

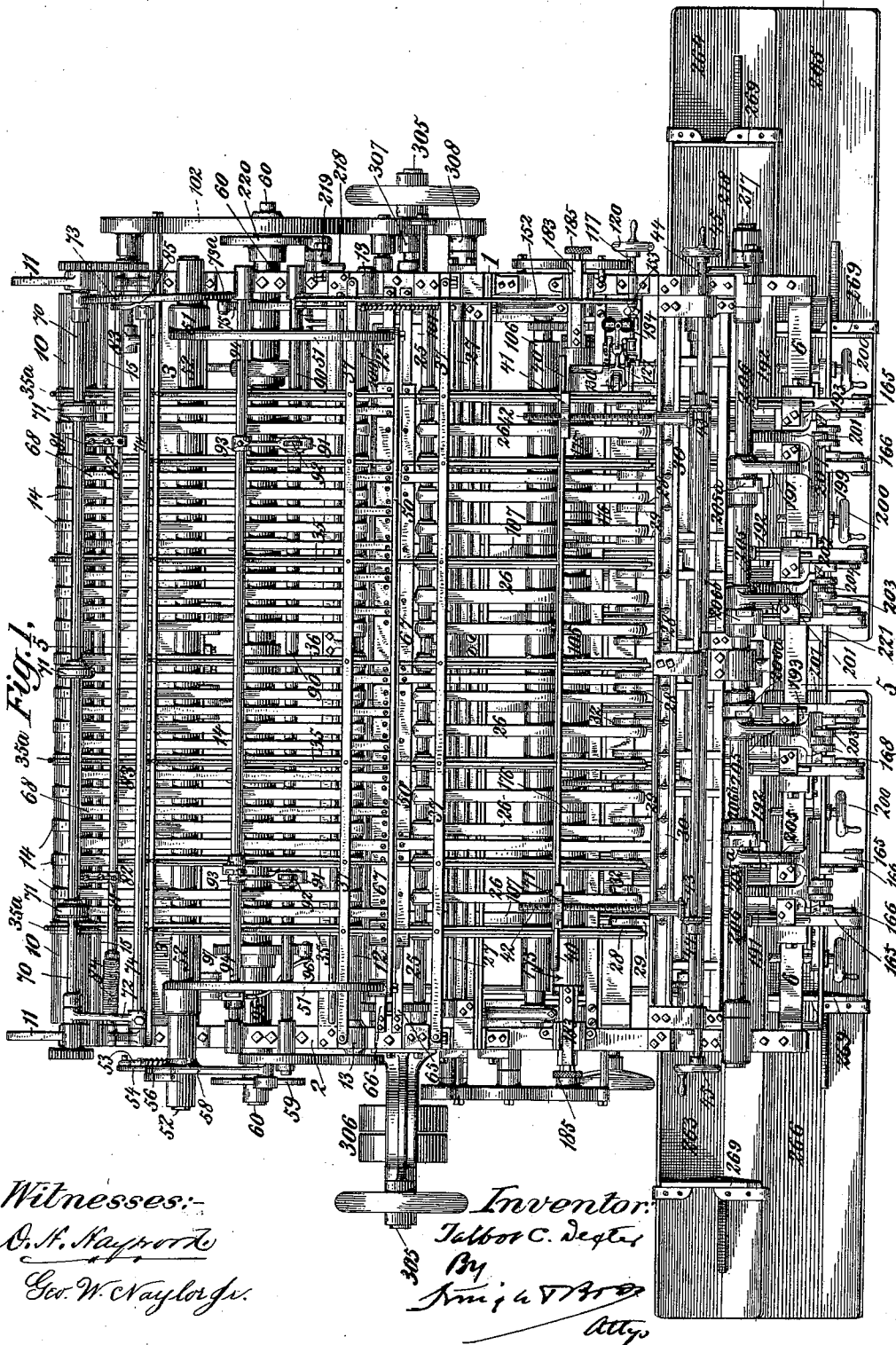
(No Model.)

13 Sheets—Sheet 1.

T. C. DEXTER.
PAPER FOLDING MACHINE.

No. 564,555.

Patented July 21, 1896.



Witnesses:
O. H. Hayward
Geo. W. Maylor Jr.

Inventor:
T. C. Dexter
By
Amos A. V. A. Jr.
Att'y

(No Model.)

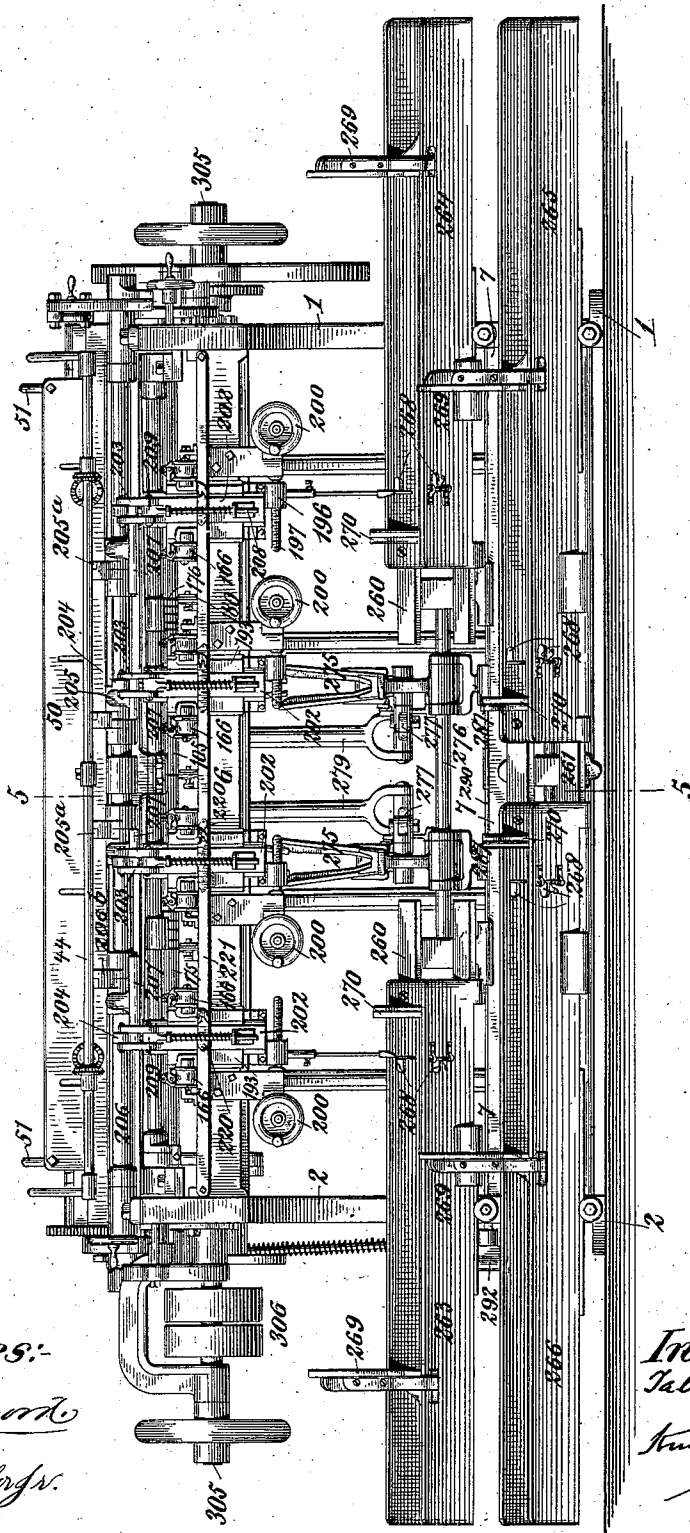
13 Sheets—Sheet 2.

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Fig. 2.



Witnesses:

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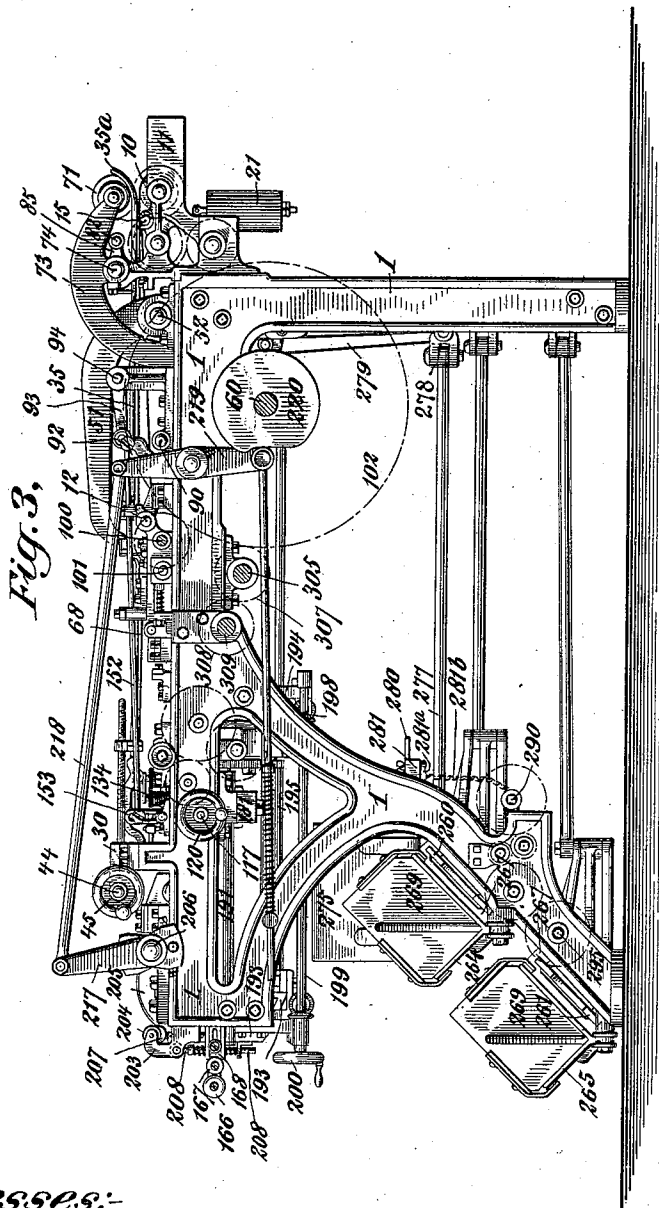
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13 Sheets—Sheet 3.

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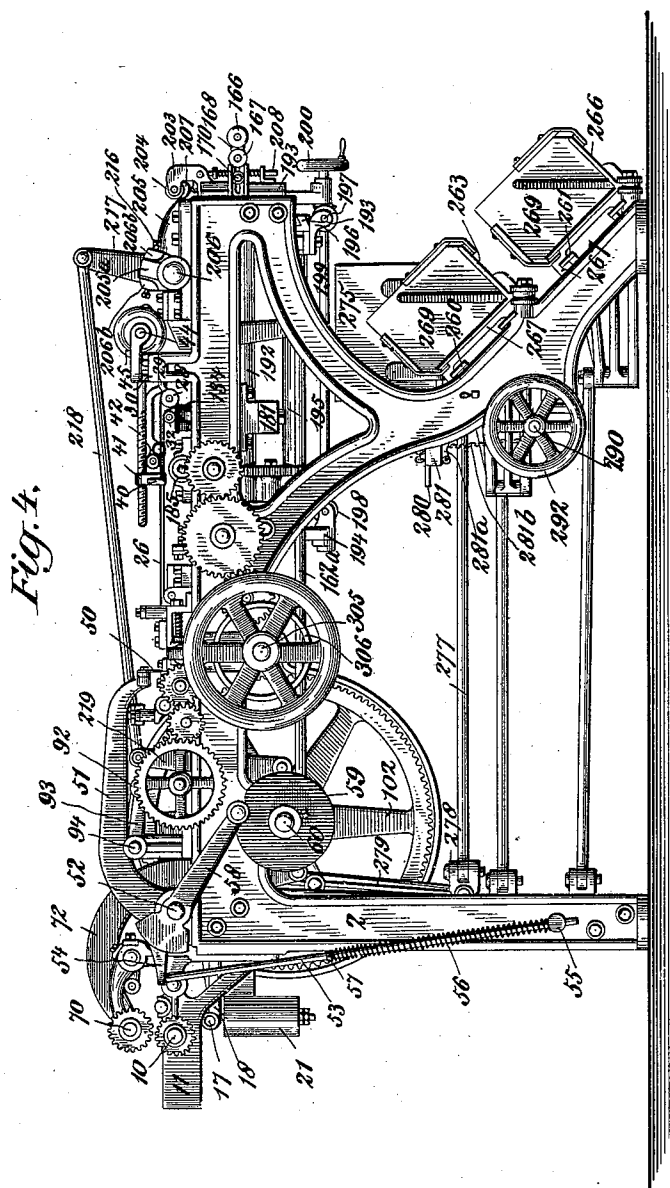
(No Model.)

13 Sheets—Sheet 4.

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Witnesses:

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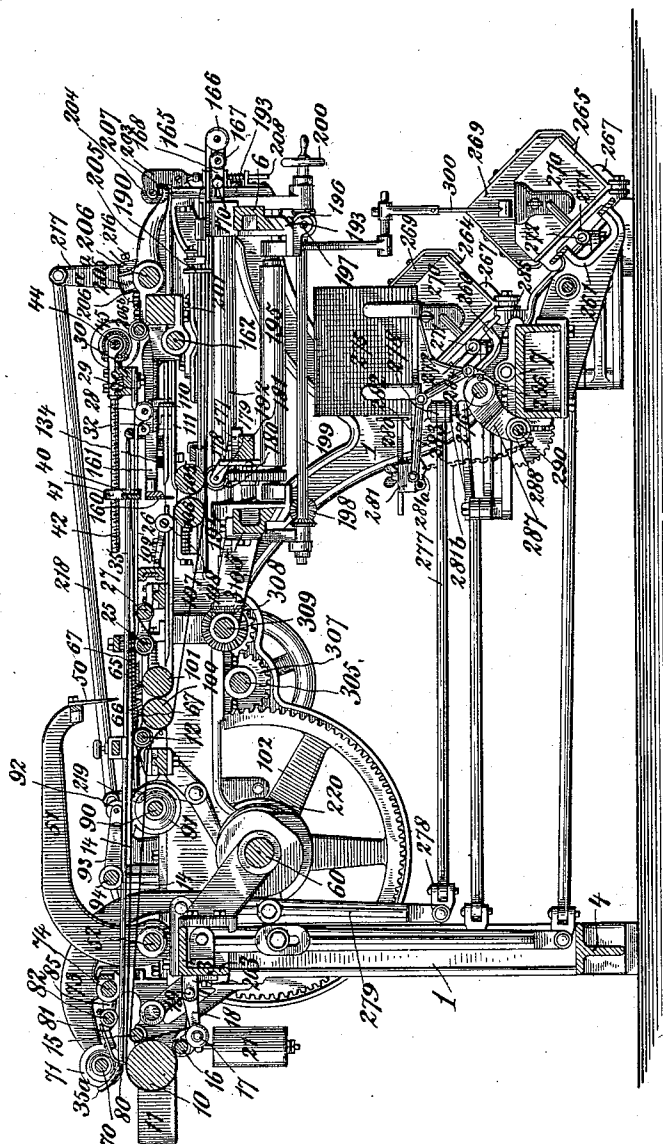
Att'y

T. C. DEXTER.
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Fig. 5.



Witnesses:-

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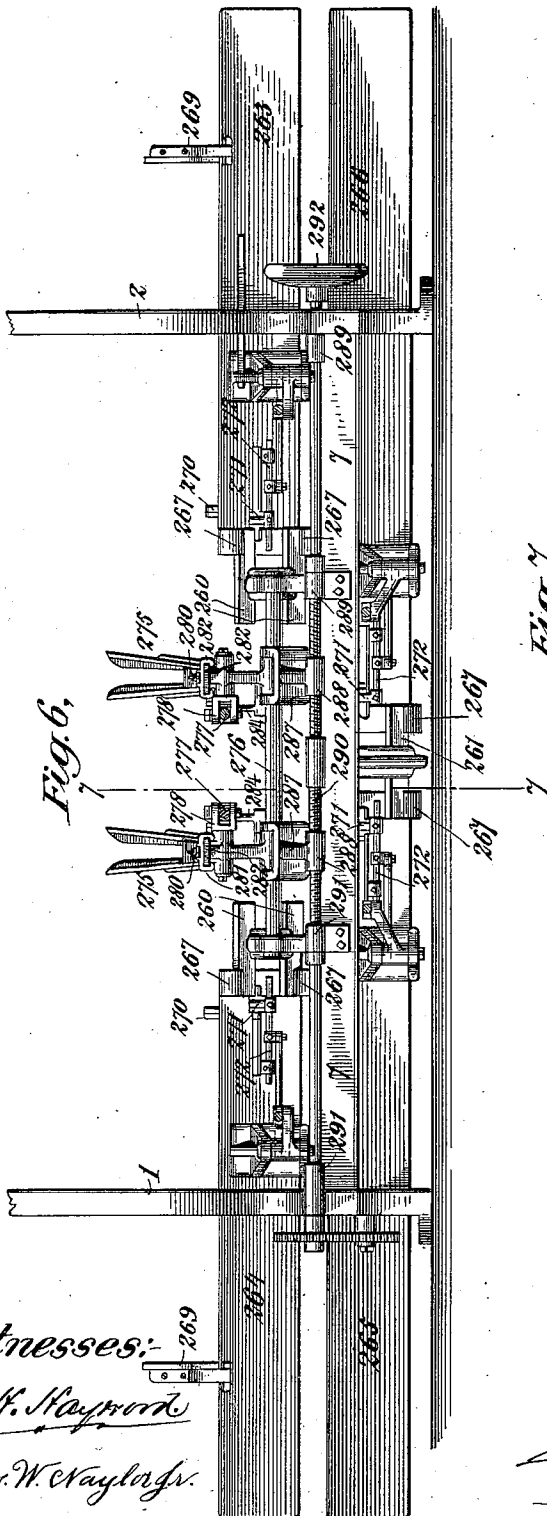
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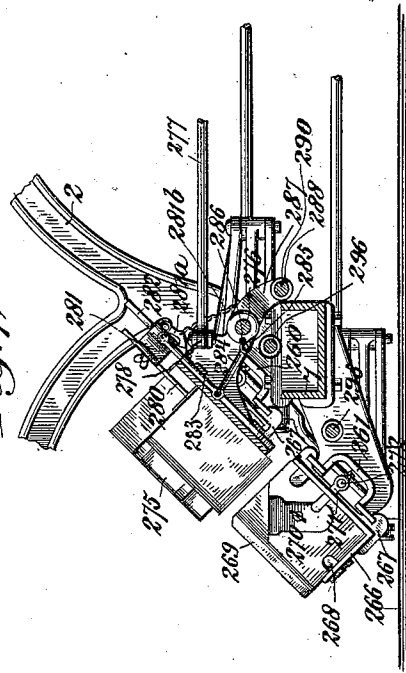
T. C. DEXTER.
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Patented July 21, 1896.



Witnesses:
O. H. Hayward
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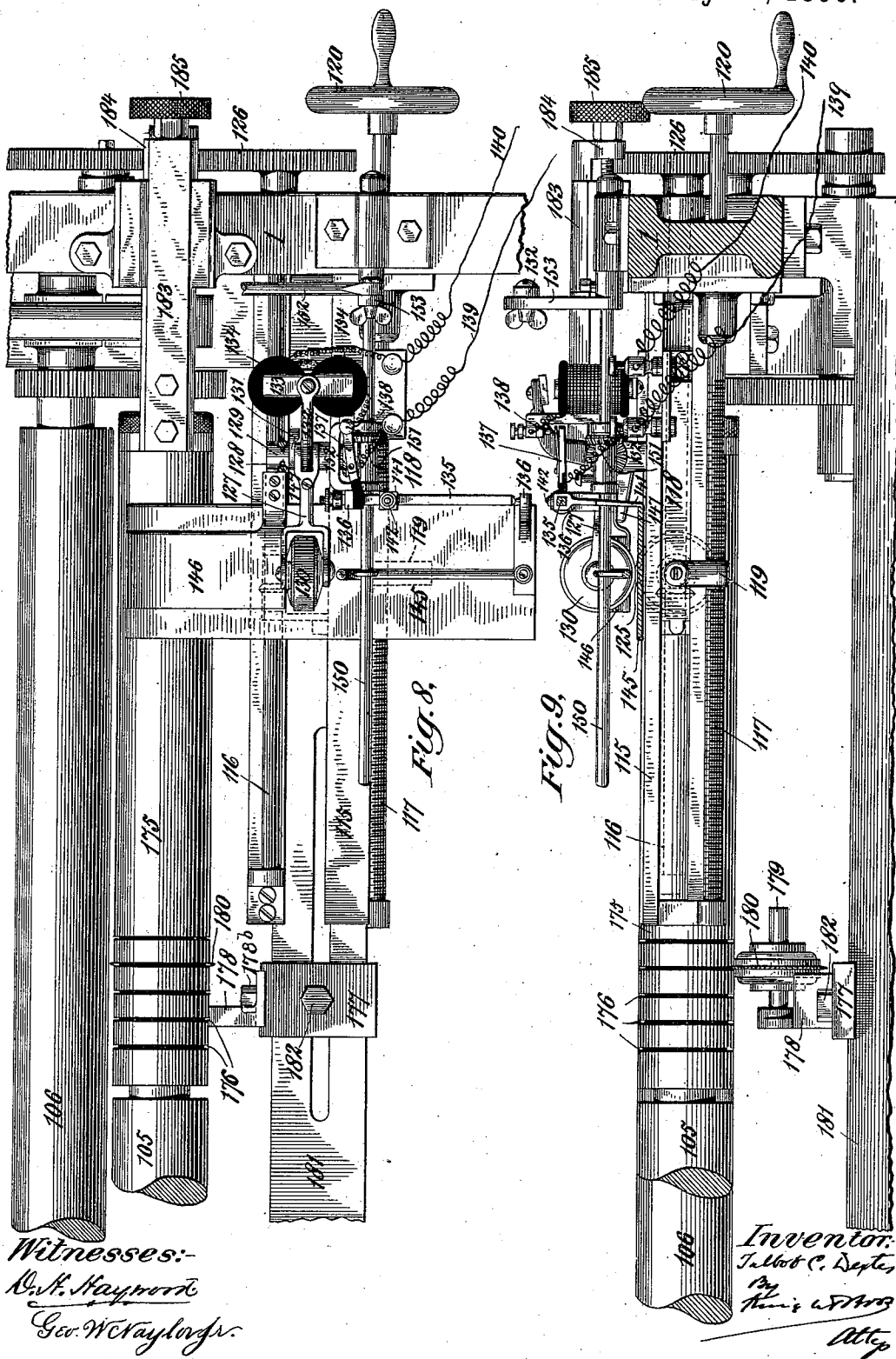


Inventor:
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T. C. DEXTER.
PAPER FOLDING MACHINE.

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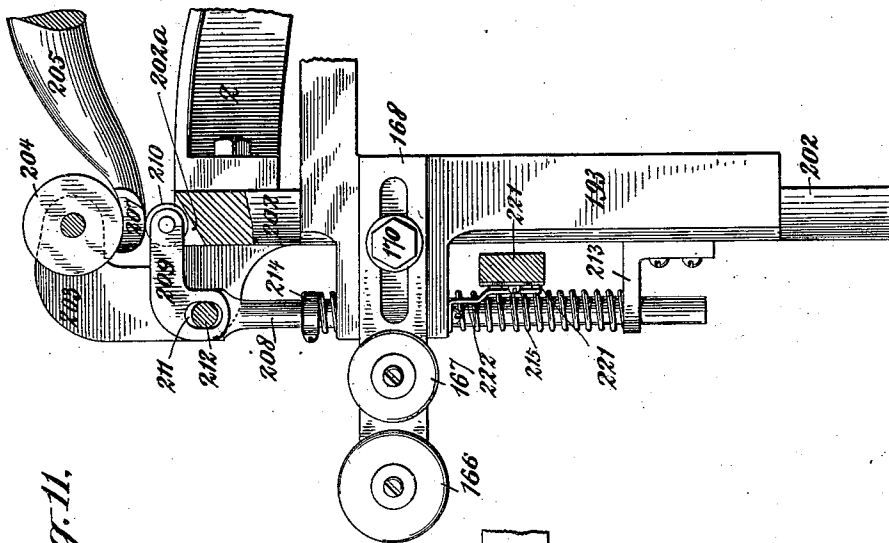


Fig. 11.

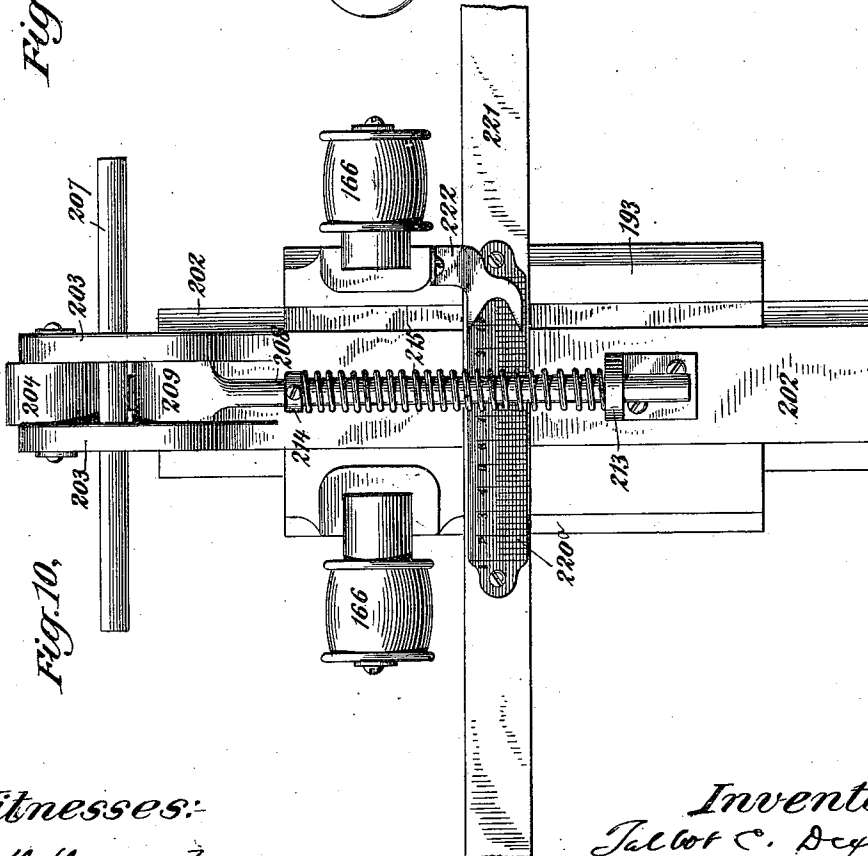


Fig. 10.

Witnesses:

C. H. Hayworth
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(No Model.)

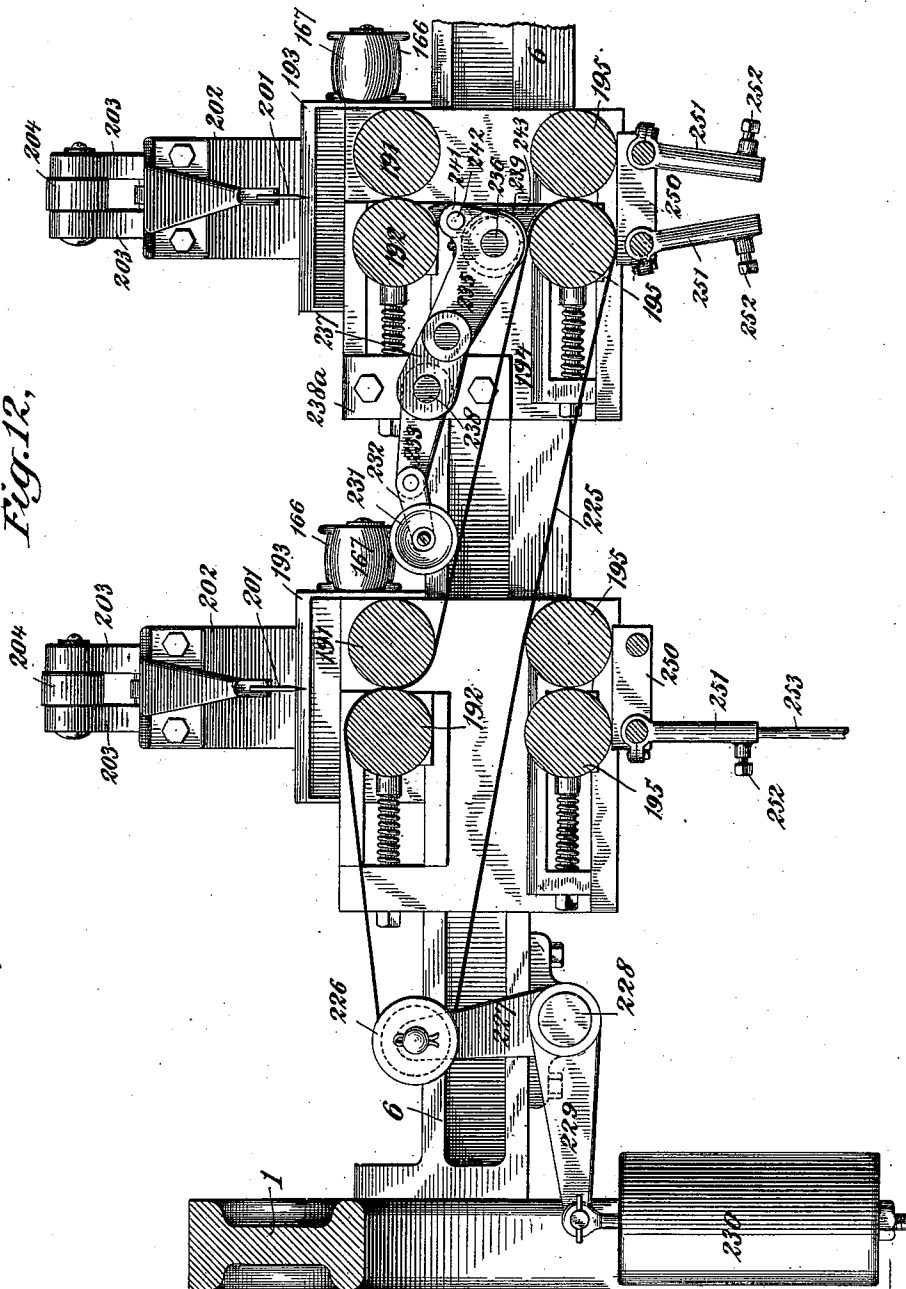
13 Sheets—Sheet 9.

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Fig. 12.



Witnesses:

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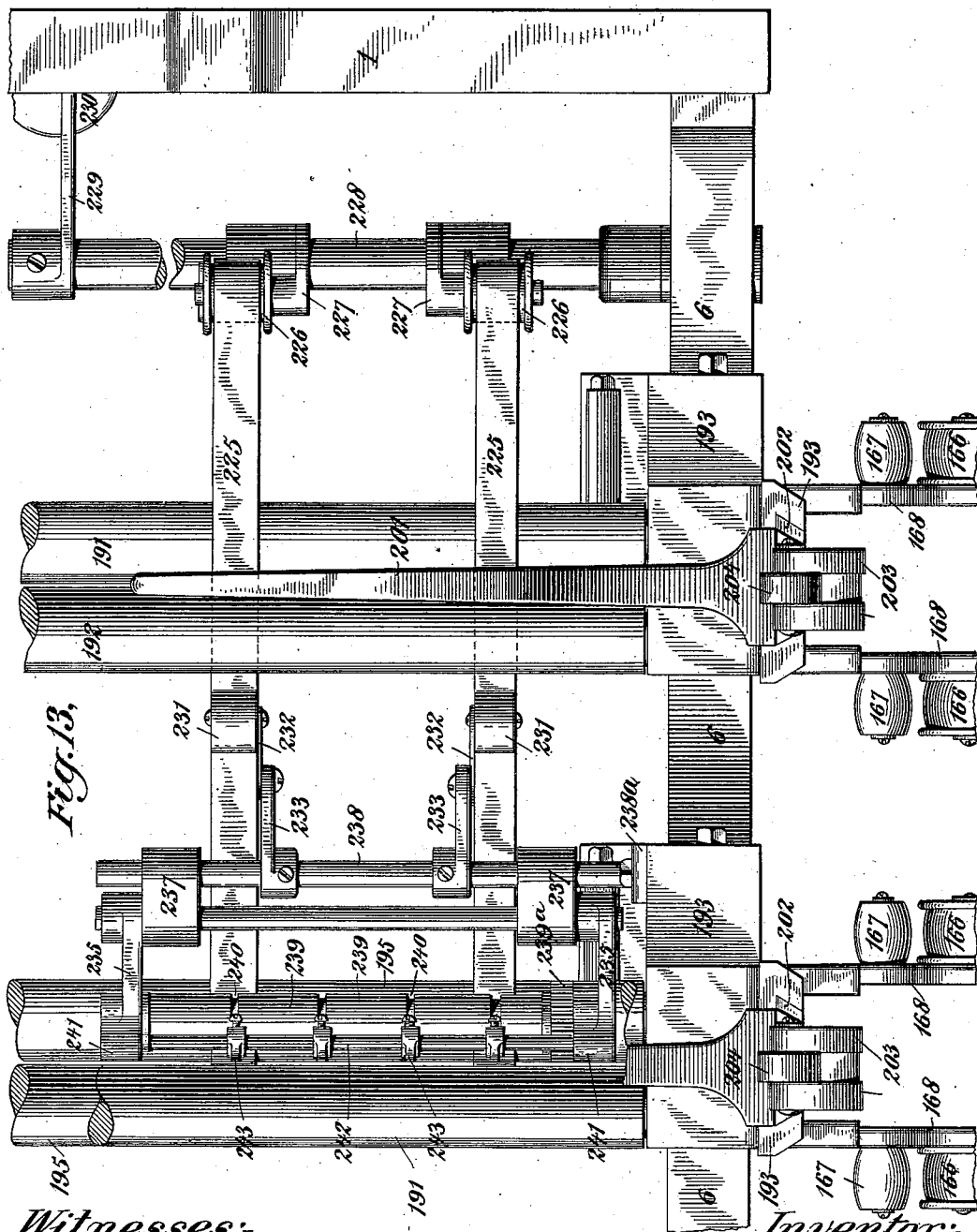


Fig. 13.

Witnesses:-

O. H. Hayward
Geo W. Taylor Jr.

Inventor:-

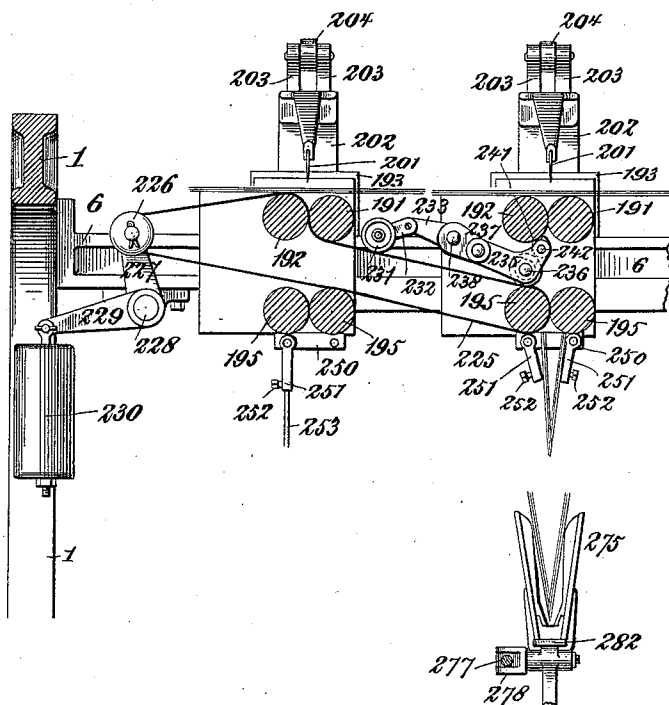
T. C. Dexter
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King & Co. Attys.

T. C. DEXTER.
PAPER FOLDING MACHINE.

No. 564,555.

Patented July 21, 1896.

Fig. 14.



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Fig. 15,

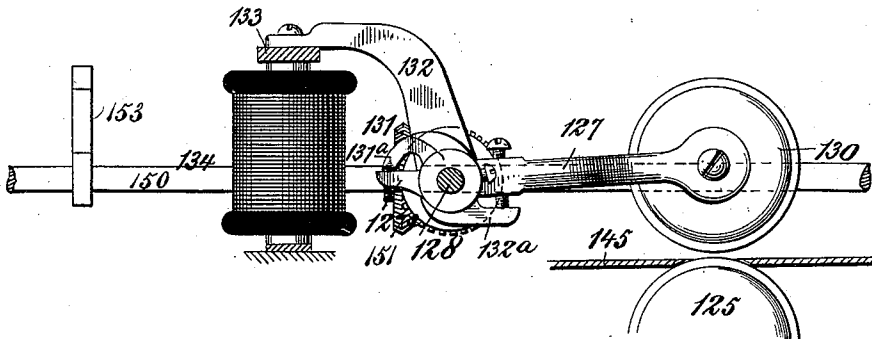
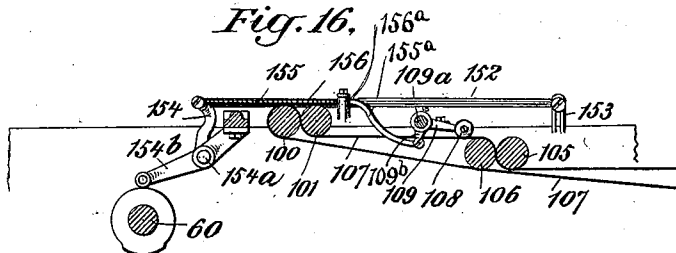


Fig. 16,



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T. C. DEXTER.
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Fig. 17,

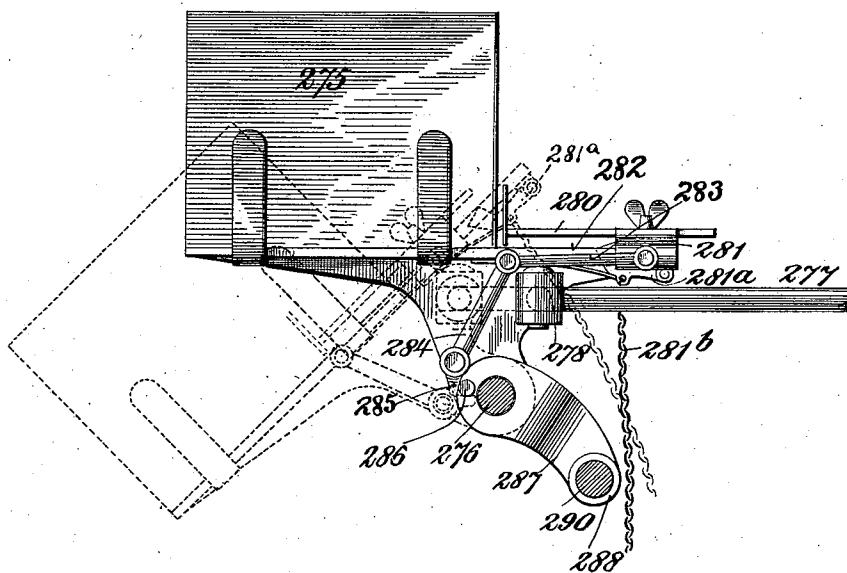
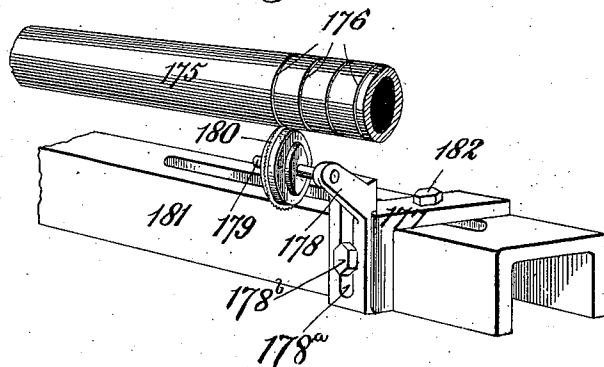


Fig. 18,



WITNESSES:

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J. Green

INVENTOR

Talbot C. Dexter

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Knight Bros.
ATTORNEY

UNITED STATES PATENT OFFICE.

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DEXTER FOLDER COMPANY, OF SAME PLACE.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 564,555, dated July 21, 1896.

Application filed August 12, 1895. Serial No. 559,104. (No model.)

To all whom it may concern:

Be it known that I, TALBOT C. DEXTER, a citizen of the United States, residing at Pearl River, in the county of Rockland and State of New York, have invented certain new and useful Improvements in Folding-Machines, of which the following is a specification.

My improved quadruple sixteen-page folding-machine is designed to fold four signatures of sixteen pages each or two signatures of thirty-two pages each at one operation.

The sheet to be folded is passed into the machine by suitable feeding devices and carried by suitable tapes to the correct position above the first pair of folding-rollers, where it is given its first fold in the center, and passed by other tapes into position over the second pair of rollers, at which point it is laterally adjusted by an improved adjustable electrically-operating registering device and given its second fold parallel to the first. As the paper passes from the second-folding rollers it is severed into four folded strips and conveyed into position above four pairs of third-folding rollers, which impart the final folding at right angles to the first and second folds and deliver the four folded signatures of sixteen pages each to four pairs of calendering-rollers, from which the signatures drop into the packing devices. If it is desired to produce two signatures of thirty-two pages instead of four of sixteen pages, the signatures from two pairs of the third-fold rollers are conveyed to the calendering-rollers below the other two pairs of third-fold rollers and follow and drop into the preceding signatures folded by said latter pairs of third-fold rollers and form signatures of thirty-two pages.

It is a conceded fact that it is quite impracticable to make four folds in a single sheet of paper to get thirty-two-page signatures, owing to the thickness of the sheet and the tendency of the pages to be drawn out of shape by the very great strain they are subjected to in making the last fold. The common method of inserting by passing two partly-folded sheets, one over the other, into position above the last-fold rollers and folding both sheets at the same time, one into the other, is also very objectionable on ac-

count of the trouble in gaging the two sheets and because it is more difficult to fold them both at the same time. It will therefore be obvious that by my improved method of separately folding the two parts and afterward inserting one within the other I obviate the difficulties enumerated and produce a thirty-two-page signature in a much simpler way.

To render the lateral adjustment of the sheet more accurate, I arrange my adjustable electrical registering device between the first and second folds at such a point that it will register the sheet at or very close to the extreme corner of the fold of the once-folded sheet, as the variation, if any, in the overlapping edges will scarcely be perceptible at the point of first fold. The construction and operation of this adjustable electrically-controlled register is quite important.

Another important feature of my invention is the location and construction of the splitting devices for severing the twice-folded sheet into four parts. I provide three cutting-disks which operate in conjunction with grooved sleeves mounted upon one of the second-fold rollers, the cutters and sleeves being adjustable to regulate the point of severance. I provide an essentially novel arrangement for operating the reciprocating folding-knives which operate in conjunction with the pairs of third-fold rollers in order that they can be adjusted to the proper points with relation to the cutters, the third-fold rollers and their knives being mounted upon adjustable carriages sliding upon the main frame. I provide an upper and lower packing-box, into which the folded signatures are delivered, the signatures for the lower packing-box being received first into a pivoted hopper, which is provided with a novel ejecting device and is adapted to throw the folded signatures into position in the lower packing-box. I also provide suitable means for simultaneously and relatively adjusting the two packing-boxes, the pivoted hoppers, and their operating mechanisms, in order that they will properly cooperate with the devices for imparting the third folds to the signatures in any adjusted position.

My invention consists, further, of novel features of construction, and in order that

my improvements will be fully understood I will first describe the same with reference to the accompanying drawings and afterward point out with more particularity the novelty in the annexed claims.

In said drawings, Figure 1 is a general plan view of my improved folding-machine. Fig. 2 is a rear elevation of the same, looking at the packing-boxes and mechanism for imparting the third fold to the signatures. Fig. 3 is a side elevation of the machine, looking at the right-hand side of Fig. 1. Fig. 4 is a side elevation of the machine, looking at the left-hand side of Fig. 1. Fig. 5 is a longitudinal sectional elevation taken on the line 5 5 of Figs. 1 and 2 and looking toward the right of the machine. Fig. 6 is a front elevation of the packing-boxes and pivoted hoppers with their operating mechanism, looking toward the rear of the machine. Fig. 7 is an enlarged detail sectional elevation taken on the line 7 7 of Fig. 6 and looking toward the left-hand end of the machine. Fig. 8 is an enlarged detail plan, and Fig. 9 is an enlarged detail sectional elevation, of part of a machine, showing one of the severing devices and the electrically-operated lateral adjustment. Figs. 10 and 11 are, respectively, a rear elevation and sectional side elevation of part of the mechanism, showing the device for operating the third-fold knives. Fig. 12 is an enlarged detail longitudinal view taken through the third-fold rollers and calendering-rollers, showing the manner of inserting one sixteen-page signature into another for forming the signature of thirty-two pages. Fig. 13 is an enlarged detail plan view of the same. Fig. 14 is a sectional representation of the manner of inserting one signature into another for forming a signature of thirty-two pages. Fig. 15 is an enlarged detail view of part of the lateral registering device. Fig. 16 is a detail view showing means for elevating small wooden rollers out of operative position. Fig. 17 is an enlarged detail elevation of the pivoted paper-hopper and the paper-ejecting device. Fig. 18 is an enlarged detail perspective view of the cutting devices.

The frame of my machine comprises the side frames 1 and 2, the top front rail 3, the bottom front rail 4, the central rail 5, the rear rail 6, and the packing-boxes-supporting rail 7, the rails 3, 4, 5, 6, and 7 extending between the side frames 1 and 2, and being securely bolted to them and properly braced to form a stout supporting-frame.

10 is a large tape pulley or roller journaled in the bars 11 of the frame-pieces 1 and 2 at the forward end of the machine.

12 is another tape-roller journaled at 13 in the frame-pieces 1 and 2, and 14 are a series of endless carrying-tapes, which pass over the rollers 10 and 12, around the guide-pulleys 15 and 16, and over the tightening-pulleys 17, which latter are journaled in the upper ends of the arms 18, pivoted at 19 to the brackets 20, and carrying tightening-weights 21 at their

outer ends. In this manner the carrying-tapes are always held taut independently of each other and allowed to travel freely around the rollers for carrying the paper into the machine.

25 is a pulley-shaft journaled in the frame-pieces 1 and 2 parallel to the pulley 12, and provided at intervals along its length with tape-pulleys, around which the endless carrying-tapes 26 pass. Tapes 26 also pass around the pulleys 28, supported in the forward ends of the arms 29, adjustably secured to the cross-bar 30, and over the guide-pulleys 27 and 32, which hold them up to their work. It will be observed that the tapes 14 extend from the forward end of the machine to the first-fold rollers, while the tapes 26 extend from the first-fold rollers to the end registering device.

35 are a series of rods having forward up-turned ends 35^a and extending from front to rear of the machine, and 36 are shorter rods extending from points adjacent to the front to the first-fold rollers. The rods 35 and 36 are secured to the cross-slats 37, and are supported directly above the carrying-tapes 14 and 26, and serve to hold the paper on the tapes and prevent its buckling.

40 is the end registering guide or blade, formed with lugs 41, which have screw-threaded openings through them for the reception of the adjusting-screws 42, which are properly journaled above the carrying-tapes and have bevel-gear connection with the transverse shaft 44, having an operating hand-wheel 45. By rotating the hand-wheel 45 the position of the end registering-blade 40 can be adjusted in a manner well understood.

50 is the first-fold knife, secured in the outer ends of the arms 51, which are keyed to the rock-shaft 52. The knife 50 is notched or slotted at its working edge for the reception of the rods 35 when the knife descends for creasing the paper and carrying it into the bite of the first-fold rollers 100 and 101, presently to be described. The rock-shaft 52 has keyed to one of its ends a crank-arm 58, having a roller journaled in its lower end which works on the face of the cam 59, keyed to the rotatable shaft 60.

54 is a crank-arm keyed to the shaft 52 inside of the arm 58, and 53 is a rod secured to the outer end of the arm 54 and extending through an opening in lug 55 on the front leg of frame-piece 2.

56 is a spiral spring surrounding the rod 53 and confined between the lug 55 and an adjustable collar 57, secured to the rod. The spring 56 assists the gravitating action of folding-knife 50 under the control of the cam 59.

65 and 66 are bars extending across the machine and supporting the plates 67, which extend parallel and form the slot or opening in which the folding-knife operates to form the crease for the first fold.

68 are slats extending to the rear and front from the bars 65 and 66 to assist the tapes 14 and 26 in supporting the sheet of paper.

70 is an intermittently-rotatable shaft, carrying the three feed-rollers 71, which are adapted to operate in conjunction with the tape-roller 10 for feeding the paper into the machine. The shaft 70 is journaled in the forward ends of the rock-arms 72 and 73, which are keyed to the rock-shaft 74. The arm 73 is extended beyond the rock-shaft 74 and provided with a roller 73^a at its end, which operates on the face of cam 75, which is keyed to the shaft 60 just inside of side frame 1.

80 are feed-regulating fingers secured to brackets 81, keyed to the rock-shaft 82, which is provided with a spiral spring 84 for holding the fingers normally in lowered position, and a rock-arm 85, which is intermittently tripped by a finger or lug (not shown) carried by arm 73, by means of which the fingers are intermittently raised.

The mechanisms for operating the drop-rollers 71 and feed-regulating fingers 80 are so timed that the rollers 71 (which are held normally out of contact with the paper) will drop upon the edge of the paper for feeding the sheet to the machine the instant the fingers 80 are raised.

90 is a rotatable shaft journaled in the top bars of the frames 1 and 2 and carrying a pair of rollers 91, whose surfaces are in the plane with the tapes 14 and slats 68.

92 are retarding-rollers journaled in the ends of arms 93, which are adjustably keyed to the rock-shaft 94, which is provided with crank-arm 95, having roller 96, which works on the face of cam 97, keyed to the shaft 60. The shaft 90 is constantly rotated by suitable gearing between it and the constantly-rotating tape-roller 12. The rollers 92 are adapted to rest on the surface of the paper being fed into the machine for an instant before the forward end of the paper strikes the registering-blade 40, to slow up the movement of the paper and prevent its striking the blade 40 too quickly and buckling the paper. As soon as the end of the paper has registered against the blade 40 the folding-blade descends to make the first fold by passing the paper through the folding-rollers 100 and 101, which are journaled in suitable bearings in the top bars of the side frame.

100 is the positively-driven roller of the first-fold rollers, receiving its power from the large gear-wheel 102, keyed to the shaft 60. The roller 101 has spring-pressed journals for taking any unevenness in the paper.

105 and 106 are the second-fold rollers, supported in suitable journals in the plane slightly below the first-fold rollers and parallel thereto.

107 are carrying-tapes extending between the roller 100 and the roller 106 for conveying the paper into position for the second fold.

108 are a series of small wooden rollers journaled upon pivoted arms 109 and resting normally on the tapes 107 for holding the paper in contact therewith. The arms 109 are mounted upon a rock-shaft 109^a, which

is normally in position to allow the rollers 108 to rotate in contact with the paper above the tapes to steady the feed and insure the sheets being pushed firmly against the end adjusting-gage. Keyed to the rock-shaft 109^a is a crank-arm 109^b, which is pivotally connected to an extension 155^a of the sliding rod 155, said sliding rod having bearing in a lug 156^a attached to the side frame and carrying a spiral spring 156, which is confined between said lug and a collar on the rod and tends to hold the rollers 108 into operative position in contact with the tape with a yielding pressure. The end of rod 155 is pivoted to a crank-arm 154 keyed to a rock-shaft 154^a having an operating crank-arm 154^b which is actuated by a cam on shaft 60, as shown in Fig. 16, for raising the rollers 108 during the intervals that the lateral register (controlled by the same cam and levers) operates.

Where a sheet of paper is to pass over a pair of rollers, and especially where you cannot have carrying-tapes in front of these rollers, it is necessary to use considerable energy on the rear of the sheet in order to insure of its being properly adjusted to the front gage. As soon as the sheet has touched the gage, however, these wheels have performed their work, and if allowed to rest on the paper while it is being drawn laterally by the electric registering device would have a tendency to counteract the action of the friction-wheels of this registering device, therefore I have found it feasible for automatically lifting these wooden friction-rollers as the registering drop-roller descends upon the sheet. That is, when the registering device is in operation, drawing the sheet laterally, the wooden wheels will be elevated sufficiently to prevent their causing unnecessary friction to the surface of the sheet; but just as soon as the lateral register has completed its work said wooden wheels will be again dropped into operative position in readiness to operate upon the succeeding sheet.

110 is the edge registering-blade for the second fold, the first folded edge coming in contact with this blade for registering the paper. The blade 110 is supported and adjusted in the same manner as the registering-blade 40.

111 are supporting-rods supporting the inward portion of the paper before it receives its second fold. The inward ends of the rods 111 are curved slightly to conform to the surface of the roller 105.

It is of the utmost importance that the folds for the class of work executed by this machine should be very accurately made in the center margins of the sheets. I am enabled to accomplish this by my improved adjustable electrical register. It will be understood that the first-fold gage will regulate the sheet perfectly parallel with the first-fold rollers, and that is sufficient until it has reached its position at the second fold, as it is unimportant what position the sheet occu-

pies laterally for the first fold. It must now be registered laterally very perfectly in order to bring it in position for being separated and folded exactly in the center of the blank margins, the accuracy of both being determined by the side registering device.

The lateral registering of the sheet is usually accomplished by a suitable device supported a few inches (from three to ten inches) from the front-edge registering-blade before the sheet receives its first fold, and as the device has but a single thickness or one edge of the sheet to deal with, and its position is relatively the same as the lateral registering device on the feed which supplied the sheet to the printing-press, the result is perfectly satisfactory. When, however, the sheet is registered laterally after it has been once folded, as in my present machine, (it being desirable to laterally register the sheet as close as possible to the cutting devices and third-folding rollers for the sake of accuracy,) the problem is a very different one, for it is a well-known fact that it is very difficult to get sheets of paper made so accurately that the edges are perfectly square and will register or be perfectly even when the sheet is once folded. As the edges of the sheet are, therefore, liable to project unevenly, it will be clear that a lateral adjustment would not be accurate if acted upon by the edge which projects farthest of the two uneven edges. To overcome this difficulty and provide a lateral register which will accurately register a sheet after it has been once folded, I provide an adjustable electrically-controlled register mounted at the right-hand side of the machine adjacent to the end registering-blade, and having a circuit-making lever which is adjustable on its supporting-bar to enable it to be adjusted to such a point that it will be acted upon by the extreme corner or edge of the once-folded sheet. In this case it would make little or no difference if the sheets were out of square, because the variation in the overlapping edges would not be perceptible at the point of fold.

Supported adjacent to the registering-blade 110, at the right-hand edge of the machine, is my improved electrically-operating lateral adjustment just referred to, which will now be more particularly described.

115 is a supporting guide-frame extending inwardly from the top rail of main side frame 1, and carrying the rotatable rod 116 and rotatable screw-threaded adjusting-rod 117.

118 is a movable carriage provided with a depending screw-threaded lug 119, through which the rod 117 passes.

120 is a hand-wheel on the outer end of rod 117, by means of which the rod 117 can be rotated and the carriage 118 moved inwardly or outwardly on the guide-frame 115.

The adjustable carriage 118 carries my improved electrical adjusting device. It comprises a continuously-operating roller, an

electrically-controlled drop-roller adapted to cooperate with the continuously-operating roller, an electromagnetic device, and an adjustable registering-arm adapted to be operated upon by the extreme folded edge or corner of the once-folded paper for closing an electric circuit and lifting the drop-roller out of operative position. Means are also provided for supporting the roller in inoperative position for the intervals between the registering of sheets.

125 is the continuously-rotating roller, (shown in dotted lines in Fig. 9,) said roller being mounted upon a short cross-shaft journaled in suitable bearings and receiving motion through suitable bevel-gearing with the rotatable shaft 116, which is rotated by gear-wheel 126.

127 is a short arm loosely journaled upon a cross-shaft 128, supported in bearings 129 and having journaled in its forward bifurcated end the drop-roller 130, which is supported directly above roller 125 and cooperates with it.

131 is a collar keyed to the short shaft 128, which supports arm 127 and formed with an integral lug 131^a, which is adapted to engage a similar lug or heel 127^a projecting from the arm 127, and by said engagement and the partial rotation of short shaft 128 hold the arm 127 and roller 130 in inoperative position.

132 is an armature-lever loosely journaled upon the shaft 128 and carrying at its free end the armature 133, and formed with the heel or lug 132^a, which is adapted to engage the end of an adjustable screw carried by the arm 127 and lift the roller 130 when the electromagnet is energized.

134 are the electromagnets.

135 is a square bar journaled at its ends between the brackets 136 and having keyed to it adjacent to one of the brackets an insulated contact-arm 137, which is adapted to contact with the point 138 and is connected with the circuit-wire 139.

140 is the other circuit-wire, the battery not being shown.

141 is the laterally registering blade or arm, which has a square opening at its upper end through which the pivoted square bar 135 passes for supporting it. A screw 142 clamps the arm 141 adjustably to the bar 135.

145 is a plate mounted on the carriage 118 and having its forward end conforming to the surface of the roller 105.

146 is a curved plate supported by bracket 147 above the plate 145. The right-hand edge of the once-folded paper is adapted to pass over the second-fold rollers 105 and 106, between the plates 145 and 146, and also between rollers 127 and 130.

150 is a rock-shaft suitably journaled in the carriage 118 and having bevel-gear 151, which meshes with a similar gear on the short shaft 128.

152 is a rod pivoted to the rock-arm 153 of the shaft 150 and extending forwardly, where

it is pivoted to the upper end of the pivoted crank-arm 154, having a rearwardly-extending pivoted rod 155, carrying a spiral spring 156 and extending through an opening in a suitable lug attached to the side frame, said spring being confined between said lug and a collar on the rod. The crank arm or lever 154 is keyed to a short rock-shaft 154^a and has an arm 154^b projecting from it, which is operated by a suitable cam on shaft 60, shaped to allow spring 156 to hold the roller 130 elevated from the surface of the paper after it has once been elevated by the electric device until the succeeding sheet reaches the position in which it must be registered, when the cam shifts the crank-arm 154 and rod 152 against the action of the spring and allows roller 130 to again drop into engagement with the paper. It will be clear from the previous description that the action of the cam in releasing the roller 130 also raises the rollers 108.

160 is the second-folding knife, supported at the forward ends of the arms 161, which are keyed to the rock-shaft 162, which is intermittently oscillated in the usual way through rod 162^a, which is connected to a crank-arm on the shaft and a lever which is actuated by a cam on shaft 60.

165 are conveying-tapes passing around the second-fold roller 106 and around the adjustable pulleys 166 and guide-pulleys 167 for conveying the four severed sheets from the splitting device into position to be passed through the four pairs of third-fold rollers. The rollers 166 and 167 are journaled upon an adjustable slide 168, which works in grooves in the sides of the carriage-frame piece 193, and are confined in any adjusted position by bolts 170. By this means the tapes 165 can be kept at the stretch.

For cutting the twice-folded sheet into four signatures I employ three cutting devices, one stationary cutting device in the center of the machine and two adjustable devices on opposite sides of the central one. Each cutting device comprises a serrated cutting-disk, which operates in conjunction with grooves in the lower roller 105 of the second-folding pair. A description of one of the devices will suffice for all, as they are identical with the exception that the central device is not made adjustable, all adjustments being made relatively to the center of the machine. The structure of the side cutters is clearly shown in Figs. 8 and 9.

The ends of the roller 105 are reduced in diameter, and upon the reduced ends are placed the sleeves 175, which have annular grooves 176.

177 is a bracket, to which is secured a vertically-adjustable arm 178, carrying the journal 179, upon which is loosely journaled the cutting-disk 180. The arm 178 fits against one of the vertical faces of angle-bracket 177, and is formed with a longitudinal slot 178^a, in which engages a headed bolt 178^b, adjust-

ably threaded and seated in the bracket 177. The bracket 177 is adjustably mounted upon the slotted bar 181, so as to be horizontally adjustable and held in any desired adjusted position by means of the screw-bolt 182.

It will be observed that the cutter 180 can be adjusted to coöperate with any one of the grooves 176 by simply loosening the bolts 182 and 178^b and slipping the arm 178 (carrying cutter 180) down and shifting the bracket 177 horizontally to the proper position for the engagement of the cutter 180 with another groove. The bolt 182 is then tightened and the arm 178 shifted vertically and the bolt 178^b tightened.

183 is a bar bolted or otherwise secured to a yoke engaging the outer end of the sleeve 175 and having a downwardly-projecting lug 184 at its outer end, in which engages an adjusting-screw 185. By means of the screw 185 the sleeves 175 can be adjusted longitudinally upon the reduced ends of the roller 105, and, by first lowering the bolts 182, the cutters 180 can be shifted upon their journal-spindles 179 at the same time by reason of the engagement of the grooves 176 therewith.

The arrangement of the cutters 180 in conjunction with the second-fold rollers is very important, as the sheet is only allowed to travel a very few inches after being separated when it comes in contact with the last-fold adjusting-guides, or by the time the rear edge is severed the forward edge is almost in contact with the adjustable guides.

In adjusting the cutting devices just described to suit a piece of work to be performed the outside cutters are first adjusted into engagement with the grooves nearest the desired lines of severance in the manner explained, and then the final adjustments are accomplished through the screws 185. It is important to have the sleeves 175 cover as much of the reduced ends of roller 105 as possible, so as not to interfere with its folding action, and to accomplish this, and at the same time afford the necessary scope of adjustment, the sleeves are made long and provided with a number of grooves, into which the cutters can be adjusted, part of the adjustment being accomplished by the movable cutters and part by the sleeves.

There are four pairs of third-fold rollers, supported at right angles to the first and second fold rollers and below the plane of the second-fold rollers. The tapes 165 convey the four severed pieces of the twice-folded sheet longitudinally above the third-fold rollers until the folded edges contact with the adjustable guides 190, (two for each pair of third-fold rollers, arranged one on each side of the vertically-reciprocating knife,) at which moment the knives for passing the paper through the third-fold rollers descend and form the final creases in the four signatures.

191 is the driver, and 192 the driven third-fold rollers, suitably journaled in the adjustable boxes or carriage side frames 193 and

194, which fit around and slide upon the main frame-rails 5 and 6, the lower edges of the side frame 193 and 194 being preferably dovetailed onto the rails. The rollers 191 are extended beyond the inner side of the carriages and have bevel-gears keyed to their extended ends, which mesh with similar gears splined to the shaft 309, a frame-piece or yoke 310 extending from each carriage and embracing the gears on the shaft, so as to cause them to slide with the carriages.

195 are calendering-rollers, also journaled in the boxes or carriage-frames 193 and 194 and receiving rotation from suitable gearing between them and the third-fold rollers. The purpose of these calender-rollers is to give the folded signatures an extra pressure while they are in transit to the packing-boxes.

196 are screw-threaded lugs depending from the carriages 193 and 194, and 197 are screw-threaded shafts engaging the opening in said lugs and having bevel-gear connection 198 with the shaft 199, which extends at right angles to the shafts 197 and is provided at its outer end with an operating hand-wheel 200. By means of the screw-threaded shafts 197 and the operating mechanism the carriages 193 194 and the rollers and their mechanism carried thereby can be adjusted to any desired position independently of each other to suit the different-sized sheets to be folded.

The folding-knives for creasing and starting the paper through the third-fold rollers have a reciprocating instead of an oscillatory movement and are operated by essentially novel and effective devices, which are operated from a single cam, are independently adjustable, and permit the free and independent adjustment of the carriages carrying the third-fold rollers and calenders without necessitating their disengagement. This mechanism will now be described.

201 is the folding-knife, secured to the dovetailed reciprocating bar 202, which is dovetailed into the carriage 193. Extending up from and formed integral with the bar 202 are the lugs 203, between which is journaled a friction-roller 204.

205 is a crank-arm keyed to the shaft 206 and having formed on its free end a curved blade or palm 207, which engages under the roller 204.

208 is a rod formed with the right-angled head 209, having a roller 210 journaled in its bifurcated end, and with which the under face of the palm 207 engages. The upper edge of the bar 202 is cut out sufficiently at 202^a to receive the roller 210.

211 is a slot formed in the head 209, through which passes a pin 212, which is secured in the arms 203 and guides and allows a slight movement of the rod 208. The rod 208 extends down through an opening in a bracket 213 and has an adjustable collar 214, which confines a spiral spring 215 between it and the bracket 213. The tendency of the spring 215 is to hold the rod 208 in elevated position

and the roller 210 in engagement with the under side of the palm 207, and thereby insure constant engagement between the palm and the roller 204. The spring 215 also receives the downward thrust imparted by the cranks 205 for reciprocating the knives and relieves the reciprocating frame from shock. The engagement of the palms 207 with rollers 204 raises the frame and knife to elevated position with the crank 205.

It will be observed that the broad palms 207 will allow for the independent adjustment of the carriages 193 and 194 and the crank-arms 205 on shaft 206, and as the carriages carrying third-folding devices are adjusted toward and away from the center the outside palms should be longer than the inside ones. The crank-arms 205 are adjustably keyed to the shaft 206 by means of the integral heels 205^a, which rest in openings 206^a formed in the boxes 206^b and secured in adjusted position by means of screws 216. The boxes 206^b are also adjustably keyed to the shaft 206.

217 is a rock-arm keyed to the right-hand end of the shaft 206, and 218 is a rod pivoted to the upper end of rock-arm 217 and extending forwardly, where it is pivoted to the upper end of a pivoted operating-lever 219 operated upon (at its lower end) by a cam 220 keyed to the shaft 60. The cam is so shaped and timed that the knives will be reciprocated at the proper intervals.

220^a are scales secured to bar 221 of the main frame, and 222 are indexes secured to the carriage-frames 193 and adapted to register with said scales for indicating the positions of the carriages, in order that they can be readily adjusted to proper relative position.

When it is desired to produce four signatures of sixteen pages each, the folded signatures are passed directly through the first, second, and third fold rollers and calendering-rollers (the first and second folds being parallel and the third folds at right angles thereto, and the sheet being laterally adjusted after the first fold and severed into four signatures after the second fold) and into the hoppers and four separate packing-boxes, which will presently be described in a manner well understood. The two outer signatures drop directly into the upper packing-boxes, while the central ones drop first into the hoppers and are thrown by them into the lower packing-boxes. When, however, it is desired to produce two signatures of thirty-two pages each, I insert two of the four completely-folded sixteen-page signatures into the other two completely-folded signatures before delivering them to the packing devices. I consider this to be a very important feature of my machine and far superior to and more accurate than the common method of inserting by passing two partly-folded sheets, one over the other, into position above the last-fold rollers, through which both sheets are passed, at the same time folding one into the other. The means which I employ for accomplishing this

result are clearly illustrated in Figs. 12, 13, and 14 of the drawings.

Passing around the roller 192 of one pair of third-fold rollers, the tightening-rollers 226, and one of the calendering-rollers 195 of an adjacent set of folding devices are the carrying-tapes 225, which convey one sixteen-page signature over into position to drop into another for forming a thirty-two-page signature.

10 The rollers 226 are journaled upon crank-arms 227, which are keyed to a short shaft 228 journaled to the rails 5 and 6.

229 is a crank-arm, also keyed to the shaft 228 and having a weight 230 attached to its outer end to properly regulate the tension of the tapes 225 and hold them stretched. When the carriages 193 194 of the two adjacent sets of folding devices, which are paired together by the tapes 225, are adjusted closer together or farther apart to receive the severed folded pieces the weight 230 will take up the slack or allow a greater length of the tapes 225.

231 are a pair of rollers journaled in the pivoted arms 232, which are pivoted to arms 233, the rollers 231 being adapted to rest upon the signatures carried by the tapes 225 over to the calendering-rollers to be inserted into the previously-folded signature from the other third-fold rollers of the coupled sets of folding devices. The arms 233 are secured to rod 238, which is supported in the carriage 193 194 by plates 238^a.

235 are arms pivoted upon the rod 236, which is supported by brackets 237 from the rod 238. Journaled in the forward ends of the arms 235 is a friction-roller 239, formed with annular grooves 240 and adapted to rest on the tapes 225 just above one of the calendering-rollers 195, and having a gear 239^a which gears with the cog geared to one of the calendering-rollers. The arms 235 have upwardly-extending ears 241, in which is journaled a small shaft 242, carrying a series of guide-fingers 243, which are curved at their lower ends to turn or guide the edge of the signature to be inserted down into the bite of the calendering-rollers and also to guide the receiving-signature from the third-fold rollers to the calendering-rollers, the friction-roller 239 serving to drive the signatures through the calender-rollers.

The process of inserting to form signatures of thirty-two pages is as follows: The full sheets of four sixteen-page signatures are fed into the folder in the usual way and receive the first, second, and third folds just the same as they do when they are to be delivered singly. The two signatures nearest the center of the machine, or directly over the hoppers, will, of course, reach their positions in the hoppers a little in advance of the signatures from the two outside third-fold rollers. The hoppers are V-shaped or so arranged as to have their sides inclined outward at the top while in the act of receiving signatures. The first signatures being dropped into the hoppers, their natural tendency will be to as-

sume the form of the hoppers. Almost instantly the signatures from the sides will be dropped into the hoppers and inside of the preceding signatures of sixteen pages, and thus by putting one sixteen-page signature into another produce signatures of thirty-two pages. As soon as one sixteen-page signature is dropped into the other the hoppers will be tilted forward, depositing the thirty-two-page signatures into the packing-box, it being understood that the movement of the hopper into its inclined position will cause the sheets to slide from them into the box.

I am aware that a machine has been constructed to produce two thirty-two-page signatures by cutting the main sheet into two parts and folding each half four times; but in folding the paper four times there is a very objectionable "draw" in the sheets, caused by one thickness being unsevered, and I therefore consider my arrangement for forming thirty-two-page signatures to be far better, as there are only three folds made.

The tapes 225 are thrown off of the tightening-pulleys 226, when it is not desired to insert one signature in another, and moved to one side, where a portion of each roll may be turned away to allow room for the tapes to be tied back out of the way. The guide-fingers may be left in position at all times, but if desired they may be easily removed with the friction-rollers by unbolting the plates 238^a. If desired, means for lifting the rollers out of operative position may be provided, and also springs may be employed to hold the friction-roller into operative contact and yet allow it to regulate itself to the thickness of the folded signature passing through it. Pivoted to the frame-piece 250, directly beneath the calendering-rollers 195, are hollow arms 251, provided with screws 252, adapted to clamp the extensible rods 253 and secure them to the arms or holders 251. The extensible guide-rods 253 assist in guiding the folded signatures into the pivoted hoppers or packing-boxes, and may be employed to engage the upper corners of the signatures to assist in supporting them as fast as they are put in place by the packers.

260 and 261 are parallel guide-frames supported from the rail 7 above and below.

263, 264, 265, and 266 are the packing-boxes, formed with grooved guide-flanges 267, which engage the parallel guides 260 and support the packing-boxes and allow them to be adjusted longitudinally—that is, transversely on the machine. Additional guides are also provided for properly supporting the packing-boxes.

268 are pivoted spring flaps or fingers, (two for each packing-box,) which operate in suitable openings in the sides of the packing-boxes for allowing the folded signatures to pass in one direction under the action of the reciprocating packer and prevent them from moving back.

269 are the movable ends of the packing-

boxes, having spring-arms for holding them in position with a yielding pressure. The ends 269 give as the signatures are packed into the boxes.

- 5 270 are the reciprocating packers, formed with depending lugs 271, which are keyed to reciprocating rods 272. The rods 272 are journaled in suitable bearings in the packing-boxes and are reciprocated by rod-and-crank connections with suitable cams on the

10 cam-shaft 60 in a manner well understood. It will be observed that the boxes 263 and 264 are supported directly below the guide-rods 253 under the calendering-rollers, so

15 that the folded signatures may fall directly into them. The boxes 265 and 266 are supported at a lower level and farther to the rear, so that it is necessary to provide some means for throwing or transferring the folded

20 signatures into them. For this purpose I provide a pair of independently-adjusted pivoted hoppers which are adapted to receive the folded signatures and throw them into the packing-boxes 265 and 266.

- 25 275 are the open-ended pivoted hoppers, journaled upon the stationary rod or shaft 276 and of substantially V shape in cross-section.

277 are rods connected by universal joints

30 278 with the hoppers 275 and at their other ends with pivoted levers 279, operated by suitable cams on the shaft 60. By the action of the cams upon the levers 279 the hoppers 275 are rocked upon their supporting-shaft

35 276 and thrown from the position shown in Figs. 5 and 7 (full lines) over into the position shown in Figs. 7 and 17 (dotted lines) for delivering a folded signature into one of the lower boxes 265 or 266.

- 40 Though I prefer to form the hoppers 275 of V-shaped cross-section, I would have it understood that they will operate with square bottom and sides or with U-shaped cross-section.

45 For the purpose of insuring the immediate expulsion of the folded sheet from the pivoted hopper I provide a kicker 280, which has a rearwardly-extending rod adjustably secured in a sliding block 281, which is dovetailed upon a rearwardly-extending bar 282

50 of the pivoted hopper. When the hopper is in normal position for receiving a folded sheet, the kicker is held in raised position by the spring-latch 281^a, pivoted to a lug on bar 282 and working in a slot in the bar (see

55 dotted lines) and engaging the forward edge of the block 281, and upon the movement of the hopper upon its shaft into its lower position the chain 281^b withdraws the catch 281^a and releases block 281 and allows the gravity of the kicker to throw it down and bring it suddenly into contact with the edge of the folded signature and quickly eject it from the hopper into the packing-box.

- 60 283 and 284 are a pair of levers pivoted together and respectively to the block 281 and

lower supporting part of hopper 275. The lever 284, which is pivoted to the hopper adjacent to its journal, is formed with a projecting heel 285, which is adapted to be engaged by a pin or lug upon the yoke 287, which embraces the journal of the pivoted hopper. The effect of this arrangement will be to elevate the reciprocating kicker when the pivoted hopper is elevated by reason of the engagement of the lug or heel 285 with the pin 286 moving the lever 283 positively in the direction to slide block 281 into elevated or rear position, when the latch 281^a will spring into engagement with and hold it. One of

70 75 80

these kicking devices is provided for each pivoted hopper. When the machine is producing two thirty-two-page signatures, the upper packing-boxes 263 and 264 are not used, the signatures being

85 delivered to the pivoted hoppers and by them thrown into the lower boxes. As the pivoted hoppers are held horizontally while they receive the signatures, it will be observed that the inserted signatures will be closely packed

90 in the receiving-signatures and they can be more satisfactorily packed.

When the machine is producing four sixteen-page signatures and it is not desired to insert, the movement of the hopper may be

95 dispensed with and it may be left in its downwardly-inclined position, as shown in Fig. 7. The two central signatures would then drop from their calender-rollers and strike the upper ends of the hoppers, and tilt themselves in

100 precisely the same way that they do when falling directly into the upper boxes. In machines that do not need the inserting devices the expense can be lessened by dispensing with the movement of the hoppers.

105 It is necessary to provide means for properly adjusting the packing-boxes and pivoted hoppers into proper relation with the third-fold rollers and calendering-rollers, so that the folded signatures will drop into

110 proper position. To accomplish this I provide the following mechanism:

287 are yokes sliding on the rod 276 and embracing the journal-supports of the pivoted hoppers. The yokes 287 have screw-

115 threaded eyes 288, through which passes a right and left screw-threaded rod 290, which is properly journaled at 289. The rod 290 is provided with an operating hand-wheel 292, so that the rotation of the rod 290 will shift

120 the pivoted hoppers closer to or farther away from each other.

295 and 296 are parallel threaded shafts having right and left threads which engage in suitable screw-threaded lugs attached to

125 the packing-boxes 263 and 264, 265 and 266, for moving said packing-boxes longitudinally for the purpose of bringing the packing ends into proper position with relation to the calendering-rollers and pivoted hoppers.

130 The shafts 295 and 296 are properly geared to the shaft 290, and the gears so propor-

tioned that all of the packing-boxes and pivoted hoppers will be relatively adjusted by the rotation of the single hand-wheel 292.

300 is an arm suitably supported from the main frame to assist the packers by engaging the upper corners of the signatures in the packing-boxes.

305 is the power-shaft, journaled in the side frames 1 and 2 and having the belt-pulleys 306 on the left-hand end. At the right-hand end of the power-shaft is keyed a small cog-gear 307, which meshes with and drives the large cog-gear 102, which is keyed to the cam-shaft 60, and the small gear 308, which is keyed to the rotatable shaft 309, which drives the third-fold rollers and calender-rollers, as already explained. The large gear 102 also meshes with a suitable gear for driving the tapes 14 and drop-roller. The shaft 309 is geared at left side of machine to the drive-roller 105 of the second-folding pair.

I am aware that it is old to insert one sheet or signature within another by passing the two sheets into position one above the other in a folding-machine and simultaneously folding both sheets, the one being folded within the other. I am also aware that it is old to insert sheets by first folding the inner or insert sheet and inserting it within the outer sheet simultaneously with the folding of the outer sheet. I am not aware, however, that it has ever been proposed to separately fold two sheets to form signatures and subsequently insert one of the previously folded or formed signatures into the other previously-formed signature.

Having thus fully described my invention, the following is what I claim as new therein:

1. In a folding-machine, the combination of the first-fold rollers, suitable feeding devices, the second-fold rollers parallel to the first-fold rollers, the carrying-tapes leading from the first-fold rollers to the second-fold rollers the series of small rollers journaled in rock-arms, means for supporting the rollers normally in operative position, means for raising them intermittently into inoperative position, the second-fold end gage, and the normally inoperative lateral sheet-adjuster, adapted to operate when the small rollers are in inoperative position, substantially as set forth.

2. The combination of suitable folding-rollers, suitable feeding-tapes leading to the folding-rollers, the series of small rollers journaled in rock-arms and adapted to rest normally in contact with the feeding-tapes, a lateral sheet-adjuster supported adjacent to the folding-rollers and comprising a constantly-rotating roller journaled beneath the plane of the tapes, and a normally inoperative coacting drop-roller supported above the plane of the tapes, and suitable operating mechanism controlling the series of small normally operative rollers and the normally inoperative drop-roller of the lateral register, whereby the drop-roller will be dropped into operative position when the series of small rollers is elevated into

inoperative position, and vice versa substantially as and for the purpose set forth.

3. The combination of suitable folding-rollers, suitable feeding-tapes leading to the folding-rollers, the series of small rollers journaled in rock-arms and adapted to rest normally in contact with the feeding-tapes, a lateral sheet-adjuster supported adjacent to the folding-rollers and comprising a constantly-rotating roller journaled beneath the plane of the tapes, and a normally inoperative coacting drop-roller supported above the plane of the tapes, an operating rock-arm, suitable connecting means extending from the operating rock-arm to the rock-arms in which the small rollers are journaled, suitable connecting means extending from the operating rock-arm to the drop-roller of the lateral register, and a constantly-operating cam engaging and controlling the movement of the operating rock-arm and so shaped that the operating rock-arm will be held normally in position to allow the series of small rollers to operate and also hold the drop-roller in inoperative position and will be intermittently rocked to reverse the positions of said rollers, substantially as set forth.

4. The combination of suitable folding-rollers, suitable feeding-tapes leading to the folding-rollers, a rock-shaft carrying rock-arms in which a series of small rollers are journaled, a crank-arm on the rock-shaft, a longitudinally-movable rod pivoted to the crank-arm, a spring holding the rock-shaft normally in position for operation of series of small rollers, a lateral sheet-adjuster supported adjacent to the folding-rollers and comprising a constantly-rotating roller journaled beneath the plane of the tapes, and a normally inoperative coacting drop-roller journaled in a suitable rock-arm, an operating-cam, a rock-arm engaging and controlled by said cam and connected with the longitudinally-movable rod and the drop-roller of the lateral register, whereby the series of small rollers and drop-roller will operate alternately, substantially as set forth.

5. In a folding-machine, the combination of mechanism for effecting the first fold, mechanism for effecting the second fold, means for conveying the sheet from the first-fold mechanism to the second-fold mechanism, and a lateral sheet adjuster or register arranged to register the sheet laterally by the corner of its first fold after it has received its first fold and before it receives its second fold, as set forth.

6. In a folding-machine, the combination of the first-fold rollers, the second-fold rollers, the carrying-tapes, and a lateral sheet-register located adjacent to the tapes leading between the first-fold rollers and second-fold rollers, and adapted to register the corner of the once-folded sheet, substantially as set forth.

7. In a folding-machine, the combination of the first-fold rollers, the second-fold rollers, the carrying-tapes, and the adjustable lateral

sheet-registering device located adjacent to the tapes leading between the first-fold and second-fold rollers and adapted to register the corner of the first fold before the second fold is imparted to the sheet, substantially as set forth.

8. In a folding-machine, the combination of the first-fold rollers, the second-fold rollers, the second-fold end gage, the adjustable carriage supported adjacent to said end gage and carrying the adjustable lateral register comprising a constantly-rotating lower roller, an electrically-controlled drop-roller, and an adjustable circuit-making arm adapted to be engaged by the corner of the once-folded sheet, substantially as set forth.

9. In a folding-machine, the combination of the first-fold rollers, the second-fold rollers, the second-fold end registering-gage, the adjustable carriage supported adjacent to said end gage and carrying the lateral registering device comprising a constantly-rotating roller, a drop-roller, an electromagnet adapted to raise said drop-roller, a pivoted bar carrying a contact, a registering-arm adjustably mounted upon said bar and adapted to be operated by the corner of the once-folded paper, and means for holding the drop-roller in raised position till time to register the succeeding sheet, substantially as set forth.

10. In a folding-machine, the combination of mechanism for effecting the first fold, mechanism for effecting the second fold, means for conveying the sheet from the first-fold mechanism to the second-fold mechanism, and an electrically-controlled lateral sheet adjuster or register adapted to register the sheet between the first and second folds; said registering device comprising a constantly-rotating roller, a drop-roller, an electromagnet controlling the position of the drop-roller, an electric circuit including said magnet, a make-and-break contact in said circuit, and an adjustably-supported registering-arm controlling the make and break and adapted to register and be actuated by the extreme corner of the once-folded sheet, substantially as set forth.

11. In a folding-machine, the combination of a pair of folding-rollers, one of which is formed with a central annular groove and ends reduced in diameter, longitudinally-movable sleeves formed with annular grooves and mounted on said reduced ends, means connected to said sleeves for adjusting their position, a stationary cutting-disk working in conjunction with the central annular groove of said roller, and two adjustably-supported cutting-disks working in conjunction with the grooves of the adjustable sleeves and automatically adjustable with the sleeves by reason of their engagement with the grooves, substantially as set forth.

12. In a folding-machine, the combination of suitable mechanism for effecting the first and second folds of a sheet, with a central fixed cutting device, side cutting devices ad-

justable to and from the fixed center, and mechanisms for effecting the third fold in the separated sections of the twice-folded sheet, said third-fold mechanism being also adjustable to and from the common fixed center, as set forth.

13. In a folding-machine, the combination of the first and second pairs of folding-rollers, the severing devices, the series of independently-adjustable third-fold rollers to which the severed signatures are delivered, the reciprocating folding-knives operating in conjunction with said third-fold rollers and adjustable with them, and a rock-shaft carrying rock-arms formed with broad curved palms which engage the reciprocating folding-knives for operating them and allow them to be adjusted with the third-fold rollers, substantially as set forth.

14. In a folding-machine, the combination of the independently-adjustable pairs of folding-rollers, reciprocating folding-knives working in conjunction with said rollers, a rock-shaft, and a series of independently-adjustable rock-arms keyed to said shaft and formed with broad curved palms which engage and operate the reciprocating knives, substantially as set forth.

15. In a folding-machine, the combination of the independently-adjustable pairs of folding-rollers, the reciprocating folding-knives operating in conjunction therewith, the reciprocating bars to which said knives are attached, the rollers journaled in said bars, the rock-shaft, and the independently-adjustable rock-arms keyed to said shaft and formed with broad curved palms which engage said rollers, substantially as set forth.

16. In a folding-machine, the combination of a pair of folding-rollers, a reciprocating bar carrying a folding-knife, lugs on said bar, a roller journaled between said lugs, a rod carrying a roller at its upper end, a spiral spring surrounding said rod and confined between a bracket on the bar and a collar on the rod, a rock-shaft having a rock-arm, and a broad curved palm formed on said rock-arm and engaging between the two rollers for operating the reciprocating knife, substantially as set forth.

17. In a folding-machine, the combination of the first and second pairs of folding-rollers parallel to each other, the central stationary cutting device and side adjustable cutting devices, and the four adjustable pairs of third-fold rollers, the cutters and third-fold rollers being adapted to be adjusted with relation to the central stationary cutting device, substantially as set forth.

18. In a folding-machine, the combination of suitable folding mechanism constructed to separately form two signatures, with suitable means constructed to subsequently insert one of the previously-formed signatures within the other previously-formed signature substantially as set forth.

19. In a folding-machine, the combination

of the device for severing a sheet into two signatures and separately folding the signatures, with means for subsequently inserting one of the previously-folded signatures with-

5 in the other previously-folded signatures substantially as set forth.

20. In a folding-machine, the combination of suitable devices for folding the several parts or signatures, with a hopper of substantial V shape in cross-section, and means for conveying two completely-folded parts or signatures successively into said hopper to insert one within the other, substantially as set forth.

15 21. In a folding-machine, the combination of the first and second pairs of folding-rollers, the four pairs of third-fold rollers, the two hoppers of substantial V shape in cross-section supported beneath the central two
20 pairs of third-fold rollers and adapted to receive the completely-folded parts or signatures therefrom, and means for conveying the completely-folded parts or signatures from the outside pairs of third-fold rollers and
25 dropping them into the hoppers inside of the signatures from the central pairs of folding-rollers, substantially as and for the purpose set forth.

30 22. In a folding-machine, the combination of two pairs of folding-rollers and their folding-knives adapted to separately form two signatures, with suitable means for subsequently delivering the previously-formed signature from one pair of rollers into the previously-formed signature of the other pair of
35 rollers, substantially as set forth.

23. In a folding-machine, the combination of two pairs of folding-rollers and their folding-knives, with a third pair of rollers supported beneath one pair of folding-rollers,
40 and carrying-tapes leading from the other pair of folding-rollers to said third pair of rollers, whereby one completely-folded signature will be inserted in another substantially
45 as set forth.

24. In a folding-machine, the combination of two pairs of folding-rollers, and their folding-knives, with a third pair of rollers below one pair of folding-rollers, carrying-tapes
50 leading from the other pair of folding-rollers to the third pair of rollers, and guide-fingers 243, substantially as and for the purpose set forth.

25. In a folding-machine, the combination
55 of two pairs of folding-rollers and their folding-knives, with a third pair of rollers supported below one pair of folding-rollers, carrying-tapes extending from the other pair of folding-rollers to said third pair of rollers, the
60 guide-fingers 243, roller 239, and rolls 231, substantially as and for the purpose set forth.

26. In a folding-machine, the combination of two pairs of folding-rollers, and their folding-knives, with a third pair of rollers beneath
65 one pair of folding-rollers, a hopper of substantially V shape in cross-section supported beneath the third pair of rollers, and carrying-

tapes leading from the other pair of folding-rollers to the third pair of rollers, substantially as set forth.

27. In a folding-machine, the combination of the independently-adjustable pairs of folding-rollers and their folding-knives, with the adjustable hoppers and adjustable packing-boxes, substantially as set forth.

28. In a folding-machine, the combination of suitable means for folding a sheet with a horizontally-pivoted vertically-oscillating open-ended hopper adapted to receive the folded sheet from the folding mechanism and
80 throw it out in the direction of its length.

29. In a folding-machine, the combination of suitable means for folding a sheet, a packing-box adapted to receive the sheets on end, and a horizontally-pivoted open-ended hopper oscillated vertically at right angles to the length of the packing-box and adapted to receive the folded sheet from the folding mechanism and throw it into the packing-box substantially as set forth.

30. The combination, in a folding-machine, of a pair of folding-rollers, the packing-box, extending at right angles to the folding-rollers, and an open-ended hopper of substantially V-shaped cross-section horizontally
95 pivoted in position to receive the folded signatures from the rollers and deposit them in the packing-box, substantially as set forth.

31. The combination, in a folding-machine, of suitable devices adapted to deliver several
100 folded sheets or signatures, with two sets or series of packing-boxes, one arranged to receive the signatures directly from the folding devices, and the other farther removed from said folding devices; and one or more pivoted
105 hoppers adapted to receive folded signatures and deposit them into the remote packing-boxes, substantially as set forth.

32. The combination, in a folding-machine, of means for folding a sheet, with a movable
110 hopper into which the folded sheet is directed, and a kicker movable simultaneously with the hopper and adapted to eject the sheet from the hopper, substantially as set forth.

33. The combination, in a folding-machine,
115 of a pair of folding-rollers, a packing-box into which the folded signatures are to be delivered, a movable hopper adapted to receive the folded signatures from the rollers, and a kicker actuated by the movement of the hopper
120 to eject the signatures therefrom into the packing-box, substantially as set forth.

34. The combination, in a folding-machine, of a packing-box, a pivotally-supported hopper adapted to receive the signatures from
125 the folders and move over into position for depositing them into the packing-box, and a gravitating kicker adapted to eject the signatures from the hopper into the packing-box, substantially as set forth.

35. The combination, in a folding-machine,
130 of a packing-box, a pivotally-supported hopper adapted to receive the signatures from the folders and move over into position for

depositing them in the packing-box, and a gravitating kicker operated by the movement of the hopper for ejecting the signatures from the hopper into the packing-box, substantially as set forth.

36. The combination, in a folding-machine, of a packing-box, a pivotally-supported hopper adapted to receive the signatures from the folders, means for moving the hopper on its pivot into position to deposit the signatures into the packing-box, an arm projecting from the hopper, a gravitating kicker slidably mounted upon the arm and links connecting the kicker and hopper whereby the kicker will be allowed to eject the signatures when the hopper is moved into ejective position and will be withdrawn when the hopper moves back, substantially as set forth.

37. The combination, in a folding-machine, of a packing-box, an open-ended hopper supported upon a suitable shaft, means for moving the hopper into position to deposit the signatures into the packing-box, an arm projecting from the hopper, a gravitating kicker slidably mounted upon said arm, a pair of links pivoted together and to the kicker and

hopper respectively, a projecting heel on one of the links, and a stationary pin adapted to engage said heel and move the kicker into operative position when the hopper is moved back after depositing a signature, substantially as set forth.

38. The combination, in a folding-machine, of the adjustable carriages carrying the folding-rollers, the adjustable packing devices, the adjustable hoppers, and suitable means for adjusting the hoppers and packing-boxes relatively to themselves and the folding-rollers, substantially as set forth.

39. The combination, in a folding-machine, of the adjustable carriages carrying folding-rollers, the adjustable packing-boxes and the adjustable pivoted hoppers; said hoppers being pivotally mounted upon a suitable shaft and adjusted by means of a yoke embracing the bearing of the hopper and adjustably mounted upon a screw-rod, substantially as set forth.

TALBOT C. DEXTER.

Witnesses:

HARRY E. KNIGHT,
WM. E. KNIGHT.