Oct. 19, 1937. D. K. BEACH 2,096,274

PULVERIZING APPARATUS

Filed Feb. 19, 1935

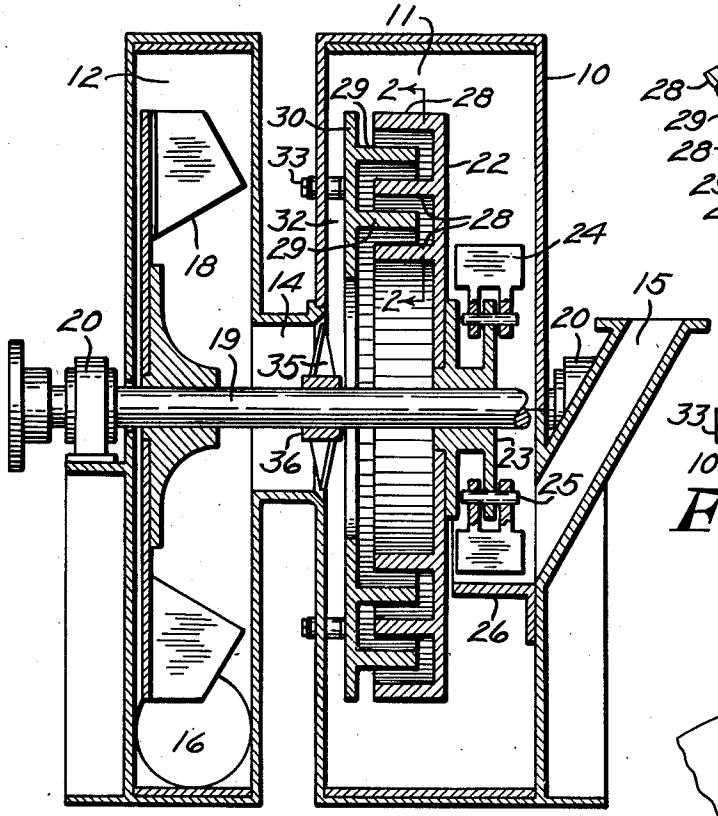


Fig. 1

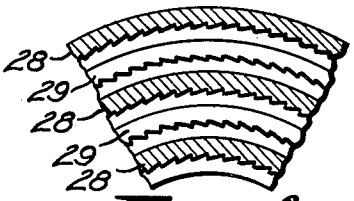


Fig. 2

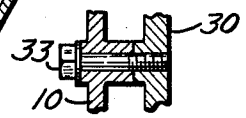


Fig. 3

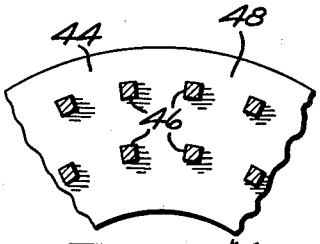


Fig. 7

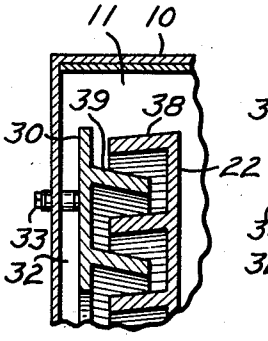


Fig. 4

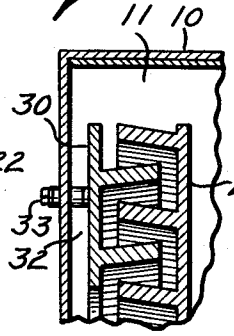


Fig. 5

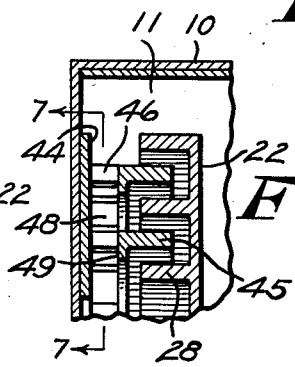


Fig. 6

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PULVERIZING APPARATUS

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4 Claims. (Cl. 83—11)

This invention relates to pulverizing apparatus, and more particularly to apparatus of the type having a rotor revoluble at high speed and arranged to reduce material to a fine powder which is removed from the machine by means of an air current.

The various parts of a machine of this type are subject to wear from contact with the material, this wear being particularly serious on the rotor. As a result of such wear the machine ceases to grind the material with sufficient fineness, and the worn parts must be replaced. Moreover, it has been found difficult to construct the revolving parts with sufficient strength to withstand the enormous centrifugal forces involved, particularly in the smaller machines.

It is accordingly the main object of the invention to provide a comparatively simple and inexpensive pulverizing apparatus which will reduce material to a fine powder with comparatively little wear on the revoluble parts of the machine.

It is a further object of the invention to provide a pulverizing apparatus so constructed and arranged that it will reduce material to a uniformly fine powder regardless of such wear as may occur on the revoluble parts of the machine.

It is a further object of the invention to provide a pulverizing apparatus which may be constructed in comparatively small sizes with parts revoluble at very high speeds without danger of breakage of parts.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a longitudinal section through a pulverizing apparatus;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a detail in section of the supporting means for the stationary pulverizing elements;

Fig. 4 is a fragmentary view showing a modification;

Fig. 5 is a fragmentary view showing a second modification;

Fig. 6 is a fragmentary view showing a third modification; and

Fig. 7 is a section on the line 7—7 of Fig. 6.

The embodiment illustrated in the drawing comprises a casing 10 shaped to provide a pulverizing chamber 11 and a fan chamber 12 laterally adjacent thereto, the two chambers being connected by a centrally located passage 14 forming an outlet for the pulverizing chamber. An inlet chute 15 for coarse material leads to the central portion of the pulverizing chamber at the side opposite to the outlet 14, and a tangentially located outlet 16 is provided for the fan chamber. A suitable fan 18 is arranged to revolve within the fan chamber, the fan being mounted on a horizontal shaft 19 supported in bearings 20. This shaft extends adjacent to the outlet 14 and preferably through the center thereof.

A vertical revoluble rotor disk 22 is provided within the pulverizing chamber 11, this disk being mounted on a hub 23 secured to the shaft 19. The disk 22 is spaced from the adjacent walls of the chamber, and the space at the inlet side of the disk is utilized as a preliminary pulverizing or crushing zone. For this purpose I provide a series of hammers 24, which are arranged to strike the coarse material as it is delivered into their path by means of the chute 15. These hammers are secured to the hub 23 by means of suitable pivot pins 25. A stationary plate 26 extends horizontally beneath the hammers to form a support for the entering material, this plate being mounted on the adjacent wall of the chamber.

The fine pulverization of the material is effected in the space or zone at the outlet side of the disk 22. For this purpose I provide a series of annular flanges 28 concentric with the shaft 19 and projecting from the disk 22 in the general direction of the outlet 14. These flanges serve as pulverizing elements which reduce the material by a rubbing action or attrition. In order to direct the material properly to the inner surfaces of the flanges 28, I provide stationary annular flanges 29 which overlap and interfit with the revolving flanges to form a zigzag passage for the material. The flanges 29 are likewise concentric with the shaft 19 and they project toward the disk 22 from an annular vertical plate 30. This plate is spaced from the adjacent casing wall to provide a passage 32 leading from the peripheral portion of the pulverizing chamber 11 to the central portion thereof. The plate 30 may be supported from the casing wall by means of screws 33. In the preferred construction the inner surfaces of the flanges 28 and 29 are ribbed or corrugated, as shown particularly in Fig. 2. Because of the annular construction of the plate 30, the central space surrounded by the flanges 28 is in direct communication with

the outlet 14 through the central opening in the plate.

Means is provided to prevent the escape of coarse particles of material through the outlet passage 14. For this purpose I prefer to utilize propeller-shaped rejector blades 35 which revolve across the outlet and hurl back into the pulverizing chamber any coarse particles which may reach them. The blades 35 are mounted on a hub 36 secured to the shaft 19.

The operation of the invention will now be apparent from the above disclosure. The shaft 19 is rotated at high speed by any suitable source of power. The coarse material is supplied to the chute 15 by means of a suitable feeding mechanism, and falls into the path of the hammers 24, which break up the material into comparatively small particles. The fan 18 produces a powerful air current which carries the particles of material around the outer edge of the rotor disk 22 and thence inwardly through the passage 32. Particles which are sufficiently fine continue to travel with the air current through the passage 14 into the fan chamber 12 and thence through the outlet 16 to a place of use or deposit. The coarse particles, on the other hand, are struck by the rejector blades 35 and hurled back into the central portion of the pulverizing chamber, where they are picked up by the outwardly flowing air current produced by the revolving flanges 28. The particles then travel outwardly through the zigzag passage defined by the flanges 28 and 29. As each particle reaches a stationary flange 29 its tangential velocity is greatly reduced by friction, and as it reaches a revolving flange 28 its tangential velocity is greatly increased by friction. This results in a pronounced rubbing action or attrition on each particle of material, which rapidly reduces its size. The centrifugal force produced by the rapid rotation will cause a layer of material to remain in contact with the inner surface of each flange, and particularly the revolving flanges 28. This effect is enhanced by the corrugations, which tend to prevent relative movement in a tangential direction between the flanges and the material in contact therewith. The layer of material on each flange forms a protection against wear, and the pulverization is largely effected by the rubbing action or attrition of the particles against this protecting layer.

When the outwardly flowing particles of material reach the peripheral portion of the pulverizing chamber, they will be picked up immediately by the air current flowing through the machine and carried inwardly through the passage 32 to the outlet 14. Particles of sufficient fineness will escape, and coarse particles will be returned by the rejector blades 35 for further pulverization. It will be seen that no effort is put forth in grinding particles to an unnecessary degree of fineness, for the fine particles are immediately removed from the machine. On the other hand, coarse particles will remain in the machine and may make several trips into contact with the revolving flanges if necessary to pulverize them to the desired degree. As a result of this action, the efficiency of the machine is very high and the ground product will be unusually uniform in size.

The annular flanges 28 are exceedingly strong and are ideally shaped to withstand the stresses set up by rotation at high speeds. Moreover, these flanges afford comparatively large areas of surface for contact with the material being pulverized, so that wear upon these surfaces is very small indeed. This wear is still further reduced by the protecting action of the layer of material held against the flanges by centrifugal force. Furthermore, such wear as does occur will not vary the area of the flanges or affect the fineness of pulverization.

In case the material being pulverized is of a particularly abrasive nature, it may be desirable to increase the thickness of the protecting layer of material by constructing the flanges as shown in Fig. 4. In this figure I have shown revolving flanges 38 and stationary flanges 39, the flanges of each set having inner surfaces which slope inwardly at a slight angle as they approach the flanges of the other set. With this construction, more pronounced pockets are formed by the flanges and their supporting plates to aid in retaining the material.

If the material is soft and readily pulverized, it may be desirable to utilize the modified construction illustrated in Fig. 5. In this figure I have shown revolving flanges 41 and stationary flanges 42, the flanges of each set having inner surfaces which slope outwardly at a slight angle as they approach the flanges of the other set. With this construction, the pulverization will be effected to a larger degree by the rubbing action of the flanges themselves against the material.

In Figs. 6 and 7 I have shown a modification in which an annular plate 44 is mounted directly against the inner wall of the pulverizing chamber. Stationary flanges 45 are supported in spaced relation with the plate 44 by means of bars 46 connecting these parts. This construction provides a passage 48 leading from the peripheral portion of the pulverizing chamber to the central portion thereof. The flanges 45 are shown formed with ribs 49 projecting inwardly from the edge adjacent to the passage 48 to prevent material from escaping laterally from the flanges into the passage. The operation of this construction will be similar to that of the embodiment illustrated in Fig. 1.

It will be noted that in each of the several constructions disclosed the annular flanges which pulverize the material are unapertured, so that the material can escape from each flange only by passing around the edge thereof. This makes it possible to retain on each flange a protecting layer of material of more or less thickness dependent upon the slope of the flange.

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

1. A pulverizing apparatus comprising a stationary casing shaped to provide a pulverizing chamber having a centrally located outlet in one wall thereof, two relatively revoluble concentric unapertured annular flanges located in the pulverizing chamber and overlapping in an axial direction, the flanges being spaced from said wall to provide a passage leading from the peripheral portion of the chamber to the outlet, the space surrounded by the flanges being in direct communication with the outlet, means to deliver coarse material to the peripheral portion of the chamber, and means to produce a current of air through the outlet and thus remove the fine material in suspension.

2. A pulverizing apparatus comprising a stationary casing shaped to provide a pulverizing chamber having a centrally located outlet in one wall thereof, a rotor mounted within the chamber and rotatable about an axis extending adja-

cent to the outlet, an unapertured annular flange projecting from the rotor in the general direction of the outlet, a second unapertured annular flange overlapping the inner surface of the first flange and spaced therefrom and from the rotor, both the flanges being spaced from the said wall to provide a passage leading from the peripheral portion of the chamber to the outlet, the space surrounded by the flanges being in direct communication with the outlet, means to deliver coarse material to the peripheral portion of the chamber, and means to produce a current of air through the outlet and thus remove the fine material in suspension.

3. A pulverizing apparatus comprising a stationary casing shaped to provide a pulverizing chamber having a centrally located outlet in one wall thereof, means dividing the chamber into a crushing zone at the side opposite the outlet and a pulverizing zone at the side adjacent the outlet, the two zones being connected only in the peripheral portion of the chamber, means to deliver coarse material to the crushing zone, means in the crushing zone to crush the coarse material, two relatively revoluble concentric unapertured annular flanges located in the pulverizing zone and overlapping in an axial direction, the flanges being spaced from said wall to provide a passage leading from the peripheral portion of the chamber to the outlet, the space surrounded by the flanges being in direct communication with the outlet, and means to produce a current of air through the outlet and thus remove the fine material in suspension.

4. A pulverizing apparatus comprising a stationary casing shaped to provide a pulverizing chamber having a centrally located outlet in one wall thereof, a rotor mounted within the chamber and rotatable about an axis extending adjacent to the outlet, the rotor serving to divide the chamber into a crushing zone at the side opposite the outlet and a pulverizing zone at the side adjacent the outlet, the two zones communicating only around the periphery of the rotor, an unapertured annular flange projecting from the rotor into the pulverizing zone, a stationary annular flange overlapping the first flange axially and concentric therewith, both flanges being spaced from said wall to provide a passage leading from the peripheral portion of the chamber to the outlet, the space surrounded by the flanges being in direct communication with the outlet, means to deliver coarse material to the crushing zone, means in the crushing zone to crush the coarse material, and means to produce a current of air through the outlet and thus remove the fine material in suspension.

DAVID K. BEACH.