April 19, 1932. A. A. HOLBECK 1,855,171

UNIT PULVERIZER

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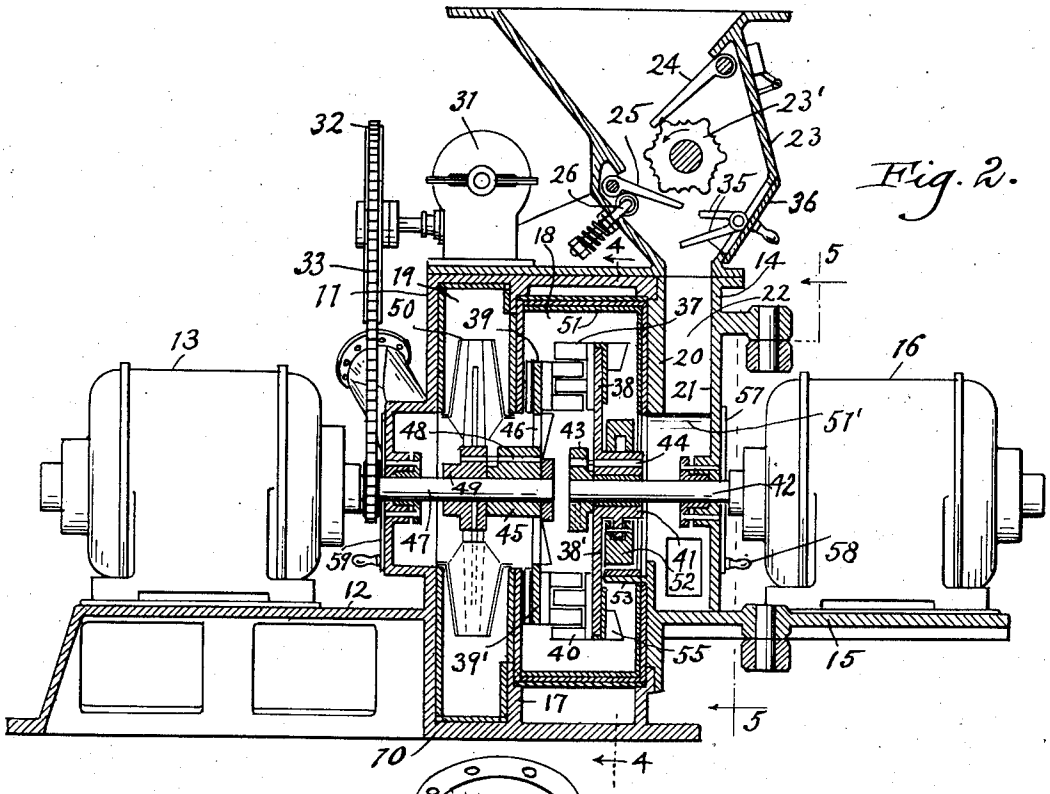


Fig. 2.

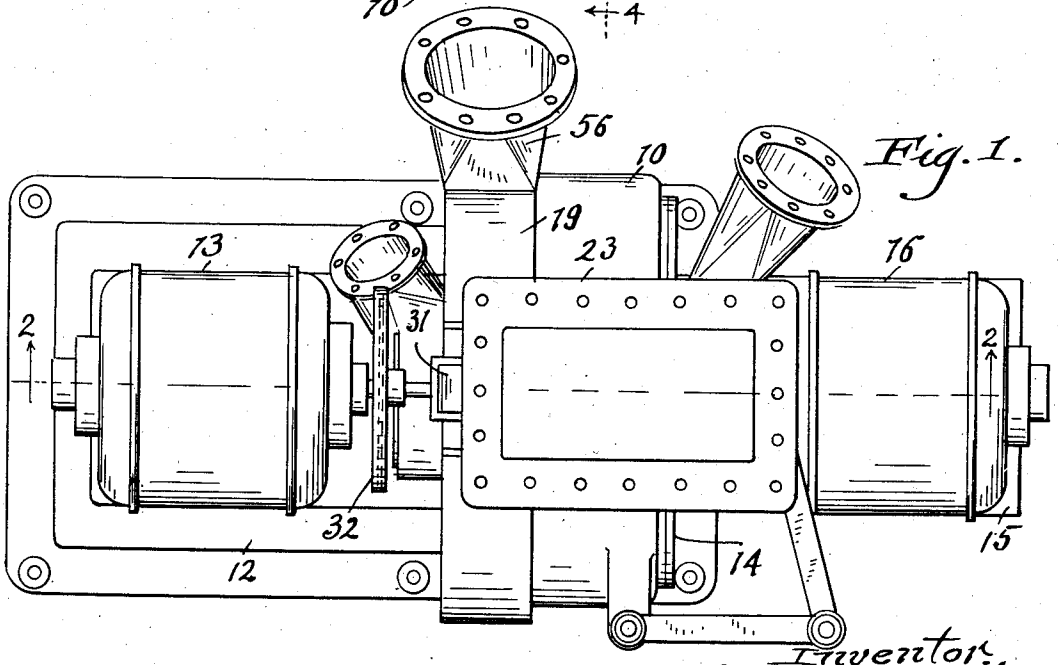


Fig. 1.

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Fig. 6.

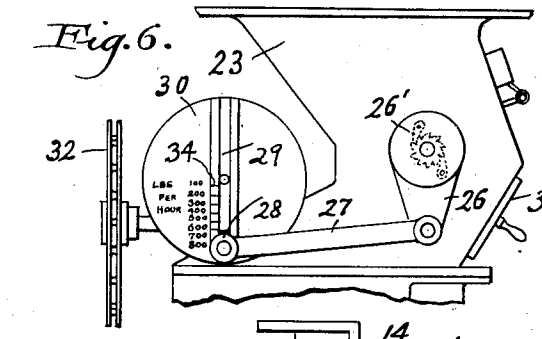


Fig. 3.

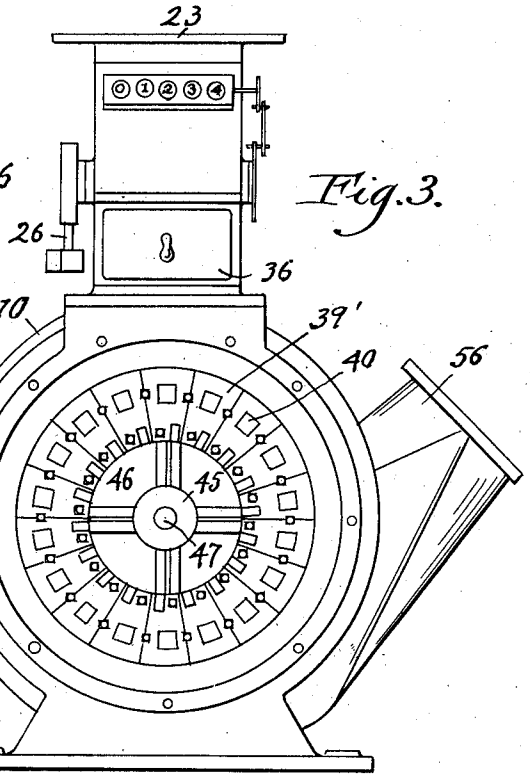


Fig. 5.

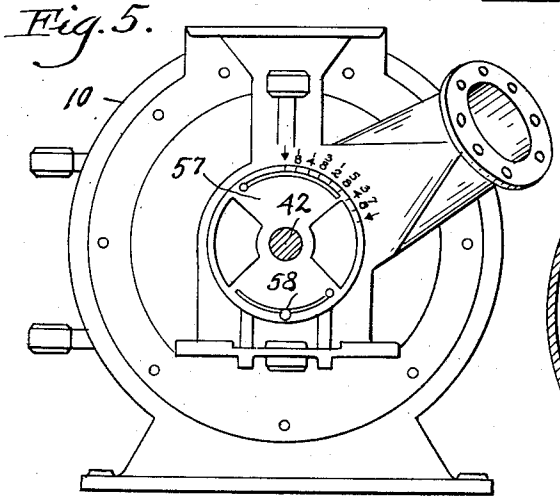
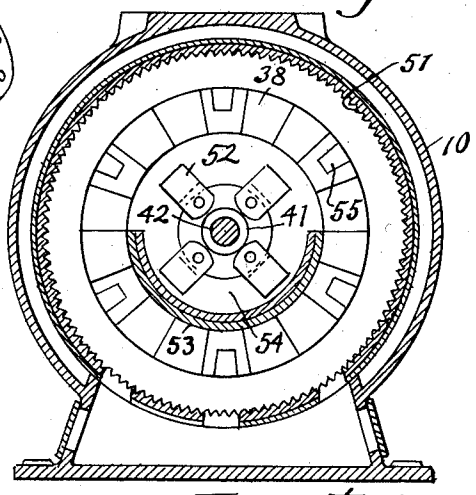


Fig. 4.



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UNITED STATES PATENT OFFICE

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UNIT PULVERIZER

Application filed January 3, 1931. Serial No. 506,414.

This invention relates to pulverizing machines of the type disclosed in my prior Patent No. 1,724,876, granted August 13, 1929, and as its principal object aims to provide an improved machine of this kind.

Another object of this invention is to provide a machine of the kind mentioned, having rotary pulverizing means from which the pulverized material is removed by a flow of air traversing said means in opposition to centrifugal force acting on the material.

Another object of this invention is to provide a machine of the kind mentioned, having rotary pulverizing means, to the exterior of which material to be pulverized is fed, and from the interior of which the pulverized material is removed.

Still another object of this invention is to provide a machine of the kind mentioned, having cooperating rotary elements forming a pulverizing unit, to the exterior of which material to be pulverized is fed, and from the interior of which pulverized material is removed against the action of centrifugal force, by a flow of air through said unit.

A further object of this invention is to provide a machine of the kind mentioned having a pulverizing chamber with a rough inner surface and with a pulverizing unit therein, and in which the means for feeding material to the exterior of the unit includes rotary means for throwing the material against said rough inner surface.

The invention may be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the appended claims.

In the accompanying sheets of drawings,

Figure 1 is a plan view of a pulverizing machine constructed according to my invention;

Fig. 2 is a longitudinal sectional elevation taken on line 2—2 of Fig. 1;

Fig. 3 is an end elevational view of the machine showing the casing cover in the open position;

Fig. 4 is a sectional elevation taken on line 4—4 of Fig. 2;

Fig. 5 is a sectional elevation taken on line 5—5 of Fig. 2; and

Fig. 6 is a partial elevation view of the feed hopper.

In the pulverizing machine disclosed in my prior patent mentioned above, material to be pulverized is fed to the interior of cooperating rotatable elements and the pulverized material is discharged substantially radially therefrom by a blower associated with one of the elements. In the operation of a machine of this design, centrifugal force acts in conjunction with the flow of air created by the blower. The machine disclosed in the accompanying drawings, to which detailed reference will presently be made, represents an improvement over the machine disclosed in my prior patent and involves a novel principle of construction and operation, wherein a flow of air acts on the material in substantially the opposite direction from that in which centrifugal force acts.

In this machine I have provided cooperating rotatable elements, comprising a pulverizing unit, to the exterior of which material to be pulverized is supplied, and from the interior of which pulverized material is removed by creating a flow of air through the unit in opposition to centrifugal force acting on the material. Before proceeding with a detailed description of this machine, however, it should be understood that the principle of my invention may be embodied in various machines other than the particular one which has been shown herein for the purpose of illustration.

As shown in the drawings, this machine is provided with a casing 10 having an end wall 11 from which a base 12 extends laterally for supporting the driving motor 13, and having at its opposite end a hinged cover plate 14 from which the base 15 extends laterally for supporting another driving motor 16. The interior of this casing is divided by the partition 17 into the substantially cylindrical pulverizing chamber 18 and the volute discharge chamber 19. The cover plate 14 is constructed with wall portions 20 and 21 spaced apart to provide the passage 22 for

supplying material to the pulverizing chamber from the hopper 23.

This hopper is mounted upon the casing of the machine so that the discharge opening at its lower end registers with the passage 22 of the cover plate 14. For controlling the feeding of material from the hopper into the passage 22, I provide the hopper with a rotatable feed member or roll 23'. An inclined plate member 24, which is pivoted to the hopper structure above the roll 23', protects the latter against damage by material falling into the hopper and also aids the flow of material into the hopper by deflecting it toward the entering side of the roll. A second plate 25 is pivoted to the hopper structure below the roll 23', and is normally pressed toward the latter by means of the spring actuated plunger 26. This latter pivoted plate prevents the material from falling directly through the hopper into the passage 22, and cooperates with the feed roll 23' to enable the latter to positively control and regulate the feeding of the material. As shown in Fig. 2 of the drawings, the exterior surface of this feed roll is of irregular or corrugated form, so that upon rotation thereof material will be pressed or scraped against the plate 25 and fed downwardly to the passage 22.

For actuating the roll 23' in such a way that the rate of feed through the hopper can be readily controlled, I provide a lever 26 which is operably connected to one end of the roll shaft by means of the ratchet 26', and which is oscillated by means of the connecting rod 27 pivoted to one end thereof. At its other end this connecting rod is pivoted to a block or cross-head 28 which is slidable in the slot 29 of the rotatable disk 30. The disk is arranged to be driven continuously in one direction by reduction gearing which is located in the housing 31, and which is, in turn, driven from the motor 13 by means of the sprocket 32 and the chain 33 cooperating therewith. A series of graduations 34 is arranged along the edge of the slot 29 of the rotatable disk 30, and by adjusting the position of the block 28 in the slot to correspond with a graduation representing a desired rate of feed, the length of the crank arm, which determines the extent of movement of the lever 26 and likewise the speed of rotation of the feed roll 23', is correspondingly varied, and in this way the feeding of material can be regulated and controlled as desired.

As the material passing through the hopper is discharged from between the feed roll and the plate 25, this material comes in contact with a plurality of permanent magnets 35 extending into the hopper. These magnets are mounted adjacent an opening in the hopper wall which is closed by a removable plate 36, and when foreign metallic particles have accumulated on the magnets the cover plate is removed to permit the foreign particles to be brushed off the magnets.

For pulverizing the material fed into the machine by the hopper 23, I provide a hollow rotary pulverizing unit 37 in the pulverizing chamber 18. This unit comprises a pair of rotatable intermeshing elements 38 and 39 between which the material is pulverized. These elements may be of any suitable form and arrangement, such as that shown in the drawings, wherein they consist of spaced, substantially parallel disks 38' and 39' each having a plurality of rows of circumferentially spaced blocks 40 thereon. The rows of blocks of each disk are spaced apart radially of the disk a distance slightly greater than the radial thickness of one block, and, moveover, the rows of one disk are located at different radial distances from the axis of rotation than the corresponding rows of the other disk so that an intermeshing of the rows of blocks is obtained, as clearly shown in Fig. 2 of the drawings. Near the centers of the disks the blocks are omitted so as to provide the pulverizing unit 37 with a hollow interior from which the pulverized material may be removed, as will be presently explained. The blocks may be made of any suitable material and may be removably secured to the disks in any desirable manner, such as by being made integral with sectional face plate members which are bolted directly to the disks.

The disk 38' is made imperforate and is provided with a hub portion 41 which is journaled upon a shaft 42 which is driven by the motor 16. A driving connection between the disk 38' and the shaft 42 is established by providing the shaft with a collar 43 at its inner end which is connected to the hub portion 41 by the break pin 44. The disk 39' is provided with a central hub portion 45 and is formed with an opening 46 therethrough intermediate this hub portion and the portion upon which the blocks 40 are secured. The hub portion 45 is journaled upon the shaft 47 which is driven by the motor 13, and is drivingly connected to this shaft by means of the break pin 48 which extends into this hub portion and into the hub portion 49 of the blower 50, which is also secured to the shaft 47 so as to be driven thereby for a purpose to be presently disclosed. It will be understood, of course, that relative rotary movement may be provided between the cooperating elements 38 and 39 by running the driving motors 13 and 16 at different speeds in the same direction, but preferably by running these motors at substantially the same speed but in opposite directions.

The interior wall of the pulverizing chamber 18 is substantially circular in form and is provided with a lining 51 having a corrugated or otherwise roughened inner surface which assists in breaking up the material preparatory to its passage between the ele-

ments 38 and 39 of the pulverized unit 37. As material is fed downwardly in the passage 22 from the hopper, this material moves axially of the casing through a central opening 51′ provided in the wall portion 20, and is thrown outwardly against the roughened inner surface of the pulverizing chamber by an arrangement of circumferentially spaced rotary hammers 52, shown in Figs. 2, 3 and 4 of the drawings. These hammers are pivoted to the hub portion of the disk 38′ and upon rotation of this disk throw the material received through the opening of the wall 20 outwardly against the rough inner surface of the pulverizing chamber. To direct the supply of material toward the hammers, I provide a laterally extending flange 53 adjacent the lower half of the opening through the wall portion 20. This flange cooperates with the pivoted hammers to form pockets, as indicated at 54 in Fig. 4, which receive the material from the passage 22. Upon rotation of the disk member 38′, these pockets are emptied successively when the material is thrown out of the same by centrifugal force and against the rough inner surface of the pulverizing chamber, whereby some of the material is caused to be broken up. In addition to the pivoted hammers provided on the disk member 38′, this member may also be provided adjacent its outer edge with circumferentially spaced blades or vanes 55 which agitate the material in the pulverizing chamber and prevent it from becoming packed or clogged therein.

The material fed into the pulverizing chamber by the rotation of the hammers 52 is supplied to the exterior or outer periphery of the hollow pulverizing unit 37. This material enters between the blocks of the outer row, and in passing radially inwardly with respect to the axis of rotation of the disk members, is pulverized between the cooperating rows of blocks. As the material becomes fine, as a result of the pulverizing action of the blocks, it is drawn into the hollow interior of the pulverizing unit by a flow of air which traverses or passes between the disk members in an inward radial direction, or, in other words, in a general direction opposed to the direction of centrifugal force acting on the material. This flow of air is created by the fan 50 driven by the shaft 47 of the motor 13. In addition to causing a flow of air through the pulverizing unit to withdraw the pulverized material therefrom, this fan also forces air and pulverized material out of the casing through a discharge nozzle 56 for delivery to any desired point of use.

For admitting to the casing the air which is to be drawn inwardly through the pulverizing unit by the fan 50, I provide the shutter or damper 57 on the cover plate 14. This shutter is concentric with the shaft 42 and is adapted to be rotated by the handle 58 so as to regulate the cross-sectional area of openings through the cover plate 14, and thereby control the rate of flow of air into the casing. If it is found during the operation of the machine that more air is required for discharging the pulverized material than can be admitted through the damper 57, I provide a similar damper 59 for controlling the cross-sectional area of supplemental air openings through the end wall 11.

In operation of my pulverizing machine, material to be pulverized is fed into the passage 22 by the hopper in the manner already described. This material is then delivered laterally from the passage 22 through the central opening of the wall portion 20 into the pockets formed between the hammers 52. The material is thrown out of these pockets and against the rough inner surface of the pulverizing chamber and thereby supplied or fed to the exterior of the rotary pulverizing unit 37. The material supplied to the pulverizing unit then passes between the rows of cooperating blocks of the rotatable elements 38 and 39 and is reduced to a fine pulverized form. The rotation of these elements causes centrifugal force to act upon the material, with the result that there is a tendency for the larger particles of material to move outwardly from between the blocks and these larger particles are thus prevented from passing between the blocks until they have been reduced to a fine pulverized form. The blower 50 causes a flow of air to pass inwardly between the disks of the elements 38 and 39, and to withdraw the pulverized material from between the blocks into the hollow interior of the pulverizing unit, from whence it is withdrawn by the blower and is delivered out through the discharge nozzle 56.

It will be understood, of course, that, if desired, suitable wear-resisting renewable lining material may be applied to various surface portions of the machine, but since the provision of such lining material does not form an essential part of my invention, detailed reference to the same has not been made.

It will now be readily seen that I have provided an improved pulverizing machine in which the material to be pulverized is fed to the exterior of a rotary pulverizing unit and is removed in pulverized form from the interior of this unit by causing a flow of air to traverse the unit in opposition to the centrifugal force acting on the material. By this arrangement it will be readily seen that the larger particles of material are prevented from passing through the pulverizing unit, while, on the other hand, the pulverized material can be readily withdrawn from the unit by the blower since the centrifugal force created by the rotation of the unit is more effective upon the large particles than it is

upon the pulverized material. It will also be seen that in throwing the material against the rough inner surface of the pulverizing chamber lumpy material is broken up as it is being fed to the exterior of the pulverizing unit.

By making up the pulverizing unit of two cooperating elements, both of which are rotatable and are adapted to be driven in opposite directions by separate or individual driving motors, it is possible to obtain high speed and more efficient cooperation between the elements, making possible a compact unit of comparatively small size.

While I have illustrated and described the pulverizing machine of my invention, it should be understood, however, that I do not intend to limit myself to the precise details and arrangements of parts illustrated and described, but regard my invention as including such changes and modifications as do not involve a departure from the spirit of the invention and the scope of the appended claims.

Having thus described my invention, I claim:

1. In a machine of the character described, the combination of a casing, cooperating oppositely rotatable elements in said casing adapted to pulverize material therebetween, driving means for causing relative rotary movement between said elements, means for supplying material to be pulverized to said elements substantially at the outer periphery thereof, and means for causing air to flow between said elements in a direction substantially opposite to the centrifugal force acting on said material.

2. In a machine of the character described, the combination of a casing, rotary means in said casing including cooperating oppositely rotatable elements for pulverizing material supplied thereto, means for supplying material to the outer periphery of said rotary means, and discharge means including a blower for causing a flow of air through said rotary means to remove pulverized material from the interior thereof.

3. In a machine of the character described, the combination of a casing, cooperating oppositely rotatable elements in said casing adapted to pulverize material therebetween, individual driving means for said elements for causing relative rotary movement therebetween, means for supplying material to said elements substantially radially inwardly with respect to the axis of said rotary movement, and means causing a flow of air for removing pulverized material from said elements in opposition to centrifugal force acting on said material.

4. In a machine of the character described, the combination of a casing, cooperating oppositely rotatable elements in said casing forming a hollow unit adapted to pulverize material supplied thereto, driving means for said elements for causing relative rotary movement therebetween, means for supplying material to be pulverized to the outer periphery of said unit, and means for removing pulverized material from said unit through the hollow interior thereof in opposition to centrifugal force acting on the material.

5. In a machine of the character described, the combination of a casing, cooperating oppositely rotatable elements in said casing forming a hollow unit adapted to pulverize material supplied thereto, individual driving means for said elements for causing relative rotary movement therebetween, means for supplying material to be pulverized to the outer periphery of said unit, and discharge means including air-flow creating means for removing pulverized material from said unit through the hollow interior thereof in opposition to centrifugal force acting on the material.

6. In a machine of the character described, the combination of a casing having a pulverizing chamber provided with a rough inner surface, cooperating oppositely rotatable elements in said casing forming a unit adapted to pulverize material supplied thereto, individual driving means for causing relative rotary movement between said elements, means for supplying material to said unit substantially at the outer periphery thereof including rotary means associated with the driving means for one of said elements for throwing said material against said rough inner surface, and discharge means for removing pulverized material from the interior of said unit including a blower associated with the driving means for the other of said elements.

In testimony whereof, I hereunto affix my signature.

AUSTIN A. HOLBECK.