P. G. GARDINER.

Machine for Pulverizing Quartz.

No. 46,789. Patented March 14, 1865.

Fig. 3,

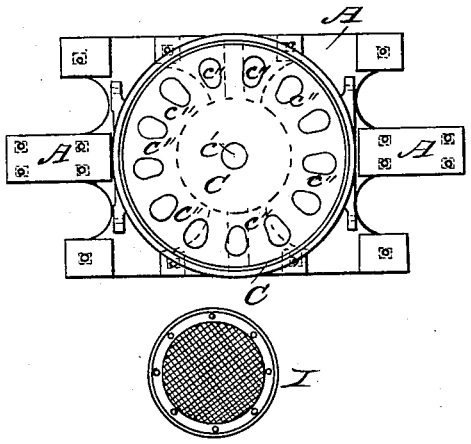


Fig. 4,

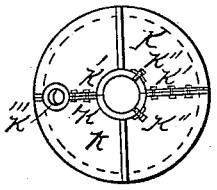


Fig. 5,

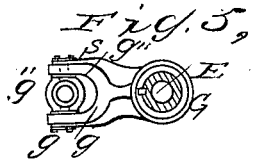


Fig. 1,

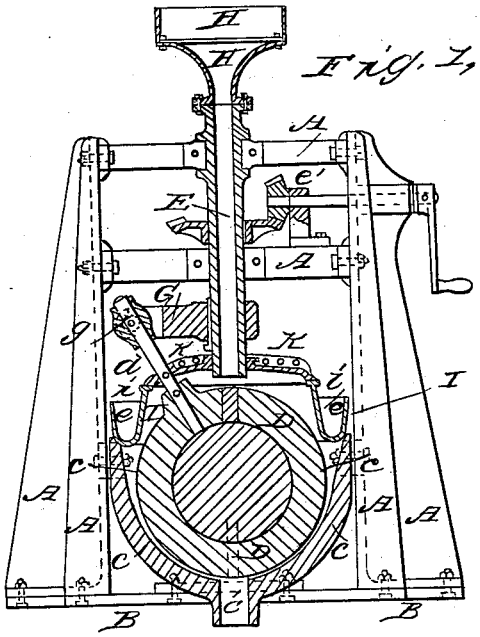
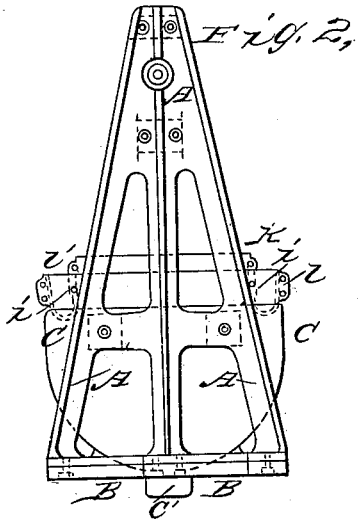


Fig. 2,



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UNITED STATES PATENT OFFICE.

PERRY G. GARDINER, OF NEW YORK, N. Y.

IMPROVEMENT IN QUARTZ-CRUSHERS.

Specification forming part of Letters Patent No. **46,789**, dated March 14, 1865.

To all whom it may concern:

Be it known that I, PERRY G. GARDINER, of the city, county, and State of New York, have invented a new and useful machine for crushing, reducing, and pulverizing quartz, and other mineral ores preparatory to separating the metallic portions thereof, more especially gold or silver, from the ore, either by a dry process or with water, and which may also be used as an amalgamator; and I do hereby declare that the following is a full and exact description of my said invention, and of the manner of constructing and using the same, reference being had to the drawings accompanying and making part of this my specification.

In the drawings, Figure I represents a vertical cross-section through the center of the machine. Fig. II represents an end elevation. Fig. III is a top view of the interior of the basin or pulverizing-vessel and the surrounding parts. Fig. IV represents in plan the cover for closing the basin and ball to prevent the escape of dust. Fig. V is a longitudinal section of the arm or crank and journal-box attached to the head of the axis of the crushing-ball.

In all the figures the same letters represent the same parts.

The nature of my invention consists, first, in the placing the crushing ball or sphere within a basin concentrically, and in so arranging the ball and basin and the interior surface of the basin, and so adapting the size of the ball to the interior surface of the basin, that no particle of matter that is not perfectly pulverized can pass between the ball and basin at the place of discharge of the dust; secondly, in giving such motion to the ball as it acts upon the ores that it shall have a compound rotating, spiral, and rubbing action, so that the ores intervening between the surface of the ball and the interior surface of the basin shall be ground finer and finer as they descend, and the action of the ball shall at the same time promote the descent and finally pass the dust off at the bottom of the basin; thirdly, in the arranging and combining a hollow shaft and tunnel with the basin and ball, so that the broken ores to be pulverized can be passed or poured through into the basin without interfering with the action of the ball and its connections, but co-operate with them; fourthly, in making the basin and pulverizing chamber closed when desired, so as to prevent the escape of dust while the ores are pulverized dry and without the use of water; fifthly, in the adaptation of the machine for use as an amalgamator; sixthly, in its adaptation to pulverizing either by the dry process or with the use of water, as may be desired.

The machinery is placed within a strong frame, firmly bolted, (shown in Figs. I, II, at A A.) This frame and all the machinery rests upon the platform or bed-plate B, which must be of sufficient thickness and strength to give steadiness and security to the working parts.

Upon the bed-plate I place the cast-iron basin or receiving and pulverizing vessel C, which is also firmly bolted to the side frame. This basin in machines of the ordinary size should have a diameter of thirty-three inches, about six inches in thickness, and the interior surface should form part of a complete sphere up to nearly its horizontal diameter, when its interior surface should widen gradually or enlarge up to its termination or rim, as shown in Fig. I, at *c c*. This leaves a space of some width between the rim of the basin and the ball where the ores first fall into the basin, and which space between the rim and the ball gradually contracts as it descends until it comes to where the complete portion of the hemisphere begins. The bottom of the basin is open at its lowest part, and is cast with a hollow flange or pipe, as shown at c', through which the dust passes off as its pulverization is completed and it is worked downward by the ball. Upon the interior surface of the basin are corrugations or recesses, as shown at c'' in Fig. III. The corrugations or recesses commence at about the line of the horizontal diameter of the basin and extend all around its interior surface, and in their length extend down the interior surface of the basin to about half the distance to the central opening, c', and the surface of the corrugations should be proportioned to about the surfaces of the plain spaces between them. The corrugations or recesses are sunk deeper into the basin's surface at their upper portions, gradually shallowing until they become at their lower parts even or flush with the interior surface of the basin. Within the basin I place the iron ball or sphere D, having its center the same as the center of the spherical part of the basin C.

This ball is in diameter about half an inch less than the interior diameter of the basin. It rests upon the bottom of the basin, at the opening e', and is then in actual contact with the basin, but its distance from the sides of the basin gradually and almost imperceptibly increases as the basin rises up to where it meets the widening of the basin toward the rim before described. The ball is set into the basin so that its center vertical line is always the same as the center vertical line of the basin, and it keeps that position at the lowest part of the basin by its own gravity. The ball may be a hollow sphere about six inches thick and thirty-two and one half inches diameter, weighing about three thousand one hundred pounds, or the hollow part may be filled with lead to increase its weight and power, when it will weigh about four thousand five hundred and fifty pounds. The ball is cast with an opening and a flange or shoulder around the outer part of the opening, into which is inserted and keyed a shaft, *d*, for operating the ball, as hereinafter described.

Above the basin is placed the vertical hollow rotating shaft E, having its vertical center line the same as that of the ball and basin below. This shaft has its bearings in the two strong cross-pieces of the frame A, by which it is securely held in its proper position, and it is provided with journal-boxes where it passes through the cross pieces of the frame, and is provided with a bush at its neck above the upper cross-piece. Upon this shaft is placed the gearing for rotating it, and in the drawings this is represented by bevel-wheels e and e', e' being attached to a driving-shaft connected with any prime mover; but the rotation of the shaft may be by a drum and belt or other usual means.

Near the lower extremity of the shaft E is the crank or arm G, which is secured at one end upon the shaft by a ring-joint and key in the usual manner, or by a wedge. The other end of the crank is divided or forked horizontally, as seen in Fig. 5 at $g\ g$. Through each fork g is inserted a pin g', which also passes into and secures the bush or sleeve g'' on each side, which bush or sleeve is slid upon the oblique shaft *d*, and by which bush or sleeve the shaft *d* is held in position and connected with the crank or arm G. At the same time a sufficient play is allowed the shaft within the bush or sleeve.

The ball D is placed in such a position in the basin, and is so held in such position by the shaft *d* and by the crank, that the ball will not come nearer to the sides of the basin at its line of horizontal diameter than one-fourth of an inch—that is to say, at that line there will be always a space between the surface of the ball and the inner surface of the basin all around of one-quarter of an inch.

On the top of the hollow shaft E is placed the tunnel H and receiving-box. This is for pouring in the broken quartz or ore to be pulverized, which should be broken before putting in to about the size of an egg or less. Upon the rim of the basin is placed the circular trough I, having its inner side, *i*, much higher than its outer side, i'. At the bottom of the trough all around are holes, through which water is let into the basin when the pulverizing is done by the wet process; but when the pulverizing is done by the dry process these holes are luted or stopped by clay stopping. Upon the edge of the inner side of the trough I place the cover or lid K, which it fits upon by a rim, so as to shut and close tightly. This cover or lid is made in two equal parts, for convenience of taking off and replacing, and the two parts are fastened together by screws in flanges attached to each of the parts, as shown in Fig. 4 at K K. The opening K′ is for admitting the vertical shaft E, to which the cover or lid K is secured by the pins K″, and the cover revolves with the vertical shaft and with the shaft of the ball.

The shaft *d* of the ball passes through the cover at the opening K‴, which is provided with a collar or flange, so as to have a greater surface about the shaft. The use of this lid is to close the basin and ball entirely when the quartz or ore is pulverized dry, to prevent the dust escaping, which otherwise would be very annoying and cause waste. When the use of water in pulverizing is intended, the lid should not be removed, but the holes in the trough be unstopped and the water let into the trough. When the pulverizing is performed by the wet process, the amalgamation may be carried on at the same time, and for this purpose a circular box having a wire-cloth sieve, L, is provided, which shuts over the top of H. Upon the wire-cloth is spread cloth of cotton or flannel, or buckskin leather, and upon this the mercury is poured, and the motion of the shaft causes the mercury to fall down into the basin through the hollow shaft in a kind of fine shower or mist, which becomes amalgamated with the paste and passes through the basin with it and out at the bottom.

Having thus described my invention and the construction of my machine, I now proceed to describe the operation thereof. The ore having been broken, as above stated, to about egg-size, or less, is thrown into the tunnel, so as to keep the basin below supplied. The rotating shaft E is put in motion, by which the crank G and its connections are set in motion, and the ball D receives and performs its required action, by which the ore is crushed and rubbed between the ball and the basin. The larger pieces of ore are caught in the recesses or corrugations, and are crushed finer and finer as they descend. The action of the ball and the gravity of the material cause the pulverized ore to descend toward the opening in the bottom of the basin, where the space between the two grinding and triturating surfaces of the ball and basin has become gradually nothing or imperceptible, and the pulverized ore is forced out underneath in the form

of a stream of fine dust, every particle being separated and diminuted to the greatest required degree of fineness. When water and mercury are used, the amalgam comes out in a pasty condition. The ball may be rotated by the shaft with almost any required velocity, and when at high velocity the pulverization is effected with great rapidity and efficiency, and the pulverized dust (or paste) falls out through the aperture at the bottom of the basin as fast as the pulverization proceeds.

I claim as my invention and improvements in the foregoing described machinery as follows:

1. The manner of combining and arranging a stationary mortar or kettle of a partly spherical interior form with a spherical concentrical ball operated by a diagonal shaft, *d*, connected with a vertical driving-shaft by the arm G, and the forked joint and bush *g g'*, operating in the manner and for the purposes described.

2. The combining and arranging the vertical hollow shaft E with the ball and basin or mortar D C, whereby the ores to be pulverized are carried down continuously without intervals for charging or discharging, and so as to distribute the falling ores equally on all sides of the ball and basin.

3. The peculiar form and structure, in two equal parts, of the cover or lid K, by which it can be placed over the kettle without disturbing the operating parts, and made to revolve with the shaft and arranged upon the trough I, as described.

4. The form and arrangement of the movable trough I, having its sides of unequal height and its trough perforated, and adapted and adjusted to the rim of the basin below and the revolving lid above, and to be used with or without water, as described.

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Witnesses:

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