No. 812,260.

PATENTED FEB. 13, 1906.

F. L. CROSS.

SHEET FEEDING MACHINE.

APPLICATION FILED JULY 12, 1902.

9 SHEETS—SHEET 1.

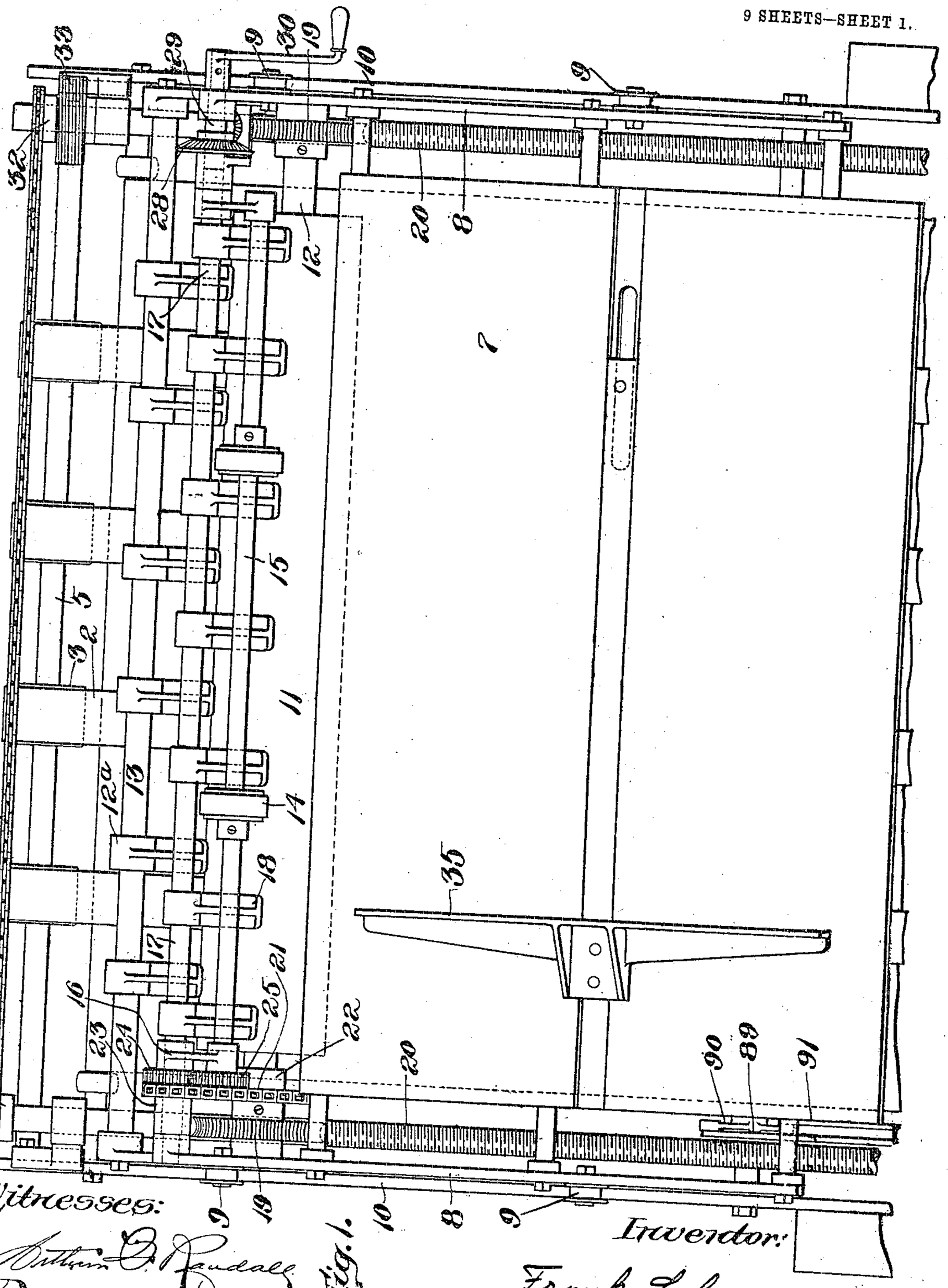

Fig. 1.

Witnesses:

William B. Randall

Katharine A. Logan.

Inventor:

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by Ira L. Fish

Attorney.

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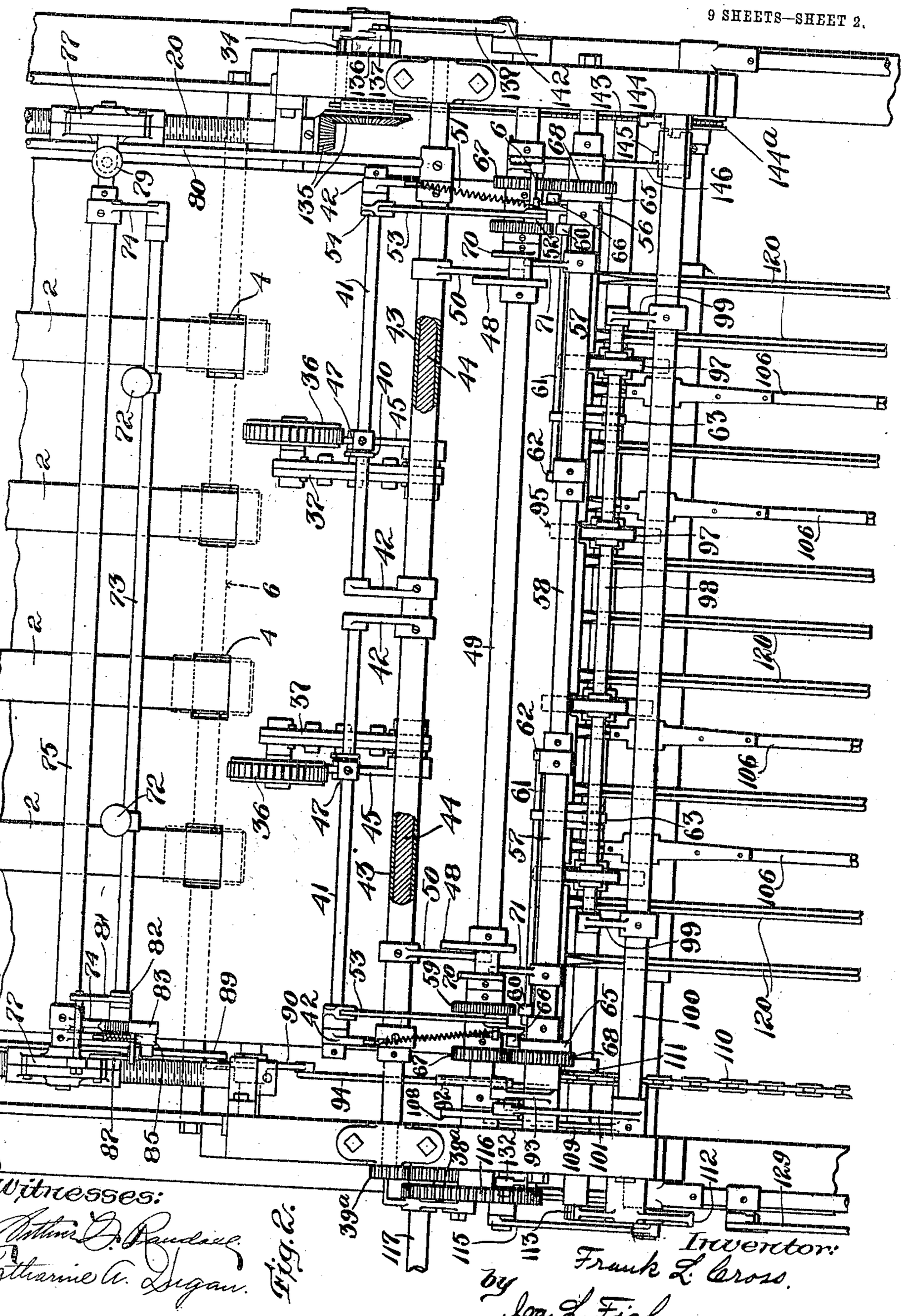

Witnesses:
Arthur D. Rundlett
Katharine A. Logan.

Fig. 2.

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9 SHEETS—SHEET 3.

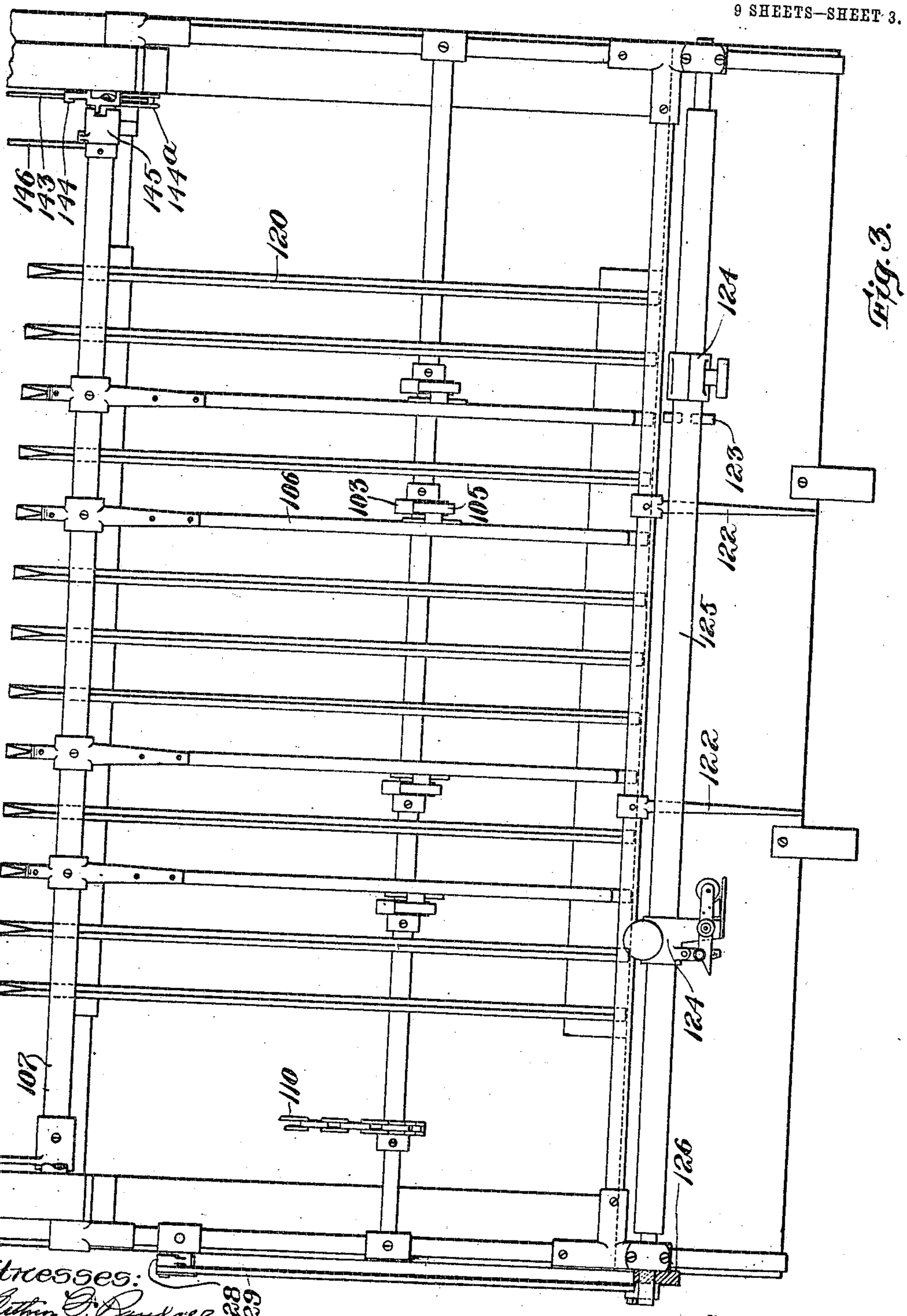

Fig. 3.

Witnesses:
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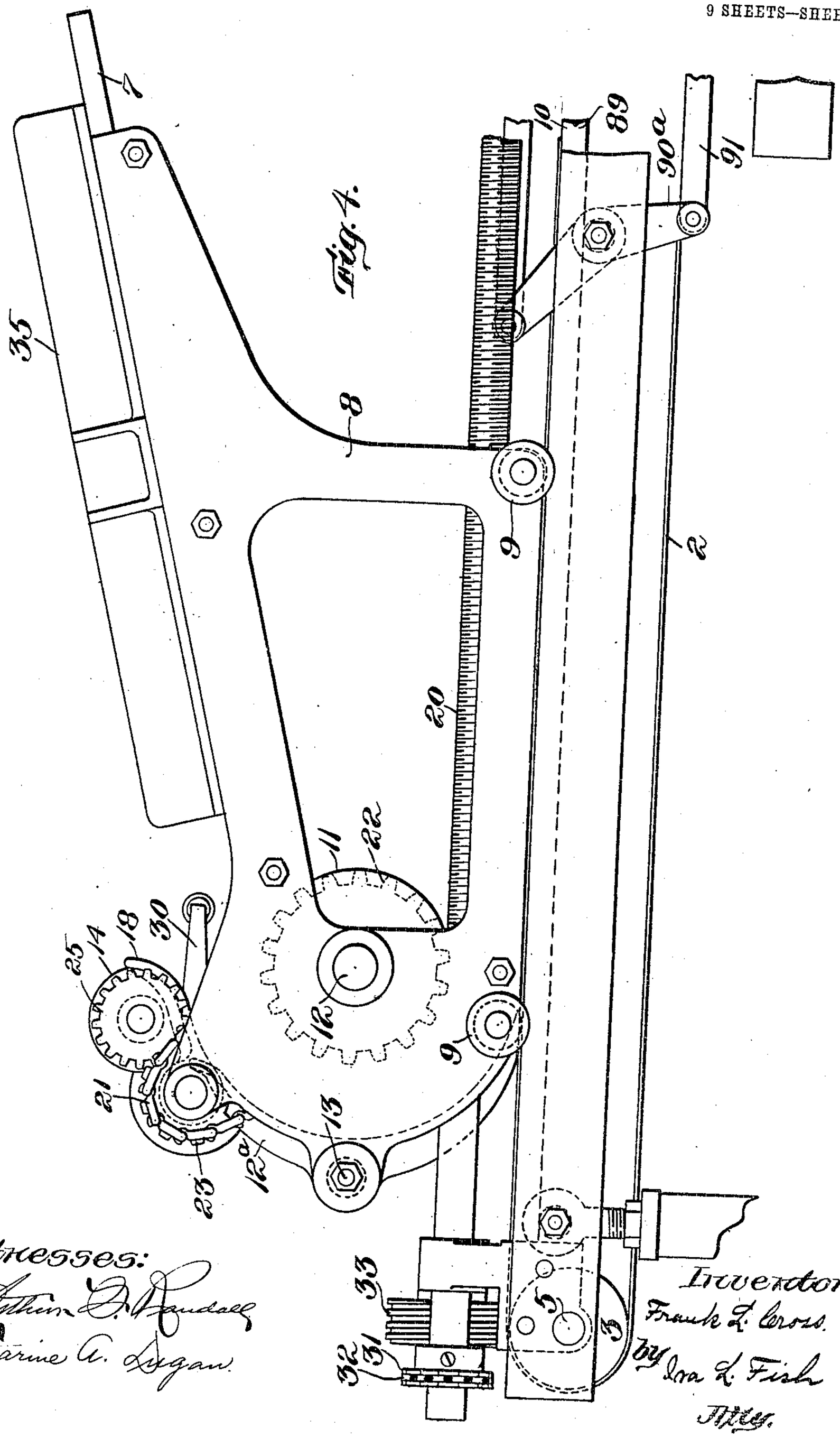
9 SHEETS—SHEET 4.



Witnesses:

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SHEET FEEDING MACHINE.

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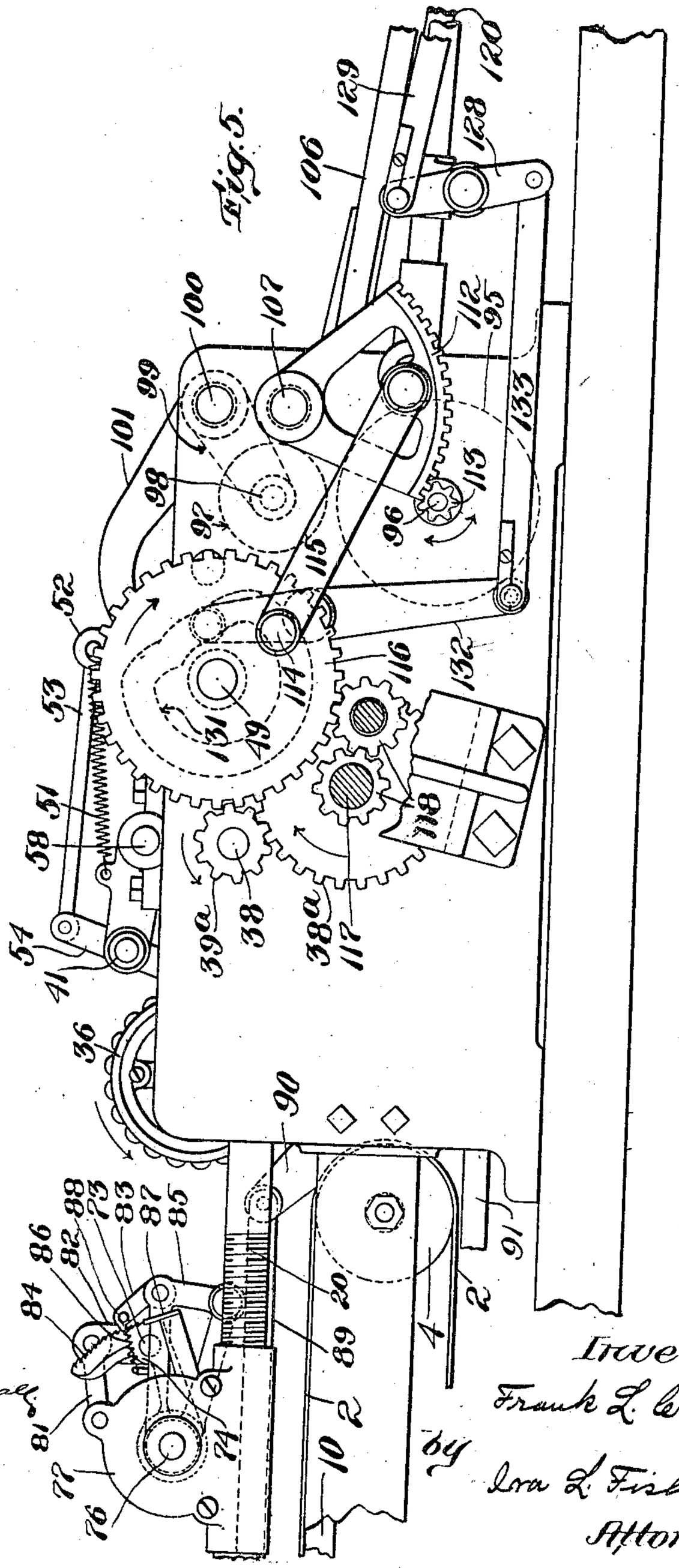
9 SHEETS—SHEET 5.

Fig. 5.



Witnesses:

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SHEET FEEDING MACHINE.

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9 SHEETS—SHEET 6.

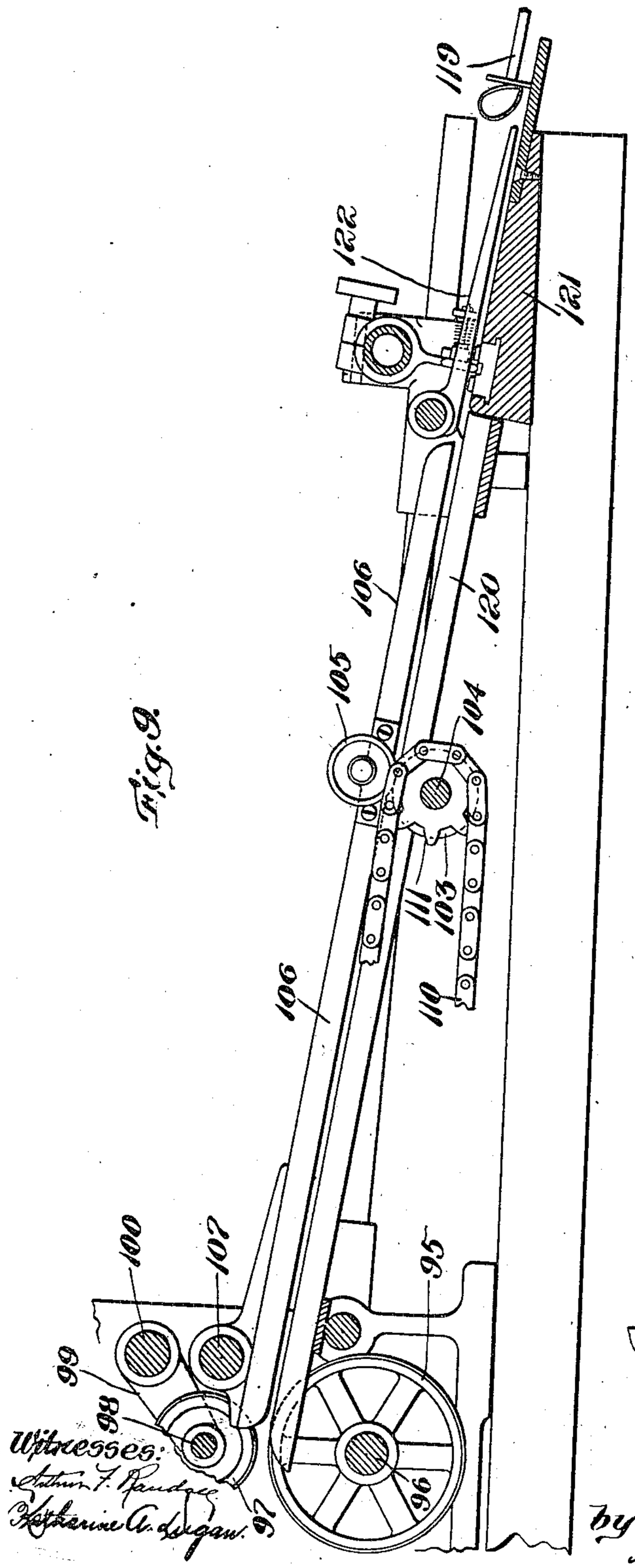

Fig. 9.

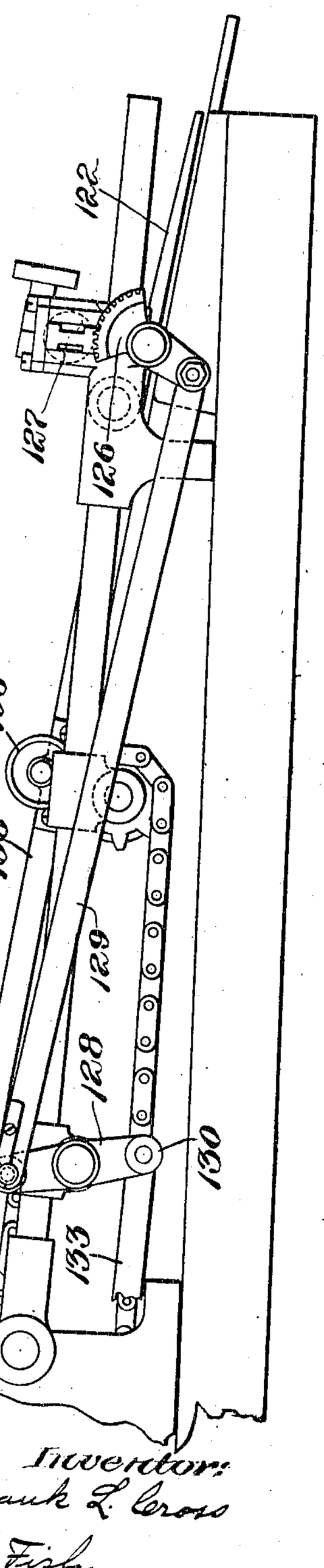

Fig. 6.

Witnesses:
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Inventor:
Frank L. Cross
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No. 812,260. PATENTED FEB. 13, 1906.

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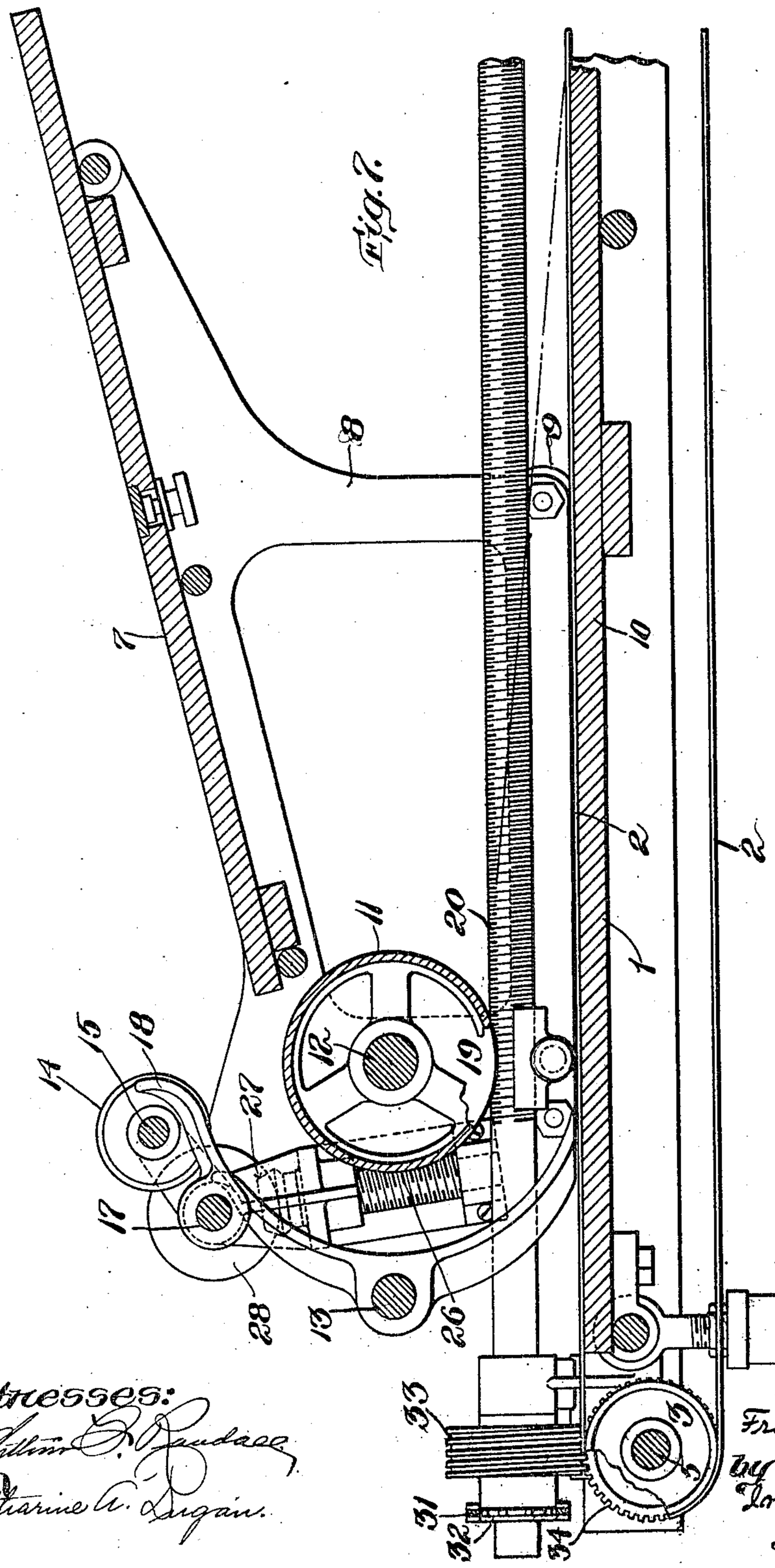
SHEET FEEDING MACHINE.

APPLICATION FILED JULY 12, 1902.

9 SHEETS—SHEET 7.



Witnesses:
William E. Lundaca
Katharine A. Dugain.

Inventor:
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Attorney.

No. 812,260. PATENTED FEB. 13, 1906.

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SHEET FEEDING MACHINE.

APPLICATION FILED JULY 12, 1902.

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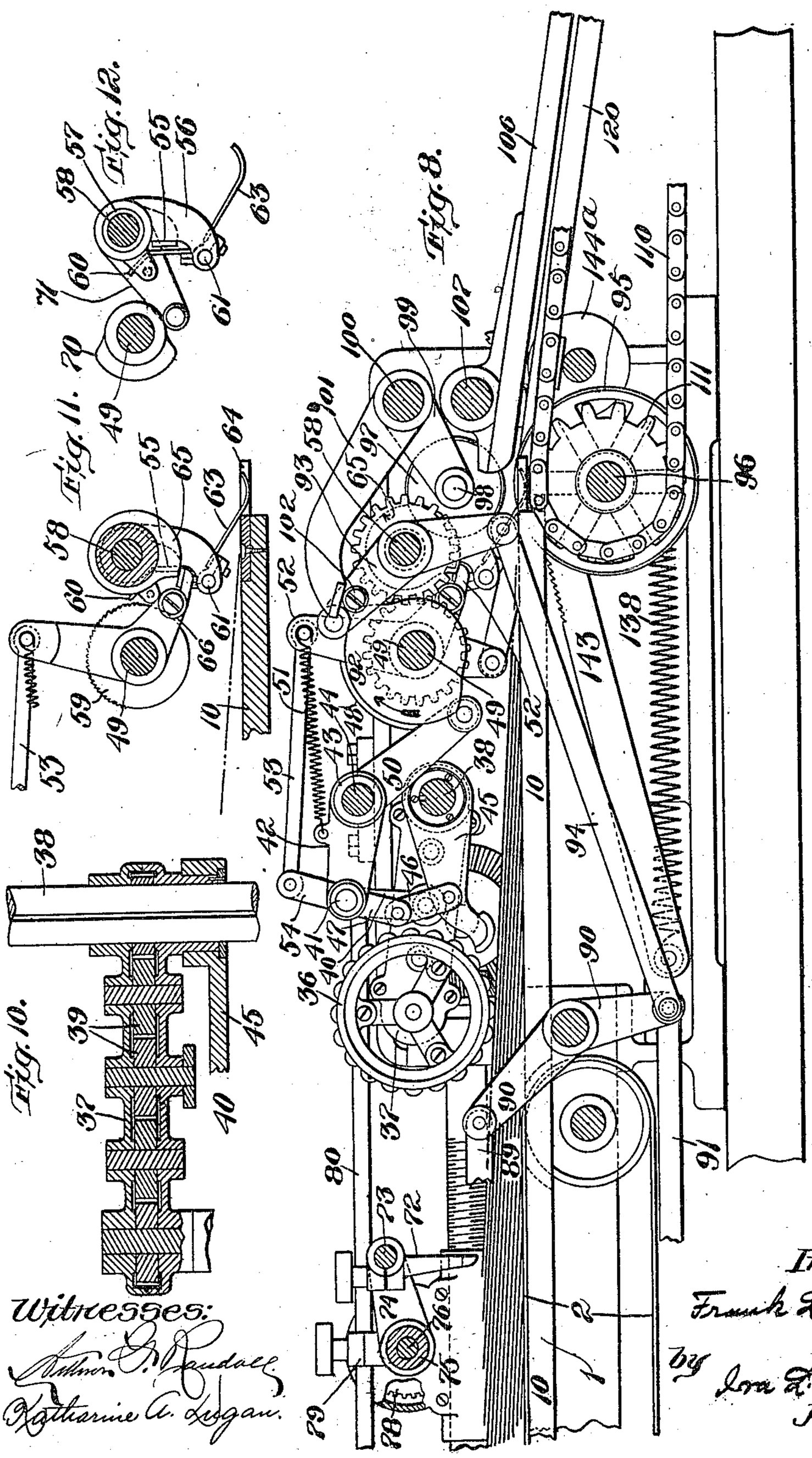

No. 812,260. PATENTED FEB. 13, 1906.

F. L. CROSS.

SHEET FEEDING MACHINE.

APPLICATION FILED JULY 12, 1902.

9 SHEETS—SHEET 9.

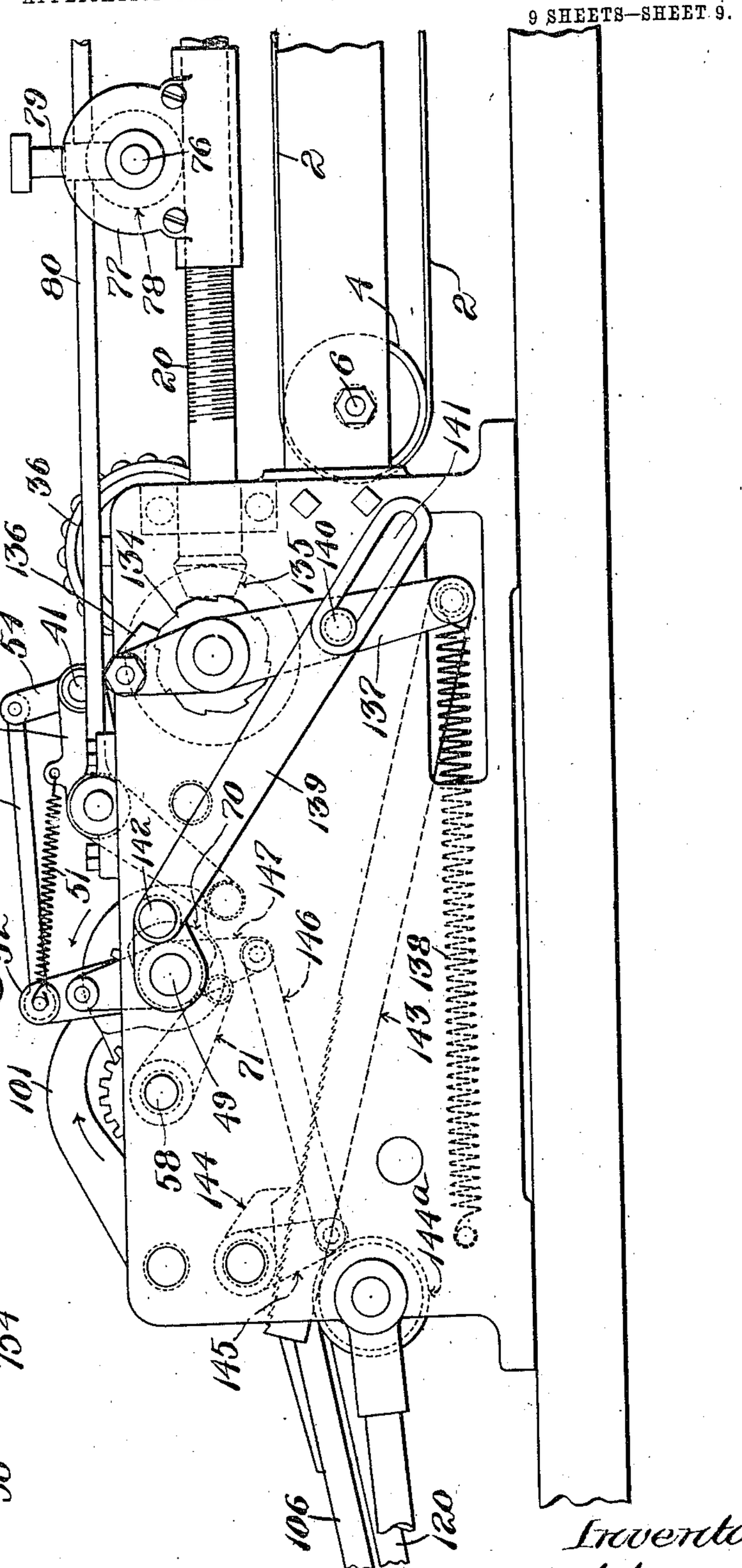

Fig. 13.

Fig. 14.

Witnesses:

Arthur D. Randall.

Katharine A. Dugan.

Inventor:

Frank L. Cross.

by Jos. L. Fish

Attorney.

UNITED STATES PATENT OFFICE.

FRANK L. CROSS, OF MYSTIC, CONNECTICUT, ASSIGNOR TO CROSS PAPER FEEDER COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

SHEET-FEEDING MACHINE.

No. 812,260. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed July 12, 1902. Serial No. 115,309.

To all whom it may concern:

Be it known that I, FRANK L. CROSS, of Mystic, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Sheet-Feeding Machines, of which the following is a specification.

This invention relates to that class of sheet-feeding machines in which individual sheets are separated from a bank or pile of sheets, so that they may be removed and presented to machines or devices for further manipulating or acting on the sheets.

I have embodied the various features of the invention in a machine in which the sheets are separated from a bank of feathered or fanned-out sheets by the action of combing devices which act to further fan or feather out the top sheets, advancing the top sheet to a greater extent than the sheets beneath it, so that the top sheet is brought into position to be seized and removed by devices which deliver the sheet from the bank and forward it to the machine to which the sheets are being fed.

Certain features of the invention relate to means for supplying a bank of feathered sheets to the feed-table by which they are supported and presented to the separating devices. Heretofore it has been customary to supply the bank of sheets to the feed-table by feeding the bank from a supply-table located above the feed-table, the bank of sheets being gradually fed from the supply to the feed table through a curved throat as the sheets were removed from the front end of the pile. This manner of supplying the bank of sheets is objectionable, for the reason that the rear end of the bank is liable to enter the curved throat, so that it is difficult and sometimes impossible to add a fresh supply of sheets to the rear end of the bank in proper relation to the sheets already in the bank. This manner of supplying the bank of sheets is also objectionable because of the difficulty in properly feeding the bank through the long and curved path. I eliminate these objectionable features of the former bank-feeding machines by providing a loader for laying a bank of feathered sheets upon the feed-table. During the operation of the machine the bank of sheets extends from the feed-table onto the loader, so that at intervals a fresh supply of sheets may be added to the rear end of the bank and by the operation of the loader be laid upon the feed-table. As the bank is fed to the separating devices the loader moves forward with the bank, and consequently the position of the loader will indicate to the operator the extent to which the supply of sheets on the feed-table is exhausted.

Certain further features of invention relate to devices for separating individual sheets from a pile or bank. These devices have the same general construction and mode of operation as the feeding device shown in my Patent No. 690,702, January 7, 1902—that is to say, the controlling mechanism for the feeding mechanism is operated by a driver which is connected with the controlling mechanism by a sheet-controlled pawl.

The advantages of my improved construction of controlling mechanism are due in part to the arrangement and construction of the devices for lifting the combing-rolls and also to the devices employed for holding the lifting mechanism out of action. The lifting mechanism is held out of action by a latch which positively locks the lifting mechanism against movement, so that there is no danger of premature operation of such mechanism due to jar or vibration of the machine. The latch requires little movement to release the lifting mechanism and when operated releases said mechanism sharply and accurately, with a resulting accuracy in the arrest of the feed of the sheet. The lifting mechanism requires little movement in lifting the combing-roll and may therefore act quickly and accurately when released and may also be reset in a fraction of the time during which the delivery devices are acting on the sheet, thus insuring the proper and accurate action of feeding mechanism.

Certain further features relate to devices for feeding a bank of feathered sheets to the combing devices in such a manner that the combing devices will act to properly separate the sheets. This involves a regulation of the feed of the bank to suit the relative arrangement of the sheets in the part of the bank being operated upon, there being little or no feed when the successive sheets are little feathered and there being a sufficient feed to keep the bank up to the combing devices when the sheets are feathered to an unusual extent.

Further features of invention relate to the

delivering devices to which individual sheets are presented and by which the sheets are forwarded to a machine for further acting thereon. These features may be embodied in any type of feeding-machines where individual sheets are to be accurately forwarded and positioned. By these devices the sheets are started forward with a gradually-increasing speed and are brought into position with a gradually-retarded motion, so that the successive sheets are accurately and uniformly presented in position to be acted upon by the machine to which they are being fed.

In the drawings I have shown a feeding-machine embodying all the features of invention which is constructed and arranged to separate individual sheets from a feathered bank of sheets and deliver the sheets successively to the front guides of a printing-press.

In the drawings, Figures 1, 2, and 3, taken together, show a plan view of the machine. Figs. 4, 5, and 6, taken together, show a side elevation. Figs. 7, 8, and 9, taken together, show a sectional elevation. Figs. 10, 11, and 12 are detail views of certain parts to be described. Fig. 13 is an elevation corresponding to Fig. 5, but showing the other side of the machine; and Fig. 14 is a modified form of mechanism for lowering the combing-rolls.

The feathered bank of sheets from which the individual sheets are separated is supported upon a feed-table 1 and is gradually fed forward as the sheets are removed by tapes 2, which extend along the upper surface of the table and pass over two series of pulleys 3 and 4, carried by transverse shafts 5 and 6. The bank of sheets is supplied to the table 1 by means of a loader, by the operation of which a bank of feathered sheets is laid upon the table 1 and by which the supply may be replenished at suitable intervals without inconvenience and without interrupting the operation of the machine. This loader consists of a supply-table 7, arranged above the feed-table, and devices which as the loader is operated act to transfer a bank of feathered sheets from the supply to the feed table and lay the bank upon the feed-table. The table 7 is carried by side frames 8, which are provided with rolls 9, arranged to run upon guiding-rails 10 at each side of the feed-table. The loader is provided with a curved guideway leading from the supply-table to the feed-table, through which the bank of sheets passes to the feed-table and by which the position of the bank is reversed as it is laid upon the feed-table. This curved guideway is formed between the periphery of a drum 11 and a series of curved guides 12^a, secured upon a transverse rod 13, carried by the side frames 8. At the entrance of the guideway pressure-rolls 14 are arranged to bear upon the bank of sheets and hold it against the drum 11 and also direct it into the guideway. These rolls are carried by a shaft 15, mounted in arms 16, secured to a rock-shaft 17. The shaft 17 also carries a series of guides 18, which bridge over the space between the rolls 14 and the guides 12^a and form a continuation of the guides 12^a. The drum 11 is secured to a shaft 12, to which are also secured worm-wheels 19, arranged to engage two screw-shafts 20 at the sides of the feed-table 1. By turning the shaft 12 the loader is operated to lay the bank of feathered sheets upon the feed-table. As the shaft 12 is revolved the drum 11 acts to feed the bank through the curved guideway, and at the same time the worm-wheels travel along the screw-shafts and move the loader at the speed of the movement of the bank through the curved guideway, so that the bank is transferred from the supply-table and laid upon the feed-table without disturbing that part of the bank already upon the feed-table. During the operation of the loader the worm-wheels act as gears and the screw-shafts act as stationary racks which coöperate with the gears to cause a travel of the loader over the feed-table. During the operation of the loader the rolls 14 are driven from the shaft 12 through a sprocket-chain 21, passing over a sprocket-wheel 22 on shaft 12 and over a sprocket-wheel 23, loose on shaft 17 and connected with a pinion 24, which meshes with a pinion 25 on shaft 15. The shaft 12 is revolved through a worm 26, engaging one of the worm-wheels 19 and carrying a bevel-gear 27, which is engaged by a bevel-gear 28, secured to a short shaft 29, to the end of which is secured a crank-handle 30.

The worm 26 not only serves to rotate the drum 11, but it also serves as a lock for preventing rotation of the worm-wheels 19 when the loader is not being operated, so that during the feed of the bank to the separating devices the worm-wheels may act as nuts for coöperating with the screw-shafts 20 to move the loader with the bank as it is fed forward. The two screw-shafts 20 are connected to rotate in unison by a chain 31, passing over sprocket-wheels 32 on the ends of the shafts. One of the shafts 20 also drives the shaft 5, through a worm 33 and worm-wheel 34, to advance the tapes 2, and thereby feed forward the bank of sheets on the feed-table. The rotation of the shaft 20 to effect the feed of the bank and also the movement of the loader with the bank is effected by mechanism which will be described later.

As the bank upon the feed-table is reduced the loader will approach the separating devices, and therefore the position of the loader upon the feed-table will indicate to the operator the size of the bank upon the feed-table. In supplying the bank to the feed-table the operation of the loader will be discontinued while the rear end of the bank is still on the supply-table, so that the operator can readily add a fresh supply on the rear of the pile and

can continue to add to the rear end of the bank and to transfer the bank to the feed-table until the table is fully supplied. As the loader is always under the direct control of the operator and maintains its relation to the bank during the feed of the bank, there is no danger that the rear end of the bank will enter the curved guideway, where it would be difficult if not impossible to properly build onto the bank with the fresh supply. The supply-table is provided with an adjustable side guide 35 for positioning the bank laterally as it is supplied to the table.

The devices for separating the sheets from the bank of feathered sheets consist of two combing-rolls, each of which acts to advance one side of the top sheet until by the action of the front edge of the sheet the combing-roll is thrown out of action. In case the edge of the sheet at one side reaches the proper position before the other the combing-roll at that side will be thrown out, while the other roll will continue in action until the front edge at that side is in proper position. In order that the front edge of the sheet may be accurately alined by this action of the combing-rolls, a device is provided in connection with each combing-roll which will act to press upon the top sheet and prevent further forward movement of the sheet at that side when the corresponding combing-roll ceases to act. During the continued action of the other combing-roll the sheet will swing about the point where this device presses on the sheet, thus accurately squaring the sheet. The pressure of this device is relieved during the delivery of the sheet and also during the combing action of the corresponding combing-roll. To secure the best results, the pressure should be entirely removed during the delivery and combing, and this is most successfully done by disengaging the device from the sheets during the periods when the pressure should be relieved, although this is not essential in order to secure beneficial results. Since the sheet-retaining device should apply its holding pressure to the top sheet at the time the corresponding combing-roll is thrown out of action, the construction may by simplified by utilizing this same device as the sheet-retaining device and as a part of the mechanism for throwing out the combing-roll, although such double function for the retaining device is not at all essential. Each combing-roll is controlled by an independent set of devices, and as these sets of devices are duplicates of each other in construction and operation a description of one set will be sufficient.

The combing-roll 36 is mounted in an arm 37, loosely mounted on a continuously-running shaft 38, to which the combing-roll is geared through a series of gears 39, so that it rotates continuously. The arm 37 is connected with a shaft 41 by a link 40, the upper end of which is loose upon said shaft. The shaft 41 is carried in arms 42, secured to a rock-sleeve 43, loosely mounted upon a transverse rod 44, and by raising and lowering the shaft 41 the combing-roll is thrown out of and into action. The mechanism for raising the combing-roll, and thus throwing it out of action, consists of an arm 45, loosely mounted on the hub of arm 37 and connected with the shaft 41 by toggle-links 46 47. The link 46 is pivoted to the arm 45 and to the lower end of link 47, and link 47 is secured to shaft 41, which is rocked at proper times to straighten or to contract the toggle. The arm 45 is so arranged that when the toggle-links are operated to straighten the toggle the free end of the arm will first engage the top of the bank of sheets and then the further movement of the toggle in straightening will raise the rod 41, and consequently the arm 37 and comb ing-roll. The arm 45 now acts as a clamp for holding the top sheets in place where it is engaged by the clamp during any further combing action of the other combing-roll until the delivery devices act upon the top sheet. When the delivery devices are about to act, the rock-sleeve 43 is operated to raise the shaft 41, and thereby lift the clamping-arm 45 from the bank of sheets. The sleeve 43 is thus rocked by a cam 48, secured to a cam-shaft 49 and arranged to operate upon an arm 50, secured to sleeve 43.

The shaft 41 is rocked to straighten the toggle, and thus lift the combing-roll, by the action of a spring 51, one end of which is connected to one of the arms 42 and the other end of which is connected to the upper end of a lever 52, which is connected by a link 53 with an arm 54, secured to the shaft 41. Through these connections the spring tends to rock the shaft 41 in a direction to straighten the toggle and lift the combing-roll. The lifting devices are held out of operation and their operation controlled by a latch 55, arranged to engage the lower end of lever 52 and hold said lever against the tension of the spring 51. The latch 55 is formed on an arm 56, secured to a sleeve 57, which is loosely mounted on a transverse rod 58.

The mechanism for operating the latch 55, and thus arresting the action of the combing-roll, consists of a disk 59, secured to the shaft 49, and a pawl 60, arranged to engage teeth on the disk, and thus connect the operating or driving disk and the controlling-latch. The pawl 60 is connected with the latch 55 by being secured to a rock-shaft 61, mounted in the arm 56, and a similar arm 62 at the opposite end of the sleeve. The pawl is normally out of the path of the teeth on the disk 59, but is so controlled by the sheet that when the front edge of the sheet reaches a certain position the pawl moves into position to engage a tooth on the disk. The pawl is thus controlled by a trip-lever 63, secured to the rock-shaft 61 and having its free end extending

across the path of the sheets and into a slot formed in a plate 64 at the front of the feed-table. When the pawl is engaged with the disk, it is thrown downward, rocking the arms 56 and 62 and sleeve 57, and at the same time the pawl is carried away from the disk. The movement of the arm 56 under the action of the disk disengages the latch 55 from the end of the lever 52, so that the lifting mechanism is operated and the action of the combing-roll arrested. Thus the mechanism which controls the combing-roll is positively and surely operated, while its operation is accurately controlled by a sensitive trip which may be operated by the edge of a thin sheet of paper.

After the combing-roll has been thrown out of action the arm 45 remains upon and clamps the pile until the delivering devices seize the top sheet, at which time the cam 48, by means of the arm 50, rocks the sleeve 43 and lifts the clamping-arm 45 from the bank of sheets. The cam 48 holds the clamping-arm in raised position until the top sheet has been removed and then allows the arms 42 and arm 37, which support the clamping-arm and combing-roll, to move toward the pile. Meanwhile the lifting mechanism and the controlling-latch 55 have been reset, so that when the arm 37 is lowered by the cam 48 the combing-roll again engages the bank and is thus thrown into action.

The means for resetting the lifting mechanism consists of a cam 65, loosely mounted on the sleeve 57 and arranged to engage a roll 66 on the arm 52. The cam 65 is continuously rotated by a gear 67, secured to the cam-shaft 49 and engaging a similar gear 68, secured to the cam. The cam is timed to rock the arm 52 while the arm 50 is engaged with cam 48, and thus swing the links 46 and 47 into the relative positions shown in Fig. 8 and at the same time bring the end of arm 52 into such position that the latch 55 may swing above it and hold it against the tension of spring 51. The latch may swing into position above the arm 52 by reason of the weight of the connected parts, or a spring may be connected thereto to draw it toward the arm 52, and it may swing into position as soon as the end of arm 52 passes below the latch 55. To avoid a sudden return of the latch and connected parts when the arm 52 is swung downward and the consequent danger of prematurely engaging the pawl 60 with the teeth of disk 59, I prefer to provide a cam 70, Figs. 12 and 13, for controlling the return of the latch. The cam 70 is secured to the cam-shaft 49 and engages the end of an arm 71, secured to the sleeve 57. The cam is so shaped and timed that it causes the latch and connected parts to swing into position without any sudden movement or jar.

With the above mechanism for throwing the combing-roll out of action and controlling its action by the sheet the combing-roll is accurately and surely controlled, and the devices for effecting the control of the combing-roll by the sheet have comparatively little movement and may be quickly and accurately reset.

By the employment of a clamp for engaging the top sheet when the combing-roll is raised the top sheet as well as those directly under it are under positive control after the combing-roll ceases to act and before the top sheet is seized by the delivery devices, with a resulting accuracy and certainty in the positioning of the sheet.

While the top sheet is being removed by the delivery devices, the remaining sheets of the bank are held from displacement by clamping-fingers 72, which rest upon the bank back of the top sheet. These fingers are adjustably secured upon a shaft 73, carried in arms 74, secured to a sleeve 75, which is loosely mounted on a transverse shaft 76. The shaft 76 is journaled in bearing-blocks 77, mounted to slide upon the screw-shafts 20. By sliding the bearing-blocks upon the screw-rods the position of the clamping-fingers may be adjusted for different lengths of sheets. The blocks are caused to move in unison without binding upon the shafts 20 by means of gears 78, secured to the ends of shaft 76, and which roll along the screw-threads on the shafts as the blocks are adjusted. The parts are held in adjusted position by a clamp 79 on one of the bearing-blocks 77, which engages a fixed rod 80, extending rearwardly from rod 44.

In order to give the clamping-fingers a right-line movement, so that they may act uniformly upon banks of different thickness and may maintain their relation to the combing-rolls whatever the thickness of the bank, the shaft 73 is rocked as it swings up and down. This is done by means of a link 81, pivoted to a bearing-block 77 and to an arm 82, secured to the rod 73, Figs. 2 and 5.

The timing of the clamping-fingers should be the same whatever the thickness of that part of the blank below the fingers, and to insure the accurate timing of the fingers the mechanism for lifting the fingers is so constructed that the fingers are always lifted the same distance above the top of the bank whatever the position of the top of the bank. In the form of such mechanism which I have shown the clamping-fingers are lifted by a pawl 83, which has a constant throw and is arranged to engage and disengage a toothed segment 84, formed on one of the arms 74. The pawl 83 is pivoted on a reciprocating lever 85 and is drawn toward the toothed segment 84 by a spring 86. As the pawl descends it is disengaged from the segment by a stationary cam-plate or guard 87, arranged to engage a pin 88, projecting from the pawl. When the pawl is disengaged from the segment, the clamping-fingers are free to descend

until they engage and rest upon the bank of sheets. When the pawl again moves upward, it will engage one of the teeth of the segment and raise the clamping-fingers a certain distance from the top of the bank. Thus each time the clamping-fingers are lowered they are disconnected from the lifting mechanism, and each time the lifting mechanism acts it lifts the clamping-fingers the same distance. The action of the fingers may therefore be accurately timed with relation to the other devices, and the timing is unaffected by variations in the position of the top of the bank of sheets.

The pawl-lever 85 is reciprocated through its engagement with a bar 89, pivoted to the upper ends of two levers 90. The levers are maintained in parallel relation by a second bar 91, pivoted to their lower ends, and the levers are rocked to move the bar 89 up and down by means of a cam 92, secured to cam-shaft 49 and engaging one end of a lever 93, the other end of which is connected with one of the levers 90 by a link 94. The bar 89 extends along the side of the feed-table and the end of the pawl-lever 85 rides on said bar, whatever the adjustment of the bearing-blocks 87.

The combing-rolls are lowered upon the bank of sheets simultaneously, and each continues to act uutil the front edge of the top sheet at the corresponding side of the sheet acts upon the trip-lever 63 at that side when the action of that combing-roll is arrested, the other roll continuing to advance the other side of the sheet until it is in proper position to arrest the action of said roll. Thus the front edges of successive sheets are brought into the same line and into position to be removed and delivered to other machines or devices.

In feeding sheets to machines wherein accurate register or positioning of the sheets is essential—as, for instance, in feeding to a printing-press—it is important that the alinement of the front edge of the sheet should not be disturbed by the delivery devices and also that the successive sheets should be brought into the same position by the delivery devices. To insure this and a uniform action of the delivery devices, these devices are so operated and arranged that they are at substantially a state of rest when they grasp the sheet and are also at substantially a state of rest when they cease to act upon the sheet, the movement of the devices being accelerated to start the sheet and being retarded to gradually bring it to a state of rest. With this action of the delivery devices the sheets may be accurately removed from the position in which they are presented to the delivery devices and be accurately and rapidly forwarded and delivered in position to be further acted upon. So far as the construction and operation of the delivery devices themselves are concerned it is immaterial what devices are employed for presenting the sheets successively thereto, and the features of invention relating to the delivery devices may be employed in various types of feeding-machines. It will also be understood that the invention is not limited to delivery devices embodying rolls for acting upon the sheet, although I prefer to employ such delivery devices, and have therefore embodied them in the machine which I have shown.

In this machine the delivery devices consist of delivery-rolls, to which the sheet is presented by the combing-rolls and by which the sheet is advanced to forwarding-rolls, which bring it to a state of rest at the front guides of a printing-press. The lower delivery-rolls 95 are secured to a shaft 96, mounted in fixed bearings, while the upper coöperating rolls 97 are secured to a shaft 98, carried in arms 99, secured to a rock-shaft 100. The shaft 100 is rocked to lower and raise the rolls 97 by the cam 92, which lowers and raises the clamping-fingers 72 through an arm 101, secured to shaft 100 and arranged to engage a roll 102 on the lever 93. The lower forwarding-rolls 103 are secured to a shaft 104, mounted in fixed bearings, while the upper coöperating rolls 105 are mounted upon arms 106, secured to a rock-shaft 107. The shaft 107 is rocked to raise and lower the rolls 105 by a cam 108, secured to the cam-shaft 49, which engages an arm 109, secured to shaft 107. The lower rolls 95 and 103 are connected, so that they have the same surface speed, by a chain 110, passing over sprocket-wheels 111 on the ends of shafts 96 and 104. The rolls are operated through a segment 112, Fig. 5, which engages a pinion 113 on the shaft 96. The segment 112 is oscillated from a crank-pin 114, to which it is connected by a link 115. The crank-pin is carried by a gear 116, secured to the end of cam-shaft 49 and connected with the driving-shaft 117 through pinions 118. The shaft 117 also drives the shaft 38 through gear 38^a and pinion 39^a.

The parts are so timed that the rolls 97 are lowered upon the rolls 95 at the limit of the back stroke of the segment 112 when the crank-pin 114 is passing the dead-center and when, therefore, the roll 95 is at rest. As the crank-pin passes the dead-center and advances, the roll 95 starts forward with a gradually-increasing speed, and as the crank-pin approaches the dead-center at the end of the advance the roll 95 is gradually brought to rest. The movement of the rolls 103 corresponds to the movement of the rolls 95. The distance between the rolls 95 and 103 is such that the sheet enters between rolls 105 and 103 before its rear end leaves the rolls 97 and 95 when feeding the shortest length of sheets which the machine is to feed, and the rotation of the rolls 95 and 103 is such that the

front edge of the sheet has been advanced to the front guides 119 of the printing-press when the rolls are brought to rest. The rolls 97 may be lifted any time after the rear end of the sheet has passed and are lifted when the rolls 95 are at rest at the end of their forward rotation. The rolls 105 are lifted as soon as the rolls 103 have come to rest, and the sheet is then free to be moved sidewise by the side register devices. In order that the rear end of the sheet when feeding long sheets may be withdrawn from between rolls 103 and 105 before the rolls 105 are lowered, the cam 108 for lowering these rolls is so shaped that they are not lowered until after the rolls 97 have been lowered and the next sheet started forward, but are lowered before the front end of this sheet reaches them.

In passing from the rolls 95 to the front guides 119 of the press the sheets pass over guides 120 and over a plate 121 at the front end of the guides. The sheets are prevented from rising from the guides and plate by the arms 106 and fingers 122, which extend over the plate 121.

The side register devices may be of any suitable construction to engage the edge of the sheet and draw it laterally against a side gage 123. The side register devices are indicated at 124 and are carried by a transverse reciprocating bar 125, there being two register devices, so that the sheets may be registered at either side. The device 124 at the right, Fig. 3, is shown in use, while the other is turned up out of the way. The bar 125 is reciprocated by a spiral segment 126, arranged to engage a spiral rack 127, secured to the end of the bar 125. Since the bar is held from rotation, the oscillation of the segment serves to reciprocate the bar. The segment is oscillated from a rock-lever 128, to which it is connected by a link 129. The rock-lever is provided with two pins 130, one on each side of its pivot, and the link is connected to one or the other of these pins, according to the register device which is to be operated. By changing the connection the timing of the reciprocation of the bar 125 is reversed to change the register from one side to the other. The rock-lever 128 is operated by a cam 131, formed in the face of gear 116 through a lever 132 and link 133.

In machines in which a feathered bank of sheets are fed to combing-rolls, which act to comb out the sheets at the front of the bank the feed of the bank should be so regulated that the successive sheets will be presented to the action of the combing-rolls in as nearly the same relation as practicable, and the feed should also be effected without materially disturbing the relation of the sheets in the different parts of the bank. In these machines the combing-rolls cause a forward movement in a number of sheets, the extent of movement being greatest in the top sheet, and the length of time the roll is in action—that is to say, the length of comb—will depend (other conditions being the same) upon the distance the front edge of the sheet is from the trip which controls the combing-roll. If the front edge of the sheet is so far from the trip when the combing-rolls begin to act that the rolls are lifted from the bank before the sheet operates the trip, then the sheet will not be seized by the delivery devices. On the other hand, if the edge of the top sheet is near the trip and there is little or no distance between the edges of the two top sheets then the combing-rolls may not act long enough to separate the two sheets sufficiently to prevent both sheets being seized by the delivery-rolls. When, therefore, the combing-rolls are remaining in action a long time—that is, when the comb is long—the bank should be fed forward and the feeding movements should continue as long as the successive combs remain long. I have accordingly devised a feeding mechanism which will feed the bank forward during the combing interval succeeding a long comb—that is to say, whenever there is an abnormally long comb the bank will be fed forward during the next comb. In case the edges of succeeding sheets are widely separated the succeeding comb will also be a long comb and there should, therefore, be a large feed of the bank. On the other hand, if the edges of succeeding sheets are near together the succeeding comb will be short and the feed of the bank need not be so great. I therefore also construct the feeding mechanism that the feed succeeding a long comb shall be proportional to the length of comb succeeding the long comb. It is desirable that the feeding movements of the pile be comparatively slow, and therefore in order to get such a feed, and also a comparatively large feed, I so construct the feeding mechanism that it feeds the bank during the entire combing interval succeeding a long comb. I have also found that the comb will be more regular if the bank is fed when there is an increase in the comb, and I accordingly construct the feeding mechanism so that the bank is fed when a comb is longer than the preceding comb.

All these features I have embodied in a simple mechanism; but it will be understood that it is not essential to a mechanism embodying this part of my invention that it contain all the features or that it be of the construction shown.

As I have already explained, the feed of the bank of feathered sheets is effected by rotation of the screw-shafts 20. The mechanism for rotating the screw-shafts comprises a ratchet connected with one of the shafts and a pawl the forward throw of which depends upon the length of time the combing-rolls are in action. In the construction shown the ratchet is in the form of a toothed wheel 134,

connected with one of the screw-shafts through bevel-gears 135. The pawl 136 for operating the ratchet is carried by a lever 137. The lever is moved in a direction to advance the ratchet-wheel by a spring 138, connected to the lower end of the lever, and is moved in the opposite direction against the tension of the spring by a reciprocating rod 139. The rod 139 is connected with the pawl-carrying lever by means of a pin 140, which engages a slot 141 in the rod, and the rod is reciprocated by a crank 142, secured to the end of the cam-shaft 49. By the engagement of the end of the slot 141 with the pin 140 the pawl on its return stroke is always moved to the same position. The forward movement of the pawl is controlled from the lifting mechanism for one of the combing-rolls through a ratchet-bar 143 and a coöperating stop-pawl 144, which is operated by the lifting mechanism. The ratchet-bar 143 is pivoted to the end of the pawl-lever 137 and rides on a roll 144ª. The pawl 144 is arranged to engage teeth on the ratchet-bar and is operated by a rock-lever 145, the end of which is connected by a link 146 with the lower end of a lever 147, the upper end of which is connected to one of the levers 52. The hub of the pawl is coupled to the hub of the lever 145, so that there may be lost motion between the parts to enable the movement of the lifting devices to continue after the pawl 144 has engaged the bar 143.

The parts are so timed that the pawl is in its rear position when the combing-rolls are thrown into action and the pawl is advancing during the combing. When the combing-roll is thrown out of action, the lever 147 is rocked and the pawl is engaged with the ratchet-bar and stops the movement thereof, and consequently the forward movement of the pawl 136. After the pawl-lever stops the rod 139 moves idly until the end of slot 141 again engages pin 140, when the pawl is returned to its rear position. If the pawl in its rear position lies directly back of a tooth in the ratchet, then on the advance of the pawl there will be a feed of the bank beginning with the combing and ending when the combing ends. If this comb is long, the ratchet will be advanced the length of a tooth, so that on the return stroke of the pawl it will again lie back of a tooth, and consequently on the next comb there will be a feed of the bank. The feeding movements of the bank will continue as long as the comb is sufficiently long for the ratchet to be advanced a tooth-space. When a short comb occurs, the forward movement of the pawl will be less than a tooth-space, and consequently the pawl on its return will not pass beyond the end of the tooth and there will be no movement of the ratchet at the beginning of the succeeding comb. There may be a feeding movement at the end of this comb, however, provided this comb is longer than the one before. In such case the pawl will engage the same tooth that it did on its previous forward movement and advance the ratchet a further distance, dependent upon the increase in the length of comb. If this comb is not long enough for the pawl to move through a tooth-space, there will be no feed at the beginning of the next comb. Whenever there is a comb longer than those preceding it, there will be a feed of the bank during the latter part of the comb; otherwise there will be no feed. Whenever there is a comb sufficiently long for the pawl to advance a tooth-space, it will be followed by a feed extending through the next comb.

In Fig. 14 I have shown a modified form of mechanism for lowering the combing-rolls upon the bank of sheets which is especially useful in machines designed for acting upon banks which vary widely in thickness. With this mechanism the combing-rolls are always lifted to the same distance above the top of the bank without regard to the thickness of the bank, so that the extent of movement does not vary with the thickness of the bank, but is constant with a resulting accuracy in the timing of the combing-rolls and a reduction in the extent of movement required to adapt the rolls for acting upon both thin and thick banks. In the form of such mechanism shown in Fig. 14 the combing-rolls are raised and lowered by a rock-lever 150, loosely mounted on the rod 44 between the two central arms 42 and having projecting arms 151, extending under said arms 42. To the upper end of the lever 150 is connected a ratchet-bar 152, the free end of which is supported on rod 58. The bar 152 is operated to lift the arms 42, and through them the combing-rolls and clamps 45, by means of a pawl 153, carried upon a lever 154, one arm of which rides on a cam 155, secured to cam-shaft 49. The pawl is provided with a stop-pin 156, which engages the lever 154 as the lever is moved to retract the pawl, so that the pawl is lifted from engagement with the teeth on the bar. A spring 158 connects the pawl 153 and rock-lever 150 and tends to hold the arms 151 in engagement with arms 42 and also to draw the pin 156 into engagement with lever 154. It is obvious that two springs might be employed; but the construction is simplified by using one spring. When the lever 154 passes from the high to the low part of the cam 155, the pawl 153 moves to the right in Fig. 14, thus lowering the combing-rolls until the pin 156 strikes the lever 154, after which continued movement of the lever 154 disengages the pawl from the bar 152, allowing the combing-rolls to rest upon the bank of sheets. When the cam 155 rocks the lever 154 in the opposite direction, the pawl engages the ratchet-bar and lifts the combing-rolls and at the same time the clamp 45. The distance

which the combing-rolls are lifted will be substantially constant without regard to the initial positions of the rolls and variations in the thickness of the bank will not affect the timing of the rolls with respect to the other operations of the machine.

What I claim, and desire to secure by Letters Patent, is—

1. In a sheet-feeder the combination with a support, of a movable loader, provided with means for laying a bank of feathered sheets upon said support as it moves over said support, substantially as described.

2. In a sheet-feeder the combination with a support, of a loader, means for operating said loader to lay a bank of feathered sheets upon said support, and means for feeding forward said bank and loader, substantially as described.

3. In a sheet-feeder the combination with sheet-separating devices, of a feed-table, a loader, means for operating said loader to lay a bank of feathered sheets upon said feed-table, and means for feeding said bank and loader toward the separating devices, substantially as described.

4. In a sheet-feeder the combination with a feed-table, of a movable loader comprising a supply-table, a curved guideway leading from the supply-table to the feed-table and means for feeding a bank of feathered sheets through the curved throat as the loader moves over the feed-table, substantially as described.

5. In a sheet-feeder the combination with a feed-table, of a movable loader comprising a supply-table, a feed-drum between the end of the supply-table and feed-table, curved guides coöperating with said feed-drum to form a curved guideway leading from the supply-table to the feed-table, and means for rotating said drum as the loader moves over the supply-table, substantially as described.

6. In a sheet-feeder the combination with a feed-table, of a loader comprising a supply-table, a curved guideway leading from said supply-table to said feed-table, a feeding-drum on one side of said curved guideway, a rack a gear connected with said drum and engaging said rack whereby as the loader is moved the drum is rotated, substantially as described.

7. In a sheet-feeder the combination with a feed-table, of a loader comprising a supply-table and feeding means for transferring a bank of feathered sheets from the supply-table to the feeding-table, a worm-wheel connected to said means, a screw-shaft engaged by said worm-wheel, whereby the operation of the feeding means is accompanied by a movement of the loader over the feed-table, and means for locking the worm-wheel whereby a rotation of the screw-shaft advances the loader without operating the feeding means, substantially as described.

8. In a sheet-feeder the combination with a feed-table, and means for advancing a feathered bank of sheets thereon, of a loader comprising a supply-table, a curved guideway leading from said supply-table to said feed-table, a feed-drum at one side of said guideway, worm-wheels connected with said drum, screw-shafts engaging said worm-wheels, means for locking said worm-wheels, whereby rotation of said shafts or rotation of said worm-wheels will move said loader, substantially as described.

9. In a sheet-feeder the combination with a feed-table of a loader comprising a supply-table, a drum between the tables, curved guides coöperating with said drum to form a curved guideway, pressure-rolls coöperating with said drum to feed a bank of feathered sheets through the guideway and means for rotating said drum and rolls and for moving the loader over the feed-table, substantially as described.

10. In a sheet-feeder the combination with feeding mechanism, of mechanism for arresting the action of the same, a latch for engaging said arresting mechanism and holding it out of operation, a pawl through the movement of which the latch is disengaged, and a toothed member for operating said pawl with which the pawl is engaged by the action of the sheet, substantially as described.

11. In a sheet-feeder the combination with a feeding device, of mechanism for arresting the action of the same, a latch for engaging said arresting mechanism and holding it out of operation, a pawl through the movement of which the latch is disengaged, a toothed member for operating said pawl with which the pawl is engaged by the action of the sheet, and mechanism for resetting the arresting mechanism, substantially as described.

12. In a sheet-feeder the combination with a combing-roll, of mechanism for lifting the same from the sheets, a latch for engaging said lifting mechanism and holding it out of action, a pawl connected with said latch, and a toothed member for operating said pawl to disengage said latch, and means for engaging said pawl with said toothed member by the action of the sheet, substantially as described.

13. In a sheet-feeder the combination with a combing-roll, of devices for lifting the same from the sheets, a lever connected with said devices, a latch for engaging said lever and preventing its movement, a pawl connected with said latch, a toothed member for operating said pawl to disengage said latch, means for engaging said pawl with said toothed member by the action of the sheet, and a cam for returning said lever into position to be engaged by said latch, substantially as described.

14. In a sheet-feeder the combination with

a combing-roll, of an arm for engaging the sheets, a toggle connected with said arm and combing-roll, mechanism controlled by the sheet for straightening the toggle to bring the arm upon the sheets and lift the combing-roll, substantially as described.

15. In a sheet-feeder the combination with a combing-roll, of an arm for engaging the sheets, a shaft from which the combing-roll is supported, a toggle between said arm and shaft, and mechanism controlled by the sheet for straightening said toggle to bring the arm upon the sheets and lift the combing-roll, substantially as described.

16. In a sheet-feeder the combination with a combing-roll, of an arm for engaging the sheets, a shaft from which the combing-roll is supported, a toggle between said arm and shaft, mechanism controlled by the sheet for straightening the toggle to bring the arm upon the sheets and lift the combing-roll, and mechanism for thereafter lifting said arm from the sheets, substantially as described.

17. In a sheet-feeder the combination with a combing-roll, of an arm for engaging the sheets, a toggle connected with said arm and combing-roll, mechanism controlled by the sheet for straightening said toggle to bring the arm upon the sheets and lift the combing-roll, mechanism for raising and lowering the arm and combing-roll, and mechanism for contracting the toggle prior to the lowering of the combing-roll and arm, substantially as described.

18. In a sheet-feeder the combination with a combing-roll, of an arm for engaging the sheets, devices between the arm and roll for lifting the roll when the arm is depressed, sheet-controlled mechanism for operating said devices to bring the arm upon the sheets and lift the combing-roll, and mechanism for lifting said arm from the sheets, substantially as described.

19. In a sheet-feeder the combination with a combing-roll, of an arm for engaging the sheets, devices between the arm and roll for lifting the roll when the arm is depressed, sheet-controlled mechanism for operating said devices to bring the arm upon the sheets and lift the combing-roll, mechanism for raising and lowering the arm and combing-wheel, and mechanism for resetting the devices between the arm and roll prior to the lowering of the arm and roll, substantially as described.

20. In a sheet-feeder the combination with a combing-roll, of a clamp arranged to engage the top sheet and hold it in place and means for engaging said clamp with the top sheet when the combing-roll is thrown out of action, substantially as described.

21. In a sheet-feeder the combination with a combing-roll, of delivery devices, a clamp, means for engaging the clamp with the top sheet when the combing-roll is thrown out of action, and means for disengaging said clamp from the sheet when the delivery devices are thrown into action, substantially as described.

22. In a sheet-feeder the combination with a combing-roll, of delivery devices, a clamp, means for engaging said clamp with the top sheet when the combing-roll is thrown out of action and disengaging said clamp when the delivery devices are thrown into action, a second clamp and means for engaging said clamp with the second sheet prior to the action of the delivery devices and disengaging said clamp prior to the action of the combing-roll, substantially as described.

23. In a sheet-feeder the combination with sheet-separating devices of a clamp for engaging the sheets, mechanism for lowering said clamp upon banks of varying height and raising said clamp a substantially fixed distance above the top of the bank, substantially as described.

24. In a sheet-feeder the combination with a clamp of a ratchet connected therewith, a reciprocating pawl for engaging said ratchet to raise and lower said clamp, and means for disengaging said pawl on lowering stroke, and engaging it on the raising stroke, whereby the clamp is raised the same distance above the sheets each time, substantially as described.

25. In a sheet-feeder the combination with sheet-separating devices, delivery devices to which the sheets are presented by the separating devices, guides in front of which the sheets are delivered by the delivery devices, and means for operating the delivery devices to start the sheets with an accelerated motion and to bring the sheet into position at the front guides with a retarded motion, substantially as described.

26. In a sheet-feeder the combination with combing-rolls the action of which is arrested by the top sheet, delivery devices to which the sheet is presented by the combing-rolls, and means for operating the delivery devices to grasp and release the sheet when both the sheet and delivery devices are at substantially a state of rest, substantially as described.

27. In a sheet-feeder the combination of a set of rolls to which the sheets are presented, a set of forwarding-rolls, guides for supporting the sheets advanced by said rolls, and means for intermittently engaging the rolls in each set with each other, and means for rotating said rolls when engaged with an accelerated and then a retarded speed, substantially as described.

28. In a sheet-feeder the combination of rolls 95, guides 120, rolls 103, a crank, connections between said crank and rolls 95 and 103 for rotating said rolls, drop-rolls 97 and 105 for coöperating with rolls 95 and 103, to advance the sheet, substantially as described.

29. In a sheet-feeder the combination with a combing device controlled by the sheet advanced thereby, of mechanism for feeding a bank of feathered sheets to said device, and means for operating said mechanism during the comb succeeding a long comb, substantially as described.

30. In a sheet-feeder the combination with a combing device controlled by the sheet advanced thereby, of mechanism for feeding a bank of feathered sheets to said device, and means for operating said mechanism to feed the bank during substantially the entire comb succeeding a long comb, substantially as described.

31. In a sheet-feeder the combination with a combing device controlled by the sheet advanced thereby, of mechanism for feeding a bank of feathered sheets to said device, and means for operating said mechanism to feed the bank of sheets when there is an increase in the length of comb, substantially as described.

32. In a sheet-feeder the combination with a combing device controlled by the sheet advanced thereby, of mechanism for feeding a bank of feathered sheets to said device, and means for operating said mechanism when there is an increase in the comb to feed the bank a distance proportional to the increase, substantially as described.

33. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device, comprising a ratchet and a reciprocating pawl, and means dependent upon the advance of the sheet by the combing device for controlling the advancing action of said pawl, substantially as described.

34. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device, comprising a ratchet and a reciprocating pawl, and means dependent upon the advance of the sheet by the combing device for arresting the advancing action of said pawl, substantially as described.

35. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device, comprising a ratchet and reciprocating pawl, and means dependent upon the advance of the sheet by the combing device for arresting the advance of said pawl, substantially as described.

36. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device comprising a ratchet, a pawl, means for advancing said pawl, means for returning said pawl to initial position, and sheet-controlled means for arresting said advancing means, substantially as described.

37. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device comprising a ratchet, a pawl, a pawl-carrying lever, a reciprocating rod for moving said lever in one direction, a spring for moving said lever in the other direction, a ratchet-bar connected with said lever, and a stop-pawl engaged with said bar by the action of the sheet, substantially as described.

38. In a sheet-feeder, the combination with a combing-roll, of mechanism for lowering said roll upon banks of varying thickness and raising said roll a substantially fixed distance above the top of the bank, substantially as described.

39. In a sheet-feeder, the combination with a combing-roll, of a ratchet connected therewith, a reciprocating pawl for engaging said ratchet to raise and lower said roll which disengages said ratchet on the lowering stroke, whereby the combing-roll is raised substantially the same distance above the sheets each time, substantially as described.

40. In a sheet-feeder the combination with a combing-roll, of a lever for raising and lowering the same, a ratchet-bar connected to said lever, a pawl-carrying lever, a pawl carried by said pawl-carrying lever, a stop for the pawl whereby the pawl disengages the ratchet-bar on the return stroke, and a cam for oscillating said pawl-carrying lever, substantially as described.

41. In a sheet-feeder the combination with sheet-separating devices, delivery devices provided with traveling surfaces for engaging and feeding forward the sheets to which the sheets are presented by the separating devices, guides in front of which the sheets are delivered by the delivery devices, and means for starting said traveling surfaces with an accelerated motion and stopping them with a retarded motion, substantially as described.

42. In a sheet-feeder the combination of sheet-separating devices, delivery devices provided with traveling surfaces acting progressively along the sheet to feed it forward, guides in front of which the sheets are delivered by the delivery devices, and means for moving said traveling surfaces from substantially a state of rest with an accelerated motion as the sheets are presented to them and with a retarded motion when they deliver the sheets at the front guides, substantially as described.

43. In a sheet-feeder the combination with sheet-separating devices, delivery devices provided with traveling surfaces acting progressively along the sheet to feed it forward, guides in front of which the sheets are delivered by the delivery devices, and means for moving said traveling surfaces with a gradually-retarded motion as they deliver the sheet at the front guides, substantially as described.

44. In a sheet-feeder the combination of delivery devices, provided with traveling

surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to the delivery devices, means for operating said traveling surfaces to grasp and release the sheet when both the sheet and said surfaces are approximately at rest, and means for operating said traveling surfaces to start the sheet with an accelerated motion and to stop it with a gradually-retarded motion, substantially as described.

45. In a sheet-feeder the combination of delivery devices, provided with traveling surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to the delivery devices, and means for operating the traveling surfaces to start the sheet from substantially a state of rest with an accelerated motion and to bring it into position with a gradually-retarded motion, substantially as described.

46. In a sheet-feeder the combination of delivery-rolls, mechanism for presenting individual sheets thereto, and means for operating said rolls to advance the sheet from approximately a state of rest with an accelerated motion and to bring the sheet into position with a gradually-retarded motion, substantially as described.

47. In a sheet-feeder the combination of delivery devices provided with traveling surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to the delivery devices, and means for operating said traveling surfaces to grasp and release the sheets when both the sheet and the surfaces are approximately at rest, substantially as described.

48. In a sheet-feeder the combination of devices separating individual sheets, delivery devices to which the sheets are presented, provided with traveling surfaces acting progressively along the sheets to feed them forward, and means for operating the traveling surfaces to grasp and release the sheet when both the sheet and surfaces are approximately at rest, substantially as described.

49. In a sheet-feeder the combination of delivery-rolls, mechanism for presenting individual sheets thereto, and means for gradually retarding the motion of said rolls as they complete their forwarding action, substantially as described.

50. In a sheet-feeder the combination of delivery devices, provided with traveling surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to the delivery devices, means for operating said traveling surfaces to bring the sheet into position with a retarded motion and to release the sheet when the surfaces and sheets are approximately at rest, substantially as described.

51. In a sheet-feeder the combination of delivery devices, provided with traveling surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to said delivery devices, and means for operating said surfaces to grasp the sheet when the surfaces and sheet are approximately at rest and to start the sheet with an accelerated motion, substantially as described.

52. In a sheet-feeder the combination of delivery-rolls, mechanism for presenting individual sheets thereto, and means for operating said rolls to advance the sheet from a state of rest with an accelerated motion, substantially as described.

53. In a sheet-feeder the combination of delivery devices provided with traveling surfaces acting progressively along the sheet to feed it forward, mechanism for presenting individual sheets to said delivery devices, and means for gradually retarding the motion of said traveling surfaces as they complete their forwarding action, substantially as described.

54. In a sheet-feeder the combination of delivery devices provided with traveling surfaces acting progressively along the sheet to feed it forward, guides in front of which the sheets are delivered by the delivery devices, and means for gradually retarding said surfaces as they bring the sheets into position at the guides, substantially as described.

55. In a sheet-feeder the combination with a combing device, of mechanism for feeding a bank of feathered sheets to said device, comprising a ratchet and reciprocating pawl, and means for arresting the advancing action of said pawl when the combing ceases, substantially as described.

56. In a sheet-feeder the combination with combing-rolls the action of which is arrested by the top sheet, delivery-rolls between which the sheet is advanced by the combing-rolls, means for engaging and disengaging said rolls, a supplemental set of delivery-rolls, front guides, and means for gradually retarding the motion of said supplemental rolls to deliver the sheet at the front guides with a gradually-retarded motion, substantially as described.

57. In a sheet-feeder the combination of sheet-delivery devices provided with surfaces acting progressively along the sheet, mechanism for presenting individual sheets to the delivery devices, means for reciprocating said surfaces and varying their speed to deliver the sheets with a gradually-retarded motion, substantially as described.

58. In a sheet-feeder the combination of delivery-rolls, means for presenting individual sheets thereto, a second set of rolls, front guides and means for gradually retarding the motion of said second set of rolls as they forward the sheet to the front guides, substantially as described.

59. In a sheet-feeder the combination of two sets of delivery devices provided with surfaces acting progressively along the sheet,

means for operating said devices to transfer the sheet from the first set of devices to the second when both sets are traveling at substantially the same surface speed, front guides before which the sheets are delivered by the second set of delivery devices, and means for gradually retarding the second set of devices as they deliver the sheet.

60. In a sheet-feeder the combination of delivery-rolls for forwarding sheets, supplemental delivery devices provided with surfaces acting progressively along the sheet, front guides before which the sheets are delivered by the supplemental devices, and means for giving the supplemental devices substantially the same surface speed as the rolls as the sheet is transferred to said devices and then retarding the surface speed of said supplemental devices to slow down the sheet.

61. In a sheet-feeder the combination with a combing-roll, of a sheet-retaining device and means for forcing said device against the top sheet with a retaining pressure when the combing-roll is thrown out of action, substantially as described.

62. In a sheet-feeder the combination with a combing-roll, of delivery devices, a sheet-retaining device, means for forcing said device against the top sheet with a retaining pressure when the combing-roll is thrown out of action, and means for relieving said pressure when the delivery devices are thrown into action.

63. In a sheet-feeder the combination with two independently-controlled sheet-advancing devices, a sheet-retaining device corresponding to each advancing device, means for forcing each retaining device against the top sheet with a retaining pressure when the corresponding advancing device is thrown out of action, substantially as described.

64. In a sheet-feeder the combination with two independently-controlled sheet-advancing devices, of sheet-delivery devices, a sheet-retaining device corresponding to each advancing device, means for forcing each retaining device against the top sheet with a retaining pressure when the corresponding advancing device is thrown out of action, and means for relieving the pressure of the retaining devices when the delivery devices are thrown into action, substantially as described.

65. In a sheet-feeder the combination with two independently-controlled combing-rolls, a sheet-retaining clamp corresponding to each roll, means for forcing each clamp against the top sheet with a retaining pressure when the corresponding combing-roll is thrown out of action, substantially as described.

66. In a sheet-feeder the combination with two independently-controlled combing-rolls, delivery devices, a sheet-retaining clamp corresponding to each roll, means for forcing each clamp against the top sheet with a retaining pressure when the corresponding combing-roll is thrown out of action, and means for relieving said pressure when the delivery devices are thrown into action, substantially as described.

67. In a sheet-feeder the combination with two independently-controlled combing-rolls, a sheet-retaining clamp corresponding to each roll, means for engaging each clamp with the top sheet when the corresponding combing-roll is thrown out of action, substantially as described.

68. In a sheet-feeder the combination with two independently-controlled combing-rolls, delivery devices, a sheet-retaining clamp corresponding to each roll, means for engaging each clamp with the top sheet when the corresponding combing-roll is thrown out of action, and means for disengaging said clamps when the delivery devices are thrown into action, substantially as described.

69. In a sheet-feeder the combination with a combing-roll, of a frame carrying said roll, mechanism for raising and lowering said frame at regular intervals, an arm for engaging the sheets, and sheet-controlled devices between said arm and frame for raising said frame and supporting it from the arm, substantially as described.

70. In a sheet-feeder the combination with a combing-roll, of a frame carrying said roll, an arm adapted to bear upon the sheets, sheet-controlled devices between the arm and frame for raising said frame and supporting it from the arm, delivery devices, and mechanism for raising the combing-roll frame when the delivery devices are thrown into action, substantially as described.

71. In a sheet-feeder the combination with a combing-roll, of a frame carrying said roll, an arm adapted to bear upon the sheets, sheet-controlled devices between the arm and frame for raising said frame and supporting it from the arm, mechanism for raising and independently supporting the frame, and means for returning the raising devices to inactive position when the frame is raised, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

FRANK L. CROSS.

Witnesses:
IRA L. FISH,
KATHARINE A. DUGAN.