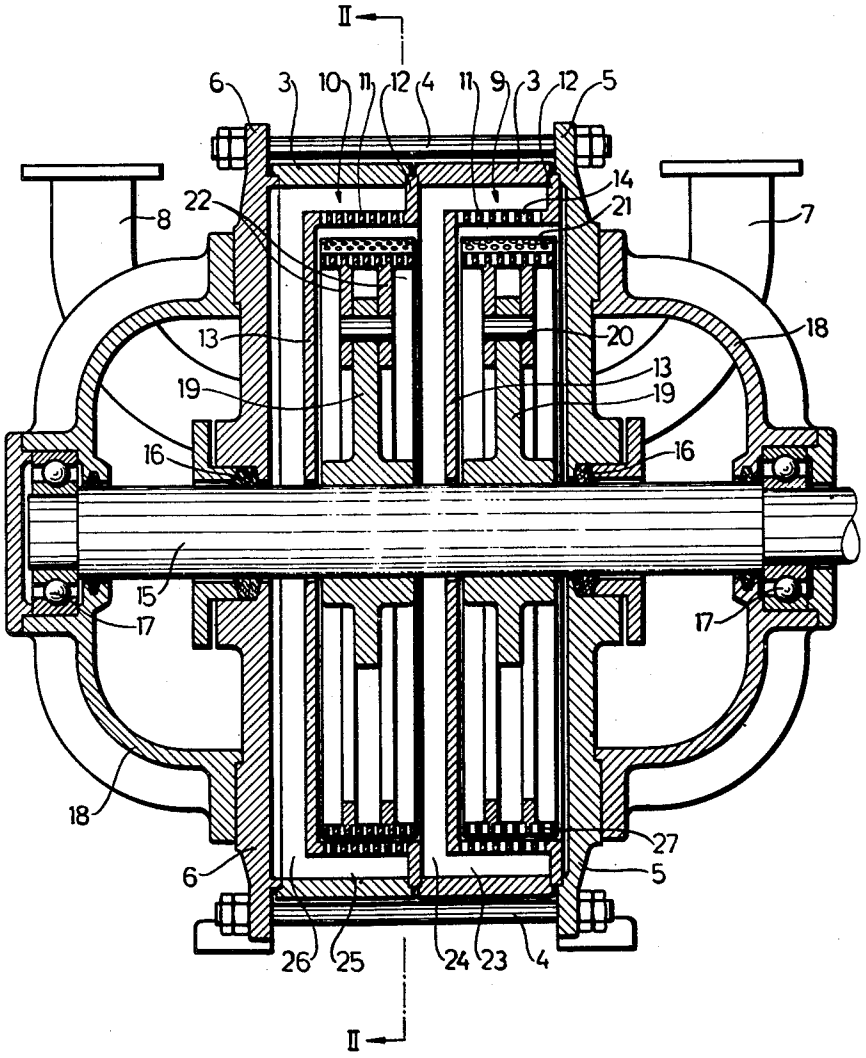
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REFINER FOR FIBER SUSPENSIONS AND PULP

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Fig. 1

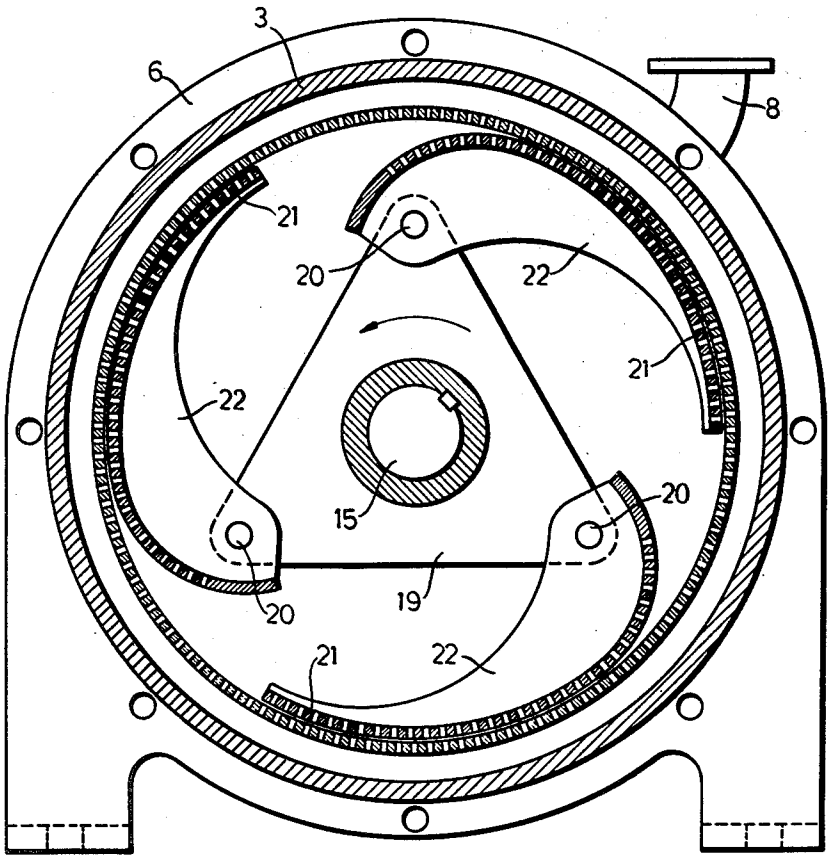


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Fig. 2



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REFINER FOR FIBER SUSPENSIONS AND PULP

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4 Claims. (Cl. 92—20)

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The invention relates to a refiner for fibre suspensions, such as pulp intended for paper manufacture, and refers particularly to a refiner of the centrifugal mill type in which grinding, i. e. separation of the fibres, is effected by cooperation between stationary and rotary grinding surfaces, the latter being pressed against the former by the centrifugal force.

The object of the invention is to provide an apparatus ensuring an effective separation of the fibres by means causing a concentration of the fibre material between the grinding surfaces. The refiner comprises in combination a stationary drum having a perforated jacket and provided with an inlet at one end, a rotatable shaft extending axially into the drum, a rotor fixed on said shaft within the drum and a number of perforated wings linked to the rotor by axially directed pivots, said wings having curved outer surfaces adapted to the curvature of the jacket to be pressed against the inside of it by the centrifugal force at the rotation of the shaft, the jacket and the wings thereby together serving as grinding members for the fibre material to bring it to pass through the perforations of the jacket.

The fibre suspension entering between the wings and the inside of the drum becomes highly concentrated, in that a large portion of the liquid immediately flows off through the perforations in the wings and in the jacket. Due to that higher concentration an effective and simultaneously indulgent treatment of the material is ensured by mutual friction between the fibres therein. The desired degree of grinding may be obtained either by giving the perforations of the drum and the wings the required dimensions, or by varying the speed of rotation of the rotor so as to increase or decrease the pressure of the wings caused by the centrifugal force.

The invention will be further described in the following with reference to the accompanying drawings which show an embodiment of the refiner. Figure 1 shows a vertical and longitudinal section through the device, and Figure 2 shows a section along the line II—II in Figure 1.

The outer casing of the mill is formed by rings 3 arranged adjacent each other so as to form a cylinder which is closed by end walls 5 and 6. The casing is held together by bolts 4 inserted between said end walls. An inlet pipe 7 to the casing enters through the wall 5, and an outlet pipe 8 extends from the other wall 6.

Two drums 9 and 10 are mounted axially after each other inside the casing. Each drum consists of a cylindrical jacket 11 having a great number of perforations 14. One end of said jacket is provided with a flange 12 directed outwardly, and the other end is closed by a tight end wall 13. The drum 9 next to the inlet 7 has its flange 12 clamped between the wall 5 and the adjacent ring 3, and the following drum 10 which is turned in the same direction, has its flange clamped between two rings 3. The perforations 14 of the drums may either be shaped as round holes or as axial slots.

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A horizontal shaft 15 extends axially through the outer casing and the drums. The shaft is journalled in ball bearings 17 mounted in yokes 18 fixed to the outer sides of the walls 5 and 6, and packings 16 are provided at the passages of the shaft through said walls. A rotor 19 (see also Figure 2) is fixed on the shaft 15 within each of the drums 9 and 10 and consists of a wheel or disk with a diameter smaller than the inner diameter of the drum. In the embodiment shown, the rotor has substantially the shape of an equilateral triangle, and three wings are pivotably connected to the corners of this rotor by pins 20 in parallel to the shaft 15. Each wing consists of a perforated plate 21 having two parallel flanges 22 on the side turned inwardly. Said flanges project perpendicularly to the plate and are directed along the periphery of the drum, one on each side of the rotor 19. The pivot 20 is inserted through these flanges and through one corner of the triangular rotor. The plate 21 is for its greater part curved in conformity with the inner periphery of the jacket but is bent inwardly in a sharper curve on to the pin 20. Thus, at rotation in anti-clockwise direction in Figure 2 there will arise a substantially wedge-shaped inlet opening for the fibre suspension between the plate and the jacket. In this opening the suspension will be subjected to a certain pressure, so that some of the liquid is filtered off through the perforations, and consequently the suspension will be concentrated to a certain degree already before entering between the grinding surfaces, where the grinding effect is caused by the action of the wing portion engaging the jacket. In the axial direction of the drum the wings have approximately the same extension as the inner length of the jacket.

In the embodiment shown, the inlet pipe 7 leads to the interior of the drum 9. The annular space 23 between the outside of the perforated jacket 11 of said drum and the surrounding casing communicates with the interior of the next drum 10 over a space 24 arranged between the two drums.

An annular space around the jacket of the drum 10 communicates with the outlet 8 over a space 26 between the end wall 13 of the drum 10 and the wall 5 of the casing.

In operation of the apparatus, fiber suspension is supplied to the drum 9, where it is caused to circulate due to the rotation of the rotor 19 and the wings 21. Hereby the suspension will have a tendency to escape through the perforations of the fixed drum 9, and thus a certain separation of liquid and, especially, lumps of fibrous material takes place. When rotating, the wings are pressed against the inside of the jacket by the centrifugal force, and at the same time each wing catches some material in the wedge-shaped gap formed between the inwardly bent portion of the wing and the jacket 11. A compression of such caught material takes place in the gap with the result that liquid flows off outwardly through the perforations of the drum as well as inwardly through the perforations of the inwardly bent wing portions. The fibre suspension entering between the jacket and the wing portion concentric therewith will therefore be highly concentrated. Thus, the apparatus effects a concentration of the fibrous material by separating liquid therefrom immediately before the fibres and especially lumps of fibres are to be treated between the stationary and the movable grinding members. This, in turn, results in an effective and indulgent treatment of the material by mutual friction between the fibres, lumps of fibres being divided into separate fibres.

When such a separation has taken place in a sufficient degree, the fibres pass through the holes in the drum, and outside it they are again mixed with the liquid previously removed, so that the treated suspension will have the same concentration as before. The material leaving the first drum 9 enters the next drum 10 through the intermediate space 24 to be subjected to a repeated treatment. As is to be seen from Figure 1, the perforations in the jacket and in the wings of the second drum may be smaller than those of the first drum. Of course, it is possible to arrange more drums after each other than is shown in the drawing, and in such case it is preferred to make the holes smaller in each following drum.

As already mentioned, the degree of grinding is dependent on the size of the holes in the grinding members and is also dependent on the pressure between the wings 21 and the surrounding drum. This pressure, in turn, is dependent on the speed of rotation and weight of the wings and may be adjusted either by regulating the number of revolutions of the rotor or the rotors or by replacing the wings by others having a greater or smaller weight or by using both these measures in combination.

As an example it may be mentioned that a refiner according to the invention constructed in practice is provided with three drums arranged after each other in a casing and having holes with diameters of 10, 7 and 4 mm. respectively. A speed of rotation of the shaft of somewhat above 400 R. P. M. has proved advantageous, but the speed may be varied upwards or downwards with regard to the quality of the material and the desired degree of grinding.

What I claim is:

1. A refiner for fibre suspensions and pulp, comprising in combination a stationary drum having a perforated jacket and provided with an inlet at one end, a rotatable shaft extending axially into the drum, a rotor fixed on said shaft within the drum and a number of perforated wings linked to the rotor by axially directed pivots, said wings having curved outer surfaces adapted to the curvature of the jacket to be pressed against the inside of it by the centrifugal force at the rotation of the shaft, the jacket and the wings thereby together serving as grinding members for the fibre material to bring it to pass through the perforations of the jacket.

2. A refiner according to claim 1, in which said wings have a width almost as great as the inner length of the drum.

3. A refiner for fibre suspensions and pulp, comprising in combination a casing having an inlet at one end and an outlet at the other end, at least two drums having perforated jackets and mounted in axial arrangement after each other within the casing in such a way that the interior of the first drum is in communication with the inlet to the casing and the interior of the next drum communicates with the outside of the first drum and so on, while the outside of the last drum in the series is in communication with the outlet from the casing, a rotatable shaft extending axially through the drums, a rotor fixed on said shaft within each drum and a number of perforated wings linked to each rotor by axially directed pivots, said wings having curved outer surfaces adapted to the curvature of the jacket to be pressed against the inside of it by the centrifugal force at the rotation of the shaft.

4. A refiner according to claim 3, in which the perforations of the drums and of the wings therein are of smaller dimensions from drum to drum, as seen in the direction of treatment.

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