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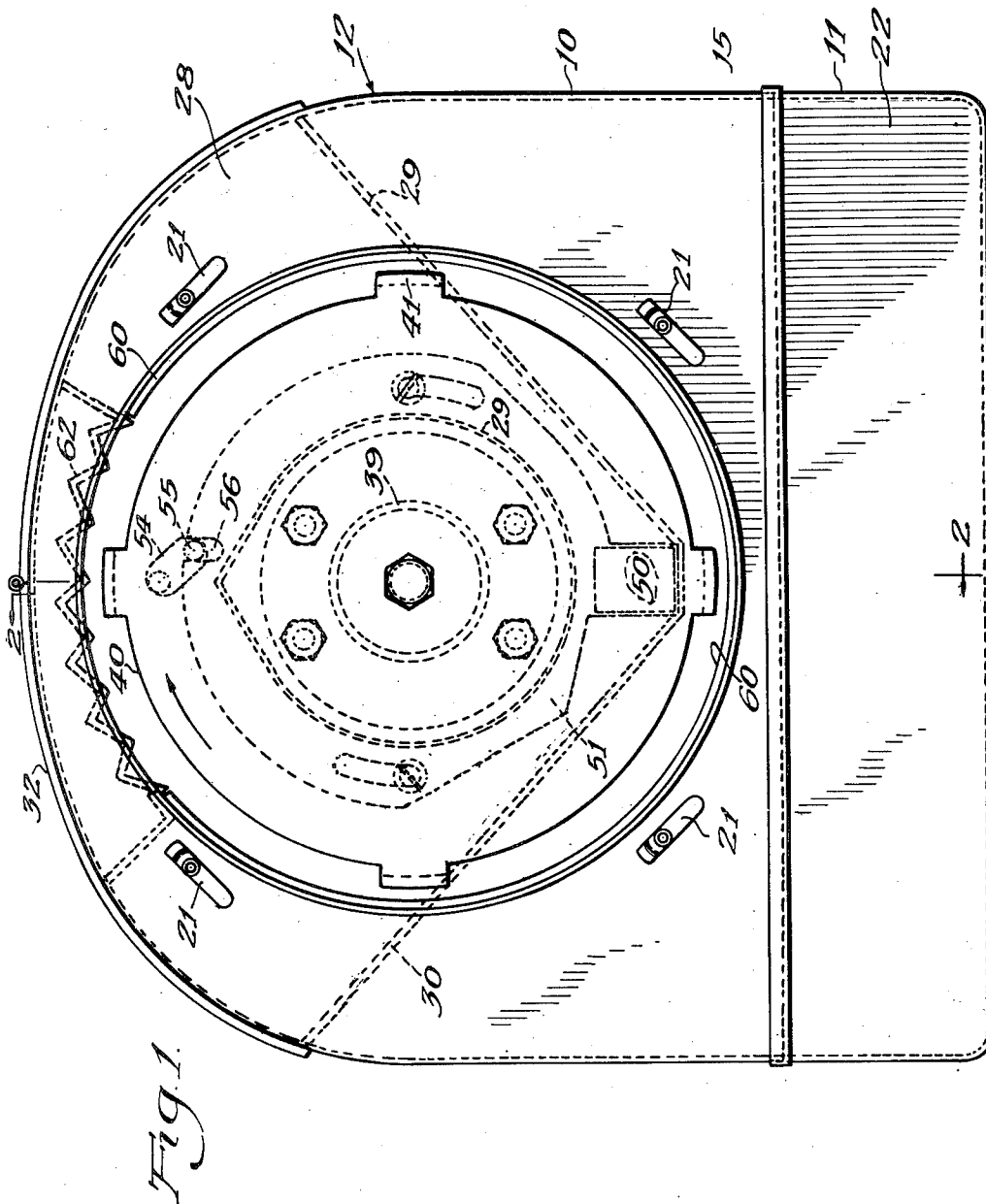
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2,473,531

DISINTEGRATOR ROTOR FOR HAMMER MILLS AND THE LIKE

Filed Sept. 17, 1943

3 Sheets-Sheet 1



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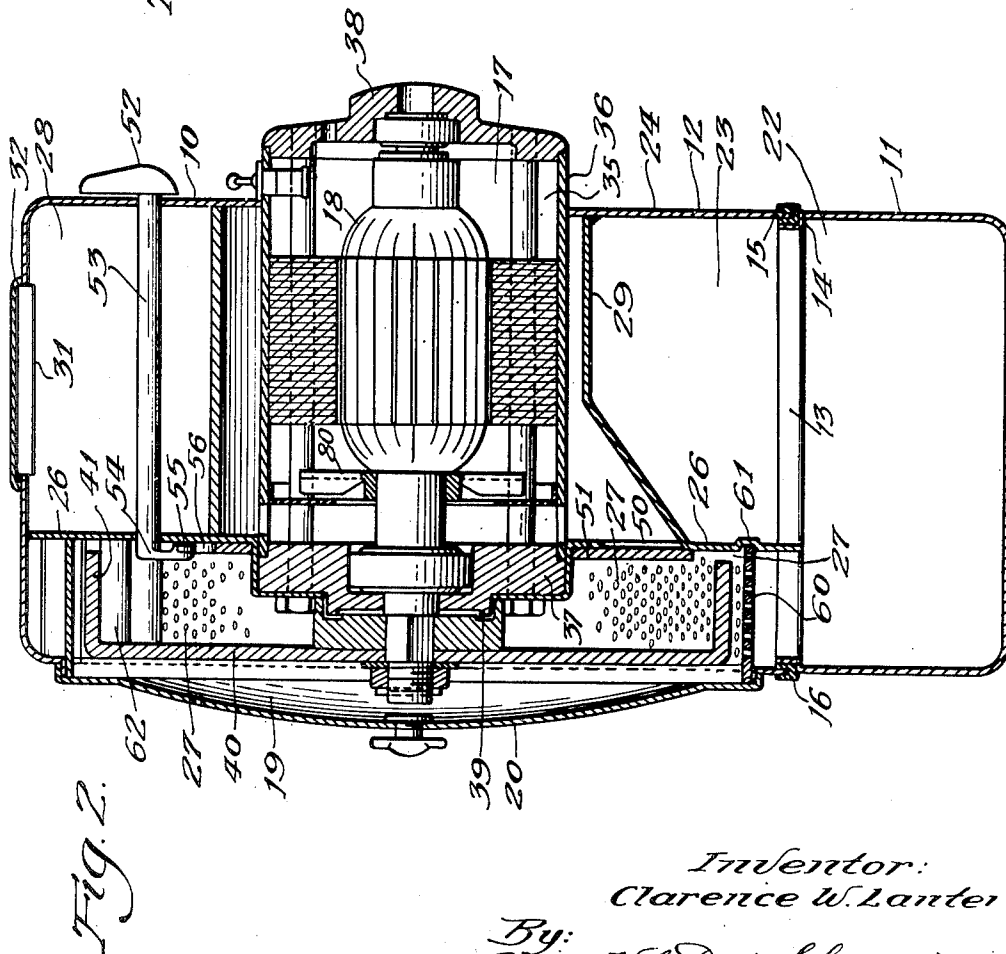
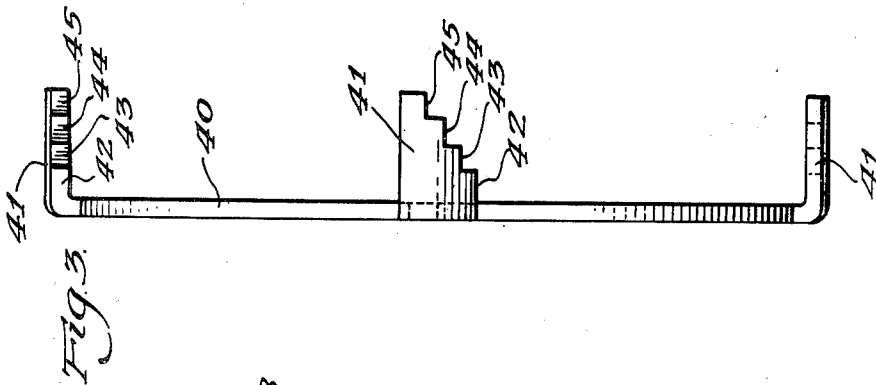
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DISINTEGRATOR ROTOR FOR HAMMER MILLS AND THE LIKE

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3 Sheets-Sheet 2



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DISINTEGRATOR ROTOR FOR HAMMER MILLS AND THE LIKE

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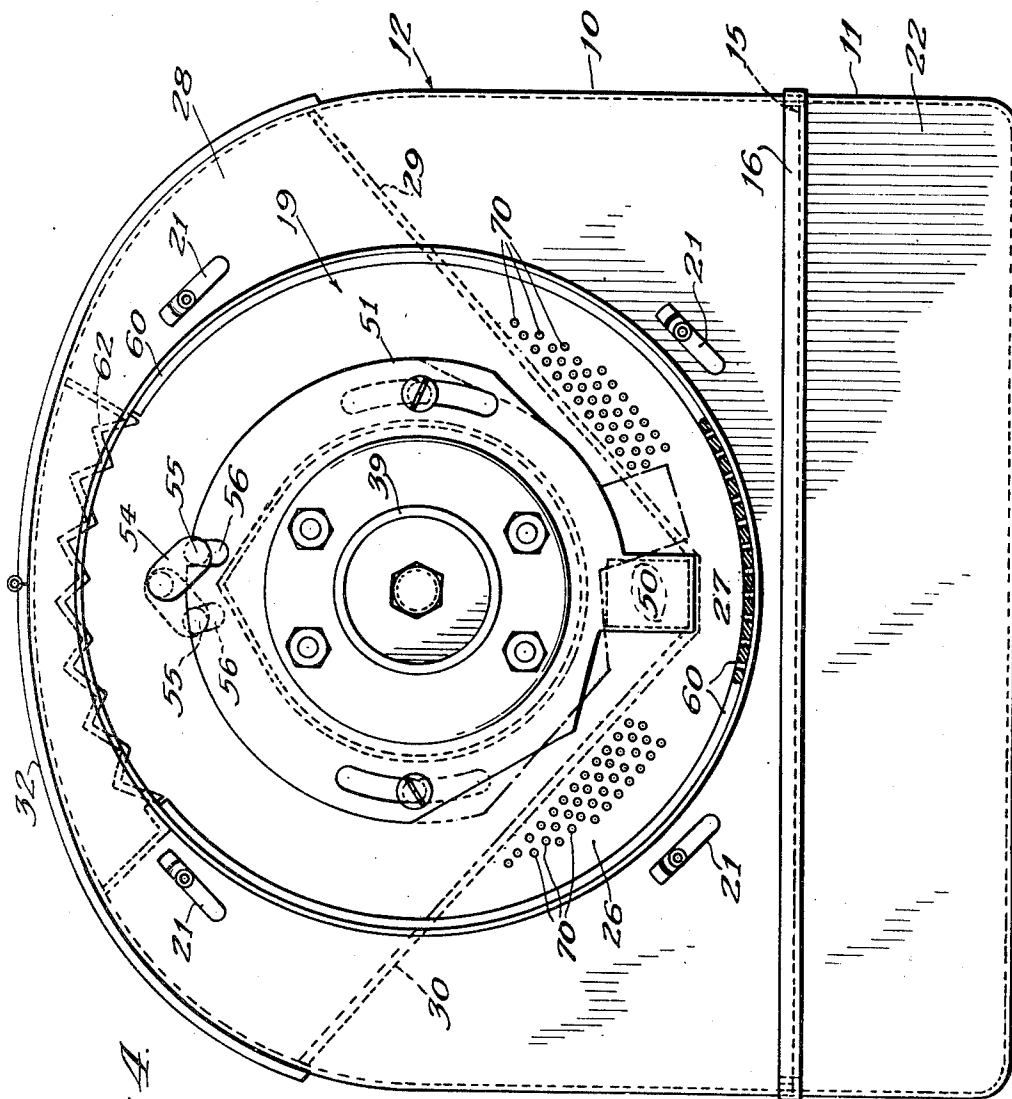


Fig. 4

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UNITED STATES PATENT OFFICE

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DISINTEGRATOR ROTOR FOR HAMMER
MILLS AND THE LIKEClarence W. Lanter, Bartlett, Ill., assignor to
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Application September 17, 1943, Serial No. 502,754

1 Claim. (Cl. 241—191)

1

This invention relates to a disintegrator or hammer mill and more particularly to the construction of the disintegrator rotor. In my co-pending application, Serial No. 502,755, filed September 17, 1943, I have described a disintegrator system, particularly adapted for home use, in which the system is completely enclosed on all sides. The present type of disintegrator rotor is particularly suitable for operation in such a system, but it is also a considerable improvement upon the former types of disintegrator rotors and may be employed in any type of hammer mill. The invention will be described here in connection with the type of mill shown in my said co-pending application but it is to be understood that the use of the disintegrator is by no means limited to that form.

The invention is illustrated in the drawings in which Fig. 1 is a front elevation partly broken away; Fig. 2 is a sectional elevation taken along the line 2—2 in Fig. 1; Fig. 3 is an enlarged view of a rotor, viewed from the side; and Fig. 4 is a view corresponding to Fig. 1 with the rotor removed.

The disintegrator comprises a metal housing 10 made up of a base 11 and a top 12. The base is provided with an inwardly flaring flange 13 providing a shoulder 14 upon which the lower edge 15 of the top rests. A gasket 16 of any suitable type may be provided within the flange in order to produce a satisfactory seal.

The back wall of the housing is provided with a circular opening 17 adapted tightly to enclose a motor 18. The front wall of the housing is provided with a larger opening 19 provided with a closure 20. The closure 20 may be held in place in any suitable manner such as by two or more handles 21 affixed to the front of the housing.

Internally the housing is divided into four main compartments as shown in Fig. 2. These comprise the bin 22 which occupies all of the base 11 and a portion 23 of the top formed by the rear wall 24, by the hopper walls 29 and 30 surrounding the motor 18, and partly by the vertical wall 26. The wall 26 also forms the rear wall for the disintegrator compartment 27. The disintegrator compartment is in the front of the disintegrator. The third compartment in the machine is the hopper compartment 28, best shown in Fig. 1 and bounded by the sloping hopper walls 29 and 30, and the upper outer wall of the top 12. An opening 31 with a cover 32 is provided in the extreme top of the housing through which grain or other material may be admitted to the hopper. The fourth and last compartment is the motor com-

2

partment 35 which is bounded by the solid annulus 36 surrounding the motor, by the front face 37, and by the rear face 38 of the motor. The motor itself projects at the rear from the housing, and at the front the shaft 39 of the motor projects into the disintegrator chamber and serves as a mounting for the disintegrator 40.

It will be observed that there is no opening to the outside from the bin or from the disintegrator chamber which remains open during operation of the device. The hopper opens to the outside only through the cover opening 31. The motor is closed from the hopper, from the bin, and from the disintegrator chamber.

The hopper is provided with a vent 50 in the vertical wall 26 which forms the back of the disintegrator chamber. The size of this opening is controllable in any suitable way. As shown, it is controlled by means of a movable face plate 51 mounted on the wall 26 around the face 37 of the motor. The plate 51 is constructed so that when it is in the position shown in Fig. 1 the hopper vent 50 is completely closed, but when it is rotated, the opening is progressively opened. The plate 51 may be rotated by manipulation of the handle 52 at the top rear of the housing, as shown in Fig. 2. This handle is secured to a shaft 53 extending through the hopper chamber and the wall 26. At its forward end is a crank arm 54, the crank of which is provided with a lug 55 extending into a slot 56 in the plate 51. Rotation of the crank arm in a clockwise direction, as shown in Fig. 1, progressively opens the opening 50, and conversely, movement of it in the opposite direction progressively closes the hopper vent and permits grain to flow at a desired rate into the disintegrator chamber.

The disintegrator chamber is provided, in addition to the disintegrator 40, with a removable screen 60 which extends approximately three-quarters of the way around the housing. This screen may be held in place in any suitable manner and is shown as set into an annular groove 61 in the wall 26 in which it is held in place by the cover 20. The screen may be removed manually after removal of the cover and replaced by another screen, or in some cases the screen may be omitted entirely. That portion of the circumference of the disintegrator chamber not enclosed by the screen is provided with a fixed crusher bar 62 as shown in Fig. 1. Both the screen and the crusher bar extend entirely across the periphery of the disintegrator chamber.

The screen provides communication between the disintegrator chamber 27 and the bin 22, this

3

communication being complete throughout the length of the screen.

A second means of communication between the bin and disintegrator chamber is provided by a group of openings 70 in the wall 26. The wall 26 covers the entire rear face of the disintegrator chamber except for the necessary motor, vent, and crank openings, and in addition is extended outwardly therefrom to the outer housing walls in the housing top. As a result, the wall 26 forms a baffle roughly in the shape of two horns, as shown in Fig. 1, between the upper front part of the bin and the upper rear part thereof. During operation of the disintegrator, the rotor produces a current of air through the screen which tends to build up a slight pressure within the bin. This pressure is relieved either, back of the baffle formed by the wall 26, through the openings 70 which admit air to the disintegrator chamber on the vacuum side of the air current produced by the rotor or otherwise.

It will be observed that except for the vent opening 50 there is no connection directly or indirectly between the outer air and either the disintegrator chamber or the bin. Furthermore when constructed as shown, no noticeable draft is produced between the hopper and the disintegrator or the bin through the vent 50. All of the circulation of the air which occurs is in a cycle from the disintegrator chamber to the bin and back again to the disintegrator chamber.

The motor 18 is directly connected, as shown, to the disintegrator 40. For this reason the motor should be a high speed device. The drawings shown are made to scale with the disintegrator arm substantially $9\frac{3}{4}$ " outside diameter. For this structure a motor of about 0.4 horse power and having a full speed of approximately 8,000 R. P. M. is preferred. Such a motor under light load will run from 6,500 to 7,000 R. P. M. The speed of the motor may be controlled by electrical means or by control of the feed of grain to it. That is, a wide opening of the gate 50 will produce coarser grinding due partially to the slowing down of the motor.

It is important that the temperature of the material being ground be kept as low as possible. The present device produces ground grain showing practically no increase in temperature. In order to accomplish this it is desired that as much cooling as possible be provided. It is, therefore, desirable that the motor be provided in the usual manner with a fan 80 and that its housing be so vented to the air as to draw a current of air through the fan into and out of the motor.

In addition the housing is all made of metal, in order that heat transmitted to any part of it by contact with the grain or with the motor be conducted to the outside and transmitted to the atmosphere.

The rotor or disintegrator or hammer, as it is variously called, is preferably constructed in the manner shown in the present drawings.

Disintegrator arms have heretofore depended largely upon a hammering action in which material to be ground is fed to variously distributed hammers and crushing blocks under extreme conditions of turbulence. The result of disintegration of that type naturally depends upon pure chance. Great turbulence obviously requires an excessive amount of power, and since the power is converted to heat, the heat generated is large.

In the present device it is desired to hold heat to a minimum. Furthermore, the more uniform the grinding, the less is the proportion of powder

4

produced. It is, therefore, desired to produce a flow which is substantially an air flow with the zone of turbulence greatly reduced and confined substantially to the area between the tip of the disintegrator and the screen.

The usual hammer or disintegrator consists of a series of arms arranged in groups, successive groups overlapping openings in the preceding group. In the present form a single disc shaped rotor is employed having at least three and preferably four faces extending at substantially right angles to the disc as shown in Fig. 3. Each arm 41 is progressively cut away to provide a series of hammer faces 42, 43, 44 and 45, thereby increasing the number of sharp corners available for contact with the grain. Each of the arms 41 occupies exactly the same position relative to the axis of rotation and also occupies substantially the entire horizontal dimension of the disintegrator chamber, and covers, when rotated, the entire peripheral rotation area of the rotor. The vertical dimension of the arm 41 is quite small, that shown being approximately $\frac{3}{8}$ ". Rotation is so rapid that grain falling from the vent 50 does not acquire a velocity sufficient to drop past the arms 41. In fact in the apparatus as shown, the grain is always struck by the upper edge of an arm 41 at its first impact. The distance between the arms 41 and the screen 60 is likewise kept small. As a result, the grain being ground is confined almost entirely to the annulus formed by the rotating inner side of the arms 41 and the screen. By maintaining all of the material in this narrow zone, the opportunity for selective action by the air upon the powder is increased so that the velocity of the air stream may be kept low, and at the same time more selective.

It will be noted that the width of the disintegrator arm is approximately $1\frac{1}{2}$ inches as compared with $\frac{1}{4}$ inch of thickness, and a distance of approximately $\frac{1}{2}$ inch between the outer end of the disintegrator arm and the screen 60. The depth of the cut in the arm 41 made to form the successive faces 42, 43, 44 and 45 is approximately equal to the width of the corresponding face. These faces are preferably hardened to insure a longer cutting life.

The size of the openings in the screen 60 is based upon the degree of fineness to which the material is to be ground. Usually the openings are from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, but for very coarse grinding it is possible to omit the screen entirely. Nevertheless, it is understood of course that practically no material is carried through the screen except by air currents until the close of the operation. The angle of the openings is such that material driven by the arms 41 cannot penetrate the openings but is driven back into the mass of grain and to the striking arms.

In operation of the device the hopper is filled to the desired extent through the opening 31. Thereafter the motor is started and after it has gotten up to speed, the gate 50 is opened by rotating the handle 52. In some cases it is desirable to interconnect the motor switch with the handle 52 in such a manner that the gate 50 cannot be opened until the motor is running. The material to be ground, which may be wheat, corn, barley, oats or other grain, or any other suitable material for grinding, for example, such as soy beans, drop from the gate 50 into the disintegrator chamber, and, as already pointed out, is struck by an arm 41 during its fall. This

5

fractures the grain and the pieces are thrown against the screen 60 from which they rebound and are again struck by an arm 41. When a sufficient degree of fineness has been established, the air currents created by the rotor carry the particles through the screen 60 into the bin 22. The outward motion of the air through the screen creates a slight suction on the inside of the arms 41 and this suction is relieved by the passage of air through the openings 70 from the bin 22. The amount of air so circulating is relatively small and as a result the powder or flour settles almost entirely within the bin and the air which is redrawn into the disintegrator chamber is relatively pure. It is not necessary that it be completely free from dust because it eventually returns to the bin. However, it is desirable that the dust settle as much as possible because any dust recirculated is subject to an additional disintegrating operation which is unnecessary.

It is perhaps surprising that no substantial draft is noticeable in the hopper chamber even though the lid be left off.

After the grinding has been completed, the motor is turned off and the top 12 is lifted from the bottom 11.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom.

What I claim as new and desire to secure by Letters Patent is:

A disintegrator rotor comprising a substantially solid disc having at least three symmetrically disposed peripheral arms at right angles to the face of the disc and substantially of the same thickness as the disc arranged to present relatively thin striking surfaces, each of said arms occupying the same peripheral rotation area upon rotation of the disc, and each arm being provided on its forward face with a series of sharp striking surfaces on different planes at right angles

6

to the face of the disc, said planes being parallel to and spaced from each other, with all said surfaces being on one side only of the disc.

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