

No. 734,466.

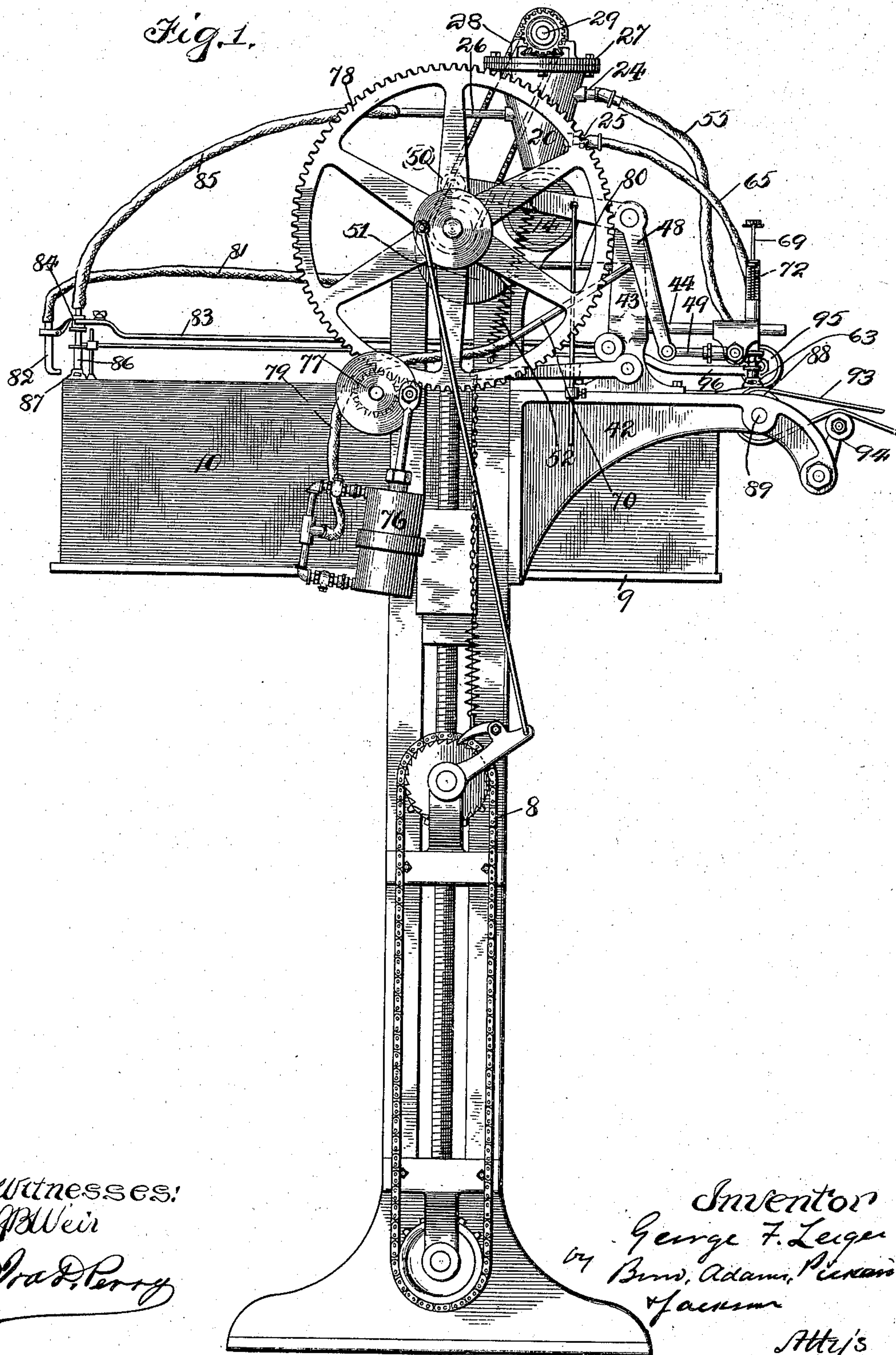
PATENTED JULY 21, 1903.

G. F. LEIGER.
PNEUMATIC SHEET FEEDING MACHINE.

APPLICATION FILED JUNE 3, 1901.

NO MODEL.

4 SHEETS—SHEET 1.



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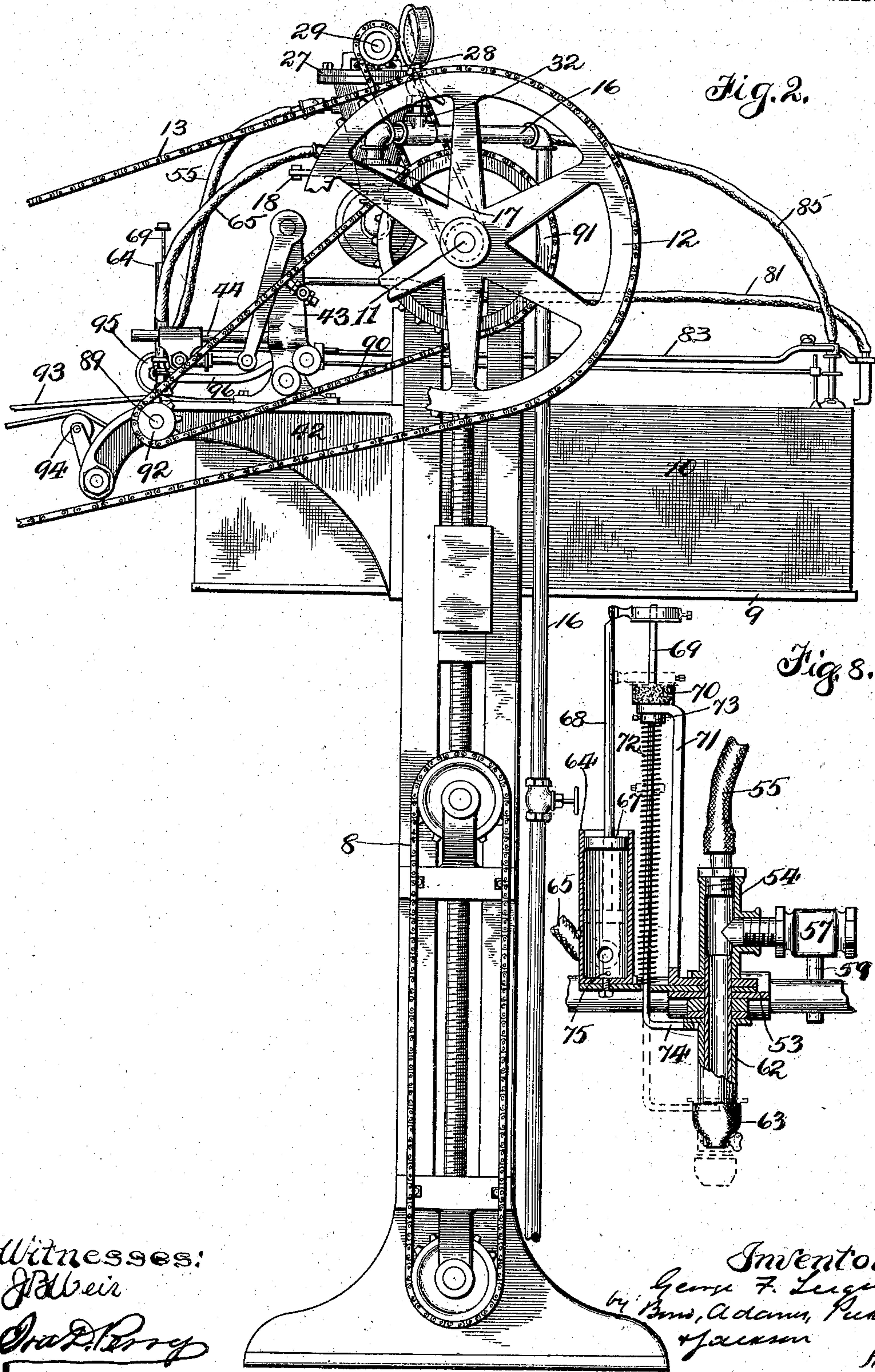
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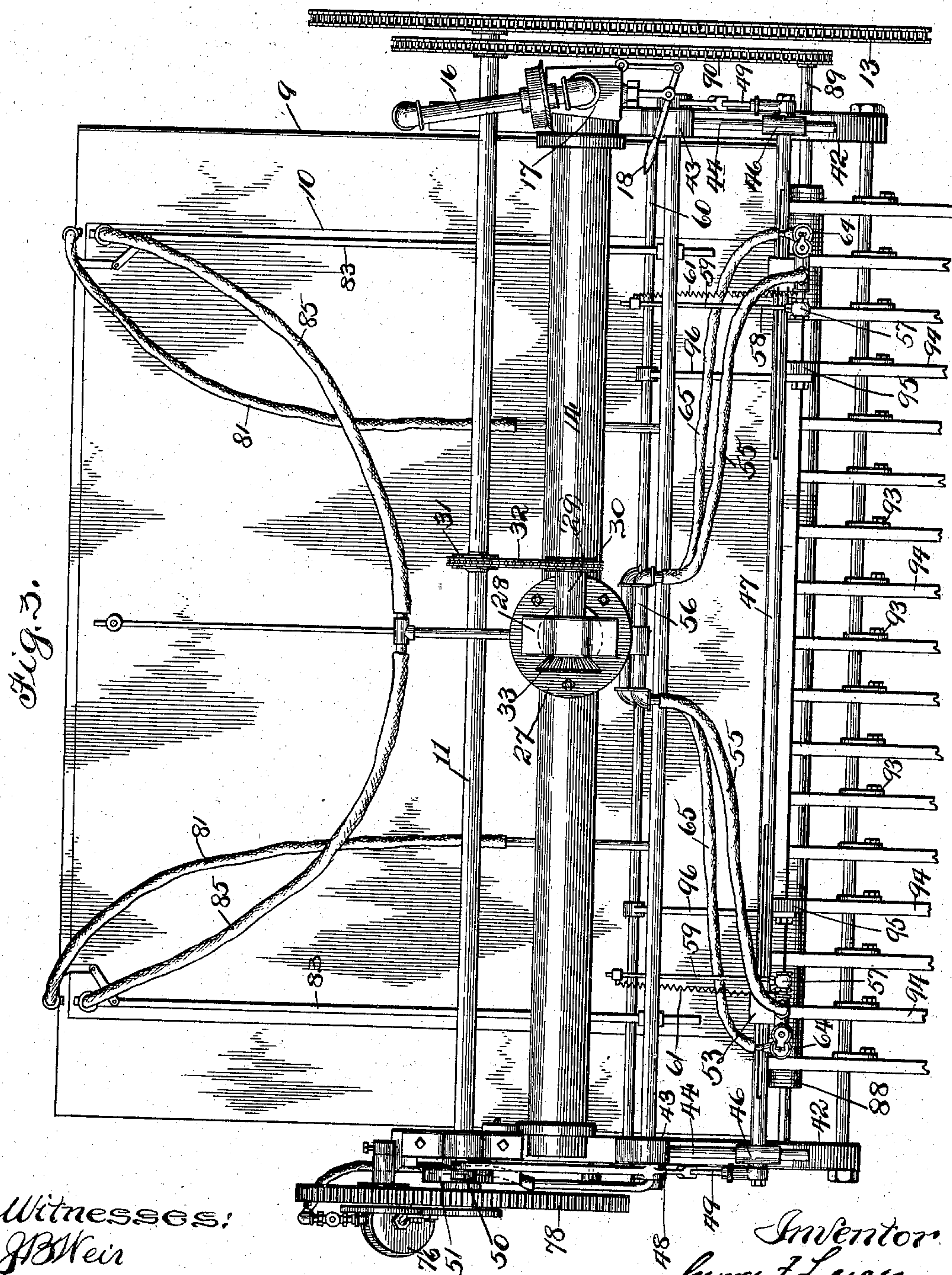
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Witnesses:

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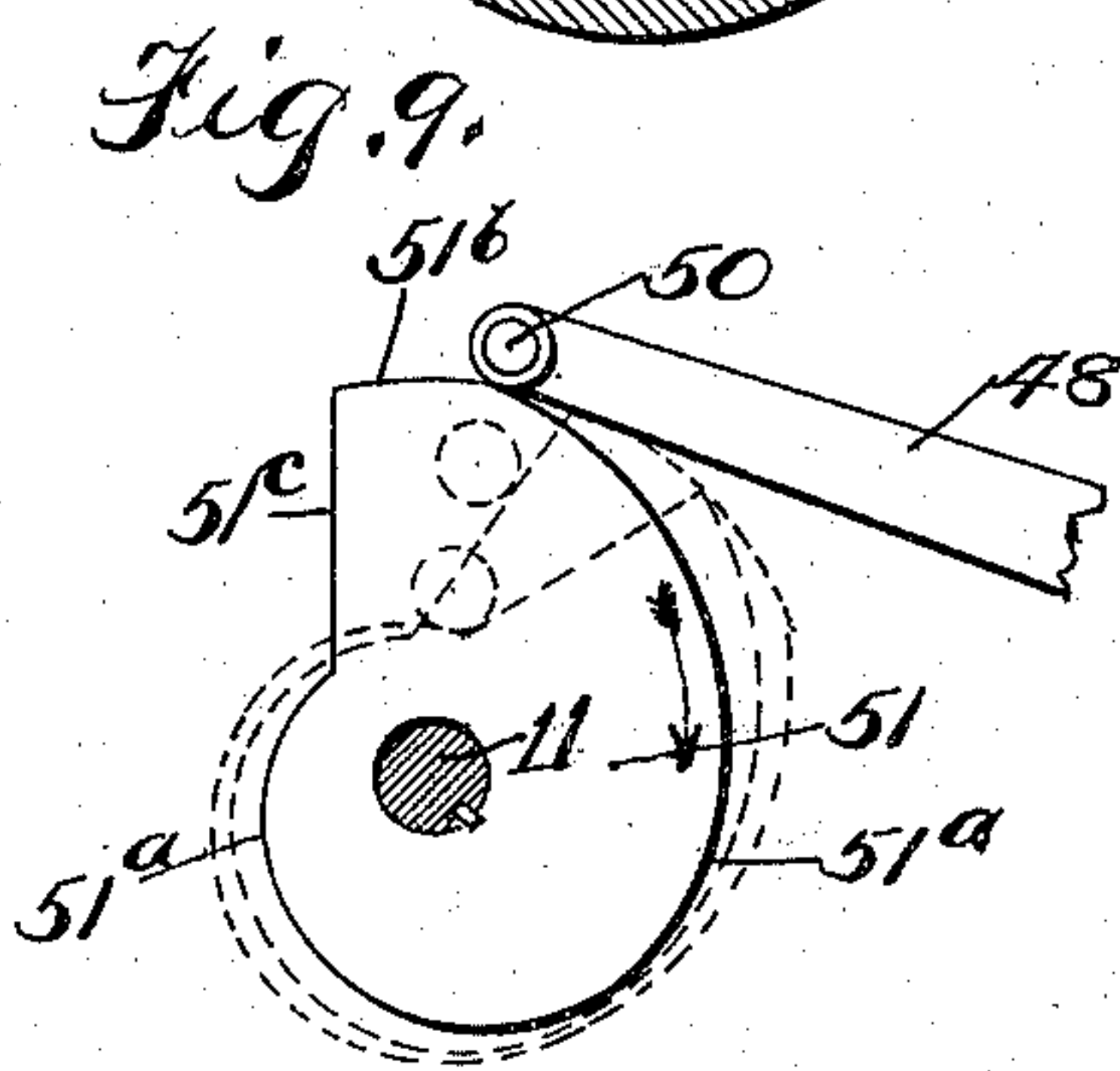
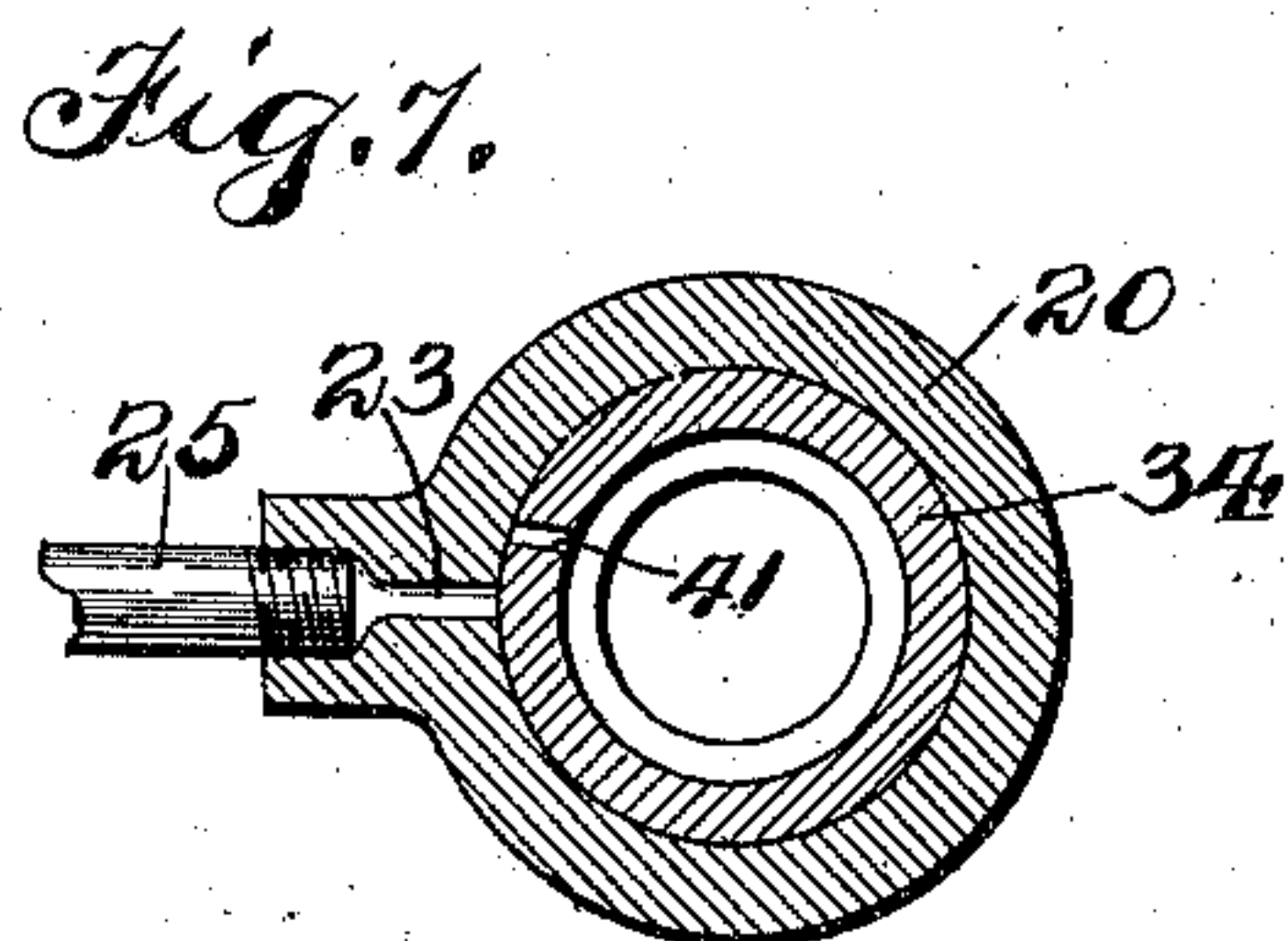
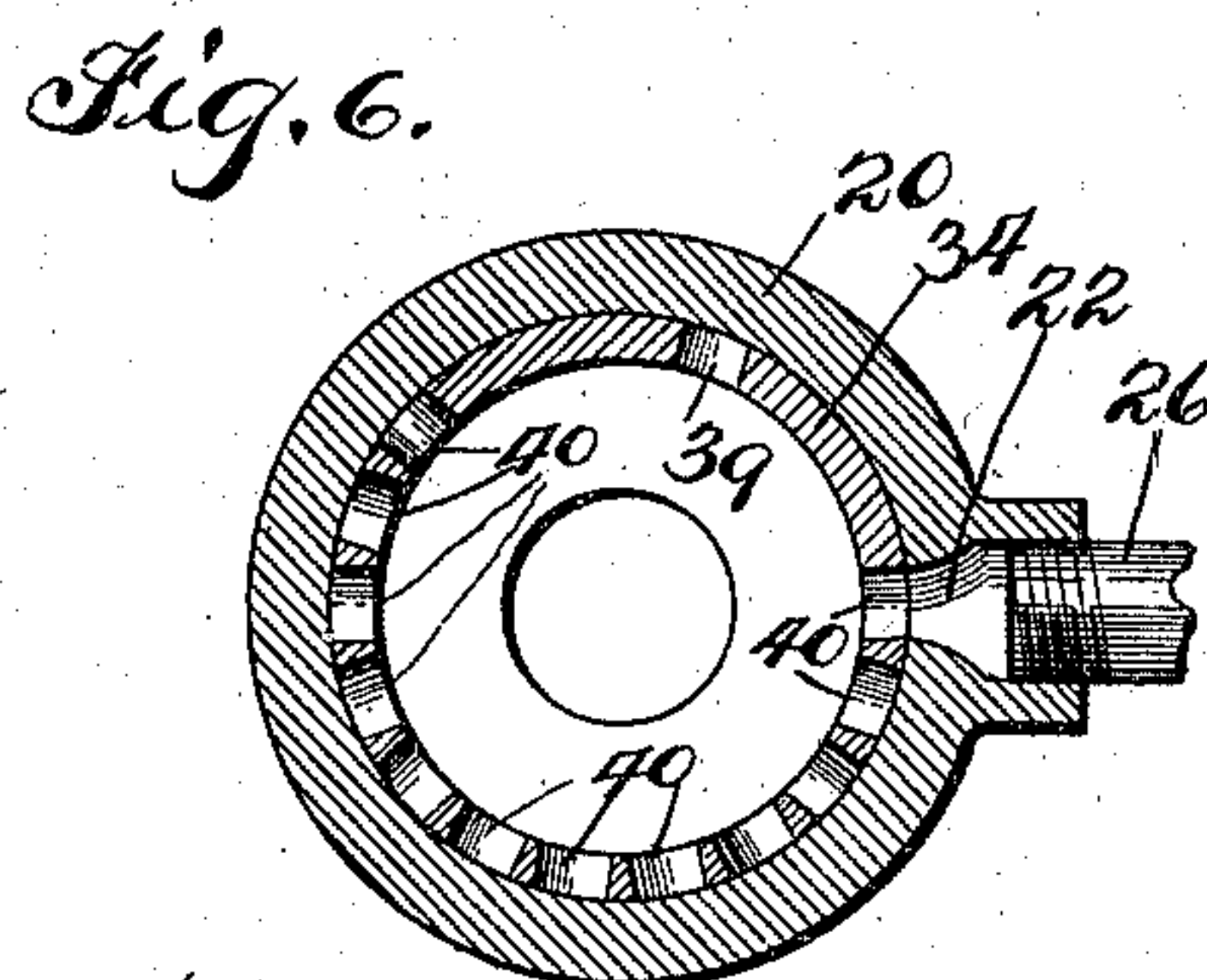
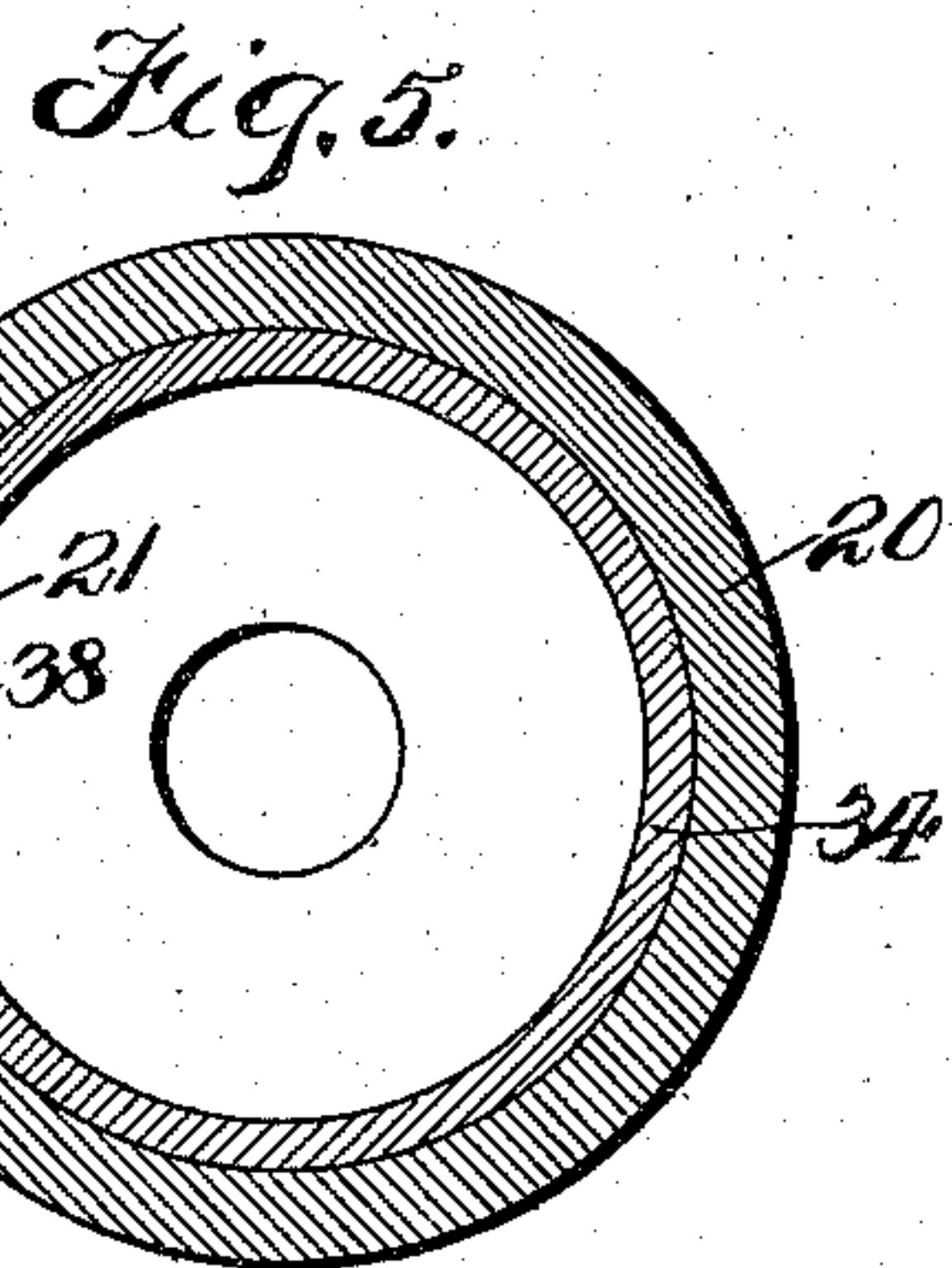
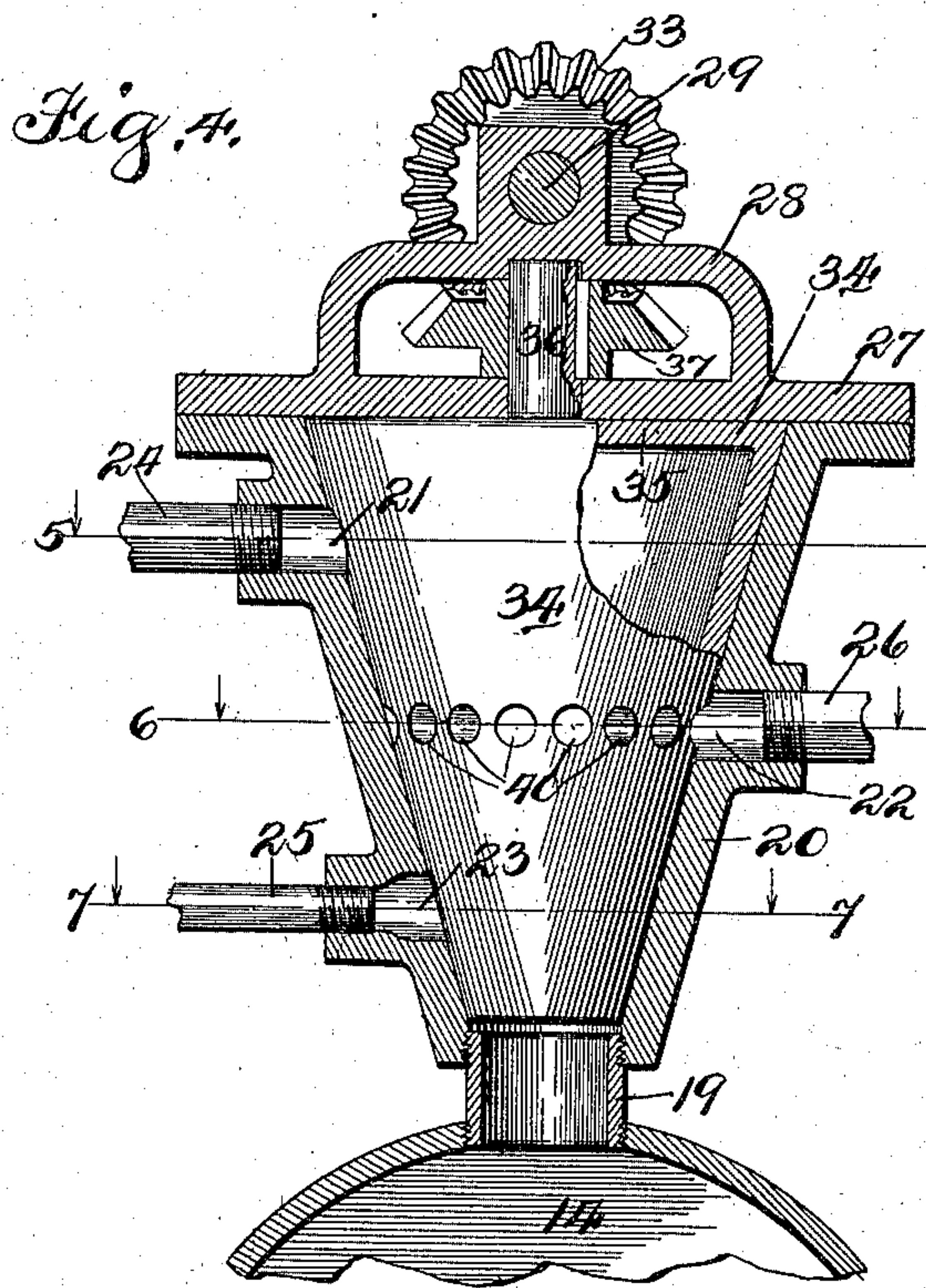
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J. B. Weir
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UNITED STATES PATENT OFFICE.

GEORGE F. LEIGER, OF CHICAGO, ILLINOIS, ASSIGNOR TO HIMSELF AND
LEWIS BENEDICT, OF CHICAGO, ILLINOIS.

PNEUMATIC SHEET-FEEDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 734,466, dated July 21, 1903.

Application filed June 3, 1901. Serial No. 62,959. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. LEIGER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pneumatic Sheet-Feeding Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to pneumatic sheet-feeding machines, and particularly to improvements in sheet-feeding machines of the character shown and described in Letters Patent to me Nos. 257,279, 583,126, 583,127, 587,383, 607,085, 659,417, and 624,228; and its principal object is to provide a new and improved form of valve by which the operations of the several pneumatic sheet-engaging and sheet-forwarding devices may be all controlled and operated through the medium of a single valve, thereby greatly simplifying the construction of the machines as shown in said Letters Patent.

Another object of my invention relates to the feeding forward of the sheets by the front picker mechanism and by the carrying-tapes to which the picker mechanism delivers the sheets; and its object is to so arrange these devices with relation to each other as to insure the proper forwarding of the sheet and to also insure the sheet being so carried away that its rear end will be carried past the front picker mechanism when it is returned from its forward stroke to engage the next sheet, and thereby prevent the tail of the sheet that has just been fed forward being engaged by the front picker mechanism. In order to insure the sheet being carried completely away from the front picker mechanism before it is ready to operate a second time to forward the next sheet, tapes have heretofore been provided which run at a higher speed than the motion of the carriage which carries the front picker mechanism, delivering the sheets to the tapes. One difficulty which arose with this arrangement was due to the fact that if one of the two front pickers let go of the sheet before the other the rapidly-running tapes would carry the side of the sheet which was first freed from the picker upon that side of the machine around faster than the other

side, causing the sheet to be forwarded out of position and twisted more or less sidewise, thus necessitating nice adjustment of all the parts and making the machine difficult to operate and expensive to construct. To overcome these difficulties, as hereinafter described, the carriage carrying the front pickers when the pickers engage the sheet is driven forward at a relatively rapid speed and delivers the sheets to feeding-tapes which run at substantially the same surface speed as the forward motion of the carriage. The rearward motion of the carriage is relatively much slower than its forward motion, thereby insuring the complete passage of the tail end of the sheet out from under the front pickers when they are in position to reengage the paper and feed the next sheet forward.

Another object of my invention is the improvement in construction and operation of sheet-feeding mechanisms in sundry details hereinafter pointed out.

Referring to the drawings, Figure 1 is a side elevation of one side of the machine. Fig. 2 is a side elevation of the other side of the machine. Fig. 3 is a top or plan view. Fig. 4 is an enlarged detail, being a view of my new and improved valve devices, partly in section. Fig. 5 is an enlarged detail, being a cross-section on line 5 5 of Fig. 4. Fig. 6 is an enlarged detail, being a cross-section on line 6 6 of Fig. 4. Fig. 7 is an enlarged detail, being a cross-section on line 7 7 of Fig. 4. Fig. 8 is an enlarged detail, being a view of the front picker mechanism, partly in vertical section; and Fig. 9 is an enlarged detail, being a diagram of the cam which operates the front carriage, shown in several different positions.

In the accompanying drawings, 8 indicates a standard, upon which the several parts hereinafter described are mounted.

9 indicates a table adapted to support a pile of sheets 10. The table 9 is supported by the standard 8 and is provided with suitable mechanism whereby as the machine is operated and the sheets successively fed from the pile the table is automatically raised, so that the top of the pile of sheets may be kept constantly at the same level. As this mechanism may be of any approved and well-known kind and description and forms no part of my pres-

ent invention, it is not necessary to describe it here.

11 indicates a driving-shaft which is journaled in the standard 8 and is driven by means of a sprocket-wheel 12, keyed to one end of the shaft, and a sprocket-chain 13 from any suitable source of power.

14 indicates a vacuum-chamber which is supported upon a bracket 15 on the standard 8.

16 indicates a tube which communicates with the vacuum-chamber 14 and with an air-pump of any suitable description or any other suitable and well-known mechanism by means of which a constant vacuum is kept up in the vacuum-chamber 14. As the air-pump or other means for maintaining the vacuum may be of any well-known kind and description and forms no part of my present invention, it is not shown in the drawings or further described. The entrance of the tube 16 to the vacuum-chamber 14 is controlled by a suitable valve 17, operated by a lever 18 in any well-known and approved way.

Referring particularly to Figs. 4, 5, 6, and 7, 19 indicates a tube which is screwed into or otherwise secured to the vacuum-chamber 14 and opens into it. 20 indicates a valve-box, which is preferably conical in form, as is best shown in Fig. 4, and it is screwed or otherwise secured to the tube 19, so as to open into the chamber 14. 21, 22, and 23 indicate circular openings through the sides of the valve-box 20, into which are screwed, respectively, pipes 24, 25, and 26, which pipes communicate with the sheet engaging and forwarding mechanism hereinafter described. The valve-box 20 is provided with a cover 27, which is suitably secured thereto and is provided with a bracket 28. 29 indicates a stub-shaft which is journaled in the bracket 28 and carries upon one end a sprocket-wheel 30.

31 indicates a sprocket-wheel which is keyed or otherwise secured to the driving-shaft 11. 32 indicates a sprocket-chain which connects the sprocket-wheels 30 and 31. 33 indicates a bevel-gear which is keyed or otherwise secured to the stub-shaft 29 at the opposite end from the sprocket-wheel 30. 34 indicates a valve which rotates within the valve-box 20. As is best shown in Fig. 4, the valve 34 is conical in form, fitting closely within the valve-box 20, so as to rotate air-tight therein. The valve 34 is hollow and open below to communicate through the tube 19 with the vacuum-chamber 14, but is closed above by a top 35, which is either formed integral therewith or secured air-tight thereto. 36 indicates a stub-shaft which is secured to or formed integral with the valve 34 and projecting upwardly therefrom is journaled in the top 27 of the valve-box 20 and in a suitable bearing on the lower side of the bracket 28. 37 indicates a bevel-gear which is keyed or otherwise secured to the stub-shaft 36 and meshes with the bevel-gear 33, whereby when the stub-shaft 29 is rotated by means of the sprocket-

wheels 30 and 31 and the sprocket-chain 32 with the rotation of the driving-shaft 11 the valve 34 is rotated in the valve-box 20. The valve 34 is provided with openings 38, 39, 40, and 41. The opening 38 registers with the opening 21, the openings 39 and 40 with the opening 22, and the opening 41 with the opening 23 in the valve-box 20 as the valve 34 rotates therein. The timing of the registrations of the several openings with each other will be hereinafter described. At present it is sufficient to say that as the several openings of the valve 34 register with the several openings in the valve-box 20 the tubes 24, 25, and 26 are put in connection with the vacuum-chamber 14, so as to cause a vacuum in said tubes.

The sheet forwarding and feeding mechanism, as illustrated in the drawings herein, and the devices for raising the rear end of the sheet and for blowing air thereunder, so as to cooperate with the sheet forwarding and feeding mechanism to insure the delivery of only a single sheet at a time by the sheet-forwarding mechanism, are substantially the same in their separate operations when connected with the vacuum-chamber as the corresponding mechanism shown in Letters Patent to me No. 624,228 and considered separately form no portion of my present invention. In order to make clear, however, the operation of the machine as a whole, it will be advisable to describe them herein again in such detail as may be necessary.

42 indicates brackets which are secured to the standard 8.

43 indicates uprights which are bolted or otherwise secured to the brackets 42.

44 indicates rods which are secured in the uprights 43, one at each side of the machine, and project forward therefrom.

45 indicates a carriage composed of slide-boxes 46 and a cross-bar 47, connecting said slide-boxes 46 together. The slide-boxes 46 are mounted upon the rods 44, so as to slide to and fro thereon.

48 indicates a bell-crank lever which is pivoted upon the upright 43 upon one side of the machine, its lower end being connected by a link 49 with the slide-box 46 upon the corresponding side of the machine, as is best shown in Fig. 1. The other end of the bell-crank lever 48 carries a roller 50, which bears upon a cam 51, which is keyed or otherwise secured to one end of the driving-shaft 11. The cam 51 being, as shown, an open one, the roller 50 is held against the surface of the cam by a contraction-spring 52, one end of which is fastened to the upper arm of the bell-crank lever 48 and the other end secured to the standard 8, as is best shown in Fig. 1.

In Figs. 1, 2, and 3 the carriage 45 is shown near the forward limit of its motion. As the shaft 11 rotates, the cam 51, bearing upon the roller 50, urges the upper arm of the bell-crank lever forward against the action of

the spring 52, drawing the carriage backward. When the roller reaches the end of the cam-surface of the cam 51, the spring 52 draws the roller immediately inward, lowering the upper arm of the bell-crank lever 48 and forcing the carriage 45 forward.

53 indicates blocks which are feathered upon the cross-bar 47, so that they may be adjustably mounted thereon longitudinally of said cross-bar.

As the forward picker mechanism which I am about to describe consists of two pickers and connected attachments which are duplicates of each other and as these are precisely the same in their details as in the last patent above named, it will be necessary to describe only one of them. Referring, therefore, to Fig. 8, in which this mechanism is shown in detail, 54 indicates a tube which is mounted upon the block 53 and by means of a flexible pipe 55 connects with a pipe 56, which opens into the pipe 24. 57 indicates a valve of any approved form and construction which opens into the tube 54. 58 (see Fig. 3) indicates a valve-stem connected with valve 57 and provided at its outer end with a stop 59, which is adjustably mounted thereon and projects downward therefrom. 60 indicates a cross-bar which is mounted in the brackets 42 and extends across the machine from side to side. 61 indicates a spiral spring, one end of which is secured to the outer end of the valve-rod 58 and the other end to the block 53 and tends to normally hold the valve-rod 58 inward and keep the valve 57 closed. When the carriage is moved forward nearly to the limit of its forward motion, the stop 59 contacts the cross-bar 60, so as to pull out the valve-rod 58 against the action of the spring 51 and open the valve 57. When the carriage makes its backward motion, the stop 59 is freed from the cross-bar 60 and immediately closes the valve 57. 62 indicates a telescopic picker-tube which is mounted upon the lower end of the tube 54 and is provided with a suitable cup 63, which is fully described in the Letters Patent to me last above named. 64 indicates a cylinder which is mounted on the block 53 and is connected by a flexible tube 65 with a tube 66, which opens into the tube 25. 67 indicates a piston which moves airtight in the cylinder 64 and is provided with a piston-rod 68. 69 indicates a rod, the upper end of which is connected with the upper end of the piston-rod 68 and passes downward through a washer 70, which is mounted upon the upper end of an upright 71, secured to the block 53, so as to form a bearing for the rod 69, which slides longitudinally through the washer 70 in the upper end of the upright 71. 72 indicates a spiral spring, the lower end of which bears upon the upper surface of the block 53 and the upper end upon a washer 73, which is adjustably secured upon the rod 69. The effect of the spring 72 is to normally hold the parts in the position shown in solid lines in Fig. 8 when there is a vacu-

um in the cylinder 64. The lower end of the rod 69 is bent at right angles and is provided with a fork 74, which embraces and engages the telescopic picker-tube 62. When the connections are opened by the rotation of the valve 34, as hereinafter described, between the cylinder 64 and the vacuum-chamber 14, a vacuum is produced below the piston 67, which is forced down by atmospheric pressure above it, carrying with it the rod 69 against the action of the spring 72 into the position shown in dotted lines in Fig. 8, allowing the telescopic picker-tube 62 to drop by its own weight. When the connections between the cylinder 64 and the vacuum-chamber 14 are closed by the rotation of the valve 34, as hereinafter described, air is admitted below the piston through a small opening 75, which being relatively quite small will permit, when the valves are opened, a sufficiently complete vacuum in the cylinder 64 to cause the piston 67 to be forced downward, as above described, and when the connection in the vacuum-chamber is closed will allow ingress of air sufficient for the spring 72 by its own expansion to lift the rod 69, together with the piston 67, the fork 74 engaging with the telescopic picker-tube 62 and positively lifting the same. 76 indicates an air-pump of any approved form and construction, which is driven by means of a gear 77, meshing with a large gear 78, which is keyed or otherwise secured to one end of the driving-shaft 11. The air-pump is connected by flexible tube 79, tubing 80, and flexible tube 81 to a tubular blower 82, which is of the usual form and construction and is supported by a support 83 from the framework of the machine. The air-pump 76 when driven forces a current of air through the tubes 79 80 81 and blower 82, blowing the current against the rear of a pile of sheets in order to assist in the separation of the top sheet from the pile in the usual and well-known manner described by me in the Letters Patent last above named. 84 indicates a tube mounted upon the support 83 over the rear end of the pile of sheets and connected by flexible tube 85 with the tube 26. 86 indicates a flexible picker-tube mounted on the tube 84 and carrying at its lower end a cup 87, which is preferably of the form and kind shown and described by me in the Letters Patent last above named. The telescopic picker 86 by means of its connection through the tube 26 with the valve 34 is given a double motion like that described in the Letters Patent to me last above named. 88 indicates a roller mounted upon a shaft 89, which is journaled in the bracket 42. The roller is driven by means of a sprocket-chain 90, a sprocket-wheel 91, which is keyed or otherwise secured to the driving-shaft 11, and a sprocket-wheel 92, which is keyed or otherwise secured upon one end of the shaft 89. 93 indicates tapes which are carried by the roller 88 and operate to carry sheets of paper forward after

they are fed to them by the pneumatic sheet-forwarding mechanism to any suitable machine for their subsequent treatment. The other pulleys around which the tapes 93 pass are not shown, as they are of any ordinary and well-known construction and operation and form a part of such other delivery mechanism as may be connected with the devices herein described. 94 indicates idler-pulleys of the usual form and construction bearing upon the under side of the tapes 93 to assist in keeping them taut. 95 indicates pulleys which are mounted upon the forward ends of arms 96. The arms 96 are pivoted at their other ends upon the cross-bar 60, allowing the pulleys 95 to drop by their own weight upon the tapes 93, so that the sheets of paper may be fed forward between the pulleys 95 and the roller 88. The rear pickers 86 are provided with small openings 97, which are sufficiently small to allow a vacuum to be produced in the said pickers when connection between them and the vacuum-chamber 14 is established, as hereinafter described, sufficient to raise the pickers and the rear end of the sheet, but of sufficient size, as soon as the connection between the vacuum-chamber and the pickers is shut off, to permit air to enter the pickers and allow them to fall by their own weight when the connection between the vacuum-chamber and the pickers 86 is shut off.

The operation of the devices hereinabove described is as follows: The machine being in position with the carriage 45 near the rear limit of its motion, it is set in operation. Rotating the valve 34 in the valve-box 20, the opening 39 in the valve 34 thereupon immediately registers with the opening 22 in the valve-box 20, establishing a communication, by means of the tubes 26 and 85, between the vacuum-chamber 14 and the rear pickers 86, which, having before been allowed to drop by their own weight, rest, with the cups 87, upon the surface of the top sheet, near the rear edge thereof. As there is always some air between the sheets as they lie in the pile, this will at once cause the picker 86 to rise by atmospheric pressure, carrying with it the top sheet of the pile. As the opening 39 is a small one, however, this communication between the picker and the vacuum-chamber is at once shut off, and air entering through the small opening 97 allows the picker 86 to drop by its own weight, carrying the sheet with it, as above described. The effect of this momentary raising of the sheet will be to slightly crimp the surface of the sheet under the cup 87, but leaving the sheet immediately below it, in case two sheets should be raised by the operation, unaffected and smooth as before. The rotation of the valve continuing, the openings 40 next pass the opening 22. It will be seen by reference to Fig. 6 that the distance between the several openings 40 is smaller than the opening 22 in the valve-box 20, so that as the wheel rotates a continuous communica-

tion is established between the tube 26 and the vacuum-chamber 14 as long as the openings 40 are passing thereby. In other words, the openings 40 are practically equivalent to a continuous slot, which might be used in place of the openings 40; but I prefer to use a series of openings 40 in order to save the weakening of the material which would be caused by a continuous slot. As soon as the first opening 40 registers with the opening 22 communication is again established between the rear picker 86 and the vacuum-chamber 14, and the picker 86 is again raised, carrying with it the tail end of the top sheet, and the tail end of the top sheet remains in its lifted position until the last of the openings 40 have passed the opening 22. The sheet having been slightly crimped by the previous dropping and raising of the picker just described, the lifting of only one sheet on the second lifting of these pickers is insured. This movement of the pickers and its results are fully described in the Letters Patent to me last above named, the means for effecting this double movement, however, being different in said application from those shown in my present invention. By means of the blower 82 a current of air is blown below the tail sheet, thus lifting free the top sheet from the pile of sheets immediately below it along considerable if not the entire length of the sheet. As soon as the last of the openings 40 passes the opening 22 the communication between the pickers 86 and the vacuum-chamber 14 is shut off, and air again passing in through the opening 97 the tail end of the sheet is freed from engagement with the pickers 86 and carried forward by the forwarding mechanism, hereinafter described, and the pickers drop upon the tail end of the sheet below, where the operation is repeated. In the meantime the forward picker mechanism operates to forward the sheet. The carriage 45 being at the limit of its motion, the opening 41 registers with the opening 23, establishing a communication, by means of the tubes 65, between the cylinder 64 and the vacuum-chamber 14, causing the piston 67 to move to the bottom of the cylinder 64, carrying with it the rod 69 and the fork 74 and allowing the telescopic picker 62 to drop, so that the cup 63 rests upon the surface of the sheet near the forward edge. As soon as the opening 41 passes beyond the opening 23 the connection between the parts above described and the vacuum-chamber is shut off and air begins to leak into the cylinder 64 through the small opening 75. As soon as the opening 41 passes beyond the opening 23 the opening 38 registers with the opening 21, establishing communication, by means of the pipes 24, 55, and 56, between the tube 54 and the vacuum-chamber 14, causing the cup 63 to engage with the surface of the sheet by atmospheric pressure below the sheet. The air leaking into the cylinder 64 through the opening 75 causes the spring 79 to operate, as above

described, to raise the rod 69 and piston 67 and by the engagement of the fork 74 with the telescopic tube 62 to positively raise the same, lifting with it the forward end of the sheet. By the coöperation of the rear picker mechanism above described the engagement of only one sheet by the front picker mechanism is insured and made certain. At this moment the cam 51 is in such position that the roller 50 passes from the cam-surface 51^a, (see Fig. 9,) leaving the spring 52 free to draw the upper end of the bell-crank lever downward and inward. This movement is a rapid one, but is controlled, as will be seen by reference to Fig. 9, by the bearing of the roller 50 upon the surface 51^c of the cam 51. As the cam rotates in the direction of the arrow shown in Fig. 9 it will be obvious that when the last part of the cam-surface 51^c passes from the roller the roller is free to be urged by the action of the spring 51 downward along the surface 51^c; but, as is indicated by the dotted lines in Fig. 9, it cannot be moved inward any faster than the surface 51^c, receding with the rotation of the cam, permits it to be. This is of course so timed that the downward movement of the upper arm of the bell-crank lever while rotating is adjusted to a definite time. The movement of the upper arm of the bell-crank lever 48 downward and inward of course drives the carriage 45 rapidly forward into the position shown in Fig. 1, carrying the front edge of the sheets between the tapes 93 and the roller 95. The forwarding-tapes 93 are driven by the sprocket-chain 90, sprocket-wheels 91 and 92, and the roller 88 at the same surface speed as the forward motion of the carriage above described, so that when the edge of the sheet is engaged by the forwarding-tapes to be forwarded, moving at the same rate of speed as the forwarding-tapes, even if one picker is disengaged before the other is the sheet cannot be misplaced, but will be fed forward in a straight line and in position to be delivered to any delivering mechanism with which the machine may be connected. Just as the carriage reaches the front limit of its motion the stop 59 contacts with the cross-bar 60, opening the valve 47, admitting air above the telescopic picker 62, and freeing the front edge of the sheet from the telescopic picker 62, leaving it free to be forwarded by the tapes, as above described. When the roller reaches its lower position, (shown in dotted lines in Fig. 9,) the cam-surface 51^a engages the roller and lifts it and the upper arm of the bell-crank lever 48 upward at a much slower speed than its downward movement, as will be readily seen by reference to the shape of the cam shown in Fig. 9. This moves the lower arm of the bell-crank lever 48 backward, returning the carriage with it. The stops 59 are thereby freed from contact with the cross-bar 60, causing the springs 61 to close the valve 57, whereby the pickers are again in condition to be operated upon by the

vacuum connections, as above described. Between the cam-surface 51^c and the surface 51^a I provide the cam 51 with a short circular portion 51^b, as is shown in Fig. 9, which causes a momentary stoppage of the carriage at the rear limit of its motion. It will of course be understood that the operations are so timed that just as the forward motion of the carriage begins the rear end of the sheet is freed from the rear pickers by the operation of the valves and parts, so as to permit the sheet to be disengaged therefrom and forwarded. At the same time as soon as the tail end of the top sheet is moved forward by the operations above described a short distance the operation of the valve is so timed that the opening 39 registers with the opening 22, and the first drop of the rear picker upon the tail end of the sheet below is accomplished. When the carriage 45 reaches the rear limit of its motion, the operations above described are repeated.

I have shown the valve-box as conical in shape and the valve therein as also conical and conforming to the inner surface of the conical box, and this is the shape in which I prefer to construct it, as it is obvious that as the rotating valve wears with this form of construction it will still keep air-tight by working a little lower into the valve-box. It is obvious, however, that the form of the valve-box and of the valve rotating therein might be considerably varied in shape and construction without departing from the essence of my invention, and I do not, therefore, confine myself to the use of the conical-shaped valve-box and valve, except as the said devices are hereinafter specifically claimed.

That which I regard as my invention, and desire to secure by Letters Patent, is—

1. The combination with pneumatic sheet engaging and forwarding mechanism, a vacuum-chamber, a valve-box connected with said vacuum-chamber, and pipes connecting said pneumatic sheet engaging and forwarding mechanism with said valve-box and opening into the same, of a rotary valve seated in said valve-box and adapted by its rotation to open and close the openings of said pipes into said valve-box at suitable intervals as said valve rotates, and mechanism for rotating said rotary valve, substantially as described.

2. The combination with pneumatic sheet engaging and forwarding mechanism, a vacuum-chamber, a valve-box connected with said vacuum-chamber, and pipes connecting said pneumatic sheet engaging and forwarding mechanism with said valve-box and opening into the same, of a rotary valve seated in said valve-box and adapted to rotate within the same, and provided with openings adapted as said valve rotates to severally register with the openings of said pipes into said valve-box to open and close the same at suitable intervals, and mechanism for rotating said valve, substantially as described.

3. The combination with pneumatic sheet

engaging and forwarding mechanism, a vacuum-chamber, a valve-box connected with said vacuum-chamber, and pipes connecting said pneumatic sheet engaging and forwarding mechanism with said valve-box and opening into the same, of a hollow valve seated within said valve-box, communicating with said vacuum-chamber and provided with openings from its interior to its exterior surface adapted when said valve is moved to severally register with said openings of said pipes into said valve-box, and mechanism for moving said valve, substantially as described.

4. The combination with pneumatic sheet engaging and forwarding mechanism, a vacuum-chamber, a valve-box connected with said vacuum-chamber, and pipes connecting said pneumatic sheet engaging and forwarding mechanism with said valve-box and opening into the same, of a hollow rotary valve seated within said valve-box, communicating with said vacuum-chamber and provided with openings from its interior to its exterior surface adapted as said valve rotates to severally register with the openings of said pipes into said valve-box to open and close the same at suitable intervals, and mechanism adapted to rotate said valve, substantially as described.

5. The combination with pneumatic picker mechanism adapted to engage the front end of a sheet of paper to forward the same, rear pneumatic picker mechanism adapted to engage and lift the rear end of a sheet of paper, a vacuum-chamber, a valve-box opening into said vacuum-chamber, and pipes connecting respectively said forward picker mechanism and said rear picker mechanism with said valve-box and opening into the same, of a valve seated in said valve-box and adapted by its movement to successively open and close the openings of said pipes into said valve-box in suitable succession and at suitable intervals, and mechanism for moving said valve in said valve-box, substantially as described.

6. The combination with pneumatic picker mechanism adapted to engage the front end of a sheet of paper to forward the same, rear pneumatic picker mechanism adapted to engage and lift the rear end of a sheet of paper, a vacuum-chamber, a valve-box opening into said vacuum-chamber, and pipes connecting, respectively, said forward picker mechanism and said rear picker mechanism with said valve-box and opening into the same, of a valve rotatably mounted in said valve-box and adapted, by its continuous rotation in the same direction, to successively open and close the openings of said pipes into said valve-box in suitable succession and at proper intervals, substantially as described.

7. The combination with pneumatic picker

mechanism adapted to engage the front end of a sheet of paper to forward the same, rear pneumatic picker mechanism adapted to engage and lift the rear end of a sheet of paper, a vacuum-chamber, a valve-box opening into said vacuum-chamber, and pipes connecting, respectively, said forward picker mechanism and said rear picker mechanism with said valve-box and opening into the same, of a valve rotatably mounted in said valve-box and provided with openings adapted to register respectively with the openings of said pipes connecting said front picker mechanism and the openings of the pipes connecting said rear picker mechanism with the valve-box and, when said valve is rotated, to open and close said openings in suitable succession and at suitable intervals, and means for rotating said valve, substantially as described.

8. The combination with pneumatic picker mechanism adapted to engage the front end of a sheet of paper to forward the same, rear pneumatic picker mechanism adapted to engage and lift the rear end of a sheet of paper, a vacuum-chamber, a valve-box opening into said vacuum-chamber, and pipes connecting, respectively, the said forward picker mechanism and the said rear picker mechanism with said valve-box and opening into the same, of a hollow conical valve adapted to rotate in said valve-box and provided with openings adapted to register with the openings of said pipes connecting said forward picker mechanism with said valve-box as the said conical valve rotates, and with a series of openings adapted to register with the openings of said pipes connecting said rear picker mechanism with said valve-box, and, as the said valve rotates, to open said connections first for a short and afterward for a longer period of time, and mechanism for rotating said valve, substantially as described.

9. In a sheet-feeding device, the combination with a reciprocating carriage, devices carried by said carriage adapted to automatically engage the front edge of a sheet of paper and forward the same as said carriage is moved forward, and mechanism for reciprocating said carriage and adapted to give to said carriage a relatively quick forward and a relatively slow rearward motion, of forwarding-tapes adapted to engage the sheet of paper when so fed forward and forward the same, and means for driving said forwarding-tapes at substantially the same surface speed as the forward motion of said carriage and during the whole of said forward motion, substantially as described.

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Witnesses:

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