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APPARATUS FOR BLEACHING PULP

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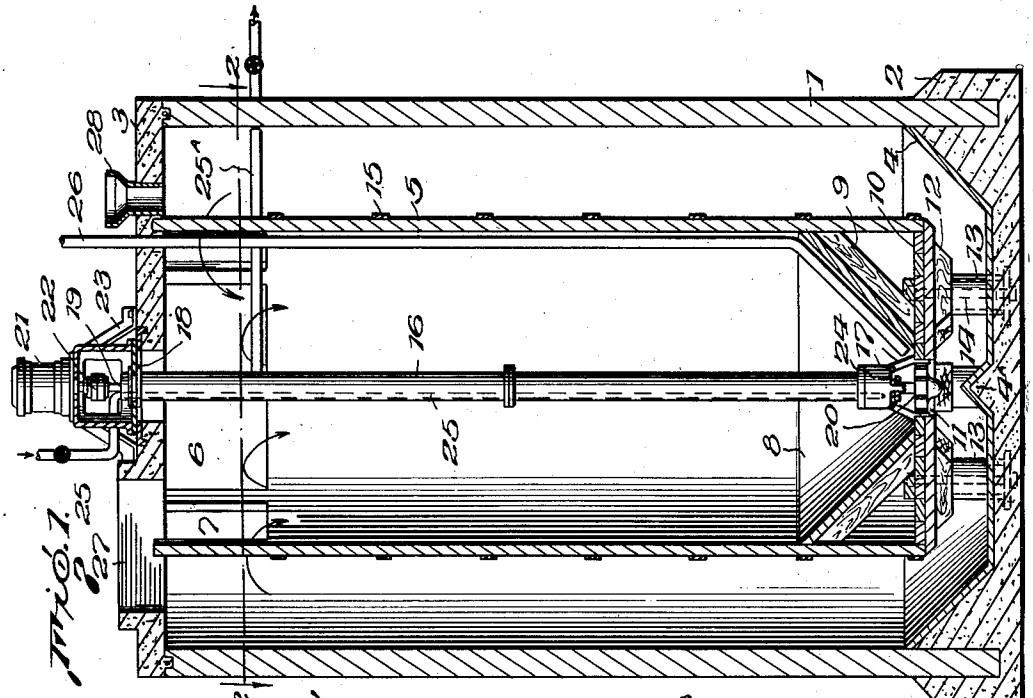


Fig. 1.

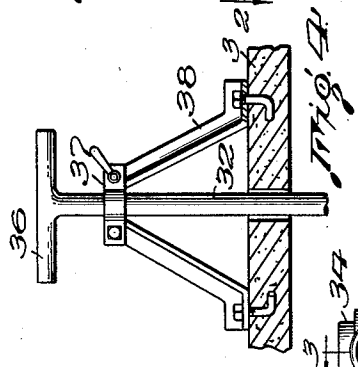


Fig. 4.

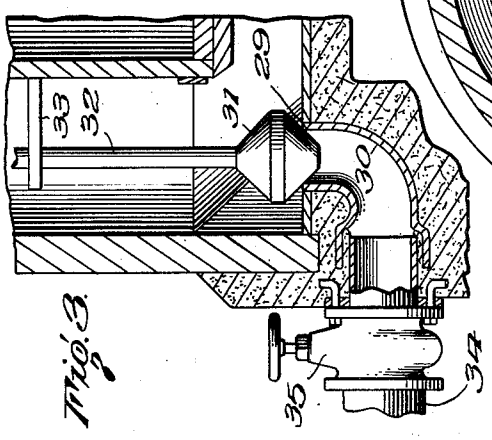


Fig. 3.

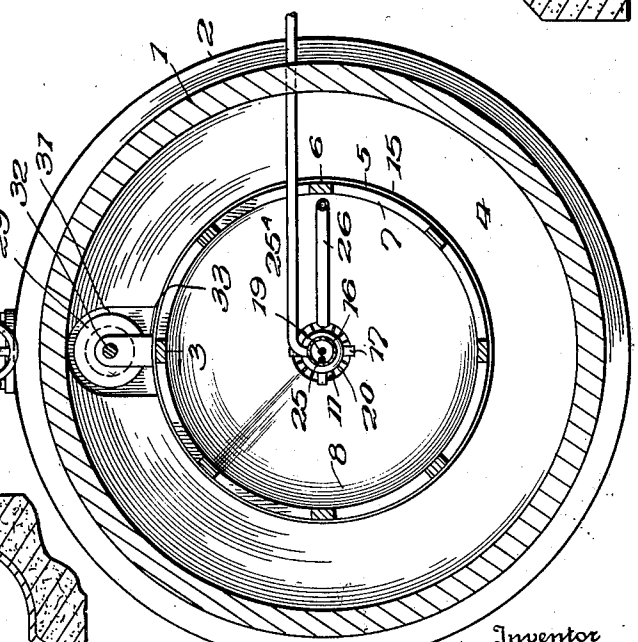


Fig. 2.

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APPARATUS FOR BLEACHING PULP

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1 Claim. (Cl. 8—2)

This invention relates to apparatus for bleaching pulp; and it comprises as a new pulp bleaching apparatus a pair of concentric cylindrical casings, adapted to allow easy flow of a pulped mass, one being within the other and in open communication near its top with the other, the inner one having a funnel shaped bottom portion, the outer cylinder being provided with a smooth bottom portion in the shape of a frustum of a cone forming a sump, pumping means within the assemblage and near the bottom adapted to establish and maintain a vertical circulation of a pulped mixture of fiber and water through said sump, through the space between the walls of the inner and outer cylinders and through the inner cylinder, and means for introducing a chlorinating agent into the circulation; all as more fully hereinafter set forth and as claimed.

Paper pulp is made by digesting wood or woody fiber with various chemicals, thereby dissolving lignin and leaving cellulose. Commonly, the separation is not quite complete and there is more or less lignin left with the cellulose. To remove this lignin and also coloring matters, it is the practice to bleach the pulp with chlorin in some way. Chlorin in water dissolves as such and it also hydrolyzes to a certain extent to produce hypochlorous acid and hydrochloric acid. On alkalization of the hydrolyzed liquid with soda or lime, the ordinary bleaching liquors are formed; these containing hypochlorites. Chlorin can exercise a bleaching activity as such, as hypochlorous acid and as an alkaline hypochlorite. All three are used in the art; sometimes severally but more commonly, in succession. There are many processes in the art involving the use of two or three of these chlorinating agents, that is, chlorin, hypochlorous acid or a hypochlorite, as successive steps; the order of succession varying with the different processes. A particularly good method of bleaching paper pulp is described in the MacMillan Patent 1,547,138, where the treatment is first with a hypochlorite, then with chlorin and, finally, with a hypochlorite again. In all methods of bleaching paper pulp and, incidentally, of getting rid of residual lignin, great care is necessary to obtain the best results; whatever the chlorinating agents used and whatever the succession of steps. It has been found by experience that the strongest fiber is obtained where digestion of the wood is not carried too far and there is a relatively considerable amount of lignin left. This type of pulp is known as "hard bleaching", since it requires a relatively large amount of chlorin and considerable care in operation to prevent weakening of the fiber. If the lignin is removed with tolerable completeness, the cellulose fiber is apt to suffer in strength or be tendered. This class of pulp is known as "easy bleaching". It is an object in the art to be able to produce a strong "hard bleaching" pulp and then bleach without sacrificing strength in the fiber.

In the present invention, a bleaching apparatus is provided wherein the bleaching action can be followed and controlled; good bleaching of hard bleaching pulp being obtained without sacrifice of strength. This requires extremely careful regulation of conditions and this careful regulation is afforded by the apparatus of the present invention. In the apparatus, the bleaching action may be accomplished by any of the processes of the usual art; but the use of the MacMillan process is more particularly contemplated herein.

In the present invention an apparatus is provided having a pair of concentric cylinders with a rather wide clearance between their walls, forming an annular passage. The walls of the passage are made of smooth material of low friction. The bottom of the outer cylinder is shaped to form a sort of sump and the inner cylinder is provided with an open funnel-shaped bottom; the lowest part of this bottom being at a sufficient height above the sump to give good clearance. The inner cylinder does not extend to the top cover, but leaves a wide opening in the top part of the apparatus to allow free passage of a circulating pulped mass. Furthermore, the shape of the sump, and the bottom of the inner casing is such that the cross sectional area of the path taken by the circulating mass progressively falls from a maximum value to a minimum at the opening in the funnel-shaped bottom, and then progressively rises to the maximum again. This type of flow path for a liquid is advantageous from a hydraulic point of view, the circulating pump being positioned at this narrowest part. Efficient and thorough circulation is assured. There are no pockets or dead spaces, and thorough circulation of pulp and chlorinating agent is gained in a short time, even with pulps of relatively thick consistency.

The apparatus as so far described is adapted to hold a charge of wood fiber and water in the form of the usual 3 or 4 per cent pulp. Within the apparatus and near the bottom is mounted a suitable pump or impeller adapted to establish and maintain a rapid vertical circulation of the pulp through the inner cylinder, through the

sump, through the annular clearance between the two cylinders and over the top of the inner cylinder. This circulation may be in either direction, but commonly it is made downward through the inner cylinder. With a mass of pulp in this rapid cyclic circulation, small, proportioned additions of a chlorinating agent may be made continuously without at any time having a local excess of chlorinating agent. Or the chlorinating agent may be introduced into the pulped mass before the circulating operation.

The apparatus shown is useful for treatment of pulp mixtures with any kind of chlorinating agent. The agent may be formed in situ during the circulating process, or be made elsewhere and introduced into the apparatus. Free chlorin may be used, alone or in combination with bleaching liquor or other chlorinating agents. In an advantageous method, a combination treatment is used. A hypochlorite bleaching liquor is first mixed with the pulp mixture in the apparatus, and then free chlorin introduced gradually while circulation is maintained.

In the accompanying drawing I have shown, more or less diagrammatically, one embodiment of my invention. In these showings,

Fig. 1 shows in vertical section a bleaching apparatus according to my invention;

Fig. 2 shows a horizontal cross section along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged view partly in vertical section, and partly in elevation, of a valved outlet for the apparatus, taken along the line 3—3 of Fig. 2; and

Fig. 4 shows an enlarged view in elevation of a portion of the top of the apparatus including a handle for operating the plug valve shown in Fig. 3.

Referring to the drawing, in which like reference numerals indicate like parts throughout the several views, an outer cylindrical shell 1 is mounted in a base 2, and is covered at the top by cover 3. All three parts as shown are made of concrete, advantageously treated with acid- and alkali-proof paint. As shown, the base is provided with a truncated cone shaped bottom 4 lined with glazed tile and carrying a boss 4A protruding from the center of the bottom. This boss aids in guiding the circulating pulped mass. Inside the outer shell is mounted an inner cylindrical shell 5, constructed as shown of wooden staves, having long staves 6 spaced at intervals and extending to the top of the outer casing where they are held by the top 3, and having the intervening staves cut off shorter so as to leave a plurality of wide openings 7 into the inner shell. Inside the lower part of the shell is a bottom 8 formed in the shape of a truncated cone, made of wooden staves, and open at the bottom. The conical bottom is braced underneath by wooden beams 9. The shell is provided with a flat double thickness bottom 10 made up of wooden staves and provided with a hole 11 through the middle. The shell is supported upon base 2 by beams 12 and posts 13, the bottom, beams, and posts being attached to the base by means of bolts 14 of which the head is embedded in the base. Hoops 15 bind together the staves forming the cylindrical shell 5.

Axially located in the inner shell is a hollow sleeve 16 supported at its lower end upon bottom 10 by means of spider 17 and at its upper end by spider 18 attached to the top 3. The shell serves as a casing for the shaft 19 of an agitator impeller pump having an impeller rotor 20 mounted upon the lower end of the shaft and rotating in hole 11, and a driving motor 21 attached to the upper end of the shaft through a coupling 22, and mounted upon a casing framework 23 attached to the top 3. A stuffing gland 24 surrounds the shaft near the lower end. Pipe 25 runs down inside the sleeve and alongside the shaft to supply water to a bearing for the shaft inside the sleeve (not shown), this bearing being adapted to be lubricated by water. A pipe 25A is provided for carrying off excess lubricating water.

Inside the inner shell and alongside the wall thereof runs pipe 26, with the end open near hole 11. The top 3 is provided with a large manhole 27 for the introduction of pulp or chemicals and a small inlet 28 for vent to atmosphere.

Referring now to Figs. 2 and 3, the base is provided with an outlet 29 adapted to allow emptying the apparatus completely. This outlet is shown as a pipe elbow 30 embedded in the base. A wooden plug valve 31 mounted on stem 32, which in turn slides in bearing 33, serves to close the outlet when the valve is resting in the outlet. The outlet is connected to a waste pipe 34 with a valve 35 which is attached to base 2. Valve stem 32 reaches above the top 3 and is provided with cross handle 36 whereby the valve may be raised and lowered. The stem slides in bearing 37 mounted by means of brackets 38 upon top 3. The bearing is provided with clamping means in order that the stem may be held in position.

In an advantageous method of bleaching pulp, using my apparatus, I make up a batch of defibered pulp and water in proportions to give a rather thin fluid mass sufficient to fill the shells. I transfer the batch to the apparatus, and start circulating it by the pump. I first add hypochlorite bleaching solution and then while the mass is being circulated, I add chlorin gradually. I continue the circulation for several minutes to an hour, depending on the temperature and the density of the solution. I then add lime, either dry or in solution, and continue circulation for some minutes. The resulting pulp is then removed and treated to remove water-soluble materials.

In using my apparatus in one particular bleaching process, I took 2500 pounds (air dry weight) of defibered pulp, and mixed it with enough water to give a proportion of pulp to the total mixture of 3 to 4 per cent. I added enough hypochlorite bleaching solution to give 0.5 per cent available chlorin based on the dry weight of the pulp and filled the shells of the apparatus with the mixture. I began circulating and I gradually introduced free chlorin gas into the mixture at a rate of 5 to 25 pounds per minute. In this particular process the total amount of chlorin passed into the mixture was 3 per cent, based on the air dry weight of the pulp. The mixture was allowed to circulate for 30 minutes. Then I added lime in dry form to the amount of 3.16 per cent based on the air dry weight of the pulp, and continued the circulation for 10 minutes longer. By this time almost 95 per cent of the available chlorin disappeared. The pulp was then removed from the apparatus and washed free of water-soluble materials by one of the usual methods. I treated the washed pulp with a hypochlorite solution having available chlorin to the amount of 3 per cent of the mixture. This is the final bleaching operation. Afterwards the pulp was thoroughly washed.

The apparatus described can be used for carry-

ing out any of the common bleaching processes, using hypochlorites or the like. In using it for simple hypochlorite bleaching with bleach liquor, the inner shell is made of concrete or similar material and the pipe for introducing chlorin is omitted. In using the apparatus for hypochlorite bleaching higher pulp densities can be used than in the particular process described. Densities can be as high as 7½ to 8 per cent pulp (air dry weight).

The apparatus can be built in a wide range of sizes, but is usually built in capacities adapted to hold pulp mixtures containing 1000 to 10,000 pounds of pulp (air dry weight).

What I claim is:

An apparatus for bleaching pulp comprising an outer shell having a sump bottom, a valved outlet in the sump bottom, a top cover for the shell, an inner shell of less diameter having a flat bottom with an orifice at the center, a conical false bottom inside the shell having an orifice in the narrowest portion of the cone corresponding with the orifice in the flat bottom, the inner shell being formed of a plurality of staves of which some extend into, and are held by, the top cover, other staves terminating below the top cover providing a plurality of passages in the inner shell near the top, the flat bottom of the inner shell being supported upon the sump bottom of the outer shell, and elevated therefrom, by means of a plurality of spaced columns, allowing free passage of liquid from the inner shell to the space between the inner and outer shells, pump impeller means located in the said orifice adapted to induce rapid circulation of a pulped mass, the pump impeller means being driven by a vertical shaft extending through the top cover, a casing for the shaft, a bearing for the shaft located in the shaft casing adjacent the impeller means, the shaft casing being supported on the flat bottom, the pump impeller means being spaced away from the sump bottom so as to allow free circulation of pulp in the space between the pump impeller means and the sump bottom and means for introducing chlorin into the apparatus at a point near the pump impeller means.

MATHEW F. McCOMBS.