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1,586,282

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GRANULATING MILL

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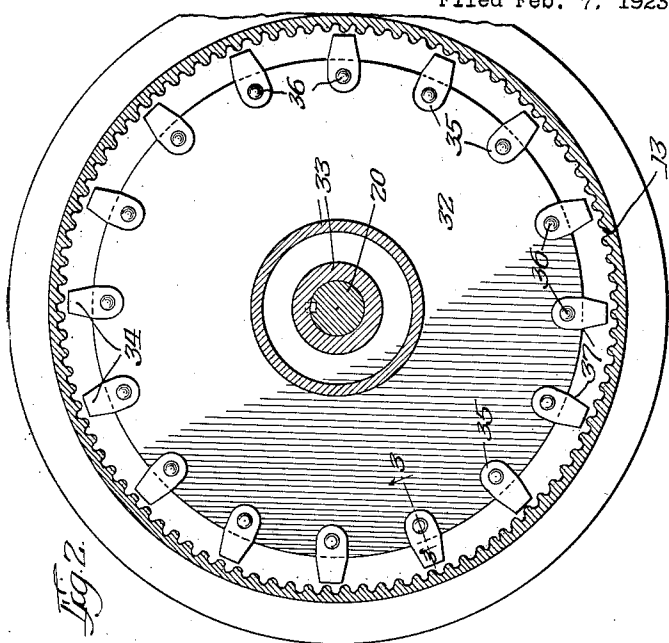


Fig. 2.

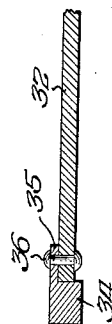


Fig. 3.

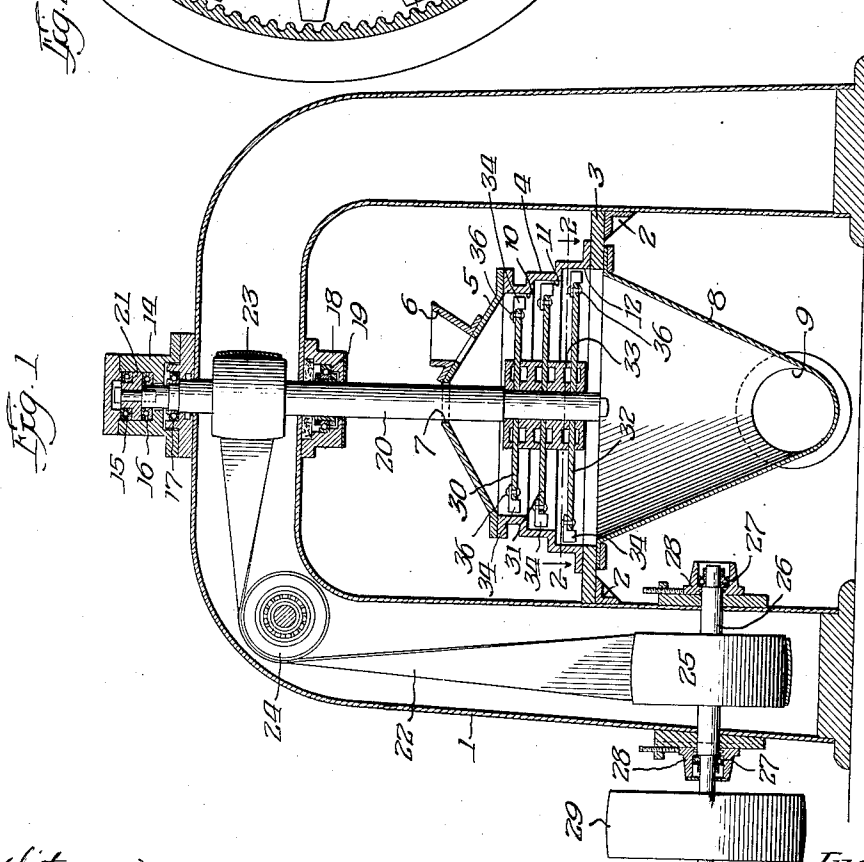


Fig. 1.

Witness:
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By

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UNITED STATES PATENT OFFICE.

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GRANULATING MILL.

Application filed February 7, 1923. Serial No. 617,482.

The present invention relates to mills for pulverizing or reducing various materials by impact. Among its objects are the provision of a mill in which the force of impact increases in proportion to the fineness of the material, and in which the material will pass through the mill rapidly, and in which the rotor is supported without bearings in or below the impact chamber.

10 In the drawing, which illustrates a preferred embodiment of the invention,—

Figure 1 is a vertical section of a mill embodying the invention.

15 Figure 2 is a section on the line 2—2 in Figure 1, and

Figure 3 is a section on the line 3—3 in Figure 2.

The mill comprises a frame 1 having a projection or projections 2 on which an annular support 3 is secured. A casing 4 is mounted on the support 3 and is provided with a cover 5 having a feed opening 6 and a central aperture 7. The casing 4 comprises a plurality of cylindrical portions 10, 11 and 25 12 which increase in diameter successively, and preferably uniformly, toward the lower or discharge end of the casing. The internal cylindrical surface of the casing is formed with longitudinally extending corrugations 13. As illustrated in Figure 1, the 30 lower end of the casing 4 is entirely open and a chute 8 opens from the lower end of the casing, the upper end of the chute being substantially co-extensive with the open 5 lower end of the casing. A pipe 9 extends from the chute 8 to convey material to the desired place.

A housing 14 supported by the frame is provided with suitable anti-friction bearings 40 such as 15, 16 and 17 and a second housing 18 secured to the frame is provided with a suitable anti-friction bearing such as 19 vertically spaced from the previously mentioned bearings. A shaft 20 is journaled in 45 the several bearings by which it is wholly supported, preferably by suspending it on one of the bearings by a collar 21 secured to the shaft. The shaft may be rotated by any suitable mechanism. The mechanism illustrated comprises a belt 22 engaging pulleys 50 23, 24 and 25, the latter being carried by a shaft 26 journaled in bearings 27 in housings 28, the shaft being also provided with a driving pulley 29. The frame 1 is hollow 55 and houses most of the operative mechanism

just described so as effectually to protect it from dust.

The shaft 20 projects through the opening 7 in the cover downwardly into the casing 4. Within the casing a plurality of disks 60 30, 31 and 32, spaced apart by blocks 33, are secured to the shaft 20. The disks are positioned respectively in the several cylindrical portions of the casing and increase in diameter successively toward the discharge 65 end of the casing, the diameters preferably increasing uniformly and preferably in proportion to the diameters of the cylindrical portions of the casing. In the mill illustrated there is one disk in each cylindrical 70 portion. In some instances it is desirable to position two or more disks of the same diameter in each cylindrical portion of the casing and the claims are intended to include a 75 construction in which the disks increase in diameter in successive groups as well as in successive single disks.

A plurality of beaters 34 are secured in spaced relation around the periphery of each of the disks 30, 31 and 32. Preferably the 80 same number of beaters are mounted on each disk and the beaters of one disk are staggered with relation to the beaters of the preceding disk. It will be noted that each disk is of such diameter as to underlie the beat- 85 ers of the preceding disk. Each beater 34 is preferably provided with a flange 35 by which it is secured to the disk as by a rivet 36. The beater projects substantially equal 90 distances above the top side and below the bottom side of the disk and that part of the beater which projects radially beyond the edge of the disk is formed with an outwardly 95 receding front face (that is, receding when the direction of rotation is considered). For practical reasons this portion is preferably formed with outwardly converging front and rear faces 37.

In operation material is fed to the chamber through the inlet opening 6. As the 100 material strikes the first disk it is thrown outwardly by centrifugal force until it reaches the edge of the disk and drops into the rotary path of the beaters carried by the first disk. The impact of the beaters breaks 105 up and reduces the material, which drops onto the succeeding disk. The corrugations in the casing prevent the material from following around the casing. It has been discovered that the receding front wall of the 110

beaters increases the disintegrating effect of their blows and also renders them co-operative with the casing by driving the material against the sides of the corrugations. When the material drops onto the second disk it is again thrown outwardly and drops into the path of the beaters on the second disk and so progresses through the mill. The peripheral speed of the beaters carried by the disks is successively greater and consequently as the material progressing through the mill becomes finer and more difficult to reduce it is subjected to blows of correspondingly increasing force. It is important that the material pass through the mill as rapidly as possible so as to avoid the deleterious effect of heat caused by the action of the mill. A mill embodying this invention produces a strong air current flowing from the feed end toward the discharge end of the casing and this current, in addition to gravity, serves to carry the material through the impact chamber with great rapidity. The construction described provides for the immediate discharge of reduced material from the chamber so that it cannot pile up into contact with the lower disk and be subjected by friction to heat which would cause many materials to form a solid mass requiring stoppage of operation of the mill. The production of this outwardly flowing air current through the chamber eliminates the necessity for packing the opening 7 around the shaft 20 and effectually avoids dust above and around the mill. By the construction described the rotor is supported wholly above the feed opening and all bearings in or below the impact chamber are eliminated.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In a mill for granulating materials without substantial attrition or excessive heating, the combination of a vertically disposed casing increasing in diameter downwardly, a plurality of horizontal vertically spaced imperforate disks, rotatably supported therein and increasing in diameter downwardly, the casing having an inlet above the disks, there being a substantially unobstructed passage between the casing and the said rotating disks through the granulating zones, a substantially free discharge around the entire periphery of the lower disks, a delivery chute open from the lower end of the casing and substantially coextensive at its upper end with the lower end of the casing, a plurality of beaters spaced around the peripheries of the several disks and project-

ing radially therefrom, and means for constricting the movement of the material to substantially a vertical path.

2. In a mill for granulating materials without substantial attrition action or excessive heating, the combination of a frame, a vertically disposed casing increasing in diameter from the top to bottom and being of maximum diameter at its lower end, a rotatable shaft supported in the frame entirely above the casing and extending downwardly into the casing, a plurality of horizontal vertically spaced imperforate disks fixed on the shaft within the casing, said disks being of progressively increasing diameter from the upper to the lowermost disk, a plurality of beaters arranged in spaced relation around the peripheries of the disks and projecting radially therefrom, said casing having an inlet above the disks for feeding the material downwardly through successive granulating zones, there being substantially a free passage for the materials between the disks and the casing, and a substantially free final discharge of the granulated material peripherally extended about the final disk, means for constricting the flow of the material in substantially a vertical path throughout the granulating zones, and means operatively associated with said casing for receiving the finished granulated product.

3. In a mill for granulating materials without substantial attrition action or excessive heating, the combination of a vertically disposed casing, a plurality of horizontal vertically spaced imperforate disks rotatably supported therein, a multiplicity of beaters secured to and circumferentially spaced around the peripheries of said disks, said disks and beaters being spaced from the inner periphery of said casing and defining successive impact granulating zones, said casing having an inlet above the disks, said disks and casing affording a substantially unobstructed downward passage of the material through the granulating zones and a substantially free discharge for the granulated material peripherally extended about the final disk, means for constricting the material to move in substantially a vertical path through the granulating zones, and means for progressively increasing the impact force of the beaters in the successive granulating zones to thereby reduce the material to a substantially uniform degree of fineness.

In witness whereof, I hereunto subscribe my name this 3rd day of February, 1923.

FRANK L. BRYANT.