

nature of the invention for "Improvements in or connected with Crushing- or Grinding-mills, more especially intended for grinding or reducing Ores containing Precious Metals, and for separating Metals therefrom by Amalgamation," and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to mills of the kind wherein grinding or reducing is effected by means of balls revolving upon a circular track.

The object of this invention is to so feed the ore or material to be ground or reduced that it is more efficiently acted upon by the balls than hitherto, and so that, in the case of grinding or reducing ores containing precious metals, the amalgamation of the precious metals is more thoroughly effected than hitherto, and the general arrangement of the mill is such that the grinding or grinding and amalgamating is or are very efficiently performed.

According to this invention I arrange the outlet or outlets from the passage or passages, by which the ore or material to be acted upon is passed into the mill at a point near to the lower part of the balls and close to the race upon which they run, and so also that where amalgamation is to be performed the delivery is immediately over a bath of mercury situated close to the portion of the mill in which the grinding effect is obtained. The outlet for the ground ore or material from the mill is situated at a higher level than the aforesaid delivery, the object of this being to prevent float gold, or fine particles of gold, or fine portions of the ore or material which may contain gold, passing across the mill without being properly acted upon.

I will describe with reference to the accompanying drawing an arrangement according to this invention which I prefer, although I do not limit myself to the precise details. Figure 1 is a vertical section, and Figure 2 is a plan with the upper part and tray removed.

I provide a circular race A mounted upon suitable foundations or framing, having a driving-shaft B passing centrally therethrough. This driving-shaft B carries at its upper part a boss C, connected to a tubular piece D, through which the ore or material is fed into the machine.

This tubular piece D, at its lower part D², extends outwards in the form of a frustrum of a cone of such a size that it leaves a space *d* between its inner surface and a portion of similar formation at E, forming the inner part of the main structure, which carries the race, and leaving at its lower part an opening *d*², which is situated close to and above the portion of the race, against which the lower parts of the balls F bear. The outlet from the mill is situated preferably at a level about or above that of the centre of the balls, as shown at G.

The balls F are driven by means of anti-friction rollers *b*, carried by arms *b*², bolted or secured to lugs *d*³, formed on the exterior of the aforesaid conical part D².

The weight of the balls F may be supplemented by means of a tray I for containing weights, the said tray I bearing, at its lower part, on the top of the balls F, and being fitted so that it can revolve round the tubular piece D aforesaid, and yet be capable of rising and falling thereon.

When amalgamation is to be effected, a trough J for containing mercury is situated immediately beneath the delivery-opening of the aforesaid conical part D², and in close proximity to the portion of the race upon which the lower parts of the balls act. When the machine is in operation the material, which has been previously reduced to a sufficiently-divided condition, is fed into the tubular piece D aforesaid, and passes down through the space *d* inclosed by its conical part, and is delivered at, or about level with, the lower part of the balls F. As water or other liquid is fed in with the material to be operated upon, and thus rises in the machine to the level of the outlets, which are preferably above the centre of the balls aforesaid, it follows that the delivery of the ore or material is always well beneath the level of the liquid in the mill, and cannot take a direct course across the mill without being properly acted upon by the balls, and where the mercury-trough J is provided it follows also that the precious metals in the ore or material are very efficiently subjected to the action of the mercury, thereby rendering amalgamation more complete. I find it advantageous to provide wings or vanes, as at *d*⁴, on the inside of the conical part D, to act as stirrers on the water, to release any air there may be amongst the material being passed into the apparatus.

The parts most subject to wear, such as the race and the under part of the tray which bears on the balls, may be made with detachable bearing parts which can be renewed when worn. *K* is the feed-hopper; *L*, a lubricator; *m*, a blade for facilitating the ejection of the material by the outlet G; and *n* is a pipe by which I draw off water and sludge from above the mercury before opening the outlet *n* to draw off the mercury containing amalgamated gold.

Having now particularly described and ascertained the nature of the said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. In mills wherein crushing or grinding is effected by balls revolving on a circular track, an outlet or outlets by which the material to be crushed or reduced in the mill is delivered near to the lower part of the balls and near to the race on which they revolve, so that the said material cannot pass to the outlet from the mill without being first operated upon by the balls substantially as hereinbefore described.

2. In mills of the kind mentioned, and arranged as claimed by the preceding claiming clause, the combination of a mercury bath so situated that the material passing into the mill is fed directly over the said bath, and thence to beneath the balls substantially as hereinbefore described and illustrated.

3. In mills of the kind mentioned, the combination with the race and balls revolving thereon, and operated by rolling contact with drivers as described of a tray for containing weights, the said tray being independent of the drivers, and so mounted that it bears on the tops of the balls, and is free to have a rotary motion imparted to it by the said balls, whilst it is also free to rise and fall substantially as hereinbefore explained.

4. The arrangement of parts constituting a mill for grinding, or for both grinding and amalgamating, substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated this 20th day of April, 1893.

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