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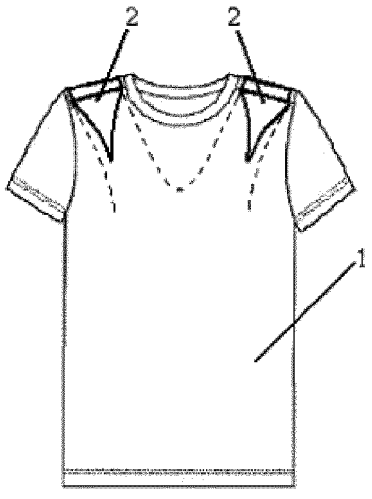
(54) **COOLING GARMENT**

(57) A cooling garment, including a garment body (1) and an external-air introducing three-dimensional member (2); and the external-air introducing three-dimensional member (2) includes a base material (2a), a side-wall material (2b) enabling an opening portion to be open during wearing, and an opening portion support material (2c). The three-dimensional member arranged on the garment enables a large amount of external air to be introduced into the internal portion of the garment, even to an exhausting area thereof, especially during movement, thus improving efficiency of air entry and exhaust.

Figure 1



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Description

Field of the Invention

[0001] The present invention relates to the field of clothes and specifically relates to a cooling garment for cooling a specific part of the body by intaking external air into the garment.

Background of the Invention

[0002] Insensible perspiration and heat dissipation are performed on human bodies every moment, and are more active during movement. The temperature of the human body rises during movement. The body function is automatically adjusted to maintain the temperature in a normal range, and the insensible perspiration and heat dissipation are reflected by sweating. In order to solve the problem of sweating, most of the sports wears available in the market take into consideration breathability and sweat-absorption quick dryness of fabrics. Breathability is a long-lasting solution for realizing comfortableness, as long as the function is sufficient, heat generated by the human body during movement can be timely dissipated, so that the temperature of the human body does not rise excessively, and sweating may be delayed and even does not happen, so that wearing comfortableness in its true sense may be realized. At the moment, the sweat-absorption quick dryness is an auxiliary means for realizing comfortableness.

[0003] Regarding the breathability of fabrics, most of the products available in the market have realized front or partial breathability of human bodies, specifically in sports wears adopting a mesh (hollowed) material, an opening support design or other breathable designs at specific portions thereof. Such a method may discharge a part of heat, but is quite limited in effect, and generally can only solve the breathability of the intaking area without solving the problem of breathability of the exhausting area, and this is just the important factor for influencing the comfortableness. For example, patent document CN102573538A discloses a garment with ventilation openings, in which the ventilation openings are formed in the breast area and/or on the back, members for closing are arranged on the openings and may be controlled by a transposition mechanism, and the ventilation openings are opened for air exchange when one sweats heavily. However, such a design can only realize the cooling effect on the intaking area of the human body, but cannot form a good air circulation path, and the introduced external air is limited. For another example, patent document CN102188053A discloses a breathable garment, where in order to solve the problem that a breathable design portion (a mesh fabric) is close to the skin after sweating, a plurality of support rings are arranged at the edge of the mesh fabric, so that the fabric layer of the garment keeps a certain distance from the skin, the garment and the human body form a convection space, the breathability is thus improved, and heat and moisture generated by the human body may be smoothly discharged particularly in the presence of wind. Even so, the external air introduced by such a design is also limited, so the problem of comfortableness cannot be fundamentally solved.

Summary of the Invention

[0004] The aim of the present invention is to provide a cooling garment, which can introduce a large amount of external air into the internal portion of the clothes even to an exhausting area thereof, especially during movement, thus improving the efficiency of air entry and exhaust and cooling a specific part of the body with an excellent cooling effect.

[0005] The technical solution of the present invention is as follows:

A cooling garment of the present invention includes a garment body (1) and an external-air introducing three-dimensional member (2), in which the external-air introducing three-dimensional member (2) includes a base material (2a) for receiving air and inducing the air into the garment, a side-wall material (2b) enabling an opening portion to be open during wearing, and an opening portion support material (2c).

[0006] The present invention utilizes the principle of negative-pressure air introduction, and the external air introducing member of a three-dimensional opening design is arranged on the garment body, so that a negative-pressure air introduction effect may be realized and the inflow quantity of the air may be improved; when the external air flows through in parallel to the member, more air can flow into the internal portion of the clothes via the base material with an air inducing effect and flow through the exhausting area to fulfill the purposes of discharging internal heat and cooling the body. As for different sports wears, the side-wall material is configured at different positions of the garments, thereby enlarging the convection space, strengthening the air introducing effect and improving the efficiency of air entry and exhaust.

Brief Description of the Drawings

[0007]

Fig. 1 is a front schematic diagram of a cooling garment in Example 1 of the present invention, in which 1 is a body, and 2 is an external-air introducing three-dimensional member.

Fig. 2 is a back schematic diagram of the cooling garment in Example 19 of the present invention, in which 1 is a body, and 2 is an external-air introducing three-dimensional member.

Fig. 3 is a structural schematic diagram of the external-air introducing three-dimensional member of the present invention, in which 2a is a base material, 2b is a side-wall material, and 2c is a support material.

Fig. 4 is a schematic diagram of an approximate triangle of the present invention, in which 3 shows a vertical distance from the arc line vertex of the approximate triangle to one of two waists of a common triangle.

Fig. 5 is a front schematic diagram of parts of a human body of the present invention, in which 4 is a nipple bust line, and 5 is a shoulder line.

Fig. 6 is a back schematic diagram of parts of a human body of the present invention, in which 5 is a shoulder line, 6 is a scapula inferior angle horizon, 7 is a waist line, and 8 is a hip line.

Fig. 7 is a schematic diagram of a flow passage of the cooling garment of the present invention, in which 9 is a width of an opening portion, 10 is a length of the external-air introducing three-dimensional member, 11 is a width at the scapula inferior angle horizon, 12 is a waist (waist line) width, and 13 is a hip (hip line) width.

Fig. 8 is a front schematic diagram of the cooling garment of Example 43 of the present invention, in which 1 is a body, and 2 is an external-air introducing three-dimensional member.

Detailed Description of the Examples

[0008] A cooling garment of the present invention includes a garment body (1) and an external-air introducing three-dimensional member (2); and the external-air introducing three-dimensional member (2) includes a base material (2a) for receiving air and inducing the air into the garment, a side-wall material (2b) enabling an opening portion to be open during wearing, and an opening portion support material (2c). More specifically, in the cooling garment of the present invention, the base material (2a) is closer to the skin than the material of the garment body (1) at the opening portion support material (2c). Generally, one external-air introducing three-dimensional member (2) may be separately arranged on left and right sides of the garment body (1), but the present invention is not limited thereto, for example, only one external-air introducing three-dimensional member (2) may be arranged on the back.

[0009] In order to fulfill the purpose of negative-pressure air introduction, the external-air introducing three-dimensional member is open, the base material (2a) may introduce external air into the opening portion, while the side-wall material (2b) has a certain height, so that the opening portion is kept open during wearing, meanwhile, the support material (2c) is used at the opening portion to avoid collapse and even closure of the opening portion, and the external air can thus well enter the internal portion of the garment by such a design.

[0010] In order to form negative pressure, the external-air introducing three-dimensional member may be in a shape of a triangle, a trapezoid, an approximate triangle or an approximate trapezoid. Compared with a common triangle or a trapezoid, the approximate triangle or the approximate trapezoid has each side being formed an arc line inwards. In view of reducing the flowing resistance of the external air, the approximate triangle or the approximate trapezoid is preferable, and the approximate triangle is more preferable. The vertical distances from the arc line apexes of the approximate triangle to two waists of the common triangle are 0 to 50 mm, the vertical distances from the arc line apexes of the approximate trapezoid to two waists of the common trapezoid are also 0 to 50 mm, and the side lengths of the approximate triangle or approximate trapezoid are not specially limited and may be designed according to ergonomics. No matter which shape is adopted, as long as the three-dimensional member is gradually widened towards the opening portion and has a maximum section area at the opening portion, the exterior and the interior of the three-dimensional member will produce a great pressure difference and form a relatively large negative pressure, thereby fulfilling the purpose of air introduction.

[0011] The inventors discover by intensive studies that the wider the opening portion is and the longer the external-air introducing three-dimensional member is, the better the air introducing effect is.

[0012] In the present invention, the wider the opening portion is and the larger the section area thereof is, the better the air introducing effect is, but the width of the opening portion cannot be wider than the single shoulder. Based on the body measurement data of Japanese males from year 2004 to 2006, the average width of a single shoulder of Japanese males at the age of 20 to 49 years is roughly 13 cm, M size garments are suitable for the population having this single shoulder width, while the single shoulder widths of commercially available M size garments are generally 12 to 14 cm, and if the three-dimensional member of the present invention is arranged on a M size garment and the opening portion thereof is located on a shoulder line (5), then the width of the opening portion may be designed to be 12 to 14 cm.

[0013] In the present invention, the longer the longitudinal length of the three-dimensional member is, and the longer the path for inducing air is, the better the inducing effect is. For example, based on the body measurement data of Japanese males from year 2004 to 2006, the average distance from a nipple bust line (4) to shoulder lines (5) of Japanese males at the age of 20 to 49 years is about 20 cm, and if the three-dimensional member of the present invention is arranged on their garments and the opening portion is located on the shoulder line (5), the length of the three-dimensional member may be designed to be 10 to 18 cm in view of aesthetic aspect.

[0014] Those skilled in the art could understand that the values of width, length and the like of the opening portion of the three-dimensional member may be correspondingly adjusted for different models of garments.

[0015] In the present invention, the external-air introducing three-dimensional member may be arranged at the breast, shoulder, back, waist and other parts.

[0016] When the external-air introducing three-dimensional members are arranged at the breast and the fore shoulder, the specific positions, taking the nipple bust line (4) as a boundary, include the following two situations: (a) the members are located under the nipple bust line (4), and external air cannot smoothly enter the opening portion and flow into the garment during vertical or riding movement, so the cooling effect is ordinary; and (b) the members are located above the nipple bust line (4), i.e., located between the nipple bust line (4) and the shoulder lines (5), the opening portions are located nearby the shoulder lines (5), and external air cannot smoothly enter the opening portions and flow into the garment during riding movement, so the cooling effect is ordinary, whereas external air can smoothly enter the opening portion and flow into the garment during vertical movement, so the cooling effect is relatively good. When the external-air introducing three-dimensional members are arranged at the breast and the fore shoulder, the opening portions are at the upper part, so that the introduced air flows to the back.

[0017] When the external-air introducing three-dimensional members are arranged at the back and the rear shoulder, the specific positions, taking a scapula inferior angle horizon (6) as a boundary, include the following two situations: (a) the members are located under the scapula inferior angle horizon (6), i.e., located between the scapula inferior angle horizon (6) and the waist line (7), the opening portions are located nearby the waist line (7), external air cannot enter the opening portions during vertical movement, a cooling effect may not be achieved, and during riding movement, external air can smoothly enter the opening portions, but the cooling area is small, so the cooling effect is ordinary; and (b) the members are located above the scapula inferior angle horizon (6), i.e., located between the shoulder lines (5) and the scapula inferior angle horizon (6), the opening portions are located nearby the scapula inferior angle horizon (6), and external air cannot smoothly enter the opening portions and flow into the garment during vertical movement, so the cooling effect is ordinary, whereas external air can smoothly enter the opening portions and flow into the garment during riding movement, so the cooling effect is relatively good. When the external-air introducing three-dimensional members are arranged at the back and the rear shoulder, the opening portions are at the lower part, so that the introduced air flows to the back.

[0018] When the external-air introducing three-dimensional members are arranged at the waist, specifically arranged at the waist on two sides of the body, external air can enter the opening portions during vertical or riding movement, but the resistance is high, a small amount of air flows into the garment, the cooling area is relatively small, and the cooling effect is thus ordinary; and the aesthetic aspect is influenced.

[0019] In conclusion, the three-dimensional members of the present invention are preferably arranged between the nipple bust line (4) and the shoulder lines (5) or between the shoulder lines (5) and the scapula inferior angle horizon (6) on left and right sides of the body. When the three-dimensional members are arranged between the nipple bust line (4) and the shoulder lines (5) on left and right sides of the body, the opening portions are preferably located nearby the shoulder lines (5), and this design is suitable for vertical movement; and when the three-dimensional members are arranged between the shoulder lines (5) and the scapula inferior angle horizon (6) on left and right sides of the body, the opening portions are preferably located nearby the scapula inferior angle horizon (6), and this design is suitable for riding movement.

[0020] In the present invention, the base material (2a) in the three-dimensional member may be provided or may not be provided. If the base material is not provided, wind (external air) is directly introduced from the surface of human skin to the opening portion, a certain air introducing effect may be achieved, but the side-wall material is separated from human skin, the introduced air is easily diffused between the side-wall material and the human skin, a large amount of air cannot flow into the exhausting area, the cooling effect is thus influenced, and the naked skin at this part may influence the aesthetic aspect. The base material (2a) is not specially limited in form, may be a woven fabric, a knitted fabric, a non-woven fabric or the like, and is preferably a material with a small ventilation capacity. If the base material (2a) is a material with a large ventilation capacity, a certain air introducing effect may be achieved, but the introduced air is directly diffused to the windward part of the body easily via the base material (2a) and cannot flow through the exhausting area, and the cooling effect is influenced.

[0021] The inventors discover by intensive studies that the ventilation capacity of the base material (2a) is preferably 100 $cm^3/cm^2/s$ or below. The ventilation capacity is more preferably 10 to 50 $cm^3/cm^2/s$ in consideration of the wearing comfortableness when one sweats. The ventilation capacity is tested according to the standards of JIS L 1096-2010

Testing methods for woven and knitted fabrics (Breathability Determination: Method A).

[0022] The side-wall material (2b) is located inside the garment, and may directly contact with the skin, or may not directly contact with the skin in the manner of being wrapped, pressed, fitted or the like by a woven fabric, a knitted fabric or a non-woven fabric. The side-wall material (2b) may be directly sewed with the garment body (1) together or may not be directly sewed with the garment body (1), and in the latter situation, the side-wall material (2b) may be treated in the manner of being wrapped, pressed, fitted or the like by a woven fabric, a knitted fabric or a non-woven fabric and then sewed with the garment body (1).

[0023] The raw material, form and the like of the side-wall material (2b) are not specially limited, as long as the opening portion can be kept open during wearing. For example, the side-wall material (2b) may be a polymer including polyester, polyvinyl alcohol or polyether, or a macromolecular material synthesized by the reaction between the above polymer and acid ester. In the synthesized macromolecular material, polyurethane foam is preferable, and polyurethane sponge is more preferable, in which the sponge can absorb a small amount of sweat and is not too hard to influence wearing.

[0024] For another example, the raw material may be a plastic raw material, a synthetic resin raw material or a rubber raw material including polyester (PET), polyurethane (PU), polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyacrylonitrile (ABS), polymethyl methacrylate (PMMA), polyoxyethylene methylene (POM), polycarbonate (PC), polyamide (PA), phenolic aldehyde, amino and the like, or a synthesized macromolecular material prepared from a plastic raw material, a synthetic resin raw material or a rubber raw material and various auxiliary agents or additives. The thermoplastic elastomer plastic material is preferable, which can introduce a large amount of air, and is not too hard to influence wearing comfortability. The thermoplastic elastomer may be thermoplastic polyurethane elastomer (TPU) plastic materials, thermoplastic polyester elastomer (TPEE) plastic materials or the like.

[0025] The height of the side-wall material (2b) is designed according to the needs of an air flow passage. The side-wall material may be continuous or discontinuous, and the height thereof may be constant or variable. In order to fulfill the purpose of maximum section area of the opening portion, the higher the side-wall material (2b) is, the better the material is, so that external air easily enters the opening portion. In order to reduce the air flowing resistance, the height of the side-wall material (2b) is preferably variable, for example, the height begins from 0 mm and reaches the maximum at the opening portion. Meanwhile, considering the increase of inflow quantity of external air and the aesthetic aspect, the height is more preferably 5 to 20 mm. In conclusion, the side-wall material is most preferably a material of which the height begins from 0 mm and reaches the maximum at the opening portion and the range of the maximum is 5 to 20 mm.

[0026] The support material (2c) is used for avoiding bending deformation of the opening portion. If the opening portion does not use the support material, the fabric of the opening portion is easily close to the skin during movement, thereby influencing the introducing effect of external air. The raw material, form and the like of the support material are not specially limited, for example, the raw material may be a plastic raw material, a synthetic resin raw material or a rubber raw material including polyester (PET), polyurethane (PU), polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyacrylonitrile (ABS), polymethyl methacrylate (PMMA), polyoxyethylene methylene (POM), polycarbonate (PC), polyamide (PA), phenolic aldehyde, amino and the like, or a synthesized macromolecular material prepared from a plastic raw material, a synthetic resin raw material or a rubber raw material and various auxiliary agents or additives. Of course, the raw material may be a non-woven fabric made of various materials; for example, the raw material may be in the form of being wrapped by a woven fabric, a knitted fabric or a non-woven fabric, or a woven tape made of various fibers. The support material (2c) may be directly sewed with the garment body (1) together or may be not directly sewed with the garment body (1), and in the latter situation, the support material (2c) may be treated in the manner of being wrapped, pressed, fitted or the like by a woven fabric, a knitted fabric or a non-woven fabric and then sewed with the garment body (1).

[0027] The support material (2c) may be directly arranged on the side-wall material (2b) and located at the top of the opening portion, or form a support ring at the opening portion to allow the introduced air to enter the garment therein from the ring. It is a relatively good choice to form an elliptical support ring at the opening portion by using the woven tape made of a thermoplastic elastomer plastic material, the width thereof is not limited, when it is too wide easily results in stuffiness and weight increase, while if it is too narrow, it results in poor three-dimensional effect of the opening and low breathability, therefore the width thereof is preferably 10 to 50 mm; in addition, the thickness is not limited, if it is too thick, the weight is increased, while if it is too thin, it influences the three-dimensional effect of the opening and results in low breathability, and the thickness is thus preferably 0.2 to 2.5 mm. The support material is nontoxic, environment-friendly and good in supporting effect, and does not have any harm to the human skin. The thermoplastic elastomer may be a thermoplastic polyurethane elastomer (TPU) plastic material, a thermoplastic polyester elastomer (TPEE) plastic material or the like.

[0028] The inventors discover by intensive studies that the opening portion is unlikely to have bending deformation when the rigidity of the support material (2c) is 5.0 mN or above. In order to avoid bending deformation for a long time, the rigidity of the support material (2c) is preferably 10.0 mN or above, more preferably 10.0 to 100.0 mN, and the rigidity range is suitable for forming an elliptical support ring by the support material (2c). The rigidity is tested according to the standards of JIS L 1096-2010 *8.2.2.1A Method Rigidity of Testing methods for woven and knitted fabrics (Gurley Method).*

[0029] The side-wall material (2b) enabling the opening portion to be open during wearing and the opening portion support material (2c) may be different materials or may be identical materials, and may be formed integrally or separately.

[0030] In the present invention, the garment body (1) is not specially limited, and may be commercially available sports T-shirt, shirt, jacket or overcoat, in which the sports T-shirt may be various sports wears including football wear, basketball wear, tennis wear, walking wear, jogging wear, running wear (including Marathon wear), bicycle riding wear, motorcycle riding wear, etc. The walking wear is suitable for being worn when the walking speed is lower than 0.8 m/s, the jogging wear is suitable for being worn when the running speed is 0.8 to 1.6 m/s, and the running wear (including Marathon wear) is suitable for being worn when the running speed is 1.6 m/s or above.

[0031] In order to better reflect the body cooling effect, the T-shirt for running or bicycle riding is preferable in the present invention. The fiber raw material of the T-shirt may be cotton, polyester fibers or other materials suitable for making sports wears.

[0032] In order that the inflow quantity of external air is increased and the external air can smoothly flow into the clothes and be discharged, when the cooling garment of the present invention is a walking wear, a jogging wear or a running wear (including a Marathon wear), the side-wall material (2b) may extend from the nipple bust line (4) to any position of the back via the shoulder lines (5).

[0033] If the side-wall material (2b) extends from the nipple bust line (4) to the waist line (7) or the hip line (8) via the shoulder lines (5), the flow passage of air on the back is smooth, the effect of cooling the body is relatively good, but a lot of side-wall materials (2b) are used, so that the cost is increased; if the side-wall material (2b) extends from the nipple bust line (4) to the scapula inferior angle horizon (6) via the shoulder lines (5), a small amount of side-wall material (2b) is used, and the cost is thus low; and the garment is not tightly close to the human back under the scapula inferior angle horizon (6) during vertical movement of the human body, a certain space is reserved, and air can smoothly flow without the supporting of the side-wall material. The side-wall material (2b) needs to extend on the scapulas in order to achieve a good supporting effect. In the meanwhile, it is better to extend along respective outer edges of the two scapulas in order to meet the requirement for maximum air amount, and forms a maximum width at the scapula inferior angle horizon (6). Otherwise, the side-wall material does not pull the garment body away from the body on the scapulas, thereby reducing the outflow effect of air. The two pieces of side-wall material (2b) closer to the center line of the body in respective extending side-wall material (2b) of the three-dimensional members arranged on left and right sides of the garment respectively can be connected (e.g., shown by dotted lines in Fig. 1) or disconnected.

[0034] In conclusion, the side-wall material (2b) preferably extends from the nipple bust line (4) to the scapula inferior angle horizon (6) via the shoulder lines (5), more preferably extends along the two side edges of the scapulas, and forms a maximum width at the scapula inferior angle horizon (6). For example, based on the body measurement data of Japanese males from year 2004 to 2006, the average distance between the scapula inferior angles of Japanese males at the age of 20 to 49 years is roughly 19 cm, and the maximum width at the scapula inferior angle horizon (6) can thus be designed to be 19 cm. It should be noted that the maximum width value is set on the basis of M size garments having the average value for adult males, but it could be understood by those skilled in the art that the maximum width may be correspondingly adjusted for different models of garment. This principle is also applicable to the following similar circumstances.

[0035] When the cooling garment of the present invention is a bicycle riding wear or a motorcycle riding wear, the side-wall material (2b) may extend from the shoulder lines (5) to any position of the back.

[0036] When the side-wall material (2b) only extends from the shoulder lines (5) to the scapula inferior angle horizon (6), the side-wall material may support the garment body, so that air can be circulated, in addition, the usage amount of the side-wall material (2b) is low, and the cost is low; however, the garment under the scapula inferior angle horizon (6) is not supported by the side-wall material (2b), and if the human body moves with the back bending, the garment comes into fit with the back of the human body completely at the position under the scapula inferior angle horizon (6), so that air may not flow smoothly; when the side-wall material (2b) only extends from the shoulder lines (5) to the waist line (7), air may smoothly flow from the shoulder lines (5) to the waist line (7), but the lower hem of the tight riding garment is shrunk on and substantially located at the hip line (8), and air cannot smoothly flow out at the hip line (8), so the side-wall material (2b) preferably extends straightly from the shoulder lines (5) to the hip line (8) to guarantee that air may flow smoothly and flow out at the hip line (8). When the side-wall material (2b) extends from the scapula inferior angle horizon (6) to the hip line (8), a maximum width is preferably formed at the hip (at the hip line), in the meanwhile, the width of the waist (the waist line) is preferably smaller than that formed at the scapula inferior angle horizon (6), the width of the waist should not be too small and is preferably not smaller than one-third of the width formed at the scapula inferior angle horizon (6). Otherwise, the side-wall material does not pull the garment body away from the body on the scapulas, and the outflow effect of air is thus reduced. In the extending side-wall material (2b) of the three-dimensional members arranged respectively on left and right sides of the garment, the two pieces of side-wall material (2b) closer to the center line of the body may be connected (e.g., shown by dotted lines in Fig. 2) or may be disconnected.

[0037] In conclusion, the side-wall material (2b) preferably extends from the shoulder lines (5) to the hip line (8). Specifically, the side-wall material (2b) extends from the shoulder lines (5) to the scapula inferior angle horizon (6), and

then extends from the scapula inferior angle horizon (6) to the hip line (8). When the side-wall material (2b) begins to extend from the shoulder lines (5), it preferably extends along the edges of the two sides of the scapulas and forms a maximum width at the scapula inferior angle horizon (6); and when the side-wall material (2b) extends to the hip line (8), it preferably forms a maximum width at the hip (at the hip line). In the meanwhile, the width of the waist (the waist line) is preferably not wider than that formed at the scapula inferior angle horizon (6), and the width of the waist should not be too small and is preferably not smaller than one-third of the width formed at the scapula inferior angle horizon (6). For example, based on the body measurement data of Japanese males from year 2004 to 2006, the average distance between the scapula inferior angles of Japanese males at the age of 20 to 49 years is roughly 19 cm, the average of half hip line is 46 cm, the average of halt waist line is 39 cm, the maximum width at the scapula inferior angle horizon (6) may be designed to be 19 cm, the maximum width at the hip (the hip line) may be designed to be 46 cm, and the maximum width at the waist (the waist line) may be designed to be 6 to 19 cm.

Examples

[0038] Test methods for parameters of physical properties and the like involved in the present invention are as follows:

(1) Ventilation capacity

[0039] Tests were performed according to the standards of JIS L 1096-2010 *Testing methods for woven and knitted fabrics (Breathability Determination: Method A).*

(2) Rigidity

[0040] Tests were performed according to the standards of JIS L 1096-2010 *8.2.2.1A Method Rigidity of Testing methods for woven and knitted fabrics (Gurley Method).*

(3) Back temperature of a testee and outlet air amount

a. Experimental samples

[0041] T-shirts made in Examples and Comparative Examples

b. Test environment

[0042] Wearing experiments are performed in a phytotron by simulating a running movement or a bicycle riding movement, the environmental temperature is 25.0 ± 0.5°C, and the humidity is 65.0 ± 5%. The air speed is set to be 2 ± 0.5 m/s during running, a treadmill is used in the running movement, and the speed is set to 1.6 m/s; the air speed is set to 4 ± 0.5 m/s during bicycle riding, a power bicycle is used in the bicycle riding movement, and the power is set to 80 W.

c. Test methods

[0043]

1) The temperature between the skin of the back (scapula inferior angle) and the garment after the testee exercises for 20 min is measured by adopting an IBUTTON DS1923-F5 button-type temperature and humidity recorder of Wdsen Electronic Technology Co., Ltd. A lower temperature indicates a better body cooling effect.

2) The outlet air amount on the back (the scapula inferior angle horizon) of the running testee is measured by adopting a V-01-AND2N electronic anemometer; the outlet air amount at the hip (the hip line) of the bicycle riding testee is measured by adopting the same anemometer. The larger air amount indicates a better body ventilation effect and a better body cooling effect. The testee is generally an adult male wearing a commercially available M size garment.

(4) The cool feeling and comfortableness of the testee and the aesthetic aspect of the garment are evaluated by sense on five levels.

Levels	comfortableness	aesthetic aspect	cool feeling
1	comfortable	aesthetic	cool
2	semi-comfortable	semi-aesthetic	neither cool nor hot
3	middle	middle	warm

(continued)

Levels	comfortableness	aesthetic aspect	cool feeling
4	semi-uncomfortable	semi-unaesthetic	very warm
5	uncomfortable	unaesthetic	hot

[0044] The present invention will be further described below in combination with Examples and Comparative Examples.

[0045] The base material of the external air introducing member is not specially limited, and the selected knitted fabrics are used, side-wall material and support material are specifically set in the Examples and Comparative Examples.

Example 1

[0046] A T-shirt for running (the size thereof is equivalent to commercially available M size) is selected as a garment body (1), and an external-air introducing three-dimensional member (2) is separately arranged between the nipple bust line (4) and the shoulder lines (5) on the left and right body sides of the garment body (1). The three-dimensional member (2) is in a shape of an approximate triangle and includes a base material (2a), a side-wall material (2b) enabling an opening portion to be open during wearing and an opening portion support material (2c), the opening portion is located nearby the shoulder line (5), and the side-wall material (2b) extends from the nipple bust line (4) to the scapula inferior angle horizon (6) via the shoulder line (5), and when the side-wall material (2b) extends from the shoulder line (5) to the scapula inferior angle horizon (6), it extends along the edges of the two sides of the scapula, and the width formed at the scapula inferior angle horizon (6) is 19 cm.

[0047] The ventilation capacity of the base material (2a) is 100 $cm^3/cm^2/s$; the support material (2c) is a thermoplastic polyurethane elastomer (TPU) plastic material with a width of 10 mm, an elliptical support ring is formed at the opening portion, the length of the long axis thereof is the width of the opening portion, and with a length of 12 cm and a rigidity of 100.0 mN; the side-wall material (2b) is polyurethane sponge, and its height begins from 0 mm and reaches 5 mm at the opening portion; the length of the three-dimensional member (2) is 15 cm, and the vertical distances from the arc line vertex of the approximate triangle to two waists of the common triangle are 20 mm; the bottom edge length of the approximate triangle is the width of the opening portion, and the vertical distance from the vertex to the bottom edge is the length of the three-dimensional member (2).

[0048] The cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 2

[0049] The ventilation capacity of the base material (2a) is 50 $cm^3/cm^2/s$, the rest is the same as that in Example 1, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 3

[0050] The height of the side-wall material (2b) begins from 0 mm and reaches 20 mm at the opening portion, the rest is the same as that in Example 2, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 4

[0051] The ventilation capacity of the base material (2a) is 10 $cm^3/cm^2/s$, the rest is the same as that in Example 3, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 5

[0052] The rigidity of the support material is 10.0 mN, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 6

[0053] The ventilation capacity of the base material (2a) is 0 $cm^3/cm^2/s$, the rest is the same as that in Example 5, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 7

[0054] The rigidity of the support material is 5.0 mN, the rest is the same as that in Example 5, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 8

[0055] The height of the side-wall material (2b) is unchanged, i.e., 20 mm, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 9

[0056] The side-wall material (2b) is polyester soft synthetic resin, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 10

[0057] The support material (2c) is PVC synthetic resin material, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 11

[0058] The three-dimensional member (2) is in a shape of an appropriate trapezoid, the vertical distances from the arc line vertexes of the approximate trapezoid to two waists of the common trapezoid are 20 mm, the bottom of the approximate trapezoid is 12 cm, i.e., the width of the opening portion, the top is 4 cm, the vertical distance from the top to the bottom is 15 cm, i.e., the length of the three-dimensional member (2), the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 12

[0059] The length of the three-dimensional member (2) is 10 cm, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 13

[0060] The width of the opening portion is 6 cm, the rest is the same as that in Example 4, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 14

[0061] The height of the side-wall material (2b) begins from 0 mm and reaches 3 mm at the opening portion, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Example 15

[0062] The height of the side-wall material (2b) begins from 0 mm and reaches 30 mm at the opening portion, the rest is the same as that in Example 7, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Example 16

[0063] The ventilation capacity of the base material (2a) is 150 $cm^3/cm^2/s$, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Example 17

[0064] The rigidity of the support material is 200.0 mN, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Example 18

[0065] The rigidity of the support material is 1.0 mN, the rest is the same as that in Example 7, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Example 19

[0066] The side-wall material (2b) and the support material (2c) form an integrated structure and are thermoplastic polyurethane elastomer (TPU) plastic materials, the rest is the same as that in Example 5, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 20

[0067] The side-wall material (2b) and the support material (2c) form an integrated structure and are thermoplastic polyester elastomer (TPEE) plastic materials, the rest is the same as that in Example 5, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 1.

Example 21

[0068] A T-shirt for riding a bicycle (the size thereof is equivalent to commercially available M size) is selected as a garment body (1), and an external-air introducing three-dimensional member (2) is separately arranged between the shoulder lines (5) on the left and right body sides of the garment body (1) and the scapula inferior angle horizon (6). The three-dimensional member (2) is in a shape of an approximate triangle and includes a base material (2a), a side-wall material (2b) enabling an opening portion to be open during wearing and an opening portion support material (2c), the opening portion is located nearby the scapula inferior angle horizon (6), and the side-wall material (2b) extends from the shoulder line (5) to the hip line (8), and when the side-wall material (2b) extends from the shoulder line (5) to the scapula inferior angle horizon (6), it extends along the edges of the two sides of the scapula, and the width formed at the scapula inferior angle horizon (6) is 19 cm; when the side-wall material (2b) extends from the scapula inferior angle horizon (6) to the waist line (7), the width formed at the waist (the waist line) is 10 cm; and when the side-wall material (2b) extends from the waist line (7) to the hip line (8), the width formed at the hip (the hip line) is 46 cm.
[0069] The rest is the same as that in Example 1. A cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 22

[0070] The ventilation capacity of the base material (2a) is 50 $cm^3/cm^2/s$, the rest is the same as that in Example 19, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 23

[0071] The height of the side-wall material (2b) begins from 0 mm and reaches 15 mm at the opening portion, the rest is the same as that in Example 20, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 24

[0072] The ventilation capacity of the base material (2a) is 10 $cm^3/cm^2/s$, the rest is the same as that in Example 21, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 25

[0073] The rigidity of the support material is 10.0 mN, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 26

[0074] The ventilation capacity of the base material (2a) is 0 $cm^3/cm^2/s$, the rest is the same as that in Example 23, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 27

[0075] The rigidity of the support material is 5.0 mN, the rest is the same as that in Example 23, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 28

[0076] The height of the side-wall material (2b) is unchanged, i.e., 15 mm, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 29

[0077] The side-wall material (2b) is polyester soft synthetic resin, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 30

[0078] The support material (2c) is PVC synthetic resin material, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 31

[0079] The three-dimensional member (2) is in a shape of an appropriate trapezoid, the vertical distances from the arc line vertexes of the approximate trapezoid to two waists of the common trapezoid are 20 mm, the bottom of the approximate trapezoid is 12 cm, i.e., the width of the opening portion, the top is 4 cm, the vertical distance from the top to the bottom is 15 cm, i.e., the length of the three-dimensional member (2), the rest is the same as that in Example 17, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 32

[0080] When the scapula inferior angle horizon (6) extends to the waist line (7), the width formed at the waist (the waist line) is 1 cm, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 33

[0081] When the scapula inferior angle horizon (6) extends to the waist line (7), the width formed at the waist (the waist line) is 19 cm, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 34

[0082] When the scapula inferior angle horizon (6) extends to the waist line (7), the width formed at the waist (the waist line) is 39 cm, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 35

[0083] When the waist line (7) extends to the hip line (8), the width formed at the hip (the hip line) is 37 cm, the rest is the same as that in Example 22, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 36

[0084] The height of the side-wall material (2b) begins from 0 mm and reaches 3 mm at the opening portion, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Example 37

[0085] The height of the side-wall material (2b) begins from 0 mm and reaches 30 mm at the opening portion, the rest is the same as that in Example 25, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Example 38

[0086] The ventilation capacity of the base material (2a) is 150 $cm^3/cm^2/s$, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Example 39

[0087] The rigidity of the support material is 200.0 mN, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Example 40

[0088] The rigidity of the support material is 1.0 mN, the rest is the same as that in Example 25, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Example 41

[0089] The side-wall material (2b) and the support material (2c) form an integrated structure and are thermoplastic polyurethane elastomer (TPU) plastic materials, the rest is the same as that in Example 24, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 42

[0090] The side-wall material (2b) and the support material (2c) form an integrated structure and are thermoplastic polyester elastomer (TPEE) plastic materials, the rest is the same as that in Example 24, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Example 43

[0091] The side-wall material (2b) and the support material (2c) form an integrated structure and are thermoplastic polyester elastomer (TPEE) plastic materials, the rest is the same as that in Example 24, a cooling garment of the present invention is obtained, and the evaluation result is shown in Table 2.

Comparative Example 1

[0092] The base material (2a) is not provided, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Comparative Example 2

[0093] The side-wall material (2b) is not provided, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Comparative Example 3

[0094] The support material (2c) is not provided, the rest is the same as that in Example 1, a T-shirt for running is obtained, and the evaluation result is shown in Table 1.

Comparative Example 4

[0095] The same style of T-shirt for running without the external-air introducing three-dimensional members (2) is obtained, and the evaluation result is shown in Table 1.

Comparative Example 5

[0096] The base material (2a) is not provided, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Comparative Example 6

[0097] The side-wall material (2b) is not provided, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Comparative Example 7

[0098] The support material (2c) is not provided, the rest is the same as that in Example 19, a T-shirt for riding a bicycle is obtained, and the evaluation result is shown in Table 2.

Comparative Example 8

[0099] The same style of T-shirt for riding a bicycle without the external-air introducing three-dimensional members (2) is obtained, and the evaluation result is shown in Table 2.

Table 1

		Mechanism part				Side-wall member		Base member	Support member							
		Shape	Length cm	Opening width cm	Distance between the scapula inferior angles cm	Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN	Air temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
	Example 1	Approximate triangle	15	12	19	PU sponge	0~5 increase	100	TPU resin	100	31.54	434	2	3	2	good
	Example 2	Approximate triangle	15	12	19	PU sponge	0~5 increase	50	TPU resin	100	31.15	519	2	3	2	good
	Example 3	Approximate triangle	15	12	19	PU sponge	0~20 increase	50	TPU resin	100	30.36	956	1	3	1	excellent
	Example 4	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	TPU resin	100	30.18	1007	1	3	1	excellent
	Example 5	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	TPU resin	10	30.15	1045	1	1	1	outstanding
	Example 6	Approximate triangle	15	12	19	PU sponge	0~20 increase	0	TPU resin	10	29.98	1082	1	3	1	excellent
	Example 7	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	TPU resin	5	30.86	809	2	1	3	good

(continued)

		Mechanism part				Side-wall member		Base member	Support member		Air temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
		Shape	Length cm	Opening width cm	Distance between the scapula inferior angles cm	Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN						
	Example 8	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	TPU resin	100	30.92	785	2	3	2	good
	Example 9	Approximate triangle	15	12	19	soft PET plastic	0~20 increase	10	TPU resin	100	30.21	982	1	4	1	fair
	Example 10	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	PVC plastic	100	30.25	968	1	4	1	fair
	Example 11	Approximate	15	12	19	PU sponge	0~20 increase	10	TPU resin	100	30.65	847	2	3	1	good

(continued)

		Mechanism part				Side-wall member		Base member	Support member		Air temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
		Shape	Length cm	Opening width cm	Distance between the scapula inferior angles cm	Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN						
Jogging shirt	Example 12	Approximate triangle	10	12	19	PU sponge	0~20 increase	10	TPU resin	100	30.84	813	2	3	1	good
	Example 13	Approximate triangle	15	6	19	PU sponge	0~20 increase	10	TPU resin	100	31.52	465	2	3	2	fair
	Example 14	Approximate triangle	15	12	19	PU sponge	0~3 increase	100	TPU resin	100	31.9	302	3	3	2	fair
	Example 15	Approximate triangle	15	12	19	PU sponge	0~30 increase	10	TPU resin	5	30.06	1041	1	2	4	fair
	Example 16	Approximate triangle	15	12	19	PU sponge	0~5 increase	150	TPU resin	100	32.1	256	3	3	2	fair
	Example 17	Approximate triangle	15	12	19	PU sponge	0~5 increase	100	TPU resin	200	31.6	403	3	4	2	fair
	Example 18	Approximate triangle	15	12	19	PU sponge	0~20 increase	10	TPU resin	1	31.66	430	3	2	3	fair

(continued)

		Mechanism part				Side-wall member		Base member	Support member							
		Shape	Length cm	Opening width cm	Distance between the scapula inferior angles cm	Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN	Air temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
	Example 19	Approximate triangle	15	12	19	TPU resin	0~20 increase	10	TPU resin	10	29.95	1051	1	1	1	outstanding
	Example 20	Approximate triangle	15	12	19	TPEE resin	0~20 increase	10	TPEE resin	10	29.93	1053	1	1	1	outstanding
	Comparative Example 1	Approximate triangle	15	12	19	PU sponge	0~5 increase	not installed	TPU resin	100	32.35	197	3	3	5	poor
	Comparative Example 2	Approximate triangle	15	12	19	absence		100	TPU resin	100	32.73	58	4	3	4	poor
	Comparative Example 3	Approximate triangle	15	12	19	PU sponge	0~5 increase	100	absence		32.51	112	4	3	4	poor
	Comparative Example 4	-	-	-	-	-	-	-	-	-	32.74	-	4	-	-	poor

Table 2

		Shape and length of mechanism part, Openning width, Distance between scapula inferior angles	Waist width cm	Hip width cm	Side-wall member		Base member	Support member		Temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
					Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN						
	Example 21	same with Example 1	10	46	PU sponoe	0~5 increase	100	TPU resin	100	31.45	1052	2	3	2	good
	Example 22	same with Example 1	10	46	PU sponge	0~5 increase	50	TPU resin	100	31.1	1094	2	3	2	good
	Example 23	same with Example 1	10	46	PU sponge	0~20 increase	50	TPU resin	100	30.24	1259	1	3	1	excellent
	Example 24	same with Example 1	10	46	PU sponge	0~20 increase	10	TPU resin	100	30.06	1287	1	3	1	excellent
	Example 25	same with Example 1	10	46	PU sponge	0~20 increase	10	TPU resin	10	30.02	1306	1	1	1	outstanding
	Example 26	same with Example 1	10	46	PU sponge	0~20 increase	0	TPU resin	10	29.83	1378	1	3	1	excellent
	Example 27	same with Example 1	10	46	PU sponge	0~20 increase	10	TPU resin	5	30.72	1185	2	1	3	good
	Example 28	same with Example 1	10	46	PU sponge	0~20 increase	10	TPU resin	100	30.89	1168	2	3	2	good
	Example 29	same with Example 1	10	46	Soft PET plastic	0~20 increase	10	TPU resin	100	30.11	1274	1	4	1	fair
	Example 30	same with Example 1	10	46	PU sponge	0~20 increase	10	PVC plastic	100	30.15	1263	1	4	1	fair

(continued)

		Shape and length of mechanism part, Openning width, Distance between scapula inferior angles	Waist width cm	Hip width cm	Side-wall member		Base member	Support member		Temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
					Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN						
Cycling shirt	Example 31	same with Example 11	10	46	PU sponge	0~20 increase	10	TPU resin	100	30.54	1214	2	3	1	good
	Example 32	same with Example 1	1	46	PU sponge	0~20 increase	10	TPU resin	100	31.67	1015	3	3	1	fair
	Example 33	same with Example 1	19	46	PU sponge	0~20 increase	10	TPU resin	100	30.21	1258	1	3	1	excellent
	Example 34	same with Example 1	39	46	PU sponge	0~20 increase	10	TPU resin	100	30.64	1198	2	3	1	good
	Example 35	same with Example 1	10	37	PU sponge	0~20 increase	10	TPU resin	100	30.59	1205	2	3	1	good
	Example 36	same with Example 1	10	46	PU sponoe	0~3 increase	100	TPU resin	100	32.05	713	3	3	2	fair
	Example 37	same with Example 1	10	46	PU sponge	0~30increase	10	TPU resin	5	30.1	1261	1	2	4	fair
	Example 38	same with Example 1	10	46	PU sponoe	0~5 increase	150	TPU resin	100	32.16	678	3	3	2	fair
	Example 39	same with Example 1	10	46	PU sponoe	0~5 increase	100	TPU resin	200	31.65	988	3	4	2	fair
	Example 40	same with Example 1	10	46	PU sponge	0~20 increase	10	TPU resin	1	31.6	1022	2	2	3	fair

(continued)

	Shape and length of mechanism part, Openning width, Distance between scapula inferior angles	Waist width cm	Hip width cm	Side-wall member		Base member	Support member		Temperature between skin and garment °C	Outlet air amount ml/s	Cool feeing	Comfortableness	Aesthetic aspect	Comprehensive evaluation
				Material	Height mm	Air permeability $cm^3/cm^2/s$	Material	Rigidity mN						
Example 41	same with Example 1	10	46	TPU resin	0~20 increase	10	TPU resin	10	29.92	1311	1	1	1	outstanding
Example 42	same with Example 1	10	46	TPEE resin	0~20 increase	10	TPEE resin	10	29.9	1313	1	1	1	outstanding
Example 43	same with Example 1	10	46	TPEE resin	0~20 increase	10	TPEE resin	10	29.95	1300	1	1	2	excellent
Comparative Example 5	same with Example 1	10	46	PU sponge	0~5 increase	absence	absence	100	32.34	580	3	3	5	poor
Comparative Example 6	same with Example 1	10	46	absence	absence	100	TPU resin	100	32.8	264	4	3	4	poor
Comparative Example 7	same with Example 1	10	46	PU sponge	0~5 increase	100	absence	absence	32.62	375	4	3	4	poor
Comparative Example 8	-	-	-	-	-	-	-	-	32.97	-	4	-	-	poor

[0100] Comprehensive evaluation indicates a conclusion made by comprehensively considering the effects of air temperature between the skin and the garment, cool feeling on the back, outlet air amount, member comfortableness, aesthetic aspect and the like.

[0101] Based on the above test results, arranging the external-air introducing three-dimensional members on the T-shirt may reduce the air temperature between the skin and the garment, increase the cool feeling on the back, effectively discharge the heat generated by human bodies and cool the body. Based on this, the comprehensive evaluation effect is relatively good with the use of appropriately triangular members, a polyurethane sponge side-wall material, a thermoplastic polyurethane elastomer (TPU) plastic support material or a side wall and support integrated material formed by thermoplastic polyurethane elastomer (TPU) plastic, or a side wall and support integrated material formed by thermoplastic polyester elastomer (TPEE) plastic. Meanwhile, if the ventilation capacity of the base material is 10 to 50 $cm^3/cm^2 \cdot s$, the height of the side-wall material is 5 to 20 mm and the rigidity of the support material is 10.0 to 100.0 mN, the comprehensive evaluation effect is better; and if the height of the side-wall material is gradually increased from 0 mm, the effect is better. Under the equivalent condition, the effect is poor in the case without the base material, the side-wall material, the support material or the three-dimensional members.

[0102] As to the flow passage size design of the external-air introducing three-dimensional members, it may be known from the above test results that in accordance with ergonomics, if the longer the members are and the wider the opening portions are, the better the body cooling effect is; if the wider the width of the side-wall material at the hip (the hip line) is, the better the body cooling effect is; if the width of the side-wall material at the waist (the waist line) is smaller than the width formed at the scapula inferior angle horizon (6), the body cooling effect is relatively good, but the width of the waist should not be too small, and when the width of the waist is 1 cm, the body cooling effect is relatively poor.

[0103] The present invention is described according to specific Examples, but it should be understood by those skilled in the art that various changes and equivalent substitutions may be made without departing from the scope of the present invention. Moreover, in order to adapt to specific occasions or materials of the techniques of the present invention, many modifications may be made to the present invention without departing from the protection scope thereof. Therefore, the present invention is not limited to the specific Examples disclosed herein, but includes all the Examples falling into the protection scope of the claims.

Claims

1. A cooling garment, comprising a garment body (1) and an external-air introducing three-dimensional member (2), wherein the external-air introducing three-dimensional member (2) comprises a base material (2a) for receiving air and inducing the air into the garment, a side-wall material (2b) enabling an opening portion to be open during wearing, and an opening portion support material (2c).

2. The cooling garment according to claim 1, wherein the external-air introducing three-dimensional member (2) is in a shape of an appropriate triangle or an appropriate trapezoid, and the base material (2a) is gradually widened towards the opening portion.

3. The cooling garment according to claim 1, wherein the external-air introducing three-dimensional member (2) is separately arranged between a nipple bust line (4) and shoulder lines (5) or between the shoulder lines (5) and a scapula inferior angle horizon (6) on left and right sides of the body.

4. The cooling garment according to claim 1, wherein the ventilation capacity of the base material (2a) is 100 $cm^3/cm^2 \cdot s$ or below.

5. The cooling garment according to claim 1, wherein the rigidity of the opening portion support material (2c) is 5.0 mN or above.

6. The cooling garment according to any of claims 1 to 5, wherein the cooling garment is a walking wear, a jogging wear or a running wear, and the side-wall material (2b) extends from the nipple bust line (4) to the scapula inferior angle horizon (6) via the shoulder lines (5).

7. The cooling garment according to any of claims 1 to 5, wherein the cooling garment is a bicycle riding wear or a motorcycle riding wear, and the side-wall material (2b) extends from the shoulder lines (5) to a hip line (8).

Figure 1

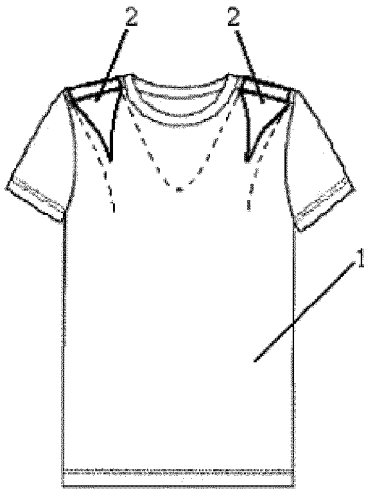


Figure 2

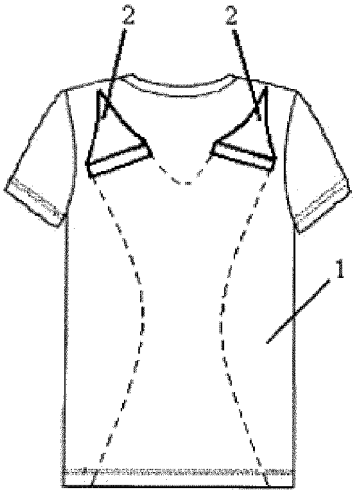


Figure 3

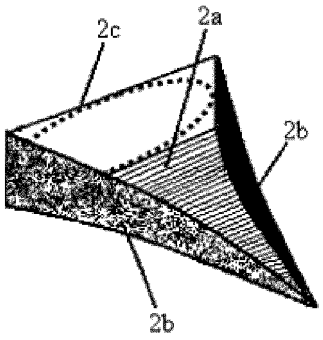


Figure 4

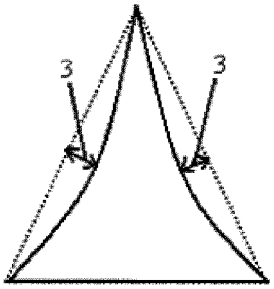


Figure 5

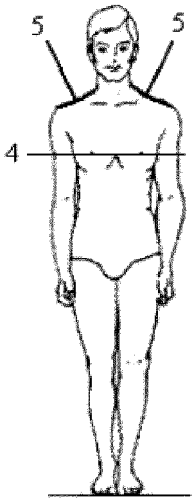


Figure 6

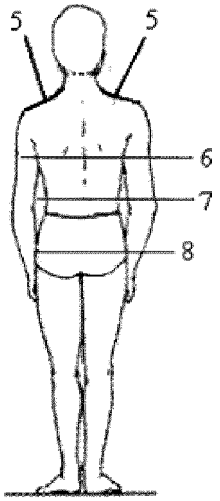


Figure 7

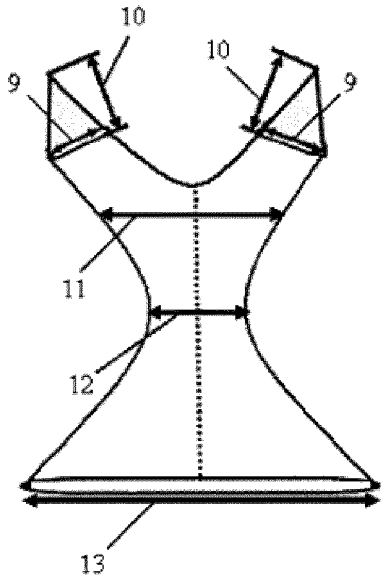
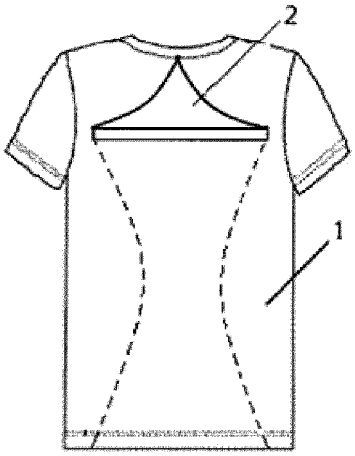


Figure 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/089309

A. CLASSIFICATION OF SUBJECT MATTER

A41D 27/28 (2006.01) i
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)

A41D/-

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)

CNPAT, CNKI, EPODOC, WPI: liu juan, ni qingmei, OTA KOICHI, xing guoliang, kūyězhéshēng, KOYAMA YOSHIRO, cooling, clothing, VENTILATE, AIR

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 202566332 U (LI, Rongji) 05 December 2012 (05.12.2012) description, paragraphs [0018]-[0023], and figures 1 and 2	1-7
A	CN 102188053 A (HONG KONG RESEARCH INSTITUTE OF TEXTILES AND APPARELS) 21 September 2011 (21.09.2011) claim 1	1-7
A	DE 202009005236 U1 (X-TECHNOLOGY SWISS GMBH) 11 February 2010 (11.02.2010) claims 1	1-7
A	US 6540585 B1 (LEE W.) 01 April 2003 (01.04.2003) claim 1	1-7
A	US 2003140399 A1 (GOLDE P.) 31 July 2003 (31.07.2003) claim 1	1-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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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
12 November 2015	26 November 2015
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHANG, Wei Telephone No. (86-10) 62414234

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/089309

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 202566332 U	05 December 2012	None	
CN 102188053 A	21 September 2011	US 2011239350 A1	06 October 2011
DE 202009005236 U1	11 February 2010	CN 102573538 A	11 July 2012
		EP 2473074 A1	11 July 2012
		RU 2012112923 A	10 October 2013
		JP 5726192 B2	27 May 2015
		KR 20120083377 A	25 July 2012
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		CA 2772581 A1	10 March 2011
		CN 102573538 B	19 August 2015
US 6540585 B1	01 April 2003	None	
US 2003140399 A1	31 July 2003	None	

Form PCT/ISA /210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 102573538 A **[0003]**
- CN 102188053 A **[0003]**