ABSTRACT: A pulping apparatus is provided, comprising a tank having a rotatable impeller therein, the impeller carrying vanes for providing a desired pulsing action across a screen or sizing ring at the bottom of the tank, the tank also having cutting means disposed therein, components of which are carried respectively on fixed portions of the tank and on the rotatable impeller, and wherein structure is provided for deflecting large solid particles toward the cutting means.
PULPING APPARATUS WITH SOLIDS DEFFCTOR

BACKGROUND OF THE INVENTION

In the pulping art, particularly as it applies to waste disposal, it has become known to utilize pulping tanks which are capable of receiving an aggregate mixture of trash, such as cans, plastics, paper products, rags and the like, for comminuting and pulping such debris into a desired size, preferably sufficiently small to pass through disposable pipe lines, or to be reduced in volume and subjected to pressure for removing water therefrom, and then to be collected. Such procedures generally reduce the volume of the trash or debris substantially, often to about 20 percent of its original volume.

Also, depending upon the size of particles being discharged from the pulp slurry tank, the slurry may be fed into a sewer for pipeline discharge, if desired. Thus, various techniques have been developed for handling waste by means of pulping tanks, one of which is the pulping apparatus bearing U.S. Pat. application Ser. No. 580,445, filed Sept. 20, 1966 in the name Combs et al. now U.S. Pat. No. 3,489,356, issued Jan. 13, 1970. The apparatus of said application has worked highly successfully to date, but the present application is directed toward providing an improvement thereover.

In accordance with the development of the pulping apparatus of this invention, it was found that, for certain debris substances, such as rags, plastic sheets and the like, short teeth carried by a rotating impeller plate did not provide the most efficient and effective size reduction in the shortest period of time. Consequently, there was developed a means for effectually shearing such rags, plastic sheets, and the like, by securing fixed retarders inwardly of the pulping tank, extending radially inwardly over moveable vanes which would be carried by the impeller, the vanes having cutting teeth secured to their upper ends, to cooperate with edges of the retarders, to effect a shearing action of certain types of debris therebetween.

It has further been found, that, due to the rotary movement of the impeller, rags, plastic sheets, and the like, have tended to buckle prior to becoming "soaked" with the water inside the pulping tank, such "balls" of debris often having air trapped therein, tending to make them lighter than the water medium at the bottom of the pulping tank. The centrifugal forces imparted to the debris from the rotating impeller would force such "balls" of material radially outwardly, and the buoyancy of such "balls" of debris relative to their water medium due to trapped air and the like would tend to make them rise in their water medium, often above the level of the teeth, retarders, and vanes with their attached cutting teeth, such that, until such cutting teeth were sufficiently large and water soaked, they would remain above the cutting elements of the pulping tank, and not be broken up until such time as they had become large enough to be carried downwardly to contact various cutting means within the pulping tank.

SUMMARY OF THE INVENTION

The present invention is directed toward providing a device for mounting inside the pulping tank for directing large particles or "balls" of debris inside the tank into the vicinity of the cutting means or elements disposed within the tank.

Accordingly, it is a primary object of this invention to provide a pulping tank having means for directing enlarged debris particles toward cutting means of the tank.

It is a further object of this invention to provide one or more deflector bars carried by the tank body of the pulping tank for accomplishing the debris-directing function of the object mentioned above.

It is a further object of this invention to provide a deflector bar according to the objects above, wherein such bar is pivoting moveable to prevent jamming of enlarged debris "balls". It is a further object of the invention to provide a deflector bar passing between the bar and other components within the pulping tank.

It is yet another object of this invention to accomplish the above object, wherein the deflector bar is provided with means resiliently urging the bar toward an original predetermined position.

It is a further object of this invention to accomplish all of the above objects, wherein the cutting means of this invention include fixed retarders carried by the tank body, and upstanding vanes having cutting teeth thereon carried by the impeller, wherein the retarders and cutting teeth of the vanes cooperate to provide a shearing or scissorlike action, and wherein the deflector bar directs "balls" of debris into a shearing zone of the pulping tank.

It is another object of this invention to provide a novel deflector device for mounting inside a pulping tank.

Other objects and advantages of the present invention will become readily apparent to one skilled in the art from the following reading of the brief description of the drawing figures, a detailed description of the preferred embodiment and the appended claims.

IN THE DRAWINGS

FIG. 1 is a vertical sectional view through a pulping tank of this invention, wherein the normal downward angular disposition of the deflector bar is illustrated, for deflecting "balls" of debris downwardly and inwardly toward the cutting means of this invention.

FIG. 2 is a fragmentary sectional view taken through the lower portion of the pulping tank which is partially illustrated in FIG. 1, generally along the lines II--II of FIG. 1, wherein the various cutting components, impeller and deflector bars of this invention are illustrated in plan view.

FIG. 3 is an enlarged transverse sectional view, through a deflector mounting of this invention, taken generally along the line III--III of FIG. 1, and wherein the normal and pivotal positions of the deflector paddle of this invention are illustrated in full line and phantom positions, respectively.

FIG. 4 is a top perspective view of a deflector assembly of this invention, wherein the normal direction of pivoting of the deflector rod is illustrated by the arrow designated in the view.

Referring now to the drawings in detail, reference is first made to FIG. 1, wherein there is illustrated the bottom portion of a pulping tank, generally designated by the numeral 10, and comprising a tank body 11, a tank discharge chamber 12, and a rotatable impeller 13.

The tank body 10 includes circumferential sidewalls 14, which are bowed radially inwardly at a lower end thereof to provide an annular flange 15 extending partially across the tank body 10. A screen or sizing ring 16 is of generally annular configuration, and is provided with a plurality of holes 17 extending therethrough, through which pulped debris particles may pass. The ring 16 is provided with a flange 18, which is secured to the tank flange 15 by means of suitable bolts or fasteners 20.

The bolts 20 also hold a plurality of retarder plates 21 in fixed relation, extending radially inwardly from the tank wall 11, each retarder plate 21 having an outer leg portion 22, disposed at an oblique angle relative to an innermost portion 23, the innermost portion 23 extending in overlying relation to the outermost portion of the impeller 13, and being provided with a chamfered or angularly cut edge 24, for facilitating the severing of debris particles between the edge 24 of the retarder plate 23 and teeth 25 carried at the top of ski blocks 26 being upstanding from and carried by a plate 27 of the impeller 13, near the periphery thereof. The ski blocks may also be provided with toothed cutting elements 28 on a radial outermost surface thereof relative to the center of rotation of the impeller 13.

The discharge cavity 12 is disposed generally beneath the plate 27 of the impeller 13, and outwardly of the sizing ring 16, being defined by sidewall portion 30, bottom wall 31, and leading to a discharge duct 32.

A shaft 33 extends upwardly through the bottom 31 of the discharge chamber 12, through a hole 34 therein, the hole 34 being sealed relative to the shaft 33 by suitable packing 35.
The plate 27 is carried by a supporting plate 36 which may be press fit or otherwise carried by the shaft 33, by means of a screw 37, with a large washer 38 further clamping the plate 27 to the carrier plate 36 by means of cap-headed screw 40 or the like threaded into the uppermost end of the shaft 33, as viewed in FIG. 1. A plurality of randomly spaced abrading or cutting teeth 41, constructed according to the construction designated in application Ser. No. 580,445, may be provided. A plurality of bottom vanes 42 extend downwardly from the plate 27, for facilitating the circulation and discharge of slurry toward the outlet duct 32, after its passage into the discharge chamber 12.

In operation, the rotation of the impeller 27, in the counterclockwise direction illustrated by the arrow in FIG. 2 effects an abrading of debris particles of many kinds. Larger particles, such as rags, sheet plastic and the like are generally propelled centrifugally outwardly by the rotation of the impeller 13, and are engaged between the teeth 25 at the upper ends of the vanes 26, and the edge 24 of the retarder plates 21, to be sheared into reduced size. Additionally, the teeth 28 attached to the outer tank 10, and the flat bars or upstanding vanes facilitate breaking up of debris particles that may otherwise tend to accumulate near the periphery of the plate 27, beneath the retarder plates 21, and inwardly of the sizing ring 16. Also, during the rotation of the impeller 13, the vanes 26 facilitate a pulsing of the slurry through the holes 17 of the screen 16, such that, whereas centrifugal force causes particles to be thrown toward the screen 16, any particles that would otherwise tend to cling to the screen 16, are withdrawn from the holes by the particle vacuum created in the wake of the ski blocks 26, due to turbulence of the slurry behind the blocks 26. Thus, sheets of plastic and the like are prevented from blocking the holes 17 in the screen 16.

One or more deflector bars 43 may be provided, radially inwardly of the tank 10 and carried by the tank body 11, one end being disposed within a deflector housing 44, which is welded or otherwise suitably secured to the wall 11 of the tank 10.

Each deflector bar 43 is generally of circular cross section, being constructed of rod stock or the like, and is provided with a bend 45, between the ends thereof, which divides the bar 43 into a free end 46 and a clamped end 47, disposed at oblique angles relative to one another. It will be noted that the clamped end 47 of the bar 43 is disposed within the housing 44 at its upper end, and is free to pivot therein. The bar 47 end is provided with a paddle 48, welded or otherwise secured to the bar end 47, and which extends generally vertically downwardly, as viewed in FIG. 3, between a housing sidewall 50 and a retainer member 51. The pad 51 maybe secured to an opposite sidewall 52 of the housing 44 such that, when the paddle 48 is pivoted from the full line position illustrated in FIG. 3 to the phantom line position illustrated therein, the forces of compression which would be developed in the resilient pad 51 would be sufficient to return the paddle 48 to its original full line position illustrated in FIG. 3, when the initial disturbing or moving force which originally tended to pivot the rod 43 is withdrawn. The free end 43 of the compression pad 51 maybe of neoprene construction, or the like, or may even comprise any suitable compression or extension spring arrangement which would accomplish the desired result according to this invention.

The free end 46 of the deflector bar 43 extends radially inwardly as shown in FIGS. 1 and 2, and downwardly as shown in FIG. 1, but, when the pad 48 is in the full line position illustrated in FIG. 3, the free end 46 of the deflector bar is bend forwardly, as viewed in plan relative to the direction of rotation of the impeller 13, as indicated in FIG. 2. Thus, the deflector bar 43 is disposed such that it would clearly not extend toward the axis of rotation of the impeller 13, but substantially forwardly thereof, as viewed in FIG. 2. Upon a particle of debris such as the ball B illustrated in FIG. 2 engaging the deflector bar 43 at its upper end, the forwardly slanted disposition of the free end 46 of the deflector bar 43, as well as its downward disposition causes a radial inward and downward, as well as forward movement of the ball B along the bar, toward its innermost or free end thereof. The particular forward disposition of the free end 46 of the bar 43 assures sliding of the ball B therealong, rather than allowing a "hanging-up" of the material of the ball B about the rod 43. The inward and downward disposition places the ball B in the vicinity of the innermost edge of a retarder plate 21, whereby the ball B may be engaged by a ski block 26, to be cut by a tooth 25 thereof, preferably being sheared between a tooth 25 and an opposing edge 24 of the innermost portion 23 of a retarder plate 21.

The pivotal movement of the deflector bar 43 prevents jamming of debris particles or balls B between the free end of the bar 43 and a retarder plate 21. It will be apparent to those skilled in the art, that the deflector bar 43, with its particular angular disposition prevents the loopyng of particles and debris therewith, thereby preventing accumulation of debris about the bar 43.

It will further be readily apparent that those skilled in the art that the deflector need not be of circular rod construction, but could be in the form of an angle, or even of platelike construction, as long as the orientation of the plate was such that particles would be deflected inwardly, downwardly, as well as forwardly, to function effectively as a deflector, but yet to prevent snagging or collection of material thereon.

It will be apparent from the foregoing that various modifications may be made in the details of construction of the pulping tank, as well as in the deflector of this invention, and even in the use and operation thereof, all within the spirit and scope of the invention, as defined in the appended claims.

What we claim is:

1. In a pulping tank adapted for the pulping of debris and the like, impeller means disposed in the bottom of the tank and mounted for rotation relative to a tank body, cutting means for engaging and cutting debris between fixed and moving portions thereof, and means, free in itself of severing portions, carried by said tank body and protruding into said tank body, away from a sidewall portion thereof, for directing enlarged debris particles toward said cutting means, wherein said direct means comprises at least one deflector disposed for normally extending radially inwardly, downwardly toward said impeller means, and forwardly relative to the direction of rotation of said impeller means.

2. In a pulping tank adapted for the pulping of debris and the like, impeller means disposed in the bottom of the tank and mounted for rotation relative to a tank body, cutting means for engaging and cutting debris between fixed and moving portions thereof, and means, free in itself of severing portions, carried by said tank body and protruding into said tank body, away from a sidewall portion thereof, for directing enlarged debris particles toward said cutting means, wherein said directing means comprises at least one deflector disposed for normally extending radially inwardly, downwardly toward said impeller means, and forwardly relative to the direction of rotation of said impeller means.

3. In a pulping tank adapted for the pulping of debris and the like, impeller means disposed in the bottom of the tank and mounted for rotation relative to a tank body, cutting means for engaging and cutting debris between fixed and moving portions thereof, and means, free in itself of severing portions, carried by said tank body and protruding into said tank body, away from a sidewall portion thereof, for directing enlarged debris particles toward said cutting means, wherein said directing means comprises at least one deflector disposed for normally extending radially inwardly, downwardly toward said impeller means, and forwardly relative to the direction of rotation of said impeller means.
6. The combination of claim 4, wherein said bar is bent for greater pivotal movement of its free end than of its mounting end.

7. The combination of claim 4, including resilient means urging said deflector bar toward a normal unpivoted position of said deflector bar.

8. The combination of claim 7, wherein said resilient means comprises a compression pad, fixedly carried at one end, the other end being in abutment with an eccentrically offset portion of said deflector bar carried by the outer end of the deflector bar.

9. The combination of claim 1, wherein said cutting means comprises upstanding vanes carried by said impeller means for cooperation with retarders fixedly carried by said tank body.

10. In a pulping tank adapted for the pulping of debris and the like, impeller means disposed in the bottom of the tank and mounted for rotation relative to a tank body, cutting means for engaging and cutting debris between fixed and moving portions thereof, and means for directing enlarged debris particles toward said cutting means, wherein said cutting means comprises upstanding vanes carried by said impeller means for cooperation with retarders fixedly carried by said tank body, wherein said vanes are disposed near the periphery of said impeller means and said retarders protrude radially inwardly of said tank into overlying relation relative to said vanes, said directing means comprising a deflector bar elongated between its ends and being carried by said tank body at one end and having a free end extending radially inwardly toward a free end of a retarder.

11. The combination of claim 9, wherein a sizing ring is disposed in an opening at the bottom of said tank body, circumferentially outwardly of said vanes.

12. A deflector for mounting inside a pulping tank comprising a bar, said bar being bent between its ends into two legs such that one leg is disposed at an oblique angle relative to the other leg, a first leg of the bar being disposed within a housing and adapted for pivotal movement at one end of said housing, a paddle secured to the extending eccentrically of said first leg, a compression pad disposed within said housing against one wall thereof, said pad being in abutment with said paddle, whereby pivotal movement of said bar such that said paddle moves against and compresses said pad causes opposing forces in said pad for urging said paddle toward its original position.

13. In a pulping tank adapted for the pulping of debris and the like, impeller means disposed in the bottom of the tank and mounted for rotation relative to a tank body, cutting means for engaging and cutting debris between fixed and moving portions thereof, and means carried by said tank body and protruding into said tank body, away from a sidewall portion thereof, for directing enlarged debris particles toward said cutting means, wherein said directing means comprises at least one deflector, said deflector having a movable portion disposed within said tank body for engaging debris to be deflected.