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AUTOMATIC HYDRAULIC PRESS.

No. 255,300. Patented Mar. 21, 1882.

Fig. 1.

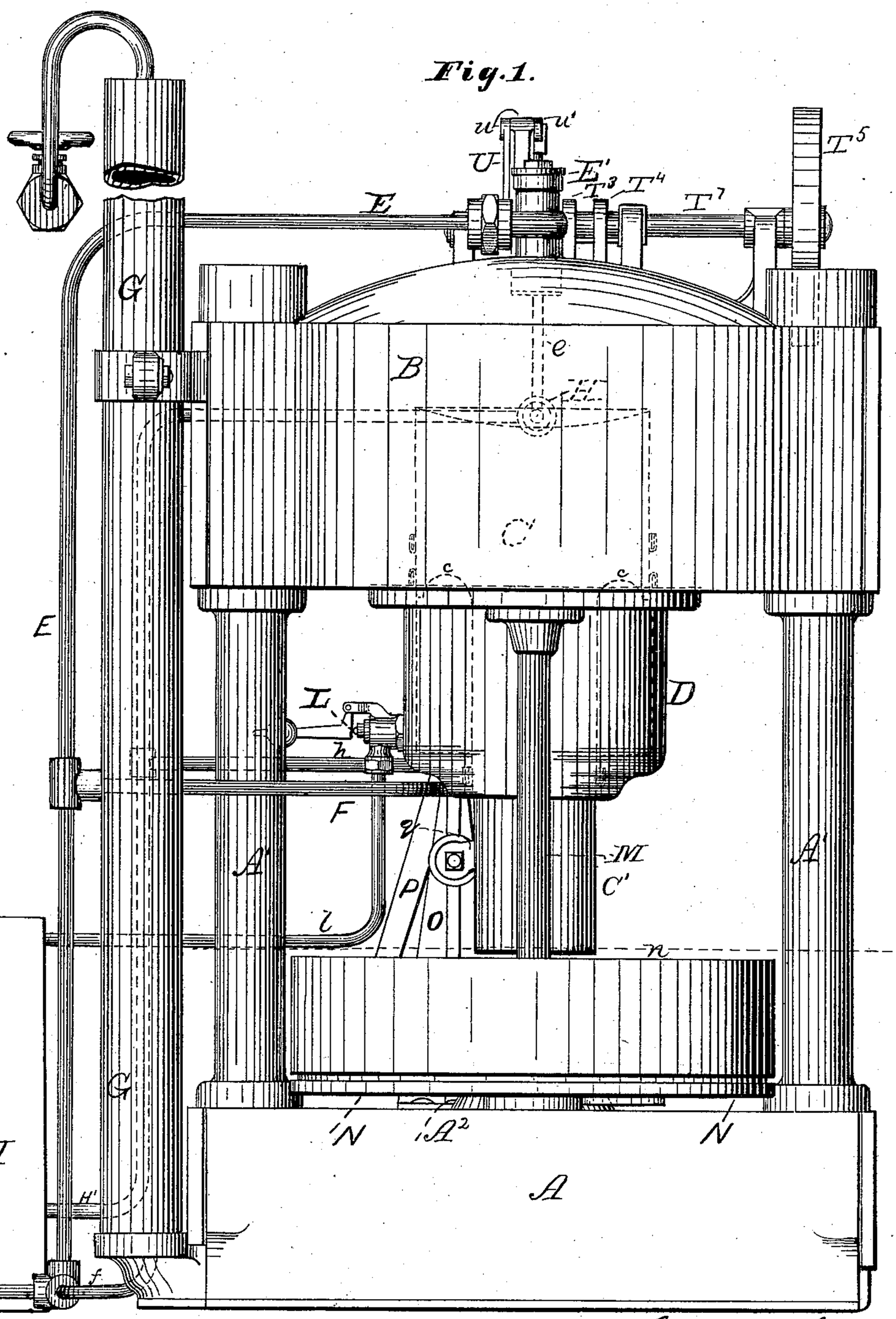

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Fig. 2.

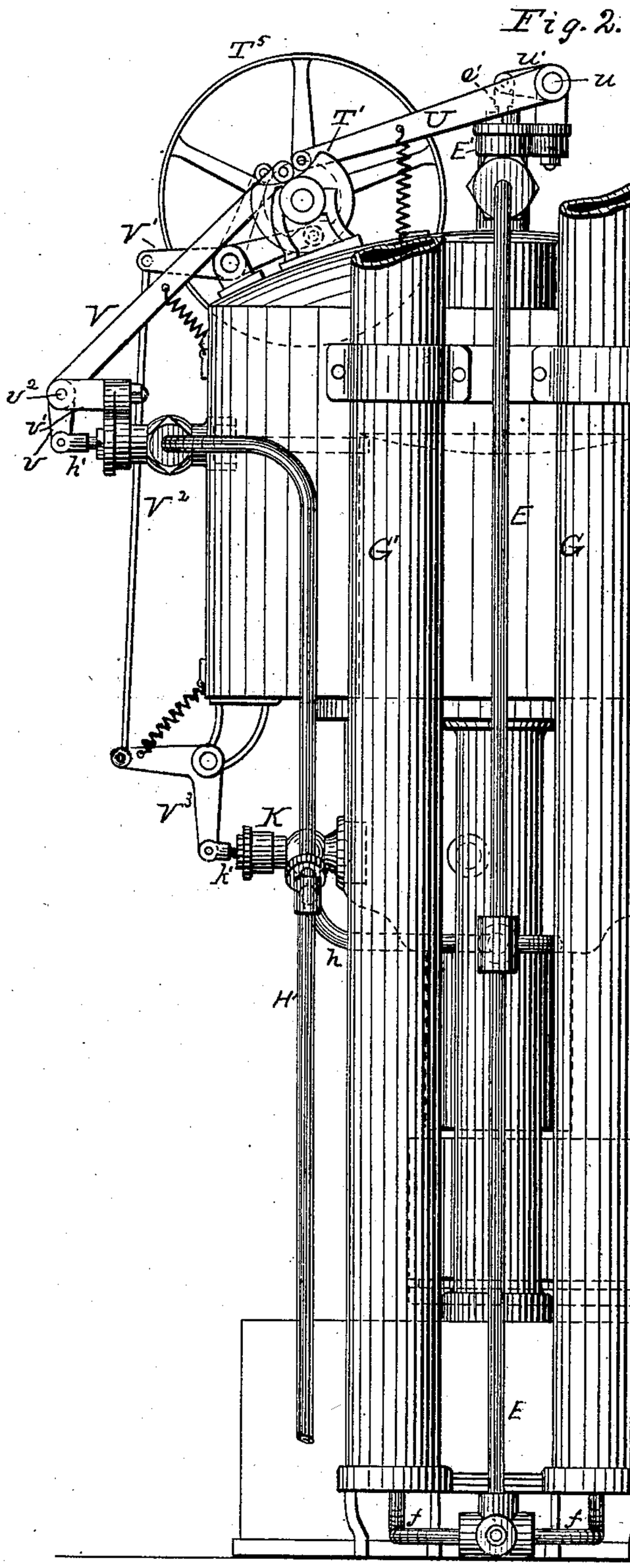

Fig. 3.

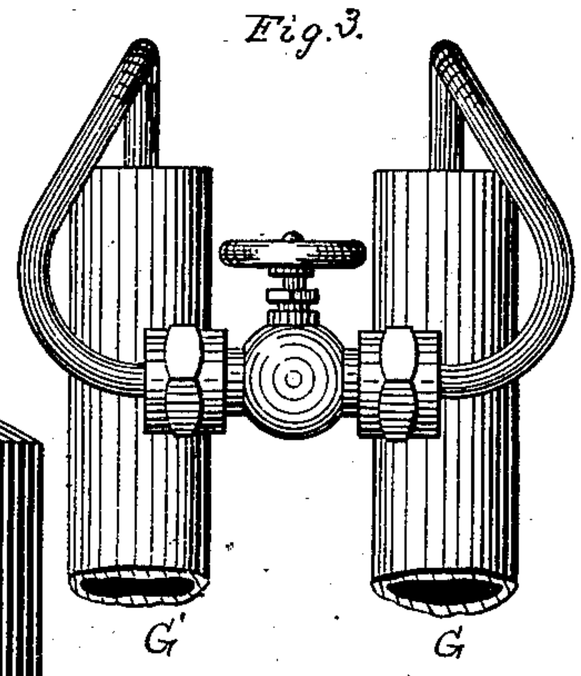

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Fig. 4.

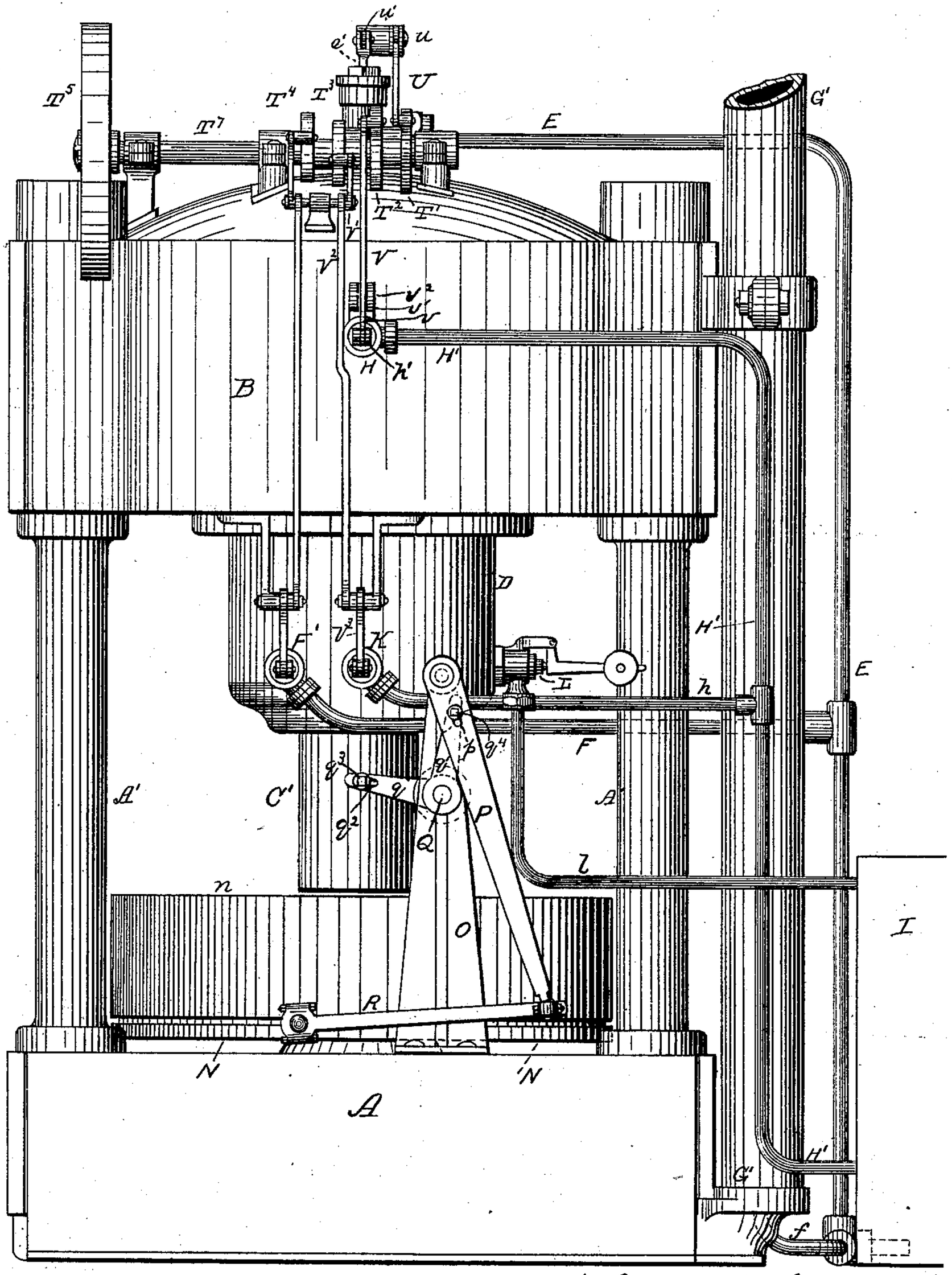

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Fig. 5.

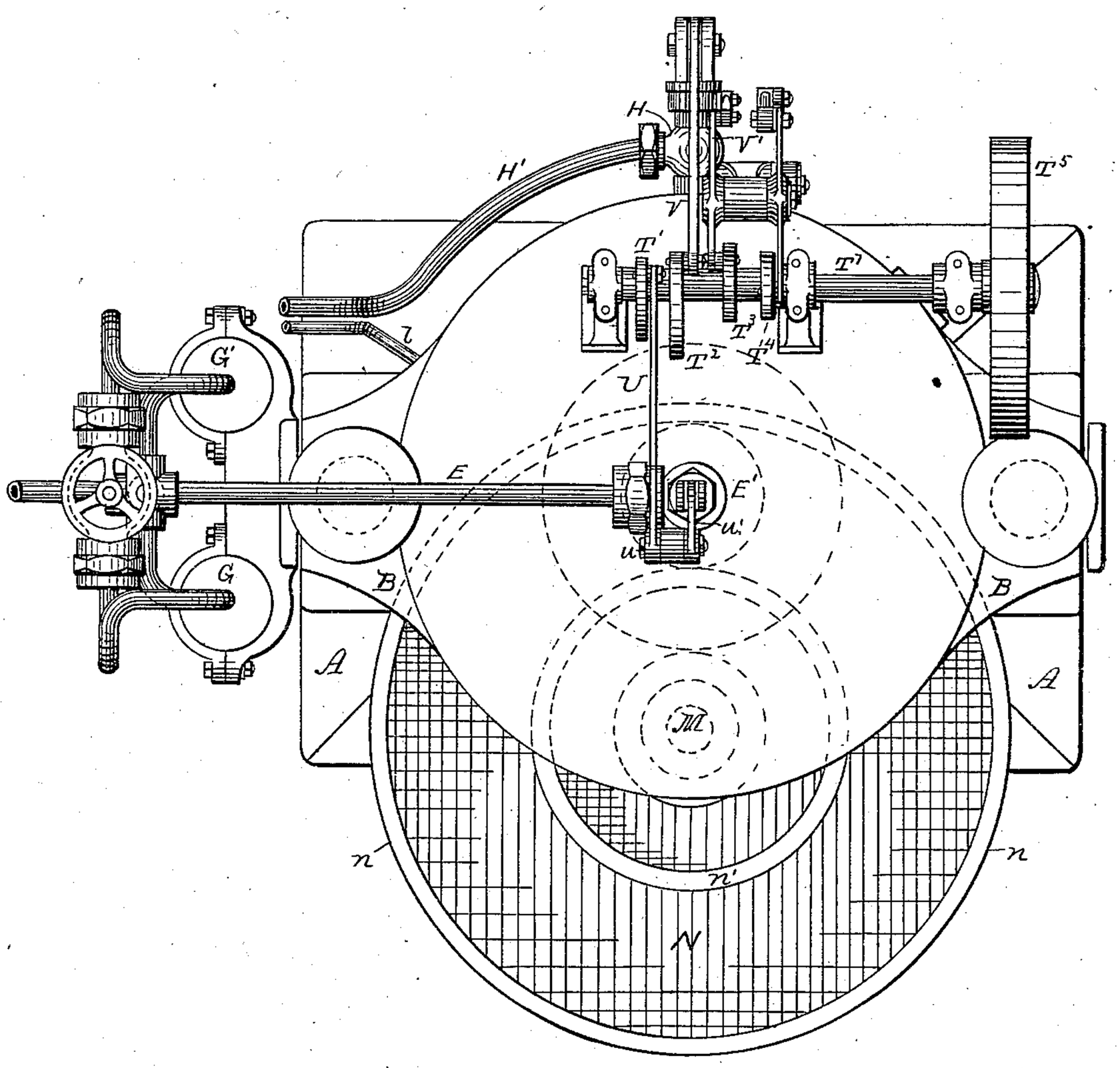

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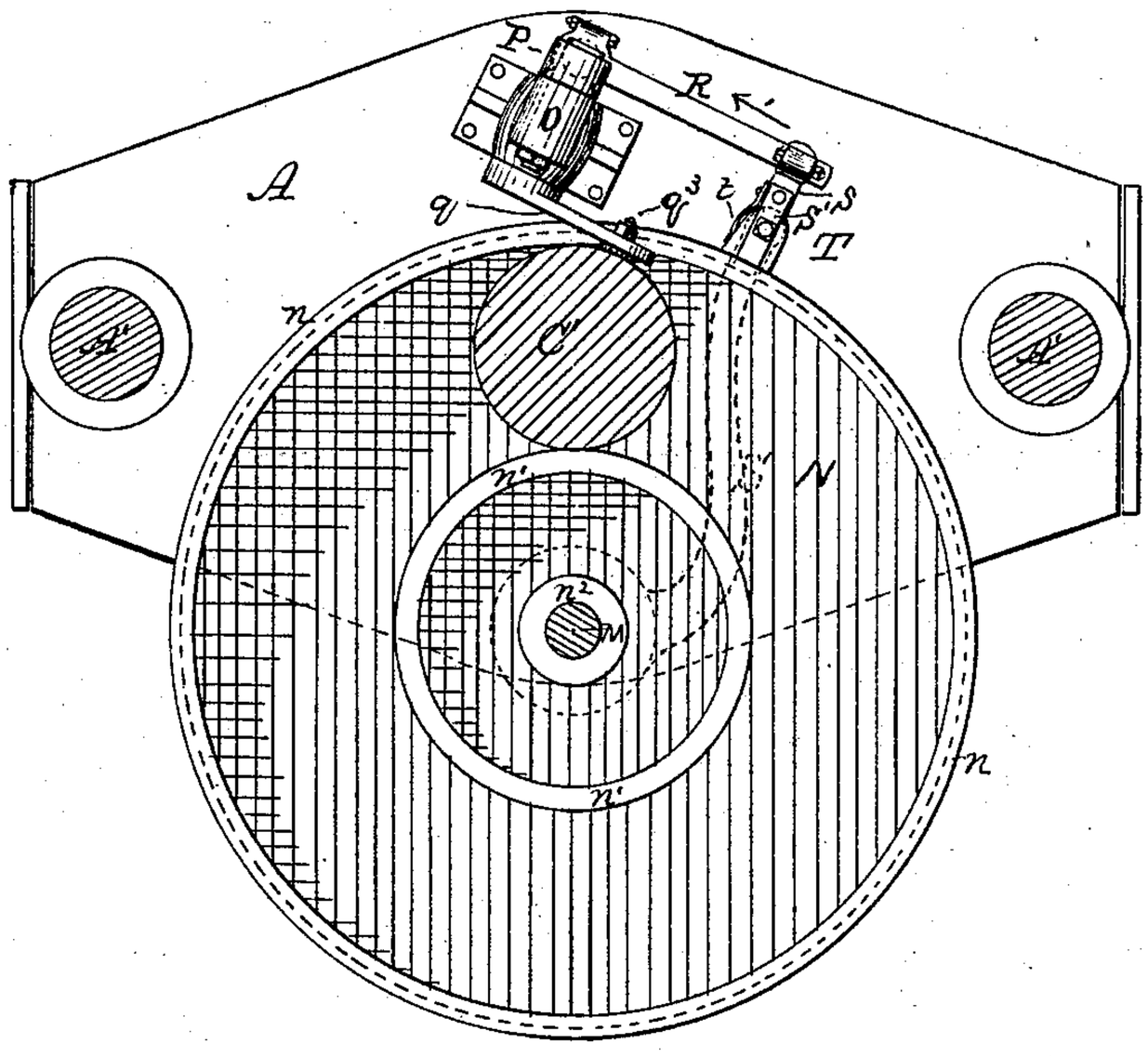
Fig. 6.



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(No Model.) 9 Sheets—Sheet 6.

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Fig. 7.

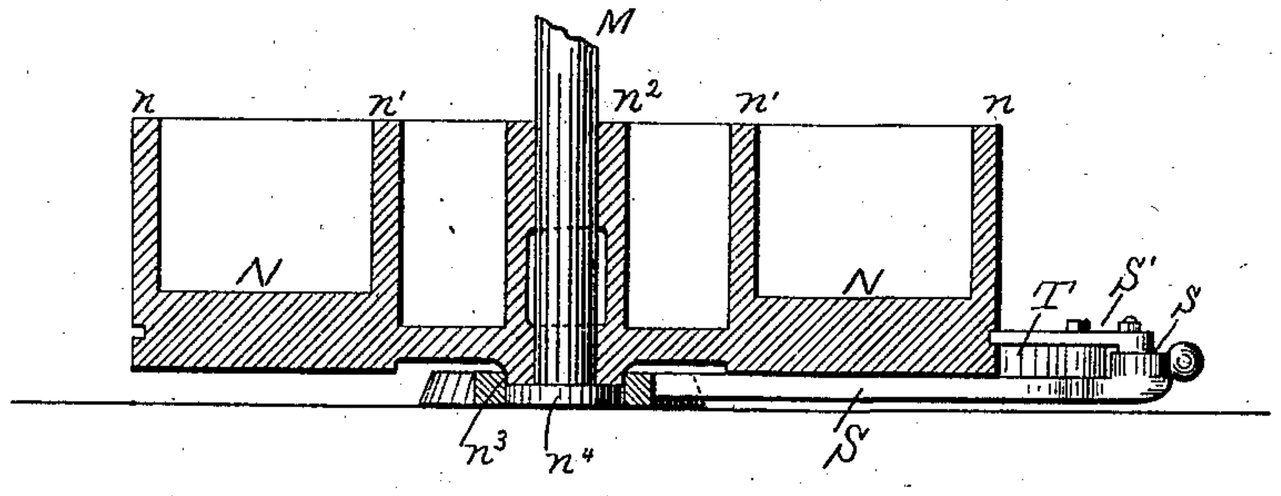

Fig. 8.

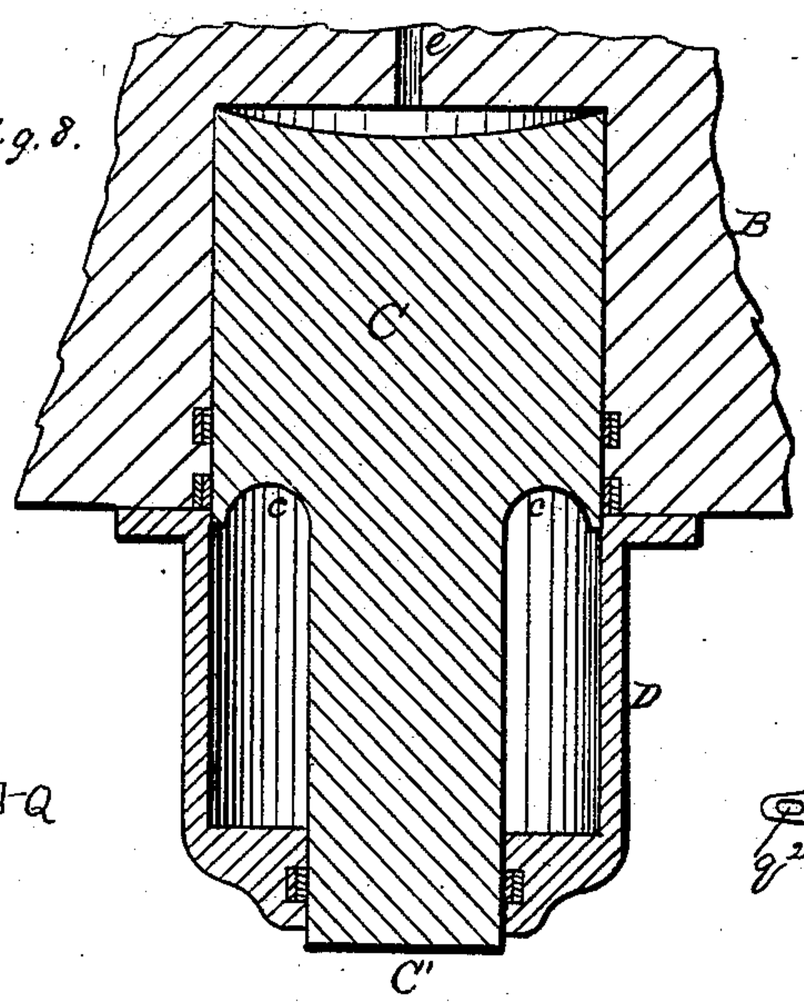

Fig. 9.

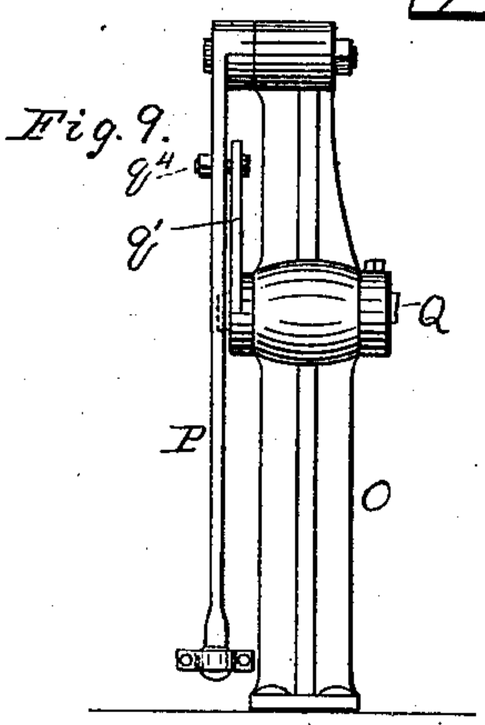

Fig. 10.

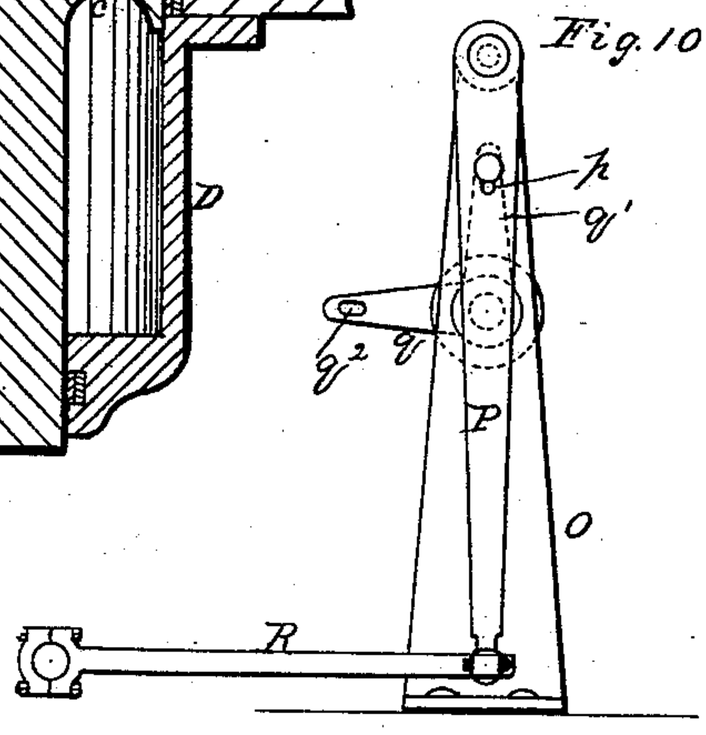

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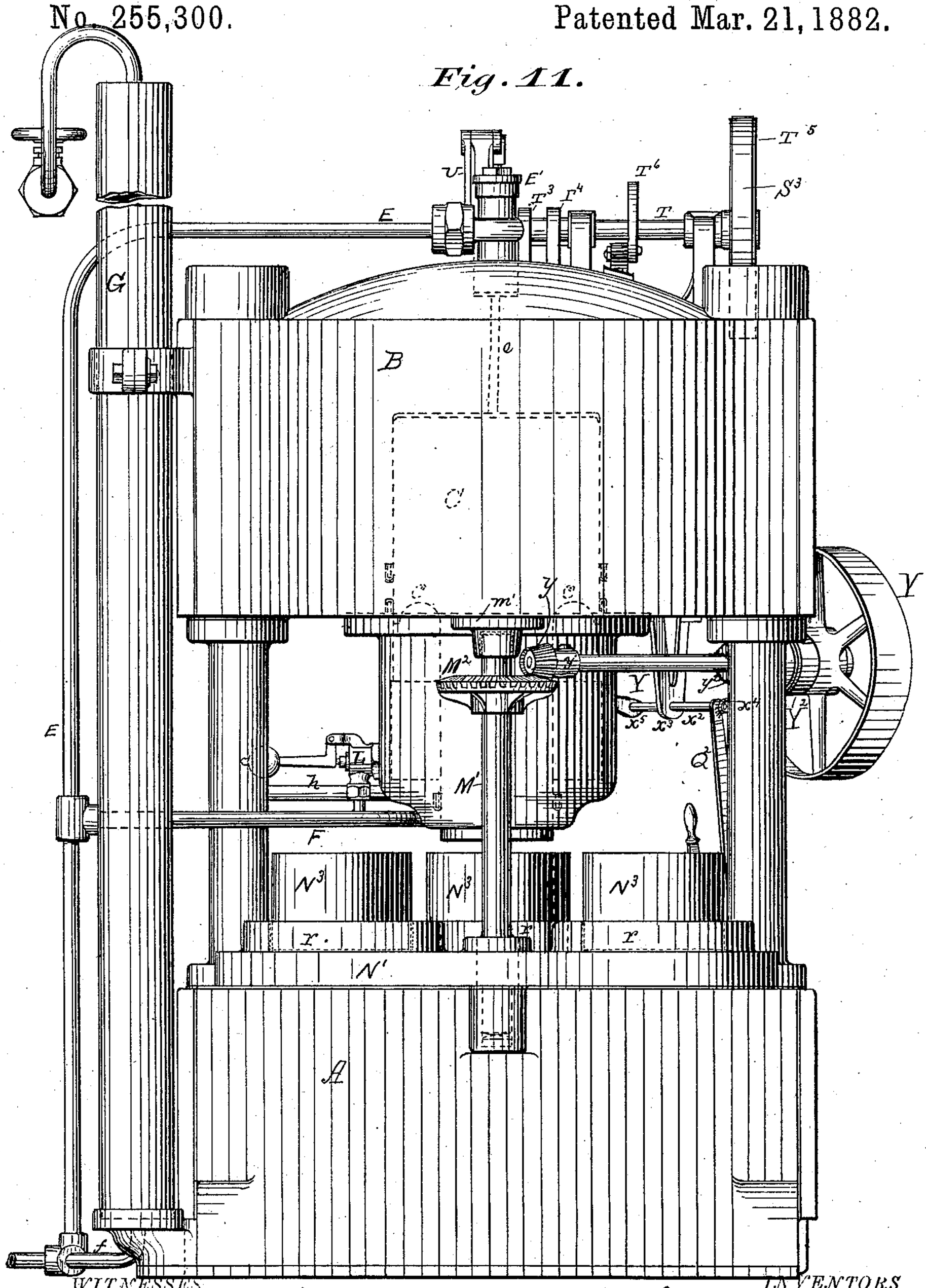
Fig. 11.



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AUTOMATIC HYDRAULIC PRESS.

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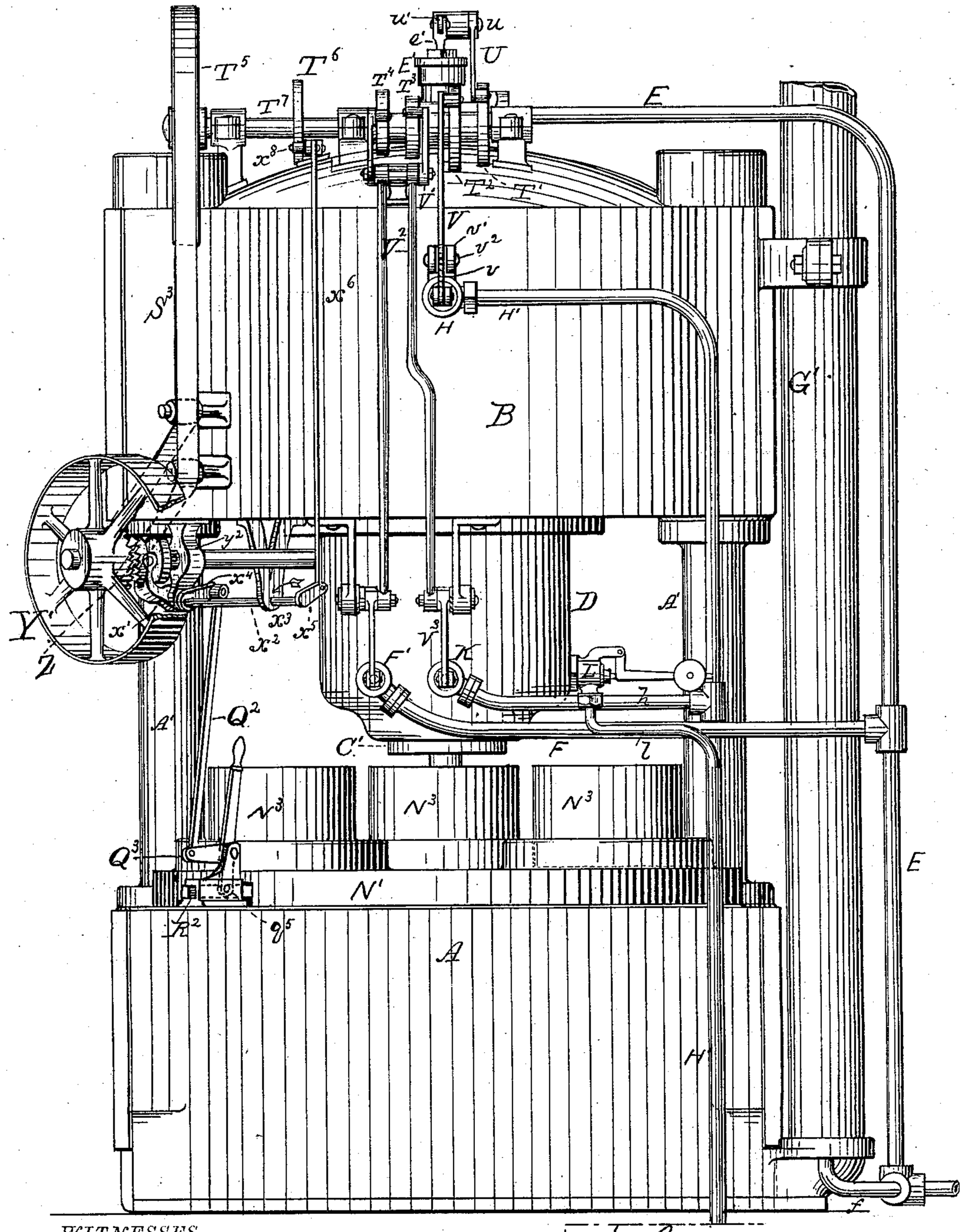
Fig. 12.



WITNESSES

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Fig. 13.

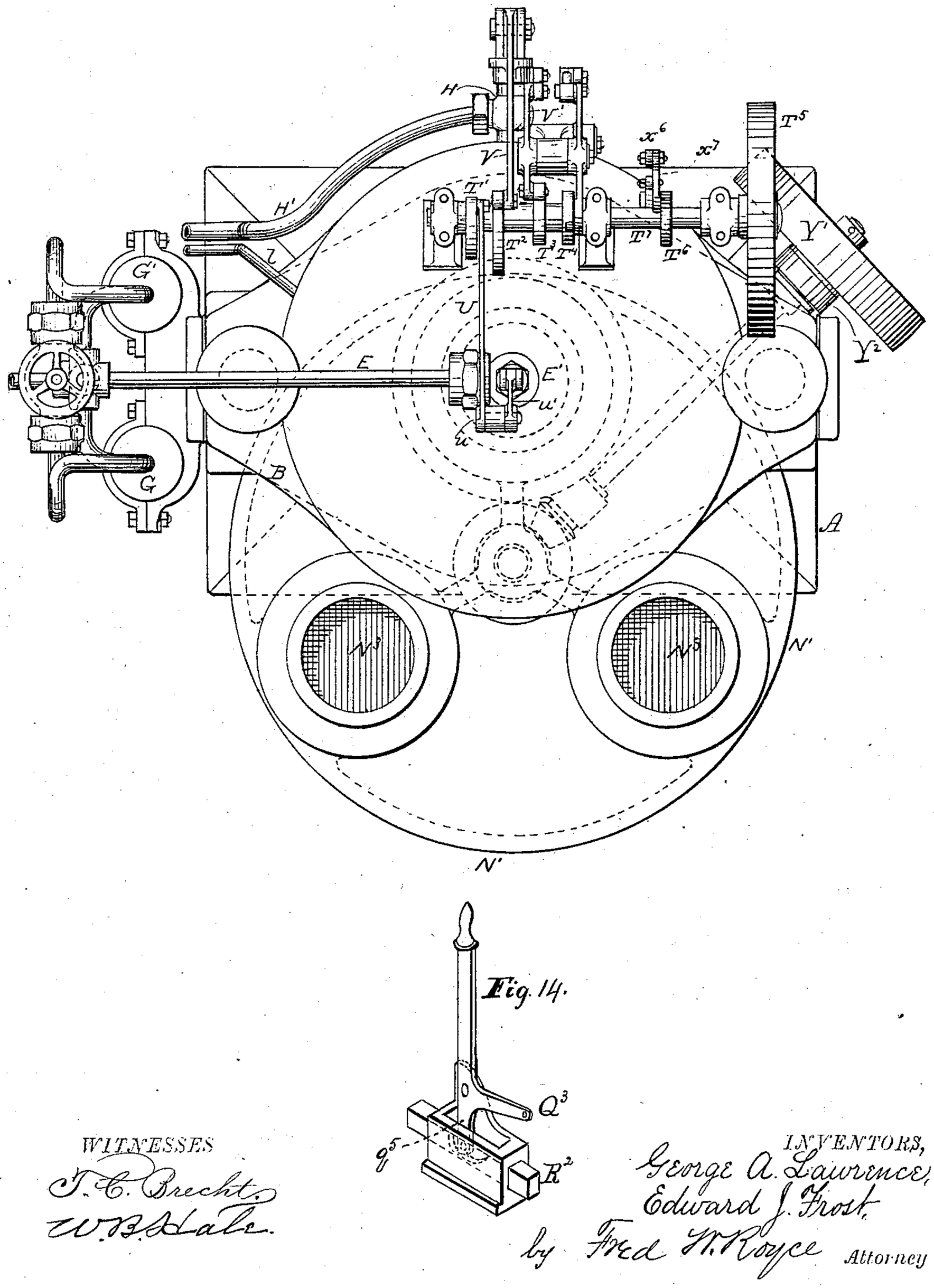

Fig. 14.

WITNESSES

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UNITED STATES PATENT OFFICE.

GEORGE A. LAWRENCE, OF NEW YORK, N. Y., AND EDWARD J. FROST, OF PHILADELPHIA, PENNSYLVANIA.

AUTOMATIC HYDRAULIC PRESS.

SPECIFICATION forming part of Letters Patent No. 255,300, dated March 21, 1882.

Application filed October 15, 1881. (No model.)

To all whom it may concern:

Be it known that we, GEORGE A. LAWRENCE, residing at New York, in the county of New York and State of New York, and EDWARD J. FROST, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, citizens of the United States, have invented certain new and useful Improvements in Automatic Hydraulic Presses; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

The object of this invention is to provide a continuously-operating apparatus involving the principle of the hydraulic press, and arranged to act upon any suitable material, proper quantities of which are successively and automatically presented to the ram or plunger, and after its action removed simultaneously with the presentation of another quantity. We have in view especially the adaptation of any apparatus of this kind to the purpose of crushing ores; but it may also, with suitable modifications, be applied to other purposes.

In the accompanying drawings, Figure 1 is an elevation of an apparatus constructed according to our invention. Fig. 2 is another elevation, viewed at right angles to Fig. 1, the top portions of the accumulator-cylinders being removed. Fig. 3 shows the top portions of the accumulator-cylinders and connecting-pipe. Fig. 4 is an elevation viewed from a point directly opposite the point of view in Fig. 1. Fig. 5 is a top view of the apparatus. Fig. 6 is a section on line *x x* of Fig. 1, and shows also a top view of the devices for rotating the platform. Fig. 7 shows a vertical diametric section of the revolving mortar, its impelling-lever and pawl being shown in full lines. Fig. 8 is a vertical diametric section of the plunger and cylinder, a portion of the surrounding head-piece being broken away. Fig. 9 is a rear view of the mechanism for communicating partial rotations to the mortar. Fig. 10 is a side elevation of said mechanism. Fig. 11 is an elevation of the modification of the hydraulic press. Fig. 12 is an elevation of the same from a directly-opposite point of view, and Fig. 13 is a top view of the same. Fig. 14 is a detached perspective view of the latch for holding the platform in position.

The letter A indicates a heavy metallic base, upon which stand pillars A′, supporting at proper height a massive metallic head-piece, B, directly above the base. This head-piece B is recessed from its under side to form a part of the cylinder in which plays the plunger C C′, the cylinder being completed by a casing, D, firmly secured to the under side of the head-piece, and having a bore coincident with the recess in said head-piece. The upper portion of the plunger fits snugly in the cylinder; but its lower portion, C′, is of considerably less diameter, so as to form a shoulder, *c*, and this reduced portion of the plunger plays through an opening in the lower end of the casing D and operates upon the ore to be crushed.

The letter E denotes a pipe, which connects with a valve chamber, E′, arranged on the top of the head-piece B, and from this chamber a passage, *e*, leads into the upper end of the cylinder above the plunger. From the pipe E a branch pipe, F, leads to a valve-chamber, F′, (see Fig. 4,) opening into the casing D below the shoulder *c* of the plunger. The valve-chambers E′ and F′ are provided with suitable valves, by which the flow of water therethrough is controlled, as will be hereinafter more particularly described.

The pipe E may be connected at its outer end to any suitable hydraulic pump, by which water may be forced through it, and said pipe is also connected by means of branches *f* (see Fig. 2) with the vertical accumulating-cylinders G and G′, arranged alongside the apparatus.

H, Figs. 2 and 4, is a valve chamber provided with a suitable controlling-valve, and connected by a suitable passage leading through the head-piece with the upper end of the cylinder above the plunger. This valve-chamber is also connected by a pipe, H′, with a tank, I, and said pipe H′ is connected by a branch pipe, *h*, with a valve-chamber, K, attached to the casing D, and communicating therewith below the shoulder *c* of the plunger.

The letter L indicates a safety-valve, arranged in the ordinary manner to relieve the

casing D of over-pressure, and connected with an eduction-pipe, *l*, which may lead off to any suitable point of discharge, preferably to the tank I, as shown.

Between one side of the upper surface of the base A and the under side of the head-piece B is secured a vertical cylindrical post, M. Centrally upon the lower portion of this post M is pivoted a horizontal circular revolving platform, N, about half of which lies directly above the base A, while the other portion extends outwardly beyond said base, as clearly shown in Fig. 2.

Around and above the central opening of the platform is preferably formed a sleeve, n^2, which embraces the post. An annular downward projection, n^3, surrounds the post and plays upon a circular bearing, n^4, at the foot thereof. This platform N is provided with two concentric annular walls, *n* and *n'*, the former of which extends upwardly from its outer edge, while the latter is arranged inwardly at a distance from the wall *n* about equal to the diameter of the lower portion, C', of the plunger, the two walls and the portion of the platform between them forming an annular mortar or ore-holder, into which the plunger plays.

Upon the top of the base A, on the opposite side thereof from the post M, is arranged a stout standard, O, at the top of which is pivoted a pendent lever, P, having a slot, *p*, near its upper end. At about or a little above the middle of the standard O a short shaft, Q, is journaled in a horizontal bearing formed in said standard. Upon the end of said short shaft, next to the lower portion, C', of the plunger, is fixed a radial arm, *q*, and at about a right angle to this arm and upon the opposite end of the shaft is fixed a similar arm, *q'*. The arm *q* has a slot, q^2, formed near its outer end, and through this slot a pin, q^3, projects from the lower portion, C', of the plunger, said pin being at a distance from the lower end of the plunger a little greater than the depth of the mortar. From a point near the outer end of the arm *q'* a pin, q^4, projects into the slot *p* in the lever P.

To the lower end of the lever P a pitman, R, has one end connected by means of a ball-joint, and the other end of said pitman is connected by a similar joint to the outer end of an arm, S, which lies under the platform N, and has its inner end pivoted to the circular bearing n^4. The outer end of the arm S has an upward projection, *s*, to which is fixed a short arm, S', which extends inwardly above said arm, and its tip enters a groove formed in the periphery of the platform.

Between the arm S and the short arm S' is pivoted a friction or jam pawl, T, the foot of which is forced against the periphery of the platform by a spring, *t*, when the arm S is moved toward the standard, but slides freely on the same when it moves in the opposite direction.

It will now be readily understood that when the plunger rises the arm *q* will be raised and the arm *q'* thrown backward, swinging the lever P in the same direction, and said lever will draw the pitman R and arm S in the direction indicated by the arrow No. 1. By this movement of the arm S the pawl T is jammed against the periphery of the platform and causes said platform to turn and bring a fresh portion under the plunger. When the plunger descends the reverse movement of the parts described takes place, and the pawl slips freely, leaving the platform in the position to which it had moved it.

Under that portion of the platform N which is under the plunger there is a raised portion, A^2, of the base A, upon which the platform slides, this raised portion serving to support the platform as the plunger descends and crushes the ore. A horizontal shaft, T^7, has its bearings in suitable standards on top of the head-piece B. This shaft carries four cams, T' T^2 T^3 T^4. The first cam, T', has resting upon its periphery a pin projecting from a lever, U, pivoted at *u* to a short shaft having a crank-arm, *u'*, connected with and arranged to operate the valve-stem *e'*, which is connected to a valve in the chamber E'. The cam T^2 has resting upon its periphery a pin projecting from a lever, V, pivoted at v^2 to a stud, *v'*, and having a bent arm, *v*, connected to and arranged to operate the valve-stem *h'*, connected with a valve in the valve-chamber H. The cam T^3 is arranged in a similar manner to control, through a lever, V', link V^2, and bell-crank lever V^3, the valve in valve-chamber K; and the cam T^4, through similar connections, controls the valve in valve-chamber F'. All of these valve-operating connections may of course be variously modified, it being only essential that they be arranged in connection with the cams to operate the valves, as hereinafter explained.

The power is applied to the belt-wheel T^5 on shaft T^7 by means of a belt leading from any suitable motor, and the operation of the apparatus is as follows: First of all, by means of a hydraulic pump connected to the pipe E, water is drawn from the tank I and forced into the accumulators G and G' through the branch pipes *f*, and this water, rising in the accumulators, compresses the air in the upper part thereof until it has reached the desired tension, a safety-valve, L, allowing the water to flow back to the tank without increasing the pressure, and also allowing the pump to work constantly. We will now suppose the plunger C to be in its elevated position, and that the annular mortar or ore-hopper has previously been filled with ore. Power being applied to the belt-wheel T^5, and motion being communicated to shaft T^7, the cams T^2 and T^3 operate through their connections, as heretofore described, to open the valves in valve-chambers K and H, so that the water in the casing D escapes through the branch pipe *h* to the pipe H' and tank I, and at the same time, owing to the suction occasioned by the descending plunger

through the valve-chamber H, water ascends from the tank I through the pipe H′ and fills the upper part of the cylinder. When the lower part of the plunger has entered the mortar which is under it the cam T^2 closes this valve in chamber H, and the cam T′ acts upon the lever U to open the valve in the valve-chamber E′, and the pressure of air in the upper portion of the accumulators then forces the water therein through the branch pipes *f*, pipe E, and passage *e* into the cylinder above the plunger, forcing said plunger downward with sufficient force to crush the ore in the mortar beneath. The downward stroke of the plunger being completed, the cam T′ acts to close the valve in chamber E′, and the cam T^2 opens the valve in chamber H, and simultaneously the valve in chamber K is also closed and the valve in chamber F′ opened by the action of the cams and connections controlling said valves, as heretofore described. The pressure of the air on the water in the accumulators now, instead of being exerted through the passage *e*, is exerted through the branch pipe F, and the water is forced into the casing D under the shoulder *c* of the plunger, and the water above said plunger escapes through the valve-chamber H and pipe H′ to the tank I, so that the plunger is forced upward after having accomplished its work of crushing the ore in that portion of the mortar which was in position to receive it. As soon as the plunger rises sufficiently the arm *q* begins to rise also, the arm *q′* acts upon the lever P, and said arm operates the pitman R, arm S, and pawl T to drag the platform through a partial rotation to present fresh ore under the plunger. When said platform has performed a partial revolution and brought a fresh portion of ore under the plunger the operations before described again take place for causing the descent of the plunger and crushing the ore. The entire operation of the apparatus, it will be seen, is automatic, the only personal attendance required being to fill the mortar with fresh ore and remove that which has been crushed.

It will be necessary to operate the hydraulic pump connected with the pipe E constantly to re-enforce the tension of the air in the accumulators.

In the modifications shown in Figs. 11, 12, and 13 a number of separate mortars for holding the ore are used upon the platform, and a different mechanism from that previously described is used for shifting the platform in order to bring the mortars successively in proper position under the plungers. In one side of the upper surface of the base A is stepped a vertical shaft, M′, having an upper bearing, *m′*, on the under side of the head-piece B. Centrally upon the lower portion of this shaft is firmly secured a circular platform, N′, somewhat more than half of which lies directly above the base A and rotates in sliding contact therewith, while the other portion extends outwardly beyond the base, as shown in the top view, Fig. 13. This platform is provided with three seats, *r*, arranged at equal distances apart about its center, and formed to receive three strong receptacles or mortars, N^3, of a proper size to receive the lower end of the plunger, and which may be brought in proper position successively to receive said plunger by the rotation of the platform. Near its upper end the shaft M′ carries a bevel-gear wheel, M^2, which meshes with a bevel-pinion, *y*, on the end of a horizontal shaft, Y, mounted in suitable bearings, *y′* and y^2, the former of which projects from the casing D and the latter depends from the head-piece. The outer end of the shaft Y carries a belt-wheel, Y′, to the inner side of which is concentrically secured belt-pulley Y^2. This belt wheel and pulley will run loose upon the shaft Y, except when brought into engagement therewith by means of a clutch, Z, operated by a lever, x', secured to a shaft, x^2, arranged obliquely under the head-piece and journaled in a hanger, x^3, and in a lug depending from the bearing of the shaft Y. From this shaft x^2 projects an arm, x^4, the outer end of which is connected by a link, Q^2, with a bell-crank lever, Q^3, pivoted between suitable lugs projecting upward from the base A. The downwardly-projecting arm q^5 of this bell crank lever (shown in dotted lines, Fig. 12) is connected with a latch-bar, R^2, playing in a suitable guide on the base A, and may be forced inwardly by means of a spring. The inner end of this latch-bar is arranged to enter suitable notches in the periphery of the platform N′ and hold said platform steady while the plunger is descending into one of the mortars.

To the end of the shaft x^2 is secured an arm, x^5, which is connected by a link, x^6, with the outer end of a lever, x^7, which is pivoted to a stud on top of the head-piece B, and has its inner end provided with a pin, x^8, which lies across the edge of a cam, T^6, fixed upon the shaft T^7. The belt S^3, passing around the belt-pulley Y^2, as shown in dotted lines, Fig. 12, passes also around the belt-wheel T^5, the shaft of which carries the cams, as heretofore described, for operating the valves, and also the cam T^6. These cams are all of a similar shape to the cam T′, (shown clearly in Fig. 2,)—that is, each comprises the greater portion of a disk having a curved indentation extending about half-way to its center. In this modification the motive power is applied to the belt-wheel Y′ by means of a belt from a suitable motor, and is transmitted through the belt S^3 to the shaft carrying cams. The operation of the valves by the cams is the same as in the modification first described. Power being applied to the belt-wheel Y′, said wheel and pulley Y^2 travel loosely upon the shaft Y, and motion being communicated by belt S^3 to the cam-shaft, the action of the cams upon the valves commences. As soon as the plunger, after completing its downward stroke, rises sufficiently clear of the mortar, the cam T^6 (being properly arranged for such

purpose) acts upon its connections to turn the shaft x^2 in the direction of the arrow, thereby moving the lever x' to clutch the belt-wheel Y′, pulley Y^2, and shaft Y, and simultaneously the rising of the arm x^4 operates through the link Q^2 and bell-crank lever Q^3 to withdraw the latch-bar R^2 from the notch in the periphery of the platform with which it was previously engaged. The shaft Y is now caused to rotate and to communicate motion through the bevel-gears to the vertical shaft M′ and platform N′. When said platform has performed one-third of a revolution and brought a fresh mortar under the plunger (said mortar having been previously filled with ore to be crushed) the cam T^6 again operates through its intermediate connections to operate the clutch to disengage the belt-wheel and the pulley Y^2 from the shaft Y, and allow the latch R^2 to enter a notch in the periphery of the platform. At this point the cams T^2 and T^3 operate through their connections, as heretofore described, and the action of the valves again commences for forcing down the plunger and afterward raising it.

Having now described our invention, and explained the operation thereof, we claim—

1. In a hydraulic press, the combination, with a suitably-arranged plunger and a platform having movement in a plane in the path of the plunger and at a right angle thereto, of automatically-operating valves for causing reciprocation of said plunger, and automatic devices for giving said platform an intermittent motion to bring fresh portions thereof successively directly in line with said plunger, substantially as described.

2. The combination, with the plunger of a hydraulic press, arranged substantially as described, of a platform having movement in a plane in the path of the plunger and at right angles thereto, and automatic mechanism for shifting said platform to bring fresh portions thereof in line with said plunger, and leave the same temporarily at rest while the plunger is performing its outward stroke.

3. In a hydraulic press, the combination, with the plunger and cylinder and the valves and water-pressure apparatus, constructed and arranged substantially as described, of the cams arranged to operate said valves, the platform provided with means for holding ore, and automatic mechanism for giving said platform an intermittent motion correlative with the action of said cams to bring and retain fresh portions of the ore successively into position to receive the plunger, substantially as described.

4. The hydraulic press composed of the cylinder provided with the shouldered plunger, the pipes leading into said cylinder above and below the shoulder of the plunger and controlled by suitable valves, the water-pressure apparatus connected with said pipes, the rotary platform carrying one or more mortars, the shaft T^7, carrying the series of cams for operating said valves through intermediate mechanism, and suitable devices connected with the plunger for communicating intermittent rotary motion to the platform, substantially as described.

5. The combination, with the plunger and rotary platform, of the suitably connected and supported arms q and q', the lever P, pitman R, arm S′, and pawl T, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

GEORGE A. LAWRENCE.
EDWARD J. FROST.

Witnesses:
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