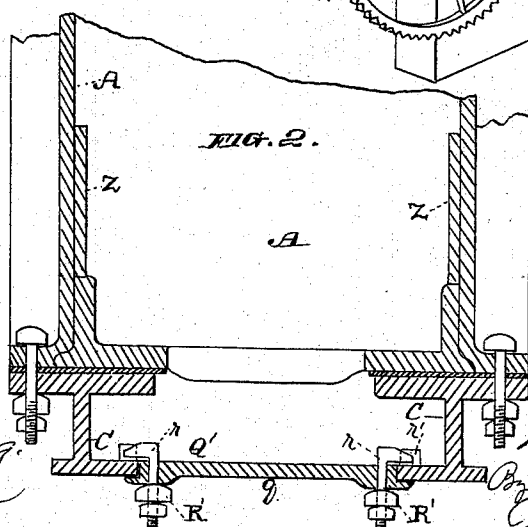
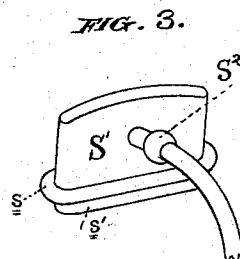


W. I. TUSTIN.
ORE PULVERIZING MILL.

No. 288,745.

Patented Nov. 20, 1883.



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(No Model.)

3 Sheets—Sheet 2.

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FIG. 4.

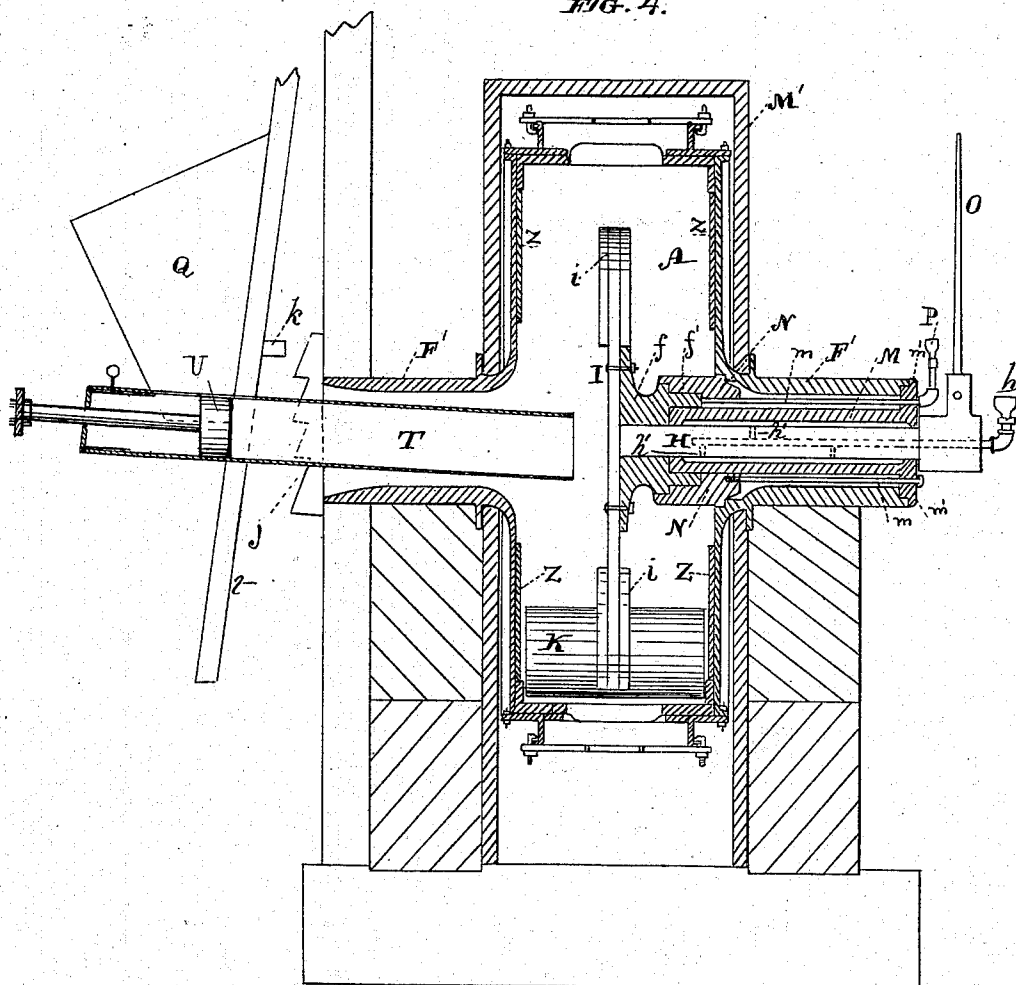
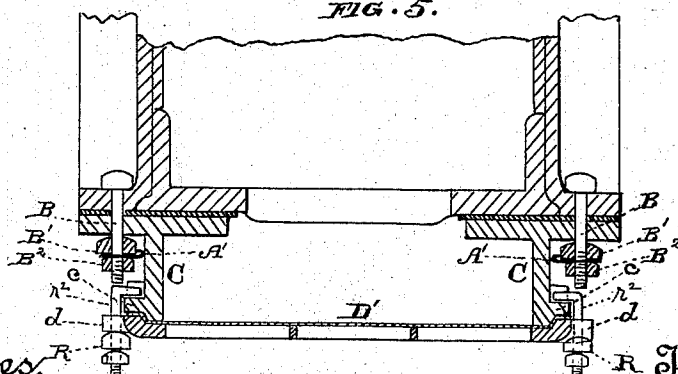


FIG. 5.



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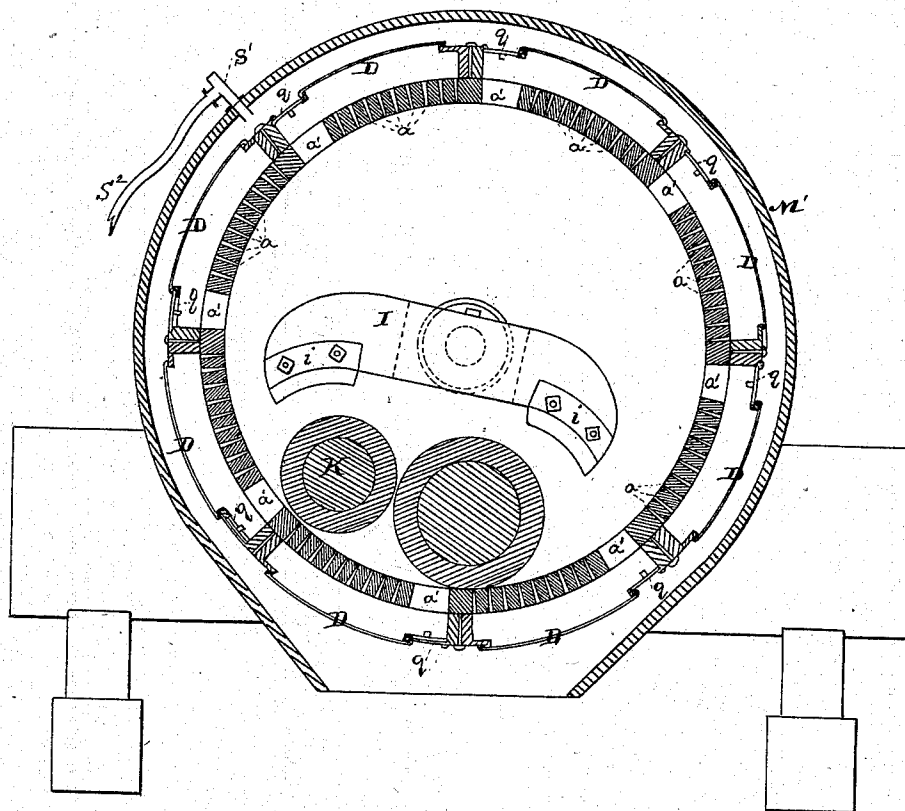
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FIG. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM I. TUSTIN, OF SAN FRANCISCO, CALIFORNIA.

ORE-PULVERIZING MILL.

SPECIFICATION forming part of Letters Patent No. 288,745, dated November 20, 1883.

Application filed August 7, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM I. TUSTIN, of the city and county of San Francisco, and State of California, have invented an Improvement in Ore-Pulverizing Mills; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to that class of crushing and pulverizing mills in which the ore or other substance to be crushed and pulverized is placed inside of a rotating barrel or cylinder, and subjected therein to the crushing and grinding action of one or more balls, cylinders, or weights.

My invention has particular reference to that certain ore-pulverizing mill secured to me by Letters Patent of the United States No. 248,122, dated October 11, 1881; and it consists in certain new and useful improvements in said mill, all of which I shall hereinafter fully explain and claim. In this present application I deem it necessary to illustrate only so much of said mill as will be necessary to explain my improvements, making reference for further particulars to said Letters Patent.

The object of my present invention is to facilitate the operation of the mill.

Referring to the accompanying drawings, Figure 1 is a perspective view of my ore-mill, a portion of the outside casing being broken away. Fig. 2 is a detail section of the barrel, showing the man-hole plate *q* and the means for securing it. Fig. 3 is a perspective view of the water-distributor. Fig. 4 is a vertical transverse section of my mill. Fig. 5 is a detail section of the barrel, showing the screens *D* and the means for securing them. Fig. 6 is a vertical longitudinal section of the mill.

My first improvement is in regard to the construction of the trunnion of the cylinder or barrel upon one side, its connection and arrangement with the indicator-shaft *H*, and the means for oiling the parts.

F' are the hollow trunnions, to which the sides of the barrel *A* are bolted, or framed with it, as shown.

H is the indicator-shaft, which heretofore has found a bearing in both trunnions, but which I now support entirely upon and within one trunnion, leaving the other free for entrance of the ore from the hopper, Fig. 4. Upon the

inner end of the shaft *H* is secured a head or casting, *f*, to which is bolted the yoke *I*, the ends of which are provided with shoes *i*. This casting has a flange, *f'*, on its outer end. The outer end of shaft *H*, which projects beyond the trunnion, is provided with the indicator-finger *O*.

Between the hollow trunnion *F'*, the flange *f'* of casting or head *f* and the shaft *H*, is a sleeve, *M*, the outer circumference of which is enough smaller than the inner circumference of the trunnion to leave a space between for the bolts *m*. This sleeve has a flange, *m'*, attached on its outer end, against which the end of the trunnion is shouldered. Around the inner end of the sleeve *M* and the flange *f'* of head *f* is an annular casting, *N*, shouldered against the head *f* and the inner end of the trunnion. The bolts *m* pass through the flange *m'* of sleeve *M* and connect with the annular casting *N*, and when drawn up tight have the effect of binding themselves and the intervening trunnion shouldered against both, all together, so that these three parts turn upon the shaft *H* and head *f* in the revolution of the barrel, while leaving said shaft free to be affected by the arms of the yoke when acted upon by the rolls, for the purpose described in my former patent. By this construction or overlapping of joints it is impossible for any grit to find its way to the journals. For the purpose of lubricating these bearings, I make the shaft *H* hollow from its outer end, where the oil-cup *h* communicates with it, to a point near its inner end, and small holes *h'* are drilled through the shaft to allow the oil from its hollow center to escape in order to lubricate the exterior of the shaft, upon which the sleeve *M* revolves.

To lubricate the flange *f'* of the head *f*, I have the oil-cup *P*, which communicates with the space between the sleeve and trunnion, so that the oil readily reaches the surface or part to be lubricated.

In the extension *C* of the rim of the barrel *A*, Figs. 1, 2, 6, at suitable intervals, are made apertures *Q*, as man-holes or discharges. These are covered by plates *q*, which are secured in place by means of the bolts *r*, having angled ends, as shown, which, when the bolts are turned around, engage with a projection or lug, *r'*, on the inner surface of the rim. The

nuts R' take the bolts on the outer ends, and therefore can be loosened readily. These angled bolts enable me to readily secure the man-hole plates in their places. The screens D, 5 Figs. 1, 5, are likewise secured. They are fitted by being clamped between the rim C and their frames, as shown in Fig. 5. The frame is provided with ears or lugs *d* on its corners, and the angled bolts *r*² pass through these ears and engage with a flange, *c*, on the screen-seat or projecting portion C of the barrel. This 10 portion is shouldered, as in Fig. 5, and the frame of the screen is correspondingly cut or shaped, so that when the frame is bolted down to the rim the screen is clamped between them 15 securely, and yet may be readily removed by unbolting the frame. The nuts R, Fig. 5, are on the outer ends of the bolts. In Fig. 6 the arrangement of these screens and man-hole 20 plates is shown clearly. The inner grating formed in the rim of the barrel is provided with the narrow slots *a* and wide slots *a'*. In my former patent the screens D were continuous, and therefore received the coarse rock 25 and ore which dropped down through the wide slots *a'*, and were therefore subjected to much wear; but by stopping the screens short off and placing the solid man-hole plates *q* under these wide slots this wear of the screens 30 is prevented, because the plates *q* receive the coarse rock. It will be seen in Fig. 5 that the extension-rim C is bolted to the rim of the main barrel by bolts B, having nuts B' and jam-nuts B². Between these I place a locking- 35 washer, A', consisting of a perforated plate having a bent inner end bearing against the outer surface of the side of rim C.

M' is the box surrounding the barrel.

S' is the water-distributer fitted through the 40 casing M', for the purpose of discharging water upon the screens to cleanse them, and passing through to wash the pulp or pulverized material out of the barrel. It consists of a flat pipe, S', having a flange, *s*, abutting against 45 the box, and a lip, *s'*, extending through said box. A pipe, S², with which the water-pipe may be coupled, supplies the water. The opposite trunnion is hollow, as before, and contains a feed-pipe, T, communicating with the 50 hopper Q, and having in its rear end the piston U, which, when the hopper is vibrated, forces the ore through pipe T into the barrel, said piston being supported in a similar manner to the piston in my former patent, before 55 referred to. This hopper is suspended from standards X by means of arms R, hinged upon a shaft above, as shown in Fig. 1. From its bottom extends downwardly an arm, *t*. Upon its inner side is a block, *k*, against which a 60 ratchet-toothed cam, *j*, on the end of trunnion F' operates, by which means the hopper is given a back-and-forth motion and concussion or jar. In order to steady the hopper in this movement, I have a rod, V, secured at one 65 end to the under arm, *t*, and pivoted at its other end in a projecting piece, *v*, on the frame. A strong spring, V', presses against this rod to

steady it and render the movement of the hopper positive.

To regulate the movement of the hopper and 70 the feed, I have a means for holding it out farther from or closer in contact with the ratchet-cam, whereby the jar or concussion may be increased, diminished, or caused to cease altogether, and the feed stopped. 75

Y is a shaft, having on one end a cam, *y*, operating against the arm *t* of the hopper. It carries on its other end a wheel, W, having a toothed periphery which is engaged by a spring-pawl, *w*. By turning this wheel by 80 means of a crank (not shown) the cam *y* forces out the hopper, or allows it to swing in for the purpose described.

In order to prevent the barrel A from wearing out, I bolt to its sides, on their inner sur- 85 faces, annular plates or washers Z, which form shoes adapted to be removed when worn for the substitution of others.

K, Figs. 4 and 8, are the crushing-rollers.

The operation of the machine is similar to 90 that which I have described in my former patent, the improvements herein being matters of construction, whereby the parts work together to better advantage in accomplishing the result. 95

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

1. In an ore-grinding mill, the barrel or cylinder A, the hollow trunnion F', the sleeve M, having 100 attached thereto flange *m'*, the annular casting N, shouldered against the trunnion, and the bolts *m*, tying these parts together, in combination with the yoke-carrying or indicator shaft H within sleeve M, and the head or casting 105 *f* on said shaft, having a flange, *f'*, all arranged substantially as herein described.

2. In an ore-grinding mill, the barrel A, hollow trunnion F', sleeve M, having flange *m'*, 110 annular casting N, and tie-bolts *m*, in combination with the shaft H, having a hollow center, and apertures *h'* through its sides, the oil-cup *h*, communicating with the hollow center of the shaft, and the yoke-carrying head *f*, having flange *f'*, all arranged substantially as 115 herein described.

3. In an ore-grinding mill, the barrel A, hollow trunnion F', sleeve M, casting N, and tie-bolts *m*, in combination with the shaft H, the yoke-carrying head *f*, having flange *f'*, and the 120 means for oiling said flange, consisting of the oil-cup P, communicating with the space between the sleeve and trunnion, all arranged substantially as herein described.

4. In an ore-grinding mill, the barrel A, 125 having the man-holes Q', made through its rim at intervals, in combination with the caps or plates *g*, covering said holes, and the means for securing said plates, consisting of the bolts *r*, having angled points engaging with lugs *r'* 130 on the inner surface of the barrel-rim, and the nuts R' on the outer ends of the bolts, substantially as and for the purpose herein described.

5. In an ore-grinding mill, the extension-

rim C, having flange *c*, and shouldered, as shown, in combination with screen-frames correspondingly shouldered, intervening screens D, and means for clamping the frames to the rim to bind the screens, substantially as herein described.

6. In an ore-grinding mill, the barrel A, having a rim, C, with a flange, *c*, in combination with the screens D and their frames, shouldered on said rim, and the means for securing said screens and frames, consisting of the bolts *r*², having angled points engaging behind flange *c*, and nuts R on the outer ends of the bolts, substantially as and for the purpose herein described.

7. In an ore-grinding mill, the barrel A, having an inner grating with narrow slots *a* and wide slots *a'*, in combination with the extension-rim C, the screens D, secured to said rim, opposite the narrow slots of the grating, and the man-hole plates *g*, secured to the rim, opposite the wide slots of said grating, substantially as and for the purpose herein described.

8. In an ore-grinding mill, the barrel A and rim C, in combination with the bolts B, having nuts B' B², and the intervening locking-washer A', having a bent inner end impinging against the side of rim C, substantially as herein described.

9. In an ore-grinding mill, the barrel A, having screens D in its rim, and the inclosing-box M', in combination with the water-distributor, consisting of the flat pipe S', having flange *s*, abutting transversely on said box, and a lip, *s'*, projecting through the box, whereby the water may be discharged over the surface

of the screens, substantially as herein described.

10. In an ore-grinding mill, the barrel A, having hollow trunnion F', and the feed-pipe T, provided with plunger U, in combination with the swinging or vibrating hopper Q, having a downwardly-projecting arm, *t*, and the pivoted steadying-rod V, secured to said arm, substantially as and for the purpose herein described.

11. The vibrating hopper Q, having arm *t*, and plunger U, in combination with the pivoted steadying-rod V, secured to said arm, and the spring V', operating against said rod, substantially as and for the purpose herein described.

12. The swinging hopper Q, having plunger U, arm *t*, and means for giving it a vibrating or concussive motion back and forth, substantially as shown, in combination with the means for regulating the length of this movement, consisting of the shaft Y, having cam *y*, impinging against arm *t*, the toothed crank-wheel W, and spring-pawl *w*, all arranged substantially as herein described.

13. In an ore-grinding mill, the barrel A, having hollow trunnions F', in combination with the yoke I, and shaft H, finding a bearing in one trunnion alone, substantially as herein described.

In witness whereof I have hereunto set my hand.

WILLIAM I. TUSTIN.

Witnesses:

S. H. NOURSE,
H. C. LEE.