No. 832,801. PATENTED OCT. 9, 1906.

A. J. MILLROSS.

ORE PULVERIZING MACHINE.

APPLICATION FILED DEC. 8, 1902. RENEWED MAR. 14, 1906.

Fig. 1.

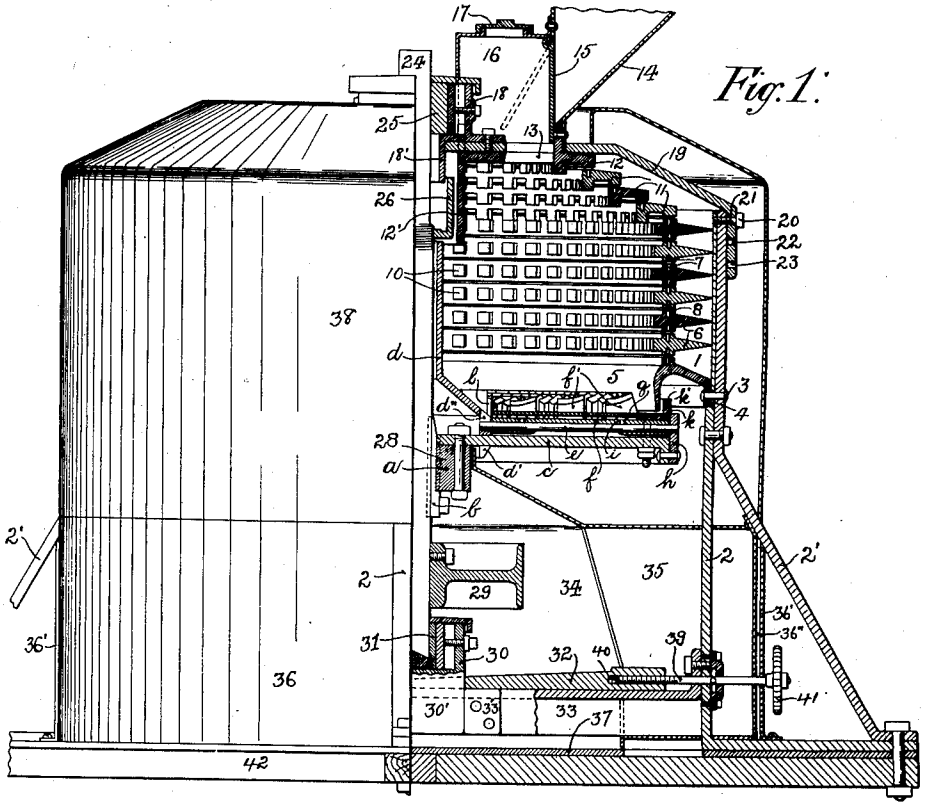
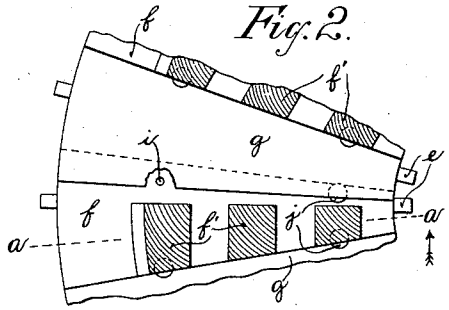


Fig. 2.



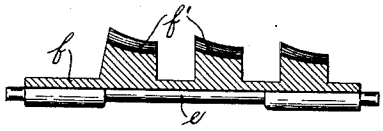
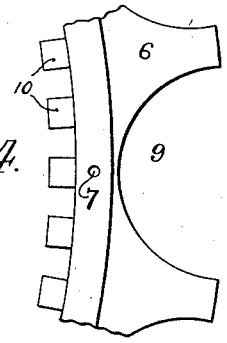


Fig. 3.

Fig. 4.



WITNESSES

Chas. L. Hyde.

M. L. Nickelson.

INVENTOR

Albert J. Millross.

BY Hazard & Harpham.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALBERT J. MILLROSS, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-FIFTH TO L. E. KNOLES, OF LOS ANGELES, CALIFORNIA.

ORE-PULVERIZING MACHINE.

No. 832,801. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed December 8, 1902. Renewed March 14, 1906. Serial No. 306,072.

To all whom it may concern:

Be it known that I, ALBERT J. MILLROSS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Ore-Pulverizers, of which the following is a specification.

My invention relates to machines for pulverizing ore or rock or other hard substances by hurling the same repeatedly against an obstacle until the substance being operated upon is reduced to the required fineness and then passes out of the machine; and the objects thereof are to provide a machine of simple construction and of great efficiency that will reduce ore or any other hard breakable substance to any degree of fineness that may be desired. I accomplish these objects by the mechanism described herein and illustrated in the accompanying drawings, in which—

Figure 1 is a side view, partly in elevation and partly in section, of my machine. Fig. 2 is a plan of a fragment of the hurling-wheel. Fig. 3 is a vertical section on the line *a a* of Fig. 2. Fig. 4 is a plan of a fragment of one of the stationary breaker-rings 6.

In the drawings, 1 is a cylindrical casing which forms the vertical sides of the pulverizing-chamber and is secured to and supported by body-frame composed of supports 2 2′, of which there are preferably four in number. To this casing and to the supports is secured by bolts 3 an annular supporting-ring 4, on which rests the lower breaker-ring 5, the other breaker-rings 6 being arranged thereabove and supported thereby. The breaker-rings 6 are alike on both sides, and either side may be placed up. These rings are provided at suitable distances apart with sockets 7 for the reception of the spacing-rivets 8, the thickness of the heads of which determines the distance of separation of the breaker-rings and the degree of fineness to which the ore is pulverized or broken. The thinner the rivet-head is the smaller the opening or interstice between the breaker-rings is and the finer the ore must be pulverized or broken before it will pass therethrough. These breaker-rings are provided with clearance-notches 9 in their outer edges for the passage to the lower portion of the mill of the pulverized or broken ore or other substance which passes through the interstices between the breaker-rings. The inner surface of breaker-ring 5 is preferably smooth. The inner surfaces of breaker-rings 6 are provided with inwardly-projecting knobs 10, which are preferably square in cross-section and are so spaced that the body of the ring is entirely or almost entirely protected from the direct impact of the body being pulverized in the pulverizing-chamber, the inner lining of which is formed by these breaker-rings. The top of the pulverizing-chamber is preferably formed of a plurality of top reducing breaker-rings 11 of gradually-decreasing size, provided with sockets and knobs and spaced apart by rivets like rings 6. The purpose of this construction is to permit of pulverized ore escaping out of the pulverizing-chamber through the top. This construction is more convenient for handling and for transportation in the mountains on animals than if the top were cast in one piece, also for the replacement of parts should one part wear faster than another. On the top reducing breaker-ring rests a closing-plate 12, provided with an ore-feed opening 13, through which ore is fed from hopper 14 into the pulverizing-chamber. A swinging gate 15, which is automatically operated to open and close, is provided to keep the discharge-outlet of the hopper closed when ore is not being fed into the chamber. The ore-feed opening and discharge-outlet of the ore-hopper are inclosed by a casing 16, having a removable plug 17 in the top thereof, through which water is fed into the machine when it is used for pulverizing wet ores. In the center of the closing-plate is an annular opening provided with a depending circular flange 12′, through which projects a depending circular flange 18′, which is cast on the bottom of and integral with box 18, which is bolted to the top frame 19, which top frame is adjustably secured to the body-frame by bolts 20, which pass through holes 21 or 22 or 23, as desired, to raise the top frame, the sides of the pulverizing-chamber being changed to correspond with the location of the top frame, so that more breaker-rings may be put in and the size of the pulverizing-chamber enlarged.

Through box 18 passes the vertical rotatable operating-shaft 24, which is surrounded in the box by packing 25, preferably of brass. Below the box is screwed upon the shaft an annular drip-cup 26, which will catch and

hold any oil which may pass down through the packing in the box, and thereby prevent the oil from mixing with the ore in the pulverizing-chamber. The flange of the top plate surrounds the drip-cup and the lower part of the box, as shown, to prevent flying ore from contacting therewith. Secured to the operating-shaft immediateiy below the breaker-rings is hurling-wheel 28, which is composed of the hub *a*, rigidly secured to the shaft by key *b*. To the hub is bolted radial spokes *c*, of which there are preferably six in number; but any other number may be used which will give sufficient rigidity. Resting upon the inner ends of these spokes and having depending portions *d'* therebetween and surrounding the operating-shaft is the tubular jacket *d*, the bottom portion of which is flaring, as shown. In the edge of the flaring base are sockets *d'*, in which the inner ends of rods *e* rest. On these rods are mounted hurling-segments *f* and *g*, the alternate sections *f* being provided with upwardly-projecting knobs *f'*, preferably square in horizontal cross-section and having curved faces, as shown in Figs. 2 and 3. These knobs are preferably of unequal height, and the faces thereof curve toward the operating-shaft and toward one edge of the segment, so that when the ore strikes the face of the knob it is given a twisting motion, like the motion imparted to a bullet fired from a rifle. The other segments *g* have, preferably, a smooth face, but may be provided with knobs, if desired. These knobs may be of any desired shape; but I prefer the form described herein, as it gives the ore the motion which I think is best adapted to cause it to disintegrate when it strikes the breaker-rings. These segments are provided with sockets *i* in one edge thereof for the reception of rivets *j*, the same as the breaker-rings, so that they may be spaced or separated to the same extent as the breaker-rings to permit the pulverized or broken ore to pass out therebetween. The outer ends of rods *e* are passed into holes in an annular ring *h* before the inner ends are dropped into the sockets. Ring *h* is bolted to the outer ends of the radial spokes, which are preferably steel bars with their outer ends turned as shown. After the hurling-segments are in place an annular ring *k*, having an upwardly-turned flange *k'*, which projects up under the breaker-ring 5, is bolted to the radial spokes. An annular ring *l* is then dropped upon the inner ends of the hurling-segments and secured to the bottom of jacket *d* by screws which pass through a vertical slot, so that ring *l* may be adjusted vertically when the openings between the edges of the segments are increased or diminished in size, and thereby hold the inner ends firmly in place. In practice I prefer to make the hurling-segment of cast-iron and cast it with the rods *e* in place therein. Below the hub of the hurling-wheel the operating-shaft is provided with pulley 29, to which power is applied to rotate the shaft. Any other means may be used to impart motion thereto, such as a bevel-gear. The bottom of the operating-shaft is mounted in box 30, having packing 31, of brass or other suitable material, therein. The opposite sides of box 30 are provided with depending legs 30', which straddle the adjusting-wedge 32 and supporting-brace 33. The supporting-brace is preferably of U-shaped iron and has stops 33' fastened on the outer sides thereof on both sides of the legs 30' of the box 30 and is bolted at its outer ends to the supports 2. These stops prevent the box 30 from moving laterally. A casing 34 is provided to prevent the pulverized ore from falling upon pulley 29 and into box 30 and surrounds the same except at one point, where it has an opening in the side for the passage therethrough of a belt to operate pulley 29. At this opening it is joined by a belt-protecting casing 35, which runs to the outside of the lower part of the outer casing of the machine. The upper portion of casing 34 is preferably cone-shaped, so that the pulverized ore will not lodge thereon, and this casing is provided with a bottom 37. The lower part of the outer casing is made up of segments, a small section 36', directly beneath the slanting portion of supports 2', being stationary and being provided with a groove 36'' in the vertical edges thereof, into which groove the edges of sections 36 may be dropped into place. The upper part 38 of the outer casing is of suitable shape to slip down over the upper portion of the mill and rest on the lower section. Should the bottom of the operating-shaft wear off, the shaft may be adjusted by the wedge 32, which is provided with a rotatable but not longitudinally-movable bolt 39, the inner end of which is threaded and works in a threaded socket 40 in the end of the wedge. This bolt has an operating-wheel 41, by means of which it is rotated. Supports 2 2' are bolted to sills 42.

In the operation of my machine power is applied to revolve shaft 24, carrying wheel 28, and ore is fed into the pulverizing-chamber. When the ore strikes wheel 28, it is hurled against the breaker-rings and is disintegrated by the impact, falling back upon the wheel and being again hurled against the breaker-rings until it is fine enough to pass through the interstices between the breaker-rings or the segments of the hurling-wheel. It will be observed that the velocity of the hurling-wheel creates air-currents through the interstices, which carry the pulverized ore therethrough. It will be observed that the interstices between the breaker-rings and the segments of the hurling-wheel and the rings of the top can be adjusted to any desired size by the thickness of the heads of the rivets which drop into the sockets of the re-

spective parts and that by this adjustment the same mill may be used for pulverizing rock to a powder or for breaking it up into small pieces. It will also be observed that the size of the pulverizing-chamber can be enlarged or diminished by putting in or taking out one or more of the breaker-rings. After the ore is pulverized or broken to the required fineness it passes out of the pulverizing-chamber and falls into a suitable receptacle (not shown) below the sills.

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

1. An ore-pulverizing machine comprising a frame having in the upper portion thereof an ore-pulverizing chamber the inner lining of the sides and top of which chamber is composed of stationary separated breaker-rings, said rings having on the inner faces thereof inwardly-projecting lugs, and the side rings having clearance-notches in the outer edges thereof, the bottom of said chamber being composed of a rotating hurling-wheel rigidly mounted on a vertical shaft, said wheel being composed of separated segments having on the upper faces of the alternate segments upwardly-projecting lugs.

2. An ore-pulverizing machine having a frame, a rotatable vertical shaft mounted in said frame; a hurling-wheel on said shaft the upper face of said wheel being composed of separated segments, the alternate segments having upwardly-projecting lugs; horizontally and separated breaker-rings surrounding said shaft above said wheel, said rings forming the sides of the ore-pulverizing chamber and having lugs on their inner faces and clearance-notches in their outer edges; a top resting on said rings composed of separated reducing breaker-rings and a central closing-plate having an ore-feeding aperture therein; a casing and ore-hopper forming a closure for said aperture.

3. In an ore-pulverizing machine the combination of a central vertical rotating shaft; a hurling-wheel affixed to said shaft, the upper surface of which wheel is composed of separated segments, the alternate members of which are provided with upwardly-projecting lugs; with a casing surrounding and projecting above said wheel, said casing having a lining composed of horizontally and separated breaker-rings having on the inner faces thereof inwardly-projecting lugs, the rings forming the vertical portion of the lining having clearance-notches in their outer edges.

4. In an ore-pulverizing machine a central vertical revoluble shaft having affixed thereto a hurling-wheel the upper surface of which said wheel is composed of sectoral plates having overlapping, separated, radial edges, in combination with a stationary pulverizing-chamber.

In witness that I claim the foregoing I have hereunto subscribed my name this 17th day of November, 1902.

ALBERT J. MILLROSS.

Witnesses:
G. E. HARPHAM,
HENRY T. HAZARD.