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CENTRIFUGAL SEPARATOR FOR STRAINING PULPY MATERIAL, SUCH AS WOOD PULP, CELLULOSE, PAPER PULP, AND THE LIKE

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Fig. 2

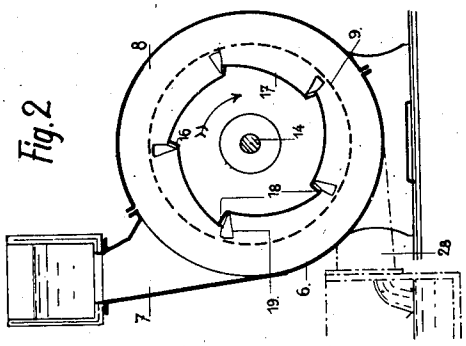


Fig. 3

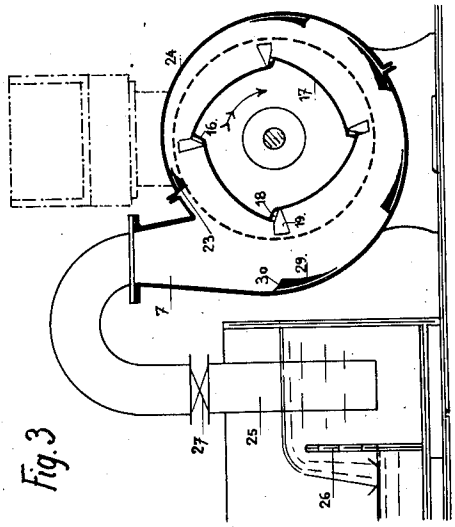


Fig. 1

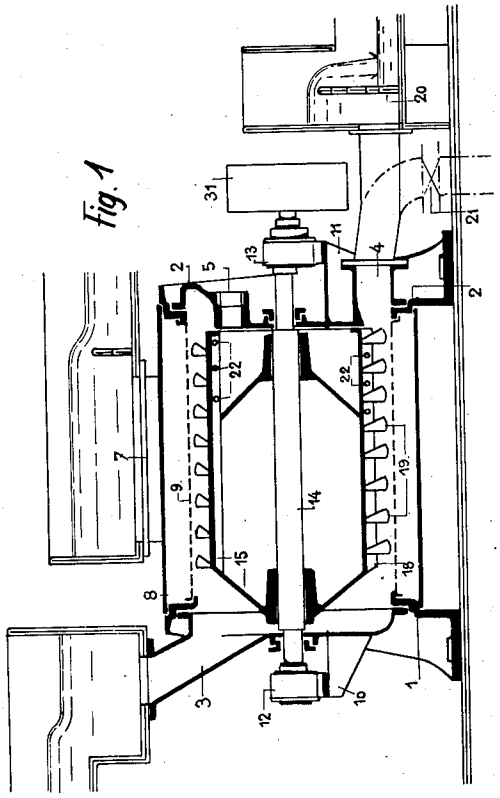


Fig. 4

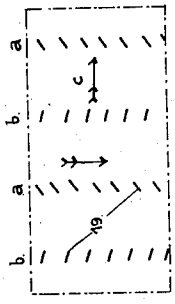
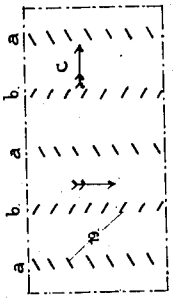


Fig. 5



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## CENTRIFUGAL SEPARATOR FOR STRAINING PULPY MATERIAL, SUCH AS WOOD PULP, CELLULOSE, PAPER PULP, AND THE LIKE

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9 Claims. (Cl. 92—35)

This invention relates to so-called centrifugal separators for straining pulpy material, such as wood pulp, cellulose, paper pulp and the like, in which centrifugal forces are utilized to cause the material to pass through the strainer these centrifugal forces being produced by blade wheels with bars on scoops which rotate in the stationary separating sieve.

Apparatus for this type are known, in which the material is subjected intermittently to compressing and expanding in radial direction, during the rotation of a centrifuging element rotating in a stationary separating sieve, and the flow of material takes place in outward direction through the stationary separating sieve. Moreover, separators with rotating sieve cylinder are known, in which, for producing a pulsating movement in the material filling the straining cylinder, bodies of various form are fixed on wheel rims fixed on the drum axle, these elements having circumferential or face surfaces gradually ascending radially in the direction of rotation and adjacent suddenly descending rear faces (British Patent 254,069). Such elements, which cut through the material cannot produce intensive pulsating effects (compressions and expansions) and do not press the material through the screen. They effect chiefly only a stirring of the material.

As compared with the known constructions, the invention consists in that in a centrifugal separator of the type above indicated with stationary separating strainer, the centrifuging drum is constructed as a hollow cylindrical drum with a wall surface broken in the circumferential direction and of a length corresponding to that of the strainer, in such a manner that in the direction of rotation gradually rising wall sections alternate with suddenly descending wall sections. Thus, giving way of the material in front of the pressing faces of the pulsating element is prevented, and consequently a much more intensive pressing and expanding is produced. Therefore, on the inner side of the strainer there are masses of deposited coarse material likewise under heavier or lighter pressing on pressure. These masses are, according to the invention, subjected to an axial oscillating movement, at the expanding by inclined blades arranged rake-like behind the descending points of the wall of the centrifuging element casing, which blades are set at an angle in successive rows and alternately inclined in opposite direction. During the separating proceeding the following forces act on the material to be sorted:

1. outwardly acting centrifugal forces,

2. the fraction of the centrifuging element causing a circulating flow,

3. the horizontally acting thrust of the blades and the radial compressions and expansions caused by the circumferential shape of the centrifuging element resulting in inwardly directed eddy movements. Consequently, the material to be sorted is continually agitated so that fresh and good fibres can repeatedly pass through the strainer perforations.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing in which:—

Fig. 1 is an axial vertical longitudinal section of the separator.

Fig. 2 is a cross section on line A—B of Fig. 1.

Fig. 3 is a similar cross section to Fig. 2, showing a modified form of construction.

Figs. 4 and 5 show two types of the arrangement of details.

The separator, which is shown with horizontal shaft on the drawing but might just as well be constructed with vertical shaft, consists of a cylindrical drum with end walls 1 and 2. The material inlet 3 is arranged on the end wall 1, whereas the end wall 2 has connections 4 and 5 for coarse material discharge and water admission. The casing consists of a cast iron semi-cylindrical body 6 with cast-on discharge 7 for the sorted material and of a removable semi-circular cover 8 so that a complete hollow body is formed. A sorting wall 9 of perforated or slotted plates and made in two or more parts for facilitating the fitting, is arranged in the hollow body and rigidly connected to the flanges of the end walls 1, 2. The end walls 1 and 2 carry cast on brackets 10 and 11 for roller bearings 12 and 13 in which a shaft 14 of centrifuging body 15 is journalled, a pulley 31 being keyed on one end of the shaft 14. The centrifuging body 15 is keyed on the shaft 14 and forms a hollow drum with a specially shaped wall, the shape of which is clearly visible in the cross sectional view shown in Fig. 2. The circumferential line is twice broken at uniform distances apart. At the break points 16 the circumferential line extends inwards from the outermost point approximately in radial direction, and then in a spirally rising curve 17 outwards to the outermost point of the next following break where the line again extends as above described. The distance between circumferential line of the centrifuging body and the sieve wall 9 concentrically surrounding same varies at different points, namely the

distance decreases in the revolving direction from a point having the greatest clearance gradually to a point having the smallest clearance and then suddenly increases to the greatest clearance. The result is that, when the centrifuging body rotates in the direction of the arrow (Fig. 2) the material to be sorted and filling the sieve wall 9 is forced outwards through the sieve interstices by the wall sections 17 of the centrifuging body rising in radial direction and is suddenly relieved from pressure at the break points of the wall of the centrifuging body. Therefore, owing to the peculiar circumferential shape of the centrifuging body pressing and relieving forces are exerted on the material, so that radially oscillating movements are imparted to the same. The sorted material which, as already mentioned, completely surrounds the sieve, flows off through the discharge 7. The flow is assisted by the fact, that a difference in gradient exists between the discharge height of the sorted material and the admission height of the admitted unsorted material. Bars 18 with cast on blades 19 arranged rake-like extend from the descending shoulder surfaces 16 of the centrifuging body. The blades are inclined at an angle to an imaginary plane extending perpendicularly to the axis of the centrifuging body, and they are alternately inclined in opposite directions in successive rows extending in the circumferential direction. According to the direction of inclination of the blades the blades, during their rotation, exert an axial thrust on the loosened pulp first in one direction and then in the other direction and produce axial oscillations in the material to be sorted. As the blades are fitted directly behind the receding points of the wall of the centrifuging body, they grip the deposited coarse material in an advantageous manner just at the moment when it is relieved from pressure.

The conveying of the separated coarse material towards the discharge and its continual separation in spite of the opposite thrust direction of the blade rakes is ensured as, in the case of an even number of blade rakes, the rows *a* (Fig. 4) which push the material towards the discharge for the coarse material (arrow *c*), are set more inclined than the other rows of blades *b* so that, owing to the difference of shifting, the coarse material is gradually conveyed. Moreover, the flow pressure from the admission to the discharge for the coarse material exerts a pushing action. In the case of an odd number of rake bars it naturally follows, that the blade bars *d* (Fig. 5) working towards discharge are in the majority in order that the conveying of the coarse material is ensured.

It is possible to particularly influence the intensity of the sifting operation and the discharge of the coarse material by changing the angle of inclination, in that the blades are made adjustable, and also by changing the running speed and by varying the counter-pressure to which the coarse material can be subjected by means of a discharge box 20 with adjustable damming height, or by means of a throttling element 21. As the liquidity of the pulp gradually decreases towards the discharge end for the coarse pulp, or the consistency of the pulp becomes greater, so that the possibility of separation is impaired, it is advisable to supply diluting water from a certain time onwards. This diluting water is introduced into the centrifuging body 12 through the connection socket 5 in the end wall 2 and pressed outwardly through bores 22 in the wall of this body into the pulp owing to the centrifugal force effect. The bores 22 for the passage of the diluting water are arranged at those points of the centrifuging body, at which the pressure on the pulp masses is relieved, that is preferably in the descending shoulder sections of the wall of the centrifuging body, so that a thorough mixing takes place. There is no reason, why this diluting water should not be introduced over the entire length of the centrifuging body.

Behind the discharge 7 for the fine pulp, viewed in the direction of rotation, a partition 23 (Fig. 3) is provided in the annular space surrounding the sieve 9, through which partition a separation of the pulp surrounding the sieve wall is effected. The pulp must circulate from the partition 23 around the sieve wall in order to pass into the open through the discharge 7. This flow of the pulp is assisted by making the casing 24 in spiral shape (Fig. 3) like the casing of centrifugal pumps and turbines. The circulating of the pulp around the sorting wall presents great advantages in that the pulp must travel along a predetermined path, that it continually cleans the sorting wall by flushing during its travel and that it is possible to exert a suction effect upon the sieve in the case of very rapid discharge of the sorted pulp and to thus further increase the efficiency of the separator. This suction effect is attained by employing a drop pipe 25 for the pulp discharge or by a pump. The employment of the drop pipe is more simple because no rotating parts are used which require power and attendance. Moreover, the suction effect of the drop pipe can be regulated in a very simple manner by damming bars 26 or throttle slides 27 which, for example in the case of a centrifugal pump, could only be attained by changing the speed of rotation. The employment of a centrifugal pump is advisable when the sorted pulp is to be brought to a higher level.

For certain purposes it is advisable, for the separator not to work with completely submerged sieve but to allow the pulp, as in the former apparatus, to flow with free drop into the higher situated admission and to flow off into the lower situated discharge 28. In this manner very favourable combinations can be carried out for stepwise separation between the several machines (see Fig. 2).

On the inner side of the circumferential wall of the casing 24 wedge-shaped projections with gradually rising ramp surfaces 29 and suddenly descending shoulder surfaces 30 are arranged which throttle the flow of the rapidly flowing sorted pulp and likewise cause compressions and sudden relieving of the pulp at these points in a similar manner as in the interior of the sieve wall. These radial impulses of the already sorted pulp also serve for keeping the sieve free.

The separator can also work when it is not completely filled with pulp but when it is so erected like the ordinary machines that the pulp flows through in free drop.

What we do claim as our invention and desire to secure by Letters Patent, is:—

1. A centrifugal separator for sifting pulpy material, such as wood pulp, cellulose, paper pulp and the like, comprising in combination a stationary sorting sieve, a centrifuging body rotatable in said sieve constructed as a hollow cylinder having a broken peripheral surface corresponding in length to that of the sieve the said surface consisting of abruptly shouldered convexly eccentric segments gradually rising sec-

tions alternating with suddenly descending sections adapted to alternately slowly compress and suddenly relieve the pulp circulating in said stationary sorting sieve and force the pulp outwardly through said sieve.

2. A centrifugal separator as specified in claim 1, comprising in combination with the centrifuging body having suddenly descending sections, bars extending from said surfaces in the direction of rotation of said body, blades arranged rake-like on said bars the blades on alternating bars being inclined in opposite directions adapted to impart alternately oppositely directed axial movement impulses to the pulp to be sorted exactly at the movement and at the point at which the pulp previously forced in outward direction is suddenly relieved.

3. A centrifugal separator as specified in claim 1, comprising in combination with the centrifuging body having an odd number of suddenly descending sections, bars extending from each of said sections in the direction of rotation of said body, and blades arranged rake-like on said bars, the blades on alternate bars being inclined in opposite directions, the number of blades inclined towards the discharge exceeding that of the blades inclined in the opposite direction.

4. A centrifugal separator as specified in claim 1, comprising in combination with the centrifuging body having an even number of suddenly descending sections, bars extending from each of said sections in the direction of rotation of said body, and blades arranged rake-like on said bars, the blades on alternate bars being inclined in opposite directions, the inclination of the blades inclined toward the discharge being greater than that of the oppositely inclined blades.

5. A centrifugal separator as specified in claim 1, in which apertures for the admission of diluting water are divided in the wall of the centrifuging body at the points at which the pressure is removed from the mass by the suddenly descending sections of the casing.

6. A centrifugal separator as specified in claim 1, comprising in combination with the sieve, a casing surrounding said screen having a discharge aperture for the sorted material, a partition in proximity to the discharge aperture adapted to separate the pulp from the sieve.

7. A centrifugal separator as specified in claim 1, comprising in combination with the sieve, a casing surrounding said sieve having a fine material discharge aperture spirally widened towards said aperture, and a drop pipe arranged at said aperture adapted to effect a suction action to accelerate the pulp flow.

8. A centrifugal separator as specified in claim 1, comprising in combination with the sieve, a casing surrounding said sieve having a fine material discharge aperture spirally widened towards said aperture, and means arranged at said aperture adapted to effect a suction action to accelerate the pulp flow.

9. A centrifugal separator as specified in claim 1, comprising in combination with the sieve, a casing surrounding said sieve, and wedge-shaped projections on said casing having gradually rising ramp surfaces and sudden descending surfaces adapted alternately to exert pressure and to suddenly relieve this pressure on the pulp surrounding said sieve.

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