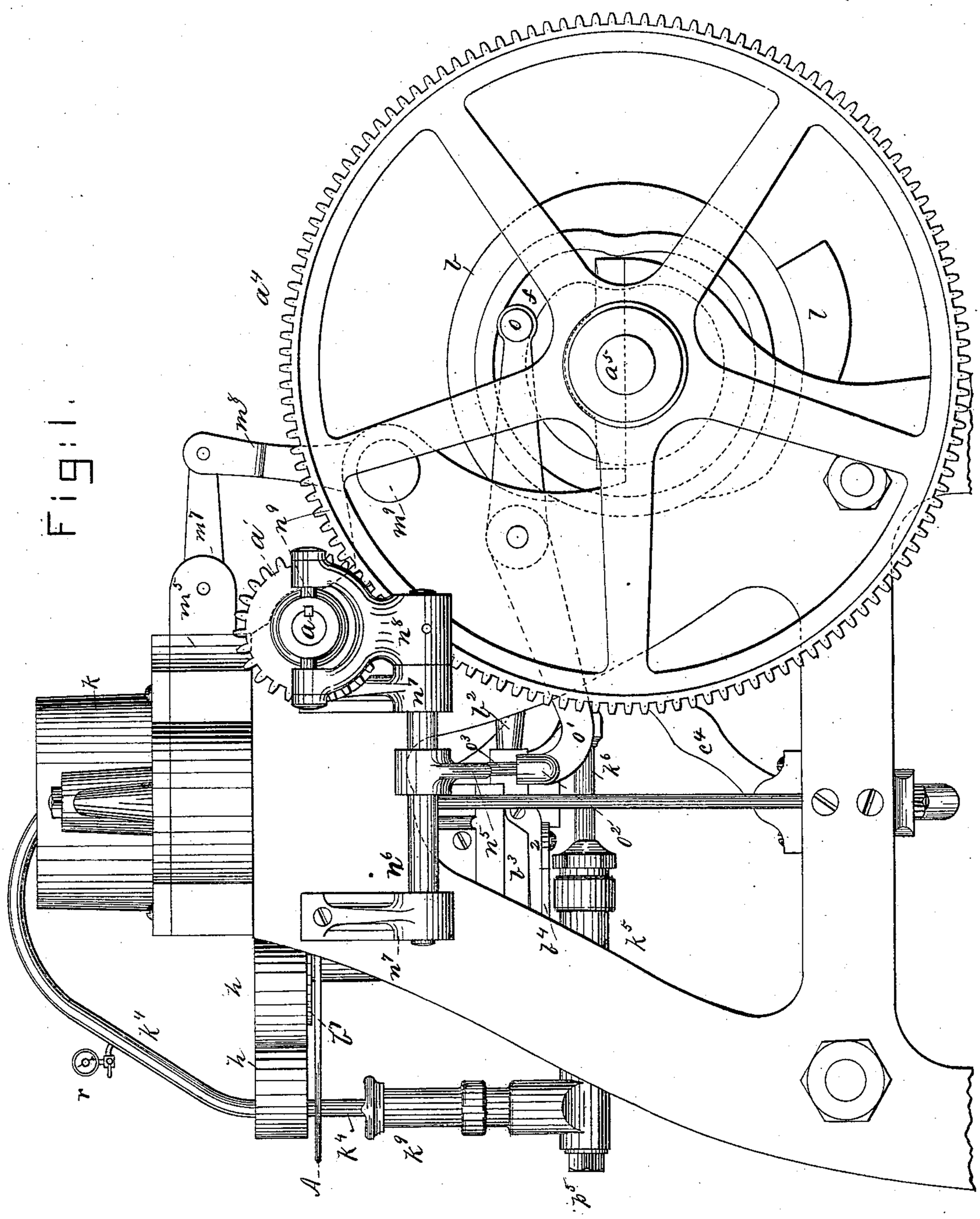
(No Model.) 5 Sheets—Sheet 1.

W. J. KEEFE.

MACHINE FOR PRESSING AND FINISHING HOLLOW ARTICLES FROM PAPER PULP.

No. 251,365. Patented Dec. 27, 1881.

Fig. 1.



Witnesses.
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(No Model.) 5 Sheets—Sheet 2.

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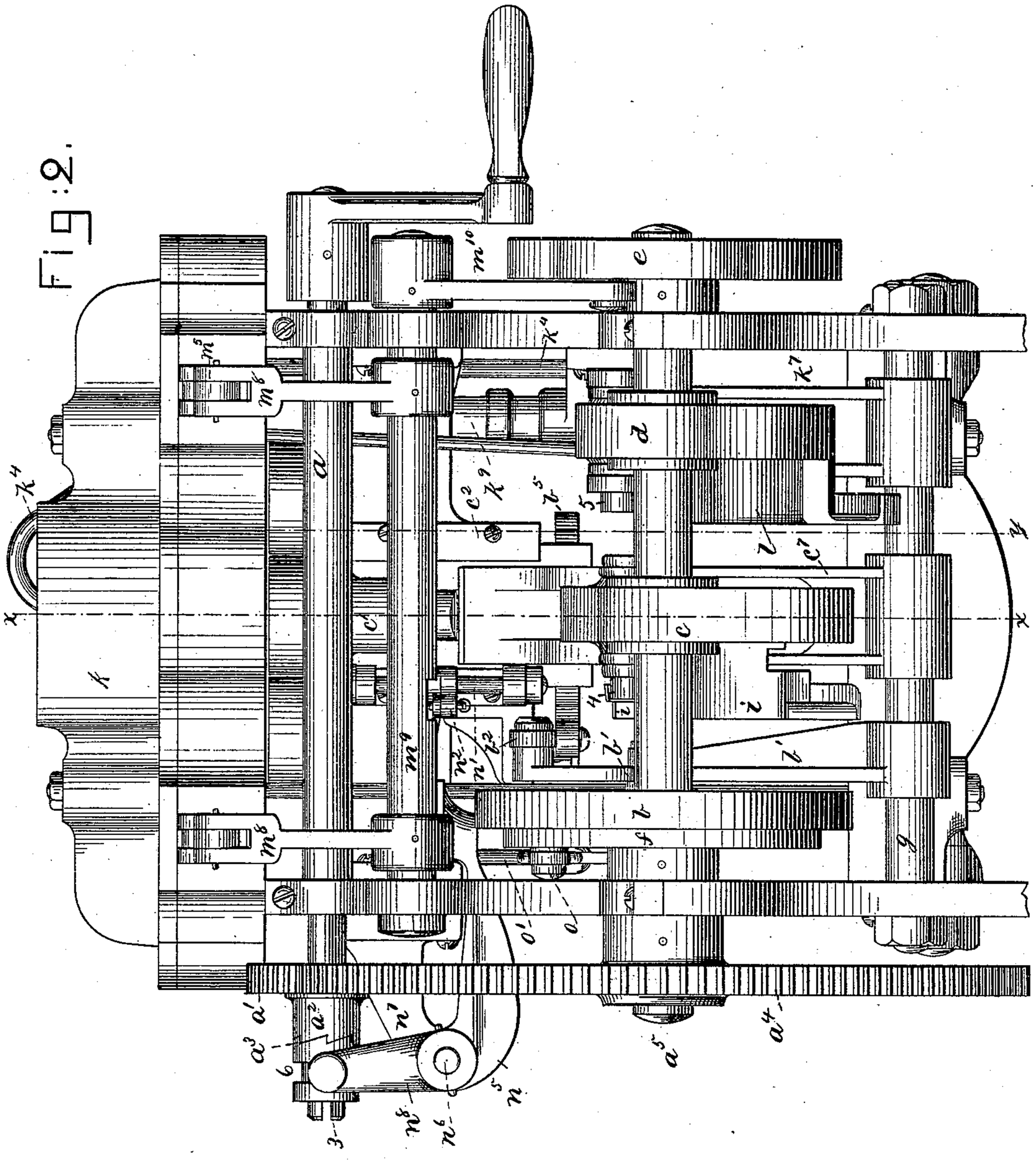
Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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MACHINE FOR PRESSING AND FINISHING HOLLOW ARTICLES FROM PAPER PULP.

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Fig: 3.

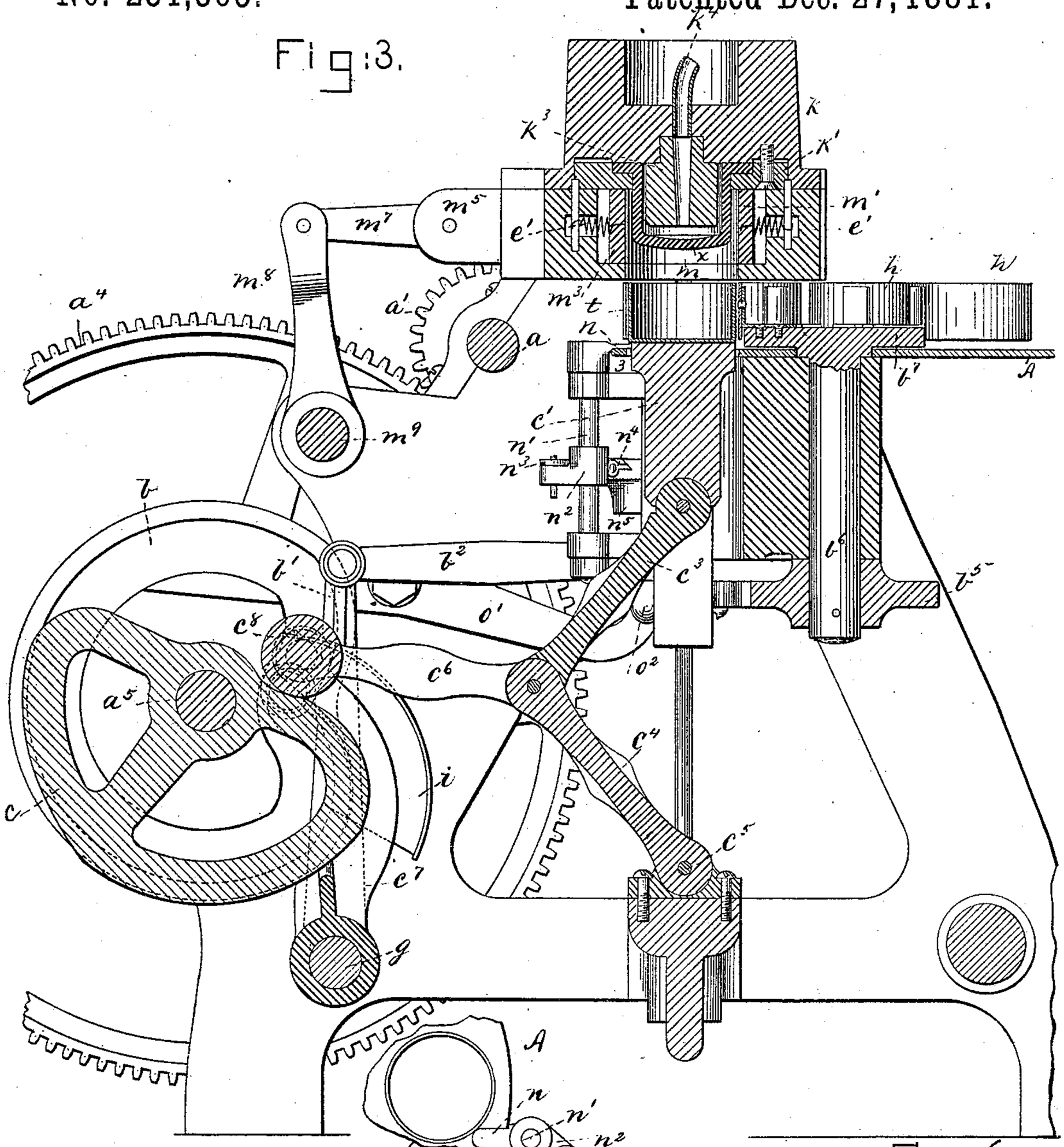

Fig: 6.

Fig: 8.

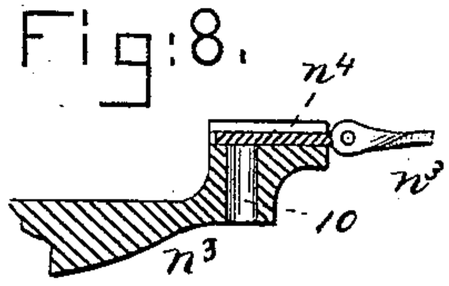

Fig: 7

Witnesses

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(No Model.)

5 Sheets—Sheet 4.

W. J. KEEFE.

MACHINE FOR PRESSING AND FINISHING HOLLOW ARTICLES FROM PAPER PULP.

No. 251,365. Patented Dec. 27, 1881.

Fig: 4

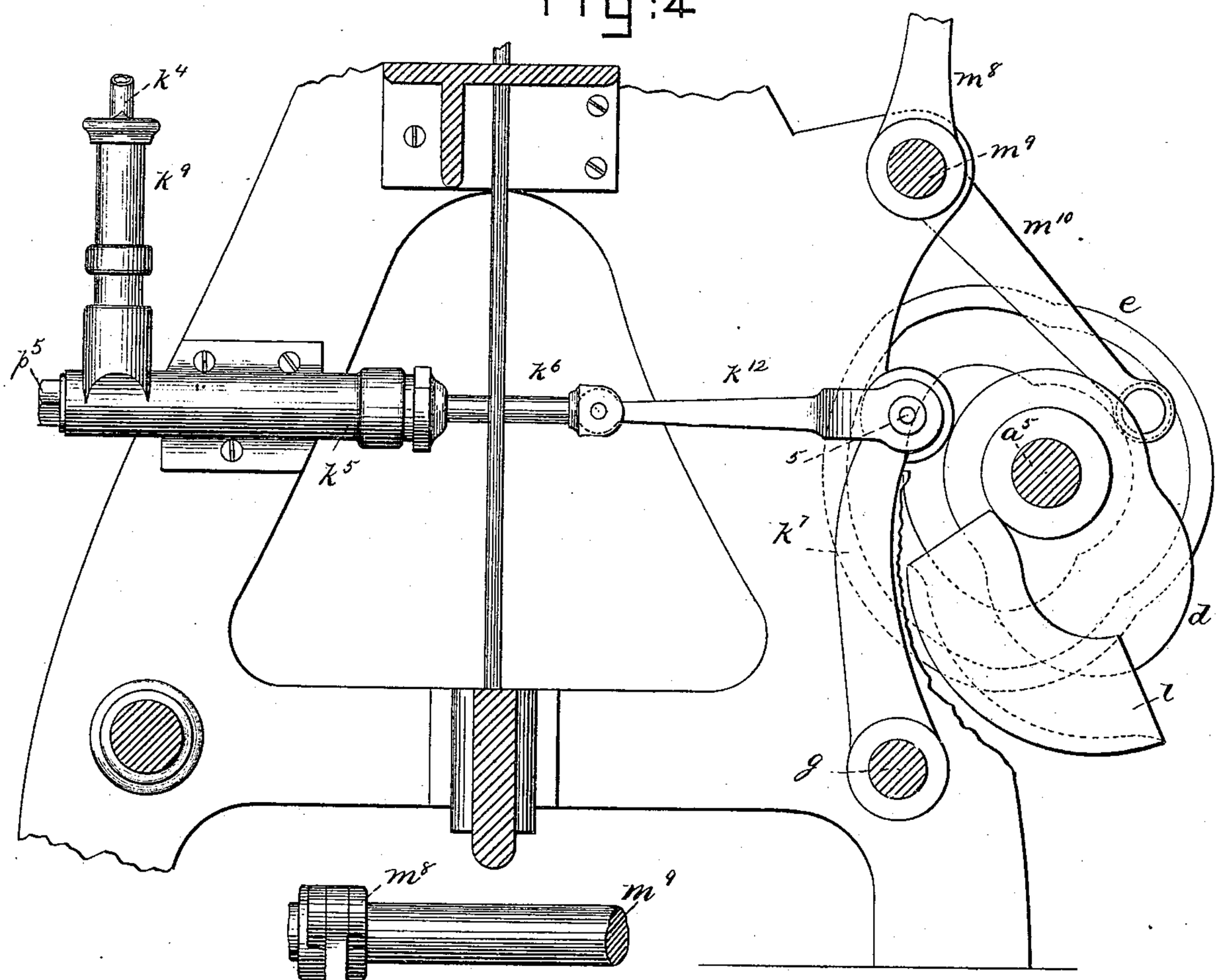

Fig: 5.

Witnesses.

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(No Model.) 5 Sheets—Sheet 5.

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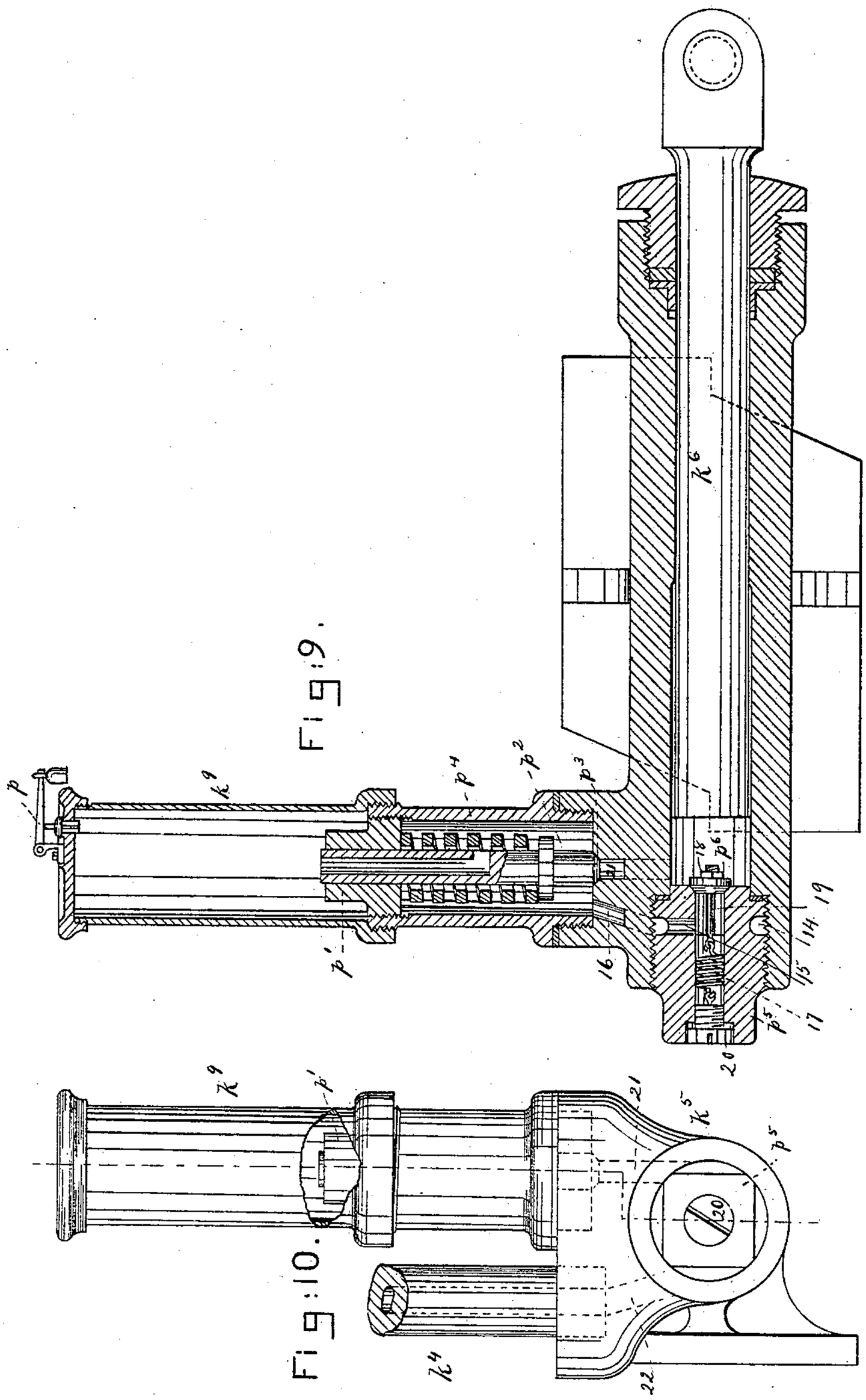

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM J. KEEFE, OF BOSTON, MASSACHUSETTS.

MACHINE FOR PRESSING AND FINISHING HOLLOW ARTICLES FROM PAPER-PULP.

SPECIFICATION forming part of Letters Patent No. 251,365, dated December 27, 1881.

Application filed April 26, 1881. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. KEEFE, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Machines for Pressing and Finishing Hollow Articles from Paper-Pulp, of which the following description, in connection with the accompanying drawings, is a specification.

This invention, relating to mechanism for pressing and finishing hollow paper-pulp articles—such as boxes, tubs, or pails—is an improvement on United States Patent No. 202,353, granted to me April 16, 1878, and on the machine represented in the Patent No. 89,433, April 27, 1869, therein referred to.

In this invention I have provided a carrier having a series of connected cells or cups to receive the boxes or other hollow articles to be pressed or finished, the said carrier being operated automatically at the proper times to place the boxes or hollow articles held in the cells or cups immediately above a plunger located directly below the opening of the matrix and in line with an expansible die, so that upward movement of the said plunger, the box resting thereon, will remove the box from the cell or cup then holding it into the open matrix, and between it and the expansible die. This done, the matrix, if for a round box, is contracted, or its parts are moved inwardly to their full extent in close contact with the box or hollow article to be pressed, and the expansible die, by hydraulic pressure instantaneously derived from a pump, is distended to such an extent as to compress or consolidate the walls of the box or hollow article against the faces of the parts of the then stationary matrix against which the exterior of the box rested before the die was expanded. As soon as the die is partially expanded by hydrostatic pressure, expanded for the purpose described in my former patent, the upward movement of the plunger is commenced, and such upward movement is continued until the full pressure of the die is obtained, after which the expansible die is relieved from hydrostatic pressure, permitting it to resume its normal size. The matrix then recedes quickly directly away from the center of the box, leaving it on the plunger, which, in its descent, returns the pressed box into the same cell of the carrier from which it was lifted to be pressed.

In order to enable the mechanism herein described to operate rapidly, as is essentially necessary for successful and profitable working, it is important that the pressed box always certainly descend with the plunger, no matter what may be its speed of operation. This I have been enabled to do in the following manner, viz: I have made the die longer than the interior depth of the box to be pressed by it, so that when the plunger is elevated to compress the bottom of the box between it and the die the said die will be lifted or shortened in length before any hydraulic pressure is exerted on it. This shortening of the length of the die, as described, keeps the bottom of the box pressed very closely against the face of the plunger, both while the sides of the box are being pressed and while the matrix is being expanded or drawn away from the outer walls of the box, this latter movement of the matrix taking place just as the plunger begins to descend. As the plunger descends after withdrawing the matrix the die, relieved from hydrostatic pressure, resumes its normal length and maintains close contact of the box with the plunger, thus obviating the admission of air between the box and plunger and insuring the retention of the box on the plunger until it be brought to the level of the top of the table, when further movement of the carrier causes the cell or cup then holding the box to detach the box from the top of the plunger and deliver it upon the stationary table. This last movement of the carrier brings a cell or cup with a new or unpressed box above the plunger. In its further movements the cell of the carrier containing the pressed box delivers the same over a proper opening in the table, through which the box is delivered upon an endless belt or other proper movable receiver. (Not shown.)

I have added to my machine a mechanism to automatically stop or arrest its action should a box fail to descend with the plunger.

Figure 1 is a right-hand end elevation of a machine containing my invention. Fig. 2 is a rear end elevation thereof. Fig. 3 is a vertical longitudinal section on the line *x x*, Fig. 2. Fig. 4 is a partial vertical section on the line *y y*, Fig. 2, looking toward the right. Fig. 5 is a partial top view, showing the carrier and table, the matrix, and devices for moving it, a portion of the top of the machine being removed

to show the said parts. Fig. 6 is a sectional detail on the dotted line, Fig. 5; Figs. 7, 8, details of the automatic stopping devices; and Figs. 9, 10, vertical longitudinal section and partial end view of the pump to control the fluid which expands the die.

The main shaft a of the machine, driven in any usual way, has upon it the loose gear a', having its hub a^2 made as part of a clutch. As herein shown, the clutch part contains ratchet-teeth to be engaged by the corresponding clutch part a^3, having ratchet-teeth, the said clutch part being keyed to, and so as to slide upon but rotate with, the shaft a. The gear a' engages the gear a^4 on the cam-shaft a^5, provided with cams b c d e f, which actuate the parts of the machine in the proper time and order. The cam b (best shown in Fig. 3) acts upon a roller or other stud of a lever, b', having its fulcrum on the rod g, and connected at its upper end by a link, b^2, with a pawl-carrying frame, b^3, (see Fig. 1,) having a pawl, b^4, kept pressed by a spring, 2, against the ratchet b^5 on the lower end of the shaft b^6. This shaft b^6, at its upper end, above the stationary table A, has a head or disk, b^7, which I denominate a "carrier," with which is connected the cells or cups h, which receive and carry the pulp-boxes or articles to be pressed and finished in the machine, the said pawl moving the said carrier and cells or cups intermittingly at the proper times to place a pulp-box above the plunger c'. This plunger c', fitted into suitable guideways, c^2, immediately below a hole or opening, 3, in the table A, as shown in Fig. 3, is connected with the upper member, c^3, of a toggle, the lower member, c^4, of which is pivoted at c^5 upon a fixed part of the frame-work. This toggle, at its center, is joined by a double link, c^6, with the upper end of a double lever, c^7, having its fulcrum on the rod g, a pin, 4, which connects the link c^6 and lever c^7, having a roll, c^8, which is acted upon by the cam c to elevate the plunger c'.

The end of the pin 4, or a roller thereon, is acted upon by the cam i to spring the toggle, as in Fig. 3. The expansible india-rubber die x, flanged about its base, as shown in section, Fig. 3, is held in place on the cross-head k by means of a flanged collar, k', bolted thereto. This cross-head has a plug, k^3, extended from its lower side into the die, but shorter than the said die. This plug, in practice, will be of the same diameter as the interior diameter of the die x. The plug k^3 receives or is connected with the pipe k^4, joined with the pump-cylinder k^5.

The piston k^6 is joined by link k^{12} with the upper end of a lever, k^7, having its fulcrum on the rod g. The lever and piston-rod are actuated at the proper times to force water into the die by the cam d. The piston is withdrawn by the cam l, which acts on the end of the pin 5, connecting the link k^6 and lever k^7, or on a roller on the said pin.

The fluid to fill the pump-cylinder k^5, pipe k^4, and die x may be introduced therein through the supply-chamber k^9, the upper part of which is covered by a removable cap having a puppet or safety valve, p, of any usual construction. This chamber k^9 contains a nut, p', having a central passage to guide the hollow stem of the valve p^2, which is kept pressed into the valve-seat p^3 by a spring, p^4, the resistance of which may be regulated in accordance with the pressure desired to be exercised by the die x by turning the said nut.

The outer end of the pump-cylinder has a hollow screw-plug, p^5, provided with a spring-held valve, p^6, having a port, 15, and an annular groove, 14, in communication with a port, 16, leading into chamber k^9.

The resistance of the spring 17, holding the valve p^6, may be regulated by turning the nut 18 at the inner end of the rod 19, upon which the valve is placed. The spring 17 is connected with screw 20. The pipe k^4 (shown broken off in Fig. 10) has its lower end in communication with the port 22, (shown in dotted lines,) the mouth of which opens into the pump-cylinder k^5.

The pipe k^4 will have a suitable pressure-gage, r, connected with it. (Shown only in Fig. 1.) The piston k^6, in its forward stroke, will force the fluid of the pump-cylinder into the pipe k^4 and die x, expanding the latter until the spring p^4 yields, when the fluid in front of the piston will thereafter enter the chamber k^9 by lifting the valve p^2. On the return-stroke of the piston k^6 the die will be relieved from fluid-pressure and the fluid will follow the piston; but should the fluid have been so wasted as to result in forming a vacuum at the return-stroke of the piston, then in such case the valve 18 will follow the direction of the movement of the piston k^6 and permit the fluid to pass from the chamber k^9, through port 16, into the plug p^5, and out from its center, then uncovered by the said valve. The chamber k^9, it will thus be seen, receives fluid under excess of pressure, and delivers it at the proper times to the pump to avoid a vacuum and furnish a sufficient supply to insure proper fluid-pressure at the next forward stroke of the piston. As the piston is drawn from the pump-cylinder the water is exhausted from the die sufficiently to enable it to contract and resume its normal size or condition.

The water or fluid employed in the pump and die is used over and over again, and the waste, which is very small, is supplied automatically, as herein shown, from a supply-chamber, k^9 having a system of valves, as described.

The matrix is composed, as herein shown, of four pieces, m m' m^2 m^3. Each part m and m^2 is attached to a wedge-shaped carriage, m^4, which is moved backward and forward positively by a wedge-block, m^5, preferably connected with the carriage by a dovetail, as shown at m^6, Fig. 6. These wedge-blocks m^5 are connected by links m^7 with arms m^8 of rock-shaft

m^9, having an arm, m^{10}, operated upon by the cam *e*. The movement of the wedge-blocks forward causes the parts *m* and m^2 to approach each other and bear against the box or other hollow article between their faces. The parts *m* and m^2 are beveled, as shown at Fig. 5, to receive the parts m' and m^3, which are correspondingly beveled at their rear sides, and kept in contact with the beveled portions of the parts $m\ m^2$ by suitable springs, e', (shown only in Fig. 3,) so that as the parts $m\ m^2$ are moved toward or from each other or the center of the box the parts m' and m^3 will be automatically moved toward and from the center of the box.

To stop the machine automatically I have added to it a finger, *n*, (see Fig. 7,) on a rock-shaft, n', which, through intermediate devices to be hereinafter described, will operate the clutch part a^3 and disengage it from the clutch part a^2 of the gear a', thus letting it run loosely on the shaft *a* when the plunger fails to bring down with it a box or other hollow article. The rock-shaft has an arm, n^2, joined by link n^3 with a sliding hole-covering plate, n^4, fitted into a guideway or groove at the end of the arm n^5 of a rock-shaft, n^6, held in bearings n^7, the said shaft n^6 having a forked arm, n^8, with pins n^9 to enter an annular groove, 6, in the hub of the clutch part a^3. The spring 8, in its normal condition, keeps the plate n^4 in such position as to cover the hole 10 at the end of arm n^5 just as the carrier is to remove a pressed box from the plunger upon the table A. If a box has been pulled down with the plunger and left below the cell or cup, the carrier, when moved, will carry the said box against the finger *n* and turn it and the rock-shaft n' far enough to withdraw the plate n^4 to uncover the said hole 10. As the carrier is so moved a cam, *f*, on the shaft a^5 acts upon a stud or pin, *o*, preferably adjustably connected with the lever o', having at its other end a socket, o^2, suitably shaped to receive in it loosely the lower end of a pin, o^3, preferably ball-shaped at its lower end, and having its upper end extended into the hole 10 of the arm n^5. If as the pin o^3 is lifted in the hole 10 the plate n^4 covers the said hole 10, as it will do if a box has not been brought down with the plunger, the said pin, meeting the plate n^4, will move the arm n^5, shaft n^6, disengage the clutch, and stop the machine; but if the plate n^4 is withdrawn to uncover the hole 10 by the presence of a box below the cell or cup, the pin will not be obstructed and the machine will continue in operation. The lower end of the pin o^3 will be so connected with the lever o' as to be drawn down positively.

The drawing, Fig. 3, shows a box, *t*, in section. This box may be produced from pulp by a machine such as represented in my Patent No. 202,353, or in my pending application filed in the United States Patent Office May 6, 1880, serial No. 9,177. The box (shown as resting on the plunger) will by the straightening of the toggle be carried upward from the position Fig. 3 into the space of the matrix, and between the interior of the matrix and the expansible die *x*, and the bottom of the box will be held between the plunger and the lower end of the shortened die, as previously described. Then the wedge-block closes the matrix against the outer sides of the box, and after that, as the plunger is somewhat farther elevated to press the bottom and lower angles or corners of the box, the die is expanded by hydrostatic pressure and the box is pressed. Having been pressed, the die is removed from hydrostatic expanding pressure and the parts of the matrix removed outward a little, after which the plunger descends, the die following it and maintaining contact with the inner side of the box-bottom until the die reaches its normal length.

The faces of the movable parts of the matrix will be chased or cut in design to emboss the box or hollow article externally. Such a box will form the subject-matter of another application for Letters Patent.

I claim—

1. In a machine for pressing boxes or hollow articles, the movable carrier and its series of cells or cups to receive the hollow article to be pressed, and a plunger and expansible die, co-operating substantially as and for the purpose described.

2. The movable carrier and its series of cells to receive the hollow article to be pressed, combined with the matrix to receive the hollow article removed from a cell of the carrier by the plunger, substantially as described.

3. The movable carrier, its series of cells or cups to receive the hollow article to be pressed, and the plunger and expansible die, combined with the movable matrix, to operate substantially as described.

4. In a machine to press hollow articles of paper-pulp, the expansible die and a matrix, combined with a pump to force a fluid into the said die, substantially as described.

5. The expansible die and plunger to place upon it the hollow article to be pressed, combined with the separable matrix, to operate substantially as described.

6. The expansible die and pump to force a fluid into or draw a fluid from it, combined with a matrix and a plunger to place the hollow article on the matrix surrounding the die, substantially as described.

7. The matrix composed of the parts $m\ m^2$ and the parts $m'\ m^3$, each provided with inclines, and the springs e', substantially as described.

8. The parts $m\ m^2$ of the matrix and the carriage m^4, combined with the wedge-blocks m^5 and suitable means to operate the said wedge-blocks, substantially as described.

9. The carriage m^4 and matrix part *m*, combined with the wedge-block connected therewith by a dovetail, substantially as described, whereby the said wedge-block is enabled to operate the said carriage positively in both directions.

10. In a machine to press hollow articles of paper-pulp, a table, A, and plunger adapted to move through it, combined with a movable carrier and cell or cup, to operate substantially as described.

11. The plunger and movable carrier provided with cells or cups to hold the pressed hollow article, combined with the finger *n* and clutch and suitable intermediate connecting mechanism, whereby the absence of a box from the plunger as the carrier is moved automatically stops the machine, substantially as described.

12. The expansible die, combined with a pump provided with a fluid-chamber, and valves p^2 and 18, to maintain the proper amount of fluid at the desired pressure, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM J. KEEFE.

Witnesses:

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JOS. P. LIVERMORE.