

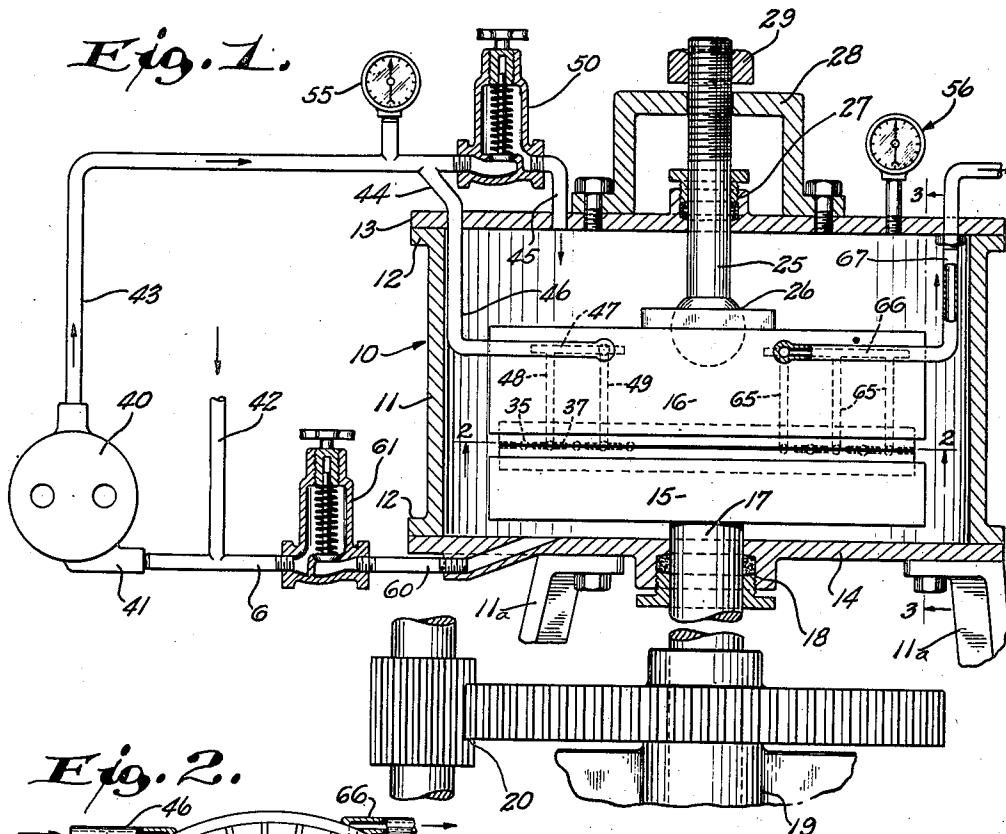
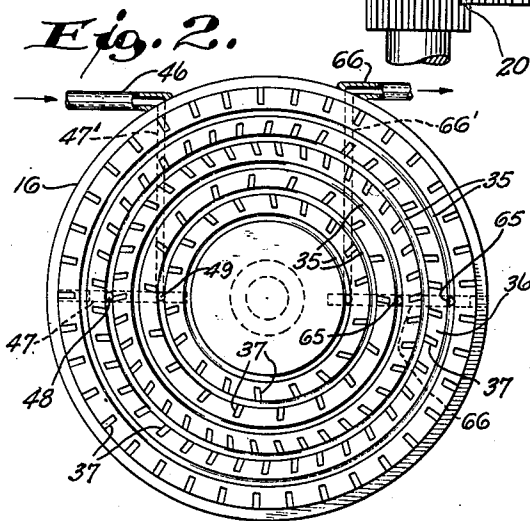
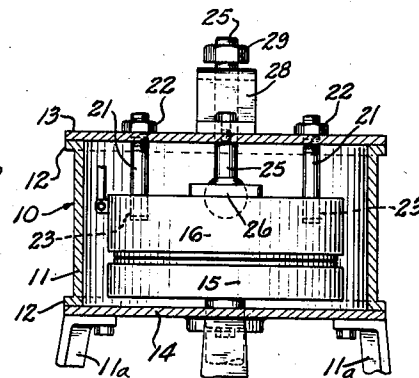
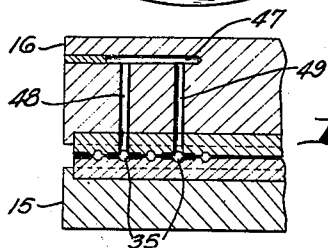
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GRINDING MILL

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GRINDING MILL

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This invention relates in general to mills and more particularly to grinding mills of the character designed and adapted for use in grinding or homogenizing emulsions, enamels, lacquers, pastes, pigments, slurries or similar materials.

An object of the invention is to provide a mill of this character wherein in a simple and practical manner very effective control is had over the pressure under which the grinding elements are forced toward each other thereby enabling the mill to grind the material to any desired particle size within the limits of its capacity, fine grinding being effected by increasing the pressure and coarser grinding by correspondingly decreasing the pressure.

Another object of the invention is to improve and enhance the grinding action, this being accomplished by dressing the coacting faces of the grinding elements in a special way, developing the desired pressure therebetween in an advantageous manner and supplying the material to be ground to the faces of the grinding elements and carrying off the ground material therefrom in a unique and highly advantageous way.

A further object of the invention is to improve, simplify and compact the structure of the mill, render it easy and economical to manufacture and to operate, enhance the efficiency of its grinding action so to improve the qualities of its products as well as increase production and withal to provide a mill which is rugged and durable and hence will stand up under sustained and severe use.

Other objects and advantages reside in certain novel features of the construction, arrangement, and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawing forming a part of this specification, and in which:

Figure 1 is a fragmentary view partly in side elevation and partly in transverse vertical section showing a grinding mill embodying the present invention, a number of the parts being diagrammatically illustrated to simplify the illustration;

Figure 2 is a view in horizontal cross section taken on line 2—2 of Figure 1 and illustrating how the coacting faces of the grinding elements are dressed;

Figure 3 is a view in transverse vertical cross section taken on line 3—3 of Figure 1; and

Figure 4 is a fragmentary view in radial cross section showing how the supply passages,

through which the material to be ground flows, are formed in the fixed grinding disk.

Referring to the drawing, and more particularly to Figures 1 to 4, inclusive, it will be seen that in one embodiment of the present invention the grinding mill may comprise a pressure-tight housing designated generally at 10, and which is firmly secured or bolted to suitable supports, fragments of which are designated at 11a. The housing 10 has a cylindrical body portion 11 having out-turned flanges 12 at its ends and to these flanges the upper and lower plates or end members 13 and 14 of the housing are securely bolted or otherwise fastened. The grinding elements are disposed in the chamber provided by the housing 10 and in the construction illustrated comprise a rotatable grinding disk 15 and a cooperable grinding disk 16 which is held against rotation, although free to move axially toward and away from the rotating disk 15.

The disk 15 is fixed to the inner end of a driving shaft 17 which extends through a stuffing box 18 provided therefor in the lower end wall 14 of the casing and which is supported for rotation in suitable bearings provided therefor, a fragment of one of which is indicated at 19.

The shaft 17, and consequently the rotating disk 15, are driven in any suitable way, usually by an electric motor (not shown) through reduction gearing illustrated diagrammatically at 20.

The grinding disk 16 is held against rotation by means of a pair of guide studs 21 (see Figure 3) having their upper portions threaded into internally threaded openings provided in the top wall 13 of the housing or casing and secured in position by lock nuts 22. The lower ends of the guide studs 21 are smooth and are a loose guiding fit in sockets 23 formed in the grinding disk 16. These studs function to hold the disk 16 against rotation but permit free axial movement thereof and a limited amount of tilting. The grinding disk 16 is centered with respect to its cooperable disk 15 by means of a short shaft 25 which has its lower end connected to the disk 15 by a ball and socket joint 26. The smooth portion of the shaft 25 slides through a stuffing box 27 provided in the upper end member 13. The upper end portion of the shaft 25 is externally threaded and extends loosely through an opening provided therefor in a bracket 28. A nut 29 threaded on the upper portion of the shaft 25 is engageable with the bracket 28 to limit the downward movement of the shaft 25 when this is desired and to provide

a mechanical means for lifting the disk 16 when this is desired. In normal operation, the nut 29 is backed off and the shaft 25 slides freely up and down.

The coacting or engaged faces of the grinding disks 15 and 16 may be dressed in the special manner shown in Figure 2. Each disk is provided with a plurality of concentric, radially spaced grooves 35 separated by annular grinding faces 36 in which are provided angled shearing slots 37. In the construction illustrated, there are five concentric grooves 35. The material to be ground is supplied under pressure to alternate intermediate grooves 35, as illustrated in Figures 1, 2, and 4, and is carried off from the other grooves 35 in the manner shown, and as will be hereafter more fully described.

As shown in Figure 2, each shearing slot 37, in all of the grinding faces 36 except the outermost, has one end in open communication with a groove 35 to which material is supplied under pressure, and is blind or closed at its opposite end, the shearing slots extending only part way across the grinding faces 36 in which they are formed. The shearing slots 37 in the outermost grinding face 35 are open at the outer periphery of the outermost grinding face 36 as they receive material from the chamber surrounding the disks 15 and 16 as will be hereafter more fully described but they also extend only part way across their grinding faces and are blind and closed at their inner ends. The blind or closed end of each shearing slot 37 functions as a dam over which particles may not pass until they have been ground or reduced to a predetermined particle size.

For the purpose of supplying the material to be ground under pressure to the grooves of the grinding disks, and also to the space in the chamber of the housing surrounding these disks, a motor-operated pump, illustrated generally and diagrammatically at 40, is provided, and has its suction side 41 connected to a source of supply of the material to be ground. The source of supply is illustrated diagrammatically at 42. The pump 40 discharges into a conduit 43 which has two branches designated at 44 and 45. The branch 44 leads through the top wall of the housing and has a flexible section 46 coupled up to a passage 47' formed in the grinding disk 16 and communicating with a second passage 47 also formed in disk 16 and serving as a manifold to other passages 48 and 49 which lead down to the alternate intermediate grooves 35 of the grinding disk 16. The other branch 45 of the conduit 43 communicates directly with the interior of the housing but in this branch a spring loaded valve 50 is incorporated. This valve may be manually adjusted and it regulates the flow of the material to the ground into the pressure chamber, and consequently provides a means for establishing a differential between the pressure under which the material is supplied to the grooves 35 and the pressure under which it is supplied to the interior of the housing. A gauge 55 may be provided on the conduit 43, and a gauge 56 may be provided for the pressure chamber.

Further control over the pressure in the chamber is had by providing a by-pass 60 between the pressure chamber and the suction side of the pump 40 and incorporating in this by-pass a pressure relief valve or spring loaded valve 61 similar in its nature to the valve 50.

The material after being ground by the action thereon of grinding faces 36 and their shearing slots 37, passes into the other grooves 35 and

then up through passages 65 communicating with these grooves to a manifold passage 66 which connects through passage 66' with the flexible pipe 67 leading off to a point of discharge.

With a construction of this character, the pressure with which the disks are forced toward each other may be readily varied by changing the adjustment of the valves 50 and 61. By decreasing the pressure under which the material is supplied to the chamber and increasing the pressure under which it is supplied between the grinding disks, coarser grinding is available. On the other hand, by reducing the pressure of the material supplied between the grinding disks, and increasing it in the chamber the disks are forced together with a greater pressure and consequently a finer particle size is had. It will be observed that during the grinding operation the material to be ground passes from the registering grooves 35 across the grinding surfaces 36 into the other grooves 35 and also some material is forced in from the pressure chamber into the outermost groove 35.

While I have shown and described one construction in which the invention may be advantageously embodied, it is to be understood that the construction shown has been selected merely for the purpose of illustration or example, and that various changes in the size, shape, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

The invention claimed is:

1. A mill of the character described comprising a housing defining a pressure-tight chamber, co-operable grinding elements in said chamber, means for holding one of said grinding elements against rotation while providing for its movement toward and away from the other, means for rotating the other grinding element, said grinding elements having their confronting faces provided with concentric registering grooves, means for supplying material to be ground under pressure to alternate registering grooves and also to said pressure chamber, means for carrying off ground material from the other of said grooves, and pressure relief means for said chamber leading back to the source of supply.

2. A mill of the character described comprising a housing defining a pressure-tight chamber, co-operable grinding elements in said chamber, means for holding one of said grinding elements against rotation while providing for its movement toward and away from the other, means for rotating the other grinding element, said grinding elements having their confronting faces provided with concentric registering grooves, means for supplying material to be ground under pressure to alternate registering grooves and also to said pressure chamber, controllable means for establishing a differential between the pressure under which the material is supplied to said grooves and under which it is supplied to said chamber, means for carrying off ground material from the other of said grooves, and pressure relief means for said chamber leading back to the source of supply.

3. A grinding mill comprising a pressure-tight casing, a pair of grinding disks therein, means for holding one of said disks against rotation while providing for axial movement thereof toward and away from the other disk, means for supporting the other disk for rotation, means for rotating said rotatable disk, the confronting faces of the disks being provided with a plurality of

concentric registering grooves and having annular grinding faces between said grooves provided with shearing slots, a pump, a conduit into which said pump discharges, said conduit having a branch, a manifold connecting said branch with alternate grooves in the disk held against rotation, said conduit having a second branch leading into the interior of the casing, a spring loaded valve for regulating the flow through said second branch, a second manifold on said fixed disk connected with the other of said grooves, and means connected with said second manifold for carrying the ground material therefrom to a point of discharge.

4. A grinding mill comprising a pressure-tight casing, a pair of grinding disks therein, means for holding one of said disks against rotation while providing for axial movement thereof toward and away from the other disk, means for supporting the other disk for rotation, means for rotating said rotatable disk, the confronting faces of the disks being provided with a plurality of concentric registering grooves and having annular grinding faces between said grooves provided with shearing slots, a pump, a conduit into which said pump discharges, said conduit having a branch, a manifold connecting said branch with alternate grooves in the disk held against rotation, said conduit having a second branch leading into the interior of the casing, a spring loaded valve for regulating the flow through said second branch, a second manifold on said fixed disk connected with the other of said grooves, means connected with said second manifold for carrying the ground material therefrom to a point of discharge, a conduit between the casing and the suction side of the pump, and a spring loaded valve for regulating flow through said conduit.

5. A grinding mill comprising a pressure-tight housing, a pair of grinding disks disposed in the housing, means for holding one of said grinding disks against rotation while providing for axial movement thereof toward and away from the other disk, means for supporting the other disk for rotation, means for rotating said rotatable disk, the confronting faces of said disks having a plurality of concentric registering annular grooves, and having annular grinding faces between said grooves provided with shearing slots, means for supplying alternate grooves with the material to be ground under pressure, and means for carrying away the ground material from the other of said grooves.

6. A grinding mill comprising a pair of relatively rotatable grinding disks, a hermetically sealed housing enclosing said disks, said disks having their confronting faces provided with a plurality of concentric radially spaced annular grooves, means for supplying alternate of said grooves with the material to be ground under pressure, means for supplying the interior of the housing with the material to be ground under pressure, and means for carrying away the ground material from the other of said grooves.

7. A grinding mill comprising a fixed grinding disk, a rotatable grinding disk cooperable therewith, said disks having their confronting faces provided with a plurality of concentric register-

ing grooves, a casing having a pressure-tight chamber in which said disks are disposed, a pump, a conduit into which the pump discharges, said conduit having two branches, one connected with alternate grooves of the fixed disk and the other connected with the interior of the casing, a spring loaded valve in said last named branch, means for carrying away the ground material from the other of said grooves, a by-pass between said chamber and the suction side of the pump, and a spring loaded valve in said by-pass.

8. A grinding mill comprising a pressure-tight housing, cooperable grinding elements in said housing having concentric annular grooves in their confronting faces, means for supplying the material to be ground under pressure to alternate of said grooves and to the interior of said housing, means controllable at will for establishing a differential between the pressure under which the material is supplied to the grooves and that under which it is supplied to the housing, and means for carrying away the ground material from the other of said grooves.

9. A grinding mill comprising a pressure-tight housing, cooperable annular grooves in their confronting faces, means for supplying the material to be ground under pressure to alternate of said grooves and to the interior of said housing, means controllable at will for establishing a differential between the pressure to which the material is supplied to the grooves and under which it is supplied to the housing, and a by-pass between the housing and the source of supply of said material, means for regulating flow through said by-pass, and means for carrying away the ground material from the other of said grooves.

10. A grinding mill comprising a fixed grinding disk, a rotatable grinding disk cooperable therewith, said disks having their confronting faces provided with a plurality of concentric registering grooves, a casing having a pressure-tight chamber in which said disks are disposed, said fixed disk having passages leading to alternate intermediate grooves thereof and having discharge passages leading from the other groove, means connected with the supply passages for supplying material to be ground thereto under pressure, and means for carrying away the ground material from the discharge passages and having means to supply material to be ground to the pressure chamber.

11. A grinding mill of the character described comprising a pair of grinding disks, means for effecting relative rotation of said disks, the confronting surfaces of said disks having a plurality of concentric registering annular grooves and being provided with annular grinding faces between said grooves, the grinding faces having shearing slots open at one end to receive the material to be ground and closed at their opposite ends to provide dams over which particles may not pass until they have been reduced to a predetermined particle size, means for supplying alternate grooves with the material to be ground under pressure, and means for carrying away the ground material.

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