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(54) Method of producing a sheet of cotton wool and pieces of cotton produced by cutting a sheet obtained using this method

(57) Method of producing a cotton wool sheet, according to which the raw cotton is subjected to preliminary beating and opening-up operations in such a manner as to obtain cotton flock, this flock is conducted to perforated cylinders or belts to form a fluffy sheet, this sheet is conducted to an impregnating bath such in a manner as to obtain a more compact sheet, this sheet is dried, and is wound onto a perforated hollow cylinder in such a manner that there is obtained a spool which is introduced into an autoclave, where it is subjected to scalding and bleaching operations, characterised in that the wetting bath is acidified and in that, before the sheet is wound on a perforated hollow cylinder, it is subjected to a fluid pretreatment by sending a series of jets of a rinsing fluid through it.

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Description

The present invention relates to a process of producing a sheet of cotton wool from raw cotton fibres, in particular from combing noil, which is obtained as a by-product in the process of manufacturing cotton fibres with the intention of spinning and weaving the combed products.

All the methods of processing cotton which are used at present start with close-packed bales, which are provided by the producer, and which must be untangled, ventilated, then cleaned in order to eliminate vegetable waste such as stems, leaves and other foreign bodies.

At the end of this preliminary operation, the longest fibres are sorted to be used for spinning and weaving high quality products.

The wastes from this first sorting or combing operation, which are generally known as combing noil, and which are considered, in cotton technology, as high-quality by-products, act as starting material for processes of manufacturing cotton wool, make-up removing products, pharmaceutical or surgical pads, etc. These by-products consist of good fibres which are well untangled and very clean, containing only a small amount of vegetable waste or other polluting agents.

The conventional method of using combing noil of this type consists in subjecting the raw (i.e. crude) cotton fibres to, successively, preliminary beating and opening-up operations in such a manner as to obtain cotton flock which is opened up and physically cleaned and then subjecting this cotton flock to a scalding treatment which consists in removing the greases (pectins, vegetable waxes, etc) which are found around the fibres, and in fluffing out these fibres, while separating out the vegetable wastes, to prepare them for subsequent treatment operations. This scalding is most frequently performed in an autoclave using a soda solution. It is generally followed by a bleaching operation, in particular using hydrogen peroxide, likewise performed in an autoclave, and intended to confer on the cotton fibres the whiteness which is necessary for the presentation thereof in the commercial environment. Conventionally, the cotton, having been subjected to this scalding and bleaching operation, is, subsequently, brought into a card room where it is processed on cards which comb the cotton fibres very finely, align them in a parallel manner, separate them from one another and make them into a nap which is subsequently processed.

For specific applications, in which it is desired to obtain cotton sheets having a certain strength, such as, for example, round pads for the removal of make-up, it has been considered advantageous to modify the conventional method described hereinabove by performing the scalding and bleaching operations, not on the cotton flock, but on a crude sheet which already has a certain cohesion; this method has the advantage that spools, wound around a cylinder, may be put into the autoclave where the scalding and bleaching operations are performed. On being removed from the autoclave the sheet only needs to be unwound, wrung out and dried in a manner known per se before it is subjected to appropriate operations for each type of application (cutting, etc).

According to these methods, which are described in particular in the documents FR-1 478 515 and FR-2 081 133, to manufacture the sheet which is to be wound onto a spool, the crude cotton fibres are conducted to perforated cylinders or belts, on which they are deposited in an approximately uniform manner to form a fluffy sheet having almost no cohesion; this sheet is brought to a wetting liquor containing hot water (50 to 70°C) and a wetting agent, in such a manner as to obtain a more compact sheet having a certain strength owing to physical cohesion, and to render this hydrophillic, and then, when this sheet is removed from the wetting liquor, it is dried between calender rollers, and wound on a cylinder which is subsequently introduced into an autoclave, in order to subject it to scalding and bleaching operations in a basic medium and at a temperature of the order of 130°C.

During the passage through the wetting liquor, the cotton sheet, which is loose at the outset, looses more than 9/10 of its thickness. This compression is connected with the acquisition of a certain cohesion in consequence of the connections between the fibres, following the chemical treatment: hydrogen bonds and other connections. These physical connections between the fibres are found to an even greater extent during the scalding and bleaching operations in the autoclave.

The above-mentioned method has permitted a cotton sheet with a certain cohesion to be obtained; however, this cohesion has proved insufficient for certain application, in particular the production of round pads which are to be used for removing make-up or for cleaning babies.

In order to overcome this disadvantage, it has been proposed, according to document FR-2 552 120, that the sheet, when it is ready to be subjected to scalding and bleaching operations in the autoclave, be wound around a hollow cylinder having perforations which are spaced uniformly on the surface thereof, that the spool which has thus been obtained be enclosed in a cylindrical sleeve, comprising, on the periphery thereof, perforations similar to those provided on the cylinder, and that there be associated, with the autoclave, a closed circuit for circulation of treatment fluids, the circuit comprising an inlet duct connected to the end of the perforated cylinder, an outlet duct connected to an aperture provided for this purpose in the autoclave, and a circulation pump.

It is thus possible to circulate the treatment fluids radially through the coils of the spool in a manner such that a pressure differential is established between the fluid entering this latter and the fluid leaving it, and, in consequence of

the losses of charge which result from the difficulty which the fluid has in passing through the spool, on which a length of sheet in excess of 1000 m may be wound.

This pressure differential causes an interlocking of the cotton fibres owing to the action of the fluid, the consequence of which is a notable increase in the cohesion of the sheet obtained after unwinding.

It has been possible to obtain substantially satisfactory pieces by cutting a sheet which has been processed in this manner. The above-mentioned method has notably permitted there to be proposed, in the commercial environment, round pads for removing make-up, which pads have a diameter of the order of 6 mm and which have been warmly welcomed by consumers. Round pads of this type have, in fact, proved very soft on the skin whilst still having a cohesion which is sufficient for them neither to tear during use nor to shed to fluff; a further quality of these round pads relates to the ability thereof to absorb conventionally used cosmetic or

A further disadvantage of the above-mentioned method relates to the fact that during the scalding and bleaching operations, it is necessary to control the variations of the pressure differential which are established between the liquid entering the spool and the liquid leaving it, in such a manner as to avoid the coils on a part of the spool being torn.

The object of the present invention is to overcome these disadvantages by proposing a method of manufacturing a cotton wool sheet of the above-mentioned type, which method is substantially less polluting and in which the treatment time in the autoclave may be substantially reduced whilst avoiding any risk of the coils being torn.

This method is characterised in that there is performed, in the impregnating bath, a sequestration of the catalytes of the cotton in the acid or neutral phase: agents for hardening the water and the cotton (calcium, magnesium) and metallic ions (iron, copper, manganese) in such a manner as to obtain a preliminary attack of the cotton fibres of such a type as to facilitate the subsequent operations of scalding and bleaching, and in that, before the sheet is wound onto a perforated hollow cylinder, it is subjected to a fluid pretreatment in that the entire width thereof is passed at right angles to banks of spraying devices comprising a series of nozzles which very close to one another and associated with a vacuum source and able to send a series of jets of a rinsing liquid through the sheet in such a manner as to obtain a preliminary connection thereof by the preliminary action of the fluid.

By way of example, it has been proved that the preliminary attack of the cotton fibres by acidification to a pH of the order of 3 to 5 may, advantageously, be performed by adding to the impregnating bath, a suitable, weakly acid concentration, together with a sequestering agent; this allows the time necessary for the treatment in the autoclave to be reduced by approximately 45 minutes. This result occurs together with the fact that the fibres are thus better prepared for being subjected to the action of the soda which, by fluffing them up and deep-cleaning them, permits the hydrogen peroxide to reach the core in such a manner as to obtain a satisfactory bleaching.

It should be noted that, after being passed between the calender rollers, the rate of removal of the sheet is between 120 and 140%; taking into account the characteristics of this fluid, it is necessary to provide a suitable rinsing with soft water upstream of the scalding operation in order not to disturb the action of the soda which is used; this renewal of the liquid which impregnates the sheet leaving the wetting liquor, permits, at the same time, a demineralisation thereof to be performed by removing the salts which form as a consequence of the action of the acid.

By way of example, it has been possible to obtain a particularly significant reduction of the time necessary for the treatment in the autoclave by passing the sheet through an impregnating bath containing from 2 to 3 g/l of wetting agents, 3 to 4 g/l of weak acid and sequestering agents.

In addition to rinsing the sheet, the fluid pretreatment permits an appreciable increase in the cohesion to be obtained during the scalding and bleaching treatment thereof; this results in a reduction of the risks of tearing following an insufficient control of the pressure differences which may prevail at the interior of the autoclave.

It has been possible to show this increase in the cohesion of the sheet which was obtained by the hydraulic pretreatment stage by means of the example which forms the object of table 1, in which the longitudinal and transverse strengths and the longitudinal and transverse expanding of one same sheet were compared upstream of the hydraulic pretreatment stage (sheet 1) on the one hand, and, on the other hand, downstream of this stage (sheet 2).

TABLE 1

	WEIGHT coton sec g/m^2	RATE of removal	STRENGTH md N	STRENGTH cd N	BREAKING strain md %	BREAKING strain cd %
Sheet 1	275	130	3	2	6	15
Sheet 2	275	130	11	7	35	114

As is shown by this table, the rate of removal corresponds to the quantity of water discharged by the sheet; the total weight thereof is thus 275 g + 130 % of 275 g, ie. 632.5 g.

Furthermore, the strengths and the breaking strains are measured in the direction of the machine (md = "machine direction") and in the transverse direction (cd = "cross direction"). A breaking strain of 6% signifies that the sheet extends by 6% before tearing.

According to a preferential characteristic of the invention, the scalding and bleaching operations are formed in a single stage by circulating a mixture of soda and hydrogen peroxide in the autoclave.

This combined pretreatment permits the total time of the treatment in the autoclave to be reduced to a duration of 3 hours in place of 5 hours, whilst a sheet of at least equivalent quality is obtained.

It should be noted that during the combined scalding/bleaching treatment, it is desirable to add, a stabilising agent sequestering heavy metallic ions Cu, Fe, Mn, to the soda/hydrogen peroxide mixture in such a manner that it is possible to "manage" the development of the chemical reaction in an optimum manner: it is, in effect, desirable that the hydrogen peroxide does not break down too rapidly in order to conserve its effectiveness throughout the entire duration of the treatment, but, at the same time, it should be almost totally consumed at the end thereof in order to avoid very polluting residual liquids being discharged.

It has been possible to observe that, in a surprising manner, the sheet, having been subjected to the hydraulic pretreatment stage, does not only have an increased cohesion upstream of the autoclave, as may have been expected, but also at the end of the treatment. This improvement of the cohesion of the finished product is proved by the example which forms the object of Table 2, in which the strengths, at the end of treatment, of a sheet having been manufactured according to the conventional process in accordance with the above-mentioned document FR-2 552 120 on the one hand, and a sheet having been produced by the method according to the invention, on the other hand, are compared.

TABLE 2

	WEIGHT G/M^2	STRENGTH md N	STRENGTH cd N
CONVENTIONAL ROUND PAD	245	11	9
NEW ROUND PAD	245	21	13
	+0 %	+91 %	+44 %

These results have been obtained by using a device which has the following characteristics:

- width between jaws: 40 mm
- velocity: 200 mm/mn
- diameter of the discs: 57 mm.

It should, however, be noted that, at the same time as its advantages, the hydraulic pretreatment stage according to the invention has the drawback of reducing the softness of the sheet to the touch, and of rendering it too rough to satisfy customers' expectations fully.

To overcome this disadvantage, it has been proposed, according to the invention, to subject the sheet to a softening treatment.

A first phase of this treatment is performed in the autoclave and consists in circulating, when the scalding and bleaching operations have been completed, a rinsing fluid, and then a softening solution which is known per se, and contains, in particular, fatty acid esters, in order to increase the softness and the suppleness of the sheet obtained after unwinding.

This first phase is broadly comparable to the action of softening agents which housewives have used on their linen for some years.

It has thus been possible to increase the suppleness of the sheet "at the heart" without, however, obtaining a sufficient softness and velvetiness at the surface.

To overcome this disadvantage, it has been proposed, according to the invention, that a supplementary surface softening treatment phase be associated with the above-mentioned first phase.

According to the invention, the wrung-out sheet which has previously been treated in the autoclave, is, prior to drying, subjected, to this end, to a supplementary treatment consisting of spraying, in fine droplets, a supplementary softening solution onto each of its surfaces.

According to a further feature of the invention, the supplementary softening solution consists of an aqueous emulsion of fatty acid amides and cationic fatty acid ester derivatives.

It has been possible to prove that the use of a supplementary softening solution of this type permits the manufacture of products which are warmly welcomed by consumers.

According to a further characteristic of the invention, during the supplementary surface softening treatment, the sheet is directed substantially vertically by means of the guide rollers and allowed to pass, at right angles, two essentially horizontal banks of spraying devices which are located, respectively, opposite one of its faces and each of which extends over the whole of its width.

Each of the banks of spraying devices may, according to the invention, advantageously consist of a series of cupels with a substantially vertical axis, mounted side-by-side, turning very rapidly about themselves about this axis and supplied with a supplementary softening solution at their lower end which is opposite the sheet.

According to this configuration, during the rotation of the cupels, the surplus of water which has been introduced "splinters" into fine droplets before being sprayed onto the two surfaces of the sheet in translation. In addition to its simplicity, and the easy nature thereof, a spraying device of this type has the advantage of not being at risk of blocking.

The invention likewise relates to pieces of any shape and, in particular, to round pads of cotton produced by cutting a sheet which is obtained using the above-mentioned method.

Pieces of this type can be distinguished in particular by the softness and velvetiness thereof, and by the strength thereof in both the longitudinal and the transverse directions.

The features of the method and the products which are the object of this invention are described in more detail below with reference to the attached drawings. In the drawings:

- Figures 1a and 1b show a block diagram of the method according to the invention;
- Figure 2 is a front view of the supplementary softening processing station; and
- Figure 3 is a top view of this same station.

As is shown in Figure 1a, the raw cotton used in this method is conducted in the direction of the arrow I to a first station A in which it is subjected to conventional preliminary beating and opening-up operations. On leaving this first station A, cotton flock, which is opened up and physically clean, is obtained, which flock is conducted in the direction of the arrow II to a second station B for forming the sheet, consisting of perforated cylinders at the interior of which a certain sub-pressure prevails. These cylinders, which are not shown in detail in the Figures, attract the fibres under the effect of their empty interior.

On leaving the second station B, there is obtained a sheet of cotton which is approximately uniform and which is displaced in translation in the direction of the arrow III and which has a fluffy appearance and has almost no cohesion.

This sheet, which has a thickness of the order of 8 cm, is subsequently brought to a wetting station C consisting of an impregnating and pretreatment bath containing, for example, a solution composed of weak acid and sequestering and wetting agents.

On leaving the impregnating bath, the sheet III is transformed into a sheet IV, the thickness of which is not more than approximately 1.5 mm and which is thus greatly compressed. This sheet, which has a certain strength as a consequence of the presence of connections between the fibres acquired under the effect of contact with the treatment liquid of the station C, is subsequently dried between the calender rollers D. On leaving these rollers, there is obtained a sheet V which is still very damp in view of the fact that it has a rate of removal of approximately 130%.

The sheet V is subsequently transferred to a hydraulic pretreatment station E where the entire width thereof is passed at right angles to banks of spraying devices, which are not shown in detail in the Figure, in such a manner as to permit the heavily mineralised treatment liquid from the impregnating bath C which impregnates the sheet, to be replaced by suitable soft water.

The banks of spraying devices equipping the station E comprise, in series, nozzles which are provided with apertures which are very fine and very close; each bank consequently sending, through the sheet, a series of pressurised jets which permit, in addition to the above-mentioned rinsing, a preadhesion of the sheet to be obtained by the effect of the fluid.

The sheet VI which has been rinsed and preadhered in this manner leaves the hydraulic pretreatment station E and is subsequently wound in a spool F on a perforated hollow cylinder 1.

Each spool F, which comprises a length of the cotton sheet VI which may be in excess of 1 km, is subsequently transferred into an autoclave associated with a closed circuit for the circulation of processing fluid, as described and shown in the document FR-2 552 120.

In this autoclave, which will not be described in further detail in the remainder of the this disclosure, the spool F is subjected, in a first step, to a scalding and bleaching treatment in a single stage by means of a mixture of soda and hydrogen peroxide; it is subsequently rinsed before being treated using a softening solution containing fatty acid esters. The acid nature of the treatment bath C and the use of the hydraulic pretreatment phase E permit the total treatment time in the autoclave, which was initially of the order of 5 hours, to be reduced to a duration of from 3 hours to 3 hours 30.

As is shown in Figure 1b, the sheet VII leaving the autoclave is subsequently unwound and transferred to a station at which it is wrung out by suction.

The sheet VII which has been wrung out in this manner is subsequently transferred to a supplementary softening treating station H which will be described in more detail hereinbelow, and then to a drying station I and, finally, to a cutting station J where it is cut into round pads with a diameter of the order of 6 cm.

As shown in Figure 2, the supplementary softening treating station is provided with two guide rollers 2, 2' which are capable of deflecting the cotton sheet VIII which is displaced substantially horizontally through this station, in such a manner that it passes over a section K in which it is directed substantially vertically.

The station H is likewise provided with two substantially vertical banks of spraying devices 3, 3' which are located, respectively, either side of the guide rollers 2 and 2' and which the cotton sheet passes at right angles during the displacement thereof over the vertical section K. Each of the vertical banks of spraying devices 3, 3' is intended to treat one of the surfaces of the sheet.

As is shown in Figures 2 and 3, the vertical banks of spraying devices 3, 3' each extend over the entire width e of the sheet VIII and are each comprised of a series of cupels 4 have an axis X-X' which is substantially vertical and are mounted side-by-side in the immediate vicinity of one another and rotating very rapidly about themselves in the direction of the arrows c about their axis X-X'. It is understood that the number of three cuples which is shown in Figure 3 has only been selected with the object of clarity, and the number of cupels of each bank is, in fact, clearly greater.

Each of the cupels 4 is supplied in the direction of the arrows b with a softening liquid containing an aqueous emulsion of fatty acid amides and derivatives of cationic fatty acid esters, at the end thereof which is remote from the sheet. During rotation of the cupels 4 in the direction of the arrows 3, the surplus of the liquid splinters into fine droplets which are sprayed in the direction of the arrows c onto each surface of the sheet VIII to permit a softening of the surface thereof.

Claims

1. Method for producing a sheet of cotton wool from raw cotton fibres, in which the raw cotton is subjected, successively, to conventional preliminary beating and opening-up operations, in particular on combs, in such a manner as to obtain cotton flock which is opened up and physically cleaned, these fibres are conducted to perforated cylinders or belts on which they are deposited in an approximately uniform manner to form a fluffy sheet having almost no cohesion, each sheet is brought to a wetting liquor containing hot water and a wetting agent in such a manner as to obtain a sheet which is more compact and has a certain strength owing to physical cohesion, and is then removed from the wetting liquor, this sheet is dried between two calender rollers and wound onto a perforated hollow cylinder in such a manner as to obtain a spool, this spool is put into an autoclave, where it is subjected to scalding and bleaching operations by circulating the treatment fluids radially through the coils thereof in such a manner as to increase the cohesion of the sheet which is obtained after unwinding by the effect of the fluid, the spool is then removed from the autoclave and wrung out and dried in a manner known per se, the method being characterised in bleaching operations are performed in a single stage by circulating a mixture of soda and hydrogen peroxide in the autoclave.

4. Method according to Claim 3, characterised in that when the scalding and bleaching operations are completed, there is circulated in the autoclave a rinsing liquid, and then a softening solution known per se, containing, in particular, fatty acid esters, in order to increase the softness and the suppleness of the sheet which is obtained after unwinding.

5. Method according to any one of Claims 1 to 4, characterised in that, before drying, the wrung out sheet, having first been treated in the autoclave, is subjected to a supplementary surface softening treatment by spraying, in fine droplets, a supplementary softening solution onto each of the surfaces thereof.

6. Method according to Claim 5, characterised in that the supplementary softening solution consists of an aqueous emulsion of fatty acid amides and the derivatives of a cationic fatty acid esters.

7. Method according to either one of Claims 5 or 6, characterised in that, during the preliminary supplementary softening treatment, the sheet is directed substantially vertically, by means of guide rollers, and is passed at right angles to two banks of spraying devices which are substantially horizontal and are situated, respectively, opposite one of the surfaces thereof, and each of which extends over the entire width thereof.

8. Method according to Claim 7, characterised in that each of the banks of spraying devices is comprised of a series of cupels with a substantially vertical axis, mounted side-by-side, rotating very rapidly about themselves about this axis, and supplied with a supplementary softening solution at the end thereof which is opposite the sheet.

9. Piece of cotton of any shape, and in particular round pads, characterised in that it is shaped by cutting a sheet obtained the method according to any one of Claims 1 to 8.

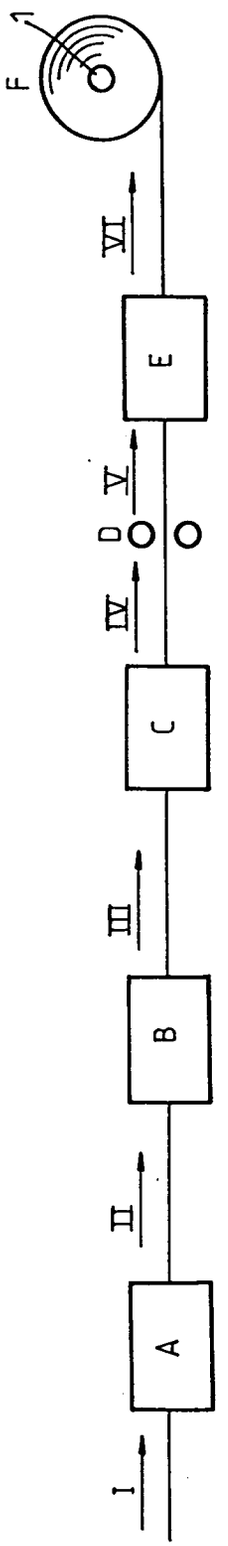

FIG.1a

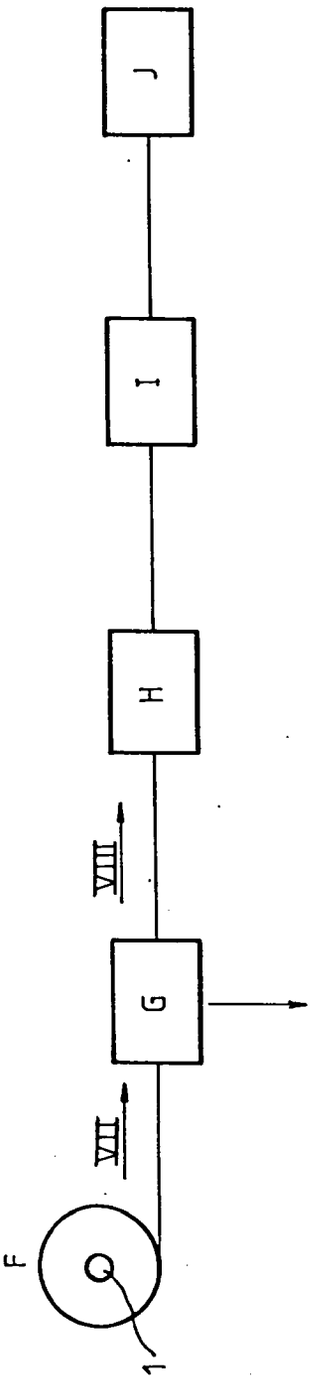

FIG.1b

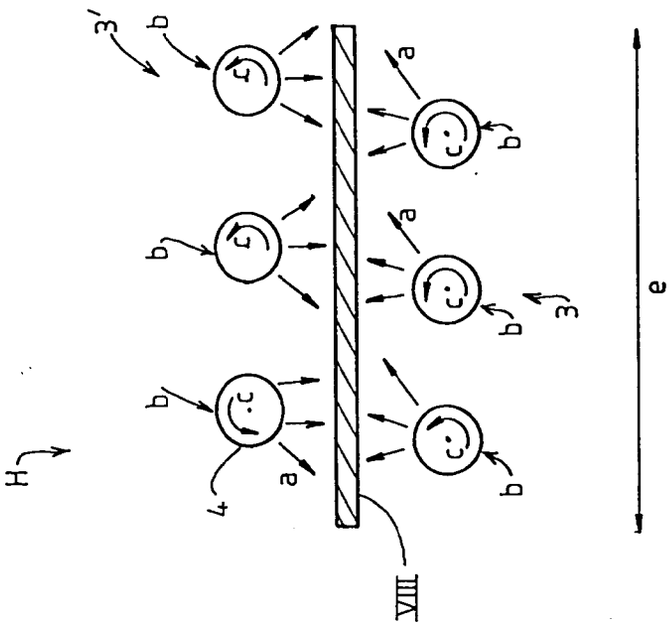

FIG.2

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 40 0676

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	FR-A-2 552 120 (TEMPO SANYS) * claims 1,7 * ---	1,9	D04H1/44 D06L1/12 D06B1/02
A	TEXTILVEREDLUNG, vol.29, no.5, May 1994, WEINFELDEN CH pages 117 - 127 H.BEHNKE 'Der Entmineralisierungsprozess' -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
D04H D06L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 December 1995	Goodall, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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