April 8, 1924. 1,489,546

R. L. PRITCHARD

PROCESS FOR THE WASHING AND DEGUMMING OF FIBERS

Filed Oct. 20, 1920

Fig. 1

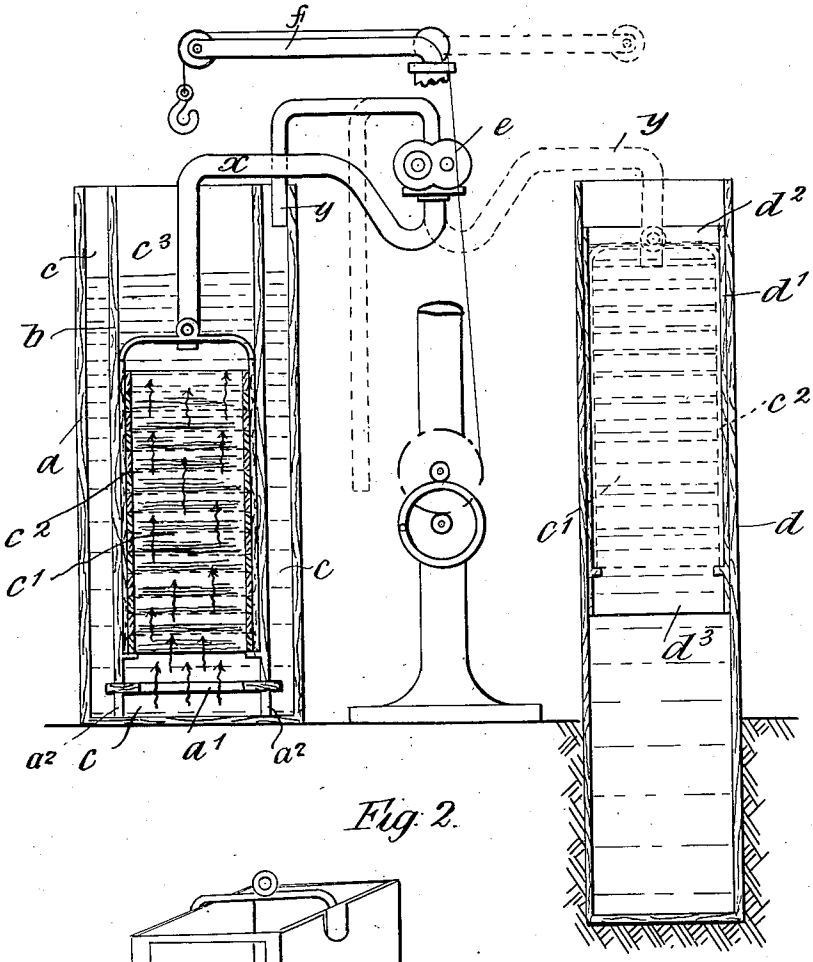
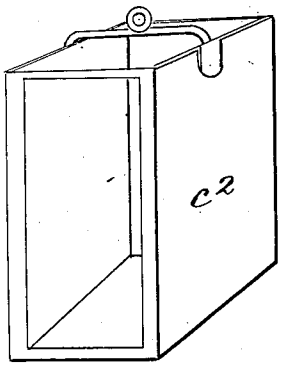


Fig. 2.



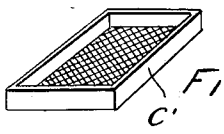


FIG. 3.

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UNITED STATES PATENT OFFICE.

REUBEN LEVI PRITCHARD, OF LONDON, ENGLAND.

PROCESS FOR THE WASHING AND DEGUMMING OF FIBERS.

Application filed October 20, 1920. Serial No. 418,261.

To all whom it may concern:

Be it known that I, REUBEN LEVI PRITCHARD, a subject of the King of Great Britain, residing in London, N. W., England, have invented certain new and useful Improvements in Processes for the Washing and Degumming of Fibers, of which the following is a specification.

This invention relates to the removal from fibers of substances either inherent to their growth and not constituting a part of their structure, or which have been derived from without after their growth. The former substances upon vegetable fibers are gum and resin, and the cleansing of fibers from them is known as degumming; whereas such substances upon animal fibers is of an oleaginous nature and the cleansing from them is known as washing of fibers. Washing includes the cleansing of all fibers from substances which have come upon them after their growth. Whether it be a degumming or washing of fibers the process is the same; the materials employed for the cleansing however, varying somewhat.

The invention herein described consists of an improved method and apparatus for applying cleansing solutions to large masses of fiber for commercial purposes. Whilst the use of fluids for the cleansing of small quantities of fiber has been more or less successful, it has hitherto been unsuccessful when employed upon large qauntities of fiber for commercial purposes. The failure is due to the fluid used being unable to either gain access to the fibers in the interior of a large mass; or from the substances removed from the fibers in the interior of the mass being unable to escape from within the mass outwards and remaining within the mass the loosened substances re-adhere to the fibers when they are dried.

According to my invention the cleansing fluid is given free access to the innermost fiber of any quantity, however large, and this is effected by the establishment of currents of the particular fluid used, which flow between the individual fibers whilst the fibers are buoyant and float in the fluid. The currents are established throughout the whole area of the mass of fibers, and without force sufficient to displace the fibers and float them towards and against each other, whereby each individual fiber is bathed upon every side with the cleansing fluid. The free currents between the individual fibers loosen the objectionable substance upon them and carry it off in the currents to be dispersed throughout the whole fluid. These currents are preferably made to circulate from below upwards and are maintained until all of the objectionable substance is loosened from the fibers.

The fluid employed must possess a solvent action upon the substance without having any injurious action upon the structure of the fibers; and for the degumming of flax and hemp and the washing of wool, a non-corrosive alkaline solution may be employed such as a solution of soap, which will suffice to effect their cleansing from the gum and resin or oleaginous substance if the fibers in the exterior of the mass do not prevent the solution of soap reaching the fibers in the interior. The substance loosened from the individual fibers by the currents of fluid being mingled throughout the fluid, some of it, held by the solvent solution, remains between the fibers after the mass of fibers is taken out of the fluid or the fluid is drained from the fibers. The residuum of loosened supstance remaining between the fibers is due to the fact that wet fibers on the instant they no longer float in a fluid cling to each other, which prevents the further escape of such substance still remaining between them which is held in solution. This residuum is removed in my invention by transferring the entire mass of fibers, after the substance is loosened from the individual fibers, into a clean neutral fluid like water in which the fibers again float; and whilst floating in the water the latter is made to flow between the fibers, which carries off the residuum of substance lying loose between the said fibers. The flow of water between the fibers is continued until pure water completely replaces the former solvent solution between the fibers. The mass of fibers is then taken out of the water and dried, with no objectionable substance remaining between them, and they are then dried clean and do not adhere to each other.

The whole process of cleansing is effected by first placing the fibers in receptacles having solid lateral walls and perforated floors, and the depth of each receptacle pref-

erably being 3 to 6 inches (7 to 15 cm.). A number of the receptacles are fastened together with their solid lateral walls forming continuous solid sides extending to any suitable depth, with the perforated floor of each acting as a cover for the receptacle immediately below, the uppermost receptacle alone having a perforated cover.

For the loosening of objectionable substance from the individual fibers, the receptacles laden with them are immersed in a suitable solvent fluid and placed upon an open support which may be 4 to 6 inches (10 to 15 cm.) from the bottom of the solvent fluid, and the same distance laterally from the outer expanse of the solvent fluid, and on which support the receptacles remain stationary. The solid lateral walls of the receptacles are continued upwards through the solvent fluid in which they are immersed and from 6 to 12 inches above, constituting an upper chamber containing the solvent fluid above the said receptacles. The solvent fluid inside and outside the receptacles is only permitted to communicate below the open support. The solvent fluid which is above the immersed receptacles is then pumped into the outer expanse of the same solvent fluid surrounding the upper extension of the solid lateral walls. The pumping of the fluid from the interior into the partitioned exterior of the same body of fluid produces a greater pressure in the fluid in the outer space, whilst diminishing the pressure in the fluid within the interior where the receptacles were immersed; and as a result of the unequal pressure, produced by the pumping, in the different parts of the communicating liquid, currents of that liquid are set up circulating from the greater pressure on the outside of the solvent fluid towards its centre within the receptacles. The solid lateral walls of the receptacles and their extension upwards do not allow the circulation of the currents through them; and the currents towards the interior can only find a way below the open support, and then upwards through the perforated floors and between the fibers into the upper chamber, which currents continue until the pressure in the solvent fluid within and without the receptacles becomes equal. The pumping of the fluid, however, continuing as it rises into the upper chamber until all the objectionable substance is loosened from the individual fibers, an equilibrium of pressure, within and without the receptacles, cannot be re-established so long as the pumping continues. The duration of the pumping and circulation of currents varies with the particular substance to be loosened from the fibers; and for the degumming of flax with a saponaceous fluid at 38° C. will effect it in from one half to two hours.

After the fibers have been sufficiently bathed by the current of a solvent fluid they are individually free from the substance; but throughout the mass of fibers some of the solvent fluid containing loosened substance remains in the space between the fibers. In this invention the latter is expelled from the mass of fibers by transferring the fastened receptacles into pure water and moving the said receptacles in the water, which is warmed to say 30° C., in such a manner that the water displaced by the moving receptacles can escape nowhere except through the perforated floors of the receptacles and between the individual fibers into the upper chamber, which should be sufficiently high to prevent the fluid expelled into it overflowing and mingling with the water in which the said receptacles are moved. The receptacles containing the fibers may be moved in any direction, but it is more feasible when made downwards. In whatever direction the receptacles are moved it must be in one direction only as a movement to and fro, or downwards and upwards, will constantly return within the mass of fibers the liquid expelled from it by the movement made in the opposite direction. The movement of the receptacles is effected slowly and steadily through the water, producing a flow of the water in the opposite direction to that in which the receptacles are moved, which passes through the perforated floors of the receptacles and between the fibers. The force of the opposite flow of the water is reduced to a minimum by the slow movement of the receptacles through the water but some of the fibers may be carried towards and against each other. The open condition of the fibers, should they crowd together, is restored by the movement of the receptacles being frequently and regularly suspended to permit the fibers to refloat apart. The extent of the downward movement of the receptacles must at least be equal to the total height of the fastened receptacles.

The opposite flow of water, when the receptacles containing the fibers are moved in the manner described, passes through the mass between the individual fibers at the same time carrying off the residuum of solvent fluid existing between the individual fibers into the upper chamber. All the fluid escaping into the upper chamber is pumped from it outside and not permitted to mingle with the water in which the receptacles are moved.

The upper chamber should be sufficiently high to prevent the water overflowing from or into it. The intermittent movement of the receptacles in the water is continued until the liquid pumped from the upper chamber contains neither solvent fluid nor substance loosened from the fibers. Before

the receptacles are moved in an opposite direction the receiving chamber, which is the upper chamber when the movement is made downwards, must be pumped clear of the liquid which had entered into it, to prevent its return within the mass of fibers when the receptacles are raised or moved in the opposite direction. The movement downwards of the receptacles is facilitated by a second chamber below, the sides of which are continuous with the lateral walls of the receptacles.

The whole treatment is completed when the liquid passing from the mass of fibers into the upper chamber contains nothing in addition to pure water. The receptacles are then raised and the fibers are removed for drying.

Drawings illustrating a form of apparatus designed to accomplish this process of degumming and washing of fibers are appended in which:—

Fig. 1 is a longitudinal section showing more or less diagrammatically apparatus for effecting the treatment of the fibers.

Fig. 2 is a perspective view of one of the cages for retaining the receptacles in which the material is placed.

Figure 3 is a perspective view of a tray for holding the material being treated.

Referring to the accompanying drawings, *a* Fig. 1 indicates a vat having within it a false vat *b*, the vat *a* being open at the upper end, the false vat *b* being open at both ends. The false vat may conveniently be supported in vat *a* by means of an open support indicated by a^1, and provided with legs a^2 resting upon the bottom of vat *a*. The dimensions of the false vat *b* are such as to leave a space on all sides between it and the vat *a*, which space is indicated by *c*. c^1 indicates receptacles for the material, which receptacles are of box like form, the bottom of each being perforated or formed of wire netting or other open material to permit the ready passage of the solvent fluid. The receptacles are placed one upon the other, in a suitable cage or holder c^2, as shown, the cage resting upon or near support a^1 in vat *a*. The walls of the false vat *b* are made of sufficient height to form an upper chamber c^3 designed to prevent the liquid flowing from the false vat *b* into the space *c* or from said space into the false vat *b*. *d* indicates a second vat provided with an inner sliding false vat d^1 adapted to receive the cage c^2 which fits snugly within d^1. The false vat d^1 is also provided with an upper chamber indicated by d^2, and in addition with a lower chamber d^3. The depth of the liquid below the receptacles should be at least equal to the total height of the receptacles within cage c^2. *e* indicates a pump so arranged as to be common to both vats *a* and *d* to pump the solvent liquid above the immersed receptacles into the space *c* between the vat *a* and false vat *b*. When dealing with vat *d* the pump, or the inlet and outlet pipes therefor, *x*, *y* are swung round as shown in dotted lines in Fig. 1, the said inlet and outlet pipes thereof being so arranged that the liquid is removed from the upper chamber d^2 and discharged to a point outside the vat *d*. *f* indicates a crane by means of which, and chains, or other means attached to the cage, the cage may be raised from one vat and placed in the other. The false vat d^1 in which the cage holding the receptacles is fastened, is moved in the water with an intermittent downward motion by its own weight or suitable means.

Claims:

1. A process for washing and degumming fibers which comprises immersing a quantity of fibers in a liquid, maintaining the fibers floating in a segregated condition in said liquid, circulating vertical currents of the liquid between the fibers, and preventing the liquid from flowing laterally.

2. A process for washing and degumming fibers which comprises immersing a quantity of fibers in a liquid, causing the fibers to float in a segregated condition in the liquid and causing vertical currents to circulate throughout the entire area of the liquid and between the fibers, said currents being prevented from flowing laterally, and being of sufficiently low velocity to prevent carrying the fibers against each other.

3. A process for washing and degumming fibers which comprises immersing a quantity of fibers in a liquid, maintaining the fibers floating in a segregated condition in said liquid, circulating continuously vertical currents of the liquid between the fibers, and preventing the liquid from flowing laterally.

4. A process for washing and degumming fibers comprising floating the fibers in a solvent liquid, holding the fibers practically stationary and in a segregated condition, circulating currents of the liquid upwardly throughout the entire area of the liquid and between the fibers, preventing the currents from flowing laterally, removing the fibers from the solvent liquid and replacing the residuum of solvent liquid remaining in the spaces between the fibers by immersing and floating the fibers in a neutral liquid and moving the fibers in one direction in said neutral liquid while floating.

5. A process for washing and degumming fibers which comprises floating the fibers in a solvent liquid, holding the fibers practically stationary and in a segregated condition, circulating currents of the liquid upward between the fibers, preventing the currents from flowing laterally, removing the fibers from the solvent liquid and washing the fibers by immersing and floating the fibers in a neutral liquid, moving the fibers in one direction in the neutral liquid, and

interrupting said movement periodically to permit the individual fibers to float free of each other.

6. A process for washing and degumming fibers which comprises circulating uni-directional currents between individual fibers whilst they float in a segregated condition in the liquid, the currents being of sufficiently low velocity to maintain such segregated condition; these currents being first produced by immersing the fibers in a solvent liquid in which they are maintained stationary at some distance from the bottom of the solvent liquid which is in free communication with the entire under surface of the fibers treated, and laterally the fibers are some distance from the outer confines of the solvent liquid in which they are partitioned by a solid vertical partition, the liquid outside the partitions being continuous with the liquid below the fibers, and said partition being extended upwards for some distance above the upper surface of the solvent liquid; transferring the solvent liquid above the immersed fibers into the liquid outside the partition; and then removing the fibers from the solvent liquid and reimmersing them in a neutral liquid like pure water, and the water being made to flow between the individual fibers by moving the fibers in the water.

7. A process for washing and degumming fibers which comprises causing the fibers to float in a segregated condition in a solvent liquid, circulating in the solvent liquid and between the fibers uni-directional currents of sufficiently low velocity to maintain the fibers in such segregated condition, then circulating a neutral liquid between the individual fibers by floating the fibers therein moving them in the neutral liquid in one direction, and periodically interrupting such movements, the movements of the fibers in the neutral liquid being made with the mass of fibers closely confined by the walls containing said neutral liquid; and finally removing the liquid which has flowed between the fibers.

8. The process for washing and degumming fibers by immersing them in liquid and causing the liquid to circulate in unidirectional currents between the individual fibers whilst the fibers float in a segregated condition in the liquid; these currents being first produced in a solvent liquid and afterwards in a neutral liquid, the first currents of solvent liquid being produced by immersing the fibers in it and maintaining them stationary above the bottom of the liquid which is in free communication with the fibers, and laterally the fibers are partitioned from the lateral confines of the solvent liquid, the liquid outside the partition being continuous with the liquid below the fibers, the partition separating the fibers laterally from the main body of solvent liquid being continued upwards above the upper surface of the solvent liquid; transferring the solvent liquid above the immersed fibers into the space between the upper extension of the solid vertical partition and the vessel containing the solvent liquid; and the currents of the neutral liquid being produced by transferring the fibers from the solvent liquid into a neutral liquid in which the fibers are moved in one direction in close apposition to the walls of the vessel containing the neutral liquid, the fibers being open to the neutral liquid between which is the only path for the neutral liquid to flow when the fibers are moved, the movement being slowly made, frequently interrupted and resumed in the one direction.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

REUBEN LEVI PRITCHARD.

Witnesses:
EDMUND HARBERD,
EDMUND H. HARBERD.