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[54] GRINDING APPARATUS

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[58] Field of Search241/256, 259

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[57] ABSTRACT

Grinding apparatus with grinding discs in opposed relationship and forming between themselves a grinding space, one of the grinding discs being constituted of two concentrically arranged annular holder members for disc grinding elements, the inner one of which is axially adjustable relative to the outer one so as to compensate for the non-uniform wear on the grinding surfaces of the disc elements.

3 Claims, 3 Drawing Figures

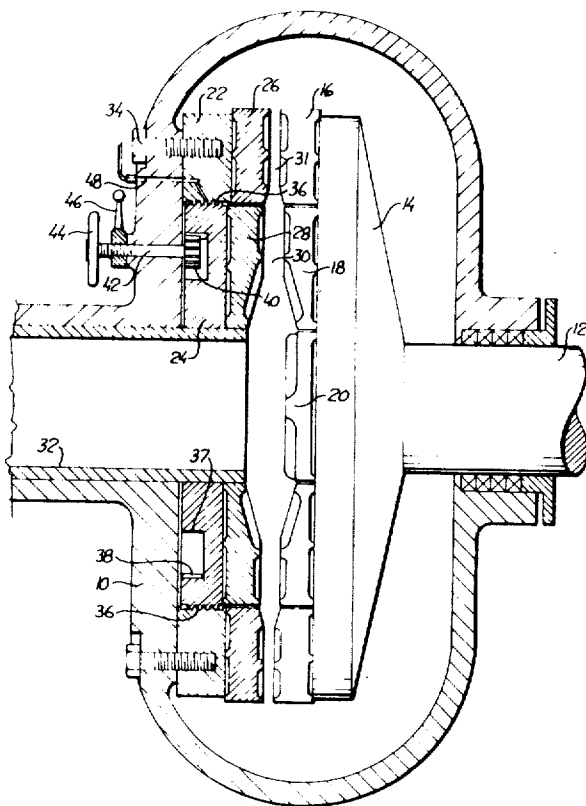
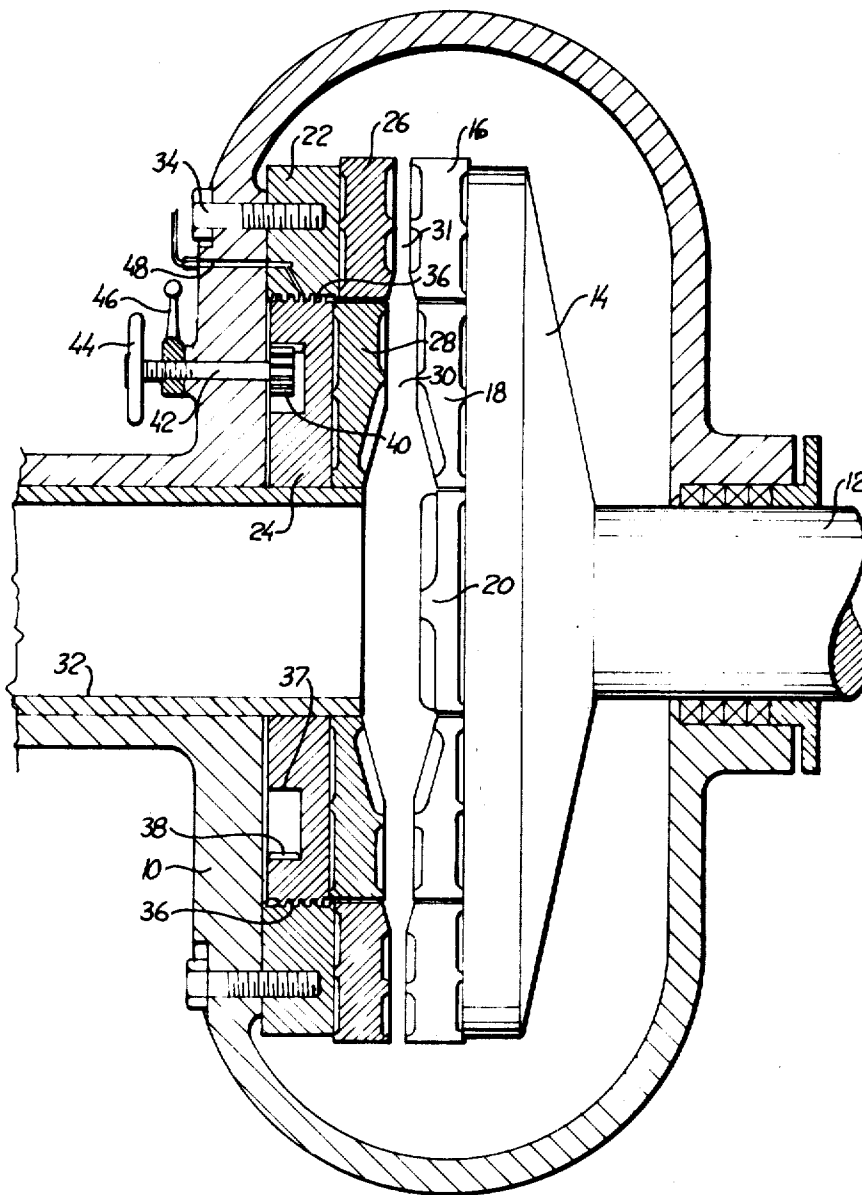
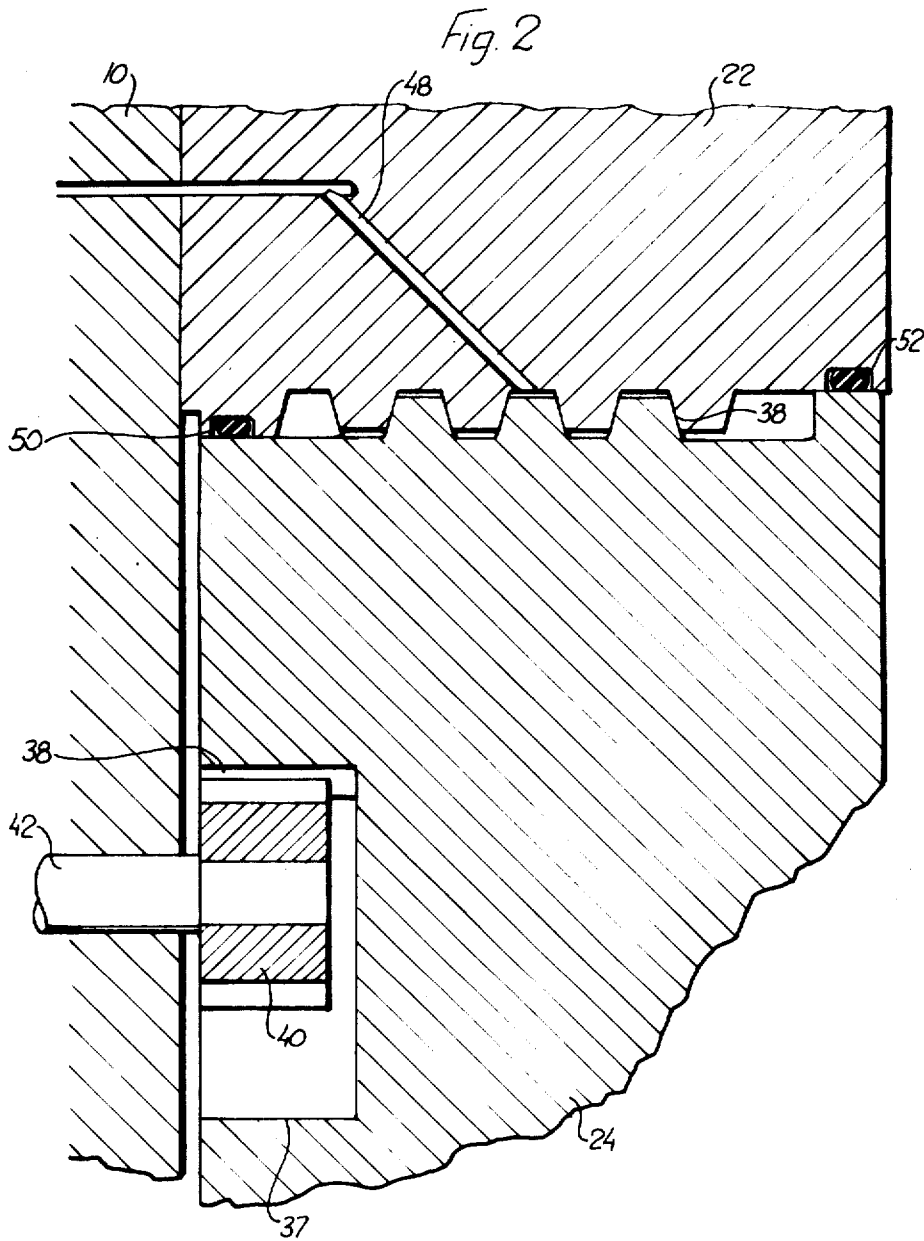


Fig. 1

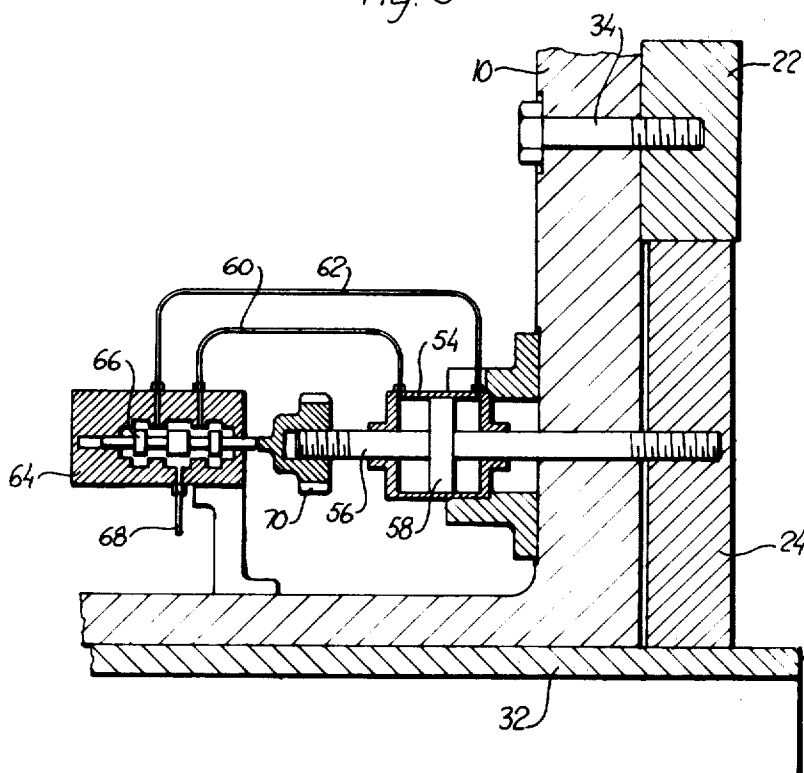


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Fig. 3



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GRINDING APPARATUS

This invention relates to a grinding apparatus.

More particularly this invention relates to a grinding apparatus with grinding discs arranged within a casing, of which discs at least one is rotatable and which discs between themselves form a grinding space for the grinding produce consisting of vegetable or similar material. As a rule the grinding discs are constructed so that a gradual disintegration such as defibration and/or raffination of the produce passing through the grinding interspace is effected. The grinding discs forming part of the apparatus are for this purpose subdivided into various grinding zones which are composed of ribs and grooves of mutually differing shapes. It is also known to conduct the grinding process in several stages between varying separate grinding members cooperating in pairs in order to attain a desired degree of disintegration of the vegetable or organic material.

One main object of the invention is to provide a grinding apparatus of the type in consideration which renders possible a treatment in two or more stages of the grinding produce between one and the same pair of grinding discs rotating relatively one another. According to one main feature of the invention at least the one grinding disc is composed of two concentric disc elements of which the inner one is axially adjustable relatively to the outer one for compensation of the non-uniform wear on the grinding surfaces of the elements. This wear is greatest in the inner or primary grinding zone which receives the coarser grinding produce whereas the produce when entering the outer or secondary grinding zone already has been subjected to a homogenization or pre-working. The non-uniform wear has previously rendered necessary replacement of the entire grinding assembly due to wear in the inner zone only, since otherwise the less effective primary grinding in this zone would have an disadvantageous reaction on the treatment in the outer grinding zone.

A further object of the invention is to provide a grinding apparatus which renders possible that the outer part of the grinding space can be adjusted with precision to a predetermined width, which often is so small as 0.02 to 0.03 mms, especially in refiners. The dimensions of the grinding space in the outer zone can be of the same order of magnitude, as the diameter of the individual cellulose fibers present in the grinding produce. Then it is essential that the outer grinding zone is formed of disc elements which are fixed stationary so that they retain a fully controllable position.

Further objects and advantages of the invention will become apparent from the following description considered in connection with the accompanying drawings, which form part of this specification and of which:

FIG. 1 shows a longitudinal sectional view of a portion of a grinding apparatus constructed according to an embodiment of the invention.

FIG. 2 shows a portion of the apparatus in the same section as in FIG. 1, but on a greater scale.

FIG. 3 shows a portion of an apparatus according to a modified embodiment of the invention.

In the drawings, reference numeral 10 denotes a portion of the rigid stand of the grinding apparatus which stand forms a casing and within which a shaft 12 carrying a grinding disc 14 is mounted rotatably. The grinding disc carries disc elements 16 and 18 arranged concentrically in known manner and usually composed of

segments. Disposed in the center may be a disc 20 which feeds the grinding produce radially outwards. A stationary grinding disc is according to the invention composed of two concentrically arranged annular holder members 22, 24 for grinding disc elements 26 and 28, respectively, which also each of them is composed of segments. Formed between said stationary disc elements 26, 28 and the rotatable disc elements 16, 18 is a grinding space 30, 31, to which the produce to be ground is supplied e.g. in the form of chips or fiber pulp through a central channel 32. The grinding disc segments are in known manner provided with grooves and ribs.

The outer holder member 22 is rigidly secured in the stand 10 by means of screws 34 equally spaced around the circumference. Formed axially of the confronting circumferential surfaces between the two annular holder members 22, 24 are radially extending interengaging threads 36 so that the inner holder member 24 when being rotated changes its axial location relative the outer holder member 22. This rotation may be brought about e.g. by having the holder member 24 formed with a recess 37 having an inner gear rim 38 which is engaged by a gear wheel 40 which is mounted on a shaft 42 in the stand 10 and which can be rotated by means of a hand wheel 44. The gear wheel 40 is locked in desired position by means of a nut 46.

The thread joint 36 between the outer stationary holder member or stator ring 22 and the inner rotatable and axially adjustable holder member or rotor ring 24 is supplied with pressure oil or grease through a conduit 48, so that the joint is continuously kept filled with such lubricant. The lubricant is prevented from penetrating out from the thread joint by means of sealing devices such as O-rings 50, 52. The thread joint is here formed with such a thread profile that it can take up axial forces acting on the inner grinding member.

According to the invention the advantage is attained that the grinding which may comprise defibration and/or refining, can be conducted in two stages with grinding spaces 30, 31 independent of one another with respect to their widths, but within the same pair of mutually cooperating grinding members. In this connection the secondary grinding space 31 is adjusted with high precision through adjustment in axial direction of the rotating grinding member 14 of the grinding apparatus and the disc elements associated therewith. This adjustment is readjusted in response to the wear on the outer grinding members so that the desired degree of defibration or raffination is obtained. The axial adjustment of the rotatable grinding member may be effected by means of a servomotor in the manner known from e.g. U.S. Pat. No. 2,891,733. The inner grinding space 30 within which the primary grinding process takes place is adjusted independently of the outer grinding space 31 determined with high precision, to a considerably greater space width by control of the annular holder member 24 and the disc element 28 supported by the same. The greater wear in this inner or primary grinding zone can in an easy manner be compensated for by adjusting the axial position of the inner grinding members 24, 28 by means of the hand wheel 44. As has become evident from the description hereinbefore, it is of essential importance that the outer grinding ring 26 is firmly anchored within

the stator ring as the width of the space in this way can be adjusted with high precision for the secondary grinding stage. According to the invention it is possible to work here with grinding spaces within the diameter for the individual cellulose fibers and less.

The embodiment shown in FIG. 3 differs from the preceding one substantially by the annular inner holder member 24 being actuated by a servomotor or a pressure device 54 which has a piston rod 56 which is rigidly secured to the stator ring 24 and carries a piston 58. Said piston subdivides the interior space of the servomotor into two chambers to which pressure medium such as oil can be supplied through conduits 60, 62 from a pilot valve 64 of a kind known per se. This valve is provided with a valve body 66 which depending on its axial position directs pressure fluid to the pressure device 54 through one or the other of the conduits 60, 64 as is described in the U.S. Pat. No 2,971,704, for example. Pressure fluid is fed to the valve 64 through a conduit 68.

A control nut 70 or similar means is screwed on the outer end of the piston rod 56. This nut cooperates with the valve body 66 in such a manner that when the inner annular holder member 24 due to an instantaneously occurring overloading emanating from the grinding produce is pushed to the left according to FIG. 3 from some predetermined position, the valve body 66 is actuated for supply of pressure fluid through the conduit 60 to the left-hand side of the servomotor 54, the holder member 24 and the disc element 28 thereby being subjected to increased pressure and pushed in a direction towards the rotating grinding disc 14 until a state of balance has been reached again. If, to the contrary, the predetermined space 30 of the primary side between the grinding members is decreased below the predetermined value, a superpressure is instead activated through the conduit 62 to act on the right-hand side of the piston 58. By rotating the nut 70 on the piston rod 56 the desired width of the primary space 30 can be adjusted to any desired value.

The adjusting nut 70 may be graduated so that it indicates various grinding interspaces which may come into consideration. A plurality of servomotors or pressure devices 54 may be arranged around the circumference of the stator casing 10 and be controlled either individually or when coupled together mechanically by means of a roller chain or through electrical rotating members, for example.

The servomotor or pressure devices according to FIG. 3 may be replaced by lockable setting screws which enter screw threads formed in the stator and which can be rotated manually or coupled together so, that they are actuated simultaneously for adjusting the axial position of the inner stator ring 24, 28. These setting screws may include an attachment screw which is entered by screwing into the stator and through which the screwing in of a fixing built into the stator ring 24 is effected. The valve 64 (FIG. 3) may be dispensed with, the grinding member 24, 28 with a so-called floating grinding space being kept pressed against the grinding produce with an adjustable pressure which is transmitted through one or several pressure devices 54.

While several embodiments of the invention have been shown and described, it is to be understood that

this is for purpose of illustration only, and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What is claimed is:

1. A grinding apparatus comprising a housing, a pair of grinding discs arranged within said housing and having grinding surfaces thereof confronting one another, one of said discs being stationary and composed of a plurality of concentrically arranged annular holder members for grinding disc elements, each composed of segments, the radially outer one of said holder members being rigidly fixed within the housing; the radially inner one of said holder members being mounted on the inner end of a rotatable shaft extending into said housing; said stationary and rotatable discs forming a grinding space therebetween for vegetable or similar produce to be disintegrated by defibration and refining of the same, said annular holder members having their confronting circumferential surfaces formed with inter-engaging threads extending radially outward of said circumferential surfaces; and means actuatable externally of the housing for adjusting the axial position of the radially inner one of said concentrically arranged annular holder members relative to said radially outer one thereof, said threads permitting said axial adjustment to be made by an unpredetermined increment by means of said inter-engaging threads, the axial position of the inner one of said concentrically arranged annular holder members relative to the fixed position of the concentric outer one of said holder members to compensate for the greater wear upon said inner grinding disc elements while maintaining the outer disc elements of said stationary grinding disc firmly anchored to said stationary holder member.

2. A grinding apparatus as defined in claim 1, wherein a supply conduit for lubricant extends through the wall of said housing and opens into the joint between threads on said outer stationary holder member and the threads on the inner axially adjustable holder member.

3. A grinding apparatus comprising a housing, a pair of grinding discs arranged within said housing and having the grinding surfaces thereof confronting one another, one of said discs being stationary and composed of a plurality of concentrically arranged annular holder members for grinding disc elements, each composed of segments, the radially outward one of said holder members being rigidly fixed within the housing; the radially inner one of said holder members being mounted on the inner end of a rotatable shaft extending into said housing; said stationary and rotatable discs forming a grinding space there-between for vegetable or similar produce to be disintegrated by defibration and refining of the same, and means actuatable externally of the housing for adjusting the axial position of the radially inner one of said concentrically arranged annular holder members relative to said radially outer one thereof to compensate for the greater wear upon said inner grinding disc elements while maintaining the outer disc elements of said stationary grinding disc firmly anchored to said stationary holder member, said externally actuatable adjusting means comprising a servomotor consisting essentially of a housing having a piston connected through conduits and a pilot valve to a source of pressure fluid.

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