Sept. 23, 1941. H. W. HARDINGE 2,256,841

GRINDING MILL

Filed Oct. 5, 1938

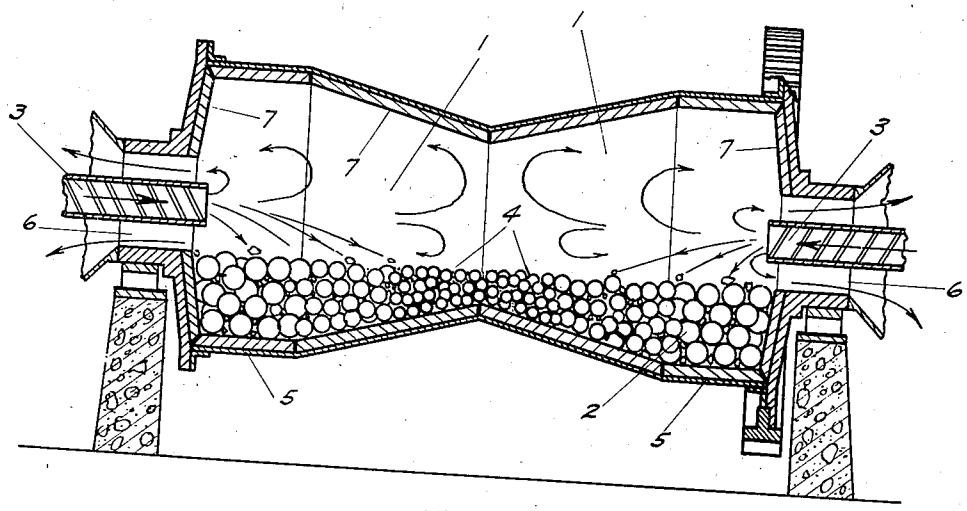


FIG. 1

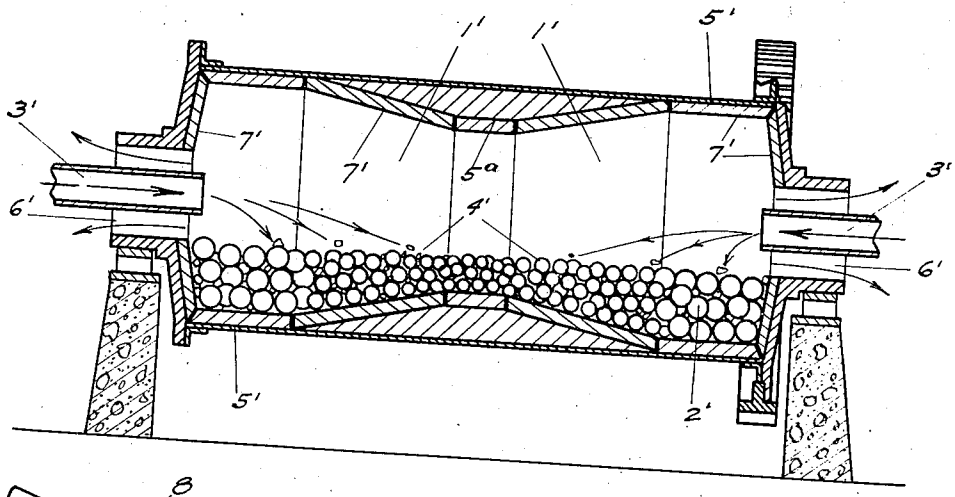


FIG. 2

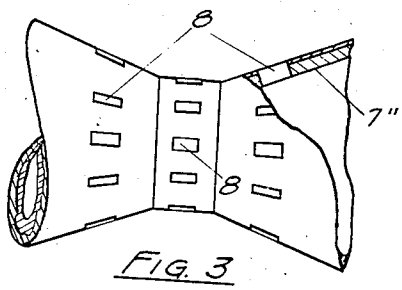


FIG. 3

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GRINDING MILL

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Application October 5, 1938, Serial No. 233,433

1 Claim. (Cl. 83—9)

This invention relates to mills for grinding materials such as, metal, ore, cement, coal or the like, and more particularly to an improvement in multiple feed and discharge mills employing balls, pebbles or the material itself for the grinding media and using a liquid, a gas, or the material itself as a conveying media. The present invention utilizes the inherent mechanical features of my original conical mill that is covered in Patent No. 908,861.

One object of this invention is to provide a mill of the type under consideration wherein the material to be worked upon is fed into one end of the mill and discharged through the same end or through the opposite end.

Another object is to provide a mill wherein the material to be ground or disintegrated may be fed into both ends of the mill and discharged from both ends of the mill.

And another object of this invention is to provide a grinding mill wherein the material to be disintegrated may be fed in through both or either ends of the mill and discharged through peripheral ports provided in the mill.

A further object is to provide a grinding mill wherein the hollow supporting trunnions have extending therethrough means to permit the material to be fed into the mill; the trunnions also serving as a discharge for the material.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangements, without departing from the spirit and scope of the appended claim.

In the drawing:

Figure 1 is a longitudinal sectional view of one form of my invention.

Figure 2 is a longitudinal sectional view of a further embodiment of my invention.

Figure 3 is a detail view, partly in section, of yet a further form of mill.

Referring to Figure 1, I have shown a grinding mill having an outer shell which forms two conical compartments or sections 1. The outer end of each section 1 is closed by an end wall, and it will be noted that adjacent to each end wall there is provided a cylindrical section 5. The end walls of the shell are formed with hollow trunnions 6 suitably journaled in supports, and as will hereinafter be described, the trunnions serve as discharge openings for the interior of the shell.

It will be noted that the conical compartments 1, the cylindrical section 5 and the side walls are provided with a lining 7 which conforms to the contour of these particular parts, and the lining may be secured in place in any desirable manner.

A feed tube 3 extends into each hollow trunnion 6 and is concentric therewith, and each tube is supported in any suitable manner (not shown). The material to be ground is admitted into the interior of the mill through the feeding tube 3 by using a gas or a liquid as a conveyor. The finest of the ground material will be conveyed by the current toward and discharged from the outlets 6, as clearly indicated by the arrows. The coarser material that is not sufficiently subdivided will drop into the mass of grinding media 2 within the compartments for further comminution owing to the reduction of its velocity in the larger diameter of the mill. Another particular advantage of the present construction is that the larger particles of feed, instead of acting on the end walls of the mill as an "air and material blast" when gas or liquid under pressure is used, will impinge on the incoming blast from the opposite feed tube 3.

In each section 1, the grinding media 2 will classify automatically according to size and weight. The largest grinding media will remain at the base of the cones where the material entering through the feed line 3 is crushed by the largest grinding media having the greatest superincumbent weight, the greatest height of fall and the highest peripheral speed. The smaller grinding media and the finer ground material 4 will travel up the cone toward the more restricted portion of the mill from which the ground material will float toward the outlets 6.

When the ground material is moving toward the outlet 6, and a gaseous conveying medium is being used, the diminished velocity of the current of outgoing conveying medium in the largest diameter region of the mill causes said gaseous medium to deposit any oversize material among the grinding media 2 for further reduction. It will be appreciated that the interior of the mill thus becomes a classifier and at the same time retains its well known characteristics as a conical mill.

In Figure 2, I have shown a somewhat different form of construction that may be employed. It will be noted that a cylindrical outer shell is provided and the interior surface is so formed as to provide two truncated cones 1', the apices of which are adjacent to the center of the shell and the bases of which are adjacent to the end walls. A cylindrical portion 5a is positioned between each apex of the cones. As was the case of Figure 1, the inner portion of the shell, the conical compartments 1', the end walls and the cylindrical section 5' are provided with a lining 7'.

In Figure 3, I have shown a construction which may be employed when it is desired to discharge the material through ports provided in the pe-

riphery of the shell intermediate the end walls of the mill. In this embodiment, it can be seen that the shell and lining 7'' are provided with a plurality of apertures or ports 8. While the ports are shown located adjacent to the center of the mill, it is to be understood, however, that they may be provided at any suitable location.

The different embodiments of my mill may be operated in certain ones or more of the following ways:

1. Feeding at one end and discharging through opposite end.
2. Feeding at one end and discharging through same end.
3. Feeding at both ends and discharging through either end.
4. Feeding at both ends and discharging through both ends.
5. Feeding at one end and discharging at both ends.
6. Feeding at both ends and discharging through peripheral ports in shell.
7. Feeding at one end and discharging through peripheral ports in shell.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein by those skilled in the art, such as lie within the scope of the appended claim.

What I claim is:

In combination, a rotary drum grinding mill having substantially planar end walls, hollow trunnions projecting outwardly from said end walls, feed tubes concentric with said trunnions interiorly thereof and spaced therefrom, means in said feed tubes for conveying material into the mill, pneumatic means for withdrawing finely divided material from the mill through the spaces between the feed tubes and trunnions, hollow imperforate truncated cone shaped wall portions in abutting relation adjacent the center of the mill and with their larger ends directed towards the end walls of the mill, an imperforate cylindrical section connecting the large end of each cone section with the adjacent end wall member, and grinding media in the mill.

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