Sept. 29, 1931. R. L. PRITCHARD 1,824,928

PROCESS AND APPARATUS FOR DEGUMMING, WASHING, AND DRYING OF FIBERS

Filed Dec. 20, 1928

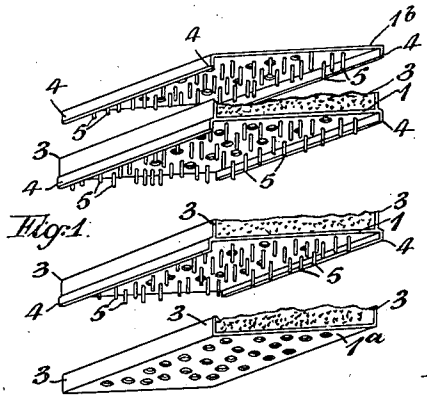


Fig. 1.

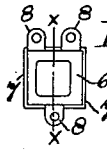


Fig. 10

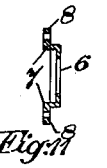


Fig. 11

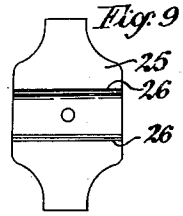


Fig. 9

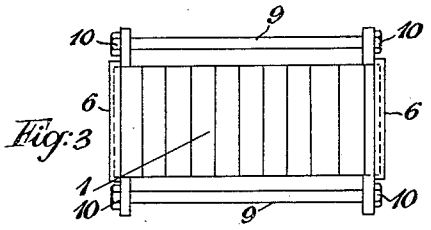


Fig. 3

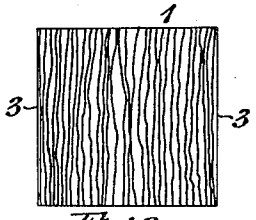


Fig. 2.

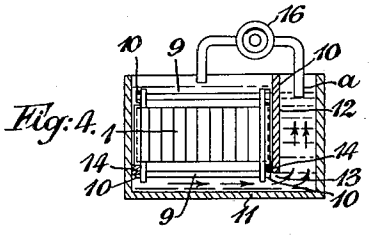


Fig. 4.

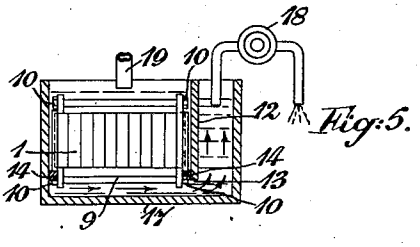


Fig. 5.

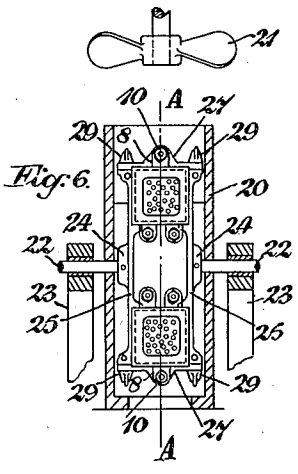


Fig. 6.

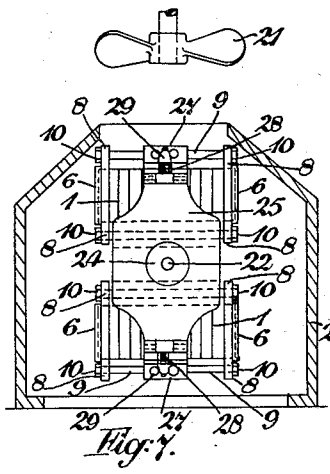


Fig. 7.

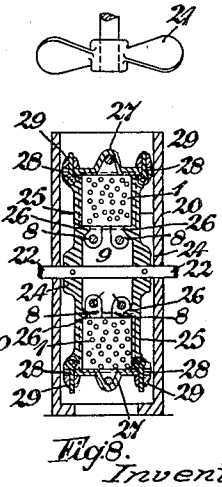


Fig. 8.

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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR DEGUMMING, WASHING, AND DRYING OF FIBERS

Application filed December 20, 1928, Serial No. 327,417, and in Great Britain June 14, 1928.

This invention relates to apparatus for degumming, washing and drying of fibers.

In subjecting fibers to the action of a solvent containing liquid for degumming or otherwise treating same, whilst the desired action of the liquid can readily take place where only small quantities of the material are being handled, it is difficult to secure the full and rapid effective treatment where the fibers are in bulk, owing to the fact that whilst a mass composed of a small quantity of fiber offers little or no impediment to the ready passage of the liquid, in bulk the outer fibers of a mass act to shield those upon the inside of the mass and so prevent the ready penetration of the liquid, either when said liquid is applied with a suitable solvent for the purpose of degumming the fibers, or in subsequent treatment for the removal of the matter freed from the fibers on rinsing same.

In order to secure the speedy and efficient treatment, it is necessary, as far as possible, for each individual fiber to be subjected to the action of the solvent or other liquid, or air as the case may be, and this is effected according to the present invention by maintaining them vertically in liquid in which they float apart, and in which they are kept from sagging and falling downwards by supports disposed at intervals along the length of the fibers. The liquid is caused to flow from above downwards along the length of the fibers, the same liquid after flowing to the end of the fibers being pumped back above the fibers, or alternatively a continuous current of fresh liquid is caused to flow down along the length of the fibers and then pumped outside. The same obstacle to the passage of air currents between the fibers for their drying occurs when a mass of wet fibers is treated, and therefore the separation or the segregation of the fibers is secured when they are taken out of liquid by causing them to fall forwards and backwards transversely of their length by subjecting the containers to a slow rotary motion, and in the constant change of direction the fibers fall to and fro in the trays which separate them from each other, and whilst lying loosely currents of air are caused to pass upwards between the fibers.

In the process according to Letters Patent No. 1,489,546 the degumming of fibers was effected in two successive stages respectively, that of dissolving the objectionable substance, and its removal or expulsion from between the fibers; but such process did not include the further and essential step of the drying of the wet fibers.

The fibers throughout the treatment by the process according to the Letters Patent 1,489,546 are maintained in a longitudinally horizontal position with their lengths transversely of the direction of the current of liquid acting upon them. In the first stage the dissolving of a substance upon the fibers and the action of the special solvent used was effectual; but in the second stage that of rinsing, which consists in physically carrying off the dissolved substance by a neutral liquid, the rinsing was uncertain and not equal throughout the whole mass of fibers owing to the flow of the neutral liquid following the path of least resistance to the neglect of other parts of the mass of fibers.

The drying of the fibers afterwards presented even greater difficulties, because in the removal of the wet fibers from the liquid they clung to each other and formed a compact mass that prevented or hindered the air from entering and reaching the fibers in the interior. The drying of wet fibers requires their separation or segregation from each other as much as in their degumming so that the currents of air can penetrate between the individual fibers and escape, carrying off the superfluous moisture from the wet fibers.

According to the present invention the fibers instead of being maintained horizontally within liquid are maintained throughout the whole of their treatment for degumming, washing, rinsing and drying in a vertical position. In the liquid their floating separates them from each other, and the flow of liquid along the lengths of the fibers from above downwards carries off the dissolved substance. The fibers are placed in trays or containers and introduced into the liquid with their lengths parallel to the

direction of the flow of liquid, and the currents of air, when the fibers are subsequently dried, flow along the length of the fibers from below upwards and between the fibers. The floor of the trays is set with a number of pins irregularly disposed and placed at suitable intervals apart over its area, and the length of the pins is equal to the depth of the tray. The trays are filled with fibers with the pins passing between them at intervals along the length of the fibers.

A number of trays filled with fibers are placed one above the other and fastened together to form a unit. The unit comprising the stacked trays is brought into a horizontal position, and then introduced into a vat filled with a liquid to a height sufficient to secure the full immersion of the said unit with the fibers in each tray lying vertically in the liquid. The length of the vat is greater than the length of the column of trays, and said vat is partitioned to form two compartments, the partition extending from the mouth of the vat to within a short distance above the floor of said vat, and the partition occupies a position at one end of the column of trays, the second compartment being about one sixth of the length of the compartment in which the trays are introduced.

The column of trays is placed upon a support in line with the lower border of the partition. The two compartments communicate through the open space below the partition. The fibers at several places throughout their length are supported by the pins which serve to keep the fibers from sagging and falling, either when in the liquid or when the fibers are afterwards dried.

In the first stage the solvent liquid from the smaller unoccupied compartment is pumped into the other compartment above the fibers, and there is a flow of the liquid along the length of the fibers towards the other compartment beneath the partition, and the pumping is continued until all of the substance to be dissolved from the fibers is dissolved in the liquid. A warm soap solution will degum flax.

For the second stage that of carrying off the dissolved substance held in solution between the fibers the column of trays is removed to another similar vat and placed therein as already described. The liquid employed for this stage is a neutral liquid such as water which is poured from a continuous fresh supply into the compartment above the trays, and which flows along the length of the fibers as before towards the other compartment from which the neutral liquid is pumped outside the vat; and this is continued until the liquid pumped outside shows no traces of the objectionable substance and solvent liquid.

After the rinsing is complete the trays containing the fibers are raised from the neutral liquid, and, the fibers being vertical, the draining of the liquid from them is effected more readily and quickly than when they lie horizontally upon each other. When the draining is finished the trays are transferred to a chamber open above with an aperture below, and they are fastened upon arms extending from a revolving shaft that revolves slowly and alternately in opposite directions, and whilst the shaft carrying the trays is revolving suitable air enters the chamber through the aperture in the floor thereof and rises upwards between the fibers by exhausting the air above the chamber and continually extracting the moist air as it rises between the fibers to fill the exhausted space above. The fibers supported by the pins along their length are kept by them from sagging and falling whilst turning when the shaft is revolving. Both the liquid and air flow only through a single tray instead of circulating through every tray of fibers in the column of trays, when the latter is maintained vertical.

In order that the invention may be the better understood drawings are appended in which:—

Fig. 1 is a perspective view showing the trays for carrying the fibers.

Fig. 2 is a plan of a loaded tray.

Fig. 3 is a view showing a number of assembled trays.

Fig. 4 is a sectional view showing the trays in the vat for the degumming treatment.

Fig. 5 is a similar view showing the trays in the rinsing vat.

Fig. 6 is a part sectional view showing the trays in the drying chamber.

Fig. 7 is a section on line A—A Fig. 6.

Fig. 8 is a sectional view showing more clearly certain details of the means for carrying the assembled trays within the drying chamber.

Fig. 9 is a view showing part of the means for supporting the trays in the drawing chamber.

Fig. 10 is a view showing a certain detail.

Fig. 11 is a sectional view on line X—X Fig. 10.

Referring to the accompanying drawings 1 indicates trays, preferably perforated, and each having at two opposite sides upwardly and downwardly extending flanges indicated respectively by 3 and 4. Although only two of the trays 1 are shown in Fig. 1, there are in fact actually a number of them employed in the process to be described.

The trays 1 are each provided upon their undersides with a number of dull pointed pins 5, the fibers being loaded upon the upper surface of each of the trays, after which the trays are placed one upon the other in

such a manner that the pins 5 of each tray pass between the fibers of the tray immediately beneath, the lower flanges 4 of each tray engaging with the upper flanges 3 of the tray beneath, thereby assisting to correctly position the said trays, each tray thus forming a cover for the tray beneath.

Preferably the pins 5 are irregularly spaced, their purpose being to support and segregate the fibers, and at the same time to maintain the said fibers in a condition such that they are parallel or substantially parallel to each other as shown in Fig. 2.

1^a indicates the lowermost tray of the pile which is similar to the trays above it except that it is not provided with lower flanges or pins, and 1^b indicates the uppermost tray which is provided only with pins and downwardly extending flanges.

6 indicates open frames provided with inwardly extending flanges 7, and having at their sides lugs 8 through which pass bars 9 provided with nuts 10, the arrangement being such that when a sufficient number of trays have been filled and superposed one upon the other they may be clamped together between the frames 6.

The unit thus formed is placed in the degumming or washing vat indicated in Fig. 4 by 11, the open sides of the trays being respectively at the top and bottom.

The vat 11 comprises an open vessel divided into two parts by means of a partition 12, extending from the top of the vat to a convenient point above the bottom of said vat whereby there is provided an opening 13 by which the two parts of the vat are in communication.

14 indicates brackets or supports disposed in the larger compartment 15 of the vat and arranged at a point above the aforesaid opening 13, said brackets or supports 14 being suitably interrupted at certain points in their length to permit the nuts 10 to pass therethrough when the assembled trays are placed in the vat, the said brackets or supports being designed to carry the said assemblage of trays.

The tray assemblage is so placed in the vat that the fibers run vertically thereof.

The vat is filled with the liquid to a height sufficient to fully immerse the trays.

16 indicates a pump connected on the suction side *a* to the smaller or unoccupied part of the vat, the liquid being discharged into the occupied compartment above the trays 1.

The action of the pump causes a gentle current of liquid to flow downwards through the trays in the direction of the length of the fibers.

The rinsing vat 17 shown in Fig. 5 is similar in construction to the vat 11, the trays being placed therein in the same position that they occupied in the former case.

A pump 18 is provided, the purpose of which, however, is in this instance to withdraw liquid from the smaller or unoccupied compartment and discharge it at a point outside the vat.

Fresh water is supplied to the occupied compartment from a suitable supply by a pipe 19. In this instance, also, the action of the pump is so regulated and the amount of water supplied is such as to produce the desired current, the clean water as it enters the vat spreading laterally in all directions so that a uniform flow along the length of the fibers is secured.

After the rinsing is completed the action of the pump and the supply of water is discontinued, the trays are removed and the fibers allowed to drain preparatory to drying.

As the trays are lifted the fibers cling together, the liquid between them running down towards the still immersed parts of the fibers which are more or less separated from each other, this separation tending to secure a more rapid and efficient draining.

The drying is effected in a chamber 20 open at its upper end, Figs. 6 and 7, and having an opening at the bottom through which warm air is drawn, as indicated by arrows, by an exhauster 21 disposed above the top of the said chamber. For facility of illustration only one chamber 20 is shown, it will, however, be understood that in practice a series or battery of said chambers may be housed in a suitable compartment, one or more fans being disposed above the chambers in the upper part of said compartment to draw the air therethrough.

Running horizontally of the chamber 20 is a shaft 22 carried in bearings 23, the said shaft having secured thereon bosses 24 having formed integral therewith plates 25 between which the tray assemblages are placed, flanges or ledges 26 formed upon the inner faces of the said plates serving to support the said trays.

The trays are held securely in position between the plates 25 by means of yoke pieces 27 secured between the outer ends of the said plates by means of swivel bolts 28 and butterfly nuts 29, the said swivel bolts being carried in bearings formed within flanges formed integral with the plates.

The shaft 22 is caused to rotate at a slow speed by suitable mechanism, not shown, such mechanism also providing for the reversal of the motion of said shaft after it has performed a predetermined number of revolutions, this action being continued throughout the drying operation.

Preferably also the temperature of the air is reduced as the drying proceeds until during the final stages it is substantially normal summer temperature.

As the shaft 22 rotates there is a constant change in the position of the trays, and as

a result thereof the fibers in them fall or tumble to and fro between the backs of two adjacent trays causing the said fibers to separate one from another and thus to permit the warm air to pass freely between them, the drying being assisted by the current of air. The drying is effected solely by the action of the air, the speed of rotation of the shaft 25 being such that centrifugal action plays no part in removing the moisture.

Claims.

1. Apparatus for the treatment of fibers with currents of fluid, comprising an open ended and covered tray in which the fibers are arranged lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, and means for causing a current of fluid to flow through said tray lengthwise of the said fibers.

2. Apparatus for the treatment of fibers with currents of fluid, comprising an open ended and covered tray in which the fibers are arranged vertically lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, and means for causing a current of fluid to flow through said tray lengthwise of the said fibers.

3. Apparatus for the treatment of fibers with currents of fluid, comprising an open ended and covered tray in which the fibers are arranged lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, and means for causing a current of fluid to flow through said tray lengthwise of the said fibers, and means for causing said fibers to fall from side to side of the tray whilst the fluid passes therethrough.

4. Apparatus for the treatment of fibers, with currents of fluid, comprising an open ended and covered tray in which the fibers are arranged vertically lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, and means for causing a current of fluid to flow through said tray lengthwise of the said fibers, and means for causing said fibers to fall from side to side of the tray whilst the fluid passes therethrough.

5. Apparatus for the treatment of fibers with currents of fluid, comprising an open ended and covered tray in which the fibers are arranged vertically lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, and means for causing a current of heated fluid to flow through said tray lengthwise of the said fibers, and means for causing said fibers to fall from side to side of the tray whilst the fluid passes therethrough.

6. Apparatus for the treatment of fibers with currents of fluid, comprising a plurality of open ended trays in which the fibers are arranged vertically lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, means for causing a current of fluid to flow through said trays lengthwise of said fibers and means for connecting a number of trays together to form a unit.

7. Apparatus for the treatment of fibers with currents of fluid, comprising a plurality of open ended trays in which the fibers are arranged vertically lengthwise in a more or less parallel condition, means for maintaining the fibers in a separated condition, means for causing a current of fluid to flow through said trays lengthwise of said fibers and means for connecting a number of trays together to form a unit, comprising a frame disposed at one end of the unit, a second frame disposed at the other end of said unit and bars connecting said frames to hold the trays tightly together.

8. Apparatus for the treatment of fibers with currents of fluid, comprising a plurality of trays, each of said trays having a floor, pins projecting inwards from said floor which penetrate between the fibers and engage them, sustaining and maintaining them in a separated more or less parallel condition, means for connecting a number of trays to form a unit comprising a frame disposed at one end of the unit, a second frame disposed at the other end of said unit, and bars connecting said frames to hold the trays tightly together, and means for causing currents of fluid to flow through each tray.

9. Apparatus for the treatment of fibers with currents of liquid for the purpose of degumming and washing same, comprising a plurality of trays each of said trays having a floor, pins projecting inwards from said floor which penetrate between the fibers and engage them, sustaining and maintaining them in a separated more or less parallel condition, means for connecting a number of trays to form a unit, comprising a frame disposed at one end of the unit, a second frame disposed at the other end of said unit, and bars connecting said frames to hold the trays tightly together, a vat, a partition dividing said vat into two compartments, said partition extending from the top of the vat to within a short distance of the bottom of the vat, means in one part of said vat, for supporting the assembled trays at a point on a level with the bottom of the partition of the vat, the two compartments communicating through the opening below the partition, means for creating a difference of pressure in one part of said vat whereby a current of liquid is caused to flow through said trays.

10. Apparatus for the treatment of fibers

with currents of liquid for the purpose of degumming and washing same, comprising a plurality of trays each of said trays having a floor, pins projecting inwards from said floor which penetrate between the fibers and engage them, sustaining and maintaining them in a separated more or less parallel condition, means for connecting a number of trays to form a unit comprising a frame disposed at one end of the unit, a second frame disposed at the other end of said unit and bars connecting said frames to hold the trays tightly together, a vat, a partition dividing said vat into two compartments, said partition extending from the top of the vat to within a short distance of the bottom, means in one part of said vat for supporting the trays at a point on a level with the bottom of the partition of the vat, the two compartments communicating through the opening below the partition, a pump for withdrawing the liquid from one part of the vat and discharging it into the other whereby there is created a difference of pressure in the vat whereby a current of liquid is caused to flow through the trays.

11. Apparatus for the treatment of fibers with currents of liquid for the purpose of degumming and washing same, comprising a plurality of trays each of said trays having a floor, pins projecting inwards from said floor which penetrate between the fibers and engage them, sustaining and maintaining them in a separated more or less parallel condition, means for connecting a number of trays to form a unit, comprising a frame disposed at one end of the unit, a second frame disposed at the other end of said unit, and bars connecting said frames to hold the trays tightly together, a vat, a partition dividing said vat into two compartments, said partition extending from the top of the vat to within a short distance from the bottom of the vat, means in one part of said vat for supporting the trays at a point on a level with the bottom of the vat, the two compartments communicating through the opening below the partition, means for supplying liquid to one part of the vat, a pump for withdrawing the liquid from the other part of the vat and discharging it outside said vat.

In testimony whereof I have hereunto set my hand.

REUBEN LEVI PRITCHARD.