(No Model.)

F. P. SNOW.

QUARTZ MILL.

No. 569,069. Patented Oct. 6, 1896.

Fig. 1.

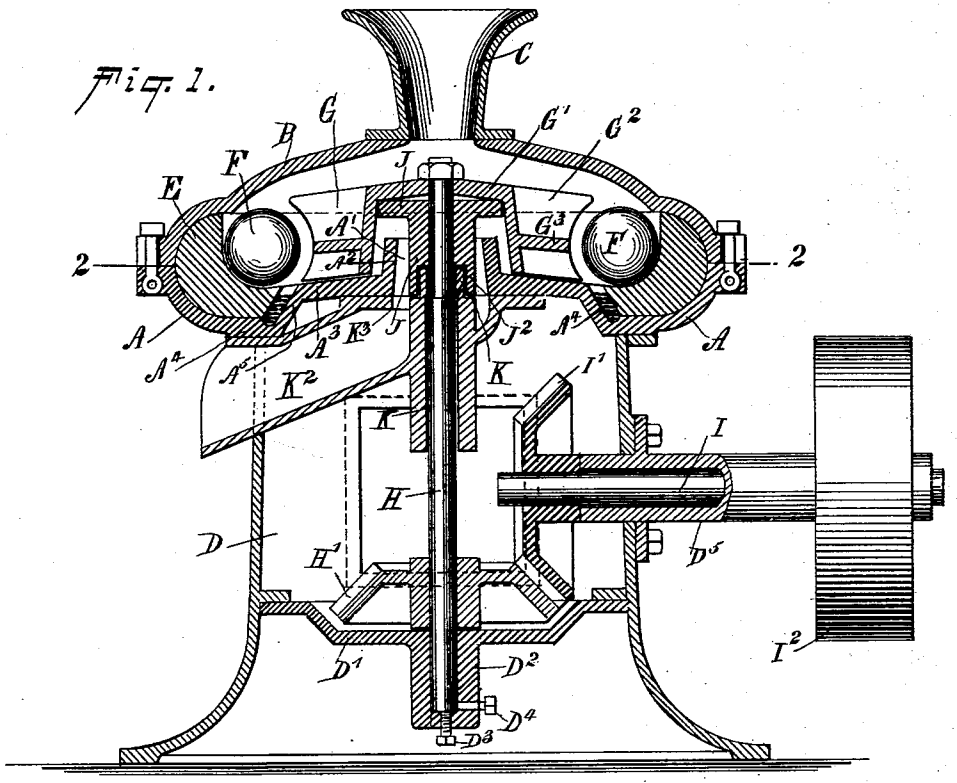
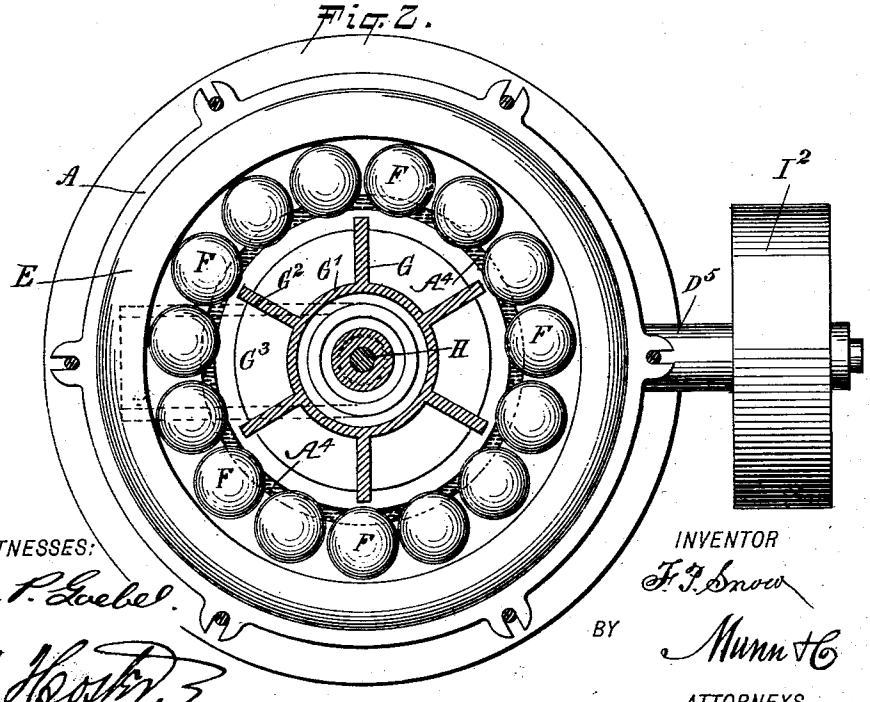


Fig. 2.



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FRANK P. SNOW, OF BAKER CITY, OREGON.

QUARTZ-MILL.

SPECIFICATION forming part of Letters Patent No. 569,069, dated October 6, 1896.

Application filed July 15, 1895. Serial No. 556,042. (No model.)

To all whom it may concern:

Be it known that I, FRANK P. SNOW, of Baker City, in the county of Baker and State of Oregon, have invented a new and Improved Quartz-Mill, of which the following is a full, clear, and exact description.

The invention relates to improvements in that class of quartz-mills in which ore or other material is crushed and pulverized by means of balls moving over a concave circular track.

The objects of my invention are, first, to provide a means of propelling the balls so that each ball receives a continuous impulse independent of the other balls, even though the several balls may vary materially in size or differ considerably in form from a perfect sphere; second, to produce a grinding-mill so well balanced that it may be driven at a high rate of speed, to utilize the centrifugal force and the weight of the balls for crushing, by which means a large crushing capacity in a mill of comparatively small dimensions and low cost is obtained; third, to provide such a means of driving the crushing-balls so that comparatively little of the power supplied for driving the mill is wasted in friction; fourth, to provide a comparatively inexpensive means of separating the crushed material.

The invention consists principally of an annular grinding-track and a series of grinding-balls propelled on the said track by the material fed to the mill.

The invention also consists of certain parts and details and combinations of the same, as will be fully described hereinafter, 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 characters of reference indicate corresponding parts in both the figures.

Figure 1 is a sectional side elevation of the improvement, and Fig. 2 is a sectional plan view of the same on the line 2 2 of Fig. 1.

The improved quartz-mill is provided with a casing A, having a removable cover B, supporting at the middle of its top a feed-hopper C, through which the water and the material to be crushed are fed to the interior of the said casing A, the latter being supported on a frame D, preferably in the shape of a closed casing having a bottom D′, as is plainly illustrated in the drawings.

In the casing A is placed a concave circular track E, on which are mounted to travel a series of grinding-balls F, adapted to be propelled on the said track by the water fed into the casing and carrying the material, the said water being set in motion to accomplish the result by a revoluble wheel or flier G, held on a central shaft H, set in a suitable bearing D^2, provided with set-screws D^3 and D^4 and formed on the bottom D′. On the lower end of the shaft H is secured a beveled gear-wheel H′, arranged within the frame-casing D and in mesh with a like beveled gear-wheel I′, fastened on a shaft I, mounted to turn in a bearing D^5, bolted to the casing D, and extending a short distance at the outside thereof, as will be readily understood by reference to Fig. 1.

On the outer end of the shaft I is secured a pulley I^2, over which passes a belt connected with other machinery for imparting a rotary motion to the said shaft I to cause the beveled gear-wheel I′ to rotate the beveled gear-wheel H′, and consequently the shaft H and the wheel G. The wheel G is provided with an inverted-cup-shaped hub G′, from which extend radially wings G^2, curved at their outer edges and terminating within a short distance of the balls F, without, however, touching the same.

The wings G^2 are connected with each other by a slightly-inclined band G^3, so that the material passing down the hopper C upon the top of the hub G′ flows over the sides thereof and over the band G^3 to then pass upon the balls and the track E, said band also forming a guard for preventing the balls F from striking the wings G^2. The under surface of the top of the hub G′ rests on the flange J′ of a collar J, secured on the shaft H and formed at its lower end with a recess J^2, into which fits the upper reduced end K′ of the bearing K for the said shaft H.

The bearing K is provided on one side with a chute K^2, formed at its upper end with a circular port K^3, concentric to the shaft H and bearing K, and registering with an opening A′, extending upwardly and formed by an annular flange or overflow A^2, forming part of the casing A. This overflow A^2 extends midway between the collar J and the side of the hub G′ to form an opening be-

tween the said side and the overflow to permit the water and crushed material to pass from the annular track E by the slightly-inclined top surface A^3 of the casing A to the said opening and overflow A^2 into the opening A′ and down the same to the annular port K^3 and chute K^2. The material with the water then passes from the latter to other devices to be further treated, if necessary.

An annular channel A^4 is formed between the track E and the side A^5 of the casing A, as is plainly shown in Fig. 1, and this channel is partly filled with mercury to take up any precious metal contained in the material ground by the balls as the latter travel over the circular track E.

The operation is as follows: When the shaft H and wheel or flier G are set in motion and water is admitted to the interior of the casing A, then the wings G^2 of the wheel throw the water tangentially toward the outside of the casing, and as the water flows continuously through the hopper C into the casing it soon forms a solid ring of water, so to speak, to envelop the balls F and to move the same around in the track E, the water finally overflowing at the overflow A^2 and opening A′ into the chute K^2 and down the same to the outside of the mill. As the water receives a rapid horizontal motion by the rotary wheel G the water in turn, owing to its motion, strikes the balls in a line almost direct with their line of motion on the track E, so as to cause the balls to travel around the circular track, and if the motion is rapid enough they will roll against the inside of the track E with a centrifugal force corresponding with their motion. As above stated, the water eventually overflows at A^2, and this it is bound to do, even against the centrifugal force imparted to it by its rapid rotation within the casing A, as it will be understood that the area of the overflow-opening A′ is larger than the neck of the hopper C, so that the water can only assume the form of a ring, the inner wall being nearly perpendicular with the overflow A^2 and with a constant motion maintaining an equilibrium; but as water is constantly admitted this balance of centrifugal force and gravity is eventually destroyed, and as the water cannot escape by the hopper C it follows that it must overflow at A^2 into the opening A′ and port K^3 to finally pass into and down the discharge-spout K^2.

If quartz or other material to be ground is introduced with the water through the hopper C, it is thrown by the centrifugal force imparted to it by the water in motion within the casing directly in the path of the crushing-balls F and the material is crushed by the said balls on the annular grinding-track E. As fast as the material is crushed the finer and lighter particles are gradually forced toward the overflow A^2 by the incoming new material and water, which at all times causes a current toward the overflow and thus carries along the crushed material, which is finally discharged with the water through the spout K^2. Particles too coarse and heavy to be partially floated and carried by the general current to the overflow must by their very nature remain in the path of the crushing-balls F until they are crushed to such a fineness that they will readily pass out with the previously-mentioned current to the overflow A^2. At the same time any particles of the precious metals contained in the material will be kept by their greater gravity close to the bottom of the casing A, to eventually fall into the mercury contained in the channel A^4 to be amalgamated. As the mercury is constantly swept by water, the said channel A^4 is kept clear and the surface of the quicksilver held in the said channel is kept clean and in its best condition for amalgamation. Thus it will be seen that the material after being pulverized passes out with the water at the overflow A^2 into the spout K^2, from which it may be run onto plates or concentrators to be treated further, if deemed necessary. The fineness of the product may be variously governed—that is, either by changing the speed of the mill or changing the supply of water or material to be ground, or both, or changing the height of the overflow A^2, which latter, however, governs the fineness of the products within certain limits. The said overflow A^2 may be made adjustable in height, and under certain conditions might even be dispensed with altogether, so as to leave the matter of gravity out of account and depending wholly for good results on the current of water opposing centrifugal force for separation.

By forming the collar J at its lower end with a recess to engage the reduced end of the bearing K, I prevent any of the finely-ground material from passing upon the bearing and shaft and consequently remove all possibility of the same collecting on the shaft at this point.

I am aware that prior to my invention grinding-mills have been made having grinding-balls moving in a circular track by mechanical means, and I therefore do not claim such a combination broadly.

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

1. A pulverizer comprising a casing, an annular track in said casing, pulverizing-balls placed in the track and adapted to be rotated to pulverize material by a liquid and the material to be pulverized being forced against them, and means for directing the liquid and material against the balls with a force to actuate said balls, substantially as specified.

2. A mill or pulverizer comprising an annular track, balls mounted on said track, a rotary wheel having arms extended outward from its hub and terminating at a point within the circumference of the row of balls, a feed-hopper, and mechanism for operating

the rotary wheel whereby water and material to be pulverized by the balls will be forced against the balls to impart pulverizing motion to them substantially as described.

3. A mill, comprising a casing having an inlet-hopper, and provided with an outlet at or near its center, an annular track held in the said casing, balls mounted to travel on the said track, and a revoluble wheel held in the said casing and extending with its wings within a short distance of the said balls, to impart a traveling motion to the water and material fed to the casing, to cause the material to propel the said balls, substantially as shown and described.

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Witnesses:
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