

(No Model.)

H. L. LIGHTNER & J. J. NEWSOM.
CRUSHING AND GRINDING MILL.

No. 542,087.

Patented July 2, 1895.

Fig. 1.

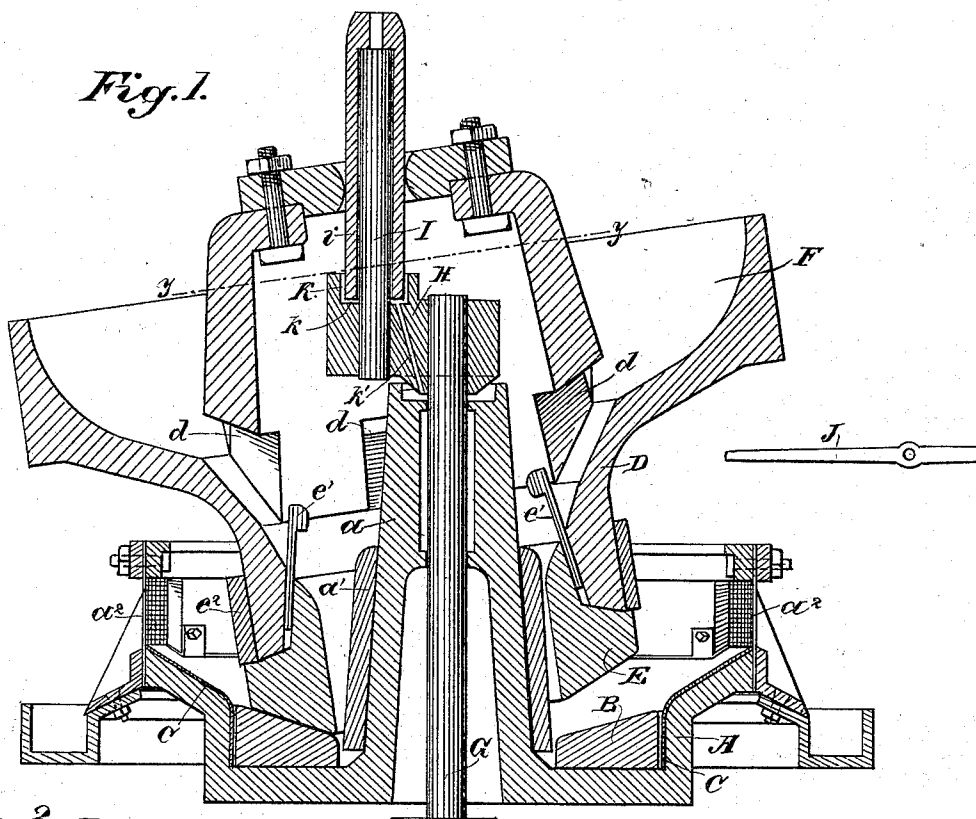


Fig. 3.

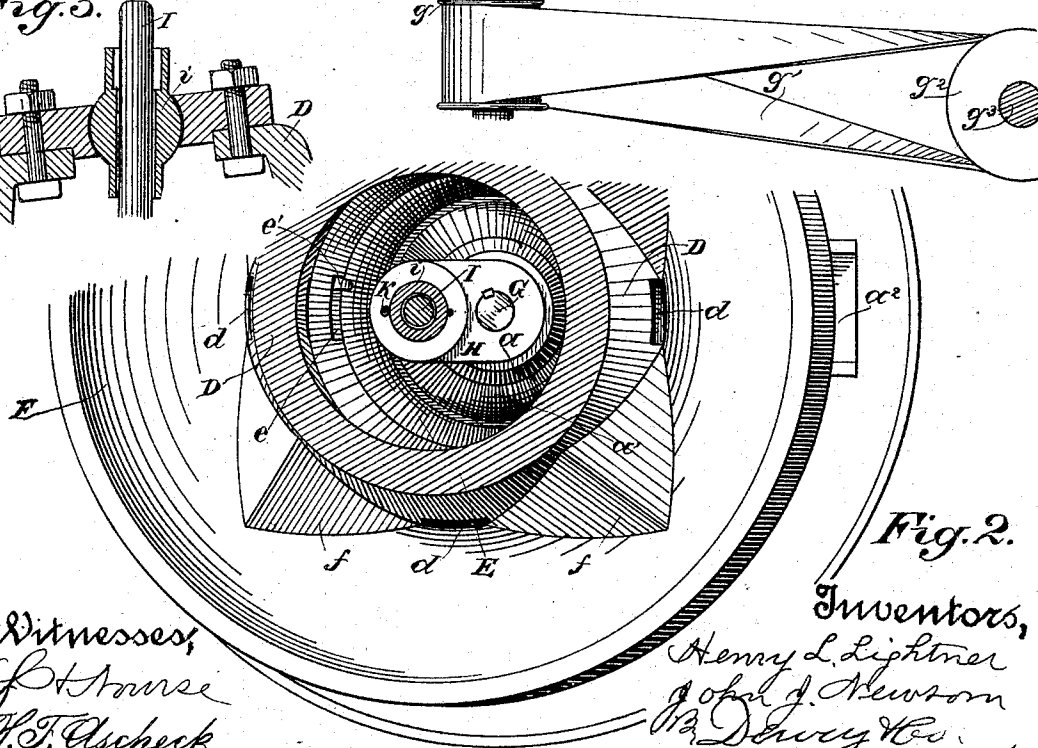
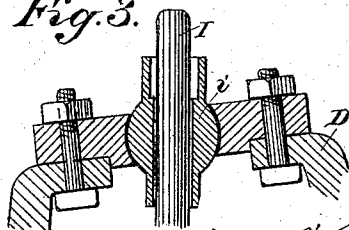


Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY L. LIGHTNER, OF SAN FRANCISCO, AND JOHN J. NEWSOM, OF OAKLAND, ASSIGNORS, BY MESNE ASSIGNMENTS, TO H. L. LIGHTNER, H. C. BIGGS, AND O. C. HASLETT, OF SAN FRANCISCO, AND JESSIE L. NEWSOM, OF OAKLAND, CALIFORNIA.

CRUSHING AND GRINDING MILL.

SPECIFICATION forming part of Letters Patent No. 542,087, dated July 2, 1895.

Application filed September 13, 1894. Serial No. 522,939. (No model.)

To all whom it may concern:

Be it known that we, HENRY L. LIGHTNER, residing in the city and county of San Francisco, and JOHN J. NEWSOM, residing in Oakland, Alameda county, State of California, citizens of the United States, have invented an Improvement in Crushing and Grinding Mills; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to that class of mills for breaking up and reducing rock, ore, and other materials, in which a muller, operating within a mortar, has imparted to it a wabbling motion over a fixed die in the mortar and about a central cone therein by means of a crank-pin applied to it.

Our invention consists of the constructions and combinations of devices which we shall hereinafter fully describe and claim.

The object of our invention is to increase the efficiency of a mill of this general character, not only with respect to its grinding or pulverizing action, but also to adapt it, by reason of the strength, shape, and weight of its parts, and especially of its muller, the hopper, and position of driving-shaft crank, to the crushing of rock.

Referring to the accompanying drawings for a more complete explanation of our invention, Figure 1 is a vertical section of our mill. Fig. 2 is a horizontal section on line *yy* of Fig. 1. Fig. 3 is a modification of the crank-pin engagement with the muller-top.

A is a mortar having in its center a high cone *a*, to the base of which is fitted a wearing-casing *a'*. In the bottom of the mortar is the die B, the surface of which, though it may in some cases be level, is preferably sloped inwardly, as shown. The sides of the mortar at the bottom slope outwardly and upwardly for some distance, thus providing a place for the amalgamating or copper plates C, and said sides then rise vertically and are formed with the usual screen-covered apertures *a*².

D represents the muller generally. It is a hollow shell or casting of a cylindrical or other shape. We have here shown it in the

shape of a frustum of a cone. Its lower end and on the inside near lower end is fitted with the shoe E, which is secured to it in any suitable manner, a good way being, as here shown, of a flange *e* of a shoe-section fitting in a dovetailed groove in the muller and secured by a key *e'*. About the outer surface of the lower end of the muller may be a strengthening-band *e*² of steel. The bottom or wearing face of the shoe is made to conform to that of the die upon which it rests, and the inside circumference is shaped so as to form the jaw of a rock-breaker, acting in connection with the cone wearing-plate *a'*. Around the exterior on the side of the muller is formed or secured a hopper F, which communicates with inwardly-sloping walls on the muller for directing the material to the interior of the latter, said hopper also communicating with feed-ports *d* made through the walls of the muller contiguous to the sloping walls into its interior. This hopper is made large enough to receive the rock from the chute of the feeder.

The hopper is preferably formed with small sloping divisional walls *f*, which serve to agitate the material as the muller is wobbled and better direct it toward the feed-ports.

G is the driving-shaft, which rises from below through the central cone *a* of the mortar. This shaft is driven from below by any suitable mechanism—as, for example, by means of the pulley *g* upon it driven by belt *g'* from an exterior pulley *g*² on a power-shaft *g*³.

Upon the upper end of the vertical shaft G, where it rises above the cone *a*, is a crank H, in the end of which is a pin I, which passes up freely through the top or cap-piece of the muller D. In order to prevent wear upon this crank-pin and reduce friction, we fit it with an exterior loose sleeve *i*, or a sleeve with a globe-joint in top of muller may be used, as shown in Fig. 3.

The operation of the mill is as follows: The material to be crushed and ground is supplied to the hopper F and passes down through the feed-ports *d* in the side of the muller into the interior of the muller. Rotation being

imparted to the drive-shaft G, the muller, by means of the crank H and the pin I, is given a wobbling motion whereby the material is first or partially crushed between the con-
 5 casing *a'* and the inner face of the shoe E, and is then fully crushed and ground or pulverized between the lower face of the shoe and the face of the underlying die B.

It will be observed that the hopper F projects well beyond the side of the mortar. This is for the purpose of enabling it to reach and operate mechanism for actuating the self-feeder and to balance the muller by its weight.

It is not necessary herein to show the self-feeder, it being sufficient to state that J is a
 15 tappet-lever, one end of which lies just under the outer edge of the hopper F, and the other end of which may be supposed to operate mechanism connected with the self-feeder in
 20 a way which is common to all this class of devices. Now, when the material in the mortar gets low and more is needed, the muller comes down far enough to enable its hopper F to come in contact with and operate the
 25 tappet-lever J.

The object of inwardly sloping the die B of the mortar is to create a tendency in the material being crushed to keep down toward the center, thus giving full opportunity to grind
 30 it and permitting it only to pass up the slope and escape when forced to do so by a continuance of the operation, and when fine enough to be washed out by the flow of water which passes in with the ore or rock.

Heretofore in this class of mills the wobbling muller has been provided with an upwardly-extending pin or arm engaging a crank on a drive-shaft located and mounted
 40 above. The overhead framework necessary for this arrangement and the general inconvenience of such a construction made it impracticable to easily remove the muller from the mortar when required; but by driving
 45 from below, as in our mill, leaving the top entirely free, it is obvious that the entire muller can be lifted off the crank-pin and removed from the mortar with facility, thus giving opportunity for repairs and cleaning.

In the previous mills the mullers were comparatively flat and low, besides being small and light, fitting well down within and being entirely inclosed by the mortars. They were not hollow inclosed shells, but were mere rings having open spiders above, from which
 55 a pin or arm extended upwardly to the driving-crank. Neither great momentum nor efficiency could be obtained by this construction because of the lightness of the muller, its distance from the line of crank-rotation,
 60 its location at the point of least motion, and the difficulty of driving it through a long arm or pin; but in our construction by making the muller-shell of a cylindrical, conoidal, or other inclosed shape and having it rise
 65 well above the mortar, and to the line of crank-motion we obtain a great weight effi-

ciency in crushing and also give an opportunity of acquiring increased momentum and centrifugal force which balances the muller during its wobbling movement and also
 70 more fully protecting the driving mechanism inclosed within. The capacity of the feed-ports *d* into the muller is purposely made small enough to prevent the entrance of any rock too large to be properly handled between
 75 the crushing surfaces below.

For the purposes of oiling we have a hole K leading down into the space between the loose sleeve *i* and the crank-pin I, said space communicating with a small chamber *k* in the
 80 top of the crank, from which a hole *k'* leads through the crank to and around the several spaces within the central cone *a* about the driving-shaft G.

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

1. A crushing and grinding mill comprising a mortar having a central cone and outwardly and upwardly sloping sides terminating in vertical encircling sides provided with screen openings; an inwardly sloping die in the bottom of the mortar, a muller of conoidal form surrounding the central cone of the mortar having a shoe on the inside near its lower end
 90 so that its inner surface may crush the material prior to its further reduction between the bottom of the shoe and the die in the mortar, said muller having its upper portion provided with inwardly sloping walls for directing the
 95 material between its inner walls and the central cone of the mortar, with feed openings through the sides of the muller communicating with the interior thereof; a hopper surrounding the muller and connected and movable
 100 with it, a rotary shaft driven from below and passing up through the cone of the mortar, a crank on the top of the shaft within the cone of the muller, and a crank pin fitted loosely through the top of the muller, substantially
 105 as herein described.

2. In a crushing and grinding mill having a mortar provided with a central cone, a muller of conoidal form, and a driving shaft passing upwardly through the cone and driven
 115 from below, a crank on the top of the shaft and fitting the top of the cone, a chamber in the top of the crank with a port leading therefrom through the crank to the space in the top of the cone, a crank pin projecting up-
 120 wardly from the crank and a loose sleeve on the pin passing loosely up through the top of the muller and having its lower end fitting the chamber in the top of the crank.

3. In a crushing and grinding mill, the combination of a mortar having a central cone, a muller having an encircling hopper and feed ports through its walls, and the means for wobbling the muller within the mortar about
 125 its central cone, consisting of the uprising central shaft driven from below, the crank on the shaft and a crank pin passing freely through
 130

the top of the muller and fitted with the loose wearing sleeve substantially as herein described.

4. In a crushing and grinding mill, the combination of a mortar having a central cone, a muller fitted in the mortar, means for wabbling the muller, and an encircling hopper around the muller, the outer edge of said hopper projecting beyond the plane of the sides of the muller to act as a contact against a mechanism for operating a self-feeder, substantially as herein described.

5. In a crushing and grinding mill, the combination, of a mortar having a central cone, a

hollow shell forming a cylindrical or conoidal muller, a non- gyratory shaft passing up through the central cone of the mortar, having a crank pin fitted thereto just below the top of the muller, and passing loosely through the same, and means for rotating the shaft.

In witness whereof we have hereunto set our hands.

HENRY L. LIGHTNER.
JOHN J. NEWSOM.

Witnesses:

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