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SHEAR GRINDING MILL WITH CENTRIFUGALLY POSITIONED PESTLES

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FIG.1.

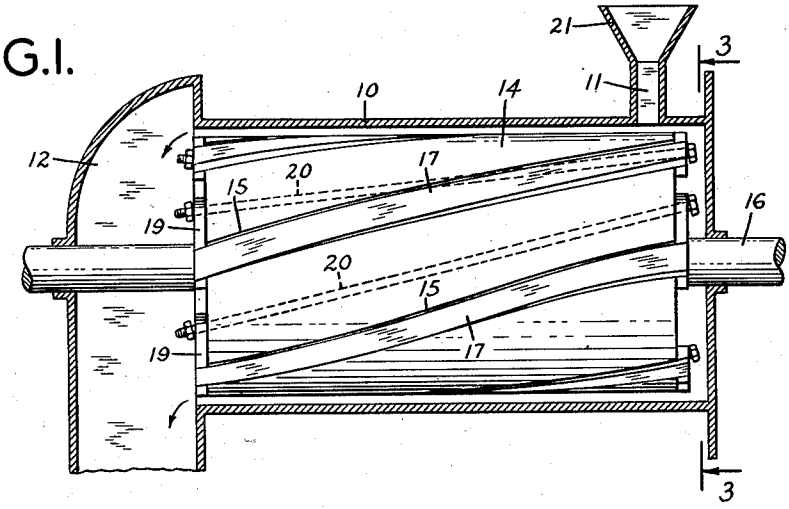


FIG.2.

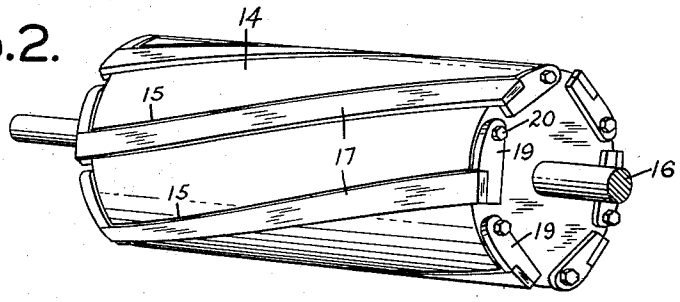
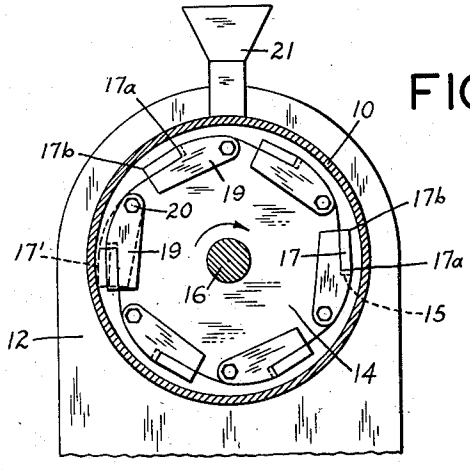


FIG.3.



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FIG. 5.

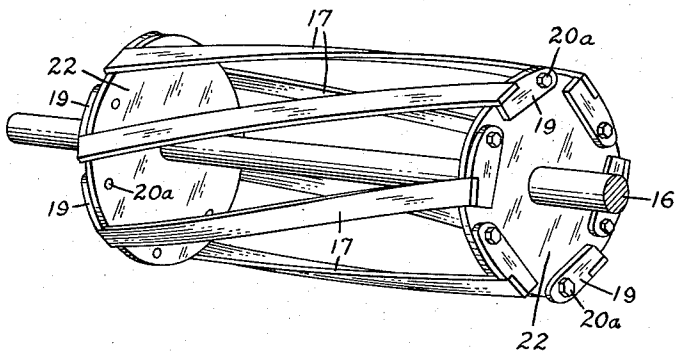
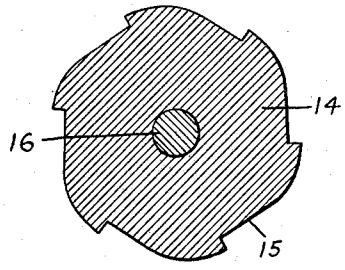


FIG. 4.



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SHEAR GRINDING MILL WITH CENTRIFUGALLY POSITIONED PESTLES

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Application June 3, 1947, Serial No. 752,102

3 Claims. (Cl. 241—238)

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The present invention relates to a grinding mill comprising a cylinder and a plurality of pestles mounted on a rotor within the cylinder.

The main object of the present invention is to provide a grinding mill capable of grinding substances such as chalk, magnesia, and the like, to a very fine powder on an industrial scale.

This and other objects, as well as the utility and advantages of the invention, will appear in the detailed description that follows with reference to the accompanying drawing, wherein:

Figure 1 is a diagrammatic cross sectional elevation through a preferred embodiment of the grinding mill of this invention;

Figure 2 is a view in perspective of the rotor of the grinding mill shown in Figure 1;

Figure 3 is a cross sectional end view of the grinding mill taken along section line 3—3 of Figure 1;

Figure 4 is a cross sectional view of the rotor, minus the pestles, shown in Figure 2; and

Figure 5 is a view in perspective of a modified form of rotor.

In essence the grinding mill of this invention includes a rotor having a plurality of bar-like pestles movably mounted on the rotor and a tubular housing such as a cylinder to enclose the rotor, the pestles being attached to the rotor in such a manner that when the rotor is rotated the centrifugal force acting on the pestles will move them outwardly of the rotor and into contact with the interior of the housing, thus subjecting any material between the interior walls of the housing and the pestles to a shearing action. In the preferred embodiment of this invention the pestles are pivotally attached to the ends of the rotor and are curved and twisted to lie spirally in the periphery of the rotor and conform to the interior of the housing, so that the material being ground within the mill is at the same time moved toward a discharge end at one end of the cylinder.

The primary advantage of the grinding mill of this invention is that it is capable of rapidly and efficiently grinding to a fine powder substances that would quickly clog the conventional hammer type mill using screens.

Referring now specifically to the accompanying drawing, the embodiment illustrated therein includes a cylinder 10 having a feed opening 11 and a discharge opening 12. A rotor 14 is mounted within the cylinder 10 for rotation on a shaft 16 which may, if desired, be provided with suitable thrust bearings, not shown. A plurality of pestles 17 of substantially rectangular cross section, curved and twisted to lie spirally within the

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periphery of the rotor 14 and conform to the interior of the cylinder 10, are provided at each end with an arm 19 pivotally attached to the ends of the rotor 14 by means of a shaft or pin 20 as shown.

The rotor 14 is preferably provided with spiral grooves 15 in its periphery. As shown in the end view, Figure 3, and in the cross sectional view of Figure 4, the surface of rotor 14 is cut away adjacent the leading edge 17a of each pestle and given a smooth contour behind the trailing edge 17b of each pestle, thus giving the rotor 14 a ratchet-like cross section. The purpose of this is to allow the pestles 17 to lie within the periphery of the rotor 14 when the rotor is at rest and to avoid forming any crevices within which the material to be ground can collect and clog the mill.

In operation the rotor is rotated at a speed sufficient to move the pestles outwardly from the rotor to the position 17' shown in dotted lines in Figure 3, so that the trailing edges 17b of the pestles come into contact with the interior of cylinder 10 as shown in dotted lines in Figure 3. The material to be ground is introduced through a hopper or the like 21 through the feed opening 11 of the cylinder 10 and subjected to a shearing action between the interior of cylinder 10 and the pestles 17. At the same time the spiral position of the pestles 17 on the periphery of the rotor 14 induces the particles that are ground to move toward the discharge opening 12 in the cylinder 10.

It is to be understood that the present invention is susceptible of numerous alterations and modifications that will readily occur to those skilled in the art upon reading the present description.

Thus, for example, the rotor 14 need not be a solid rotor but may, as shown in Figure 5, merely consist of a pair of end flanges 22 corresponding to the ends of the rotor 14 shown in Figures 1 to 4 of the drawing to which the pestles 17 may be pivotally attached by means of arms 19 and individual pivot pins 20a. It is also possible to provide two rotors on the same shaft and having pestles disposed at opposing angles so that material fed into opposite ends of the cylinder will be discharged between the two rotors and the thrust of one rotor will be counteracted by the other.

The pestles need not necessarily be mounted on arms that are pivotally attached to the rotor but may be resiliently supported in slots, or the like, so that they will leave the periphery of

the rotor and bear against the interior of the cylinder when they are subjected to the action of centrifugal force by the rotation of the rotor.

While the clearance between the periphery of the rotor and that of the cylinder is not critical and depends primarily upon the material to be ground in the mill, it has been found that $\frac{3}{16}$ of an inch is ample when it is desired to grind substances such as magnesia and chalk to a fine powder with a rotor having a diameter of the order to $5\frac{5}{8}$ inches.

The feed hopper 21 may be hermetically sealed to prevent the introduction of air. It is also possible to provide the feed end of the cylinder with an opening through which air under pressure can be forced to facilitate the movement of the ground material through the mill, especially if the pestles are disposed longitudinally rather than spirally with respect to the rotor. If the pestles are disposed spirally with respect to the rotor, and the rotor consists of a pair of end flanges for supporting the pestles, the latter will act like the vanes of an air compressor and thus assist in feeding the ground material through the mill.

Although only one specific embodiment of the grinding mill of this invention has been described with specific reference to the accompanying drawings, it is to be understood that the scope of this invention includes all such modifications and alterations as will readily occur to those skilled in the art upon reading the present description, and as come within the scope of the appended claims.

I claim:

1. A grinding mill comprising a cylinder having a feed opening at one end and a discharge opening at the other end, a rotor having an overall cylindrical periphery and mounted for rotation within said cylinder, a plurality of pestles of substantially rectangular cross section curved and twisted to lie spirally in the periphery of the rotor and conform to the interior of the cylinder, and a pair of arms for each pestle, one arm being rigidly fixed to and extending laterally from each end of each pestle, each pair of arms being pivotally attached to each end of the rotor to permit each pestle to pivot out of the periphery of the rotor and against the interior of the cylinder by the action of centrifugal force.

2. The apparatus defined in claim 1 wherein the rotor comprises a cylindrical body, the periphery of which is provided with spiral grooves to receive the pestles, said periphery adjacent the trailing edges of said grooves being cut away to give the periphery a smooth contour behind each pestle.

3. The apparatus defined in claim 1 wherein the rotor comprises two spaced end flanges mounted rigidly upon a rotatable shaft and each pair of arms is pivotally attached to said flanges.

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