Sept. 7, 1965 C. D. PARTEN 3,204,881

PULVERIZING APPARATUS

Original Filed Jan. 28, 1959 2 Sheets-Sheet 1

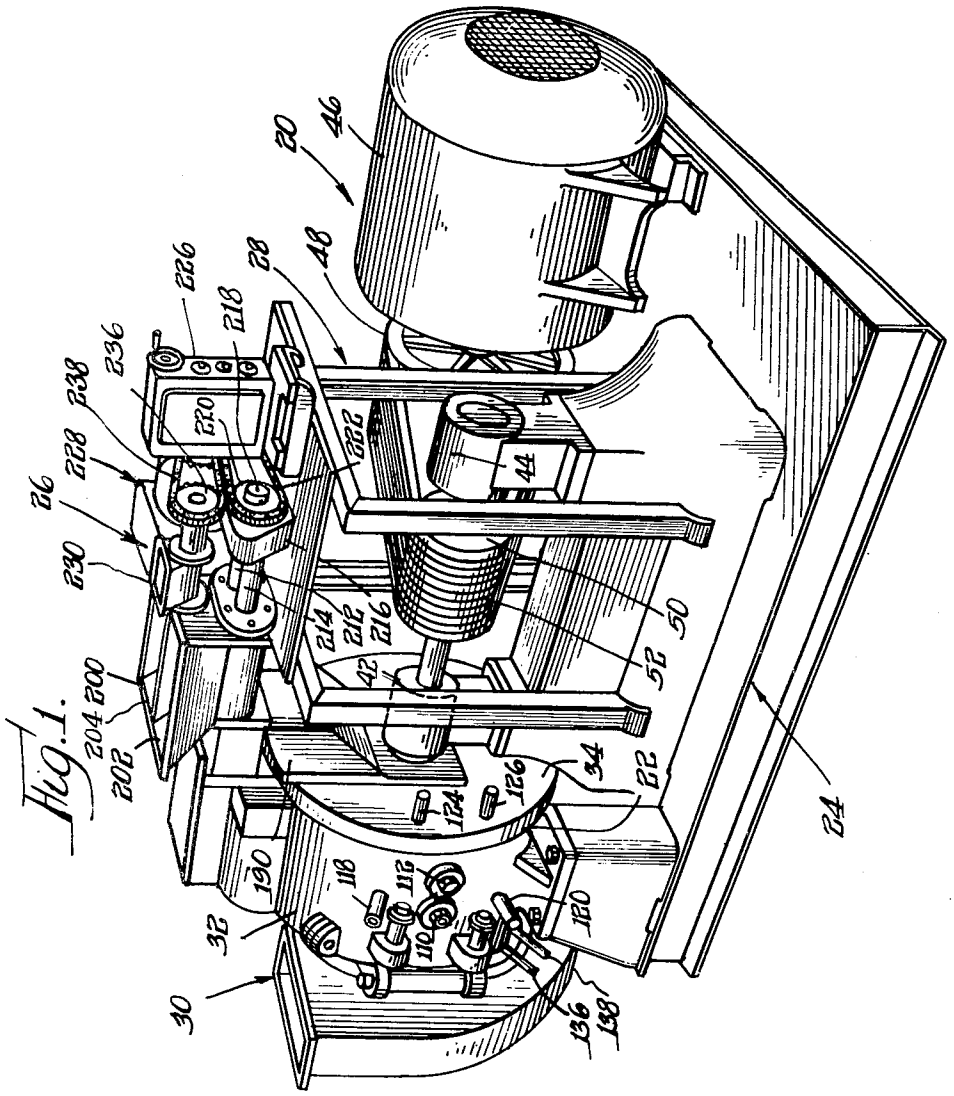


Fig. 1.

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Fig. 3.

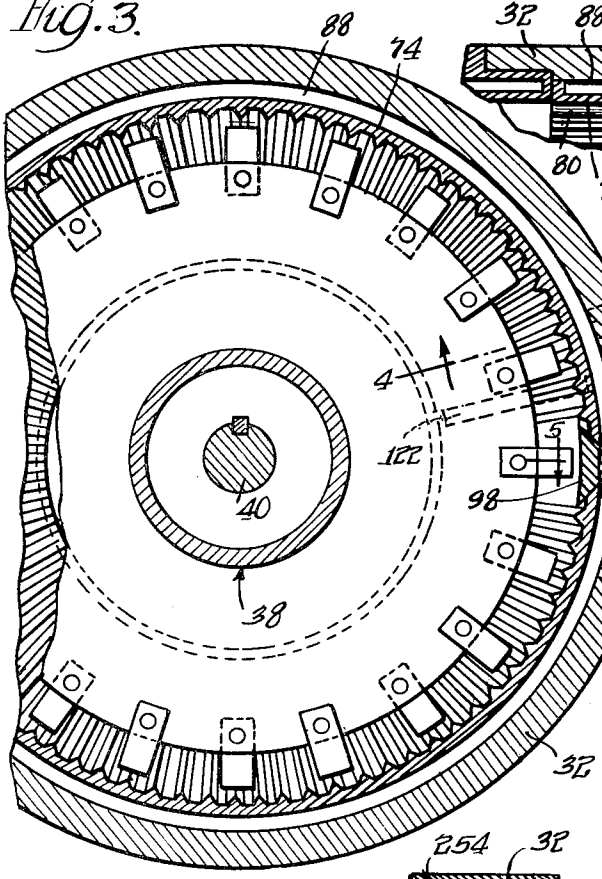


Fig. 4

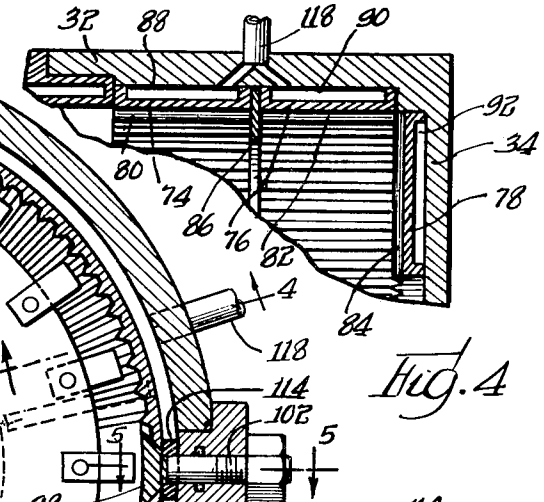


Fig. 5

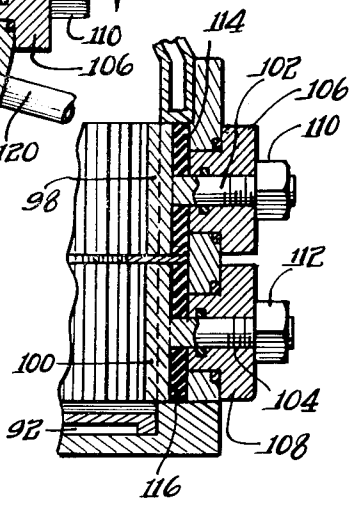
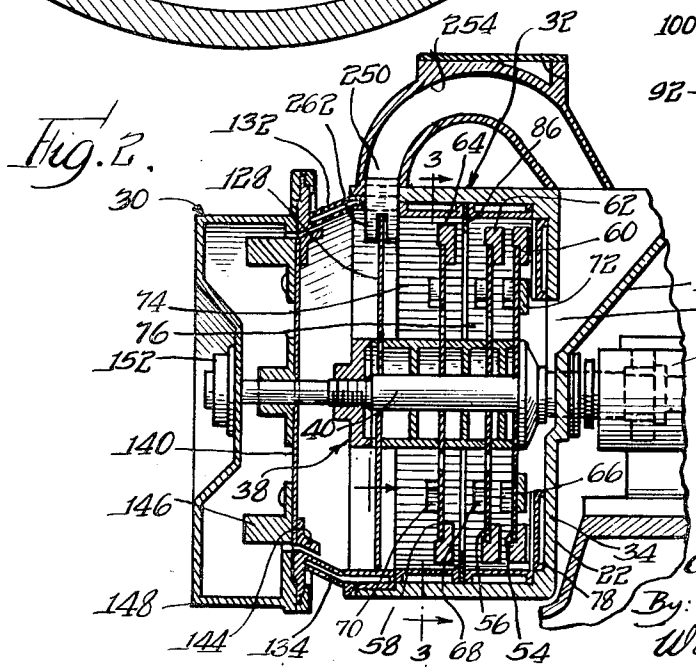


Fig. 2.



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PULVERIZING APPARATUS

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Original application Jan. 28, 1959, Ser. No. 789,544, now Patent No. 3,082,962, dated Mar. 26, 1963. Divided and this application Aug. 31, 1962, Ser. No. 220,724
4 Claims. (Cl. 241—66)

This is a division of application Serial No. 789,554, filed January 28, 1959, now Patent No. 3,082,962.

The present invention relates to a novel grinding or pulverizing apparatus, and more particularly to a novel so-called "air-swept" type grinder or pulverizer wherein the material to be processed is carried through the apparatus with a flowing stream of gas or air.

An apparatus of the type contemplated herein is capable of grinding or pulverizing a material to provide a fine powder. It will be appreciated that certain materials to be ground or pulverized can be damaged by the heat created during the grinding operation, and it is, therefore, an object of the present invention to provide a novel apparatus which is constructed for more efficiently cooling the material during the grinding operation so as to reduce any possibility of injury to the material as a result of overheating.

Other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a perspective view showing an apparatus incorporating features of the present invention;

FIG. 2 is a fragmentary partial substantially vertical and longitudinal sectional view of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged fragmentray cross sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 in FIG. 3; and

FIG. 5 is a fragmentary sectional view taken along line 5—5 in FIG. 3.

Referring now more specifically to the drawings wherein like parts are designated by the same numerals throughout the various figures, an apparatus 20 incorporating features of the present invention is shown best in FIGS. 1 and 2 and is provided with grinding or pulverizing chamber means 22 supported on a suitable base structure 24. An assembly generally designated by the numeral 26 is supported above the base means by a suitable frame structure 28 for feeding one or more ingredients to the pulverizing or grinding means 22, and fan means 30 is associated with the pulverizing or grinding means 22 for drawing air or gas therethrough, which air or gas is utilized for directing pulverized material to a desired point of discharge.

The pulverizing or grinding means 22 comprises a housing having a cylindrical outer wall 32 and an end wall 34 having an ingredient inlet opening 36 therethrough. A grinding or pulverizing rotor generally designated with the numeral 38 is provided, which rotor has an elongated shaft 40 extending through a suitable opening in the end wall 34 and rotatably supported by bearings 42 and 44 mounted on the base means 24. The rotor shaft is driven by any suitable means such as an electric motor 46 having a drive pulley 48 fixed on its output shaft, which drive pulley is connected with a pulley 50 on the rotor shaft 40 by belt means 52.

The rotor means is provided with a plurality of beater plates 54, 56 and 58 fixed on the shaft 40 within the housing walls 32 and 34. The beater plates which are preferably imperforate, respectively carry sets of peripheral

circumferentially spaced beater blocks or blades 60, 62 and 64 and also sets of blades or beater blocks 66, 68 and 70 at opposite sides thereof. In addition, the beater plate 54 has an annular series of spaced blade or block members 72 fixed on its side facing the end wall 34 and spaced radially inwardly from the peripheral blocks.

Liner members 74 and 76 are disposed within the cylindrical housing portion 32 and an annular liner member 78 is disposed against the inner surface of the housing end wall 34, which liner members respectively have inner ribs or corrugations 80, 82 and 84 as shown best in FIGS. 4 and 5 for cooperation with the beater blades or blocks to grind and pulverize material passing through the apparatus.

As will be understood, the material enters the milling chamber through the opening 36 with a flowing stream of air or gas and is directed radially outwardly between the beater plate 54 and the liner member 78. The partially ground material then passes around the beater plate 54 and between the beater plates 54 and 56 and then around the beater plate 56. As the beating or pulverizing action progresses, a circulating swirling motion is imparted to the air or gas and material entrained therein so that the larger particles gravitate toward the liner member 76. In order to obtain further pulverizing or grinding action on these particles, a reclassifier or baffle ring 86 is provided between the liner members 74 and 76 for directing the material radially inwardly so that it will be acted upon by the elements carried by the beater plate 58.

Considerable heat will be generated by the grinding process as the material flows around the beater plates, and cooling means is provided for preventing overheating and injury to the material. In accordance with a feature of the present invention, more efficient cooling is obtained by forming channels in the liner members 74, 76 and 78 so that the liner members cooperate with the housing portions 32 and 34 to provide fluid coolant passageways 88, 90 and 92 as shown in FIGS. 2, 3, 4 and 5. It is important to note that with this arrangement the coolant is in direct contact with the liner members so that the most effective cooling of these liner members and, thus, the material being ground adjacent to and contacting the liner members is obtained.

The liner members 74 and 76 must fit within the cylindrical housing 32 snugly in order to prevent coolant from leaking from the passageways 88 and 90. This is accomplished easily and relatively economically in accordance with the present invention by splitting the liner members 74 and 76 and by providing them with beveled ends between which wedging blocks 98 and 100 are forced. As shown in FIGS. 3 and 5, the wedge members are respectively secured to studs 102 and 104 which extend outwardly through bushings 106 and 108 mounted in the housing wall 32. Nut members 110 and 112 are threaded onto the outer ends of the studs for drawing the wedge members firmly against the beveled ends of the liner members or rings so as to expand the rings into aggressive engagement with the interior surface of the cylindrical wall 32. Strips 114 and 116 of resilient sealing material are provided between the wedging blocks 98 and 100, respectively, and the outer wall 32 for interrupting the fluid passageways 88 and 90. As shown in FIGS. 1, 3 and 4, a conduit 118 is connected with the cylindrical housing wall 32 and communicates with both of the passageways 88 and 90 for directing liquid coolant to the passageways at one side of the strips 114 and 116, and a drain conduit 120 communicates with these passageways at the opposite sides of the strips. Similar strip means 122 (see FIG. 3) is provided for interrupting the passageway 92, and branch fluid inlet and outlet conduits

124 and 126 are connected with the passageway 92 at opposite sides of the strip 122. It will be appreciated that the fluid inlet conduit 118 will be connected to any suitable source of coolant such, for example, as water.

In addition to the above-mentioned beater plates, the rotor includes a perforated mill plate 128 having a plurality of small apertures 130 of predetermined size therethrough. Properly ground or pulverized material is carried by an air stream through the apertures 130 while relatively large particles of the material are retarded and gravitate toward the periphery of the mill plate for recirculation in the manner described in the above-mentioned copending application.

The rotor shaft extends from the mill plate through an inwardly tapered housing portion 132 secured to the cylindrical wall 32. The housing portion 132 is formed with internal substantially annular coolant passageway means 134 which is interrupted in much the same manner as the passageway 92 and is connected with branch coolant inlet and drain lines 136 and 138, respectively, as shown in FIG. 1. Adjacent the outer end of the housing portion 132, a cone plate 140 having apertures therethrough is secured to the rotor shaft for further retarding milled particles of relatively large size, and blades 144 are secured to the cone plate for directing the larger particles so that they may be recirculated.

The cone plate 140 also carries a plurality of centrifugal fan blades 146 which are disposed within a housing 148 of the fan means 30. The housing has an outlet which may be connected to suitable duct means, not shown, for directing the pulverized material to a suitable point of discharge or to suitable means, not shown, for separating the material from the flowing air stream. It is to be noted that a bearing 152 is fixed on the end wall of the fan housing 148 and rotatably receives and supports the outer end of the rotor shaft 40 whereby to improve the stability of the rotor.

The pulverizing apparatus may be utilized for processing various materials such, for example, food products including sugar, various grains and many others. It is often desirable to obtain a finished product which includes two or more pulverized ingredients mixed together such as a cake mix which includes flour and various ingredients. Such ingredients cannot be readily mixed uniformly after they have been finely pulverized. Therefore, it is to be noted that the feeding means 26 is constructed so as to feed a plurality of ingredients simultaneously to the milling chamber so that the ingredients will be thoroughly and uniformly mixed with each other during the milling or pulverizing process. Thus, as shown in FIG 1, the feeding means is provided with a pair of hoppers 200 and 202 separated by a partition 204, which hoppers may be filled with different ingredients to be processed or with the same ingredients if desired. Feed screws extend through the bottoms of the hoppers and means which provides separate passageways having outlet openings within duct means 190 which extends to the inlet 36. Portions of the feed screw rods extend rearwardly through tubes 212 and 214 and are driven in timed relationship by output gears of a transmission 216 having an input shaft 218. A sprocket 220 on the input shaft is driven by a chain 222 which extends from a sprocket, not shown, on an output shaft of a variable speed reducer unit 226 which is driven by a motor unit generally designated by the numeral 228. It will be appreciated that by predetermining the rate at which the feed screws are driven with respect to each other, the materials from the hoppers 200 and 202 are fed in predetermined proportions to the milling chamber.

In the embodiment shown, another ingredient hopper 230 having a feed screw extending therethrough is disposed for directing another ingredient into the hopper 202 through an opening in the end of the hopper 202. This enables an ingredient in the hopper 230 to be mixed with the ingredient in the hopper 202 before the ingredients are discharged into the duct 190. The feed screw carries a sprocket 236 fixed on a rear extension thereof, which sprocket is driven by a chain 238 extending from another sprocket, not shown, on another output shaft of the variable speed reducer unit 226.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. A pulverizing apparatus of the type described comprising shell means defining a milling chamber and having a material inlet and a material outlet, material pulverizing rotor means within said shell means, said shell means including a portion presenting a cylindrical inner surface between said inlet and said outlet, a liner member within said shell means and cooperating with said shell means for defining a fluid coolant passageway connectable with a source of fluid coolant which serves to cool the liner member and thereby the material being pulverized, said liner member comprising a split cylinder having opposing ends and radially outwardly projecting opposite side flanges defining a channel therebetween for providing said passageway, said flanges having split cylindrical edges completmentary to said cylindrical surface, and a wedge element between said ends for expanding the liner member and urging said edges into firm engagement with said cylindrical surface.

2. A pulverizing apparatus, as defined in claim 1, comprising seal means between said wedge means and said housing means and interrupting said channel, and fluid inlet means through said shell means adjacent one end of the channel at one side of said seal means, and fluid outlet means through said shell means adjacent an opposite end of the channel at an opposite side of said seal means.

3. A pulverizing apparatus, as defined in claim 1, which includes centrifugal fan housing means at said outlet end of the chamber, said rotor means including a shaft extending axially through said fan housing means, and a fan blade assembly on said shaft within said housing means for drawing gas through the pulverizing chamber so that the flowing gas carries pulverized material particles therewith.

4. A pulverizing apparatus, as defined in claim 1, wherein said liner member includes inwardly projecting protuberance means which supplement the rotor means in the material pulverizing operation.

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