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C. L. WAGNER

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MULTIPLE STAGE PULP WASHER

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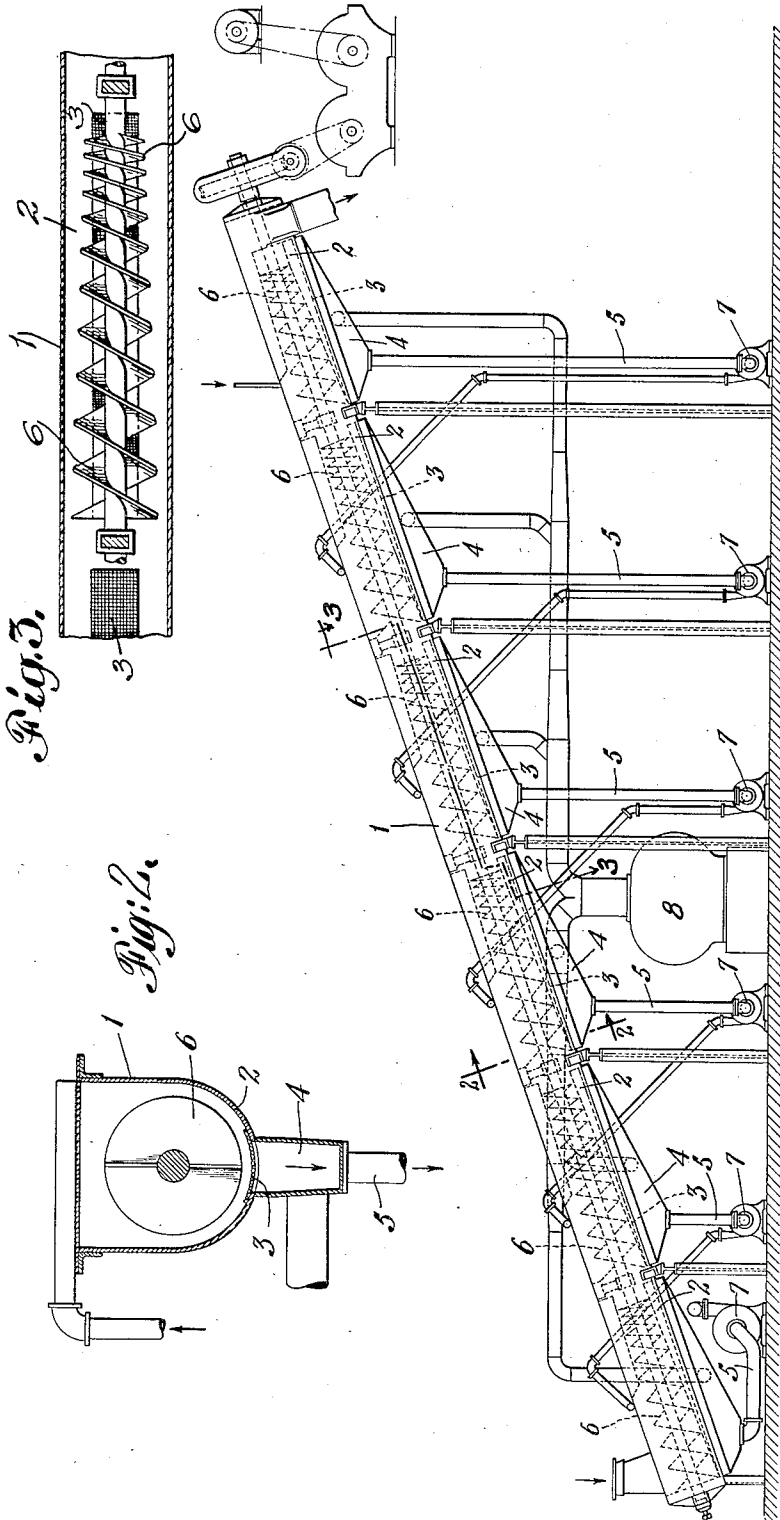


Fig. 1.

Fig. 2.

Fig. 3.

INVENTOR
Charles L. Wagner
BY C. Campbell Herndon
ATTORNEY

UNITED STATES PATENT OFFICE

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MULTIPLE STAGE PULP WASHER

Charles L. Wagner, Boonton, N. J., assignor to
J. O. Ross Engineering Corporation, New York,
N. Y., a corporation of New York

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6 Claims. (Cl. 141—12)

This invention relates to a method and apparatus for washing pulp.

In the paper industries, particularly in the production of chemical pulps by the "kraft", "sulphate", "soda" and "sulphite" processes as well as pulp from the bleachers, the pulp must be washed. Various processes and apparatus are at present in use for this purpose. The diffusion process for kraft, sulphate, soda and sulphite pulps consists of a series of tanks either of the closed pressure type or the open or gravity action type wherein raw pulp is washed first with weak liquors, then clean water, the last washings being discarded as to dilute for evaporation to recover the chemicals. Under this process a great deal of chemical is lost and the water finding a soft spot in the pulp passes through without proper washing of the pulp. This latter is known as "channeling". The apparatus is bulky and takes a long time to wash the pulp requiring from three to eighteen hours. Pulp characteristics are changed by excessive soaking. In the diffusion process osmosis takes place with respect to individual fibres and to a certain extent assists in the washing. Another process is vacuum washing for kraft, sulphate, soda and pulp from the bleachers. This process is seldom used for sulphite pulp. It consists of a large drum having a screen surface rotating in a container surrounding the bottom, with vacuum removal of the heavy liquor causing pulp to adhere to the surface of the drum as a blanket. Subsequent washing of the adherent pulp by water sprays give a rapid surface washing, resulting in dilute liquors and large chemical losses. Foaming occurs due to soap formed by rosin and alkali, more or less contained in all woods, but more so in the more resinous woods. Such foaming causes great losses of chemicals by carrying them off in the foam. This process requires only a short time, generally from thirty to forty-five seconds. It is an extravagant method because of heavy chemical losses and dilution of the liquors requiring excessive steam for evaporation and no osmosis takes place. Another process for sulphite pulp is the acid process which consists of washing in blow pits. These pits are of concrete and have a drain in the bottom and are partly filled with water, then the pulp and liquor is introduced therein from the digester. Large volumes of water are sprayed on the top of the mass for the purpose of washing. This so dilutes the liquor in the blow pit as to render the resultant liquor practically impossible to recover therefrom economically the chemicals or

the heat values. In such case the liquor is generally wasted by disposal into streams causing serious pollution. Osmosis and surface washing take place in the acid process. Other methods of removing the liquors by mechanical means have been used by squeezing out the liquor and chemicals. Such mechanical processes are harmful as the fibres of the pulp become knotted, torn or otherwise injured and in addition the expense incident to the use of the necessary power is a considerable item. The subsequent washing is difficult due to the compacting and interlocking of the fibres.

Among the objects of my invention are:

To produce a clean pulp as free as possible from contaminating chemicals and residual impurities; to prevent excessive dilution of the liquors which must be concentrated to recover the chemicals contained therein; to allow time for osmotic action to supplement the surface washing; to prevent the formation of foam in the liquors due to the rosin in the woods; to reduce the washing costs by the elimination of attendance and decrease of the power required by other methods. Other objects will appear more fully hereinafter.

Referring to the drawing:

Figure 1 is a view in side elevation partly in section of a device embodying the principles of my invention.

Figure 2 is a cross sectional view of Figure 1 along the line 2, 2, looking in the direction of the arrows.

Figure 3 is a cross sectional view of Figure 1 along the line 3, 3, looking in the direction of the arrows.

In carrying out my invention, I propose to provide a long sloping container 1 having incline conveyor troughs 2 fitted with screens 3, suction boxes 4 and liquor discharges 5 with helical conveyors 6 in flight sections. Each section of the helical conveyor 6 diminishing in diameter and lead or pitch. Pumps or ejectors 7 raise the weakest washing liquid to the next preceding stronger stage thereby securing in effect a countercurrent flow of pulp and liquid whereby the proper washing may be secured with one-fifth or one-sixth of the water used in the other processes. The suction on all boxes 4 under the screens 3 is maintained at a small vacuum by suitable pump 8 to assist gravity flow of the liquid against the surface capillarity of the fibres. The pulp or fibre mass should not at any time exceed a density of fifteen per cent for the best operation of the device although satisfactory opera-

tion may be secured with the densities lower and higher even up to twenty-five per cent.

The operation of the process is as follows:

The contents of the digester having been
 5 "blown" to a cyclone tank provided with steam outlets, and suitable means for draining off free liquor and a valve to discharge the fibre mass, the liquor is first drawn off, then the pulp is dis-
 10 charged to a tank or trough and diluted somewhat with liquor from the washer. The final liquor from the washer goes to a tank used for diluting pulp and having an overflow to liquor recovery storage for the excess liquor. The pulp or fibre mass after having been diluted is run
 15 into the lower end of the washer by gravity where it is further diluted by liquor from the succeeding section so as to reach a density or "freeness" whereby the excess liquor will be drawn by gravity and suction through the screen bottom and
 20 pumped to the liquor tank. The pulp partly deprived of liquor is moved forward and upwardly by the helical conveyor and is compacted slightly in the forward movement by the reducing spiral lead and the diminishing diameter so that a considerable part of the heavy liquor can be drawn
 25 away by gravity and suction. The pulp is in no way compressed so that the fibres are not harmed. As the mass reaches the end of the first section it falls to the enlarged end of the next section
 30 and is diluted by liquor from the next succeeding section and the process is repeated in the same manner. This repetition may be carried out for as many sections as may be required. Heated water is used in the ultimate and some-
 35 times in the penultimate section. The action being of a displacing nature allows osmosis to proceed whereby the heavier liquors are displaced by the lighter. Osmosis is a function of a membrane or a cell wall such as obtains with fibres,
 40 pith cells, etc., whereby a solution of crystalloid substances (chemicals used in cooking) are transferred from one liquid to another through a membrane, colloids not being transferred. The movement of crystalloids is usually from a stronger
 45 to a weaker solution. By my process the action is substantially countercurrent and an increased concentration of the chemicals is secured while at the same time a decrease in the quantity of washing water is secured thereby permitting
 50 easier and greater recovery of chemicals particularly as foaming is avoided. As the pulp is not compressed but only slightly compacted the fibres are not knotted and torn but are gently rubbed against each other assisting in surface and os-
 55 motic washing.

Various modifications of my device might be made and still fall within the scope thereof such as the number of sections, changing the angle of inclination or declination, vacuum conditions and variations in the pumps or other auxiliary equip-
 60 ment.

What I claim is:

1. A pulp washer comprising a plurality of aligned inclined conveyor troughs, a helical conveyor diminishing in diameter and pitch in each
 65 trough to convey the pulp upwardly through each trough from one trough to another and to press

the chemicals and wash water out of the fibres of said pulp, means for washing said pulp in each trough.

2. A pulp washer comprising an inclined series of aligned conveyor troughs, a helical conveyor 80 in said troughs to deliver the pulp upwardly from the lowest trough through the intermediate troughs to the topmost trough, means for admitting wash water to the topmost trough, suction boxes in the bottom of each of said troughs, 85 means for withdrawing from the suction boxes the wash water and displaced liquor from each trough and for reusing such wash water and displaced liquor in an adjacent trough.

3. A pulp washer comprising an inclined series 90 of conveyor troughs, a helical conveyor in said troughs, said helical conveyor diminishing in diameter and lead in each of said troughs to press the pulp in each trough and deliver the pulp upwardly to the next adjacent trough, 95 means for washing the pulp in each trough, a suction box in each trough, a screen over said suction box, means for creating a vacuum in said suction box and under said screen to withdraw the water and displaced liquor for use in 100 another trough.

4. A pulp washer comprising an inclined series of aligned conveyor troughs, a helical conveyor in said troughs, said helical conveyor having sections in each trough, each section similarly 105 diminishing in diameter and lead to compact and deliver the pulp upwardly from one section to the next adjacent section, means for washing the pulp in each trough, a suction box in each trough, a screen for said suction box, means for creat- 110 ing a vacuum in said suction box under said screen to withdraw the wash water and displaced chemicals, means for reusing the wash water and displaced chemicals to wash the pulp in adjacent troughs, means for admitting wash 115 water to the uppermost trough, and means for withdrawing the wash water and displaced chemicals from the lowermost trough.

5. A pulp washer comprising an aligned inclined series of conveyor troughs, screens and 120 suction boxes for each of said troughs, a helical conveyor of decreasing diameter and lead in said troughs to deliver the pulp from a point of admission serially through the aligned series of troughs to the point of discharge of the pulp, 125 means for admitting wash water at the end opposite to the admission of the pulp and means for withdrawing and delivering all the wash water and displaced liquor serially through the aligned series of troughs to the point of discharge of 130 the wash water and displaced liquor said point of discharge being opposite to the point of discharge of the pulp.

6. The process of washing pulp which consists in raising the pulp upwardly and delivering said 135 pulp from one washing to another, compacting the pulp during the raising of the pulp, withdrawing the wash water and displaced chemicals from a higher elevation and reusing same to wash the pulp at a lower elevation. 140

CHARLES L. WAGNER.