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Mill for Grinding Ore.

No. 209,838. **Patented Nov. 12, 1878.**

Fig. 1.

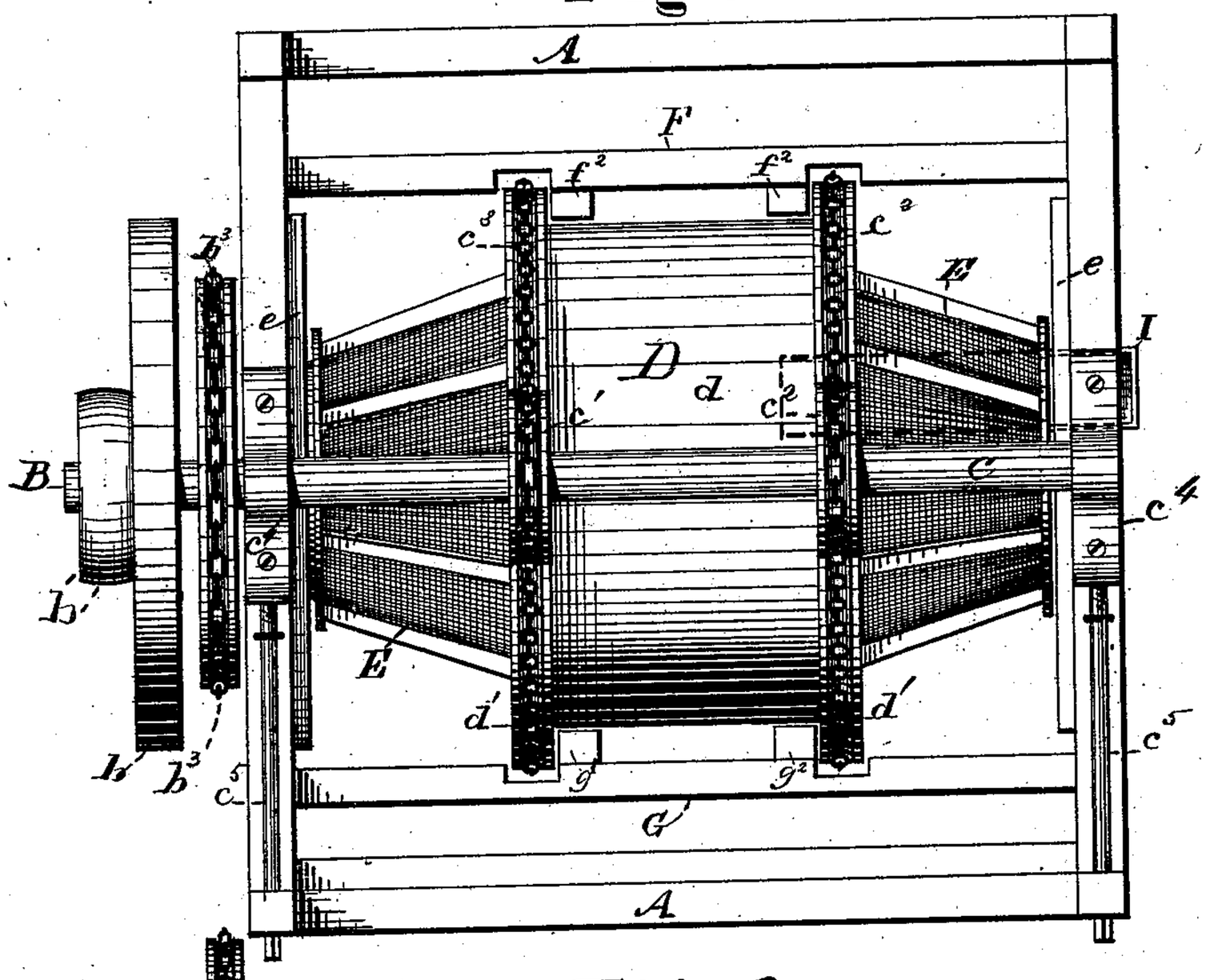

Fig. 2.

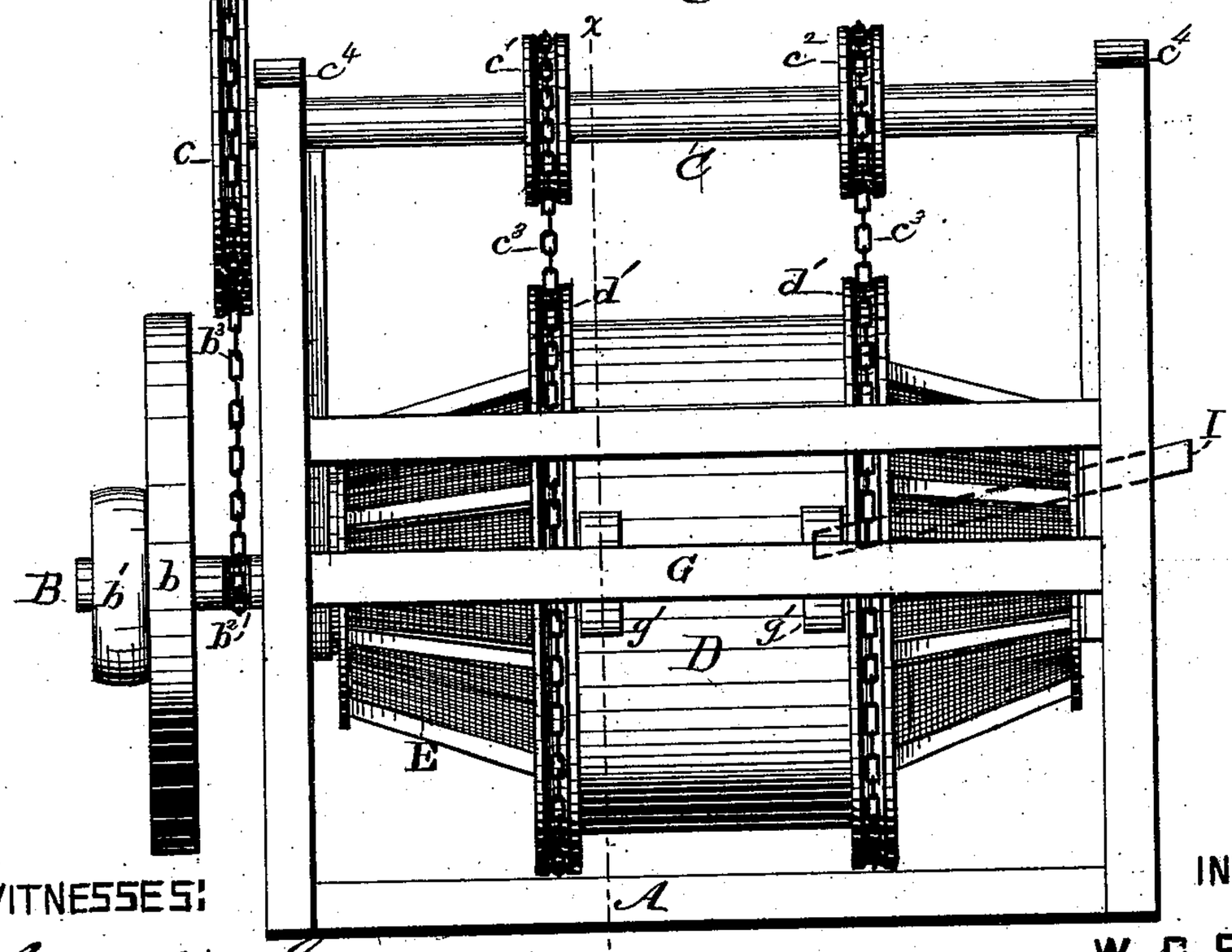

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Fig. 3.

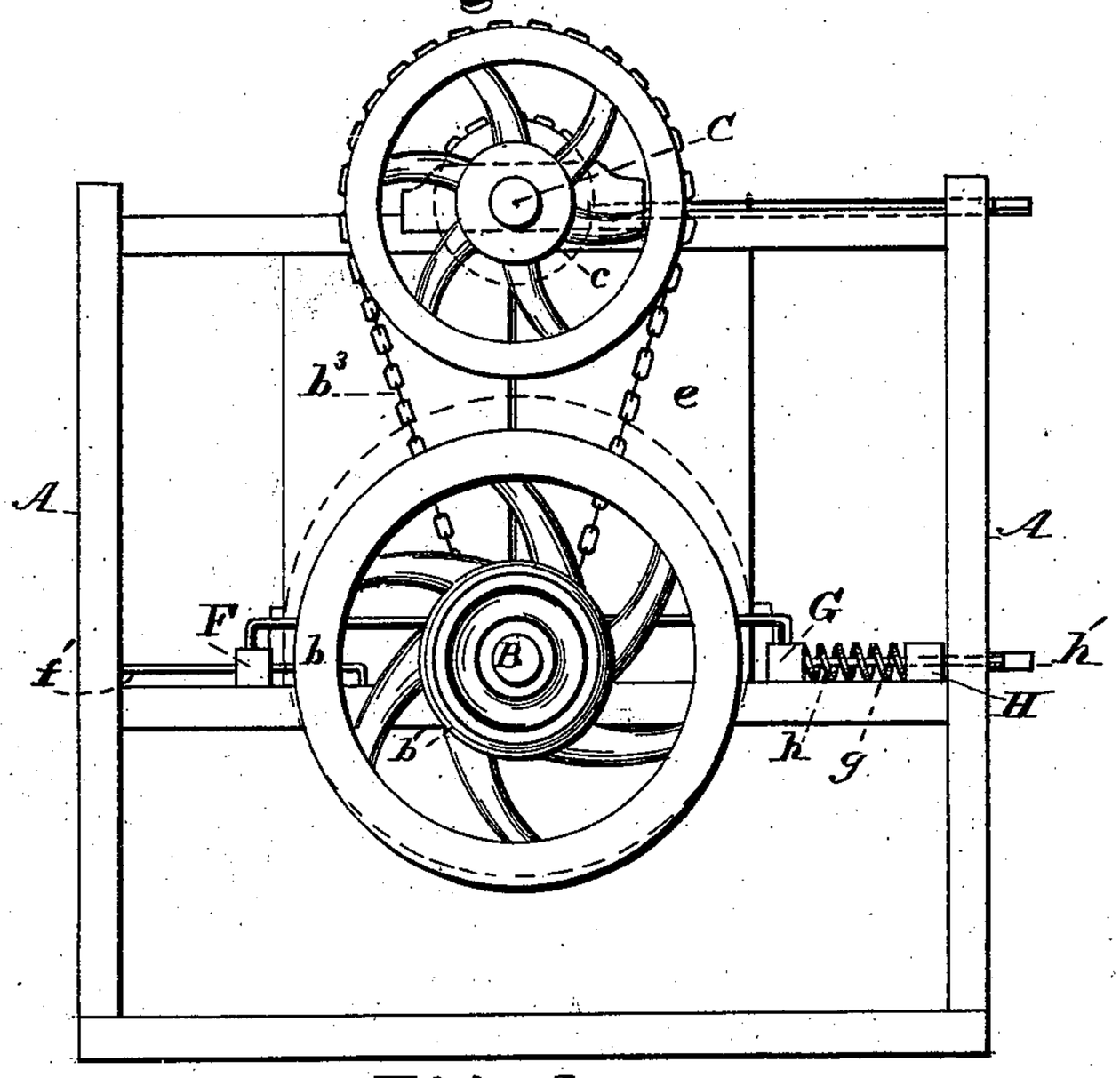

Fig. 4.

Fig. 4,a.

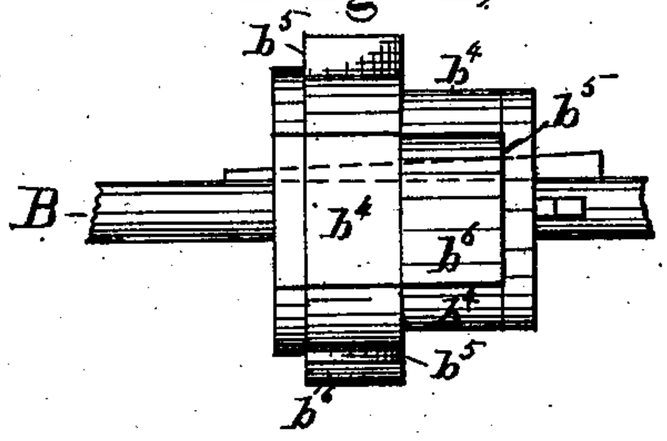

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Fig. 5.

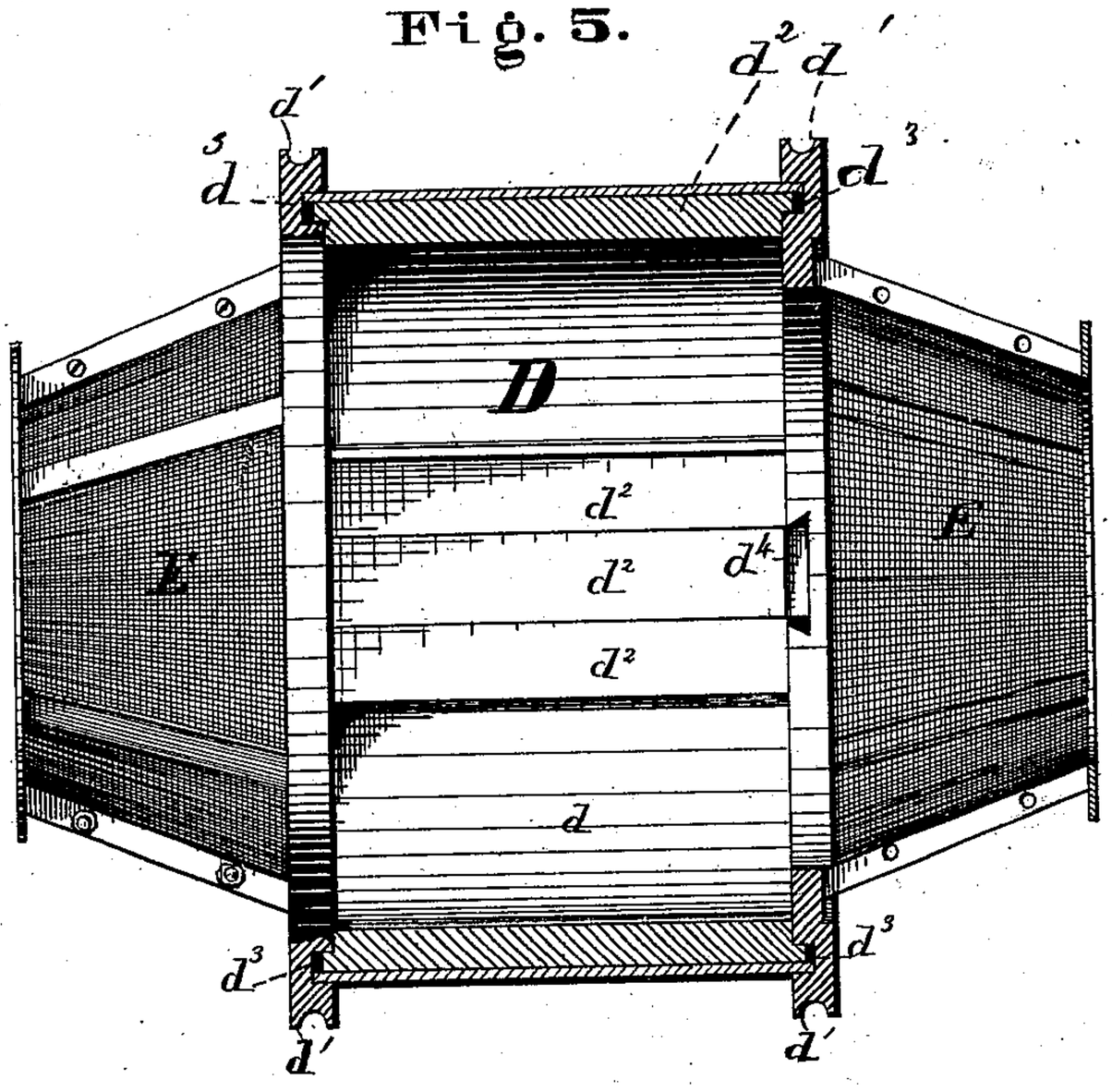


Fig. 6.

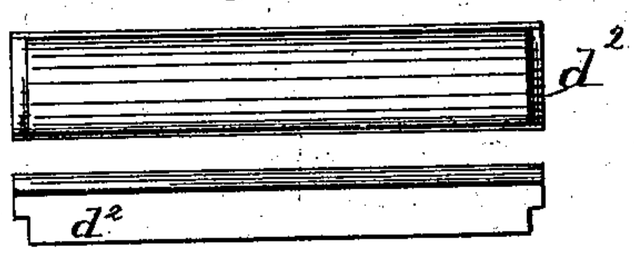


Fig. 7.

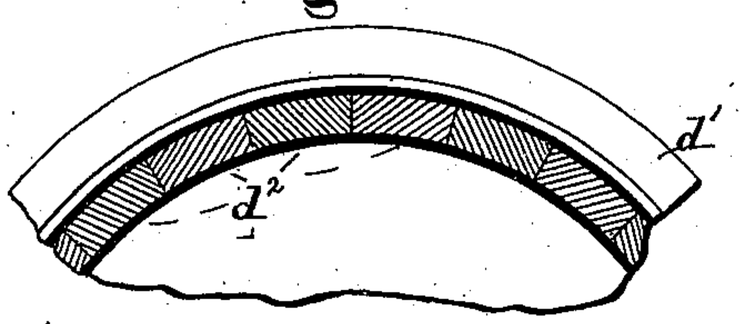
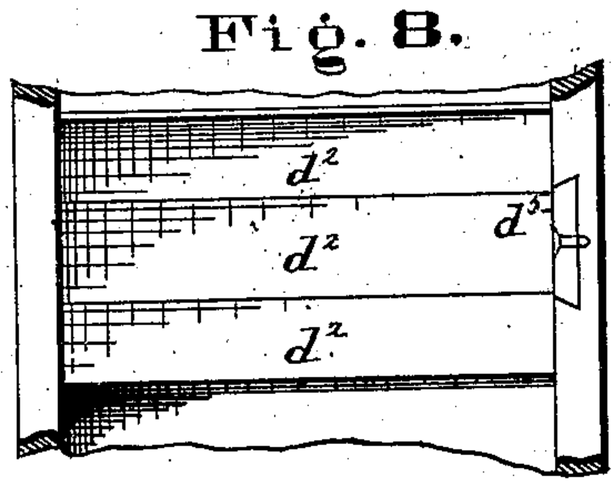


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM C. SALMON, JOHN F. SALMON, AND WILLIAM H. HARRIS, OF PORTLAND, OREGON.

IMPROVEMENT IN MILLS FOR GRINDING ORE.

Specification forming part of Letters Patent No. **209,838,** dated November 12, 1878; application filed January 25, 1878.

To all whom it may concern:

Be it known that we, WILLIAM CUTLER SALMON, JOHN FOSTER SALMON, and WILLIAM HENRY HARRIS, of Portland, county of Multnomah, and State of Oregon, have invented a new and useful Improvement in Quartz-Mills; and we do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

This invention consists mainly, first, in the combination, with revolving shoes or crushers, of a suspended cylinder for holding the ore and presenting the same to the action of the crushers; and, second, in the combination, with the foregoing, of certain means for adjusting the parts relatively to each other.

It consists, further, in certain details of construction, all of which will be fully described hereinafter.

In the drawings, Figure 1 represents a plan view of our improved mill; Fig. 2, a side elevation of the same; Fig. 3, an end elevation; Fig. 4, a sectional elevation on the line *x x*, Fig. 2; Fig. 5, a sectional elevation of the cylinder detached; Fig. 6, face and edge views of the removable dies, and Figs. 7 and 8 partial views of the cylinder with the dies in position.

To enable others skilled in the art to make and use our invention, we will now proceed to describe fully its construction and manner of operation.

A A, Figs. 1 and 2, represent any proper frame-work or equivalent means for supporting directly or indirectly the moving parts of the mill.

B represents the main shaft, suitably supported in any proper bearings in the frame-work, which is provided with the fly-wheel *b* and the pulley b^1, the latter being adapted in any proper manner to receive movement from the main source of power. b^2 also represents a pulley, which is grooved or otherwise adapted to transmit movement to a belt or chain, b^3, or other intermediate means for driving the auxiliary shaft hereinafter referred to.

b^4 b^4, Figs. 4, 4^a, represent shoes or crushers, consisting of annular disks of proper size, having two or more projecting blocks, b^5, with peripheral bearing-faces b^6, as shown. These shoes or crushers are preferably about two-thirds of the diameter of the cylinder (inside measure) in which they revolve, and are removably secured to the main shaft in proper relations to each other by flanges and keys, or in any other suitable manner.

C, Figs. 1, 2, and 3, represents the auxiliary shaft before referred to, which is suitably supported in proper bearings in the frame-work, and is provided with the pulley *c*, adapted to receive movement from the pulley b^2 of the main shaft through the chain b^3, as shown. C^1 C^2 also represent pulleys, located at proper points on this shaft, which are grooved or otherwise adapted to transmit movement to belts or chains c^3 c^3, or other proper intermediate means for revolving the cylinder hereinafter described.

C^4 C^4, Figs. 1 and 4, represent the bearing-blocks of this shaft, which are made adjustable upon the frame-work in any proper manner; and c^5 c^5, set-screws for properly moving the same when desired.

D, Figs. 1, 2, and 5, represents the cylinder or mortar in which the ore to be crushed is acted upon by the shoes before referred to, which consists of a central cylindrical portion, *d*, constructed of any proper material having the requisite strength.

d^1 d^1 represent pulley-rims, having grooves adapted to receive and hold the power-chains c^3 c^3, before referred to. By means of these chains and their connections the cylinder is properly supported, and also given revolution.

d^2 d^2, Figs. 6, 7, and 8, represent dies of proper material, which are held in a proper groove, d^3, Fig. 5, upon each side of the cylinder, in such manner as to form the inner periphery of the same.

d^4, Fig. 4, represents an opening through the flange of one of the grooves, by means of which the dies may be readily introduced into the groove, and also be readily removed therefrom when worn. This is accomplished, it will be understood, by thrusting one end of the die into the groove on one side of the cyl-

inder, and by passing the other end through the slot or opening d^4 in the flange of the opposite groove, after which the die is moved laterally in the grooves until its proper position is reached.

d^5, Fig. 8, represents a suitable block, by means of which the opening is properly closed when all the dies are in place.

The cylinder, it will be observed, is eccentrically located relatively to the shaft B, so that the shoes bear upon one side of the same a little above the bottom, as shown.

E E represent screens of proper material, made in the shape of a conic frustum, the bases of which are rigidly secured to the ends of the cylinder in such manner that the interior spaces communicate with each other to form a single chamber, as shown. The outer ends of the screens are left open; but they are held sufficiently near the solid sides *e*, Figs. 1 and 3, of the frame work to prevent the escape of material in this direction.

F, Figs. 1 and 3, represents a bar extending across the machine, which is secured at its ends by guide-rods, f^1 f^1, which permit movement freely in a lateral direction.

f^2 f^2, Figs. 1 and 4, represent guide-blocks, projecting from the inner face of this bar in such manner as to bear against the periphery of the cylinder between the pulley-rims, as shown in Fig. 1.

G, Figs. 2, 3, and 4, represents a bar of similar construction, located on the opposite side of the machine, which is held by the guide-rods *g g*, and is provided with the guide-block g' g', as shown.

H represents an actuating-bar, located upon the outer side of the bar G, upon the same guide-rods *g g*, as shown.

h h represent springs of proper construction, located upon the rods *g g*, between the bars G H, as shown.

h' h' represent set-screws, by means of which the bar H may be advanced when desired.

I, Figs. 1 and 2, represents a chute, located at one end of the machine, by means of which the ore to be crushed may be discharged into the cylinder. A certain relation exists between the movement of the main shaft and the cylinder, the latter, by means of the intermediate connections described, revolving much more slowly than the former, the revolutions being in the proportion of about one to twenty.

The operation is substantially as follows: The quartz having been delivered through the chute to the cylinder, and the machine having been set in motion, the crushers upon the main shaft will act upon the ore which is held by the cylinder, and properly crush the same.

By the revolution of the cylinder, the uncrushed ore is constantly carried into proper position to receive the action of the crushers, and also the crushed ore is delivered to the screens and discharged from the mill. If uncrushed ore is thrown into the screens at any time by the action of the mill, it falls upon an inclined surface, and is hence returned to the cylinder.

The operation of the mill, it will be understood, is continuous, fresh ore being supplied from time to time through the chute without interference with the operation of the machine, and the crushed ore being delivered by the action of the mill through the screens on the sides.

By means of the adjusting devices described, the relative position of the crushers and the cylinder may be adjusted to compensate for the wear of the dies and crushers. This is accomplished, it will be understood, by swinging the cylinder on its support into the proper position, and then confining it there. The support also may be adjusted so that the cylinder will always be in line below it.

By means of the blocks, the cylinder also is held from improper movement in a longitudinal direction.

By means of the intermediate spring *h* on the guiding-rods *g*, the cylinder is adapted to swing away from the crusher when any substance too hard to be crushed is presented for its action, by which means the parts are prevented from receiving the injury that would otherwise occur under such circumstances.

Some of the advantages of the described construction are as follows:

The ore to be crushed by the movement of the revolving cylinder is constantly subjected to the action of the crushers until reduced to fine dust, and is then discharged through the screens.

Compensation for the wear is readily made by means of the mechanism described.

Worn dies and crushers are readily removed when desired, and new ones are readily inserted in their places.

By means of this construction, also, a largely-increased number of strokes per minute can be obtained over the drop-stamp mill worked by cams, a shaft having four crushers being capable of making three hundred strokes a minute, while the cam-stamp can only make from seventy-five to eighty drops per minute.

The circular or grinding stroke is advantageous, as the ore is crushed more readily than by a drop-stroke.

The position of the ore is constantly changed, so that caking cannot readily occur.

The crushed ore, also, is constantly removed, so that only the uncrushed portions remain under the crushers.

In this mill, also, unlike the drop-mill, the crushers are not subjected to wear or strain when there is little or no ore in the mill.

The mill can be constructed at small expense, and be run with little power.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The suspended adjustable cylinder D, in combination with the crushing-cylinder B, lo-

cated within the suspended cylinder, substantially as described.

2. In combination with a suspended adjustable cylinder, an adjustable supporting-shaft, C, and the supporting-chains for holding the same, substantially as described.

3. In combination with a suspended cylinder, substantially as described, adapted to receive and hold the ore to be crushed, the revolving crusher, substantially as described, and mechanism, substantially as described, for adjusting the suspended cylinder to and from the crusher.

4. In combination with a cylinder having grooves d^3, as described, the removable dies, substantially as described.

5. In combination with the suspended cylinder and devices for holding the same in its proper position, the yielding spring *g*, as and for the purpose described.

6. In combination with the suspended cylinder, the bars F G, one of which is adjustable, as and for the purpose described.

This specification signed and witnessed this 4th day of January, 1878.

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J. F. SALMON.
W. H. HARRIS.

Witnesses:
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