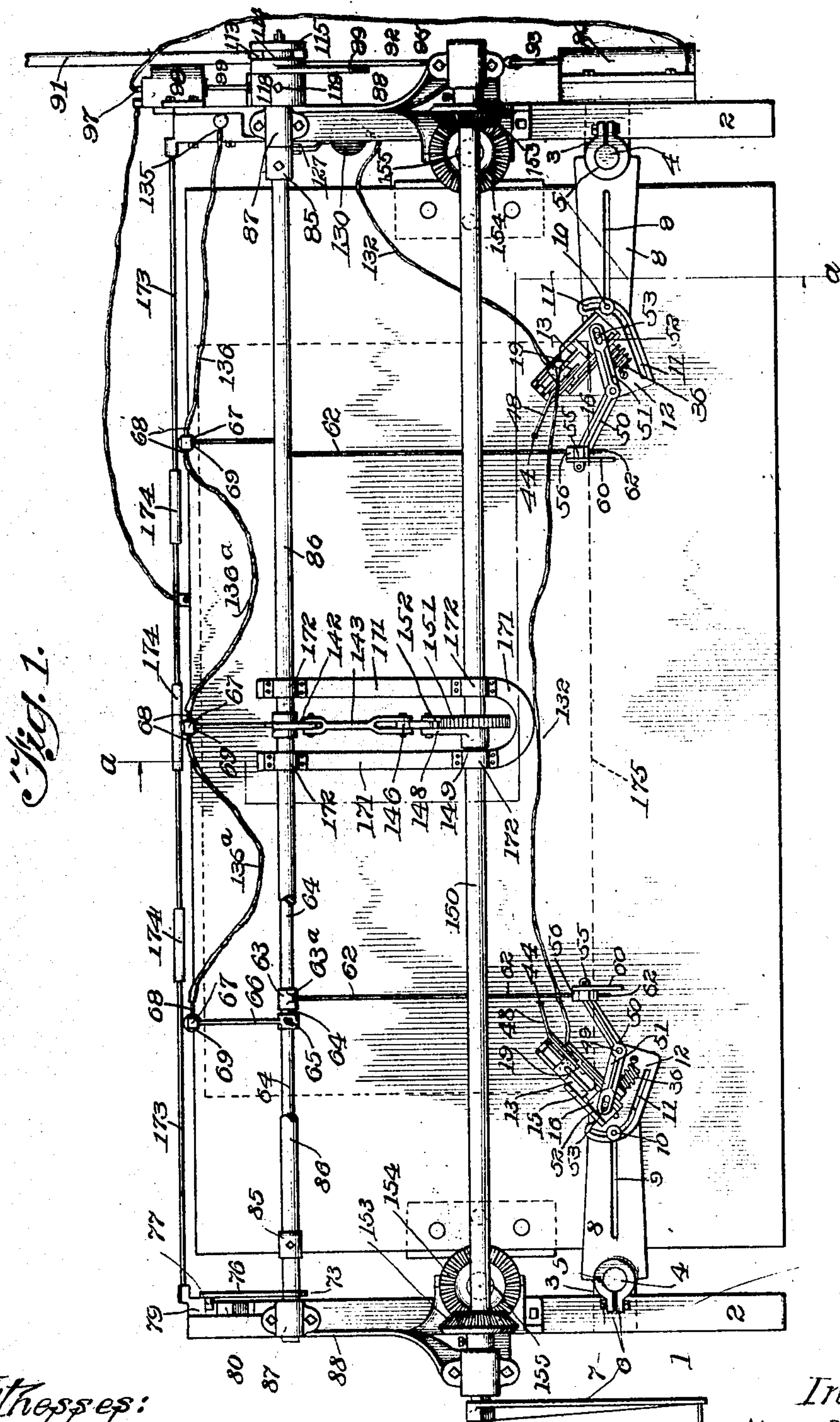


A. B. GRAHAM.
PAPER FEEDING MACHINE.
APPLICATION FILED DEC. 31, 1903.

7 SHEETS—SHEET 1.



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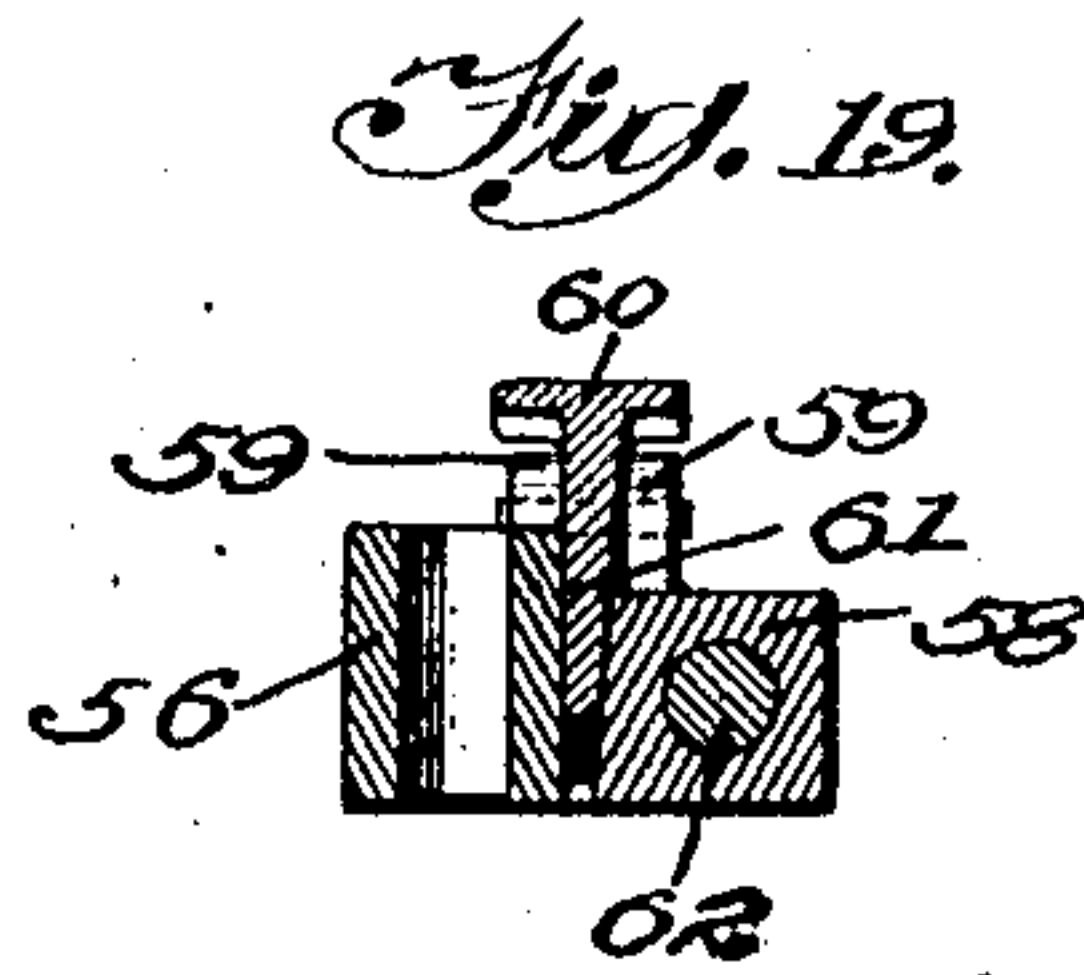
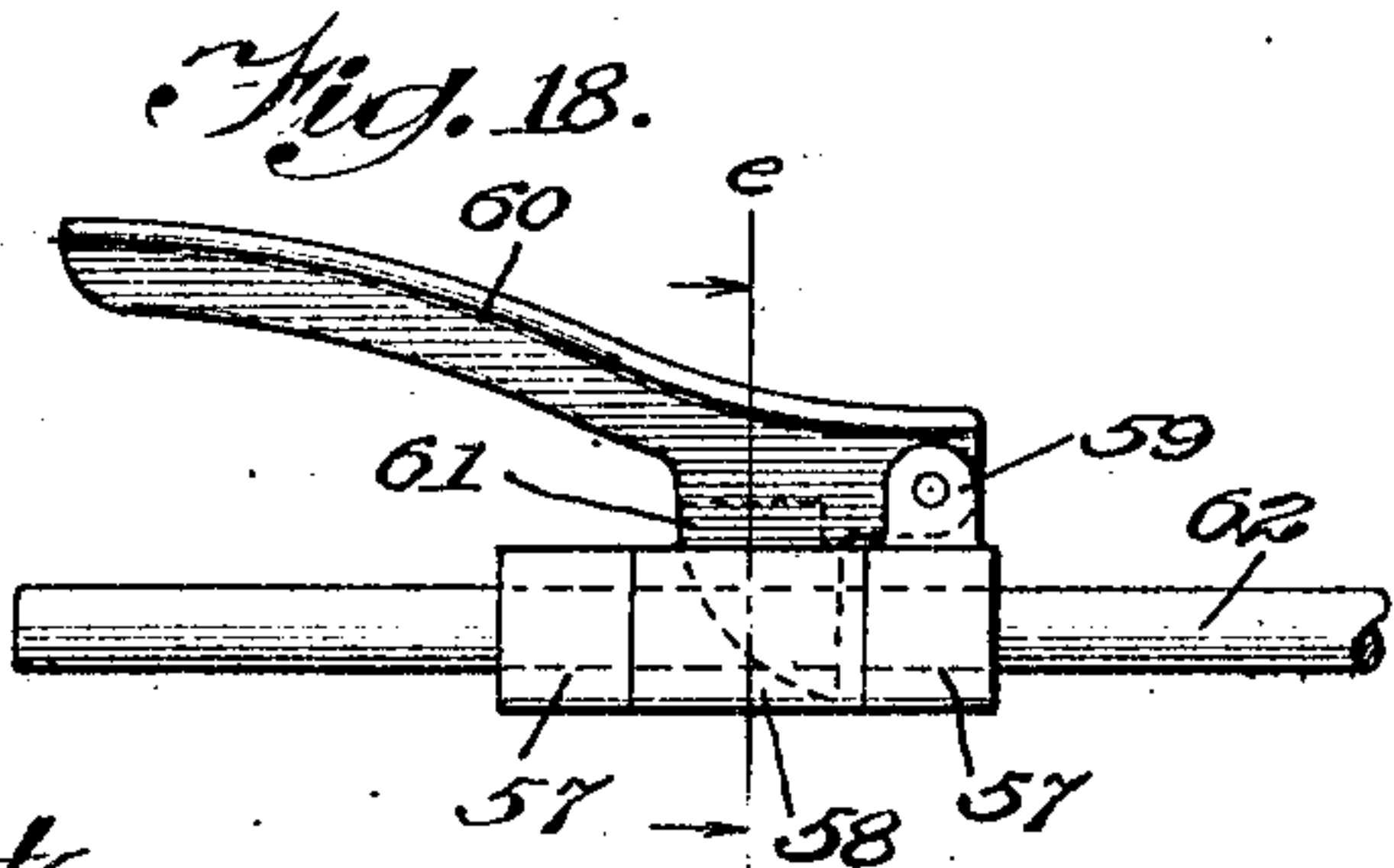
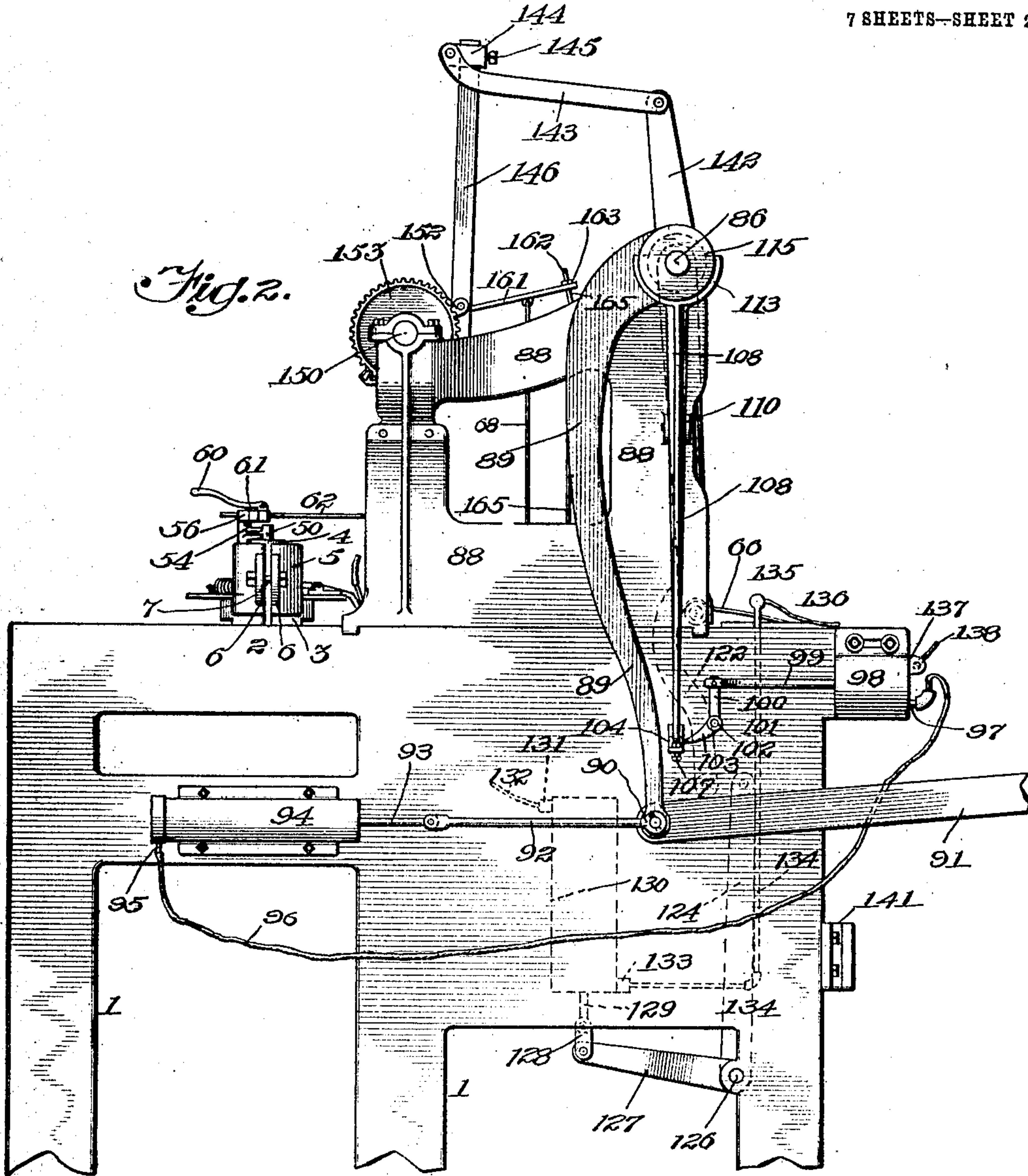
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7 SHEETS—SHEET 2.



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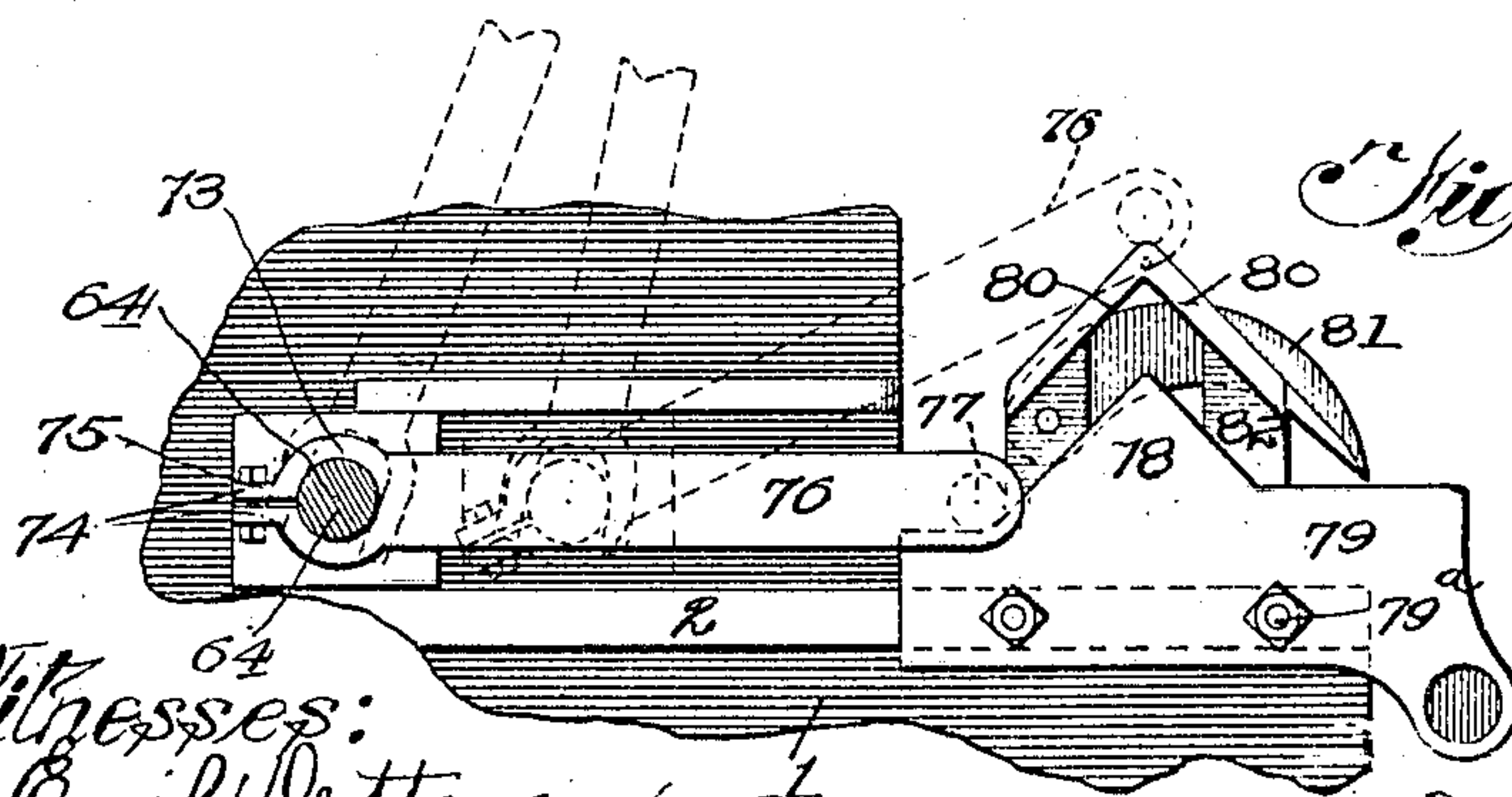
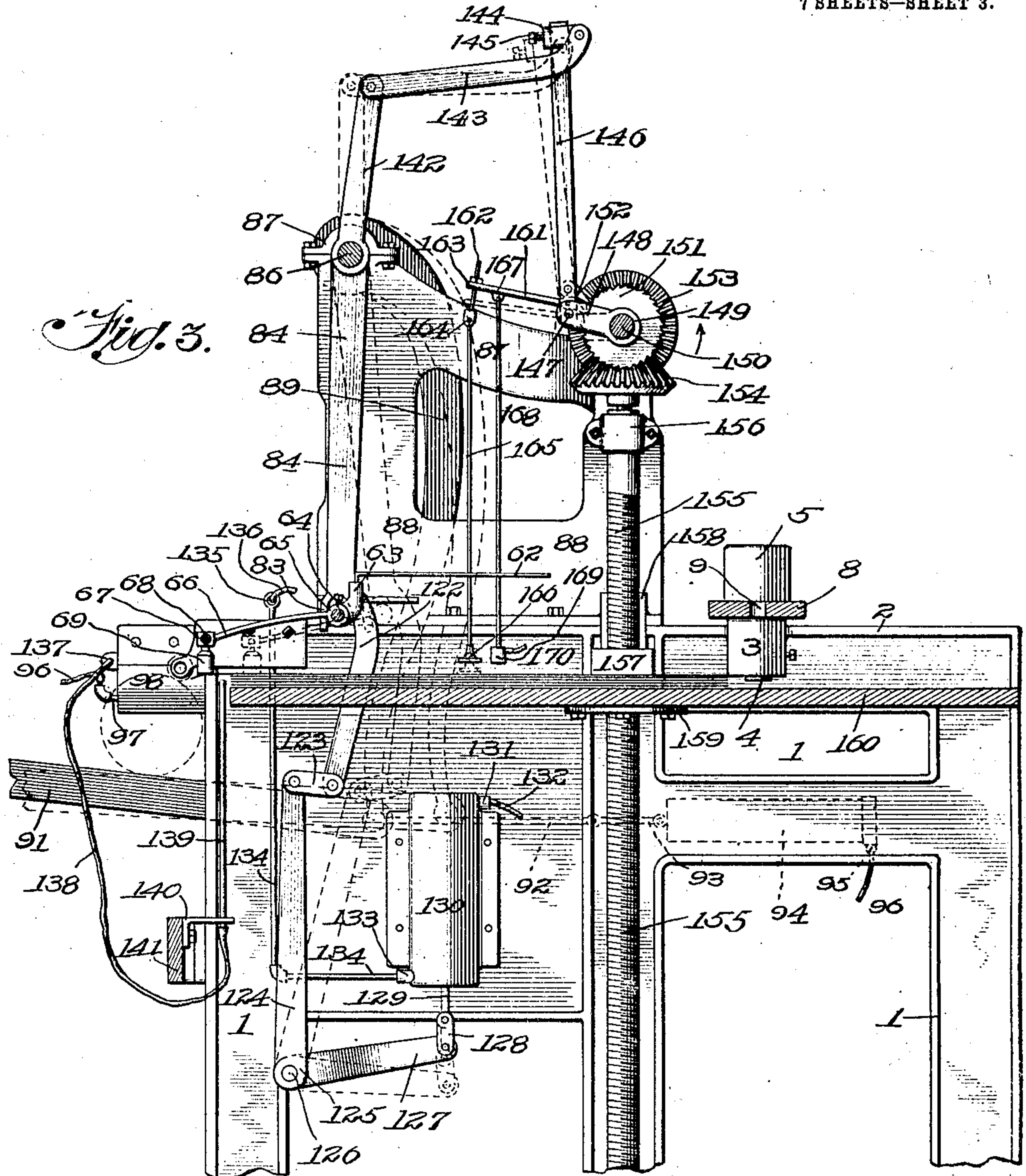
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7 SHEETS—SHEET 3.



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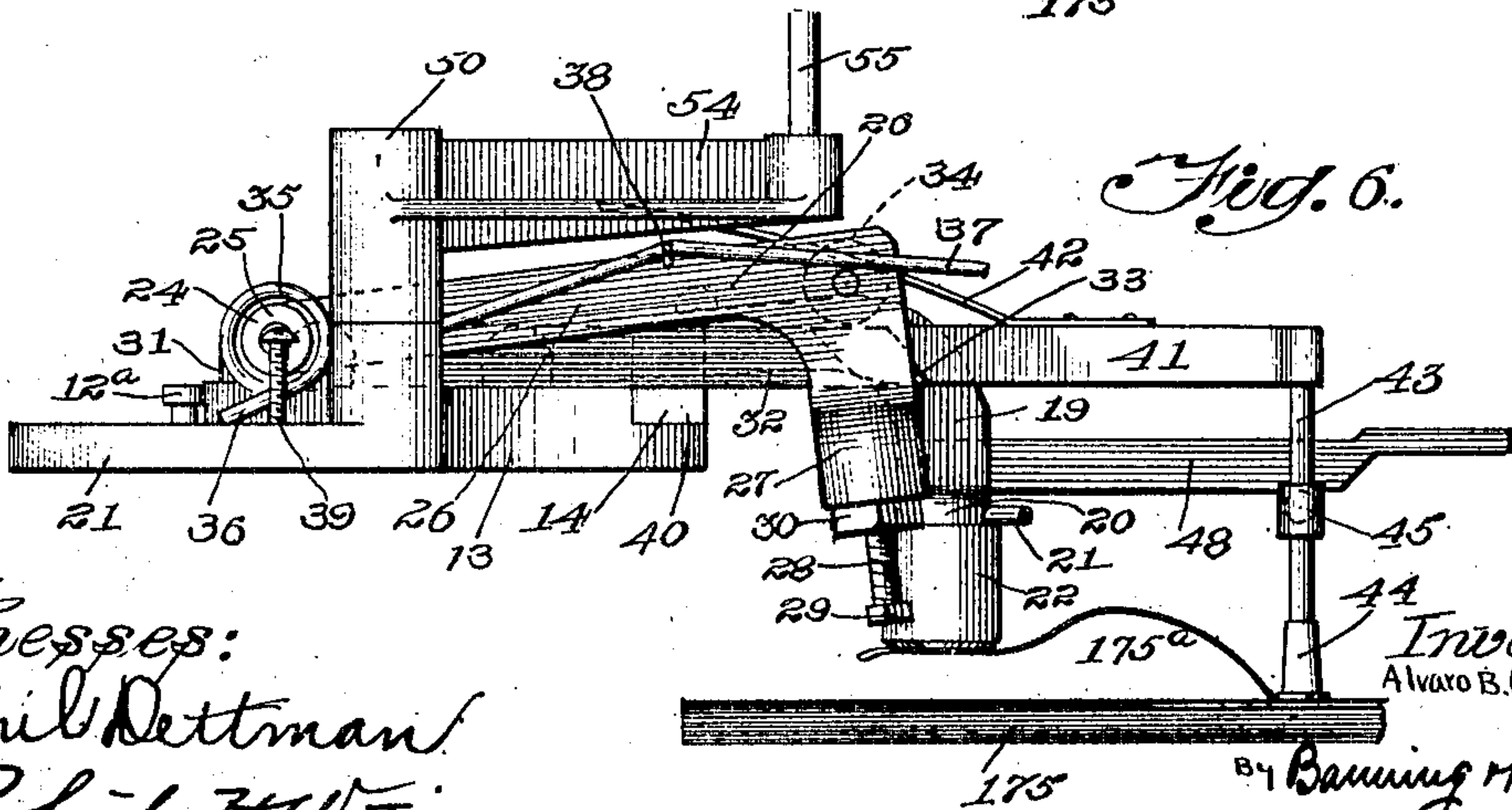
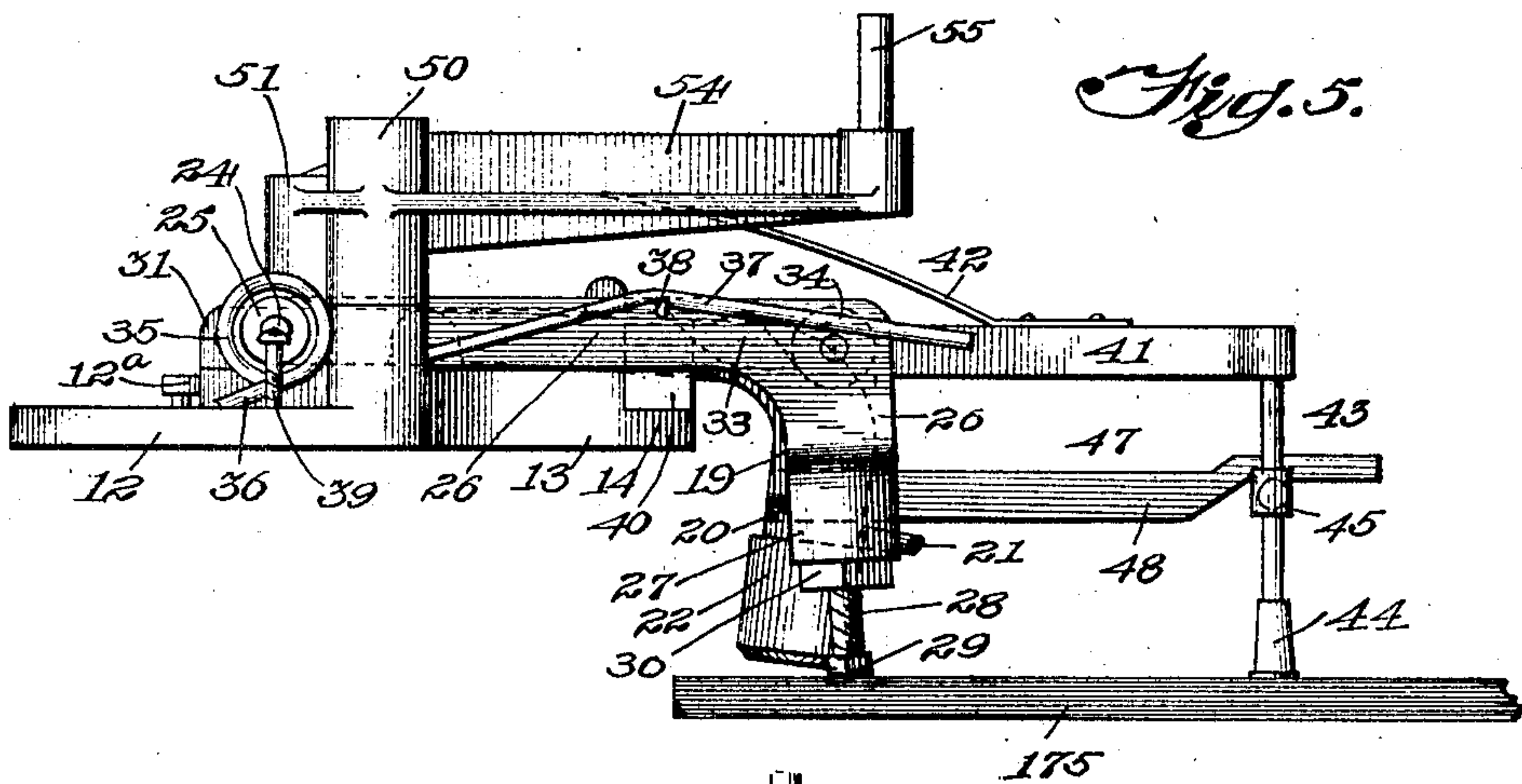
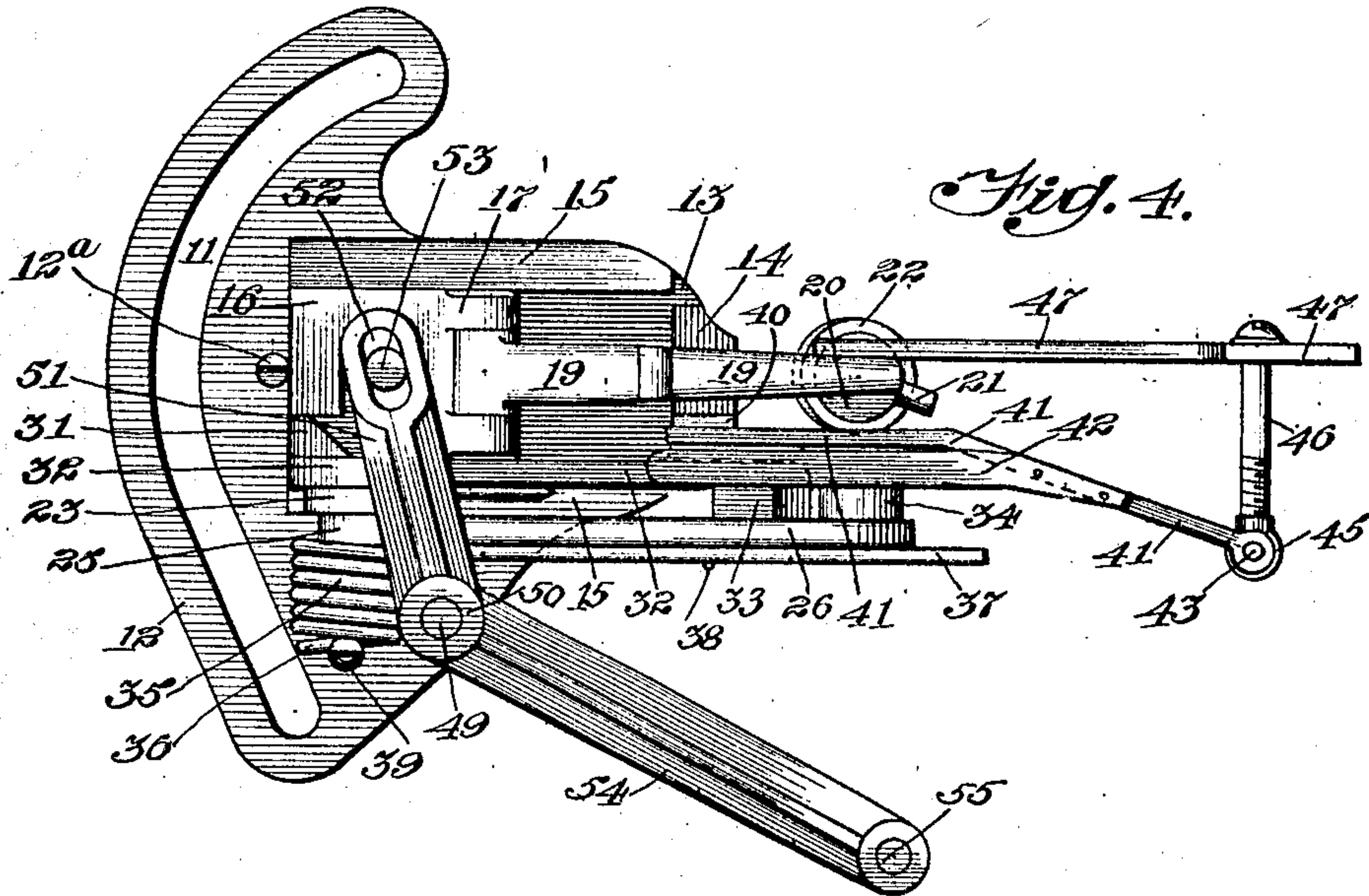
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7 SHEETS—SHEET 4.



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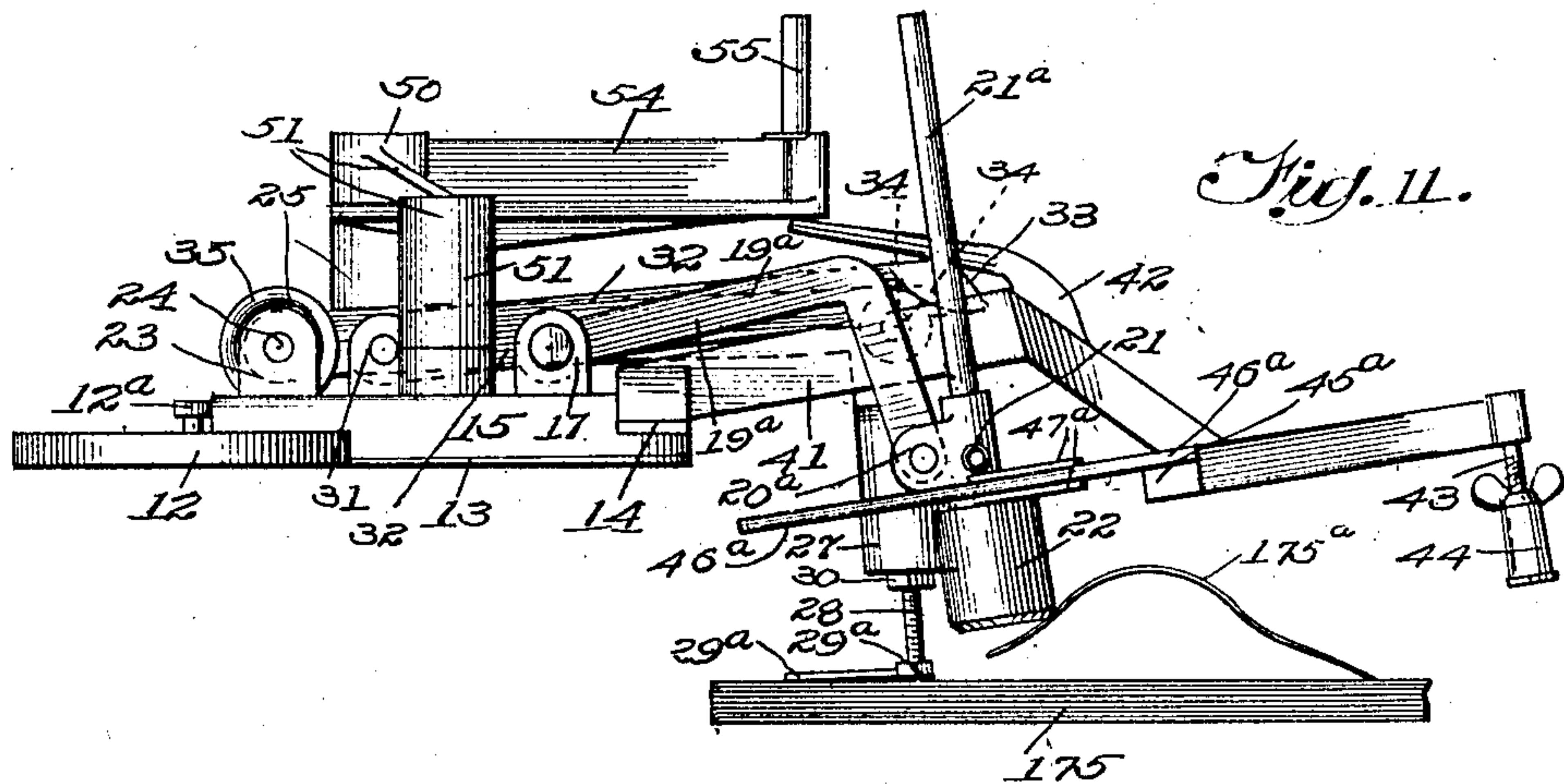
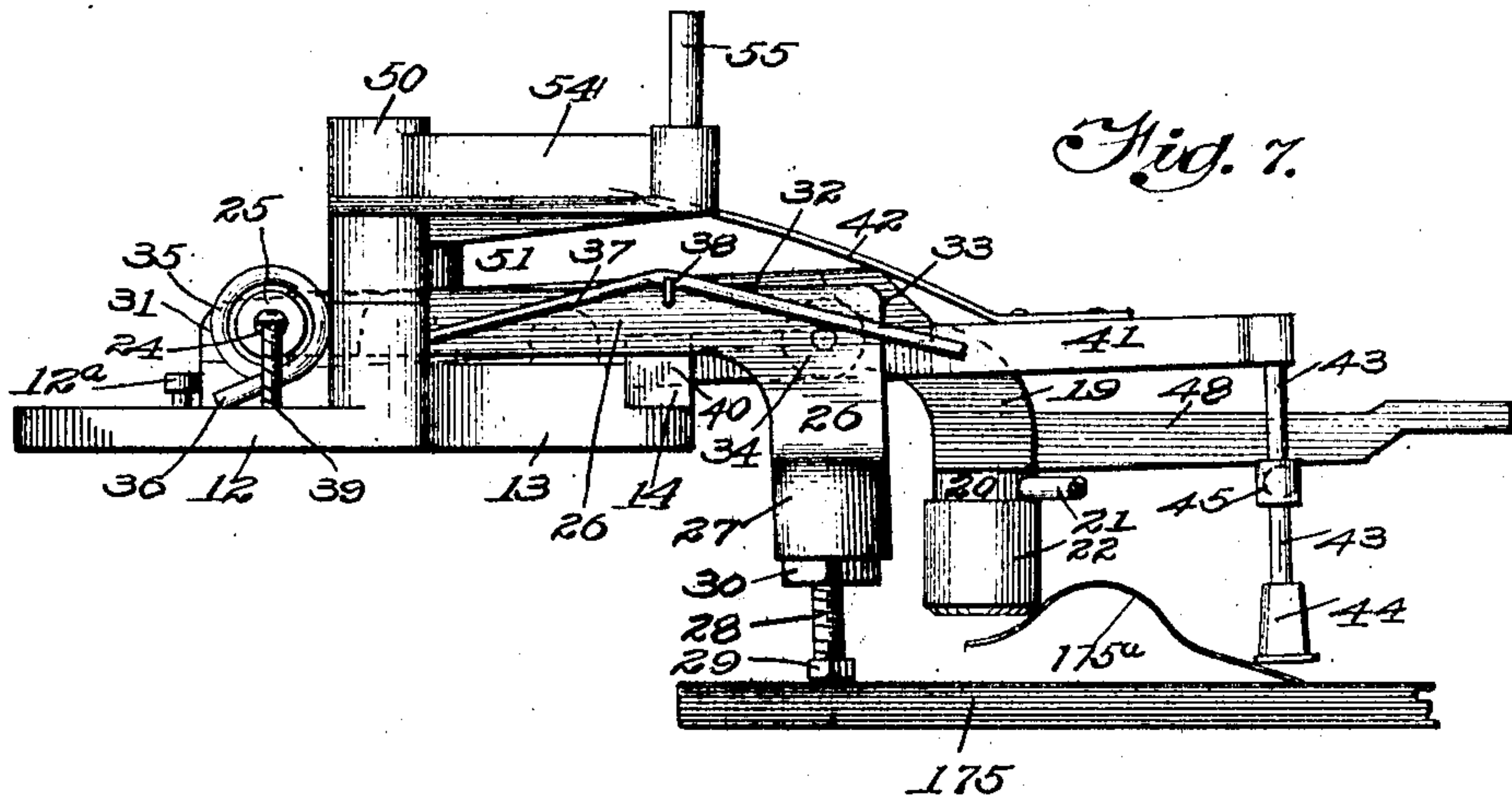
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APPLICATION FILED DEC. 31, 1903.

7 SHEETS—SHEET 5



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7 SHEETS—SHEET 6.

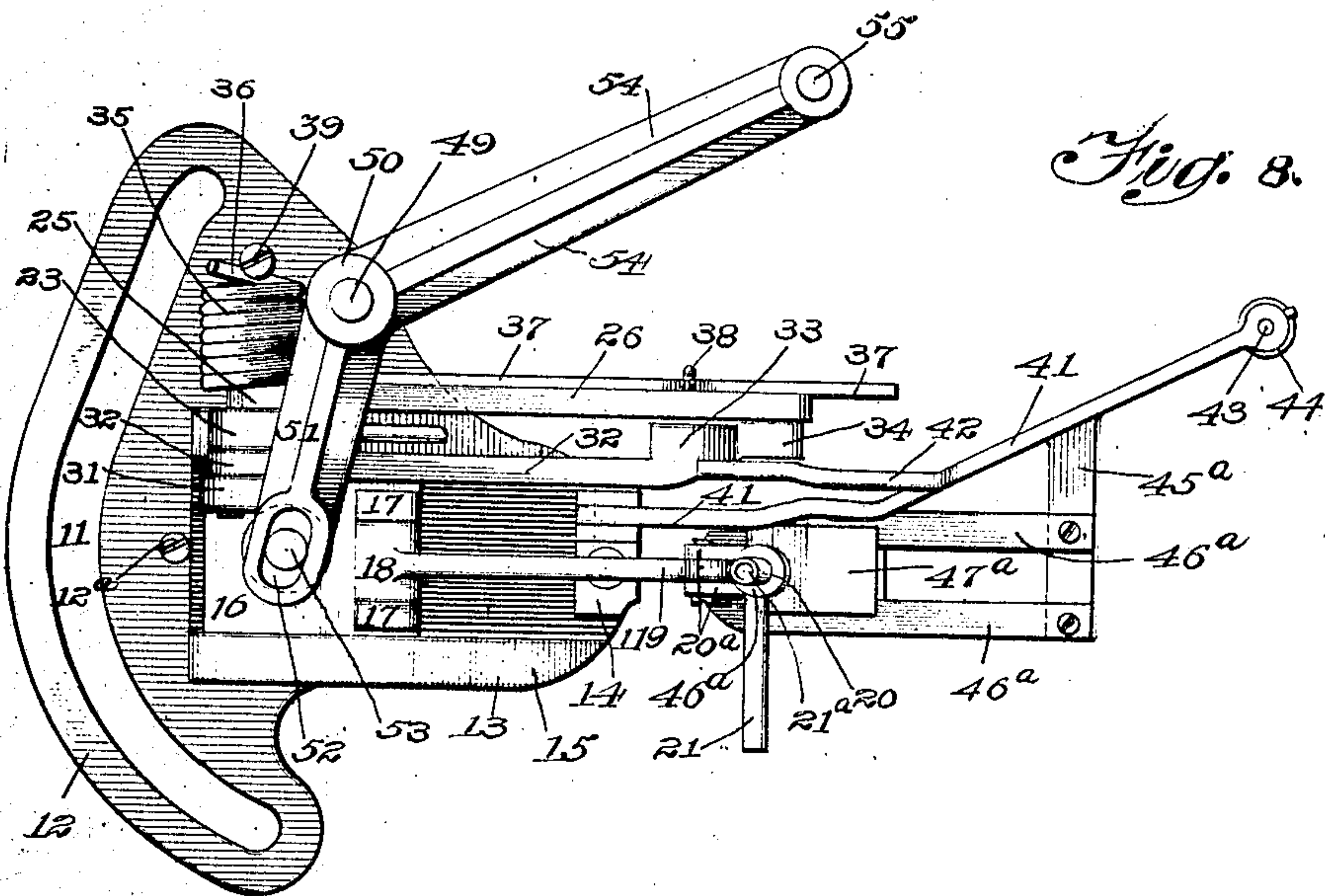


Fig. 8.

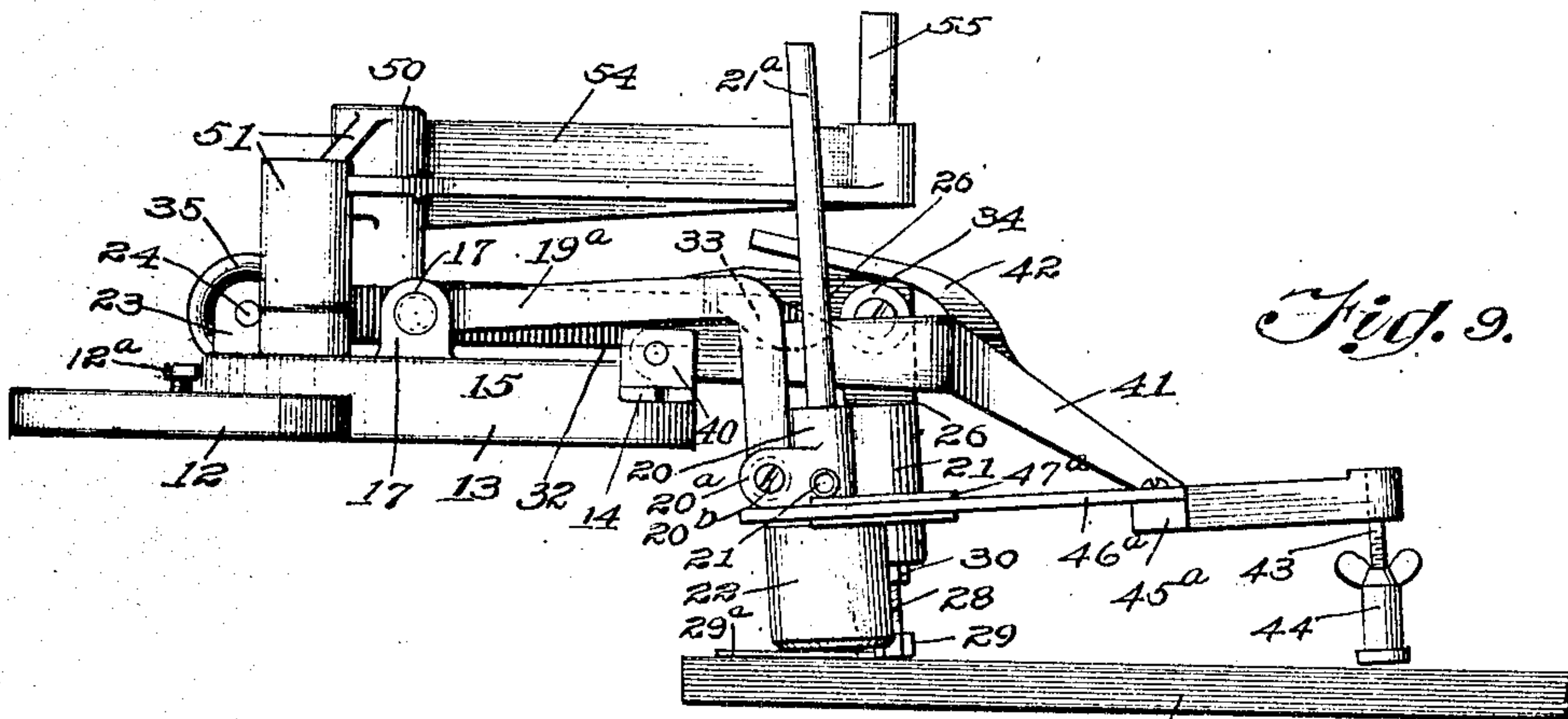


Fig. 9.

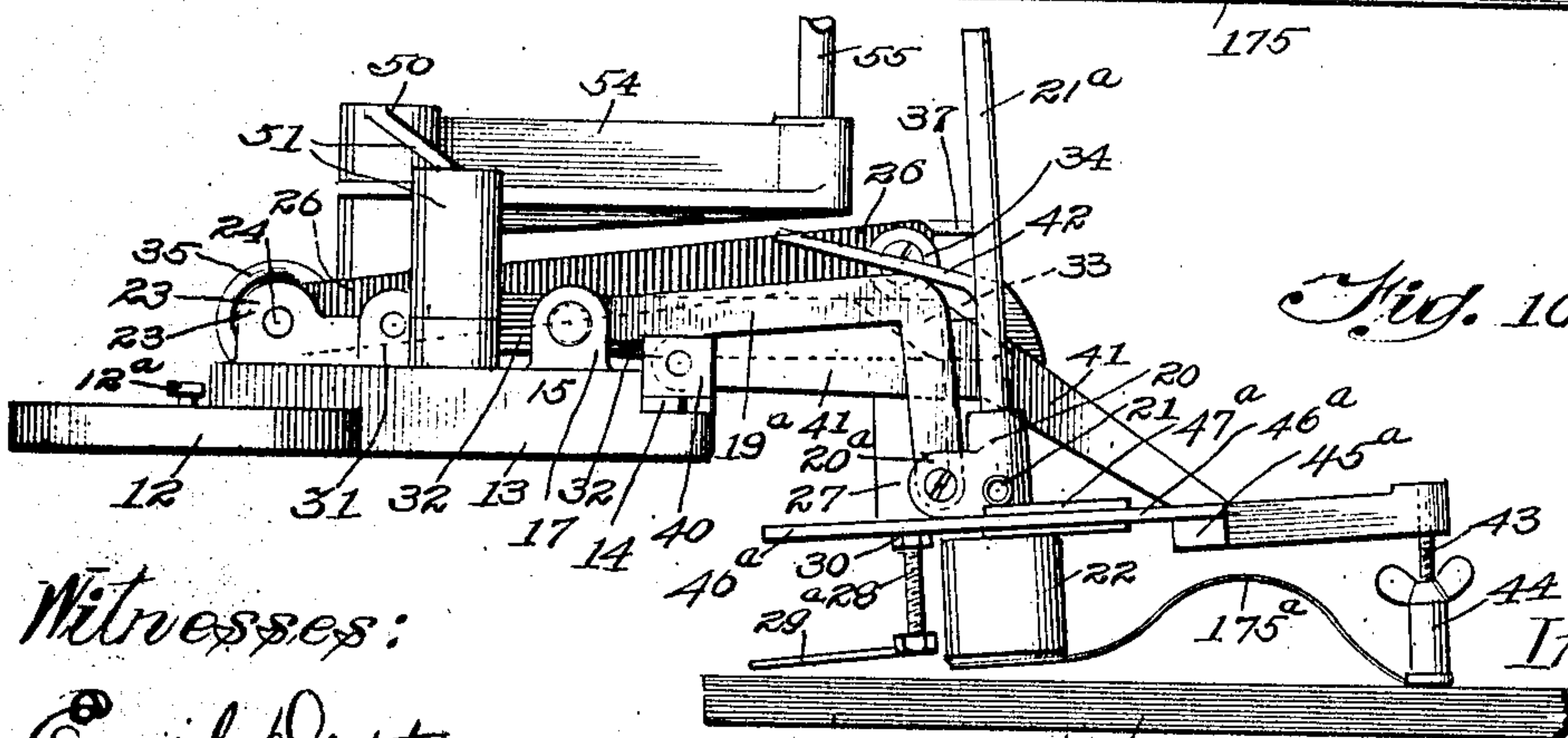


Fig. 10.

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7 SHEETS—SHEET 7.

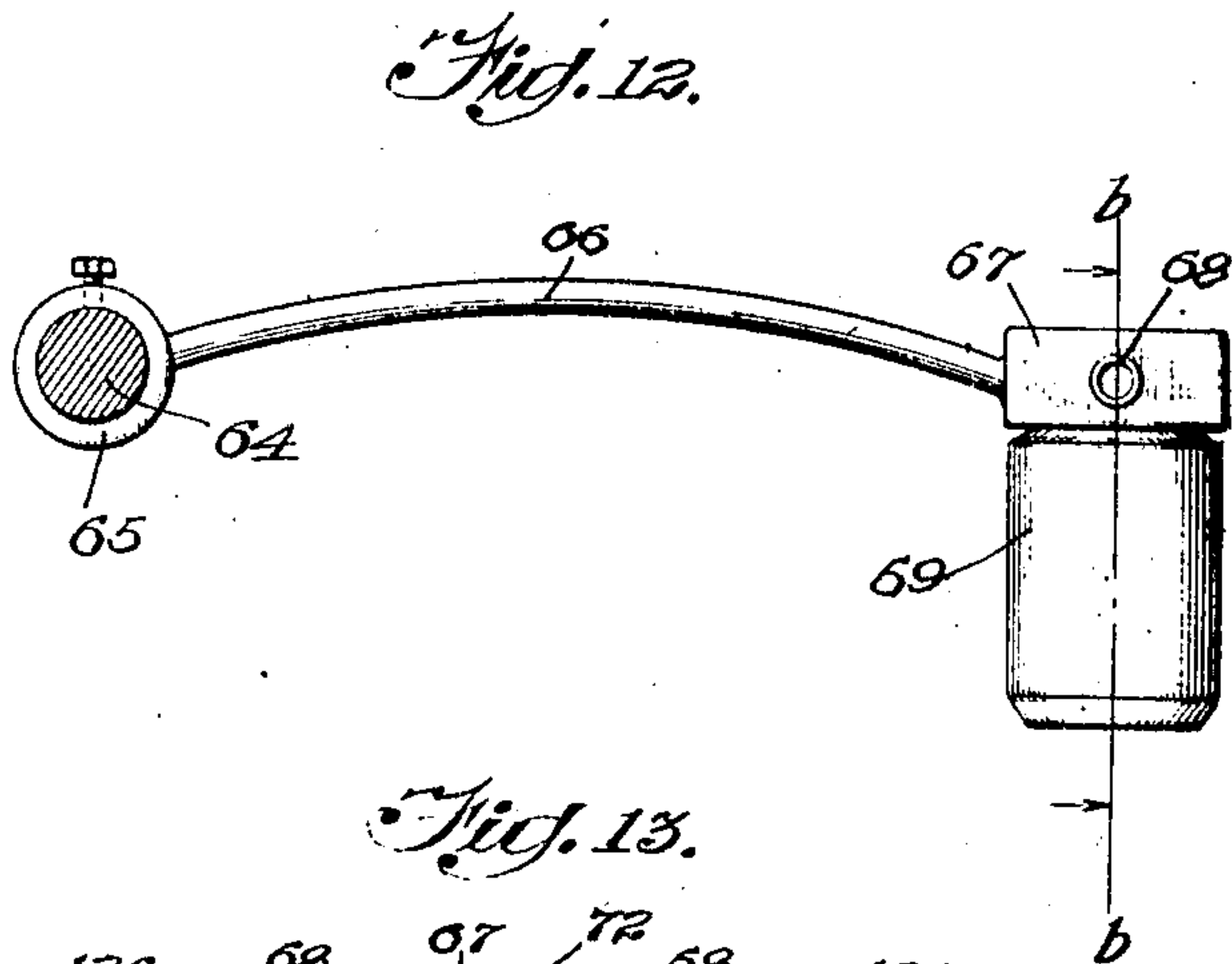
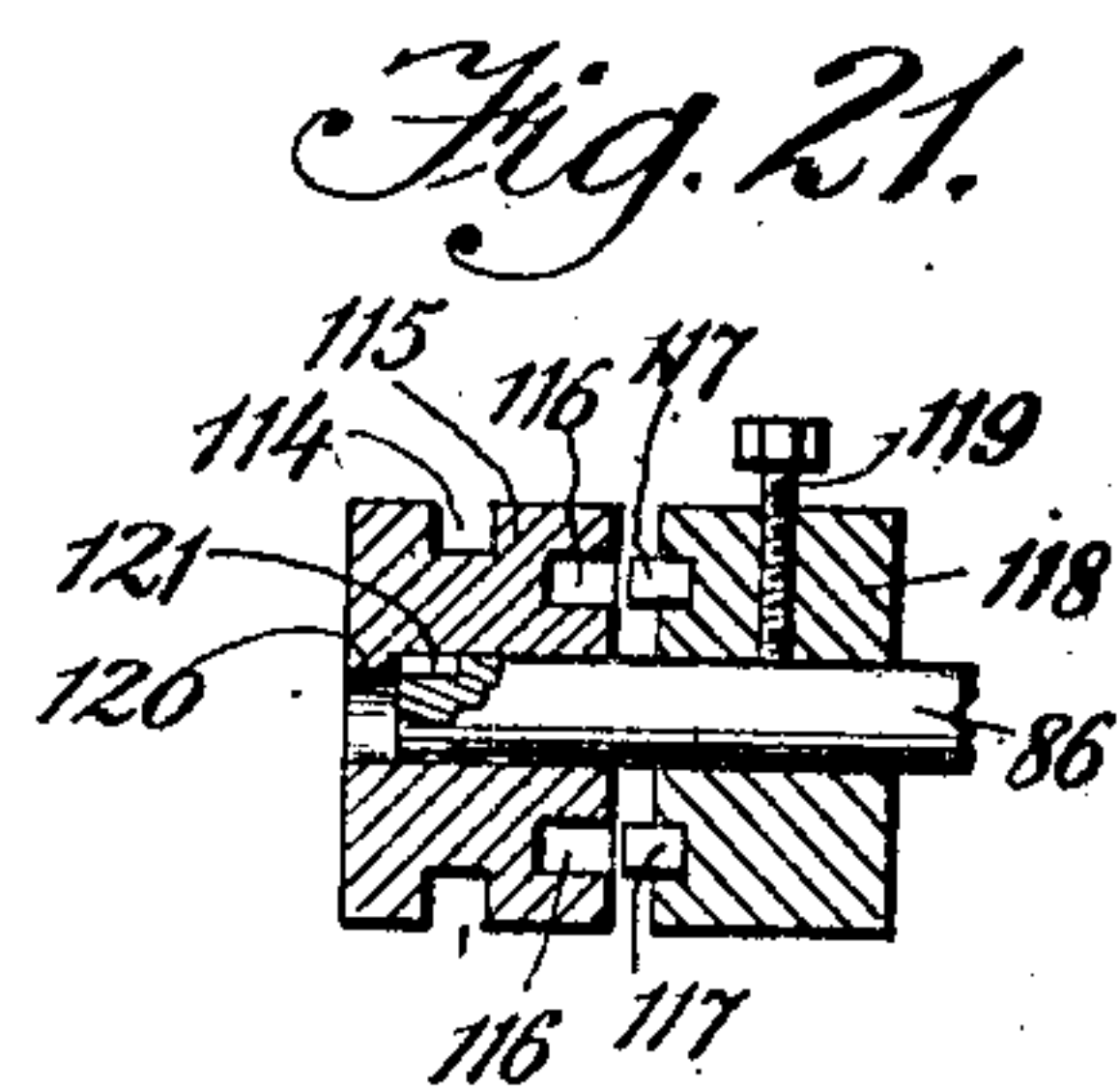
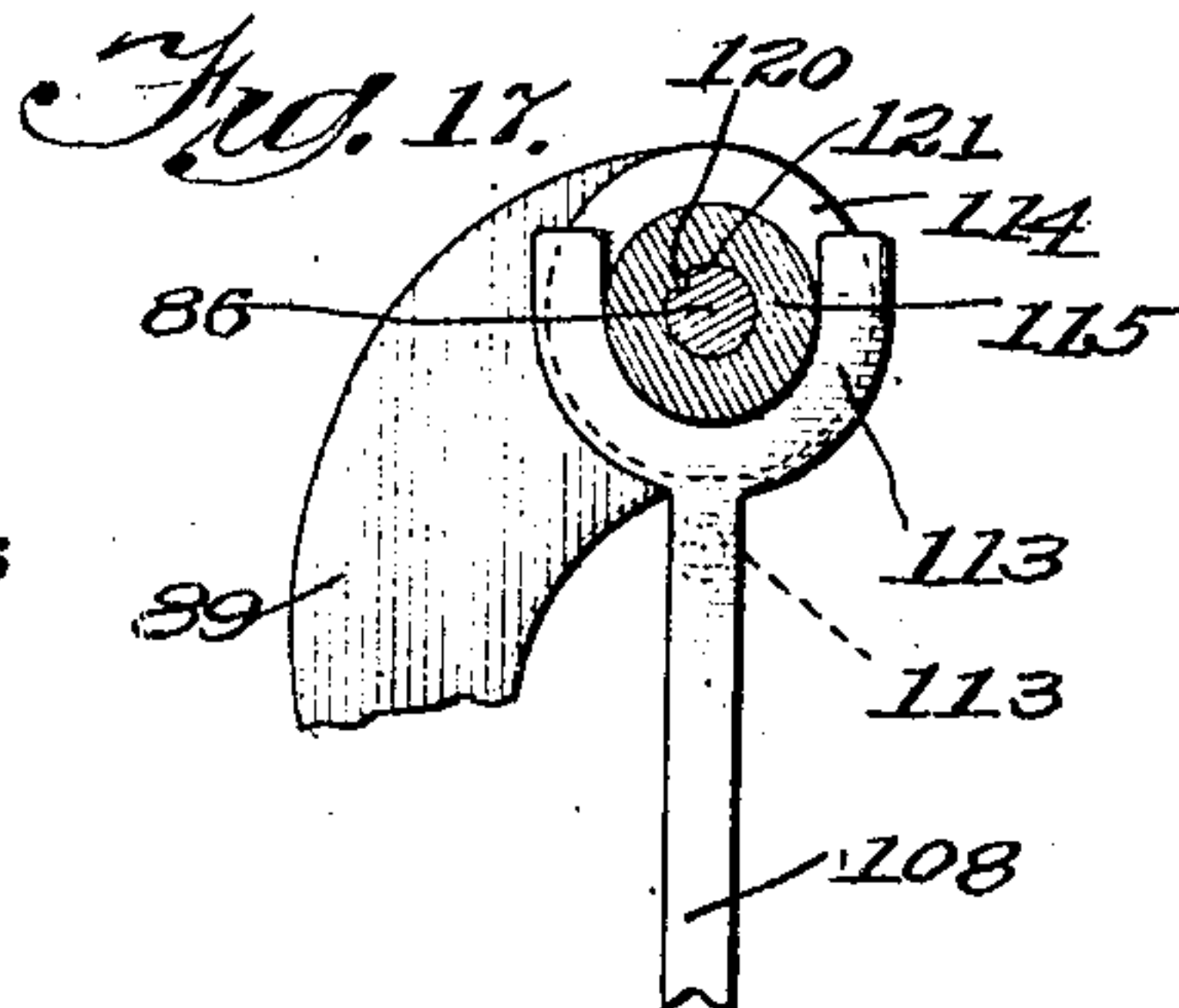
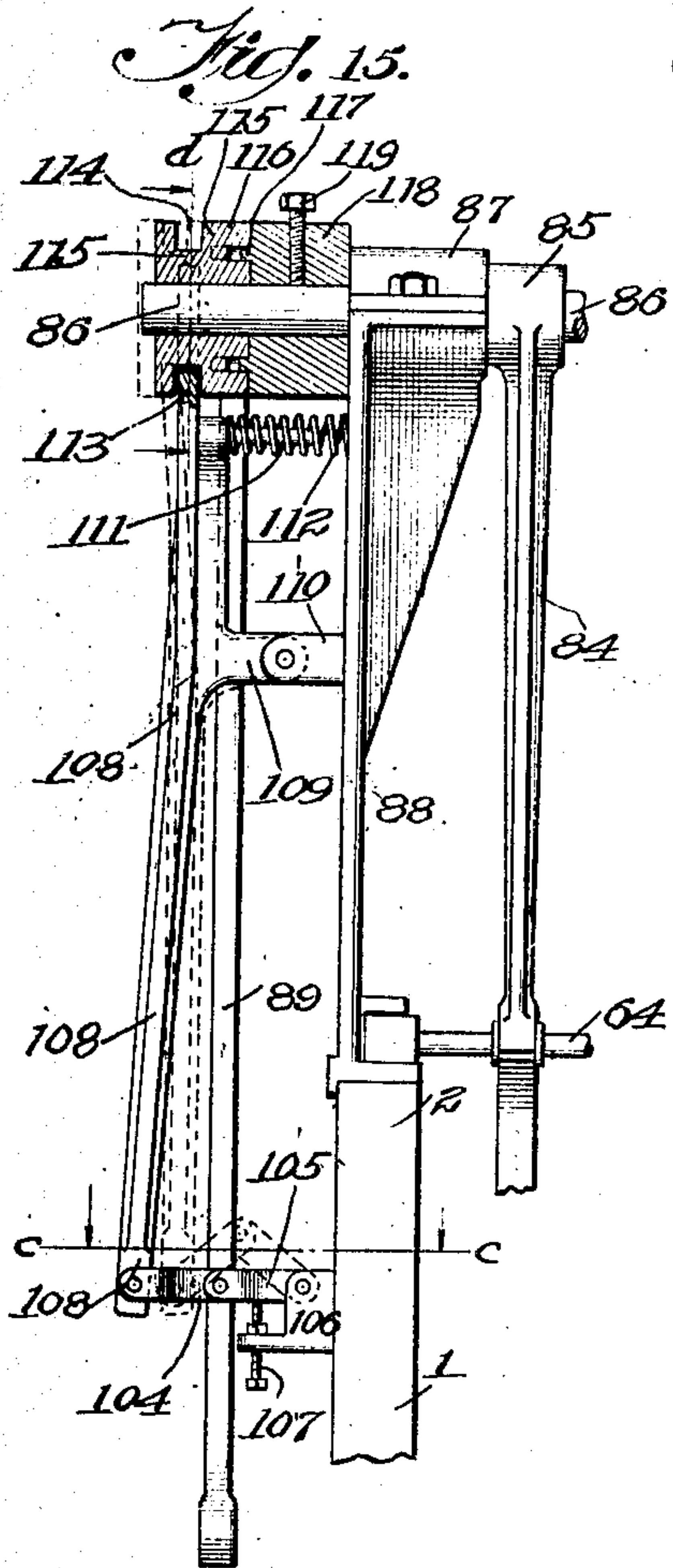
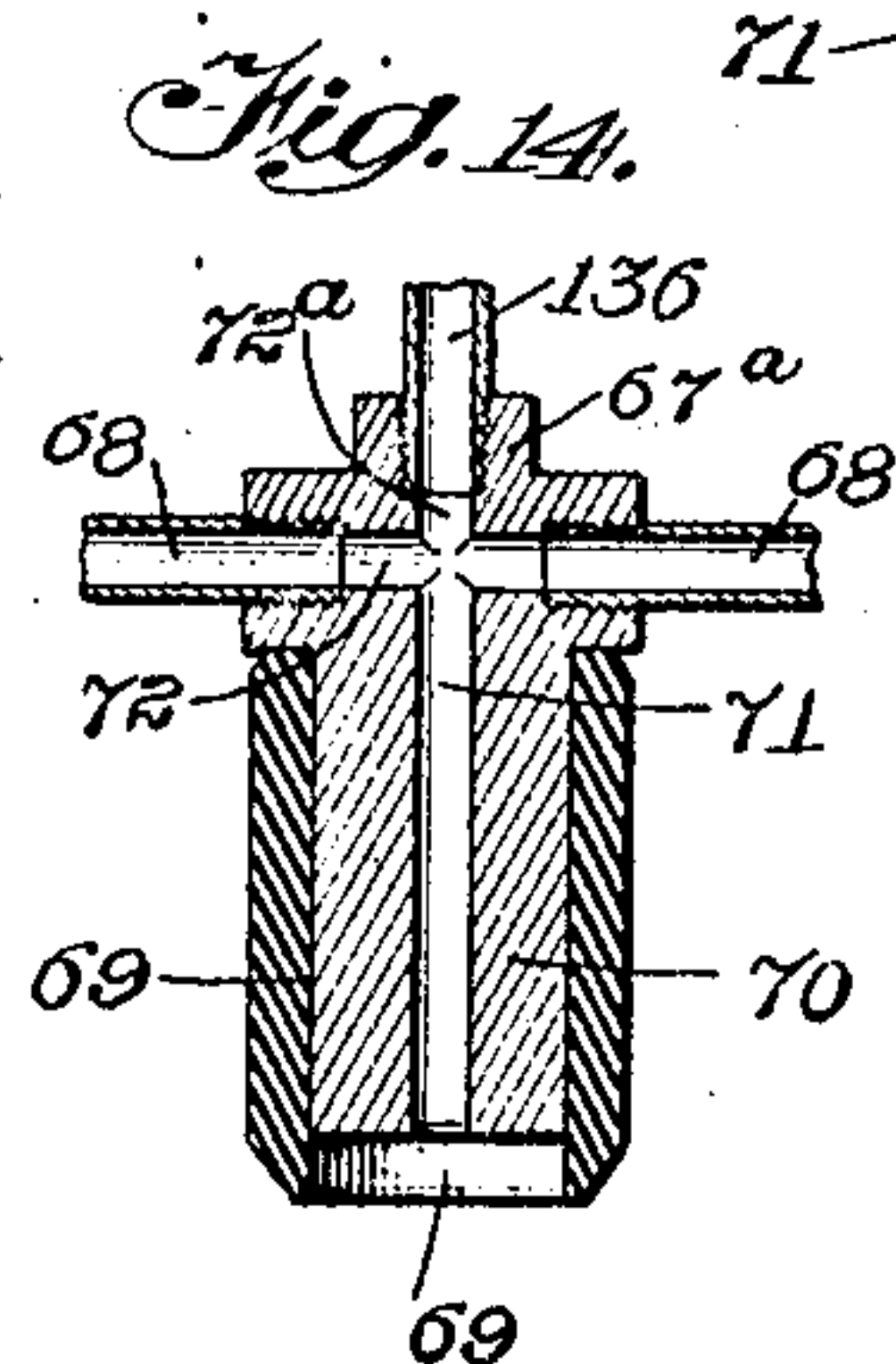
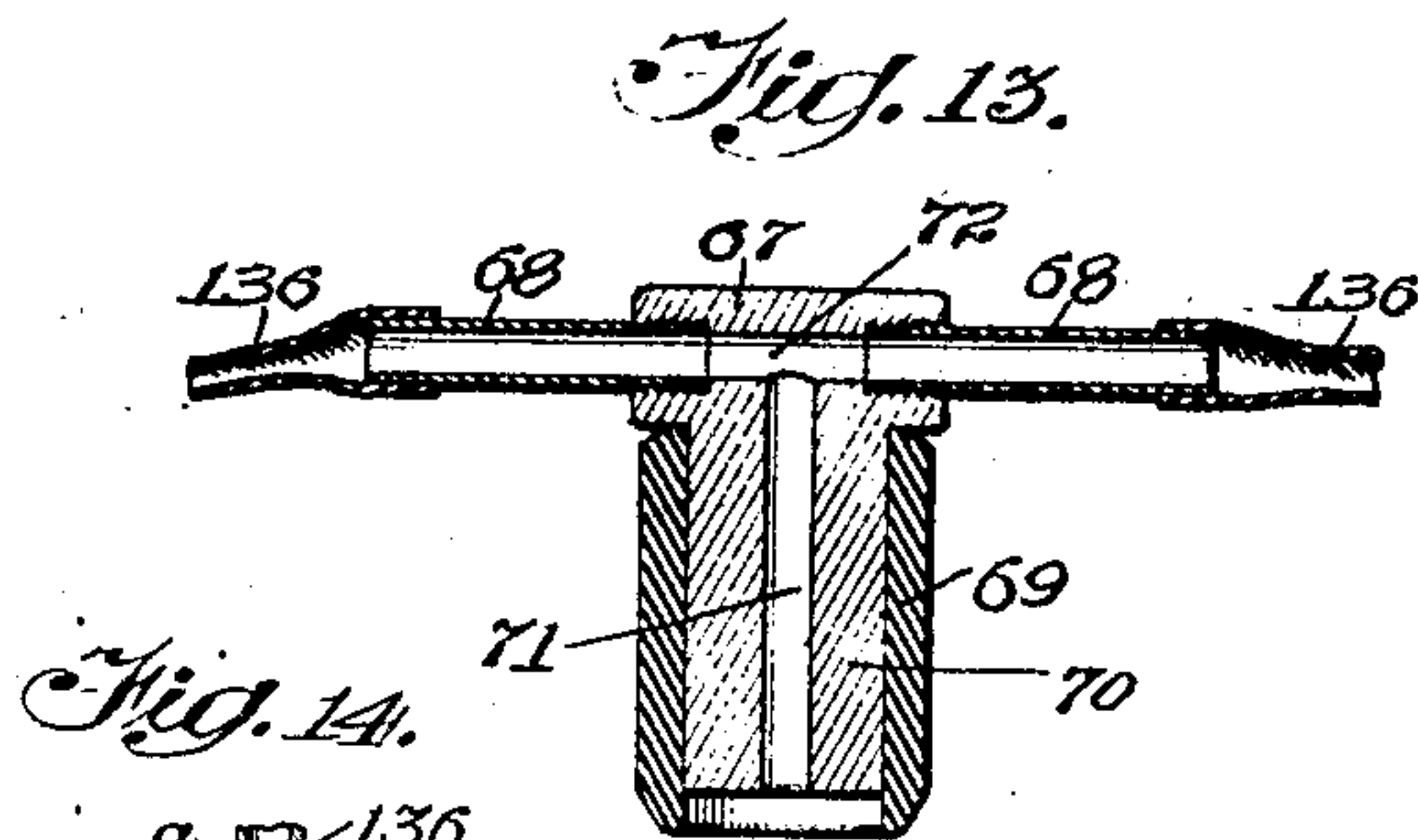
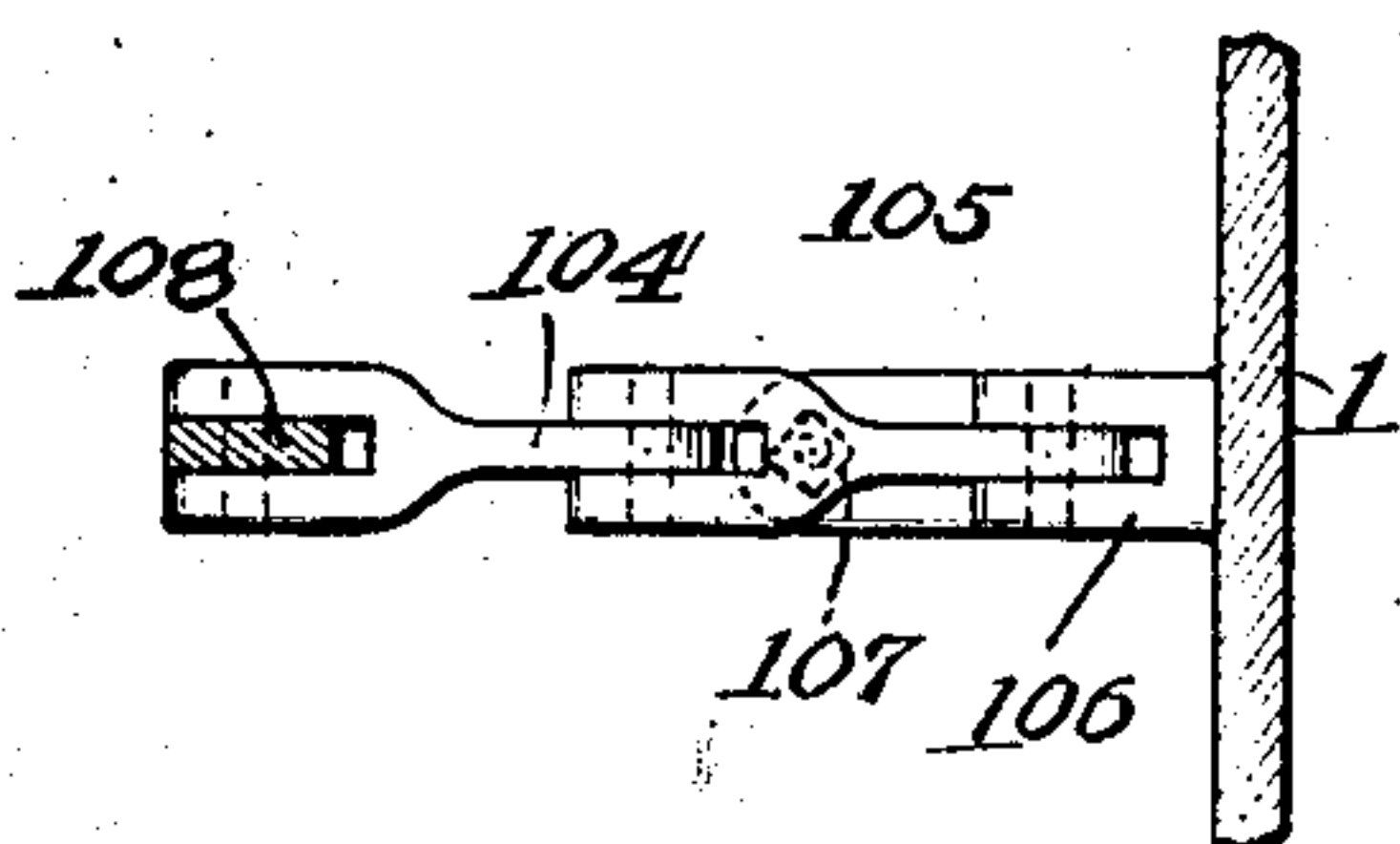


Fig. 16.



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UNITED STATES PATENT OFFICE.

ALVARO B. GRAHAM, OF CHICAGO, ILLINOIS.

PAPER-FEEDING MACHINE.

No. 871,498.

Specification of Letters Patent.

Patented Nov. 19, 1907.

Application filed December 31, 1903. Serial No. 187,371.

To all whom it may concern:

Be it known that I, ALVARO B. GRAHAM, 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 Paper-Feeding Machines, of which the following is a specification.

This invention relates to a paper feeding or sheet delivery mechanism more especially intended for use in delivering or feeding paper sheet by sheet from a pile or stack to a printing press, folding machine or other appliance; and has for its objects to insure the delivery or feeding of but one sheet of paper at a single operation of the feeding or delivery devices; to positively separate a single sheet, which is the top sheet in each instance, from a stack or pile of paper without liability of carrying with the top or delivered sheet the second or following sheet on the pile or stack; to give the feeding mechanism an action by which the rear corners of the top or to be delivered sheet will be carried inwardly to release the corners from the remaining sheets of the pile or stack, and free the top or to be delivered sheet for the delivery or feeding thereof; to improve the construction and operation of the devices by which the buckling or inward movement of the rear corners of the sheet is attained; to buckle or inwardly move the rear corners of the top sheet by the employment of suction, supplied through suction cups which operate to raise and carry inward or buckle the corners of the sheet and release the rear corners at the proper time for the advance or delivery of the sheet; to improve the construction and operation of the retainers for holding the rear corners of the sheets of the stack or pile when the top sheet is being buckled or carried inwardly at its rear corners; to improve the construction and operation of the forward feed devices employing for that purpose suction cups which are advanced after the forward or leading edge of the sheet has been raised and held by the cups; to automatically throw the feeding mechanism out of operation in case of doubling or an improper feeding of the sheet; to improve the construction and operation of the mechanism for raising the carrying table of the stack or pile of sheets; to improve the construction and operation of the suction pump for the vacuum cup operating on the rear and front of the sheet; and to improve generally the construction and operation of the several devices and appliances which en-

ter into the machine or mechanism as a whole.

The invention consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings Figure 1 is a top or plan view of the machine or mechanism of the invention; Fig. 2 an end elevation with the lower portion of the frame broken off; Fig. 3 a sectional elevation on line *a a* of Fig. 1 looking in the direction of the arrow; Fig. 4 a top or plan view of the suction cup and its operating devices or mechanism for buckling or moving inwardly the rear corners of the top sheet; Fig. 5 a side elevation of the devices of Fig. 4, showing the parts in their normal position; Fig. 6 a side elevation of the devices of Fig. 4, showing the parts at the commencement of their initial movement for buckling or moving inwardly the rear corner of the top sheet; Fig. 7 a side elevation of the devices of Fig. 4, showing the parts at the completion of the buckling or moving inwardly of the rear corners of the sheet; Fig. 8 a top or plan view, showing a modified construction of the suction cup and the devices for buckling or inwardly moving the rear corners of the sheet; Fig. 9 a side elevation of the devices of Fig. 8, showing the parts in normal position; Fig. 10 a side elevation of the devices of Fig. 8, showing the parts at the commencement of the movement to buckle or inwardly move the corner of the sheet; Fig. 11 a side elevation of the devices of Fig. 8 showing the parts at the completion of the buckling or inwardly moving of the corner of the sheet; Fig. 12 a side elevation of one of the suction cups for the forward or leading edge of the sheet, showing its connection to the rock shaft by which it is raised and lowered with the rock shaft in section; Fig. 13 a sectional elevation of the suction cup shown in Fig. 12, taken on line *b b* of said figure; Fig. 14 a sectional elevation showing a modification in the construction of the suction cups for the forward or leading edge of the sheet; Fig. 15 a side elevation partly in section of the devices for automatically throwing the machine or mechanism out of operation; Fig. 16 a detail partly in section of the trip links for releasing the clutch of the device shown in Fig. 15, taken on line *c c* of said figure; Fig. 17 a detail on line *d*, showing the portion of the forked arm for moving the clutch of the device shown in Fig. 15 into and out of engagement; Fig. 18

a detail, showing the clamp for attaching the actuating rod of the rock shaft for the front suction cups to the vibratable arm operated for the movements of the parts of the rear suction cup; Fig. 19 a cross section on line e e of Fig. 18, looking in the direction of the arrow; Fig. 20 a detail, being a side elevation of the cam or incline and the arm for oscillating the rocking shaft carrying the front vacuum cups; and Fig. 21 a detail in section of the clutch device for the forked arm shown in Fig. 15.

The machine is constructed with a frame or end support 1 for each end thereof; and each frame or end support has a top rail 2, formed with which or secured to which at a point rearwardly of the longitudinal center is a socket or bearing 3 into which is entered a pin 4, which pin projects above the socket and has secured thereto a slotted socket or clamp 5, having on each side of its slot or opening ears 6 for the passage of the stem of a clamping bolt 7 by which the socket or clamp is fixedly secured to the pin. An arm 8 extends from the socket or clamp 5 and this arm has longitudinally therein a slot 9, through which passes a clamping bolt 10, the stem of the bolt also passing through a slot 11 in a plate 12, which slot has a straight and curved formation for the plate to assume different angling relations to the arm. It is to be understood that the parts so far described are duplicated on each end of the machine and that the devices carried by the plate 12 are likewise duplicated for each end of the machine, so that a description of one side, as to the devices, will be a description of both sides.

The plate 12 has an extension or nose 13, the extreme end of which has a depression 14, and extending from the nose back over onto the body of the plate 12 on each side is a rib or flange 15, forming a guideway between the two ribs or flanges, in which is located a sliding head or block 16, having at its forward or inner end ears 17 between which is pivotally mounted an eye or socket 18 of an arm 19, extending forwardly or inwardly over the nose or extension 13 and having its forward end downwardly turned and formed into a head 20 having a chamber into which leads a nipple 21, and the head 20 has attached thereto a suction cup 22, made of rubber or other suitable material, with its acting end or edge beveled, in the arrangement shown, to furnish a bearing edge against which a sheet of paper will be drawn and held at its corner.

The plate 12 has extending up therefrom an ear 23 projecting laterally from which is a pin or journal 24, which is encircled by a sleeve 25 at the end of an arm 26, which arm extends forward over the plate, and its forward end is downwardly turned and terminates in a head 27 into which is entered a

threaded stem 28 having a head 29, which head, when the parts are normal or at rest, presses against the stack or pile of papers, and, as shown, after the stem 28 has been correctly adjusted for its head to act properly, it is locked and held in its adjusted position by a lock or jam nut 30 abutting against the head. The construction shown in Figs. 4, 5, 6 and 7 has a head only, but in the construction shown in Figs. 8, 9, 10 and 11, the head has extending out therefrom a foot or plate 29^a giving a greater bearing on the sheets of paper. The adjustment of the stem 28 should be one to give the head 29, or the head with the foot 29^a, a bearing on the sheets which will serve to hold the corners down, after the top sheet has been raised by the action of the suction cup, and while the first sheet is being carried forward for delivery, after the release of its rear corners from the suction cups, so as to prevent the second sheet from being carried forward with the first sheet.

An ear 31 extends upwardly from the slide 16 and has a pivot extending laterally therefrom to which is pivoted the rear end of an arm 32, which arm extends forward and over the plate 12 and has on its inner side face a cam or double inclined block 33 with which an anti-friction roller 34, carried by the arm 26, engages for the travel of the roller over the cam or inclined faces of the block to raise the arm 26 and with it the presser head or foot 29 clear of the stack or pile of paper, as shown in Fig. 6, clearing the presser head or foot from engagement with the sheets of paper so that the corner of the first sheet is perfectly free to be raised up by the action of the suction cup, and with the passage of the roller down the opposite side or inclined face of the cam or block, the arm is returned to its normal position for the presser head or foot to bear on the stack or pile of sheets. The arm 26 with its presser head or foot is returned to normal position, in the arrangement shown, by a spring 35 coiled around the sleeve or socket of the arm 26; one end 36 of which spring bears against the face of the plate 12 and the other end 37 of which extends parallel with the arm 26 and engages with a stop 38 on the arm 26, so that with the raising of the arm 26 the end 37 of the spring is under a tension, which acts as the roller 34 passes down the inclined face of the cam or block 33 to force or carry down the arm 26 for the presser head or foot to bear against the pile or stack of paper. The spring is held on the sleeve or socket and the socket is held on its journal pin or pivot 24 by a stop screw 39, but these parts could be otherwise held in place.

The depression 14 of the neck or extension 13 has located therein a block 40 to which is pivoted the rear end of an arm 41 on which is a bar or plate 42, having a rear-

ward and upward inclination and extending over the end of the arm 32 so that when the outer end of the arm 32 is raised, by the engagement of the under face of the cam or block 33 with the roller 34, it will engage with the under face of the inclined bar or plate 42 and raise the arm 41; and the arm 41 will drop to normal position when the roller 34 clears the under face of the cam or block 33, with the limit of the rearward movement of the slide 16 which carries the arm 32, the arms 26 and 41 rising and falling from their pivotal connection to the plate 12 and the neck or extension 13 of said plate.

15 The outer end of the arm 41 has depending therefrom a rod or stem 43 on the lower end of which is a clamp or presser head 44 which, when the arm 41 is down, presses against the pile or stack of paper at a point forward of the rear corners, which point furnishes the defining line for the buckling or inward movement of the corners, as shown in Figs. 4 to 11 both inclusive.

The rod or stem 43, in the construction shown in Figs. 4, 5, 6 and 7, has thereon an adjustable collar 45, extending laterally from which is a rod or stem 46 which, as shown, is threaded at its inner end to enter a boss on the collar or sleeve 45 for the end of the rod or stem 46 to furnish the means of locking the sleeve or collar 45 in its adjusted position on the rod or stem 43. The outer end of the laterally extending rod or stem 46 has a nicked head, in the construction shown, for turning the rod or stem; and the rod or stem adjacent to the head is engaged by an arm or bar 47, the under face 48 of which is inclined and rides on the face of the rod or stem 46, as shown in Figs. 4 and 5, for instance. The rear end of the arm or bar 47 is fixedly attached to the arm 19 carrying the suction cup, so that with the forward movement of the slide 16 the inclined face 48 of the arm or bar 47 will act to raise the cup from its normal position shown in Fig. 5 to its full raised position shown in Fig. 7, and with the receding movement of the slide 16, the arm or bar 47 by its inclined under face 48 allows the suction cup to drop from its full raised position shown in Fig. 7 to its normal position shown in Fig. 5, thus giving the suction cup its rising and falling movement and its inward and outward travel to buckle or move inwardly the corner of the top sheet of paper.

The construction shown in Figs. 8, 9, 10 and 11 differs from the construction shown in Figs. 4, 5, 6 and 7 in that the actuating arm or bar 41 for the suction cup is inclined or has a diagonal run instead of being straight, and instead of a laterally adjustable rod or stem the bar or arm 41 of the construction shown in Figs. 8 to 11 inclusive has a laterally extending plate or bar 45^a, extending rearwardly from which are plates or

bars 46^a with a space between the two plates or bars 46^a in which is located a slide 47^a which rides on the bars 46^a and is attached to the head 20 of the suction cup. The head 20 of the suction cup has ears 20^a between which is pivoted by a suitable pin or pivot 20^b, the downwardly turned end of an arm 19^a corresponding to the arm 19 and pivoted between ears 17 on the slide 16. The bars 46^a have an upward inclination, when the presser head 44 is resting on the stack of paper as shown in Fig. 9, and with the forward movement of the slide 16, the slide 47^a moves outwardly on the guide bars 46^a, and such outward movement, owing to the upward inclination of the side bars, acts to raise the suction cup 22 with the sheet of paper caught and held against its acting end face, and to buckle or move inward the corner of the sheet, as shown in Fig. 10, such movement continuing until the bars assume the position shown in Fig. 11, at which time the corner of the sheet is released from the suction cup and the rear edge of the sheet is free of the stack of sheets so that the upper sheet can be fed forward by the front feeding devices. The arm 41 with its presser head 44 is raised by contact with the end of the arm 32, as the roller 34 passes under the cam block 33, freeing the upper sheet of paper from the presser head 44 to be fed forward by the front feeding mechanism.

A stud or pin 49 extends up from the plate 12 and has mounted thereon a socket or bearing 50, extending laterally from which on one side is an arm 51 having in its outer end a slot 52 into which is entered a pin 53 upwardly projecting from the slide 16, and by which arm with its slot and the pin, the slide is reciprocated, the return movement of the slide being limited, as shown, by a stop pin 12^a on the plate 12 at the outer or rear end of the slideway. An arm 54 extends laterally from the side of the socket or bearing 50 and its outer end has an upwardly extending pin 55 which receives a block or head 56 having on one side ears 57 between which is located a block 58, and on the block or head 56 and one of the ears 57 are ears 59, between which is pivoted one end of a finger piece or lever 60, having a depending wedge 61 which enters the spaces between the head or block 56 and the block 58 and furnishes the means for moving the block 58 outwardly, so that the blocks 56 and 58 in connection with the finger piece or lever and its wedge form a clamp.

A rod 62 at its rear end passes through the ears 57 and the block 58 so that when the block is forced outward by the depression of the finger piece or lever 60 through the action of the wedge 61, the end of the rod will be tightly clamped and held by the block and ears connecting the rod 62 with the slide 16 through the pivoted or rocking arms 51

and 54, by which the reciprocating movements of the slide 16 will be given from the reciprocation of the rod 62 forward and backward. The forward end of the rod 62 is secured in a boss 63^a on a socket or sleeve 63, attached to a shaft 64 by a set screw or otherwise, by which the socket or sleeve can be properly adjusted on the shaft. The shaft 64 has secured thereto a socket or sleeve 65 by a set screw or otherwise, and extending out from this socket or sleeve is a rod or arm 66, the outer end of which has secured thereto a head 67 carrying a suction cup.

The construction shown in Fig. 1 has three rods or arms 66 and three heads 67 and, as shown, one of the end heads and the center head has laterally projecting nipples 68, and the other end head has a single lateral nipple 68, for the attachment to the nipples of a hose or pipe leading to a suction pump. The construction of head 67 in one form, being the form shown on Fig. 1 of the drawing for the two-nipple head is detailed in Figs. 12 and 13, and in this construction the head 67 carries the suction cup 69, in the shape of a rubber tube encircling a center 70 depending from the head, with the acting end of the tube beveled to form a proper edge for engaging the sheet of paper. The center 70 has a central hole or bore 71, which communicates with a cross hole or bore 72 in alignment with the attaching nipples 68, and below the center 70 within the tube is a chamber formed by the projecting end of the tube.

A modification of the suction cup is shown in Fig. 14, in which the head has a central boss 67^a for the attachment of the hose or tube, and extending through this boss is a central hole or bore 72^a in communication with the cross hole or bore 72. This form of cup can be used for the central cup in the arrangement of Fig. 1, and when so used the end cups can be provided with a single nipple 68, as in the cup shown at the left hand of Fig. 1.

The shaft 64 is to be rocked or oscillated with the forward and backward movement of the rod 62 so as to raise and lower the front suction cups. The construction shown for rocking or oscillating the shaft 64 is a split socket 73 having, on each side of the split, ears 74 for the passage of a clamping bolt 75 by means of which the socket can be adjusted on the shaft and securely locked thereto, and extending from the shaft is an arm 76 the outer end of which has journaled thereon by a suitable pin or pivot a roller 77, which roller engages with and rides up on a cam 78 having its opposite faces inclined as shown in Fig. 20, and this cam is carried by a plate 79 attached by bolts 79^a to the top rail 2 of the end frame 1, in the construction shown. A guard 80, corresponding in shape to the shape of the cam 78 is located above the cam and is carried by a plate 81 attached to the top rail 2

of the end frame, and between the cam 78 and the guard 80 is a passage 82 for the travel of the roller, so that in its travel the roller will be held in the passageway and be given an upward and downward direction of travel by which the outer end of the arm 76 will be raised and dropped to rock the shaft 64, the roller in the forward movement of the arm traveling in the passageway 82 and in the return movement of the arm traveling over the exterior face of the guard 80, as shown by the dotted lines in Fig. 20. The rock shaft 64 with the arm 76 in normal position, as shown by the full lines in Fig. 20, carries the front suction cups in contact or close relation to the sheet of paper; the advance of the rock shaft 64, and with it the arm 76 causes the roller to ride up the rear incline of the cam initially raising the suction cups with the paper held thereby, and, as the roller passes down the forward incline of the cam the cups drop slightly and are raised to their full limit with the riding of the roller up the front incline of the guard 80 with the receding movement of the arm and are dropped to normal position with the travel of the roller down on the rear face of the guard, the suction cup releasing the paper at the terminus of the forward travel of the roller in its partially dropped position so that on the return movement the sheet of paper will have been dropped and the suction cups are non-operative.

The rock shaft 64 is straddled by a fork 83 on the end of an arm 84 so that the forward and backward movements of the shaft 64 will be given thereto as the arm 84 is oscillated or vibrated. The upper end of the arm 84 terminates in a socket 85 attached by a set bolt or screw or otherwise to a rock shaft 86 for the vibrating or oscillating movements of the arm 84 to be given thereto by the rock of the shaft 86. The shaft 86 is journaled at each end in suitable journal boxes 87 on uprights or frame pieces 88, attached to the top rails of the end frames, one upright at each end of the machine, and one end of the rock shaft 86 projects beyond its journal box and has hung or suspended therefrom a lever 89, the lower end of which is connected by a pin or pivot 90 with the end of a pitman 91, reciprocated in any suitable manner so as to vibrate or oscillate the lever 89, and to the pin or pivot 90 is connected one end of a link 92, the other end of which is pivotally connected with the end of a piston rod 93 for reciprocating a piston in the cylinder of a suction pump 94, which pump, in the arrangement shown, is attached to the end frame 1 of the machine. The pump at its acting end has a nipple 95, connected with which is a hose 96 the other end of which is connected with a nipple 97 having communication with a cylinder 98, open at the opposite end to that having the nipple.

The cylinder 98 has therein a piston attached to a piston rod 99, the outer end of which is forked and pivotally connected to an arm 100 extending up from a sleeve 101 mounted on a journal pin 102, from which sleeve extends a trip arm 103, the point of which is arranged to strike the under side of toggle links 104 and 105 at the central point of pivot of such links and raise the links from their normal position, shown in full line in Fig. 15, to the position shown by the dotted lines in said figure. The outer end of the link 105 is pivotally connected to a bracket 106 having an ear through which passes an adjusting screw 107 by means of which the links are held from dropping down below a straight line, as shown in Fig. 15. The free end of the link 104 is pivotally attached to a lever 108, which lever has a lateral ear 109, pivotally connected to an ear or bracket 110 so that the lever can be oscillated or vibrated toward and from the end of the frame; the upper end of the lever has projecting out therefrom a pin 111 encircled by a coiled spring, one end of the spring bearing against the face of the lever and the other end against the face of the upright 88, by means of which spring the lever is returned to normal position. The upper end of the lever has a fork or stirrup 113 which is entered into a circumferential groove 114 in the head 115 carrying the arm 89, so that with the outward throw of the forked end of the lever 108, the head will be moved or slide outward on the end of the shaft 86, disengaging the connection of the arm 89 with the shaft. The head 115, in the arrangement shown, is engaged with the shaft by holes 116 in its inner face which engage pins 117 on a collar 118 locked to the shaft 86 by a set bolt 119 or otherwise, so that when the parts are normal and the pins 117 are engaged with the holes 116, the shaft 86 will be rocked from the vibration of the arm or lever 89 and cause the arm 84 to advance and recede the rock shaft 64 to give the required throw for operating the front suction cups and the devices by which the corner suction cups for the rear of the sheet are operated. The disengagement of the head 115 from the collar 118 allows the arm or lever to vibrate without rocking the shaft 86, and, as shown, the sliding head 115 is held in proper relation on the end of the shaft 86 by a tongue 120 entering a groove 121 in the shaft, as shown in Fig. 21, for the tongue and groove to be disengaged when the head is moved back and to be engaged when the head is moved forward.

An arm 122 is attached at its upper end to the shaft 64 and its lower end is connected by a pivoted link 123 with the end of an arm 124, having a sleeve 125 mounted on a journal pin 126 extending out from the end frame and the sleeve 125 has extending out therefrom an arm 127, the outer end of

which is connected by a pivotal link 128 with the piston rod 129 of a piston in the cylinder of a vacuum pump 130 attached to the end frame of the machine. The pump 130 at its upper end has a nipple 131 to which is connected the end of a hose 132 which hose is connected with the nipples 21 of the heads 20 carrying the suction cups 22, the hose in the arrangement shown consisting of two sections, one section leading to the head of one suction cup and the other section connecting the heads of the two suction cups, as shown in Fig. 1. The lower end of the suction pump 130 has a nipple 133 connected with which is a pipe 134, extending laterally and upwardly and having at its upper end a nipple 135 connected with which is the end of a hose 136, the hose leading to and having connection with the heads 67 through the nipples 68 for the front suction cups; and, as shown in Fig. 1, the hose 136 leads to the head of the end suction cup, and sections of hose 136^a connect the heads of the other suction cups, but the hose 136, with the construction of head shown in Fig. 14, would be connected with the center suction cup and that suction cup would be connected by hose sections 136^a with the end cups. The cylinder 98 at its closed end, has a nipple 137 leading from which is a hose 138 connected with the end of a vertical pipe 139, the upper end of which terminates below the plane of travel of the front suction cups; and, as shown, the pipe 139 is held by a bracket 140 attached to a cross piece 141 on the frame. This pipe, with its open end below the plane of travel of the top or delivered sheet, furnishes a means for automatically stopping the mechanism in case of a failure of the suction cups at the front side of the machine to engage and carry forward the top sheet, as with the release of a top sheet such sheet would drop over the open end of the tube 139 and shut off the inflow of air through the tube to the cylinder 98, and with the stoppage of such inflow a vacuum would be created in front of the piston of the cylinder 98 by which the pressure on the piston at the open end of the cylinder would move the piston inward and, through the piston rod 99 and arms 100 and 103, trip the links 104 and 105 for the spring 112 to act and throw the upper end of the lever 108 outward, disengaging the head 115 from the collar 118 and stopping the rocking of the shaft 86 and the parts actuated therefrom.

The rock shaft 86 has fixedly secured thereto an arm 142 to the upper end of which is pivoted a link or bar 143, having its outer end pivotally connected with a slide 144, movable on a standard or lever 146 and adjustable thereon to different lengths, and when adjusted, locked thereto by a set bolt 145, so that the throw of the arm 142 for-

ward and backward at its outer end, from the rock of the shaft 86, will give the standard or lever a corresponding movement by which the lever 146 will be moved vertically downward and upward. The standard or lever 146, at its lower end, has a pin or pivot 147 connecting it with the outer end of an arm 148, extending out from a socket 149, pivotally mounted on a shaft 150, and fixedly attached to the shaft 150; and adjacent to the socket and arm is a ratchet wheel 151 engaged by a pawl 152, pivotally attached to the standard or lever 146 at a point above the pivot 147 by which the standard or lever and the swinging arm 148 are connected together. The arrangement is one by which the forward or front throw of the arm 142 from the rock shaft 86, as shown by the dotted lines in Fig. 3, will give the standard or lever 146 a downward throw or movement, carrying with it the pawl 152, for the pawl to act and advance the ratchet wheel one or more notches, giving the shaft 150 an intermittent rotation. The rearward or return throw of the arm 142 from the rock shaft, as shown by the full lines in Figs. 2 and 3, will give the standard or lever 146 an upward throw or movement, carrying with it the pawl 152, for the pawl to pass over one or more teeth or notches in the ratchet wheel and into position for the next forward or front throw of the arm 142 to cause the pawl to act and advance the ratchet wheel and give the shaft 150 another partial rotation.

The intermittently revolving shaft 150, at each end thereof, has a bevel gear 153, which meshes with a bevel gear 154 on the end of a vertical shaft 155, which shaft has an exterior screw thread nearly its entire length. The shaft 155 is mounted in suitable journal boxes 156 and passes through a head 157, having a guide extension 158 and connected with a plate 159 attached to the under side of a platform or table 160 on which the stack or pile of the sheets of paper is placed.

The vertical shafts 155 are given an intermittent rotation from the intermittently revolving shaft 150, and this rotation of the shafts 155 through the threaded heads 157 operates to raise the table 160 a graduated distance, in each instance, corresponding to the thickness of a sheet of paper so that the top of the pile or stack of sheets will be in a correlation with the suction cups as to cause the suction cups to act and deliver the top sheet with each full movement of the feeding mechanism. An arm 161 extends out from the standard or lever 146 and this arm has a downward and upward movement given thereto coincident with the down- and up-movement of the standard or lever and at its outer end, has secured thereto a rod 162, held in adjusted position by a set nut 163 and having at its lower end a head 164 in which is pivoted the upper end of a rod 165, carry-

ing at its lower end a presser head 166, which is given a falling and rising movement from the arm 161, by which it is carried, and when down this presser head serves to hold the stack or pile of paper at the center while the rear corners of the top sheet are being buckled or moved inward, but with the release of the rear corners and the raising of the leading edge of the top sheet by the front suction cups, the presser head is raised, as shown by the full lines in Fig. 3, so that the top sheet is free to be fed forward and delivered. The down movement of the presser head is coincident with the down thrust of the pawl 152, in rotating the horizontal shaft 150 and operating the vertical shafts 155 to raise the table 160, and the movements of the presser head and the table are so timed and regulated as to cause the presser head to contact the top of the pile or stack of papers, when the table is raised into position for the first sheet to be removed by the action of the suction cups. The arm 161 has ears 167 on its under side between which is pivoted the upper end of a rod 168, carrying at its lower end a suction cup 169 connected by a hose 170 with the supply hose for the rear suction cups, and this suction cup 169 will act, if required, and raise the top sheet at the center so as to give the sheet a greater clearance and freedom in movement in being carried forward and delivered by the front suction cups.

The construction shown has the shafts 150 and 86 tied together by a yoke-shaped connection 171, the connection having on its side bars journal boxes or bearings 172 encircling the respective shafts so that in the operation of the machine one shaft can not be sprung or wobble to any great extent, as both shafts must move together and one shaft furnishes a support for the other. At the front of the machine, in the construction shown is a shaft 173 having thereon rollers 174 and furnishing a support for the leading edge of the sheet as it is carried forward by the front suction cups and for the body of the sheet as it is fed to the printing press, folder, or other mechanism or appliance.

The operation is as follows: The parts, as shown in Figs. 1, 2 and 3, are in their normal position or at rest; the movement of the pitman or connecting rod 91, in the direction away from the pump 94, carries with it the lower end of the arm or lever 89, rocking the shaft 86 in the direction to swing the lower end of the arm 84 forward or in the direction of the delivery side of the machine, at which time the rear suction cups have raised and buckled or moved inwardly the rear corners of the top sheet of paper and have reached the limit of their inward and upward movement, and released the rear corners of the sheet, freeing the rear edge of the top sheet from the remaining sheets of the pile or

stack for the top sheet to be moved forward or toward the delivery side of the machine at its leading edge, such edge having been caught and held against the face of the suction cups at the front or delivery side of the machine. The throw of the lower end of the arm 84 forwardly through the fork 83 straddling the shaft 64 moves the shaft forward or toward the delivery side of the machine, and such forward movement of the shaft through the lifting rods or arms 66, raises all of the suction cups at the front of the machine by reason of the travel of the roller 77 up the cam or incline 78, there being first an upward throw and then a downward throw and then a straight line throw given to the cups. The forward movement of the shaft 64 carries with it the arm 122, and through the link 123 moves the upper end of the arm 124 forward, raising the outer end of the arm 127 for the upward movement of such arm through the link 128 and piston rod 129 to create a vacuum in all of the front suction cups through the pipe 134 and hose 136 and 136^a, by which the leading edge of the top sheet will be drawn against the acting edges of the suction cups and be there held and carried forward with the forward movement of the cups, until the leading edge has passed beyond or over the guide shaft or rod 174 to enter the press, folder or other mechanism or appliance. The throw of the pitman or connecting rod 91 away from the pump carries with it the piston rod 93 traveling the piston in the pump cylinder correspondingly and creating a suction through the pipe 96 from the cylinder 98 in front of the piston in said cylinder without, however, creating a vacuum, as air is supplied to the cylinder from the pipe or tube 139, the upper end of which is open for the admission of air as long as the sheets of paper are fed forward and upheld at their leading edge in the feeding movement, with the result that the piston in the cylinder 98 remains in a fixed position and the trip for throwing the mechanism out of operation does not act.

The forward movement of the shaft 64, through the connecting rods 62 and the clamp connecting the rod 62 with the arm 54 carries the arm forward, giving a reverse movement to the arm 51 by which the slide 16 is carried rearward carrying with it the arm 19 and the suction cup 22, and also carrying with it the arm 32, the cup and arm being moved rearward from the position shown in Figs. 7 and 11; and during such movement the rear corners of the sheet are free from the action of the suction cup, and the leading edge of the sheet is caught and held up and moved forward, carrying with it the body of the sheet by the action of the front suction cup.

The return movement of the rear corner

suction cups is coincident with the forward movement of the front suction cups, and when the front suction cups have reached the limit of their forward throw and released the leading edge of the sheet, the rear corner suction cups, and the parts or elements coacting therewith, have returned to normal position, which is the position shown in Figs. 4, 5, 8 and 9, at which time the piston of the pump 130 has reached the limit of its forward throw and the shaft 64 has been carried forward to the limit of its front throw, and the pitman 91 has reached the limit of its forward or front throw. The rearward or return throw of the pitman or connecting rod 91 moves the arm or lever 89 rearwardly, rocking the shaft 86 in the opposite direction for the rock of the shaft to move the lower end of the arm 84 rearwardly, giving the shaft 64 a rearward or reverse travel and carrying the front suction cups with the top sheet of paper released therefrom rearward and in a raised position by reason of the travel of the roller 77 up and over the guard 80 until the limit of rearward throw of the pitman 91 is reached, when the parts come to the normal position shown in the figures. The rearward movement of the shaft 64 carries with it the arm 122, and through the link 123 moves the upper end of the arm 124 rearward, forcing down the outer end of the arm 123 and through the links 128 and 129 giving a reverse travel to the piston of the pump 130, creating a suction through the hose 132 in the rear corner suction cups, by which each rear corner of the top sheet will be brought against the acting edge of the suction cups and held thereagainst, during the upward and inward movement of the rear corner suction cups. The return travel of the shaft 64 through the connecting rods 62 moves each arm 54 rearward, throwing the outer end of each arm 51 inwardly, each arm carrying therewith its slide 16. The inward movement of the slide 16 carries inwardly the arm 19 with its suction cup 22 and the arm 32 with its cam or block 33, for the inclined faces of the cam or block to raise first the arm 26, raising the presser head or foot 29 to release the corner of the upper sheet of paper, freeing the corner for the buckling or inward movement thereof with the upward and inward travel of the suction cup; and during this upward and inward travel of the suction cup 22 the arm 41 remains in its normal position with its presser head 44 resting on the pile or stack of papers for the lateral support 46 to be engaged by the inclined under face 48 of the arm 47 to raise or carry up the arm 19 with its suction cup 22 for the construction shown in Figs. 4, 5, 6, and 7 or for the slide 47^a to travel on the inclined bars 46^a and raise the suction cup 22. The arm 26 is held in its raised position until the roller has been engaged by both sides of the cam or incline and the cam or incline has passed the

roller, leaving the roller free to drop, at which time the slide 16 has reached the limit of its inward movement and the suction cup 22 has been raised to the limit of its upward movement. The return of the slide 16 to its normal position rearwardly with the forward throw of the shaft 64 as already described, carries the arm 19 with its suction cup 22 back to normal position, the cup falling by the descent of the incline 48 upon its lateral support, or the return of the slide 47^a on the bars 46^a, and at the commencement of the return movement of the slide 16 the roller has dropped so that the under face of the cam or block 33 will lie over the roller as the slide 16 returns, causing the roller to act and raise the inner end of the arm 32 for such inner end to strike the inclined bar 42 and raise the upper end of the arm 41 lifting the presser head 44 from the pile or stack of sheets, so that the top sheet is perfectly free at its rear portion to be carried forward by the action of the front suction cups as already described.

The shaft 86 has the arm 142 fixedly mounted thereon, so that the forward rock of the shaft 86 to carry the front suction cups rearward and to operate the rear suction cups, moves the upper end of the arm 142, and through the link 143 and slide 144, carries the upper end of the arm or lever 146 in the same direction, and at the same time, owing to the connection of the lever or arm 146 with the swinging arm 148, the lever or arm 146 and the swinging arm 148 are carried downward, and this downward movement of the arm or lever 146 and the arm 148 carries the pawl 152 downward, for the pawl to engage a notch or tooth of the ratchet wheel 151 and give the horizontal shaft 150 a partial rotation forward to the limit of the engagement of the pawl with the notch or tooth of the ratchet wheel. The rearward or return rock of the shaft 86 to carry forward the front suction cups and move outward the rear corner suction cups returns the arm 142 and the arm or lever 146 to normal position, as shown by the full lines in Figs. 2 and 3, and with such return of the arm 142 and the arm or lever 146 to normal position the lower end of the swinging arm 148 will be raised, carrying upward the pawl the distance required for its acting end to be in position to engage a notch or tooth of the ratchet wheel, for the next down or forward throw of the pawl to advance the ratchet wheel 151 giving the shaft 150 a further slight rotation in a forward direction. This action of the pawl will occur with each forward and return rock of the shaft 86, giving the shaft 150 an intermittent rotation, and the amount of forward rotation given to the shaft 150 at each advance or forward rotation thereof is just sufficient to move the table or platform 160, on which

the pile or stack of paper is supported, the distance of the thickness of a sheet of paper, so that the top sheet of paper, as each sheet is delivered, will be brought into position for the proper cooperation thereon of the front and rear suction cups. The forward throw of the arm 142 and with it the lever or arm 146 carries down the outer end of the arm 161 and with it the presser head 166, forcing and holding the presser head 166 on the stack or pile of papers through the rod 165, during the period of time in which the rear suction cups are buckling or moving inward the corners of the top sheet, and with the release of the rear corners and the engagement of the front suction cup with the leading edge of the sheet, the arms 142 and 146 return to normal position raising the outer ends of the arm 161, and lifting the presser head 166 clear of the stack or pile of papers, so that the top sheet is free to be moved forward and delivered. The downward throw of the arm 163 through the rod 168 carries the suction cup 169 into position for such cup, when the vacuum is created therein coincident with the vacuum in the front suction cups, to raise the top sheet at its center and assist in clearing such sheet for a free and clear forward movement thereof by the action of the front suction cups.

It will be seen from the foregoing description of the parts and their operation that the suction cups and their movements are so timed that one set of cups is in use when the other set of cups is out of use, and one set of cups is traveling forward in operative position while the other set of cups is traveling rearward out of operation, and at the same time the main suction pump is brought into use to create a vacuum in the front suction cups and break the vacuum in the rear suction cups and vice versa, thus making the suction cups alternately operative in performing their respective offices. The closing of the mouth of the pipe or tube 134, in the event of a droppage of a sheet by the front suction cups, operates to break the equalization of pressure in the cylinder 98, creating a vacuum therein by which the pressure on the rear face of the piston of the cylinder will operate to break the toggle links and stop the sheet carrying mechanism, as already described.

The machine as a whole is simple in construction, and the parts have a unity of action and a correlation by which a reliable and effective delivery of a single sheet of paper is assured, it being practically impossible for the rear corner suction cups to act and raise more than the top sheet, and with the rear edge or corners of the top sheet released it is practically impossible for the front suction cups to carry forward more than the released top sheet.

The presser head 166 is operative with the

rise and fall of the arm 161 and this arm works coincidingly with the throw of the pawl by which the horizontal and vertical shafts are turned to give the table a graduated distance of rise. This presser head when down prevents further upward movement of the table and if resting on the paper will keep the pawl from reaching and passing a tooth of the ratchet wheel, with the result that, if the height of the paper is such as to prevent the pawl from reaching and passing a tooth, by reason of the presser head 166 resting on the top of the pile of sheets, no upward movement of the table will take place until the first sheet or the top sheet has been removed by the operation of the delivery devices for the reason that the pawl moves in the space between two teeth without engaging either tooth. It will thus be seen that the sheets of paper will be delivered one at a time and that the upward movement of the table is held in abeyance until the pile of sheets thereon has been reduced, by the removal of a sheet or sheets, sufficiently for the pawl and ratchet to act and turn the shafts to raise the table the graduated distance for a sheet to be acted upon by the delivery mechanism.

What I claim as new and desire to secure by Letters Patent is:

1. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm carrying the suction cup and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, and means for moving the L lever and initially raising the cup with the corner of the sheet of paper held against its acting edge at the commencement of the inward movement of the slide and continuing the upward movement carrying therewith the corner of the sheet with the continued inward or forward movement of the slide until the limit of such movement is reached and then breaking the vacuum of the cup releasing the corner of the sheet for the sheet to be carried forward after the release of its corner from the cup and during the return movement of the cup to normal position, substantially as described.

2. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm having the suction cup attached to its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, a primary presser foot engaging the corner of the sheet of paper adjacent to the suction cup and having a pivotal attachment at its rear end to a fixed point, a lifter arm adjacent to the arm carrying the presser foot and pivotally attached at its rear end to the slide, a cam on the lifter arm, and a roller on the arm of the presser foot for the movements of the slide to raise

and lower the presser foot, in proper relation to the movement of the suction cup for releasing and holding the corner of the sheet of paper, substantially as described.

3. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm having the suction cup attached to its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, a primary presser foot engaging the corner of the sheet of paper adjacent to the suction cup and having a pivotal attachment at its rear end to a fixed point, a lifter arm adjacent to the arm carrying the presser foot and pivotally attached at its rear end to the slide, a cam on the lifter arm, a roller on the arm of the presser foot, and a spring engaging the arm carrying the presser foot, for the movements of the slide to raise and lower the presser foot in proper relation to the movement of the suction cup for releasing and holding the corner of the sheet of paper, substantially as described.

4. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm having the suction cup attached to its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, an arm pivotally attached at its rear end and extending forward of the arm carrying the suction cup and carrying a presser head, and means for lifting the arm and the presser head said means actuated from the forward movement of the slide at the completion of the forward throw of the suction cup for releasing the paper from the presser head, substantially as described.

5. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm carrying the suction cup at its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, an arm carrying a presser foot adjacent to the suction cup and having its rear end pivotally attached to a fixed point, a lifter arm adjacent to the presser foot arm and having its rear end pivotally attached to the slide, a cam on the lifter arm, a roller on the presser foot arm, an arm adjacent to the arm carrying the suction cup and having its rear end pivotally attached to a fixed point and having an inclined rearward extension engaged by the free end of the lifter arm and carrying at its free end a presser head, and a connection between the presser head arm and the suction cup arm causing the suction cup arm to rise and fall with the movements of its carrying slide, substantially as described.

6. In a sheet delivery mechanism, the combination of a suction cup for the rear

corner of the paper, an arm carrying the suction cup at its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, an arm carrying a presser foot adjacent to the suction cup and having its rear end pivotally attached to a fixed point, a lifter arm adjacent to the presser foot arm and having its rear end pivotally attached to the slide, a cam on the lifter arm, a roller on the presser foot arm, an arm adjacent to the arm carrying the suction cup and having its rear end pivotally attached to a fixed point and having an inclined rearward extension engaged by the free end of the lifter arm and carrying at its free end a presser head, bars connected with the presser head arm and rearwardly extending with an upward inclination, and a slide on the bars connected with the head of the suction cup for giving the suction cup its rising and falling movement from the movements of the slide, substantially as described.

7. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm carrying the suction cup at its forward end and having a rising and falling movement given thereto, a slide carrying the arm, an L lever for reciprocating the slide, a spring engaging the presser foot arm and operating to return and hold the arm in normal position, an arm carrying a presser foot adjacent to the suction cup and having its rear end pivotally attached to a fixed point, a lifter arm adjacent to the presser foot arm and having its rear end pivotally attached to the slide, a cam on the lifter arm, a roller on the presser foot arm, an arm adjacent to the arm carrying the suction cup and having its rear end pivotally attached to a fixed point having an inclined rearward extension engaged by the free end of the lifter arm and carrying at its free end a presser head, bars connected with the presser head and rearwardly extending with an upward inclination, and a slide on the bars connected with the head of the suction cup for giving the suction cup its rising and falling movement from the movements of the slide, substantially as described.

8. In a sheet delivery mechanism, the combination of a suction cup for the rear corner of the paper, an arm carrying the suction cup, a slide having the rear end of the suction cup arm pivotally connected therewith, a fixed support for the slide, a presser arm pivotally attached at its rear end to the fixed support and extending forward of the suction cup arm, a head carried by the presser arm and resting on the paper during the advance of the suction cup, means actuated by the movement of the slide to raise and lower the presser arm, and a connection between the suction cup arm and the presser arm for the advance of the slide to raise the

suction cup with the presser resting on the paper, substantially as described.

9. In a sheet delivery mechanism, the combination of a supporting plate, a slide movable in and out on the supporting plate, 70 an arm pivotally mounted on the slide, a suction cup at the free end of the slide arm and having a cornerwise in and out movement and a rising and falling movement given thereto, an arm pivotally attached at 75 its rear end to the supporting plate, a presser foot carried by the arm adjacent to the suction cup and engaging and holding down the corners of the sheets of paper after the top sheet has been released therefrom and is 80 being carried inward by the suction cup, a lifter arm pivotally attached at its rear end to the slide and extending forward adjacent to the presser foot arm, a cam on the end of the lifter arm, a roller on the presser foot 85 arm engaging with the cam, a spring engaged with the presser foot arm, a presser arm pivotally attached at its rear end to the supporting plate and extending forward of the suction cup arm, a head on the presser arm 90 resting normally on the pile of papers, a rearwardly and upwardly inclined extension on the presser arm engaged by the free end of the lifter arm, and a connection between the presser arm and the suction cup arm for giving 95 the suction cup a rising movement with the inward travel of its arm and slide and a falling movement with the outward travel of its arm and slide, substantially as described.

10. In a sheet delivery mechanism, the 100 combination of a supporting plate, a slide movable in and out on the supporting plate, an arm pivotally mounted on the slide, a suction cup at the free end of the slide arm, and having a cornerwise in and out move- 105 ment and a rising and falling movement given thereto, an arm pivotally attached at its rear end to the supporting plate, a presser foot carried by the arm adjacent to the suction cup and engaging and holding down the 110 corners of the sheets of paper after the top sheet has been released therefrom and is being carried inward by the suction cup, a lifter arm pivotally attached at its rear end to the slide and extending forward adjacent 115 to the presser foot arm, a cam on the end of the lifter arm, a roller on the presser foot arm engaging with the cam, a spring engaged with the presser foot arm, a presser arm pivotally attached at its rear end to the support- 120 ing plate and extending forward of the suction cup arm, a head on the presser arm resting normally on the pile of papers, a rearwardly and upwardly inclined extension on the presser arm engaged by the free end of 125 the lifter arm, a connection between the presser arm and the suction cup arm for giving the suction cup a rising movement with the inward travel of its arm and slide and a falling movement with the outward travel of 130

its arm and slide, an L lever pivotally mounted on the supporting plate and pivotally connected at one end with the slide and connected at its other end with the carrying means for the front delivery devices, substantially as described.

11. In a sheet delivery mechanism, the combination of a supporting plate, a slide movable in and out on the supporting plate, an arm pivotally mounted on the slide, a suction cup at the free end of the slide arm, and having a cornerwise in and out movement, and a rising and falling movement given thereto, an arm pivotally attached at its rear end to the supporting plate, a presser foot carried by the arm adjacent to the suction cup and engaging and holding down the corners of the sheets of paper after the top sheet has been released therefrom and is being carried inward by the suction cup, a lifter arm pivotally attached at its rear end to the slide and extending forward adjacent to the presser foot arm, a cam on the end of the lifter arm, a roller on the presser foot arm engaging with the cam, a spring engaged with the presser foot arm, a presser arm pivotally attached at its rear end to the supporting plate and extending forward of the suction cup arm, a head on the presser arm resting normally on the pile of papers, a rearwardly and upwardly inclined extension on the presser arm engaged by the free end of the lifter arm, a connection between the presser arm and the suction cup arm for giving the suction cup a rising movement with the inward travel of its arm and slide and a falling movement with the outward travel of its arm and slide, an L lever pivotally mounted on the supporting plate and pivotally connected at one end with the slide, a rod attached to the other end of the lever, a sliding and rocking shaft having the forward end of the rod connected therewith and carrying the delivery devices for the front or leading edge of the sheet of paper, substantially as described.

12. In a sheet delivery mechanism, the combination of a swinging arm having a longitudinal slot in its body, a supporting plate having a curved slot transversely of its body and attached to the swinging arm, a slide carried by the supporting plate, a rising and falling arm pivotally attached at its rear end to the slide, a suction cup attached to the front end of the slide arm, a rising and falling arm pivotally attached at its rear end to the supporting plate and an adjustable presser foot at the end of the arm and adjacent to the suction cup, substantially as described.

13. In a sheet delivery mechanism, the combination of a swinging arm having a longitudinal slot in its body, a supporting plate having a curved slot transversely of its body and attached to the swinging arm, a slide carried by the supporting plate, a rising and

falling arm pivotally attached at its rear end to the slide, a suction cup attached to the front end of the slide arm, a rising and falling arm pivotally attached at its rear end to the supporting plate, an adjustable presser foot at the end of the arm and adjacent to the suction cup, and a spring engaging the arm and holding the presser foot against the pile of papers at the rear corner, substantially as described.

14. In a sheet delivery mechanism, the combination of a swinging arm having a longitudinal slot in its body, a supporting plate having a curved slot transversely of its body and attached to the swinging arm, a slide carried by the supporting plate, a rising and falling arm pivotally attached at its rear end to the slide, a suction cup attached to the front end of the slide arm, a rising and falling arm pivotally attached at its rear end to the supporting plate, an adjustable presser foot at the end of the arm and adjacent to the suction cup, a spring engaging the arm and holding the presser foot against the pile of papers at the rear corner, an arm pivotally attached at its rear end to the slide, a cam on the arm, and a roller carried by the presser foot arm and engaged by the cam for raising the presser foot clear of the paper with the initial advance of the slide, substantially as described.

15. In a sheet delivery mechanism, the combination of a swinging arm having a longitudinal slot in its body, a supporting plate having a curved slot transversely of its body and attached to the swinging arm, a slide carried by the supporting plate, a rising and falling arm pivotally attached at its rear end to the slide, a suction cup attached to the front end of the slide arm, a rising and falling arm pivotally attached at its rear end to the supporting plate, an adjustable presser foot at the end of the arm and adjacent to the suction cup, a spring engaging the arm and holding the presser foot against the pile of papers at the rear corner, an arm pivotally attached at its rear end to the slide, a cam on the arm, a roller carried by the presser foot arm and engaged by the cam for raising the presser foot clear of the paper with the initial advance of the slide, an arm pivotally attached at its rear end to the forward end of the supporting plate and engaged by the free end of the arm having the cam, a presser arm carried by the free end of the arm, and a connection between the presser arm and the suction cup arm for raising the suction cup with the forward movement of the slide, substantially as described.

16. In a paper feeding mechanism, the combination of a suction cup adapted to engage the top sheet at the corner, means for traveling the suction cup inward and outward, means operating to gradually raise the cup from the start to the finish of the inward

movement and until the terminus of the inward movement is reached and said means operating to gradually lower the suction cup during the outward movement and until the limit of outward movement is reached, means for applying suction to the cup to raise the corner of the top sheet from the pile of sheets and carry the corner inward, gradually raising the corner in the inward movement and releasing the corner of the sheet at the end of the inward movement of the cup, substantially as described.

17. In a sheet delivery mechanism, the combination of a suction cup, means for giving a rising and falling movement and a diagonal or cornerwise in and out travel to the suction cup, the rising movement of the cup commencing at the initial start of the inward travel thereof and continuing during the inward travel, a presser foot located and operating adjacent to the suction cup, means for giving a rising and falling movement to the presser foot, said means operating for the initial rise of the foot to occur at the start of the inward travel and rise of the suction cup, and when the suction cup has carried the extreme corner of the top sheet of paper from beneath the presser foot said means causing the foot to return to normal position, and a presser head located and operating in advance of the suction cup and resting on the paper during the inward travel of the cup and raised from the paper during the outward travel of the cup, the cup, presser foot and presser head serving to buckle and move inwardly the rear corners of the top sheet only and give such sheet a clearance for delivering the same, substantially as described.

18. In a sheet delivery mechanism, the combination of a suction cup for each rear corner of the sheet operating to buckle and carry inward the corners of the top sheet, means for holding the corners of the stack sheets after the initial start of the suction cup inwardly, means for holding the top sheet during the inward movement of the cup, a reciprocating and rocking shaft at the delivery side of the mechanism, a series of suction cups carried by the reciprocating and rocking shaft, and a connection between the reciprocating shaft and the carrying means for each rear corner suction cup for giving opposite directions of travel to the front and rear suction cups, substantially as described.

19. In a sheet delivery mechanism, the combination of a suction cup for each rear corner of the sheet operating to buckle and carry inward the corners of the top sheet, means for holding the corners of the stack sheets after the initial start of the suction cup inwardly, means for holding the top sheet during the inward movement of the cup, a reciprocating and rocking shaft at the delivery side of the mechanism, a series of suction cups carried by the reciprocating and

rocking shaft, a connection between the reciprocating shaft and the carrying means for each rear corner suction cup for giving opposite directions of travel to the front and rear suction cups, and means for creating a suction between the rear and front cups alternately, substantially as described.

20. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft, a plurality of arms forwardly extending from the shaft, a suction cup for each arm, an arm laterally extending from the shaft, and a double-inclined way coacting with the forward end of the lateral arm for rocking the shaft and giving the suction cups a rising and falling movement, substantially as described.

21. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft, a plurality of arms forwardly extending from the shaft, a suction cup for each arm, an arm laterally extending from the shaft, an incline at the outer end of the arm, a guard over the incline and forming a two-pathway of travel for the outer end of the lateral extending arm, causing the arm to rock the shaft and give a rising and falling movement to the suction cups, substantially as described.

22. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft, a plurality of arms forwardly extending from the shaft, a suction cup for each arm, an arm laterally extending from the shaft, an incline at the outer end of the arm, a guard over the incline and forming a two-pathway of travel for the outer end of the lateral extending arm, causing the arm to rock the shaft and give a rising and falling movement to the suction cups, a suspended arm having its lower end engaged with the reciprocating and rocking shaft, a rocking shaft carrying the suspended arm, and means for rocking the shaft of the suspended arm, substantially as described.

23. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft at the delivery side of the machine, a plurality of arms forwardly extending from the shaft, a suction cup for each arm, a suspended arm engaged at its lower end with the reciprocating and rocking shaft, a shaft carrying the suspended arm, a lever adapted to be engaged with and disengaged from the shaft of the suspended arm, and means for oscillating the lever and giving the shaft a rocking movement, substantially as described.

24. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft at the delivery side of the machine, a plurality of arms forwardly extending from the shaft, a suction cup for each arm, a suspended arm engaged at its lower end with the reciprocating and rocking shaft, a shaft

carrying the suspended arm, a lever adapted to be engaged with and disengaged from the shaft of the suspended arm, means for oscillating the lever and giving the shaft a rocking movement, a clutch having a fixed member attached to the shaft and a sliding member carrying the actuating arm or lever, a vibratable lever engaged with the sliding member of the clutch, a link connection for the lower end of the vibratable lever, and a trip actuated by shutting off the air supply to a cylinder for automatically stopping the mechanism, substantially as described.

25. In a sheet delivery mechanism, the combination of a rock shaft for operating front and rear suction cups, an arm or lever for rocking the shaft, a clutch having its fixed member attached to the shaft and its movable member carrying the arm or lever, a lever having its upper end engaged with the sliding member of the clutch, a link connection for the lower end of the clutch lever, a trip finger for raising the link connection, a piston rod for moving the trip finger to raise the links, a cylinder for the piston of the rod, an air supply pipe having its open end below the delivery travel of the sheets, a connection from the air supply pipe to the cylinder in front of the piston, and a suction pump connected with the cylinder for creating a vacuum in front of the piston with the stoppage of the air supply to the cylinder and causing the piston of the cylinder to move inwardly and actuate the trip finger and stop the sheet delivery mechanism, substantially as described.

26. In a sheet delivery mechanism, the combination of a rock shaft for operating front and rear suction cups, an arm or lever for rocking the shaft, a clutch having its fixed member attached to the shaft and its movable member carrying the arm or lever, a lever having its upper end engaged with the sliding member of the clutch, a spring operating to move the upper end of the clutch lever outwardly with the release of the lower end of the lever, a link connection for the lower end of the clutch lever, a trip finger for raising the link connection, a piston rod for moving the trip finger to raise the links, a cylinder for the piston of the rod, an air supply pipe having its open end below the delivery travel of the sheets, a connection from the air supply pipe to the cylinder in front of the piston, and a suction pump connected with the cylinder for creating a vacuum in front of the piston with the stoppage of the air supply to the cylinder and causing the piston of the cylinder to move inwardly and actuate the trip finger and stop the sheet delivery mechanism, substantially as described.

27. In a sheet delivery mechanism, the combination of a rock shaft for operating front and rear suction cups, an arm or lever for rocking the shaft, a clutch having its

fixed member attached to the shaft and its movable member carrying the arm or lever, a lever having its upper end engaged with the sliding member of the clutch, a link connection for the lower end of the clutch lever, a trip finger for raising the link connection, a piston rod for moving the trip finger to raise the links, a cylinder for the piston of the rod, an air supply pipe having its open end below the delivery travel of the sheets, a connection from the air supply pipe to the cylinder in front of the piston, and a suction pump connected with the lever for rocking the shaft and with the cylinder for creating a vacuum in front of the piston with the stoppage of the air supply to the cylinder and causing the piston of the cylinder to move inwardly and actuate the trip finger and stop the sheet delivery mechanism, substantially as described.

28. In a sheet delivery mechanism, the combination of a reciprocating and rocking shaft carrying front and delivery suction cups, an arm depending from the shaft, an L lever connected with the arm and with the piston rod of an air pump, a suction for the top and bottom of the air pump, a pair of suction cups operating on the rear corner of the top sheet, a connection from the lower end of the suction pump with the front suction cups, and a connection from the upper end of the suction pump with the rear corner suction cups for alternately creating a suction in the front and rear cups from one and the same suction pump, substantially as described.

29. In a sheet delivery mechanism, the combination of a rocking shaft, an arm fixed to and upwardly extending from the shaft, a link pivotally attached at one end to the shaft arm, a lever with which the other end of the link is adjustably connected, an intermittently rotatable shaft, an arm pivotally connected with the lever and loosely mounted on the intermittently rotatable shaft, a ratchet wheel on the intermittently rotatable shaft adjacent to the arm, a pawl carried by the lever and engaging the ratchet wheel, a pair of vertical shafts each having an exterior screw thread, a gear connection between the vertical shafts and the shaft having the ratchet wheel thereon, and a table or platform carried by the vertical shafts for raising the table or platform step by step from the intermittent rotation of the ratchet wheel shaft, substantially as described.

30. In a sheet delivery mechanism, the combination of a rocking shaft, an arm fixed to and upwardly extending from the shaft, a link pivotally attached at one end to the shaft arm, a lever, a slide adjustable on the lever and having the end of the link pivotally connected therewith, an intermittently rotatable shaft, an arm connected with the lever and loosely mounted on the intermittently rotatable shaft, a ratchet wheel on the

intermittently rotatable shaft adjacent to the arm, a pawl carried by the lever and engaging the ratchet wheel, a pair of vertical shafts each having an exterior screw thread, a gear connection between the vertical shafts and the shaft having the ratchet wheel thereon, and a table or platform carried by the vertical shafts for raising the table or platform step by step from the intermittent rotation of the ratchet wheel shaft, substantially as described.

31. In a sheet delivery mechanism, the combination of front and rear suction cups operating to respectively raise and carry forward the leading edge of the top sheet of paper and to raise and buckle and move inwardly the rear corners of the top sheet of paper, a central suction cup having a rising and falling movement given thereto, and means for creating a suction in all of the cups for the suction in the center cup to be coincident with the suction in the front delivery cups, substantially as described.

32. In a sheet delivery mechanism, the combination of front and rear suction cups operating to respectively raise and carry forward the leading edge of the top sheet of paper and to raise and buckle and move inwardly the rear corners of the top sheet of paper, a central presser head having a rising and falling movement given thereto, and means for alternately creating suction in the front and rear cups for the suction in the front cups to operate with the central presser head raised, substantially as described.

33. In a sheet delivery mechanism, the combination of a main rock shaft, means for rocking the shaft, a slidable and rocking shaft actuated from the main rock shaft, suction cups carried by the slidable and rocking shaft and operating on the leading edge of the top sheet of paper, suction cups operating on the rear corners of the top sheet of paper, and means actuated from the sliding and rocking shaft to buckle and move inwardly the rear corners of the top sheet of

paper with the inward travel of the rear suction cup, substantially as described.

34. A clamp consisting of a head adapted to receive a pivot having an oscillating movement, a slidable block carried by the head and adapted with the head to receive a rod, and a wedge pivotally mounted on the head and operating to force the block outward and clamp the rod between the head and block, substantially as described.

35. A clamp consisting of a head adapted to receive a pivot having an oscillating movement, a slidable block carried by the head and adapted with the head to receive a rod, a wedge pivotally mounted on the head, and a lever carrying the wedge to clamp and release the rod, substantially as described.

36. A clamp consisting of a head, a slidable block carried by the head and adapted with the head for the passage of a rod to be clamped, a wedge mounted on the head and engaging the block, and means for forcing the wedge into and out of engagement with the slidable block, substantially as described.

37. In a sheet delivery mechanism, the combination of a sheet carrying table, a pair of vertically rotatable shafts for raising and lowering the table, a horizontal shaft intermittently rotatable and common to both vertical shafts, a ratchet and pawl device for intermittently rotating the horizontal shaft and operating the vertical shafts in raising and lowering the sheet carrying table a graduated distance, a vibratable lever for actuating the pawl, and a presser head carried by the vibratable lever and engaging the top of the sheets and preventing the ratchet and pawl from acting until the pile of sheets is lowered a sufficient distance for the pawl to pass a tooth of the ratchet, substantially as described.

ALVARO B. GRAHAM.

Witnesses:

OSCAR W. BOND,
WALKER BANNING.