July 20, 1937. W. E. WILLIAMS 2,087,492

GRINDING AND MIXING HAMMER MILL

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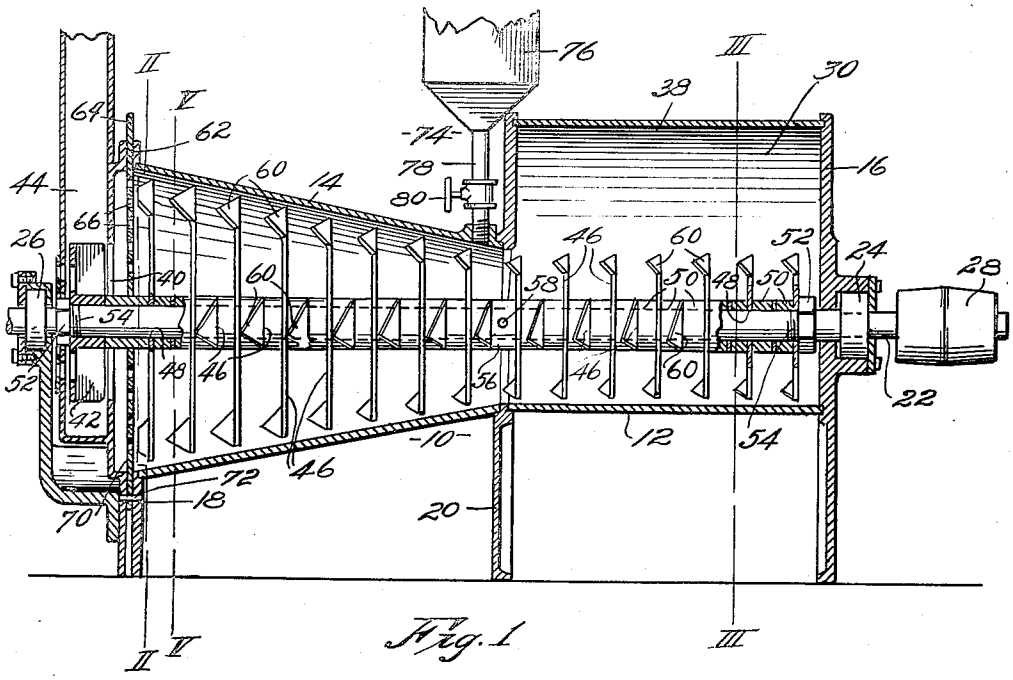


Fig. 1

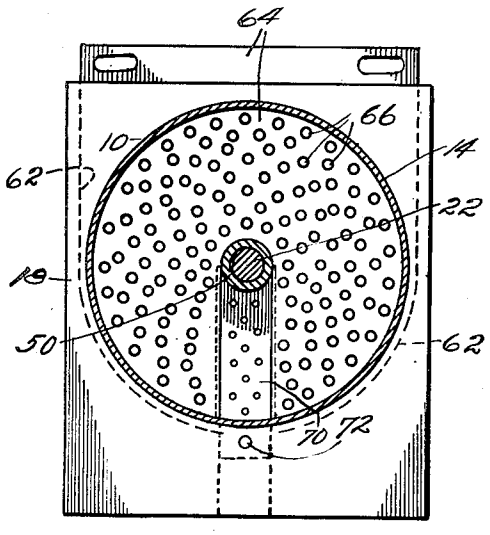


Fig. 2

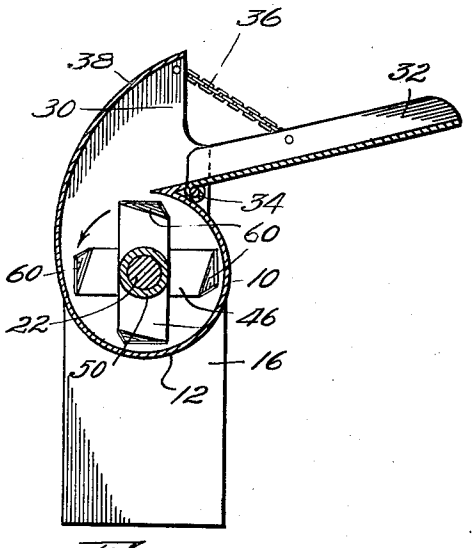


Fig. 3

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Fig. 4

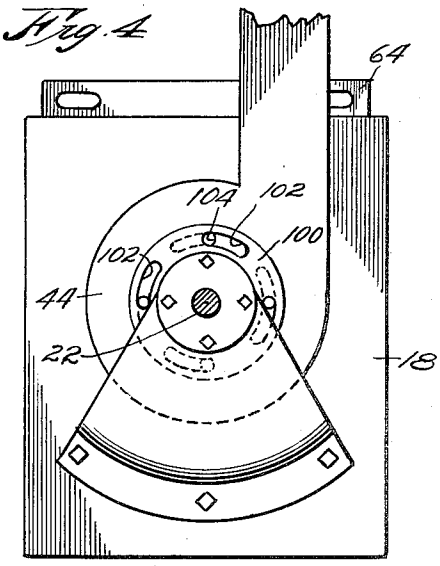


Fig. 5

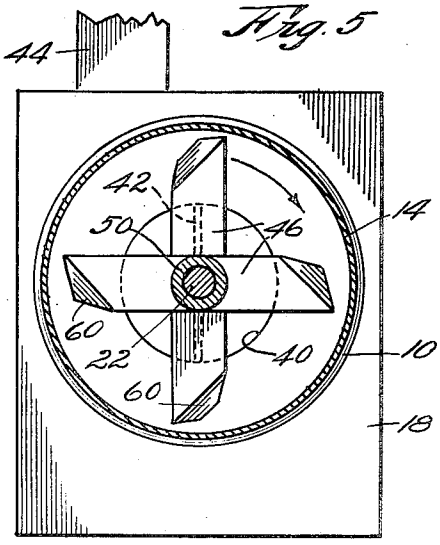


Fig. 6

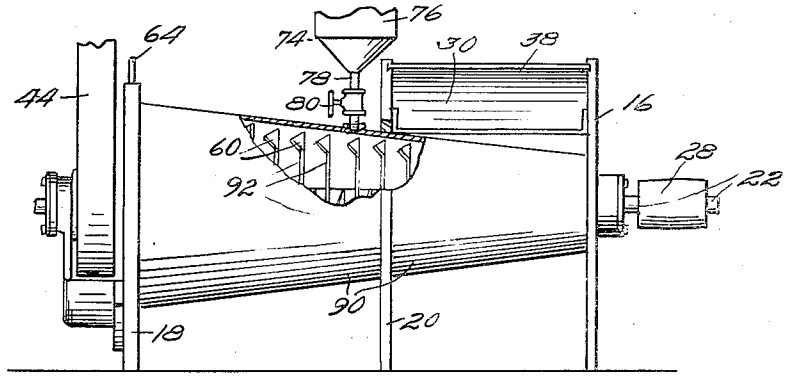
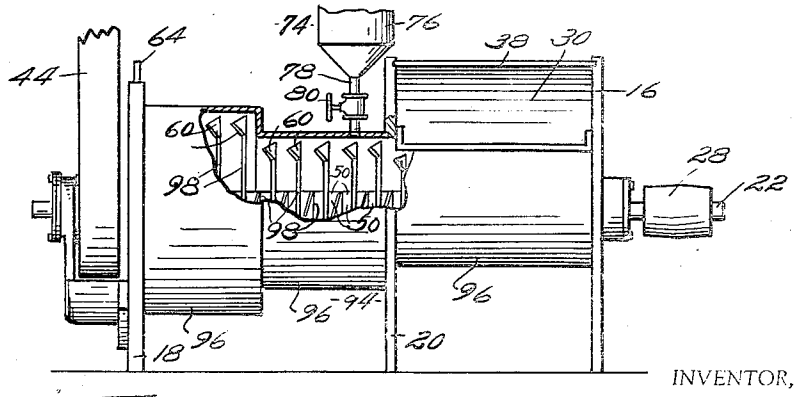


Fig. 7



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Patented July 20, 1937 2,087,492

UNITED STATES PATENT OFFICE

2,087,492

GRINDING AND MIXING HAMMER MILL

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Application May 2, 1932, Serial No. 608,605

4 Claims. (Cl. 83—11)

This invention relates to grinding and mixing hammer mills in which a series of rotatably mounted hammers are driven at a high rate of speed to cut, mix, and propel the material.

One of the principal objects of the present invention is the provision of a hammer mill having a suitable casing provided with a receiving or intake opening and a vertically disposed, screened discharge opening, and a series of rotatable hammers mounted in said casing.

Another object of this invention is the provision of a mill having a series of rotatably mounted hammers formed to grind and mix the material, and also to propel the same through the casing.

A further object is the provision of a mill comprising a conical shaped casing having a receiving opening and a discharge opening, a series of graduated hammers rotatably mounted in said casing coaxially therewith, each hammer of said series being spaced substantially a like distance from the wall of said casing.

A still further object of the present invention is the provision of a mill having a plurality of hammers driven at different peripherial speeds, whereby the speed of the treated material is gradually increased from the receiving opening to the discharge opening.

Another object of this invention is to provide a mill having a series of hammers mounted for rotation on a horizontally disposed shaft positioned within a casing, and a material feed device adapted to deliver material into said casing for mixing with the material being ground, said feed device being positioned to deliver the material into the casing intermediate the ends of the series of hammers.

Other objects are rigidity and simplicity of construction, economy and efficiency of operation and adjustability to the general requirements of custom grinding and mixing.

Other objects will appear during the course of the specification, wherein reference is had to the drawings, in which:

Figure 1 is a vertical, longitudinal section partly in elevation, of a grinding and mixing mill of the hammer type embodying this invention.

Fig. 2 is a vertical cross section taken on line II—II of Fig. 1.

Fig. 3 is a vertical cross section taken on line III—III of Fig. 1.

Fig. 4 is an end elevation of the mill.

Fig. 5 is a vertical cross sectional view taken on line V—V of Fig. 1.

Fig. 6 is an elevation, partly in section, of a modified form showing a uniform conical casing throughout the length of the series of hammers.

Fig. 7 is an elevation, partly in section, of a mill having a casing formed by series of stepped cylindrical sections.

Like reference characters refer to similar parts and the numeral 10 designates a casing, comprising a substantially cylindrical portion 12 and a conical portion 14. These portions are interconnected and positioned in axial alignment. End plate 16 serves as a closure for 12 and extends downwardly to serve as a support of the mill; likewise end member 18 serves to close the outer end of the conical portion of the casing and extends to serve as a support whereby the axis of the casing is maintained in substantially a horizontal position. In some instances it might be deemed advisable to incline the axis of the casing to facilitate proper feeding and discharging of the material. At the juncture of the cylindrical and conical portions a frame 20 serves to interconnect these parts and to support the casing intermediate supports 16 and 18.

A shaft 22 is rotatably mounted in suitable bearings 24 and 26 which are carried by the end plate 16 and member 18 respectively. This shaft extends through and beyond casing 10 and is in substantially coaxial alignment therewith. A pulley 28 is fixed to one of the extended ends of shaft 22 by means of which the same may be driven at a suitable rate of speed.

The cylindrical portion 12 is formed at its upper portion to present an intake or receiving opening 30, through which the material to be ground is fed. Associated with this opening is a hopper 32 hinged at 34, and adjustably held in any desired position of inclination by means of a supporting chain 36. It will be noted that the back wall 38 of the extended cylindrical member 12 serves to prevent the escape of material from the mill while the same is in operation. The small end of the conical portion 14 is substantially the same diameter as the cylindrical portion and is adjacent thereto, while the large end of portion 14 is mounted in member 18, which has a discharge opening 40, which may be of any suitable size.

Outside of casing 10 and mounted on shaft 22 is an exhaust fan 42, which is adjacent discharge opening 40 and which when rotated as hereinafter described, will cause air to be drawn through the casing and discharged through fan housing 44. Mounted on shaft 22 within casing 10 is a plurality of hammers or beaters 46. These hammers are elongated members having holes 48 formed through their center portion, through

which the shaft is threaded. These hammers are spaced apart the proper distance by means of sleeves 50. When the hammers are positioned on the shaft as shown in Fig. 1, nuts 52 which are associated with the threaded portions 54 of shaft 22 are tightened, thereby securing the hammers in fixed relation with said shaft. For the convenience of operation, a stationary collar 56 may be rigidly attached to the shaft by any suitable means such as a pin 58. The relative position of adjacent hammers may be easily varied by means of the mechanism just described.

It will be noted by referring to Figs. 1, 3, and 5 that the outer ends of hammers 46 are formed to present wings 60. These wings are so constructed that when shaft 22 is rotated in the direction indicated by arrows, the material being fed into the cylinder will be driven toward the discharge opening and transversely toward the center of the casing. The action of the material, due to its high rotary motion, will have a tendency due to centrifugal force to be thrown to the inner walls of the casing. Thus it is apparent that with these combined forces acting upon the material it will be thoroughly mixed, ground and delivered to the opening 40.

Positioned in slot 62 formed in end member 18, intermediate opening 40 and the end hammer, is a removable screen or grate 64. The openings 66 of said screen determine the size of the particles of the ground material. When it is desired to grind material to a different fineness, another plate may be substituted for 64. Plate 64 is slotted as at 68 to span sleeve 50 so that it may be raised vertically from its operative position without interfering with the movable parts. To seal the opening formed by slot 68, a stationary tongue 70 is rigidly supported at 72 in end member 18. Screen 64 and tongue 70 may be fitted together in any suitable manner. This tongue 70 may be provided with small sized openings, or may be made plain.

When grinding feed of a certain class it is desired that a certain quantity of liquid or dry material be mixed therewith, and it is for this purpose that a material feeding device 74 is provided. This device consists of a container 76, in which the material is deposited, 78 is a conduit interconnecting 76 with casing 10, and 80 is a control valve by means of which the rate of flow is regulated. It will be noted that 74 communicates with the interior of casing 10 intermediate the ends of the series of hammers 46, thus delivering to the grinding chamber the supplemental material after said material has been partially ground and given a considerable momentum.

The outer ends of hammers 46 are preferably positioned substantially a uniform distance from the adjacent casing wall. Therefore it is apparent that the hammers contained within the cylindrical portion of the casing would necessarily be of like length, while the hammers within the conical portion 14 would be graduated as shown.

As shown in Fig. 6, casing 90 may be substantially the frustum of a cone throughout its entire length. When so constructed, the hammers 92 will be graduated and uniformly lengthened from the smaller diameter to the larger diameter.

The modified form shown in Fig. 7 includes a casing 94 formed of stepped cylindrical sections 96. These sections are each provided with a series of hammers 98 of equal length. In the operation of this mill the operator puts the machine in operation in the usual manner and when the hammers have reached a suitable speed for grinding, material is fed through the receiving opening 30 into the cylindrical portion 12 where it is acted upon by the hammers 46. These hammers grind the material and force it inwardly toward the axis of the cylinder and outwardly toward the conical portion 14. As it passes into the conical section of the casing, its speed is accelerated due to the increased length of hammers which are rotating in a like number of revolutions as are the beaters in the feed portion 12. The peripherial speed of the outer ends of the longer hammers is such that the speed of travel of the material through 14 is materially accelerated, thus causing a finer grinding so that it will pass through openings 66 formed in screen 62 and by the action of the exhaust fan 42 will be drawn through opening 40 and forced through fan housing 44 to any desired locality. When required that a liquid such as molasses or a granular material such as sugar be mixed with the ground feed, such material is placed in container 76 and end valve 80 is opened a sufficient distance to allow the proper quantity of said material to be delivered into the casing where it will be properly mixed with said material.

In order to vary the amount of suction produced by fan 42, a shutter 100 having openings 102 formed therein is positioned on fan housing 44 to control openings 104 formed in said housing. By admitting more or less air through openings 104 the amount of air drawn through casing 10 will be varied.

Great difficulty has been experienced in machines of this type in which material such as molasses is mixed with the ground material, due to the fact that the molasses adheres to the casing walls and the moving parts and is extremely hard to remove therefrom. This difficulty is obviated in the present mill by simply closing off valve 80 just before the final feed of material is delivered through 30. This final feed or charge will serve to scour and completely clean the casing and connecting parts of all of said sticky material.

When the mill is being used to mix materials as stated above, the screen 64 may be removed as shown in Fig. 5 of the drawings, to permit the free passage of the mass which is more or less of an adhesive nature.

Many forms of casings might be embodied in this invention without departing from its novel features, also in grinding or mixing certain materials it is apparent that projections might be included on the inner wall of the casing to cooperate with the hammers in grinding or mixing the materials.

What I claim is:

1. A mill of the class described comprising a casing having a receiving opening and a discharge opening; a series of spaced apart hammers carried by a horizontally disposed shaft, wings carried by said hammers having their faces positioned at an angle to the plane of rotation of the hammers rotatably mounted in said casing; a substantially vertically disposed screen positioned in said casing intermediate said series of hammers and the discharge opening; and a material feed device associated with said casing and adapted to deliver material into said casing adjacent the central portion thereof and intermediate the first and last hammers of the series.

2. A mill for grinding and mixing food ingredients comprising a closed casing, a rotor mounted for rapid rotation in said casing, grinding hammers mounted in said rotor, a fan housing having its intake opening communicating with the interior of said casing and having a discharge opening, a fan shaft mounted for rotation and extending through said fan housing, a fan mounted on said shaft to turn therewith in said housing, and means for feeding material to be ground into said casing in the path of said hammers, in combination with means for introducing molasses into said casing and in the path of said hammers, and means for simultaneously with the introduction of said molasses driving said fan from the shaft of said rotor.

3. A mill for grinding and mixing food ingredients comprising a closed casing, a grinding means, means for feeding such food ingredients to said grinding means, a fan housing having its intake opening communicating with the interior of said casing and having a discharge opening, an evacuating fan mounted for rotation in said fan housing and between the blades of which said food ingredients pass, in being discharged from said casing, a screen interposed between said grinding means and the intake opening of said fan housing, and driving connections for driving said grinding means and rotating said fan from a single source of power and simultaneously in combination with means for introducing molasses into such food ingredients subsequent to the entry of the latter into said casing and prior to the passage of said food ingredients between the blades of said evacuating fan during the rotation of the latter incident to the evacuation of said food ingredients from the mill.

4. A mill of the class described comprising a casing having a receiving opening and a discharge opening; a vertically disposed sectional screen having members slidably interconnected and positioned across said discharge opening; and a plurality of hammers mounted for rotation in said casing about the longitudinal axis thereof and formed with surfaces inclined to the direction of travel, to propel the material being ground in one direction longitudinally of said axis of rotation, one of said hammers being positioned adjacent said screen.

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