 492 to correct the alignment without interfering with the operative mechanism of the pull-up grippers.

As shown particularly in Figures 8, 9, 12 and 13 of the drawings, the pull-up gripper mechanism for the second fold gauge 490 comprises a pair of reciprocating gripper plates 509 and cooperating movable gripper members 515, operating in suitable recesses 485^a in the frame member 485 upon opposite sides of the vertical plane of the second fold knife 495, and mounted upon a pair of vertical slide bars 511 working in guideways 512 in cross-bar 491 and connected by a cross-rod 513. The slide bars 511 are recessed to receive the movable gripper members 515, which are of bell-crank shape pivotally mounted in the recesses of said bars and having gripper fingers projecting into operative

relation with the lower gripper members 509 above referred to. The upper and lower members of the pull-up grippers 509, 515 also reciprocate through the recesses 490^b of the second fold gauge 490 above referred to. The heels of gripper member 515 are engaged by expansion spiral springs 516 held at one end by screw pins 517 passing through the heels of the gripper members and at their other ends by shouldered guide pins 518 threaded through lugs 519 of plates 511 and held in the desired adjusted positions by lock nuts 520. The upward moving of the pull-up grippers throws the heels of members 515 into engagement with the stops 521 on brackets 512 for opening the grippers against the action of their springs to receive the lower edge of the sheet between the gripper members. As the pull-up grippers move downwardly the heels of the movable members are moved away from stops 521 with the result that the sheet will be gripped and pulled accurately into engagement with front gauge 490, the continued downward movement of the pull-up grippers causing the gripper jaws to slide off the sheet and leave it in engagement with the gauge.

For operating the described pull-up grippers, the rod 513 connecting slide bars 511 carries between said bars an oval shaped antifriction roller 526, engaged by the forked end of the bell-crank lever 527 pivoted at 528 on the rigid bracket arm 529 projecting from the machine frame. The bell-crank lever 527 has pivoted to one arm a rod 530 adjustably connected at its other end 531 with a bell crank lever 532, journalled upon the bearing shaft 501 and carrying an antifriction roller 533 operating in peripheral engagement with the cam 535 mounted upon the main cam shaft 25.

The girder frame 485 is formed with transverse channels 540 to receive two oppositely arranged second fold registering gripper mechanisms. Each of these side registering grippers is preferably constructed as shown in Figure 34 of the drawings, in which a housing 545 is formed with a gauging face or shoulder 545^a, a track 546, a gripper operating stop or shoulder 547 and a threaded attaching socket 548. The housing is also provided with the spaced forwardly presented guide walls 549, 549^a to receive sheets. A reciprocating slide member 550 operates in the guideway or track 546 and carries a rigid lower gripper member 551 that projects forwardly toward the guide members 549, 549^a. Pivoted at 552 upon the slide member 550 is the movable gripper jaw 553 of approximately bell-crank shape having pivoted to its heel 554 a rearwardly projecting shouldered pin 555 extending into a hollow thimble 556, which is threaded through a block 557 and is held in the desired adjusted position therein by means of a lock nut 558. An

expansion spiral spring 559 is mounted upon pin 555 and confined between the head of the pin and the end of the adjustable thimble for imparting a normal spring closing tendency to the registering gripper. By this arrangement the pressure of the closing spring can be adjusted to suit the requirements of the work performed, and when required the springs can readily be changed.

The two second fold side registering grippers are of exactly the same construction and are similarly mounted at opposite sides of the central vertical longitudinal plane of the machine as will now be explained. The socketed boss member 548 of the described gripper housing is mounted to slide in one of the channels 540 above referred to, it being confined therein by a removable plate 548^a. An adjusting screw rod 560 freely journaled in a bracket 561 secured to the machine side frame is threaded through said socket member 548 and held against lengthwise movement in bracket 561, so that by rotating the threaded rod by means of the hand-wheel 563 secured to its outer end, the registering gripper can be adjusted inwardly or outwardly in the machine. The movable gripper member is actuated by a second threaded rod 565 threaded through the sliding gripper block 557 and freely journaled in the bracket block 561 referred to. This rod 565 has a cylindrical outer portion 565^a to permit it to reciprocate as well as rotate in the bearing 561. This cylindrical portion 565^a is formed with a spline groove 565^b to receive a spline key (not shown) carried in the hub of a gear wheel 567, which is mounted upon the cylindrical portion of rod 565, so as to permit the rod to slide through the gear and also rotate therewith. This splined gear 567 meshes with an intermediate gear 568 driven by a similar gear 569 fixed to the adjusting screw rod 560. When the hand-wheel 563 is rotated for adjusting the housing of the gripper, the screw rod 565 will be similarly rotated for correspondingly shifting the movable member of the gripper.

The outer end of screw rod 565 carries a grooved collar 570 engaged by a pin 571 mounted in the end of an operating lever 572 which is pivoted at 573 upon the bracket arm 574. The lever 572 is connected through the rod 575 with one arm of a three armed lever 580 mounted on the vertical pivot of bracket 581. The operating lever 572 at the opposite side of the machine is connected through rod 576 with a second arm of said lever 580. The third or inwardly presented arm 580^a of said lever 580 carries a vertical pin 585, which passes up through a pivot opening in block 586 having laterally projecting pivot pins 587 journaled in the forked lower end 588 of a vertical lever 589 mounted on a horizontal pivot 590 carried by the bracket 581. This lever 589 carries

at its upper end an antifriction roller 591 operating upon the cam 592 mounted upon main cam shaft 25. The block 586, just referred to, is allowed lateral play in the forked end 588 and is furthermore free to move vertically upon the pin 585 to give the necessary freedom of movement in translating motion from the vertical power lever 589 to the horizontal three armed lever 580. While the described mechanism simultaneously operates both the side registering grippers, it will, of course, be understood that only one of said side registers is used at one time.

Arranged parallel with the channels 540 are the scale plates 595 with which the indicators 596 upon the side register housings register for indicating the desired position of the side registers for operating upon different sizes of sheets.

The second and third fold mechanisms are mounted in an auxiliary frame or housing 600 pivotally mounted at bottom, 601, upon the transverse girder 603 and at top, 602, in the bracket 604 rigidly secured to the inner face of side frame A. Suitably journaled in the auxiliary frame or housing 600 are the second fold rollers 605, 606, the third fold rollers 607, 608 and the pressure feed roller 609, all standing in vertical parallel relation in position to receive sheets delivered by the second fold knife into the bite of the first pair of said rollers. The rollers 605, 608 and 609 are mounted in movable spring pressed journal bearings having adjustable springs for yieldingly holding them to their work. The rollers 605, 606 are geared together at bottom, and the rollers 607, 608 and 609 are geared together at bottom; the intermeshing gears of rollers 605, 606 being connected with intermeshing gears of rollers 607, 608 and 609 through the intermediate gear 612 as clearly shown in Figure 11 of the drawings. Power is applied to said system of geared folding rollers by the mechanism hereinafter described.

The slotted second fold folder plate 610 is mounted upon the housing 600, so as to be presented parallel with the plate 475 above referred to, the slots of plates 475 and 610 being in proper alignment to receive the thrust of the second fold knife 495 as it creases the paper through the folding plate 610 into the bite of the second fold rollers 605, 606.

The folded sheet passes through rollers 605, 606 into the bite of rollers 607, 609 from which the leading folded edge passes into the loop fold grid consisting of the member 615 adjustably mounted upon housing 600 by bracket 615^a, the upper adjustable member 616 and the adjustable gauge 617 of well known construction. As the sheet is forced into the loop folding grid, its leading edge is arrested by the gauge 617 and the sheet looped laterally into the bite of the third fold

rollers 607, 608 by which is imparted the final fold as the sheet is delivered to the packing box hereinafter referred to.

In some cases it is found desirable to impart the third of final fold to the sheet with the assistance of a folding blade or knife, such as shown at 620. This action is illustrated in Figure 18 of the drawings. This knife 620 is formed with a reciprocating cross-head operating in the guideways 621 of the housing frame and carrying upon the ends of the cross-head the pivotal trunnion blocks 623 engaged by the forked ends of the rock arms 624 mounted upon the rock shaft 625. A rod 630 projects rearwardly from the cross-head of knife 620 through a guide opening in a flange 631 of the auxiliary housing. A collar 632 secured upon the rod 630 confines expansion spiral spring 633 upon rod 630 between the collar and the flange 631 of the frame. The rod 630 is formed with a recess or notch adapted to receive a pivoted latching plate 635 pivoted to flange 631 for holding the knife 620 in its inoperative position with spring 633 under compression, when the final fold is made as a loop fold without the assistance of the knife. The rock shaft 625 carries at its upper end a rock arm 640 operating in peripheral engagement with controlling cam 641 adjustably and removably mounted upon a worm gear 642 journaled upon the housing frame at 643, and driven by an intermeshing worm 644 hereinafter referred to. When knife 620 is held in inoperative position by latching plate 635, the operating rock arm 640 will be held out of contact with cam 641 as indicated by dotted lines in Figure 14.

The knife 620 is also formed with integral tip-in guide flanges 620^a having inwardly presented curved sheet engaging faces, which guide flanges operate in the peripheral annular grooves cut in the feed roll 609. When cam 641 is removed and the knife 620 is held stationary in its inner position, as shown in Figure 17, the guide flanges 620^a are presented in the path of the folded sheets which are deflected or tipped into the bite of final fold rollers 607, 608 without folding.

The pivotally mounted frame or housing 600 is formed with an inwardly presented horizontal shelf 650 above which is a vertical ribbed wall 651 having an inner curved end 652 presented adjacent to the folding roller 608. This shelf 650 forms a part of the bottom wall of the packing box and the wall 651 forms one of the side walls of the packing box as hereinafter explained. Mounted in slots formed in the vertical side wall 651 are a series of pivoted spring dogs or fingers 655 past which the folded sheets are forced by the packer pusher in the packing box and by which the folded sheets are engaged at one edge.

Upper pivot member 602 of the auxiliary

frame or housing is extended above the housing arm to receive a beveled gear 660, which rotates upon the vertical pivot of the housing. This gear 660 is driven by a similar gear 661 mounted upon the inner end of a short horizontal shaft 662 journaled in the side frame A and the upward extension bearing bracket 663 formed integral with bracket 604 above referred to. The shaft 662 carries upon its outer end a smaller gear 665, which is freely journaled upon the shaft and a larger gear 666 which is keyed to the shaft 662. A removable screw bolt 667 passes through an opening in gear 666 and is seated in a threaded opening in the inner gear 665 for securing said gears together when shaft 662 is driven by gear 665. Keyed upon a stub shaft 670 projecting from side frame A is an intermediate gear 671 driven by the pinion 20 on main driving shaft 10 and meshing with the above named gear 665. Also freely journaled upon the stub shaft 670 is a smaller gear 672 in mesh with the above named gear 666. These gears 671 and 672 are adapted to be coupled by means of the screw bolt 667, which can be removed from its described position in gears 665, 666 and inserted in registering openings in gears 671, 672. This specific arrangement of gears is illustrated in Figures 3 and 14 of the drawings, but it will be understood that the construction and arrangement is the same as illustrated in Figures 35 and 36 with reference to the change gears 139, 140, 275 and 266. The purpose of the described gearing is to enable the operator to adjust the speed of operation of the second and third fold mechanisms to suit the operation of the rest of the machine upon the particular folded product.

Referring more particularly to Figures 5 and 14 of the drawings, it will be observed that the beveled gear 660 upon the pivot center of the frame or housing 600 also meshes with and drives a bevel gear 675, carried upon the outer end of a shaft 676 journaled in suitable bracket bearings at the top of housing 600 and carrying between its ends the worm 644 above referred to. The inner end of shaft 676 carries a beveled pinion 677 which meshes with and drives the beveled pinion 678 keyed to the projecting upper end of the shaft of the vertical folding roller 607 above referred to. The vertical second and third fold rollers and pressure roller are driven by the means described through the gearing hereinbefore explained.

The auxiliary frame or housing 600 carrying the second and third fold mechanisms, as described, being pivoted upon the same axis as the intermediate beveled gear 660, it will be clear that the frame or housing can be moved from its inner operative position shown in Figures 5, 10 and 14 outwardly into its inoperative position as shown in Figure 11, without disturbing the operating mech-

anism, the gear 675 rotating upon gear 660 in these movements into and out of operative positions. This moving of the auxiliary frame away from the rest of the machine permits ready access to operative parts, which in the normal operation of the machine are completely covered up by the mechanism carried in said auxiliary frame. The housing 600 is formed adjacent to its lower end with an integral bracket lug 680 upon which is pivoted a latch 681 provided with an operating handle 682 and engaged by a spring actuated rod 683, to cause it to spring into latching engagement with the stud 685 carried by the cross-frame or girder 603 of the machine frame. When the auxiliary frame is in its operative position, it is held by said latch. By hand operation the latch can be readily released and the auxiliary frame pulled outwardly into inoperative position shown in Figure 11.

690 is the removable packer box platform resting upon bolsters 691 carried by the machine girder 603. This platform 690 is formed with a curved inner edge fitting around the curved edge wall of the shelf 650 of housing 600 and supported in the same horizontal plane as said shelf to receive in upright position the folded sheets as they are delivered from the final fold rollers 607, 608. The curved adjacent edges of shelf 650 and platform 690 are concentric with the pivotal axis of the auxiliary frame or housing 600.

A mechanical counter 695 is mounted at the rear edge of platform 690 upon a bracket 696 and having its oscillating operating arm 697 connected to a rod 698, which projects forwardly beneath the platform 690 and is connected with a spring dog or detent 699 pivotally mounted in an opening 690^a and projecting up into the path of sheets carried forward by the packer pusher, so as to actuate the counter every time a folded sheet is deposited. Projecting horizontally inwardly from the side frame B on approximately the level of the top of the auxiliary housing 600 is a rigid bracket arm 700, on which is mounted a socketed head 701 that can be adjusted inwardly and outwardly toward the vertical longitudinal plane of the machine. This head 701 carries a downwardly projecting arm 702 upon which are adjustably mounted the horizontal guide arms 703 constituting an adjustable skeleton side frame for the packer box. The arms 703 are presented parallel with the ribbed wall 651 of the auxiliary housing above referred to. Pivotaly mounted in suitable recesses in the inner faces of the arms 703 are the spring dogs or detents 704 arranged oppositely with respect to the dogs 655 above referred to for engaging the outer edges of the folded products and supporting them upright in the packer box.

705 is a heavy abutment block resting upon the table 690 in the path of the folded sheets

as they are packed in the packing box and sliding outwardly upon the table as the packing box is filled.

710 is a track bar rigidly secured to girder member 485 and projecting rearwardly therefrom beneath the inner end of the table 690. 711 is a slotted head mounted upon the track bar 710 to reciprocate thereon. This sliding member 711 is formed with an upwardly projecting bracket arm 712 formed in its upper end with a horizontal socket 713, in which is mounted the lower arm of the packer pusher grid 715. This grid, as shown best in Figure 5 of the drawings, comprises a vertical back member 715 from which project the series of parallel horizontal packer arms 716 adapted to reciprocate forwardly and backwardly at right-angles to the side walls 665 and 703 of the skeleton packer box. This packer pusher grid is removably secured in the socketed head of reciprocating bracket 712 by means of a set screw 717. The pusher grid can be removed from its reciprocating frame when desired by simply loosening the screw and sliding the grid outwardly through the opening in side frame B. An arm 718 projects inwardly from socketed head 713 and is formed at its inner end with a downwardly presented slot 719 arranged for the passage of the counter tripper 699, whereby arm 718 will firmly support each folded sheet on opposite sides of the tripper as the sheets are forced past said tripper in the act of actuating the counter and forcing sheets into the packing box.

Reciprocating head 711 carries a pivot bolt 720 projecting inwardly from it upon which is pivoted connecting rod 721 connected at its other end 722 to the lower end of a long rock lever 723, journaled at 724 and carrying at its upper end an antifriction roller 725 operating upon the internal cam 726 adjustably mounted upon the cam shaft 25. The mounting of this cam 726 is preferably as shown in Figures 19 and 20 of the drawings, in which cam 726 is rotatably mounted upon cam shaft 25 and is held against displacement to the left by a spacing collar 727, which is shown resting against the hub of cam 465 above referred to. Formed integral with the cam is an outwardly projecting annular flange 728 carrying at top an inwardly presented tooth 729, which normally engages a toothed disk 730 keyed to the shaft 25 by means of set screw 731. An expansion spiral spring 732 is seated in a pocket formed in the hub of disk 730 and engages the face of the loose cam 726 to hold it pressed to the left with the tooth 729 in engagement between two teeth of the disk 730. When it is desired to adjust or time the operation of the reciprocating packer pusher, the operator presses cam 726 toward the disk 730, compressing spring 732 and disengaging tooth 729 from the teeth of disk 730, when the cam can be rotated for-

wardly or backwardly upon its shaft the desired extent, and then released to permit spring 732 to again move it to its normal position with the tooth 729 again engaging with the toothed disk 730.

The lowest arm 716^a of packer grid 715 is rectangular in cross-section as shown in Figures 8, 9 and 10 of the drawings, and the arm 718 has a channel in its upper face forming a continuation of socket 713 of bracket arm 712 so that the arm 716^a is firmly supported from end to end to properly sustain the packer grid in upright position. The rear face of arm 718 is formed with a rib extending almost its entire length which is presented in the same transverse vertical plane as the engaging rib surfaces of the packer grid arms 716.

An automatic throw out of the sheet feeding combers is provided to stop feeding from the pile and arrest the table elevating mechanism, when the supply of sheets on the table becomes practically exhausted. This throw-out mechanism comprises a rock shaft 750 journaled in side frame B, (see Figures 1 and 4) carrying an upwardly projecting prop or arm 751 adapted to be moved under the frame member 129 of the comber supporting frame 126. An actuating arm 752 projects forwardly from shaft 750 in the path of the upwardly movable pile supporting frame 81, so that said shaft will be rocked and prop arm 751 moved beneath frame member 129 when the frame 81 reaches the upward limit of its desired movement. This action will prevent the combers from moving down into engagement with the pile and consequently no more sheets will be fed and the table elevating mechanism will not act. This rock shaft 750 also carries a stop arm 753 adapted to engage a spring stop 754 for limiting its movement and holding it in arresting position, also an external hand lever 755 and a lever 756 to which a hand control (not shown) at the rear or other convenient part of the machine may be attached.

The structure of the angularly adjustable end gauge carrying a pull-up gripper is embodied in slightly different forms for the first fold and second fold mechanisms; that for the first fold being adjustably mounted upon the removable grid, while that for the second fold is centrally pivoted upon a part of the machine frame. Claims on this part of the structure are drawn to include either or both of said embodiments.

The first fold rollers 250, 251 are geared together in the usual manner, the axle of roller 251 projecting through side frame A and carrying a gear 251^a, which meshes with and is driven by the pinion 20 upon the main drive shaft 10.

When the reversible top guide tip-in member 320 and attached folding bar 415 are in the position shown in Figures 32 and 33, it

will be observed that the fingers 418 rest upon upstanding fingers 470^a attached to guide frame 470 above referred to.

In Figures 2, 7, 10, 12, 14 and 16 the positions of the sheet "S" are shown in various stages with reference to the several mechanisms.

Referring to the side pile gauges 212 and 215, shown particularly in Figures 1, 4 and 6 of the drawings, it will be observed that the lateral adjustment of these gauges can be effected first by moving the supporting bars 200 laterally with respect to the pile, and second by reversing the position of brackets 207 upon the supporting bars 200. These brackets 207 can be mounted upon the bars 200 with their arms projecting toward or away from the edge of the pile of sheets, it being only necessary to reverse the gauges 212 or 215 in their supporting sockets to present their gauge faces in engagement with the side edges of the pile.

By means of the adjustable gearing arranged between the drive shaft and the feed mechanism which carries sheets from the drop roller delivery to the first fold mechanism and also between the drive shaft and the second and third fold folding mechanisms, the operator can regulate the speed of movement of the sheets with reference to the folding and gauging mechanisms so as to obtain the greatest output of folded products of a given size. The speed of the folding and gauging mechanisms being directly dependent upon the controlled speed of main driving shaft 10 as above explained, it will be clear that these mechanisms can be made to operate fast or slow, as may be required, to take care of the number of sheets, small or large, supplied by the feeding and conveying mechanisms. For reasons explained, a greater number of small sheets than large sheets can be carried through the machine at a maximum speed to meet the increased speed of operation of the gauging and folding mechanisms and therefore the improved machine is capable of producing a maximum output of folded products of any and all sizes within its range.

It will be observed that the folder cam shaft and the feeder cam shaft are operated in unison by the intermediate inclined shaft alongside frame B. The individual cams upon these two shafts are as usual adjustably mounted upon their shafts, but in addition to these independent cam adjustments, the timing coupling illustrated in detail in Figures 23 and 24 enables the operator to adjust the timing of the feeder cam shaft with relation to the folder cam shaft to suit the particular size of sheets and the folding operation performed.

I claim:

1. In a folding machine, the combination of suitable folding mechanism, a sheet con-

- veyor leading to said folding mechanism, a pivotally mounted frame resting normally in spaced relation above said conveyor and movable upon its pivot into elevated position away from said conveyor, and feed-up devices carried by said pivot frame in operative relation to said conveyor and movable into and out of operative position therewith, said feed-up devices comprising supporting members, spring-pressed arms pivoted upon said supporting members, rollers journaled upon said arms, and interengaging lugs upon said supporting members and arms to limit the movement of said arms in one direction.
2. In a folding machine, the combination of folding mechanism, including folding rollers, with a reversible sheet guiding bar.
3. In a folding machine, the combination of folding mechanism, including folding rollers, with a sheet guiding bar reversibly mounted upon pivoted arms above said folding rollers.
4. In a folding machine, the combination of folding mechanism, including folding rollers, with a combined top guide, tip-in bar and folder bar reversibly mounted upon pivoted arms above said folding rollers.
5. In a folding machine, the combination of suitable folding mechanism, with a pivotally mounted frame carrying a sheet deflecting tip-in bar normally supported above said folding mechanism, whereby said bar will be raised into inoperative position when said frame is elevated.
6. In a folding machine, the combination of suitable folding mechanism, with a pivotally mounted frame carrying a reversible top guide and tip-in bar normally supported above said folding mechanism, whereby said bar will be raised into inoperative position when said frame is elevated.
7. In a folding machine, the combination of suitable folding mechanism, with a pivotally mounted frame carrying a reversible top guide, folder bar, and tip-in bar normally supported above said folding mechanism, whereby said bar will be raised into inoperative position when said frame is elevated.
8. In a folding machine, the combination of suitable folding mechanism, means for conveying sheets thereto, a pivotally mounted top frame, an auxiliary pivoted frame carrying a reversible sheet guiding bar, and a connection between said top frame and said auxiliary frame whereby said guiding bar will be raised with said top frame.
9. In a folding machine, the combination of suitable folding mechanism, means for conveying sheets thereto, a pivotally mounted top frame, an auxiliary pivoted frame carrying a reversible sheet guiding bar, and links carried by said top frame detachably engaging said auxiliary frame.
10. In a folding machine, the combination of sheet folding mechanism including folding rollers and means for operating said rollers, with conveyor tapes leading to said folding rollers, and driving mechanism for said conveyor tapes, including adjustable change speed gears by which the speed of the tapes can be adjusted with relation to the speed of the folding rollers.
11. In a folding machine, the combination of sheet folding mechanism including folding rollers and means for operating said rollers, with conveyor tapes leading to said folding rollers, a tip-in sheet deflecting guide supported adjacent to said folding rollers, and driving mechanism for said conveyor tapes, including adjustable change speed gears by which the speed of the tapes can be adjusted with relation to the speed of the folding rollers.
12. In a folding machine, the combination of suitable folding mechanism, sheet conveying means leading to said folding mechanism, a removable sheet guiding grid, an end gauge angularly adjustable upon said removable grid, and a pull-up gripper upon said end gauge.
13. In a folding machine, the combination of suitable folding mechanism, sheet conveying means leading to said folding mechanism, a removable sheet guiding grid, an end gauge mounted upon said removable grid, a pull-up gripper device upon said end gauge, and a gripper operating device detachably engaging a part of said pull-up gripper device.
14. In a folding machine, the combination of suitable folding rollers, a folding knife, sheet conveying means leading to said folding rollers, a removable sheet guiding grid carrying pull-up and registering mechanism, and a folder bar carried by said grid and supported normally above one of said rollers.
15. In a folding machine, the combination with suitable folding mechanism, of an angularly adjustable end gauge, and pull-up gripper mechanism mounted upon said end gauge and adjustable therewith.
16. In a folding machine, the combination of suitable folding mechanism, sheet conveying means leading to said folding mechanism, a removable adjustably mounted end gauge, and pull-up gripper mechanism adjustably mounted upon said end gauge.
17. In a folding machine, the combination with suitable folding mechanism, of a centrally pivoted angularly adjustable end gauge, and pull-up gripper mechanism mounted upon said end gauge and adjustable therewith.
18. In a folding machine, the combination with suitable folding mechanism, of a unitary angularly adjustable gauging mechanism comprising an end gauge and pull-up gripper carried by the end gauge.

19. In a folding machine, the combination with suitable folding mechanism, of a centrally pivoted angularly adjustable end gauge, and pull-up gripper mechanism centrally mounted upon said end gauge and adjustable therewith, and operating means for said gripper.

20. In a folding machine, the combination of a machine frame, suitable folding mechanism, with means for conveying sheets thereto, a removable grid supporting an end gauge, a pull-up gripper carried by said end gauge, a rock shaft connected with said pull-up gripper, a vertically reciprocating cam plate mounted upon the machine frame, and a rock arm upon said rock shaft removably engaging said cam plate.

21. In a folding machine, the combination of horizontally disposed first fold folding mechanism, vertically disposed second and third fold folding mechanisms, and means for conveying sheets thereto, with a sheet guiding grid supporting pull-up and registering mechanism removably mounted above the second and third fold mechanisms in operative relation to the first fold mechanism.

22. In a folding machine, the combination with suitable folding mechanism, of an angularly adjustable end gauge formed of two laterally extending gauge members connected by an arched connecting member, a pivot support for said connecting member, pull-up grippers mounted upon said arched connecting member, and means for securing said gauge in the desired adjusted position.

23. In a folding machine, the combination of suitable folding mechanism, with a side registering gripper comprising an adjustable housing, a gripper reciprocally mounted in said housing, a screw rod threaded through said housing, a second screw rod threaded through said reciprocating gripper, gearing between said screw rods to cause them to rotate in unison, and operating means for reciprocating said second screw rod for operating the gripper.

24. In a folding machine, the combination of suitable folding mechanism, with a side registering gripper housing, a gripper movably mounted in said housing and comprising a reciprocating block having a fixed jaw, a pivoted jaw, an adjustable sleeve threaded through a lug upon said reciprocating block, a guide rod extending from said pivoted jaw into said adjustable sleeve, and a spring upon said guide rod confined between said pivoted jaw and said sleeve.

25. In a folding machine, the combination of suitable folding mechanism, with a side registering gripper mechanism comprising a housing having a gauge face, a reciprocating block operating in said housing and carrying a fixed jaw, a movable jaw pivoted upon said block and formed with a heel, an adjustable hollow sleeve threaded through a projection

on said block, a guide rod pivotally connected with the heel of the movable gripper and extending into said hollow sleeve, a spring upon said guide rod confined between said sleeve and said heel, a gripper opening stop upon said housing in the path of said heel, and means for reciprocating said block.

26. In a folding machine, the combination of suitable folding mechanism, with a side registering gripper mechanism comprising a housing having a gauge face, a reciprocating block operating in said housing and carrying a fixed jaw, a spring actuated movable jaw pivoted upon said block, a screw rod threaded through said block, a rotary adjusting member splined upon said screw rod to rotate the rod and permit longitudinal movement of the rod through said adjusting member, a grooved collar upon said screw rod, and an operating lever engaging said grooved collar.

27. In a folding machine, the combination of suitable folding mechanism, with two oppositely arranged side registering gripper mechanisms, each comprising an adjustable housing, a gripper reciprocally mounted in said housing, a screw rod threaded through said housing, a second screw rod threaded through said reciprocating gripper, gearing between said screw rods to cause them to rotate in unison, one of said gears being splined upon said second screw rod, and operating means for said two mechanisms comprising grooved collars upon said second screw rods, levers engaging said grooved collars, and a cam operated system of links and levers operatively connecting said first mentioned levers.

28. In a folding machine, the combination with suitable folding mechanism and an end gauge, of a pull-up gripper mechanism comprising a centrally pivoted housing having spaced parallel guide channels in planes upon opposite sides of its pivotal mounting, pivotally connected fixed and movable jaws movably mounted in said guide channels, a rod connecting said grippers, an antifriction roller upon said connecting rod, and a forked operating lever engaging said antifriction roller.

29. In a folding machine, the combination with a main frame supporting the main folding mechanism in a horizontal plane, of a horizontally swinging auxiliary frame mounted upon vertical pivots upon the main frame and movable toward and away from the main frame, an auxiliary folding mechanism for imparting a fold at right angles to the folding mechanism carried by the main frame mounted in said auxiliary swinging frame.

30. In a folding machine, the combination with a main frame supporting the main folding mechanism in a horizontal plane, of an auxiliary swinging frame mounted upon

vertical pivots upon the main frame, and movable toward and away from the main frame, an auxiliary folding mechanism for imparting a fold at right angles to the folding mechanism carried by the main frame mounted in said auxiliary swinging frame, and a latching device for securing the auxiliary swinging frame in its operative relation to the main frame.

31. In a folding machine, the combination with a main frame supporting the main folding mechanism in a horizontal plane, of an auxiliary swinging frame mounted upon vertical pivots upon the main frame, and movable toward and away from the main frame, an auxiliary folding mechanism mounted in said auxiliary swinging frame, and gearing for driving said auxiliary folding mechanism including a gear rotating upon the pivotal axis of said auxiliary frame.

32. In a folding machine, the combination with a main frame supporting the main folding mechanism in a horizontal plane, of an auxiliary swinging frame mounted upon vertical pivots upon the main frame, and movable toward and away from the main frame, an auxiliary folding mechanism mounted in said auxiliary swinging frame, and gearing for driving said auxiliary folding mechanism including a power driven auxiliary shaft upon the main frame and a driven gear rotating upon the pivotal axis of said auxiliary frame.

33. In a folding machine, the combination of a main frame, a power shaft, and main folding mechanism upon the main frame driven from said power shaft, with an auxiliary horizontally swinging frame vertically pivoted upon the main frame and movable toward and away from the main frame, auxiliary folding mechanism mounted in said auxiliary swinging frame, a driving gear for said auxiliary folding mechanism rotating upon the pivotal axis of said auxiliary frame, and a driving train between said power shaft and said driving gear.

34. In a folding machine, the combination with a main frame supporting the main folding mechanism in a horizontal plane, of an auxiliary swinging frame mounted upon vertical pivots upon the main frame, an auxiliary folding mechanism mounted in said auxiliary swinging frame, and a packer box, said auxiliary frame carrying one wall of said packer box.

35. In a folding machine, the combination with a main frame supporting the main folding mechanism, and a packer box, of an auxiliary pivoted frame swinging upon the main frame into and out of operative position, auxiliary folding mechanism upon said pivoted frame arranged to deliver folded products to said packer box, and a packer box wall

mounted upon said pivoted frame and movable therewith.

36. In a folding machine, the combination with a machine frame having knife guideways, and suitable folding rollers, of a reciprocating folding knife mounted upon blocks operating in said guideways, trunnion blocks carried by said knife, a rock shaft carrying forked rock arms which engage said trunnion blocks, and cam operated mechanism for rocking said rock shaft.

37. In a folding machine, the combination with a machine frame having knife guideways, and suitable folding rollers, of a reciprocating folding knife mounted in said guideways, a rock shaft carrying rock arms engaging said knife, a cam operated lever, a link operatively connected with said rock shaft, and a detachable pin connecting said link with said cam operated lever.

38. In a folding machine, the combination with a machine frame, suitable folding rollers, a tip-in sheet deflector, and a reciprocating folding knife, of knife operating mechanism, and means detachably connecting said knife with its operating mechanism adapted to also engage the machine frame for securing the knife against movement in inoperative position.

39. In a folding machine, the combination with suitable folding and feeding rollers, and a cooperating loop forming grid, of a knife formed with sheet deflecting tip-in guides, detachable operating means for said knife, and means for holding said knife in either its inner position or its outer position.

40. In a folding machine, the combination of suitable folding mechanism including a folding roller having axial portions of reduced diameter, tape pulleys of less diameter than said folding roller journaled upon said reduced axial portions of said roller, and sheet conveying tapes operative upon said pulleys and presented within the circumference of said roller.

41. In a folding machine, the combination of suitable folding mechanism including a folding roller having axial portions of reduced diameter, sectional tape pulleys of less diameter than said folding roller journaled upon said reduced axial portions of said roller, and sheet conveying tapes operative upon said pulleys and presented within the circumference of said roller.

42. In a folding machine, the combination of suitable folding mechanism, a pivotally mounted frame, a sheet guiding bar normally supported above the plane of feed of said folding mechanism and pivoted separately from said frame, and connections between said frame and said bar whereby said bar will be raised into inoperative position when said frame is elevated.

43. In a folding machine, the combination

of suitable folding rollers, a folding knife,
sheet conveying means leading to said folding
rollers, a removable sheet guiding grid carry-
ing pull-up and registering mechanism, and
5 a pair of folder bars carried by said grid and
supported normally above said rollers.

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