Aug. 26, 1941. W. M. SHELDON 2,253,733

IMPACT PULVERIZER

Filed March 31, 1938

Fig. 1

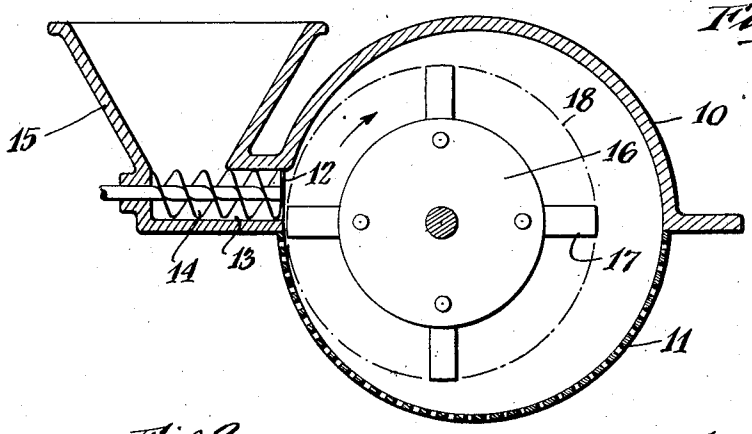


Fig. 2

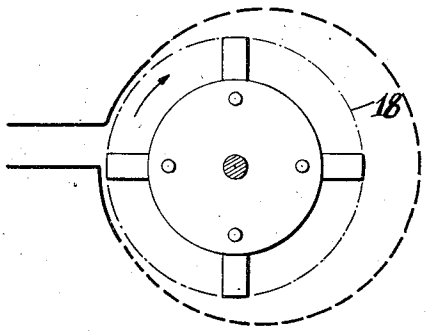


Fig. 3

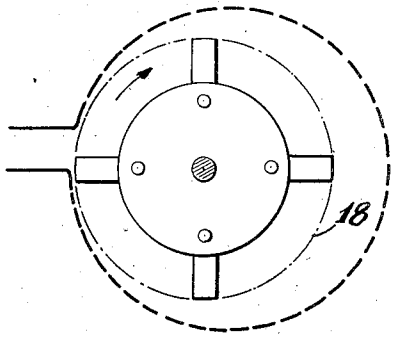


Fig. 4

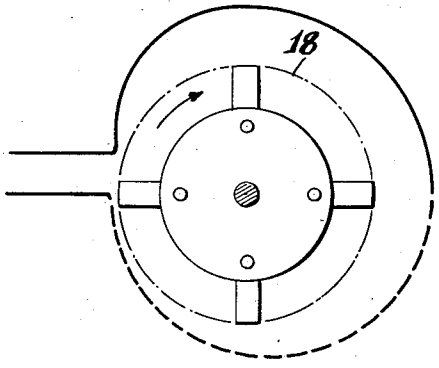
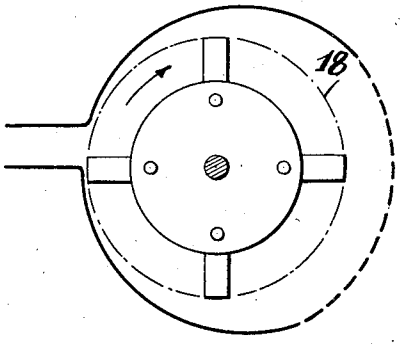


Fig. 5



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IMPACT PULVERIZER

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Application March 31, 1938, Serial No. 199,205

3 Claims. (Cl. 83—11)

This invention relates to improvements in pulverizers of the type in which a rotor comprising a series of radially arranged hammers or beaters is rotated in a mill chamber the peripheral wall of which has openings therethrough for escape of the pulverized material, and has for its principal object the provision of means for reducing the percentage of too fine material. In the grinding of soap, molding compounds, etc., it is desirable to make a product that contains no coarse particles larger than the desired size and yet contains as small an amount as possible of fine material particles smaller than the desired size.

Theoretically, the best way to reduce the percentage of unduly fine material would be to strike each particle a single shattering blow, and, before any of the fragments are struck again, to remove from the mill all the fragments which are of the desired size or smaller. Practically, this is apparently impossible. I have discovered, however, that the number of impacts on material already sufficiently reduced to the desired size can be cut down very materially by so shaping the peripheral wall of the mill chamber and so mounting the rotor therein that the space between the chamber wall and the periphery of the rotor increases in the direction of rotation of the rotor from the point of entry of material and decreases as such point is approached. The increase in space first mentioned enables a large part at least of the fragments thrown tangentially by the hammers to travel along or adjacent to the wall of the chamber without again coming into contact with the hammers until the material which has been reduced to the desired size can pass out through the openings in the chamber wall. In such a mill, many of the fragments doubtless rebound into the path of movement of the hammers, but the number which do so is much less than is the case when the wall of the chamber is throughout closely adjacent the periphery of the rotor. In this way an approach is made to the ideal condition of striking each particle a single blow on entry into the grinding chamber and then discharging the material of the desired size from the chamber before being struck again by the hammers.

Reducing the number of impacts per revolution apparently avoids some of the work previously done in the unnecessary and undesirable production of too fine material and thereby reduces power consumption, since it has been found that the consumption of power per pound of material ground is materially reduced.

A pulverizing mill according to the invention and certain modifications thereof are illustrated diagrammatically, by way of example, in the accompanying drawing, wherein:

Fig. 1 is a section through the mill chamber, feed hopper and feed screw, and showing the rotor but not the chamber for receiving the reduced product and other operating parts;

Figs. 2, 3, 4 and 5 show diagrammatically different forms of mill chamber walls and their position with respect to the circular path described by the outer ends of the rotor hammers.

As shown in Fig. 1, the peripheral wall of the mill chamber comprises two semi-cylindrical portions 10 and 11, the upper one being imperforate and the lower one perforate for the discharge of ground material. At one side is a feed opening 12 from a feed conduit 13 having a feed screw 14 for feeding material to be ground from a hopper 15 into the mill chamber. The rotor mounted with its axis of rotation horizontal, is of well-known hammer type comprising a hub or body portion 16 to which a series of hammers 17 are pivotally attached. The path described by the hammer tips is shown in broken line 18, and this circle will, for convenience, be referred to as the periphery of the rotor.

The rotor is offset with respect to the mill chamber wall in such a way that the nearest point of approach between the periphery of the rotor and the chamber wall is at the feed opening. With such an eccentric relationship, the material entering the chamber will immediately be struck by the upwardly moving hammers. As the particles are carried around past the upper imperforate portion of the chamber wall, they tend more and more to travel in paths outside of the periphery of the rotor in the increasing space between the periphery of the rotor and the chamber wall, being carried along by the air current produced by the rotor.

At the point where the particles first reach the perforate portion, or screen, 11 the latter is spaced well away from the periphery of the rotor to permit the broken up material to move along the screen without contacting the hammers of the rotor and to let the particles of the desired size and smaller pass through the screen openings. By having the space between the periphery of the rotor and the screen progressively reduced, the over-size material is gradually brought back into the path of the hammers, and by the time the end of the screen adjacent the feed opening is reached the sufficiently reduced material will very largely have passed through the screen, so that further subdivision thereof is avoided.

The effect of eccentrically mounting the rotor in decreasing the proportion of undesirably fine material is shown by the following screen analyses of soap powders produced in a mill of the kind shown in Fig. 1 having a 12" diameter mill chamber, with the rotor mounted in the customary way, i. e., concentric with the mill chamber wall, and with the rotor mounted eccentrically as shown in Fig. 1:

	Eccentricity		
	None	¼"	½"
	Percent	*Percent*	*Percent*
On 12 mesh	Trace	0.22	0.65
Through 12 on 20 mesh	2.17	9.31	14.80
Through 20 on 80 mesh	67.50	73.20	72.20
Through 80	30.30	18.10	12.35

With the concentric rotor, the clearance between the rotor and chamber wall was about $\frac{3}{16}$" for the upper imperforate wall and $\frac{1}{16}$" for the lower perforate wall. With the eccentric rotor, the clearance adjacent the feed inlet was about $\frac{1}{16}$" and increased to ½" (¼" eccentricity) or 1" (½" eccentricity) at the opposite side of the casing. In all three cases, the screen and the rotor R. P. M. were the same.

Usually, the inner surface of the imperforate section should, most desirably, be smooth to aid the particles to slide around on such surface instead of rebounding therefrom back into the path of the hammers, although it has been found desirable in some cases to use a suitably roughened or corrugated surface. The perforate portion of the chamber wall may be formed by the customarily used perforated plate or screen as indicated by the drawing, or may be of other suitable form. It has been found of advantage to have the perforations, as shown in Fig. 1, smaller in the first part of the screen, that is, the part first reached by the material, than in the last part.

While in the mill shown in Fig. 1 there is a gradual increase in spacing of the periphery of the rotor from the chamber wall along the upper imperforate portion of the wall and a gradual decrease in spacing along the perforate portion of the wall, this particular arrangement is not essential. The imperforate portion of the chamber wall may, for example, extend concentric with the rotor for a short distance up and down from the feed opening, as shown in Fig. 2; or the perforate portion of the wall may be concentric with the rotor at the side opposite the feed opening, as shown in Fig. 5. Again, one portion may be partly concentric and partly not, as shown in the upper part of Fig. 4. Also, the entire chamber wall may be perforate, as shown in Fig. 3. However, the arrangement of Fig. 1 is preferred, both because of the excellent results obtained with it, and from considerations of manufacture.

In all the arrangements shown, that portion of the chamber wall past which the rotor hammers move upward toward the feed opening, and where gravity opposes the movement of the material particles by the air current produced by the rotor, gradually approaches the periphery of the rotor until it is quite close where the material has to move vertically upward and where the opposing force of gravity is greatest. This is of advantage in overcoming a tendency of oversize material to accumulate in a layer on the portion of the chamber wall referred to when such wall portion is spaced substantially away from the periphery of the rotor so that the air current produced by the rotor is not strong enough to keep the material in motion which is away from the rotor close to the wall.

What is claimed is:

1. An impact pulverizer, comprising a horizontally set cylindrically shaped chamber having a feed opening in one side of the peripheral wall thereof, said wall having a substantially plain inner surface and being imperforate for a substantial distance upward from the feed opening, a high speed rotor having circumferentially spaced hammers mounted eccentrically in said chamber so that the path of the ends of the rotor hammers is closest to the peripheral wall of the chamber at the feed opening and is at a substantial distance from said wall opposite the feed opening, said wall diverging from the path of the ends of the hammers in the direction of rotation of the rotor from the feed opening and converging toward said path as the feed opening is approached, the increase in space between the ends of the hammers and said wall enabling a large part of the fragments thrown tangentially by the hammers to travel along or adjacent to said wall without again coming into contact with the hammers until the sufficiently pulverized material can pass out through the wall apertures, means for driving the rotor so that its hammers move upwardly past the feed opening, and means for supplying material to be pulverized to said chamber through the feed opening, said wall having apertures for the discharge of pulverized material at a distance from the feed opening, said apertures being of a size to permit the passage of material reduced to the desired size and to retain oversize particles.

2. An impact pulverizer, comprising a horizontal cylindrical chamber having a feed opening in one side of the peripheral wall thereof and an upper portion of the peripheral wall of which has a substantially plain inner surface and is imperforate, and a lower portion of which wall is perforate to permit the passage of material reduced to the desired size and to retain oversize particles, means for supplying material to be pulverized to said chamber through the feed opening, a high speed rotor having circumferentially spaced hammers mounted in said chamber with its axis offset horizontally with respect to the axis of the chamber so that the path of the ends of the rotor hammers is closest to the peripheral wall of the chamber at the feed opening and is at a substantial distance from said wall opposite the feed opening, said wall diverging from the path of the ends of the hammers in the direction of rotation of the rotor from the feed opening and converging toward said path as the feed opening is approached, the increase in space between the ends of the hammers and said wall enabling a large part of the fragments thrown tangentially by the hammers to travel along or adjacent to said wall without again coming into contact with the hammers until the sufficiently pulverized material can pass out through the wall apertures, and means for driving the rotor so that its hammers move upwardly past the feed opening.

3. An impact pulverizer, comprising a horizontal cylindrical chamber about 12 inches in diameter having a feed opening in one side of the peripheral wall thereof and an upper portion of the peripheral wall of which has a substantially plain inner surface and is imperforate, and a lower

portion of which wall is perforate to permit the passage of material reduced to the desired size and to retain oversize particles, means for supplying material to be pulverized to said chamber through the feed opening, a high speed rotor having circumferentially spaced hammers mounted in said chamber with its axis offset horizontally with respect to the axis of the chamber so that the path of the ends of the rotor hammers is approximately $\frac{1}{16}$ of an inch from the peripheral wall of the chamber at the feed opening and is spaced from one-half inch to one inch from said wall opposite the feed opening, and means for driving the rotor so that its hammers move upwardly past the feed opening.

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