

June 1, 1937.

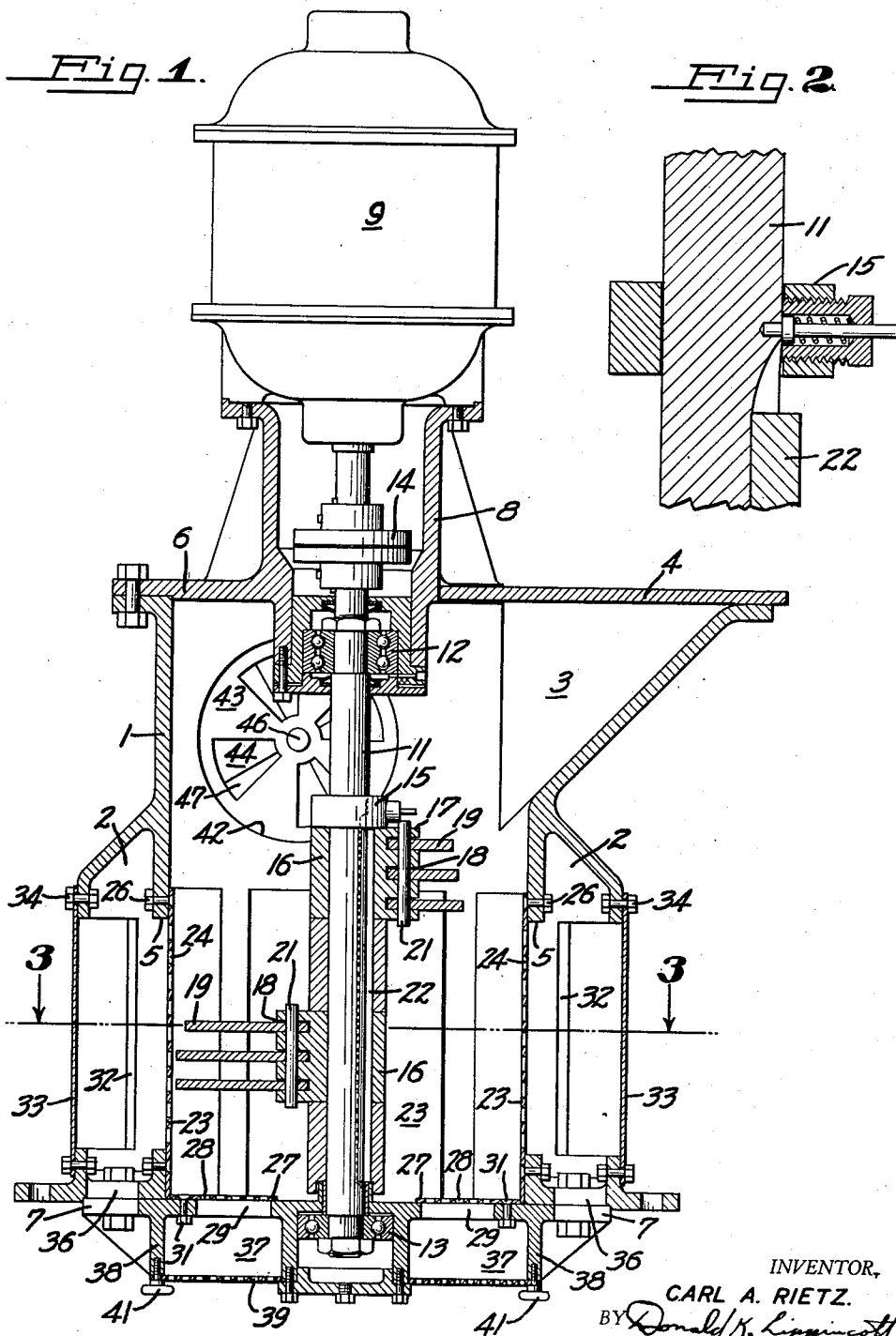
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2,082,419

DISINTEGRATOR

Filed Nov. 24, 1933

2 Sheets-Sheet 1



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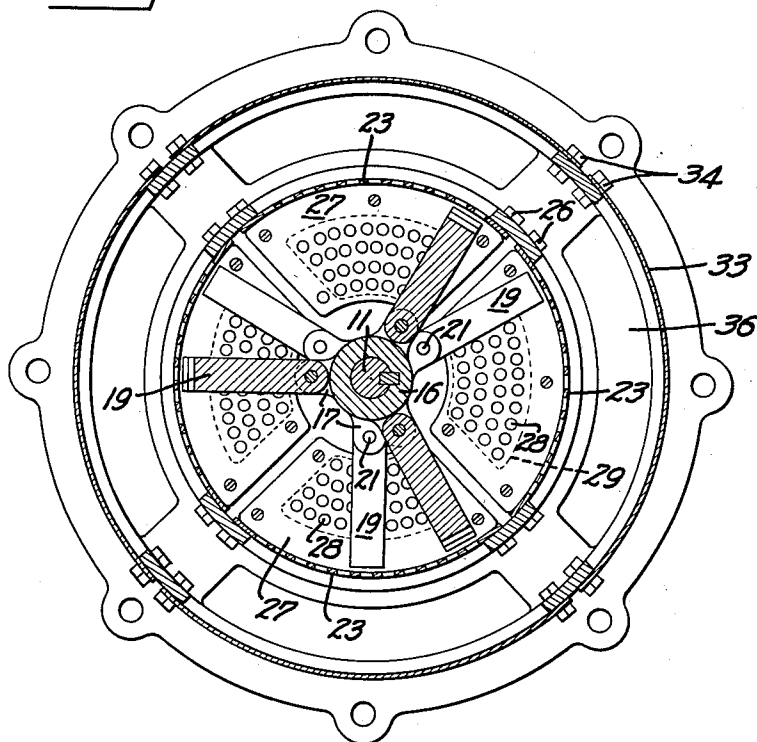
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Fig. 3.



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2,082,419

DISINTEGRATOR

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Application November 24, 1933, Serial No. 699,531

1 Claim. (Cl. 83—11)

My invention relates to disintegrators and particularly to the hammer mill type of disintegrators.

One of the objects of my invention is the provision of a disintegrator possessing a high degree of efficiency.

Another object of my invention is the provision of a disintegrator which requires but a fraction of the power required to drive devices, of similar capacity, in present use.

Still another object of my invention is the provision of a mechanism which is not likely to be damaged by the admittance of objects which are not disintegratable.

A further object of my invention is the provision of a device which will successfully disintegrate tacky, damp or other materials difficult to comminute.

Still another object of my invention is the provision of a device which occupies a minimum of floor space.

Another object of my invention is the provision of a disintegrator which is capable of comminuting a wide range of substances.

A further object of my invention is the provision of an improved method of disintegrating materials.

Another object of my invention is the provision of a disintegrator which may be used to classify certain types of materials.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claim.

Referring to the drawings:

Figure 1 is a vertical sectional view of the disintegrator of my invention.

Figure 2 is a fragmental vertical sectional view of the rotor retaining collar.

Figure 3 is a horizontal sectional view taken in a plane indicated by the line 3—3 of Figure 1.

Considered broadly, the disintegrator of my invention comprises a housing provided at its upper end with an intake port or hopper for the introduction of the material to be disintegrated. A vertically disposed shaft is mounted in the housing and is provided with a plurality of preferably pivoted arms extending radially therefrom. Means are provided for rotating the shaft. A discharge opening is provided in the housing and a foraminated plate is disposed over the opening to grade the disintegrated material. Means are also

provided for circulating an air current through the housing.

Disintegrators of the horizontal hammer mill type have long been in use for the reduction of ores and like substances and are, undoubtedly, among the most efficient mechanisms for the treatment of these materials. They, however, enjoy little success when used in the reduction of semi-plastic or damp substances or, for example, sage leaves or peanut brittle which, in machines of the character described, are very difficult to comminute.

I have produced a mechanism, hereinafter described, which is capable of successfully disintegrating materials ranging from various kinds of ores and mineral substances to those materials, particularly vegetable matter and herbs, which are considered difficult to reduce in the ordinary hammer mills.

This is accomplished by providing a rotor having pivoted arms of varying length, disposed in spiral relationship thereabout, which is driven at high speed within a foraminated housing. The particular arrangement of the rotor arms causes them to contact the material in a series of rapidly successive, horizontally directed, impacts and also sets up a powerful air current flowing through the housing with the result that the material therein is maintained in violent agitation.

Materials, such as sage leaves mentioned above, are prevented, by the turbulent air current, from adhering to the side walls of the chamber and clogging the screen openings. It has been found that, with the mechanism of my invention, sage leaves were reduced, in a shorter length of time than with other machines, to powdered form fine enough to pass through a screen of 300 per inch lineal mesh.

One of the chief difficulties in handling these lighter materials in the horizontal mills has been the tendency for a portion of the materials to be held in equilibrium necessitating the use of an externally originating draft directed through the mill to keep the material agitated.

In the vertical mill of my invention this condition does not obtain due to several factors. First, the incoming material tends to fall through the mill, urged by gravity. Second, the mill acts as a centrifugal blower urging the material outwardly through the grading screens. Third, the pressures at each end of the mill differ due to the difference in peripheral speed of the blades, and fourth, the blades are placed in helical relationship to provide a screw effect. All of these factors

prevent the setting up of equilibrium in the material.

Another feature of the mill is that it is possible to classify materials which are made up of components having different specific gravities. As an example, it has been found that it is possible to remove periclase, or native magnesia, from lime; this being caused by the lighter lime (Sp. Gr. 2.6) being ejected from the mill while the heavier periclase (Sp. Gr. 3.67-3.90) falls and is caught in a trap at the bottom of the mill.

Another unique feature of my mill is that there appears to be no tendency to reduce the substances to a fineness below the dimensions of the outlet screen. If, for example, coffee beans are run through a mill of the usual construction, the size of the delivered particles is heterogeneous, the delivery including extremely fine powder as well as particles just small enough to pass through the screen. Such diversified sizes necessitate additional separation, with a possibility of loss if finely divided material much smaller than the screen apertures is not desired. My mill, however, does not powder coffee beans, but reduces substantially all the material to a uniform size, just sufficiently small to pass through the screen. No grading is needed, and loss by the production of fines is avoided.

In greater detail, and referring to Figure 1 of the drawings, the disintegrator of my invention comprises a tubular housing 1, provided with an annular jacket portion 2, and a hopper or material intake 3. A removable cover plate 4 is provided for normally closing the hopper 3. Apertures 5, which function as the discharge openings, are provided in the side wall of the housing 1. It will be understood, of course, that the hopper shown, for the admittance of material, is used only for purposes of illustration; screw or belt conveyors being contemplated where continuous automatic feeding is desired.

The housing 1 is provided with end plates 6 and 7; the former having a tubular extension 8 which supports the prime mover or motor 9. A shaft 11 is rotatably mounted in the housing; being provided, adjacent its ends, with bearings 12 and 13 suitably mounted in their respective end plates. A flexible coupling 14 is interposed between the shaft of the motor 9 and the upper end of the shaft 11.

Removably secured on the shaft 11, by means of the latch collar 15, are a plurality of hubs 16 having, preferably three, equally spaced projections 17. These projections are cut to provide grooves 18 in which the arms, or beaters, 19 are disposed; and pins 21 are passed through the lugs and the arms to provide a journal for the latter.

It will be noted that the arms 19 vary in length; the shortest being disposed adjacent the material inlet 3 and the longest adjacent the end plate 7. The purpose for this arrangement of the arms is to apply the incoming load of material to the rotor gradually; the shortest arms contacting the coarse material first, thus requiring less consumption of power than would be the case if the arms were longer. It will be noted also that the arms are presented edgewise to the incoming material, facilitating their movement through the material and consequently demanding a lesser expenditure of power from the motor. As the coarser material is broken up by the shorter arms it passes progressively to the next longer arms with the result that the ma-

terial, in degree of coarseness, is distributed in the chamber in proportion to the length of the arms. It will further be noted that the ends of the longer arms, and the faces of the lower set of arms, are spaced from the housing walls to obviate the danger of lumps of material wedging between the arms and the screens. All of the foregoing, it has been found, combine to effect power economies up to 50% over the power required to drive horizontal hammer mills of like capacity.

It is desirable that the arms 19 be arranged about the shaft in a plurality of helically disposed groups. A key 22 is provided in the shaft and each hub 16 has its mating keyway so located that the projections 17 on each hub are disposed on, substantially, a helix about the axis of the shaft.

This arrangement of the hubs 16 is to place the arms 19 in position to create, in effect, a triple thread screw which, when rotated at high speed, sets up a powerful air current flowing through the housing 1. This air current is utilized to cause a violent agitation of the material being processed.

Grading screens 23, preferably four in number, are disposed about the interior of the housing 2 and are provided with foraminae 24; screws 26 being provided to secure the screens to the housing and to permit the placing of screens of different mesh or apertures. Grading screens 27, also provided with foraminae 28, are disposed over apertures 29 formed in the end plate 7; screws 31 being provided to permit the removal of these screens for the reasons given above.

The jacket portion 2 of the housing 1 is provided with apertures 32 and cover plates 33, held by screws 34, are provided for sealing the apertures. The function of these plates is to form a closure for the jacket and to permit access to the screws 26 when it is desirable to change the grading screens 23. A plurality of openings 36 are provided venting into the jacket 3, through which part of the disintegrated material may be discharged.

Means are provided for entrapping nondisintegratable objects from the material being worked upon. For the most part the material to be comminuted is selected and there is no danger of foreign objects getting into the whirling rotor and causing serious damage. In some materials, however, there is a scattering of so-called "tramp iron" which, if allowed to enter and remain in the housing for any length of time, is liable to cause damage necessitating costly shutdowns and repairs.

When working with materials in which this "tramp iron" is present, the grading screens 27 are removed, allowing the iron to fall into a trap or sump 37 formed by the housing for the bearing 13, and an annular wall 38 formed on the end plate 7. A screen 39 is secured to this wall and replaces the removed screens 27. Removal of any great accumulation of the iron may be effected by dismounting the screen 39 by removing the holding screws 41.

Means are provided for regulating the flow of the air current through the housing. Disposed adjacent the intake port 3 is an aperture 42 provided with a ported louvre plate 43 upon which a similar ported plate 44 is rotatably mounted by means of the pivot pin 46. The plate 44 may be rotated to vary the size of the apertures 47, thereby regulating the quantity of air admitted

to the chamber. Suitable means not shown, such as a locking screw or clamp, may be provided for holding the plate 44 in its adjusted position.

5 It is possible, with but little modification, to both disintegrate and classify materials in my mill.

10 This classification of materials is made possible due to the difference in peripheral speed of the blades. The short blades will produce less outward movement of the adjacent air than will the longer blades. There is therefore less pressure in the air currents at the upper end of the mill. The lighter particles of material will be affected by these low pressure currents and will be carried by them through the screen openings. 15 The particles which are slightly heavier will fall through the low pressure zone and be picked up by a current strong enough to propel them through the screen.

20 It will be seen that the air currents are disposed in strata in the housing; the pressure of these currents being in proportion to the length of the blades, and if the grading screens are provided with grouped holes of different sizes, as described above, an efficient means for classifying the materials will be provided. By adjusting the speed of the motor and the quantity of air entering the housing through the ports 47, it is possible to vary the size of the discharged particles 25 through a wide range.

30 In reiteration, comparative tests have shown

that the disintegrator of my invention possesses a higher degree of efficiency than the horizontal types in general use; the superiority residing in the vertical positioning of the rotor, the novel placement and pivoting of the beater arms, and the creation of the turbulent air currents within the housing. The simplicity of the device renders it capable of economical manufacture, and due to its compact design it occupies but a fraction of the floor space required for the horizontal 10 type of mill.

I claim:

A disintegrator comprising a housing, a vertically disposed beater rotatably mounted in said housing, said beater comprising a shaft, a plurality of helically disposed groups of arms pivotally mounted on said shaft and comprising relatively flat blades positioned edgewise in planes normal to the axis of said shaft, said blades being of graduated length so as to create within said housing zones of different pressure due to the difference in peripheral speeds of the blades when said beater is rotated, means for admitting material to be disintegrated to said housing adjacent said zone of lowest pressure, means disposed in a vertical plane and overlying said pressure zones for classifying thereat disintegrated material graded according to the ability of the pressure of a zone to float said material, and means for collecting said graded material. 30

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