(No Model.)

A. M. ROUSE.

MACHINE FOR PULVERIZING ORES AND OTHER MATERIALS.

No. 350,564. Patented Oct. 12, 1886.

Fig. I.

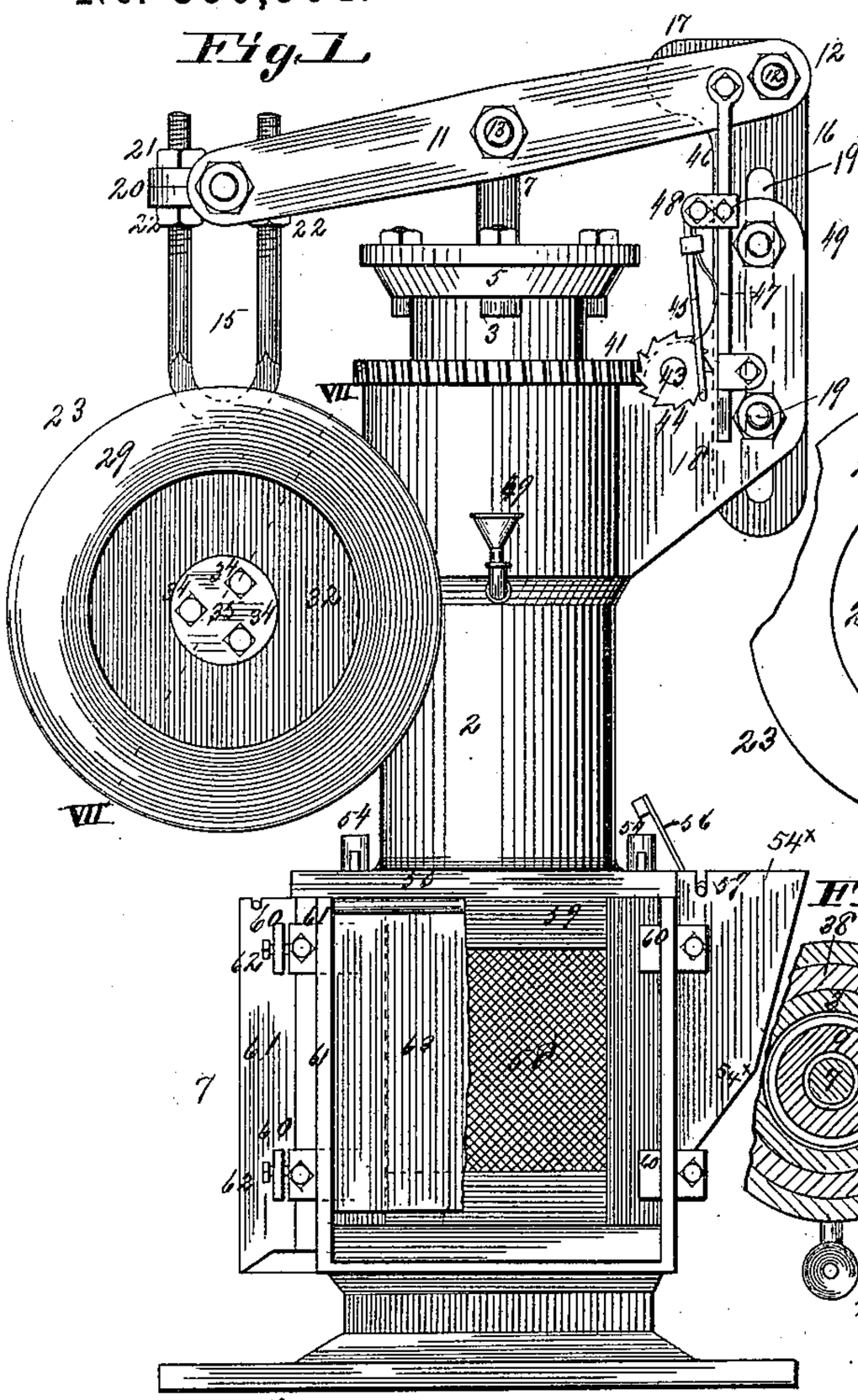

Fig. II.

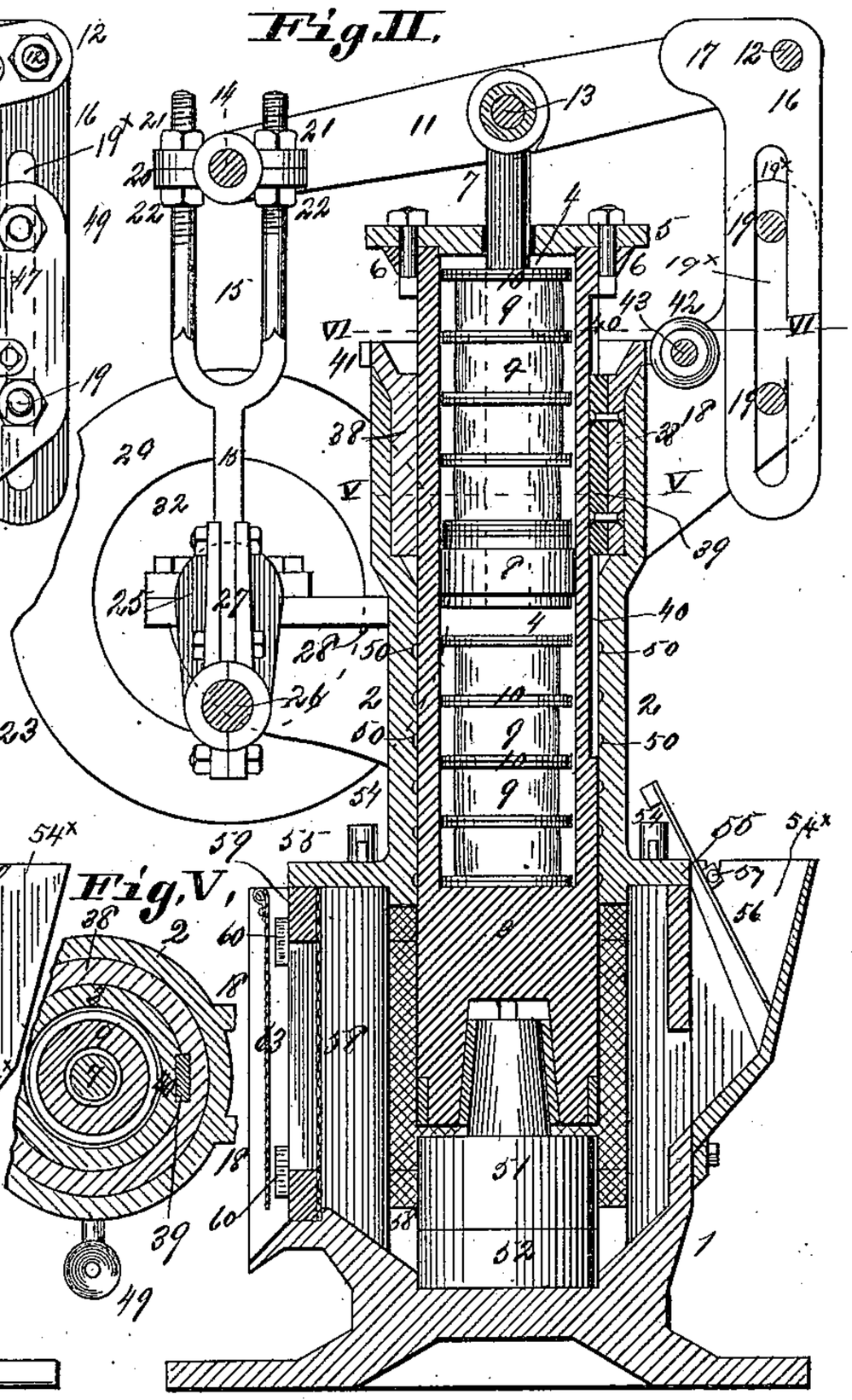

Fig. III.

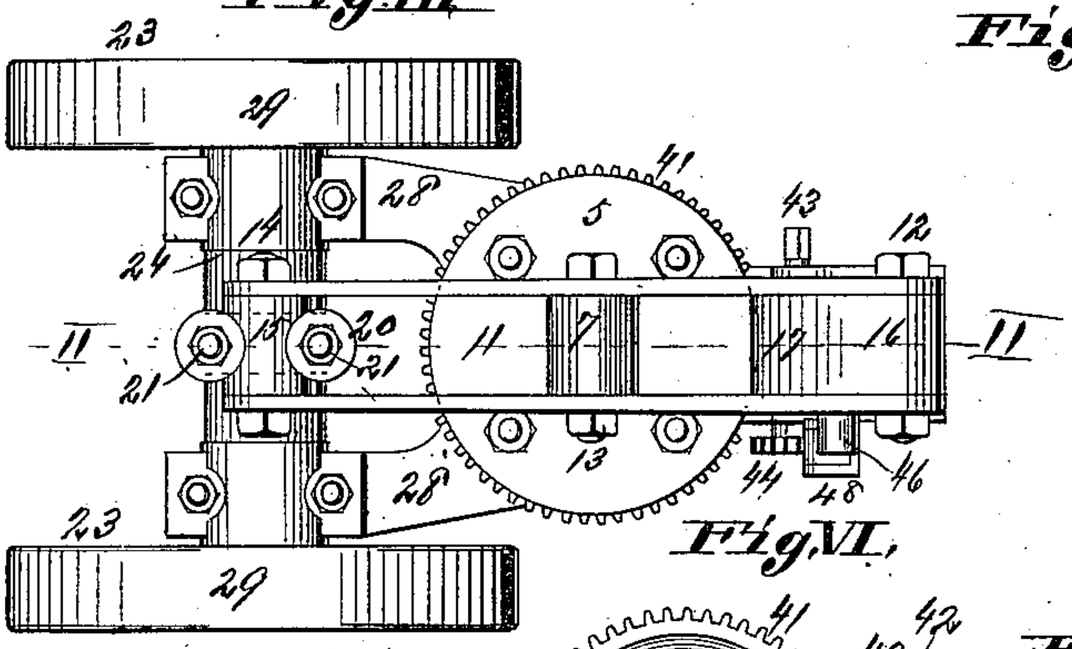

Fig. IV.

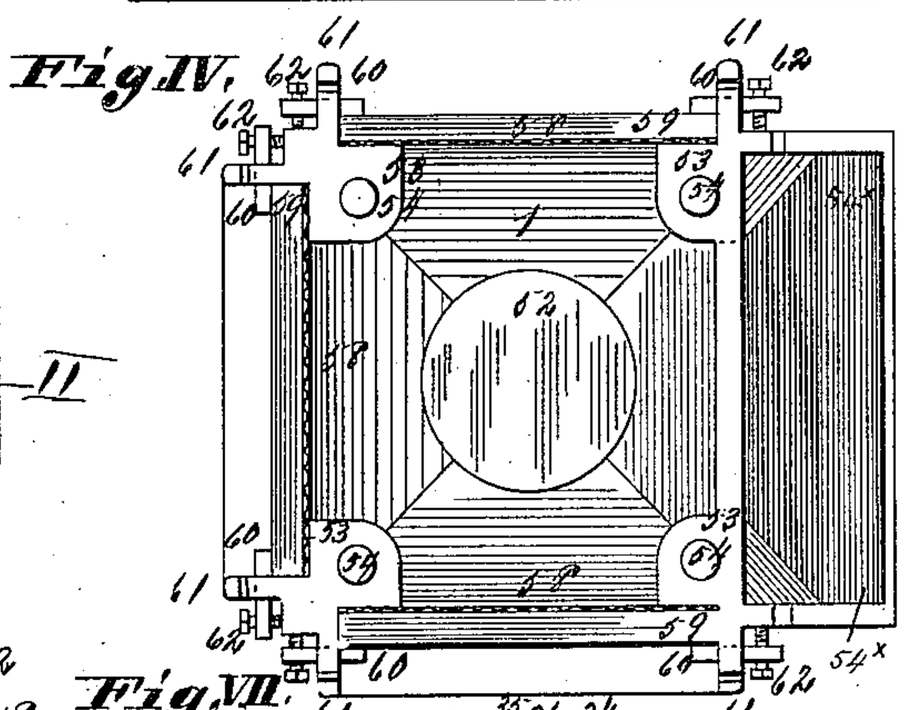

Fig. V.

Fig. VI.

Fig. VII.

Attest;
F. A. Hopkins
Edward Stier

Inventor;
Albion M. Rouse
By Knight Bros.
Attys.

UNITED STATES PATENT OFFICE.

ALBION M. ROUSE, OF BOULDER, COLORADO.

MACHINE FOR PULVERIZING ORES AND OTHER MATERIALS.

SPECIFICATION forming part of Letters Patent No. 350,564, dated October 12, 1886.

Application filed November 11, 1885. Serial No. 182,442. (No model.)

To all whom it may concern:

Be it known that I, ALBION M. ROUSE, of the city and county of Boulder, in the State of Colorado, have invented a certain new and useful Improvement in Machines for Pulverizing Ores and other Materials, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure I is a side view with part broken away. Fig. II is a vertical section at II II, Fig. III. Fig. III is a top view of the upper part of the machine, the mortar not being shown. Fig. IV is a top view of the mortar, the cylinder and piston being removed. Fig. V is a detail horizontal section at V V, Fig. II. Fig. VI is a horizontal section at VI VI, Fig. II. Fig. VII is a section at VII VII, Fig. I.

My invention consists in the described construction and combinations of parts whereby rapid linear and slow rotary motion is given to a pestle in the mortar, and whereby the power used to elevate the pestle can be partially stored for use in the descent of the pestle.

1 represents the mortar. I do not confine myself to the form of mortar shown, as this may vary without essential change of the novel features of the machine.

2 is a hollow cylinder cast upon or bolted to the mortar 1.

3 is the body of the pestle, having an axial chamber or bore, 4, closed at top by a head, 5, bolted to lugs 6 upon the pestle-cylinder. The head has a central hole, through which passes the piston-rod 7, carrying a piston, 8, capable of working a few inches in the bore 4.

9 are rubber springs or blocks, between the contiguous faces of which, and also between the contiguous faces of the end blocks and the ends of the piston, are interposed washers or facings 10, of leather or other similar material, one of which is secured to each end of each block, as shown. The rubber springs 9 (even when under pressure, as hereinafter described) are considerably less in diameter than the bore 4 of the pestle, so that they will not bind, but move freely therein, while the facings or washers 10 are but slightly less in diameter than said bore, so that they too may move freely in the direction of the axis of the bore, while at the same time confining the said spring-blocks against lateral displacement. Above the piston 8 all of the spring-blocks and washers are centrally perforated for the passage of the piston-rod 7, while those below require no such perforation, and are preferably without it, although they may, if preferred, have holes through the central part to increase their elasticity. The leather facings are lubricated in the bore by dry pulverized graphite, which has the effect of polishing the surfaces that come in contact, and reduces the friction to a minimum. I have described my preferred construction of springs; but springs of any other character may be used. The piston 8 and springs 9 do not fill the whole length of the chamber or bore 4, the piston having some lost motion in the chamber. In practice I impart to the piston a six-inch stroke, and so proportion the parts that when the spring-blocks are in their normal or relaxed condition there shall be but four inches of space or lost motion through which the piston moves before it begins to exert its influence upon the pestle through the medium of the interposed spring-blocks, for the purpose hereinafter fully described. The upper end of the piston-rod is connected to the lever 11, which is composed of two parallel bars connected together by the fulcrum-pin 12, and the wrist-pins 13 and 14 of the piston-rod 7, and the connecting-rod 15. The lever 11 is fulcrumed on a block, 16, which is interposed between the two bars of the lever 11, and has a projection, 17, extending between the bars of the lever to hold the lever in line. The block 16 is adjustably secured between two lugs, 18, projecting from the cylinder 2, the means of attachment being by two grip-bolts, 19, which pass through the lugs and through a vertical slot, $19^{\times}$, in the block 16. The block 16 may be vertically adjusted after loosening the bolts 19, and when they are again made tight the block 16 is held rigidly in position. The connecting-rod 15 is forked at the upper end, and the two arms of the fork pass through the ends of the wrist-box 20, in which the wrist-pin 14 has bearing. The parts of the arms passing through the box 20 are screw-threaded and carry nuts 21 and 22, bearing, respectively, against the top and bottom of the box 20. This construction give means for the adjustment of the box upon the connecting-

rod. The purpose of making the lever 11 adjustable at the ends upon the fulcrum-block and connecting-rod is for the adjustment of the piston as the stamp-shoe and anvil-block wear away, or new ones are supplied.

The machine is driven by belts upon the balance belt-wheels 23, which are upon a crank-shaft, 24. The wrist-pin 26 of the crank 25 is connected to the lower end of the connecting-rod by a box, 27. The crank-shaft has journal-bearing upon lugs 28 cast upon or bolted to the cylinder 2.

In order that the other parts of the machine may not be broken or strained by the momentum of the balance-wheels and the power of the belts, should anything arrest the motion of the machine, I make the rims of the balance-wheels in separate pieces from the hubs and connect them by an adjustable friction device, which I will now describe. The rim of the drive or balance wheels is marked 29. 30 is an annular flange or web extending inwardly from the rim. 31 is a flanged hub upon the crank-shaft, made with an annular recess to receive a ring, 33, of raw-hide, and to receive one side of the web 30. 32 is a disk, which is connected to the flange 31 by bolts 34, near the center, the bolts passing through a circular plate, 35, and a rawhide disk, 36, which latter is in a recess of the metal disk 32. The disk 32 has a recess like the annular recess of the flange 31 and for a similar purpose, namely, to receive a rawhide ring and one side of the web 30. Between the flanged hub 31 and the disk 32 is a disk, 37, of rawhide. The arrangement is such that friction between the parts causes the crank-shaft 24 to turn with the rim 29 under ordinary circumstances. When, however, the rotation of the crank-shaft is stopped by accident, the rims continue to turn upon the hubs. The degree of friction is regulated by the bolts 34. It will be seen that if no packing were employed the friction between opposing surfaces of the parts of the wheel incident to their relative rotation would be so great that the parts would soon become heated and swell to such an extent as to bind, thereby defeating the purpose of the invention. In order to avoid this defect in prior existing devices, I employ a packing of material softer than the surfaces between which it is interposed, whereby the heat generated is reduced to a minimum, and the slight expansion of the parts resulting from the presence of that little whose generation cannot be prevented, amply provided for.

38 is a revolving sleeve working in a recess of the cylinder 2, and upon which the pestle works. Upon the inner side of the sleeve 38 is a feather, 39, which enters a vertical groove or seat, 40, in the side of the pestle. The object is to allow the vertical movement of the pestle in the sleeve while the pestle is forced to turn with the sleeve. The upper edge of the sleeve has worm-gear teeth 41, which engage with worm-wheel 42 on shaft 43. The shaft 43 carries a ratchet-wheel, 44, engaged by pawl 45 suspended from the lever 11 by a hanger, 46, to which the pawl is adjustably hinged.

47 is a spring holding the pawl in contact with the ratchet-wheel. The construction is such that at each upward movement of the lever 11 the wheel 44 is turned the distance of one tooth. Thus the pestle will be slowly turned around. The pawl is hinged to a bracket, 48, which is adjustable on the hanger 46, so that when the lever 11 is adjusted upward or downward the pawl may be adjusted to its proper relative position with the ratchet-wheel.

To prevent sand getting between the cylinder 2 and pestle 3, I introduce a stream of water between them through the cup 49. Annular grooves 50 are made in the cylinder to serve as distributers of the water on its way into the mortar. The sheet of water acts as a cushion, cutting off the vibration of the pestle from the cylinder in great degree.

I do not desire to limit myself to the formation of the grooves 50 in the cylinder, for the reason that the same result may be accomplished by forming them in pestle.

I am aware that it is a common expedient to cool and eliminate as much as possible the friction between wearing surfaces by means of a current of water, and also that it has been proposed to provide the surface of a piston with longitudinal grooves which are supplied with water; but such are not the equivalent of my annular grooves. By the use of longitudinal grooves the water runs off too freely and does not form an effectual cushion between the wearing surfaces. By the use of annular grooves the piston is completely surrounded by a thin sheet of water which gradually trickles down from one groove to another. It will be observed that the longitudinal groove 40 places the upper grooves, 50, in communication with each other, whereby they are kept filled directly from the supply-pipe without depending upon the passage of water from one to the other between the surfaces of the pestle and cylinder. This groove 40 does not extend downward far enough to pass the lower end of the cylinder when the pestle is in its lowermost position, and hence it does not drain the grooves of water, as do all other devices of this character of which I am aware.

51 is the stamp-shoe, inserted in the bottom of the pestle-body in the usual manner.

52 is an ordinary mortar-die or anvil. As the shoe and anvil wear away, the lever 11 is lowered upon the connecting-rod 15, and the fulcrum-block 16 is also lowered to compensate for the wear. Should the stamp-shoe break or become detached from the body of the pestle, the crank 25 could not pass the lower center, and all rigidly-connected parts would stop; hence the necessity of the described construction of the belt balance-wheels 23.

As to the reaction of the power in the operation of this machine, attention is called to the arrangement and movement of the parts,

and as this feature is a valuable one I will give some points from the machines I now have in operation. The weight of the pestle is four hundred pounds, and of the balance-wheels two hundred pounds each. The wheels are driven at a speed of two hundred revolutions per minute with a two and one-half inch rubber belt on each wheel. In the upward movement of the piston the spring column above it is carried up to the head, resulting in compression of the springs until the power stored exceeds the weight of the pestle. The pestle will then move faster than the piston, and its momentum will carry it beyond the movement of the piston, which moves upward until the lower set of springs comes in contact with the piston while the piston is descending, resulting in the compression of the lower set of springs equal to the unspent momentum of the pestle, which descends with great force, owing to the momentum of the balance-wheels pressing the piston upon the lower springs and the reaction of the springs against the piston, aided by the weight of the pestle. The machine requires three-horse power to drive it, and will in twenty-four hours reduce ten thousand pounds of hard ore in water to pass through a forty-mesh screen. The marginal projection of the pestle-head 5 forms a touch-point for working any feeding device. The mortar is shown with upright corner-pieces 53, of the requisite strength, and ending in tenons or studs 54, which pass through the base-flange 55 of the cylinder 2, and have mortises for the passage of keys, by which the parts are attached together. The parts may be secured together in any other manner, or may be cast in one piece. The sides of the hopper bottom slope toward the die or anvil. On one side is the hopper $54^{\times}$, into which the broken ore is fed in any preferred manner.

56 is a gravitating gate, which is supported on trunnions 57, resting in bearings at the sides of the hopper. The upper end of the gate is weighted, so that it gravitates into the position shown in Figs. I and II, while it swings toward a vertical position beneath the entering ore.

58 are gauze-screens, which are shown at three sides of the mortar. The screens 58 are secured to rectangular frames 59, which bear against the corner-pieces 53, and are confined at their edges between vertical flanges 61, which project from the corner-pieces 53. These flanges 61 are perforated for the passage of latch bars or levers 60, each of which bears at one extremity against the frame 59, and is provided at the other with a set-screw, 62, tapped therein and bearing against the corner-piece 53. It will thus be seen that by turning the screw in such direction it will feed through the bar or lever 60. Its end will abut against the corner-piece 53, whereby the lever 60, being fulcrumed in the flange 61, will be rocked and its free end made to press against the frame 59 and hold the latter securely to its bearing.

63 are plates, which hang outside the screens and serve to deflect downward the slime after it passes through the screens.

I do not confine myself to the brackets 18 and 28 when the same are made upon or fast to the machine, for the fulcrum-bearing of the lever and the bearing of the crank-shaft may be on supports separated from the cylinder of the machine.

I claim—

1. The combination, with the mortar 1, of the pestle 3, having the longitudinal groove 40, the cylinder 2, having the annular grooves 50, and the water-feed, substantially as and for the purposes set forth.

2. The combination, with the pestle 3, of the working-lever 11, formed of parallel bars, as described, means for connecting said pestle and lever, the fulcrum-block 16, having the projection 17, and the mechanism for operating said lever, as set forth.

3. The combination, with the mortar, the working-lever, the stamp-pestle, and the sleeve 38, surrounding the same, of the spline and groove connecting them, as described, gearing for rotating said sleeve, and connection between said gearing and the working-lever, for the purpose set forth.

4. The combination of the mortar, the working-lever, the stamp-pestle 3, the sleeve 38, surrounding the same, the spline and groove connecting them, as described, the worm-wheel 41 on said sleeve 38, the worm-screw 42, engaging therewith, the ratchet-wheel 44, and the pawl 45, depending from the working-lever, as set forth.

5. The balance-wheel having a hub composed of a fixed disk, 31, adjustable disk 32, adjusting-screws 34, engaging the disks together, the rim 29, having web 30, and suitable friction-packing between the disks and web 30, for the purpose set forth.

6. The combination of lever 11, fulcrum-block 16, with extension 17, crank 25, balance belt-wheels 23, connecting-rod 15, lever piston-rod 7, piston 8, springs 9, pestle 3, cylinder 2, and mortar 1, substantially as set forth.

7. The combination of the operating-piston 7 8 and the pestle 3, having a chamber containing the piston-head, and springs above and below the piston-head, with space for lost motion between the piston-head and the springs, substantially as set forth.

ALBION M. ROUSE.

In presence of—
EDMUND J. BORDEN,
ALBION E. ROUSE.