

(No Model.)

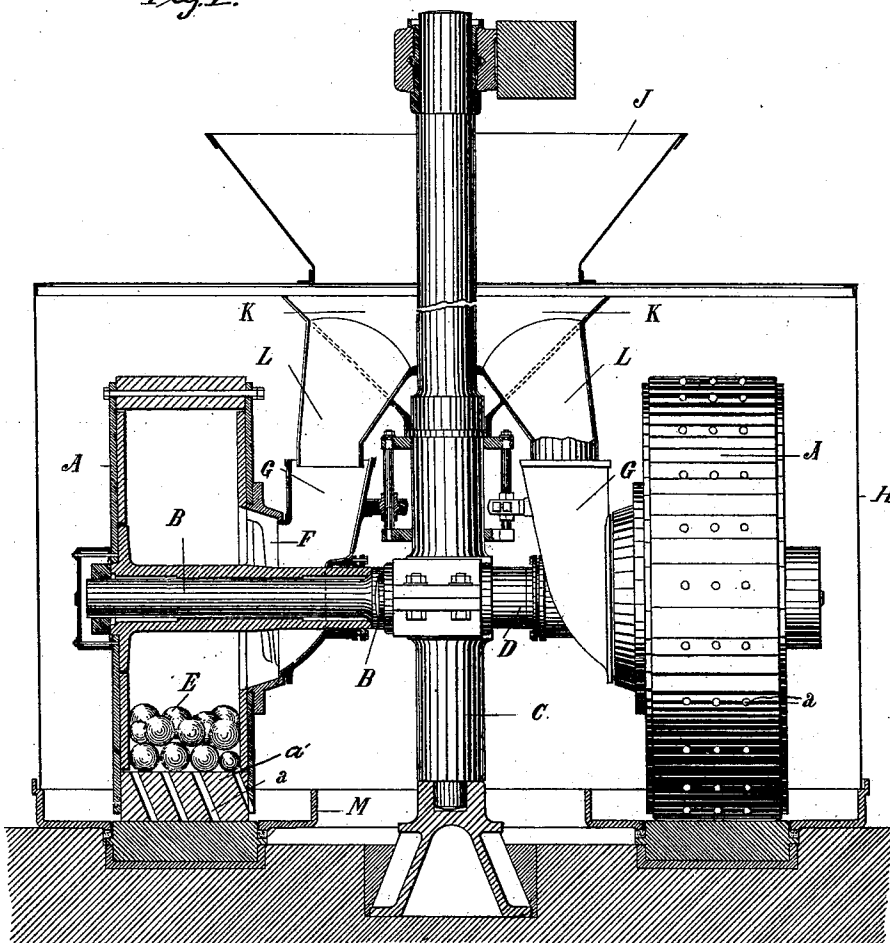
2 Sheets—Sheet 1.

R. STEINBACH.  
GRINDING AND CRUSHING MILL.

No. 507,943.

Patented Oct. 31, 1893.

*Fig. 1.*



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(No Model.)

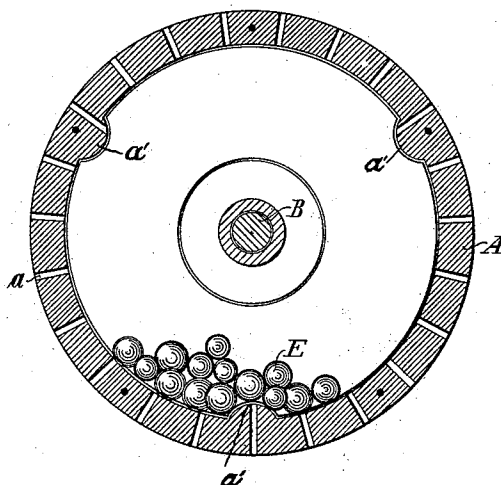
2 Sheets—Sheet 2.

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FIG. 2.



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# UNITED STATES PATENT OFFICE.

REINHOLD STEINBACH, OF MAGDEBURG, GERMANY, ASSIGNOR TO THE  
GRUSONWERK, OF SAME PLACE.

## GRINDING AND CRUSHING MILL.

SPECIFICATION forming part of Letters Patent No. 507,943, dated October 31, 1893.

Application filed December 27, 1892. Serial No. 456,389. (No model.) Patented in Belgium January 20, 1892, No. 100,177; in France January 25, 1892, No. 222,585, and in Germany February 9, 1892, No. 66,444.

*To all whom it may concern:*

Be it known that I, REINHOLD STEINBACH, a subject of the King of Prussia, and a resident of Magdeburg, in the Kingdom of Prussia, German Empire, have invented new and useful Improvements in Grinding and Crushing Mills, (for which Letters Patent have been granted me in Germany, No. 66,444, dated February 9, 1892; in Belgium, No. 100,177, granted January 20, 1892, and in France, No. 222,585, dated January 25, 1892,) of which the following is a specification.

My invention relates to grinding and crushing mills and more particularly to combined edge-runner and ball mills.

An important feature of a mill constructed according to this invention is that the runners or mill stones are made hollow and balls are placed in the hollow interiors of the same, into which interiors the material to be crushed is first introduced. Communication between the interior and exterior peripheries of each runner is afforded by a series of holes formed in its circumference. In this manner each runner forms a ball mill which not only disintegrates the material introduced into its interior to such an extent that it can fall through the holes in the periphery of the runner but the small pieces which fall through the said holes are further disintegrated by being crushed in the pan as the runners roll over them.

In order that my invention may be clearly understood, I will now proceed to describe the same with reference to the accompanying drawings, in which—

Figure 1 illustrates a vertical edge runner and ball mill, constructed according to my invention, partly in vertical section. Fig. 2 illustrates a transverse section of one of the hollow runners.

In the said drawings A A designate the two hollow runners adapted to turn in the well-known manner upon the arms B and D and driven by means of the shaft C. *a a* are holes in the periphery of the said runners. The interior space of each runner, which is provided with the reinforced portions *a'* and with the balls E has communication through the axial opening F in its inner wall, with the

feed hopper J which surrounds the shaft C. The reinforced portions *a'* on the inner surface of the rollers increase the effect of the balls on the material in the rollers, as will readily be understood.

The material to be crushed which is previously broken up into coarse pieces is first conducted to the feed hopper J which is fixed upon the stationary sheet-metal casing H, which surrounds the whole mill so as to prevent the escape of dust and through which the shaft C passes, and drops into the distributing funnel K provided within the sheet metal casing and secured upon the said shaft C. Thence it passes through the two outlets L and the admission funnels G into the runners A A in which it is disintegrated by the balls E. When the material arrives at a certain degree of fineness it is ejected through the holes *a* in the periphery of the runners into the runner pan M.

As shown, the holes *a* are arranged to point obliquely toward the center of the pan, because by reason of centrifugal action the material would pass sooner toward the outer circumference of the pan if the holes were, for instance, at a right angle to the axis of rotation.

By the arrangement described the material from one runner is thrown in front of the next runner which disintegrates it completely. A scraper or guide (not shown in the drawings) arranged behind each runner then moves the pulverulent material toward the circumference of the runner pan into a discharge opening provided therein.

The advantage of the employment of the hereinbefore described arrangement of apparatus consists in that with a given expenditure of power such as would be needed for an ordinary vertical mill a greater output than the ordinary output is realized, because without increasing the masses to be moved in the runners made to form ball mills, a preliminary disintegration of the material introduced into the said runners is effected.

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. In a vertical mill, the combination of a horizontal circular base forming a lower grind-

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ing member, a main drive shaft extending vertically from said base and provided with laterally extending axes, hollow vertical runners or upper grinding members mounted upon said lateral axes and provided with peripheral openings, and grinding balls confined within the runners and performing with the inner peripheries of said runners, the initial grinding of the material to be reduced, to permit its escape through the peripheral openings for further grinding, substantially as explained.

2. In a vertical mill, the combination of the central vertical shaft, the axes extending laterally from said shaft, and the hollow runners formed with inner peripheral projections having peripheral openings and provided with grinding balls within them, substantially as and for the purpose set forth.

3. In a vertical mill, the combination of the

central shaft, the axes extending from said shaft, and the hollow runners and their contained balls; said runners being provided with oblique peripheral openings, substantially as shown and for the purpose set forth.

4. In a vertical mill, the combination of the runner pan, the central vertical shaft, the lateral axes on said shaft, the hollow peripherally perforated runners traveling on said axes in the runner pan, and having the inner axial openings, and the feed hoppers, having chutes or channels for communicating with the axial openings around the axes, and conducting the material to be ground from the feed hopper to the inner surface of the hollow runners, substantially as shown and described.

REINHOLD STEINBACH.

Witnesses:

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