(No Model.) 3 Sheets—Sheet 1.

W. I. TUSTIN.

ORE PULVERIZING MILL.

No. 248,122. Patented Oct. 11, 1881.

Fig. 2.

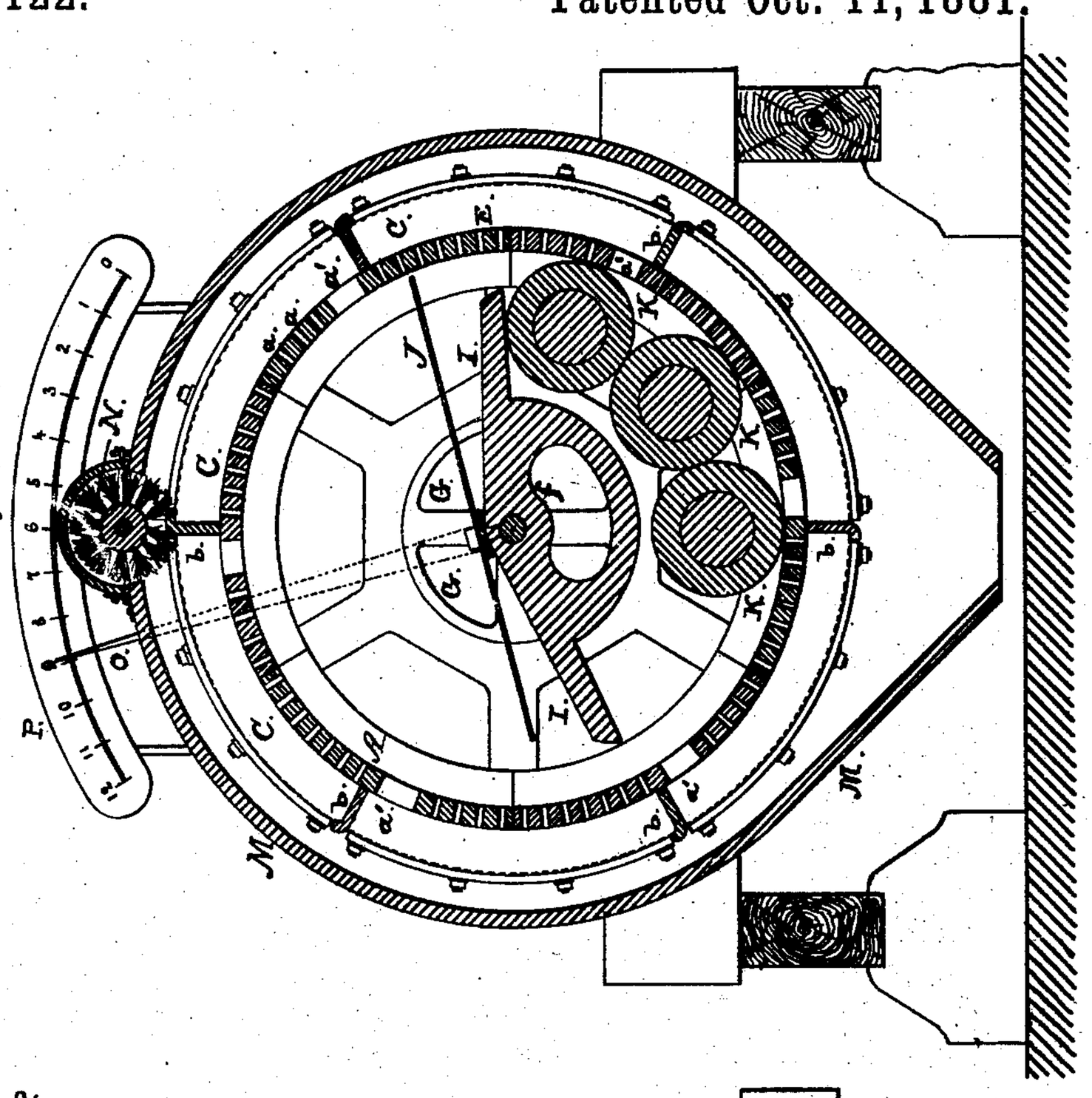
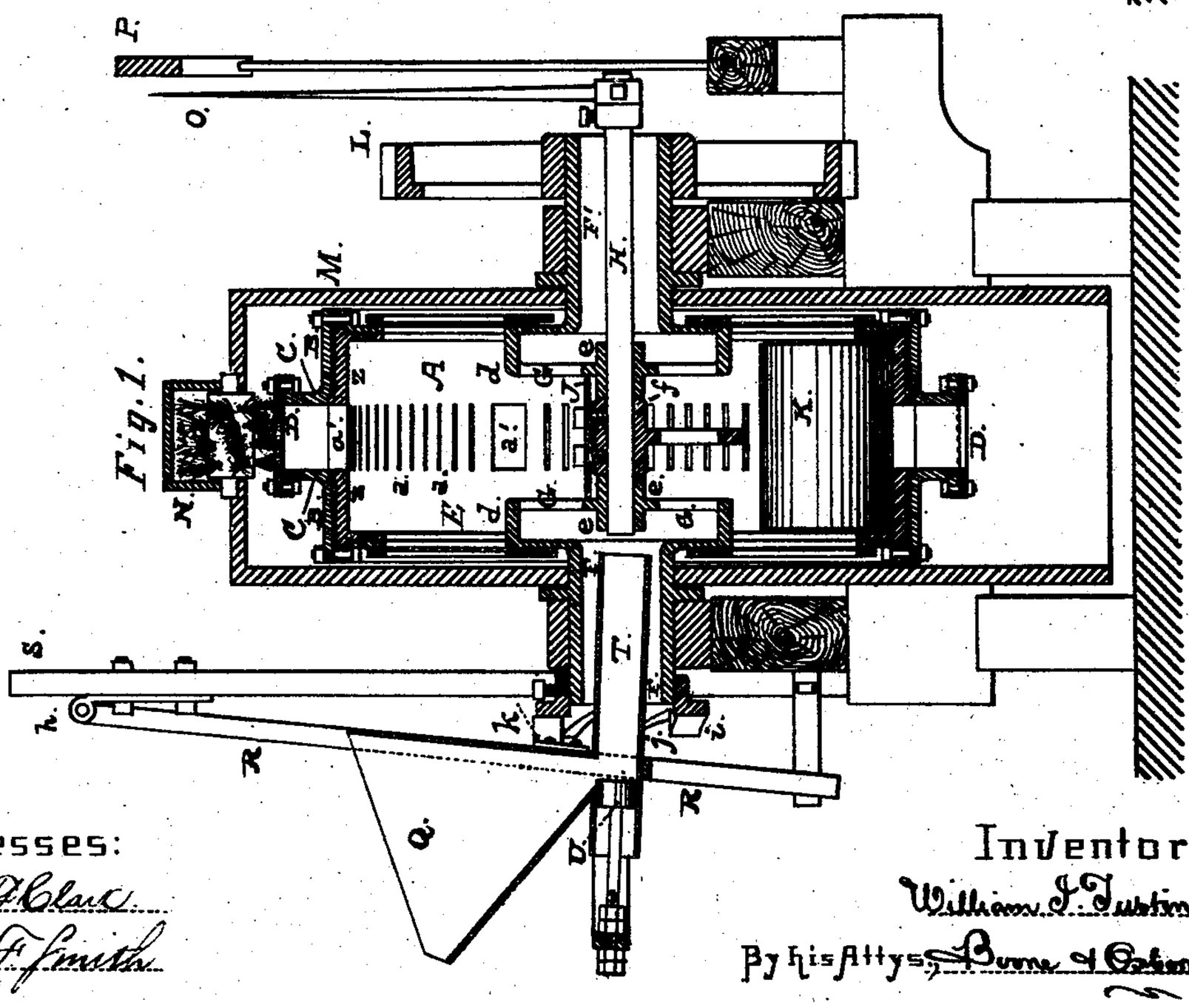


Fig. 1.



Witnesses:
Wm. A. Clark
Wm. F. Smith

Inventor:
William I. Tustin.
By his Attys, Burns & Coburn.

(No Model.) 3 Sheets—Sheet 2

W. I. TUSTIN.

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Fig. 4.

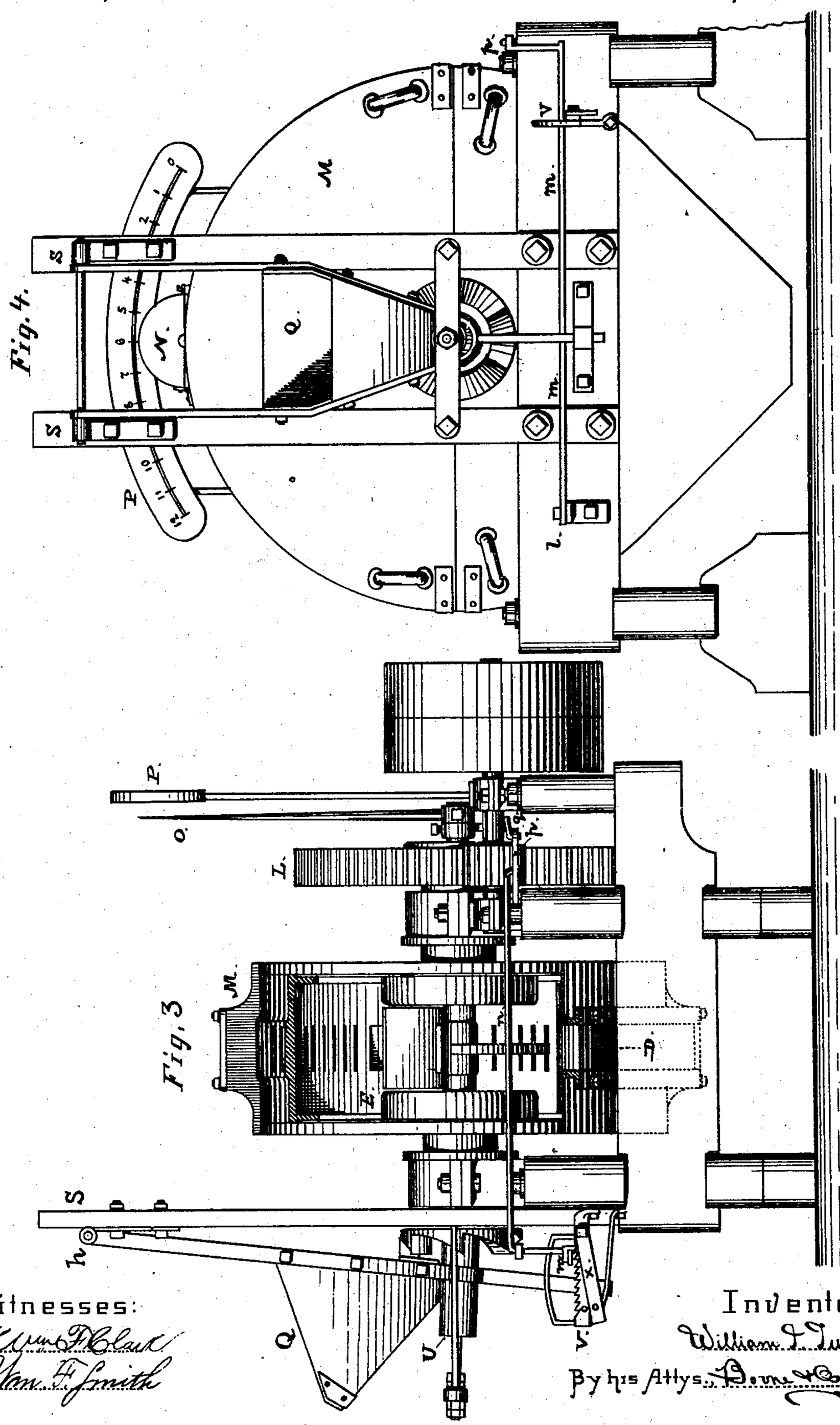


Fig. 3

Witnesses:

Wm. F. Clark

Wm. H. Smith

Inventor:

William I. Tustin,

By his Attys. Dewey & Colton

(No Model.) 3 Sheets—Sheet 3.

W. I. TUSTIN.

ORE PULVERIZING MILL.

No. 248,122. Patented Oct. 11, 1881.

Fig. 5.

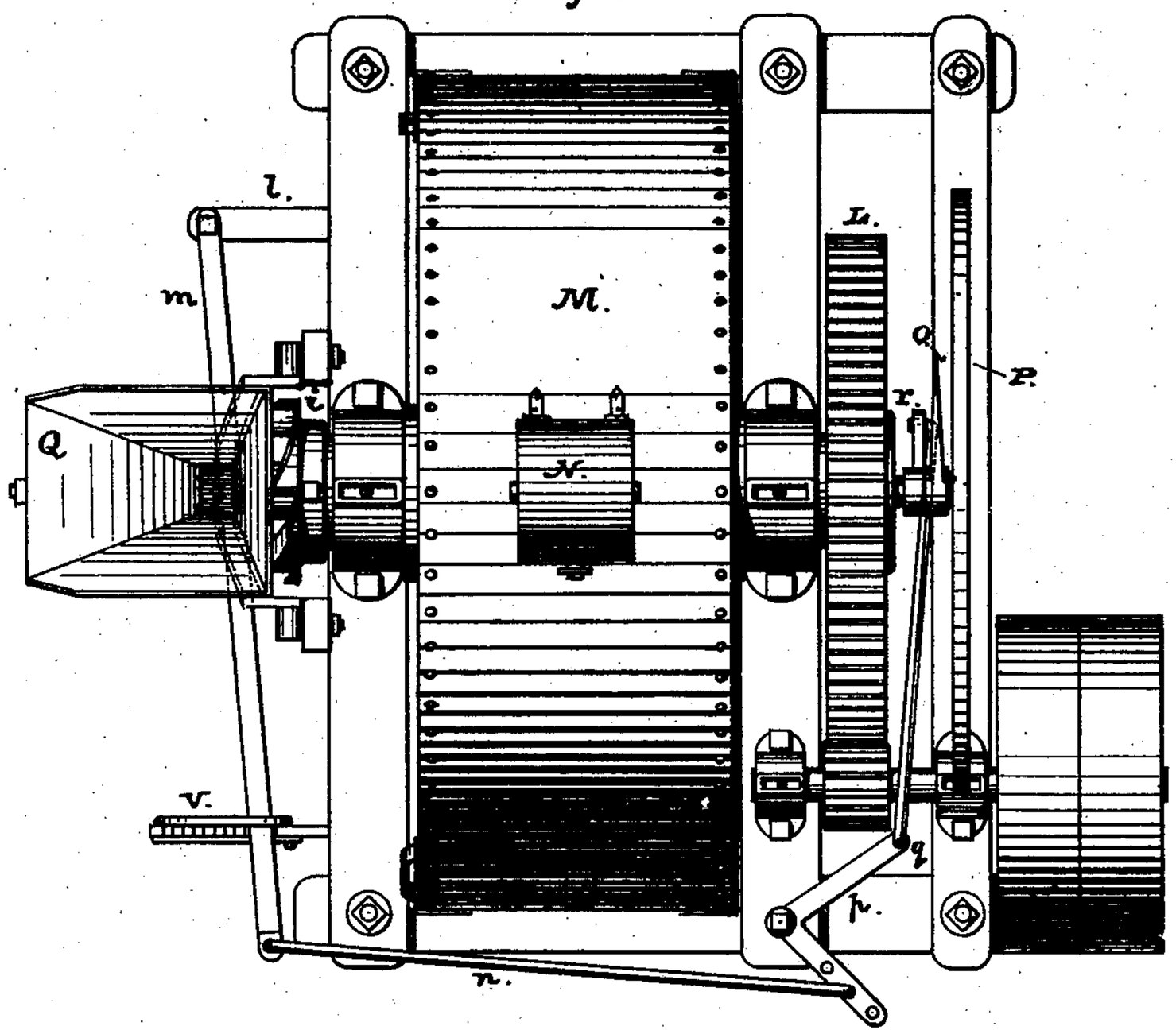


Fig. 8.

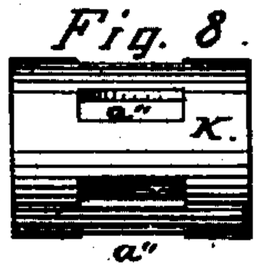


Fig. 9

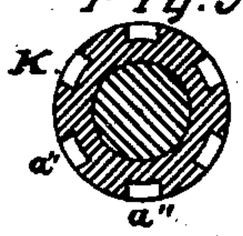


Fig. 6.

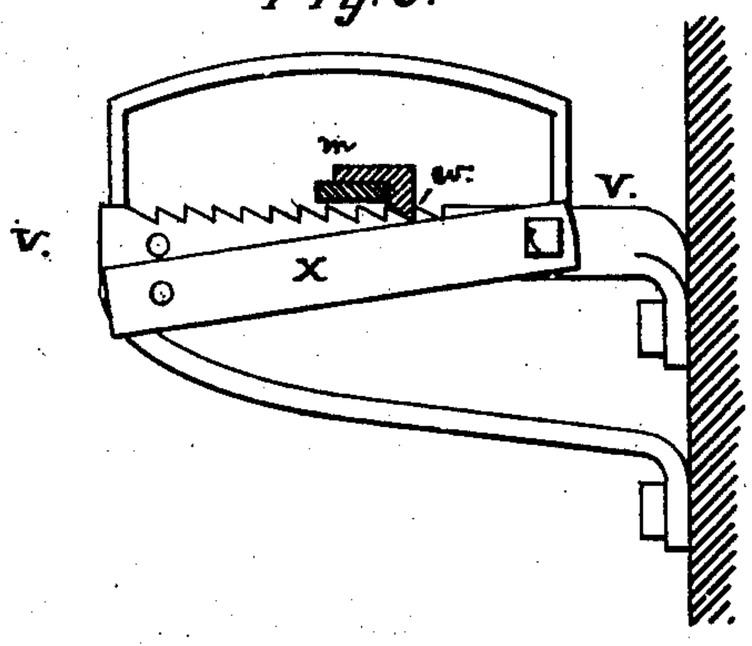
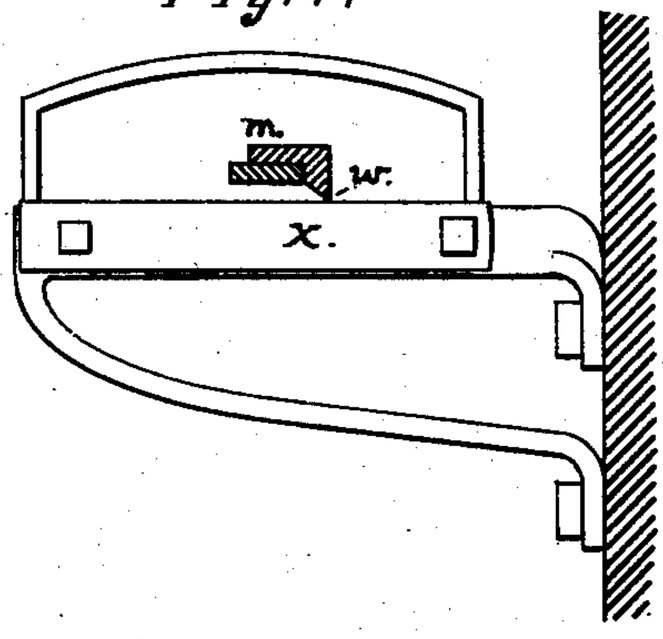


Fig. 7.



Witnesses:

W. Voit

Wm. F. Clark

Inventor:

William I. Tustin

By his Attys. Poore & Osborn

UNITED STATES PATENT OFFICE.

WILLIAM I. TUSTIN, OF SAN FRANCISCO, CALIFORNIA.

ORE-PULVERIZING MILL.

SPECIFICATION forming part of Letters Patent No. 248,122, dated October 11, 1881.

Application filed March 17, 1881. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM I. TUSTIN, of the city and county of San Francisco, in the State of California, have made and invented certain new and useful Improvements in Ore-Pulverizing Mills; and I do hereby declare that the following is a full, clear, and exact description of my said invention, reference being had to the accompanying drawings.

My invention has reference to that class of crushing and pulverizing mills in which the ore or other substance to be crushed and pulverized is placed inside a rotating barrel or cylinder and subjected therein to the crushing and grinding action of one or more balls, cylinders, or weights.

The object of the invention is to improve the construction of the several parts, whereby the operation of the ore-pulverizing mill is more effective both in feeding and grinding the ore. These objects I attain by the construction substantially as shown in the drawings and hereinafter described.

In the drawings, Figure 1 is a transverse vertical section of my pulverizing-mill. Fig. 2 is a side elevation in section. Fig. 3 is an end view of the mill, showing a vertical section of the cylinder and the rods connecting the independent shaft or axle with the feeding mechanism. Fig. 4 is a side elevation, showing feed-hopper and graduated scale. Fig. 5 is a top-plan view, showing the manner of connecting the independent shaft with the feeding mechanism. Fig. 6 shows the ratchet and pawl for setting the feed mechanism at a fixed point. Fig. 7 shows the same device arranged to permit an automatic feed.

A is a short barrel or cylinder made of iron castings. Each side may be made of one casting and the rim of two castings, or each side and its half of the rim can be made of a single casting. In Fig. 1 I have represented the rim as being made of two separate pieces, which are bolted to the periphery of the side pieces. Each rim-casting B extends only partially across the space between the sides, and it has a rectangular flange, C, projecting outward from its inner edge. The space between these flanges forms the groove or channel which surrounds the cylinder midway between its sides, while the portion on each side of the channel forms tracks Z for rollers to move upon. A wire cloth or screen, D, is stretched across this space entirely around the cylinder, and is bolted to the outer edges of the flanges, as shown. A removable lining, E, is placed around the interior of the cylinder against its rim, and slots *a a* are cut in it transversely across the channel, so as to form the cross-bars or grating. These slots are made quite narrow for a short distance, and then at intervals wider slots *a'* are made, so that any particles which may pass through the narrow slots and are too large to pass through the screen will find their way back into the cylinder again through these wide slots as the cylinder rotates. A partition or elevating-shelf, *b*, is placed across this channel on one side of each wide slot, so that the particles which pass through the main slots and are too large to pass through the screen will be arrested and directed into the cylinder again, and thus be prevented from remaining in the channel.

The cylinder is mounted on hollow trunnions F F', which are cast in separate pieces and bolted to each head of the cylinder. Each hollow trunnion has an enlarged end, which fits against and is bolted to the inside of the cylinder in the center of each side, while the trunnions pass through the sides and rest upon the bearings on which the cylinder is supported. The inside large end of each trunnion has a rim, *d*, projecting from its outer edge, and a skeleton end or head, G, forms a box or hub, *e*, for a shaft, H, that passes across the center of the cylinder and through one of the hollow trunnions. Upon this shaft, between the hubs *e*, a head or casting, *f*, is secured, from which two radial arms, I I, extend. A chute, J, is secured upon the head or casting *f*, so as to extend across the inside of the cylinder above the center shaft, for the purpose hereinafter stated. Inside of this barrel or cylinder, below the radial arms, I place one or more weights or rollers, K K. Usually these weights will be short rollers extending across the floor of the cylinder and resting upon both the side tracks and intervening grating. Two or more of such rollers will be placed inside of the barrel or cylinder, side by side, so that they will press against each other, and in each of the outside rollers will be made a number of narrow pock-

ets or cavities, *a''*, extending across the middle portion of the roller in a longitudinal direction, leaving the ends of the rollers smooth and plain, as shown at Figs. 8 and 9, Sheet 3. These cavities or pockets serve as buckets to catch the ore and throw it forward or backward upon the intermediate rollers, thus preventing the ore from accumulating behind the rear roller or in front of the front roller. Each one of the rollers can be supplied with these pockets or buckets, if desired.

The cylinder is driven by power applied to a spur-wheel, L, on the trunnion F', so as to rotate it continuously in one direction. The ore is fed into the cylinder through the hollow trunnion F by an automatic feeding device, hereinafter explained, so as to fall upon or in front of the rollers. One of the radial swinging arms I extends on each side of the series of rollers, so as to keep them in their proper relative positions, while the chute J serves to catch any ore that may be carried up and fall from the side of the cylinder and transfer or conduct it to the opposite side of the cylinder, in front of the rollers. The head *f*, with its arms I, confines the rollers K within a given space, and prevents them from being brought in contact with the chute J.

The barrel or cylinder I surround by a case, M, the bottom of which is open, and in a housing on the top of this case, or at any other convenient point, I mount a rotary brush, N, so that its bristles will brush against the screen as it passes and free it of any particles which may lodge in its meshes. Now, as the cylinder rotates the rollers will be carried a short distance up its ascending side, the height to which they will be carried being proportionate to the friction and resistance they encounter and the speed of the rotation of the cylinder. When the end roller strikes the swinging radial arm I it will carry that arm up with it and partially rotate the shaft H, to which the radial arms are attached. The friction and resistance encountered by these rollers is in proportion to the amount of ore in the cylinder—that is, the greater the quantity of ore in the cylinder the greater will be the resistance encountered by the rollers and the higher they will be carried up the side of the cylinder. I therefore attach a pointer or indicating-hand, O, to the end of the shaft H outside the trunnion, and secure a graduated indicating-scale, P, opposite the pointer, so that the position of the rollers will be indicated by the hand or pointer on the scale. I can thus at any time determine at a glance what is the quantity of ore in the cylinder.

By properly constructing my feeding device and connecting it with the shaft H, I am also able to provide an automatic feeder in the following manner:

Q is the hopper of the feeder, in which the ore is placed. This hopper I attach to a bar, R, suspended by means of a hinge, *h*, from a stanchion, post, or frame, S, so that the hopper will hang just above the hollow trunnion F. The lower end of the hopper I connect by an inclined tube or spout, T, with the inside of the cylinder, the spout or tube passing underneath the hopper and through the hollow trunnion F.

Around the hollow trunnion F, on the outside of the cylinder, I secure a ring, *i*, the outer edge of which is formed with long ratchet-shaped teeth *j;* and on the hanging bar R, I secure a block, *k*, which will ride over these teeth and drop from their points to their bases as the cylinder rotates, thus giving to the swinging hopper and its feeding tube or spout a back-and-forth motion and concussion or jar. In the outer end of this feeding-spout T, outside of the opening which leads from the hopper into the tube, I place a stationary plunger, U, that will force the ore through the tube every time the hopper moves back and allow the ore to drop down into the tube in front of it every time the hopper moves forward.

In order to render the feeding operation automatic, I extend the lower end of this swinging bar R, to which the hopper is attached, to a considerable distance below the hopper. At one side of the machine I secure an arm or lug, *l*, Fig. 5, and to the outer end of this lug I attach one end of a lever, *m*. This lever extends horizontally alongside the machine, passing inside of the lower end of the swinging bar R, and its opposite end I connect by means of a rod, *n*, with one arm of a bell-crank lever, *p*, on the opposite side of the machine. The other arm of the bell-crank lever I connect by a rod, *q*, with an arm, *r*, on the shaft H, and this arm *r*, being attached to the same shaft with the indicating-pointer O, will move with the shaft, so that when too much ore is being fed to the cylinder the rollers will be carried higher up the side of the cylinder, and the shaft H will be caused to rotate by the action of the rollers upon the radial arms. Through the medium of the connecting-rods and bell-crank lever this rotation of the shaft H will cause the horizontal lever *m* to move the lower end of the swinging bar R and the hopper outward, so that the ratchet-teeth on the ring *i* will have less effect on the swinging mechanism, and will reduce the amount of ore fed to the cylinder.

In some cases it will be necessary to suspend the feeding operation entirely, and yet allow the cylinder to rotate. To provide for this I attach a horizontal bar or arm, V, Fig. 6, to the side of the machine, so that it will project out under the moving end of this lever *m*. The upper edge of this arm I form into ratchet-teeth, as shown. I also provide the lever *m* with a pawl-projection, *w*, which will engage with the ratchet-teeth, so that I can set the lever at any desired point, either to give a limited feed or to throw the feeding mechanism entirely out of action. To one side of the arm *v*, I attach one end of a plate, *x*, which can be raised up to a horizontal position and fixed in place alongside the arm *v*. The upper edge of this plate is smooth, and projects slightly above

the teeth on the arm when thus horizontally fixed, so that the pawl *w* will ride on the smooth edge, as shown in Fig. 7. When the plate is raised up in this manner the automatic operation of the feeding mechanism is not interfered with, as the lever *m* will move freely and be actuated, as hereinbefore described, by the rollers, radial arms, and shaft H.

I thus provide a complete, positive, and reliable rotary pulverizing-mill, and by supplying an automatic feeding device I remove one of the principal objections heretofore urged against this class of mills—to wit, difficulty of regulating the feed.

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

1. In a rotary crushing and grinding mill, the case M, in combination with the cylinder A, formed in two sections, and provided with screen D and internal lining, E, substantially as shown, and for the purpose described.

2. In an ore-grinding mill, the combination of the ore-cylinder provided with tracks *z*, the rollers K K, and the elevating-shelves *b*, as set forth.

3. The swinging radial arms I I, connected with the rotating axial head or hub *e*, in combination with a series of crushing-rollers, said arms extending upon opposite sides thereof, substantially as and for the purpose set forth.

4. In combination with a rotary barrel or crusher provided with a groove or channel formed in its rim and shelves or elevators *b*, shaft H, the chute J, the head *f*, provided with the radial arms I I, arranged as described, and the rollers K K, substantially as and for the purpose described.

5. In a rotary crushing and grinding mill, the swinging radial arms I I, crushing-rollers K K, arranged as described, the indicating hand or pointer O, the shaft H, and the graduated indicating-scale P, combined and arranged substantially as herein set forth.

6. In combination with a hollow trunnion, a swinging hopper, Q, having a tube or spout, T, leading from its lower end through the hollow trunnion, of the ratchet-ring *i*, and the block K on the hopper, substantially as described.

7. In combination with the hollow trunnions F F′, the swinging radial arms I I, the shaft H, and the crushing and grinding rollers K K, of the swinging hopper Q, downwardly-projecting bar R, the lever *m*, arm *r*, connecting-rod *n*, bell-crank lever *p*, and connecting-rod *q*, substantially as above described.

8. In combination with the horizontal lever *n*, the arm *r*, intermediate connections, and the shaft H of the ratchet-bar V, lever *m*, and the pawl-projection *w*, substantially as and for purpose described.

9. In a rotary crushing or grinding mill, the hopper Q, supported by hinged bar R, said hopper having an inclined tube or spout, T, in combination with the stationary plunger U and hollow trunnion F, and means, substantially as described and shown, for imparting to the hopper a swinging motion, substantially as and for the purpose set forth.

In witness whereof I have hereunto set my hand and seal.

WILLIAM I. TUSTIN. [L. S]

Attest:
WM. F. CLARK,
W. VOIT.