H. W. HARDINGE.

GRINDING MILL.

APPLICATION FILED OCT. 22, 1919.

1,366,651. Patented Jan. 25, 1921.

Fig. 1.

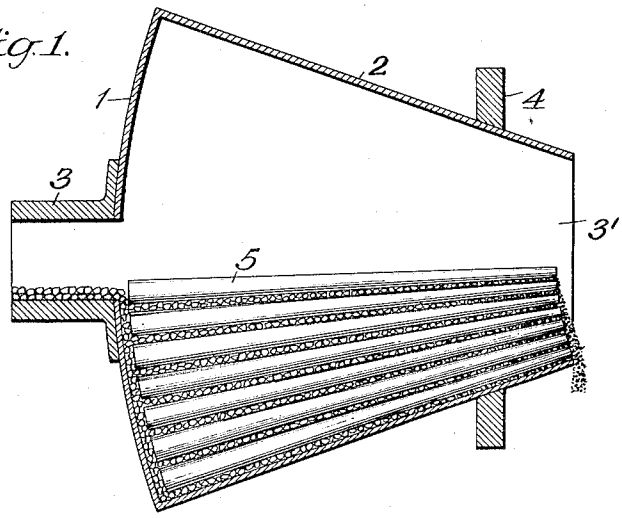


Fig. 2.



Fig. 3.

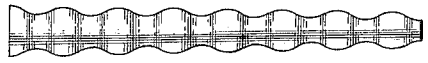
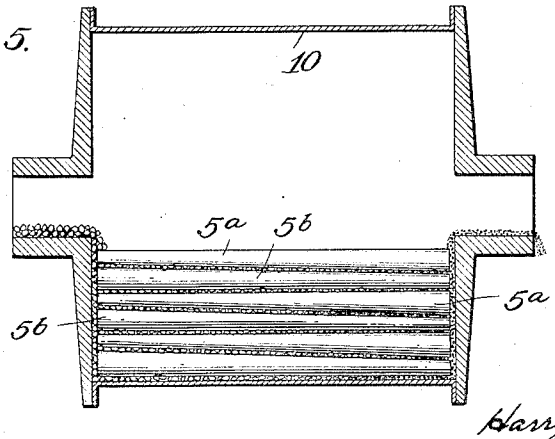


Fig. 4.



Fig. 5.



INVENTOR

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UNITED STATES PATENT OFFICE.

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GRINDING-MILL.

1,366,651. Specification of Letters Patent. Patented Jan. 25, 1921.

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To all whom it may concern:

Be it known that I, HARRY W. HARDINGE, a citizen of the United States, residing at New York, county and State of New York, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a full, clear, and exact description.

This invention relates to grinding media employed in mills for disintegrating ores, rocks and other materials and has for its object the provision of grinding rods having advantages and characteristics hereinafter more specifically mentioned.

Heretofore, the grinding media employed in mills have been mainly in the form of pebbles, balls or cylindrical rods. I propose to employ rods having a conical or frusto-conical form, said rods being larger at one end than at the other.

Referring to the drawings which illustrate what I now consider preferred forms of my invention:

Figure 1 is a sectional elevation of a drum of a conical mill embodying a plurality of my novel rollers.

Figs. 2, 3 and 4 are detail views illustrating various forms of rollers.

Fig. 5 is a sectional view illustrating the arrangement of rollers when employed in cylindrical mills.

My invention is especially adapted for use in connection with conical mills. In Fig. 1 I have shown the rotatable drum of such a mill, said drum comprising an inlet portion 1, a conical outlet portion 2 and bearings 3 and 4 or other well known methods of support. Within said drum a plurality of grinding rods 5 are provided, said rods being larger at one end than at the other, the rods being preferably so arranged that the large ends lie adjacent the base or largest portion of the conical outlet portion 2 of said drum.

The material to be ground enters the rotating drum through the trunnion 3, or other well known means of ingress, passes through the drum and leaves at or near the opposite end 3'. The material first comes into contact with the rods 5 at their larger ends. These larger ends crush the material and exert the maximum force thereon. The crushing force diminishes as the material passes from the larger ends of said rods 5 to the smaller ends thereof due to the decreasing weight, the decreasing peripheral speed of each rod and the decreasing average distance of the rods from the rotational axis of the drum. It will therefore be clear that not only is it true that my rods adapt themselves readily to the conical form of mill, but when so employed they result in a distribution of the grinding force or forces which is highly advantageous.

While the rods 5 shown in Fig. 1 are of plain conical or frusto-conical shape, as shown in Fig. 2, it will be understood that they may be otherwise constructed. Thus each rod may be corrugated as shown in Fig. 3 or spirally grooved as shown in Fig. 4.

Furthermore, while the rods 5 are preferably employed in conical mills they may also be advantageously employed in cylindrical mills. When so used substantially one-half (5^a) of the rods have their large ends adjacent to the small ends of the remainder (5^b) of said rods so that the aggregate general shape is cylindrical to conform to the cylindrical shape of the drum employed. This arrangement is shown in Fig. 5 in which the drum 10 is adapted to be rotated about the axis 11—11. Among other advantages of my rods when employed in cylindrical mills, it will be seen that when one end of a rod becomes unusually worn it may be reversed and the other end subjected to wear.

What I claim is:

A grinding mill comprising in combination, a rotatable hollow drum having an outlet portion whose interior is frusto-conical for automatically classifying material according to size on rotation of said drum and provided with outlet means for discharging fines at the periphery of a conical section of said frustum, and a plurality of cone-shaped members loosely mounted within said outlet portion of said drum and with their smaller ends toward the outlet opening.

In testimony whereof I hereunto affix my signature.

HARRY W. HARDINGE.