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Chaussettes

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Description

TECHNICAL FIELD

[0001] The innovation covers the field of legwear, more particularly the technical sock category used by athletes and people living active lifestyles.

BACKGROUND

[0002] A sock is a type of clothing used to cover a wearer's feet with the aim of providing comfort inside shoes. This comfort can be provided by way of a softer cushioned feel, by removal of sweat, and/or by providing warmth in colder environments.

[0003] Sweat is a natural way to facilitate cooling of body temperature, since evaporation of sweat is an endothermic (i.e., heat absorbing) process. During exercise, body temperature rises, and may result in excessive sweating. Sweat must be evaporated to cause endothermic cooling of a body. Since this evaporation is an integral part of sweat cooling, it may be desirable for clothing articles to have the ability to transfer moisture through them in order to promote evaporation of sweat.

[0004] As compared with other clothing articles, socks contend with more difficult conditions, since socks are tightly fitted against a wearer's skin and are typically covered with shoes having limited breathability. Such conditions result in less evaporation and prolonged wetness, which in turn result in increased friction against the wearer's skin - giving rise to blisters as well as bacteria growth, bad odor, and other disorders.

[0005] There exist specialized synthetic fiber socks which quickly spread the moisture all across the sock fabric, working on the principle of increasing the surface area of moistened fabric to increase the evaporation. This principle of increasing moistened fabric area performs reasonably well in garments where the fabric is in direct interaction with the atmosphere, but the reduced atmospheric interaction specific to the context of socks tends to limit the effectiveness of conventional moisture-spreading fabrics when applied to socks. The special cross-section design of these synthetic fibers enables the fabric made with them to hold greater amounts of moisture, but this moisture is evenly spread throughout (i.e., along the inner side as well as outer side), resulting in a condition similar to that of a natural fiber fabric, wherein once sweating begins, a wearer's skin remain in contact with wet fabric until the fabric is completely dried after evaporation.

[0006] US 5319807 A discloses a sock which has a sole which provides a cushion effect due to the use of terry loops. The terry fabric is formed from body yarns which are preferably acrylic and nylon. Hydrophobic wicking yarns such as polyester or polypropylene are knitted together with the body yarn into common terry loops with the wicking yarn pleated to the inside, closest to the skin of the wearer.

[0007] US 4615188 A discloses a two-ply sock, i.e. a sock which is entirely formed from multi-layer material. The terry loops of the outer ply appear to be located facing outward, i.e. away from the skin of the wearer.

5 **[0008]** US 5708985 A discloses a sock which has, at a sole portion thereof, an outer surface of an outer layer knitted with a flat knit stitch and an inner surface provided with a number of longitudinally spaced ribs which extend substantially parallel to one another from the heel to the toe. The ribs are defined by an additional layer of moisture-wicking yarn which is knitted with terry loops extended from the inner surface of the outer layer inwardly.

10 **[0009]** US 3250095 A, on which the preamble portion of claim 1 is based, discloses a sock that is knitted on a circular knitting machine using hydrophobic yarns, hydrophilic yarns and elastic yarns throughout the foot and leg portion. The structure of the material is a rough terry or standard plating terry construction in which hydrophobic yarns form terry loops on the inside surface of the sock so that the inside surface of the sock is comprised of predominately hydrophobic yarns and the hydrophilic yarns are plated with the hydrophobic yarns so as to be positioned on the outside surface of the sock, so that the outside surface of the sock is comprised of predominately hydrophilic yarns. The elastic yarns are plied together with the hydrophilic yarns.

15 **[0010]** In view of the limited airflow inside a shoe, it would be desirable to provide a sock capable of keeping a wearer's skin isolated from wet fabric while exhibiting good wicking performance to expedite evaporation.

SUMMARY

20 **[0011]** The present invention accordingly provides a sock with the features of claim 1. Preferred embodiments are defined in the dependent claims.

25 **[0012]** With the constraint of low airflow in mind, socks according to various embodiments of the present invention include at least a sole portion thereof comprising a specialized layered fabric including a dual face or dual layer material (e.g., terry material) with a hydrophobic inner face (or layer) and a hydrophilic outer face (or layer). The sole portion of the sock corresponds to a sole portion of a wearer's foot having a maximum number of sweat glands and almost no airflow. The inner face (or layer) of the sock is arranged for placement in contact with skin of a wearer. With the inner face (or layer) being rich in hydrophobic fibers and the outer face (or layer) being rich in hydrophilic fibers, moisture is adsorbed from a wearer's skin by the hydrophobic fibers of the inner face (or layer) and is immediately absorbed by the absorbent outer face (or layer) where it is spread all over. This dual face or dual layer structure promotes transport of moisture to the side which is to interact with the atmosphere, thereby isolating skin from moist outer fabric. Skin covered with such a sock and additionally covered with a shoe may be maintained in a dry condition despite the constraint of reduced interaction of the sock with a sur-

rounding atmosphere. No matter how slow the evaporation process, socks according to embodiments of the present invention promote separation of wetness from the wearer's skin, thereby avoiding problems of excessive friction, blisters and discomfort associated with use of conventional socks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a perspective view of a sock according to one embodiment of the present invention, showing different constructions corresponding to different foot and ankle locations.

FIG. 2 is a top plan view showing the inner side of a slit-open sock according to the embodiment shown in FIG. 1.

FIG. 3 is a bottom plan view showing the outer side of a slit-open sock according to the embodiment shown in FIGS. 1-2.

FIG. 4A is a perspective schematic view showing a dual face terry material proximate to skin of a wearer, with an (upward-facing) inner face including loops (or pile) of hydrophobic yarn arranged to adsorb droplets of sweat for transport away from the skin.

FIG. 4B is a perspective view of the dual face terry material of FIG. 4A with an (upward-facing) outer face including hydrophilic yarn, and showing absorption of sweat by the outer face following transport of sweat to the outer face by the hydrophobic inner layer.

FIG. 5 is a table providing results of tests for vertical wicking and absorbency of a dual face terry material that may be used to fabricate at least a portion of a sock according to embodiments to the present invention.

FIG. 6 is a schematic stitch diagram for a dual face terry material of at least a portion of a sock according to embodiments of the present invention.

DETAILED DESCRIPTION

[0014] As noted previously, a sock according to the present invention may include a dual face or dual layer material (e.g., terry material) at at least a sole portion thereof, with the inner face or layer including a hydrophobic yarn, the outer face or layer including a hydrophilic yarn, and the inner face or layer being arranged for placement in contact with skin of a wearer. This construction essentially provides low absorbency fibers along the inner face (or layer) and high absorbency fibers along the

outer face (or layer). Such construction is designed to transport moisture away from skin of a wearer via absorption using the hydrophobic yarn of the inner face or layer, and to spread moisture within the outer face via absorption using the hydrophilic yarn of the outer face or layer, to permit evaporation of sweat from the outer face or layer to a surrounding environment.

[0015] Examples of hydrophobic yarns that may be used in constructing portions of a sock as described herein include, but are not limited to, polypropylene, polyester, acrylic, and blends of the foregoing materials. As will be recognized by one skilled in the art, other hydrophobic materials or combinations of materials may be used. Examples of hydrophilic yarns that may be used in constructing portions of a sock as described herein include, but are not limited to, wool, cotton, viscose, and blends of the foregoing materials. As will be recognized by one skilled in the art, other hydrophilic materials or combinations of materials may be used.

[0016] In certain embodiments, a sock as described herein includes plaiting of stretch hydrophobic yarn. Such plaiting may be provided in the dual face or dual layer material arranged in at least the sole portion of the sock. Such plaiting may be tailored to specific zones of a sock to provide desired level of stretch characteristics.

[0017] In certain embodiments, an inner face or inner layer of the dual face or dual layer material consists of 100% hydrophobic yarn. Such yarn may keep a wearer's skin dry and isolated while providing cushioning.

[0018] In certain embodiments, an outer face or outer layer of the dual face or dual layer material (or an outer face or outer layer of the entire sock) comprises hydrophilic yarn to transport sweat from the inner face or inner layer to the outer face or outer layer. Sweat is absorbed by the outer face or outer layer and spread around such face or layer by absorption to promote evaporation. In certain embodiments, the outer layer or outer face of the entire sock (not just the sole portion) comprises hydrophilic material to maximize evaporation of sweat to an ambient environment.

[0019] In certain embodiments, an inner side or inner layer of the dual face or dual layer material has minimal to no affinity for moisture or sweat. Such inner side or inner layer may have an absorbency test value of at least 30 seconds according to AATCC Test Method 79. Such test method measures a propensity of fabric to take up water, whereby a fabric sample is placed in an embroidery hoop with all creases removed, a burette dispenses a drop of water onto the surface of the fabric from a distance of 9.5 mm below the burette, and time is recorded until the water drop is complete absorbed into the fabric.

[0020] In certain embodiments, an outer face or outer layer of the dual face or dual layer material has great affinity for moisture or sweat. Such outer side or outer layer may have any absorbency test value of 5 seconds or less.

[0021] In certain embodiments, an outer face or outer layer of the dual face or dual layer material (which covers

the entirety of the sole portion, and in certain embodiments preferably covers the entire outer perimeter of a sock) exhibits excellent spread of moisture, with the outer face or outer layer being arranged to interact with an ambient atmosphere. Such outer face or outer layer may exhibit vertical wicking of at least 10 centimeters in 30 minutes. Vertical wicking tests (e.g., AATCC Test Method 197 or Consumer Testing Lab method CTL-FW-1 06) generally involve placement of suspension of vertically aligned fabric specimen with a cut edge in a container of liquid, (e.g., distilled water) and recordation of height of liquid that is absorbed for a specified time. Such tests are used to evaluate the ability of fabric to transport liquid along and/or through the fabric.

[0022] In certain embodiments, a sock as disclosed herein may have separate colors on inner and outer sides (or faces) thereof. In certain embodiments, an inner face (or layer) may include a first color, an outer face (or layer) may include a second color, and the first color differs from the second color. In certain embodiments, the provision of separate colors along inner and outer sides (or faces) of a sock may exclude heel and toe areas of the sock.

[0023] In certain embodiments, a sock may include a mesh or mesh channeled material portion arranged to be positioned along a top portion of a wearer's foot where conditions of less sweat and greater airflow may be experienced. Such mesh or mesh channeled material portion may include hydrophilic main yarn and stretch hydrophobic plaiting yarn.

[0024] In certain embodiments, a sock may include a plain knit fabric portion arranged to be positioned along a wearer's ankle. Such plain knit fabric portion may include hydrophilic main yarn and stretch hydrophobic plaiting yarn.

[0025] In certain embodiments, a sock may include a plain knit fabric portion arranged to be positioned along a wearer's ankle. Such plain knit fabric portion may include hydrophilic main yarn and stretch hydrophobic plaiting yarn.

[0026] In certain embodiments, a sock may include reverse plaited terry fabric portions arranged to be positioned along a wearer's heel and along a wearer's toes, and intended to provide increased (e.g. maximum) cushioning. Such reverse plaited terry fabric portions may include hydrophilic and/or hydrophobic main yarn and stretch hydrophobic plaiting yarn.

[0027] In certain embodiments, a sock may include simulated rib fabric portion arranged to be positioned at a top portion of the sock (e.g., above an ankle portion) for maximum grip along a wearer's leg. The simulated rib fabric portion may include hydrophilic main yarn, stretch hydrophobic plaiting, and laid-in elastic yarn.

[0028] In certain embodiments, at least a sole portion of a sock may include two thread terry fabric construction with dual faces or layers, having a hydrophobic inner pile, stretch hydrophobic plaiting, and hydrophilic main yarn in the outer layer or face.

[0029] In certain embodiments, at least a sole portion of a sock may include an inner pile (e.g., embodying an inner face or layer) comprising hydrophobic yarn, with stretch plaiting in the middle, and with an outer face or outer layer comprising hydrophobic yarn.

[0030] In certain embodiments, a hydrophobic inner face or inner layer portion is arranged to press against and contact a hydrophilic outer face or outer layer portion under application of elastic pressure and/or body weight of a wearer. Such contact causes adsorbed moisture on the hydrophobic inner face or inner layer portion to be absorbed by the hydrophilic outer face or outer layer, into which the moisture is rapidly spread to promote evaporation.

[0031] While the present invention will be described with reference to a few specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention.

[0032] FIG. 1 is a perspective view of a sock according to one embodiment of the present invention, showing different constructions corresponding to different foot and ankle locations depending on functional requirements at those places. Mesh channels 5 are arranged to be positioned at a top portion of a wearer's foot where there is lesser sweat and greater airflow. The mesh channels 5 include hydrophilic main yarn and stretch hydrophobic plaiting yarn. A plain knit fabric portion 2 arranged to be positioned along a wearer's ankle includes standard plain knit fabric with hydrophilic main yarn and stretch hydrophobic plaiting yarn. Reverse plaited terry fabric is provided at heel and toe portions 3 for maximum cushioning, with hydrophilic main yarn and stretch hydrophobic plaiting. A simulated rib fabric portion 1 arranged to be positioned at a top portion of the sock (e.g., above an ankle portion) to receive a wearer's leg and provide maximum grip, with such portion 1 including hydrophilic main yarn, stretch hydrophobic plaiting, and laid-in elastic yarn. A sole portion 4 includes two thread terry fabric construction with dual faces, having a hydrophobic inner pile, stretch hydrophobic plaiting, and hydrophilic main yarn.

[0033] FIG. 2 is a top plan view showing the inner side of a slit-open sock according to the embodiment shown in FIG. 1. Provided at the top of the sock and arranged to be positioned around a wearer's leg is an inner surface 6 of false rib fabric for maximum grip, with hydrophilic main yarn, stretch hydrophobic plaiting, and laid-in hydrophobic elastic yarn. Arranged to be positioned around a wearer's ankle and/or leg is an inner surface 7 of standard plain knit fabric including stretch hydrophobic plaiting yarn with hydrophilic main yarn on an outer side thereof. Reverse plaiting terry fabric is provided along inner heel surface 8 and inner toe surface 9, with thick terry pile for maximum cushioning including hydrophilic and or hydrophobic main yarn with stretch hydrophobic plaiting. Arranged to be positioned at a top portion of a wearer's foot is an inner surface of mesh fabric 10 at a location having lesser sweat and greater airflow, with such fabric including stretch hydrophobic plaiting yarn with hydrophilic

main yarn on an outer side. Arranged to be positioned along a sole portion of a wearer's foot is an inner surface of a two thread terry fabric 11 with dual face construction, having an inner pile (or inner face) made with hydrophobic yarns, with stretch hydrophobic plaiting in the middle, and with hydrophilic main yarn on an outer side or outer face.

[0034] FIG. 3 is a bottom plan view showing the outer side of a slit-open sock according to the embodiment shown in FIGS. 1-2. Provided at the top of the sock and arranged to be positioned around a wearer's leg is an outer surface 12 of simulated rib fabric for maximum grip, with hydrophilic main yarn, stretch hydrophobic plaiting, and laid-in hydrophobic elastic yarn. Arranged to be positioned around a wearer's ankle and/or leg is an inner surface 13' of standard plain knit fabric including hydrophilic main yarn with stretch hydrophobic plaiting yarn. Reverse plaiting terry fabric is provided along inner heel surface 14 and inner toe surface 15, exhibiting plain stitch, with hydrophilic main yarn and stretch hydrophobic plaiting. Arranged to be positioned at a top portion of a wearer's foot is an outer surface of mesh fabric 16 at a location having lesser sweat and greater airflow, with such fabric including hydrophilic main yarn with stretch hydrophobic plaiting yarn on an inner side. Arranged to be positioned along a sole portion of a wearer's foot is an inner surface of a two thread terry fabric 11 including dual face construction, exhibiting plain stitch with hydrophilic main yarn on an outer side, with stretch hydrophobic plaiting in the middle, and with hydrophobic yarn pile on an inner side.

[0035] FIGS. 4A-4B illustrate the functioning of the dual face or dual layer terry fabric as described herein. Sweat vapor¹⁷ is exuded by a wearer's skin 18 and momentarily adsorbs to inner terry pile 19 made of hydrophobic yarns. Under elastic pressure and body weight the two layers of fabric (i.e., the hydrophobic inner layer 19 and the hydrophilic outer layer 20), are pressed against each other. Adsorbed moisture on the inner side 19 of the terry fabric is absorbed up by the outer hydrophilic layer 20 the moisture it is spread rapidly for evaporation.

[0036] FIG. 5 is a table providing results of tests for vertical wicking and absorbency of a dual face terry material (fabric) that may be used to fabricate at least a portion of a sock according to embodiments to the present invention. An inner face portion of the material exhibited an absorbency test value of greater than 30 seconds upon testing according to AATCC Test Method 79. An outer face portion exhibited an absorbency test value of 1.8 seconds upon testing according to AATCC Test Method 79. The results clearly show that this fabric has no affinity for moisture on the inner side, while the outer layer is highly absorbent. With respect to vertical wicking, the vertical wicking of the outer layer is also excellent, showing that moisture is rapidly spread for quick evaporation. The foregoing results are also indicative of the fact that the layer next to a wearer's skin remains dry.

[0037] FIG. 6 is a schematic stitch diagram for a dual face terry material (fabric) of at least a portion of a sock according to embodiments of the present invention. Such figure illustrates knit stitch hydrophilic main yarn 21, knit stitch, plaited stretch hydrophobic yarn 22, and float stitch terry hydrophobic yarn 23 arranged in an exemplary construction.

10 Claims

1. A sock comprising a sole (4) of dual face terry fabric (11) including an inner face (19) arranged for placement in contact with the skin (18) of a wearer and an outer face (20), wherein the inner face (19) comprises terry hydrophobic yarn (23) forming the terry piles and the outer face comprises knit stitch hydrophilic main yarn (21), **characterized in that** the terry piles on the inner face (19) are formed by float stitch terry hydrophobic yarn (23).
2. The sock according to claim 1, wherein the dual face terry fabric (11) further comprises knit stitch plaited stretch hydrophobic yarn (22).
3. The sock according to any one of claims 1 or 2, wherein the inner face consists of 100% hydrophobic yarn (23).
4. The sock according to any one of claims 1 to 3, wherein the outer face consists of 100% hydrophilic yarn (21).
5. The sock according to any one of claims 1 to 4, wherein the hydrophilic yarn (21) is selected from wool, cotton, viscose and blends thereof.
6. The sock according to any one of claims 1 to 5, wherein the hydrophobic yarn (23) is selected from polypropylene, polyester, acrylic and blends thereof.
7. The sock according to any one of claims 1 to 6, wherein the inner face (19) comprises a first color, the outer face (20) comprises a second color, and the first color differs from the second color.
8. The sock according to any one of claims 1 to 7, wherein the outer face of the entire sock comprises hydrophilic yarn.

Patentansprüche

1. Eine Socke mit einer Sohle (4) aus zweiseitigem Schlingen- oder Frotteegewebe (11), mit einer Innenseite (19), die zur Anordnung in Kontakt mit der Haut (18) eines Trägers eingerichtet ist, und einer

Außenseite (20), wobei die Innenseite (19) hydrophobes Schlingen- oder Frotteegarn ("terry hydrophobic yarn")(23), das die Schlingen- oder Frotteeflore bildet, und die Außenseite hydrophiles Grundmaschenstich-Hauptgarn ("knit-stitch hydrophilic main yarn") (21) aufweist,

dadurch gekennzeichnet, dass

die Frottee-Flore an der Innenseite (19) durch hydrophobes Flottungs-Schlingengarn oder Flottungs-Frotteegarn ("float stitch terry hydrophobic yarn") (23) ausgebildet sind.

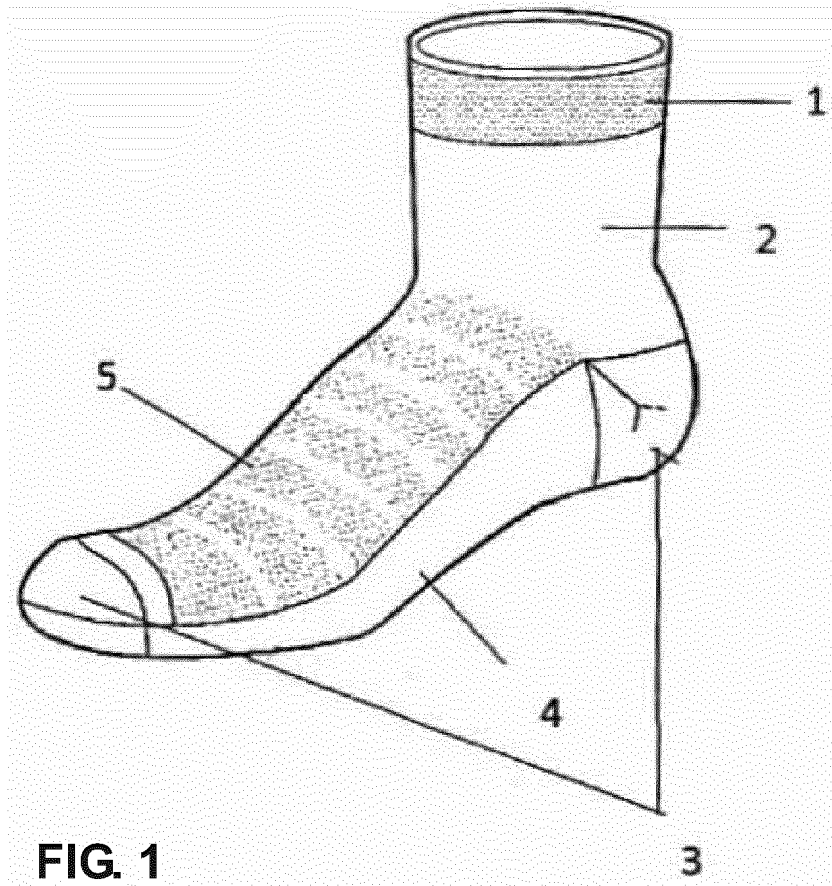
2. Die Socke gemäß Anspruch 1, wobei das zweiseitige Frotteegewebe (11) ferner verflochtenes hydrophobes Grundmaschenstich-Stretchgarn ("knit-stitch plaited stretch hydrophobic yarn") (22) aufweist. 5
3. Die Socke gemäß einem der Ansprüche 1 oder 2, wobei die Innenseite aus 100% hydrophobem Garn (23) besteht. 10
4. Die Socke gemäß einem der Ansprüche 1 bis 3, wobei die Außenseite aus 100% hydrophilem Garn (21) besteht. 15
5. Die Socke gemäß einem der Ansprüche 1 bis 4, wobei das hydrophile Garn (21) ausgewählt ist aus Wolle, Baumwolle, Viskose und Mischungen davon. 20
6. Die Socke gemäß einem der Ansprüche 1 bis 5, wobei das hydrophobe Garn (23) ausgewählt ist aus Polypropylen, Polyester, Acryl und Mischungen davon. 25
7. Die Socke gemäß einem der Ansprüche 1 bis 6, wobei die Innenseite (19) eine erste Farbe aufweist, die Außenseite (20) eine zweite Farbe aufweist, und die erste Farbe sich von der zweiten Farbe unterscheidet. 30
8. Die Socke gemäß einem der Ansprüche 1 bis 7, wobei die Außenseite der gesamten Socke hydrophiles Garn aufweist. 35

flottantes.

2. Chaussette suivant la revendication 1, dans laquelle l'étoffe (11) éponge double-face comprend en outre du fil (22) hydrophobe extensible natté en mailles tricotées. 40
3. Chaussette suivant l'une quelconque des revendications 1 ou 2, dans laquelle la face intérieure consiste en 100% de fil (23) hydrophobe. 45
4. Chaussette suivant l'une quelconque des revendications 1 à 3, dans laquelle la face extérieure consiste en 100% de fil (21) hydrophile. 50
5. Chaussette suivant l'une quelconque des revendications 1 à 4, dans laquelle le fil (21) hydrophile est choisi parmi la laine, le coton, la viscose et leurs mélanges. 55
6. Chaussette suivant l'une quelconque des revendications 1 à 5, dans laquelle le fil (23) hydrophobe est choisi parmi le polypropylène, le polyester, l'acrylique et leurs mélanges. 60
7. Chaussette suivant l'une quelconque des revendications 1 à 6, dans laquelle la face (19) intérieure comprend une première couleur, la face (20) extérieure comprend une deuxième couleur et la première couleur diffère de la deuxième couleur. 65
8. Chaussette suivant l'une quelconque des revendications 1 à 7, dans laquelle la face extérieure de toute la chaussette comprend du fil hydrophile. 70

Revendications

1. Chaussette comprenant une semelle (4) en étoffe (11) éponge double-face ayant une face (19) intérieure destinée à être mise en contact avec la peau (18) d'un porteur et une face (20) extérieure, dans laquelle la face (19) intérieure comprend du fil (23) hydrophobe éponge formant les poils éponge et la face extérieure comprend du fil (21) principal hydrophile en mailles tricotées, 50
- caractérisée en ce que**
- les poils éponge sur la face (19) intérieure sont formés par du fil (23) hydrophobe éponge en mailles 55



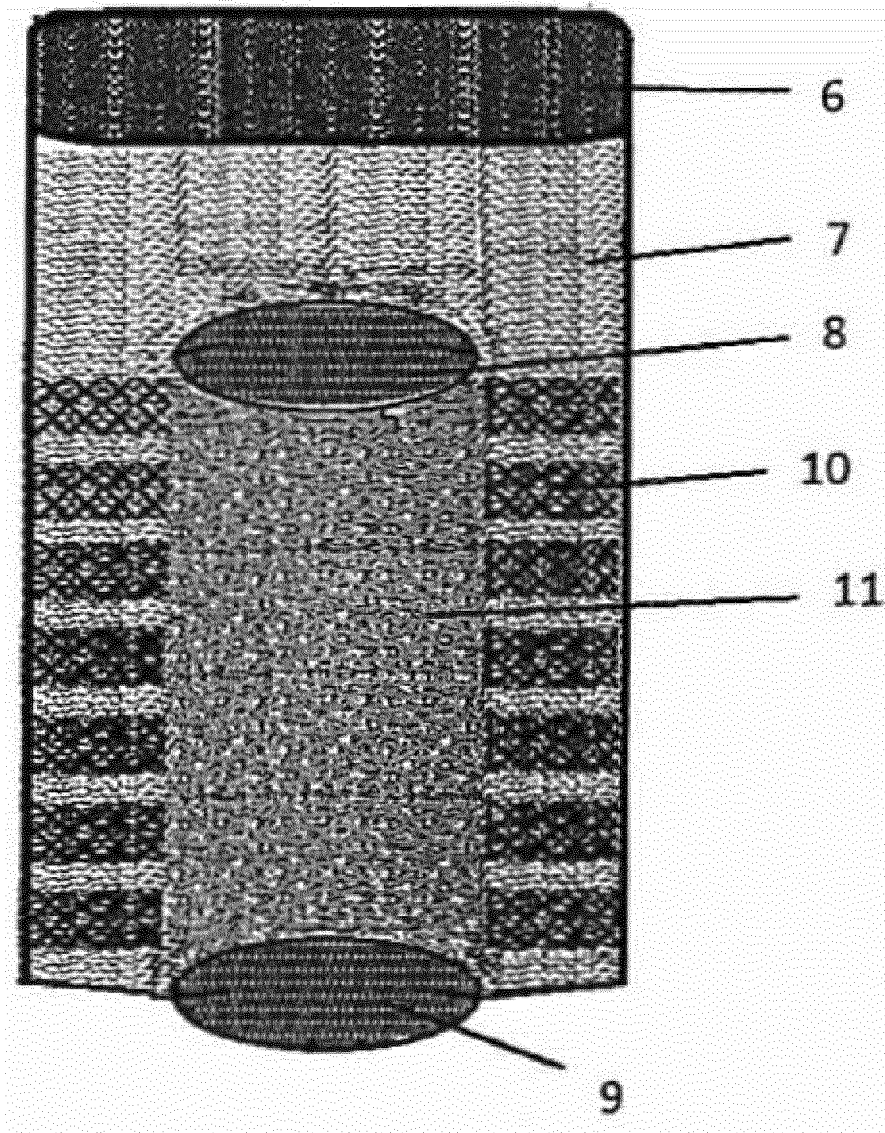


FIG. 2

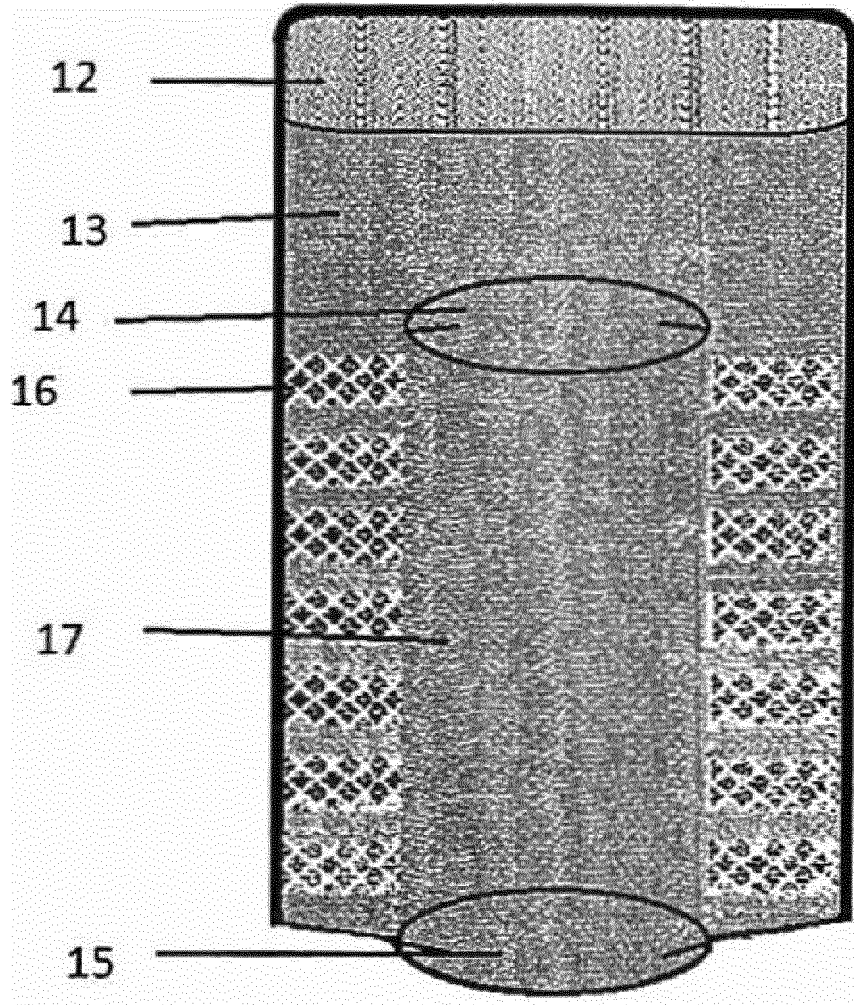


FIG. 3

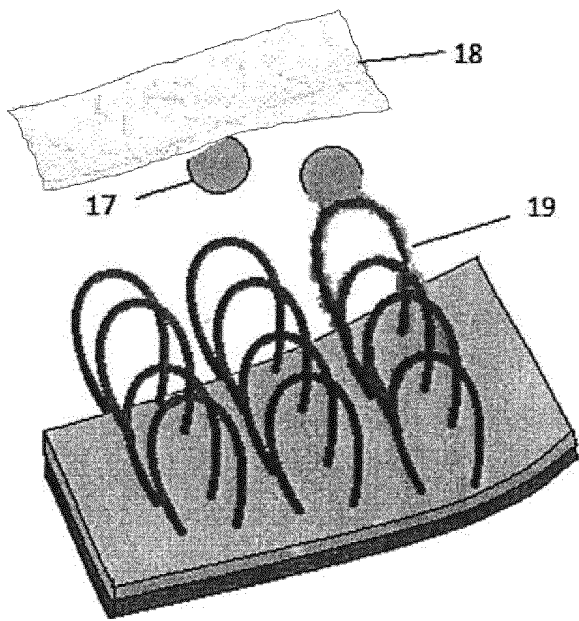


FIG. 4A

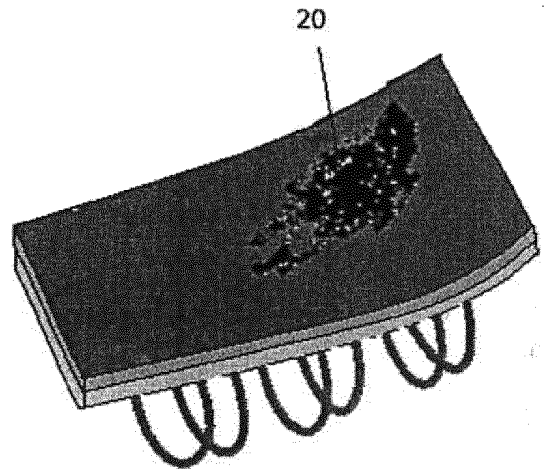


FIG. 4B

Absorbency (AATCC-79)	
Outer Side	1.8 sec
Inner Side	>30 sec
Vertical Wicking (CTL-FW-106)	
Length Wicking, 5 Min	.08 cm
Length Wicking, 30 Min	13 cm

FIG. 5

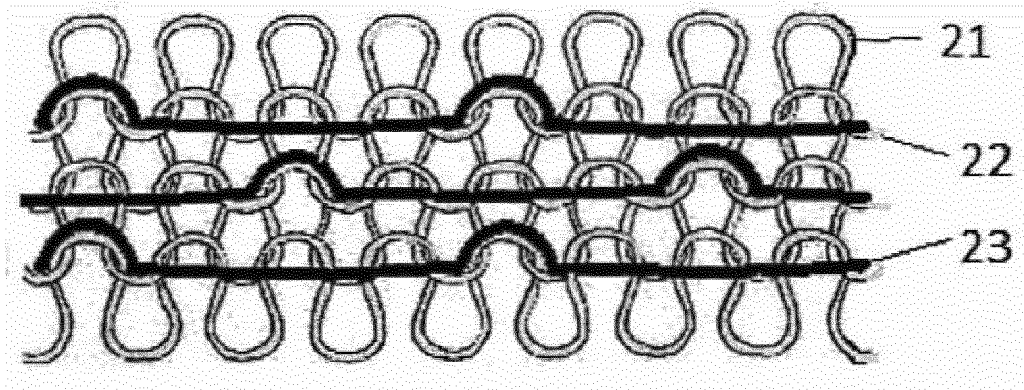


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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