F. Leclère. Sheet 1. 4 Sheets.

Paper Molding.

No. 84,835. Patented Dec. 8, 1868.

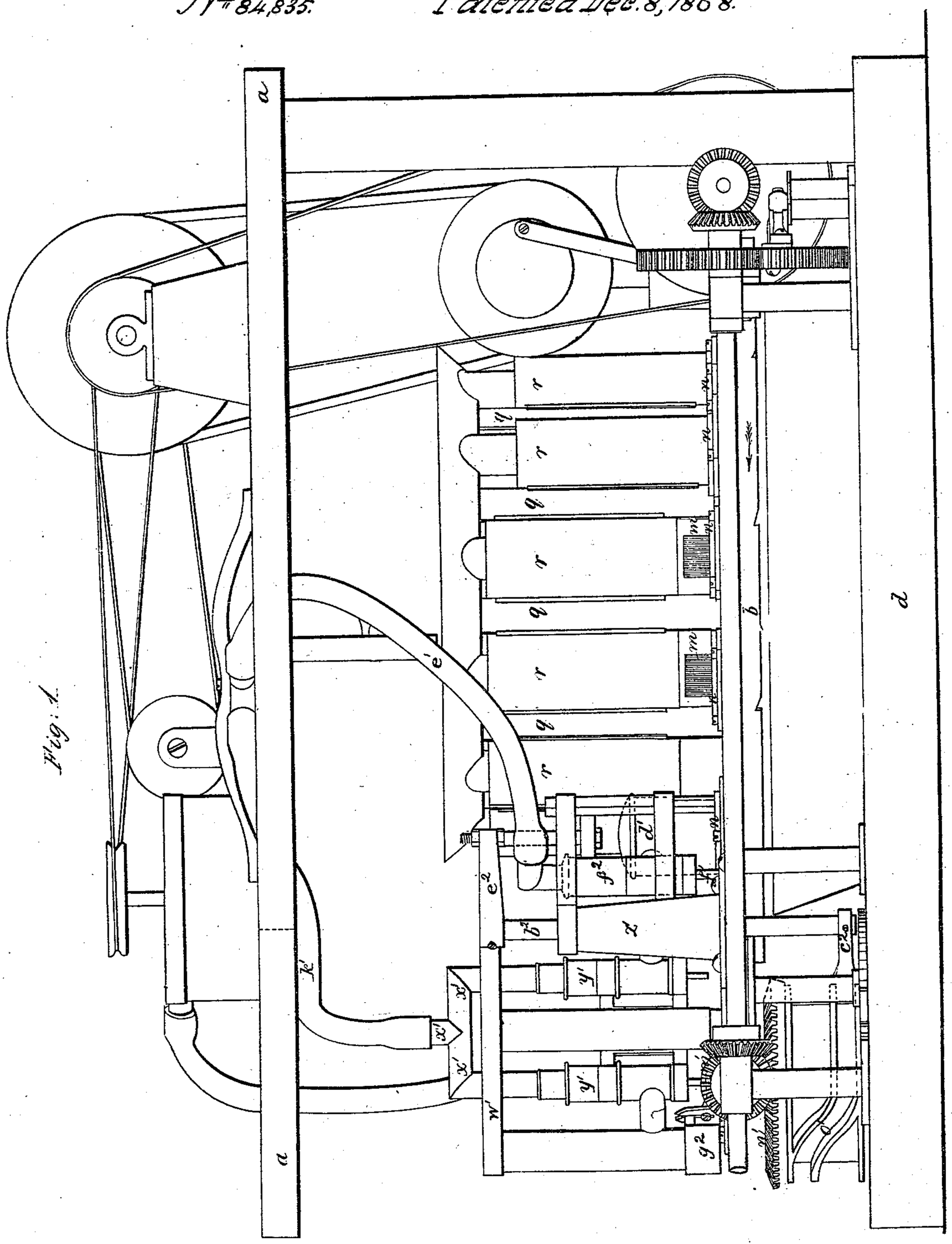

Fig: 1.

Witnesses

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F. Leclère. Sheet 2. 4. Sheets.

Paper Molding.

No. 84,835. Patented Dec. 8, 1868.

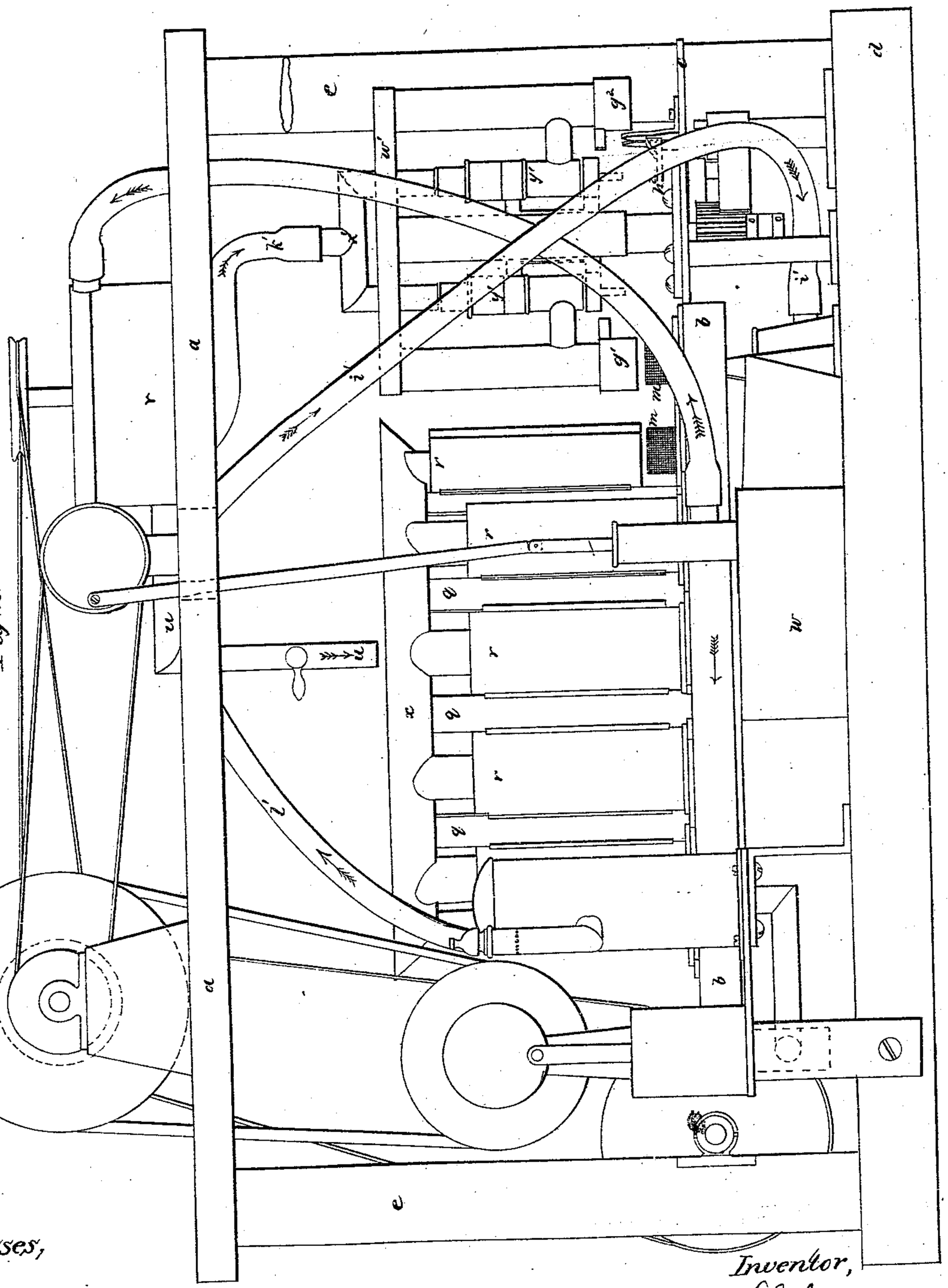

Fig. 2.

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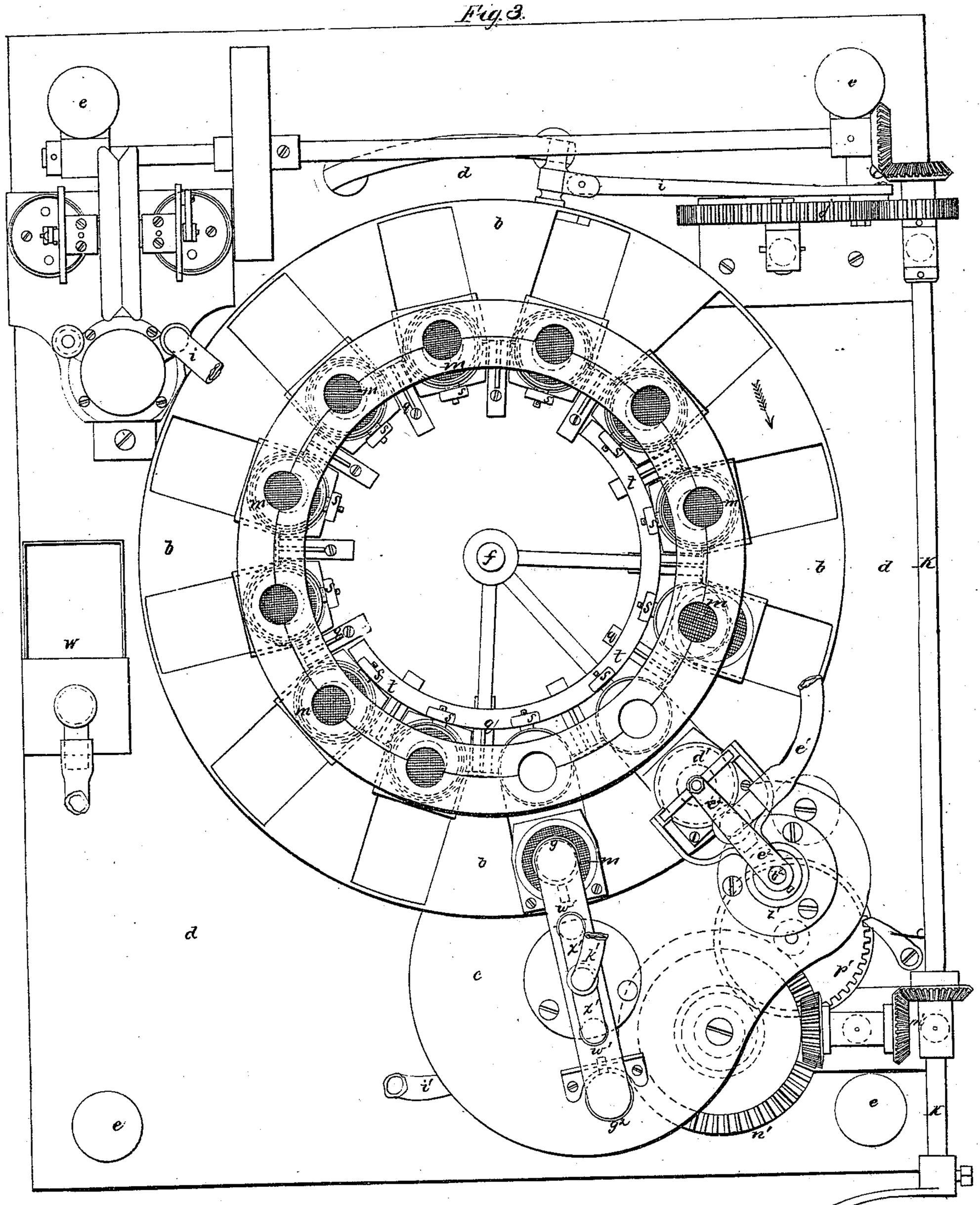
F. Leclère. Sheet 3. 4 Sheets.

Paper Molding.

No. 84,835. Patented Dec. 8, 1868.

Fig. 3.



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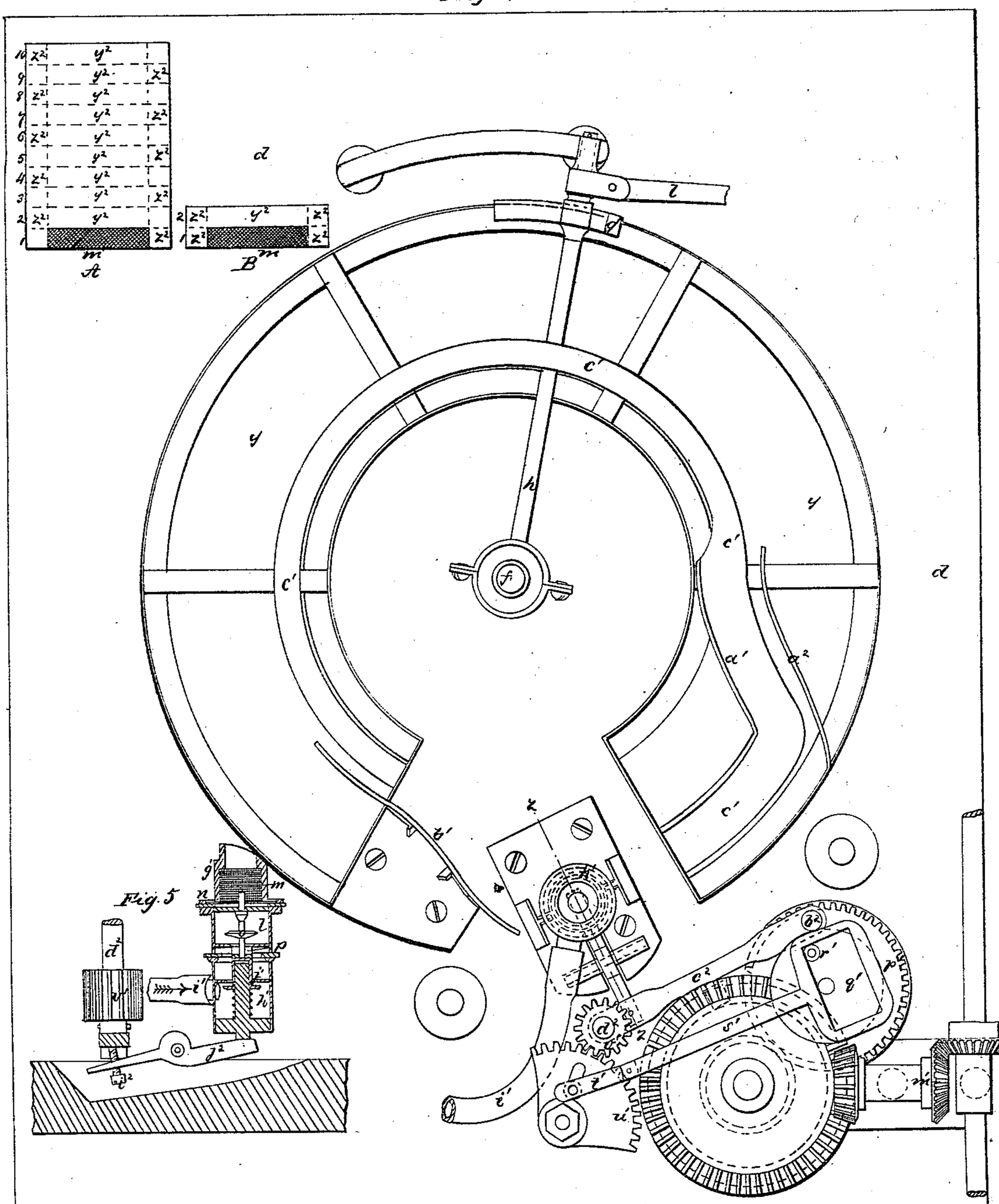
F. Leclère. Sheet 4 - 4 Sheets.

Paper Molding.

No. 84,835. Patented Dec. 8, 1868.

Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANÇOIS LECLÈRE, OF BOSTON, MASSACHUSETTS.

IMPROVED APPARATUS FOR MAKING PAPER BOXES.

Specification forming part of Letters Patent No. **84,835,** dated December 8, 1868.

To all whom it may concern:

Be it known that I, FRANÇOIS LECLÈRE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Forming Hollow Articles from Paper-Pulp; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

This invention is designed for the formation of hollow paper articles from paper-pulp, and is illustrated in this specification in its application to the formation of paper boxes, though applicable, as will be obvious, to the formation of hats and other objects.

I am aware that it is not new to collect on pervious formers hollow articles by causing the deposit on such formers of the fibrous material contained in paper-pulp, during which deposit the water of the pulp passes off through the pores of the former; but all of the previous efforts in that direction have produced articles more or less faulty, some of which have been seamy and not of uniform strength, having in themselves lines in which fracture or breakage soon occurred. Other articles, made by previous processes, have been lacking in uniform thickness, and in none of said processes has the practical manufacture been attended with that certainty and dispatch needed for profitable operation.

In said previous processes a leading feature has been to have the paper fiber mixed with as little water as possible, while in my process I use a very thin pulp in a peculiar way, the object of which is to secure such uniformity in the thickness of the article formed that the departure from perfect uniformity shall be hardly perceptible; and this, which is the main feature of my invention, I accomplish by employing over the pervious former a column of thin pulp, which in height several times exceeds the height of the article to be made.

The difference between this process and the previous processes may be thus illustrated, with reference to the diagrams marked A and B, each representing a pervious former covered by a cylinder, each cylinder to be filled with pulp, that in A being a mixture of a given quantity of fiber with about two units of water, and that in B being a mixture of the same quantity of fiber with about ten units of water.

Suppose, then, that the former is so proportioned that the areas of its top and its vertical periphery are equal, and that the height of the cylinder at A is double the height of the former, and that the height of the cylinder at B is ten times that of the height of the former, and that the diameters of the cylinders are such that in the imaginary divisions represented by dotted lines the cubic contents of each cylindrical division y^2 shall equal the cubic contents of each tubular division z^2, and that the cubic contents of each of said divisions equals the amount of cubic displacement of each former. Then it will be seen that in the cylinder at A, as the water percolates through the pervious former till the pulp is on a level with the top of the former, a deposit of fiber will be made on the top and sides of the former of equal thickness, because, without reference to the difference of pressures, an equal amount of water will have passed through both the sides and the top, leaving on the equal areas equal amounts of solid matter; but it will also be obvious, when taking into account the differences of pressures, that the deposit will be greatest at the bottom of the sides of the former, because, as the pressure of water is greatest there, it will escape there faster, and will leave on the former at the place where it escapes the solid matter for which it is a vehicle.

The pulp being now on a level with the top of the former, and the quantity of solid matter in the tubular division z^2 surrounding the former being about one-third of that originally placed in the cylinder, it will be seen that as the water escapes through the former the deposit already on its sides will be regularly increased from the top to the bottom, while at the bottom of the cylinder will be formed a flange integral with the matter deposited on the former.

Now, in the cylinder at B it will first be observed that the ratio of the difference of pressures at the top and bottom of the former is much less than the ratio in the cylinder at A, and hence there will be a less variation of thickness from that cause.

It will also be seen that, as the pulp settles

to the top of the former, depositing the solid matter in the cylindrical sections y^2 on the top of the former and the solid matter in the tubular division z^2 on the sides of the former, there will be left in the tubular division z^2 immediately surrounding the former only about one-nineteenth part of the unit of solid matter originally placed in the cylinder; hence the deposit of the solid matter contained in said division will but very slightly increase in a taper from the top to the bottom the thickness of the paper deposit on the sides of the former.

The difference in thickness in the vertical or nearly vertical boundaries of articles made by my process is thus made so slight as to be of no practical importance whatever, though, if desired, it may be entirely reduced, or even reversed, by admission into the cylinder, around its base, of fine streams or of a film of water less in amount than the quantity which will percolate through the former.

Besides the advantages which my process of working thin pulp in a high column over a pervious former gives in obtaining hollow articles of substantially uniform thickness, the fibers are themselves better interlaced thereby, so that the resultant products are of the maximum strength.

My invention further consists in certain combinations by which the cylinders and the formers are operated, and in certain processes by which the water in the partially-compacted pulpy articles is expressed, and by which the said articles are transferred toward their completion, as will be explained beyond.

Of the drawings, Figures 1 and 2 are elevations of opposite sides of a machine by which I practice my improved process of depositing paper-pulp on pervious formers, and embodying certain details and combinations of mechanism of my invention, by which my process is automatically effected. Fig. 3 is a plan of said machine, with the top plate *a* of its frame and the parts thereunto directly attached removed. Fig. 4 is a plan, with the cylinder-carrying wheel *b*, the plate *c*, and the pumping mechanism removed to show the parts located beneath the removed portions. Fig. 5 is a vertical sectional elevation taken in the plane of the line *z z*, seen in Fig. 4.

The base of the machine is marked *d*, and this, with the posts *e*, supporting the top plate *a*, together make up the frame. The vertical shaft *f*, on which the horizontal wheel *b* revolves, is fixed in the base *d*, and intermittent rotary motion is imparted to the wheel by means of a pawl, *g*, engaging in notches formed in the lower edge of the outer rim of wheel *b*, the pawl being borne and pivoted on the radius-arm *h*, which is moved back and forth by the jointed connecting-arm *i*, which is worked from a crank-pin in the gear *j*, which is driven by a pinion on the main driving-shaft *k*, to which the power is applied which actuates all parts of the machine.

The plate of the wheel *b* is slotted, as seen in Fig. 3, and in each slot is fitted, as a carriage capable of sliding in the slot, a valve-box, *l*, (seen in section in Fig. 5,) said valve-box having fitted upon its upper surface a pervious former, *m*, surrounded by a rubber packing-ring, *n*. Each valve-box *l* contains a puppet-valve, *o*, fitted to rise and fall, so as to control the passage or seat made in the diaphragm of the valve-box, the lower end of the valve-spindle projecting below the box *l*, being guided in a stirrup or bail-like projection, *p*, which has a function of opening another valve, which operates, at one portion of the machine, with each valve *o*, as will be hereafter explained.

On each side of each opening for the valve-boxes *l* are guides *q*, which serve to keep in place during their rise and fall the cylinders *r*, which are spaced around the plate *b*, and are located over the formers *m* when they occupy the position which they have nearest the shaft *f*.

The cylinders *r* are made to rise as they rotate with wheel *b* by reason of the action of the friction-rolls *s* on the stationary incline *t*, the rolls engaging and disengaging with the incline as the wheel *b* turns in the direction indicated by arrows on the drawings.

The cylinders, when in their lowest position, rest on the rubber packing-rings *n*, so that they will contain, without leakage, the paper-pulp which is discharged into each of them successively as it passes under the pipe *u*, leading from a pulp-vat, *v*, in which the pulp is kept agitated by any suitable stirrer worked from the prime motor, said vat being supplied with paper-pulp by means of a pump from a reservoir, *w*.

Over the tops of the cylinders *r* is a ring-trough, *x*, secured to the guides *q*, and rotating with them. Said trough has discharging-pipes, one over each cylinder, so that as each cylinder comes to rest under the pipe *u*, and the cock therein is so adjusted that the cylinder beneath will be filled with pulp to the desired height before the next cylinder is moved underneath pipe *u*, the trough *x* preventing all overflow.

Beneath the wheel *b*, and fixed to the bed *d*, is a sector-like trough, *y*, which catches the water which drains off from the pulp during the process of forming hollow objects on the porous formers.

On the receiver *y* are secured two inclines, a^1 and b^1, which are operative on the valve-boxes *l* as the wheel *b* revolves, to cause said boxes to move outwardly and inwardly in the slots made in the wheel for that purpose, the impact of the boxes *l* with incline a^1 causing the outward movement of the boxes which are moved inward by impact with incline b^1.

The incline a^2 operates to keep the boxes *l* from being thrown outwardly too rapidly when incline a^1 comes into contact with them.

Another incline, c^1, is secured to the receiver *y*, the function of which is to operate on the spindles of valves *o* to lift them as they move in their circular path over said incline.

I will now describe the operation of the ma-

chine so far as it refers to the mechanism before described, limiting the description to tracing the operation of one cylinder, as the others are but duplicates.

Suppose one of the cylinders r beneath the pulp-pipe u, and resting on the packing-ring n of a valve-chamber, l, beneath the cylinder, which thus covers a porous former, m, at which position the valve o of the valve-chamber l is closed upon its seat. The cylinder remains in said position till filled sufficiently; then the pawl g moves it intermittently with the wheel b, in which operation the incline c^1 lifts the valve o and permits the pulp to settle upon former m, discharging the water through the former into the receiver y and depositing the fiber of the pulp on the former. When in the rotary movement of the wheel the roll s of the cylinder arrives at the incline t, which will be when there is no free pulp left in the cylinder around the former m, the roll s ascends the incline t and elevates the cylinder till its base is raised above the top of the wet fiber deposited on the former m, at which time the valve-box l of the cylinder referred to will have arrived at the incline a^1, which then begins to force the valve-box l and its superincumbent former outward till the center of the former m arrives at the arc of the circle in which is located the center of the device by which most of the moisture remaining in the pulp is expelled.

Connected with the machine, and operated as shown in the drawings, or in any other suitable way, is an apparatus for forcing air under pressure into a cylinder, d^1, which is raised and lowered with its center over the center of the former when left in the position last described, the pipe conveying air from the air-forcing apparatus being flexible or jointed, and being marked e^1 in the drawing. This cylinder has a closed top and an open bottom, which shuts down upon the packing-ring n on the valve-case l, so that, when the stem f^1 of the valve controlling the passage between the pipe e^1 and the cylinder d^1 is operated by the act of the closing downward movement of cylinder d, an air-pressure is brought upon the pulp covering the former m, and the moisture in the pulp is driven out of it through the former m, the valve o still remaining open. The cylinder d^1 then rises, and the intermittent rotative movement of the wheel b carries the former, covered with the nearly dry paper, under a cap, g^1, which descends and covers the former m. Then a valve-box, h^1, to which the air-pipe i^1 is attached, is lifted, and the end of the spindle of the valve j^1 in the valve-box h^1 comes into contact with the bail p of valve-box l, opening valve j^1 against the resistance of the spring which keeps it closed, and the spindle of valve j^1, coming into contact with the spindle of valve o, opens said valve, so that a current of air passes by valves j^1 and o from the pipe i^1 and, entering the concavity of the former m, drives the paper article thereon from its surface into the cap g^1, which then rises, and the former m proceeds by intermittent rotative movement of the wheel b again under the pulp-delivery spout u.

There are two caps like g^1, the other marked g^2, so arranged as to change in position by a half rotative movement alternately back and forth, so that after the paper body has been received by one cap, g^1, it changes position with the other cap, g^2, which cap g^2 is then ready to descend on the next presented former m, to perform the function already described as performed by g^1. When g^2 descends to receive the paper article from a former, m, g^1 also descends over a removable block of the shape of former m, and when closed down over the block an air-blast from pipe k' drives the paper body upon the block, releasing it from the cap g^1, the blast being caused by the opening of a valve consequent on the descent of g^1. The movable block is taken when cap g^1 rises, preparatory to swinging back to its first position, and is, with the paper article upon it, submitted to heat, to further dry the paper before it is pressed or otherwise finished.

It will be unnecessary to describe the air-forcing pumps and the means by which they are operated, as there is nothing novel or peculiar in them, and they are sufficiently shown in the drawings to indicate to any ordinary mechanician their combination and manner of operation with my machine. The pipe l', proceeding from the air-chamber of the pumps, connects with a branch of a cross-pipe sustained over the machine, from the other three branches of which pipe proceed the air-pipes i^1, j^1, and k', before mentioned.

To operate the cylinder d^1 in its rise and fall, and the air-valve therein, and to operate the caps g^1 g^2 in their rise and fall, and in their interchange of position, and to cause the air-valves co-operative with said caps to perform their functions, the following mechanism is made use of: On the driving-shaft k is a bevel-gear meshing into a similar gear, m', on a shaft, which rotates a bevel-pinion, which meshes into the bevel-gear n', formed on the upper corner of the cylinder-cam o', which, in rotating, carries a spur-pinion, (seen in dotted lines, Figs. 3 and 4,) which pinion, meshing into the spur-gear p', turns the disk q', in which is the crank-pin r'. This crank-pin, working in the slotted head of the slide s', causes it to reciprocate and to rest at the proper times, and by means of the connecting-link t', attached to a wrist in the segment-gear u', causes the segment to turn back and forth on its center at intervals, and to give a rotative movement of one hundred and eighty degrees to the pinion v', into which the teeth of the segment mesh. The pinion v' is fixed on a vertical shaft, d^2, which extends upward through a sleeve secured to the plate c, and carries at its upper end the bar w', from which depend the caps g^1 g^2. The bar w' has fixed to it a sleeve, which surrounds the sleeve secured to plate c, and the air-pipe k' discharges into a branched pipe, x', carried by the bar

w', which pipe connects with valve-chambers y^1, located between the sleeves on the shaft of pinion v' and the caps g^1 g^2, there being air-discharge passages between the valve-chambers y^1 y^1 and the caps g^1 g^2, which are controlled by the valves in the chambers y^1 y^1, so that when either of said valves is opened an air-blast will enter the cap with which it is connected, and will blow out therefrom the paper article which may be held in said cap.

On plate c is fixed the guide-stand z^1, which guides the spindle b^2, which is raised and lowered at the same time that the shaft d^2 of pinion v' is raised and lowered by the action of the cylinder-cam o', there being a bar, c^2, which connects and supports the lower ends of the shaft d^2, and of the spindle b^2, there being about midway of the length of said bar a roll or pin, (seen in dotted lines in Fig. 4,) which enters the groove of the cam o', so that as the cam revolves the bar c^2 and the air-vessel d^1 and the caps g^1 and g^2 are raised and lowered.

The air-vessel d^1 is connected to spindle b^2 by the arm e^2, and is guided in rising and falling by suitable ways, there being connected with d^1, so as to rise and fall therewith, a valve-chamber, f^2, which receives air from flexible pipe e^1.

The valve in f^2, by which air is admitted to and is cut off from chamber d^1, is opened as d^1 shuts upon the packing-ring n by contact of the end of valve-spindle f^1 with an adjustable stop.

When either of the caps g^1 or g^2 is in the position shown in the drawings, as occupied by g^2, descent of the caps causes the spindle of the valve in the chamber y^1 most remote from the wheel b to come against an adjustable stop, h^2, so as to open the valve and admit from pipe k' a blast of air into the cap g^1 or g^2, as the case may be, to expel the paper article contained in the cap upon the block placed beneath the cap to receive the article.

It will be seen that in the semi-rotations of the caps g^1 g^2 back and forth the flexible pipe k not only bends in rising and falling, but twists and untwists one hundred and eighty degrees at each semi-revolution of the caps. When either of the caps g^1 or g^2 is in position nearest the wheel b, and descends so as to cover the former m, having upon it the paper article to be taken off from said former, then the end of shaft d^2 strikes an adjustable screw, i^2, in one end of lever j^2, which is thereby operated to lift valve-case h^1, the effect of which is to admit air beneath the former m from pipe i^1, and to blow therefrom the paper article into cap g^1 or g^2, as will be readily understood by inspection of Fig. 5, the case h^1 being guided in suitable ways fixed to the bed-plate d.

The flange made on the paper boxes or other articles, if not needed, may be trimmed off, and the cuttings may be returned to the rag-engine, to be reconverted into pulp, and the water which has been drained through the formers may be used repeatedly.

The air-pressure employed in the cylinder d^1 to expel the water remaining in the gathered pulp may be of any degree of intensity necessary to effect the purpose.

Instead of working the air-controlling valves solely by the movement of the valve-chests, they may be moved by lifters operated intermittently by the mechanism; or the valves may be worked by the conjoined movement of the valve-chests and of lifters.

Time can be given for the water to drain off through the porous formers, and rapid production of the formed articles can be obtained by increasing the diameter of the wheel b and the number of cylinders or hollow prisms carried thereby.

In some cases it will be of advantage to make use of steam instead of air to press upon the pulp to accelerate the discharge of water from the pulp through the pervious former, and in some cases the cylinders r, or their prismatic equivalents, may be closed at the top after receiving the pulp, so that air or steam under pressure may be admitted to accelerate the deposition of the solid matter of the pulp.

I claim for the purpose specified—

1. The described process of using thin pulp in high columns over pervious formers, substantially as set forth.

2. Also, the combination of the wheel b with cylinders, r, arranged to rise and fall over the formers m, substantially as and for the purpose set forth.

3. Also, the combination of the wheel b and slides conveying the formers m with inclines to move the slides outward and inward as the wheel revolves, substantially as and for the purpose set forth.

4. Also, the combination with the cylinders r and their conveyer b, of the valves o and the incline c^1, operative thereon, substantially as and for the purpose set forth.

5. Also, the process of condensing the pulp on the former and expelling the water therefrom against atmospheric pressure by covering the pulp-covered former with a close vessel, d^1, and admitting therein air under pressure, substantially as and for the purpose set forth.

6. Also, the process for removing the paper from the pervious former by covering the pulp on the former with a cap fitting thereon and admitting an air-blast within the former, substantially as and for the purpose set forth.

7. Also, the process for removing the paper from the cap which received it from the former, and for transferring the paper to a receiving-block, by covering the receiver-block with the cap and admitting an air-blast into the cap, substantially as and for the purpose set forth.

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