Feb. 7, 1933. C. J. LINDEQUIST 1,896,180

MULTIPLE CENTRIFUGAL SEPARATOR

Filed March 22, 1930

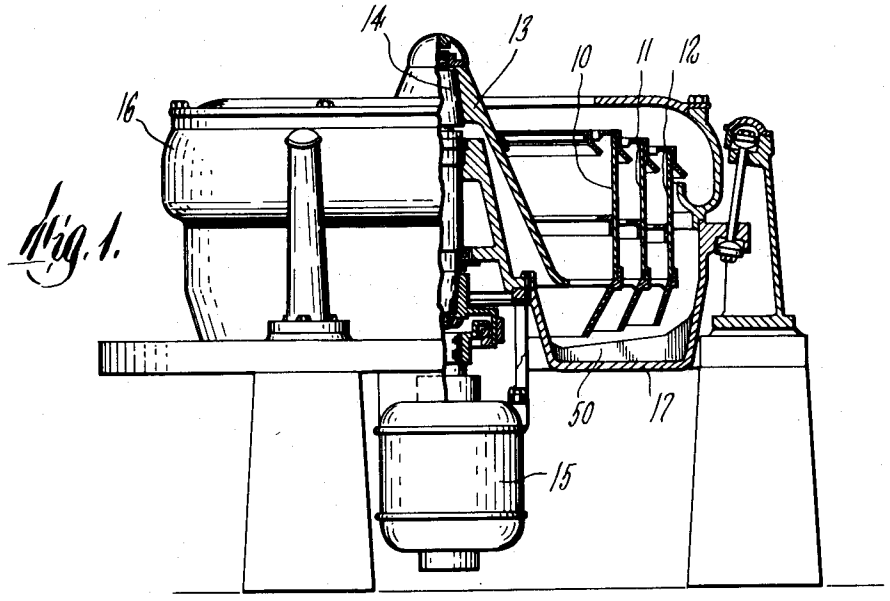


Fig. 1.

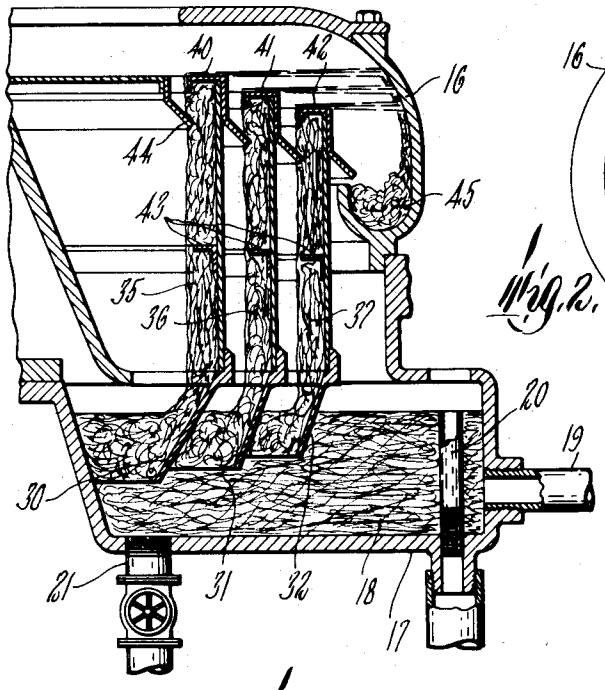


Fig. 3.

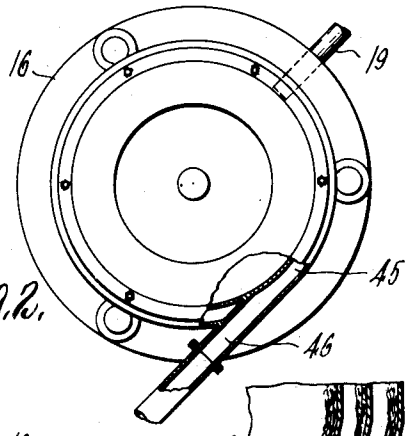


Fig. 2.

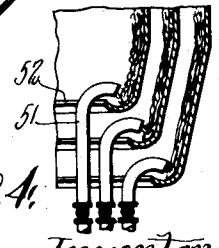


Fig. 4.

Inventor:
Charles J. Lindequist,
by Wright Brown Quinby & Clay
Attys.

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UNITED STATES PATENT OFFICE

CHARLES J. LINDEQUIST, OF NORWOOD, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CENTRIFUGAL ENGINEERING AND PATENTS CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY

MULTIPLE CENTRIFUGAL SEPARATOR

Application filed March 22, 1930. Serial No. 438,044.

This invention relates to apparatus for the purifying of liquids such as aqueous suspensions of cellulosic materials. The invention relates more particularly to aqueous suspensions of wood pulp such as may be employed in the manufacture of paper and other articles. It is highly desirable that such pulp be entirely free of particles of grit or other impurities when the stock reaches the paper making machine.

To this end the stock may be passed through a suitable centrifuge wherein it may be caused to travel from one end of a whirling drum to the other over internal ribs or barriers which assist in breaking up fiber bunches in the pulp suspension and which cause some of the pulp to collect in pools against the inner surface of the whirling drum, the pulp in these pools exerting a combing action on the stream of pulp suspension flowing thereover to catch the heavier particles of foreign matter which may be carried along in the pulp stream. Owing to the peculiar characteristics of wood pulp suspensions, there is a limit to the speed of rotation of such a drum for practical operation. There is also a practical limit to the rate at which pulp suspensions may pass through a drum of given diameter. Considerations of floor space and especially of structural strength to withstand the disintegrating tendencies of the centrifugal force of rotation set practical limits to the diameters of the drums employed. It is desirable, however, to increase the output of a centrifuge as much as possible without taking up an excessive amount of floor space or unduly complicating the structure. For this purpose a multiple centrifuge may be constructed with a series of coaxial drums mounted one within the other, the walls of these drums being spaced apart so as to permit streams of pulp to flow in parallel within each drum. One of the difficulties encountered in a structure of this kind is the provision of practical and efficient means for supplying streams of pulp to the several drums. According to the present invention, the several drums are provided with skirts which dip into a pool of pulp, the pulp being picked up by the centrifugal component of the motion given to pulp in contact with the portions of these skirts which project below the surface of the pool.

For a more complete disclosure of the invention, reference may be had to the description thereof which follows and to the illustration thereof on the drawing, of which—

Figure 1 is an elevation of a centrifuge embodying the invention, part of the centrifuge being broken away to show the inner members in vertical section.

Figure 2 is a plan view of the centrifuge illustrated in Figure 1, a portion of the discharge system being broken away.

Figure 3 is a fragmentary section of the centrifuge showing the course of the pulp stock streams therethrough.

Figure 4 illustrates a modified stock feeding device.

Referring to the drawing in detail, the centrifuge may consist of any convenient number of drums which are preferably mounted one within the other (if more than one drum is employed on a common shaft). In the centrifuge illustrated on the drawing, three drums 10, 11 and 12 are illustrated by way of example, these drums all being secured to a central conical member 13 which, in turn, is mounted on the upper end of a shaft 14. The shaft may be driven as by an electric motor 15 or by any other suitable means. The drums are supported in a suitable cylindrical housing 16 which is preferably open at the top to facilitate cleaning. The housing 16 is provided with a bottom portion 17 shaped to hold an annular pool 18 of pulp stock. This pool may be maintained at a substantially constant level by a supply pipe 19, an overflow 20 being employed to take care of any excess stock which may be supplied to prevent the level of the pool 18 from rising too high. A drain pipe 21 may also be provided to drain the pool 18 and for cleaning out the centrifuge.

Extending downwardly from the drums 10, 11 and 12 are skirts 30, 31 and 32, respectively. These skirts all dip into the pool 18 at an angle so as to pick up pulp from the pool by centrifugal action as the skirts rotate therein. Since the diameters of the several drums are

different while the angular speed of rotation is the same, the linear speed of the drums will vary. To offset this difference, the angle of the skirts 30, 31 and 32 may be varied, the inner skirt 30 being at the greatest angle on the perpendicular. The inner skirt 30 thus has a larger horizontal component than the skirts 31 or 32, so that the centrifugal effect is increased thereby sufficiently to overcome the difference in linear speed. The skirts 31, 32 may also be made progressively shorter than the skirt 30 so as to project less deeply into the pool. This also helps to counteract the difference of linear speed in the several skirts. As the pulp is picked up from the pool 18, it enters substantially vertical pools 35, 36 and 37 against the walls of the several drums. As more pulp enters these pools, the pulp therein is displaced upwardly until it is discharged at the upper ends of the several drums.

To maintain the pools in the drums, flanges 40, 41, 42 are formed on or attached to the upper ends of the respective drums, these flanges extending inwardly as shown. One or more intermediate circular ribs 43 may be mounted within each drum, over which rib or ribs pulp must flow in its upward course. The flow of pulp over the ribs and flanges tends to break up fiber bunches and to render the pulp more homogeneous and uniform in consistency.

In order to catch impurities of lesser density than the pulp stock suspension, skimming rings 44 may be provided, these rings being adapted to dip their outer ends into the pools 35, 36 and 37, so that these streams of stock must flow under the edges of the skimming ring. Thus floating impurities are caught and held by the rings. The streams flowing over the edges of the flanges 40, 41 and 42 are flung outwardly against the casing 16 where they are caught in a channel 45 from which the stock flows off to a suitable discharge pipe 46.

In order to avoid rotation of the entire pool 18 of stock, a series of radial baffle plates 50 may be mounted on the bottom 17 of the casing.

Figure 4 illustrates a modified device for supplying the several streams, this comprising a set of pipes 51, one for each drum. Each pipe, as shown, may have a bend at its discharge end to feed the pulp directly to the interior of its corresponding drum. The lower edge of each drum may be bent inwardly, as at 52, to cause the stock to flow upwardly and over the flanges at the upper ends of the drums.

I claim:

1. A centrifuge for purifying liquids, comprising a casing having a lower portion adapted to hold a pool of liquid to be purified, a plurality of open-ended concentric drums one within the other, a skirt extending downwardly and inwardly from each drum and submerged in the pool in the casing, the skirt on the inner drum extending to a greater depth in the pool than the skirt on the outer drum, and a shaft supporting said drums for rotation about its axis.

2. A centrifuge for purifying liquids, comprising a casing having a lower portion adapted to contain a pool of liquid to be purified, a plurality of coaxial open-ended drums one within the other within said casing, a skirt on each drum extending angularly from the lower end thereof into said pool, the inward slope of the submerged skirt on the inner drum being at a greater angle from the perpendicular than that of the submerged skirt on the outermost drum, and a common shaft carrying said drums for rotation about its axis.

3. A centrifuge for purifying liquids, comprising a casing having a lower portion adapted to contain a pool of liquid to be purified, a plurality of coaxial open-ended drums one within the other, a skirt mounted on the lower end of each drum, said skirt extending downwardly and inwardly into said pool, the submerged skirt on the innermost drum extending more deeply and at a greater angle to the perpendicular than the skirt on the outermost drum, and a common shaft for supporting said drums for rotation about its axis.

4. A centrifuge for purifying liquids comprising a container for a pool of liquid to be purified, a plurality of coaxial open-ended drums one within the other supported for rotation above said pool, and a converging skirt extending downwardly from each said drum, said skirts extending to different depths below the surface of the pool.

5. A centrifuge for purifying liquids, comprising a container for a pool of liquid to be purified, a plurality of coaxial open-ended drums one within the other supported for rotation above said pool, and a converging skirt extending downwardly and inwardly from each drum, the inward convergence of the several skirts being at different angles from the perpendicular.

In testimony whereof I have affixed my signature.

CHARLES JOHN LINDEQUIST.