May 1, 1962 A. J. A. ASPLUND 3,032,282

GRINDING APPARATUS FOR FIBROUS MATERIAL

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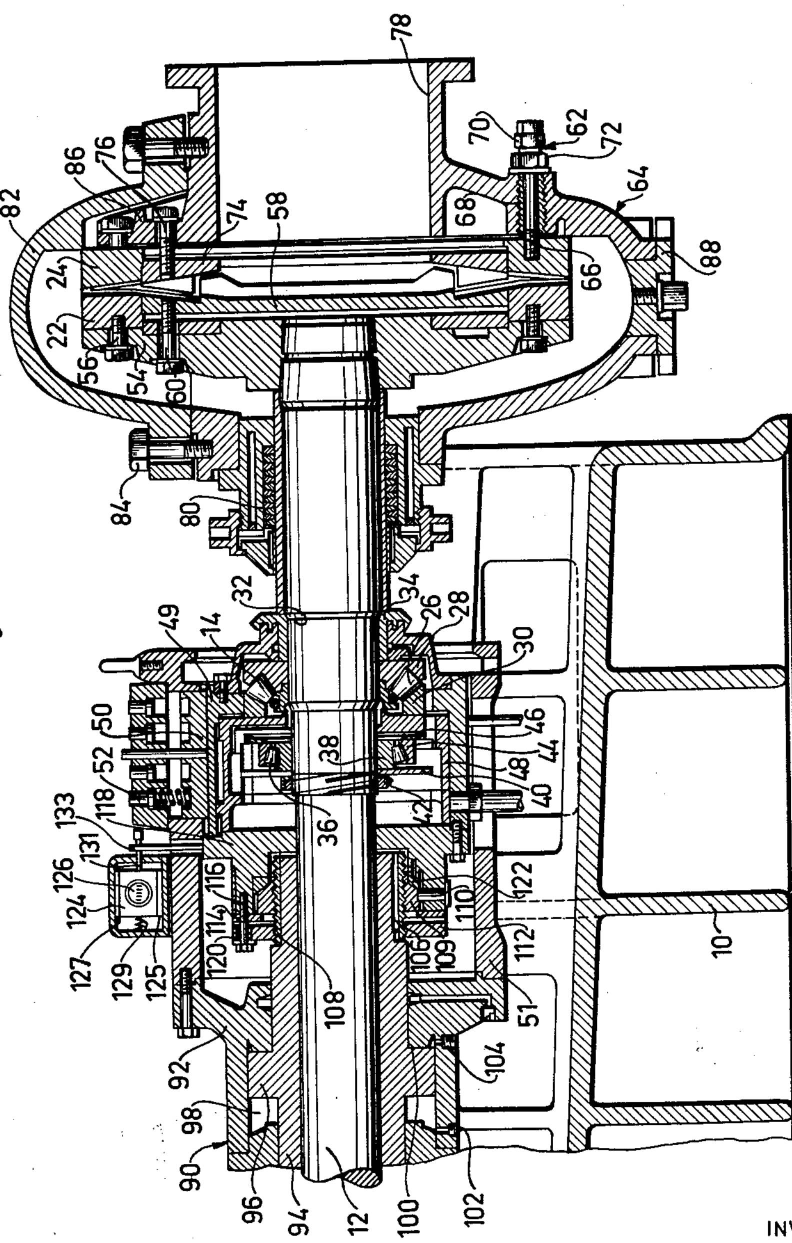

Fig. 1

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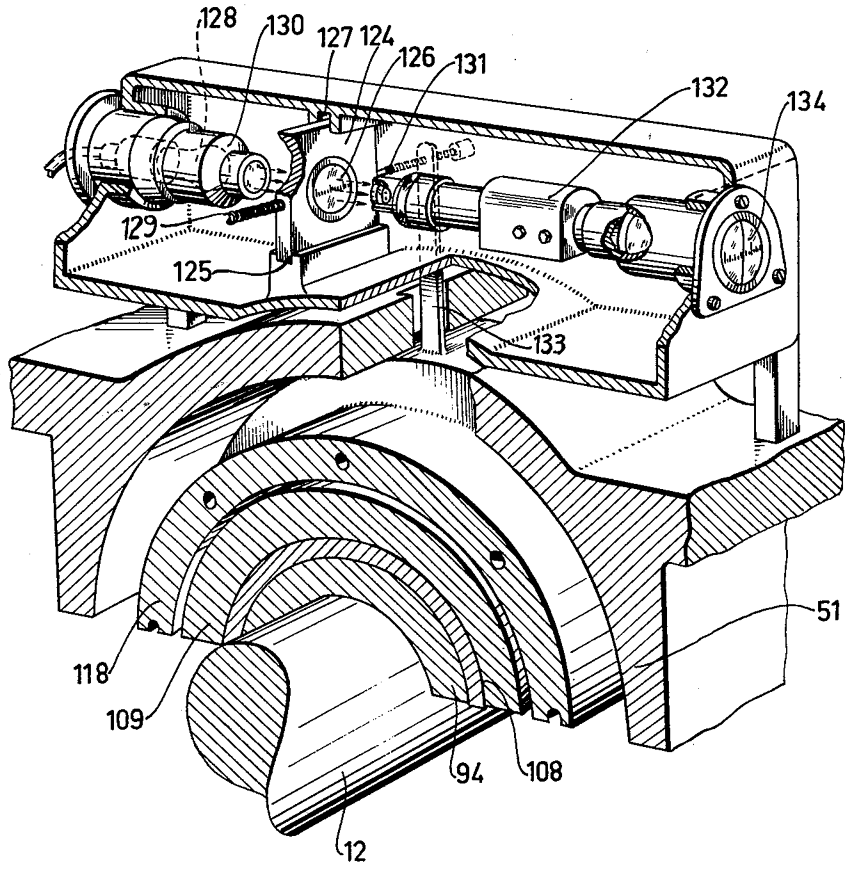
Fig. 2



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GRINDING APPARATUS FOR FIBROUS MATERIAL

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2 Claims. (Cl. 241—256)

This invention relates to grinding apparatus.

More particularly this invention relates to grinding apparatus for the breaking down of fibrous material.

Still more particularly this invention relates to grinding apparatus for the breaking down of fibrous material such as refiners of disc or cone or Jordan type, which apparatus includes a rotatable grinding member carried by a horizontal shaft mounted in a frame and also a stationary grinding member, of which members one is axially displaceable and transmits grinding pressure to the other grinding member by means of a servo-motor, preferably hydraulic.

It is important that the spacing between the two grinding members, or the so called grinding gap, is adjusted in such a manner as to bring the grinding effect into agreement with the quality one desires the stock to attain. The size of the grinding gap may vary from fractions of one hundredth of a millimetre up to a few tenths of a millimetre, and in exceptional cases the size may reach such high values as one millimetre.

For indicating and controlling the size of the gap mechanical measuring devices have generally been used previously. Grinding apparatus of the kind in consideration may be large units utilizing a grinding pressure up to 100 tons and more and it is inevitable in their operation that vibrations are produced which affect the measuring devices and which are enlarged in said measuring devices to the same extent as the accuracy of measurement is increased. The total effect is vibrations of the indicators of such intensity as to make the reading complicated. Even if the indicators are provided with pointers of a very light material it is hard to avoid the natural motions because of the vis inertia.

One main object of the invention is to provide means to render the indication independent of the vibrations and therefore very accurate and easy to establish. According to one main feature of the invention the mutual axial position of the two grinding members and thus the size of the gap between said members is indicated by means of an optical device having an element following the axial movements of the displaceable grinding member.

The invention is especially suited for grinding apparatus of the type wherein the servo-motor has a piston which in itself is rotationally stationary and transmits the grinding pressure to the rotatable grinding member by way of likewise stationary members and also by way of rotatable members. In connection with such grinding apparatus the element of the micrometer is preferably connected to a rotationally stationary member of the grinding pressure transmitting means.

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 is a vertical longitudinal section through a portion of a refiner constructed in accordance with the invention.

FIG. 2 is a perspective view on a larger scale of a micrometer device forming part of the refiner.

Referring to the drawings reference numeral **10** designates the frame of the refiner carrying a shaft **12** mounted in two bearings, on of which is shown in FIG. 1 and generally denoted **14**. At its left end the shaft **12** is connected with the shaft of a driving motor (not shown). At its opposite end the shaft **12** carries a grinding disc **22**. The shaft **12** and the grinding disc **22** are adjustable in an axial direction relatively to a stationary grinding disc **24**.

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The bearing **14** located adjacent the grinding disc **22** has conical rollers **26** co-operating with a ring **28** carried by the shaft and with a rotationally stationary ring **30**. This bearing is capable of absorbing both axial and radial loads. An annular spacing member **34** is located between the inner ring **28** and a shoulder **32** formed on the shaft **12**. The bearing **14** is maintained under continuous pressure by means of an axial thrust bearing **36** preferably of conical type. The inner ring **38** of said bearing **36** is fixed to the shaft **12** through an oil centrifuging disc **40** held by means of a stop nut **42**. The outer ring **44** of the bearing **36** is pressed against the stationary ring **30** of the bearing **14** through the intermediary of a pre-compressed conical cup spring **46** and a sleeve **48**. The initial axial pressure acting on said bearing corresponds to the precompression of the spring **46** which may amount to some tons and is at least equal to the axial power component acting on the bearing **14**, which component is produced by the weight of the rotating parts, possible unbalances inherent in said parts etc. In order to be capable of absorbing radial loads, the bearing **14** must be subjected also to an axial load which latter is ensured by the device just described, even when the apparatus is out of operation. The sleeve **48** is surrounded by an inner bearing housing **49** in which the bearing ring **30** is accommodated and which is axially displaceable together with the shaft **12** in an outer bearing housing **51**. In order to eliminate the effect of a play between the two bearing housings **49** and **51** a sliding shoe **50** is arranged to exert a pressure on the bearing housing **49** by means of pre-compressed springs **52**.

The rotating grinding disc **22** is secured to a rotor disc **54** by means of bolts **56**. Radially within the grinding disc **22** may be located a second grinding disc **58** rigidly secured to the rotor disc **54** by means of bolts **60**. The stationary grinding disc **24** is connected with the casing **64** enclosing the grinding discs by means of circumferentially spaced locking and adjusting devices **62**. Each device **62** comprises a fixing bolt **66** in threaded engagement with the grinding disc **24** and is passing with play through a sleeve **68**. This sleeve is threaded into the casing **64** and intended to adjust the position of the grinding disc **24** relatively to said casing. The adjusting sleeve **68** has a polygonal head **70** and is locked by means of a nut **72**. By the concentric location of the locking and adjusting members relatively to one another bending moments deforming the grinding disc **24** are avoided.

The casing **64** carries radially within the grinding disc **24** a second stationary grinding disc **74** rigidly connected with said member **64** by means of bolts **76**. The adjacent surfaces of the two grinding discs **22** and **24** are channelled in known manner for the purpose of producing the desired disintegration of the material to be ground. The discs **58** and **74** may form a supply duct for the material introduced through a channel **78** provided in the casing **64** and preferably also produce a some predetermined pre-disintegration of said material.

The casing **64** is constructed so as to have great strength in order to be capable of withstanding the high steam pressure prevailing therein and also the transmission of the grinding pressure to the frame **10**. A stuffing box **80** is interposed between the shaft **12** and the casing **64**. The casing **64** is horizontally divided in a plane disposed above the stuffing box **80** and the wall of the channel **78**. In this way the casing is provided with a top part or cap **82** not participating in the transmission of the grinding pressure from the stationary grinding disc **24** to the frame and detachably connected with the casing by means of bolts 84. Upon removal of the part 82 the grinding discs are accessible for inspection and adjustment, an oval opening in the casing also being uncovered through which the grinding discs may be removed for replacement. The casing 64 is provided with an extension 86 projecting upwardly above the plane of division of the casing and enclosed by the top part 82 and here acting as a countersupport for the grinding disc 24. At the base there is an opening closable by a cover 88.

The grinding disc 22 is maintained under pressure acting in the direction towards the grinding disc 24 by means of a servo-motor generally designated by 90. The latter comprises a casing 92 rigidly connected with the frame and a piston 94, both the casing and the piston surrounding the shaft 12 concentrically and with play. The piston 94 has a central flange 96 axially displaceable within a chamber 98, the end wall 100 of which limits the path of free movement of the piston towards the grinding disc 24. The chamber 98 has at its both ends inlets and outlets 102, 104 for a pressure liquid such as oil. The piston 94 is held against the surrounding casing 92 only with a suitably adjusted small play.

A sleeve 108 formed with external threads may be rigidly secured, for instance by a key joint 106, to the end of the servo-motor piston 94 facing the bearing 14. The thread has a pitch of the order of 5 mms. The sleeve 108 carries an annular member 109 threaded thereon and formed with an axially extending groove engaged by a pin 110. The sleeve 108 also carries a ring 112 threaded thereon, and axially spaced from the latter there is disposed an annular disc 114. A number of circumferentially spaced bolts 116 pass with play through the ring 112 but are threaded into the disc 114 and into a member 118 forming a cover closing the bearing housing 49. The bolts compress springs 120 abutting against the ring 112, and this structural device results in eliminating the effect of play between the threads connecting the members 94 and 118. The member 109 has a spherical face abutting against a ring 122 provided in the cover 118. The total pressure exerted by the springs 120 is larger than the resistance of the parts connected with the shaft 12 when displaced to the left.

The servo-motor piston 94 is adapted to rotate by means of transmission members, not shown. As the housing 49, on the other hand, is stationary the member 109 will be displaced axially upon the rotation of the servo-motor piston and in its movement entrain the housing and also the grinding disc 22. This particular construction of the refiner is disclosed in greater detail in the patent specifiication No. 2,891,733 (patent appln. No. 443,638).

The axial position of the grinding disc 22 relatively to the grinding disc 24 is observed and controlled by means of the optical measuring instrument or micrometer whose construction is especially illustrated in FIG. 2, in which for the sake of clarity, those parts disposed adjacent the member 118 and the shaft 12 have been omitted. A plate 124 is displaceably mounted in axially extending guides 125 and 127 in the stationary frame 10 and a portion connected thereto, respectively. The plate has a transparent window 126 provided with a scale. A special spring 129 maintains the plate 124 into continuous

abutment against an adjustment screw 131, which is threaded into an arm 133 secured to the member 118. The servo-motor piston 94 when moved axially in one or the other of its both directions of displacement entrains the element 118 and thus also the plate 124, for which reason changes in the axial position of the grinding member 22 are corresponded by an axial displacement of the plate and the scale of the window 126. The micrometer further comprises an electric bulb 128 located in a casing 130 and directing a beam of light perpendicularly to the longitudinal axis of the shaft 12 and through the window 126. The beam of light continues through a lens system provided in a casing 132 to a projection screen 134 provided with a scale where the positional changes of the scale 126 are reproduced magnified so that they may be conveniently observed with an accuracy of one hundredth of a millimetre or even more exactly. Besides the plate 124 the various parts of the micrometer are rigidly secured to the frame 10 and thus assume a firm position. No part has any natural motion. Thanks to the adjustment screw 131 the scale 126 may be adjusted to assume a zero position, for instance, when the grinding discs in their starting position are in direct metallic contact with one another.

While one more or less specific embodiment of the invention has 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 I claim is:

1. In a grinding apparatus for the breaking down of fibrous material, a frame, a horizontal shaft mounted therein and carrying a rotative grinding member, a rotationally stationary grinding member for co-operation with the rotative grinding member, of which grinding members one is displaceable and adapted to transmit grinding pressure toward the other by means of a servo motor, optical means comprising a plate mounted on a support to having a sliding movement thereon in company with the shaft during its axial adjustment to indicate the extent of spacing between the disks, said plate having a scale-bearing window, light projection means, and a screen remote from the window and having an indication of positional changes of the scale thereon, and means for adjusting the position of the plate relative to its support so that a start from a zero position on the scale can be had when the grinding members are in contact.

2. In a grinding apparatus as provided for in claim 1, wherein the support on which the plate is mounted is provided with spaced-apart grooves in which opposite edges of the plate are slidably received, an arm extending from an element movable with the shaft, threaded means engaging said arm and operative against the plate to thereby adjust the plate in the grooves, and a spring arranged to bias the plate in a direction toward the threaded means.

References Cited in the file of this patent

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2,891,733 Asplung ---------------- June 23, 1959

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