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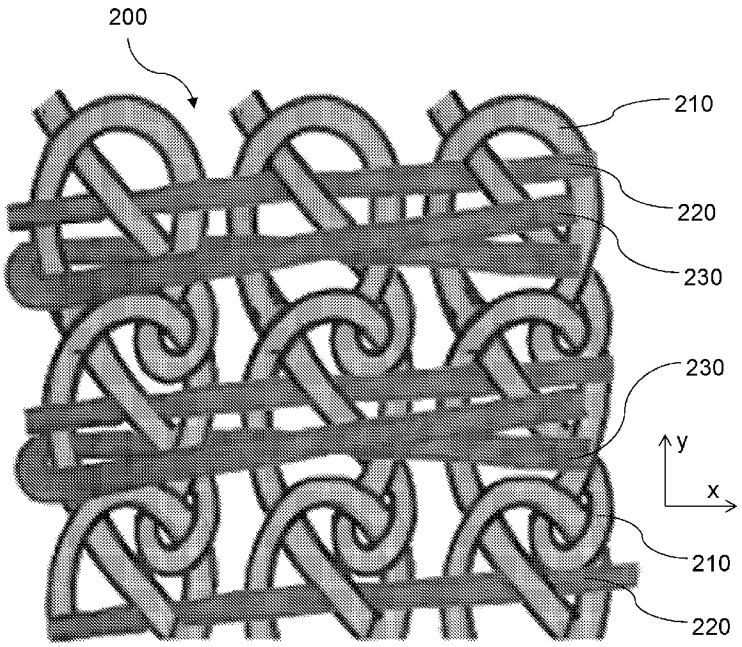

Figure 2A

(57) Abstract: The present disclosure generally relates to an absorbent fabric (100) formed as a 5 unitary layer having a first surface (110) and an opposing second surface (120). The fabric comprises different yarns (200) knitted together between the first and second surfaces (110,120). The yarns (200) comprise first yarns (210) running in a wale direction for wicking fluid, second yarns (220) running in a course direction for distributing fluid along the fabric (100), and third yarns (230) running in the course 10 direction for absorbing fluid. The first yarns (210), second yarns (220), and third yarns (230) are interconnected to each other such that fluid is communicable between the first yarns (210), second yarns (220), and third yarns (230), the first surface (110) comprises substantially of the first yarns (210), and the second surface (120) comprises substantially of the third yarns (230).

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ABSORBENT FABRIC

Cross Reference to Related Applications

The present disclosure claims the benefit of Singapore Patent Application No. 10202260483R filed on 16 December 2022 which is incorporated in its entirety by reference herein.

Technical Field

The present disclosure generally relates to an absorbent fabric. More particularly, the present disclosure describes various embodiments of an absorbent fabric formed as a unitary layer.

Background

The listing or discussion of a prior-published document in this specification should not necessarily be taken as an acknowledgement that the document is part of the state of the art or is common general knowledge.

There are various types of absorbent fabrics, such as to absorb bodily fluids from a user. For example, absorbent fabrics have been used in products such as sanitary pads, as well as in undergarments. However, current absorbent fabrics are usually composites of multiple layers, resulting in the fabrics being thick and uncomfortable.

Therefore, in order to address or alleviate at least one of the aforementioned problems and/or disadvantages, there is a need to provide an improved absorbent fabric.

Summary

According to an aspect of the present disclosure, there is an absorbent fabric formed as a unitary layer having a first surface and an opposing second surface. The fabric

comprises a plurality of different yarns knitted together between the first and second surfaces. The plurality of different yarns comprise a plurality of first yarns running in a wale direction for wicking fluid, a plurality of second yarns running in a course direction for distributing fluid along the fabric, and a plurality of third yarns running in the course direction for absorbing fluid. The first yarns, second yarns, and third yarns are interconnected to each other such that fluid is communicable between the first yarns, second yarns, and third yarns, the first surface comprises substantially of the first yarns, and the second surface comprises substantially of the third yarns.

An absorbent fabric according to the present disclosure is thus disclosed herein. Various features, aspects, and advantages of the present disclosure will become more apparent from the following detailed description of the embodiments of the present disclosure, by way of non-limiting examples only, along with the accompanying drawings.

Brief Description of the Drawings

Figure 1 is an illustration of an absorbent fabric in accordance with embodiments of the present disclosure.

Figures 2A and 2B are illustrations of knitted yarns of the absorbent fabric.

Figures 3A to 3C are illustrations of the absorbent fabric with three different yarns.

Figures 4A to 4C are illustrations of the absorbent fabric with four different yarns.

Figures 5A and 5B are further illustrations of the absorbent fabric with different yarns.

Description

For purposes of brevity and clarity, descriptions of embodiments of the present disclosure are directed to an absorbent fabric in accordance with the drawings. While aspects of the present disclosure will be described in conjunction with the

embodiments provided herein, it will be understood that they are not intended to limit the present disclosure to these embodiments. On the contrary, the present disclosure is intended to cover alternatives, modifications and equivalents to the embodiments described herein, which are included within the scope of the present disclosure as defined by the appended claims. Furthermore, in the following detailed description, specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be recognized by an individual having ordinary skill in the art, i.e. a skilled person, that the present disclosure may be practiced without specific details, and/or with multiple details arising from combinations of aspects of particular embodiments. In a number of instances, known systems, methods, procedures, and components have not been described in detail so as to not unnecessarily obscure aspects of the embodiments of the present disclosure.

In embodiments of the present disclosure, depiction of a given element or consideration or use of a particular element number in a particular figure or a reference thereto in corresponding descriptive material can encompass the same, an equivalent, or an analogous element or element number identified in another figure or descriptive material associated therewith.

References to “an embodiment / example”, “another embodiment / example”, “some embodiments / examples”, “some other embodiments / examples”, and so on, indicate that the embodiment(s) / example(s) so described may include a particular feature, structure, characteristic, property, element, or limitation, but that not every embodiment / example necessarily includes that particular feature, structure, characteristic, property, element, or limitation. Furthermore, repeated use of the phrase “in an embodiment / example” or “in another embodiment / example” does not necessarily refer to the same embodiment / example.

The terms “comprising”, “including”, “having”, and the like do not exclude the presence of other features / elements / steps than those listed in an embodiment. Recitation of certain features / elements / steps in mutually different embodiments does not indicate that a combination of these features / elements / steps cannot be

used in an embodiment. The terms “a” and “an” are defined as one or more than one. The use of “/” in a figure or associated text is understood to mean “and/or” unless otherwise indicated. The recitation of a particular numerical value or value range herein is understood to include or be a recitation of an approximate numerical value or value range.

The term “set” is defined as a non-empty finite organisation of elements that mathematically exhibits a cardinality of at least one (e.g. a set as defined herein can correspond to a unit, singlet, or single-element set, or a multiple-element set), in accordance with known mathematical definitions. The terms “first”, “second”, etc. are used merely as labels or identifiers and are not intended to impose numerical requirements on their associated terms.

In representative or exemplary embodiments of the present disclosure, there is an absorbent fabric 100 as shown in Figure 1. The absorbent fabric 100 is formed as a unitary or single layer having a first surface 110 and an opposing second surface 120. The absorbent fabric 100 may be used in products such sanitary pads, diapers, and gusset materials. The absorbent may be used to make absorbent garments worn by a user, particularly at parts of the body where there may be excretions of bodily fluids, such as urine, menstrual blood, breast milk, saliva, and sweat. Examples of such garments include brassieres, panties, lingerie, active wear, sportswear, swimwear, socks, footwear, and similar close-fitting or form-fitting garments. The absorbent fabric 100 can be used for standalone absorbent materials such as bedding materials, towels, or wipes. The absorbent fabric 100 can be used for medical textile applications such as wound dressings and slow-release drug delivery dressings.

The absorbent fabric 100 includes a plurality of different yarns 200 knitted together between the first surface 110 and second surface 120. Preferably, the yarns 200 are knitted together by warp knitting and in a single knitting run.

For example as shown in Figures 2A and 2B, the plurality of different yarns 200 include a plurality of first yarns 210, a plurality of second yarns 220, and a plurality of

third yarns 230. The plurality of first yarns 210 run in a wale direction for wicking fluid. The plurality of second yarns 220 run in a course direction for distributing fluid along the absorbent fabric 100. The plurality of third yarns 230 run in the course direction for absorbing fluid. Notably, wale refers to a column of loops running vertically (y-axis), and course refers to a crosswise row of loops running horizontally (x-axis).

The first yarns 210, second yarns 220, and third yarns 230 are interconnected to each other such that fluid is communicable between the first yarns 210, second yarns 220, and third yarns 230. Further, the first surface 110 comprises substantially of the first yarns 210. This may mean that the first yarns 210 form from 55% to 100%, such as 60% to 99%, 65% to 98%, 70% to 97%, 75% to 96%, 80% to 95%, or 85% to 90%, of the first surface 110. Further, the second surface 120 comprises substantially of the third yarns 230. This may mean that the third yarns 230 form from 55% to 100%, such as 60% to 99%, 65% to 98%, 70% to 97%, 75% to 96%, 80% to 95%, or 85% to 90%, of the second surface 120.

In some embodiments, the yarns 200 are knitted such that each of the first yarns 210 adopts a looping structure and each of the second yarns 220 is held in place by each loop of the first yarns 210 that each of the second yarns 220 contacts in the course direction. The first yarns 210 may be arranged in a half-tricot, tricot, single atlas, diamond net, or pillar stich arrangement.

In some embodiments, the yarns 200 are knitted such that each of the third yarns 230 is intermittently interlooped with the first yarns 210 such that at least some of the third yarns 230 extend outwardly from the second surface 120. The outward extension of the third yarns 230 create a lofted surface on the second surface 120. The third yarns 230 may be intermittently interlooped with the first yarns 210 at regular or irregular intervals. For example, the third yarns 230 are intermittently interlooped with the first yarns 210 from every second to every tenth loop of the first yarns 210 in the course direction.

In some embodiments, the first yarns 210 acquires fluid, for example when the first surface 110 contacts the user's skin, and wicks the fluid to the second yarns 220.

The second yarns 220 distribute and spread the fluid along the absorbent fabric 100, specifically along a plane parallel to the first surface 110 and second surface 120. The third yarns 230 receive the fluid from the second yarns 220 and absorb the fluid. The third yarns 230 are thus able to absorb fluid from the user, while the first surface 110, which comprises substantially of the first yarns 110, remains dry and comfortable for the user.

In some embodiments, the third yarns 230 are soaked with fluid, such as a liquid drug, and the second surface 120 is in contact with the user's skin. The third yarns 230 deliver the liquid drug through the second surface 120 to the user's skin, while the second yarns 220 and first yarns 210 prevent the liquid drug from leaking through the first surface 110.

In some embodiments, the third yarns 230 are soaked with fluid, such as a liquid drug, and the first surface 110 is in contact with the user's skin. The second yarns 220 receive the liquid drug from the third yarns 230 and spread the fluid along the absorbent fabric 100. The first yarns 210 receive the liquid drug from the second yarns 220 and deliver the liquid drug through the first surface 110 to the user's skin. This allows for slow release of the liquid drug from the first surface 110, such as for skin care and cosmetic applications.

The first yarns 210 and second yarns 220 is made of a material suitable for wicking and/or distributing fluid, such as a hydrophobic material. This may be because the material is inherently hydrophobic in nature or because it has been treated to have hydrophobic properties (e.g. hydrophilic yarns such as wool or cotton that have been treated or functionalized with a hydrophobic treatment).

The material of the first yarns 210 and second yarns 220 may be naturally moisture-wicking and/or be treated to become moisture-wicking. For example, the material may be 100% polyester fabric with French Terry knit and a denier differential that assists in moving fluid. Other suitable materials include blends of polyester, polypropylene, polyethylene, nylon, regenerated materials (e.g. viscose blends), natural fibres (e.g. bamboo), and cotton. The material may optionally have triangular

ridge structures of French Terry knitting that may face the user's skin, and the advantage of these structures is that less surface area comes into contact with the skin and therefore reduces any sensation of feeling wetness against the skin. The material may optionally have flat structures with a capillary gradient to generate differential capillary forces that move the liquid.

As an example, the material of the first yarns 210 and second yarns 220 may be 51% cotton. The material may be treated with a hydrophilic material or composition (e.g. polyethylene oxide, polyvinyl alcohol, polyacrylamide, poly acrylic acid, polyvinyl pyrrolidone, hydrophilic silicones, or hydrophilic polyurethanes) and/or a hydrophobic material or composition (e.g. silicones, polyfluoroalkyl acrylates, polyacrylates, polyurethanes, or waxes) to create a net hydrophilic gradient. This results in a combination of a "pushing" force generated by the hydrophobic properties and a "pulling" force generated by the hydrophilic properties that may wick any moisture or liquid through the first yarns 210 and second yarns 220.

The rate of wicking may be controlled to be faster or slower. The rate of wicking may be controlled by the density, thickness, or composition of the first yarns 210 and second yarns 220 and/or by the amount and type of hydrophobic and/or hydrophilic material applied to the first yarns 210 and second yarns 220. In another embodiment, the rate of wicking may be set such that the first surface 110 that may be in direct contact with the user feels dry or mostly dry to the user.

Additionally, the differential capillary forces can be created by the fabric structure of the absorbent fabric 100 with different pore sizes that form funnel-like structures through the material in cross-section, where liquid is pulled from the larger pore sizes to the smaller pore sizes, due to the differential capillary pressure.

The third yarns 230 is made of an absorbent material suitable for absorbing and retaining fluid. The absorbent material may be inherently hydrophilic or may have been treated to provide a hydrophilic material. For example, a texturized polyester can be used to hold liquid, such as a polyester towel material. For example, the absorbent material may include cotton, a cotton blend, foam, a synthetic material,

absorbent polymeric foam, a nanotechnology-based or -produced material, or any other moisture-absorbent material. The absorbent material may have a weight of 50 to 900 g/m^2, such as 180 to 300 g/m^2. For example, the absorbent material may be made from an 80:20 blend of polyester:nylon with a microfiber double terry knit. Other suitable absorbent materials include polypropylene, polyethylene, or any cellulose-based fabric and their blends including cotton, bamboo, etc.

In some embodiments, the absorbent material may be a 100% polyester double terry fabric. This material is approximately 90% air and so allows for a higher absorbent capacity, as moisture fills up the air gaps of the polyester terry fabric without significant expansion of the polyester fibres. This does not translate into significantly thicker absorbent fabric 100. In some embodiments, the absorbent material may be made from a blended fibre comprising two or more of superabsorbent polymer (SAP), hydrogel, and polyester.

In some embodiments, the yarns 200 may include an antimicrobial agent or substance. For example, the antimicrobial substance may be one or more substances selected from the group consisting of a silver-containing substance, titanium dioxide, a quaternary silane, hydrogen peroxide, triclosan, and zinc pyrithione. Additionally or alternatively, the yarns 200 may include an anti-odour agent or substance that combats odour. For example, the substance that combats odour may be one or more substances selected from the group consisting of nanoparticles with acid-neutralising pockets, high surface area mineral compositions, high surface area ceramic compositions, high surface area clay compositions, and plant-based deodorizers such as essential mint oils. Further additionally or alternatively, the yarns 200 may include a stain-resistant, stain-release, or stain-proof agent or substance. Further additionally or alternatively, the yarns 200 may include a stretchable or elastic material to impart stretch and recovery properties to the absorbent fabric 100, which can improve drapability, fit, and freedom of movement for the user.

Preferably, the absorbent fabric 100 is washable and reusable while maintaining at least its initial absorbency. More preferably, the absorbent fabric 100 is washable for

at least 20 machine wash and dry cycles such that the absorbent fabric 100 remains reusable with at least 90% of its initial absorbency.

The absorbent fabric 100 is formed as a single layer with different types of yarns 200 with different functionalities. Particularly, the single-layer absorbent fabric 100 has first yarns 210 for fluid wicking, second yarns 220 for fluid distribution, and third yarns 230 for fluid absorption. These functionalities remain after multiple use, wash and dry cycles with insignificant functional and aesthetic change. Further, the various yarns 200 of the absorbent fabric 100 are knitted in a single machine run such that the absorbent fabric 100 does not have any additional layers. This knitting of the yarns 200 allows the different yarns 200 to be simultaneously interconnected in a desirable manner to achieve the various yarn functionalities, including wicking, distribution, and absorption. This knitting process also allows the various yarn functionalities to be efficiently combined and integrated in the single-layer absorbent fabric 100, such that the absorbent fabric 100 has excellent fluid management and absorption properties, while minimizing the thickness of the absorbent fabric 100.

The absorbent fabric 100 may have various forms with various knitting configurations of the different yarns 200, including but not limited to the first yarns 210, second yarns 220, and third yarns 230. It will be appreciated that the distribution components (second yarns 220) interconnect the acquisition components (first yarns 210) and the absorbent components (third yarns 230). The distribution components receive the fluid acquired by the acquisition components and distributes along the absorbent fabric 100 for evenly distributed retention within the absorbent components. The knitting and interloping interconnection between the various yarns 200 enable the distribution components to be connected with the acquisition components and the absorbent components, hence the distribution components can distribute fluid across the acquisition components and the absorbent components as well to facilitate wicking. The absorbent components absorb and retain the liquid transported by the distribution components. The absorbent components are interconnected closely with the distribution components, and the high liquid retention capability of the material of the absorbent components ensures high liquid retention capacity of the absorbent fabric 100.

In some embodiments as shown in Figures 3A to 3C, the different yarns 200 of the absorbent fabric 100 include the first yarns 210 running in the wale direction for wicking fluid, the second yarns 220 running in the course direction for distributing fluid along the absorbent fabric 100, and the third yarns 230 running in the course direction for absorbing fluid. The first yarns 210, second yarns 220, and third yarns 230 are designated as P1, P2, and Q1, respectively. Notably, the first surface 110 comprises substantially of the first yarns 210 (P1), and the second surface 120 comprises substantially of the third yarns 230 (Q1).

Each of the first yarns 210 (P1) may adopt a looping structure and each of the second yarns 220 (P2) may be held in place by each loop of the first yarns 210 (P1) that each of the second yarns 220 (P2) contacts in the course direction. Each of the third yarns 230 (Q1) may be intermittently interlooped with the first yarns 210 (P1) such that at least some of the third yarns 230 (Q1) extend outwardly from the second surface 120, thereby forming a lofted second surface 120. The third yarns 230 may be intermittently interlooped with the first yarns 210 at regular or irregular intervals, such as from every second to every tenth loop of the first yarns 210 in the course direction.

The first yarns 210 (P1) and second yarns 220 (P2) may include a suitable wicking material as mentioned above. For example, the material for the first yarns 210 (P1) and second yarns 220 (P2) may have a Denier value of 30 D to 1000 D. For example, the material for the first yarns 210 (P1) may have a Denier value of 30 D to 50 D. For example, the material for the second yarns 220 (P2) may have a Denier value of 100 D to 150 D. The third yarns 230 (Q1) may include a suitable absorbent material as mentioned above. For example, the material for the third yarns 230 (Q1) may have a Denier value of 30 D to 2000 D. For example, the material for the third yarns 230 (Q1) may have a Denier value of 800 D to 1200 D.

In some embodiments as shown in Figures 4A to 4C, the different yarns 200 of the absorbent fabric 100 include the first yarns 210 running in the wale direction for wicking fluid, the second yarns 220 running in the course direction for distributing

fluid along the absorbent fabric 100, and the third yarns 230 running in the course direction for absorbing fluid. The different yarns 200 further include a plurality of fourth yarns 240 running in the course direction for distributing fluid along the absorbent fabric 100, similar to the functionality of the second yarns 220. The first yarns 210, second yarns 220, third yarns 230, and fourth yarns 240 are designated as P1, P2, Q1, and P3, respectively. The first surface 110 may comprise substantially of the first yarns 210 (P1), and the second surface 120 may comprise substantially of the third yarns 230 (Q1) and fourth yarns 240 (P3). Alternatively, the first surface 110 may comprise substantially of the first yarns 210 (P1) and fourth yarns 240 (P3), and the second surface 120 may comprise substantially of the third yarns 230 (Q1).

Each of the first yarns 210 (P1) may adopt a looping structure and each of the second yarns 220 (P2) may be held in place by each loop of the first yarns 210 (P1) that each of the second yarns 220 (P2) contacts in the course direction. Each of the third yarns 230 (Q1) may be intermittently interlooped with the first yarns 210 (P1) such that at least some of the third yarns 230 (Q1) extend outwardly from the second surface 120, thereby forming a lofted second surface 120. The third yarns 230 may be intermittently interlooped with the first yarns 210 at regular or irregular intervals, such as from every second to every tenth loop of the first yarns 210 in the course direction. The fourth yarns 240 (P3) may be intermittently interlooped with the first yarns 210 (P1), such that the fourth yarns 240 (P3) intermittently separate the third yarns 230 (Q1).

The third yarns 230 and fourth yarns 240 may have an alternating arrangement along each course, such as shown in Figure 4B. Further, the third yarns 230 (Q1) may be thicker than the fourth yarns 240 (P3). This may result in portions of the second surface 120 comprising the third yarns 230 (Q1) being thicker than portions of the second surface 120 comprising the fourth yarns 240 (P3), such as shown in Figure 4B. Alternatively, the fourth yarns 240 (P3) may be thicker than the third yarns 230 (Q1), which may result in portions of the second surface 120 comprising the fourth yarns 240 (P3) being thicker than portions of the second surface 120 comprising the third yarns 230 (Q1). Yet alternatively, the third yarns 230 (Q1) and

fourth yarns 240 (P3) have substantially equal thickness, which may result in the second surface 120 comprising substantially of the third yarns 230 (Q1) and fourth yarns 240 (P3) having substantially equal thickness. It will be appreciated that the thickness of the yarns 200 may be adapted and used for aesthetic purposes, such as for sight and/or feel. For example, the thickness of the third yarns 230 (Q1) and fourth yarns 240 (P3) may be varied within a course, or within courses to create a desired texture.

The first yarns 210 (P1), second yarns 220 (P2), and fourth yarns 240 (P3) may include a suitable wicking material as mentioned above. For example, the material for the first yarns 210 (P1), second yarns 220 (P2), and fourth yarns 240 (P3) may have a Denier value of 30 D to 1000 D. For example, the material for the first yarns 210 (P1) may have a Denier value of 30 D to 50 D. For example, the material for the second yarns 220 (P2) may have a Denier value of 100 D to 150 D. For example, the material for the fourth yarns 240 (P3) may have a Denier value of 30 D to 1000 D. The third yarns 230 (Q1) may include a suitable absorbent material as mentioned above. For example, the material for the third yarns 230 (Q1) may have a Denier value of 30 D to 2000 D. For example, the material for the third yarns 230 (Q1) may have a Denier value of 800 D to 1200 D.

In some embodiments as shown in Figure 4B, the third yarns 230 (Q1) and fourth yarns 240 (P3) occupy the same surface (second surface 120) of the absorbent fabric 100. In other words, the second surface 120 comprises substantially of the third yarns 230 (Q1) and fourth yarns 240 (P3). In some other embodiments, the fourth yarns 240 (P3) may occupy the opposing surface (first surface 110) instead. In other words, the first surface 110 comprises substantially of the first yarns 210 (P1) and fourth yarns 240 (P3). For example, each of the first yarns 210 (P1) may adopt a looping structure and each of the fourth yarns 240 (P3) may be held in place by each loop of the first yarns 210 (P1) that each of the fourth yarns 240 (P3) contacts in the course direction. Further, the third yarns 230 (Q1) and fourth yarns 240 (P3) may be present across the entire course on the respective opposing surfaces. This may provide additional wicking properties that may be useful in certain applications.

In some embodiments as shown in Figures 5A and 5B, the absorbent fabric 100 may be divided into a plurality of different regions. For example, the absorbent fabric 100 may be divided into one or more first regions 100A and one or more second regions 100B. Alternatively, the absorbent fabric 100 may comprise only the first regions 100A or only the second regions 100B.

In one embodiment as shown in Figure 5A, the first region 100A includes the first yarns 210 (P1), second yarns 220 (P2), and third yarns 230 (Q1), similar to the embodiments shown in Figures 3A to 3C. The second region 100B includes a set of absorbent islands 130 and a set of wicking seas 132 separating the absorbent islands 130 from each other. Each absorbent island 130 includes the first yarns 210 (P1), second yarns 220 (P2), and third yarns 230 (Q1), and each wicking sea 132 includes the first yarns 210 (P1), second yarns 220 (P2), and fourth yarns 240 (P3), similar to the embodiments shown in Figures 4A to 4C. Each absorbent island 130 may be defined in a hexagonal shape. It will be appreciated that the absorbent island 130 may be defined in any shape, and that each wicking sea 132 may similarly be defined in any shape.

In one embodiment as shown in Figure 5B, the first region 100A includes the first yarns 210 (P1), second yarns 220 (P2), and third yarns 230 (Q1), similar to the embodiments shown in Figures 3A to 3C. The second region 100B includes a set of wicking islands 140 and a set of absorbent seas 142 separating the wicking islands 140 from each other. Each wicking island 140 includes the first yarns 210 (P1), second yarns 220 (P2), and fourth yarns 240 (P3), and each absorbent sea 142 includes the first yarns 210 (P1), second yarns 220 (P2), and third yarns 230 (Q1), similar to the embodiments shown in Figures 4A to 4C. Each wicking island 140 may be defined in a hexagonal shape. It will be appreciated that the wicking island 140 may be defined in any shape, and that each absorbent sea 142 may similarly be defined in any shape.

As shown in Figure 5A, the third yarns 230 (Q1) and fourth yarns 240 (P3) in the second region 100B alternate along each course to form the absorbent islands 130 and wicking seas 132. As shown in Figure 5B, the third yarns 230 (Q1) and fourth

yarns 240 (P3) in the second region 100B alternate along each course to form the wicking islands 140 and absorbent seas 142. The second region 100B thus has an alternating arrangement of the third yarns 230 (Q1) and fourth yarns 240 (P3). It will be appreciated that the yarns 200 may be arranged in various ways and is not limited to the shapes and patterns shown in Figures 5A and 5B, such as the hexagonal absorbent islands 130 and hexagonal wicking islands 140. It will be appreciated that the thickness of the yarns 200, including the first yarns 210 (P1), second yarns 220 (P2), third yarns 230 (Q1), and/or fourth yarns 240 (P3), may be adapted and used for aesthetic purposes, such as for sight and/or feel.

In the foregoing detailed description, embodiments of the present disclosure in relation to an absorbent fabric are described with reference to the provided figures. The description of the various embodiments herein is not intended to call out or be limited only to specific or particular representations of the present disclosure, but merely to illustrate non-limiting examples of the present disclosure. The present disclosure serves to address at least one of the mentioned problems and issues associated with the prior art. Although only some embodiments of the present disclosure are disclosed herein, it will be apparent to a person having ordinary skill in the art in view of this disclosure that a variety of changes and/or modifications can be made to the disclosed embodiments without departing from the scope of the present disclosure. Therefore, the scope of the disclosure as well as the scope of the following claims is not limited to embodiments described herein.

Claims

1. An absorbent fabric formed as a unitary layer having a first surface and an opposing second surface, the fabric comprising:

a plurality of different yarns knitted together between the first and second surfaces, the plurality of different yarns comprising:

a plurality of first yarns running in a wale direction for wicking fluid;

a plurality of second yarns running in a course direction for distributing fluid along the fabric; and

a plurality of third yarns running in the course direction for absorbing fluid,

wherein the first yarns, second yarns, and third yarns are interconnected to each other such that:

fluid is communicable between the first yarns, second yarns, and third yarns;

the first surface comprises substantially of the first yarns; and

the second surface comprises substantially of the third yarns.

2. The fabric according to claim 1, wherein the fabric is washable for at least 20 machine wash and dry cycles such that the fabric remains reusable with at least 90% of its initial absorbency.

3. The fabric according to claim 1, wherein:

each of the first yarns adopts a looping structure; and

each of the second yarns is held in place by each loop of the first yarns that each of the second yarns contacts in the course direction.

4. The fabric according to claim 1 or 2, wherein the third yarns are intermittently interlooped with the first yarns such that at least some of the third yarns extends outwardly from the second surface.

5. The fabric according to claim 4, wherein the third yarns are intermittently interlooped with the first yarns from every second to every tenth loop of the first yarns in the course direction.

6. The fabric according to any one of claims 1 to 5, wherein:

the plurality of different yarns further comprises a plurality of fourth yarns running in the course direction for distributing fluid along the fabric; and

the first yarns, second yarns, third yarns, and fourth yarns are interconnected to each other, such that fluid is communicable between the first yarns, second yarns, third yarns, and fourth yarns.

7. The fabric according to claim 6, wherein the second surface comprises substantially of the third yarns and fourth yarns.

8. The fabric according to claim 7, wherein the fourth yarns are intermittently interlooped with the first yarns, such that the fourth yarns intermittently separate the third yarns.

9. The fabric according to claim 7 or 8, wherein the third yarns are thicker than the fourth yarns.

10. The fabric according to claim 7 or 8, wherein the fourth yarns are thicker than the third yarns.

11. The fabric according to claim 7 or 8, wherein the third yarns and fourth yarns have substantially equal thickness.

12. The fabric according to claim 6, wherein the first surface comprises substantially of the first yarns and fourth yarns.

13. The fabric according to claim 12, wherein:

each of the first yarns adopts a looping structure; and

each of the fourth yarns is held in place by each loop of the first yarns that each of the fourth yarns contacts in the course direction.

14. The fabric according to any one of claims 6 to 11, comprising:

a set of absorbent islands; and

a set of wicking seas separating the absorbent islands from each other,

wherein each absorbent island comprises the first yarns, second yarns, and third yarns; and

wherein each wicking sea comprises the first yarns, second yarns, and fourth yarns.

15. The fabric according to claim 12, wherein each absorbent island is defined in a hexagonal shape.

16. The fabric according to any one of claims 6 to 11, comprising:

a set of wicking islands; and

a set of absorbent seas separating the wicking islands from each other,

wherein each wicking island comprises the first yarns, second yarns, and fourth yarns; and

wherein each absorbent sea comprises the first yarns, second yarns, and third yarns.

17. The fabric according to claim 16, wherein each wicking island is defined in a hexagonal shape.

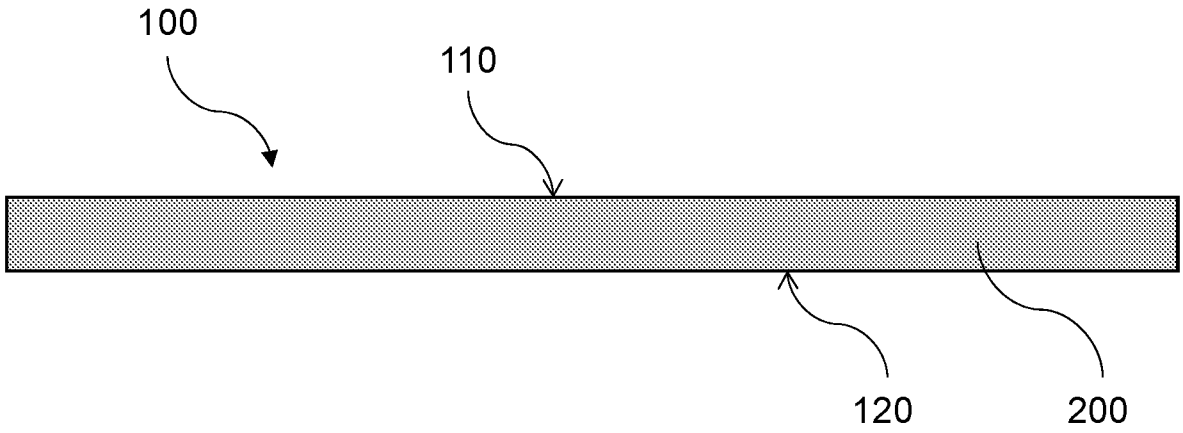


Figure 1

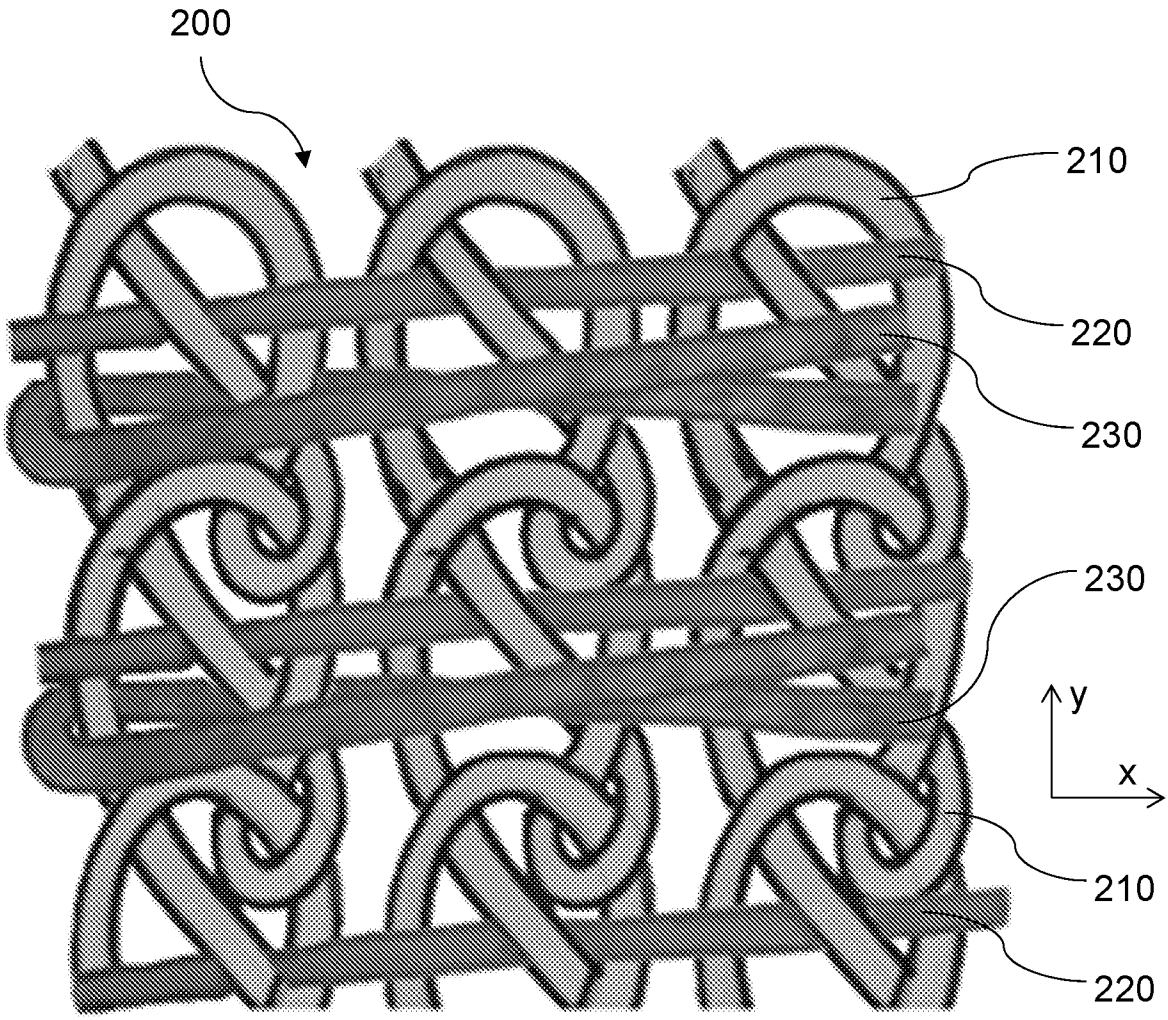


Figure 2A

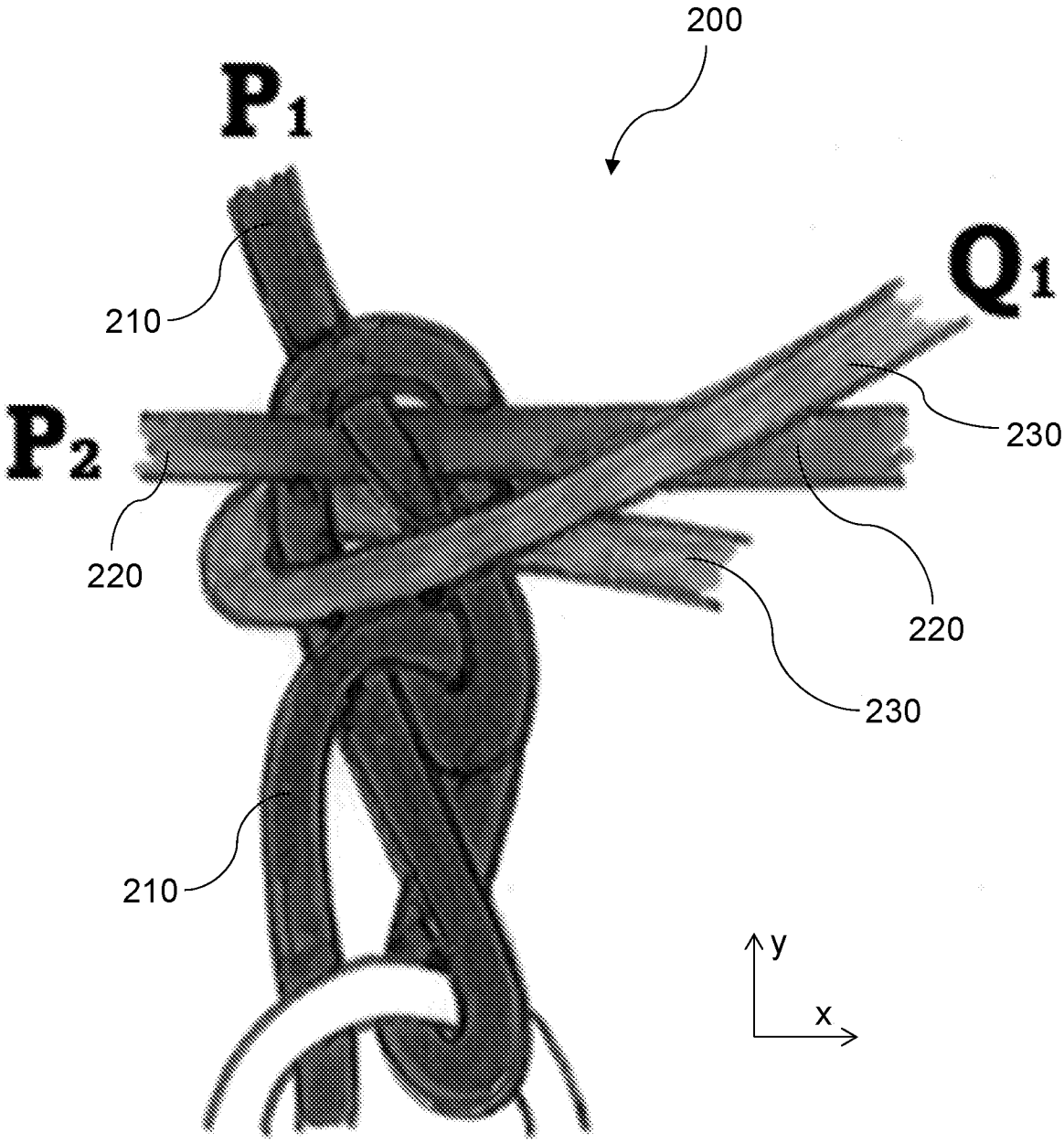


Figure 2B

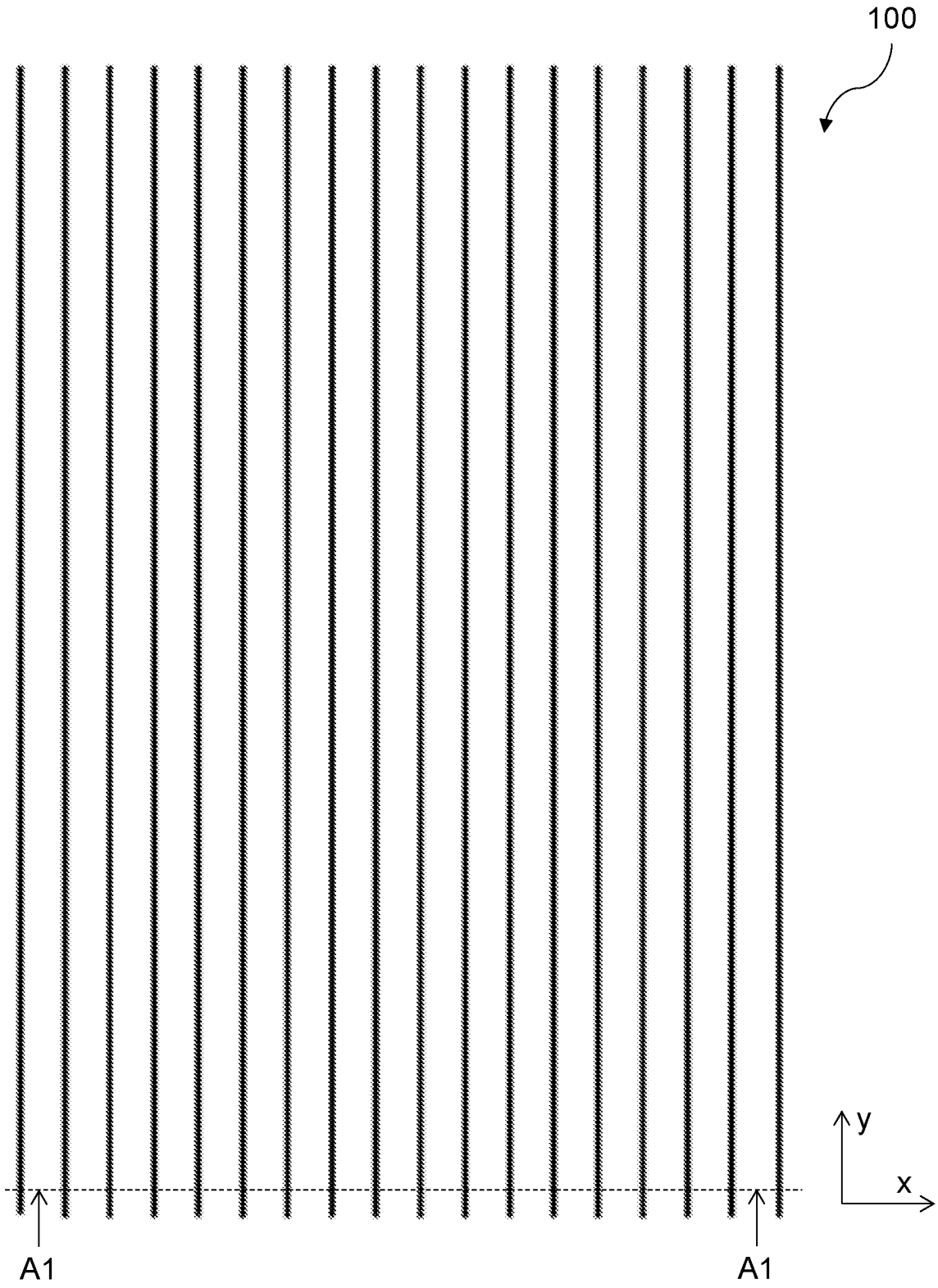


Figure 3A

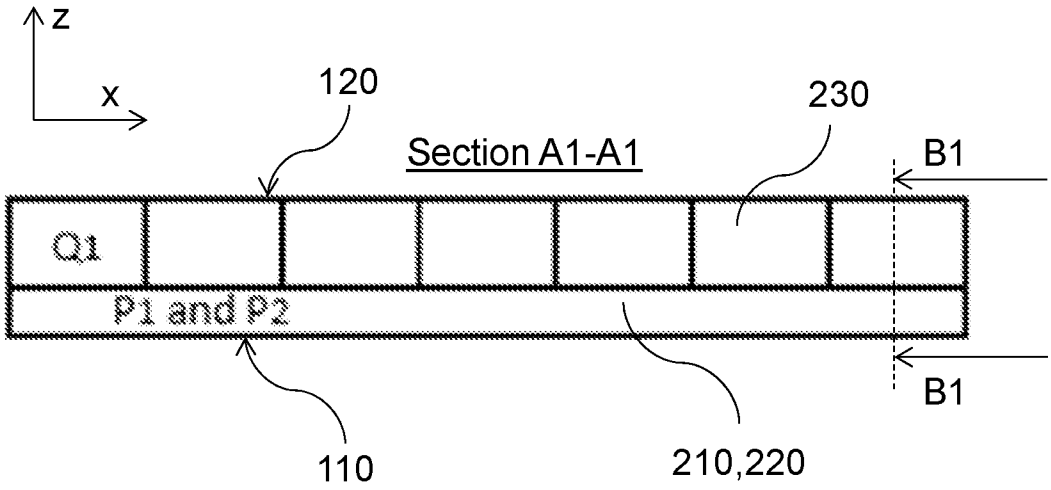


Figure 3B

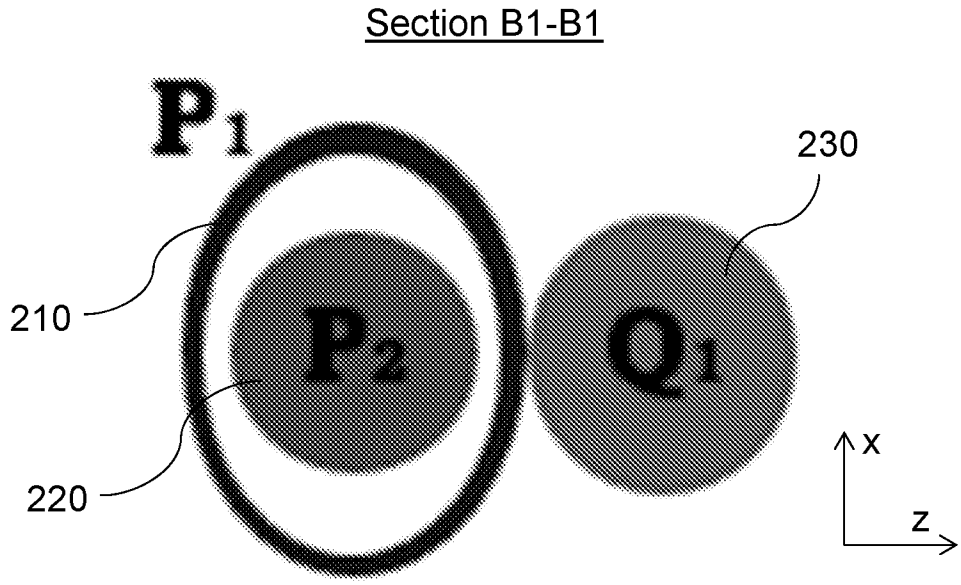


Figure 3C

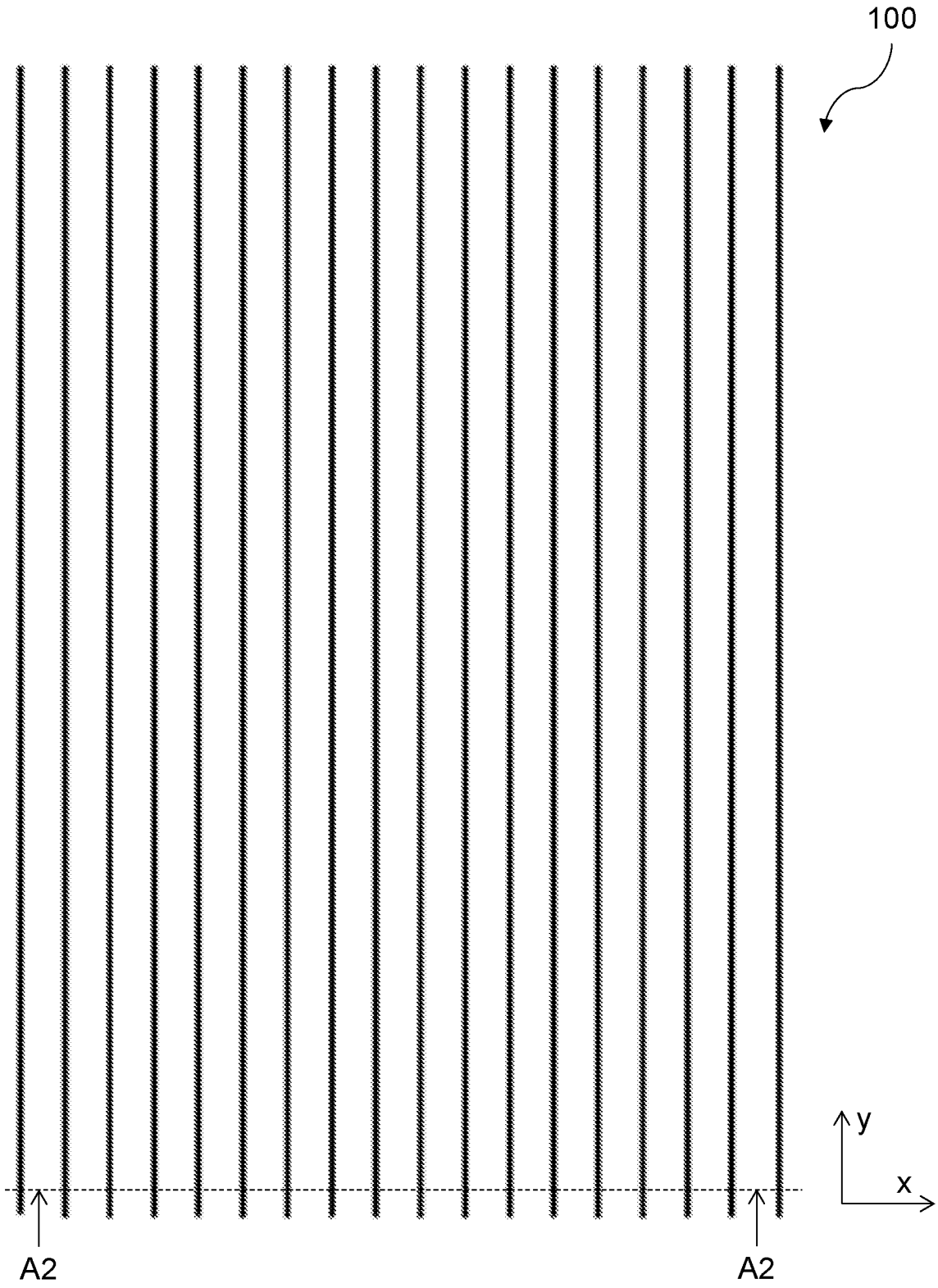


Figure 4A

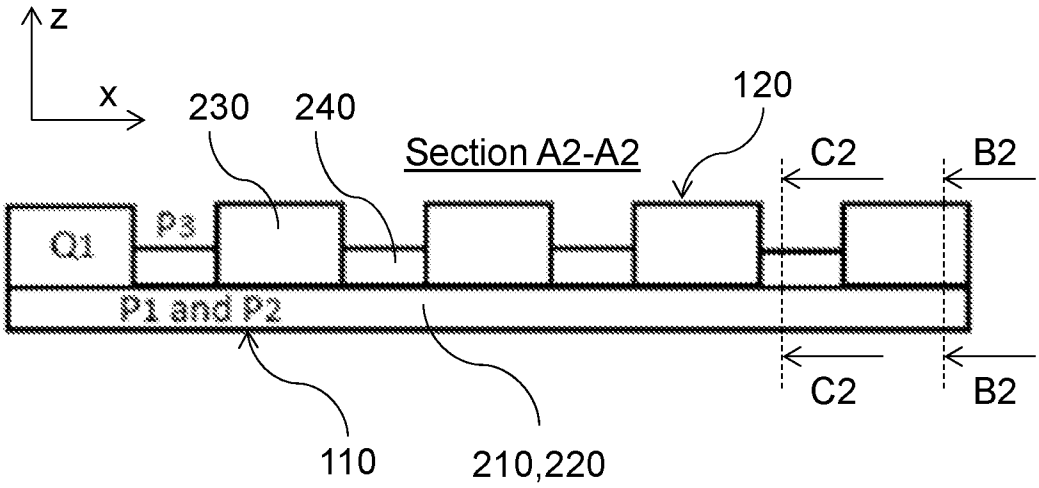


Figure 4B

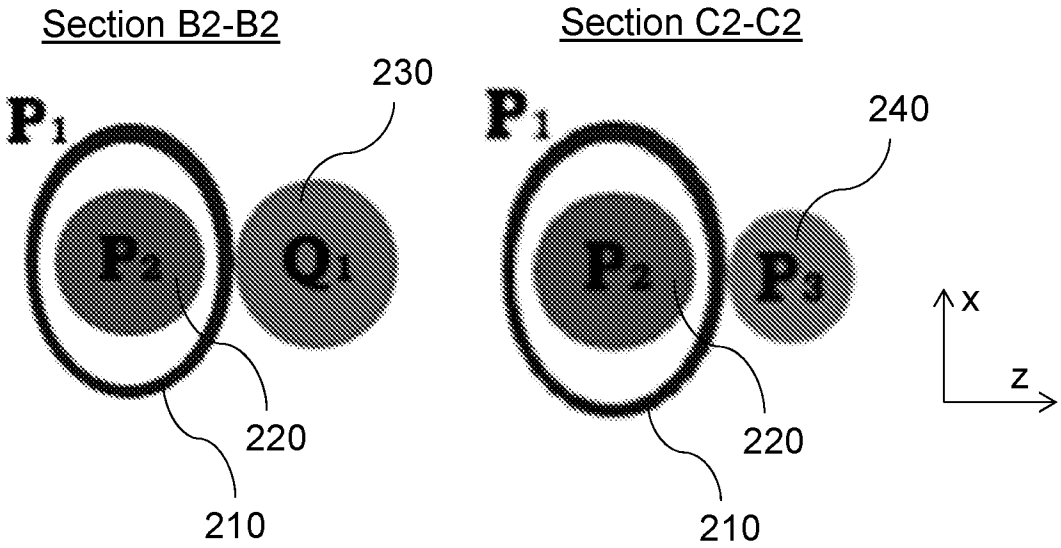
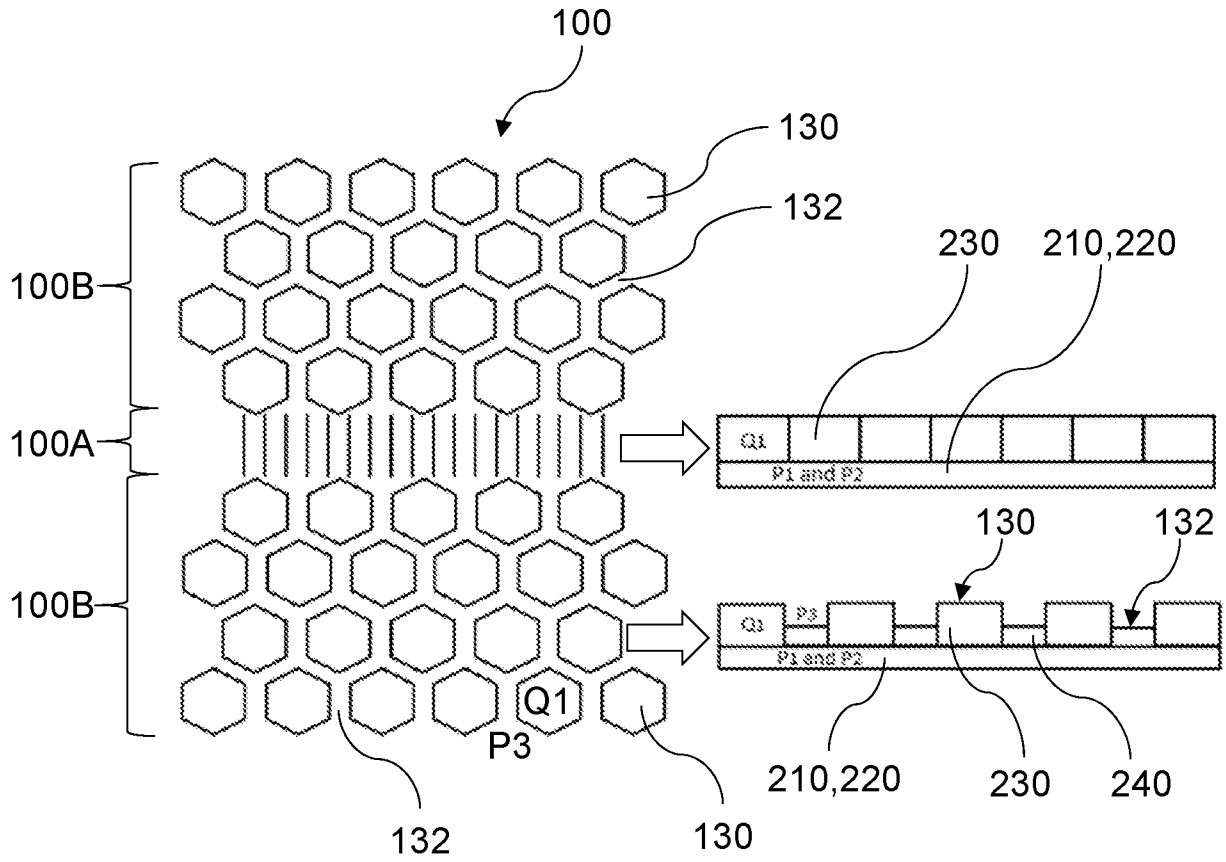


Figure 4C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100B
100A
100B
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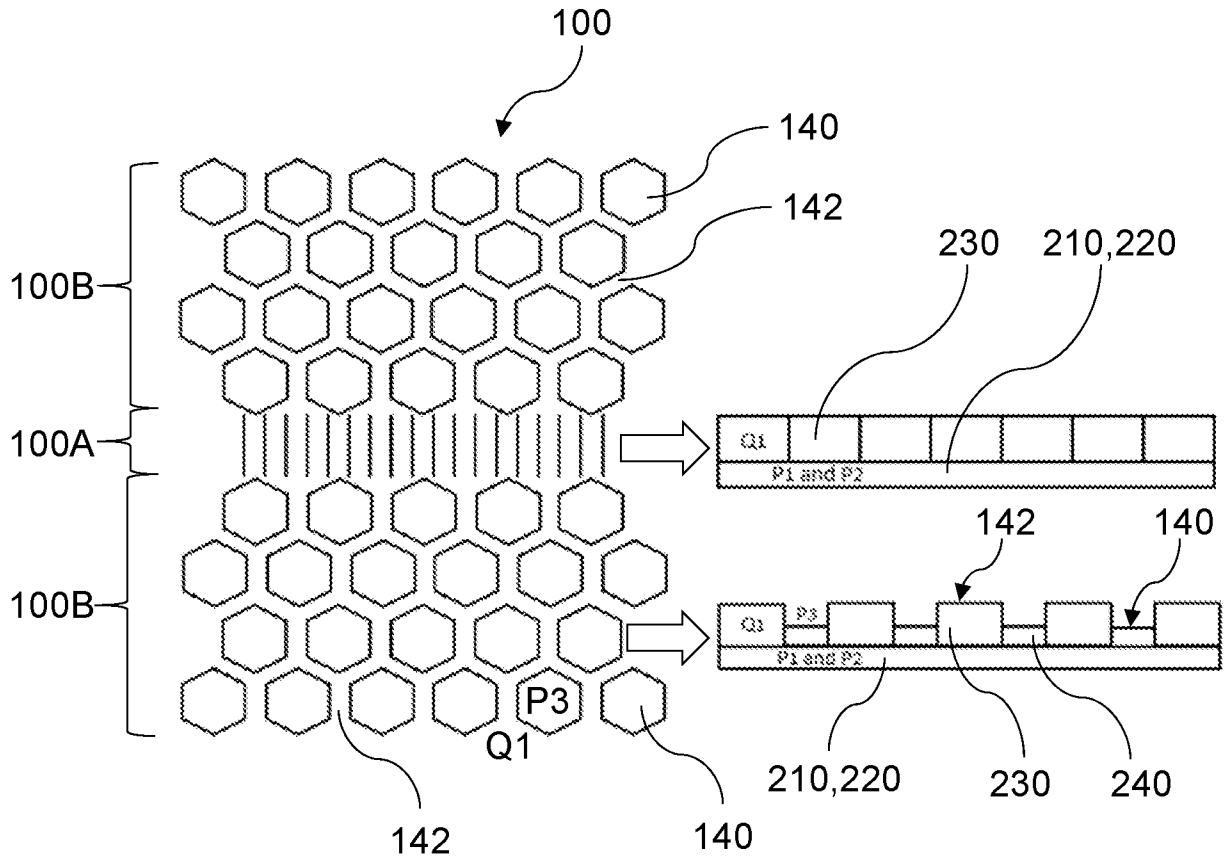
130
132
Q1
P3
P1 and P2
Q1
P3
210,220
230
240
132
130

Figure 5A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100B
Q1
P1 and P2
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140
Q1
P3
P1 and P2
P3
Q1
210,220
230
240
142
140

Figure 5B

INTERNATIONAL SEARCH REPORT

International application No
PCT/SG2023/050834

A. CLASSIFICATION OF SUBJECT MATTER
INV. D04B21/08 A61F13/15
ADD.

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)
D04B A61F

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 practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 429 802 A2 (GUILFORD MILLS INC [US]) 5 June 1991 (1991-06-05) page 5, lines 49-51; page 6, lines 10-27; figures 1-2; examples 1,2	1-17
X	US 5 759 662 A (HEIMAN MARK J [US]) 2 June 1998 (1998-06-02) col.1, I; col.3, l.39-43; figures 1-4	1-5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 2024	11/03/2024

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, Fax: (+31-70) 340-3016	Messai, Sonia

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SG2023/050834

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0429802 A2	05-06-1991	AT E132213 T1	15-01-1996
		DE 69024466 T2	15-05-1996
		EP 0429802 A2	05-06-1991
		US 5065600 A	19-11-1991
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