E. R. KAST.

SHEET AND SIGNATURE HANDLING MECHANISM.

APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 1.

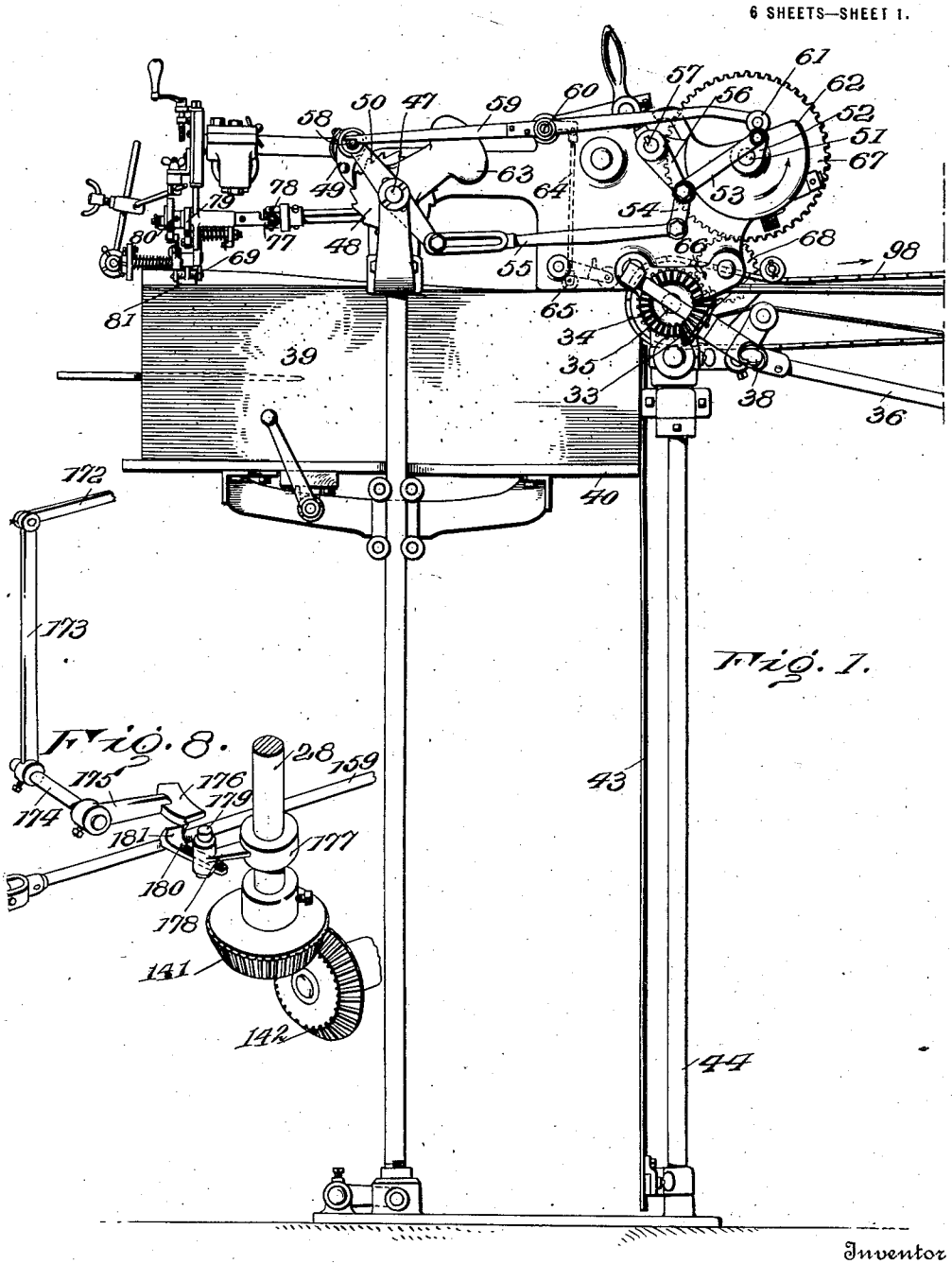


Fig. 1.

Fig. 8.

Witnesses

James H. Anderson

E. E. Warfield.

Inventor

Edward R. Kast.

By Mauro, Cameron, Lewis & Massie

Attorneys

E. R. KAST.

SHEET AND SIGNATURE HANDLING MECHANISM.

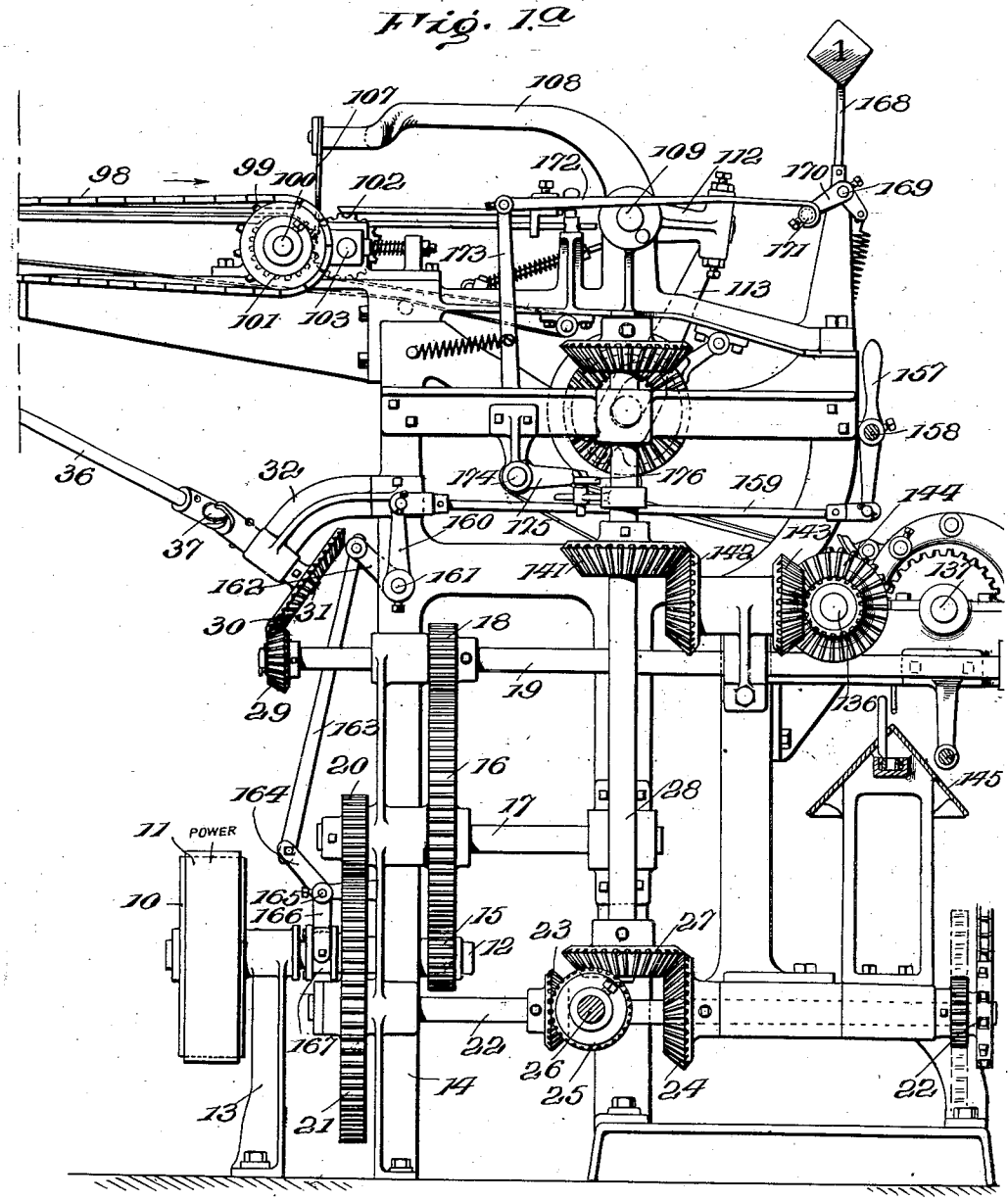
APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 2.

Fig. 1a



Inventor

Witnesses

James H. Anderson

E. E. Warfield

Edward R. Kast.

By Mauro, Cameron, Lewis & Massie

Attorneys

E. R. KAST.

SHEET AND SIGNATURE HANDLING MECHANISM.

APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 3.

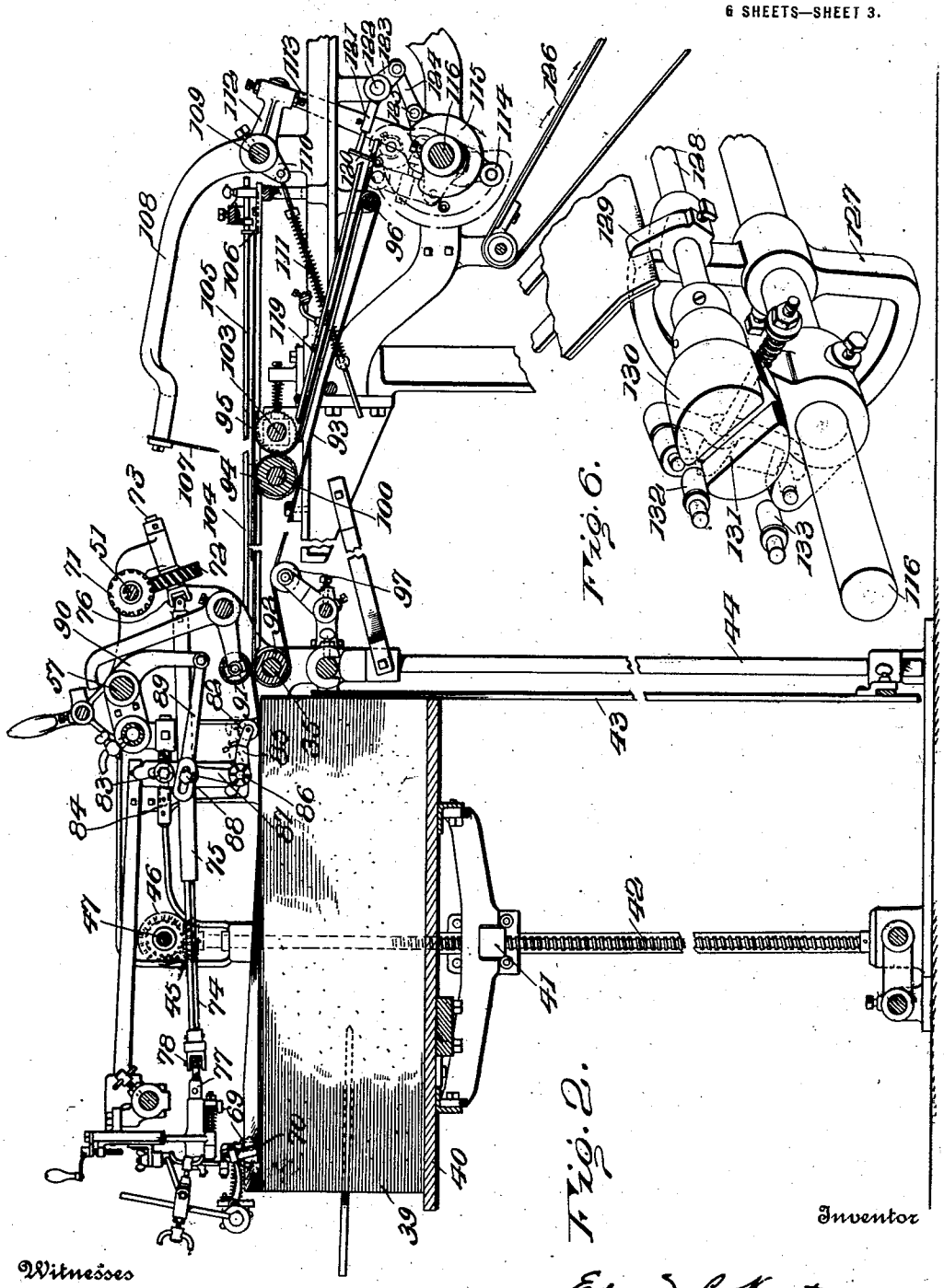


Fig. 2.

Witnesses

James H. Anderson

E. E. Harfield

Inventor

Edward R. Kast.

By Mauro, Cameron, Lewis & Massie

Attorneys

E. R. KAST.

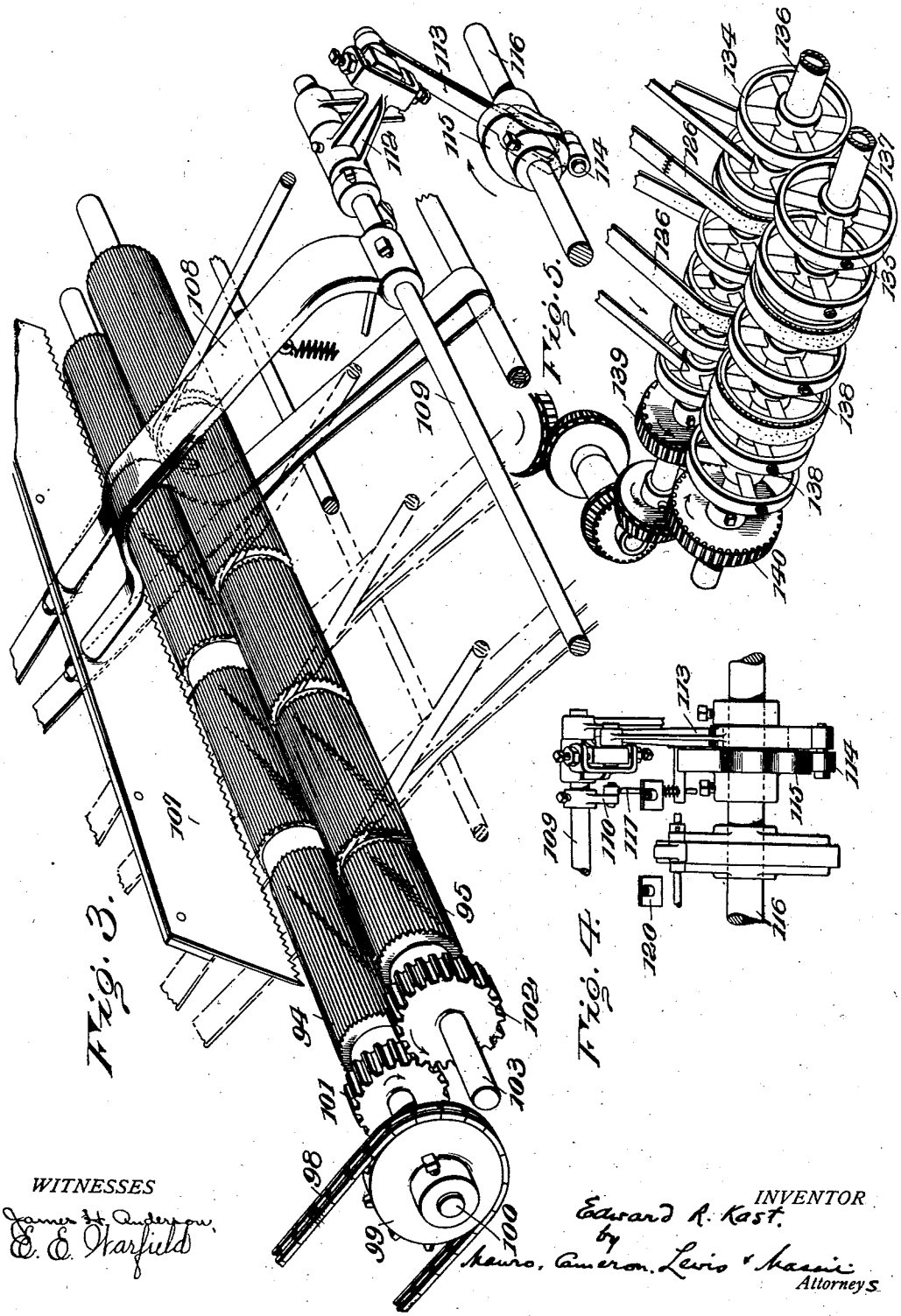
SHEET AND SIGNATURE HANDLING MECHANISM.

APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 4.



WITNESSES

James H. Anderson.

E. E. Warfield

INVENTOR

Edward R. Kast.

by

Munro, Cameron, Lewis & Munro

Attorneys

E. R. KAST.

SHEET AND SIGNATURE HANDLING MECHANISM.

APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 5.

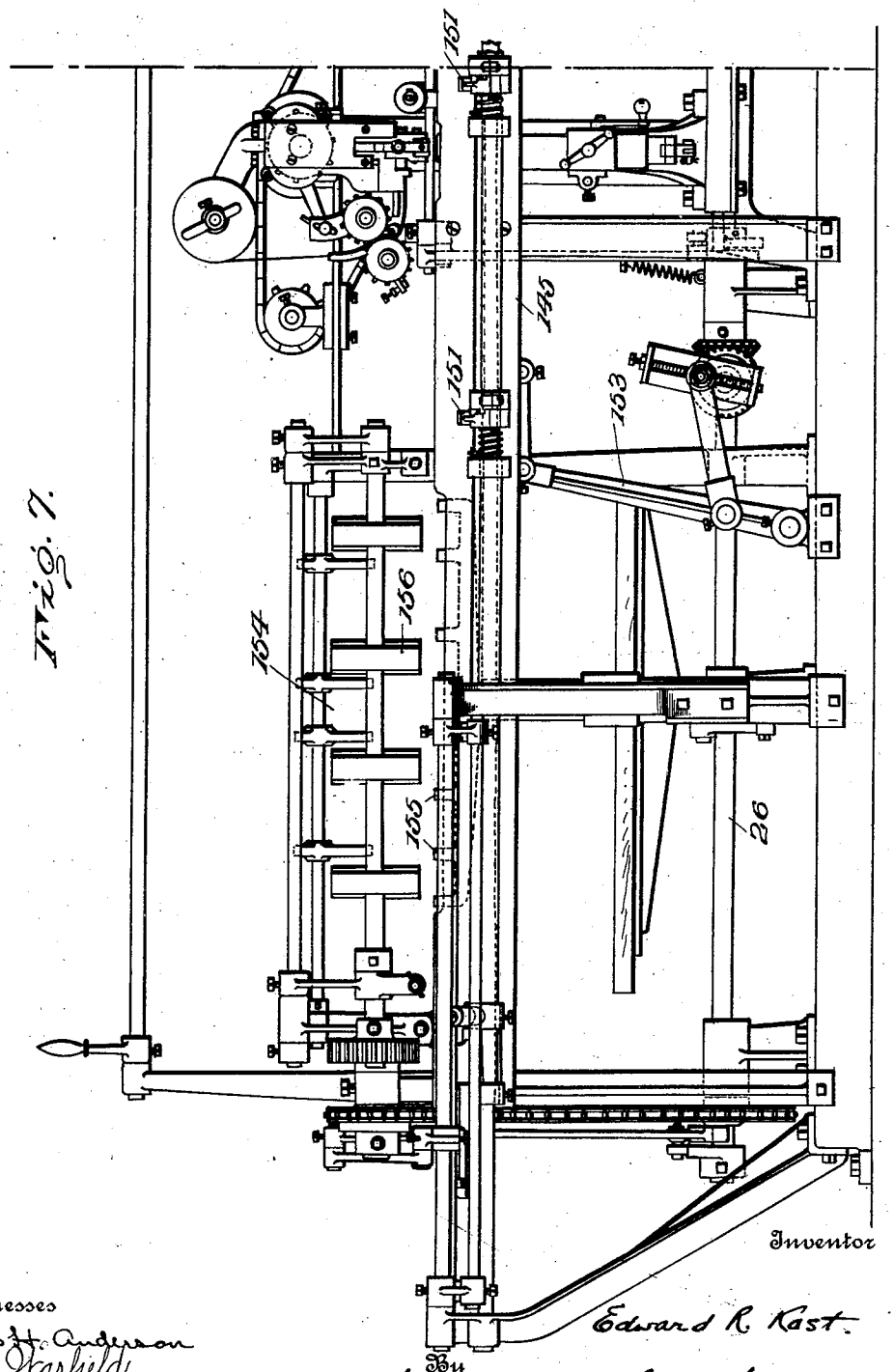


Fig. 5.

Witnesses

James H. Anderson

E. E. Warfield

Inventor

Edward R. Kast.

By

Mauro, Cameron, Lewis & Massie

Attorneys

E. R. KAST.

SHEET AND SIGNATURE HANDLING MECHANISM.

APPLICATION FILED MAR. 10, 1913.

1,177,525.

Patented Mar. 28, 1916.

6 SHEETS—SHEET 6.

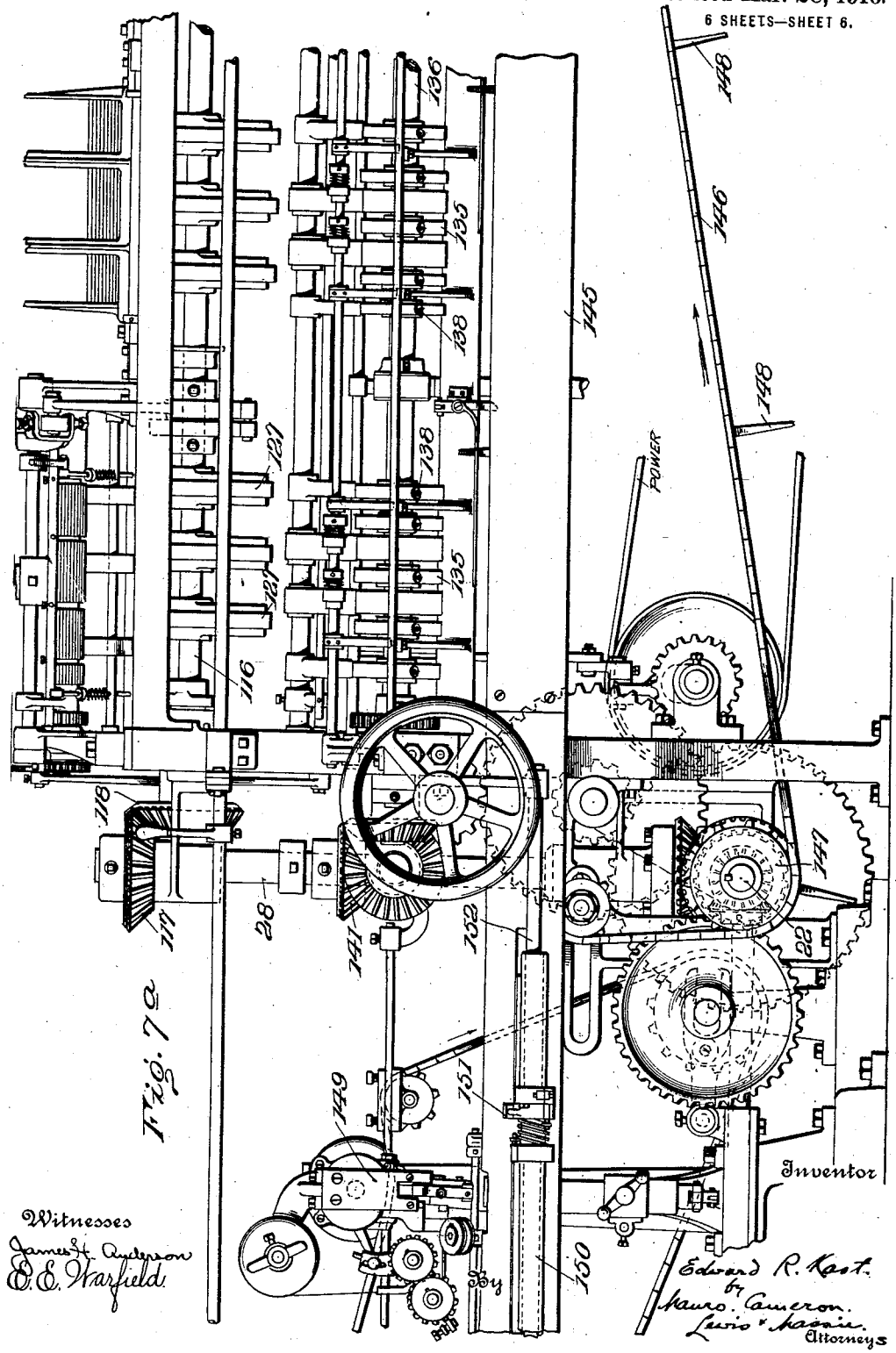


Fig. 7a

UNITED STATES PATENT OFFICE.

EDWARD R. KAST, OF BALTIMORE, MARYLAND, ASSIGNOR TO KAST INSETTING & GATHERING MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

SHEET AND SIGNATURE HANDLING MECHANISM.

1,177,525. Specification of Letters Patent. Patented Mar. 28, 1916.

Application filed March 10, 1913. Serial No. 753,362.

To all whom it may concern:

Be it known that I, EDWARD R. KAST, of Baltimore, Maryland, have invented a new and useful Improvement in Sheet and Signature Handling Mechanism, which invention is fully set forth in the following specification.

The present invention relates to machines for insetting signatures, and more particularly is a machine for folding sheets of paper into signatures, then passing said signatures to suitable means that open the same, and then insetting said opened signatures one within another.

In machines for insetting signatures that I have heretofore constructed, the signatures have been stacked or piled in hoppers from which they have been withdrawn by appropriate mechanism, opened, and then inset with other signatures; but in mechanically forming books or magazines I have sometimes found it highly desirable to be able to present to the machine a pile of sheets rather than a pile of signatures, to the end that there is effected a large economy in time and labor. By the machine of the present invention, the sheets are accurately and rapidly folded by appropriate mechanism into signatures, and the signatures are then automatically fed to appropriate signature-opening mechanism from which they are delivered to means which bring together or inset a plurality of said opened signatures. Entire books or magazines, or any desired part of the same, may be mechanically formed by presenting to the machine successive piles of sheets in the proper order or sequence. On the other hand I have secured very satisfactory results in a commercial way by forming the main body of the books or magazines by the use of mechanisms such as described and claimed in my applications Serial Nos. 508,160, 712,315, 718,062 and 718,063, wherein signatures formed in any suitable manner are piled in hoppers from which they are mechanically withdrawn, opened and inset, the covers for such magazines being presented in a pile in sheet form to the improved mechanism hereinafter described, which mechanism feeds the sheet forward to folding mechanism, then feeds it to means that opens the same, and then assembles it with the other signatures inset by the mechanisms of my said applications. Preferably, I employ in association with the sheet feeding and folding means and the insetting mechanism automatic stitching and delivery mechanism.

The invention furthermore consists in certain details of construction, and combination and arrangement of parts to be more fully described and then pointed out in the claims.

The inventive idea is capable of being embodied in a variety of mechanical structures, one of which, for the purpose of illustrating the invention, is shown in the accompanying drawings, in which drawings,

Figures 1 and 1ª are end elevations, illustrating the means for feeding and folding the sheets and insetting the signatures. Fig. 2 is a transverse section corresponding to Figs. 1 and 1ª. Figs. 3 and 4 are details of the folding mechanism. Fig. 5 is a detail perspective illustrating the suction rollers that open the signatures. Fig. 6 is a detail perspective of the means for reversing the signatures, so that they are fed between the opening rollers open edges foremost. Figs. 7 and 7ª are side elevations of an insetting machine supplied with my invention, and Fig. 8 is a detail.

Referring to the drawings, wherein like reference numerals indicate like parts, 10 is a pulley to which power is applied, as by belt 11, from any suitable motor (not shown), said pulley being mounted on a shaft 12 having bearings in standard 13 and the frame of the machine 14. On said shaft 12 is mounted a pinion 15 which meshes with a gear 16 keyed to counter-shaft 17, said gear 16 meshing in turn with a pinion 18 fixedly secured to a shaft 19 having bearings in the frame of the machine.

On one extremity of counter shaft 17 is fixed a pinion 20 which meshes with a gear 21 mounted on a shaft 22. Said shaft 22 has keyed thereto bevel gears 23 and 24, the former meshing with a bevel gear 25 secured to a shaft 26 and the latter with a bevel gear 27 mounted on the lower end of a vertical shaft 28. Shaft 26 conveys power to the delivery end of the machine and vertical shaft 28 to the sheet-folding and signature-insetting mechanism, as will be more fully explained hereinafter.

On one end of shaft 19 is mounted a bevel gear 29 which meshes with a bevel gear 30 mounted on one end of a stub shaft 31 carried by a bracket 32 secured to the machine

frame. A similar stub shaft (Fig. 1) carries a bevel gear 33 which meshes with a bevel gear 34 mounted on a shaft 35, and these stub shafts are connected by a rod 36, universal joints 37 and 38 connecting said stub shafts and rod.

Any suitable sheet supporting and feeding mechanism may be employed and the same is operated from said shaft 35. As here shown, (Figs. 1 and 2) a pile of sheets 39 are mounted on a platform 40, provided with a pair of nuts 41 (one of which is shown in Fig. 2) each of which engages a screw 42 having suitable bearings. The platform 40 and the sheets 39 thereon are automatically fed upwardly by the rotation of said screw 42, the sheets 39 being kept in alinement by engaging guide rods 43 secured to bars 44. As here shown, the rotation of said screws 42 is effected through bevel gears 45 and 46 (Fig. 2), the former being mounted on the upper end of said screw 42 and the latter on a transverse shaft 47. This latter shaft has a ratchet wheel 48 secured thereto, which ratchet is operated through a pawl 49 mounted on one arm of a pivoted lever 50, movement being applied to the other arm of said lever from a shaft 51 through crank arm 52 and suitable link connections 53, 54 and 55, links 53 and 54 being connected to the free end of an arm 56 pivoted on shaft 57. Further movement is imparted to the other end of lever 50 by reason of the engagement of a pin 58 carried thereby with one arm of a lever 59 pivoted at 60, the other arm of said lever being provided with a roller 61 engaging a cam 62 carried by said shaft 51. Clockwise movement of said lever 50 and pawl 49 is effected by means of counterweight 63 secured to lever 50.

Secured to pivot 60 is a rod 64 on the lower end of which is provided a roller 65 which acts to regulate the height of the pile of signatures 39. When the pile becomes low enough lever arm 59 is rocked upwardly, permitting the upward movement of pawl 58 and downward movement of weight 63 so that the ratchet 49 is rotated to elevate the pile when the continued rotation of shaft 51 acts through crank arm 52 and links 53, 54 and 55 to move lever 50 in a counter clockwise direction. Shaft 51 is driven from shaft 35 through gears 66 and 67 and a pinion 68 (Fig. 1).

Preferably I employ a well-known form of sheet feeding mechanism which is provided with buckling means, that is to say means for buckling each top sheet on the pile so that it can be readily fed forward to the folding mechanism. Preferably, this buckler comprises transversely reciprocating rollers 69, one operating on each of the rear corners of the top sheet and each acting in association with a stationary finger 70 that rests on the top sheet in front of each buckling roller. Reciprocating movement is imparted to each buckling roller in any suitable or well-known manner and as here shown each roller is reciprocated from shaft 51 through worm 71 on shaft 51 engaging worm gear 72 on stub shaft 73, said shaft 73 being connected to a shaft comprising telescoping members 74 and 75 through universal connection 76. Member 74 is connected to a stub shaft 77 through universal connection 78 and said stub shaft is provided with cams 79 and 80, the former controlling the reciprocation of the buckling rollers and the latter the movement of gripping fingers 81 (one of which is shown in Fig. 1) which engage the second sheet on the pile when the corners of the top sheet are moved inwardly by the buckling rollers. As heretofore stated, two buckling rollers are employed and it will be understood that the connections just described between shaft 51 and each roller 69 and finger 81 are the same for each. The top sheet being thus aired is fed forward to any suitable folding mechanism by any suitable means, as here shown two reciprocating feed rollers 82 being employed for this purpose. Each of these rollers is mounted on a carriage 83 that slides along a bar 84, said roller being carried by one arm 85 of a bell-crank lever pivoted to said carriage at 86, the other arm 87 of said lever being provided with a pin 88 which is connected to one end of a slotted link 89, the other end of said link being connected to the free end of lever arm 90 secured to shaft 57. As the sheet is fed to the folder, it is engaged by two drop rollers 91, and roller 92 carried by shaft 35, which roller 92 is accordingly positively driven. Around roller 92 passes a plurality of tapes 93 (one of which is shown in Fig. 2), these tapes also passing around folding rollers 94 and 95 and idler roller 96. The tapes pass over folding roller 94, and under folding roller 95, and there are provided tension rollers 97 that engage said tapes. The folding rollers 94 and 95 are grooved, as usual, and are driven from shaft 35 through a sprocket wheel mounted thereon, chain 98 and sprocket wheel 99 which is mounted on shaft 100 that carries roller 94. Rollers 94 and 95 are rotated in opposite directions by means of intermeshing gears 101 carried by shaft 100 and 102 carried by shaft 103 on which latter shaft roller 95 is carried. As each signature is fed forward between rollers 91 and 92, it is carried by the positively driven tapes 93 under guides 104 and 105, until it is brought to rest by a stop 106 carried by said guide rods 105. Between the inner extremities of said guide rods 104 and 105 and, in a plane normal to the tangent of the folding rollers 94 and 95, there is provided an opening at which point a vertically movable blade 107 engages the signa-

ture to fold the same at this point and to pass the signature, folded edge foremost, between said rollers 94 and 95. The blade 107 is carried by an arm 108 pivoted to a shaft 109, this shaft being provided with an arm 110 to which the pressure of a spring 111 is applied to force the blade downward into engagement with the signature. There is also secured to this shaft 109 an arm 112 to the free end of which is secured the upper end of a fork 113, the lower end of which fork is provided with a roller 114 that engages a cam 115 carried by shaft 116, which latter is driven from vertical shaft 28 through bevel gears 117 and 118. When the roller 114 is in engagement with the cut-away portion of the cam 115, the blade 107 is in its lowermost position, and when roller 114 engages the unbroken surface of the cam, the blade is elevated, as shown in Fig. 2. The signature having passed between rollers 94 and 95 folded edge foremost is carried by the tapes 93 under guide rods 119 until said folded edge is engaged by alining fingers 120 mounted on the end of one arm 121 of a lever which is pivoted at 122, the other arm 123 of said lever being connected to a fork 124 carrying a roller 125 that is engaged by a cam similar to cam 115, to the end that the alining fingers 120 are moved into and out of the path of each signature as it is carried by tapes 93. Mechanism is provided for reversing the signatures so that they are fed to the means for opening the same open edges foremost and said mechanism is arranged adjacent to said alining fingers. Immediately after said fingers 120 have performed their function of alining each signature as it passes off of the tapes 93, and said fingers are elevated out of the path of said signature, the signature-reversing mechanism seizes the folded edge of said signature and delivers the same onto belts or tapes 126 open edges foremost.

As here shown, the means for reversing each signature comprises a plurality of segment-shaped members 127 (see particularly Figs. 6 and 7[a]) mounted on shaft 116. A shaft 128 is carried by said members, and keyed to said shaft is a plurality of fingers 129 which are adapted to engage the folded edge of the signature and clamp the same against said segment-shaped members 127. These fingers are moved to the position for gripping the signatures, and to the position for releasing the signatures, by the rotation of shaft 128. As here shown, a tumbler 130 is mounted on the end of said shaft 128, and said tumbler provided with a tumbler slot 131 that is engaged by pins 132 and 133 mounted on the frame of the machine, the former acting to rock said shaft 128 to grip the signature and the latter acting to release the signature. The shaft 116 is a continuously rotating shaft, and after the signature has been gripped by the mechanism just described, the rotation of said shaft brings the signature to a position over belts or tapes 126 with the open edges of the signature toward the signature opening means, at which time pin 133 engages tumbler slot 131, thus rocking the gripping fingers 129 and releasing the signature which falls upon the belts or tapes 126 that carry the signature to the signature-opening means. Any suitable signature-opening means, such as described in my applications before referred to may be employed, but I have herein illustrated that form shown in my application Serial No. 508,160, wherein the signature is fed between two series of rotating members or rollers 134 and 135 mounted on hollow shafts 136 and 137, said rotating members being provided on their peripheries with suction orifices 138 which are in communication with the hollow shafts, which latter are connected to a suitable source of suction (not shown.) Belts 126 pass around pulleys intermediate the rotary members 134 on shaft 136, and said members 134 and 135 are rotated in opposite directions by means of intermeshing gear wheels 139 and 140. Power is applied to rotate said members from vertical shaft 28, through bevel gear 141 mounted thereon and meshing with a bevel gear 142 mounted on a short stub shaft, on the other end of which stub shaft is mounted a bevel gear 143 that meshes with a bevel gear 144 keyed to hollow shaft 136. As the signature passes between these rotary members, the suction orifices 138 on the members 135 engage one fold of the signature and the suction orifices on the member 134 engage the other fold of the signature, the signature being thus opened as the members 134 and 135 rotate. Any suitable means (not shown) may be employed to release the signatures from the rotary members 134 and 135 so that they will drop upon a support 145, here shown in the form of a saddle, arranged directly beneath said opening rollers. While there is herein illustrated (see Fig. 7[a]) only two signature-opening mechanisms, it will be understood that as many signature-opening mechanisms may be employed as there are signatures to be inset to constitute the book or pamphlet. It will further be understood that each of the signature-opening mechanisms acts simultaneously with the other signature-opening mechanisms to open a signature, and that the opened signatures are simultaneously deposited on the support or saddle 145, where they are held in opened position.

Means are provided for assembling the signatures by moving the opened signatures along said saddle under the several signature-opening mechanisms, to the end that a signature opened by the first mechanism is inset in a signature opened by the second

mechanism, said two signatures being then moved under the third mechanism where they are inset within a signature opened by said third mechanism, and so on throughout the entire machine. The particular form of means, herein illustrated and described for moving the opened signatures along said saddle past the series of signature-opening mechanisms, is a conveyer chain 146 which is driven from shaft 22 by means of sprocket wheel 147 mounted on said shaft and engaging said conveyer chain 146. This conveyer chain is provided with pins 148 that project through an opening in the top of the saddle, said pins engaging the groups of signatures deposited on the saddle, and advancing them forward through the insetting part of the machine, preferably to the mechanism for stitching the books or magazines. As here illustrated, two stitching or stapling machines 149 are arranged to operate on the books or magazines as they are fed along the saddle, but it will be understood that any desired number of stitching mechanisms may be employed, and also that I preferably employ with this machine any suitable delivery mechanism, such as that illustrated in my application Serial No. 718,062.

Any suitable means for feeding the signatures past the stitching mechanism to the delivery mechanism may be used, but I prefer to employ that shown in my application Serial No. 745,973, which mechanism I have here indicated as 150. This mechanism includes signature-engaging members 151 that are carried by a sleeve mounted on a rod 152, said sleeve and members 151 being reciprocated longitudinally of the saddle 145 by power derived from shaft 26 through pivoted lever 153, all as fully described in my said application. The groups of signatures are fed past the stitching mechanisms by the means referred to, and are brought to the delivery 154 of any suitable construction. Preferably, I use that form of delivery employing a vertically reciprocating plate 155 that operates through an opening in the saddle 145 and delivers the stitched books or pamphlets between two sets of oppositely rotating rollers 156, one set of which is shown in Fig. 7.

The machine may be manually stopped through handle 157 (Fig. 1ª) pivoted at 158, said handle being connected to a link 159, one end of which is secured to an arm 160 pivoted on shaft 161. Secured to this shaft is a second arm 162, to which is connected one end of a link 163, the other end of said link being connected to one arm 164 of a bell crank lever pivoted at 165, the other arm 166 of said lever having a forked engagement with clutch member 167.

In my Patent No. 1,039,541, dated September 24th, 1912, I have described and claimed an improved form of calipering device, which employs a signal 168 pivoted on a shaft 169, which shaft is rotated upon the passage of a defective signature. I have herein provided means for automatically stopping the machine upon the rotation of shaft 169 (see Fig. 1ª). Secured to said shaft is an arm 170 provided with a pin 171, which is engaged by the hooked end of an arm 172, the other end of said arm being connected to the upper extremity of one arm 173 of a bell crank lever pivoted at 174, the other arm 175 of said lever being provided with a small plate 176 (see Fig. 8). Keyed to vertical shaft 28 is a collar 177 to which is secured an arm 178 in the end of which a pin 179 is vertically movable. Normally this pin is in the position indicated in Fig. 8, and when the shaft 169 is rocked under the influence of the calipering device, plate 176 engages pin 179 and depresses the same into the position shown in Fig. 1ª. Secured to link 159 is a finger 180, and when said pin 179 is in its lowermost position, upon the continued rotation of shaft 28, it engages said finger 180 and moves link 159 to the right, thereby opening the clutch and stopping the machine. Finger 180 is provided with a cam portion 181 and further rotation of arm 178 engages the lower end of pin 179 with the surface of said cam, which acts to return pin 179 to the position shown in Fig. 8, after link 159 has been moved to open the clutch.

As will be apparent, the invention is not limited to the particular structural embodiment thereof illustrated and described, but is susceptible of a variety of embodiments conforming to the definition of the invention given in the claims which follow.

What is claimed is:—

1. In a machine for insetting signatures, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-opening means in coöperative relation with said folding mechanism, said means receiving the folded sheets or signatures from said folding mechanism and opening the same, and a support positioned between the floor and said signature-opening means on which the opened signatures are dropped and held open.

2. In a machine for insetting signatures, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-opening means, means receiving the signatures from said folding mechanism and delivering them to said signature-opening mechanism, and a support positioned between the floor and said signature-opening means on which the opened signatures are deposited and held open.

3. In a machine for insetting signatures,

the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-opening means receiving the folded sheets or signatures from said folding mechanism and opening the same, means receiving the signatures from said folding mechanism and presenting them to the signature-opening mechanism open edges foremost, and a support on which the opened signatures are deposited and held open.

4. In an insetting machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, means coöperating with said folding mechanism for reversing the folded sheets or signatures, signature-opening mechanism receiving the folded signatures from said reversing means and opening the same, and a support on which the opened signatures are deposited and held open.

5. In an insetting machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, means coöperating with said feeding mechanism for reversing the folded sheets or signatures, signature-opening mechanism receiving the folded signatures from said reversing means open edges foremost and opening the same, and a support on which the opened signatures are deposited and held open.

6. In an insetting machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-reversing means, means transferring the signatures from said folding to said reversing means, signature-opening means, means transferring the signatures from said reversing to said signature-opening means, and a support on which the opened signatures are deposited.

7. In an insetting machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-reversing means, means transferring the signatures from said folding to said reversing means, signature-opening means, means transferring the signatures from said reversing to said signature-opening means open edges foremost, and a support on which the opened signatures are deposited.

8. In an insetting machine, the combination of a plurality of signature-opening mechanisms arranged in a series, means for receiving an opened signature and progressing it so opened to a position in register with another of said mechanisms to receive an opened signature from said last-mentioned opening mechanism about the outside of said first-mentioned opened signature, a support for sheets of paper related to one of said signature-opening mechanisms, folding mechanism, means for feeding the sheets to said folding mechanism, and means feeding the folded sheets or signatures to said signature-opening mechanism.

9. In a book or pamphlet making machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-opening means receiving the folded sheets or signatures from said folding mechanism and opening the same, a support on which the opened signatures are deposited and held open, and means stitching said signatures while they are held open.

10. In a book or pamphlet making machine, the combination of a plurality of signature-opening mechanisms arranged in a series, means for receiving an opened signature and progressing it so opened to a position in register with another of said mechanisms to receive an opened signature from said last-mentioned opening mechanism about the outside of said first-mentioned opened signature, a support for sheets of paper related to one of said signature-opening mechanisms, folding mechanism, means for feeding the sheets to said folding mechanism, means feeding the folded sheets or signatures to said signature-opening mechanism, and means for stitching the inset signatures together.

11. In an insetting machine, the combination of a plurality of signature-opening mechanisms arranged in a series, means for receiving an opened signature and progressing it so opened to a position in register with another of said mechanisms to receive an opened signature from said last-mentioned opening mechanism about the outside of said first-mentioned opened signature, a support for sheets of paper related to one of said signature-opening mechanisms, folding mechanisms, means for feeding the sheets to said folding mechanism, signature-reversing means receiving the signatures from said folding mechanism, means feeding the folded signatures to said signature-opening mechanism open edges foremost, and means stitching the inset signatures together.

12. In a book or pamphlet making machine, the combination of a support for sheets of paper, folding mechanism, means for feeding the sheets to said folding mechanism, signature-opening means receiving the folded sheets or signatures from said folding mechanism and opening the same, means receiving the signature from said folding mechanism and presenting it to said signature-opening means, a support on which the opened signatures are deposited and held open, means stitching said signatures while they are held open, and means for delivering the stitched books or pamphlets.

13. In a book or pamphlet making machine, the combination of a plurality of signature-opening mechanisms arranged in a series, means for receiving an opened signature and progressing it so opened to a position in register with another of said mechanisms to receive an opened signature from said last-mentioned opening mechanism about the outside of said first-mentioned opened signature, a support for sheets of paper related to one of said signature-opening mechanisms, folding mechanisms, means for feeding the sheets to said folding mechanism, means feeding the folded sheets or signatures to said signature-opening mechanism, means for stitching the inset signatures together, and means for delivering the stitched books or pamphlets.

14. In an insetting machine, the combination of a plurality of signature-opening mechanisms arranged in a series, means for receiving an opened signature and progressing it so opened to a position in register with another of said mechanisms to receive an opened signature from said last-mentioned opening mechanism about the outside of said first-mentioned opened signature, a support for sheets of paper related to one of said signature-opening mechanisms, folding mechanism, means for feeding the sheets to said folding mechanism, signature-reversing means receiving the signatures from said folding mechanism, means feeding the folded signatures to said signature-opening mechanism open edges foremost, means stitching the inset signatures together, and means for delivering the stitched books or pamphlets.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

EDWARD R. KAST.

Witnesses:
JOHN W. HEWES,
M. E. WELLENER.