

May 11, 1943.

W. M. SHELDON

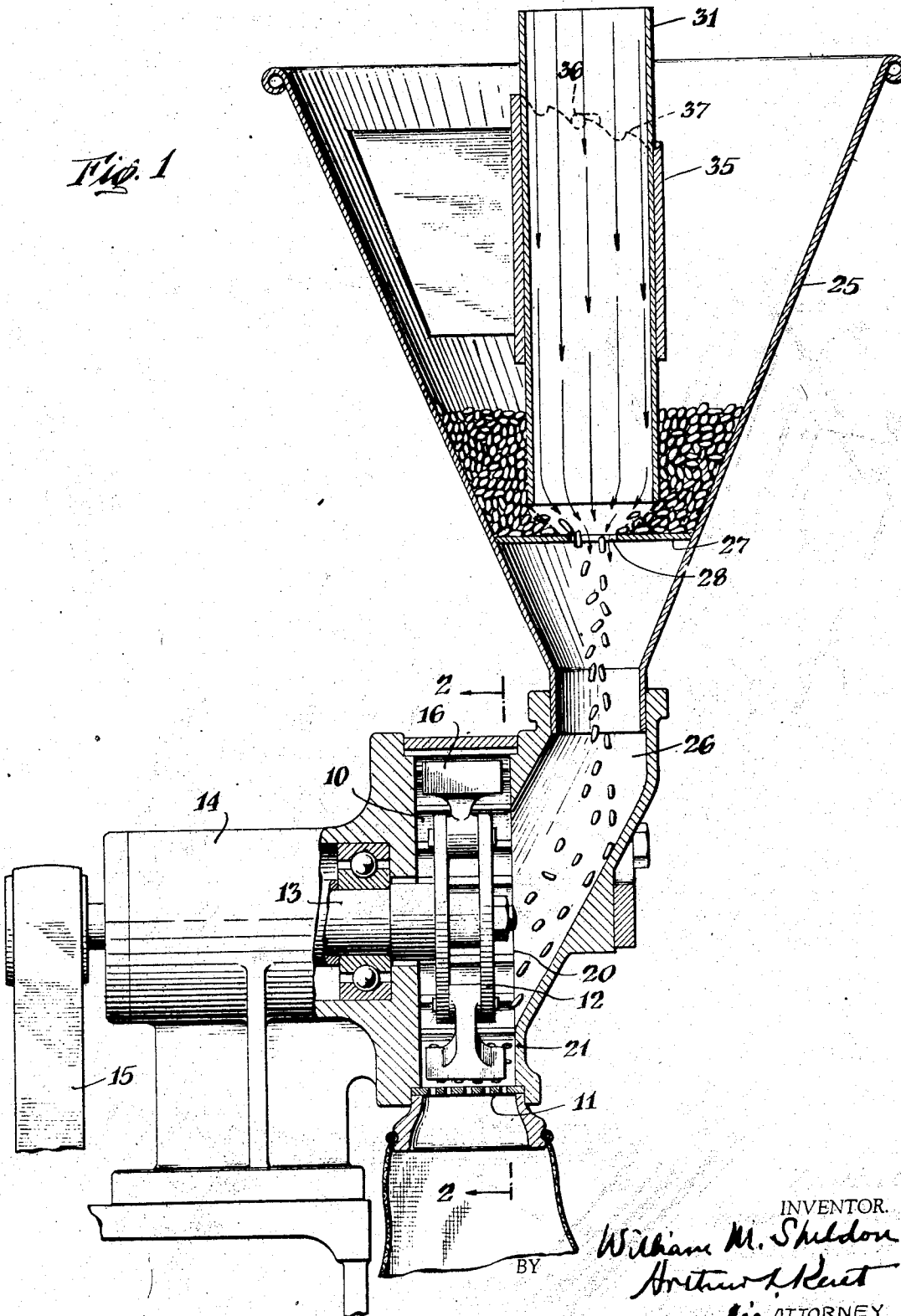
2,319,192

PULVERIZING MILL

Filed July 21, 1941

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Fig. 1



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Fig. 2

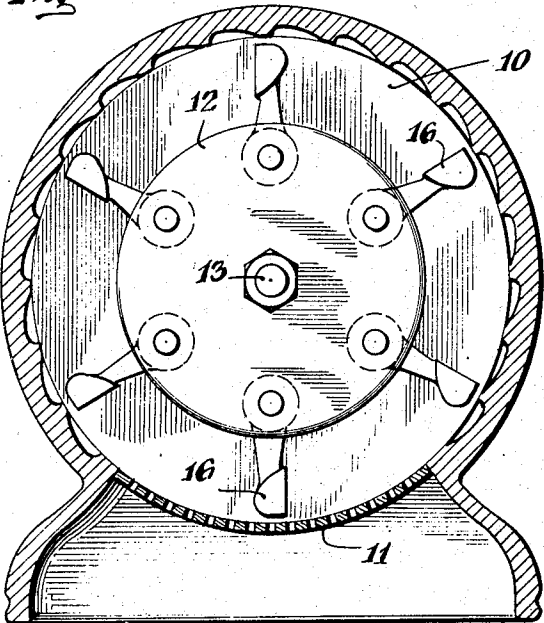


Fig. 4

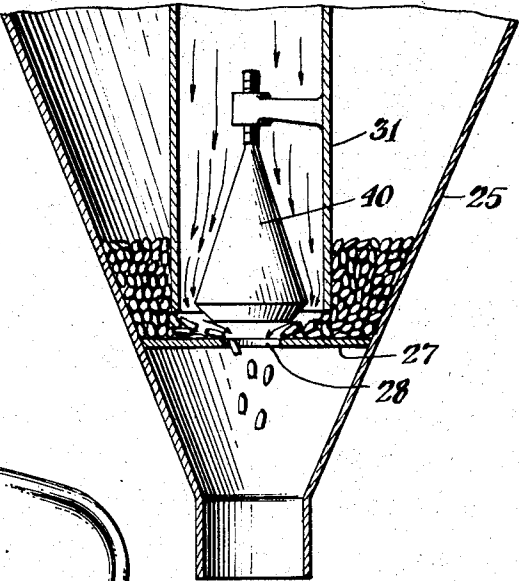
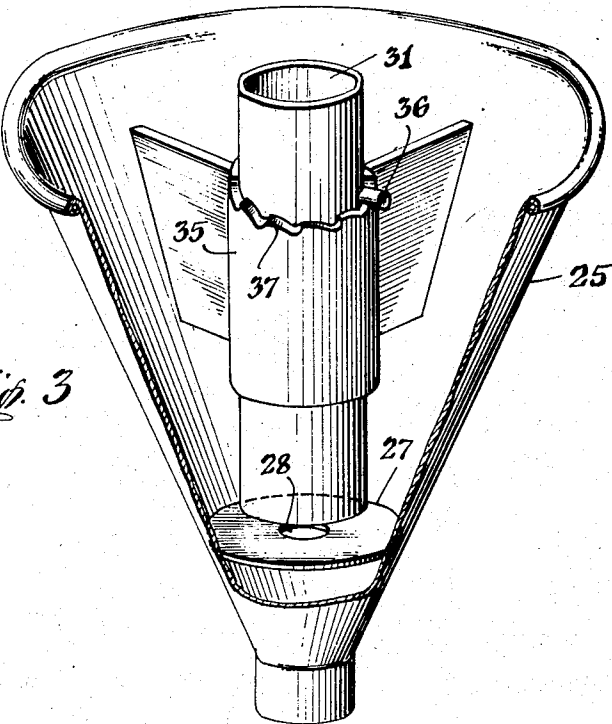


Fig. 3



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PULVERIZING MILL

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6 Claims. (Cl. 83-11)

This invention relates to pulverizing mills of the rotary beater, or hammer, type, that is, mills in which a high speed rotor having a plurality of circumferentially spaced hammers, or beaters, is mounted in a mill chamber a lower portion of the peripheral wall of which is formed by a screen or is otherwise provided with suitable openings for the escape of the pulverized material. More particularly, the invention relates to means whereby the material to be pulverized is supplied at a controlled rate to the mill chamber, and the object of the invention is to provide an improved pulverizing mill having feeding means which makes novel use of air flow induced by the negative pressure produced in the mill chamber by the high speed rotor.

A full understanding of the invention can best be given by a detailed description of a pulverizing mill embodying the invention in the form now considered best, and such a description will now be given in connection with the accompanying drawings illustrating such a mill, in which:

Fig. 1 is a sectional view of the mill taken on line 1-1 of Fig. 2;

Fig. 2 is a sectional view taken on line 2-2 of Fig. 1;

Fig. 3 is a perspective view of the material feeding means; and

Fig. 4 is a sectional view illustrating an alternative form of feeding means intended especially for feeding material of relatively high density.

Referring first to Figs. 1, 2 and 3, the drawings show a hammer mill of well-known form having a cylindrical mill chamber 10 formed by a casing the peripheral wall of which is imperforate except for a lower perforate portion, or screen, 11 for the escape of the pulverized material. A high speed rotor 12 is mounted in the mill chamber carried by a shaft 13 extending through bearings in a housing 14 and which carries a pulley for a belt 15 by which the shaft is rotated at high speed from a suitable motor. The rotor has the usual pivotally mounted circumferentially spaced hammers, or beaters, 16. The material to be pulverized enters the mill chamber through a feed opening 20 in the end wall 21 of the chamber adjacent the axis of rotation of the rotor, and most desirably concentric with the axis as shown. The material to be pulverized is supplied to the feed opening 20 from a hopper 25 through a closed passage 26. The hopper has a flat or slightly coned bottom 27 having a discharge opening 28 therein. An air inlet passage 30 is provided opening downward directly over the discharge opening 28, the outlet opening of

the air inlet passage being substantially larger than the discharge opening 28 and spaced away from the hopper bottom sufficiently to permit the material to pass beneath it. Most desirably, the air inlet passage is provided by a pipe 31 extending vertically downward within the hopper.

The air inlet pipe 31 is raised from the hopper bottom sufficiently to permit the material, when the mill is not in operation, to flow inward beneath the lower end of the pipe a short distance determined by its natural angle of repose, indicated by dotted lines in Fig. 1. The size of the pipe end with relation to the size of the discharge opening 28 is such that, if the pipe end is not spaced too far from the hopper bottom, a line from any point on the bottom edge of the pipe defining the angle of repose of the material will not pass through the discharge opening. Consequently, under static air condition no material will flow out through the discharge opening. When the mill is in operation, however, the rotor, acting as a suction fan, induces a strong current of air to flow down through the pipe 31 and through the discharge opening 28 and the closed passage 26 and through the feed opening 20 into the mill chamber, and this air current as it flows against and past the material beneath the end of the air inlet pipe sweeps material from the mass standing at its angle of repose and carries it inward and down through the discharge opening and through the passage 26 into the mill chamber. The material will thus be fed into the mill chamber at a controlled rate so long as the supply of material is maintained in the hopper and the mill is in operation; and when the mill stops this flow of material to the mill chamber also stops. The air pipe is most desirably a straight cylindrical pipe as shown, but, whatever its shape, it should be of sufficient cross-sectional size in all parts to avoid retardation of the air flow by reason of skin friction.

The rate at which the material is fed to a mill exerting a given suction from a hopper having a discharge opening of a given size and an air inlet pipe with a bottom or outlet end of a given size will depend on the spacing of the lower end of the air inlet pipe from the hopper bottom and may be varied within the feed range of the apparatus by raising or lowering the pipe. The air inlet pipe is therefore most desirably made vertically adjustable. For this purpose as shown, the air inlet pipe is mounted to slide within a supporting sleeve 35 fixed within the hopper and is supported in the sleeve by means of a stud or pin 36 extending from the pipe and resting on the

upper edge of the sleeve which is shaped as a stepped cam 37.

For the feeding of comparatively high density materials, such as lead sulphide in $\frac{1}{4}$ " and smaller pieces, it is better to have a restricted annular outlet opening at the lower end of the air pipe in order to cause the air to flow against the material at a higher velocity than it does when the pipe has an unobstructed open end. As shown in Fig. 4, the air pipe is provided with a restricted annular outlet opening by having a deflector 40 mounted centrally within the outlet end of the pipe. This deflector should be of a shape to avoid the causing of eddy currents and resulting flow resistance, and a conical deflector, as shown, mounted so as to be vertically adjustable has been found entirely suitable.

The new mill may be used to advantage for grinding or pulverizing all kinds of dry material in individual pieces or in granular condition, provided the material is not tacky or gummy. It has been found especially suitable for light materials such as wheat, oat, corn, buckwheat, rye and barley grains, split peas, and granulated sugar, and for such light materials a restricted annular outlet opening for the air pipe, provided either by means of a deflector or otherwise, has not been found to be needed. In feeding the higher density materials, however, it is better to provide a higher air flow velocity by having a restricted annular opening at the outlet end of the air pipe.

What is claimed is:

1. The combination with a pulverizing mill comprising a high speed rotor having a plurality of circumferentially spaced beaters mounted within a chamber having a suction feed opening adjacent the axis of rotation of the rotor, of means for supplying material to be pulverized to the feed opening of the mill at a controlled rate comprising a hopper for receiving the material to be pulverized having a bottom with a discharge opening therein, means providing a suction passage leading from said discharge opening to said suction feed opening, and means providing an air inlet pipe extending into the hopper the outlet end of which is substantially larger than said discharge opening and is positioned directly over said discharge opening and spaced from the hopper bottom sufficiently to permit material to pass beneath it.

2. The combination with a pulverizing mill comprising a high speed rotor having a plurality of circumferentially spaced beaters mounted within a chamber having a feed opening adjacent the axis of rotation of the rotor and having outlet openings in its peripheral wall for the discharge of the pulverized material; of means for supplying material to be pulverized to the feed opening of the mill at a controlled rate comprising a hopper for receiving the material to be pulverized having a bottom with a discharge opening therein, means providing a suction passage leading from said discharge opening to the feed opening of the mill chamber, and means providing an air inlet pipe extending into the hopper the outlet end of which is substantially larger than said discharge opening and is positioned directly over said opening and spaced from the hopper bottom sufficiently to permit material to pass beneath it.

3. The combination with a pulverizing mill comprising a high speed rotor having a plurality of circumferentially spaced beaters mounted within a chamber having a feed opening adjacent the axis of rotation of the rotor and having outlet openings in its peripheral wall for the escape of the pulverized material; of means for feeding material to be pulverized to the mill chamber at a controlled rate comprising a hopper for receiving the material having a bottom with a discharge opening therein, an air inlet pipe extending downward within the hopper, the open lower end of said pipe being substantially larger than said discharge opening and being directly over the opening and spaced from the hopper bottom sufficiently to permit the material to pass beneath it, means for adjusting said pipe toward and from the hopper bottom, and means providing a suction passage leading from the discharge opening of the hopper to the feed opening of the mill chamber.

4. The combination with a pulverizing mill comprising a high speed rotor having a plurality of circumferentially spaced beaters mounted within a chamber having a feed opening adjacent the axis of rotation of the rotor and having outlet openings in its peripheral wall for the escape of the pulverized material; of means for feeding material to be pulverized to the mill chamber at a controlled rate comprising a hopper for receiving the material having a bottom with a discharge opening therein, an air inlet pipe circular in cross-section extending downward within the hopper, the lower end of said pipe having a restricted annular outlet opening of substantially larger diameter than said discharge opening and being positioned concentric with said discharge opening and spaced from the hopper bottom sufficiently to permit the material to pass beneath it, and means providing a suction passage leading from the discharge opening of the hopper to the feed opening of the mill chamber.

5. The combination with a pulverizing mill comprising a high speed rotor having a plurality of circumferentially spaced beaters mounted within a chamber having a feed opening adjacent the axis of rotation of the rotor and having outlet openings in its peripheral wall for the escape of the pulverized material; of means for feeding material to be pulverized to the mill chamber at a controlled rate comprising a hopper for receiving the material having a bottom with a discharge opening therein, an air inlet pipe extending downward within the hopper, the lower end of said pipe being circular in cross-section and being substantially larger than said discharge opening and being directly over the opening and spaced from the hopper bottom sufficiently to permit the material to pass beneath it, a deflector circular in cross-section mounted centrally within the outlet end of the air pipe providing a restricted annular air outlet, and means providing a suction passage leading from the discharge opening of the hopper to the feed opening of the mill chamber.

6. A pulverizing mill as claimed in claim 5 in which the deflector is a vertically adjustable cone.

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