(No Model.) 3 Sheets—Sheet 1.

W. H. HOWLAND.

CRUSHING AND PULVERIZING MACHINE.

No. 434,786. Patented Aug. 19, 1890.

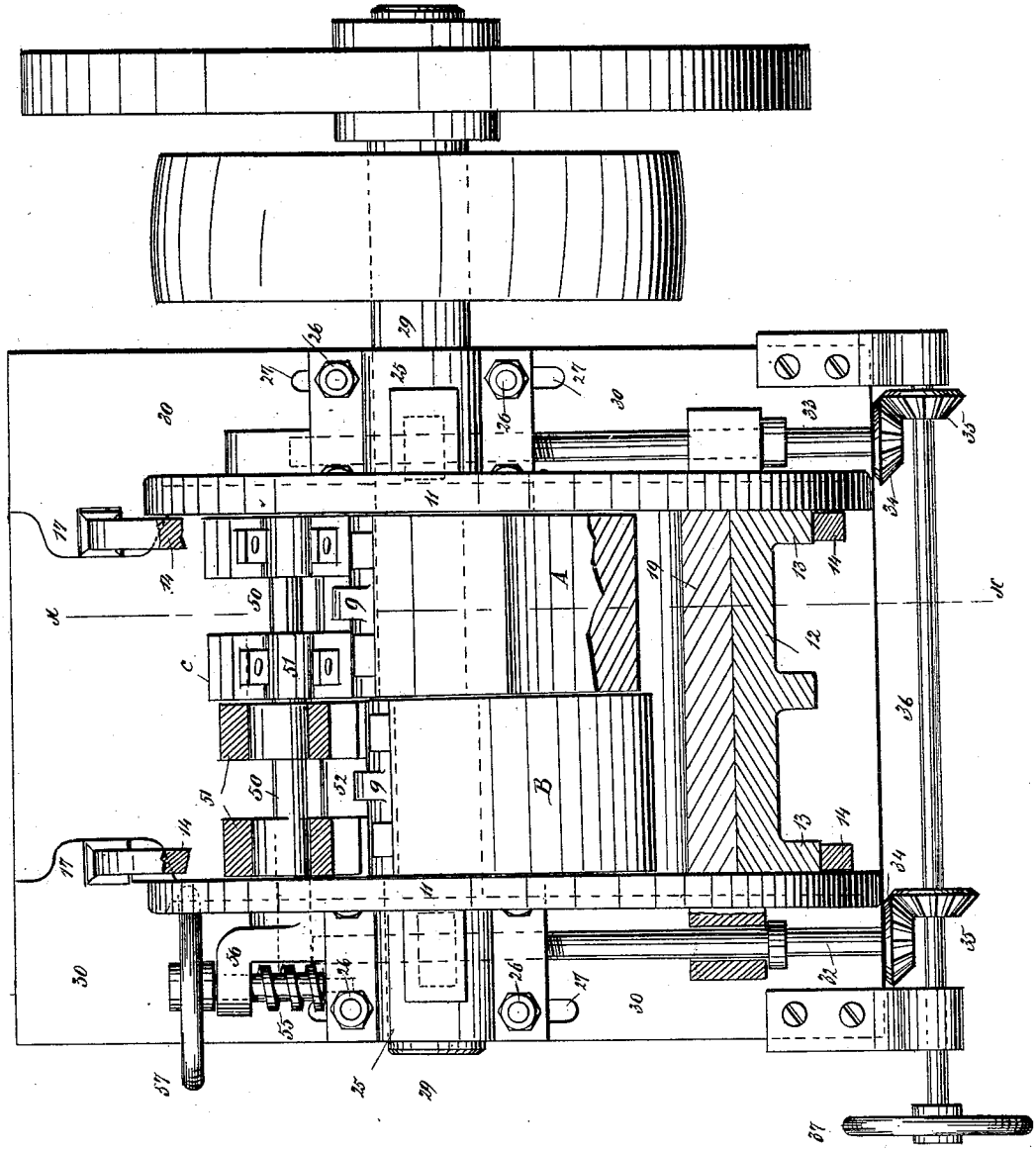


Fig. 1.

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Fig. 2.

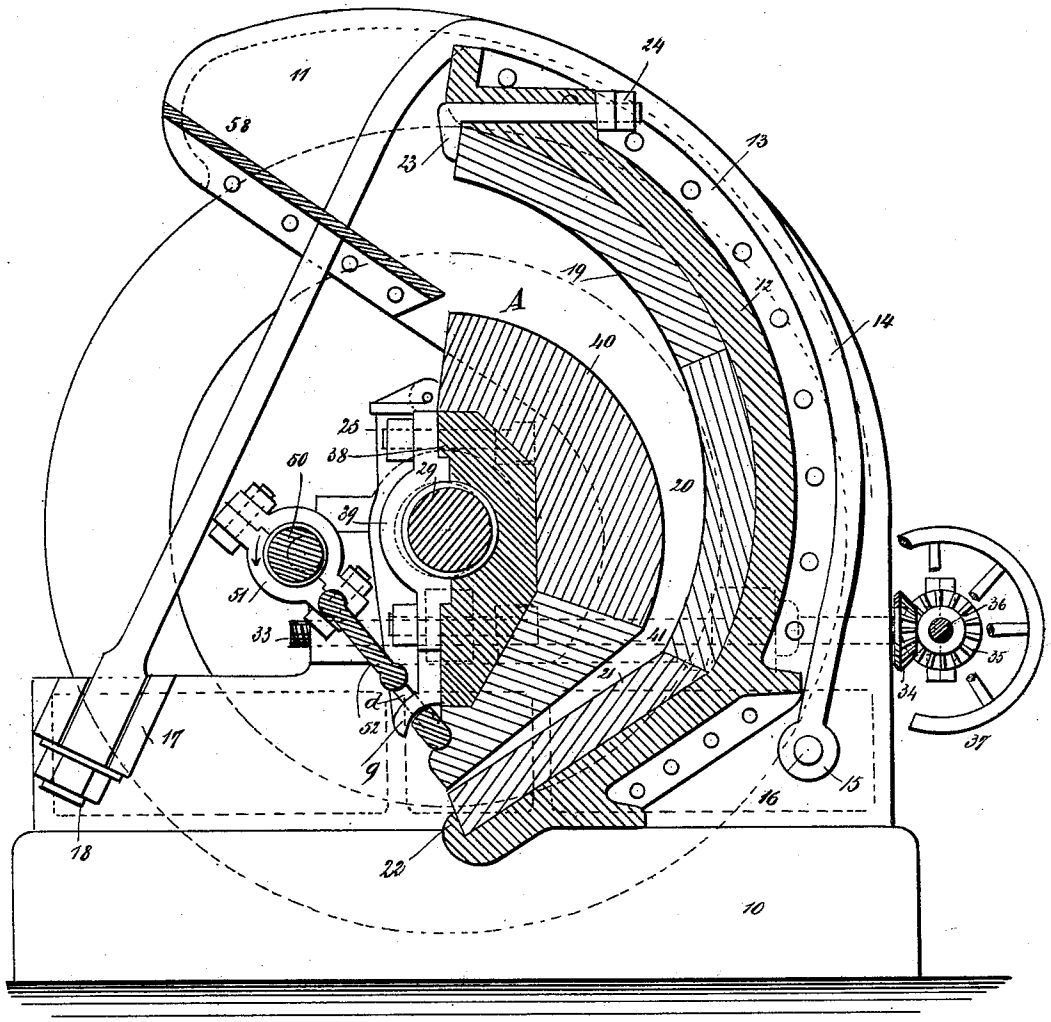
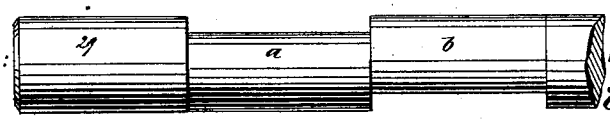


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

W. H. HOWLAND.

CRUSHING AND PULVERIZING MACHINE.

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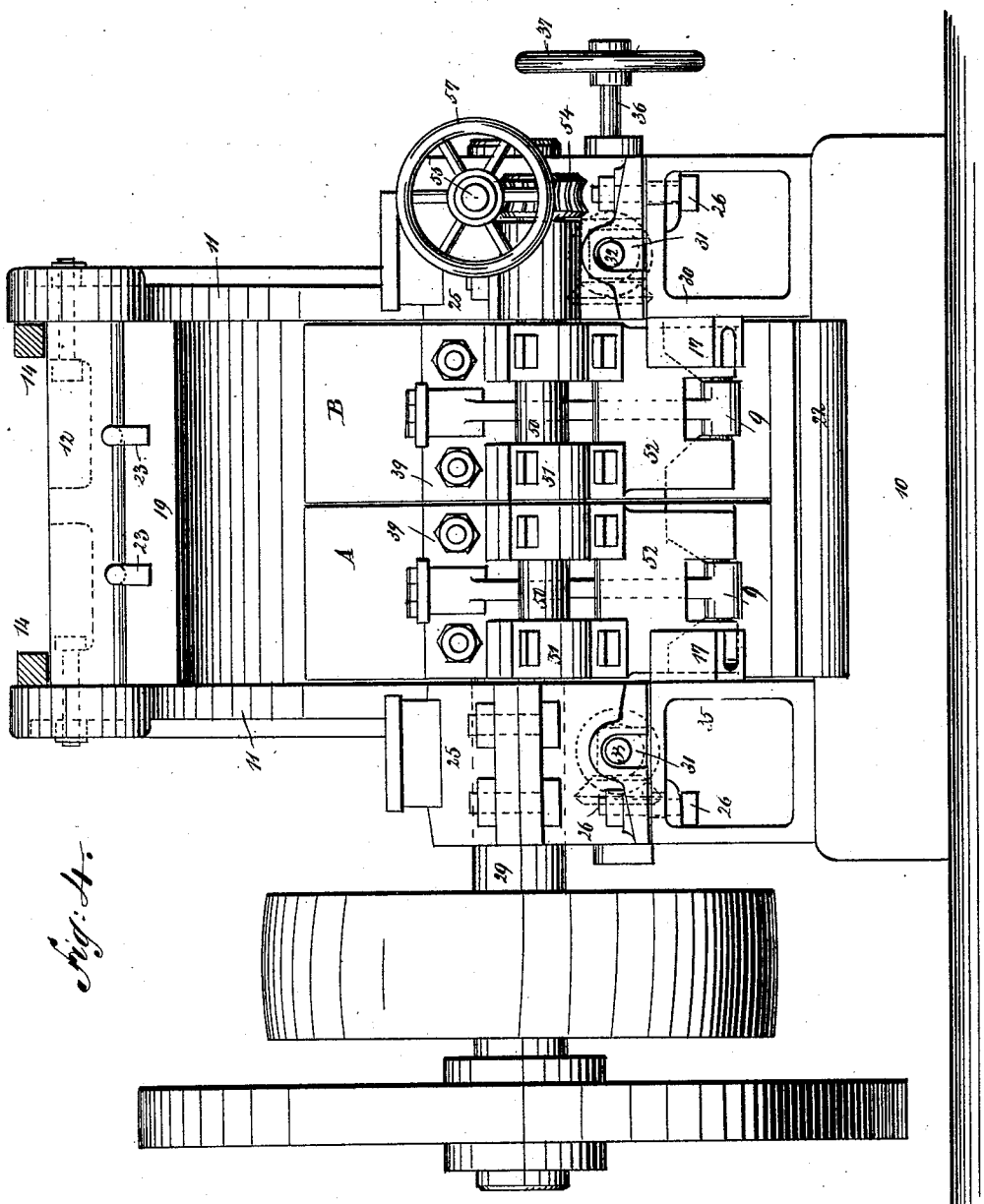


Fig. 4.

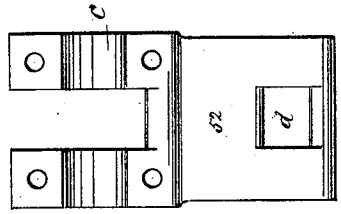


Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM H. HOWLAND, OF BERGENFIELD, NEW JERSEY.

CRUSHING AND PULVERIZING MACHINE.

SPECIFICATION forming part of Letters Patent No. 434,786, dated August 19, 1890.

Application filed November 27, 1888. Serial No. 291,974. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. HOWLAND, of Bergenfield, in the county of Bergen and State of New Jersey, have invented a new and Improved Crushing and Pulverizing Machine, of which the following is a full, clear, and exact description.

The object of this invention is to improve the construction of that class of machines usually called "stone" and "ore" crushers, in a manner such that the material operated upon may be crushed and pulverized to any required degree of fineness, and that, too, without becoming impregnated with metallic particles torn from the surface of the operating-jaws.

A further object of the invention is to provide for the bodily adjustment of the movable jaws and at the same time to provide for the adjustment of the lower edges of said jaws; and a still further object of the invention is to equalize the strain upon the driving-shaft.

The invention will first be described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of my improved crushing and pulverizing machine, parts being broken away and parts being shown in section. Fig. 2 is a longitudinal sectional view taken on line *x x* of Fig. 1. Fig. 3 is a side view of a portion of the main driving-shaft. Fig. 4 is an elevation of the rear of the crusher and pulverizer, the tie-bars being shown in section and the deflecting-plate removed; and Fig. 5 is a detail view of one of the lower sections of the adjusting eccentric-straps, the toggle-connections formed upon the strap-section being also shown.

In the drawings, 10 represents a base or bed plate of any proper form and material, and to this bed-plate there are secured side plates or standards 11, which serve as supports for a back-plate 12 that is securely bolted to place between the said side plates. The back plate 12 is formed with flanges 13, through which the connecting-bolts are passed, and upon the upper faces of these flanges I place heavy tie-bars 14, formed with eyes 15 that engage studs 16, which extend inward from the side faces of the plates 11, the opposite ends of the tie-bars extending through apertured bosses 17, there to be engaged by nuts 18.

To the back plate 12 there are connected facing-plates 19, 20, and 21, the plates 19 and 20 being metal, while the plate 21 is preferably made of buhr-stone, the said plate abutting against a shoulder 22, that extends upward from the lower edge of the plate 12, the plates 19 and 20 being held to place by hooked bolts 23, which pass through apertures formed in the upper portion of the plate 12 to engage with nuts 24, this construction being best shown in Fig. 2.

Upon the bases 30 of the side plates 11 there are mounted bearings 25, which said bearings are bolted to the bed-plates 30 by bolts 26, which pass through slots 27 formed in the bed-plates. These bearings 25 support the main driving-shaft 29, which said shaft is formed with eccentric sections *a b*, said eccentric sections being in opposition, the one to the other, as is clearly shown in Fig. 3.

In recesses formed in the lower portions of the bearings 25 I place nuts 31, (see Fig. 4,) and these nuts are engaged by threaded shafts 32 and 33, said shafts being provided with bevel gears or pinions 34, that are engaged by corresponding gears or pinions 35, carried by a transverse shaft 36, said shaft being mounted in proper bearings, so as to extend across the front of the machine. To one end of the shaft 36 there is secured a hand-wheel 37. By this arrangement I provide for the bodily adjustment of the shaft 29 and all parts carried thereby, such adjustment being brought about by loosening the bolts 26 and by turning the shaft 36 in a proper direction to move the shaft 29 toward or from the fixed jaw of the crusher, which said jaw is made up of the back plate 12 and the facing-plates 19, 20, and 21.

To the eccentric sections *a* and *b* of the shaft 29 there are secured movable jaws A and B, said jaws being made up of back plates 38, straps 39 bolted to the back plates, and facing-plates 40 and 41, said facing-plates being held to the plates 38 by bolts arranged

in the usual well-known manner, such as that indicated by dotted lines in the drawings. The plate 41, which is opposed to the plate 21, is preferably made from a block of buhr-stone, and the opposing faces of the plates 21 and 41 are preferably plane surfaces, in contradistinction to curved surfaces, such as are the surfaces of the other facing-plates of the machine.

To provide for the holding of the lower edges of the jaws A and B at a proper distance from the lower edge of the fixed jaw, I mount a shaft 50 to the rear and preferably slightly below the shaft 29, this shaft 50 being formed with a number of eccentric sections, to which there are secured sectional straps 51, the lower strap-section *c* being made integral with toggles 52, which toggles bear against recesses formed in the rear faces of the plates 41, the toggles being apertured at *d* to receive horns 9, that extend downward from the straps 39.

In order that the shaft 50 may be readily adjusted and at the same time locked in any position to which it may be moved, I mount a worm-gear 54 upon the shaft 50, said gear being engaged by a worm 55 that is mounted in a bracket 56, secured to one of the bearings 25, this worm being provided with a hand-wheel 57. From the construction described it will be seen that if the hand-wheel 57 be turned so as to move the worm 55 in a proper direction to turn the shaft 50, as indicated by the arrow shown in Fig. 2, the lower edges of the movable jaws A and B will be carried toward the lower edge of the fixed jaw.

Above the movable jaws and between the plates 11 there is mounted a deflecting-plate 58, to which the material to be operated upon is delivered, such material sliding thence downward between the fixed and the movable jaws, there to be crushed, broken, and pulverized as the movable jaws are forced forward and downward toward the fixed jaw.

By mounting the jaws A and B upon opposing eccentric sections I balance the strain upon the shaft 29, and by forming the surfaces of the plates 21 and 41 plane surfaces that are adjusted so as to extend from each other from the lower edges of the jaws, I provide for the gradual reduction of the material being operated upon and for a grinding abrading action between the jaws, the first action of the jaws when the plates 40 press the material against the plates 19 and 20 being to crush and disintegrate the material. It will be noticed that the weight of the jaws A and B is wholly supported by the shaft 29, the toggles serving only to hold the lower edges of the jaws at a proper distance from the lower edge of the fixed jaw the arrangement being such that the full weight of said movable jaws is thrown against the material held between the fixed and movable jaws at each revolution of the supporting-shaft, the movements of the jaws being vertical as well as lateral. The connection between the movable jaws and the eccentric being just to the rear of the vertical center of the movable jaws, each revolution of the driving-shaft causes the upper and central parts of the jaws to strike forward and downward blows against the material being operated upon. The lower extremities of the jaws being held in position by the toggles have practically only vertical motions. It is this up-and-down motion, in connection with the lateral blows of the jaws, that gives the machine its pulverizing qualities. As there is but one shaft to revolve and no complications of the machine, the shaft may be revolved at almost any desired speed, and as each jaw weighs over five hundred pounds it follows that at a speed of four hundred revolutions per minute each jaw will strike over one hundred tons per minute without including the force exerted by the eccentric.

Although I have described the pulverizer forming the subject-matter of this application as one arranged for use in connection with stone or ore, I desire it to be distinctly understood that the machine could be used for the grinding and crushing of other material—such as cereals or coffee—and in practice it will be found that owing to the sliding, as it were, of the movable jaws in front of the fixed jaw, all material operated upon will be thoroughly disintegrated and crushed.

By facing the lower portions of the jaws with non-metallic material I obtain a product that is practically free from metallic particles, as will be readily understood.

Among other advantages of my invention, I would state that the machine can be adjusted while running to crush or pulverize to any size desired, from cubes of one inch down to forty-mesh or finer. The wear of the jaws can be taken up as desired. The machine will take ore as it comes from the mines and turn it out forty-mesh fine at a reasonably rapid gait, either wet or dry. The machine is admirably adapted to the reduction of all kinds of gold, silver, copper, and iron ores, phosphates, cements, plaster, pyrites, &c. The working parts of the machine consist simply of two or more cam-shaped jaws made up of a wearing-die bolted to an eccentric-box. When three or more jaws are used the eccentrics are turned on the thirds or quarters, as the case may be. By this arrangement the work of the jaws is continuous, while at the same time the strain is equalized and liability to heat is greatly lessened.

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

1. In a crusher, the combination, with the drive-shaft having an eccentric section and a movable jaw hung upon said eccentric section, of an adjusting-shaft parallel with the drive-shaft and provided with an eccentric to adjust the lower end of the movable jaw, substantially as set forth.

2. In a crusher and pulverizer, the combination, with a fixed jaw, of a driving-shaft formed with eccentric sections, movable jaws centrally mounted upon the said eccentric sections and wholly supported by the driving-shaft, an adjusting-shaft formed with eccentric sections, and toggles connected to the eccentric sections of the adjusting-shaft and arranged to bear against the lower portions of the movable jaws, substantially as described.

3. In a crushing and pulverizing machine, the combination, with a fixed jaw, of a driving-shaft formed with eccentric sections, movable jaws mounted upon said eccentric sections and provided with spurs or horns, an adjusting-shaft formed with eccentric sections, and toggles connected to the eccentric sections of the adjusting-shaft and formed with apertures adapted to receive the horns of the movable jaws, substantially as described.

WILLIAM H. HOWLAND.

Witnesses:
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C. SEDGWICK.