May 9, 1950 G. J. LIPSCOMB 2,506,882

APPARATUS FOR DILUTING AND WASHING PULP SOLUTIONS AND LIKE MATERIALS

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Fig. 1.

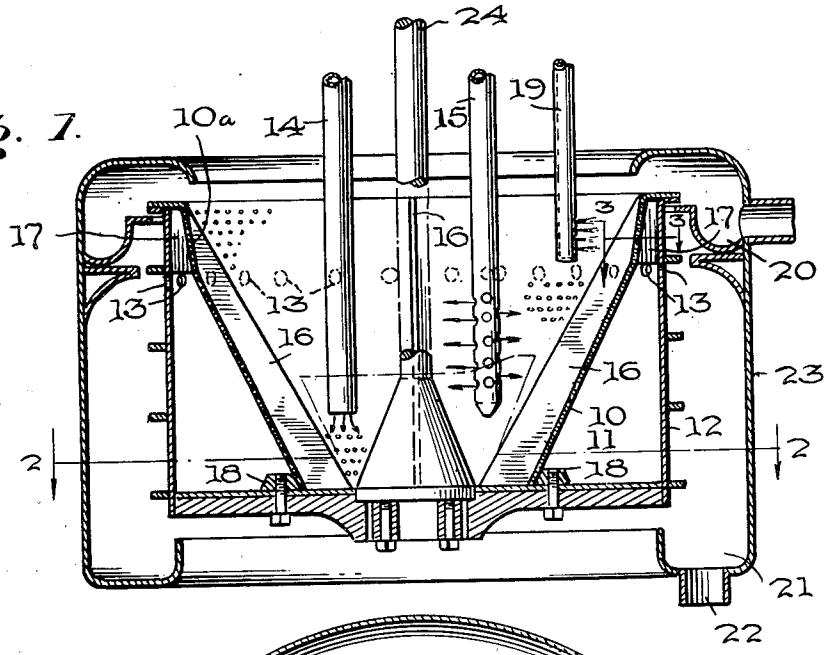


Fig. 2.

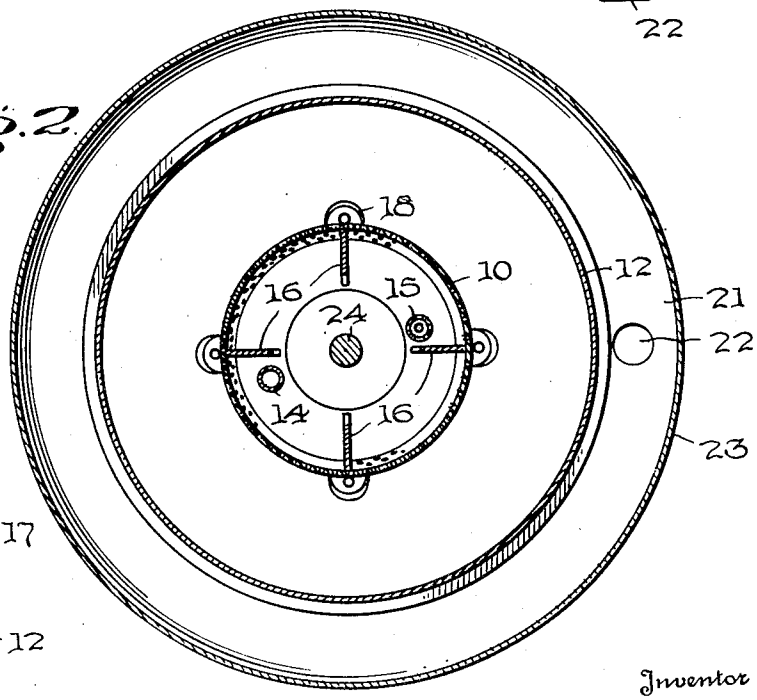
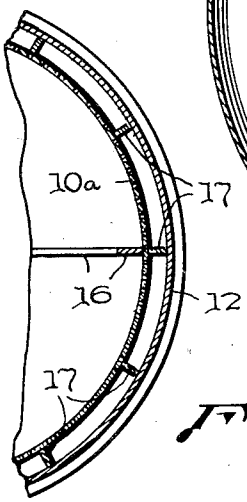


Fig. 3.



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APPARATUS FOR DILUTING AND WASHING PULP SOLUTIONS AND LIKE MATERIALS

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5 Claims. (Cl. 68—23)

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This invention relates to an improved apparatus for diluting and washing materials such as paper pulp and similar materials.

The primary object of the invention is to provide a comparatively simple apparatus of the centrifugal type wherein the pulp solution or other material and dilution water are continuously delivered to the interior of a rotatable, perforate inverted cone member through which said liquids pass while the pulp particles rise to the surface of the liquid and move upwardly along the upper portion of the cone surface which is exposed above the liquid in the cone, wash water being applied to the pulp passing over this otherwise exposed upper area of the cone before it is finally discharged continuously from the upper edge of the cone.

Still another object is to control the flow of the liquid through the revolving cone under the influence of centrifugal force so that such flow will be comparatively slow or gentle to facilitate floatation of the pulp particles. Preferably, this flow control is effected by confining the liquid around the exterior of the cone so as to produce a balanced pressure or a back pressure at the exterior of the submerged portion of the cone.

Still another object is to provide means for preventing slippage or relative movement of the body of liquid within the cone with respect to the latter whereby the cone and liquid therein will revolve substantially as a unit.

With these and other objects in view the invention consists in certain details of construction and combinations and arrangements of parts all as will hereinafter be more fully described and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawing illustrating what is, at present, believed to be the preferred form of apparatus for carrying out the present method.

Figure 1 is a vertical sectional view taken axially of the cone member, portions of the drive connections being illustrated more or less diagrammatically;

Fig. 2 is a transverse section on the line 2—2 of Fig. 1; and

Fig. 3 is a detail sectional view on the plane indicated by the line 3—3, Fig. 1.

Generally described, the invention contemplates continuously delivering the pulp solution and dilution water to the interior of a revolving, perforated inverted cone 10 partially submerged in that liquid which is temporarily retained in a chamber 11 surrounding the cone so that the liquid in said chamber will maintain a balanced

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pressure at the exterior of the cone and cause the liquid to pass gently or slowly through the cone while the pulp or pulp particles rise to the surface and tend to accumulate on the exposed area 10a of the inner surface of the cone. The pulp on this portion 10a of the cone gradually moves upwardly and is finally discharged from the edge of the cone under the influence of centrifugal force. During the initial portion of this movement of the pulp upwardly of the exposed area 10a of the cone it is partially dewatered very rapidly, after which displacement water is sprayed thereon to give it a final displacement wash, a portion of this water being thrown off centrifugally before the pulp is finally discharged.

In the present apparatus, the inverted perforate cone 10 is mounted in a revolving basket or container 12, the cone and basket being closed at the bottom and the side wall of the basket having an annular series of horizontally arranged discharge openings 13 located at a point to maintain the cone submerged to the desired level in liquid which is delivered continuously to the interior of the cone by pulp solution supply pipe 14 and dilution water supply pipe 15. Both of said pipes discharge into the cone at a level below the discharge openings in basket 12 so that the water or liquid in the chamber 11 formed by the basket will exert a back pressure slightly less than the force with which the liquid tends to escape through the perforations in the cone wall.

In order to prevent slippage of the body of water with the cone relatively to the cone when the latter is rotating, the inner surface of the cone is provided with a series of longitudinal ribs 16, which extend the full length of the cone or at least from the bottom of the cone to the surface of the liquid. Four of these ribs are shown in the present machine. Adjacent its upper edge, the cone is also provided on its outer face with a plurality of stiffening members or ribs 17 but these ribs extend only from the upper edge of the cone down to the lower extremity of the exposed or unsubmerged area of the cone. This is due to the fact that that portion of the cone above the level of the liquid is subjected to the full effect of the centrifugal force generated by the revolving mass whereas the submerged portion of the cone is supported, so to speak, by the back pressure of liquid in chamber 11. In practice, the ribs 16, 17 are all welded to the cone to form a unit which can be slipped into the basket 12 with a neat fit. Preferably a series of circumferentially spaced lugs 18 are attached to the bottom of the basket at points to engage the lower, outer edge of the cone

and maintain the cone properly positioned in said basket.

As previously indicated the upper portion 10a of the cone is utilized for washing the pulp with displacement water supplied through a pipe 19 and for partially drying the washed pulp before it is discharged from the upper edge of the cone. That is, as the pulp solution and dilution water are fed into the cone, the highly diluted pulp moves under the influence of centrifugal force radially outward towards the perforated cone wall. Due to the back pressure of liquid in chamber 11 which practically balances the force with which the pulp is impelled towards the cone, the liquid flows gently through the perforations over the entire area of the submerged portion of the cone. The pulp is lighter in weight than the liquid and gradually rises to the surface, this action being augmented somewhat by reason of the fact that the water is heavier and takes precedence in approaching and passing through the screen formed by the cone perforations. As the pulp accumulates on the inner surface of the cone at the liquid level the centrifugal force causes it to rise up along the surface 10a of the cone, the inclination of this surface 10a being somewhat greater than that of the lower portion of the cone in order to retard the upward movement of the pulp. This affords an ample time interval to permit a final washing and subsequent partial drying of the pulp before it is discharged. In this connection it will be understood that the inclination of area 10a will vary, depending upon the material being treated so that, at a given speed of rotation the material will be gently urged up said surface by virtue of the vertical component of the centrifugal force. Preferably, the wash water is sprayed on the pulp on area 10a through small orifices in supply pipe 19, and the spray openings are located about midway the height of area 10a so that as the pulp passes over the lower portion of said area between the liquid level and the lowermost orifice it will be partially dewatered and then as it moves into registry with the spray of displacement water it will receive a final washing. Finally, as the pulp passes between the upper orifice and the upper edge of the cone this wash water is partially thrown off by centrifugal force, after which the pulp is discharged into a trough 20 where a stream of water carries it to a suitable deposit tank (not shown).

The water overflowing from chamber 11 through openings 13 in the basket or container 12 is discharged into a trough 21 provided with a drainage outlet 22. In the present illustration trough 21 is formed in the lower portion of a housing 23 for the machine and the pulp trough 20 is mounted on, or constitutes, the top of said housing.

Power for revolving the cone may be derived from a standard motor (not shown) of 1200 to 1500 R. P. M. operatively associated with the cone. For instance, the motor shaft 24 may be connected to the basket 12 direct or through suitable gearing thus revolving the cone and basket as a unit.

As previously stated, as the liquid is heavier than the pulp particles, there is a tendency for the water to take preference in approaching and passing through the cone perforations so as to minimize the possibilities of said perforations, which are rather small, being plugged up or closed by pulp. In addition the liquid in chamber 11 will not revolve with the basket and screen but, relatively speaking will remain stationary and thus acts as an automatic wiper or cleaner for that portion of the surface of the cone located below the basket discharge openings 13.

What is claimed is:

1. In a centrifugal apparatus for diluting and washing pulp and similar materials, a rotatable open topped container having imperforate bottom and side walls, a foraminous inverted cone member concentrically supported in said container extending from said bottom wall to the upper edge of said side wall, pulp supply means terminating near the bottom of said inverted cone member for delivering pulp suspended in a liquid to the lower portion of the interior of said inverted cone member, said side wall being formed with apertures adjacent the upper edge thereof for discharging liquid from the rotatable liquid chamber formed between said inverted cone member and said container, thereby maintaining an accumulation of liquid in said chamber exerting a back pressure on said cone member, washing liquid supply means terminating between the upper edge of said cone member and the level of said apertures for delivering washing liquid to the interior of said cone member at a point above said apertures, and stationary pulp receiving means surrounding the upper edge of said container for collecting pulp centrifugally discharged from said upper edge.

2. In a centrifugal apparatus for diluting and washing pulp and similar materials, a rotatable open topped container having imperforate bottom and side walls, a foraminous inverted cone member concentrically supported in said container extending from said bottom wall to the upper edge of said side wall, pulp supply means terminating near the bottom of said inverted cone member for delivering pulp suspended in a liquid to the lower portion of the interior of said inverted cone member, a plurality of circumferentially spaced impeller ribs extending along the interior of said cone member upwardly from the bottom thereof to the upper edge thereof, said side wall being formed with apertures adjacent the upper edge thereof for discharging liquid from the rotatable liquid chamber formed between said inverted cone member and said container, thereby maintaining an accumulation of liquid in said chamber exerting a back pressure on said cone member, washing liquid supply means terminating between the upper edge of said cone member and the level of said apertures for delivering washing liquid to the interior of said cone member at a point above said apertures, and stationary pulp receiving means surrounding the upper edge of said container for collecting pulp centrifugally discharged from said upper edge.

3. In a centrifugal apparatus for diluting and washing pulp and similar materials, a rotatable open topped container having imperforate bottom and side walls, a foraminous inverted cone member concentrically supported in said container extending from said bottom wall to the upper edge of said side wall, pulp supply means terminating near the bottom of said inverted cone member for delivering pulp suspended in a liquid to the lower portion of the interior of said inverted cone member, diluting liquid supply means terminating near the bottom of said inverted cone member for delivering pulp diluting liquid to the lower portion of the interior of said inverted cone member, said side wall being formed with apertures adjacent the upper edge thereof for discharging liquid from the rotatable liquid chamber formed between said inverted cone member and said container, thereby maintaining an

accumulation of liquid in said chamber exerting a back pressure on said cone member, washing liquid supply means terminating between the upper edge of said cone member and the level of said apertures for delivering washing liquid to the interior of said cone member at a point above said apertures, and stationary pulp receiving means surrounding the upper edge of said container for collecting pulp centrifugally discharged from said upper edge.

4. In a centrifugal apparatus for diluting and washing pulp and similar materials, a rotatable open topped container having imperforate bottom and side walls, a foraminous inverted cone member concentrically supported in said container extending from said bottom wall to the upper edge of said side wall, pulp supply means terminating near the bottom of said inverted cone member for delivering pulp suspended in a liquid to the lower portion of the interior of said inverted cone member, said side wall being formed with apertures adjacent the upper edge thereof for discharging liquid from the rotatable liquid chamber formed between said inverted cone member and said container, thereby maintaining an accumulation of liquid in said chamber exerting a back pressure on said cone member, washing liquid supply means terminating between the upper edge of said cone member and the level of said apertures for delivering washing liquid to the interior of said cone member at a point above said apertures, the sides of said inverted cone member from a point adjacent the level of said apertures to the upper edge of said cone member being inclined at a greater angle with respect to the horizontal than the sides of said cone member extending from the level of said apertures to the bottom of said cone member, whereby the upward movement of pulp is retarded above the level of said apertures, and stationary pulp receiving means surrounding the upper edge of said container for collecting pulp centrifugally discharged from said upper edge.

5. In a centrifugal apparatus for diluting and washing pulp and similar materials, a rotatable open topped container having imperforate bottom and side walls, a foraminous inverted cone member concentrically supported in said container extending from said bottom wall to the upper edge of said side wall, pulp supply means terminating near the bottom of said inverted cone

member for delivering pulp suspended in a liquid to the lower portion of the interior of said inverted cone member, said side wall being formed with apertures adjacent the upper edge thereof for discharging liquid from the rotatable liquid chamber formed between said inverted cone member and said container, thereby maintaining an accumulation of liquid in said chamber exerting a back pressure on said cone member, washing liquid supply means terminating between the upper edge of said cone member and the level of said apertures for delivering washing liquid to the interior of said cone member at a point above said apertures, the sides of said inverted cone member from the level of said apertures upward to the top edge of said cone member being inclined at a greater angle with respect to the horizontal than the lower portions of the sides of said cone member, whereby the upward movement of pulp is retarded above the level of said apertures, reinforcing ribs extending from said greater inclined side portions of said inverted cone member outwardly to the sides of said container for reenforcing the construction of the cone member without disturbing the liquid in said liquid chamber, and stationary pulp receiving means surrounding the upper edge of said container for collecting pulp centrifugally discharged from said upper edge.

GASTON J. LIPSCOMB.

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