July 18, 1944. H. BANNING 2,353,983

PURIFICATION OF PULP

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Fig. 1

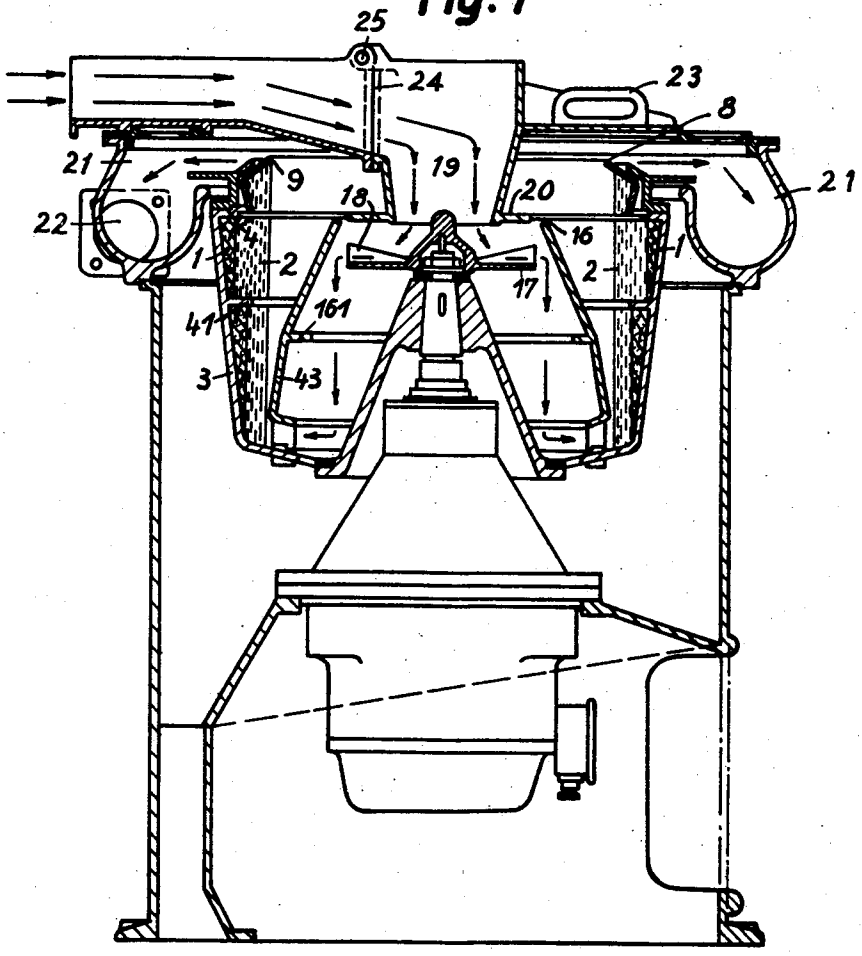


Fig. 2

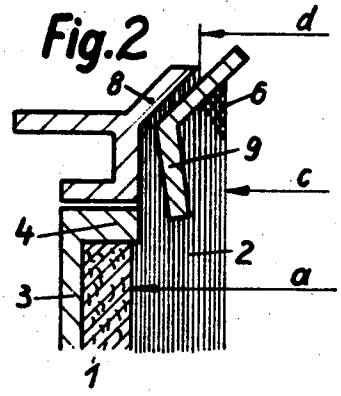
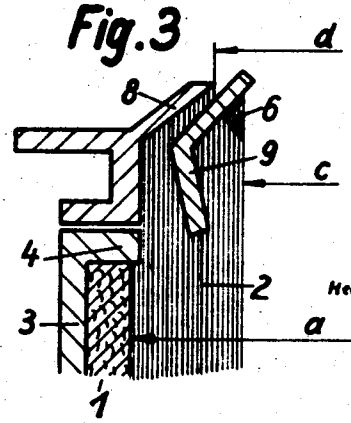


Fig. 3



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Fig. 4

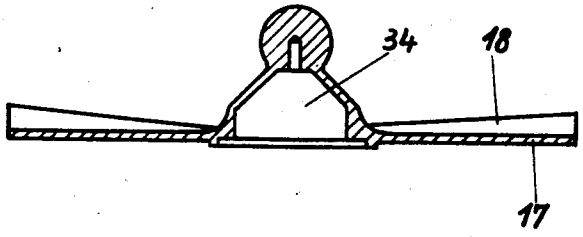
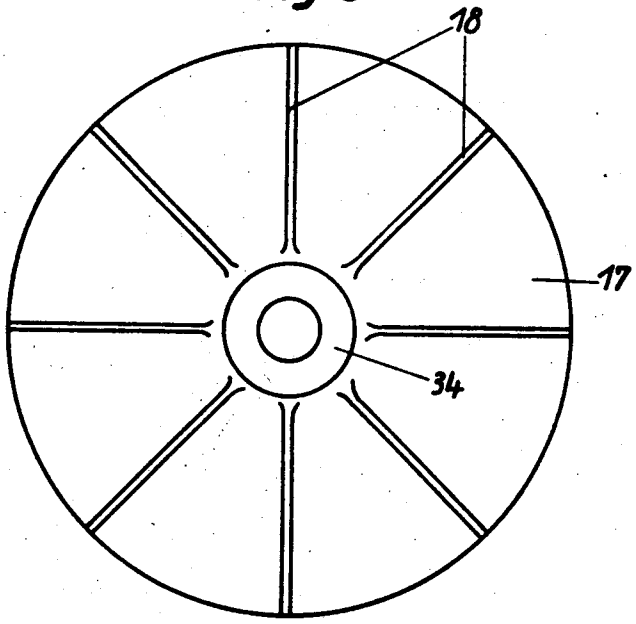


Fig. 5



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UNITED STATES PATENT OFFICE

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PURIFICATION OF PULP

Hellmuth Banning, Duren, Rhineland, Germany; vested in the Alien Property Custodian

Application March 7, 1938, Serial No. 194,265
In Great Britain March 10, 1937

3 Claims. (Cl. 233—46)

The present invention relates to improvements in the purification of paper-, cellulose- or wood-pulp in centrifuges.

Centrifuges for the purification of cellulose-, paper- or wood-pulp are known in which the drum or the outer drum of a concentrically mounted plurality of drums is provided with one or more annular parts or rings projecting radially inwards. While the centrifuge is in rotation cellulose fibres separate out from the vertical fluid stream and deposit as a cushion or cushions of fibres against the wall of the drum beneath the ring or rings, and become more compact the longer the centrifuge is in operation. The specifically heavier impurities are thrown against and embedded in this cushion. The specifically lighter impurities, if present, separate during rotation of the centrifuge, collect on the inner vertical surface of the fluid stream and are driven by the rise of the latter to the highest possible point, where they are obstructed by a ring or like obstructing device. This obstruction is known as a damming and skimming ring and forms together with another ring or annular part, an outlet channel for discharging the purified pulp. This channel further has a throttling action on the speed at which the fluid stream climbs within the drum.

In order that the maximum purification effect of the centrifuge shall be obtained, it is desirable that each particle of the fluid stream should remain as long as possible in the centrifuge, thus being submitted for as long as possible to the centrifugal force set up. A low stream velocity for each particle favours the easy deposition of attached impurities. On the other hand it is desirable that the output shall be high, which means that as great a quantity of material as possible should pass through the centrifuge in unit time.

Therefore in accordance with the present invention in a centrifuge for the purification of cellulose-, paper- or wood-pulp there are provided for the purified pulp at least two outlets whereby the inlet end of one of the outlets is situated farther from the axis of the centrifuge than the inlet end of the second or other outlet and whereby the one outlet, the outer one, has a substantially damming and throttling action and the second or other, the inner one, acts substantially as a discharging weir, for the purpose of maintaining the distance between the axis of the centrifuge and the inner vertical surface of the fluid stream constant, the conditions being such that there is a minimum of feed, which minimum should be equal to or greater than the output of the outer channel.

Further, according to the invention, a centrifuge is provided for the purification of cellulose-, paper- or wood-pulp characterized in that one discharge outlet for the purified pulp comprises at least two bounding surfaces its inlet end being situated further from the axis of the centrifuge than its outlet end and the bounding surfaces being so shaped that they each possess at least one point of inflection above which the pulp is directed inwards toward the axis of the centrifuge and wherein the outermost bounding surface below the first or only point of inflection rises parallel to the axis of the centrifuge.

It is a further object of this invention to provide a centrifuge of the class described in which a novel skimming means is provided for collecting the lighter impurities from the solution at a point adjacent the outlet of the drum.

According to the present invention there is further provided a centrifuge for the purification of cellulose-, paper- or wood-pulp comprising one or more drums and provided with a consecutive feed, and wherein the material to be purified is introduced so that it impinges on to an accelerating device in the form of a disc or impeller attached at or near the top of the main spindle driving the centrifuge and located beneath a stationary inlet, so that the material is accelerated and thrown off radially in a direction parallel or substantially parallel to that of the centrifugal force, towards the upper part of the drum or inner drum, where more than one drum is provided.

The disc or impeller may be removable and may be provided with radial or scoop-shaped ribs or baffles or the like. Further a spray protecting cover may be provided either attached to the ribs or baffles or to a stationary inlet forming part of the cover of the centrifuge. Further this stationary inlet may be constructed to pivot vertically so that the interior of the centrifuge may be rendered accessible for cleaning.

It is further of importance that the discharge channel or outlet be constructed in such a shape that accumulations of fibres on the walls or the outlet may be easily removed.

The invention will now be described with reference to the following diagrammatic drawings in which:

Fig. 1 diagrammatically illustrates in vertical section a double drum centrifuge provided with a feed accelerating device and a discharge channel in accordance with the invention.

Fig. 2 illustrates on a larger scale the discharge channel shown in Fig. 1.

Fig. 3 shows a slight modification of the channel shown in Fig. 2.

Fig. 4 is a section through the feed accelerating disc shown in Fig. 1.

Fig. 5 is a plan view of the feed accelerating disc shown in Figs. 1 and 4.

In all the figures like parts are represented by like reference figures or letters.

a represents the distance between the cushion of fibres 1 and the axis of rotation of the centrifuge. *c* represents the distance between the inner unbroken vertical surface of the fluid stream 2 and the axis of the centrifuge and *d* the distance between the inner circumference of the outermost ring and the axis of the centrifuge. The lighter impurities collect at 6 if present, the heavier impurities settle on and between the fibres of the cushion.

The conditions, such as speed of rotation, rate of feed and dimensions of the rings 8 and 9 and the cross-sectional area of the discharge channel are arranged so that *c* is always less than *a*. The distance *c* is principally controlled by the distance *d* and *c* is always less than *d* on account of the throttling action set up by the discharge channel.

Figure 1 shows the outer portion of a discharge channel constructed in accordance with the invention. The cushion of fibres 1 is retained by the ring 4 on which an annular part or ring 8 is mounted forming with an annular part or ring 9 a discharge channel. The surface of the ring 8 in contact with the fluid stream is shaped as shown in the figures so that it first rises vertically and is then inclined inwards towards the axis of the centrifuge. The outer face of the ring 9 first rises at an angle inclined to the inner face of the ring 8 and then inclines inwards parallel to the ring 8 from a point at a corresponding height to that of the point of inflection of the ring 8. If desired the upper part of the ring 8 may incline towards the upper part of the ring 9. Thus any point on the ring 8 is always at a greater distance from the axis of the centrifuge than any corresponding point on the ring 9. The lower part of the discharge channel thus is of conical cross-section diminishing in size in the upward direction. The lighter impurities 6 collect beneath the ring 9 as shown in the figures. In this case the distance *d* in connection with the cross-sectional area of the discharge channel controls the distance *c*. The shorter *d* is, the shorter *c* will be. The wall of the drum, may be the outer drum of a plurality of concentric drums, and may have a plurality of cushion-promoting rings.

The throttling action can be increased by increasing the inclination of the rings 8 and 9 towards one another.

Discharge channels having the above-mentioned characteristics provide in particular for a decrease in the speed of the fluid stream. Furthermore the throttling effect taking place principally in the upper part of the channel, i. e., in a position remote from the uppermost part of the cushion in which the heavier impurities collect and remote from the uppermost part of the fluid stream where the lighter impurities, if present, collect. Thus, any whirling of deposited heavy impurities, or of lighter impurities which may have collected, is avoided. Again the discharging purified pulp leaves the centrifuge at a minimum distance radially from the axis, the inclination towards the axis of the upper part of the channel causing a decrease in the circumferential speed and consequently providing for a decrease in the power consumption of the centrifuge.

The centrifuge shown in Figure 1 comprises two conical drums one inside the other attached together and rotating on a common axis.

Referring now to Figure 1, 3 is the wall of the outer drum and 43 the wall of the inner drum 161, 4 and 41 are annular parts or rings projecting radially inwards beneath which cushions of fibres containing the heavy impurities deposit against the drum walls. The space between the drum walls increases in accordance with the invention, the point of inflection of the inner drum wall being shown at the ring 161. The inner drum has a wall shaped into two portions of which one has the greater diameter and is provided with rings 16 and 161 for promoting the formation of separated cushions on the interior of the drums. The outer drum has an outwardly and upwardly flared straight wall 3 and is provided with two rings 4 and 41 for promoting the formation of cushions. A discharge opening is formed by rings 8 and 9, the lighter impurities collecting at 6 under the ring 9. In accordance with the invention the lower part of the ring 8 first rises parallel with the axis of the centrifuge and is then inclined inwards. The skimming and damming ring 9 first rises at an angle inclined towards the ring 8 and then is inclined inwards parallel to the upper portion of the ring 8.

Further Figure 1 illustrates a two-drum centrifuge which contains a feed accelerating device. Further details of this feed accelerating device are shown in Figures 4 and 5. The accelerating device comprises a disc 17 mounted on the top of the main shaft of the centrifuge by which it is rotated with the drums. Radial ribs 18 are provided on the disc 17. The pulp to be purified enters the centrifuge and passes through the stationary inlet 19 and impinges on the rotating disc 17 from which it is thrown by centrifugal force against the wall 16 of the inner drum. The lower end of the inlet 19 is provided with a flange 20 to prevent the pulp stream from splashing or spraying over the top of the inner drum. The stream passes down the inner drum building up the cushions on the interior thereof, and is then thrown radially outwards into the outer drum where it climbs, forming cushion 1 and the purified pulp leaves by the discharge channel formed between rings 8 and 9 and falls into the stationary trough 21 and leaves the centrifuge through the outlet 22. The lighter impurities 6 may be removed by a skimming pipe.

In order to clean the centrifuge and remove the cushions which have formed against the walls, the cover of the centrifuge is lifted by the handle 23 and the inlet 19 together with the flange 20 is swung vertically along the line 24 of the hinge 25. The disc 17 thus becomes exposed and can be removed. The walls of the drums are now readily accessible for hand scraping or spray washing, the cleansing operation being performed in shorter time than usual due to the afore described construction. The shape of the inner drum wall renders access to the outer drum wall easy for the removal of the fibre cushions.

It will be understood that the invention is not limited to the details of construction and procedure herein illustrated and described, but that departures may be made therefrom within the scope of the invention and without sacrificing its chief advantages.

What I claim is:

1. A centrifugal separator for the purification of paper-, cellulose- or wood-pulp from impurities, comprising at least one drum with a bottom, an annular flange on said drum above said bottom, said flange extending interiorly of the drum for the formation of a deposit of fibres holding heavy impurities in the space below said flange, an annular body arranged on said drum above said flange, said annular body having a wall the lower portion thereof extending in a substantially vertical direction and the upper portion thereof extending in an upwardly and inwardly inclined direction, the upper edge of said annular body forming an overflow edge and being nearer to the axis of the drum than the innermost edge of said annular flange, and an annular member disposed inside said annular body, the outer surface of said annular member being spaced from the inner surface of the wall of said annular body to form a throttling passage for the discharge of the entire flow of the purified material, the upper edge of said annular member extending beyond the upper edge of said annular body, and the inner surface of said annular member forming skimming means for the separation of the light impurities.

2. A centrifugal separator for the removal of impurities from paper, cellulose, or wood-pulp fluid mixtures, comprising at least one drum with a bottom, mounted for rotation upon a substantially vertical axis, an annular flange on said drum above said bottom, said flange extending interiorly of the drum for retaining a deposit of fibres holding heavy impurities in the space below said flange, a frustro-conical discharging member associated with said drum for discharging the purified suspension of fibres, the inside surface of said discharging member forming one wall of an annular channel for continuously leading the purified suspension upwardly, and the upper overflow edge of the discharging member forming an outlet weir for said channel, said overflow edge being substantially nearer to the axis of the drum than the lower edge of the frustro-conical member, said lower edge of the frustro-conical member being substantially nearer to the axis of the drum than the innermost edge of said annular flange, and a second frustro-conical member concentrically disposed within said first frustro-conical member and having the upper edge thereof terminating at an elevation at least as high as the upper edge of said first member, the outer surface of said second member being substantially parallel to and spaced apart from the inner surface of the first member to thereby form a second wall for said channel, and a third frustro-conical member extending downwardly and inwardly from the base of said second frustro-conical member to form an annular inlet to said channel, said inlet having a gradually increasing cross-section as the inlet progresses downwardly from the channel, whereby a throttling effect is obtained as the fluid flows upwardly toward the channel outlet.

3. A centrifugal separator as claimed in claim 2, wherein the inner surface of said third frustro-conical member is provided with an annular recess for retaining the lighter impurities in said fluid mixture.

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