United States Patent [19]

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[54] **PULP GRINDER**

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[51] **Int. Cl.** **B02c 7/06,** B02c 7/14

[58] **Field of Search** 241/244, 250, 259.1, 259.3, 241/259.2, 37

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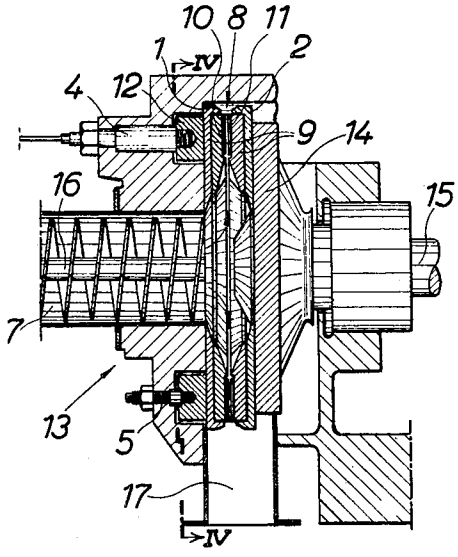
[57] **ABSTRACT**

Pulp grinder intended for cellulose, paper or other equivalent pulp and comprising at least one non-rotating blade disk and at least one rotating blade disk with grinding surfaces opposing each other, the non-rotating blade disk being secured to the body of the grinder by the use of three fixing pins, by the aid of which the grinding surfaces can be adjusted to be parallel. At least one fixing pin is heatable, and thus changeable as to its length, for instance with the aid of electric current, of a temperature-controlled fluid or vibration.

2 Claims, 5 Drawing Figures



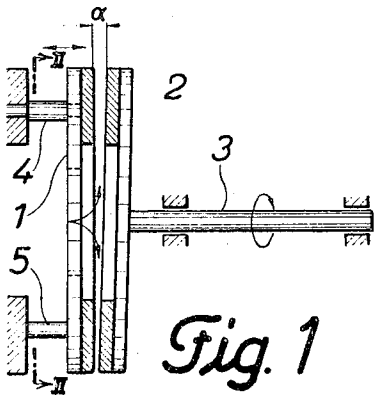


Fig. 1

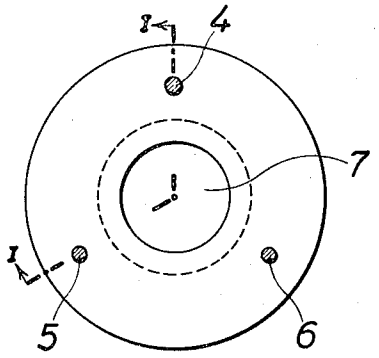


Fig. 2

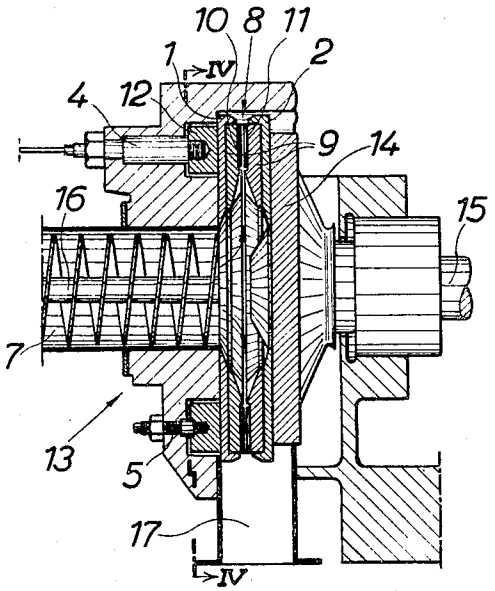


Fig. 3

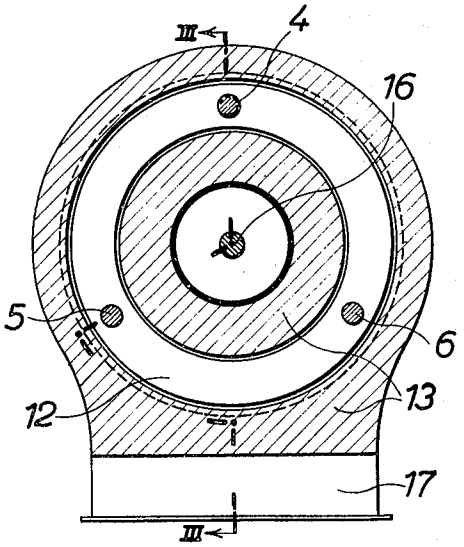


Fig. 4

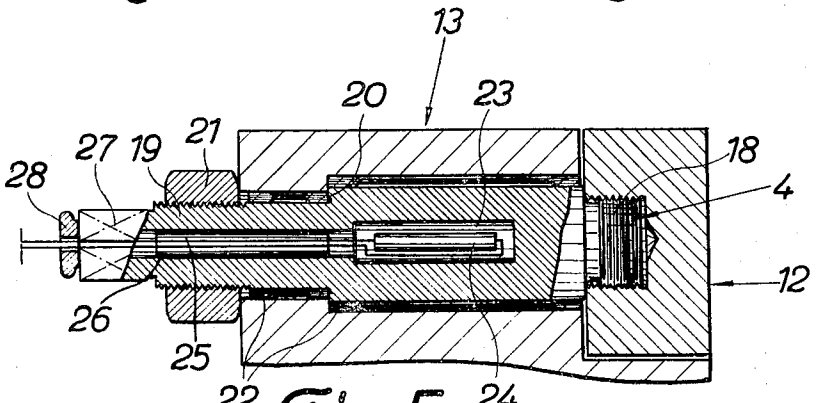


Fig. 5

PULP GRINDER

In grinders the distance between the blade disks rotating with reference to each other, or the grinding gaps, are adjusted by displacing one or several blade disks axially.

This is accomplished according to methods previously known in themselves with the aid of mechanical, hydraulic or pneumatic devices. The quality of the ground pulp is decisively influenced not only by the width of the grinding gap but also by the accuracy with which the grinding surfaces are parallel. During operation of the pulp grinder, certain parts of the body structure of the grinder warm up, causing thermal expansion and as the result of this, an error in the parallel alignment. When the grinding surfaces no longer are parallel, the quality of the pulp deteriorates. Even an error as small as 0.05 mm in the parallel alignment of the grinding surfaces has to be corrected. In devices of prior art the practice has been followed that the pulp grinder is stopped after it has reached operating temperature and an impairment of the pulp quality due to thermal stresses has been noticed. Subsequently, the grinding gaps have been adjusted with the aid of one or several fixing pins to be parallel once again.

The aim of the present invention is to eliminate this drawback and to provide a pulp grinder wherein the adjustment can be made during operation of the grinder. The invention is characterized in that at least one fixing pin is heatable, and thereby adjustable in its length, for instance by the aid of electric current, of a temperature-controlled medium or of vibration. These modes of producing and transferring heat may all be applied for changing the length of one fixing pin, or regulating pin.

According to an advantageous embodiment, at least one fixing pin or regulating pin is heatable by the aid of an electrical resistor placed in a cavity within it. Hereby such an effect is achieved that when the power in the electrical resistor is regulated, for instance, by changing the intensity of the current passing through it, the temperature of the pin is altered and the resultant change of the pin's length adjusts the nonrotating blade disk to be in desired position with reference to the rotating blade disk. It is also possible to place in the cavity electrodes, which are supplied with electricity, while the cavity is filled with a liquid or gas.

According to another embodiment, the regulating pin itself is an electrical resistor. It is also possible to place within the pin an induction coil, by means of which the temperature may be raised.

Heat may be introduced along with a fluid. For conducting the fluid, ducts are provided in the regulating pin in which a circulation of temperature-controlled liquid or gas is arranged. In this case it is advantageous that it is also possible to cool the pin.

Heat transfer may also be by conduction with the aid of a solid, thermally well conductive substance. According to a further embodiment, the regulating pin may be heated by the aid of vibration, such as ultrasound.

The invention is described in closer detail in the following by the aid of an example, with reference to the attached drawing, wherein

FIG. 1 represents, schematically, a disk grinder with one blade gap, in section carried along the line I—I in FIG. 2,

FIG. 2 shows the section along the line II—II in FIG. 1,

FIG. 3 is a more detailed longitudinal section of the pulp grinder, along the line III—III in FIG. 4,

FIG. 4 shows the pulp grinder of FIG. 3, sectioned along the line IV—IV in FIG. 3, and

FIG. 5 is the regulating pin in the upper part of FIG. 3, on a larger scale and longitudinally sectioned.

Referring to FIG. 1, the angle α illustrates the angle between the non-rotating blade disk 1 and the rotating blade disk 2, which is the deviation from parallel alignment due to bending of the grinder body 13. The bending of the body 13, again, is caused by the fact that the pulp grinder reaches, after it has been started, its operating temperature. According to the invention, this error deviation may be corrected by changing the length of the regulating pin 4 during operation, by the aid of a heater resistor.

FIG. 2 shows the location of the regulating pin 4 and those of the fixing pins 5 and 6 in the fixing arrangement of the nonrotating blade disk. The opening seen in the centre is the pulp feed aperture 7.

FIGS. 3 and 4 show the design of the pulp grinder in greater detail. The surfaces of the blade disks 1 and 2 facing each other have been provided with blades 9, whereby the grinding surfaces 10 and 11 and the grinding gap 8 between them are formed. The non-rotating blade disk 1 has een provided with a reinforcing ring 12, to which one end of the fixing pins 4, 5 and 6 has been attached. The opposite ends of the pins have been attached to the body 13 of the grinder. The rotating blade disk has been mounted by means of a flange 14 on the shaft 15, which is rotated by a drive motor (not depicted). Within the feed aperture 7 there is a feed screw 16, which supplies pulp into the grinding gap 8 between the blades 9 of the blade disks 1 and 2, whence the pulp moves under effect of centrifugal force to the outer periphery and further to the exit port 17.

In FIG. 5 the design of the regulating pin 4 has been shown in greater detail. The end 18 of the regulating pin 4 adjacent to the blade disk has been attached by thread to the reinforcing ring 12 of the non-rotating blade disk 1. The opposite end of the regulating pin 4, indicated by reference numeral 19, has been attached to the body 13 by means of a shoulder 20 on the pin and a nut 21. Heat transfer from the pin 4 to the body 13 has been prevented by means of insulators 22. Within the regulating pin 4 there is a concentric hollow cavity 23, containing a resistance 24, and a duct 25 intended for the leads of the electrical resistance carries out from the cavity 23. The duct 25 is thermally insulated against the body of the pin 4 by the insulation 26. The end 19 of the pin 4 attached to the body has been provided with a nut end 27 and a packing 28.

Prior to starting the grinder, the blade disks 1 and 2 are adjusted to be exactly parallel. After the grinder has reached its operating temperature, 3 to 4 hours after starting, the body has been bent to such degree that the rotating blade disk 2 is no longer parallel with the non-rotating blade disk 1. In the exemplary case, the distance between the blade disks becomes larger at their upper margin than at the lower margin. The difference in the distances may be on the order of 0.15 mm. The disks are then adjusted to be parallel, during operation, by increasing the current passing through the resistance 24 within the regulating pin 4, whereby the pin 4 is warmed and lengthens, pushing the non-rotating blade

disk **1** at its upper edge toward the rotating blade disk **2** until the blade disks are parallel. Parallel-relationship may be observed by measuring the distances between the blade disks at the top and bottom or by observing the quality of the pulp. When the pulp presents a good quality, the blade disks are parallel.

In some cases the distance between the blade disks may become larger at the bottom than at the top. In that instance the pins **5** and **6** below the axis may be arranged to be regulating pins, or two fixing pins may be provided above the axis and one regulating pin under the axis in the vertical plane passing through the axis. However, adjustment may also be accomplished in this case by means of an arrangement as in the example. It is possible to make such arrangements that an electric current already flows through the resistance **24** when the pulp grinder is started and that the temperature of the regulating pin **4** is such that it can be lowered by reducing the current. A regulating range of the regulating pin temperature of ±50°C suffices for parallel adjustment of the blade disks in both cases in question. A further advantage of the device according to the invention is that by its aid the parallel alignment control of the blade disks can be easily automated, whereby the blade disks will at all times be parallel, independent of the temperature of the pulp grinder.

If desired, in lieu of an electrical resistor, the fixing pin may be made to receive interiorly thereof a temperature controlled heating fluid so as to adjust the heat and length of the pin. Furthermore, the pin may be heated through imparting vibration thereto by a suitable device such as, for example, an ultrasonic vibrator (not shown).

It is obvious to one skilled in the art that various embodiments of the invention may vary within the scope of the claims set forth below. For instance, the number of blade disks and grinding gaps may vary, and introduction of the pulp may be in a manner different from that described in the exemplary case. The shape, and the attachments and insulations, of the fixing and regulating pins may also be of another kind. Depending on the design of the pulp grinder, the regulating pin need not either necessarily to be located above the axis; it may also lie under the axis in a vertical plane passing through the axis.

I claim:

1. Improvement in a pulp grinder for cellulose, paper or other equivalent pulp and comprising at least one non-rotating blade disk and at least one rotating blade disk which have grinding surfaces facing each other, the non-rotating blade disk being secured to the body of the grinder by means of three fixing pins, said fixing pins being adapted to contact the non-rotating blade disk and deflect the latter so that the grinding surfaces are adjustable to be parallel, wherein the improvement comprises in that at least one fixing pin includes means for heating said pin so as to be variable in length.

2. Pulp grinder as claimed in claim **1**, said fixing pin being hollow, and said means for heating said pin comprising an electrical resistor located within said hollow pin.

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