No. 789,809. PATENTED MAY 16, 1905.

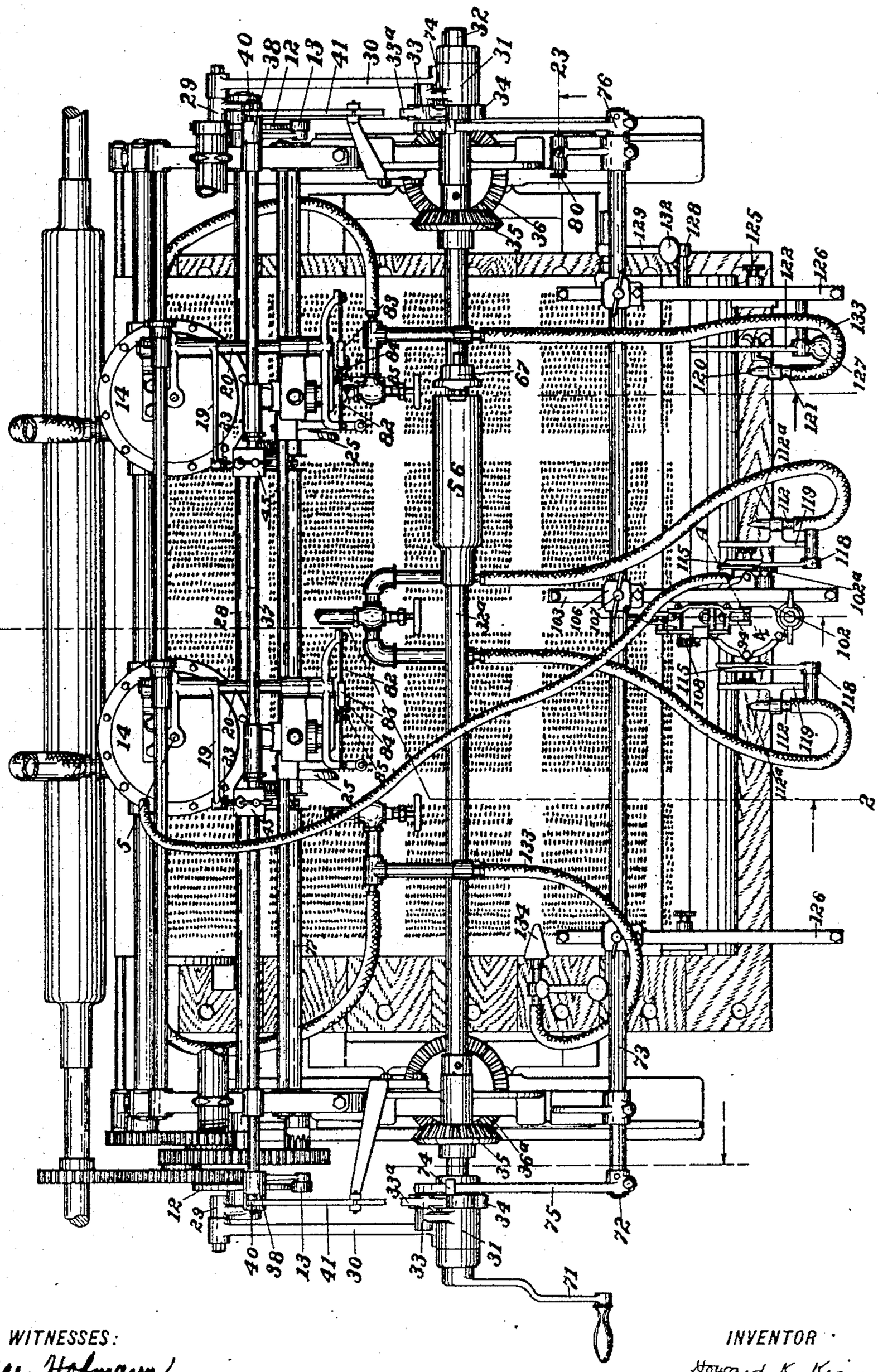
H. K. KING.

SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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No. 789,809. PATENTED MAY 16, 1905.

H. K. KING.

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APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 2.

Fig. 2

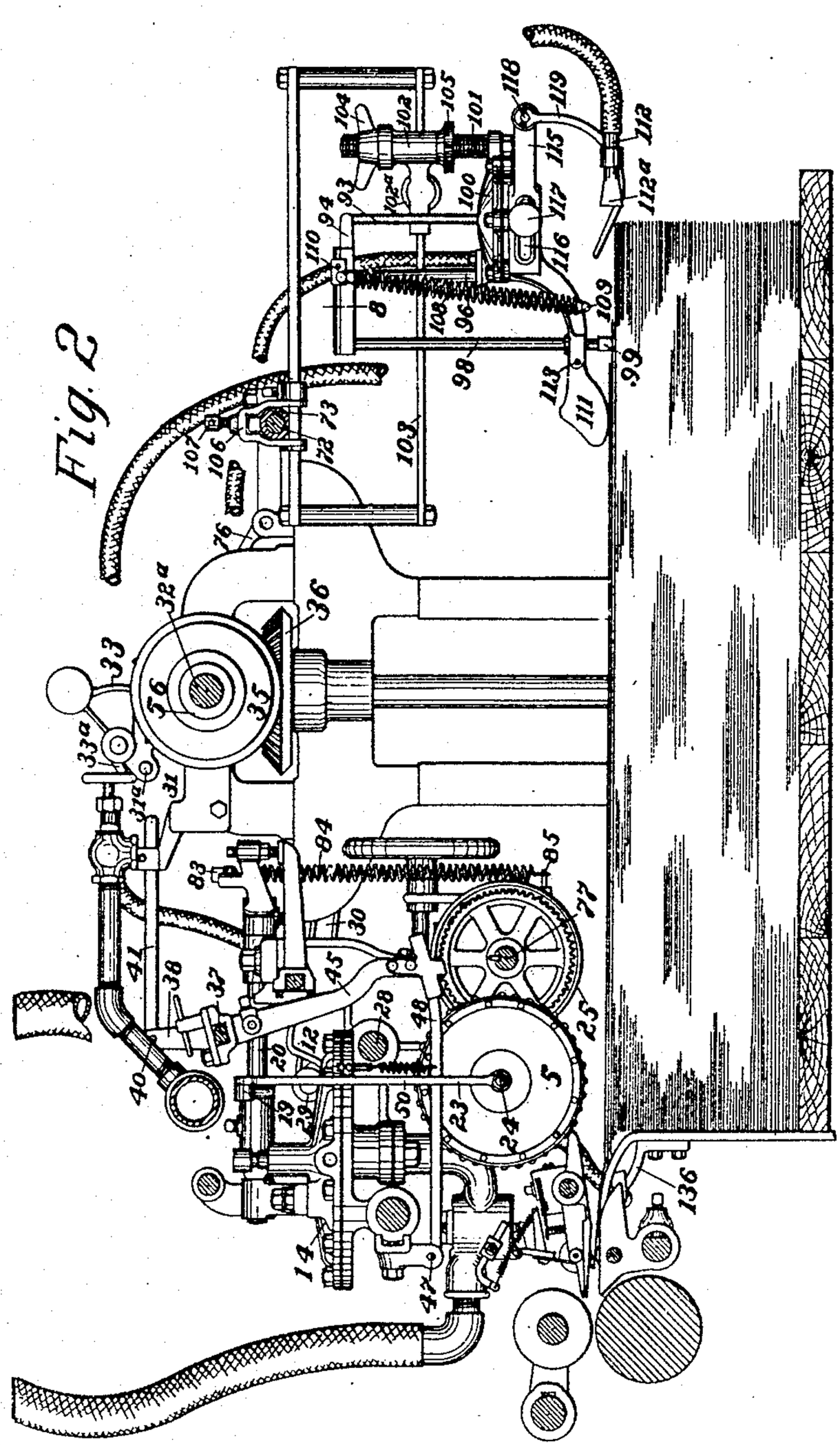


Fig. 3

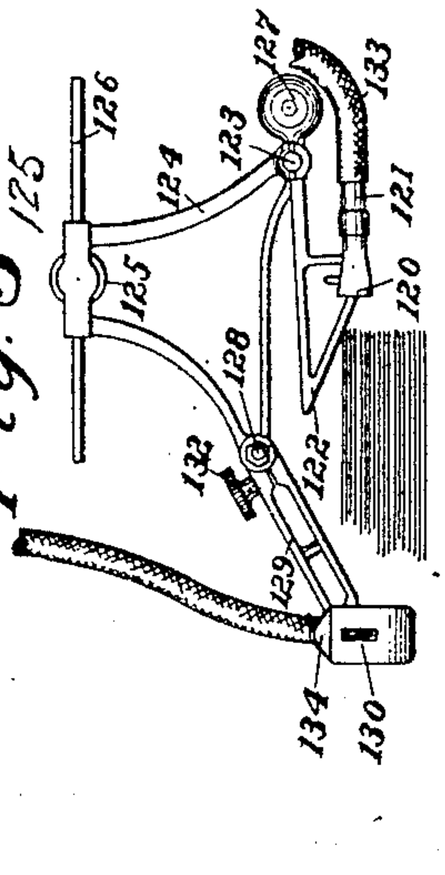


Fig. 4.

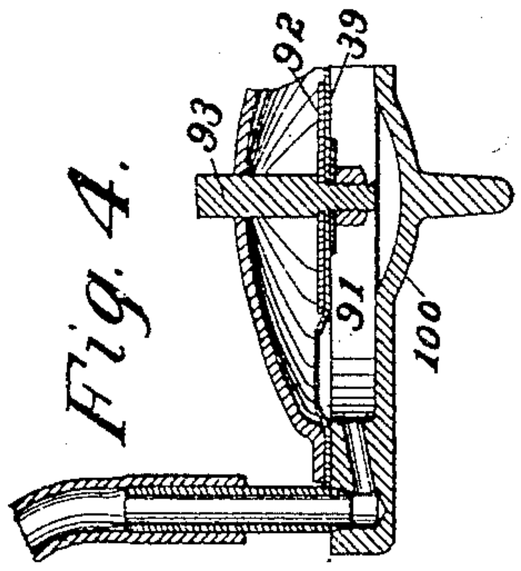


Fig. 5.

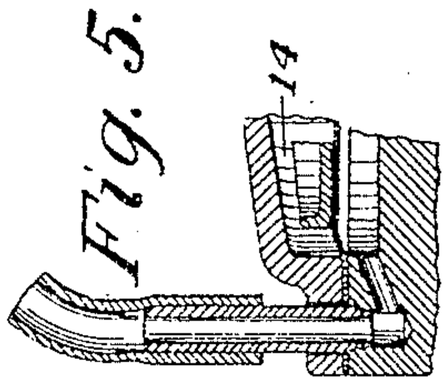
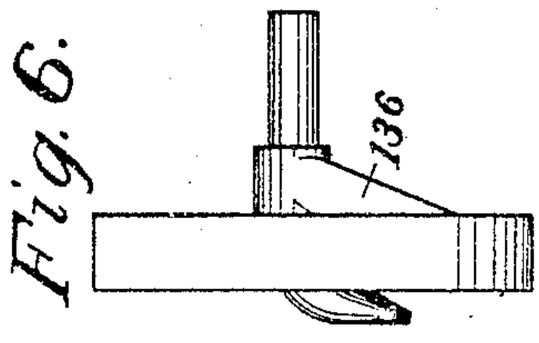


Fig. 6.



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No. 789,809. PATENTED MAY 16, 1905.

H. K. KING.

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APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 3.

Fig. 8.

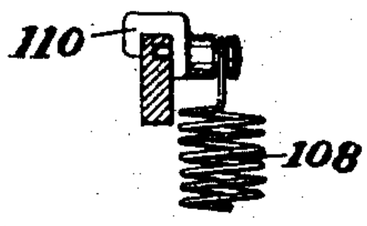


Fig. 7

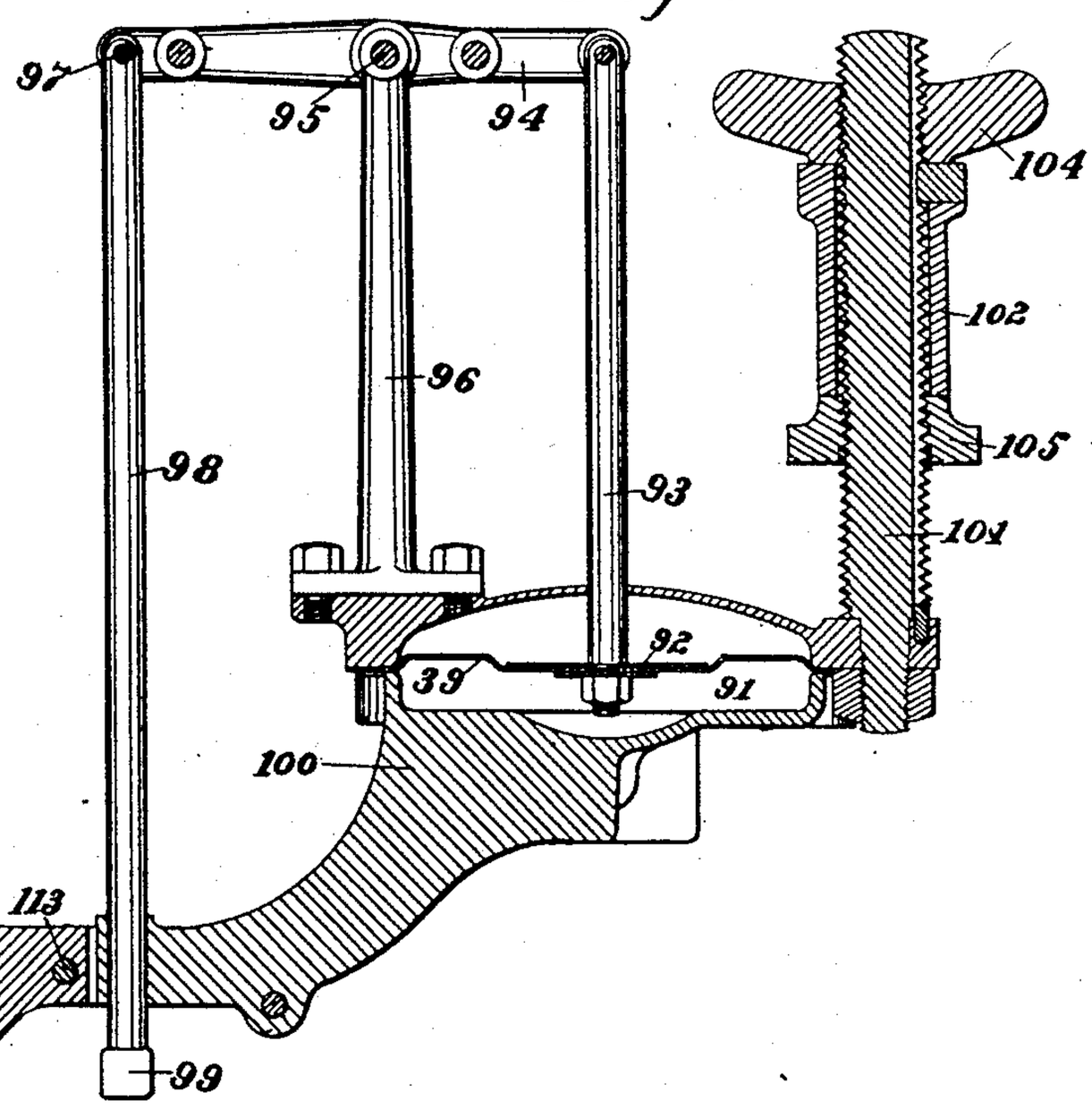


Fig. 9

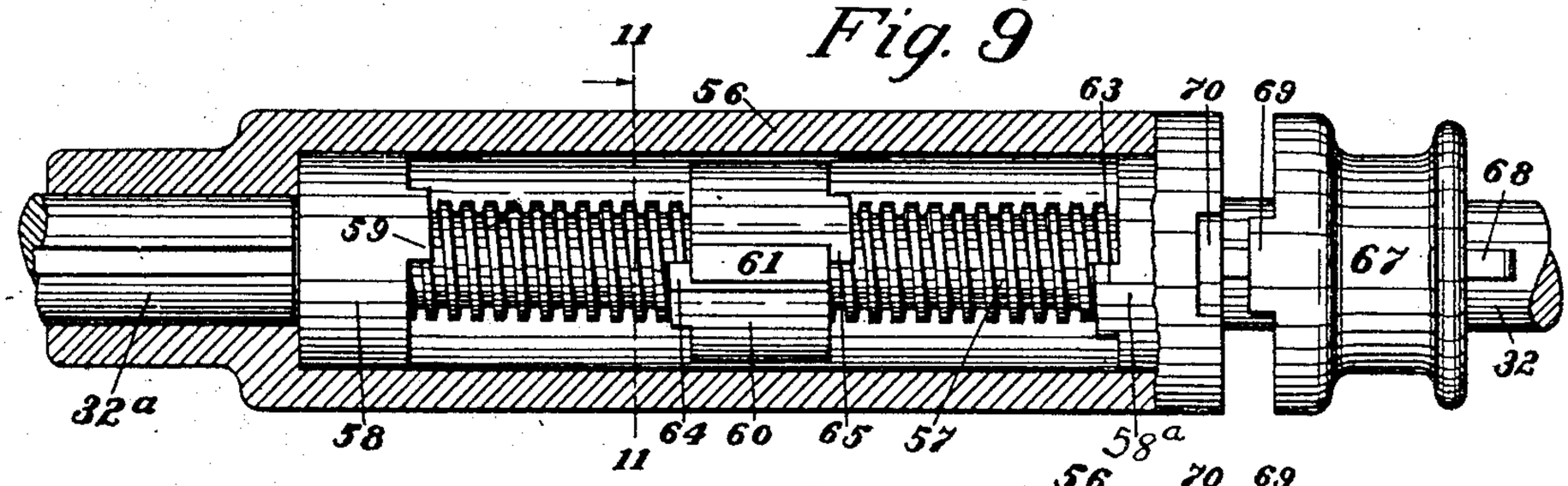


Fig. 11.

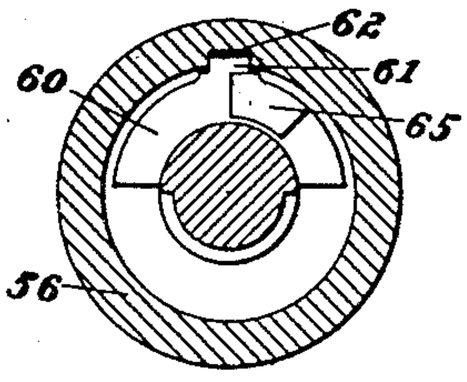
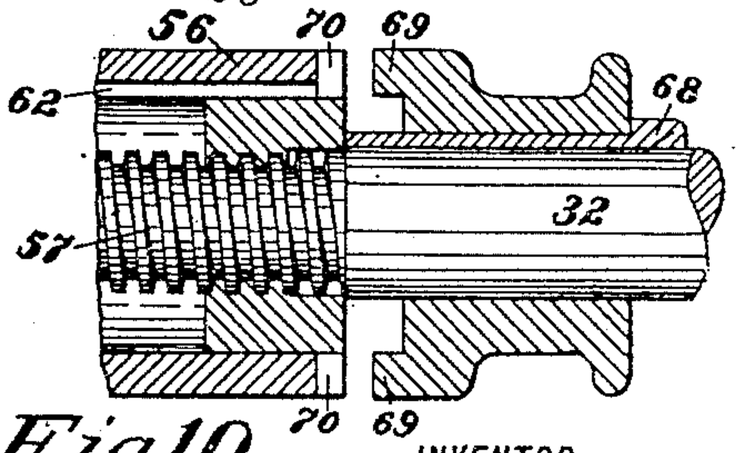


Fig. 10.



WITNESSES:

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No. 789,809. PATENTED MAY 16, 1905.

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SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 4.

Fig. 12

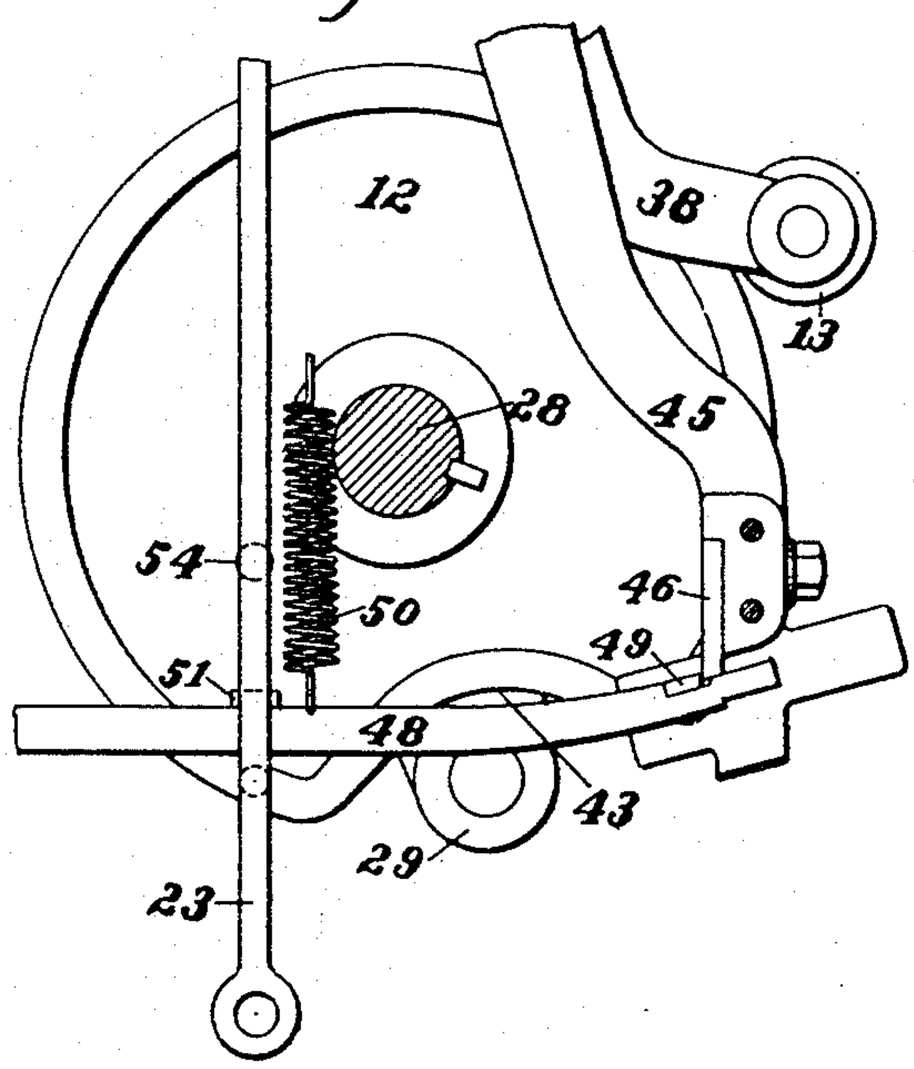


Fig. 13

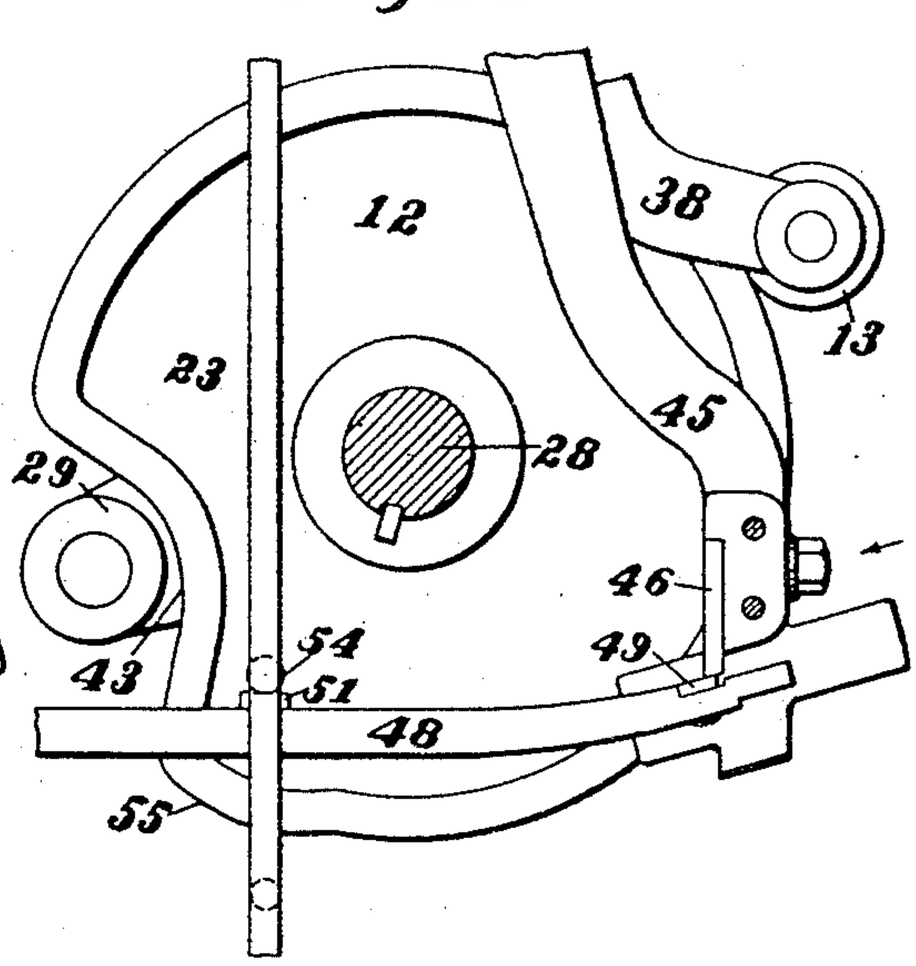


Fig. 14

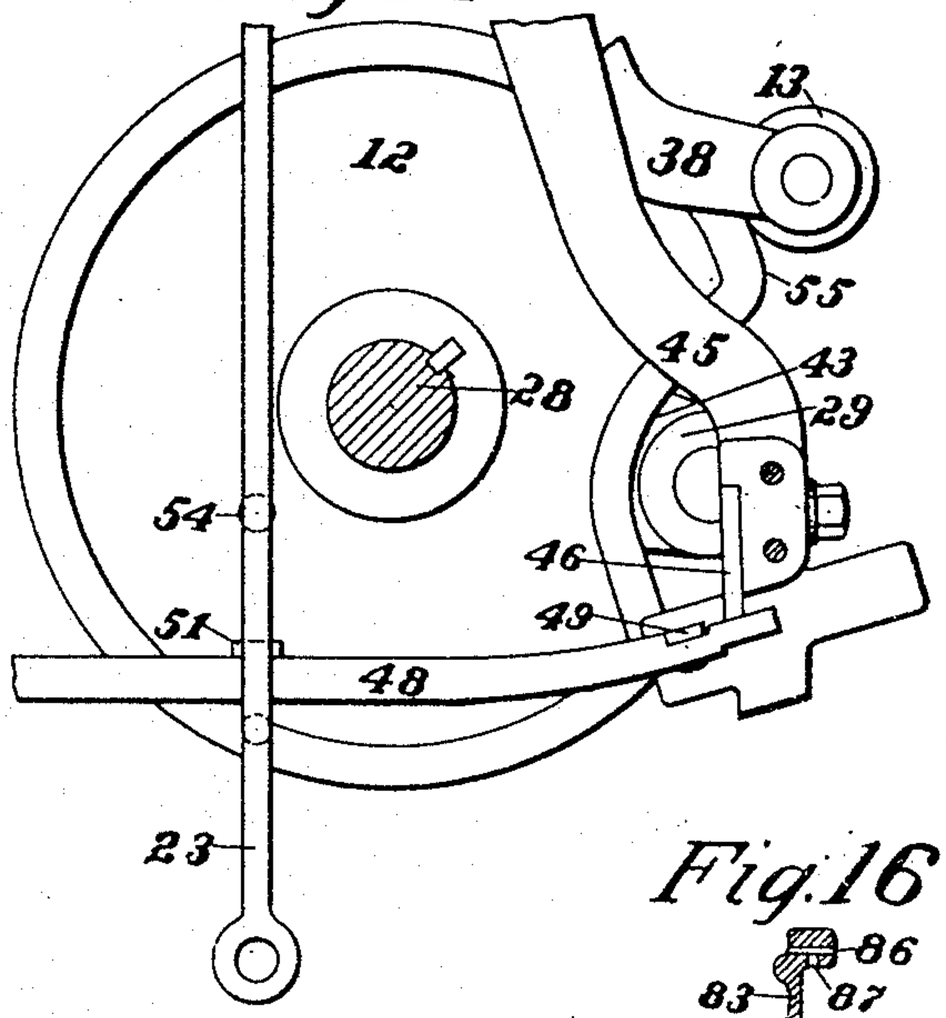
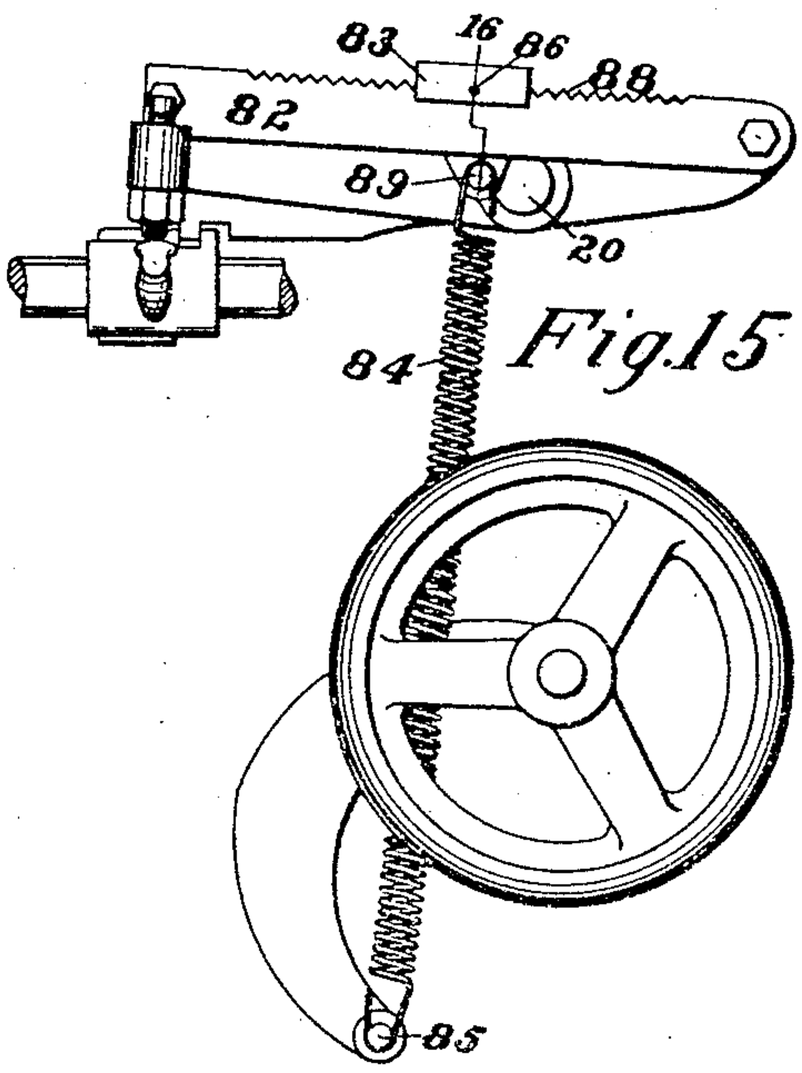


Fig. 16

Fig. 15



WITNESSES:

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No. 789,809. PATENTED MAY 16, 1905.

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SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 5.

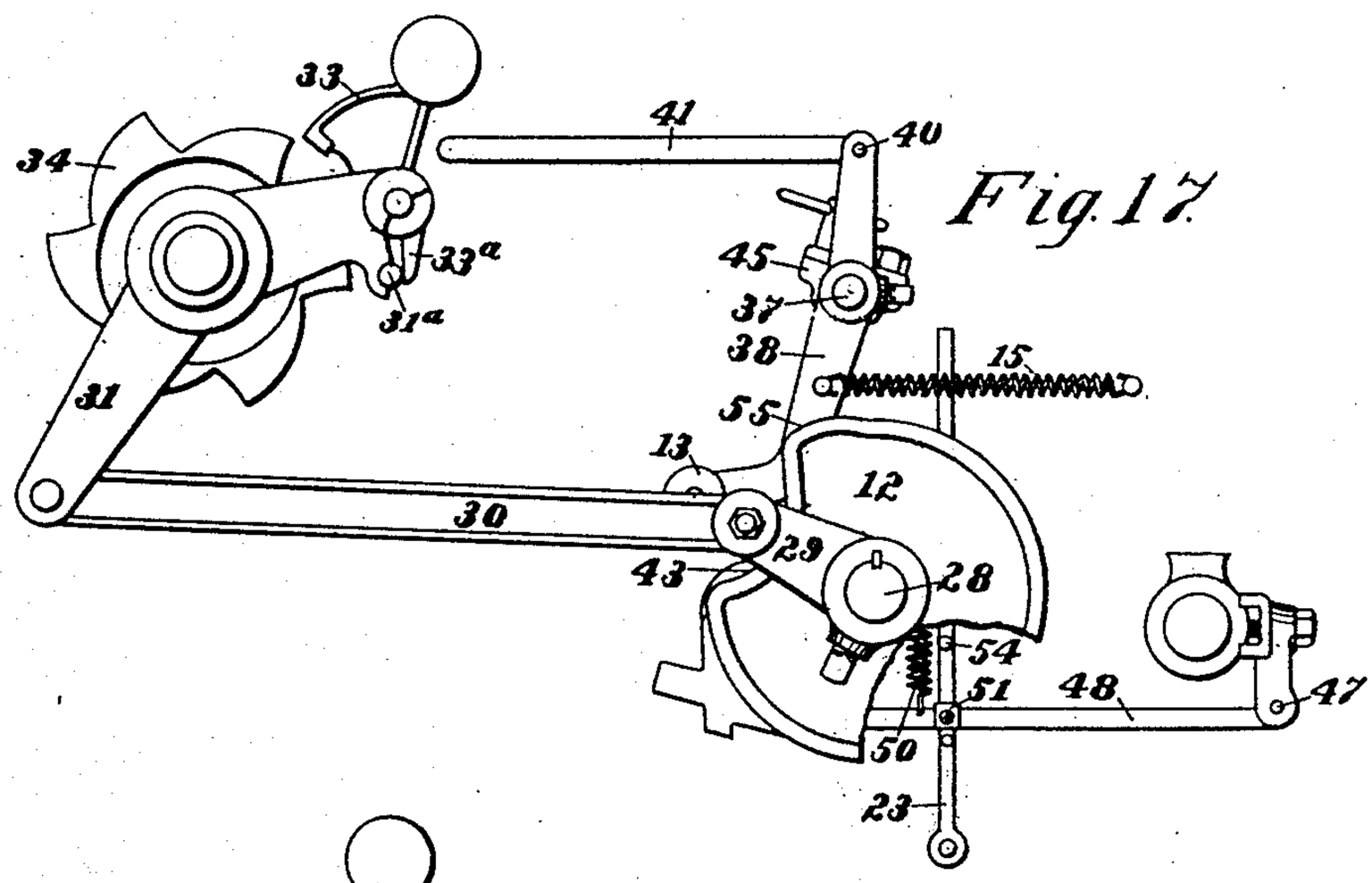

Fig. 17.

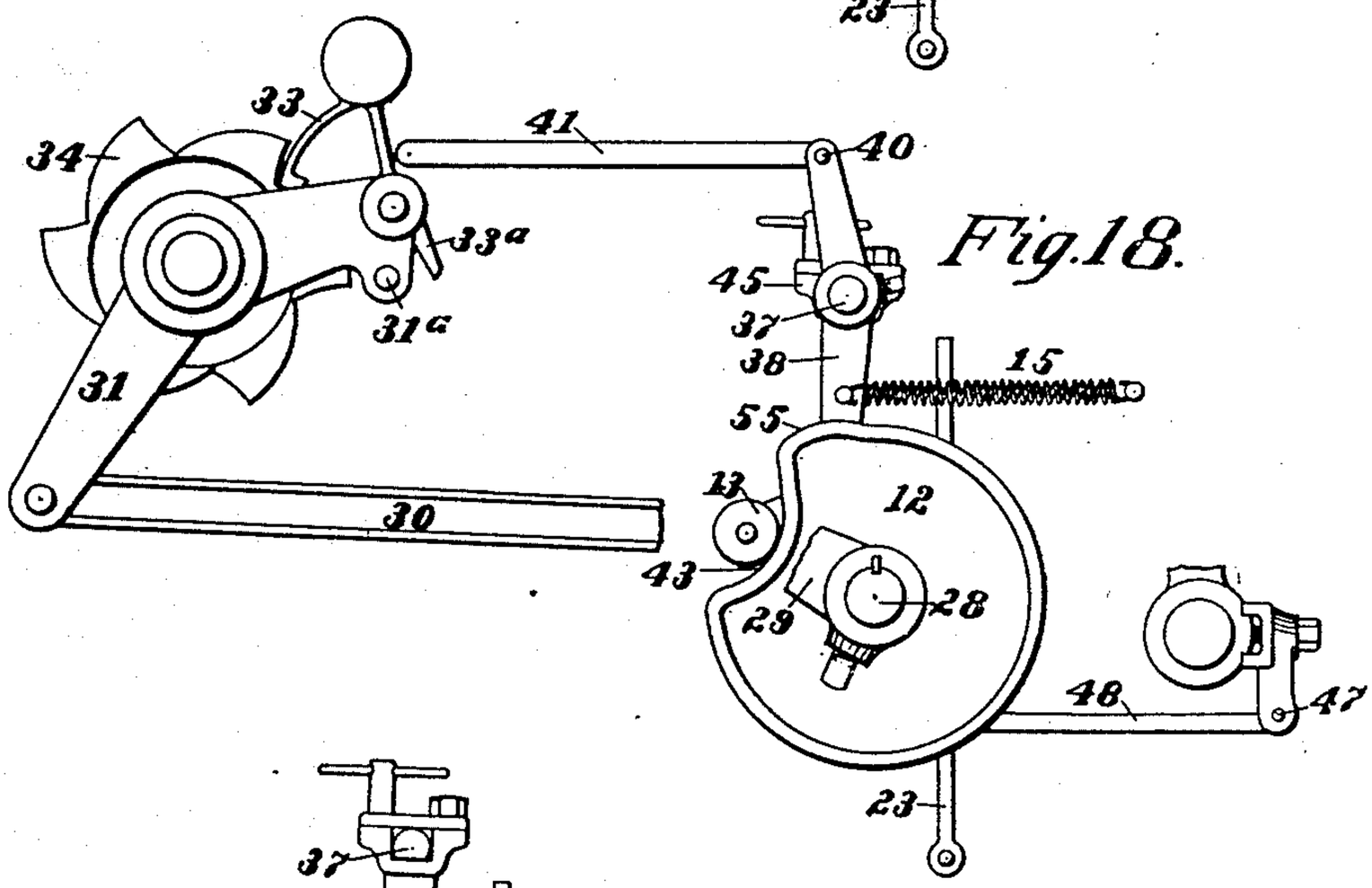

Fig. 18.

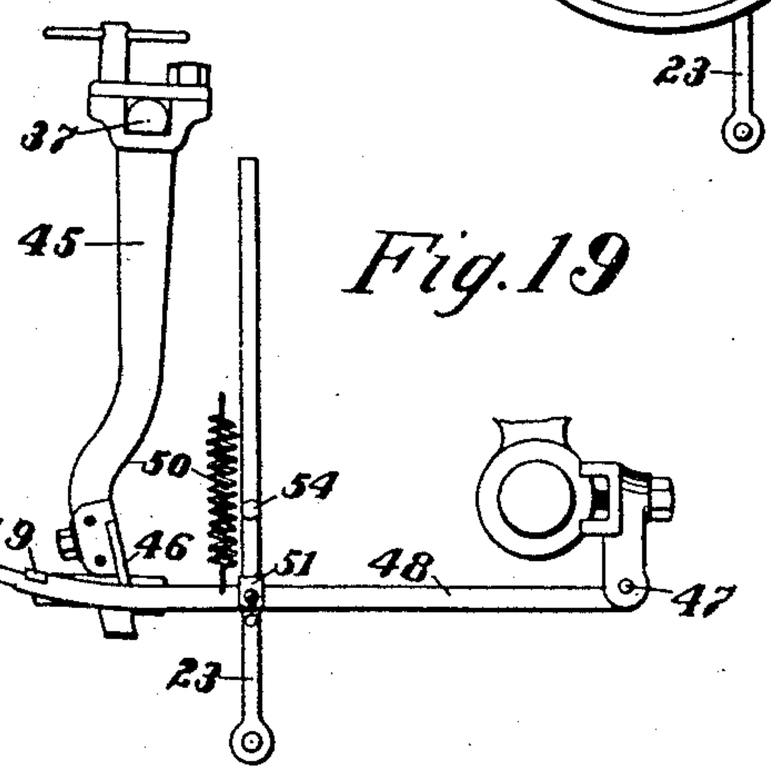

Fig. 19

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No. 789,809. PATENTED MAY 16, 1905.

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SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 6.

Fig. 20

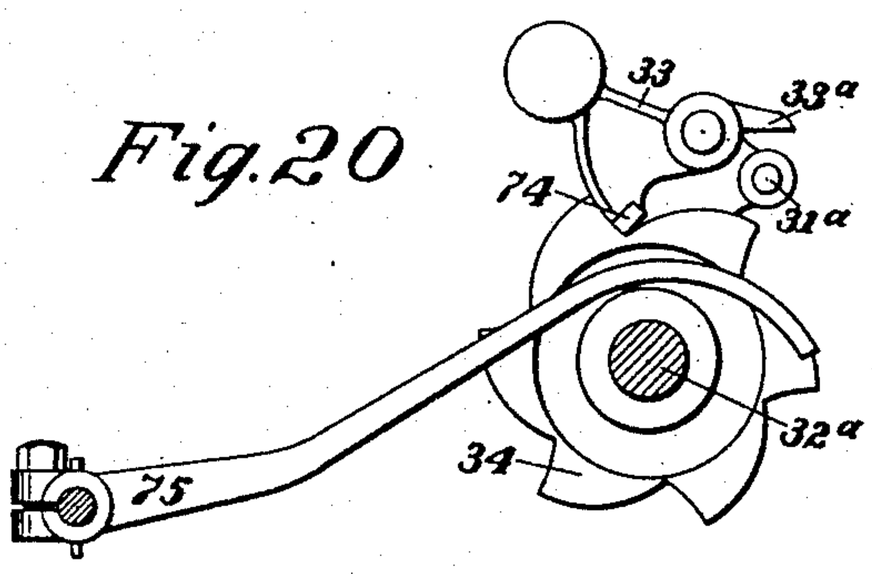


Fig. 21

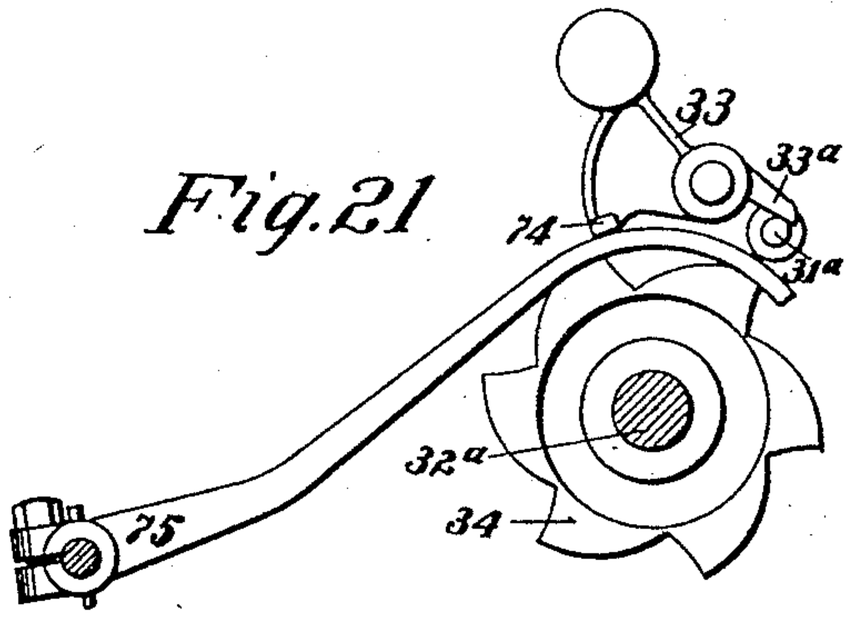


Fig. 22

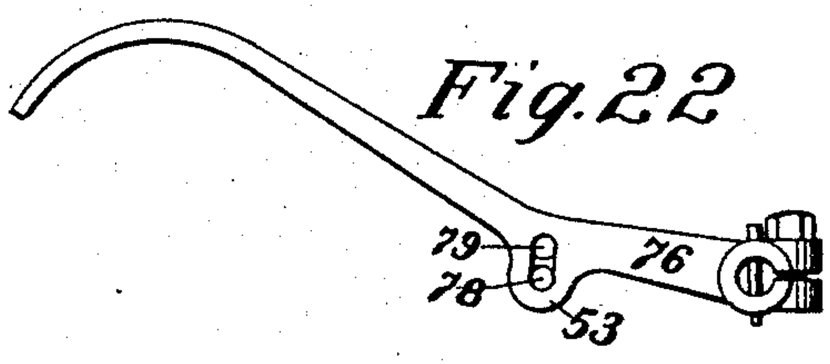


Fig. 23

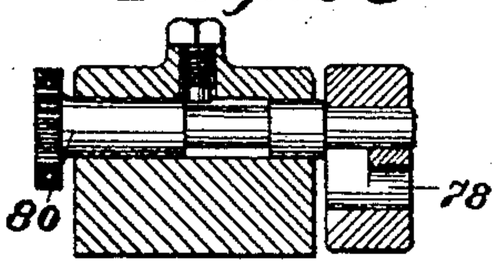


Fig. 24

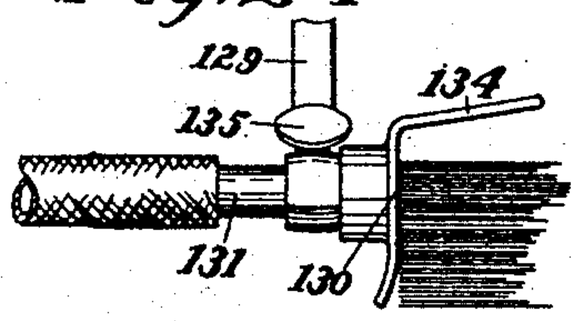
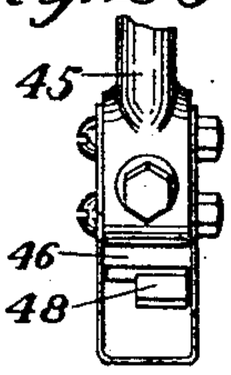


Fig. 25



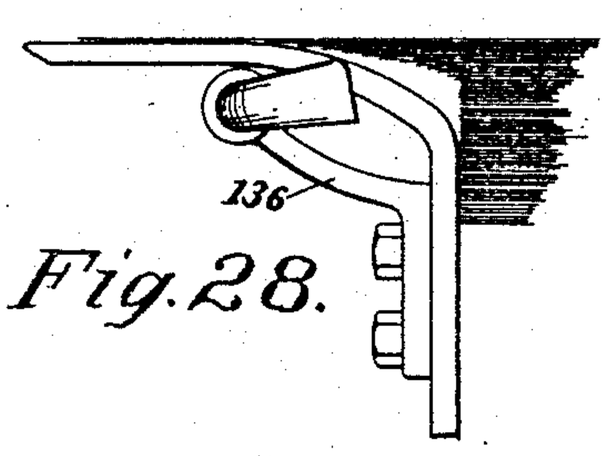


Fig. 28.

WITNESSES:

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No. 789,809. PATENTED MAY 16, 1905.

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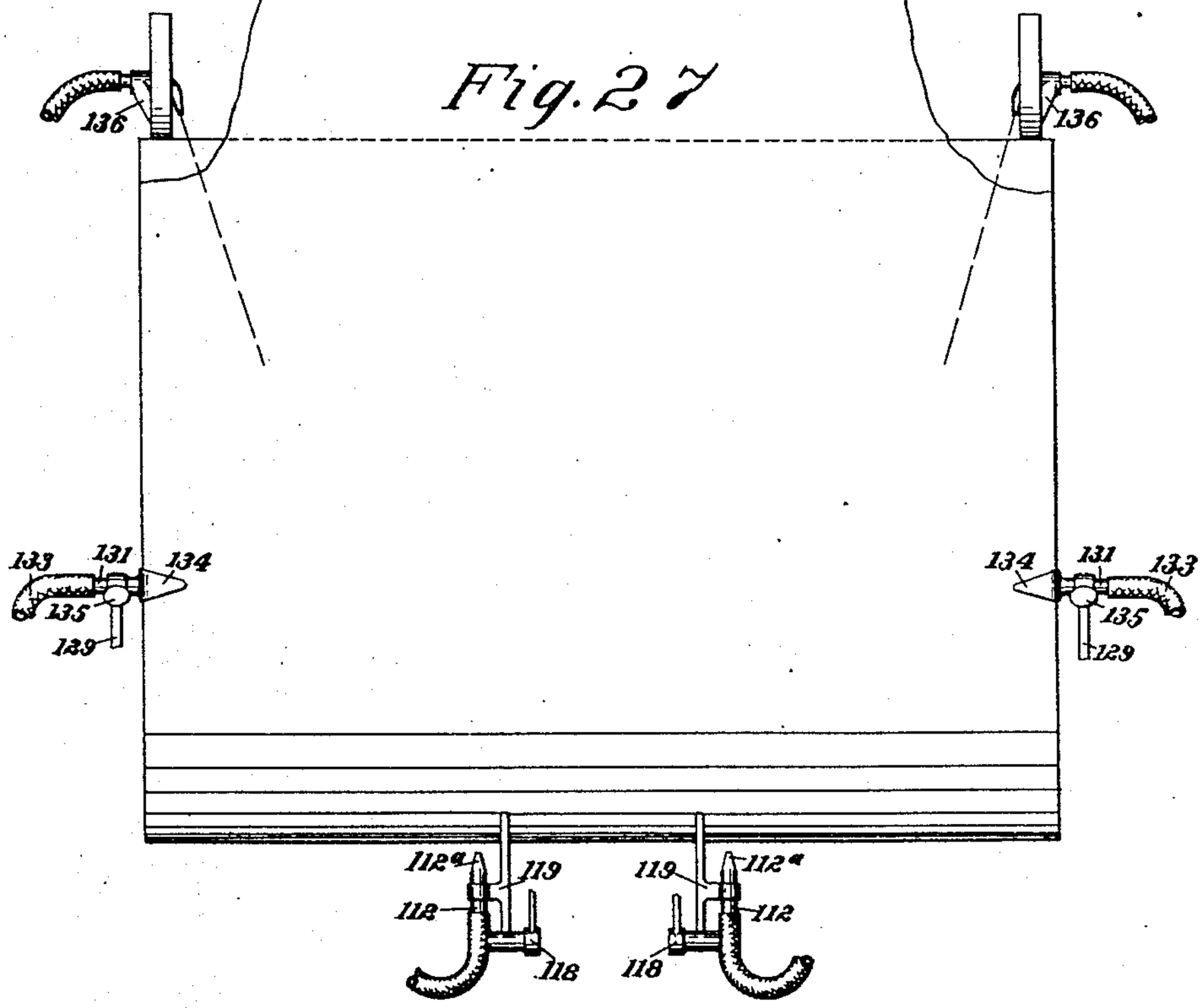
SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 7.

Fig. 27



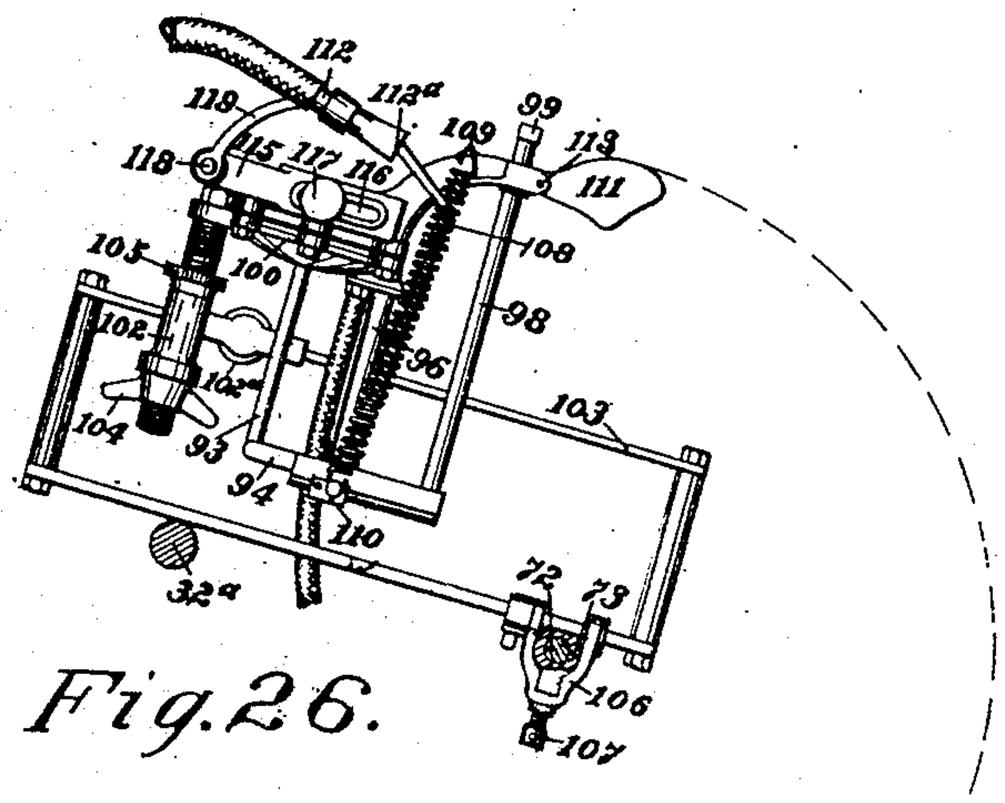


Fig. 26.

WITNESSES:

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SHEET FEEDING DEVICE.

APPLICATION FILED MAR. 12, 1904.

8 SHEETS—SHEET 8.

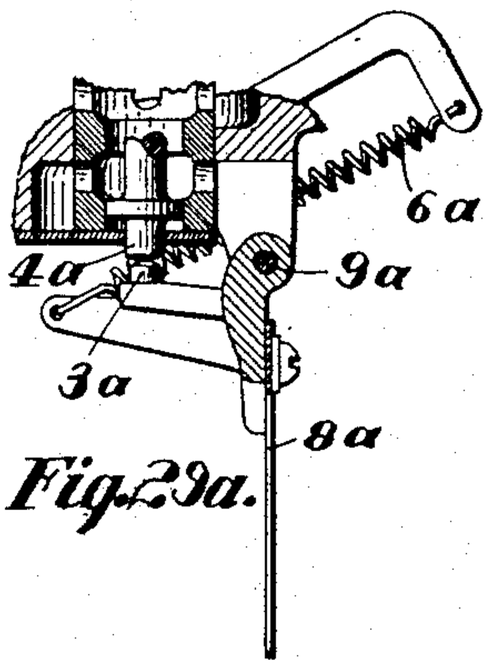

Fig. 29a.

Fig. 29.

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his Attorney

No. 789,809. Patented May 16, 1905.

UNITED STATES PATENT OFFICE.

HOWARD K. KING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO CHAMBERS BROTHERS COMPANY, A CORPORATION OF PENNSYLVANIA.

SHEET-FEEDING DEVICE.

SPECIFICATION forming part of Letters Patent No. 789,809, dated May 16, 1905.

Application filed March 12, 1904. Serial No. 197,750.

To all whom it may concern:

Be it known that I, HOWARD K. KING, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Sheet-Feeding Device, of which the following is a specification.

My invention relates to feeding-machines, and is especially adapted for use in connection with the feeding of sheets in which individual sheets are separated from a pile or bank of sheets and delivered to a receiving device.

My invention relates especially to improvements in the device described and shown in patent to me, No. 768,375, dated November 23, 1904.

My invention comprises improvements in automatic means for regulating the height of the table, controlled by the combing-wheel, and in pneumatically-controlled presser-foot means.

My invention relates especially to improved means for automatically controlling the height of the table supporting the sheets and improved means, pneumatically controlled, for clamping or pressing the pile of sheets at the rear.

Instead of automatically controlling the height of the table by an independent presser-foot and associated mechanism, as shown in my copending application above referred to, I provide in the device herein shown and described means controlled by the combing-wheel itself for automatically regulating the height of the pile of sheets.

Referring to the accompanying drawings, Figure 1 is a plan view of my device. Fig. 2 is a sectional view on line 2 2 of Fig. 1. Fig. 3 is a detail in side elevation of the air-blast-guiding means. Fig. 4 is a sectional view of a portion of the presser-foot head on line 4 of Fig. 1. Fig. 5 is a partial detail in section of one of the combing-wheel heads on line 5 of Fig. 1. Fig. 6 is a plan or top view of a front piling-guide. Fig. 7 is a sectional view of the pneumatically-controlled presser-foot and associated mechanism. Fig. 8 is a detail in part section on line 8 of Fig. 2. Fig. 9 is a view in part section of the sleeve 56, connecting the abutting shafts 32 and 32ª. Fig. 10 is a sectional detail of a part of said sleeve and abutting clutch member. Fig. 11 is a cross-section on line 11 11 of Fig. 9. Fig. 12 is a detail of the latching members and cam for controlling the operation of the table-raising device. Fig. 13 is a similar view showing the various members in different relative positions. Fig. 14 is a similar view showing the members in different relative positions. Fig. 15 is a detail showing means for varying the spring tension on the combing-wheels. Fig. 16 is a cross-section of member 83 on line 16 of Fig. 15. Fig. 17 is a detail of the pawl-and-ratchet mechanism and means for operating the same. Fig. 18 is a similar view showing the parts in different relative positions. Fig. 19 is a detail of the latching members. Fig. 20 is a detail of the pawl and ratchet members and lever for rendering pawl inoperative. Fig. 21 is a similar view showing said members in different relative positions. Fig. 22 is a detail of a member for rendering the pawl inoperative. Fig. 23 is a cross-section on line 23 of Fig. 1. Fig. 24 is a side elevation of one of the blowpipes and side guide. Fig. 25 is a detail in elevation of the latch-pieces 46 and 49 and the guard and guide member surrounding the same. Fig. 26 is a view of the pneumatically-operated presser-foot and its supporting-frame thrown out of operative position. Fig. 27 is a diagrammatic view showing the disposition of the blowpipe. Fig. 28 is a detail in side elevation of one of the front blowpipes. Fig. 29 is a vertical section of the pressure-head, valve, valve-trip, and associate mechanism. Fig. 29ª is a fragmentary detail of the valve-trip.

Similar numerals refer to similar parts throughout the several views.

Referring to Fig. 2, the combing-wheel 5 is supported on the stud 24, which is rigidly secured to the frame 25, which rocks upon the shaft 77. The stud 24 is supported by the connecting-rod 23. The other end of the connecting-rod is secured to the arm 19, which is rotatably rigid with shaft 20. Shaft 20 is rocked by the pneumatic means embracing

the head 14 in precisely the manner described in my patent above referred to—that is to say, the shaft 20 is provided with the arm 18, which is also rotatably rigid therewith. The free end of arm 18 is provided with an adjustable toe-piece adapted to rest upon the top of the piston-rod 17. Piston-rod 17 is connected with the piston 17^a and diaphragm 17^b in pressure-head 14 and is adapted to be operated thereby. The upward movement of said piston-rod 17 obviously causes the upward movement of the free end of arm 18, the rotative movement of the shaft 20, and the consequent upward movement of arm 19, connecting-rod 23, and combing-wheel 5. The admission of compressed air to the head 14 for the operation of diaphragm 17^b and the piston is controlled by the valve 7^a, provided with the vertically-movable piston 4^a. (See Fig. 29.) From an inspection of the drawings it will be seen that when the piston 4^a is in the depressed position shown in said Fig. 29 communication is established between the compressed-air supply and the head 14. When, however, the said piston is lifted to its most elevated position, communication between-air pressure and head 14 is intercepted and at the same time communication is established between head 14 and the outside atmosphere. The operation of piston 4^a is controlled by the sheet-operated valve-trip 8^a. This trip is pivoted at 9^a and has a rearwardly-extending arm provided with the toe-piece 3^a. This toe-piece 3^a is adapted to encounter the lower end of piston 4^a. The valve-trip 8^a is normally held by spring 6^a in the position shown in Fig. 29^a. The piston 4^a is therefore normally maintained in the elevated position or the position in which communication between compressed-air supply and head 14 is prevented. The lower end of trip 8^a is adapted to be encountered by the front edge of the sheet as the same is advanced by the combing-wheel 5. When so encountered, the trip 8^a assumes the position shown in Fig. 29, which permits the descent of piston 4^a and the establishment of communication between head 14 and the air-pressure. This causes in the manner above described the elevation of the combing-wheel 5 from the sheet. The sheet is carried forward by the feed and drop rollers, fully described in my patent above referred to and shown but not described or claimed in this application. When the sheet has passed entirely under and beyond the trip 8^a, the trip resumes its normal position in response to the tension of spring 6^a. The piston 4^a is again elevated, as above described. Communication between head 14 and the compressed air is cut off, and communication between the head 14 and the outside atmosphere is established, whereby the piston-rod 17 falls and the combing-wheel is again lowered and the cycle is complete. Thus it is seen that the pneumatically-operated means for raising and lowering the combing-wheel is controlled by the advancing sheet.

Table-raising means.—In order that the pile of sheets may be kept at the required height for most efficient operation thereon by the combing-wheel, I provide the following automatic mechanism: Upon the shaft 28 (see Figs. 2 and 17) is mounted the crank 29, which is connected by the connecting-rod 30 to the bell-crank 31, which is loosely supported upon the shaft 32. Upon the other end of said bell-crank 31 is pivotally secured the counterbalanced pawl 33. Upon the shaft 32 is also mounted and rotatably rigid therewith the ratchet 34. Upon the shaft 32 is also mounted the beveled gear 35, which coöperates with the beveled gear 36 of the vertical screw, which raises and lowers the table in the manner precisely as described in my said patent. The shaft 28 is driven from the train of gears operating the various parts of the machine, and it is obvious that with each rotation of said shaft, provided the pawl 33 were maintained in the operative position, the ratchet would be moved one step, thereby communicating movement to the vertical elevating-screw to cause the raising of the table. If, however, the vertical elevating-screws were moved a portion of a turn with each rotation of shaft 28, the table would be raised too rapidly, and the following automatic mechanism for the control of said elevating means is provided, including not only means for throwing the pawl into the operative position, but also automatic means for controlling the last-mentioned means.

Automatic control of the table-raising mechanism.—Upon the shaft 28 (see Figs. 2, 17, and 18) is also provided the cam 12. Upon the shaft 37 is mounted rotatably rigid therewith the arm 38, upon the lower free end of which is provided the wheel 13, adapted to engage with the periphery of the cam 12. Upon the other free end of member 38 is pivotally secured at 40 the rod 41. The spring 15, secured to said member 38, is adapted normally to maintain the wheel 13 in engagement with the periphery of the cam 12, so that with each rotation of cam 12 the member 38 will be given an oscillating movement as wheel 13 enters and leaves the depression 43 in cam 12. It is also to be noted that when wheel 13 is in the depression of cam 12 the member 38 will assume such a position as to move 41 toward the pawl 33 to throw it forward, so as to coöperate with ratchet 34, as shown in Fig. 18. In this position crank 31 is at the beginning of its stroke, so that with the further rotation of shaft 28 crank 31 is moved so as to actuate the ratchet 34 one notch, and the crank is then returned again to the initial position, as shown in Fig. 17. The pawl in returning from the position shown in Fig. 20 to the position shown in Fig. 17 is pushed by the tooth of the

ratchet into the inoperative position, as shown in Fig. 17. The limit of such movement from the position shown in Fig. 20 to the position shown in Fig. 17 is provided by the engagement of projection 33ª on said pawl member 33 with the stop-pin 31ª on the bell-crank 31, and said pawl is maintained in said inoperative position while said bell-crank 31 is in the position shown in Fig. 17 and until said pawl passes the point of said tooth, unless the same is previously operated by member 41. It is again, however, thrown into the operative position by the time the relative parts assume the position shown in Fig 18, as above described, for a further operation of ratchet 34. This would be the normal operation of the various parts and would result in a partial rotation of the elevating-screws with each rotation of shaft 28 if it were not for the following restraining means. Secured also to shaft 37 (see Fig. 2) and rotatably rigid therewith is the arm 45, provided with a latch-piece 46, preferably of hardened metal. It is obvious that if 45 and 38 are both rigid with shaft 37 that the restraining of one of these members will result in the restraining of the other. For this purpose I pivotally secure at 47 the member 48, provided at its free end with the latch-piece 49, which is adapted to encounter the latch-piece 46. Said member 48 is controlled by the spring 50 normally to maintain the same in engagement with latch-piece 46. Upon the member 48 is secured the bumper-block 51, and upon the connecting-rod 23 is secured the pin or projection 54, which is adapted to engage bumper-block 51 in certain positions of the connecting-rod 23. It will now be seen that when member 48 is held in the position engaging member 45, as shown in Fig. 12, the wheel 13 will be kept out of contact with the cam 12, so that upon the rotation of cam 12 the wheel 13 is not permitted to respond to the actuation of spring 15 and follow the periphery of cam 12, but is held constantly in the position shown in Fig. 12, irrespective of the position of cam 12, in which position it follows that pawl 33 will remain in the position shown in Fig. 17—that is, will not be thrown into the operative position by the contact therewith of rod 41, as shown in Fig. 18, but will remain in the inoperative position, as shown in Fig. 17, and the oscillations of crank 31 will be idle—that is, inoperative to actuate the ratchet 34. It therefore follows that so long as latch-piece 49 engages with latch-piece 46, as shown in Fig. 12, there can be no operation of ratchet 34, and consequently no operation of the vertical elevating-screws of the table, and this is the normal position of said latch-piece as long as the pile of sheets is at the required height; but the moment said pile falls below a predetermined height the combing-wheel naturally falling to such level causes such a movement of the connecting-rod 23 as to bring the projection 54 into engagement with 51. This results in the unlatching of 49 from 46, as shown in Fig. 13, and permits the wheel 13 to engage with the periphery of the cam 12 and make operative the pawl-and-ratchet mechanism above described.

My mechanism provides also that the pawl-and-ratchet mechanism shall again be rendered inoperative the moment the pile of sheets is brought to the required height. Upon the cam 12 it will be noted that there is a slight enlargement at 55 upon the periphery of said cam. The engagement of this enlargement with the wheel 13 results in throwing the arm 45 into the position shown in Fig. 14. This results in bringing 46 back of latch-piece 49, so that it will be encountered by 49 before the wheel is permitted to enter the depression 43 in the following revolution of cam 12 unless 54 and 51 are still in engagement due to the fact that the paper has not yet been sufficiently elevated. In other words, so long as the pile of sheets at the exact point where the combing-wheel engages the same is at the normal or predetermined height the elevating mechanism is maintained inactive; but the moment that the pile falls below the predetermined or required height upon the descent of the combing-wheel the elevating system comes into operation to raise the table, but is immediately rendered inoperative when the required height is again attained.

The special advantage or utility of providing means controlled by the combing-wheel for the automatic control of the elevating mechanism is that the efficiency of the combing-wheel may be thereby greatly increased. By the proper adjustment of the pressure exerted by the combing-wheel upon the pile of sheets the desired rate of speed or the efficiency of the combing operation may be obtained. It is consequently of great importance that the height of the pile at the exact point of contact between the combing-wheel and the pile should at all times be uniform, and it is thought to be new in the art to thus bring into positive operative relationship the means for maintaining the normal height of the sheets with the means for combing the uppermost sheets in a horizontal direction one in advance of the other.

Arbitrary means for rendering the pawl and ratchet inactive.—Referring to Figs. 1, 20, 21, 22, and 23, where it is desirable for any cause to throw the pawl-and-ratchet mechanism arbitrarily into the inoperative position, the following mechanism may be used: Upon the pawl 33 is provided the projection 74, under which resides the lever 75, which is keyed to the end of shaft 72, which is rotatable in and extends through the fixed shaft 73, the arm 75 being keyed to one end of this shaft while the arm 76 is keyed at the other end, so that the pawl operated by each combing-wheel may be rendered inactive at the same time. Fig. 20

shows the arm 75 in the position not affecting the pawl. Fig. 21 shows the arm 75 in the position rendering the pawl inactive or idle. Fig. 22 shows the arm 76, which is disposed at the opposite side of the machine, with a similar result. In arm 76, however, in addition the lug or enlargement 53 is provided with the apertures 78 and 79. Fig. 23 shows the bolt 80, which is adapted to coöperate with the apertures 78 and 79 to hold said member 76 in one of two positions, one position rendering the pawl inactive or idle, the other position out of engagement with said pawl. Thus it follows that 76 and 75 both being rotatably rigid with shaft 72 it is possible to lock said members 75 and 76 either in the position which does not affect the pawls or in the position which renders the pawl-and-ratchet mechanism on each side of the machine inactive.

Adjustment of spring tension exerted on combing-wheel.—In Figs. 1 and 15 I show the means for varying the amount of pressure exerted by the combing-wheel upon the pile of sheets which consists in securing to the rocking shaft 20, which reciprocates the combing-wheel into and out of engagement with said sheet, a serrated cross-bar or member 82, which passes to either side of the axis of rotation of the rocking shaft 20 and upon which is slidably seated the member 83, to which is secured at 89 one end of the spring 84, the other end being secured at 85 to the stationary part of the machine. A pin 86 projects into the slot 87 of member 83, (see Fig. 16,) in which the cross-bar 82 is seated for engagement with the serrations 88 on said cross-bar 82, so that said member 83 will be held in whatever position of adjustment it is placed along bar 82. It will now be obvious that when the point 89 of spring connection is on the same side of the shaft 20 as the connecting-rod 23, which supports the combing-wheel, the spring 84 will coöperate with the weight of the wheel in pressing the pile of sheets, while when the point of spring connection 89 passes to the other side of shaft 20 it will tend to counterbalance or oppose the weight of combing-wheel, and thus lessen the force of said combing-wheel upon the pile of sheets. Hence by moving said block 83 toward one end or the other of bar 82 the pressure exerted by the combing-wheel upon the pile of sheets may be increased or diminished at will.

Independent elevating means.—In the mechanism herein shown in the drawings I employ two combing-wheels, each combing-wheel controlling independently-operative elevating-screws and mechanism operating thereon, so that the table may be raised at opposite points corresponding to the height of the sheets at its respective combing-wheel.

The connecting means between the table and the vertical elevating-screws for raising and lowering the same are preferably such as to permit of a limited tilt of the table without causing a binding upon the elevating-screws. In other words, the threaded sleeves which coöperate with the elevating-screws to which the table is secured are so connected that there is permitted a certain amount of free movement between said table and said sleeves. This has been fully described in my patent above referred to and is not made the subject of claims in this case. It is obvious, however, that such tilting movement must of necessity be limited and that the two elevated mechanisms, each controlled by a different combing-wheel, must preferably have such independent movement controlled within certain limits to prevent damage being done to the machine. For this purpose I provide the following mechanism:

Automatic limit of independent operation of elevating means.—As above stated, the shaft 32 is provided with a gear 35, which cooperates with a gear 36, secured to one of the elevating-screws. This is the mechanism connected with one of the combing-wheels, while a similar mechanism is connected with the other combing-wheel, except that an independent shaft 32^a is provided with the beveled gear 36^a, secured to the elevating-screw at the other side of the machine, and for the purpose above mentioned I have provided means for limiting the independent movement between shaft 32 and shaft 32^a.

Referring to Fig. 9, I show a sleeve 56, which is keyed to or rotatably rigid with the shaft 32^a. The shaft 32 has a threaded extension 57, which projects into said sleeve and has rigidly secured to the end thereof the head 58, which is provided with a lug 59. This head 58 fits snugly in the sleeve 56 and is adapted to rotate therein. Coöperating with the thread of screw 57 is the split nut 60, which is provided with a lug 61 or projection, adapted to reside in the longitudinal channel 62 in said sleeve to prevent the rotation of the nut independently of the sleeve. Upon the shaft 32 at the end of the sleeve through which the threaded part of shaft 32 projects is rigidly secured the collar 58^a, having the lug 63. Upon the split nut 60 are provided the lugs 64 and 65. These lugs are so proportioned and positioned as to coöperate with the lugs 59 and 63, respectively, depending upon the position of said nut. It now follows that the shaft 32 will have a movement independent of shaft 32^a to such an extent as will result in the moving of the nut 60 from one end of the interior of the sleeve to the other—that is, throughout the travel of the nut upon the extension of the threaded portion 57 of shaft 32. The moment that the nut 60 reaches the position in which the shoulder or lug 64 will encounter lug 59 it is obvious that shaft 32^a will be rotatably locked with shaft 32 through the engagement of sleeve 56, nut 60, and mem-

ber 58, connected with said shaft 32, and upon the movement of the nut 60 in the opposite direction by the reversal of the relative movements of shafts 32 and 32ª, the moment lug 65 encounters lug 63 the said two shafts 32 and 32ª are again rotatably locked together. Thus it is secured or provided that said shafts 32 and 32ª will be permitted such independent movement only as will suffice to move the nut 60 into engagement with the lugs 59 and 63 at the opposite ends of sleeve 56, and to such extent only, therefore, will each of the two combing-wheels be independent of each other in their respective automatic control of the mechanism for raising the table. This range of movement is within the limits of tilt to which the table may be safely subjected with respect to its supporting devices.

Arbitrary means for securing the simultaneous operation of the elevating-screws.—While normally it is desirable to have the combing-wheel exert independent control of the different elevating means with respect to the height of the pile of sheets at the point operated upon by said combing-wheel, there are times when it is desirable to couple said elevating means so that all may be operated simultaneously. For this purpose I have provided the following mechanism: Referring to Figs. 9 and 10, I provide the collar 67, which is slidably mounted on shaft 32, but is provided with a key or feather 68 to prevent independent rotatable movement of said collar 67 on said shaft 32. Upon the sides of collar 67, which is approximate the sleeve member 56, I provide a pair of oppositely-disposed lugs 69, which are adapted to coöperate with the recesses 70 in sleeve member 56. Normally when it is desired to have the shafts 32 and 32ª independently movable with respect to each other within prescribed limits the member 67 is maintained on shaft 32 away from sleeve member 56; but when it is desired arbitrarily to couple or lock shaft 32 rotatably rigid with shaft 32ª member 67 is pushed along the shaft 32 until the lugs 69 occupy the recesses 70 of sleeve member 56, thus securely locking the two shafts together. This is especially desirable when the shafts are manually operated to raise or lower the table by the operation of the handle 71 (shown in Fig. 1) and also when only a single combing-wheel is used.

Pneumatically-operated presser-foot.—For the purpose of clamping the pile of sheets to the rear of the top sheet when that sheet is being carried forward and also for the purpose of exerting a restraining effect upon the sheet as the same is being operated on I provide the following pneumatically-operated mechanism: Referring to Figs. 2 and 7, 91 indicates a diaphragm-chamber which is supplied with compressed air from a suitable source, but which is preferably in pneumatic communication with one of the heads controlling the combing-wheel and is controlled by the same valve that controls said head. The diaphragm-chamber is provided with a flexible diaphragm 39, to which is connected the diaphragm-piston 92. To the diaphragm-piston 92 is secured the vertical rod 93, which has pivotal connection with the beam 94, which is pivotally supported at 95 to the upright 96. To the other end of the beam 94 is pivotally secured at 97 the vertical member 98, carrying the presser-foot 99. It will thus be observed that by the admission of compressed air into the chamber 91—that is, below the diaphragm 39—the diaphragm and piston 92 will be forced upwardly, and therefore will cause a downward movement of rod 98 and presser-foot 99, or rather exert a downward pressure upon the same through members 93 and 94. When the compressed air is permitted to escape from chamber 91 beneath the diaphragm 39, the piston 92 is consequently permitted to descend. By said downward pressure on 98 said presser-foot is made to clamp the pile of sheets to the rear of the top sheet, when the same is combed free therefrom—that is, when the valve-trip is actuated by the advancing sheet the presser-foot is operated to clamp the pile to the rear thereof. The framework 100, to which the diaphragm-chamber 91 and the upright 96 are integral, is supported by the member 101, which is adjustably secured in the threaded sleeve 102, which in turn is adjustably connected with the parallel frame 103, Fig. 2, which in turn has adjustable connection with the fixed bar 73, extending across the machine and secured to the stationary framework thereof. The vertical adjustment of framework 100 is secured by the lock and thumb nuts 104 and 105. The lateral adjustment of member 102 on framework 103 is secured by thumb-screw 102ª. The transverse lateral adjustment in two directions, one at right angles with the other, between the framework 103 and the hollow shaft 73 is secured by the yoke 106 and set-screw 107.

By loosening the screw 107 sufficiently the entire frame structure 103 and the presser-foot mechanism supported thereby may be swung around over the shaft 73, as shown in Fig. 26, so as to be out of the way and to permit easy access to the table for loading or for other purposes. The lower side of shaft 73 is flattened, so as to hold the frame 103 level when the same is returned to normal position and the set-screw made tight.

Adjustable spring tension.—As above stated, when pressure is exerted on the under part of diaphragm 39 to force it upward said pressure is communicated, through the intermediate mechanism, to presser-foot 99 to cause the same to clamp securely the pile of sheets. When, however, the compressed air is permitted to escape or the pressure is withdrawn from diaphragm-piston 92, the only

pressure exerted by presser-foot 99 is that due to the tension of spring 108, which is secured to the framework 100 at 109 and at the other end to a sliding member 110, which is adapted to travel forward or backward from one side to the other of the pivot-support 95 of the beam 94, from which arrangement it is obvious that the tension exerted on presser-foot 99 by spring 108 may be varied at will or made negative.

Presser-weight.—The member 111, which is pivoted at 113 to the member 100, serves as an additional presser-weight for the further regulation of the combing operation. This weight is preferably positioned in tandem—that is, in line with the presser-foot 99 in the direction of the movement of the sheets. The purpose of this weight is to steady the top sheet after it has left the influence of the presser-foot 99 and to keep it from being pushed back or buckled by the springs of the tripping mechanism in substantially the same manner as described with respect to the weights shown in Figs. 44, 45, and 46 in the patent above referred to. The further purpose of said member 111 is for retarding this part of the sheet—namely, the middle rear portion—and has the effect of maintaining the alinement of same as it is combed forwardly—that is, when one combing-wheel only is used it aids in keeping the paper moving in a straight line.

Blowpipe and automatic adjustment—Rear blowpipes.—To the adjustable frame 100 is adjustably secured the bracket 115 by means of a slot 116 and a thumb-screw 117, and to the outer end of bracket 115 is loosely secured by the pivot 118 the member 119, the free end of which is adapted to rest against the rear of the pile of sheets, as shown in Fig. 2. To member 119 is secured the nozzle 112^a of blowpipe 112 in such a way that the blast of air therefrom will be maintained in the right direction, or rather the said nozzle will be maintained in the right position at all times by the member 119 accommodating itself to the varying elevation of the pile of sheets upon which it rests. In this way the adjustment of the nozzle 112^a is always maintained automatically to suit the height or elevation of the pile of sheets.

The member 119 is so inclined at its outer extension as to permit an elevation of the rear ends of the sheets as they are being combed forward, but at the same time serves as a limit to said upward movement of said sheets, due to the air-blast being driven between them.

Referring to Fig. 3, the nozzle 120 of blowpipe 121 is similarly supported on the counterbalanced arm 122, which is pivoted at 123 to the supporting-frame 124, which is adjustably secured, by means of the thumb-screw 125, to the horizontal member or the frame 126. Thus it will be seen that member 122 by resting upon the rear of the pile of sheets will vary its position, as the elevation in the pile varies, to maintain the required position of the blowpipe or nozzle 120 with respect to said pile. The counterbalance 127 is provided to lessen the pressure of the arm 122 on the pile of sheets.

Side blowpipe and guide.—Upon the frame 124 is secured by the pivot 128 the arm 129, carrying at its free end the nozzle 130 of blowpipe 131. Adjustment of the same is secured by thumb-screw 132. This nozzle is adapted to discharge in a direction approximately at right angles with the nozzle 120 of blowpipe 121 and to direct the blast consequently into the side of the pile of sheets. The nozzles 130 and 120 are usually not intended to be used both at the same time, but are preferably adapted for alternative use, for which purpose hose 133, which is shown in Figs. 1 and 3, may be connected either with the pipe 131 or 121, as required.

Side guides.—The nozzle member 130 also serves as a side guide for the advancing sheets and at the same time is provided with an overhanging arm or projection 134, (see Fig. 3,) which serves to limit the upward movement of the sheets due to the air-blasts driven against them. The further adjustment is provided for nozzle and guide member 130 on blowpipe 131, which is secured by the thumb-screw 135. The side guides are especially useful in connection with moving the sheets by a single combing-wheel. The pivotal connection 128 between member 129 and supporting-frame 124, as above stated, serves as means of adjustment. This joint connection 128 is maintained stiff enough by the thumb-screw 132 normally to support 129 in its position against gravity, but is adapted to yield when nozzle and guide member 130 is encountered by the table, so that said nozzle and guide member 130 may be raised thereby.

Front blowpipes.—Referring to Figs. 6, 27, and 28, I provide blowpipes (preferably two or more) secured by brackets 136 to the front piling-guides and so as to discharge the air-blasts against the front of the pile of sheets beneath the uppermost ones which have passed beyond them. These nozzles are directed, preferably, on lines converging toward each other, as indicated in Fig. 27. The advantage of the blasts at these points is that they are particularly effective as encountering the edges of the sheets after they have been partly separated or advanced one beyond the other by the combing operation. This assures the entrance of air between each individual sheet of the uppermost of the pile. It is also to be noted that the upward movement of the sheets, due to these air-blasts, is limited by the top sheet which had already passed under the front guide-fingers of the machine. (Not shown.)

What I claim is—

1. In a sheet-feeding machine, the combination of means for combing the sheets, means controlled by the advancing sheet for raising and lowering the combing means and automatic means controlled by the combing means for raising the pile of sheets.

2. In a sheet-feeding machine, the combination of means for combing the sheets, means controlled by the advancing sheet for raising and lowering the combing means out of and into engagement with the pile of sheets, and automatic means controlled by the combing means for raising the pile of sheets.

3. In a sheet-feeding machine, the combination of a combing-wheel and means for automatically raising the pile of sheets, comprising a screw-operating ratchet, a coöperating pawl adapted normally to assume the inoperative position at each oscillation, cam-operated means connected with the operative mechanism of the machine for controlling the pawl, and latching means controlled by the combing-wheel for controlling the cam-operated means.

4. In a sheet-feeding machine, the combination of a combing-wheel, a presser-foot, mechanism controlled by the advancing sheet for causing the relative operations of the combing-wheel and presser-foot, and a presser-weight operating in tandem with the presser-foot.

5. In a sheet-feeding machine, the combination of a pneumatically-controlled combing-wheel, means for raising the pile of sheets to be combed, means for normally restraining the operation of the sheet-raising mechanism and means connected with the combing-wheel for operating the restraining means.

6. In a sheet-feeding machine, the combination of a combing-wheel, means for raising the pile of sheets to be combed, latching means controlled by the combing-wheel for restraining the operation of the sheet-raising mechanism adapted to be operated to permit the operation of the sheet-raising mechanism when the pile of sheets falls below a predetermined height.

7. In a sheet-feeding machine, the combination of a combing-wheel, means for raising the pile of sheets to be combed, latching means for restraining the operation of the sheet-raising mechanism adapted to be operated by mechanism connected with the combing-wheel to permit the operation of the sheet-raising mechanism when the pile of sheets falls below a predetermined height.

8. In a sheet-feeding machine, the combination of a combing-wheel, means for raising the pile of sheets to be combed, latching means for normally rendering inactive the raising means and means for unlatching said latching means when the combing-wheel falls below a predetermined height.

9. In a sheet-feeding machine, the combination of a combing-wheel, mechanism for raising and lowering the combing-wheel, a normally inactive sheet-raising mechanism, and means connected with the raising and lowering mechanism of the combing-wheel for rendering active the sheet-raising mechanism.

10. In a sheet-feeding machine, the combination of a combing-wheel and means for automatically raising the pile of sheets, comprising normally inactive pawl-and-ratchet screw-operating mechanism, cam-operated means for controlling the pawl-and-ratchet mechanism and latching means operated by the combing-wheel for controlling the cam-operated means.

11. In a sheet-feeding machine, the combination of a combing-wheel and raising and lowering mechanism therefor, normally inactive sheet-raising mechanism adapted to be connected with the other operative parts of the machine, and latching means controlled by the raising and lowering mechanism of the combing-wheel for controlling the sheet-raising mechanism.

12. In a sheet-feeding machine, the combination of a combing-wheel, screw means for elevating the pile of sheets, cam-operated pawl-and-ratchet means for operating the screw means, latching means for normally rendering inactive the cam operation of the pawl-and-ratchet means and means connected with the combing-wheel for operating the latching means.

13. In a sheet-feeding machine, the combination of combing means, screw means for raising the pile of sheets, normally inactive pawl-and-ratchet means for operating the screw means, cam-operated means for making active the pawl-and-ratchet means, latching means controlled by the combing means for restraining the cam-operated means.

14. In a sheet-feeding machine, the combination of a combing-wheel, screw means for raising the pile of sheets, pawl-and-ratchet means for operating the screw means so constructed as to render the pawl inoperative after each oscillation and normally inactive means controlled by the combing-wheel for rendering the pawl operative.

15. In a sheet-feeding machine, the combination of combing means, screw means for raising the pile of sheets, a counterbalanced pawl having an over-the-center movement from the operative to the inoperative position, a ratchet coöperating therewith for operating the screw, and means controlled by the combing means for throwing the pawl into the operative position.

16. In a sheet-feeding machine, the combination of a combing-wheel, screw means for raising the pile of sheets, normally inactive pawl-and-ratchet means for operating the screw means, spring-controlled cam-operated mechanism for rendering active the pawl-and-ratchet means, latching means for restraining the spring-controlled cam-operated mechan-

ism and means connected with the combing-wheel for operating the latching means.

17. In a sheet-feeding machine, the combination of a combing-wheel, a rocking shaft for supporting the same, a cross-bar secured to the rocking shaft and means movably connected with the cross-bar for varying the pressure of the combing-wheel upon the sheets.

18. In a sheet-feeding machine, the combination of a combing-wheel, a rocking shaft for supporting the same, a cross-bar secured to the rocking shaft, and a spring having movable connection with the cross-bar for varying the pressure of the combing-wheel upon the sheets.

19. In a sheet-feeding machine, the combination of a combing-wheel, means for raising and lowering the combing-wheel out of and into engagement with the pile of sheets comprising a rocking arm, and adjustable spring-controlled means for varying the pressure of the combing-wheel upon the pile of sheets, or rendering said pressure negative, by shifting the line of spring tension from one side to the other of the axis of rotation of the rocking arm.

20. In a sheet-feeding machine, the combination of combing means and pneumatically-operated presser-foot means controlled by the advancing sheet for clamping the pile or a portion of the pile of sheets being combed.

21. In a sheet-feeding machine, the combination of combing means and a pneumatically-controlled presser-foot for operating on the pile of sheets, and mechanism controlled by the advancing sheet for causing the combing means and the presser-foot to act relatively.

22. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith having its pivotal support intermediate its two extensions, a movable diaphragm having a vertically-reciprocative rod connected therewith and also pivotally secured to the rocking member, and means for introducing air-pressure beneath the diaphragm.

23. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member and means for introducing air-pressure beneath the diaphragm.

24. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith, having its pivotal support intermediate its two extensions, a movable diaphragm having a vertically-reciprocative rod connected therewith and also pivotally secured to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member, and means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member.

25. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member and means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member.

26. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith having its pivotal support intermediate its two extensions, a diaphragm having a vertically-reciprocative rod connected therewith and also pivotally secured to the rocking member, means for introducing air-pressure beneath the diaphragm, and adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine.

27. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member, means for introducing air-pressure beneath the diaphragm, and adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine.

28. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith having its pivotal support intermediate its two extensions, a diaphragm-chamber having a vertically-reciprocative rod also pivotally secured to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member, means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member, and adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine.

29. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member, means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member, and adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine.

30. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith having its pivotal support intermediate its two extensions, a diaphragm having a vertically-reciprocative rod connected therewith and also pivotally secured to the rocking member, means for introducing air-pressure beneath the diaphragm, adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine, and means whereby said presser-foot and its associated mechanism may be swung above the machine to give access to the pile of sheets or the table for supporting the same.

31. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member, means for introducing air-pressure beneath the diaphragm, adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine, and means whereby said presser-foot and its associated mechanism may be swung above the machine to give access to the pile of sheets or the table for supporting the same.

32. In a sheet-feeding machine, a pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative rod, a substantially horizontal rocking member pivotally connected therewith having its pivotal support intermediate its two extensions, a diaphragm having a vertically-reciprocative rod connected therewith and also pivotally secured to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member, means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member, adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine, and means whereby said presser-foot and its associated mechanism may be swung above the machine to give access to the pile of sheets or the table for supporting the same.

33. In a sheet-feeding machine, pneumatically-operated presser-foot mechanism comprising a vertically-reciprocative presser-foot member, a substantially horizontal rocking member having pivotal connection therewith, a diaphragm-chamber having a movable diaphragm therein, means for communicating movement from the diaphragm to the rocking member, means for introducing air-pressure beneath the diaphragm, a spring connected with said rocking member, means for shifting the line of spring tension from one side to the other of the pivotal support of said rocking member, adjustable means for securing said presser-foot and its associated mechanism to the framework of the machine, and means whereby said presser-foot and its associated mechanism may be swung above the machine to give access to the pile of sheets or the table for supporting the same.

34. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between several sheets during the combing operation, a nozzle secured to said blowpipe having a discharge-aperture extending below the top of the pile of sheets and provided with a substantially horizontal flange extending over and resting upon the pile of sheets.

35. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between the sheets, a counterbalanced supporting-frame therefor adapted to rest upon the pile of sheets and to be raised and lowered thereby to automatically maintain the nozzle of the blowpipe in the proper position.

36. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between several sheets during the combing operation, a nozzle secured to said blowpipe having a discharge-aperture extending below the top of the pile of sheets and provided with a substantially vertical and a substantially horizontal flange for engaging the edges and the top of the pile of sheets.

37. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between the sheets, a pivoted counterbalanced supporting-frame therefor adapted to rest upon the pile of sheets and to be raised or lowered thereby to automatically maintain the nozzle of the blowpipe in the proper position.

38. In a sheet-feeding machine, the combination of a blowpipe for directing a current or air between the sheets, a supporting-frame therefor adapted to rest upon the pile of sheets and to be raised or lowered thereby to auto-

matically maintain the nozzle of the blowpipe in the proper position, and adjustable means for securing said frame to the machine.

39. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between the sheets, a counterbalanced supporting-frame therefor adapted to rest upon the pile of sheets and to be raised and lowered thereby to automatically maintain the nozzle of the blowpipe in the proper position, and adjustable means for securing said frame to the machine.

40. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between several of the uppermost sheets during the combing operation, a nozzle secured to said blowpipe having a discharge-aperture extending below the top of the pile of sheets and having a substantially horizontal flange projecting above the aperture and over the pile of sheets.

41. In a sheet-feeding machine, the combination of a blowpipe for directing a current of air between the sheets, a pivoted counterbalanced supporting-frame therefor adapted to rest upon the pile of sheets and to be raised or lowered thereby to automatically maintain the nozzle of the blowpipe in the proper position, and adjustable means for securing said frame to the machine.

42. In a sheet-feeding machine, the combination of combing means and a blowpipe for directing currents of air between the sheets, a supporting-bracket therefor having pivotal connection with the framework of the machine, said pivotal connection being such as to permit the yielding of the bracket to the upward movement of the table, but otherwise to maintain an adjustable position against gravity.

43. In a sheet-feeding machine, the combination of combing means, a blowpipe for directing a current of air between the sheets, adjustable means for supporting the nozzle of said blowpipe adapted to maintain its position against gravity but permit its yielding when encountered in its upward motion by the table.

44. In a sheet-feeding machine, the combination of combing means, a blowpipe adapted to direct a current of air between the sheets and a flange integral with the blowpipe and adjacent the nozzle thereof as means connected therewith for guiding the sheets.

45. In a sheet-feeding machine, the combination of combing means, a blowpipe adapted to direct a current of air between the sheets and a horizontal flange connected with the blowpipe and adjacent the nozzle thereof as means connected therewith for limiting the upward movement of the sheets due to the current of air.

46. In a sheet-feeding machine, the combination of combing means, a pneumatically-operated presser-foot, a presser-weight operating in tandem with the presser-foot with respect to the line of travel of the sheet and a blowpipe for directing a current of air between the sheets, adjustable means for securing the presser-weight, the blowpipe, the presser-foot and its associated mechanism to the framework of the machine.

47. In a sheet-feeding machine, the combination of combing means, a pneumatically-operated presser-foot, a presser-weight operating in tandem with the presser-foot with respect to the line of travel of the sheet, a blowpipe for directing a current of air between the sheets, adjustable means for securing the presser-weight, the blowpipe, the presser-foot and its associated mechanism to the framework of the machine so that said presser-weight, blowpipe and presser-foot and its associated mechanism may be rotated above the machine when so desired.

48. In a sheet-feeding machine, the combination of a pneumatically-operated presser-foot, a presser-weight operating in tandem thereto with respect to the line of travel of the sheet and a blowpipe for directing a current of air between the sheets, means for supporting the presser-foot, presser-weight and blowpipe in an associated structure so that the same may be adjustably secured to the framework of the machine and may also be arbitrarily rotated above the machine out of the operative position.

49. In a sheet-feeding machine, the combination of a combing-wheel, front piling-guides for the sheets, blowpipes secured to the front piling-guides beneath the advancing top sheet.

50. In a sheet-feeding machine, the combination of a combing-wheel, front piling-guides for the sheets, blowpipes secured to the front piling-guides beneath the top sheet, and delivering in relatively convergent directions.

51. In a sheet-feeding machine, the combination of a combing-wheel, screw means for raising the sheets, normally inactive pawl-and-ratchet means for operating the screw means and means controlled by the combing-wheel for rendering active the pawl-and-ratchet means, additional means for arbitrarily holding the pawl out of operative position and locking means therefor.

52. In a sheet-feeding machine, the combination of a plurality of combing means, a plurality of screws for raising the pile of sheets at different points, independently-operated means each controlled by a different combing means for operating each screw means.

53. In a sheet-feeding machine, the combination of a plurality of combing means, a plurality of screws for raising the pile of sheets at different points, independently-operated means each controlled by a different combing means for operating each screw means, and automatic means for limiting the independent operation of the different screw means.

54. In a sheet-feeding machine, the combi-

nation of a plurality of combing means, a plurality of screws for raising the pile of sheets at different points, independently-operated means each controlled by a different combing means for operating each screw means, and automatic means for limiting the amount of independent operation of the different screw means.

55. In a sheet-feeding machine, the combination of combing means, a table for holding the sheets, a plurality of screws for raising the table at different points, a plurality of independently-operative devices for operating the independent screws, each device controlled by a different combing means, automatic means for limiting the amount of independent operation of the various screws.

56. In a sheet-feeding machine, the combination of a plurality of screws for raising the table at different points, a plurality of independently-operative devices for operating the respective screws, automatic means for limiting the amount of independent operation of said screws, and means for arbitrarily preventing independent operation of said screws.

57. In a sheet-feeding machine, the combination of combing means, a plurality of screws for raising the table at different points, a plurality of independently-operative devices for operating the respective screws, each device controlled by a different combing means, automatic means for limiting the amount of independent operation of said screws, and means for arbitrarily causing the simultaneous operation of said screws.

58. In a sheet-feeding machine, the combination of combing means, a plurality of screws for raising the table at different points, a plurality of independently-operative devices for operating the respective screws, each device controlled by a different combing means, automatic means for limiting the amount of independent operation of said screws, and arbitrary means for causing the simultaneous operation of all the screws.

59. In a sheet-feeding machine, the combination of combing means, a plurality of screws for raising the table at different points, a plurality of independently-operative devices each controlled by a different combing means for operating the respective screws, automatic means for limiting the amount of independent operation of said screws, and arbitrarily-operative locking means for causing the simultaneous movement of all the screws.

60. In a sheet-feeding machine, the combination of combing means, a plurality of screws for raising the table at different points, a plurality of independently-operative devices for operating the respective screws, each device controlled by a different combing means, automatic means for limiting the amount of independent operation of said screws, and manually-operative means for arbitrarily locking the screw-operating mechanisms so as to cause their simultaneous actuation.

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Witnesses:
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