

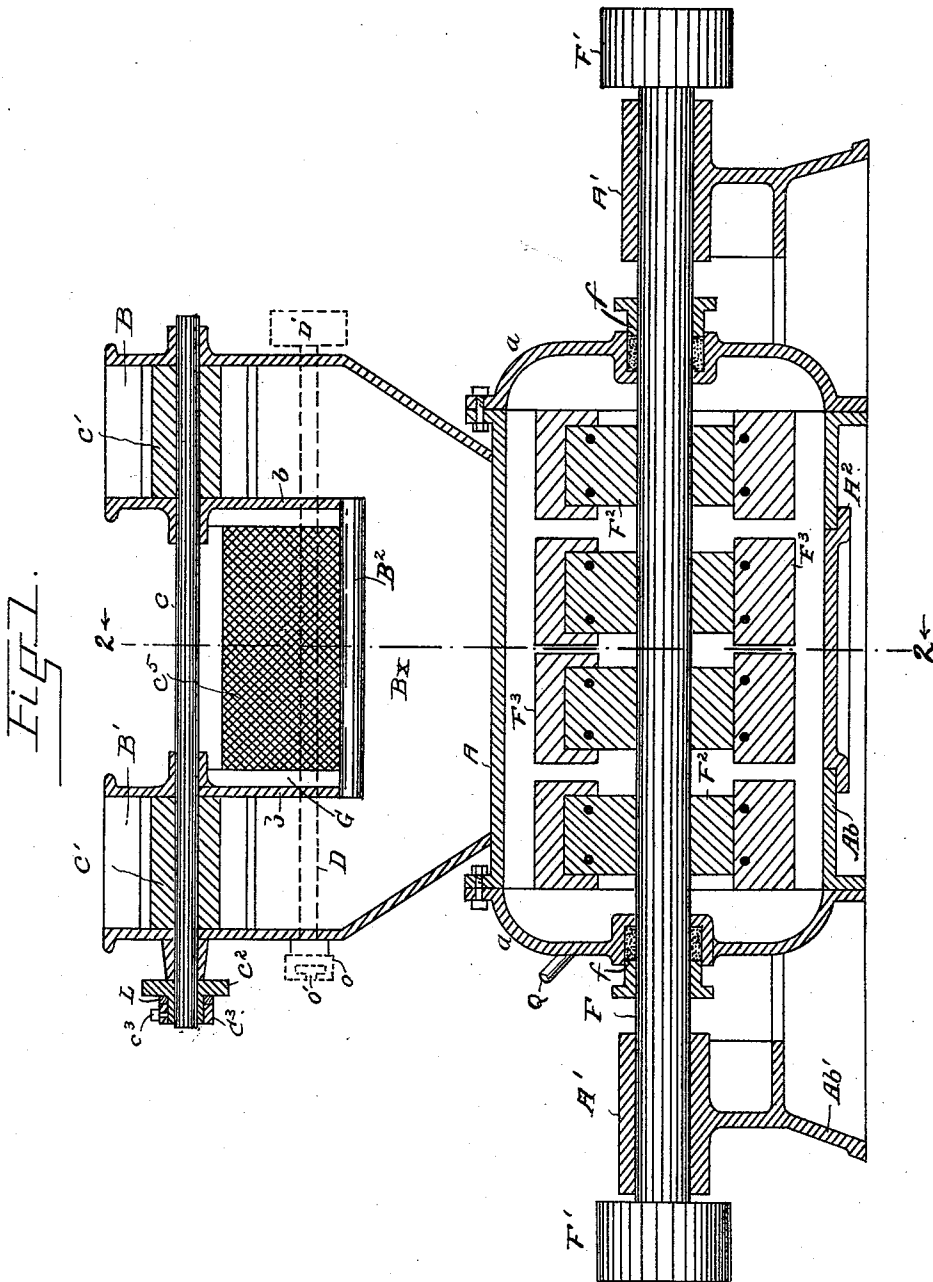
(No Model.)

3 Sheets—Sheet 1.

W. M. FULLER.
PULVERIZING MACHINE.

No. 517,381.

Patented Mar. 27, 1894.



WITNESSES:

L. C. Hills
E. A. Bond.

INVENTOR:

Willard M. Fuller;

BY

Collamer & Co.,
ATTORNEYS.

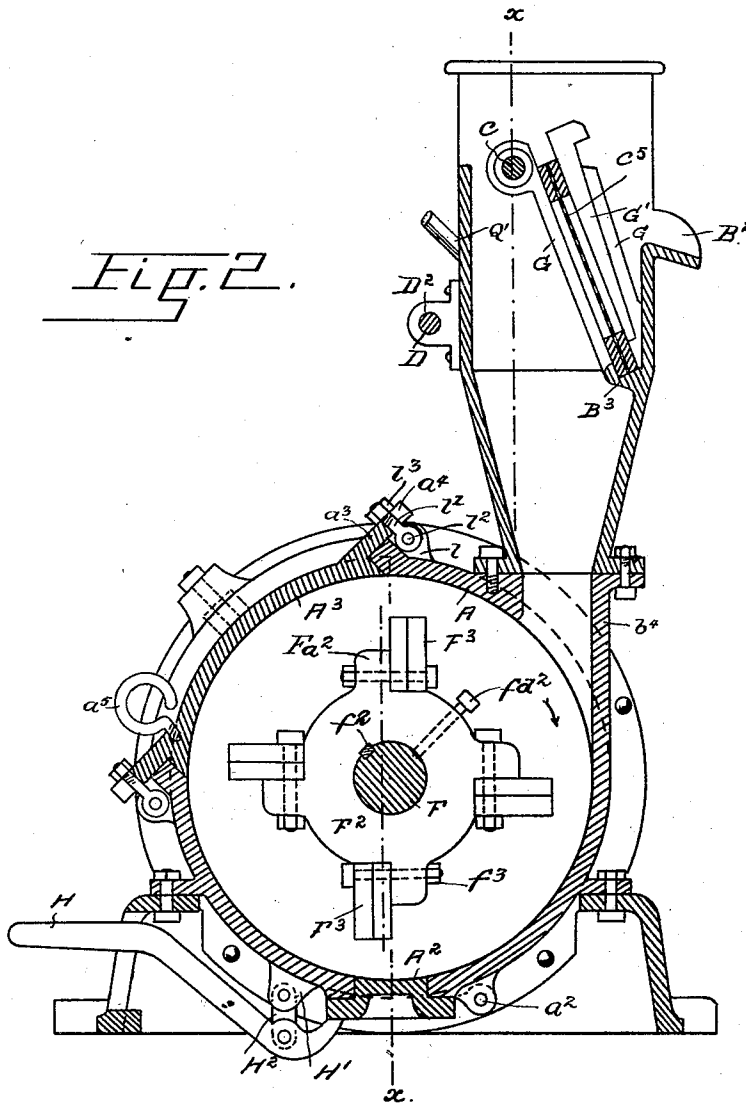
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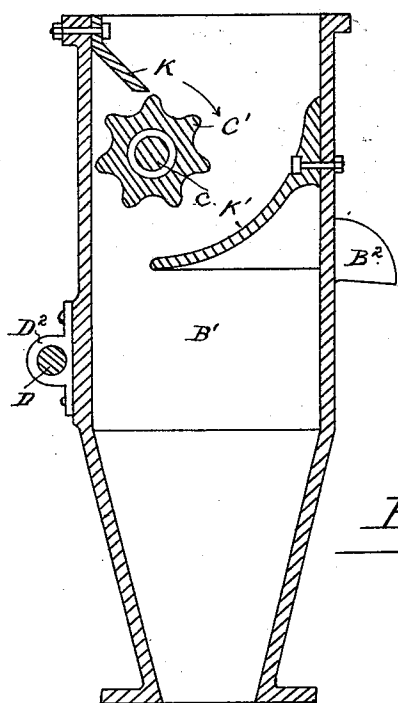


Fig. 3.

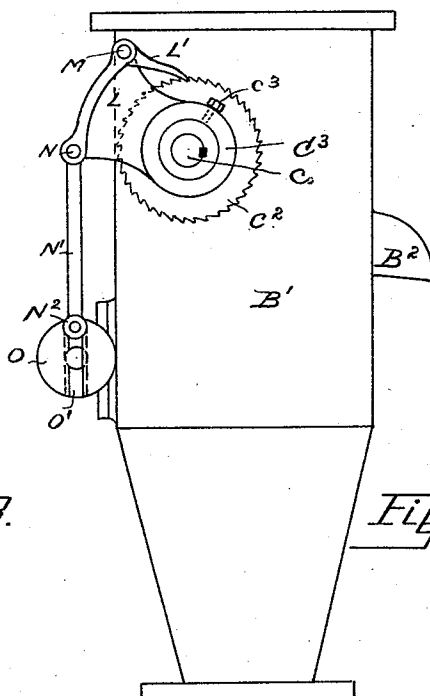


Fig. 4.

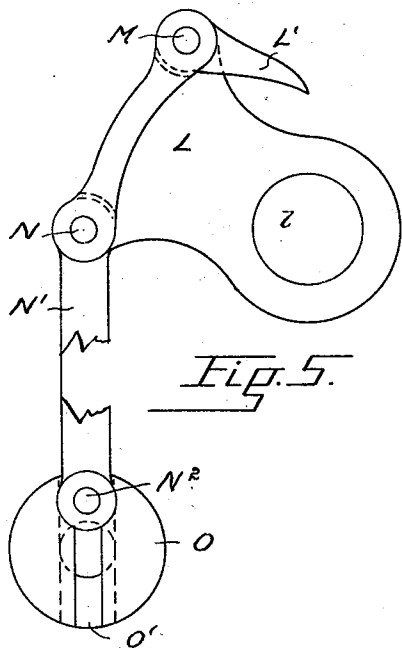


Fig. 5.

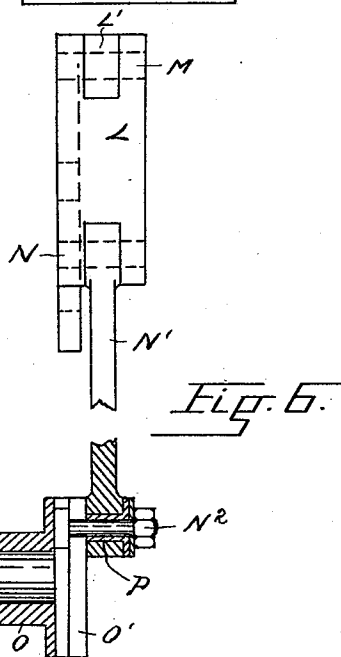


Fig. 6.

WITNESSES:

L. C. Hills
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UNITED STATES PATENT OFFICE.

WILLARD M. FULLER, OF DENVER, COLORADO.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 517,381, dated March 27, 1894.

Application filed August 7, 1893. Serial No. 482,596. (No model.)

To all whom it may concern:

Be it known that I, WILLARD M. FULLER, a citizen of the United States, and a resident of Denver, Arapahoe county, State of Colorado, have invented certain new and useful Improvements in Pulverizing-Machines; and my preferred manner of carrying out the invention is set forth in the following full, clear, and exact description, terminating with claims particularly specifying the novelty.

This invention relates to grinding mills, and more especially to those adapted to pulverize ore and other hard bodies, in order that it may be afterward smelted or otherwise treated in its fine condition; and the object of the same is to effect certain improvements in machines of this character.

To this end the invention consists in certain details of construction, as set forth in the following specification and as illustrated in the accompanying drawings, wherein—

Figure 1 is a central longitudinal section of this machine on line $x-x$ of Fig. 2. Fig. 2 is a section taken on the line 2-2 of Fig. 1 and looking in the direction of the arrows; Fig. 3 an enlarged vertical section, and Fig. 4 an end elevation of one of the end compartments of the hopper; and Figs. 5 and 6 are respectively a side elevation and an edge view partly broken away, of the agitating mechanism, on a still larger scale.

This machine belongs to that class of attrition pulverizers wherein a revolving center carries with it a mass of the material being pulverized, and said mass bears or grinds against a thin interior coating of the same material within a cylinder surrounding said center concentrically, and wherein water is present to carry off the fine or ground particles by its flow or current, while the larger and heavy particles sink within the water and are ground. To this end a peculiar hopper is formed and used in connection with the grinding mechanism through which the coarse material to be ground is fed, and also through which the fine and ground material is discharged with the water. The main principles of the machine are well known in the art and no claim is made thereto herein, but the specific details of construction which serve to carry out the end in view are relied upon as involving novelty, utility, and advantage, and

as serving to produce an improved machine of this character.

The device comprises three main parts, viz: the grinding mechanism, the hopper, and the agitating mechanism; and these parts will now be described.

The grinding mechanism.—The letter A designates a cylinder mounted on and supported by a suitable base A^b and having end heads a properly bolted to the cylinder proper and provided with stuffing boxes ff . Through the latter is journaled a shaft F having pulleys F' (preferably at both ends) whereby power is communicated thereto to rotate the shaft without vibration. The shaft may also be journaled in bearings A' supported by pillow-blocks A^b in alignment with the stuffing boxes $f f$ —the better to prevent vibration. At the bottom of the cylinder A is a trap door A^2 fitting closely into a suitable aperture in the cylinder as shown, and hinged as at a^2 to said cylinder at one side of the aperture. H is a lever the tip of whose shorter arm stands under the free edge of this door A^2 and holds the door normally closed by the weight of its longer arm, while the fulcrum of this lever is permitted to swing by the following construction: H' is an ear on the cylinder, and H^2 is a link pivoted at one end to this ear and at the other end to the lever; whereby, when desired, the lever can be drawn bodily outward to allow the door A^2 to fall suddenly and completely open to discharge the contents of the cylinder in case of an emergency, such as the choking of parts, the link H^2 swinging to permit; or, the outer end of the lever can be slightly raised to permit the exit of water; or, to close the door after it has been opened the tip of the lever can be moved as will be seen to be necessary. At another point in the cylinder A—preferably its top—is an opening possibly sufficiently large to permit a man to enter if the machine is large, or at least of sufficient size to permit tools or the hands to be inserted when it is desired to clean the device. This opening is closed by a door A^3 having at each edge ears a^3 with radial slots a^4 , and preferably also having a handle a^5 . l are ears on the cylinder, to which at l^2 are pivoted eye-bolts l' adapted to be swung through and into said slots a^4 and to have their nuts l^3 tightened to hold the door closed tightly.

Upon the shaft F within the cylinder A is located a number of hubs F² (four are shown, though there may be more of them or less—all of the same construction), held thereon by
 5 keys f² or by set screws f¹² as seen in dotted lines, and each hub has a number—preferably four—of truly radial spokes or ears F^{a2}. F³ are plates secured to the flat forward faces of these spokes by means of bolts f⁴, each
 10 plate being preferably in two parts, the rear part for holding the forward part, and the latter capable of being replaced when worn. Power is imparted to the shaft F to cause it and its hubs to revolve in the direction of the
 15 arrow in Fig. 2, and at a speed of at least three hundred revolutions per minute, the outer ends of the plates clearing the interior of the cylinder by some considerable distance as shown.

20 *The hopper.*—The letter B* designates the hopper as a whole, and it is connected to and communicates with an opening arranged tangential to the top of the cylinder A above the downwardly-moving side of the hubs F². The
 25 center of the hopper is depressed, while its ends B and B' rise to some height and are open at their tops for the reception of the material to be pulverized; and these ends are separated from the center by vertical parti-
 30 tions b. G G are inclined and nearly parallel guides secured to the inner faces of these partitions and terminating at their lower ends above a shelf or ledge B³ within the hopper, and c⁵ is a screen of any desired mesh, se-
 35 cured within a suitable frame, the latter being passed down between the guides G G and held therein by a wedge G' at each side. B² is an exit opening in one side of the hopper body opposite the screen and about on a level with
 40 its vertical center. Thus it will be seen that if water within the cylinder A rises, it passes through the screen and carries the finely ground material with it, and flows out the exit B² to wherever it is desired to convey it;
 45 while the larger and heavy particles of material to be ground—and which by their size and weight will not be carried in the water—pass down in the end portions of the hopper to the grinding mechanism as is desired.

50 *The agitating mechanism.*—The very fact that the material to be ground is probably in lumps of considerable size and weight, causes it to be necessary to feed it to the grinding
 55 mechanism with some considerable regularity; otherwise the machine would soon become choked and possibly broken or injured. In bearings D² on the outside of the hopper I mount a shaft D rotated by power applied to pulley D' either from the main shaft F or
 60 other suitable source, and one end of this shaft D carries a disk O with a diametric T-shaped slot o' across its outer face. Another shaft c is journaled through the ends B B' of the hopper and carries fluted wheels c' within
 65 such ends, these wheels turning close under inclined delivery boards K and above curved shelves K' for a purpose to be described be-

low. On one end of the shaft c is keyed the long hub of a ratchet wheel c², said hub being encircled by the eye l' of an arm L which
 70 eye is held in place by a ring C³ having a set-nut c³ holding the ring on the hub outside the eye; and L' is a pawl pivoted at M to the outer end of the arm L near its upper corner. The lower corner thereof is in turn pivotally
 75 connected as at N with a pitman rod N' which extends down and stands over the face of the disk O. N² is a bolt whose head engages the T-shaped slot o' in said disk and whose shank passes through a collar P which is journaled
 80 loosely in an eye in the lower end of the pitman-rod N'; whereby the rotation of the disk causes the reciprocation of the rod N' to a greater or less degree, according to how the bolt N² is set in the slot o' and hence how long
 85 is the crank thus formed. The movements of the pitman rod cause the arm L to rock on the hub of the ratchet wheel, and the pawl L' at each forward impulse turns said wheel for a partial rotation. By this means the
 90 fluted wheels c' are caused to turn forward, and a certain quantity of ore is fed under these wheels over the shelves K' and drops into the cylinder to be ground.

Operation: With the above construction of
 95 parts, the operation of this machine is as follows: The doors A² and A³ of the cylinder are closed tightly so as not to leak, and water is admitted, either through an inlet pipe Q in one end of the cylinder, through a pipe Q' in
 100 the hopper, or elsewhere, and allowed to rise to and through the screen c⁵ and flow out the exit B². Ore or other material to be ground is then fed into the open upper ends of the hopper in lumps of suitable size, and power
 105 applied to revolve the shafts F and D. The latter, by its connection with the shaft c, turns the fluted wheels c' intermittently and passes sufficient material down the hopper to the grinding mechanism. Here within the cyl-
 110 indier the lumps of ore are crushed and broken by attrition against the other material within the cylinder; and, after the material has become sufficiently fine, the outflowing current of water carries it up the hopper, through
 115 the screen, and out the exit B². The screen can be replaced by one of any desired mesh; but, if large, the current of water must be caused to flow with greater speed and power in order to carry off larger ground particles.
 120 The adjustment effected by the bolt on the bolt N² is obviously to regulate the feed of ore to the grinding mechanism, according to its hardness and to the size of lumps to which it has been broken before it comes to the pul-
 125 verizer. The uses of the top and bottom doors in the cylinder need no explanation. The whole is of metal of considerable strength; and the sizes, shapes, and proportions of parts, as well as their specific construction,
 130 may be varied considerably without departing from the spirit of my invention.

What is claimed as new is—

1. In a pulverizing machine, the combina-

tion with a horizontal cylinder, a feed thereto and exit therefrom, and grinding mechanism therein; of a door tightly closing an opening in the bottom of the cylinder, a hinge between one edge of said door and the body of the cylinder, an ear on the cylinder near the other edge of said door, a lever whose body stands beyond the body of the door and whose shorter arm passes under the free edge of the door, and a link pivoted to said ear and to said lever, as and for the purpose set forth.

2. In a pulverizing machine, the combination with a casing, and rotary grinding mechanism therein; of a hopper rising from said casing, the body of said hopper above the casing being divided by two vertical partitions and one wall of such hopper between the partitions being cut away to form an exit, a screen across the central compartment below said exit, and means for causing an upward flow of water from said casing and the grinding mechanism, through the screen, and out the exit, as and for the purpose set forth.

3. In a pulverizing machine, the combination with the grinding mechanism, an upright hopper supported thereon and provided with separate end feed compartments, an exit opening in the hopper between said compartments, and a screen across the central compartment below said exit; of a single shaft journaled through both said compartments and carrying fluted wheels therein, guide boards above and shelves below said wheels, a rotating shaft journaled in bearings on the exterior of the hopper, and connections substantially as described between said shafts for turning the wheel-carrying one intermittently, as and for the purpose set forth.

4. In a pulverizing machine, the combina-

tion with the grinding mechanism, a feed hopper rising therefrom, a shaft journaled through the hopper, and a fluted wheel on said shaft within the hopper; of a ratchet wheel fast on one outer end of said shaft and having a long hub, an arm having an eye journaled on said hub, a ring detachably secured to said hub outside the eye, a pawl pivoted to the outer end of said arm and engaging the teeth of said ratchet wheel, and means substantially as described for imparting oscillatory motion to said arm to a regulated extent, as and for the purpose set forth.

5. In a pulverizing machine, the combination with the grinding mechanism, a feed hopper therefor, an agitator within said hopper, a shaft on which the agitator is supported, a ratchet wheel having a long hub secured to said shaft, an arm having an eye journaled on said hub, a ring also on said hub for retaining the eye in place, and a pawl pivoted to the outer end of said arm and engaging the teeth of the wheel; of a shaft journaled in bearings exterior to the hopper, a disk on one end of said shaft having a diametric slot in its outer face of T-shaped cross-section, a bolt whose head stands in said slot, a collar through which the bolt passes, and a pitman-rod having an eye at one end pivoted on said collar and having its other end pivoted to said arm, as and for the purpose set forth.

In testimony whereof I have hereunto subscribed my signature on this the 13th day of December, A. D. 1892.

WILLARD M. FULLER.

Witnesses:

JAMES A. KILTON,
N. M. LAWS.