W. C. GLASS.

SHEET FEEDING MECHANISM.

APPLICATION FILED NOV. 8, 1912.

1,327,546.

Patented Jan. 6, 1920.

12 SHEETS—SHEET 1.

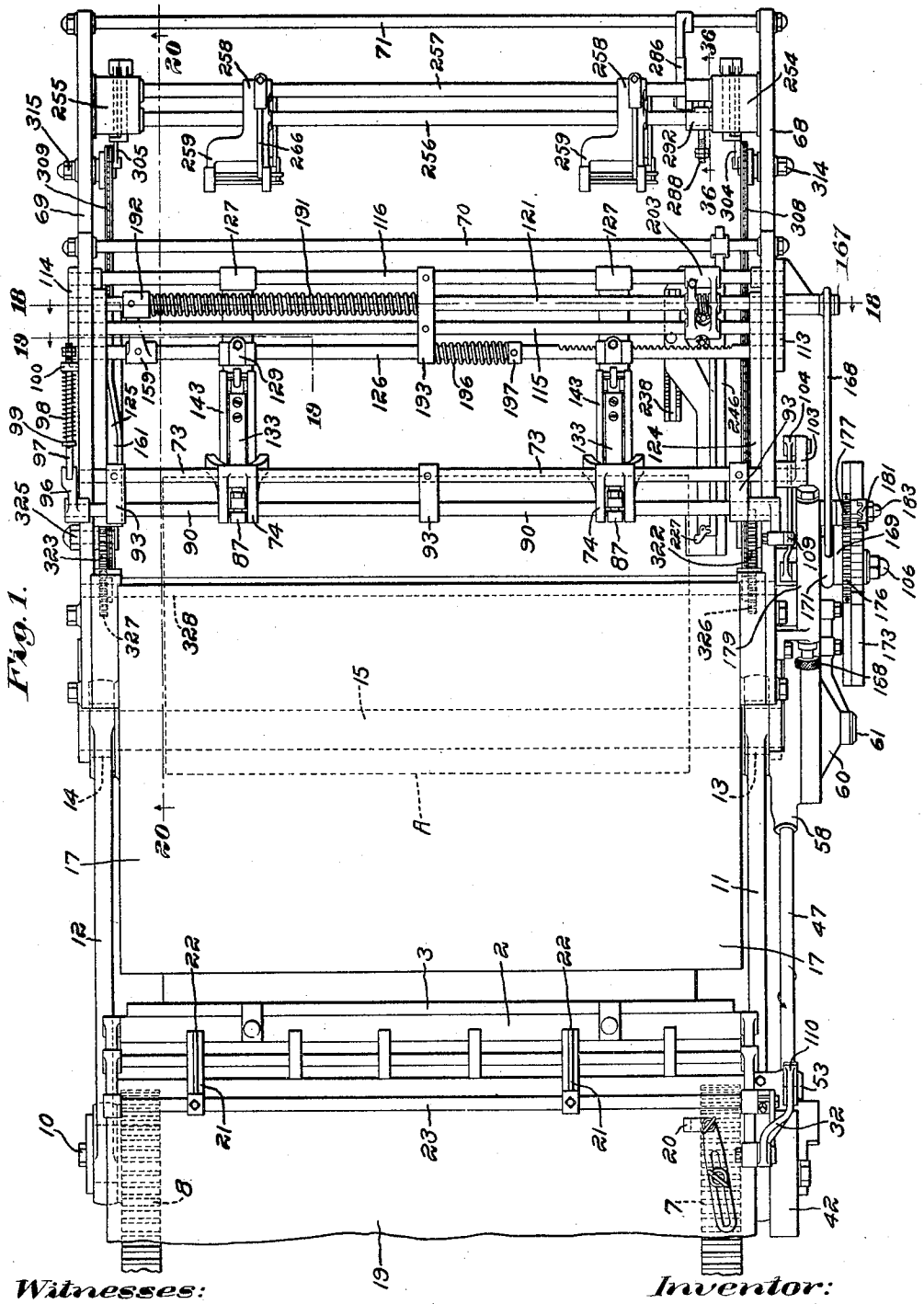


Fig. 1.

Witnesses:
Carl L. Choate.
Horace A. Grossman

Inventor:
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12 SHEETS—SHEET 2.

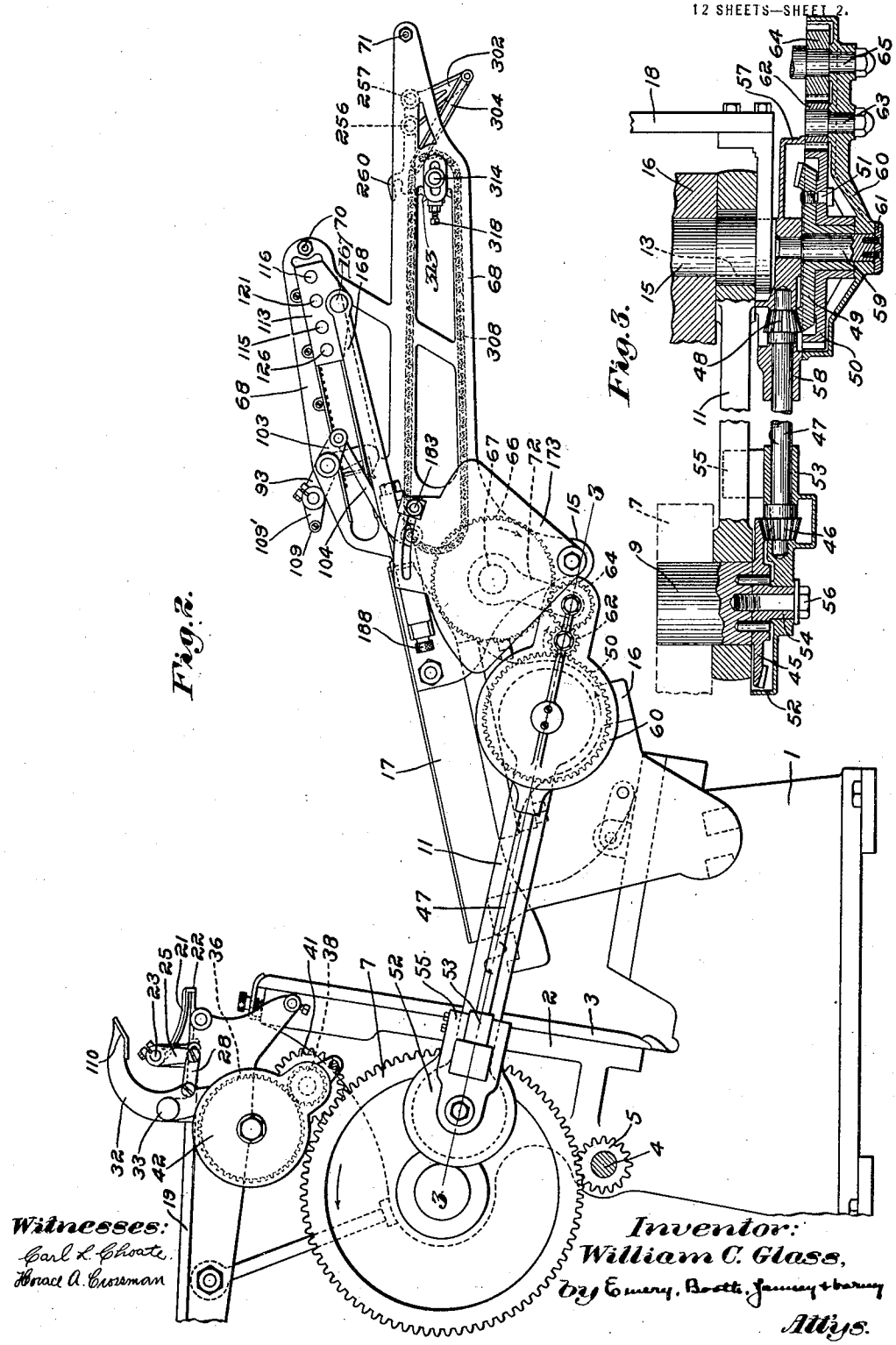


Fig. 2.

Fig. 3.

Witnesses:
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Bruce A. Crossman

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12 SHEETS—SHEET 3.

Fig. 5.

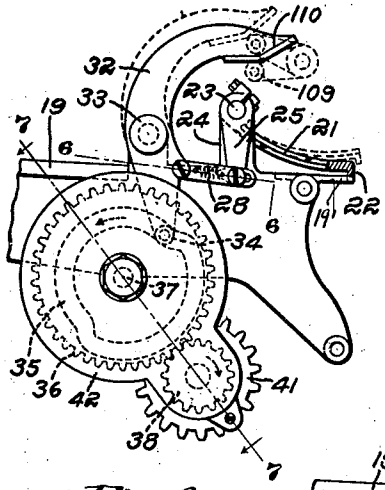


Fig. 6.

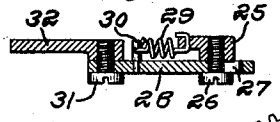


Fig. 4.

Fig. 7.

Witnesses:

Carl L. Choate.

Horace A. Crossman

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William C. Glass,

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12 SHEETS—SHEET 4.

Fig. 11.

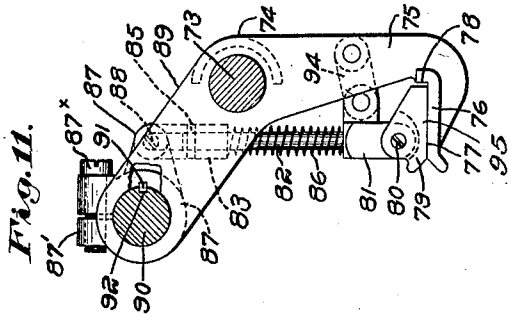


Fig. 10.

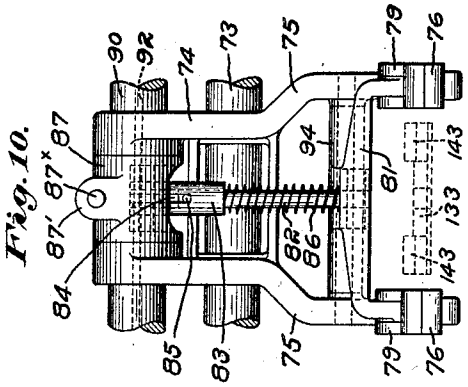


Fig. 9.

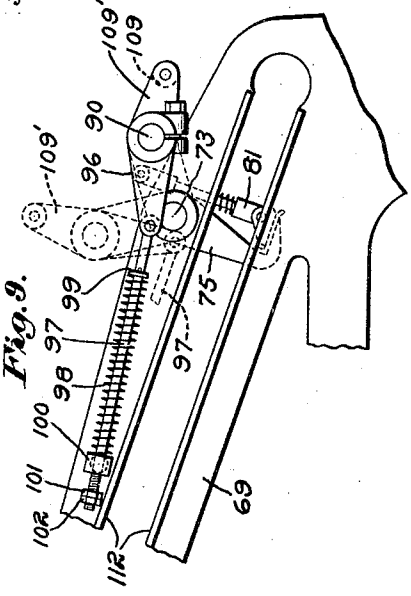
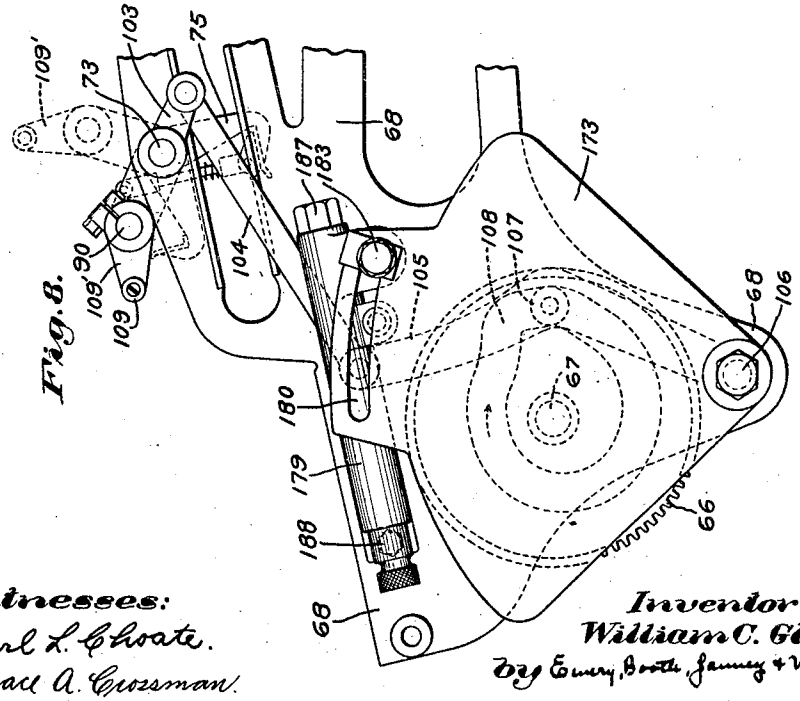


Fig. 8.



Witnesses:

Carl L. Choate.

Horace A. Crossman.

Inventor:

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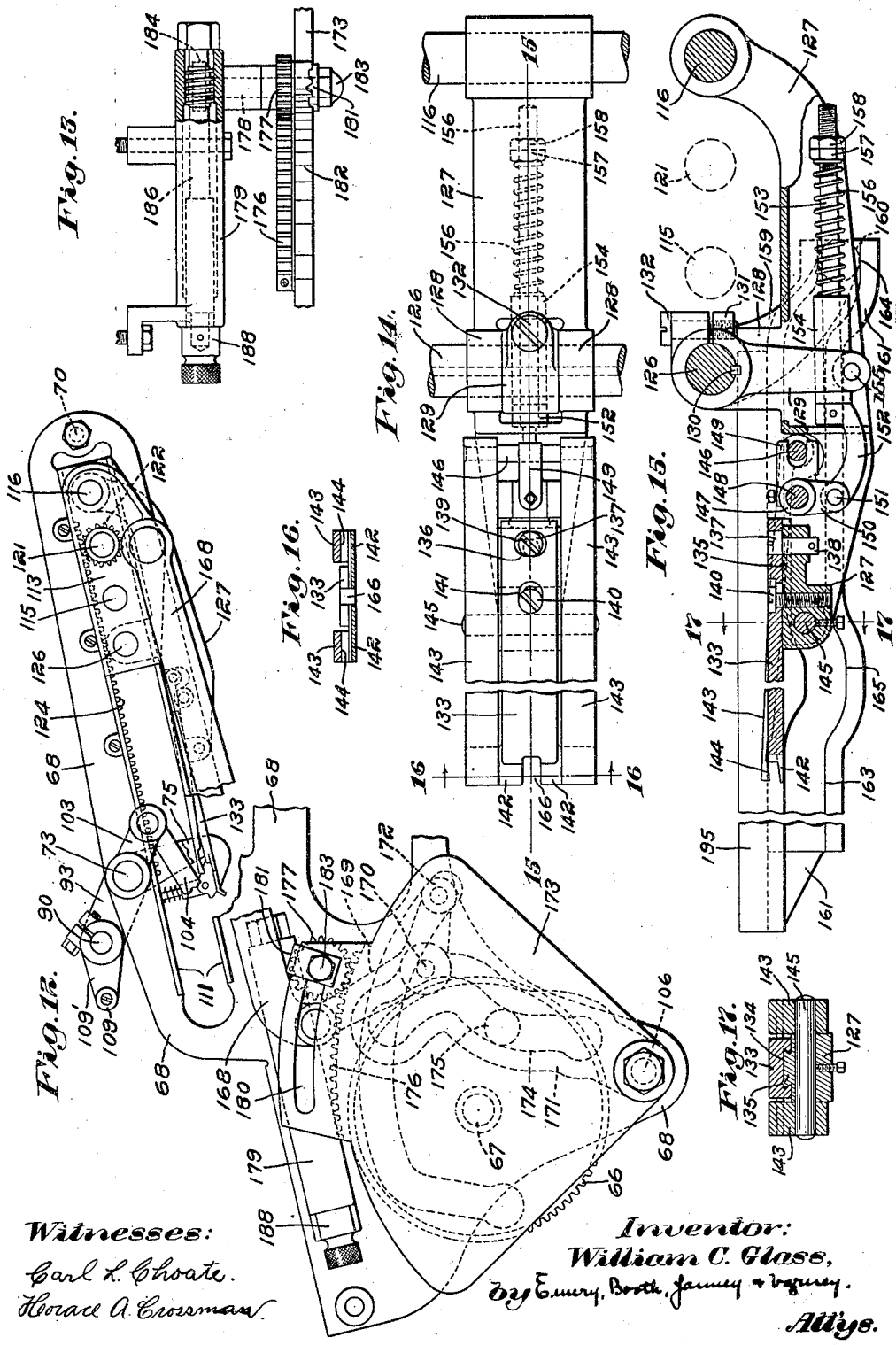
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12 SHEETS—SHEET 5.



Witnesses:
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12 SHEETS—SHEET 6.

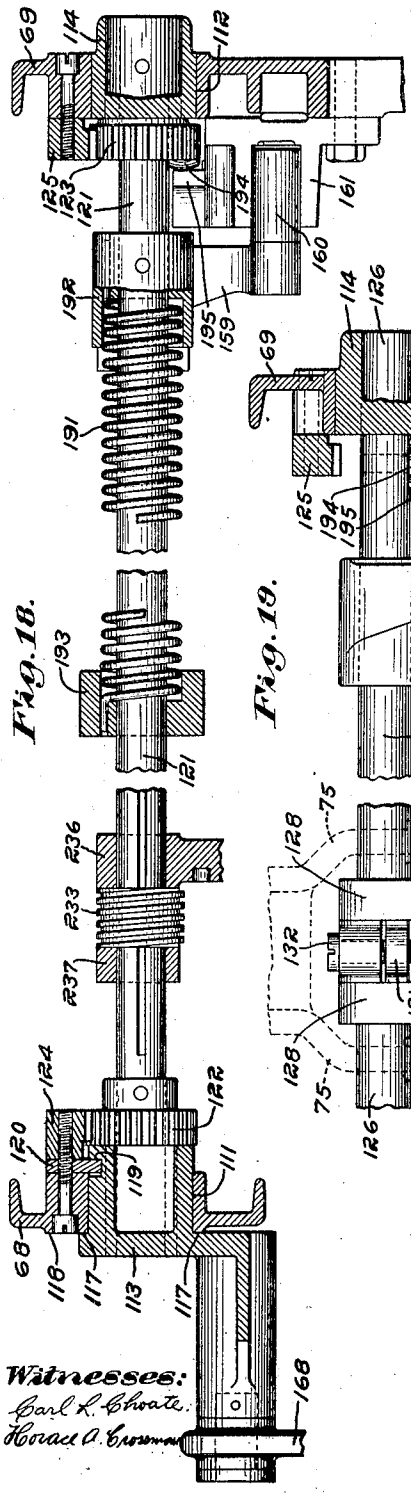


Fig. 18.

Fig. 19.

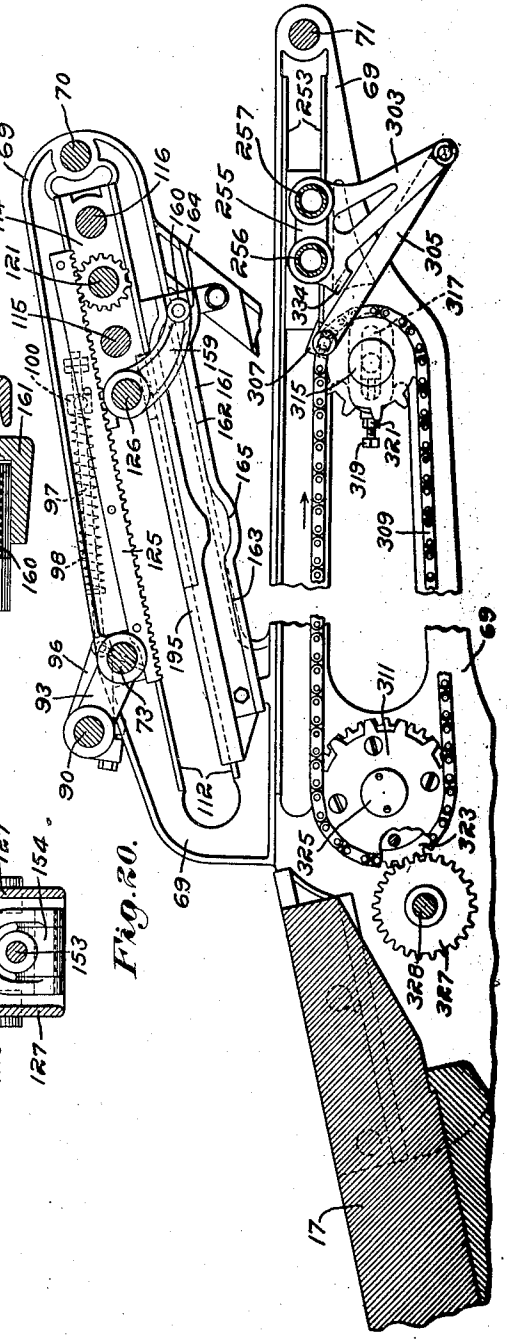


Fig. 20.

Witnesses:
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Horace A. Crossman.

Inventor:
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12 SHEETS—SHEET 7.

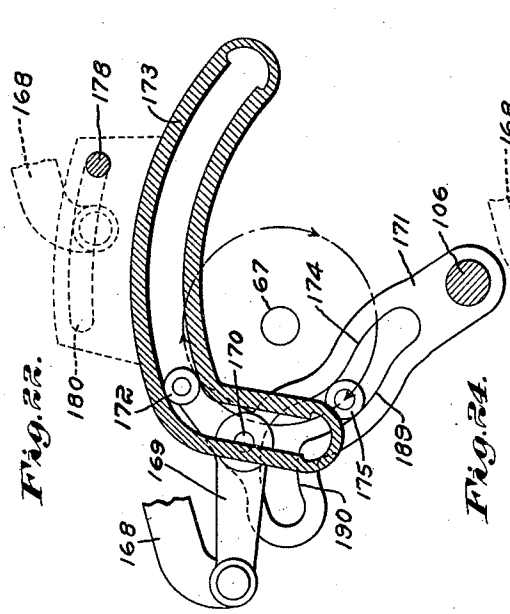


Fig. 22.

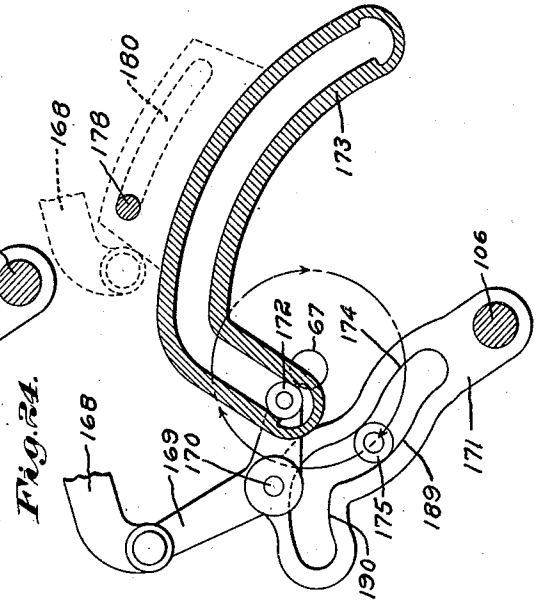


Fig. 24.

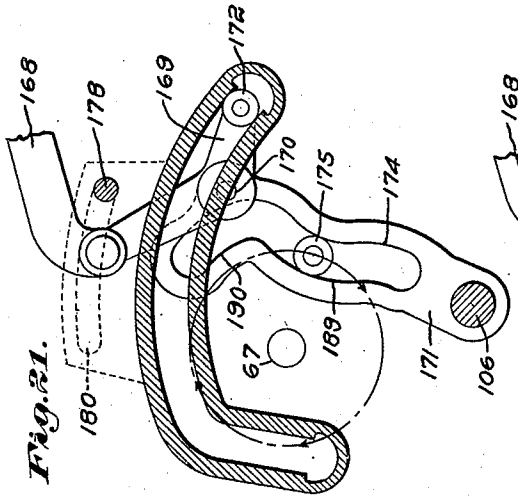


Fig. 21.

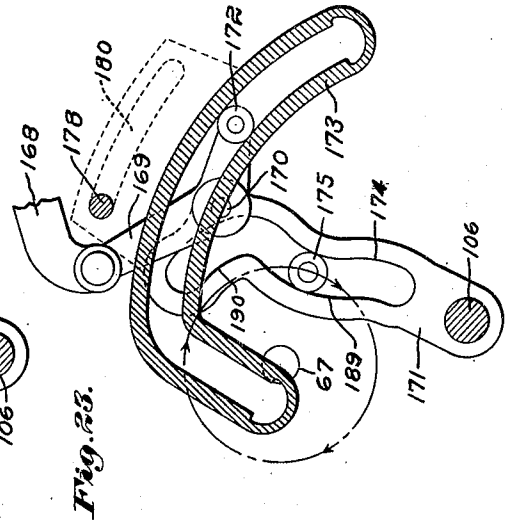


Fig. 23.

Witnesses:

Carl L. Choate.

Horace A. Grossman.

Inventor:

William C. Glass,

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SHEET FEEDING MECHANISM.

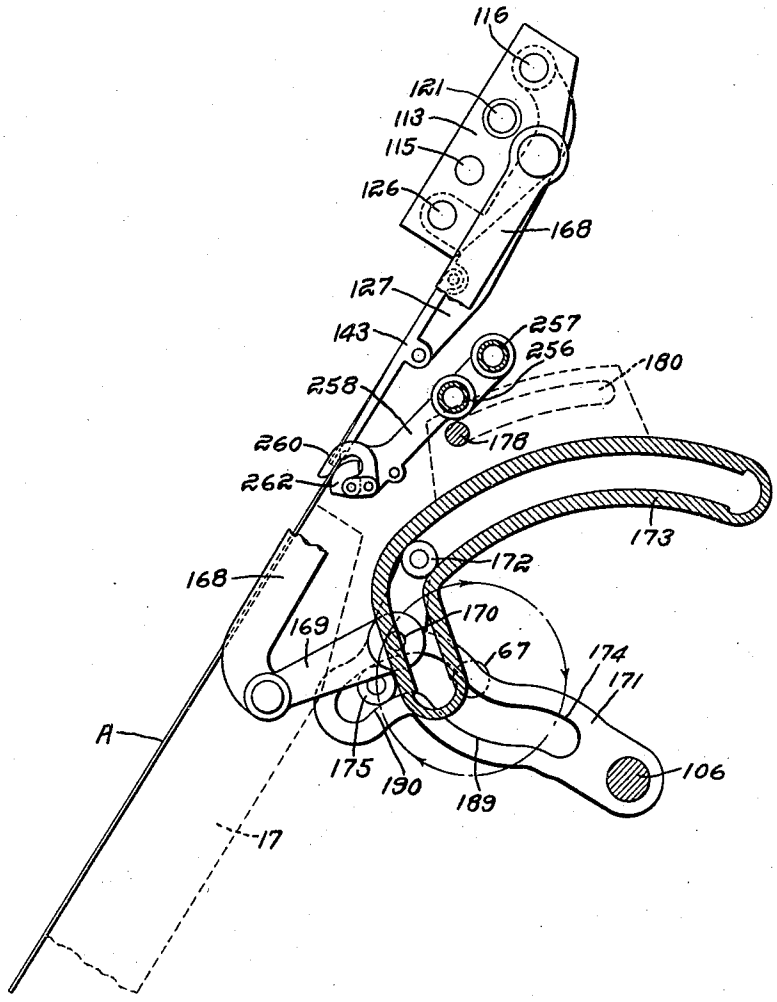
APPLICATION FILED NOV. 8, 1912.

1,327,546.

Patented Jan. 6, 1920.

12 SHEETS—SHEET 8.

Fig. 25.



Witnesses:

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Patented Jan. 6, 1920.

12 SHEETS—SHEET 9.

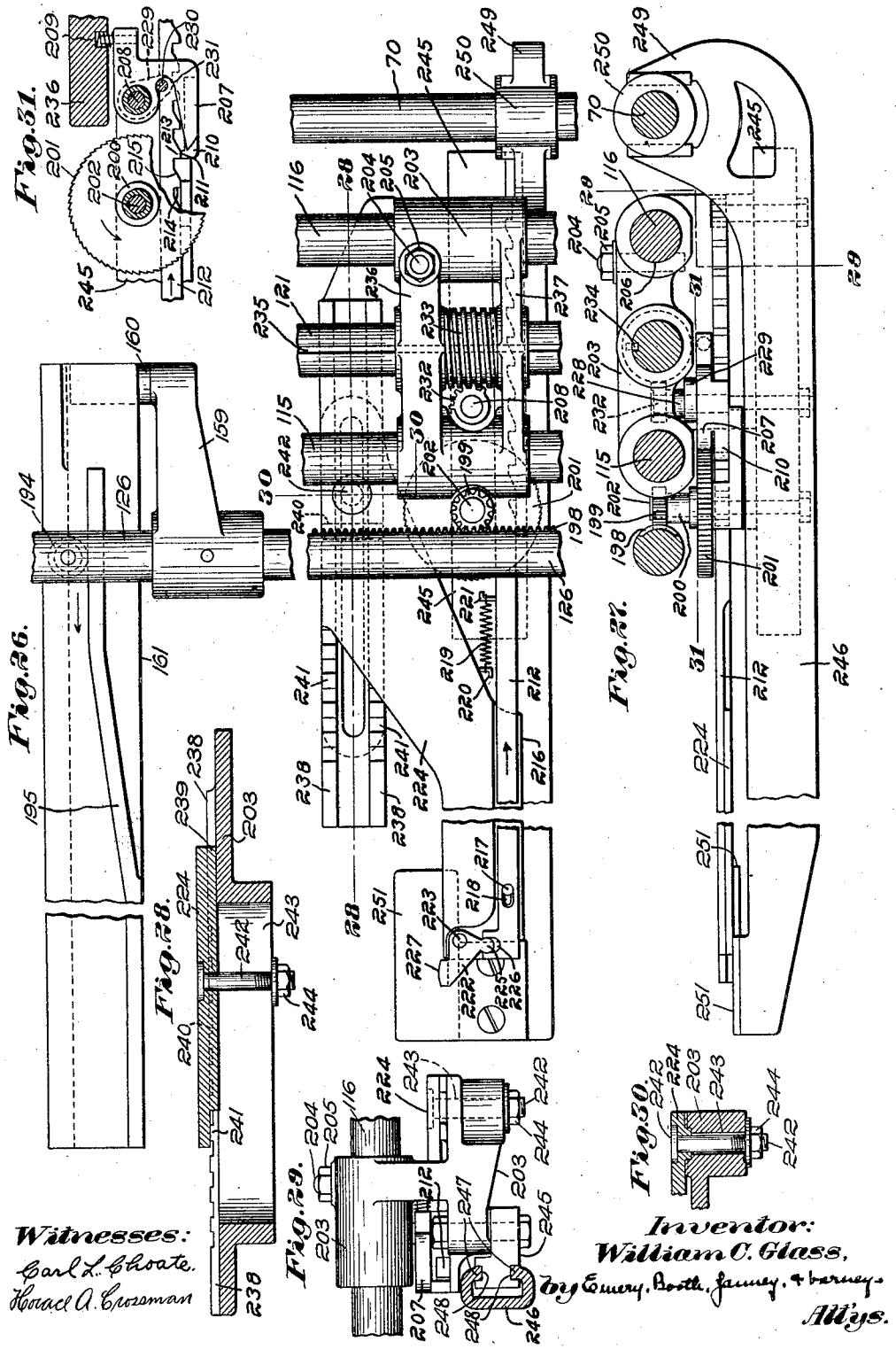


Fig. 31.

Fig. 26.

Fig. 27.

Fig. 28.

Fig. 29.

Fig. 30.

Witnesses:
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Horace A. Crossman

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SHEET FEEDING MECHANISM.

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Patented Jan. 6, 1920.

12 SHEETS—SHEET 10.

Fig. 33.

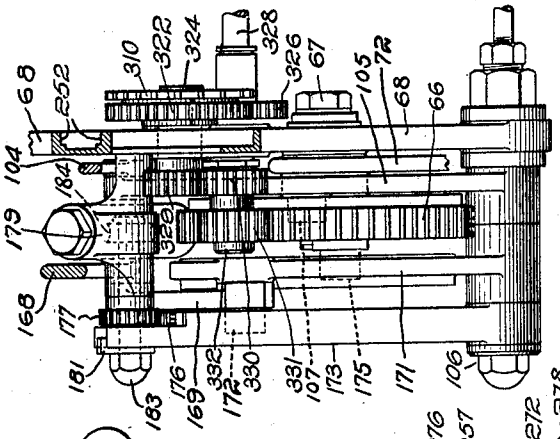


Fig. 37.

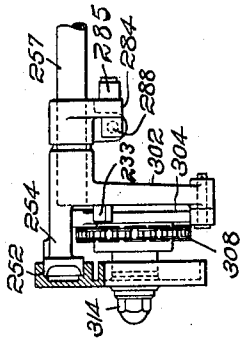


Fig. 32.

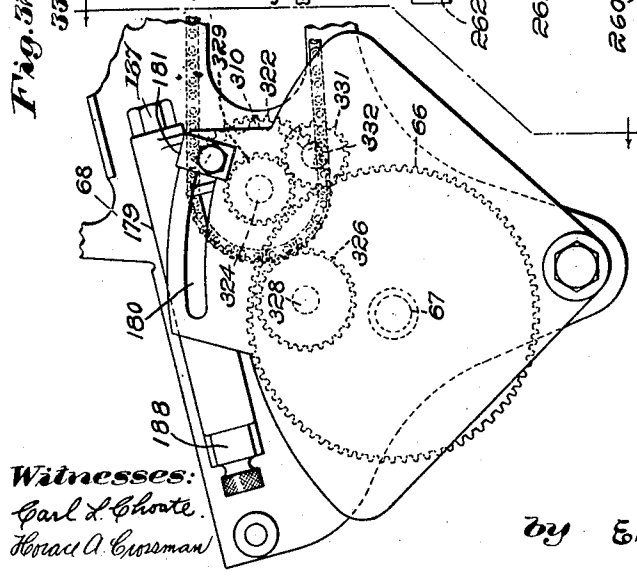


Fig. 34.

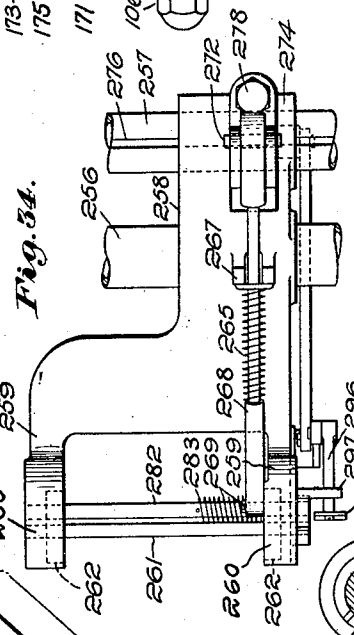


Fig. 35.

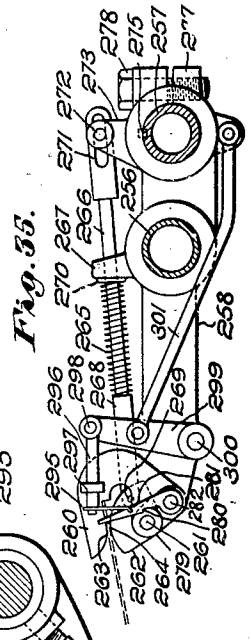
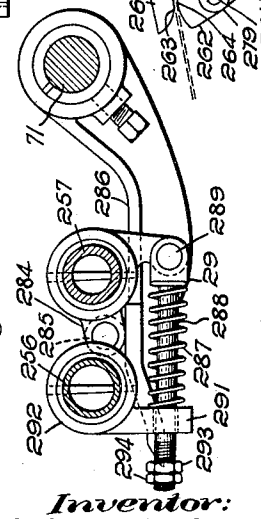


Fig. 36.



Witnesses:
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SHEET FEEDING MECHANISM.

APPLICATION FILED NOV. 8, 1912.

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Patented Jan. 6, 1920.

12 SHEETS—SHEET 11.

Fig. 39.

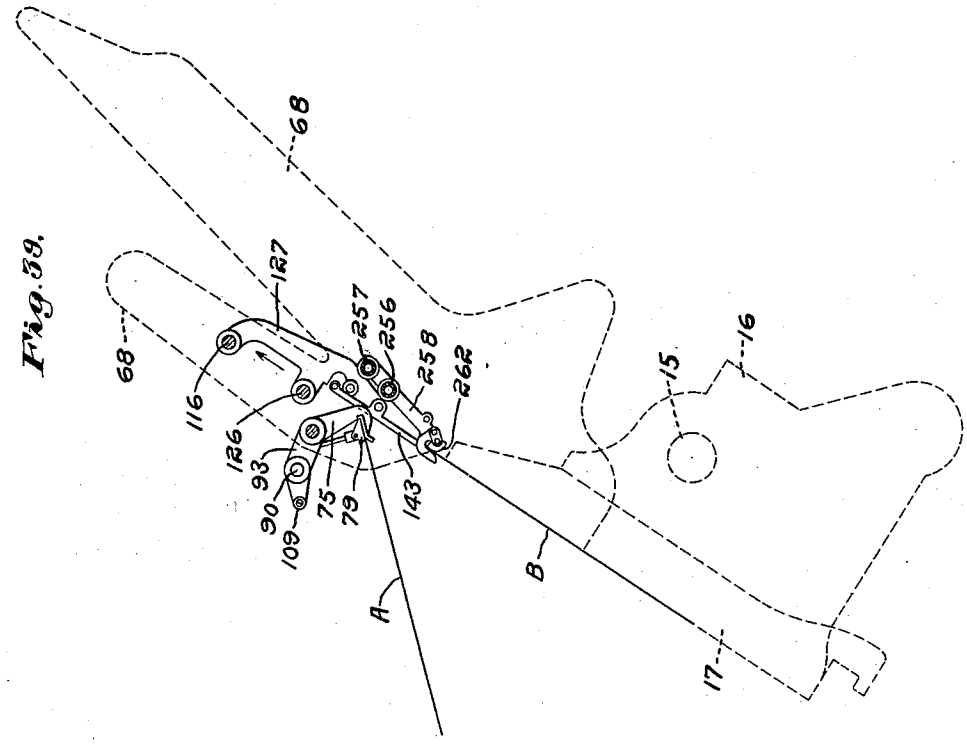
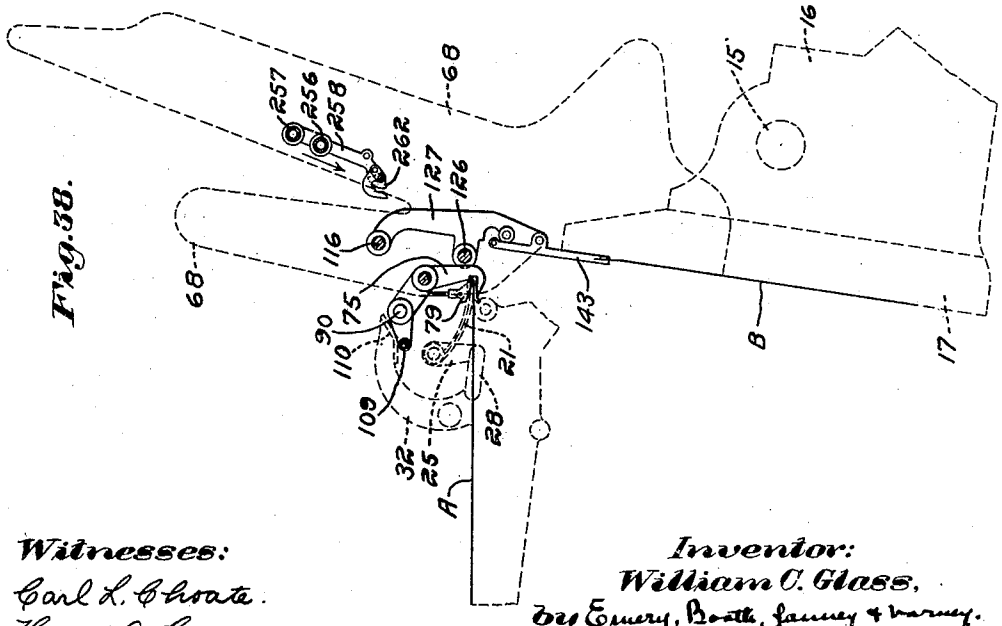


Fig. 38.



Witnesses:
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Patented Jan. 6, 1920.

12 SHEETS—SHEET 12.

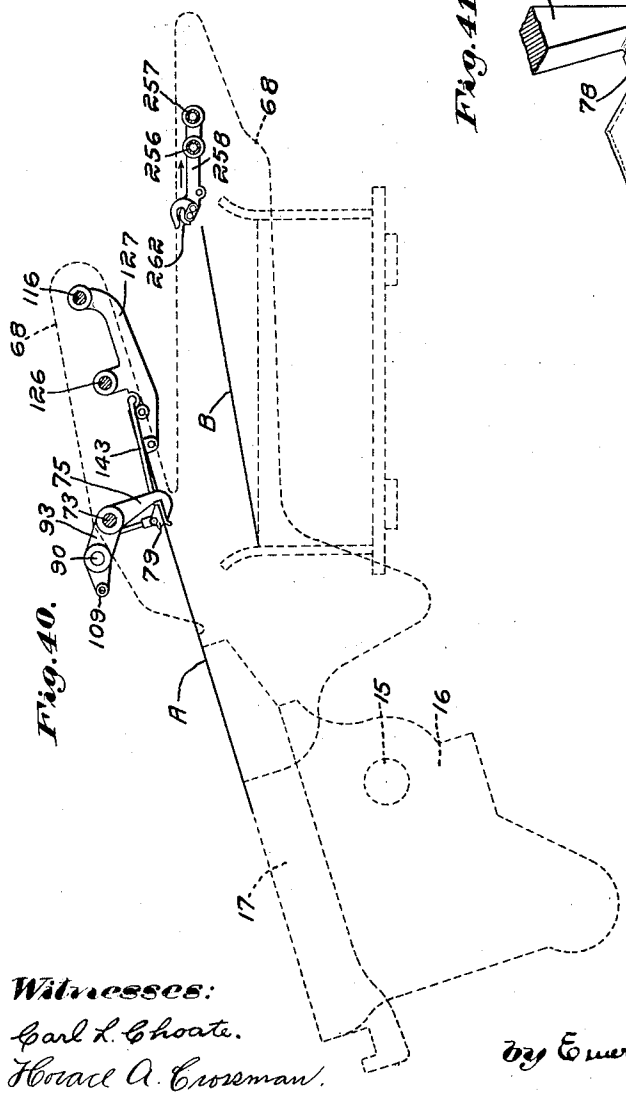


Fig. 40.

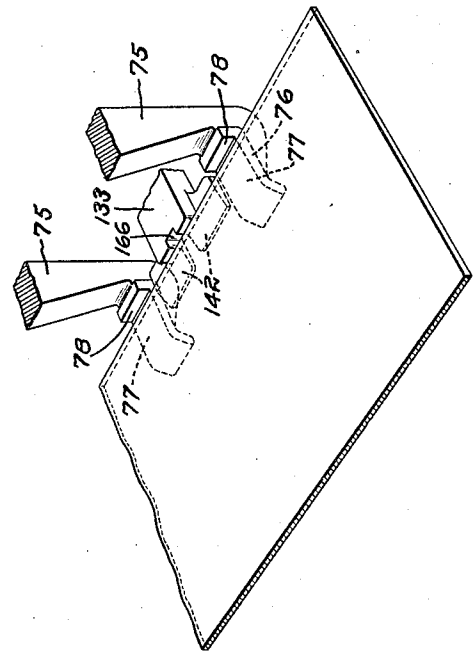


Fig. 41.

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UNITED STATES PATENT OFFICE.

WILLIAM C. GLASS, OF JAMAICA PLAIN, MASSACHUSETTS.

SHEET-FEEDING MECHANISM.

1,327,546. Specification of Letters Patent. **Patented Jan. 6, 1920.**

Application filed November 8, 1912. Serial No. 730,165.

To all whom it may concern:

Be it known that I, WILLIAM C. GLASS, a citizen of the United States, and a resident of Jamaica Plain, county of Suffolk, and State of Massachusetts, have invented an Improvement in Sheet-Feeding Mechanisms, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to sheet feeding mechanisms, and more especially, though not exclusively, to mechanisms for feeding sheets of cardboard into a press which creases and cuts the sheets to make box blanks.

My invention will be best understood by reference to the following specification, when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a plan of a printing press of common form, having a sheet-feeding mechanism embodying my invention, the parts being shown in the position which they occupy when the press is wide open;

Fig. 2 is a side elevation of the press and the sheet-feeding mechanism, with the parts in the same position as in Fig. 1;

Fig. 3 is a detail plan section, partly broken away, on line 3—3 of Fig. 2, illustrating a portion of the gearing by means of which the sheet-feeding mechanism derives its power from the crank-pin at one side of the press;

Fig. 4 is a side elevation of the press, showing the positions which the parts of the press and sheet-feeding mechanism occupy when the press is closed;

Fig. 5 is a detail side elevation, at an enlarged scale, of a portion of the feed-table and the stop-finger mechanism;

Fig. 6 is an enlarged detail plan section on line 6—6 of Fig. 5;

Fig. 7 is a detail sectional view, partly in elevation, on line 7—7 of Fig. 5;

Fig. 8 is a detail side elevation, at an enlarged scale, of a portion of the sheet-feeding mechanism, illustrating particularly the first set of grippers and their actuating mechanism;

Fig. 9 is an elevation viewed from the opposite side of the machine from that seen in Fig. 8, illustrating the first set of grippers;

Fig. 10 is a rear elevation of one pair of the first set of grippers;

Fig. 11 is an elevation viewed from the right hand side of Fig. 10;

Fig. 12 is a side elevation of a portion of the sheet-feeding mechanism, illustrating particularly the first and second set of grippers in the relative positions which they occupy when the first is about to deliver a sheet to the second;

Fig. 13 is a detail plan partly in section, illustrating the adjusting means for the changing of the stroke of the second set of grippers;

Fig. 14 is a detail plan at an enlarged scale of one pair of grippers of the second set;

Fig. 15 is a sectional view on line 15—15 of Fig. 14, showing the gripper opening and closing cam in connection with the gripper mechanism;

Fig. 16 is a detail sectional view on line 16—16 of Fig. 14;

Fig. 17 is a detail sectional view on line 17—17 of Fig. 15.

Fig. 18 is a sectional view on an enlarged scale on line 18—18 of Fig. 1, looking toward the left;

Fig. 19 is a detail sectional view on an enlarged scale on line 19—19 of Fig. 1;

Fig. 20 is a sectional view partly broken away on line 20—20 of Fig. 1;

Figs. 21 and 22 are diagrammatic views illustrating the "Whitworth quick return motion" used in connection with the second set of grippers, illustrating the cam in the position which it occupies when the grippers take their maximum stroke;

Figs. 23 and 24 are similar diagrammatic views, illustrating the "Whitworth quick return motion", the cam being illustrated in the position which it occupies when the grippers take their minimum stroke;

Fig. 25 is a diagrammatic view illustrating the "Whitworth quick return motion", in connection with the second and third sets of grippers, the grippers being shown in the relative positions which they occupy at the moment when the sheet is transferred from

the second to the third set. This view illustrates particularly the fact that the variation in the stroke of the second set of grippers takes place beyond the transfer point;

Fig. 26 is a detail plan on an enlarged scale, partly broken away, of the side register mechanism;

Fig. 27 is a side elevation of the side register mechanism illustrated in Fig. 26;

Fig. 28 is a detail sectional view on line 28—28 of Fig. 26;

Fig. 29 is a detail section on line 29—29 of Fig. 27;

Fig. 30 is a detail section on line 30—30 of Fig. 26;

Fig. 31 is a detail plan section on line 31—31 of Fig. 27;

Fig. 32 is a detail side elevation of a portion of the sheet-feeding mechanism illustrating particularly the mechanism of the third set of grippers;

Fig. 33 is a sectional view on line 33—33 of Fig. 32;

Fig. 34 is a detail plan of one pair of grippers of the third set;

Fig. 35 is a side elevation of the grippers shown in Fig. 34;

Fig. 36 is a detailed sectional view at an enlarged scale on line 36—36 of Fig. 1;

Fig. 37 is a detail sectional view at an enlarged scale on line 37—37 of Fig. 1;

Fig. 38 is a diagrammatic view illustrating the first set of grippers about to take the sheet from the feed-table, and showing the second set of grippers holding a previously fed sheet between the platen and the bed;

Fig. 39 is a diagrammatic view illustrating the first set of grippers carrying the first sheet toward the transfer point, where the same is to be transferred to the second set of grippers, this view also illustrating the second set of grippers in the act of transferring to the third set of grippers the sheet which has just been withdrawn from the press by the second set of grippers;

Fig. 40 is a diagrammatic view, illustrating the first set of grippers, transferring the first sheet to the second set of grippers, and illustrating also the third set of grippers just dropping the previously creased and cut sheet upon the pile in the sheet-receiving rack, or elevator; and

Fig. 41 is a perspective view of a portion of the first and second sets of grippers, illustrating how the shoulders of the first set pass beyond the shoulders of the second set to bring the front edge of the sheet against the shoulders of the second set. In this view, the spring-pressed grippers are omitted for the sake of clearness.

Referring to the drawings, and to the embodiment of my invention which I have there disclosed for illustrative purposes, I have there shown a press of common form, to which the sheet-feeding mechanism of my invention is applied, I will first briefly describe the press.

Press. (See Figs. 1, 2, 3 and 4).

A frame 1 provides a bed 2, to which a chase 3 is secured. Journaled in suitable bearings in the frame is a main driving shaft 4, the usual fly-wheels being omitted, for the sake of clearness. Secured to the shaft are two pinions 5 and 6, meshing with gears 7 and 8, respectively, constituting crank-disks provided with crank-pins 9 and 10. These crank-pins are connected by draw-bars 11 and 12 to eccentric bushings 13 and 14, swiveled on a platen shaft 15, mounted in a platen bridge 16, forming a part of a rocking platen 17, said bushings being connected to each other by a bar 18, by means of which the bushings may be turned in unison upon the platen shaft which passes eccentrically through the bushings. The bar 18 is provided with means of adjustment (not shown) of common form, by which the bushings may be set to vary the strength of the impression at will, or to throw off the impression entirely.

Feed-table and stop-finger mechanism. (See Figs. 1, 2, 4, 5, 6 and 7).

The press may be provided with a feed-table 19, suitably supported thereon above the bed of the press, and serving as a support for a supply of the sheet cardboard, and provided with a plurality of feed-table extensions 19′. The feed-table may be provided with side register means, herein a stop 20 of common form, and one or more other stops 21 in the form of fingers, having notched abutments 22, against which the front edge of the sheet may be placed by the operator. These fingers may be secured to a rock-shaft 23, mounted in suitable bearings 24 on the frame of the feed-table. The fingers may be elevated at appropriate times in the operation of the machine by suitable mechanism, herein driven by the press gear 7. Herein there is secured to the rock-shaft 23 an arm 25, having secured thereto a stud 26, located in a slot 27 provided in one end of a link 28, and urged toward the left (Figs. 5 and 6) in said slot by a spring 29, secured at one end to said arm, and at its other end to a pin 30, fixed to the link. This spring provides for a yielding downward pressure of the fingers 21 upon the feed-table extensions, while the arrangement is such that the fingers may be positively lifted to allow the sheet to pass beneath the abutments 22 of the fingers.

The link 28 is herein pivoted at 31 to a cam lever 32, fulcrumed at 33 and having journaled thereon a cam roll 34, actuated by a cam 35 formed in the face of a gear 36 journaled on a stud 37. Herein the gear

36 is driven by a pinion 38, secured to one end of a shaft 39, journaled in a bearing bracket 40, and having secured to its other end a gear 41, meshing with the press gear 7. The gears 36 and 38 may be provided with a casing 42, secured to the bracket 40 and the stud 37.

In order to facilitate setting up the mechanism, and adapting it to the press so that the gear 41 will properly mesh with the press gear 7, the bearing bracket 40 may be swiveled on the stud 37, and may be provided with a segmental slot 43, to receive a clamping screw 44. By this means, the pinion 41 may be adjusted with relation to the press gear 7, so as to properly mesh therewith, regardless of inaccuracies and slight differences in presses.

Driving gearing for gripper mechanisms. (See Figs. 1, 2, 3, 4 and 33.)

As a convenient means of driving the gripper mechanisms hereinafter described, and timing the same with relation to the press, I preferably employ the driving mechanism which I will now describe. Secured to the crank-pin 9 is a beveled gear 45, meshing with a beveled pinion 46 secured to one end of a shaft 47, while a beveled pinion 48 secured to the other end of the shaft meshes with a beveled gear 49, having secured thereto a spur gear 50, preferably by means of a shear pin 51, designed to shear off, and prevent injury to the mechanism, in the event of any accident which would tend to stop the rotative movement of the gear 50.

Inclosing the beveled gear 45 and pinion 46, is a gear casing 52, which also forms a bearing 53 for one end of the shaft 47. This casing may be swiveled on a hub 54, formed on the gear 45, and may be held against rotation by suitable means, herein a jaw 55, embracing the link 11, the casing being held in place by suitable means, herein a stud 56. Inclosing the beveled gear 49 and pinion 48, is a casing 57, which also forms a bearing 58 for the other end of the shaft 47, as well as a support for a fixed stud or shaft 59 for the gears 49 and 50. Inclosing the gear 50 is a casing 60, swiveled on the stud 59, and held in place thereon by suitable means, herein a washer 61 secured to said stud.

The casing 60 may also constitute a support for a gear 62, journaled on a stud 63 and meshing in turn with a gear 64, journaled on a stud 65. The casing 60 may also constitute a housing for the gears 62 and 64. The gear 64 meshes with a gear 66, journaled on a stud 67 secured to a side frame member 68. This side frame member and a similar side frame member 69, both secured to the sides of the platen 17, are rigidly connected to each other by suitable means, herein tie-rods 70 and 71, and form a suitable support at the front of the press for the several gripper mechanisms which will presently be described.

Referring now to the gears 64 and 66, these gears are held in mesh with each other by a link 72, pivoted at its lower end to the stud 65 and at its upper end to the stud 67. Incidentally, this link facilitates the assembling of the parts, inasmuch as it admits of the location of the gear 64 being slightly varied to compensate for variations in the placing of the other parts. Comparing the position of the parts shown in Fig. 2 with the position shown in Fig. 4, it must be evident that as the press opens and closes, the casing 60 will oscillate about the axis of the stud 59, and gear 50, and consequently the gear 62 will swing back and forth in a partial revolution about the gear 50. Now, assuming that the press gear 7 is driven in the direction indicated by the arrow thereon, (Figs. 2 and 4), the gear 50 will be driven in the direction of the arrow thereon (Figs. 2 and 4). It will now be evident that when the gear 62 is swung upwardly from the position shown in Fig. 2 to the position shown in Fig. 4, it is being revolved in the same direction as the direction of rotation of the gear 50. On the other hand, when the press is open, the gear 62 will be swung from the position shown in Fig. 4 to the position shown in Fig. 2, and the direction in which it is thus revolved is contrary to the direction of rotation of the gear 50. As a consequence, the speed of rotation of the gear 62 will be diminished during the closing movement of the press and accelerated during the opening movement. Since the gear 66 is driven through the gear 64 by the gear 62, it must be evident that this rotative movement of the gear 66 will be uneven,—that is to say, during a portion of its rotation, its movement will be slow, and during the remainder of a given rotation, its movement will be relatively rapid.

In the cycle of the press, opening movement takes place in approximately one-half the rotation of the gear 7, and the closing movement also takes place in the remaining half of the rotative movement, while it is found that the gear 66 rotates approximately two-thirds of a rotation during the opening movement of the press, and one-third of the rotation on the closing movement, due to the described swinging movement of the pinion 62 with relation to the gear 50. This irregular rotative movement may be translated into a uniform reciprocatory movement, or a reciprocatory movement having any desired dwells, retardations or accelerations, by the use of a variation of the well-known Whitworth quick return motion, which will be hereinafter described in connection with the second gripper mechanism.

First gripper mechanism. (See Figs. 8, 9, 10 and 11).

Mounted in suitable bearings in the side frame members 68 and 69, is a rock-shaft 73 carrying sheet grippers, which it will be convenient to refer to as the first set of grippers, since they act upon the sheet first by taking the same from the feed-table and delivering it to a second set of grippers. Loosely mounted on the rock-shaft 73, but held against swinging movement thereon, is a lever, or a plurality of levers, 74 (herein two levers), which carry the grippers. Since these two levers and the parts carried thereby are exactly similar, a detailed description of one will suffice for both. Each lever 74 is preferably forked, and provided with two arms 75—75, having formed thereon, or secured thereto, fixed grippers 76—76, having sheet-gripping surfaces 77—77, and shoulders 78—78, which may serve as abutments for the front edge of the sheet. Supported upon the arms 75 are two movable grippers 79—79, herein pivoted at 80 to a forked yoke 81, the latter being secured to a rod 82 mounted to slide in a sleeve 83. This sleeve is provided with a longitudinal slot 84, in which a pin 85, secured to the rod 82, plays. Encircling the rod 82 is a spring 86, interposed between the yoke 81 and the sleeve 83, and tending to move them apart, or in other words, tending to urge the grippers 79 toward the grippers 76. The sleeve 83 is formed to receive one arm of a lever 87, to which it is pivoted at 88. This lever is interposed between a pair of arms 89 on the lever 74, and is secured to a rock-shaft 90 by a key 91, located in a key-way, or spline, 92. The rock-shaft 90 is mounted in suitable bearings in the arms 89 of the lever 74, and is also journaled in bearings provided in one or more arms 93 secured to the rock-shaft 73. Therefore, the levers 74 may be adjusted longitudinally of the rock-shafts 90 and 73, and yet receive their rocking motion from the shaft 73 without being actually secured thereto. The lever 74 and the lever 87 may be held against longitudinal sliding movement by providing the lever 87 with a split ear 87^1 and a clamping screw 87^x, by means of which the lever 87 may be clamped to the rock-shaft 90. The yoke 81, carrying the grippers 79, may be held against lateral displacement by a link 94, pivoted at one end to the yoke 81, and at its other end to the lever 75. The movable gripper 79 is provided with a sheet-engaging surface 95, which coöperates with the sheet-engaging surface 77 of the fixed gripper 76, and said sheet-engaging surfaces preferably diverge at their entrance, so as to guide the entering edge of the sheet therebetween.

As a means for applying spring pressure to the grippers 79 at appropriate times in the operation of the machine, the rock-shaft 90 has secured thereto an arm 96, to which is pivoted a rod 97 encircled by a spring 98, bearing at one end against a fixed collar 99 on the rod, and at its other end against a pivoted block 100, through which said rod is arranged to slide. A nut 101 and check-nut 102, threaded onto the rod 97, serve to limit the motion of the latter, under the influence of the spring 98. The arm 96 is fixed upon the rock-shaft 90 in such a position that in one position of the arm (see full line position, Fig. 9), the arm is nearly in line with the rod 97, and consequently the spring 98 exerts its minimum force upon the springs 86 to cause the latter to urge the grippers 79 toward the grippers 76, the consequence being that at that time, the springs 86 furnish a very light pressure upon the sheet. When, however, the lever 75 is swung from the full line position (Fig. 9) to the dotted line position, the arm 96 is disposed at a substantial angle (see dotted line position, Fig. 9) to the rod 97, the result being that the spring 98 will serve to apply additional pressure to the grippers by exerting upon the strings 86 a force greater than the pressure of the latter, this occurring during the carrying movement of the grippers.

Since the pivot connecting the arm 96 to the rod 97 is placed eccentrically with relation to the axis of the rock-shaft 73, about which it swings, said pivot in swinging downward will approach the abutment 100, and consequently cause the spring 98 to be placed under greater tension during the carrying movement of the grippers. Sometimes in operating on very thin cardboard, it is found desirable to utilize only the pressure of the springs 86, during the transferring of the sheet. Under such circumstances, the nut 101 and check-nut 102 may be adjusted to limit the motion of the rod 97, under the influence of the spring 98, so that the spring 98 becomes practically ineffective. By utilizing the spring 86, pressure may be independently applied to the two pairs of grippers, and the two pairs may be caused to grip the sheet with substantially equal pressure.

A rocking motion may be imparted to the rock-shaft 73 and the described parts carried thereby by any suitable means, but herein, there is secured to the rock-shaft an arm 103, connected by a link 104 to a cam lever 105, fulcrumed on a stud 106, fixed to the side frame member 68, and said cam lever having journaled thereon a cam roll 107, actuated by a suitable cam 108, the latter being herein formed in one face of the gear 66.

By the described mechanism, when the press closes, the grippers 76 and 79 are caused to swing forward into position to receive the sheet from the feed-table in a man-

ner which will be more fully described hereinafter, and at the proper moment the grippers are positively opened by the engagement of the cam-roll 109 journaled on an arm 109[1] secured to the rock-shaft 90, with a cam 110 formed on or secured to the cam lever 32 hereinbefore described (see Figs. 4 and 5). This cam is so shaped and placed that the grippers will open to receive the sheet from beneath the fingers 21, and when the press starts to open, the cam lever 32 will lift the cam 110, thus releasing the roll 109, and allowing the grippers instantly to close under the combined pressure of the springs 86 and 98.

The grippers now having received the sheet will be swung into the proper position to deliver the same to the second set of grippers, which will presently be described, and at the moment of delivery, the grippers will be partially relieved of the pressure of the spring 98, so that the second set of grippers may draw the sheet from the first set against merely a slight resistance offered by the spring 98 acting through the springs 86 pressing the grippers upon the sheet. By an inspection of Fig. 10, it will be seen that the two pairs of grippers on each lever 75 are so placed as to receive between them the grippers of the second set of grippers, which will now be described.

Second gripper mechanism. (See Figs. 12 to 24, inclusive.)

Mounted in guideways 111 in the side frame member 68 and in guideways 112 in the side frame member 69, are two slides 113 and 114, rigidly connected to each other by rods 115 and 116. Preferably, the slide 113 is provided with shoulders 117 arranged in sliding contact with a finished face 118 of the side frame member 68, to hold the slide against lateral movement in one direction, while the slide is provided with a groove 119, which receives a key 120 secured to the frame member 68, to hold the slide against lateral movement in an opposite direction. At the other side of the machine, the slide 114 is preferably without lateral guides, so that the side frame is free to come and go somewhat, without affecting the position of the slides 113 and 114.

Since these slides are very short as compared with the width of the machine, it is desirable to provide some means for insuring their movement in unison, so that the sheet will be held square during its forward motion. To this end, there is journaled in the slides a shaft 121, having secured thereto a pair of pinions 122 and 123, meshing with racks 124 and 125, secured to the side frame members 68 and 69 respectively.

Mounted in the slides 113 and 114, is a rock-shaft 126, which is capable of longitudinal sliding movement for a purpose which will be explained in connection with the side register mechanism hereinafter described. Mounted upon the rock-shaft 126, and upon the fixed rod 116, is a plurality of gripper supports 127 (herein two). Each of these gripper supports is capable of sliding on the fixed rod 116, but is compelled to move longitudinally with the sliding rock-shaft 126, by being forked to provide a pair of arms 128, between which is located an arm 129 secured to the rock-shaft 126. The gripper supports 127 are capable of adjustment longitudinally of the rock-shaft 126, the latter for that purpose being provided with a spline, and the arm 129 being provided with a key 130, and a split ear 131, having a clamping screw 132.

Each of the gripper supports, with the mechanism mounted thereon, is exactly similar to the other, and a detailed description of one will suffice for both. Mounted on each gripper support 127 is a gripper 133, which is fixed in the operation of the machine, but capable of lengthwise adjustment it being provided for this purpose with a dove-tailed groove 134, which receives a correspondingly dove-tailed guide 135 on the gripper support 127. As a means for adjusting the gripper longitudinally, it may be provided with a transverse slot 136, having therein the head of an eccentric stud 137, provided with a shank 138 swiveled in the gripper support 127. The eccentric stud may be provided with a slot 139, to receive a screw-driver by means of which it may be conveniently rotated to advance or retract the gripper. By advancing one or the other of the grippers 133, the sheets may be squared very readily. The gripper may be secured in the desired position of adjustment by a clamping screw 140 passing through a longitudinal slot 141 provided in the gripper, said screw being threaded into the gripper support 127.

The gripper 133 is provided at its forward end with laterally extending sheet-gripping surfaces 142, preferably having a slight downward incline toward their extremities to facilitate the extrance of the edge of the sheet.

Coöperating with these fixed gripping surfaces are two movable grippers 143, having sheet-engaging surfaces 144, preferably having a downward incline corresponding to the surfaces 142. These movable grippers are preferably mounted on a pivot 145 on the gripper support 127, and said grippers are connected to each other by a pin 146. A bell-crank lever 147 secured to a rock-shaft 148 mounted in bearings in the gripper support 127, is provided with a forked arm 149, which receives the pin 146. The bell-crank lever is provided with a pair of arms 150, pivoted at 151 to a collar 152 interposed between said arms. The collar

152 is secured to a rod 153, arranged to slide through a sleeve 154 pivoted at 155 to the arm 129, the latter for that purpose being forked to straddle the sleeve 154. A spring 156, encircling the rod 153, bears at one end against the sleeve 154, and at its other end against a nut 157, threaded on the rod and serving as a means of adjustment for the spring. A lock-nut 158 may be provided to secure the nut 157 in the desired position of adjustment.

As a means for rocking the shaft 126 to actuate the movable grippers 143, said rock-shaft has secured thereto an arm 159, having journaled thereon a cam-roll 160, located in the cam path of a stationary cam 161 secured to the side frame member 69. By giving the cam path the proper shape, it may be caused to utilize the forward and backward movement of the slides 113 and 114, and the described mechanism carried thereby, to open and close the grippers. To this end, the cam is provided with two straight portions 162 and 163, and two depressed portions 164 and 165, the latter being shallower than the former. When the slides 113 and 114 and the mechanism carried thereby are in their retracted position shown in Figs. 16 and 20, the grippers are open. When, however, the slides and mechanism carried thereby start to advance, the cam roll 164 rises into the straight elevated portion 162 of the cam path, thus acting through the arm 159, rock-shaft 126, arm 129, and sleeve 154, to place the spring 156 under tension, and apply the spring pressure to close the grippers 143 upon the sheet, thus gripping the latter firmly against the grippers 143. This occurs at an appropriate time in the operation of the machine, as will be described hereinafter. The depth of the depression 165 is only sufficient to cause the spring pressure of the grippers upon the sheet to diminish at that point, without being entirely removed, and hence there is no danger of the grippers dropping the sheet during their forward movement.

In some cases, when box blanks are being cut, it is desirable to have the cut extend clear to the front edge of the sheet, and since the sheet is to be held in the press by the second set of grippers during the cutting and creasing operation, it is necessary to provide the gripper 133 with a notch 166, to permit the sheet to be cut clear up to its front edge without interference with the gripper.

I will now describe the preferred form of mechanism by which the slides 113 and 114, and the second set of grippers carried thereby, are given their forward and backward movements. The slide 113 is provided with a laterally projecting stud 167, connected by a link 168 to one arm of a bell-crank lever 169, fulcrumed at 170 upon a lever 171, the latter being fulcrumed on the stud 106, hereinbefore described. The other arm of the bell-crank lever 169 has journaled thereon a cam-roll 172, located in a cam path provided in a cam 173, which is fixed in the operation of the machine, but is adjustable about the axis of the stud 106, as will presently be described.

The lever 171 is provided with a slot 174, in which is located a crank-pin, or roller, 175, carried by the gear 66 hereinbefore described. This mechanism constitutes what is familiarly known as the "Whitworth quick return motion," with this difference, that the present device is a reversal of the Whitworth quick return motion. In other words, instead of converting a uniform rotary motion into a reciprocatory motion having a slow motion in one direction and a quick return, it converts, or more correctly speaking, is capable of converting the non-uniform rotation of the gear 66 into a uniform, reciprocatory motion. This would be the case if the slot 174 in the quick return lever 171 were made straight, but as it is desirable to give the second set of grippers a motion that will be more rapid at some points than at others, and which will have suitable dwells, the slot 174 is given an irregular outline. This irregular shape of the slot and the results accomplished thereby, will be referred to more particularly hereinafter.

The cam path of the cam 173 is formed in part on an arc of a circle struck from the axis on which the lever 171 rocks, while the remainder of the cam path takes a drop toward the fulcrum of the lever. It will be convenient to refer to the first part of the cam path as the concentric part, and the remaining part as the dip or drop. The extent of the concentric portion of the cam path is such that when the cam is placed in the position shown in Figs. 12, 21 and 22, the cam-roll 172 will remain in the concentric part of the cam path during the entire stroke of the lever 171, and consequently the motion which is imparted to the second set of grippers will be uninfluenced by the cam 173. This is the extreme travel given to the second set of grippers, and consequently at this time, these grippers will move to their maximum distance beyond the front edge of the platen. This length of stroke is used for the smallest size of sheet, since it is desirable that the sheet shall be placed as near as possible to the center of the platen, so that the platen pressure may be equalized.

On the other hand, if it be desired to shorten the stroke of the second set of grippers, this may be accomplished by suitable adjustment of the cam 173, so that the stroke of the cam-roll 172 will begin at some point

toward the left (Figs. 23 and 24) of the right-hand end of the cam path, and end at some point in the dip or drop in the cam path. As a result, the stroke of the second set of grippers will be shortened, the amount depending upon the position at which the cam 173 is set.

While any other suitable adjusting means may be employed, and while the adjusting means may be altogether dispensed with if desired, I preferably employ manually operable adjusting means, which will now be described. Referring particularly to Figs. 12, 13 and 33, the cam 173, as before stated, is pivotally mounted upon the stud 106. Formed on, or secured to the cam 173, is a segmental gear 176, with which meshes a pinion 177, secured to a shaft 178, the latter being journaled in a bracket 179 secured to the side frame member 68. The shaft 178 extends through a segmental slot 180, provided in the cam 173, and preferably through an index 181 coöperating with a series of suitable graduations 182 on the cam 173. These graduations and index may serve to assist the operator in properly adjusting the cam for the desired length of stroke of the second set of grippers.

The shaft 178 may, if desired, be provided with a clamping nut 183, which serves not only to firmly clamp the cam in the desired position of adjustment, but also serves as a means for tying the cam firmly to the bracket 179, the latter in turn being firmly fixed to the side frame 68, the consequence being that these parts provide, as it were, a sort of rigid box-like structure for the mechanism supported thereby (see Fig. 33). Secured to the shaft 178, is a worm gear 184, meshing with a worm 185, the latter being formed on, or suitably secured to, a worm shaft 186, journaled in suitable bearings provided in the bracket 179. The worm shaft 186 may be provided at one end with a suitable collar, or shoulder 187, to take the end thrust of the shaft in one direction, and may be provided at its other end with a suitable collar, or shoulder 188, to take the end thrust in the opposite direction. If desired, the collar 187 may be in the form of a polygonal head, to receive a wrench, and the collar 188 may be knurled to facilitate manual rotation of the worm shaft.

By loosening the clamping nut 183, and rotating the worm shaft 186 in the proper direction, the cam 173 may be adjusted to the desired position, and secured in the selected position of adjustment, by tightening up the clamping nut 183.

Referring now to Figs. 21 and 22, wherein the cam 173 is shown in such a position of adjustment that the shaft 178 is located at the extreme right-hand end of the slot 180, this adjustment of the cam is such that with each rotation of the gear 66 carrying the crank-pin, or roll, 175, the second set of grippers will be caused to travel its full stroke, since the cam-roll 172 does not leave the concentric portion of the cam path in the cam 173. Referring now to Figs. 23 and 24, wherein the cam 173 is shown in such a position of adjustment that the shaft 178 occupies a position at the extreme left-hand end of the slot 180: in this position of adjustment of the cam, the cam-roll 172 begins its stroke at the point shown in Fig. 23, and ends its stroke at the point shown in Fig. 24. Now it must be evident that, although the fulcrum of the bell-crank lever 169 always travels to and fro a fixed distance, the distance through which the second set of grippers will travel will be dependent upon the control which the cam 173 exercises upon the cam-roll 172. That is to say, if when the cam-roll 172 in traveling toward the left (Fig. 23) reaches the end of the concentric portion of the cam track, it starts to descend into the drop, or dip, the bell-crank lever 169 will commence to rock about its fulcrum in a clockwise direction with respect to the lever 171, by which it is carried, and consequently, although the fulcrum of the bell-crank lever is still advancing toward the position shown in Fig. 24, there will be a slowing down in the movement of the link 168, and hence a lessening of the stroke of the second set of grippers. To state a concrete example,—with the cam 173 placed in the position shown in Figs. 21 and 22, the second set of grippers may have a stroke of twelve inches, and will travel its maximum distance into the press, but with the cam placed in the position shown in Figs. 23 and 24, the stroke of the grippers may be reduced to only nine inches, and the grippers will travel into the press their minimum distance. By properly adjusting the cam, any desired variation in stroke between these may be obtained.

Referring now to the slot 174 in the lever 171, it has already been stated that this slot may be given such a shape as to cause the grippers to be given a motion which may have suitable dwells, or pauses, and may be slow or fast according to the requirements of the grippers. Now, it must be evident that since the second set of grippers is to hold the sheet stationary in the press during the impression, the grippers must pause in their motion, and to that end, the slot 174 is formed with a portion 189, which in the position of the lever 171 shown in Fig. 22 is concentric or coincident with the path of the crank-pin, or roll 175. The extent of this concentric portion 189 of the slot in the lever is, of course, determined by the length of the dwell required.

When the sheet has been cut and creased, and the press opens, it is desirable that the second set of grippers shall carry the sheet

as rapidly as possible out of the press, transfer the sheet to the third set of grippers, and then recede to its initial position, where it is to receive a new sheet from the first set of grippers. To this end, the slot 174 is provided with an abrupt turn 190, which will produce the desired movement (see Fig. 25), and when the second set of grippers has reached the end of its stroke, the new sheet is transferred thereto from the first set of grippers. The sheet now, having been transferred from the first set of grippers to the second set, is carried forward into the press.

It will be readily apparent that when the press is closing and the slides 113 and 114, together with the second set of grippers and all the other mechanism carried by said slides, are advancing downwardly to carry the sheet into the press, these parts will acquire considerable momentum, and therefore, in order to counterbalance the weight of these parts and take up any back-lash which might result in an inaccurate positioning of the sheet. I provide suitable means, herein a torsional spring 191, encircling the shaft 121, said spring having one end fixed to a collar 192 secured to said shaft, and its other end fixed to an abutment 193, through which the shaft passes, this abutment being fixed to the rods 115 and 116. When the gripper mechanism advances downwardly to carry the sheet into the press, the spring 191 will be wound and placed under such tension that it will take up all of the back-lash of the parts, and moreover, when the grippers start to raise, the power stored up in the spring will assist the driving mechanism to lift the gripper mechanism. In fact, it is found that the power thus stored up is practically sufficient in itself to return the parts to their initial position.

Side register mechanism. (See Figs. 26 to 31, inclusive).

If desired, there may be provided a side register mechanism, which when the second set of grippers has received the sheet, will cause the sheet and grippers to be shifted bodily, so as to accurately register sidewise. To that end, the rock-shaft 126, which carries the supports of the second set of grippers, may be mounted to move longitudinally, and there may be provided suitable means actuated by contact with the edge of the sheet to determine the extent of such movement. Herein, longitudinal motion is imparted to the shaft 126 by a cam-roll 194, journaled thereon and engaging a fixed cam 195, which is herein for convenience of manufacture formed on the cam 161, secured to the side frame member 69. This cam-roll is urged toward its cam by a spring 196 (see Fig. 1), bearing at one end against the fixed abutment 193, and at its other end against a collar 197, secured to said shaft. It will now be evident that if the spring 196 were to hold the cam-roll 194 continuously in contact with the cam 195, as the second set of grippers is moved forward and back it would be shifted laterally a distance equal to the throw of the cam.

I will now describe the means by which the lateral motion of the sheet and the second set of grippers is stopped, when the side edge of the sheet has reached a predetermined point. Formed on the sliding rock-shaft 126, is a rack 198, which (see Fig. 27), is given a circular formation because of the rocking motion of said shaft. This rack meshes with a pinion 199, secured to a sleeve 200, the latter having fixed thereto a ratchet 201. The sleeve 200 is journaled on a stud 202, fixed to a support 203. This support is mounted upon the fixed rods 115 and 116, in such a manner as to be capable of longitudinal adjustment thereon, and is held fixed in the desired position of adjustment by suitable means, herein a clamping stud 204 and nut 205, said stud having a lateral recess 206, which receives the rod 116.

Coöperating with the ratchet 201 is a pawl 207, pivoted on a stud 208 and urged toward said ratchet by a spring 209. Carried by the pawl 207 is a dog 210, having a tooth 211 coöperating with a rack-bar 212 provided with one or more teeth 213, each of which is provided at its forward side with an abrupt shoulder 214, and at its rearward side with an inclined surface 215, for a purpose which will presently appear. The rack-bar 212 is mounted to slide in a suitable guide 216, and is limited in its movement by a fixed pin 217, located in a slot 218 provided in said rack-bar. A spring 219 secured at one end to a fixed pin 220, and at its other end to a pin 221 carried by the rack-bar 212, tends to hold the rack-bar in the position shown in Fig. 26. The rack-bar 212 is connected to a trigger 222 pivoted at 223 upon a supporting plate 224. The trigger 222 is connected to the rack-bar 212 preferably by being provided with a tooth 225 located in the slot 226 provided in said rack-bar. The trigger 222 is provided with a suitable sheet edge engaging surface 227, adapted to be engaged by one side edge of the sheet, when the latter is shifted laterally, while grasped by the second set of grippers. When this engagement occurs, the rack-bar 212 will be shifted longitudinally in the direction of the arrow thereon (Fig. 31), whereupon the particular tooth 213, which is engaged by the tooth 211 of the dog 210, will allow the latter to release the pawl 207, and permit the same to engage the ratchet 201 and lock the same against further rotation under the

influence of the pinion 199 and rack 198. It will now be evident that since the shaft 126 is locked against longitudinal sliding motion, the cam-roll 194 carried thereby will no longer follow its cam 195 under the influence of the spring 196, and consequently, the grippers carried by the shaft 126 will be held in the proper position to maintain an accurate side register of the sheet, when the latter is carried into the press.

As a means for resetting the described mechanism, so that the same shall be prepared to act upon the next sheet, I may provide suitable means actuated by the equalizing shaft 121 to withdraw the pawl 207 from its ratchet 201, and simultaneously withdraw the tooth 211 of the dog 210 from its position between the teeth 213 of the rack-bar 212. To this end, there is loosely mounted upon the stud 208 a sleeve 228, having formed on, or secured thereto, an arm 229 provided with a pin 230 adapted to engage the pawl 207 in the end of a slot 231 provided in the latter. Formed on, or secured to the sleeve 228, is a worm gear segment 232, meshing with a worm 233 on the shaft 121. When, during the backward movement of the second set of grippers, the shaft 121 is rotated by the coöperative action of the pinions 122 and 123 with the racks 124 and 125, the worm 233 acts through the worm gear segment 232, arm 229 and pin 230 to withdraw the pawl and dog from their described engagement, and thus allow the trigger 222 and rack-bar 212 to be returned to their initial position under the influence of the spring 219. Contemporaneously, the shaft 126, rack 198, pinion 199 and ratchet 201, are returned to their initial position under the influence of the cam 195. In order that the side register mechanism may be adjusted laterally upon the fixed rods 115 and 116, the worm 233 is provided with a key 234, arranged to slide in a keyway or spline 235, provided in the equalizing shaft 121, and the worm is held in its proper position with respect to the worm gear segment 232, by being placed between two cross members 236 and 237 of the adjustable sliding support 203.

It quite often happens that the sheets are cut out of square, that is to say, the side edges of the sheet are not exactly at right angles with the front edge. In many cases, the box blanks, before being creased and cut, are printed upon a press similar in its general characteristics to the cutting and creasing press, and during the printing operation, one of the side edges of the sheet is placed against a side gage, which insures the proper side register of the sheet. Now it must be evident that, if the side edge of the sheet is out of square, the trigger 222 should engage the edge of the sheet at the same point where the side register gage of the printing press engaged the sheet during the printing of the latter. Otherwise, the sheet would not be accurately side-registered for the cutting and creasing operation. To this end, therefore, the trigger 222, and the rack-bar 212 are adjustable longitudinally of the side edge of the sheet, this being accomplished by adjustably mounting the supporting plate 224 upon the supporting member 203. Herein the member 203 is provided with guideways 238, in which a tongue 239 on the plate 224 is mounted to slide. The plate 224 may be held in a plurality of predetermined positions of adjustment corresponding to the spacing of the teeth 213 of the rack-bar 212. Herein, this is accomplished by providing the adjustable plate 224 with a tooth, or a pair of teeth, 240, interlocking with two adjacent teeth of a series of teeth 241, formed on the guideways 238. The plate 224 may be adjusted by simply lifting the same slightly and moving it along the required distance, after which the teeth 240 are dropped into place. The plate may then be secured by suitable means, herein a bolt 242, passing through a slot 243 provided in the member 203, and having a nut 244 (see Figs. 28 and 30), by means of which the plate is borne down firmly against its guideways. The teeth 240 and 241 are utilized in order that the teeth upon the rack-bar, as hereinbefore described, will always be properly placed, so as to coöperate with the tooth 211 of the dog 210.

Since the side edge of the sheet must be supported so as to coöperate with the trigger 222, and moreover, since the trigger and its supporting plate 224 must be made very long and thin, in order to extend between the platen and bed of the press, when the latter is closed, it is desirable that there shall be provided a slide 245, which herein is bolted to the inside of the supporting member 203, said slide being mounted to slide in a suitable fixed guide 246. Herein the guide 246 is in the form of a channel (see Fig. 29), provided with finished webs 247, forming guideways for the slide 245, the latter for this purpose being provided with finished grooves 248, to receive the same. Herein the guide 246 is provided with a jaw 249, in which is placed a collar 250, encircling the stay-rod 70, hereinbefore described. This holds the guide 246 against forward and backward movement, while at the same time permitting the same to be adjusted laterally with the other parts of the side register mechanism.

As before stated, it is necessary to provide suitable means to support the edge of the sheet, so that it shall properly engage the trigger 222. For this purpose, there is secured to the guide 246 a sheet-supporting plate 251, which serves to support the edge

of the sheet, as well as to form a supporting guide for the plate 224. This supporting plate 251 is located beneath the trigger 222, when the trigger is retracted, (see Figs. 26 and 27), but when the sheet is carried into the press, the trigger and the plate 224 advance along the supporting plate 251 until the trigger occupies a position well in advance of the supporting plate 251. The latter plate, as will be evident from an inspection of Fig. 1, is placed close to the edge of the platen 16, when the latter is open, so that inasmuch as there is only a slight gap separating the supporting plate and the platen, the side register trigger and the plate 224, on which it is pivoted, are accurately supported and guided onto the face of the platen.

Third gripper mechanism. (See Figs. 1 to 20, and 32 to 37, inclusive).

Mounted to slide in suitable ways 252 and 253 in the side frame members 68 and 69, respectively, are two slides 254 and 255, connected to each other by a fixed rod 256 and rock shaft 257, on which one or more gripper supports 258 may be mounted. These gripper supports (herein two), together with the parts supported thereby, are preferably exactly similar, and hence a detailed description of one will suffice for both.

Referring now more particularly to Figs. 34, 35 and 36, the gripper support 258 is provided with a pair of arms 259, having suitably formed thereon, or secured thereto, fixed grippers 260. Mounted in bearings in the arms 259 is a rock-shaft 261, on which is fixed a pair of grippers 262. The fixed grippers 260 are provided with sheet-engaging surfaces 263, and the rocking grippers 262 are provided with sheet-engaging surfaces 264, the latter being herein formed eccentrically with relation to the axis of the rock-shaft 261, so that when once the sheet is introduced between the grippers, any effort to withdraw the same will only result in the sheet being gripped all the more firmly. Preferably, the sheet-engaging surfaces 263 and 264 diverge quite sharply at their entrance, so as to guide the sheet with certainty and accuracy into the proper position to be gripped therebetween.

The pressure for the movable grippers may be supplied by a spring 265, encircling the rod 266, bearing at one end against a fixed abutment 267, and at its other end against a shoulder 268 on said rod, the latter being pivoted at 269 to one of the rocking grippers 262. The rod 266 is mounted to slide through a washer 270, and through the forked abutment 267, against which the washer rests. The other end of the rod 266 is herein provided with a slot 271, in which is located a pin 272 secured to a lever 273, mounted on the rock-shaft 257. The slot 271 provides a certain amount of lost motion between the rod 266 and the lever 273, so that during the gripping action, the pressure of the spring 265 may be exerted without restraint. In order that the grippers may be capable of lateral adjustment, while at the same time providing a construction whereby the lever 273 may be secured to the rock-shaft 57, the support 258 is provided with a fork 274, between the sides of which the lever is interposed, and the latter is provided with a key 275, located in a key-way, or spline 276, provided in the rock-shaft 257. The support 258 and the parts carried thereby may be held against longitudinal sliding movement on the rod 256 and rock-shaft 257, by providing the lever 273 with a split ear 277, and a clamping screw 278, by means of which the lever may be caused to grip the rock-shaft.

As a means for holding the grippers open to receive the sheet, there is herein provided a collar 279, secured to the gripper rock-shaft 261, said collar being provided with a tooth 280, normally engaged by a trigger, or latch, 281 secured to a rock-shaft 282 mounted in the arms 259. This trigger, or latch, extends across the opening between the grippers (see Fig. 35) in position to be engaged by the edge of the entering sheet, whereby the trigger or latch is tripped, and the grippers 262 released so as to grip the sheet under the influence of the spring 265. The trigger or latch 281 may be normally held in locking engagement with the tooth 280 by a suitable spring, herein in the form of a helical torsional spring 283, encircling the rock-shaft 282, and having one end secured to said rock-shaft, and the other to the adjacent arm 259.

It will be evident that the grippers, after receiving the sheet from the second set of grippers, and having carried the sheet to a point above the receiving rack, or elevator, must be provided with some means for releasing the sheet and resetting the movable grippers and trigger, ready to receive another sheet. To that end, there is secured to the rock-shaft 257 a cam lever 284, on which is journaled a cam-roll 285, adapted to cooperate with the fixed cam 286 secured to the stay-rod 71 (see Figs. 1 and 36). The cam-roll may be maintained in operative engagement with the cam by a spring 287, encircling a rod 288 pivoted at 289 to the cam lever. This spring bears at one end against a shoulder 290 on the rod 288, and at its other end against a fixed abutment 291, in the form of a lug provided on a collar 292, secured to the rod 256. When the cam-roll 285 passes entirely off of the cam 286, as it does during the forward motion of the grippers, there must be provided a suitable stop to prevent the cam-roll from dropping below the forward extremity of

the cam, and to that end, the rod 288 is herein provided with a nut 293, and a check-nut 294, threaded thereonto, and arranged to engage the lug 291, through which the rod slides.

It will now be evident that when the grippers return, after having received the sheet from the second set of grippers, the cam-roll 285 will ride up onto the cam 286, and will act through the lever 284, rock-shaft 257, lever 273 and rod 266, to positively swing the grippers 262 into open position, so as to release the sheet. As a means for positively ejecting the sheet from the grippers, when thus released, there may be provided an ejector 295, herein in the form of a plate secured to a rod 296, mounted to slide in a guide 297, said rod being pivoted at 298 to a lever 299, the latter being fulcrumed at 300, on the support 258. The lever 299 is herein connected by a lever 301 to the lever 273. It will now be apparent that when the lever 273 is rocked in the direction of the arrow thereon (Fig. 35), it will act through the described connections to cause the grippers to release the sheet and the ejector to eject the sheet from between the grippers.

The slides 254 and 255 may be actuated by any suitable mechanism to impart a forward and backward motion thereto, but I preferably employ the mechanism which I will now describe. Formed on, or secured to, the slides 254 and 255, are rigid arms 302 and 303, connected by links 304 and 305 to special links 306 and 307 of a pair of chains 308 and 309. These chains are supported and carried at one end by sprocket wheels 310 and 311, and at the other by sprocket wheels 312 and 313. Herein the sprocket wheels 312 and 313 are idlers, and are mounted on studs 314 and 315, in slots 316 and 317, and are provided with suitable means of adjustment, herein a pair of adjusting screws 318 and 319, preferably provided with lock-nuts 320 and 321.

The other sprocket wheels 310 and 311 are secured, respectively, to spur gears 322 and 323, provided respectively with hubs 324 and 325, journaled in the side frames 68 and 69, respectively. These spur gears mesh with, and are driven by, gears 326 and 327, secured to a shaft 328 and having their hubs journaled in the side frame members 68 and 69. The hub 324 passes through the side frame 68, and has secured to its outer end a spur gear 329. This gear meshes with, and is driven by, a gear 330, suitably formed on, or secured to, a gear 331 journaled on a stud 332, the latter being secured to the side frame 68. The gear 331 in turn meshes with, and is driven by, the gear 66 hereinbefore described.

By means of the gearing just described, the chains 308 and 309 are driven in the direction of the arrows thereon (Figs. 20 and 32), and the chains moving continuously in one direction act to impart to the slides 254 and 255 a reciprocatory motion, through the use of the links 304 and 305. Referring now to the motion of the gear 66, it will be remembered that this gear has an uneven rotation, and is rotated approximately two-thirds of a rotation on the opening movement of the press, and approximately one-third of a rotation on the closing movement of the press. This variable movement will consequently be imparted through the gearing just described to the chains 308 and 309, and consequently, the slides 254 and 255, and the gripper mechanism carried thereby, will receive a relatively slow movement during the closing of the press, and a relatively rapid movement during the opening of the press. The rapid movement of the grippers during the opening of the press is desirable, owing to the fact that it is toward the end of this movement that the third set of grippers deposits the sheet upon the pile in the receiving rack, or elevator. In Fig. 20, the parts are shown in the position which they occupy when the press is fully opened. As a means for preventing the links 304 and 305 from vibrating while the special chain links 306 and 307 are traveling from left to right (Fig. 20), the arms 302 and 303 are herein provided with lugs 333 and 334, which (see Figs. 20 and 32) are adapted to limit the swinging motion of the links 304 and 305.

General operation.

Having thus specifically described the machine and the mode of operation of its various mechanisms, I will now describe the general operation, and the coöperative action of its various mechanisms, referring more particularly to Figs. 38, 39 and 40. The operator places a sheet A upon the feed-table, with its front edge against the abutments 22 of the fingers 21, and with one side edge against the stop 20 (Fig. 1). When the press closes, the first set of grippers advances and grasps the front edge of the sheet (Fig. 38). At this moment, the fingers 21 are lifted, thus releasing the sheet to allow the latter to be drawn off the feed-table. In the meantime, a previously fed sheet B is being held in the press by the second set of grippers (Fig. 38), while the sheet is being cut and creased.

Referring now to Fig. 39, which shows the press about one-quarter open, the first set of grippers, having grasped the sheet A, starts to swing, and carry the same toward the point where it is to be transferred to the second set of grippers. Meantime, the third set of grippers has advanced to a point

near the edge of the platen, and the second set of grippers has retracted, carrying the sheet B into the third set of grippers (see Fig. 39). The third set of grippers is already open, ready to receive the sheet B, while the tension of the springs 153 of the second set of grippers is diminished at this moment, under the influence of the depressed portion 165 of the cam 161. The front edge of the sheet B strikes and trips the triggers 281, whereupon the third set of grippers firmly grasps the sheet and, since at this moment the second set of grippers is retracting more rapidly than the third set, the sheet will be withdrawn from the second set. The second set of grippers, now being empty, continues to move upwardly toward the right (Fig. 39), and the third set of grippers moves rapidly upward toward the right, carrying the sheet B off the face of the platen, to a point above a suitable feed rack indicated in dotted lines (Fig. 40), and releases the sheet, allowing the same to fall upon a pile in the rack.

Referring now to Fig. 40, the second set of grippers, having reached the limit of its travel toward the right, opens to receive the sheet A, while the first set of grippers carries the front edge of the sheet into the second set, and brings the front edge of the sheet up against the shoulders of the second set. At this moment, there is a minimum tension upon the grippers of the first set, owing to the fact that the pressure of the spring 98 is at this moment diminished (Fig. 9). The platen is now fully open, and starts to close. Now, as the grippers of the second set start toward the platen and close upon the sheet, the latter will be pushed from between the grippers of the first set between which the sheet is held, by merely a light spring pressure.

It will be observed that (see Fig. 40), while the sheet A is being transferred from the first set of grippers to the second set, about half of the sheet is lying practically flat upon the face of the platen, onto which it has been drawn by the first set of grippers. In transferring the sheet from the first set of grippers to the second set, the shoulders of the first set travel a short distance beyond the shoulders of the second set (see Fig. 41), thus bringing the front edge of the sheet up against the shoulders of the second set. The grippers of the second set now start toward the platen, but do not close until after they have started, and hence if the sheet should by any possibility be askew, or not up against the shoulders of both pairs of grippers, of the second set, the front edge of the sheet will engage first one shoulder and then the other and will at once be brought with certainty into accurate register against both shoulders before the grippers have fully closed and before the sheet has been entirely withdrawn from the first set of grippers.

The side register mechanism now comes into play, and automatically shifts the sheet laterally to whatever extent may be necessary to properly position the same laterally, it being understood that the sheet is meanwhile grasped by the second set of grippers, which is, of course, moved bodily with the sheet. The second set of grippers continues its advance, and carries the sheet into position upon the platen, firmly holding the sheet accurately positioned in both directions, ready for the cutting and creasing operation. The press closes, performs the cutting and creasing operation, and then opens, after which the second set of grippers recedes, carrying the sheet out of the press in the manner described in connection with sheet B, after which the finished sheet is transferred to the third set of grippers, and finally deposited upon the receiving rack, or elevator.

While I have herein shown and described one specific embodiment of my invention for illustrative purposes, and have disclosed and discussed in detail the construction and arrangement incidental to one specific application thereof, it is to be understood that the invention is limited neither to the mere details or relative arrangement of parts, nor to its specific embodiment herein shown, but that extensive deviations from the illustrated form or embodiment of the invention may be made without departing from the principles thereof.

Having thus described one embodiment of my invention, what I claim and desire by Letters Patent to procure is:—

1. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a forward and backward motion to said sheet-holding means to carry a sheet into and out of the press, and means for utilizing the forward motion of said sheet-holding means to move the same laterally thereby to position the sheet laterally.

2. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a forward and backward carrying movement to said sheet-holding means, sheet-shifting means to utilize the forward motion of said sheet-holding means to shift the same laterally, means operated by engagement with the sheet to stop, said lateral shifting movement, and means to utilize the backward motion of said sheet-holding means to reset said sheet-shifting means in its initial position.

3. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, side-register means under the control of the sheet automatically to position the sheet laterally,

and means permitting adjustment of said side-register means in the direction of said carrying movement.

4. A sheet-feeding mechanism for presses having, in combination, sheet grasping means, means to impart a carrying movement to said sheet-grasping means, side-register means automatically to position the sheet laterally while firmly grasped by said grasping means, said side-register means including a sheet-edge engaging member, and means permitting adjustment of said engaging member in the direction of said carrying movement.

5. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift said sheet-holding means laterally, and means operated by engagement with the sheet to lock said cam-follower so that the same shall thereupon cease to coöperate with said cam.

6. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift said sheet-holding means laterally, a ratchet means operated by said cam-follower for rotating said ratchet, and means including a pawl operated by engagement with the sheet to lock said ratchet against rotation.

7. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift said sheet-holding means laterally, a ratchet, means operated by said cam-follower for rotating said ratchet, a sheet-engaging trigger, and means operated by engagement of said trigger with the sheet to lock said ratchet against rotation.

8. A sheet-feeding mechanism for presses having, in combination, sheet-feeding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift and sheet-holding means laterally, a ratchet, a rack and pinion operated by said cam-follower for rotating said ratchet, a pawl coöperating with said ratchet, a sheet-engaging trigger, and means operatively connected to said trigger normally to hold said pawl out of engagement with said ratchet.

9. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift said sheet-holding means laterally, a ratchet, a rack and pinion operated by said cam-follower for rotating said ratchet, a pawl coöperating with said ratchet, a dog carrying said pawl, a toothed bar normally acting through said dog to hold said pawl out of engagement with said ratchet, and means operated by engagement with the sheet to render said bar ineffective to hold said pawl out of engagement with said ratchet.

10. A sheet-feeding mechanism for presses having, in combination, sheet-holding means, means to impart a carrying movement to said sheet-holding means, means including a cam and a spring-pressed cam-follower for utilizing said carrying movement to shift said sheet-holding means laterally, a ratchet, a rack and pinion operated by said cam-follower for rotating said ratchet, a pawl coöperating with said ratchet, a dog carrying said pawl, a bar provided with a series of teeth one of which acts through said dog to hold said pawl out of engagement with said ratchet, sheet-engaging means, operated by engagement with the sheet to render said bar ineffective to hold said pawl out of engagement with said ratchet, and means permitting said sheet-engaging means to be placed in a plurality of predetermined positions of adjustment corresponding to said teeth.

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

WILLIAM C. GLASS.

Witnesses:
LOUIS A. JONES,
CLARA L. STUART.