No. 706,655. Patented Aug. 12, 1902.

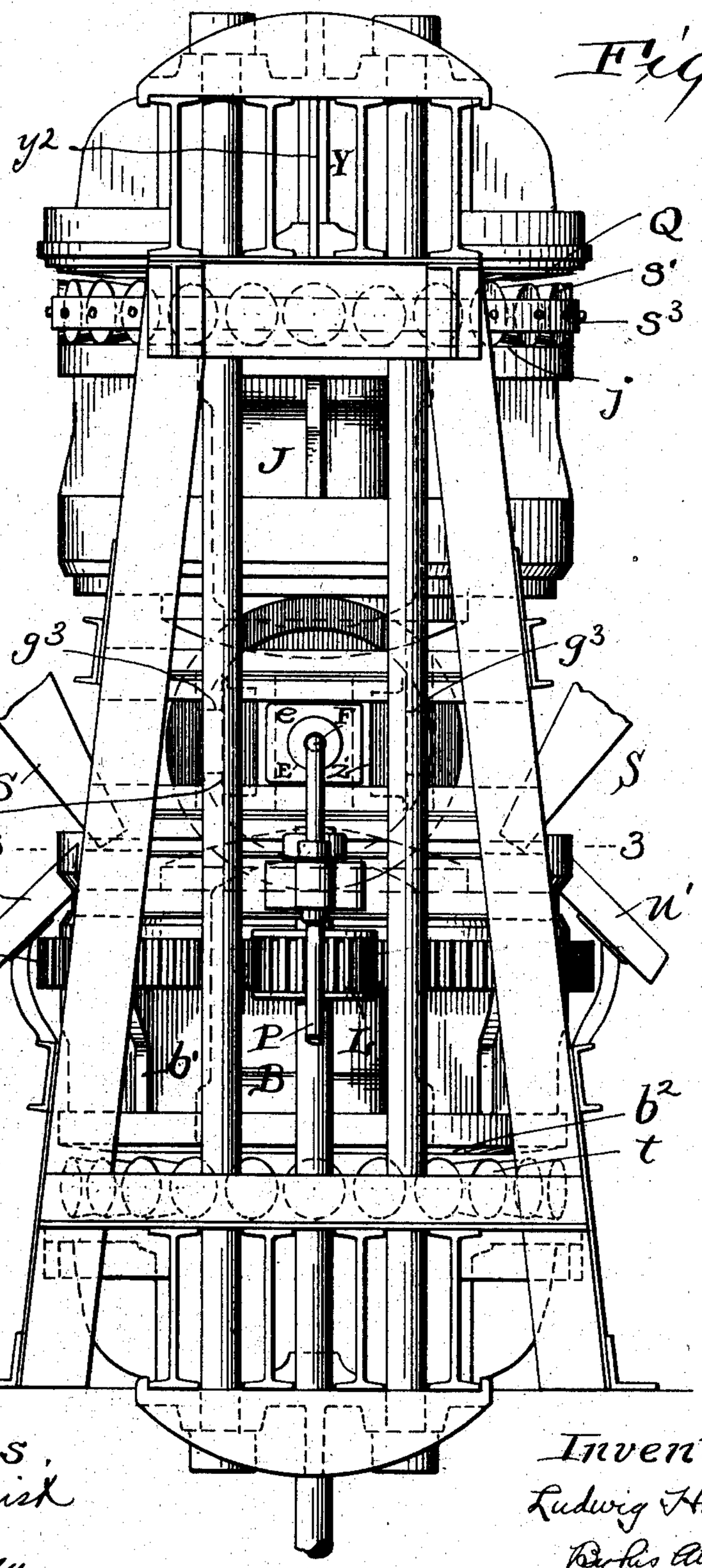
L. HERMAN.

CRUSHING AND PULVERIZING MACHINE.

(Application filed Feb. 23, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses,
E. B. Gilchrist
F. D. Cummen

Inventor,
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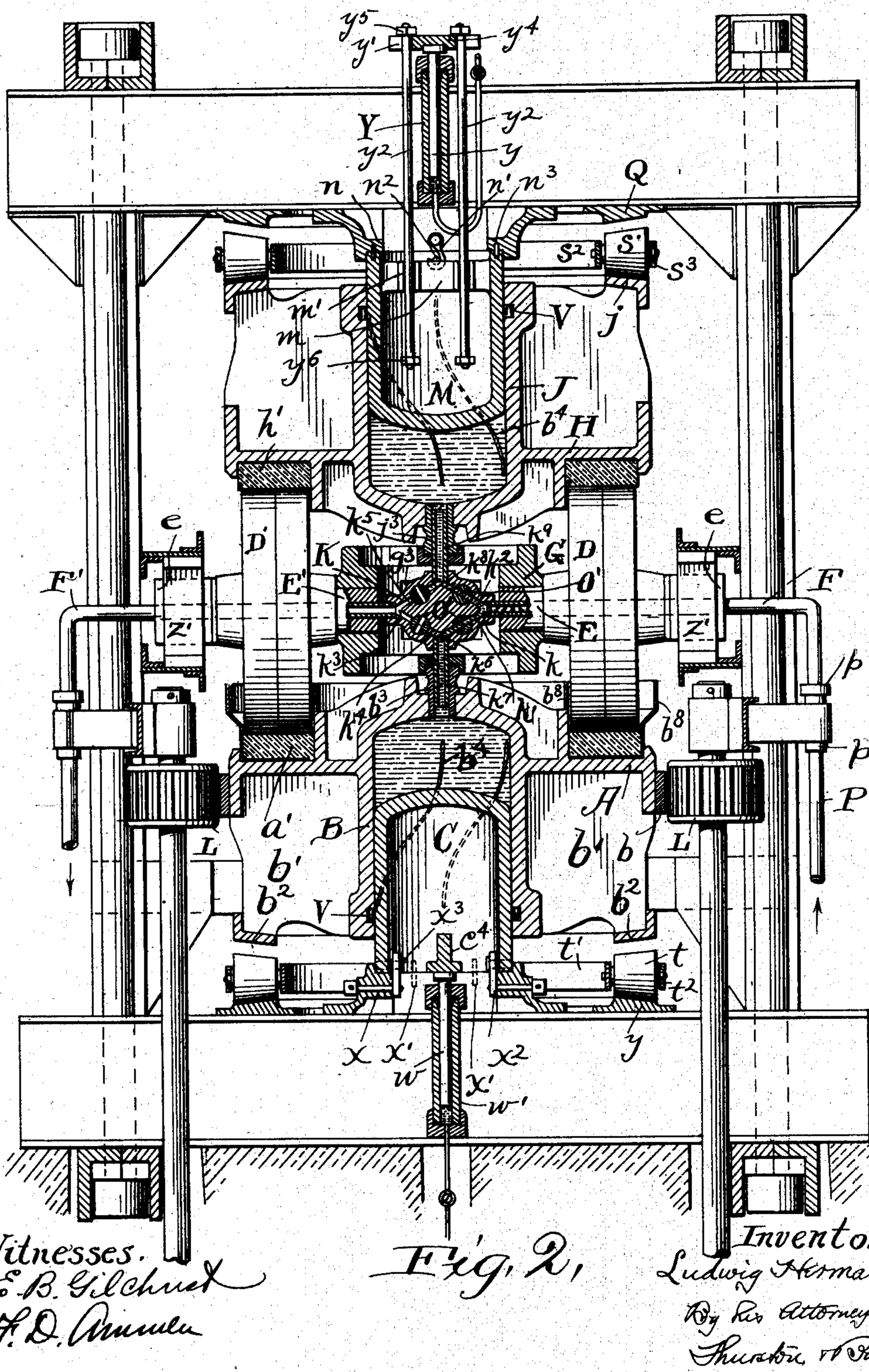

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Fig. 2.

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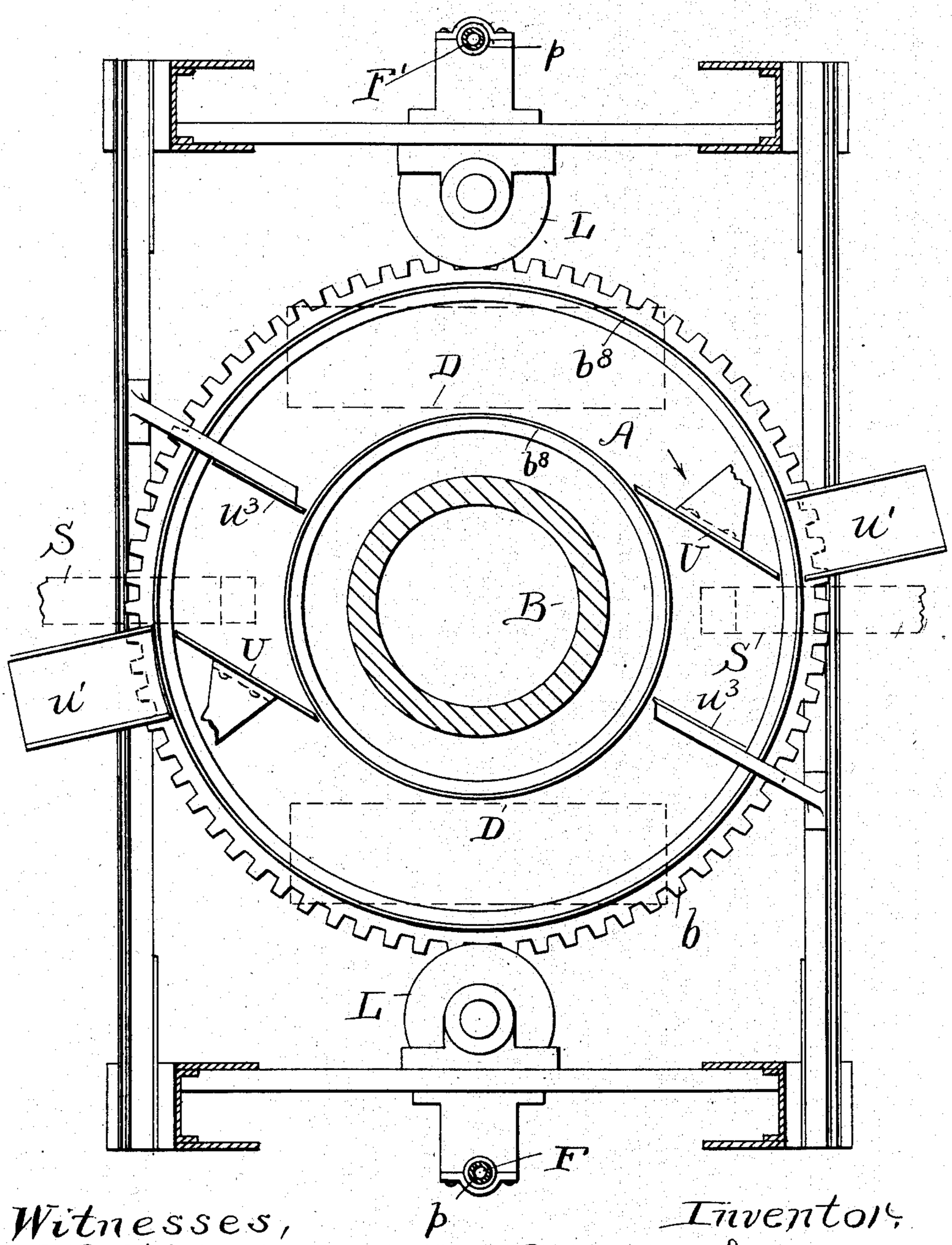

Fig. 3.

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UNITED STATES PATENT OFFICE.

LUDWIG HERMAN, OF CLEVELAND, OHIO.

CRUSHING AND PULVERIZING MACHINE.

SPECIFICATION forming part of Letters Patent No. 706,655, dated August 12, 1902.

Application filed February 23, 1901. Serial No. 48,441. (No model.)

To all whom it may concern:

Be it known that I, LUDWIG HERMAN, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Crushing and Pulverizing Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The invention relates to a machine especially adapted to crushing and pulverizing refractory materials.

My invention includes, essentially, a rotating table, rotatable crushing-wheels whose peripheries bear upon said table, and means for yieldingly pressing these contacting surfaces toward each other.

The best embodiment of my invention—to wit, the machine shown in the drawings—includes a rotating table and rotating crushing-wheels running on the same under yielding high pressure produced by means of a hydraulic press, which serves at the same time as a center bearing of said rotating table, thereby reducing friction to a minimum.

The following is a description in detail of the machine shown in the drawings, and the claims point out definitely the parts and combinations of parts shown in the drawings and herein described, which constitute the invention.

In the drawings, Figure 1 is a side elevation of a machine embodying my invention. Fig. 2 is a sectional front elevation, and Fig. 3 is a horizontal sectional plan on the line 3 3 of Fig. 1.

Referring to the parts by letters, A represents a rotating table, between which and the crushing-wheels, to be presently explained, the material is crushed and pulverized. This table is fast to an endwise-movable hydraulic cylinder B, which is rotatably mounted on a fixed piston C. This rotatable member B consists, in addition to the cylinder and table referred to, of a concentric track b^2, having an inclined lower face and a plurality of ribs b', which extend between and connect this ring with the cylinder and table. This rotatable member is caused to rotate by means of two (more or less) driven pinions L engaging with a gear b, which is secured to or formed upon this rotatable member and is concentric therewith.

The wheels D D′, whose peripheries bear upon the table A at diametrically opposite points, are rotatably mounted on two shafts E E′, which shafts are supported in such manner as to permit them, and consequently the wheels D D′, to move in paths parallel to the axis of said table. One end of each of these shafts is supported in a box e, which is vertically movable in guides z' in the sides of the framework of the machine. It might be here stated that any framework may be employed which is capable of supporting the parts withstanding the strains incident to their use and operation. The inner end of each of these shafts is secured in a ring-shaped piece G. Two or more of these crushing and pulverizing wheels D D′ may be employed. Each of them may be in one piece or may consist of several disks, all loosely mounted on the shafts E E′, so as to be capable of independent rotation. In the drawings each wheel is shown formed of two parts. The object of dividing the wheel is to obviate unnecessary friction, for the surface of the table moves faster as the distance from its axis increases, and a broad-faced wheel rolling on a flat surface could not accommodate itself to the different velocities.

In some cases it would be admissible to make the wheels of a conic shape with the table corresponding, or the face of the wheels may be made crowning and the track grooved.

The surfaces of the grinding-wheels shown are cylindrical; but obviously these surfaces might be of other specific forms, provided the surfaces of the tables with which said wheels engage were correspondingly formed.

H represents a rotatable table, which is secured to an endwise-movable hydraulic cylinder J, which latter is rotatably mounted in axial line with the cylinder B upon a fixed piston M. The face of this table H is parallel with the face of table A, and it bears upon the peripheries of the wheels D D′ at points thereon which are diametrically opposed to points on said wheels where they bear upon the table A.

By admitting a fluid—as, for example, water or oil—into both cylinders B and J at equal

pressures from an accumulator these crushing-wheels will be pressed with great force, depending upon the accumulator-pressure between these two tables, (or rather between two hardened annular plates a' and h', which are secured, respectively, to said tables,) and consequently the pressure between the crushing-surfaces—to wit, the top of the plate a' and the peripheries of the crushing-wheels D D'—may be sufficient to crush and pulverize any material fed onto said table and by it carried beneath said crushing-wheels. The lower cylinder should be slightly larger than the upper cylinder to balance the weight of the running parts. This same result might obviously be secured by a proper variation of the pressure in the two cylinders. This proper variation in pressure might be effected with the precise mechanism shown in the drawings if the pipe P were connected with an accumulator and the corresponding pipe on the opposite side of the machine were connected with another accumulator under a different pressure.

The inlet-pipe F passes longitudinally through shaft E. The inner end of this pipe is connected with a port k, formed in a block K. This block contains also the ports k' k^2, which are connected with the inlet-port k and diverge therefrom. An outlet-pipe F' passes through the shaft E' and connects with a port k^3 in said block K, with which the two diverging ports k^4 k^5 are connected. The two ports k' k^4 converge and are united in a port k^6, into which a pipe k^7 is connected, which pipe communicates with the cylinder B through an axial opening therein. This pipe is surrounded by a stuffing-box b^3, which permits it to move longitudinally. The ports k^2 and k^5 converge and are joined in a port k^8, in which a pipe k^9 is secured. This pipe enters an axial opening in the cylinder J, passing through the stuffing-box j^3, secured therein, which permits the pipe to move longitudinally therein. The ports k' k^2 k^3 k^4 are provided, respectively, with stop-cocks O', and access to these stop-cocks for the purpose of operating them is had through a hole g^3 in the ring G.

The outer end of the inlet-pipe F is turned into a vertical position and is connected with the pipe P, which is itself connected with the accumulator, the connections between said pipes being by means of a stuffing-box p, in which the end of the pipe F may move vertically.

It will be understood that the described means for admitting fluid under pressure to the two cylinders is simply the preferred means. Any suitable arrangement of pipes and valves suitable for the purpose may of course be employed in lieu of the arrangement shown.

In the operation of the mechanism described the parts by reason of their described construction and connection are self-adjusting to this extent: that either of the cylinders B or J and its attached table is capable of independent vertical movement, and the shafts E E', on which the crushing-wheels D D' are mounted, are likewise capable of vertical movement, which movement is permitted because the boxes e, in which the outer ends of said shafts are secured, are vertically movable in the guides z' and because the ring G and the inner ends of said shafts are rigidly secured to each other and necessarily move together. The vertical movement of these parts will be occasioned by the variable thickness of the layer of the material to be crushed. There will be a backward yielding of the table or the wheels, or both, which will prevent the mechanism from being stopped or injured. The material to be ground may be fed automatically through spouts S onto the table A, and the ground material may be scraped from said table by scrapers U into discharge-chutes u'. The material fed onto the table is held thereon by the vertical flanges b^8 and may be spread and leveled by plates u^3, held at the desired distance above said table. The other parts of the mechanism shown are for most part provided for the purpose of rendering the operation of the parts heretofore described more efficient or for the purpose of preventing serious damage by the failure of these parts to operate in the manner intended or for the purpose of facilitating the repair and renewal of various parts which may wear.

Supported on the frame of the machine below the track is an annular track y, having an inclined top face. On this track a plurality of cones t rest, which are mounted in two rings t' t^2. In the ordinary operation of the mechanism heretofore described these cones have no useful function; but if the fluid in the lower cylinder B should escape through any leak or break in the conduit through which it is carried into the cylinder or past the packing of the cylinder or if through any other cause this cylinder and its table is no longer sustained against the pressure from above the ring c of the rotatable member, of which said cylinder is a part, will descend and rest upon these cones. This member would or might continue to rotate, but it would then rotate upon these cones, and thereby cause no damage. A similar series of cones s' and their supporting-rings s^2 s^3 are supported upon a track j, forming part of the upper rotatable structure, which includes the cylinder J and table H, and above it is a fixed track Q, with which said cones may engage. A sufficiently great upward movement of this upper construction, comprising the cylinder and table and track, due to any leak of fluid from said cylinder or from any other cause, would carry these cones against the upper track, and as the machine continued to rotate no injury would result. The packing for each of these cylinders is, as shown, the ordinary U-shaped leather ring V, which is located in an annular groove in

the cylinder near its open end. Any other suitable form of packing may, however, be employed. Shallow grooves b^4 are also formed, extending longitudinally in the inner face of the cylinder, their lower ends terminating in the annular groove in which this packing-ring is placed. The liquid flowing down these longitudinal grooves is delivered into this U-shaped leather ring, which is thereby expanded against the piston. The liquid in these grooves b^4 is also delivered onto the outer face of the fixed piston and effectually lubricates it. The renewal of this U-shaped packing-ring is necessary from time to time, and the machine contains novel mechanism whereby it may be renewed with comparative ease, which means are applicable to any hydraulic press.

Referring to the lower piston C, it will be seen that it is cored out and that its lower edge rests upon a ring x, fast to the frame of the machine. The top edge of this ring and the lower edge of this piston contain holes in which dowel-pins x' are placed, which prevent the rotation of the piston. Hooks x^2 are pivoted to the supporting-ring and take over pins x^3 on the inner face of the piston, and thus endwise movement of the piston under ordinary circumstances is prevented. Any equivalent means for separably connecting the piston and its support may be employed. In the lower end of the piston is a cross-bar c^4, with which the upper end of a hydraulic piston w engages. The cylinder w' of this piston is rigidly fastened to the frame of the machine. Now when one wishes to renew the packing in the cylinder B the piston C is unhooked from its supporting-ring and then is lifted by this hydraulic piston w last referred to. Of course the fluid in the upper end of the cylinder B is at this time allowed to escape through the discharge-pipe F'. The piston C is of such length that when it is moved up as far as it will go in the cylinder its lower edge passes the groove in which this packing-ring V is placed. The old packing may be removed and new packing substituted, and then the piston C may be allowed to descend to the position shown in the drawings. During this operation the cylinder B, table A, &c., will have to be blocked up. A more or less similar contrivance is provided for, permitting the renewal of the packing in the upper cylinder. The upper piston M is held against a supporting-ring n by hooks n', mounted on the ring, and pins n^2, projecting from the piston, and is prevented from rotation by dowel-pins n^3, as in the case of the lower piston. A hydraulic cylinder Y is secured to the framework above the piston. Two depending rods y^2 are detachably secured to the cross-head y^4 of the piston y and to a cross-arm m, fast to the piston M. These rods enter notches y' in cross-head y^4 and notches m' in cross-arm m, and they have enlargements y^5 y^6, which engage with said cross-head and cross-arm, respectively. To renew the packing in this upper cylinder, the piston M is unhooked and allowed to drop into the lower end of said cylinder J, from which the fluid is permitted to escape. The upper end of the piston M will pass below the groove containing the packing V, which may be removed and new packing substituted. Then by the operation of the hydraulic mechanism described this piston is raised to its operative position and there secured by the hooks n'.

Having described my invention, I claim—

1. In a machine of the character described, the combination of a fixed cylindrical piston, a cylinder rotatively mounted thereon, means for admitting a fluid under pressure into said cylinder, a table secured to said cylinder, and rotatable crushing-wheels bearing upon said table, and means for yieldingly pressing said table and crushing-wheels against each other, substantially as described.

2. In a machine of the character described, the combination of a rotatable table, means for rotating it, a parallel table capable of being rotated, and rotatable grinding-wheels between said tables and in contact with both, hydraulic means for pressing both of said tables toward each other and against said grinding-wheels, substantially as described.

3. Two pistons fixed in axial alinement, two cylinders rotatively mounted on said pistons respectively, each cylinder having a table fixed to it, means for admitting fluid under pressure into both cylinders, mechanism for rotating one or both of said cylinders, and rotatable grinding-wheels located between said tables and in contact with both, substantially as described.

4. Two pistons fixed in axial alinement, two cylinders rotatively mounted on said pistons respectively, each cylinder having a table fixed to it, means for admitting fluid under pressure into one or both cylinders, two boxes, movable in paths parallel with the axes of the pistons, two shafts supported at their outer ends in said boxes, a member rigidly connected to the inner ends of said shafts, crushing-wheels rotatively mounted on said shafts and lying between and engaging with said tables, and mechanism for rotating one of said tables, substantially as described.

5. In a machine of the character specified, the combination of two tables rotatably mounted in axial alinement and capable of axial movement, crushing-wheels located between said tables and in contact with both, said wheels being rotatable about an axis at right angles to the axis of the tables and capable of movement in paths parallel with the axis of said tables, and yielding means for pressing said tables toward each other and against said crushing-wheels, substantially as described.

6. In a machine of the character specified, the combination of a cylindrical piston, a support therefor, dowel-pins engaging said two parts, and hooks preventing their separation,

a cylinder rotatively mounted on said piston, a table fast to said cylinder, means for rotating it, and rotatable wheels which bear upon said table, substantially as described.

7. In a machine of the character specified, the combination of a piston, a fixed support therefor, and means for connecting and disconnecting said piston and its support, a cylinder rotatably mounted on the piston and having an internal annular packing-groove near its open end, a crushing-table secured to said cylinder, mechanism for rotating the same, crushing-wheels bearing upon the surface of said table, a fixed hydraulic cylinder, its piston, and means connecting said piston with the piston first named, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

LUDWIG HERMAN.

Witnesses:
E. L. THURSTON,
ALBERT H. BATES.