United States Patent

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[72] Inventor **Alfred Max Hurter**
Beaconsfield, Quebec, Canada

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[73] Assignee to Stadler Hurter International Ltd., Montreal, Quebec, Canada

[54] BLEACHING SYSTEM INCLUDING A SINGLE, TRIPLE-DECK TABLE WASHER

11 Claims, 1 Drawing Fig.

[52] **U.S. Cl.** **68/181,** 8/156, 68/184, 162/19, 162/60, 162/89, 162/242

[51] **Int. Cl.** **D21c 9/02,** D21c 9/10

[50] **Field of Search** ..... 162/232; 68/184; 210/(Horizontal Filter Digest), 325; 8/156; 68/181; 162/17, 19, 60, 88, 89, 242, 41, 43

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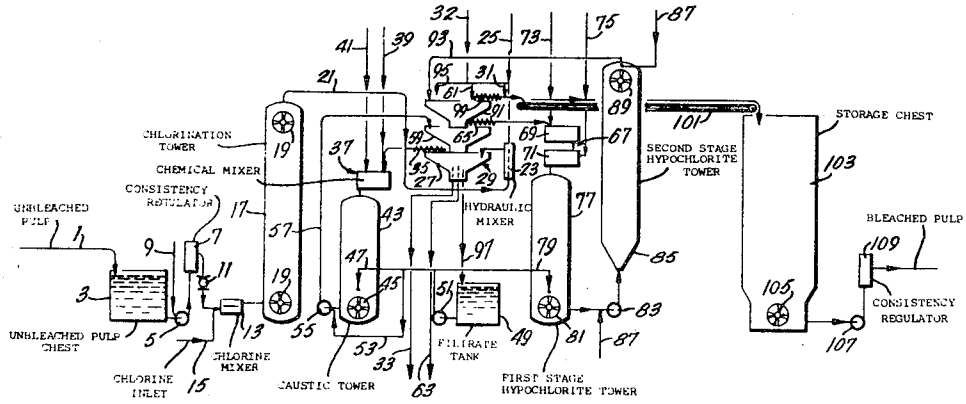
Primary Examiner—S. Leon Bashore
Assistant Examiner—A. D'Andrea, Jr.
Attorney—Alan Swabey

ABSTRACT: Apparatus used in the bleaching of pulp. Pulp is conveyed from a chlorination tower to a first deck of a three deck table washer. The washed pulp is then conveyed to a caustic treatment tower and after treatment therein conveyed to a second deck of the three deck table washer. After this second wash, the pulp is treated in a hypochlorite tower and thereafter washed on a third deck of the table washer. Each deck of the table washer has a circular, rotatable, horizontal screen thereon and a vacuum acts to draw the effluent wash water through the screen. The table washer can wash pulp at a consistency between 1½ and 5 percent.



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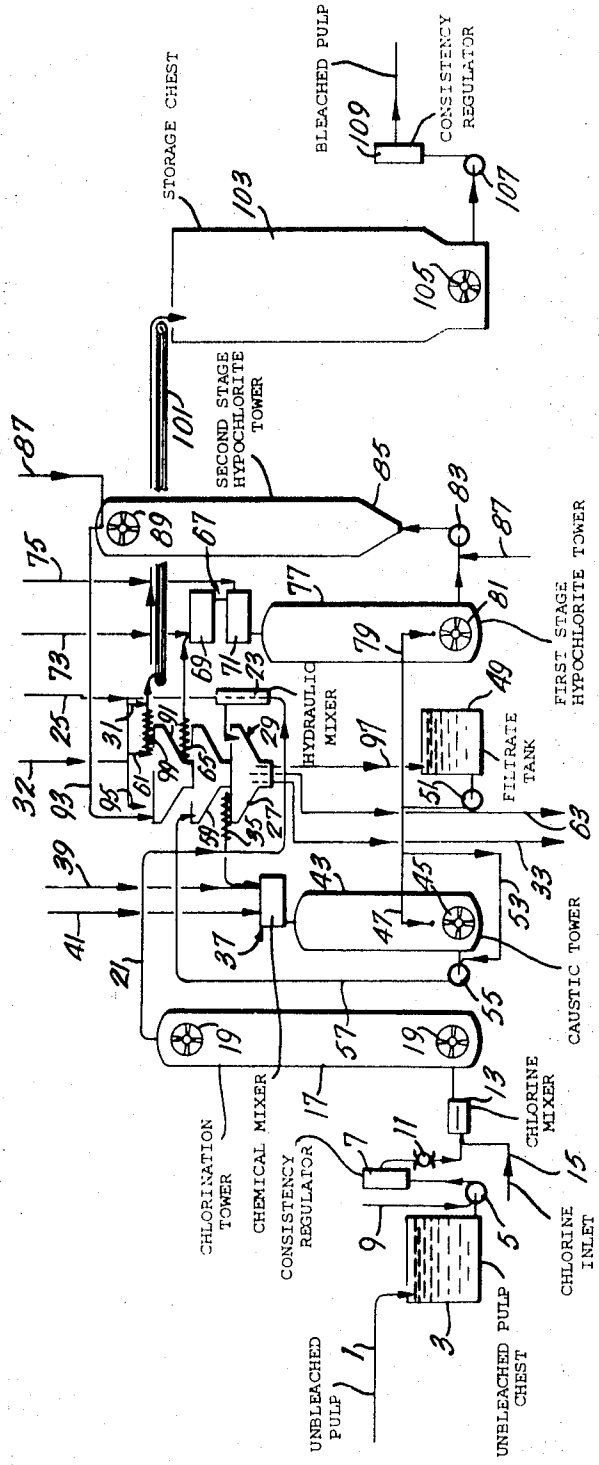

INVENTOR
Alfred Max HURTER

Allan Swabey

ATTORNEY

BLEACHING SYSTEM INCLUDING A SINGLE, TRIPLE-DECK TABLE WASHER

This invention relates to a compact and simplified pulp bleaching system and a method of bleaching pulp.

The bleaching system is designed to make it economically feasible for use with a pulp mill having a production as small as 40 to 50 tons of pulp a day or as large as 300 tons of pulp per day by utilizing a minimum amount of simple equipment particularly in the amount of washer equipment required. The system is particularly designed to use at least one table washer for washing the pulp between treatment stages in the bleaching system. A single table washer can be made to serve up to six treatment stages in the bleaching system for production of 100 tons of pulp a day or less. The system, in using a table washer, makes very economical and efficient use of the wash water use in the bleaching system. The pulp can be washed at relatively high consistency ranging between 1½ and 5 percent and, therefore, very little fresh water is required in the system. Because of the small amount of fresh water required, most of the filtrate from the washer can be led directly to a sewer. Since only a small part of the filtrate is reused in the system, only one filtrate tank and pump is required.

The bleaching system is further designed to use a minimum number of stock pumps. Only two pumps are used in the bleaching system. If the pumps at the unbleached pulp supply chest and the bleached pulp storage chest are included, only four pumps are required in the system which is less than that normally used in a bleaching system.

The invention is particularly directed toward a method of bleaching pulp including the steps of passing the pulp through a plurality of bleaching stages in succession to bleach the pulp. The pulp is passed between at least two successive bleaching stages to a washer at a consistency ranging between 1½ and 5 percent.

The invention is also directed toward a system for bleaching pulp including a plurality of treatment towers for bleaching the pulp and means for feeding the pulp to be bleached through the towers in succession. The system includes a washer capable of washing pulp having a relatively high consistency ranging between 1½ and 5 percent and includes means for feeding the pulp during passage between at least two successive towers to and from the washer. The system is particularly designed to use a table washer.

A preferred embodiment of the bleaching system will now be described in detail having reference to the FIGURE which illustrates a flow sheet of the bleaching system.

The bleaching system illustrated uses a three deck table washer in a plant especially adapted for bleaching pulp obtained from cotton linters. However, the system could serve equally well for the bleaching of bagasse, straw, reeds, jute, hemp, and even some hardwood kraft pulps or softwood sulfite pulps if these pulps do not require a high level of brightness.

As shown in the drawing, the unbleached pulp is fed into the bleaching system through line **1** to an unbleached pulp chest **3**. From the chest the pulp is pumped by stock pump **5** through a consistency regulator **7**. The consistency regulator determines the amount of water added through line **9** to the pulp to obtain a consistency of approximately 3½ percent required for the next operation. From the consistency regulator the pulp passes through a flow control valve **11** to a chlorine mixer **13** where chlorine, added through line **15**, is intensively mixed with the pulp. The mixer preferably has a retention time of one minute to obtain thorough mixing. From the chlorine mixer the pulp-chlorine mixture is passed to the bottom of a chlorination tower **17**. The tower is a simple cylindrical tank having a dished top and a dished or flat bottom and no internal fittings or appurtenances. At the top and bottom of the tower are two propeller agitators **19** for agitating the chlorinated pulp. These agitators preferably are fixed blade, bare shaft, cantilevered, radial units with outboard bearings. From the top of the tower the chlorinated pulp flows through line **21** and, through gravity, to a hydraulic mixer **23**, located below the top of the chlorination tower. The pulp id diluted to a consistency of approximately 2½ percent in the hydraulic mixer **23** by adding fresh water from line **25**. At this consistency the pulp flows on to the first stage or deck **27** of a three-deck table washer **29**. The pulp is washed by fresh water from line **31**, fed from supply line **32**, leading to the first stage **27**. The filtrate from this washer flows through line **33** to the sewer.

The washed pulp is removed from the first stage **27** of the table washer **29** by a feed conveyor **35** at a consistency of 12 percent and fed to a steam and chemical mixer **37** where caustic (NaOH) and steam are added to the pulp from lines **39** and **41** respectively. FRom the mixer the pulp falls into the caustic tower or tank **43**. This tower again is a simple cylindrical tank with dished top and dished or flat bottom and without special internal fittings or appurtenances. At the bottom of this tower, there is another radially mounted propeller agitator **45** similar to the ones in the chlorination tower **17**. A single low pressure dilution line **47** is provided within the caustic tower. The pulp within the tower is diluted with filtrate through line **47** pumped from a filtrate tank **49** by pump **51**. The pulp passes from the bottom of the caustic tower, is diluted to a consistency of about 3 percent by filtrate from filtrate tank **49** through line **53**, and pumped by stock pump **55** through line **57** to the second stage **59** of table washer **29**. Here it is washed by fresh water supplied through line **61** from supply line **32**. The filtrate from the second state **59** of the table washer is passed to the sewer through line **63**.

From the second stage of the table washer, the pulp is removed at 12 percent consistency by feed conveyor **65** and feed to a steam and hypochlorite mixer arrangement **67**. Because of the rapid and irregular rate of reaction that could occur if the hypochlorite and steam were mixed simultaneously, one mixer **69** for the steam and one mixer **71** for the hypochlorite, are used in series. STeam is fed to the steam mixer **69** through line **73** and hypochlorite is fed to mixer **71** through line **75**.

From the mixers **69**, **71** the pulp is fed to a first stage hypochlorite tower **77** which is identical, except for being taller, to the caustic tower **43**. AT the bottom of the hypochlorite tower the pulp is diluted to a consistency of approximately 6 percent with the filtrate from filtrate tank **49** through line **79**. A single agitator **81** is located at the bottom of the hypochlorite tower and is of the same design as those previously described.

From the bottom of the first stage hypochlorite tower the pulp is pumped by pump **83** to an upflow second stage hypochlorite tower **85**. If needed, a further adjustment to the pH or bleach of the pulp can be made by adding chemicals to it at the suction side of pump **83** through one or more lines **87**. The second stage tower **85** is provided with a conical bottom. At the top of the upflow tower, fresh water is added through line **87** to dilute the pulp to a consistency of 3 percent. An agitator **89** is located at the top of the upflow tower. From the top of the second stage tower the pulp is fed to the third stage **91** of the table washer **29** through line **93** where it is washed with fresh water from line **95** supplied through line **32**. The filtrate from the third stage **91** flows through line **97** to the filtrate tank **49**. The filtrate from the filtrate tank **49** is used to dilute the pulp to a required consistency at various points in the system through lines **47**, **53** and **79** as previously described.

The washed pulp is removed from the third stage by feed conveyor **99** onto a table conveyor **101** and is fed to a high density stock storage chest **103** having an agitator **105** at the bottom. The bleached pulp can be withdrawn from the storage chest by pump **107** for further use in the pulp mill with its consistency regulated by consistency regulator **109**.

The three-deck table washer **29** shown in the bleach system is a standard type of pulp washer well known in the art. Each deck or stage of the washer generally comprises a circular, rotatable, horizontal screen onto which the pulp is fed. The pulp is carried around by the screen while wash water is directed onto the pulp, passing through it and the screen aided

by a vacuum condition under the screen. The table washer 29 used is of the type manufactured, for example, by MultiFiber Process Ltd., a Canadian company in Montreal.

The use of table washers permits the bleaching system to use less water in the washing system than the standard bleaching systems which use cylinder or drum washers. The table washers permit the pulp to be fed onto the washers at a relatively higher consistency, ranging from 1½ percent to 5 percent, as compared to a consistency of approximately one-half percent required by cylinder washers. This permits a reduction in the amount of water to be handled by the system and thus a reduction in the equipment required. A further advantage is that fresh water can be used for diluting the pulp coming from the chlorination tower 17 rather then using the filtrate from the third and second stages in counterflow direction to the first stage as is generally done in using table washers in other applications The filtrate from the first and second stages can instead be directly led to the sewer. Only that filtrate from the third stage of the table washing is collected for diluting the pulp in the system. Therefore, only one filtrate tank and one filtrate pump is required in the system.

For pulp mills producing only 50 tons of pulp a day, one large diameter single deck table washer can be used in the bleaching system having three feed and three takeoff points equally spaced about the table. For production of 100 tons of pulp a day, a two-deck table washer normally is required, and for production of 150 to 300 tons of pulp a day, three decks, as shown in the preferred embodiment, would be used.

In addition to the simplified design and low cost, the bleaching system described, using a table washer, is ideally suited for processing bagasse pulp. Many agricultural residues such as bagasse do not form a good filter cake on a standard drum or cylinder washer generally used in bleaching systems. In fact, pulps produced form agricultural residues, such as cotton linters, hemp and jute, cannot be picked up by a drum washer. In the case of a table washer, the stock merely flows onto the horizontal table, and there is no question of picking up and forming a filter cake as is required by a standard drum washer. The use of table washers overcomes the problems in bleaching systems of washing agricultural residues which cannot be effectively washed on drum washers.

While the system shown in the preferred embodiment uses four treatment towers with a three deck or stage table washer, it will be obvious that more or less towers may be used to bleach the pulp along with more or less decks or stages in the table washer.

The system described has five identical pulp agitators in the treatment towers. In a smaller plant, the agitator 19 at the bottom of the chlorination tower can be eliminated and the tower can be fitted instead with a conical bottom.

All the treatment towers 17, 43, 77 and 85 used in the system are of the same to reduce fabrication costs and preferably made of rubber-lined steel.

I claim:

1. Apparatus for use in making pulp including at least two bleaching means, a single table washer having at least two separate washing sections, first means for directing pulp from one of said bleaching means onto one section of said table washer where the pulp is washed, second means for feeding the washed pulp from the one section of the washer to the other of said bleaching means, third means for directing the pulp from the other bleaching means after bleaching onto the other section of said table washer where the pulp is washed, and fourth means for feeding the washed pulp from the other section after washing.

2. Apparatus as claimed in claim 1, wherein said first and third means include means for diluting the pulp to a consistency ranging between 1½ and 5 percent prior to its entry onto the sections of the table washer.

3. Apparatus as claimed in claim 1, wherein the single table washer comprises at least two decks, each deck forming one section of the table washer.

4. Apparatus as claimed in claim 1, including means for collecting filtrate from only one section of the table washer.

5. Apparatus as claimed in claim 1, wherein each bleaching means includes at least one bleaching tower.

6. Apparatus as claimed in claim 1, wherein at least one of said first and third means includes a pump for pumping the pulp to the table washer.

7. Apparatus for use in making pulp including means for treating the pulp with chlorine, means for treating the pulp with caustic, and means for treating the pulp with hypochlorinate, a single table washer having three separate washing sections, first means for directing pulp form the chlorination means onto a first section of said table washer where the pulp is washed, second means for feeding the washed pulp from the first section of the table washer to the means for treating the pulp with caustic, third means for directing the pulp from the means for treating the pulp with caustic to a second section of said table washer where the pulp is washed, fourth means for feeding the washed pulp from the second section to the means for treating the pulp with hypochlorinate, fifth means for directing the pulp from the means for treating the pulp with hypochlorinate to a third section of the table washer where the pulp is washed, and sixth means for feeding the washed pulp from the third section of the table washer.

8. Apparatus as claimed in claim 7, wherein at least one of said first, third and fifth means includes means for diluting the pulp to a consistency ranging between 1½ and 5 percent prior to its entry onto the sections of the table washer.

9. Apparatus as claimed in claim 7, including means for collecting the filtrate from only one of the sections of the table washer.

10. Apparatus as claimed in claim 7, wherein the first and fifth means include pumps for pumping the pulp to the respective sections of the table washer.

11. Apparatus as claimed in claim 7, wherein the table washer comprises three decks, each deck forming one section of the table washer.