Jan. 30, 1951 B. G. DE KLERK 2,539,947

APPARATUS FOR THE CONTINUOUS AFTERTREATMENT OF FLOCCULENT TEXTILES

Filed Feb. 6, 1947 2 Sheets-Sheet 1

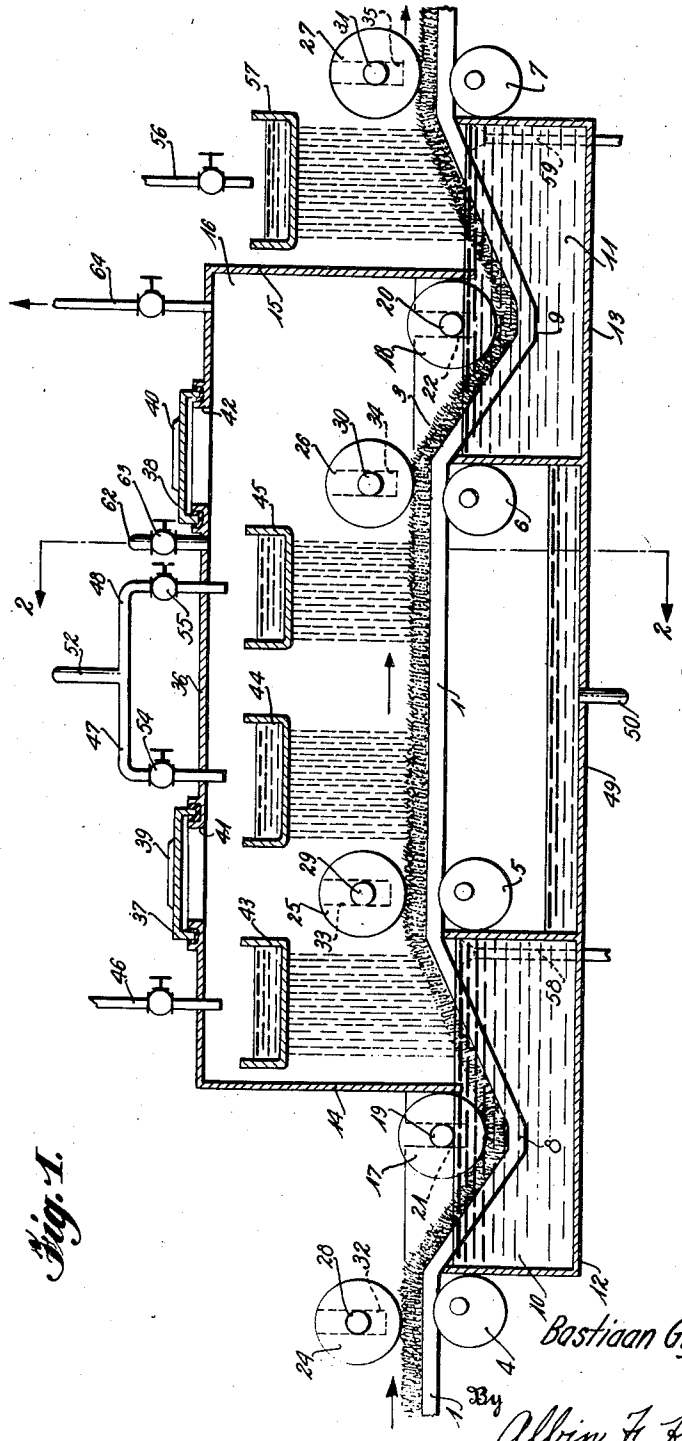

Fig. 1.

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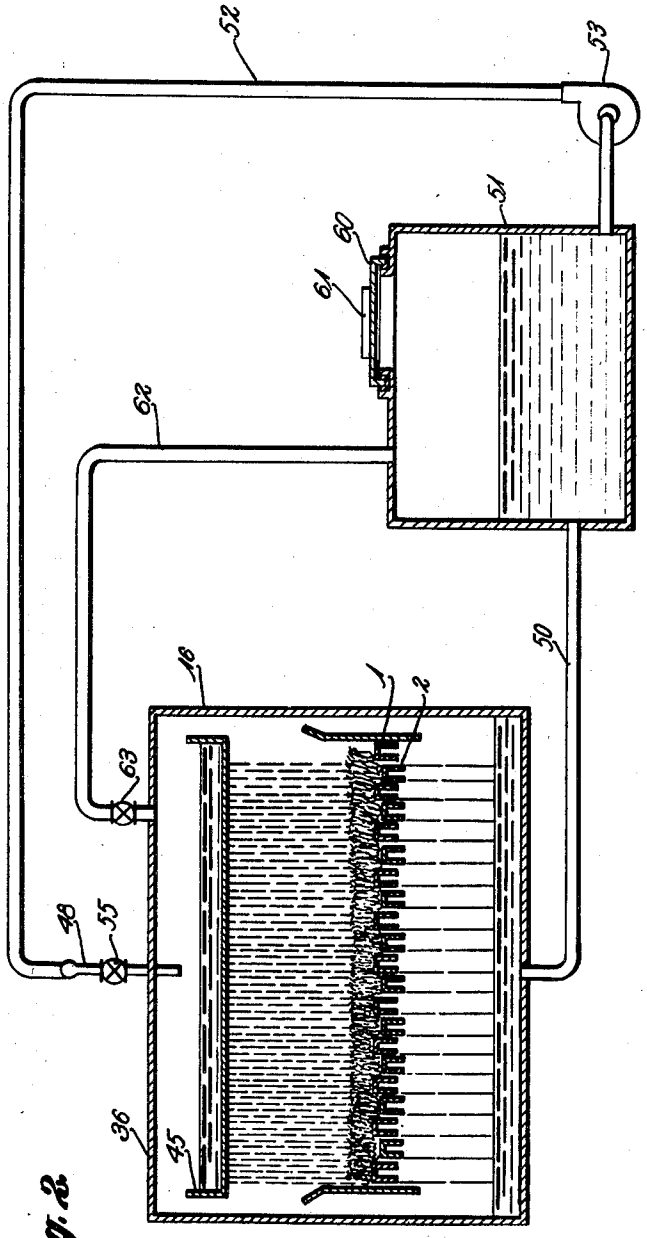

Fig. 2.

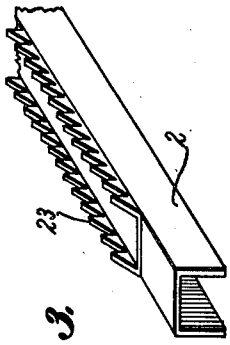

Fig. 3.

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APPARATUS FOR THE CONTINUOUS AFTER-TREATMENT OF FLOCCULENT TEXTILES

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4 Claims. (Cl. 68—22)

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This invention relates to apparatus for the liquid treatment of flocculent textiles.

In the liquid treatment of flocculent textiles it is known to spread out the textile material on a conveyer or the like and to spray liquids on succeeding portions thereof in order to wash, deacidify, desulphurize, bleach, tone up or otherwise treat the material. These operations are normally conducted in open rooms within the operating plant where the atmosphere of the entire room is exposed to the gases which may be evolved during the treatment process and where the chemicals used in the treating process are exposed to air. By way of example, one form of continuous procedure for the treatment of flocculent textiles which conforms to the general description set forth above is shown in British Patent 332,003.

The known procedures for continuous treatment of flocculent textiles, while generally satisfactory, are subject to the limitation that, where the treating media required are sensitive to oxygen, or where the gases to be used in or evolved from the treatment reactions are either costly or poisonous, the exposed, open plant continuous method cannot be employed.

It is therefore an object of the present invention to provide apparatus for the continuous liquid treatment of flocculent textiles which is characterized by the isolation of the treatment zone from the surrounding atmosphere of the plant whereby the escape of dangerous or valuable gases is prevented while the treatment zone is protected from the effects of atmospheric air.

It is a further object of this invention to attain the foregoing objects by a simple but effective process and by the use of inexpensive and easily constructed apparatus.

Other objects and advantages of this invention will be apparent from the following detailed description of one of its forms in conjunction with the annexed drawings wherein:

Figure 1 is a view in side elevation of a machine for the continuous treatment of flocculent textile material in a closed zone;

Figure 2 is a view in section taken on the line 2—2 of Figure 1; and

Figure 3 is a fragmentary perspective view of a portion of the apparatus used for propelling the flocculent material through the machine.

In the drawings the reference numerals 1 and 2 represent the conveying elements for conveying the fleece of flocculent material 3 to, through, and from the liquid treatment zones. The elements 1 and 2 are arranged in alternating groups to define a fleece supporting grid, as may be seen

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in Figure 2. The elements 1 and 2 are bars, the bars 1 being stationary and defining the path of the material through the machine and the alternating bars 2 being mounted for eccentric oscillatory movement to propel the fleece through the machine, the eccentric rollers 4, 5, 6 and 7 serving to drive the bars 2. The use of the bars 1 and 2 to define a grid for the propulsion of the material and the mode of driving the bars 2 is shown in British Patent No. 332,003 and hence forms no part of this invention.

According to this invention the bars 1 and 2 between the rollers 4 and 5 and again between the rollers 6 and 7 are bent to define depressions at 8 and 9 in the material path and these depressions are deeply immersed in sealing liquids 10 and 11 disposed in tanks 12 and 13 respectively which constitute an integral part of the liquid treatment machine. Also immersed in the sealing liquid are the lower edges of front and rear walls 14 and 15 of a closed treatment chamber 16.

Since the textile material supported on the bars 1 and 2 will pass into and from the treatment chamber 16 through sealing liquids 10 and 11, it is necessary to prevent floating of the material. This is accomplished by the use of rollers 17 and 18 located respectively in tanks 12 and 13, the rollers being supported on guide pins 19 and 20 respectively, the ends of which ride in slots 21 and 22 provided in the side walls of the tanks 12 and 13. By this expedient floating of the textile material in the sealing zones is prevented and the fibrous fleece is compressed and forced onto the bent portions of the grid at 8 and 9. The bars 2 in the upward slopes in tanks 12 and 13 are provided with teeth 23 extending obliquely upward in the direction of material propulsion, see Figure 3.

Pressing rollers 24, 25, 26 and 27 are associated with eccentric rollers 4, 5, 6 and 7 respectively, the rollers 24, 25, 26 and 27 being provided with axially extending pins 28, 29, 30 and 31 which ride in slots 32, 33, 34 and 35 provided in suitable standards, not shown, which are located on both sides of the machine. The rollers 24, 25, 26 and 27 serve to press out liquids entrained by the textile material.

The top 36 of the treatment chamber 16 is provided with two removable covers 37 and 38 having therein observation windows 39 and 40. The removable covers 37 and 38 are mounted in seals 41 and 42 respectively so that the treatment chamber may be maintained leakproof even in the event of the maintenance of a pressure below atmospheric therein.

Within the chamber 16 there are located containers 43, 44 and 45 adapted to spray or distribute treating liquids on the flocculent material being passed thereunder. The containers 43, 44 and 45 are fed from feed pipes 46, 47 and 48 which pass through the top wall 36 of chamber 16 in a gas-tight manner.

The liquids sprayed from the containers 44 and 45 are collected in container 49 and through conduit 50 are led to container 51. From container 51 the liquids are recirculated through conduit 52 by operation of pump 53. Conduit 52 is branched at a point just above cover plate 36 to feed selectively either or both of containers 44 and 45 through conduits 47 and 48, the control being effected by valves 54 and 55.

The washing liquid sprayed from container 43 within the chamber 16 is recovered in tank 12 and another washing liquid supplied through a pipe 56 to a spray container 57 located outside of the chamber 16 is recovered in tank 13.

It will be noted that the level of the sealing liquid is maintained by overflow standpipes 58 and 59 located in tanks 12 and 13 respectively.

The spraying vessels 43, 44, 45 and 57 may be connected in series, if desired, so as to make it possible to transfer certain quantities of liquid from the spraying system comprised of container 57 and tank 13 to the system comprised of container 43 and tank 12 and from there to the system including containers 44 and 45 and tank 49. This arrangement is of practical value where the sealing liquids 10 and 11 are merely dilutions of the actual treating liquid sprayed from the containers 44 and 45.

It will be noted that the container 51 is provided with a cover 60 having an observation window 61 therein, the cover 60 being mounted in seals similar to those described in connection with covers 37 and 38. Furthermore, a gas evacuation pipe 62 is provided which connects the tank 51 to the top 36 of the chamber 16 through a valve 63.

Also for gas control there is provided a valved pipe 64 passing through the cover 36 of the treatment chamber 16.

The manner in which the process is conducted is partly apparent from the foregoing description. The flocculent textile material 3, which may have been subjected to a pretreatment before the treatment now to be described, is spread out on the grid defined by the bar elements 1 and 2 and is delivered by operation of the bar elements 2 in the direction of the arrow in Figure 1. The material is fed between rollers 4 and 24 onto the first bent grid and slides down into the sealing liquid 10, the material being held down, compressed and forced into the grid at this point by the roller 17. The material then passes to the rising part of the grid, to the right of depression 8 in Figure 1, whereon its upward movement is regulated and insured by teeth on the bars 2, as is shown in Figure 3. By action of the roller 25, the sealing liquid entrained by the material from the tank 12 is in large measure pressed out so that, according to the position of the partition between tanks 12 and 49, it may escape partially or completely into one or the other of these vessels. The fleece is then propelled over the horizontal central grid within the container 16 between the rollers 25 and 26 and is there sprayed from above with treating liquids from the spray containers 44 and 45. This liquid is collected after passage through the fleece in the collecting vessel or tank 49, the pressing out action of the roller 26 assisting in the recovery of the treating liquid. The pressed out fleece is then passed through the liquid seal 11 and conveyed further in the direction of the arrow.

The treating liquid recovered in the tank 49 is passed through pipe 50 into a lower collecting and storing vessel 51 from which it is delivered by pump 53 for reuse in the manner heretofore described. The collecting vessel 51 is closed except for the gas pipe 62 which connects it to the treatment chamber 16. The gas pipe 62 functions to lead gas entrained by the spraying liquid back to treatment chamber 16.

Where the treating liquids, the fleece or the reaction between the treating liquids and fleece may be deleteriously effected by the presence of oxygen, inert gas may be introduced into the chamber 16 through valved conduit 64.

The process and apparatus described above favor the performance of a number of important textile operations which are otherwise difficult to control.

Example I

Staple fiber which is produced from viscose by a known process wherein the freshly spun masses which are coagulated but have not yet been decomposed to form cellulose hydrate may be advantageously treated in accordance with the present invention. The cut fibers are decomposed with diluted acids or with dilute solutions of acids and salts, so that most of the poisonous hydrogen sulphide is developed not on the spinning machine, but during the subsequent decomposition. According to the present invention the unstretched fibers are decomposed by spraying with a decomposing medium and a remarkably durable curled fiber is formed. The process and apparatus of the present invention are suitable for carrying out this decomposition continuously and for deacidifying the xanthogenate fiber cuttings and for collecting the evolved hydrogen sulphide in concentrated form. To this end the cut fibers are sprayed in the treatment chamber with the cold decomposing medium and the hydrogen sulphide containing gases are sucked out of the chamber under a low negative pressure (gauge) through the conduit 64. The first liquid seal in the container 12 is fed with substantially acid-free, but sufficiently concentrated, salt solutions such as sodium sulphate or other spinning salts in order to prevent liquefaction of the xanthogenate yarns and premature decomposition thereof. The second liquid seal in the container or tank 13 may consist of a dilute salt-and-acid solution, such as is naturally formed when water is sprayed onto the fibrous fleece onto which acid and salt have adhered.

Example II

In the production of staple fiber from viscose, freshly spun and cut cellulose hydrate fibers contain, in addition to salts, acids and other impurities, a large percentage of the carbon disulphide which was employed in the production of the viscose. This carbon disulphide is customarily eliminated from the fibrous masses by washing with hot water. According to the process and apparatus of the present invention, carbon disulphide in the form of an almost undiluted vapour may be continuously eliminated from the cellulose fibers by spraying the textile material in the chamber 16 with hot water, for example, from 30° to 90° C. The carbon disulphide may then be withdrawn from the chamber through the conduit 64 and subjected to reconditioning or re-

generation. In this case the liquid seals are maintained with cold water. The elimination of the carbon disulphide from the loose fibers by spaying with hot water or with a diluted hot spinning bath, produces a marked curling of the fibers in addition to the volatilization of the carbon disulphide from the interior of the yarn.

The methods described in Examples 1 and 2 may be combined by treating the cut xanthogenate fibers with highly heated decomposing medium which is sprayed in the chamber 16. In this case the hydrogen sulphide and the carbon disulphide are simultaneously evolved and can be withdrawn together through conduit 64. The combined treatment affords advantages in the elimination of a treatment chamber and further intensification of the fiber curl is effected. On the other hand, the combined methods entail increased expense in separating the jointly recovered hydrogen sulphide and the carbon disulphide for separate regeneration.

Example III

Protein fiber such as casein wool, particularly after it has been treated with nitrate solutions, as taught in German Patents Nos. 692,232 and 702,001, has an unpleasant yellow discoloration which is due partly to oxidation but mostly to diazotisation. The discoloration withstands normal reducing and bleaching agents such as sulphur dioxide, sodium thiosulphate, hydrogen peroxide and the like. However, it can be completely removed by treatment with a dilute solution of sodium hydrosulphite ($Na_2S_2O_4$). This substance, while excellent in removing the discoloration from protein fibers, is especially sensitive to oxygen in aqueous solutions, and immediately decomposes, for example, as when heated to 45° C., with sulphur separation by oxidation. This sensitivity is increased when the sodium hydrosulphite is in aqueous neutral or acid solutions.

Despite the foregoing, by the use of the methods and apparatus of the present invention it is possible to use sodium hydrosulphite to bleach casein fibers in a continuous manner. In this case the sealing liquids 10 and 11 are water and a substantially oxygen-free atmosphere is maintained within the container 16.

By operation in accordance with the present invention losses due to oxidation of sodium hydrosulphite are maintained at a low level, despite the fact that the water seals are by no means free of dissolved hydrosulphite resulting from splashing of the liquid and entrainment by the textile material. It has been found that the liquid seal has a relatively steady level and therefore a small surface absorbs relatively little oxygen as compared with a spraying liquid which would offer a large surface to oxygen due to its redistribution in the form of drops. Hence, during treatments with sodium hydrosulphite the containers 12 and 13 are filled and the flow from spraying vessels 43 and 57 is cut off. While the liquid seals are effective when water is used, their effectiveness is considerably increased if strong dilutions of the spraying liquid are used.

It is understood that the apparatus described and the examples given do not constitute the only modes of practicing the invention, and that various treating liquids and sealing liquids may be used in accordance with the needs of any particular treating requirements. It should be noted in connection with the third example where oxygen within the treating chamber 16 is to be kept at a minimum, that nitrogen or other inert gases of low oxygen content may be introduced into the chamber in sufficient extent to prevent the establishment of too high a pressure differential between the interior of chamber 16 and atmosphere, it being apparent that a high pressure differential might break the liquid seals.

It has been suggested, particularly in the spraying of textiles, that the spraying liquid withdrawn from the collecting vessels carries large amounts of gas with it, which tends to reduce the gas volume in the chamber. For purposes of economy where the gases are valuable and, in any event to maintain an adequate pressure within the chamber 16, the gas recycling conduit 62 is used.

What is claimed is:

1. Apparatus for treating flocculent textiles which comprises a treatment chamber including top, side and end walls, a tank underlying each end wall, a wall extending between said tanks and forming therewith a bottom to said chamber, each tank extending above the lower edge of the respective end wall so that a pool of liquid in each tank can function to seal ingress and egress openings to the tank, a conveyor to support and convey a quantity of flocculent material to and through said tanks under said end walls and through said chamber, said conveyor extending generally horizontally in a plane above the lower edges of the end walls of the chamber within the chamber and to and from said tanks but extending below said edges of the end walls of the chamber within the tanks, and means for applying a treating liquid to said material during its passage through said chamber.

2. Apparatus for treating flocculent textiles which comprises a treatment chamber including top, side and end walls, a tank underlying each end wall and extending above the lower edge of the respective end wall so that a pool of liquid in each tank can function to seal ingress and egress openings to the tank, a conveyor to support and convey a quantity of the flocculent material to and through said tanks under said end walls and through said chamber, said conveyor extending generally horizontally in a plane above the lower edges of the end walls of the chamber within the chamber and to and from said tanks but extending below said edges of the end walls of the chamber within the tanks, and means for spraying a plurality of treating liquids on said material during its passage through said chamber, means following a spraying means in the direction of conveyance of the material for pressing the treating liquid from the flocculent material, a collecting trough extending between said tanks and functioning as a bottom wall to the chamber and to recover the treating liquid pressed out of said material and means for returning the recovered liquid to said spraying means.

3. Apparatus as claimed in claim 2 further comprising means for withdrawing or supplying gas to said treatment chamber.

4. Apparatus as claimed in claim 2 in which the means for returning the recovered liquid includes a liquid recovery tank and which further comprises a conduit extending from the top of said liquid recovery tank to the top of said treatment chamber to function as a gas return line between said tank and the treatment chamber.

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