

S. W. Powell,

Bone and Plaster Mill.

N<sup>o</sup> 72,418.

Patented Dec. 17, 1867.

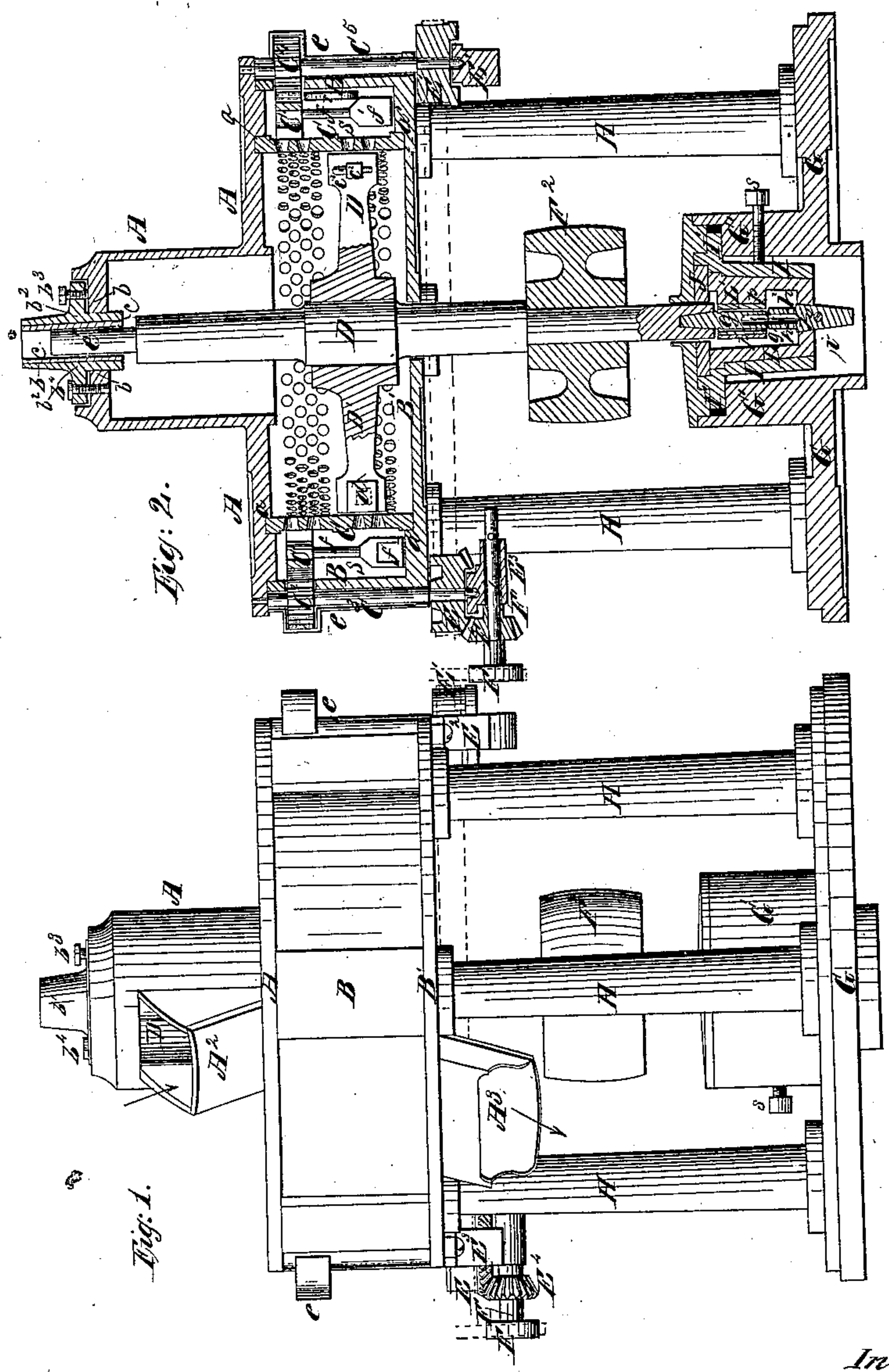


Fig. 2.

Fig. 1.

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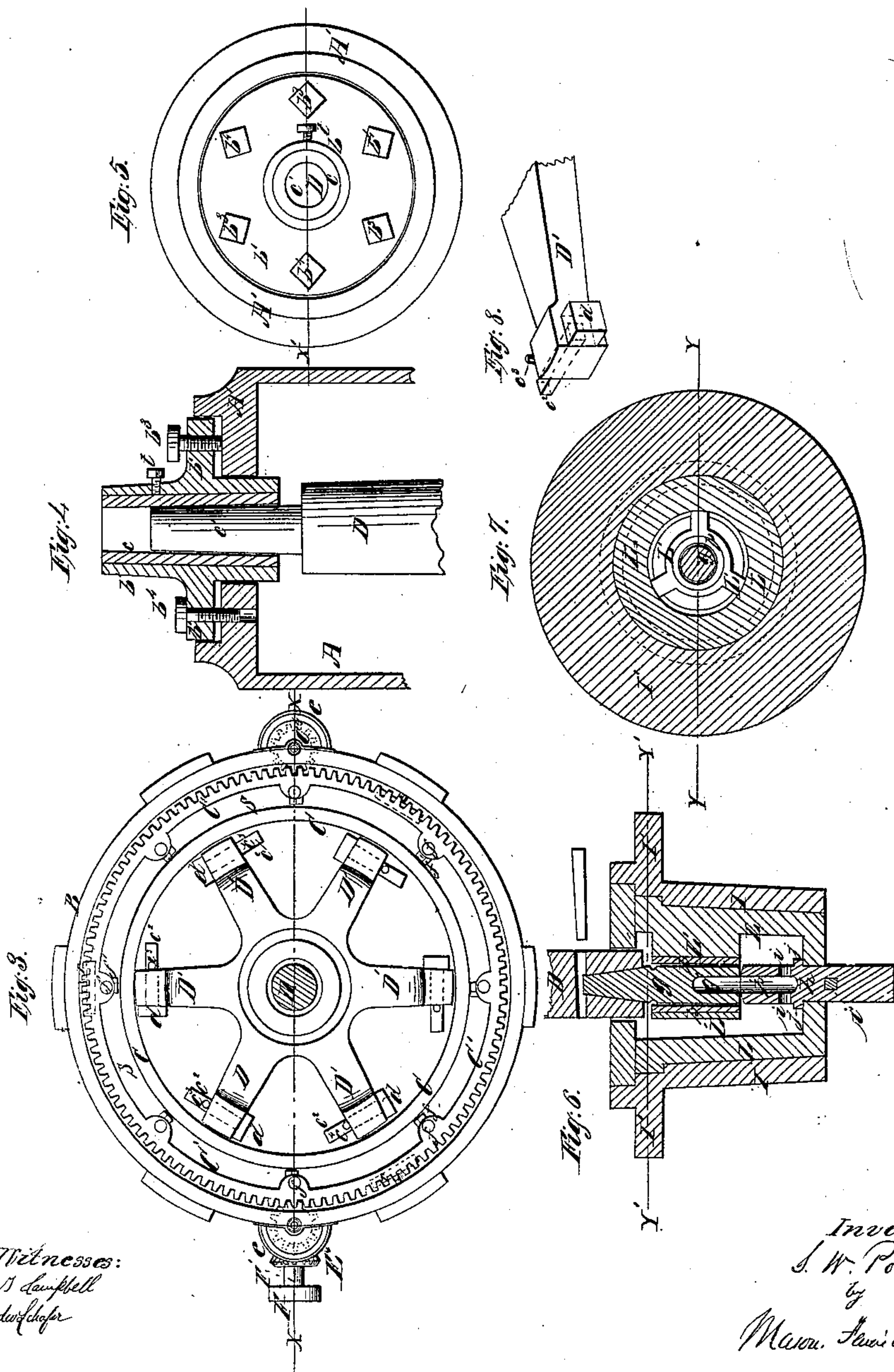
*S. W. Powell,*

*2 Sheets. Sheet 2.*

*Bone and Plaster Mill.*

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# United States Patent Office.

SAMUEL W. POWELL, OF BROOKVILLE, MARYLAND.

*Letters Patent No. 72,418, dated December 17, 1867.*

## IMPROVED BONE AND PLASTER-MILL.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, S. W. POWELL, of Brookville, in the county of Montgomery, and State of Maryland, have invented a new and improved Mill for Crushing Bones, Plaster, and other substances; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1, sheet 1, is an elevation of one side of the mill or crusher.

Figure 2, sheet 1, is a vertical section through the mill, taken in the plane indicated by line X in fig. 3 of sheet 2.

Figure 3, sheet 2, is a top view of the mill, as seen by removing its cover and the upper bearing of the spindle.

Figure 4, sheet 2, is a diametrical section through the upper bearing-box of the spindle, enlarged.

Figure 5, sheet 2, is a top view of the upper spindle-box and its chair.

Figure 6 is a diametrical section of the step for the spindle and its lubricating-box.

Figure 7 is a horizontal section taken through fig. 6 in the plane Y'.

Figure 8 is a perspective view of one of the hammers or crushers and its arm.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to certain novel improvements on machinery which is designed particularly for crushing, and reducing to powder, bones, plaster, hard guano, and other substances used for manuring land and other purposes.

One part of my invention relates to improvements on that class of crushing or pulverizing-machines wherein the reduction of hard substances is effected by hammers striking against them with great force, such hammers being arranged within a hollow case, and caused to rotate with great velocity, so as to effect, by percussion, what is sometimes effected by grinding.

The nature of my invention consists in the arrangement of one or more revolving hammers having a rotary motion in a horizontal plane within a perforated ring or case, which latter is enclosed in a cylindrical curb or shell in such manner as to leave a concentric space or chamber between the said ring and outer curb for receiving the crushed substance and allowing of its discharge from the machine by a series of revolving clearers, as will be hereinafter described.

The invention also consists in so constructing the perforated ring through which the crushed substance is forced, and also the top and bottom portions of the outer case or curb, that when one portion of said ring becomes so much worn as to fail in the performance of its object, it can be turned over and a new surface presented, as will be hereinafter described.

It also consists in the arrangement of one or more clearers within the vertical concentric chamber formed outside of a perforated ring, said clearers receiving a circular motion, and being so constructed as to keep said chamber clear of the crushed substance forced through the perforated divisional ring as will be hereinafter described.

It also consists in the employment of crushing-hammers, which are so constructed and applied to their arms that these hammers can be detached from the said arms and reversed when one or more of their edges or surfaces become too much worn, at the same time providing for keeping the hammers always in the same horizontal compass, as will be hereinafter described.

It also consists in providing for adjusting and setting the spindle, carrying the crushing-arms and hammers, so that the axis of this spindle shall always coincide with the axis of the perforated ring, within which the hammers revolve, as will be hereinafter described.

It also consists in forming a tapering journal upon the upper end of the spindle of the hammer-arms, and in fitting this tapering journal into a bushed cap, which is vertically adjustable, and seated into a chair upon the cap of the curb or other case of the machine, as will be hereinafter described.

It also consists in a lubricating step-box, which is constructed in a peculiar manner, and seated in a chair upon the base of the mill, so that it can be adjusted horizontally and fixed in proper position, said box being provided with a removable bushing and removable step, as will be hereinafter described.

It also consists in the employment of a hollow centre-feeding removable step, as will be hereinafter described.



It also consists in providing the spindle which carries the crushers with a removable hardened-metal and tubular foot-piece, constructed as will be hereinafter described.

It also consists in so constructing the step-box and arranging the step, the foot-piece on the spindle, and the journal-box therein, that the oil in the step-box shall have access to the upper as well as the lower ends of the journal-box, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

In the construction of a machine for pulverizing substances by percussion, it is necessary to have the crushing-devices revolve with great velocity. For this reason the frame of the machine should be made very strong, and erected in a substantial manner, so that there shall be as little vibration as possible. The frame which I have shown in the drawings consists of a number of vertical pillars, which are mounted upon and rigidly secured to a base-plate, G, so as to stand at regular intervals apart around this plate, as shown in figs. 1 and 2. On top of these pillars H, and firmly secured thereto in a horizontal plane, is the curb or case of the crushing-devices. This case consists of a short cylinder, B, constructed with a bottom, B', in the upper surface of which a circular concentric depression is made, which leaves an elevated shoulder,  $a'$ , within which a perforated ring, C, is snugly fitted, as shown in fig. 2. On top of this cylindrical curb, and closely fitted thereon, is a cover or cap, A, which is constructed with a concentric annular groove,  $a$ , in its bottom, of sufficient diameter to receive the upper edge of the perforated cylindrical division C, and serve, in conjunction with the circular shoulder  $a'$ , to hold said division C firmly in place, in a position concentric to the axis of a vertical spindle, D. This cap or cover A is also constructed with a central hollow elevation, A', the upper part of which has a circular chair formed on it for receiving an adjustable journal-box,  $b'$ , and holding this box in position for receiving the upper end of the spindle D. This cap or cover A is clamped or bolted down firmly in place upon its curb B in any suitable manner which will admit of the removal of this cover at pleasure. The cylindrical division C is constructed with both ends alike, so that when that portion of its interior surface which is in the plane of the crushers becomes too much worn by the striking of the hard substances being crushed against it, this ring can be turned over and a new surface presented in the plane of the hammers.

It will be seen, by reference to fig. 2, that the ring or division C is thickly perforated, the holes flaring outward so as to clear easily of the pulverized substance forced through them into an annular chamber, S. Ring C serves as a means of preventing the escape of the substances being pulverized from the crushing-chamber, which it encloses until such substances are reduced to a powder fine enough to pass through the perforations made through this ring. Between the ring C and the curb or casing B is an annular space, S, within which revolve a number of clearers, consisting of vertical rods having scrapers or shovels,  $f'$ , on their lower ends, which latter effect the discharge of the crushed substance from the machine through the spout A<sup>3</sup>. The vertical rods  $f$  are secured, at proper distances apart, to a horizontal toothed ring, C<sup>1</sup>, which is supported upon anti-friction rollers,  $r$ . This ring is rotated by means of two pinion spur-wheels, C<sup>2</sup> C<sup>4</sup>, enclosed in cases,  $e$ , and arranged diametrically opposite each other, as shown in figs. 2 and 3. The spur-wheels C<sup>2</sup> C<sup>4</sup> are keyed upon vertical shafts C<sup>3</sup> C<sup>5</sup>, which have their bearings in the cover A and in brackets E<sup>2</sup> E<sup>3</sup>. The shaft C<sup>3</sup> carries a belt-drum, E, which communicates motion through a belt indicated in red lines, fig. 2, to a belt-drum, E<sup>1</sup>, which is keyed on the vertical shaft C<sup>5</sup> of spur-wheel C<sup>4</sup>. Shaft C<sup>3</sup> is driven by a bevel-spur wheel, E<sup>4</sup>, on a driving-shaft, F', which spur engages with teeth formed on the lower end of the belt-drum E. The shaft F' has its bearing in the bracket E<sup>3</sup>, and carries a belt-wheel, F, on its outer end, as shown in fig. 2. The spur-wheels C<sup>2</sup> C<sup>4</sup> and the drums E E<sup>1</sup> being constructed precisely alike, they will rotate with the same speed, and thus communicate a regular rotary motion to the toothed ring carrying the shovels or clearers.

The substance which it is desired to reduce to powder is fed into the chamber, surrounded by ring C, through the hopper A<sup>2</sup> and cylindrical elevation A<sup>1</sup>, where it is acted upon by a number of radial arms, D', projecting horizontally from the spindle D. These arms being swiftly rotated, compel the substance brought in contact with them to fly off toward the ring C, where it is repeatedly struck by hammers  $d$ , upon said arms, until it is reduced to such a degree of fineness as will allow it to escape, through ring C, into the chamber S.

The radial arms D' are made very strong, so as to resist the influences which would otherwise cause them to break or fly to pieces, and the ends of these arms are slightly enlarged, and constructed with vertical flat faces. Square holes are made through said arms, near their outer extremities, for receiving the square shanks  $c^2$  of the hammers  $d$ , and allowing of the latter being secured in place, by means of keys,  $c^3$ , inserted through the said shanks. The face of each hammer  $d$  is square, *i. e.*, it has four equal sides and four right angles, and the shank  $c^2$  of each hammer is located exactly in the centre of its back face. These hammers are applied to their arms D', so that their outer edges almost touch the inner surface of the perforated ring C; consequently, if the hammers were made oblong, they could not be reversed, when one side or edge wears away, as often as the square-faced hammers which I have described and shown. The hammers  $d$ , on account of their being made of the form shown, can be reversed four times before it is necessary to remove them and substitute new ones. In order to prevent undue wearing away of the hammers, I shall face them with steel. The spindle D is supported at its lower end upon a step,  $h$ , and at its upper end by a cap or journal-box,  $b'$ , and at an intermediate point, between the step and bottom, B', of the curb, a belt-drum, F<sup>2</sup>, is keyed, by which motion can be transmitted to said spindle from any convenient prime-motor. The lower end of the spindle D has a tapering socket made centrally in it, into which is inserted the tapering end of a cylindrical foot-piece,  $g$ . This foot-piece is made of steel, with its lower end rounded or convex, and it is bored out, as shown at  $g'$ , so as to reduce the thickness of metal, and allow of its being chilled or hardened equally. The lower end of this foot-piece rests upon the upper convex end of a step,  $h$ , which is drilled out, as shown at  $h'$ , to facilitate the hardening of it, and also to allow oil entering cross-holes  $i$   $i$  to rise through its centre, and lubricate the impinging-points of the step and foot-piece, as shown in figs. 2 and 6. This foot-piece  $h$  is also constructed with an enlarged shoulder,



*j*, upon it, which rests upon the bottom of the oil-cup *L*, and is held firmly thereon by a key, *z'*. The foot-piece *g* passes through a box, *L'*, which is lined with Babbit metal, *p*, and which is held in a central position in this box, below its upper end, by means of three arms, which allow oil in cup *L* to rise between them, and thus lubricate foot-pieces *g*, at both ends of said box. Cup *L* is suitably covered, and seated into a circular flanged case, *I*, the flange *I'* of which is supported upon a chair, *G'*, rising centrally from the base-plate *G*. This flanged case *I* is supported by its chair in such manner that it is allowed to receive a horizontal adjustment for centring the step and spindle with respect to the ring *C* and its curb *B*. This adjustment is effected by means of three set-screws *s*, (one of which is shown in fig. 2,) which are tapped through the chair *G'*, at regular intervals apart, and in a horizontal plane. The inner ends of these screws *s* abut against the side of the case *I*, and hold it firmly in the desired position. The upper end of the spindle *D* is reduced and tapered, as shown at *c'*, and fitted into a journal-box, *b'*, which is lined with Babbit metal *c*, that is held in place in said box by means of a set-screw, *t*. The bore of the lined box *b'* is made to conform to the tapering journal *c'*, so that, by depressing this box *b'*, any wearing of the journal and its lining can be compensated for, and the parts kept in proper running order. The box *b'* is constructed with a circular flanch, which is fitted snugly into a circular recess formed in the head *b* of the chair. Through this circular flanch screws *b<sup>3</sup>* are tapped, which support the box *b'*, upon the head *b*, and admit of the vertical adjustment of this box, for the purpose described. Said screws also admit of the box *b'* being adjusted and set vertically. The screws *b<sup>4</sup>*, which are also tapped through the flanch of box *b'*, are tapped into the head *b* of the chair, for the purpose of securing the box down firmly in place, after it has been properly adjusted, by means of the set-screws *b<sup>3</sup>*. For lubricating the upper box *b'*, a cup may be applied on top of it, which will contain oil, and also serve as a cover for keeping out dust and other foreign substance.

Having thus given a particular description of the several parts of my improved machine, I will now briefly describe the operation of the machine. The substance which it is desired to crush is fed into the space encircled by the perforated ring or case *C*, through the hopper *A<sup>2</sup>* and hollow elevation *A<sup>1</sup>*, and, falling upon the rapidly-rotating arms *D'*, this substance will be instantly thrown off, and brought within the path or circuit of the hammers *d*. Here the substance is repeatedly struck by the hammers, and struck with such force and rapidity that it is rapidly reduced to powder. The perforated case *C* retains the substance within it until reduced to such a degree of fineness that it will pass through the outwardly-flaring perforations through this case, which it is caused to do by centrifugal force. After escaping through the case *C*, the powdered substance is arrested in the annular chamber *S*, when it is collected by the shovels *f'*, and discharged from the machine through the spout *A<sup>3</sup>*, into suitable receptacles.

It will be seen that the perforated case *C* serves as a division, and a resisting object for the substances being crushed, and thereby keeps them in position to be acted upon by the hammers, and it also serves as a sieve or screen for allowing of the separation of the powder from the uncrushed lumps, during the operation of the machine.

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

1. The clearers or discharging-devices *f*, applied within a space, *S*, enclosed by the shells, *C B*, of a crushing-machine, substantially as and for the purpose described.
2. Applying the clearers *f'* to a toothed ring, *C'*, which is supported within the annular space *S*, and driven by means substantially as described.
3. The reversible perforated case or division *C*, applied to a machine operating substantially as described.
4. The construction of the cover *A*, with a central, elevated, hollow enlargement *A<sup>1</sup>*, forming a chair for receiving a vertically-adjustable journal-box, which supports the upper end of the spindle *D*, substantially as described.
5. The arrangement, within a perforated case, *C*, of one or more revolving arms, carrying removable and reversible square-faced hammers *d*, substantially as described and for the purpose set forth.
6. The vertically-adjustable journal-box *b'*, supported upon a chair formed on cover *A<sup>1</sup>*, and adapted for receiving the tapering end *C'* of the spindle *D*, substantially in the manner and for the purpose described.
7. The step *h*, constructed with perforations in it, substantially as described.
8. The construction of the oil-cup *L*, for receiving the step *h*, and with a journal-box, *L'*, for receiving the foot-piece *g*, substantially as described.

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Witnesses:

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