

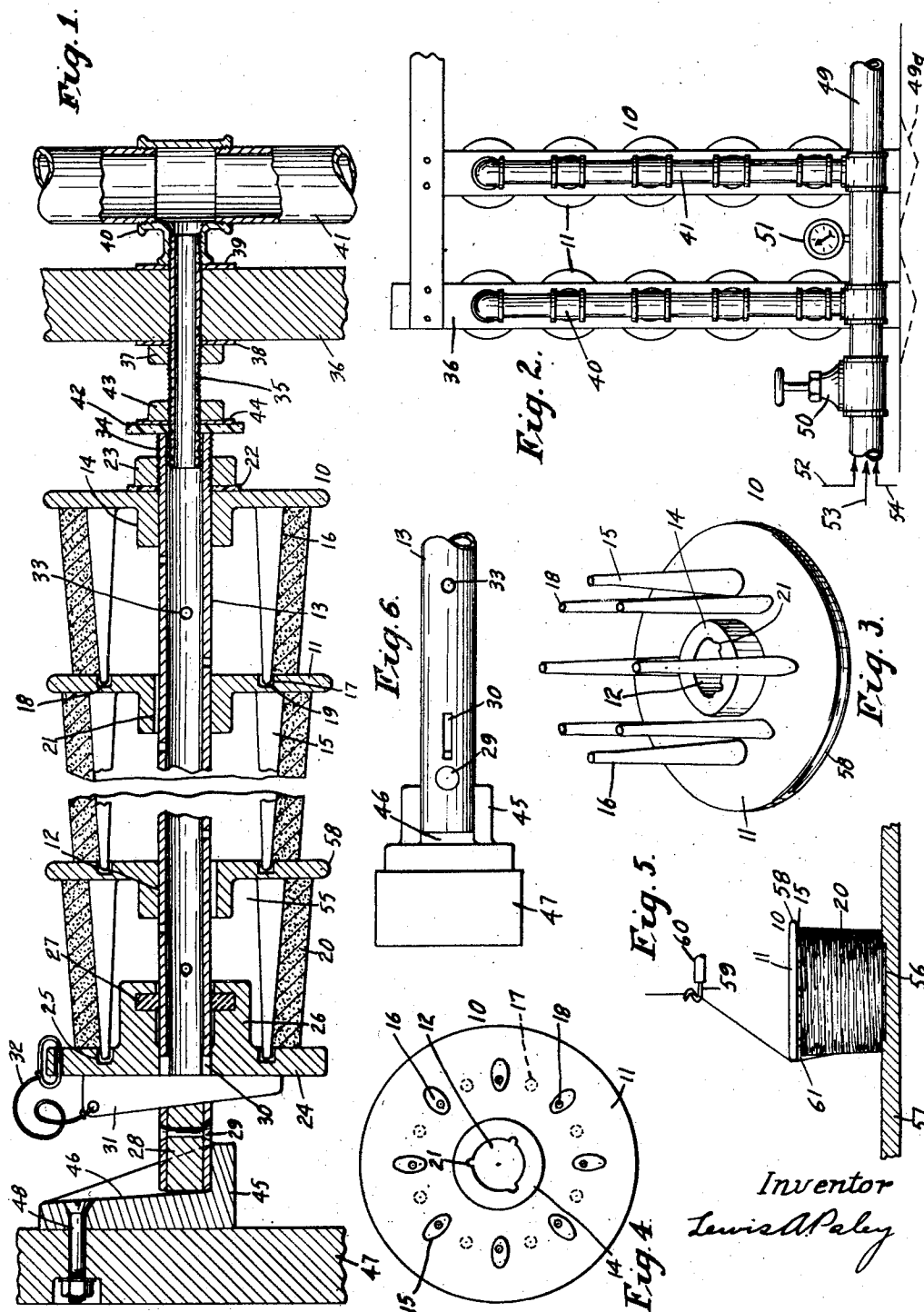
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METHOD OF AND APPARATUS FOR TREATING ARTIFICIAL FIBERS

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METHOD OF AND APPARATUS FOR TREATING ARTIFICIAL FIBERS

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This invention relates to a method of and apparatus for treating artificial fibers and relates more specifically to a process of and an apparatus adapted for treating cakes of artificial fibers such as rayon, artificial wool, etc., with fluids and liquids such as water, air, and or desulphuring, bleaching and dyeing solutions.

In the manufacture of rayon, artificial wool and other artificial fibers, it is customary to pass a solution containing cellulose or cellulose nitrate through spinnerettes into a coagulating bath or fluid where the cellulose solution is coagulated into a large number of fine filaments. The process in the remaining steps varies considerably but usually the filaments of the thread are passed through a funnel extending into a "bucket" rotating at a high speed. The funnel reciprocates vertically at a slow speed axially of the bucket so that the twisted thread is deposited on the inner wall of the bucket as it passes from the lower end of the funnel, so as to form a "cake" of rayon. The walls of the bucket are slightly tapered and after the spinning is complete, the bucket is inverted and the cake of rayon slides out onto a support. In another process, the thread from the spinnerettes passes through the coagulating bath and then to a rotating bobbin. In this process the thread on the bobbin is untwisted and a later manufacturing step must be employed to put the final twist in the thread.

In the standard viscose process which produces a cake of twisted thread directly from the spinnerettes, the cake of rayon contains various impurities which must be removed before the rayon is in condition for drying and marketing. Some of the impurities are acid, sodium sulphate or bisulphate, organic sulphur compounds, resins and coloring matters. The acid and soluble salts are usually removed by washing with water, the sulphur compounds with alkaline desulphuring solutions and the resins and coloring matter with bleaching solutions. Various mechanical contrivances are used in these purifying processes and the effectiveness of these devices has a marked influence on the tenacity, elasticity, color, dyeing properties and quality of the

resulting rayon and therefore on the selling price of the rayon.

In purifying the cakes of rayon, it is desirable that the sulphur content of the rayon be reduced to as low a point as possible so that uniform dyeing results are obtained. It is generally preferable to bleach the rayon if this can be effected without seriously lowering the tenacity and elasticity. When both alkaline and acid solutions are used in the same apparatus, the materials for the apparatus must be carefully selected so that corrosion of the apparatus and resulting discoloration of the rayon does not result. In purifying the cakes of rayon, the thread should be handled in the wet state, or even in the dry state, as little as possible so that the fiber cakes are not deranged and the fine filaments are not broken with a resulting lowering of quality and selling price of the rayon. The cakes of rayon shrink somewhat during the purifying process so that the apparatus used must provide for this shrinkage.

An object of this invention therefore, is to provide a highly efficient method of purifying cakes of artificial filaments which will remove soluble salts, sulphur compounds, resins and coloring matter from the rayon and not lower its tenacity, elasticity and quality or produce undesirable dyeing characteristics. Another object of the invention is to provide an apparatus for carrying out this improved method which will insure a minimum handling of the fibers and a high resulting quality of the rayon due to freedom from broken filaments.

Another object of the invention is to provide an apparatus in which washing, desulphuring, bleaching, dyeing, drying and unwinding can be accomplished without removing the cakes from the supporting holders.

A still further object of the invention is to provide an apparatus which can be constructed of carefully selected non-corrosive materials and which will have provision for taking up the shrinkage of the cakes as they are purified; also to improve methods of and apparatus for treating fibers, in other respects hereinafter specified and claimed.

Reference is to be had to the accompanying

drawings forming a part of this specification, in which

Figure 1 is a fragmentary sectional elevation through the improved fiber treating apparatus for carrying out my improved method,

Figure 2 is a fragmentary elevation of a group of these apparatus,

Figure 3 is a perspective view of one of the improved fiber cake holders forming part of the treating apparatus,

Figure 4 is an elevation of one of the cake holders,

Figure 5 is a fragmentary elevation of one of the holders inverted for the last unwinding step of the method, and

Figure 6 is a fragmentary plan view of one end of the treating apparatus.

Referring to the drawings by numerals, 10 indicates one of my improved holders which consists preferably of a disc-like base member 11 having a central opening 12 for the purpose of receiving a tube 13. A hub 14 extends on one or both sides of the disc 11 adjacent the opening 12 for the purpose of maintaining the plane of the disc 11 substantially normal to the axis of the tube 13. Each holder 10 has an annular series of spokes or grids 15 extending from one surface thereof and substantially normal thereto. The outer edge of each spoke 16 extends outwardly from the disc 11 at a slight inclination thereto so that said spoke edges 16 form a frustro-conical cake support, this inclination being preferably about equal to the inclination of the inner surface of the bucket which forms the fiber cake. This arrangement enables an operator to slip a fiber cake over the spokes after removal from the bucket so that when the bottom of the cake rests on the disc 11, said cake will be loosely supported internally by the outer, inclined edges 16 of the spokes. Holders having different diameters on the outside of the spokes 16 may be provided in order to fit cakes of different sizes since cakes may vary in wall thickness and inside diameter due to variation in the length of spinning time or for other reasons. These holders are preferably rigid or integrally formed, molded or cast.

The tube 13 is passed through the openings 12 of a number of the cake holders containing cakes, so as to form a series of the holders and cakes. Each disc 11 is provided on its face opposite the spokes 15, with an annular series of openings 17 adapted to receive the grid ends 18 of the adjacent holder 10. Each aperture 17 preferably passes only part way through the disc 11 and the holder is so proportioned, that a clearance 19 will be left between the spoke ends 18 and disc 10 when freshly spun cakes 20 are in place on the holders. These clearances permit the discs 11 to be moved closer together at intervals in the purification process as the cakes shrink

in width so as to maintain a fluid-tight joint at all times between the discs and the cakes 20. In order to allow fluids free access to each holder and cake, a plurality of shallow grooves 21 are formed on the inner surface of the hubs 14 parallel to the axis thereof. The holder 10 on one end of the series bears against a fluid-tight gasket 22 which in turn bears against a nut 23 screwed to the end of the tube 13. The cake holder on the other end of the series is closed by a cover 24 in the form of a disc having grid receiving apertures 25 and a hub 26, the latter being provided with a fluid-tight internal gasket 27 bearing against the tube 13.

One end of the tube 13 is preferably closed by a plug 28 held in place by a rivet 29, and a slot 30 passes through the tube 13 adjacent the plug 28, said slot being adapted to receive a wedge 31. This wedge is driven into the slot 30 and presses against the outer face of the cover 24 so as to force the holders firmly together and make a fluid tight joint between the cakes 20 and discs 11. If desired, a wire or other flexible connecting member 32 connects the cover 24 with a wedge 31 so that the latter is not mislaid when the apparatus is disassembled. It should be understood that any other type of device for forcing the holders and cakes together, may be used instead of the wedge 31, if desired. It is thus seen that the series of cakes and holders form an approximately cylindrical closed container adapted to receive internally, purifying fluids and solutions under pressure through ports 33 formed in the walls of the tubes 13.

It is convenient to admit the fluids and solutions to the open end 34 of the tube 13 while the axes of said tubes are maintained substantially horizontal although any other position of the tubes, such as vertical, may be used if desired. The horizontal grouping of the tubes is shown in Figs. 1 and 2, wherein the end 34 of each tube seats over the end of a pipe 35, the latter passing through an upright standard 36. The pipe 35 is secured to the standard 36 in any suitable way such as by a nut 37 seated on a washer 38, and a washer 39 on the opposite side of the standard 36 is confined by a T pipe-fitting 40 connected to a header 41. A fluid-tight gasket 42 is arranged on the pipe 35 between the end of tube 13 and a nut 43, the latter being seated on a metal washer 44. The tube 13 and pipe 35 are threaded to receive the various nuts and fittings.

In order to force the tube 13 against the gasket 42, the end of said tube adjacent the plug 28 is forced downwardly into a socket 45 having a cam or wedge surface 46 which is slightly inclined to the vertical. As the plug end of tube 13 moves downwardly, the wedge surface 46 moves said tube axially to the right as seen in Fig. 1, thus forcing the open end of

said tube against gasket 42 to make a fluid tight joint therewith. The socket 45 is attached to a standard 47 in any suitable way such as by a bolt 48 so that the tube 13 is supported in a substantially horizontal position. It is thus seen that the tube 13 with its holders 10 and fiber cakes 20, is portable and may easily be carried as a unit from place to place by operators, and can be easily removed from its supporting standards for loading and unloading the fiber cakes. Each pair of standards 36 and 47 supports a plurality of tubes of fiber cakes arranged one above the other as shown in Fig. 2. The headers 41 connect the ends of all of the pipes 35 and said headers are connected to a supply main 49 which supplies various fluids and solutions for purifying and otherwise treating the fiber cakes 20. A valve 50 is positioned on the main 49 for regulating the pressure and amount of treating solutions and fluids supplied to the fiber cakes while a pressure gauge 51 on said main indicates the static pressure thereof as distinguished from centrifugal and dynamic pressure. The solutions are collected in troughs 49^a and may be returned or recirculated through the system or may be run to the sewer as desired.

The arrows 52, 53 and 54 indicate that any desired number of pipe lines may be connected to the main 49 for independently supplying a variety of fluids and solutions to the fiber cakes. When liquids or solutions are used, these enter the enclosed cylindrical space 55 inside the cakes 20 under pressure and ooze or pass outwardly through the fiber cakes carrying with them the undesired impurity contained in the fiber cakes. These solutions trickle down from cake to cake supported on the standards 36 and 47, gradually increasing in volume and treating the fiber cakes in the lower tiers or rows externally with the purifying solutions. It will be seen in Figure 2 that the pressure of the solution inside the space 55 will decrease the higher the cake is above the supply main 49 due to loss of head and this will tend to make the cakes at the top of the rack be treated somewhat slower than those at the bottom. This tendency, however, will be somewhat neutralized by the effect of the water trickling down the exterior of the cakes and it may be found desirable in some cases to attach the main 49 to the headers 41 at a point intermediate the ends of said headers in order to make the cakes at all levels be treated in equal lengths of time. It is desirable in most cases to recirculate the treating solutions or fluids in order to get as high a volumetric efficiency as possible. Compressed air may be passed through the cake walls after each treatment with solution in order to free the cake of that solution before treatment with the next solution.

The fiber cakes made by the standard vis-

cose process contain as impurities, sulphuric acid, sodium sulphate and bisulphate, resins, coloring matter, organic sulphur bodies and other impurities which may be in the coagulating bath or viscose. The water soluble materials, as acid and salts, may be removed easiest and at least expense, by supplying water at ordinary temperature under pressure through the main 49 to the inside of the cake space 55, this water then oozing or passing outwardly through the cakes carrying with it the water soluble impurities. Warm or hot water may be used if desired. The organic sulphur compounds, resins and coloring matters may be largely removed by then admitting to the inside of the cakes, a 0.1% to 0.5% solution of sodium carbonate at a temperature of 80-100° C., at a pressure of 1/4 to 5 lbs. per sq. in. When this solution is first admitted to the cakes, the cakes turn a bright yellow due to the dissolved impurities passing from the fiber cakes. This phenomena lasts for about five minutes and in less than ten minutes the cakes have turned white again. A short washing period with water under pressure will now remove the last traces of impurities and the cakes are then ready for drying. If it is desired to produce fibers of a pure white color, chlorine gas may be dissolved in the solution of sodium carbonate before same is used for treating the fiber cakes. This chlorine bleaches out the last traces of coloring matter left in the fiber and these fibers are especially desired for producing textiles which are not dyed. The chlorine may be passed through the cakes in gaseous form if desired or may be dissolved in any suitable liquid.

Before drying, the purified cakes may be dyed if desired by introducing the desired dye solution under pressure into the space 55 through main 49. This dyeing operation may be carried out on a separate rack, if so desired, by removing the tubes of cakes from the washing rack to a special dyeing rack. The drying of the cakes is accomplished by introducing warm, dry and compressed air into the space 55 through the main 49. This air first of all drives the excess liquid out of the fiber cakes and continued passage of the air through the fibers quickly dries same. This drying operation is especially effective since the fibers of the cakes are fairly loosely packed giving free passage to the air. Since the cakes tend to shrink some in width during the purification steps of the process, it is desirable but not essential to drive the wedge 31 deeper into the slot 30 after washing of the cake as this forces the discs 11 closer together thereby compressing the cakes and keeping same flush and fluid-tight against said discs. However, the fluid pressure inside the cakes also tends to spread the cakes out against the discs 11 and prevent loss of

the treating solutions between the cakes 20 and discs 11.

One of the salient features of my invention lies in the fact that the entire purifying, dyeing, washing, drying and unwinding steps of the method may be carried out without disturbing the fiber cakes and without removing said cakes from the holders 10. This improves the quality of the fiber by preventing broken filaments and also reduces the cost and time of manufacture. The unwinding operation is accomplished by removing the holders 10 carrying the dried cakes 20, from the tubes 13 and inverting said holders. The grid ends 18 are then placed in a shallow, annular recess 56 formed in a supporting shelf 57 which may be attached to any suitable unwinding machine not shown. The outer edge of the discs 11 have a rounded surface 58 which serves as a spooling ring or guide ring for the fiber thread as it unwinds from the outside of the cake. A pig-tail 59 is positioned above the disc 11 on a suitable supporting arm 60 and the thread leads through this pig-tail to a reel, package, cope, spool or other rotating member which unwinds the cake from holder 10 leaving said holder free for another cycle of operations as above described. The depth of the recess 56 is such that when the cake 20 slips down the grids 15 and rests on the shelf 57, a clearance 61 is left between the top of the cake and the disc 11 to permit the fiber thread to unwind freely from the top of the cake.

It is important that the proper materials be selected for constructing the apparatus since certain parts of same are generally exposed to both acid and alkaline solutions, the alkaline solution being hot. If improper materials of construction are used, corrosion will take place and the cakes will be discolored. In the preferred form, the tubes 13 are constructed of laminated phenol condensation material and the holders 10 and cover 24 of molded phenol condensation material or other molded composition. The apparatus may also be made of aluminum, and the holders of die-cast aluminum base alloy, either used bare or, preferably, sand-blasted and then given a protective coating of baked, phenol condensation enamel or other corrosion-proof coating. Other suitable materials may be used if so desired.

In brief, the freshly spun fiber cakes are slipped onto the spokes 15 of holders 10 and these holders are placed on the tube 13 together with cover 24. Wedge 31 is then driven lightly into slot 30 and the open end 34 of the loaded tube 13 is then placed on the open end of pipe 35. The closed end of tube 13 is then pushed into cam socket 45 which forces tube end 34 against the fluid-tight gasket 42. Purifying solutions or fluids in the order, water, hot sodium carbonate solution and water are now admitted into the

cake space 55 through main 49, headers 41 and pipes 35 and tubes 13, these liquids passing through the cake walls from the inside to the outside of the fiber cakes and purifying same. Warm air is now admitted to the space 55 under pressure to effect a pressure drying of the cakes. The holders 10 are then removed from the tubes 13, inverted, and placed on the winding machine shelf 57 with the ends 18 of the spokes 15 seated in recess 56. The fiber thread can now be unwound from the cake 20 through pig-tail 59 by a suitable winding machine, after which the holder 10 is sent back through the above cycle of operations.

I would state in conclusion, that, while the illustrated and described examples constitute a practical embodiment of my invention, I do not limit myself precisely to same since manifestly, the same can be considerably varied without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. The method of treating freshly spun viscose fiber cakes which includes washing the soluble impurities from said cakes with water, and treating said cakes with a hot solution containing sodium carbonate.

2. The method of purifying freshly spun cakes of twisted viscose fiber which includes placing said cakes on a rigid support in closed, end-to-end position and successively passing cold and warm fluids under pressure through the walls of said cakes.

3. The method of purifying freshly spun cakes of twisted viscose fiber which includes placing said cakes on a rigid support in closed, end-to-end position and passing water and then warm sodium carbonate solution under pressure to the inside of said cakes so that said cakes are cleansed by the passage of treating fluids through the walls of said cakes to the outside thereof.

4. The method of purifying freshly spun cakes of twisted viscose fiber which includes placing said cakes on a rigid support in closed, end-to-end position, and passing only the following treating fluids under pressure through the walls of said cakes; water, hot sodium carbonate solution and compressed air, the latter being for the purpose of drying the cakes.

5. In a treating apparatus for self-supporting twisted fiber cakes, holder means adapted to be inserted after the formation of said cakes for supporting said cakes in end-to-end position so as to form a closed cylinder, and means for introducing a fluid under pressure into the inside of said cylinder and then passing same outwardly through the walls of said cakes.

6. In a treating apparatus for self-support-

ing twisted fiber cakes, individual, rigid holders for said cakes adapted to be inserted after the formation of said cakes, supporting means for grouping said holders in a series with said cakes in end-to-end position to form a closed cylinder, and means for introducing a fluid under pressure into the inside of said cylinder and then passing same outwardly through the walls of said cakes.

7. In a twisted fiber cake treating apparatus, individual, rigid holders for said cakes adapted to be inserted after the formation of said cakes and to be grouped in a series with said cakes in end-to-end position in the form of a closed cylinder, and means for introducing successively fluids under pressure into the inside of said cylinder for treating said cakes, the last fluid introduced being adapted to dry said cakes.

8. In a twisted fiber cake treating apparatus, individual, rigid holders for said cakes adapted to be inserted after the formation of said cakes and to be grouped in a series with said cakes in end-to-end position in the form of a closed cylinder, and means for introducing successively fluids under pressure into the inside of said cylinder and then outwardly through the cakes, the last fluid introduced being adapted to dry said cakes, said holders bearing said dried cakes when disassembled from series form being provided with surfaces serving as thread guides during a subsequent unwinding of said fiber from said holders.

9. A holder for insertion into self-supporting twisted fiber cakes after the formation of said cakes, comprising means for supporting said cakes individually and in end-to-end interengaging position, means for treating said cakes by fluids under pressure when in end-to-end position, said holder being adapted to support each cake independently after said treatment and act as a thread guide during the unwinding of said fiber thread from said holder.

10. A holder for twisted, self-supporting fiber cakes, comprising a disc, and a plurality of spokes extending laterally from one face of said disc and adapted to be inserted into the inside of a cake after the formation of said cake for supporting a plurality of cakes in end-to-end series position for treatment with fluids, the outer edge of said disc serving as a thread guide to permit unwinding of said fiber cake from said holder after treatment.

11. A holder for twisted self-supporting fiber cakes comprising a disc, a plurality of spokes rigidly attached to one face of said disc so as to be inserted into the inside of a fiber cake after the formation of said cake for supporting same, said holders being mounted in interengaging relation with the cakes in end-to-end position for treatment with fluids under static pressure.

12. An apparatus for treating twisted self-supporting viscose fiber cakes, which comprises a holder disc having rigidly attached spokes internally engaging a cake after the formation of said cake, said disc having an aperture, a tube having a plurality of fluid ports and adapted to pass through the disc apertures of a plurality of said holders so as to position a plurality of cakes in closed end-to-end position, and means for supplying treating fluids under pressure through said tube ports to the inside of said cakes so that said fluids pass outwardly through the walls of said fiber cakes.

13. An apparatus for treating fiber cakes which comprises a tube having a plurality of fluid ports, a series of interengaging cake holders mounted on said tube, means for supporting the ends of said tube, and means for supplying treating fluids under pressure through said tube ports to the inside of said cakes so that said fluids pass outwardly through the walls of said cakes.

14. An apparatus for treating self-supporting twisted fiber cakes, which comprises a holder disc having rigidly attached spokes adapted to be inserted into a cake after the formation of said cake for supporting same, each disc having apertures in a face adapted to register with and engage the ends of the spokes of an adjacent holder to form a series of holders and cakes, a cover adapted to close the open end of the series of cakes, means for pressing said cakes and holders together, and means for admitting treating fluids under pressure to the inside of said series of cakes so that fluids pass outwardly through the walls of said cakes.

15. The method of treating freshly spun viscose fiber cakes, which includes washing the soluble impurities from said cakes with water, and removing substantially all of the remainder of the impurities by passing a 0.1% to 0.5% hot solution of sodium carbonate through the walls of said cakes.

16. The method of treating freshly spun viscose fiber cakes, which includes washing the soluble impurities from said cakes with water, and removing substantially all of the remainder of the impurities by passing a dilute solution of sodium carbonate through the walls of said cakes, said solution having a temperature of 80°-100° C.

17. The method of treating freshly spun viscose fiber cakes, which includes washing the soluble impurities from said cakes with water, and removing substantially all of the remainder of said impurities by passing a hot solution of sodium carbonate through the walls of said cakes under a pressure of $\frac{1}{4}$ pounds to 5 pounds per square inch.

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