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(54) Title: MOISTURE-MANAGEMENT IN HYDROPHILIC FIBERS

(57) Abstract: A nano technology process for the manufacture of a fabric that comprises fibers, such as man-made fibers, cotton fibers or cellulose fibers, which are essentially hydrophilic, with improved moisture-management performance, in which the fibers are individually encapsulated with a nano chemistry water-repellant surface.

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MOISTURE-MANAGEMENT IN HYDROPHILIC FIBERS

Field of the Invention

The present invention relates to a process for imparting to hydrophilic fibers less absorbing of moisture properties, and improved moisture-management in yarns and fabrics thereof. More specifically, the present invention relates to cotton or man-made cotton or cellulose fibers within yarns or fabric constructions, where their moisture transmission throughout is improved.

Background of the Invention

Moisture-management rapidly accumulates increased interest in high-tech textile industry as an important factor in recreational as well as customary garments and apparels. The need for fast drying type fabrics, especially for athletic purposes, has so far been satisfied with the use of synthetic hydrophobic materials that do not absorb moisture. However, the ability to control perspiration absorption, transport, and evaporation off skin tissue through apparels, made of natural hydrophilic materials, especially ones as cotton, to the atmosphere enables their use in areas traditionally governed by the synthetic fabrics.

Moisture-management is defined in the Journal of Textile and Apparel, Technology and Management, Vol. 2, Issue 3, Summer 2002, as "the controlled movement of water vapor and liquid water (perspiration) from

the surface of the skin to the atmosphere through the fabric". Although mostly referred to perspiration, this term may be more broadly related to release of liquid, secreted from different body organs through skin tissue, and its subsequent transport and removal.

Cotton fabrics are well known to impart a more pleasant feeling upon contact with skin tissue, and are mostly preferred due to either their natural origin or other superior qualities over synthetic fibers. However, being essentially of hydrophilic nature, they are known to absorb liquids secreted through skin tissue, and release them only too slowly into the atmosphere, especially when a wearer is being engaged with excessive physical activity. These features produce a heavy apparel when wet, which imparts an uncomfortable wet and sticky sensation to the wearer. Additional effects are the limiting of one's motion, and induction of a cold feeling during recess.

Several approaches are known to date in processing hydrophilic fabrics, e.g., cotton, into fast drying type. Drying rate of cotton fabrics with reduced thickness turned to be equal to that of polyester fabrics. Other solutions employed the use of blends of cotton and synthetic fibers, e.g., cotton/polyester, cotton/nylon, or cotton/polypropylene, hydrophobic backing layers as silicone, or waxes on the fabric side, which is close to the skin, or scouring, bleaching, and finishing of 100% cotton fabrics (for the last approach see, Moisture Management: Myths, Magic and

Misconceptions, William A Rearick, Vikki B. Martin, and Michele L. Wallace, Cotton Incorporated, Cary, NC).

Moisture-management in hydrophilic fabrics is translated into a wicking process of the liquid absorbed, in which a spontaneous transport of the liquid is driven through pores and spaces in the fabric by capillary forces. The surface tension of the liquid causes a pressure difference across the curved liquid-air (vapor) giving a liquid movement. Wicking is also affected by the morphology of the fiber surface, and may be affected by the shape of the fibers. The rate of wicking is affected by the size and geometry of the capillary spaces between fibers. Therefore, wicking can be improved by changing the fiber surface by absorption of surfactant.

Although the aforementioned detailed reference relates mostly to cotton, the inventive concept of the present invention applies equally to other raw materials, from which man-made fibers, yarns, and various types of fabrics, garments, and apparels may be produced. Cotton and cellulose, the latter also having hydrophilic tendency and good water absorption similar to that of cotton, are good examples of raw materials from which moisture-management improved man-made fibers may be produced. Such man-made fibers are, therefore, good potential candidates for the fabrication of improved moisture-management textile products according to the teaching of the present invention, while sustaining their other virtues essentially unaffected. In its broader scope, the present invention,

therefore, relates also to man-made yarns and fabrics and end-uses thereof, which are made of essentially hydrophilic materials, and which are of improved moisture-management qualities according to the teaching of the present invention.

It is therefore an object of the present invention to provide a process for the manufacture of yarns and fabrics with improved moisture-management performance.

Still another object of the present invention is to provide a process for the manufacture of fabrics possessing improved performance of moisture-absorption, moisture-transportation, and moisture-evaporation.

Still another object of the present invention is to provide a process for the manufacture of fabrics with improved wicking effect.

Still another object of the present invention is to provide a process for the manufacture of modified encapsulated fibers within a fabric.

Still another object of the present invention is to provide a nano technology process for the manufacture of silicone-encapsulated fibers in a fabric, where the silicone encapsulation is of particulate form of nano-scale size, and therefore the encapsulation being applied include nano chemistry process.

In still another object of the present invention the fabrics and fibers thus manufactured are of surface area and morphology that while being silicon-encapsulated improved, their moisture-management and wicking are improved.

Still another object of the present invention is to provide silicon-encapsulated fibers in a fabric, where the encapsulation includes a nano technology chemistry.

Still another object of the present invention is to provide fabrics comprising silicone-encapsulated fibers.

In still another object of the present invention the fabrics comprising silicone-encapsulated fibers for moisture-management improvement comprise woven, non-woven, textured, or knitted forms.

Still another object of the present invention is to provide garment and textile articles comprising silicone-encapsulated fibers imparting more comfortable sensation upon use, and improved moisture-management, wicking, transportation, and evaporation.

In still another aspect of the present invention the fibers, yarns, fabrics, and end-uses textiles thereof, are essentially made of hydrophilic

materials, which are good water absorbents. Particularly, the fibers, yarns, and fabrics of the present invention are either cotton or man-made cotton or cellulose fibers, yarns and fabrics, respectively.

In one preferred embodiment, the present invention provides a process for the manufacture of silicon-encapsulated cotton yarns and fabrics with improved moisture-management performance, the moisture-management being expressed in moisture-absorption, moisture-transportation , i.e., wicking, and moisture-evaporation.

In a second preferred embodiment, the present invention provides a process for the manufacture of silicone-encapsulated man-made cotton or cellulose yarns and fabrics with improved moisture-management performance, the moisture-management being expressed in moisture-absorption, moisture-transportation, i.e., wicking, and moisture-evaporation.

Summary of the Invention

The present invention provides the benefits of both a fabric comprising modified textile fibers, imparting a pleasant sensation upon contact with skin tissue, and improved moisture-management performance, essentially alleviating uncomfortable perspiration and heat off the skin.

Moisture- or water- management in hydrophilic yarns and fabrics, especially in hydrophilic cotton or man-made cotton or cellulose yarns and fabrics, is achieved through wicking of excessive moisture through the fibers themselves and through pores in between them. Wicking in hydrophobic silicone-encapsulated fibers is carried-out through capillaries formed between individually encapsulated fibers. That is, each fiber is encapsulated with a moisture-repellant material, the fibers are tightly bound together, and wicking does not take place through the fibers themselves. Especially, treatment of either cotton or man-made fibers with silicone, which is a hydrophobic material, and silicone encapsulation is therefore of double purpose; preventing penetration of moisture inside the fibers themselves, for example during body perspiration, or in any other form of secretion of water, aqueous solutions, suspensions, dispersions and the like at the same time ensuring moisture-transportation and evaporation through capillary wicking in between the fibers.

Furthermore, a commonly known drawback in most contemporary improved fabrics in this field is the gradual, continuous deterioration in

moisture-management during use, and especially after repeated washings. Contrary to that, the process of the present invention, and the fibers, and fabrics thereof, offer at least sustaining moisture-management performance level during use, and in most cases even its improvement, especially after repeated washings. The latter phenomenon results due to washing-off of extra silicone particles inhabiting the inter-fiber capillaries, thus opening them, and allowing better breath ability, and wicking of moisture absorbed. This fact sets an important advantage of the process of the present invention over other processes for the manufacture of fibers and fabrics thereof known in this field, demonstrating a more resilient, life-extended fiber, fabrics, textile, and garment articles comprising it.

In accordance with the nano technology process of the present invention, encapsulation treatment of the fibers is carried-out with water-repellant nano chemistry silicone. Preferably, this encapsulation is conducted essentially by bringing each individual fiber in contact with silicone nano-particles, also termed nano-silicone. Preferably, this contact takes place by immersing the fibers in particulate silicone suspension, thus ensuring maximal silicone coverage of each fiber surface area. Since silicone is a hydrophobic material, moisture penetration into the cotton fibers is thus prevented, while capillary wicking process takes over in moisture transportation off the skin, the concurrent evaporation, and as a result a cool and comfortable feeling.

A preferable feature of the fibers, aiding in the wicking process, is their surface morphology. As is demonstrated in Figure 1, the cotton fibers employed, may be of an alternating concave/convex and flattened shape. The fibers morphology may be alternatively described as that of bean shape, where the fibers take a slightly flat and twisted shape. Such morphology forms multiple conduits, in which moisture-air surface tension increases, vertical capillarity of moisture is enhanced, and as a result wicking process is accelerated.

Fabrics, textiles, apparels, and garments of the present invention may further comprise other types of fibers in combination with the modified cotton or man-made cotton or cellulose fibers. In one embodiment of the present invention the fabrics comprise cotton fibers, which are incorporated with Lycra in a volume ratio of 1:10.

All the above and the characteristics and advantages of the invention will be further explained through the following illustrative and non-limitative examples.

Examples and Test Results

Wicking tests of untreated and treated cotton fabrics have been conducted under two standard test methods, i.e., Drop Test, and Vertical Wicking, the latter being according to both M&S (Marks and Spencer) and Nike standard test.

The results, presented in the following Tables, refer either to time-dependent advance of moisture in the capillary channels of a cotton fabric, in accordance with the Vertical Wicking test method, or to time-dependent area coverage advance of the moisture in the fabric, measured close to starting and advanced time points, in accordance with the test method of Drop Test. The Drop Test also includes percentage measurements of moisture evaporation at a pre-determined time-point.

In both tests, the fabrics were further tested for sustaining wicking performance level after repeated washes. It should be mentioned in this regard, that although it is common practice to test fabrics up to between 10 and 20 wash rounds, the tests of the fabrics of the present invention continued further to up to 30 wash rounds. Another point is that each wash round included 30 cycles at 40^0C, Tumble Dry, that is, the fabrics were washed and dried repeatedly.

Absorbency test were conducted in accordance with Nike absorbency test method and standard, and were aimed at measuring the susceptibility of

the fabric to take in and retain a liquid (usually water) within the pores and construction of the fabric. Absorbency rate of a drop was measured in five different areas, and in both front and back surfaces of the fabric. The minimal time period required for determining absorbency in fabrics was set to 30 seconds.

Analysis of the results is provided in accordance with the following Tables I-VI.

Fabrics made essentially of cotton fibers or cotton/Lycra combinations with known relations, were tested for moisture-management before and after treatment. Table I herein summarizes time-dependent results obtained for pre-treated fabrics under Nike standard test. According to this standard, the advance of moisture through the fabric essentially measures wicking; this is done by the vertical test at the fabric length 'L' and the fabric width 'W'. As is noted in the caption below, a time-dependent distance of 15 cm in maximal 30 minutes time interval is a minimal requirement for quality assurance.

Table I - FABRIC SAMPLES BEFORE TREATMENT

VERTICAL WICKING
NIKE PF3-2001

	WICKING						WICKING								
	BEFOR WASH			AFTER 1 WASH			AFTER 5 WASHES			AFTER 20 WASHES			AFTER 30 WASHES		
	TIME	L	W	TIME	L	W	TIME	L	W	TIME	L	W	TIME	L	W
	min.	cm	cm	min.	cm	cm	min.	cm	cm	min.	cm	cm	min.	cm	cm
5276	3	8	7	3	9	6.5	3	10.5	7.5	3	10	7	3	10	7
100%COTTON 40/1	22	15		17	15		11	15		11	15		11.5	15	
RIB	30		12.5	30		13	30		13.5	30		14	30		14
7017	3	8	8	3	7.5	7.5	3	8.5	9	3	7.5	8.5	3	7.5	8.5
1%PIMA 80/1 / 9%LYCRA	26	15		22	15		21	15	15	18	15	15	18	15	15
SINGLE	27		15	23		15									
7625	3	7.5	7.5	3	6.5	7.5	3	8	8.5	3	8	8	3	8	8.5
92%COTTON 30/1 / 8%LYCRA	24		15	22		15	20	15	15	19	15	15	19	15	
SINGLE	26	15		25	15								20		15
6719	3	8	8	3	8	8	3	8.5	8.5	3	9	8.5	3	9	8.5
95%COTTON 40/1 / 8%LYCRA	22	15		22	15		19	15	15	17	15	15	18	15	
SINGLE	30		15	26		15							19		15
7481	3	7	8	3	8	8	3	8.5	8.5	3	8	9	3	8	8.5
92%PIMA 50/1 / 8%LYCRA	23		15	22	15	15	19	15		16	15		16	15	
SINGLE	24	15					20		15	18		15	18		15

WICKING
STANDARD:
MINIMUM 15cm. IN
MAXIMUM 30 min

Table II - FABRIC SAMPLES AFTER TREATMENT

VERTICAL WICKING NIKE PF3-2001

	WICKING						WICKING								
	BEFOR WASH			AFTER 1 WASH			AFTER 5 WASHES			AFTER 20 WASHES			AFTER 30 WASHES		
	TIME	L	W	TIME	L	W	TIME	L	W	TIME	L	W	TIME	L	W
	min.	cm	cm	min.	cm	cm	min.	cm	cm	min.	cm	cm	min.	cm	cm
5276	3	8.5	6.5	3	8.5	7	3	9.5	7	3	10	7	3	10	7.5
100%COTTON 40/1	24	15		18	15		14	15		12	15		10	15	
RIB	30		12.5	30		13	30		13.5	30		14	30		15
7017	3	8	8	3	7.5	8	3	7.5	8	3	8.5	8.5	3	8	8.5
91%PIMA 80/1 / 9%LYCRA	22	15		24		15	22	15	15	18	15	15	17	15	15
SINGLE	26		15	25	15										
7625	3	7.5	8	3	7	7.5	3	8	8	3	7.5	8	3	8	8
92%COTTON 30/1 / 8%LYCRA	23		15	21		15	19		15	20		15	18		15
SINGLE	25	15		23	15		22	15		21	15		19	15	
6719	3	7.5	7.5	3	8.5	8	3	9	8.5	3	9	8.5	3	9	8.5
95%COTTON 40/1 / 8%LYCRA	26	15		21	15		19	15		16	15		15	15	
SINGLE	30		12	29		15	25		15	18		15	17		15
7481	3	8	7.5	3	7.5	7.5	3	8	7.5	3	8	8.5	3	8	8.5
92%PIMA 50/1 / 8%LYCRA	27	15		23	15		20	15	15	17		15	18	15	15
SINGLE	29		15	25		15				18	15				

WICKING
STANDARD:
MINIMUM 15cm. IN
MAXIMUM 30 min

The results obtained were further compared to those of treated fabrics comprising silicone-encapsulated cotton fibers or silicone-encapsulated cotton/Lycra fiber combinations.

It is clear from Table I, that all pre-treated fabrics pass the wicking test, and are not affected by repeated washing. Successful wicking, as the results in Table II demonstrate, is observed also in the treated fabrics, in most cases accompanied by an exceptional improvement with increasing wash rounds, contrary to ordinary decrease in performance.

Wicking test was also conducted under Drop Test standard, and moisture evaporation test as well. Same fabrics that were tested for wicking as shown in Tables I and II, were tested here, only according to this standard the area coverage of moisture in the fabrics was measured at close to starting and end time points. Evaporation was measured at a time point of 10 minutes after moisture-absorbance, and relative to the wet fabric weight. The minimum requirements for successfully passing this test were between 600 to 1000 mm^2 area coverage, and between 20% and 40% relative evaporation. The results are summarized in Tables III and IV below.

WICKING & EVAPORATION DROP TEST

Table III -FABRIC SAMPLES BEFORE TREATMENT

M&S TEST P 136 A

SAMPLE	BEFORE WASH			AFTER 1 WASHES			AFTER 5 WASHES			AFTER 20 WASHES			AFTER 30 WASHES		
	WICKING AREA (sq.mm)		EVAPOR. %	WICKING AREA (sq.mm)		EVAPOR. %	WICKING AREA (sq.mm)		EVAPOR. %	WICKING AREA (sq.mm)		EVAPOR. %	WICKING AREA (sq.mm)		EVAPOR. %
	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.
5276	844	981	**12.5**	777	922	**20**	828	959	**22.2**	740	939	**20**	829	1060	**11.11**
7017	1014	1255	**10**	1036	1094	**20**	1014	1193	**20**	895	1154	**20**	1005	1154	**11.11**
7625	592	683	**10**	550	769	**11.1**	636	777	**20**	637	754	**20**	653	824	**11.1**
6719	888	1080	**22.2**	699	955	**12.5**	776	973	**22.2**	857	989	**20**	769	980	**11.11**
7481	801	879	**11.1**	632	929	**20**	824	964	**18.2**	813	949	**22.2**	622	925	**22.2**

Table IV- WICKING & EVAPORATION DROP TEST

FABRIC SAMPLES AFTER TREATMENT
M&S TEST p-136A

SAMPLE	BEFORE WASH			AFTER 1 WASHES			AFTER 5 WASHES			AFTER 20 WASHES			AFTER 30 WASHES		
	WICKING AREA (sq. mm)		EVAPOR. %	WICKING AREA (sq. mm)		EVAPOR.	WICKING %		EVAPOR. AREA (sq. mm)	WICKING		EVAPOR. %	WICKING AREA (sq. mm)		EVAPOR. %
	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.	1min.	10min.	10min.
5276	1017	1248	20	722	903	22.2	1060	1295	25	776	1017	22.2	758	980	30
7017	883	1181	22.2	852	984	22.2	955	1126	22.2	1071	1133	22.2	949	1121	25
7625	751	854	20	593	777	22.2	628	751	20	678	774	30	653	728	25
6719	848	1022	20	741	1005	18.2	813	955	22.2	791	949	20	769	955	22.2
7481	746	1005	22.2	871	955	20	842	954	22.2	895	1041	20	871	942	25

STANDARD
M&S
EVAPORATION: 20% - 40%
WICKING : 600-1000 sq. mm

Table III demonstrates that all pre-treated fabrics pass successfully the wicking test, while essentially and mostly do not comply with the minimum sufficient level of evaporation. In contrast, the same type of fabrics comprising silicone-encapsulated cotton fibers or combinations of silicone-encapsulated cotton fibers/Lycra pass successfully both wicking and evaporation tests. The exceptional successful and even improved results of both wicking and evaporation tests are repeated under this standard as well. It is therefore straightforwardly concluded that this phenomenon is inherent to those fabrics that comprise silicone-encapsulated cotton fibers.

It should also be noted that the combination of both good wicking and good evaporation performances results in the desired goal of the present invention, as well as the one in the field of fast-drying type hi-tech fabrics. That is, fabrics that comprise silicone-encapsulated cotton fibers in accordance with the teaching of the present invention, provide both moisture-absorbance and fast moisture-transport and moisture-release.

Absorbency tests were conducted to assure the minimum requirement for standard moisture-absorption rate, substantially being set to minimum time interval of 30 seconds. Tables V and VI herein, present the pre-treated and treated fabrics, respectively. As can be clearly seen, silicone-

encapsulation does not negatively affect the susceptibility to moisture of the fabrics.

In summary, according to the results presented hereinabove, the novel fabrics of the present invention essentially and substantially demonstrate excellent moisture-management performance, which is also durable with time and repeated use. The fabrics of the present invention are, therefore, excellent materials for various garment and textile applications, and for various daily, regular, recreational, or many other applications.

While examples of the invention have been described for purposes of illustration, it will be apparent that persons skilled in the art can carry out many modifications, variations and adaptations, without exceeding the scope of the claims.

ABSORBENCY
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Table V - FABRIC SAMPLES BEFORE TREATMENT

FABRIC	ABSORBENCY									
	BEFORE WASH		AFTER WASH		AFTER 5 WASHES		AFTER 20 WASHES		AFTER 30 WASHES	
	Right	Link	Right	Link	Right	Link	Right	Link	Right	Link
	sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
5276										
100%COTTON 40/1	1	1	1	1	1	1	1	1	1	1
RIB										
7017										
91%PIMA 80/1 / 9%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										
7625										
92%COTTON 30/1 / 8%LYCRA	2	2	2	2	1	1	1	1	1	1
SINGLE										
6719										
95%COTTON 40/1 / 8%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										
7481										
92%PIMA 50/1 / 8%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										

ABSORBENCY
STANDARD:
MAXIMUM 30sec

ABSORBENCY

AATCC 79

Table VI - FABRIC SAMPLES AFTER TREATMENT

FABRIC	ABSORBENCY									
	BEFOR WASH		AFTER WASH		AFTER 5 WASHES		AFTER 20 WASHES		AFTER 30 WASHES	
	Right	Link	Right	Link	Right	Link	Right	Link	Right	Link
	sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
5276										
100%COTTON 40/1	1	1	1	1	1	1	1	1	1	1
RIB										
7017										
91%PIMA 80/1 / 9%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										
7625										
92%COTTON 30/1 / 8%LYCRA	2	2	2	2	1	1	1	1	1	1
SINGLE										
6719										
95%COTTON 40/1 / 8%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										
7481										
92%PIMA 50/1 / 8%LYCRA	1	1	1	1	1	1	1	1	1	1
SINGLE										

ABSORBENCY
STANDARD:
MAXIMUM 30sec

CLAIMS

1. A nano technology process for the manufacture of a fabric comprising fibers, said fibers being essentially hydrophilic, with improved moisture-management performance, said process comprising the step of individually encapsulating said fibers with a nano chemistry water-repellant surface.

2. The process of claim 1, wherein said fibers are cotton fibers.

3. The process of claim 1, wherein said fibers are man-made fibers, preferably cotton fibers or cellulose fibers.

4. The process of claim 1, wherein said encapsulating of said fibers with said water-repellant surface essentially imparts superior moisture-management performance to said fabric.

5. The process of claim 1, wherein said water-repellant surface is a particulate silicone surface, wherein the particles of said silicone surface are of nano-scale size.

6. The process of claim 1, wherein said encapsulation is carried-out by essentially immersing said fibers in particulate silicone suspension, said suspension comprising silicone particles in nano-scale size.

7. The process of claim 1, wherein the cross section of said fibers are of bean shape, said cotton fibers being in slightly flat and twisted shape.

8. The process of claim 1, wherein the encapsulated cotton fibers are further tightly bound to form a fabric, said fabric comprising open channels between said fibers.

9. The process of claim 8, wherein the improved moisture-management performance is essentially conducted by wicking of moisture through said open channels.

10. The process of claim 1, wherein said fabric further comprising synthetic fibers in pre-determined amount.

11. The process of claim 10, wherein said synthetic fiber is Lycra.

12. The process of claim 1, wherein said fabric further comprises washing additives, bleaching additives, dying finishing additives, colorants, finishing additives.

13. A fabric with improved moisture-management performance, said fabric comprising fibers encapsulated with water-repellant surface, said fibers being essentially hydrophilic.

14. The fabric of claim 13, wherein said fibers are cotton fibers.

15. The fabric of claim 13, wherein said fibers are man-made fibers, preferably said man-made fibers are cotton or cellulose fibers.

16. The fabric of claim 13 - 15, wherein said encapsulated water-repellant surface essentially imparts superior moisture-management performance to said fabric.

17. The fabric of claim 16, wherein said moisture-management performance essentially translated into wicking of said moisture, said wicking essentially being carried-out through inter-fiber channels in said fabric.

18. The fabric of claim 13, wherein said water-repellant surface is a particulate silicone surface, wherein the particles of said silicone surface are of nano-scale size.

19. The fabric of claim 11, wherein the cross section of said fibers is of bean shape, said fibers being in slightly flat and twisted shape.

20. The fabric of claim 13, further comprising synthetic fibers in pre-determined amount.

21. The fabric of claim 20, wherein said synthetic fiber is Lycra.

22. A textile article comprising a fabric of any of claims 13 to 21.

23. The textile article of claim 22, essentially having superior moisture-management performance.

24. The textile article of claim 23, wherein said article is any of apparel, garment, or clothing.

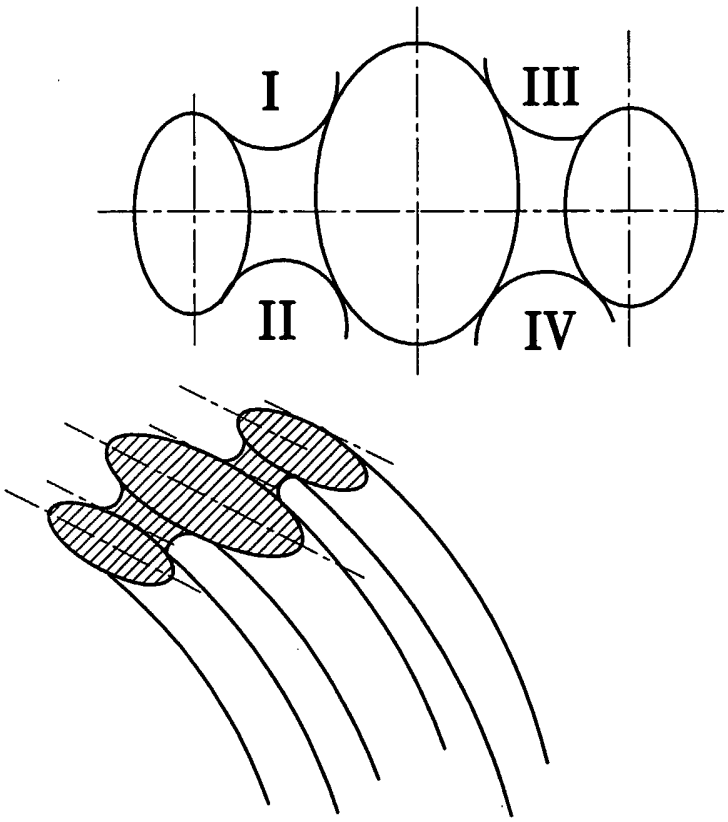

Fig. 1

INTERNATIONAL SEARCH REPORT

ational application No
.../IL2005/001153

A. CLASSIFICATION OF SUBJECT MATTER
D06M23/08 D06M15/643 D06M11/79

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 February 2006	07/03/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Koegler-Hoffmann, S

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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