

**No. 639,960.**

**Patented Dec. 26, 1899.**

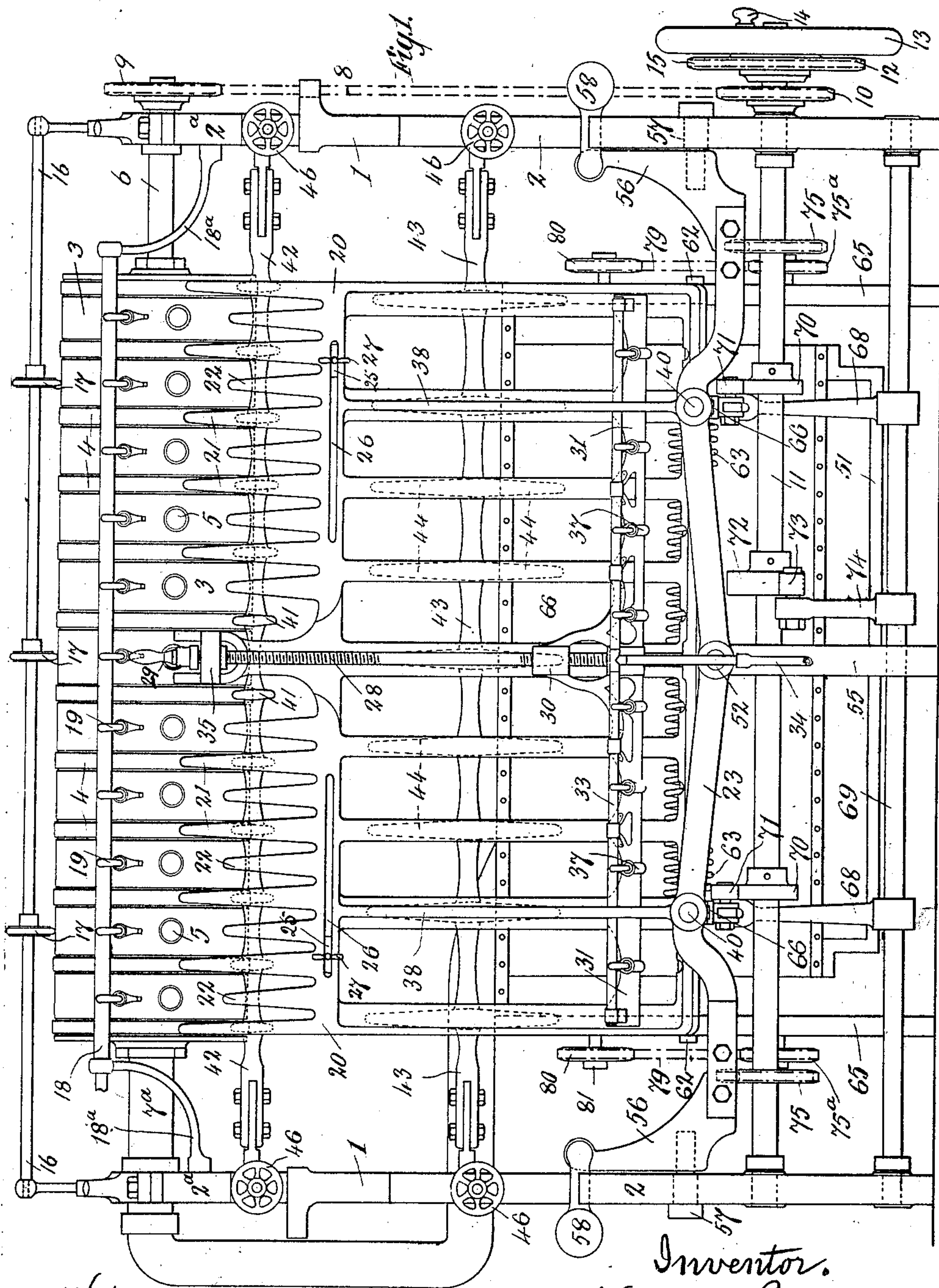
W. CARTER.

## PNEUMATIC FEEDING MACHINE.

(Application filed Apr. 12, 1899.)

(No Model.)

**5 Sheets—Sheet 1.**



Witnesses,  
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A. Witt.

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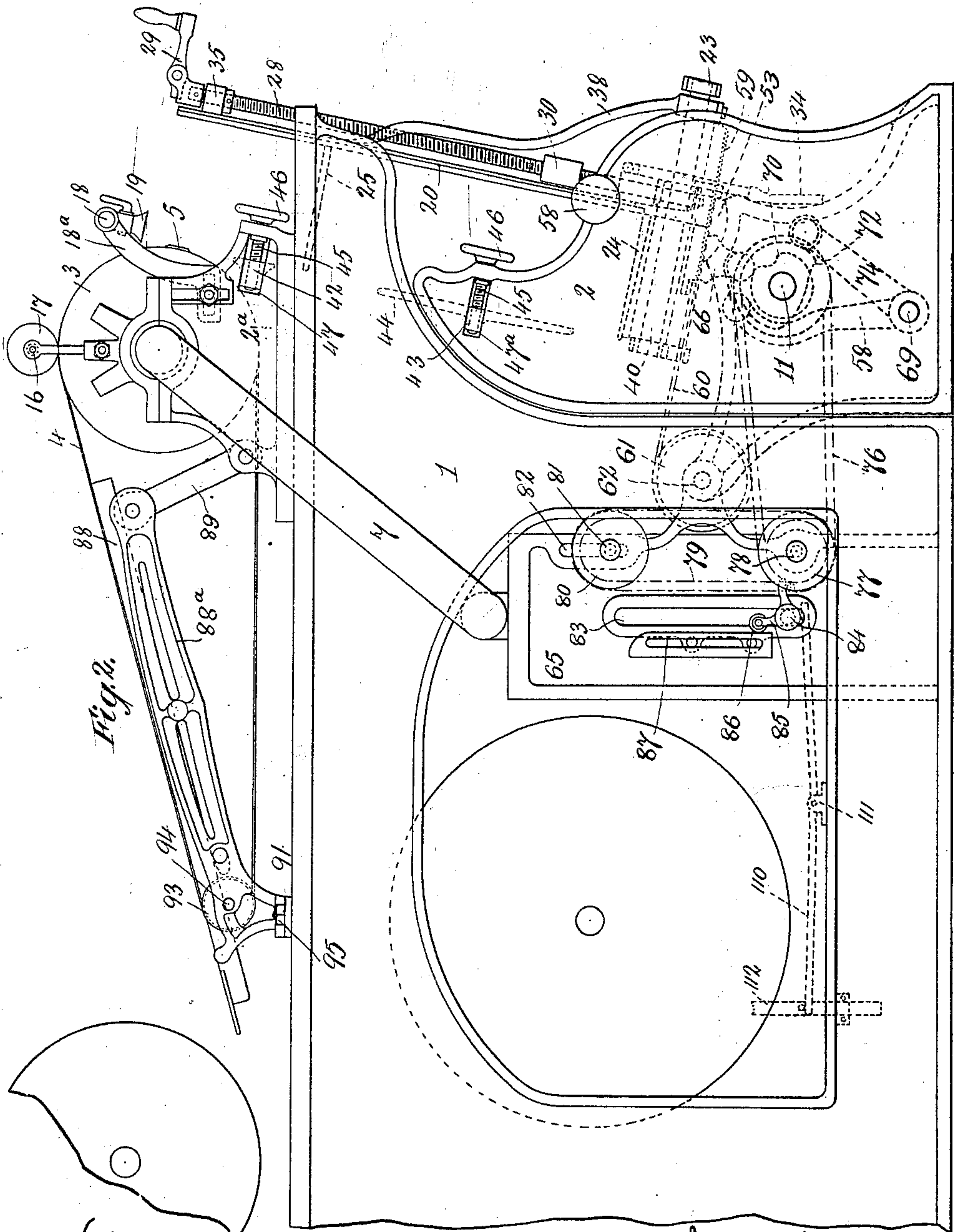
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5 Sheets—Sheet 2.



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5 Sheets—Sheet 3.

Fig. 4.

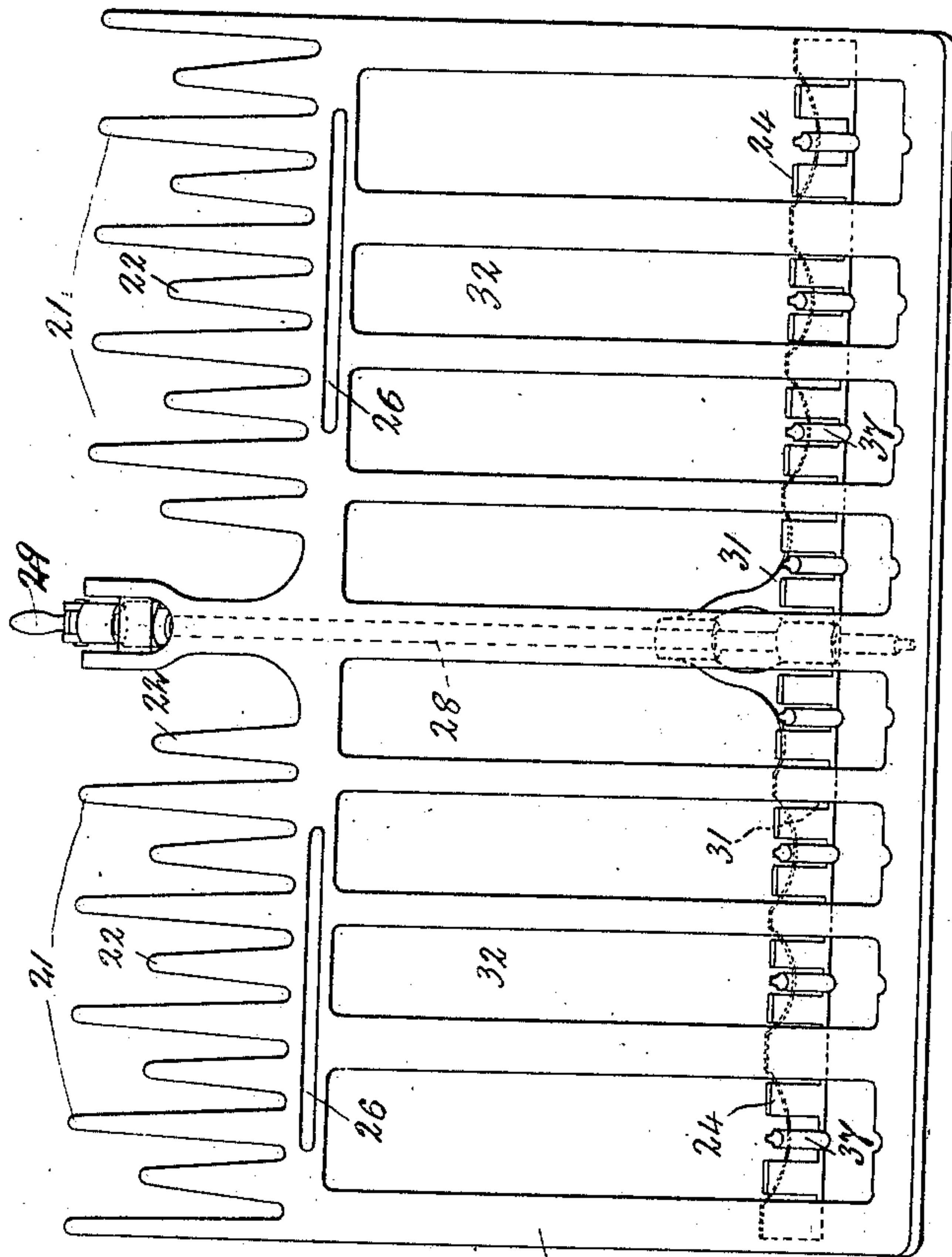
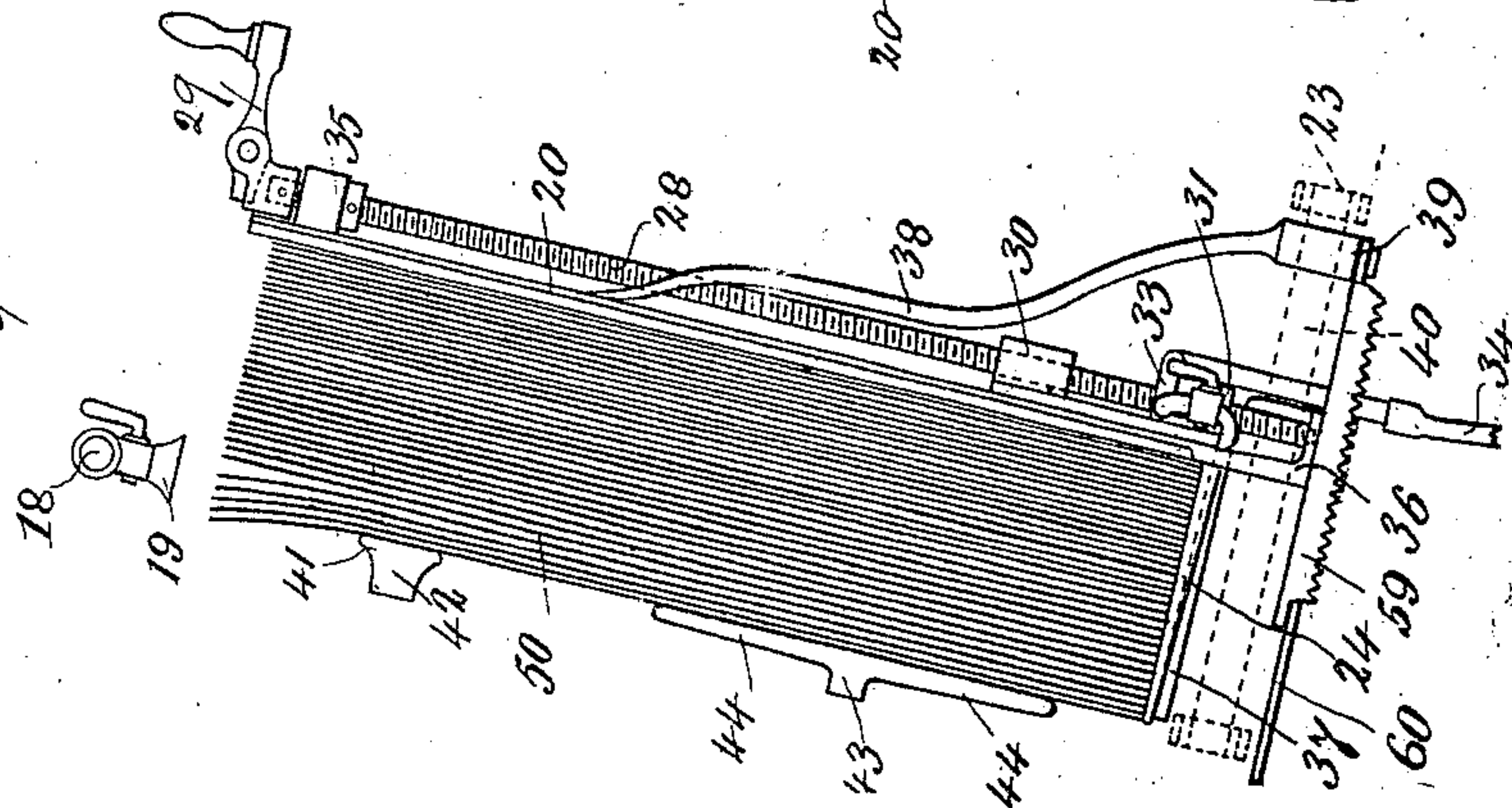


Fig. 3.



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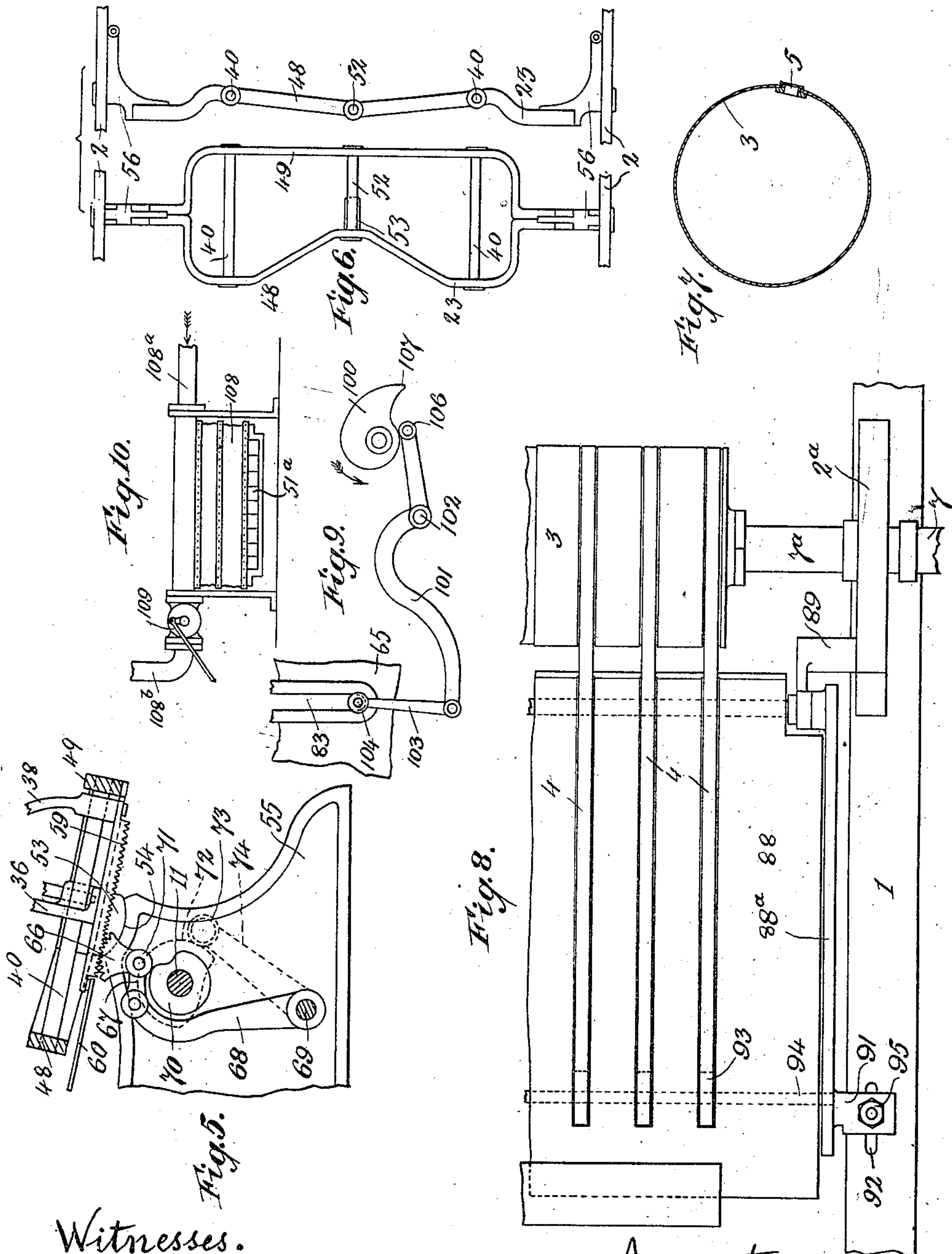
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(Application filed Apr. 12, 1899.)

(No Model.)

5 Sheets—Sheet 4.



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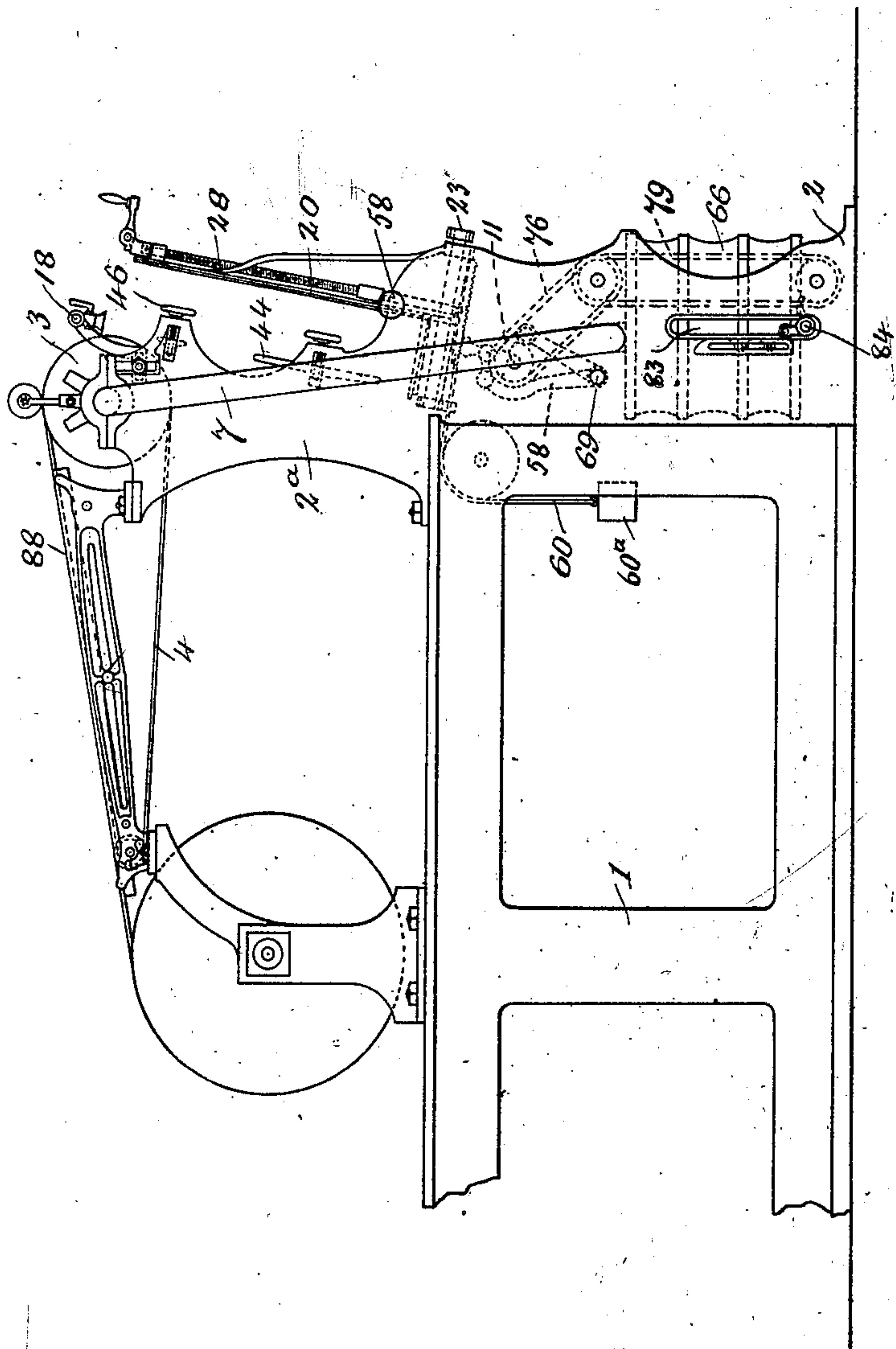
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(No Model.)

5 Sheets—Sheet 5.

Fig. 11.



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# UNITED STATES PATENT OFFICE.

WILLIAM CARTER, OF GLASGOW, SCOTLAND.

## PNEUMATIC FEEDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 639,960, dated December 26, 1899.

Application filed April 12, 1899. Serial No. 712,722. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM CARTER, lithographic printer, a subject of the Queen of Great Britain, residing at 62 Bothwell Circus, Glasgow, Scotland, have invented certain new and useful Improvements in Pneumatic Feeding Mechanism for Feeding Sheets of Paper to Printing and other Machines, (for which I have made application for British patent, No. 6,864, dated March 30, 1899,) of which the following is a specification.

This invention relates to pneumatic feeding mechanism for feeding sheets of paper to printing, lithographic, and other machines. The invention is a development of and improvement upon my prior application, Serial No. 701,278, dated January 5, 1899.

The features of novelty constituting the present invention are pointed out in the claims at the end of the specification, and in order that my said invention may be clearly understood I have hereunto appended five explanatory sheets of drawings, whereon—

Figure 1 is a front elevation of the feeding mechanism. Fig. 2 is a side view of the same. The mechanism is shown as attached to a Wharfedale printing-machine, which is broken away. Fig. 3 is a side view, and Fig. 4 a back view, of the sheet-holder. Fig. 5 is a detail view of the mechanism for actuating the sheet-holder. Fig. 6 is a plan and side view of the cradle of the sheet-holder. Fig. 7 is a section of the suction feed-roller. Fig. 8 is a plan of part of the feed-table. Fig. 9 shows a modification of the bellows-actuating mechanism. Fig. 10 shows an arrangement which may be used in conjunction with the suction-producer. Fig. 11 shows the invention adapted to an American overhead-feed two-revolution printing-machine or an ordinary lithographic machine.

On the drawings the same reference-numerals wherever repeated indicate the same or similar parts.

- 1 is the frame of the printing-machine.
- 2 is the frame of the feeding mechanism.
- 3 is the suction feed-cylinder.
- 4 are endless feeding-tapes running around the cylinder.
- 5 are the suction holes or cups of the cylinder.
- 6 is the cylinder-shaft.

7 is the suction-pipe, which communicates by the hollow trunnion 7<sup>a</sup> with the feed-cylinder.

8 is an endless chain which drives the chain-wheel 9 on the shaft 6.

10 is a chain-wheel on the shaft 11 and around which the chain 8 passes.

12 is a loose chain driving-wheel on the shaft 11, which can be clutched or locked when desired to the starting-wheel 13, fixed upon the shaft 11, by means of the locking-pin 14.

15 is an endless chain (in dotted lines) passing around the wheel 12 and which can be driven from any suitable revolving shaft on the machine to which the sheets of paper are being fed.

16 is a cross-shaft provided with rubber-tired friction-wheels 17.

18 is an air-blast pipe (supported by brackets 18<sup>a</sup>) arranged across the upper part of the machine.

19 are a series of blast-taps provided on the pipe 18, which latter can be supplied with air under pressure from any suitable source, such as a small bellows, revolving fan, or the like. (Not shown.)

20 is the sheet-holder, which, as shown, is preferably made in the form of a light slotted cast-metal frame having a series of alternate long and short fingers 21 22 at its upper end. The purpose of this alternation of long and short fingers is to prevent adhesion of the sheets of paper together by atmospheric pressure or by electricity, as the consequent bending or ridging up of the pack tends to separate the sheets slightly one from the other, whereby the paper is fanned out and the sheets slightly separated, so as to more readily admit air from the blow-pipe nozzles between the sheets, which much facilitates the pulling off of the individual sheets by the suction device, and in addition the pile on insertion may be much more easily straightened and put into proper alinement for feeding than would be the case were not such fingers used. The use of these alternate long and short fingers is only of advantage when feeding thin papers, such as tissue, &c. This sheet-holder is held in an inclined position (nearly vertical) upon a cradle 23. (See also Fig. 6.) The pile of paper sheets to be fed to the machine is held in po-



sition upon edge, resting upon rests 24, projecting from a cross-bar 31 at the front of the holder, and are prevented from moving out of position laterally by means of gages 25, clamped in the proper position on the holder by screws passing through slots 26 in the holder and provided with butterfly-nuts 27 at their outer ends.

28 is an adjusting-screw operated by the hinged handle 29 and working in the screwed nut 30, connected with the cross-bar 31, the bearing 35, and a foot-step made on the bottom of the holder (see Fig. 3) for raising and lowering the cross-bar and the rests attached thereto in order to adjust the holder for the reception of various sizes of paper sheets. One projecting rest 24 is preferably provided on the bar 31 for each vertical slot 32 of the holder. Between the prongs of each rest 24 an air-blast pipe 37 may project, said pipes being perforated at their upper sides and being connected at their front ends to a cross-pipe 33, to which air under pressure from any suitable source (such as a bellows) is supplied through a flexible pipe 34.

38 are struts for supporting the holder. 39 are collars at the lower ends of these struts, which slide upon the guide-bars 40 of the cradle.

42 is a pinching-bar made with a series of short arms or projections 41, against which the paper sheets are pressed or pinched. 43 is a second pinching-bar which is made with a series of long arms or projections 44, projecting at each side. These bars 42 43 can be adjusted in position either nearer to or farther away from the holder by means of screws 45 at each end, provided with hand-wheels 46. The bars slide at each end in slots 47 47<sup>a</sup>, made in the side frames 1 and 2. The pinching-bars, as clearly shown at Fig. 2, are held at an angle which exactly corresponds to the angle of inclination of the holder.

The cradle, as shown at Fig. 6, consists of two bent bars 48 49, connected together at the ends. Both bars are bent downward at the center, while the bar 48 is also bent inward at the center. The cradle is provided with the cross-bars or guide-bars 40 at the ends and also a cross-bar 52 at the center. Secured to the under side of this cross-bar 52 is a rocking block 53, which has a curved lower face (see Figs. 2 and 5) adapted to rest in the curved face 54 of the central frame 55 of the machine. (See Fig. 5.) The bars 48 49 are secured at each end to an arm 56, which works upon a pivot-pin 57, passed through the side frame 2 and which has jointed to it a weighted locking-lever 58, capable of being locked into a recess in the side frame 2. Secured to the under side of each collar 39 and its corresponding foot-step 36 on the holder (working on its guide-bar 40) is a rack 59, Figs. 2 and 5, whose front end is attached to a strap 60, secured to a drum 61, Fig. 2, on a cross-shaft 62, provided with torsion-springs 63, tending to revolve it in such a manner as

to wind up the strap. The shaft 62 revolves in bearing-brackets on the frames 65 of the bellows 66. Instead of using torsion-springs spiral springs may be connected in any well-known manner, so as to act directly upon the straps 60, or weights may be attached to the ends of these straps. (See Fig. 11.) Each rack 59 has gearing with it a toothed segment 66, jointed to a link 67, which again is jointed to a slightly-curved lever 68, keyed to the shaft 69. The main shaft 11 has on it two cams 70 70, each of which acts upon a roller 71, connected to each segment 66. Near the center of the shaft 11 there is a cam 72, which acts upon a roller 73, pinned to the upper end of a lever 74, also keyed on the shaft 69. This mechanism, as will be hereinafter described, actuates the sheet-holder.

In order to actuate the bellows, there is provided at each end of the shaft 11 a chain-wheel 75, from which a chain 76 passes to a chain-wheel 77, revolving on a pin 78, secured in the bellows-frame 65. Secured to the wheel 77 is a second wheel 75<sup>a</sup>, from which an endless chain 79 passes around a wheel 80, revolving on a pin 81, secured adjustably in a slot 82 in the bellows-frame. Slidably fitted in each vertical slot 83 of the bellows-frame is a block 84, upon which is pivoted a two-armed catch 85, whose one arm is pointed, so as to enter between the links of the chain 79, and whose other arm is provided with a roller 86, running upon a guide 87, curved sharply at its upper end. Each guide is secured to the bellows-frame.

The bellows 66 is supported between the side frames 65 and has at its lower side a shelf 51, upon which weights can be placed, so as to regulate the action of the bellows, and thereby control the suction of the feed-cylinder.

The frame 88<sup>a</sup> of the feed-table 88 is jointed at each side to a cranked lever 89, fulcrumed in the side plates 2<sup>a</sup>, carrying the feed-cylinder bearings. At its rear end the table-frame is furnished at each side with a shoe 91, provided with a bolt and nut 95, whereby it can be adjusted in position in a slot 92, Fig. 8, made in each side frame of the machine.

The endless feed-tapes run over guide-rollers 93 on the cross-shaft 94.

The *modus operandi* is as follow: The table is first adjusted so as to give it the proper position and to stretch the tapes 4 by means of the sliding shoes 91 and the slots 92, and when adjusted is locked in position by screwing up the nuts 95. After this has been done the pile of sheets is inserted in the holder 20 (which for this purpose is brought nearly to the horizontal position by disengaging the levers 58 from their recesses and then pulling the holder backward against the action of the spring 63) in the manner shown at Fig. 3, where 50 indicates the sheets; and the gages 25 and rests 24 adjusted, (the latter by means of the screw 28 and the former by shifting



them laterally in the slots 26 and then clamping them in place by means of the butterfly-nuts 27,) and then the holder is pushed up into the position (nearly vertical) shown at Figs. 2 and 3, which can easily be done, owing to the fact that the block 53 of the cradle of the holder works ball-and-socket-wise upon the curved face 54 of the frame 55, and then the weighted levers 58 are locked into the recesses of the frames 2, so as to prevent the cradle swinging back out of position. It may here be stated that when the levers 58 are released from the recesses the powerful springs 63, acting upon the straps 60, while permitting the holder, with its cradle, to be turned upon the face 54, prevent it falling back entirely out of place. The cradle being securely locked in position by the levers 58, the holder is slid along the guide-bars 40 until the pile of sheets presses against the pinching-bars 42 and 43, against which the sheets are held tightly by the action of the springs 63. The machine is now set in motion by clutching (by the pin 14) the loosely-running driving chain-wheel 12 to the fixed wheel 13 on the shaft 11, whereupon said shaft is set in rotation, with the result that the chain 8 actuates the wheel 9 and shaft 6 and revolves the feed-cylinder 3, while at the same time the chain-gears 75, 75<sup>a</sup>, 76, 77, 79, and 80 at each side of the machine are set in motion. The running of the chain 79 carries up the finger of the block 84, and the block itself (which is connected to the bellows 66) is caused to ascend the slot 83, with the roller on its arm 85 bearing against the guide 87. This ascension of the block 84 (one at each side of the machine) compresses the bellows against the action of the weights on the shaft 51. When the block nearly reaches the top of the slot 83, the roller 86 of the arm 85 works around the curved upper end of the guide 87, with the result that the finger is disengaged from the chain 79, and immediately this disengagement takes place the weights of the bellows drop and expand the bellows suddenly, thereby creating a sudden suction in the pipe 7 and the feed-cylinder. This sudden suction is timed to take place just as the suction-cups 5 of the feed-cylinder come opposite the upper end of the first sheet of the pile, with the result that the sheet is lifted and carried by the feed-cylinder directly onto the tapes 4. The rollers 17 assist in gripping and feeding forward the sheets.

In order to insure that the sheets shall be easily lifted one at a time, it is necessary that the holder should be caused to recede slightly just at the moment when the suction of the cups 5 acts upon the front sheet of the pile and during its process of removal, so as to relieve the pinching action and loosen the sheets, and this receding movement is effected by the cam-and-rack mechanism. Each cam 70 is shaped, as shown in full lines at Fig. 5, so as to allow its roller 71 and toothed segment 66 to move downward once in each

revolution, whereby the segment can move out of engagement with the rack 59. The cam 72, which is shaped as shown in dotted lines at Fig. 5, causes the arm 74 to move forward and to remain in this position during about two-thirds of the revolution of the cam, and then, owing to the roller 73 of the arm 74 running against the reduced part of the cam, to recede and remain in this position during about one-third of the revolution of the cam. As the arm 74 is rigidly secured to the shaft 69 and as the arm 68 is likewise secured, it follows that the said arm 68 receives a similar motion. As the cams have not a positive action springs (not shown) are employed to keep the rollers of the arms bearing against the faces of the cams. Now when the arm 74 is moved forward each arm 68, along with its segment 66, is also moved forward, and owing to the fact that each roller 71 at such times runs upon the extended part of its cam (see Fig. 5) each segment is in engagement with its rack 59, whereupon it follows that each rack is moved forward—that is, caused to recede—thereby moving back the holder on the guides 40 of the cradle and relieving the pressure on the paper sheets. When the reduced part of the cam 72 bears upon the arm 74; the racks and holder are free to move back again to their former positions under the action of the spring 63 and again press the sheets against the pinching-bars 42 43. When the rollers 71 traverse the reduced parts of the cams 70, the segments 66 are moved out of engagement with the racks, so that at such times the holder is left entirely free, whereby an automatic forward feed under the action of the springs 63 is permitted, sufficient to compensate for the sheets as they are withdrawn one by one. This compensating movement of the holder is timed to take place just before the suction-cups 5 act upon the front sheet of the pile. The blasts of air delivered through the nozzles 19 and perforated pipes 37 tend to separate or blow apart the sheets, so as to reduce the likelihood of two or more sheets being lifted together by the suction-cups.

By making the holder with long and short projections 21 22 and slots 32 the sheets are not so liable to adhere to one another. This construction also reduces the weight of the holder.

Instead of using the arrangement shown at Figs. 1 and 2 for actuating the bellows a cam-action may be employed, as shown at Fig. 9. The mechanism consists of a cam 100, which is of a "comma" shape, as shown, a bent lever 101, fulcrumed at 102 on the side frame of the bellows, a link 103, and a sliding pin 104, working in the vertical slot 83 of the bellows-frame. A set of this mechanism is provided at each side of the bellows, and the pins 104 (which correspond to the blocks 84) are connected to the bottom of the bellows. The cams 100 are secured on the cross-shaft 11. Owing to the peculiar shape of the cams



100 the pins are caused to ascend and compress the bellows slowly, and when each roller 106 reaches the point 107 of each cam the pins are allowed to fall suddenly, (under the  
5 action of the weights, as aforescribed,) and thereby expand the bellows suddenly and produce a sharp and decided suction at the suction-cups 5.

If desired, where the suction for the machine  
15 is derived from some outside source, such as an engine, and the suction is a constant one a bellows 108 may be connected with the suction-pipe, as shown at Fig. 10, so as to augment the sucking action at certain times, and  
20 thereby give the necessary sudden suction whenever a sheet is being removed from the pile. Connected with the bellows are the pipe 108<sup>a</sup> from the engine and the pipe 108<sup>b</sup> to the suction feed-cylinder 3, and this latter pipe  
25 is provided with a valve 109, operated, so as to open and close at the proper times, by suitable mechanism driven by the machine. The bellows 108 whenever the valve 109 is opened would, through the reduction of the vacuum  
30 produced by the opening of the valve, suddenly expand to a certain extent under the action of weights 51<sup>a</sup> at its under side, and thereby produce a sudden suction at the suction-cups 5.

Should the feed-cylinder miss a sheet, the  
35 blocks 84 of the bellows would fall right down to the bottom of the slots 83, which is a thing they never do when the machine is properly working, and would strike a lever 110, (see dotted lines, Fig. 2,) fulcrumed at 111 and connected to a trigger 112, which latter would be moved so as to actuate the usual check-action of the printing-machine.

The arrangement for the American style of  
40 printing-machine, Fig. 11, is practically the same as for the English machines, but slightly altered in the arrangement of the parts. In this case the holder may be pulled forward by weights 60<sup>a</sup>, attached to the straps 60, instead of by springs.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating  
50 sheet-holder and a rockable cradle upon which the holder reciprocates, substantially as set forth.

2. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating  
55 sheet-holder, means for reciprocating the holder and a rockable cradle upon which the holder reciprocates, substantially as set forth.

3. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating  
60 sheet-holder, means for reciprocating the holder, a rockable cradle provided with pivots at each side and with guides upon which the holder reciprocates, substantially as set forth.

4. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating

sheet-holder, means for reciprocating the holder, a rockable cradle provided with pivots at each side, guides upon which the holder  
70 reciprocates, and a cross-bar with rocking block which rocks upon a supporting-frame connected with the machine, substantially as set forth.

5. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating  
75 sheet-holder, means for reciprocating the holder, a rockable cradle provided with pivots at each side, guides upon which the holder reciprocates, a cross-bar with rocking block  
80 which rocks upon a supporting-frame and hinged weighted levers for locking the cradle in position, substantially as set forth.

6. In a device of the class described, the combination with a frame for holding the paper to be fed, of pneumatic mechanism for  
85 feeding the paper sheets from the frame, a movable cross-bar provided with a number of projections serving as rests or supports for the pile of sheets at one edge, and a screw for  
90 raising and lowering the cross-bar, substantially as shown and described.

7. In a device of the class described, the combination with a frame for holding the paper to be fed provided with a plurality of vertical  
95 slots and with alternating long and short fingers at its upper end, of a movable rest for supporting one edge of the pile of sheets, and a screw for raising and lowering the rest, substantially as shown and described.

8. In a device of the class described, the combination with pneumatic mechanism for  
100 feeding the paper sheets, of a vertical or inclined sheet-holder consisting of a slotted frame provided at its upper end with long and  
105 short fingers, substantially as described and for the purposes set forth.

9. In pneumatic mechanism for feeding paper sheets, the combination of a movable  
110 sheet-holder, means for moving the holder and adjustable pinching-bars having projections or arms against which the paper is pinched, substantially as set forth.

10. In pneumatic mechanism for feeding paper sheets the combination of a frame, a movable  
115 holder carried by the frame, means for moving the holder, slots made in the frame, pinching-bars 42, 43 carried in the slots and screws for adjusting the pinching-bars in the slots relatively with the holder, substantially  
120 as set forth.

11. In pneumatic mechanism for feeding paper sheets the combination of a frame, a movable  
125 holder carried by the frame, racks fitted to the holder, means for pulling the holder forward and toothed segments operated by cam-and-lever mechanism for moving the holder backward, substantially as set forth.

12. In pneumatic mechanism for feeding paper sheets the combination of a frame, a movable  
130 holder carried by the frame, racks fitted to the holder, straps fitted to the racks, springs acting upon the straps so as to pull the holder forward and means for moving the holder



backward against the action of the springs, substantially as set forth.

13. In pneumatic mechanism for feeding paper sheets the combination of a frame, a movable holder carried by the frame, racks fitted to the holder, straps fitted to the racks, springs acting upon the straps so as to pull the holder forward, segments gearing with the racks, levers linked to the segments, a cam for actuating the levers, and means for operating the cam, substantially as set forth.

14. In pneumatic mechanism for feeding paper sheets the combination of a frame, a movable holder carried by the frame, racks fitted to the holder, straps fitted to the racks, springs acting upon the straps so as to pull the holder forward, segments gearing with the racks, levers linked to the segments, a cam for actuating the levers, means for operating the cam, cams for moving the segments into and out of gear with the racks and means for operating these cams, substantially as set forth.

15. In pneumatic mechanism for feeding paper sheets the combination of a frame, a rockable cradle carried by the frame, a movable holder which slides upon the cradle, means for pulling the holder forward and toothed segments operated by cam-and-lever mechanism for moving the holder backward, substantially as set forth.

16. In pneumatic mechanism for feeding paper sheets the combination of a reciprocating sheet-holder, a cross-bar fitted to the holder, rests for the paper sheets on the cross-bar, means for raising and lowering the cross-bar on the holder, a series of perforated pipes fitted on the cross-bar and means for causing a blast of air to issue through the perforations of the pipes, substantially as set forth.

17. In pneumatic mechanism for feeding paper sheets the combination of a frame, a suction device for feeding the sheets carried by the frame, a bellows for producing the suction, weights for expanding the bellows, chain and chain-wheel gear driven from a power-shaft for collapsing the bellows and means for connecting the chain-gear to the bellows, substantially as set forth.

18. In pneumatic mechanism for feeding paper sheets the combination of a frame, a suction device for feeding the sheets carried by the frame, a bellows for producing the suction, weights for expanding the bellows, chain and chain-wheel gear driven from a power-shaft for collapsing the bellows means for connecting the chain-gear to the bellows and means for automatically disconnecting the chain-gear from the bellows whenever the latter is collapsed so that the weights may suddenly act upon the bellows and produce a sudden suction in the suction device, substantially as set forth.

19. In pneumatic mechanism for feeding paper sheets the combination of a frame, a suction device for feeding the sheets carried by the frame, a bellows for producing the suction, weights for expanding the bellows,

chain and chain-wheel gear driven from a power-shaft for collapsing the bellows, blocks connected to the bellows and escapement-levers pivoted on the blocks for connecting the chain-gear to the bellows and means for automatically disconnecting the chain-gear from the bellows at certain times, substantially as set forth.

20. In pneumatic mechanism for feeding paper sheets the combination of a frame, a suction device for feeding the sheets carried by the frame, a bellows for producing the suction, a frame for the bellows, slots made in the frame, weights for expanding the bellows, chain and chain-wheel gear driven from a power-shaft for collapsing the bellows, blocks on the bellows working in the slots of the bellows-frame, pivoted escapement-levers each having two arms one of which can lock into the chain-gear and the other being provided with a roller, and guides secured to the frame upon which the rollers of the escapement-levers travel, substantially as set forth.

21. In pneumatic mechanism for feeding paper sheets the combination of a frame, a rotating suction-cylinder carried by the frame, suction-cups on the cylinder, means for rotating the cylinder, a bellows for producing the suction, weights for actuating the bellows in one direction and cam mechanism for actuating the bellows in the opposite direction, substantially as set forth.

22. In pneumatic mechanism for feeding paper sheets the combination of a frame, a rotating suction-cylinder carried by the frame, suction-cups on the cylinder, means for rotating the cylinder, a bellows for producing the suction, weights for actuating the bellows in one direction, levers connected with the bellows for actuating it in the opposite direction and cams for operating the levers so as to produce a sudden suction in the suction-cylinder when the sheets are being lifted, substantially as set forth.

23. In pneumatic mechanism for feeding paper sheets the combination of a frame, a rotating suction-cylinder carried by the frame, suction-cups on the cylinder, chain-gear for rotating the cylinder, a bellows for producing the suction in the cylinder, means for operating the bellows, a reciprocating sheet-holder, means for reciprocating the holder, a rockable cradle upon which the holder is carried and means for locking the cradle in position, substantially as set forth.

24. The combination of the frame, the rotating suction-cylinder fitted in the frame, means for rotating the cylinder, endless feed-tapes passing around the cylinder and over pulleys carried by an adjustable feed-table, and means for adjusting the feed-table, substantially as set forth.

25. The combination of the frame, the rotating suction-cylinder fitted in the frame, means for rotating the cylinder, endless feed-tapes working in conjunction with the cylinder, means for producing the suction in the



cylinder, means for regulating the suction, the reciprocating sheet-holder 20, the cradle 23 upon which the holder is carried, means for locking the cradle in position, racks 59 secured to the holder, means for pulling the holder forward, segments 66 gearing with the racks, levers 68 connected to the segments, a shaft 69 carrying the lever 68, a lever 74 connected to the shaft 69, a cam 72 for operating the lever 74 and shaft 69, and cams 70

for throwing the segments 66 into and out of gear with the racks 59, substantially as set forth.

Signed at Glasgow, in the county of Glasgow, Scotland, this 29th day of March, 1899. 15

WILLIAM CARTER.

Witnesses:

WILLIAM GALL,  
THOMAS GRACE.