

**April 30, 1940.**

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**2,198,709**

# PULP BLEACHING APPARATUS

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4 Sheets-Sheet 1

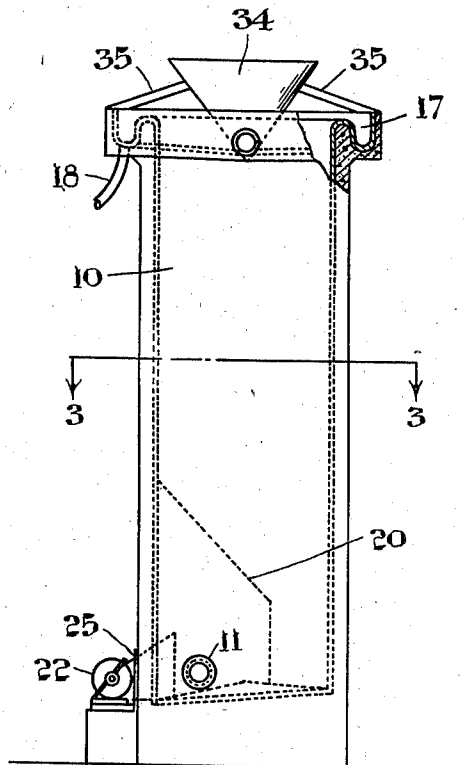
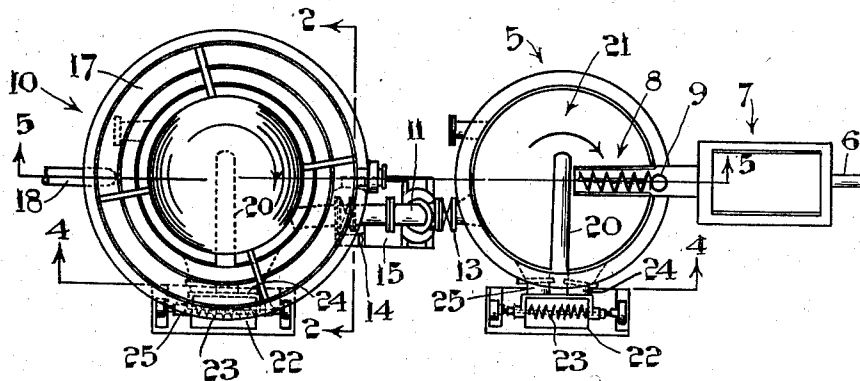


**FIG. 2**

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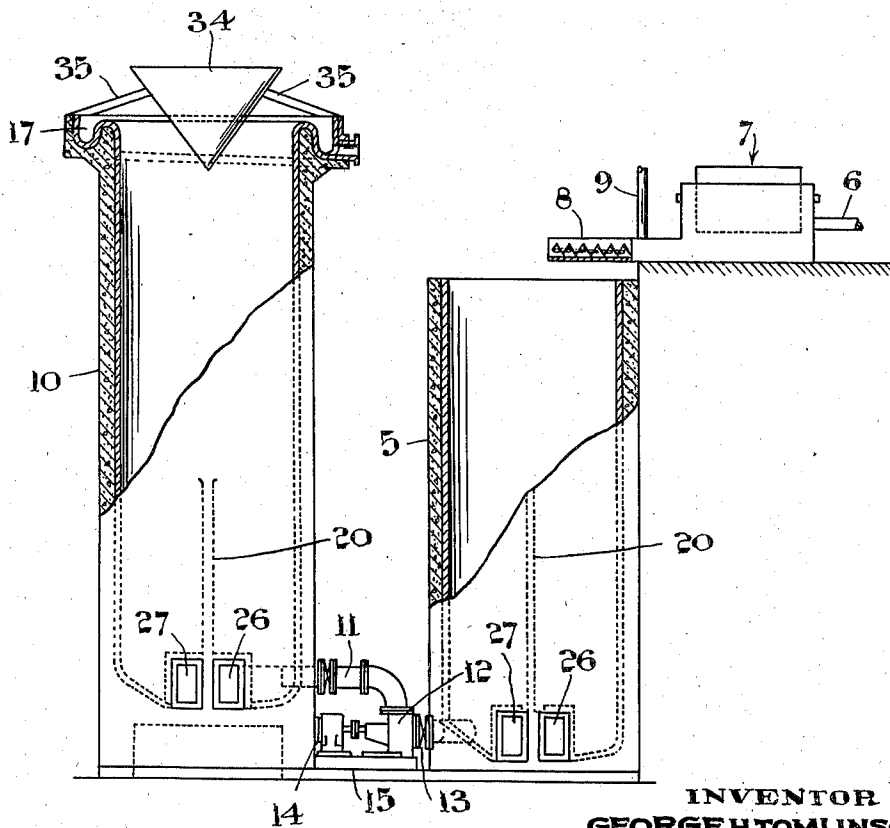
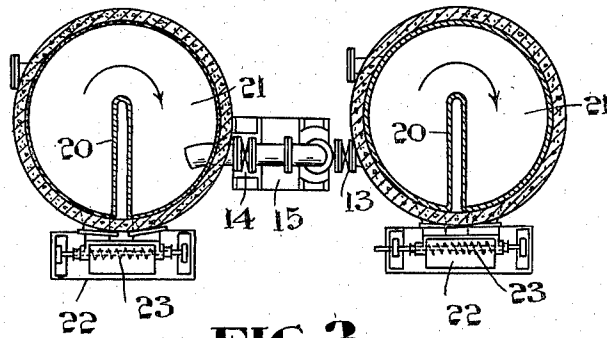
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4 Sheets-Sheet 3

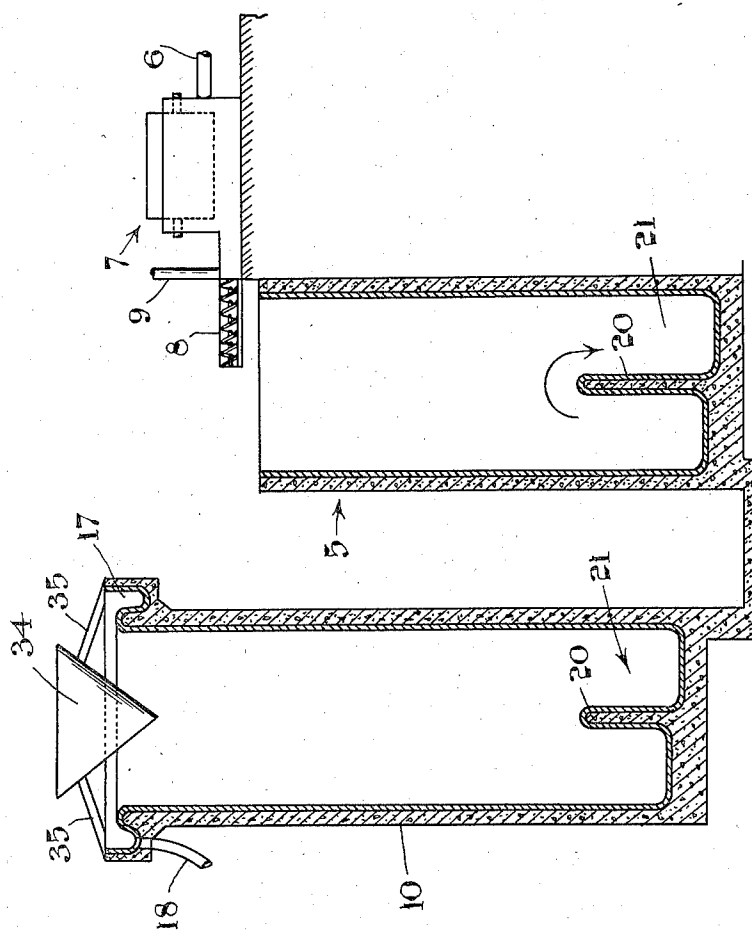


FIG. 5

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PULP BLEACHING APPARATUS

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4 Sheets-Sheet 4

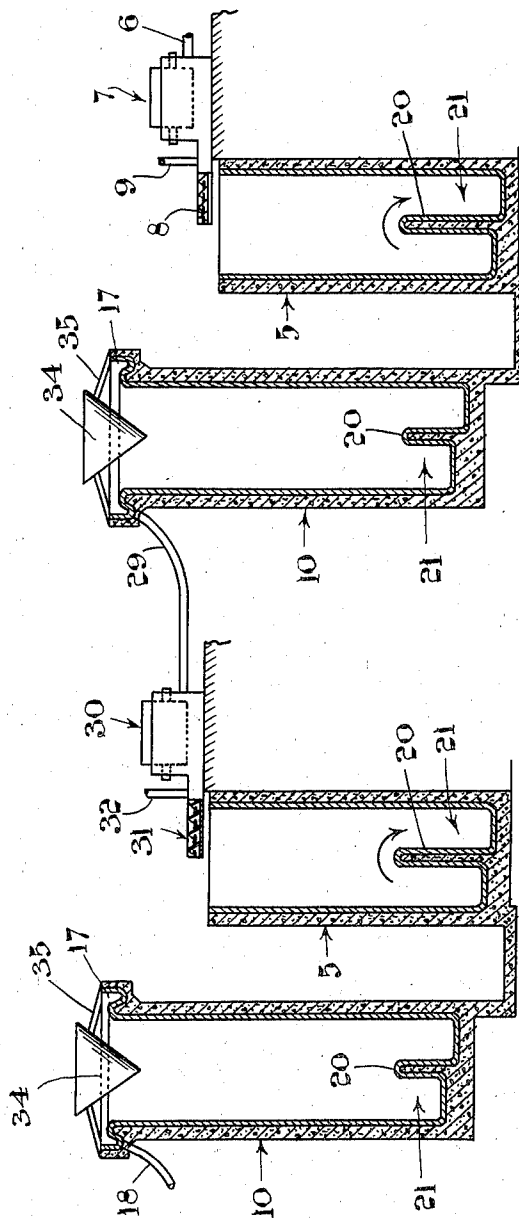


FIG. 6

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## UNITED STATES PATENT OFFICE

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## PULP BLEACHING APPARATUS

George H. Tomlinson, Westmount, Quebec,  
CanadaApplication October 30, 1937, Serial No. 171,889  
In Canada October 7, 1937

4 Claims. (Cl. 68—27)

This invention relates to the bleaching of wood pulps; and it comprises a continuous bleaching system wherein a flowing stream of pulp is intimately mixed with a solution of bleaching liquor and then passed through one or more bleaching units comprising a succession of bleaching towers in which all portions of the pulp are subjected to the same bleaching condition for the same length of time, said bleaching units being designed to handle the pulp at a consistency ranging between 6% and 10% so that a larger yield of uniformly bleached pulp is obtained with a substantial reduction in steam and bleach consumption as compared with prior systems in which the pulp is bleached at lower consistencies.

More particularly, the invention consists in the provision of one or more bleaching units comprising (a) a downflow bleaching tower to which the stream of pulp is fed after being intimately mixed with the bleaching liquor; (b) means for continuously transferring the pulp stock from the bottom of the downflow tower to the bottom of an upflow bleaching tower in which the pulp rises to produce an overflow equivalent to the amount of pulp entering the downflow tower and (c) an external circulating circuit connected with each tower so that a portion of the pulp is continuously withdrawn from the bottom of the tower at one point and returned to the bottom of the tower at another point to keep the pulp thoroughly mixed and to prevent short circuiting or channelling of the pulp in its passage through the towers.

When using a single bleaching unit designed in accordance with this invention the overflow from the upflow tower is passed to a conventional washing system. Where several units are employed in series with multi-stage bleaching the overflow from each unit is preferably passed to a washer and then intimately mixed with a fresh solution of bleach liquor before being introduced into the downflow tank of the next succeeding unit.

Proceeding now to a more detailed description of this invention reference will be had to the accompanying drawings, in which—

Fig. 1 is a top plan view of one form of bleaching system designed in accordance with this invention.

Fig. 2 is a section along the line 2—2 of Fig. 1.

Fig. 3 is a horizontal sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 1.

Fig. 5 is a vertical sectional view taken along the line 5—5 of Fig. 1.

Fig. 6 is a side elevation on a reduced scale of a slight modification in which a plurality of units designed in accordance with this invention are used in series for multi-stage bleaching.

Referring more particularly to the bleaching system appearing in Figs. 1 to 5 inclusive, 5 designates a downflow bleaching tower open at the top to receive the pulp which is fed to said tower after being intimately mixed with a solution of bleaching liquor. The mixing of the pulp and bleaching liquor may be accomplished in any desired manner, the quantity of bleach added to the pulp being suitably regulated to suit the character of the pulp and the amount of bleaching required. In the present instance the pulp is first passed through line 6 to an Oliver or other conventional vacuum filter diagrammatically indicated at 7. During its passage through the filter 7 the pulp is preferably thickened to a consistency of approximately 8%. The thickened pulp is passed from the filter 7 into the top of tower 5 by a suitable worm conveyor 8 in which the pulp is thoroughly mixed with a solution of bleaching liquor supplied through line 9. During the bleaching operation the pulp stock is continuously transferred from the bottom of tower 5 to the bottom of an upflow tower 10 through line 11, pump 12 and line 13. The pump 12 is preferably driven by a variable speed motor 14 mounted on a base 15 which also supports the pump 12. The amount of pulp transferred from tower 5 to tower 10 is sufficient to fill the tower 10 and to produce an overflow therefrom which is equivalent to the amount of pulp entering tower 5. The overflow from the top of tower 10 spills into a trough 17 from whence it is passed through line 18 to a conventional washing system.

The speed of the pump 12 is regulated to maintain a substantially constant level in tower 5. This may be accomplished by hand regulation of the motor or by using some type of automatic motor control actuated by a float or other control device acting in response to variations in the level of the stock in tower 5.

An external pulp circulating and agitating system is connected in closed circuit with the bottom portion of each tower to ensure sufficient recirculation and agitation of the pulp during its passage through the towers. In this connection it will be noted that the bottom wall of each tower is provided with a midfeather 20 affording a substantially horse-shoe shaped cir-

culating channel 21 connected in closed circuit with an external casing 22 containing a screw impeller 23. Casing 22 is provided with intake and discharge connections 24 and 25 which are fastened to the tower over suitable openings 26 and 27 provided at opposite sides of the midfeather 20. When the impeller 23 is in operation pulp is drawn into one end of the casing through the opening 26 and intake connection 24 and is returned to the tower at the opposite side of the midfeather through the discharge connection 25 and opening 27. By confining this circulation of the pulp to a comparatively narrow channel in the bottom of each tower short circuiting or channelling of the stock in its passage through the towers is prevented with much less power than would be necessary if the whole mass of stock was kept in motion by the recirculating system.

In cases where the introduction of chemicals or steam for heating the stock is necessary or desirable such introduction may be made into the external circulating system of each tower to ensure uniform distribution.

The herein described external circulation of stock from the bottom zone of each tower is necessary to ensure uniform bleaching of the stock when the latter is introduced into the tower 5 at consistencies ranging between 6 and 10%. The same apparatus can, of course, be usefully employed for bleaching the stock at much lower consistencies but, in such cases, the capacity of the towers is, of course, substantially reduced and the amount of steam required for heating the stock is also increased.

In the use of the system described herein the pulp, after being intimately mixed with a solution of bleaching liquor, is fed into the tower 5 until the latter is filled to the desired level. The pump 12 and the impeller 23 in the external circulating system of tower 5 are then put into operation to effect the necessary recirculation of the stock in tower 5 in addition to the transfer of the stock from this tower to the bottom of tower 10. The impeller 23 contained in the external circulating system of tower 10 is now started up and the filling of tower 10 proceeds until the stock spills over into the trough 17, the rate of spillage being proportionate to the rate at which the stock is introduced into the tower 5.

In some cases it may be desirable to install a multi-stage bleaching system in which a plurality of bleaching units are employed in series. Such an arrangement is shown in Fig. 6 wherein it will be noted that the overflow from the upflow tower 10 of one unit is passed through line 29, conventional vacuum filter 30, and worm conveyor 31 to the downflow tower 5 of the next succeeding unit. In this case the filter 30 is employed as a pulp washer in the well known manner. During its passage from the conventional vacuum filter 30 to the tower 5 the partially bleached pulp is intimately mixed with fresh bleaching liquor supplied to the worm conveyor 31 through line 32.

It will be noted that the tower 10 of each unit is higher than the tower 5. This facilitates in-

stallation of the washing or thickening equipment since it permits the proper flow of stock to be obtained by locating this equipment substantially level with the upper portion of tower 10. Moreover, when using a centrifugal pump for transferring the stock from tower 5 to tower 10, the pump can be designed for any required differential in head. Consequently, with a properly designed pump, the desired level of stock in tower 5 may be conveniently maintained by merely altering the speed of the pump.

A conical deflector 34 is supported in the upper end of each tower 10 by suitable supporting members 35. As the pulp rises to the upper edge of the tower 10 it is formed into an annular stream by the deflector 34 and deflected into the trough 17.

Having thus described my invention what I claim is:

1. Pulp bleaching apparatus comprising a mixing device to which pulp and bleaching liquor are supplied, a tall downflow bleaching tower to which the mixture of pulp and bleaching liquor is fed from said mixing device, said mixture being introduced into the top of said tower, a tall upflow tower means for continuously transferring the pulp stock from the bottom of the downflow tower to the bottom of the upflow tower so that the pulp rises in said upflow tower to produce an overflow equivalent to the amount of pulp entering the downflow tower, each of said towers being provided with an internal partition affording a substantially horseshoe-shaped open top circulating channel in the bottom portion of the tower, said partition comprising a vertical wall extending from one side of the tower partly across the bottom wall to a point spaced from the opposite side, and an external circulating circuit connected to the ends of the circulating channel of each tower so that a portion of the pulp is continuously withdrawn from the bottom of the tower at one end of the channel and returned to the bottom of the tower at the opposite end of the channel to keep the pulp thoroughly mixed and to prevent short circuiting or channelling of the pulp in its passage through the towers.

2. Pulp bleaching apparatus as set forth in claim 1 in which the external circulating circuit associated with each tower comprises an external casing having intake and discharge connections at opposite ends thereof registering with spaced openings formed in the circumferential wall of the tower at opposite ends of the horseshoe-shaped circulating channel formed by said partition and an impeller housed in said casing.

3. Pulp bleaching apparatus as set forth in claim 1 in which the downflow tower is considerably shorter than the upflow tower.

4. Pulp bleaching apparatus as set forth in claim 1 in which the upflow tower is provided at the top with an overflow trough and with a centrally located conical deflector by which the pulp rising from the bottom to the top of said tower is formed into an annular stream and deflected into the overflow trough.

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