March 22, 1927. 1,621,869

F. L. BRYANT

METHOD OF GRANULATING DRY MATERIALS

Filed July 12, 1924

Fig. 1.

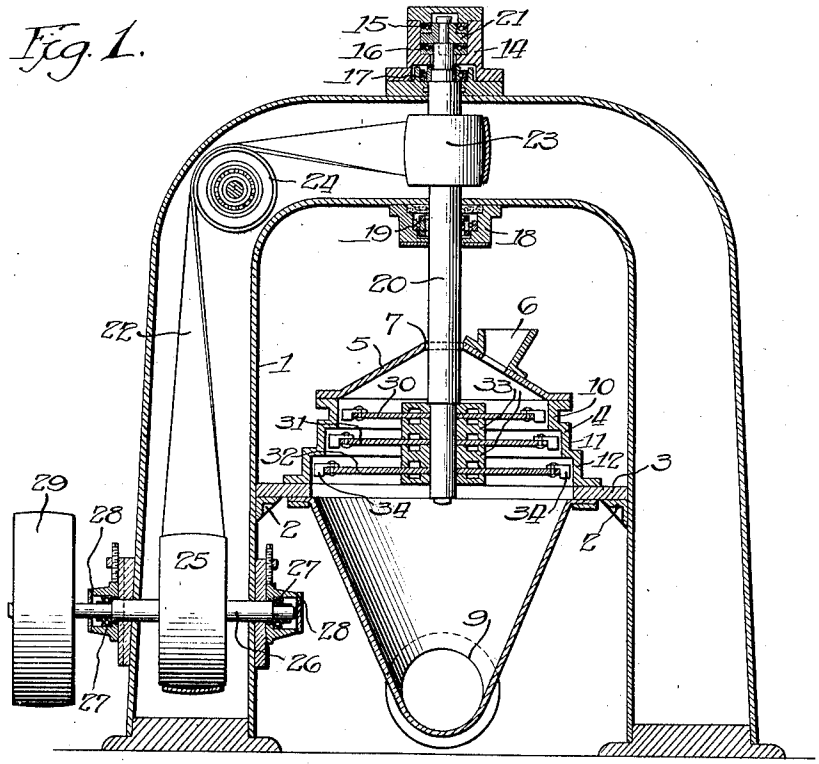
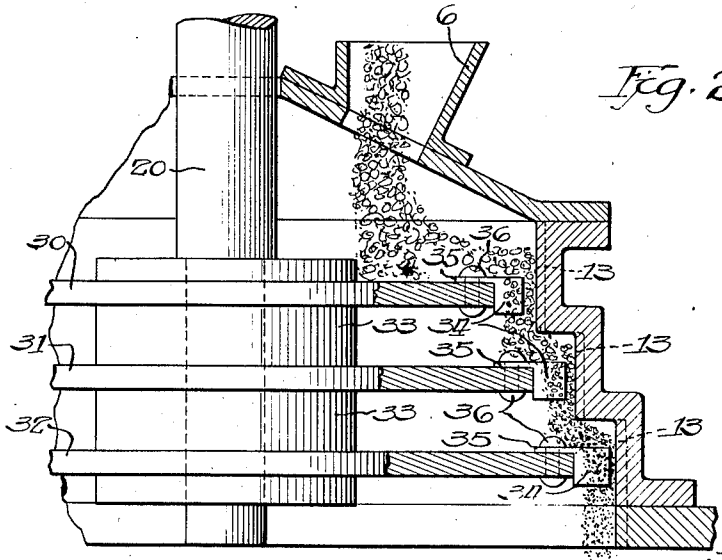


Fig. 2.



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Patented Mar. 22, 1927. 1,621,869

UNITED STATES PATENT OFFICE.

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METHOD OF GRANULATING DRY MATERIALS.

Application filed July 12, 1924. Serial No. 725,548.

The present invention relates to methods of pulverizing and reducing to fine powder form various dry granular materials which are of such a nature that they cannot successfully be pulverized by abrasion or grinding. Thus far the only successful method of reducing such material to the desired degree of fineness consists in imparting to the material in a flowing stream a succession of impact blows by which the particles are broken up and reduced in size without excessive heating, such as occurs in grinding mills, which heating causes the material to cake and solidify, thus defeating the intended result. My present invention relates to a process of treatment on the impact principle. Heretofore, so far as I am aware, in carrying out this broad method of reduction by impact, the material in a flowing stream has been subjected successively to impact blows of equal intensity. I have discovered that by subjecting the material to a succession of impact blows delivered with successively increasing force, a superior result is obtained and the material is more perfectly and effectively brought to the desired pulverized form.

The invention is capable of being carried out by various kinds and forms of apparatus; but, in order that one practical means for practicing the invention may be known I have, in the accompanying drawing, disclosed a form of mill designed to carry out my improved method of pulverizing and grinding material which forms the subject matter of an application filed by me on the 7th day of February, 1923, Serial No. 617,482 and referring to the drawing—

Fig. 1 is a vertical section; and

Fig. 2 is an enlarged fragmentary view partly in elevation and partly in vertical section of the flow controlling and impact mechanism, showing the general course of the material passing therethrough.

Referring to the drawing, the mill therein, shown comprises an inverted U-shaped frame 1 provided with ledges 2 on which an annular support 3 is mounted. A casing 4 is mounted on the support 3 and is provided with a cover 5 having a feed chute 6 and a central aperture 7. The lower end of the casing 4 is entirely open and registers with the inner periphery of the support 3, and to the under side of the latter a discharge chute 8 extends downwardly and communicates with a pipe 9 through which the pulverized material is conveyed to any desired place of delivery.

The casing 4 comprises a plurality of cylindrical portions 10, 11 and 12 which increase in diameter successively, and preferably uniformly, toward the lower or discharge end of the casing. The internal cylindrical surface of each section of the casing is preferably formed with longitudinally extending riffles or teeth 13.

A housing 14 mounted on top of the frame 1 is provided with suitable anti-friction bearings such as 15, 16 and 17, and a second housing 18 secured to the under side of the top member of the frame is provided with suitable anti-friction bearings such as 19 vertically spaced from the previously mentioned bearings. A shaft 20 is journaled in 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; that illustrated comprising a belt 22 engaging pulleys 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 and houses most of the operating mechanism just described so as to effectively protect it from dust.

The shaft 20 projects through the opening 7 in the cover 5 downwardly into the casing 4. Within the casing a plurality of discs 30, 31 and 32, spaced apart by blocks 33, are secured to the shaft 20. The discs are positioned respectively in the several cylindrical portions of the casing, and increase in diameter successively toward the lower discharge 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 disc in each cylindrical portion. If desired, two or more discs of the same diameter may be located in each cylindrical portion of the casing, in which case the successive groups of discs will be of increasing diameter from top to bottom of the casing.

A plurality of beaters 34 are secured in spaced relation around the periphery of each of the discs 30, 31 and 32. Preferably the same number of beaters will be mounted on each disc and the beaters of one disc staggered with relation to the beaters of the next

adjacent disc. Each disc is of such diameter as to underlie the beaters of the preceding disc. Each beater is preferably formed with a flange 35 by which it is secured to the disc as by a rivet 36. The beater projects substantially equal distances above the top side and below the bottom side of the disc.

In operation, the material in dry granular form is fed to the chamber through the feed hopper 6. As the material falls on the first disc it is thrown outwardly by centrifugal force until it reaches the edge of the disc and drops by gravity into the rotary path of the beaters carried by the first disc. The impact of the beaters, delivered crosswise of the direction of flow of the material, breaks up and reduces the latter, which drops onto the succeeding disc, some of it being thrown against the riffles or corrugations 13 in the casing, by which the material is additionally impacted, and prevented from whirling around the casing. When the material drops onto the second disc it is again thrown outwardly by centrifugal force and then drops by gravity into the path of the beaters on the second disc, and in this manner progresses through the mill. The peripheral speed of the beaters carried by the discs 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 reducing process be carried out as rapidly as possible so as to avoid the deleterious effect of heat thereon. A mill such as that described produces a strong air current flowing from the feed end toward the discharge end of the casing, and this current, aided by gravity, serves to carry the material through the impact chamber with great rapidity, and also to carry off such heat as is generated. The apparatus described also provides for the immediate discharge of the reduced material from the lower chamber so that it cannot pile up into contact with the lower disc and be subjected to the heat of friction which would cause many materials to form a solid mass requiring stoppage and clearing out of the mill.

From the foregoing it will readily be understood that the apparatus shown and described is in no sense a grinding mill, but an impact mill designed to handle light, dry material, such, for instance, as acid phosphate used in the preparation of commercial baking powders. The pulverizing is accomplished mainly by the blows of the beaters against the material passing over the peripheral edges of the discs, and the casing is not a grinding element, but a mere retainer or restrainer of the material, with the riffles or teeth, where employed, cooperating in a measure with the beaters in the impacting of the material. As hereinabove stated, the subjection of the material to a succession of impact blows delivered with successively increasing force at successive stages of the flow of the material, whereby the latter is reduced to a predetermined degree of fineness without attrition or excessive heating, constitutes the chief novel and most important feature of the present method or process; and the apparatus hereinabove described and shown in the drawing is well adapted to carry out this method of treatment although, manifestly, the same method is capable of being caried out by many other and specifically different forms of apparatus employing the same principle of action on the material; and hence the described method of treatment is by no means dependent upon the apparatus herein shown and described, which is presented for the purpose of illustration and to teach the public at least one practical means by which the novel method of treatment may be carried into effect.

I claim—

1. The method of granulating materials by impact without substantial attrition or excessive heating, which consists in placing all of the particles thereof in suspension and feeding the same downwardly through successive annular granulating zones, and while in suspension imparting to them a succession of impact blows at different horizontal planes while constricting the material to move in substantially a vertical path through the granulating zones, causing said blows to be delivered with successively increasing force during the gravitation of said particles until the material is reduced to a substantially uniform degree of fineness, and causing a substantially free passage of the material throughout the granulating zones and annular final discharge.

2. The method of granulating materials by impact without substantial attrition or excessive heating, which consists in placing all of the particles thereof in suspension and feeding the same downwardly through successive annular granulating zones while restraining the particles to move in substantially vertical paths, and while in suspension imparting to them a succession of impact blows during the passage of the material through the granulating zones and while the materials are gravitating downwardly, causing said blows to be delivered with succes sively increasing force during the gravitation of the particles through the successive granulating zones until the material is reduced to a substantially uniform degree of fineness, and causing a substantially free passage of the material throughout the granulating zones and annular final discharge.

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