March 28, 1950 C. F. PAUL 2,502,022

OPPOSED DISK ROTOR TYPE CENTRIFUGAL PULVERIZER

Filed May 1, 1944 2 Sheets-Sheet 1

Fig. 1

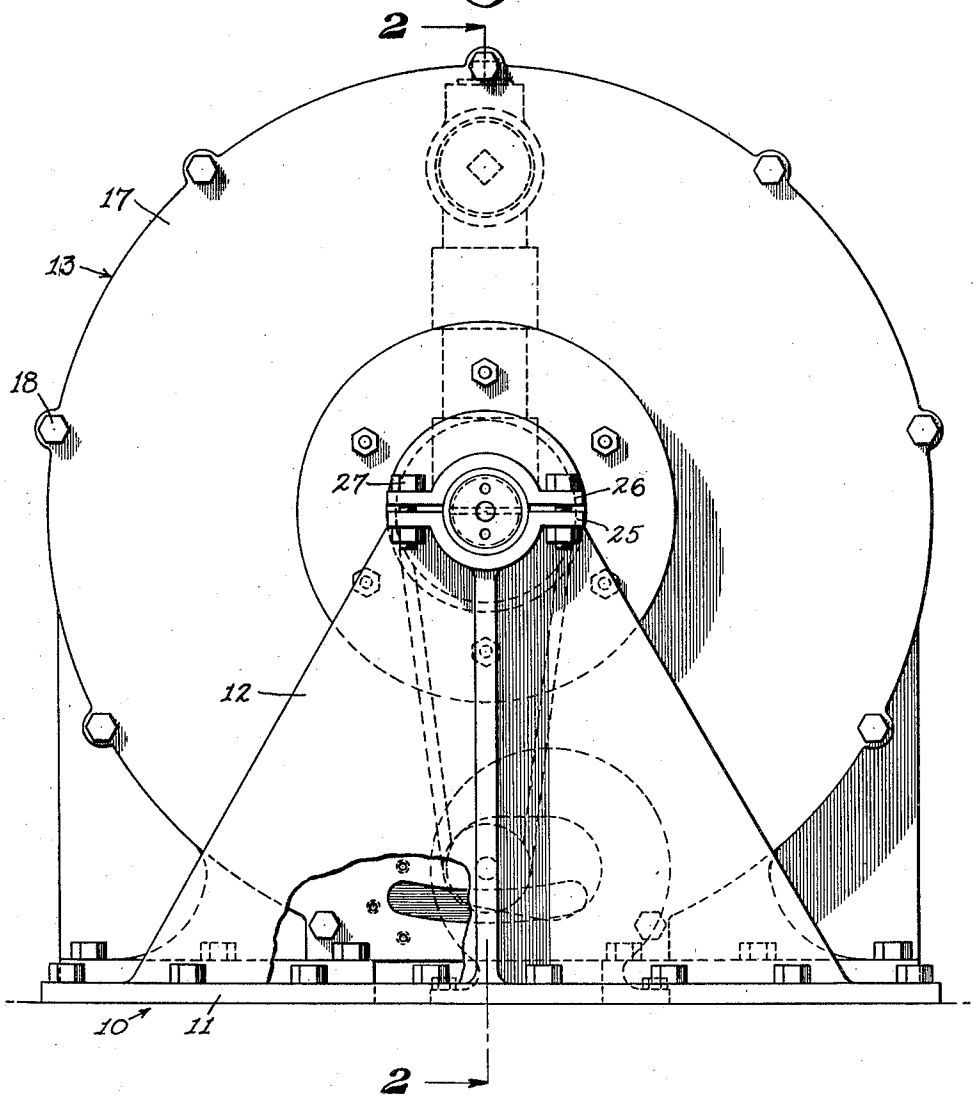

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Fig: 2

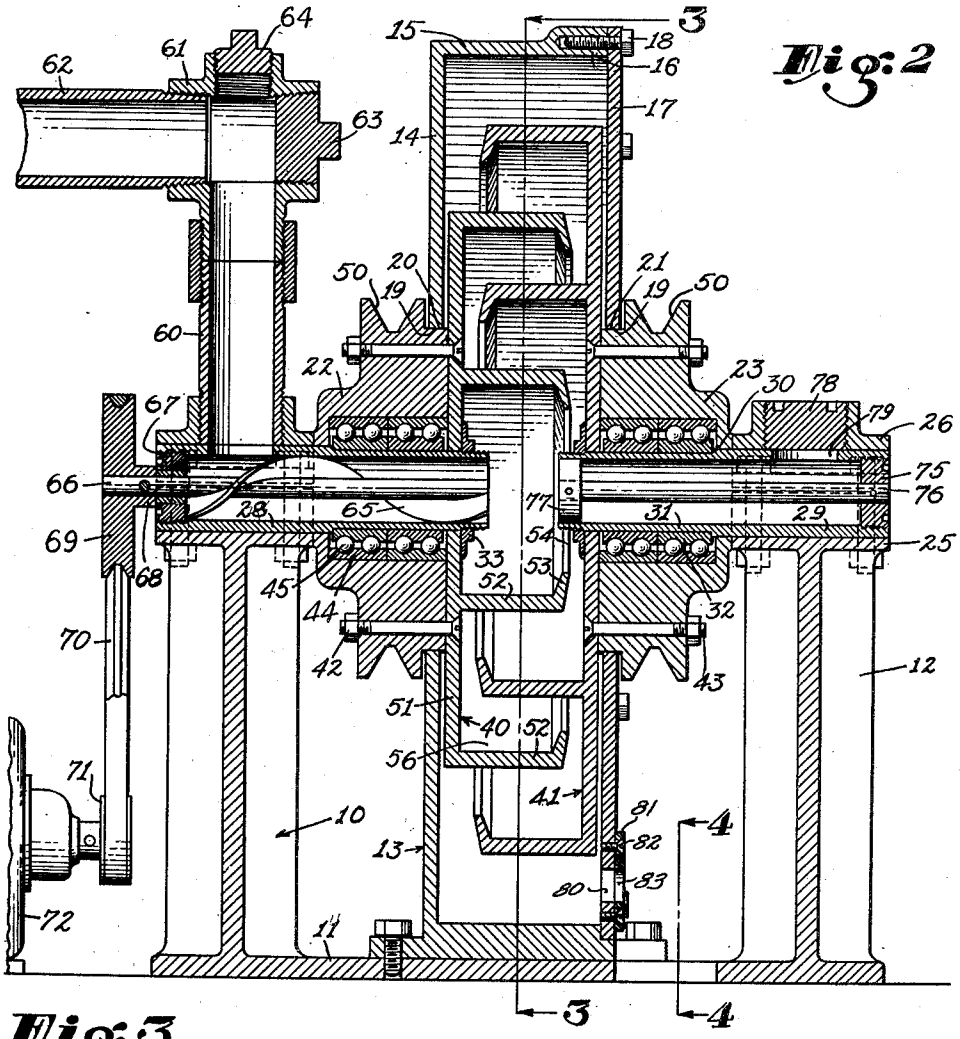


Fig: 3

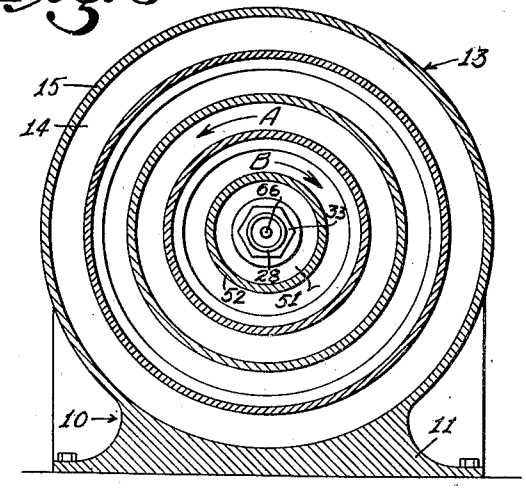
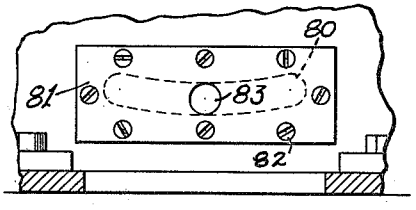


Fig: 4



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2,502,022

OPPOSED DISK ROTOR TYPE CENTRIFUGAL PULVERIZER

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3 Claims. (Cl. 241—163)

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This invention relates to a bombarding machine suitable for use in the reduction of materials, such for example, as disassociation of materials from other materials, like quartz, the destruction of coal for producing synthetic resin components and other materials; the primary object in operation of the machine being to reduce the substance under treatment to its individual crystallography.

It is the primary object of the invention to provide a new and improved machine of the character indicated wherein materials can be bombarded by a cyclonic action created by the opposite rotation of two or more centrifugal pockets formed by a succession of ring members.

A further object of the invention is to provide a new and improved device of the character described wherein counter slip streams are created by oppositely rotated annular flange-like rings whereby a high degree of turbulence is created in the space between the rings, into which area material is adapted to be projected by the centrifugal action of the innermost of the concentric rings and the substance under treatment is reduced by the combination of the centrifugal force followed by the cyclonic turbulence in the intermediate surface, said machine being capable of generating heat which is often advantageous in treating certain materials.

An important object of the invention is to provide a new and improved machine of the character described in which any tendency to abrasion of the operating parts is minimized.

A still further object of the invention is to provide a new and improved device of the character described in which there is a plurality of concentric annular pockets between flanged rings suitably mounted on bearings whereby alternate rings may be oppositely rotated at high rates of speed, with means for introducing a substance or substances to be treated into the inner of the concentric rings, either wet or dry or a combination of a dry substance coupled with the introduction of a liquid, said rings being capable of opposite rotation whereby the material is subjected to cyclonic bombardment while being passed centrifugally from one ring to the rest until it has been discharged into a housing beyond the outermost ring from which housing the treated substance may be withdrawn.

An advantage of importance resides in the provision of a new and improved machine capable of use in a manner adapted to subject the material to an abrasive treatment resulting from a cooperative action of an air force and a centrifugal force and a rotative force and removing the material from the field of action of the air force and its cooperative forces and adapted immediately thereafter to subject the material to another combination of an air force, and a centrifugal and rotative force greater than the first named centrifugal and rotative force of another air force and another centrifugal force greater than the first named combination of forces.

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These and additional advantages of the invention will be made further apparent from the description which is taken in connection with the drawing.

The essence of the apparatus invention resides in a machine which embodies a rotor mounted for rotation at high speed, incorporating an annular pocket in which material first accumulates under the influence of centrifugal force, then escapes at the open end of the pocket from which it is discharged at high velocity into an oppositely disposed concentric pocket of similar design which is either stationary, idly mounted, or rotated in an opposite direction. The best results are achieved by rotating the rotors in opposite directions. Increased effect is obtained by employing a series of the alternately disposed concentric pockets. Means for introducing material for treatment into the innermost pocket is provided, and there is provided a confining housing or chamber to receive the products of reduction, with suitable means for removing the latter.

The essence of the process invention resides in subjecting a material to reduction in form and crystallography by the cooperative action of air, rotational and centrifugal forces in one pocket space and subsequently moving the materials into another pocket space and subjecting the material to another cooperative action of air and rotational and centrifugal forces of greater magnitude than those first acting on the material.

In the drawings:

Figure 1 is an end view of a machine embodying my invention.

Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a cross sectional view to a reduced scale of the structure of Figure 2 along the line 3—3 in the direction indicated.

Figure 4 is a fragmentary elevation as indicated by the line 4—4 in Figure 2.

I provide a suitable supporting frame 10 comprising a base 11 and vertical standards 12.

Upon the base 11 is bolted or otherwise mounted an annular housing 13 which for convenience of manufacture assembly may have one plane wall 14 and an integral annular flange 15, the latter being provided with threaded bosses 16 whereby a plane closure plate 17 may be bolted upon the flange by means of cap screws 18. A suitable sealing gasket not illustrated may obviously be employed between the flange 15 and the plate 17, if necessary or desirable. The central area of the plates 14 and 17 are cut out to define annular bearing elements 19 which closely engage hubs 20 and 21 of pulleys 22 and 23 subsequently described in greater detail.

The frame members 12 provide rigid mountings in the form of sockets 25 and caps 26 secured by bolts 27 for rigidly clamping stationary hollow shafts 28 and 29. These shafts may be identical. They are preferably formed with an intermediate shoulder 30 and a reduced inner section 31, the latter of which supports one-half of one or more ball races 32. The inner ends of both shafts are threaded as illustrated to receive nuts 33.

Mounted on the shaft 28 is a rotor 40 and on the shaft 29 is a rotor 41. These are subsequently described in greater detail. The pulley 22 is bolted to the rotor 40 by means of bolts 42 and the pulley 23 is bolted to the rotor 41 by bolts 43. These pulleys contain outer ball races 44, and between the inner and outer ball races are balls 45, whereby bearings are provided for rotation of the pulleys 22 and 23 with their respective rotors 40 and 41 on the stationary shafts 28 and 29.

The pulleys are formed with V notches 50 for receiving conventional V belts, not illustrated, which may be driven by any suitable high speed power means for rotating the pulleys. These pulleys are to be rotated in opposite directions whereby the rotors 40 and 41 rotate oppositely, as indicated at A and B, Figure 3.

The rotor 40 comprises an annular plate 51 formed with one or more integral cylindrical flanges 52 which terminate in annular lips 53 inclined away from the plate 51. In the lips are provided circular openings 54, and this construction of the rotor provides annular pockets 56 for purposes which will become further apparent.

The rotor 41 is constructed similarly to the rotor 40 except that its annular flanges and retaining pockets alternate centrifugally, i. e. in distance from the center of the rotor, with the flanges and retaining pockets of the rotor 40. The flanges of the two rotors overlap so that any material originally disposed in the inner cylindrical pocket formed by the innermost flange 52 must necessarily be passed along a sinuous course in moving centrifugally from the inner cylindrical member through the concentric outwardly succeeding cylinders.

In the top of the left-hand cap 26 as viewed in Figure 2, is provided a large tapped hole for receiving a threaded pipe 60 which may extend upwardly a suitable distance and be connected by a pipe cross member 61 of well known construction to a horizontally disposed pipe member 62 extending away from the machine to a source of the material to be treated in the machine. Threaded plugs 63 and 64 may be employed for closing the other holes in the cross pipe member when those holes are not being used.

During some uses of the machine certain things such as water or other fluids may be introduced through the openings in the pipe cross member after removing the plugs 64 and/or 63.

A conveyor screw 65 mounted on a shaft 66 in the hollow shaft 28 moves the material passing through the pipe 60 into the cylindrical member 52. The shaft 66 has a bearing arranged in the outer end of the shaft 28 and including a thick plug 67 screwed into the end of the shaft 28 constructed to receive a bushing element of a hollow stub shaft 68 integrally joined to V pulley 69. The stub shaft is fastened to the shaft 66 by a pin or the like. A V belt 70 connects the pulley 69 with a V pulley 71 on the shaft of an electric motor 72.

By means of well known connecting means (not shown) this motor may, if desired, also drive the rotors of the machine in opposite directions.

The hollow in the shaft 29 may be closed at its outer end by a threaded plug 75 screwed into the end of the shaft. Fastened in the plug 75, a rod 76 extends inwardly to the inner end of the shaft 29 and has fastened to its end a removable closure member 77. In a tapped hole in the top of the right-hand cap 26 is screwed a plug 78 which covers a hole 79 in shaft 29. It can be seen that by this construction material to be brought into my bombarding machine can be introduced, when desirable, through the hollow shaft 29 as well as through the shaft 28, after removing the closure members 77 and 78.

For removing the finely ground or powdered solid material from my machine, an arcuate slot 80 is provided near the bottom of the machine and it may have a closure plate 81 fastened in place by a plurality of screws 82. In the plate 81, is provided a hole 83 of suitable diameter and when the material treated in my machine is in a fluid state it may often be removed through the hole 83.

It can be readily seen that either of the rotor plates 40 and 41 may be disconnected from its power source and left to float idly and remain stationary or to be revolved by action of the material at a slower speed than the driven rotor plate. Or the undriven rotor plate may be fastened, when desired, to its associated stationary hollow shaft by any suitable conventional means such as one or more set screws (not shown).

Some of the advantages of my bombarding machine will be apparent from the foregoing description. Other advantages arise from the opposite rotation of the alternate rotors which causes opposing eddies to effect a bombarding action. To accomplish this, the rotors should be driven at a high rate of speed.

There may be a planetary atmospheric condition, that is, a thin layer of still or slow moving air next to a layer of material, thus the material will usually move over the lips substantially at rest, notwithstanding the peripheral speed of the rotors. Abrasion of the rotor flanges is thus further minimized.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent machines which may be apparent to those skilled in the art.

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

1. A disintegrating machine comprising a sup-

porting frame, spaced axially aligned horizontal shafts fixed on the frame, an annular housing attached to the frame encompassing the space between said shafts comprising lateral and circumferential wall portions, a rotor rotatably mounted on one of said shafts and a drive therefor in one direction, a rotor on the other shaft in axially spaced relation to the first rotor and a drive therefor in the opposite direction, each said rotor comprising a radially extending annular plate, a plurality of flanges of equal breadth and substantially uniform thickness extending transversely from the side of the plate adjacent the other rotor and lips of substantially equal depth at the free edges of the flanges extending radially inwardly toward the common axis of the shafts forming pockets, said lips being beveled laterally outwardly, said flanges on one of the rotors being intermeshed in alternate relationship and at substantially equal distances from adjoining flanges of the other rotor and overlapping for distances not less than substantially one-half the breadth of the flanges, means forming a feed passage through one of the rotors to a location within the innermost flange and one of the lateral wall portions having a laterally directed outlet adjacent the circumferential wall portion.

2. A disintegrating machine comprising a supporting frame, spaced axially aligned horizontal shafts fixed on the frame, an annular housing attached to the frame encompassing the space between said shafts comprising lateral and circumferential wall portions, a rotor rotatably mounted on one of said shafts and a drive therefor in one direction, a rotor rotatably mounted on the other shaft in axially spaced relation to the first rotor and a drive therefor in the opposite direction, each said rotor comprising a radially extending annular plate, a plurality of flanges of substantially equal breadth extending transversely from the side of the plate adjacent the other rotor and lips of substantially equal depth at the free edges of the flanges extending radially inwardly toward the common axis of the shafts forming pockets, said lips being outwardly beveled at an angle not greater than 135 degrees from the respective flange, said flanges on one of the rotors being intermeshed in alternate relationship and at substantially equal distances from adjoining flanges of the other rotor and overlapping for distances greater than one-half the breadth of the flanges, means forming a feed passage through one of the shafts and the corresponding rotor to a location within the innermost flange and one of the lateral wall portions having a laterally directed outlet adjacent the circumferential wall portion.

3. A disintegrating machine comprising a supporting frame, spaced axially aligned horizontal

shafts fixed on the frame, at least one of said shafts having a feed bore therethrough and a feed device associated therewith, an annular housing attached to the frame encompassing the space between said shafts comprising spaced parallel radially disposed side walls and a cylindrical outer wall, a rotor rotatably mounted on one of said shafts and a drive therefor in one direction, a rotor rotatably mounted on the other shaft in axially spaced relation to the first rotor and a drive therefor in the opposite direction, each said rotor comprising a radially extending annular plate, a plurality of flange strips of equal breadth and uniform thickness extending transversely at right angles from the side of the plate adjacent the other rotor and lips of substantially equal depth at the free edges of the flanges extending radially inwardly toward the common axis of the shafts forming pockets, said lips being outwardly beveled away from the plate at an angle not greater than 135 degrees from the respective flange, said flanges on one of the rotors being intermeshed in alternate relationship and at substantially equal distances from adjoining flanges of the other rotor and overlapping for distances greater than substantially one-half the breadth of the flanges, one of the side walls of the housing having a laterally directed outlet spaced radially inwardly from the outer wall thereof and adapted thereby to form a pocket at said outer wall.

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