

[54] GRINDING APPARATUS ESPECIALLY FOR LIGNOCELLULOSE CONTAINING MATERIAL

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241/37

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[58] Field of Search 241/34, 37, 135,
241/145, 256

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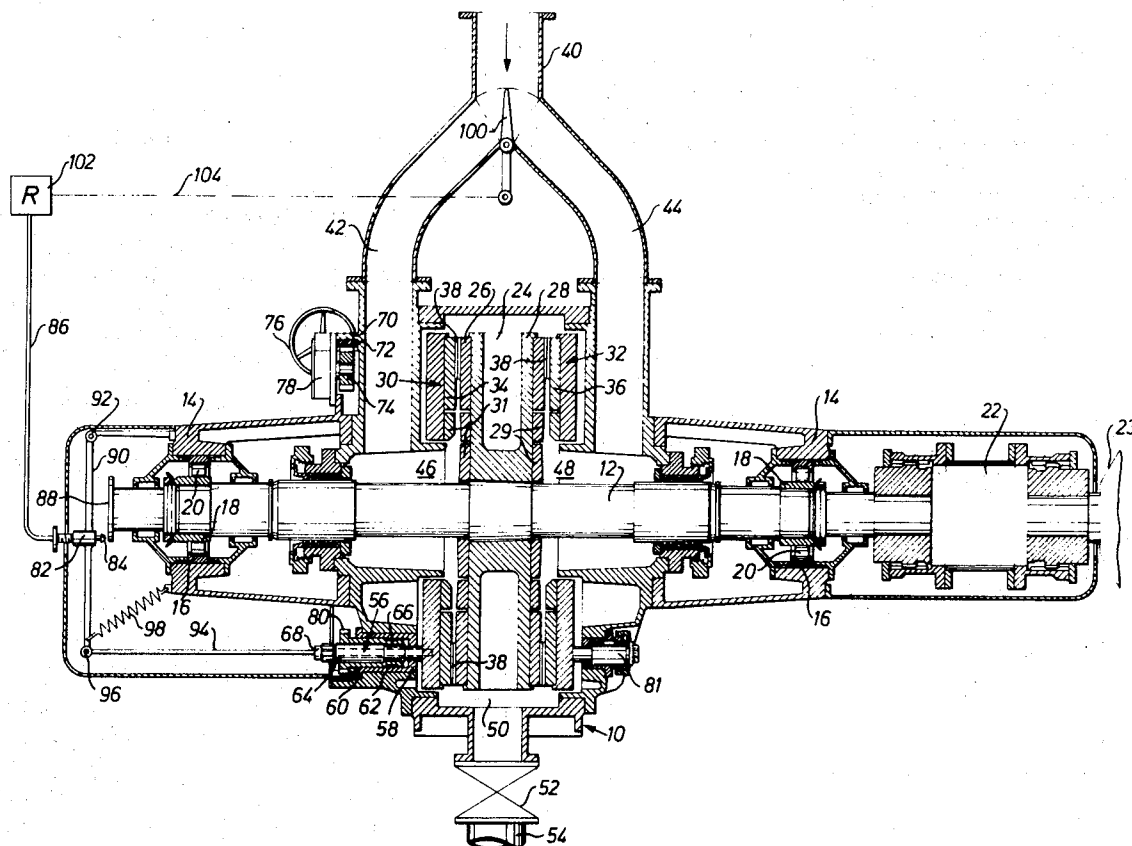
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ABSTRACT

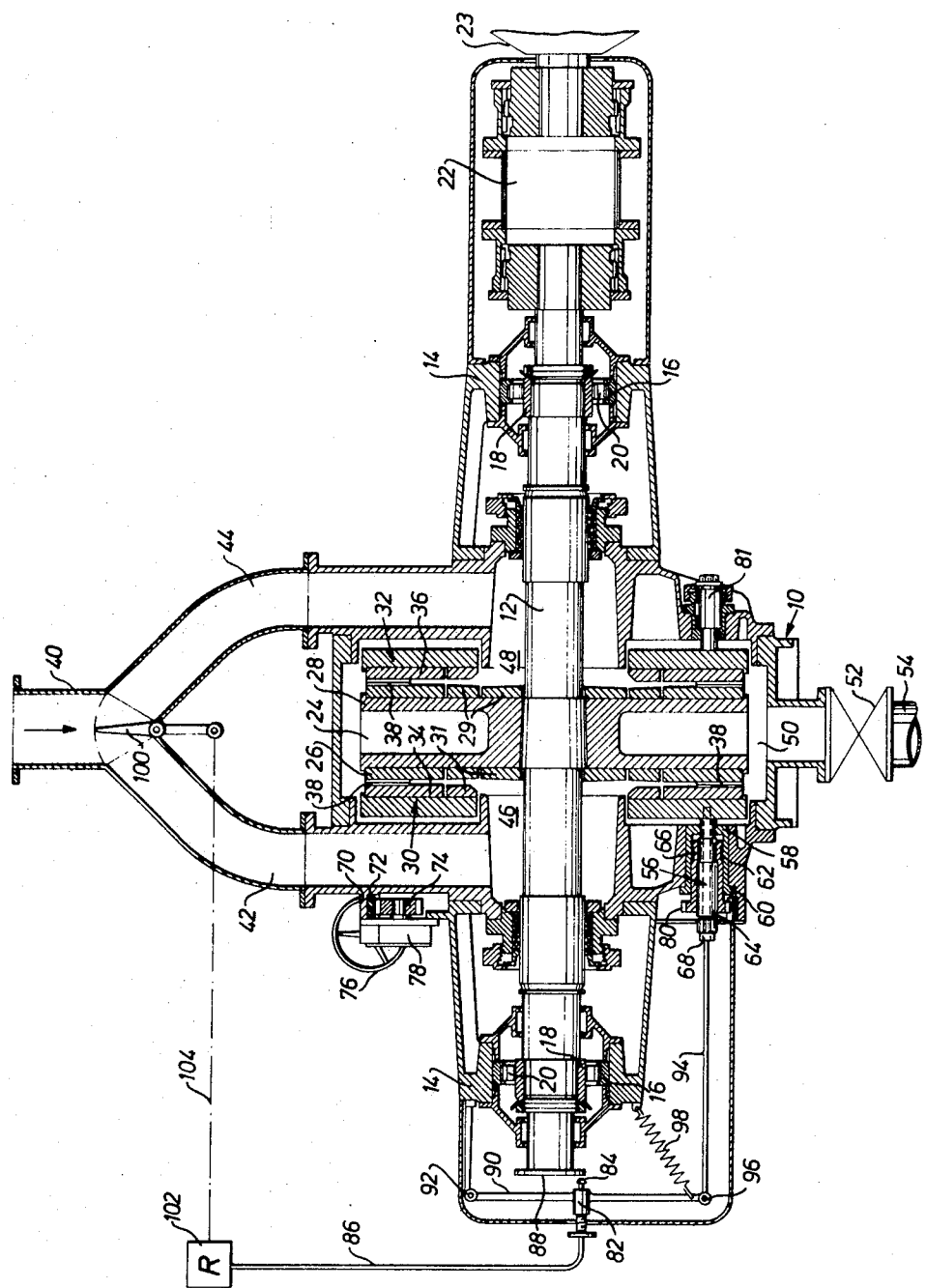
A grinding apparatus especially for lignocellulose containing material having two pairs of cooperating grinding discs. In each pair of grinding discs one disc is fixed to a stationary casing and the other carried on a common shaft extending through the casing from end to end and mounted rotatably in bearings permitting axial self-adjustment of the shaft responsive to the pressure prevailing in the interspaces between each pair of cooperating grinding discs; the disc mounted on the rotatable shaft performing a rotational movement relative to the disc which is fixed to the stationary casing. Each pair of cooperating grinding discs has a supply channel for the material to be ground. A feeler member is provided to ascertain the axial position of the shaft and adapted to emit an impulse to a control or regulation member for distributing of the material to be ground to the supply channels in such a manner that divergences in the width of the interspaces within the two pairs of cooperating discs are compensated by increase of the supply of material to be ground to the channel communicating with the interspace having momentarily the smaller width.

3 Claims, 1 Drawing Figure



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GRINDING APPARATUS ESPECIALLY FOR LIGNOCELLULOSE CONTAINING MATERIAL

FIELD OF THE INVENTION

This invention relates to a grinding apparatus intended especially for treatment of ligno-cellulose containing material and provided with two grinding discs carried by a rotatable, axially self-adjustable shaft, each of said grinding discs cooperating with a grinding disc mounted in a stationary casing. Each pair of cooperating grinding discs has a supply channel for the material to be ground.

THE PRIOR ART

The width of the grinding interspaces between the two pairs of grinding discs is adjustable in order to compensate for wear on the grinding discs. As the material to be ground which by way of example may be in the form of an aqueous suspension of pulp or wood particles, is fed uniformly through said channels to the interspaces in each pair of grinding discs, it might be expected that the shaft should adjust itself to an intermediate position so that the same grinding effect is attained in each of the grinding interspaces. However, experience has shown that the finished pulp may change its composition to the extent that under continued operation it will develop a greater of lesser quantity of material which has not been completely ground, which material is referred to as splinters. These splinters will appear regardless whether or not the spacing between the stationary grinding discs is continuously adjusted to compensate for the wear so as to maintain the aggregate width of the interspaces constant. The applicant has discovered that this non-uniformity in the grinding despite such adjustments is caused by the wear on the grinding discs. The operative grinding surfaces of said discs are subdivided into ridges or projections spaced from one another by grooves the depth of which is reduced by the wear and tear. In practice it is not possible to make the grinding discs so uniform with respect to the quality or volume of the material as to produce uniform wear due to the fact that the ridges of one or both discs in the one pair of cooperating discs is subjected to greater wear than the the ridges of other pair of cooperating discs. By reason of this uneven wear the grooves on one side of the grinding discs become shallower than on the other side and thus the resistance to the passage of the stock between the grinding discs is increased in the shallower side with the consequent result that a smaller quantity of stock can pass between them and, in turn the shaft will assume a position of equilibrium in which the interspace will become greater between the pair of less worn grinding discs. Even if the aggregate grinding interspace should be the correct one, a greater quantity of pulp will pass through the pair of discs having the lesser wear and this pulp will not be ground sufficiently due to the width of the interspace.

Other reasons for a non-uniform degree of the grinding effect in the two pairs of grinding discs come into question also, such as unavoidable tolerances occurring in the manufacture of the discs which tolerances produce an effect on the quality of the grinding quality from the very outset.

SUMMARY OF THE INVENTION

The main object of the invention is to eliminate the

aforementioned problems and which is essentially attained by providing a member for sensing axial position of the shaft, and to emit an impulse at least to one control or regulating member located in said channels for distributing the material to be ground, so that divergences in the width of the interspace between the two pairs of cooperating discs and consequently the grinding degree, are compensated by increasing the supply of stock to be ground with consequent increase in the inlet pressure to that channel which momentarily is communicating with the interspace having the lesser width. Thus, if a displacement of the shaft should occur so that one of the pairs of grinding discs tends to obtain too large an interspace, the two members react so that the supply of pulp to his side is reduced whereas said supply is increased to the other side whereby the shaft is forced back to its normal mid-position.

Other objects and advantages of the invention will become apparent from the following detailed description of a grinding apparatus shown in longitudinal vertical section on the accompanying drawing which forms part of this specification.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, reference numeral 10 denotes the stationary frame of the apparatus which frame forms a casing housing rotatable shaft 12 extending from end to end therethrough. The shaft 12 is supported at its ends within bearing housings 14 by bearings 16 which may be cylindrical roller bearings having an inner bearing ring 18 of greater width than the rollers 20 so as to allow for axial displacement of the shaft. The shaft is driven over a coupling 22 from a motor 23, said coupling being of a type permitting the axial displacement of the shaft.

The shaft 12 carries a retainer member 24 for two grinding discs 26, 28 each of which may be composed in known manner by a plurality of disc segments disposed about the circumference. Arranged within the stationary casing are grinding discs generally denoted 30, 32 and comprising specific disc elements 34 and 36, respectively, which form the stationary grinding surfaces and which also may be composed of segments arranged about the circumference. The segments of the grinding discs facing one another are in known manner formed with ridges or projections 38 extending in both radial and peripheral directions and separated from one another by grooves. The active grinding surfaces are thus formed by the top surfaces of these ridges. The retainer member 24 or the grinding disc 30, 38 may be covered by plates 29 or 31, respectively, which also may be subdivided into segments, if desired.

From a common supply channel 40 for liquid suspension of the vegetable material in the shape of particles such as chips or partially disintegrated pulp, two branch channels 42, 44 extend each to an associated room 46 and 48, respectively, inside of the associated pair of grinding discs 26, 34 and 28, 36, respectively. Radially outside the pairs of grinding discs, a common chamber 50 is arranged for the finally ground pulp which is discharged through a conduit 54 through a valve 52.

The stationary grinding disc 30 is axially adjustable by means of several adjusting members 56, for instance six, distributed about the circumference. Each of said members preferably consists of a sleeve 58 which is rigidly secured to the frame 10 and which engages an

outer sleeve-formed screw 60 by means of threads 62. Threads 66 are also formed between the sleeve-formed screw 60 and an inner sleeve-formed screw 64. The end portion of a central screw 68 is screwed into the disc 30. The screw 68 bears against the disc 30 and can be displaced axially but not rotated. The threads 62 and 64 are unidirectional but have different pitch such as 3 mms for the outer one and 4 mms for the inner one.

Provided on an annular flange 70 on the stationary casing is a ring 72 having an inner gear intermeshing with a tooth wheel 74 which can be rotated by means of a hand wheel 76 through a gear 78. The sleeve-formed screws 60 of the adjusting member 56 are provided with gear rings 80 also intermeshing with the inner gear 72 which extends about the shaft 12. By rotating the hand wheel 76 all screws 64 are displaced axially carrying along the disc 30. In this way a further adjustment can also be made during the operation of the machine for readjusting the width of the interspaces between the two pairs of grinding discs in response to wear of the ridges 38. Due to the different pitch of the threads 62, 64, a fine adjustment can be made but nevertheless the threads can be made sufficiently strong to withstand the high axial pressures to which the grinding discs are subjected during operation. The resulting axial displacement will thus be the difference in pitch between the two threads so that in the embodiment shown by way of example the displacement will amount only to 1 mm per revolution of the screw 60. This device is described in more detail in the co-pending U.S. Pat. application Ser. No. 159,069 filed July 1, 1971, which is a continuation of application Ser. No. 6112 filed Jan. 27, 1970, now abandoned.

The stationary disc 32 is adjusted to correct position by means of a plurality of adjustment screws 81 distributed about the circumference and which are not adapted to be actuated during operation of the apparatus.

According to the invention, a member 82 is adapted to sense the axial position of the shaft 12. In the illustrated embodiment, said member is formed with a nozzle 84 to which a pressure fluid such as compressed air, for example, is supplied through a pipe 86. The nozzle 84 cooperates with a disc 88 which is fixed onto the shaft 12 and the plane surface of which extends perpendicularly to the axis of rotation of the shaft. The fluid escaping through the nozzle 84 is throttled to varying degrees in response to the axial position of the shaft 12 relatively to the nozzle. This adjustment can be made manually from a predetermined starting position.

The member 82 is mounted on an arm 90 which is journaled to the pivot 92 which is fixed to the frame 10. Rigidly connected to one of the set screws 68 is a rod 94 which is journaled to the arm 90 by means of the pivot 96. A spring member 98 urges the arm 90 and consequently the pneumatically actuated member 82 towards the plate or disc 88 and thus eliminates the effect of the bearing play. The arm 90 is dimensioned so that the nozzle 84 moves half as much axially as the pivot 96 which in turn performs the same axial movement as the disc 30.

Mounted in the branch zone adjacent the supply channel 40 is a valve member 100 which in the drawing for the case of simplicity is illustrated as a hinged damper which from a mid-position is displaceable towards the inlet openings of one or the other of the branch channels 42 or 44, respectively. A control or regulator means 102 of a conventional type is actuated

by the fluid pressure in the pipe 86 to readjust the valve 100 over a conventional control system diagrammatically indicated by the line 104.

OPERATION OF THE PREFERRED EMBODIMENT

The apparatus is operated in the following manner. Pulp suspension is supplied through the conduit 40 and the two branch channels 42, 44 to the rooms 46 and 48, respectively, inside the two pairs of grinding discs 26, 30 and 28, 32, respectively. The pulp passes in generally outward direction between the ridges 38 of the two pairs of cooperating grinding discs, the shaft 12 then adjusts itself so that the grinding pressure acting axially becomes equalized in the interspaces of the two pairs of discs. This pressure may be very great such as many tens of tons, for example. During the grinding operation, the ridges 38 are subjected to a relatively great wear which necessitates readjustment the disc 38 at regular intervals by rotation of the hand wheel 76 so that the aggregate width of the interspaces between the pairs of grinding discs regains the predetermined value. This readjustment of the grinding interspaces for compensation of the wear on the ridges can also be effected automatically e.g. by a gauge responsive to the degree of grinding of the finally ground pulp suspension.

As already mentioned above, it cannot be avoided that in spite of the intended uniform supply in even quantities of suspension of particles to the two pairs of grinding discs the shaft will not always adjust itself so that the grinding spaces remain equally wide. In practice it is unavoidable to prevent unequal wear on the ridges on the four discs and thus the grooves acquire different depths with the result that the resistance to the flow of pulp in outward direction as well as the pumping effect of the grinding discs will vary. The shaft will then tend to displace itself in one or the other direction in response to the prevailing conditions and thereby the predetermined widths of the interspaces will be changed. According to the invention, such displacement of the shaft 12 will cause the nozzle 84 to emit an impulse to the control member 102 which in turn readjusts the valve 100 so as to cause more pulp suspension to flow to that side of the apparatus where the width of the interspace has been reduced. Thus equilibrium is reestablished so that both pairs of grinding discs will operate with the predetermined spacing.

When the stationary disc 30 is readjusted to some predetermined value, this value of readjustment must be distributed on the grinding spaces between the pairs of cooperating grinding discs. This means that the displacement of the shaft in axial direction has to amount to only one half of this value. For this reason the nozzle 84 only moves half the distance towards the disc 30 in axial direction in each readjustment to compensate for the wear on the grinding discs.

The member reacting on the axial position of the shaft may be of an electrical or mechanical type. Each of the branch channels for supplying the particular suspension may have a separate control device such as a flap. Instead of a valve or a flap the control may be effected by means of a pump, the motor of which is actuated by the control member 102.

While one more or less specific embodiment of the invention has been shown and described, it is obvious 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.

I claim:

1. A grinding apparatus intended especially for ligno-cellulose containing material to be ground and provided with two grinding discs supported by a rotatable axially self-adjustable shaft, each of said grinding discs cooperating with an associated grinding disc mounted in a stationary casing, each pair of cooperating grinding discs having its supply channel for material to be ground, characterized in that a sensing member is disposed to sense the axial position of the shaft and to emit an impulse to means located in said channels for controlling the distribution of the material to be ground so that divergences in the width of the interspaces between the two pairs of cooperating discs are compensated by increase of the supply of material to be ground to that channel communicating with the interspace

having momentarily the smaller width.

2. A grinding apparatus as claimed in claim 1 which is provided with means effective to adjust one of said grinding discs to the aggregate width of the interspaces in accordance with the wear on the grinding discs, and connectd to the sensing member so that upon a predetermined axial displacement of the grinding disc, the latter is automatically readjusted to a position relative to the shaft a distance which is equal to one half of said displacement.

3. A grinding apparatus as claimed in claim 1, in which the means for controlling the distribution of the material to said channels is also effective to control the supply of material to a conduit connected to a supply source and which is common to said channels.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,754,714 Dated August 28, 1973

Inventor(s) ROLF BERTIL REINHALL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority Data

September 30, 1970 Sweden 13286/1970

Signed and sealed this 9th day of July 1974.

(SEAL)
Attest:

MCCOY M. GIBSON, JR.
Attesting Officer

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