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(54) COOLING GARMENT

KÜHLENDES KLEIDUNGSSTÜCK

VÊTEMENT DE REFROIDISSEMENT

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Description

Technical Field

[0001] The present invention relates to a cooling garment that not only has excellent contact cold sensation and gives persistent contact cold sensation but also can reduce heatful feeling and is suitably wearable in wearing scenes such as offices and homes.

[0002] Documents WO 2014/084041 A1 and US 2006/080987 A1 disclose garments according to the preamble of claim 1.

Background Art

[0003] In recent years, there has been a demand for reduction of carbon dioxide emissions into the atmosphere as well as energy saving for the purpose of environmental protection. In general household and offices, efforts are being made to reduce the air-conditioning load and achieve energy saving mainly by adjusting the temperature setting of air conditioners as appropriate. On the other hand, a simple change in the temperature setting of air conditioners may lead to deviation from the temperature and humidity range that a person feels comfortable. Particularly in the summer, it is a problem to feel discomfort such as heatful feeling due to an increase in the temperature inside a garment. Therefore, in those textile products such as bedding and underwear that come into direct contact with the skin, contact cooling materials are used. These materials are designed to increase the thermal conductivity from the skin by using fibers having good thermal conductivity and to increase the contact area through improvement of the water absorbing properties of the fibers and reduction of the irregularities on the fiber surfaces.

[0004] For example, Patent Literature 1 proposes a composite fabric for a cool feeling material which can give a cold sensation by using a nanofiber nonwoven fabric composed of fibers having a diameter of 50 nm to less than 2.5 μm that are made of a polyurethane or an elastomer-based polymer, and in which the strength and the air permeability of the composite fibric can be maintained by laminating the composite fabric with a knitted fabric.

[0005] Further, as a woven or knitted fabric excellent in comfort which not only inhibits an increase in the temperature inside a textile product by improving the heat transfer through a contact with the skin and inhibits an increase in the humidity by effectively absorbing insensibly transpired moisture but also maintains a comfortable time as long as possible by not giving a sticky feeling even with liquid-phase sweat, Patent Literature 2 proposes a pile woven or knitted fabric using a composite yarn composed of filaments having a high heat conduction coefficient and cellulose short fibers.

[0006] In addition to the above-described technologies, garments into which external air is sent by fans attached to the respective garments are used against unpleasant feeling such as heatful feeling in the summer. In these garments, it is proposed to cool the body by evaporating sweat from the body with air blown from the fans and thereby utilizing an effect of removing vaporization heat from the surroundings at the time of sweat evaporation, or to cool the body by increasing a temperature gradient in the vicinity of the body surface with air circulation.

[0007] For example, Patent Literature 3 proposes a garment in which an air flow can be forcibly generated between an outer fabric and a lining fabric by attaching the lining fabric and the body is cooled by sending external air taken in by a fan to a space between the outer fabric and the lining fabric.

[0008] Moreover, Patent Literature 4 proposes a garment that cools the body by allowing air to flow in a flow path formed by a spacer inside the garment. Patent Literature 5 discloses an air blower and a protective suit including the air blower. Patent Literature 6 discloses a pad for cooling a space between mother and child. Patent Literature 7 disclsoses a cooling suit.

Citation List; Patent Literature

[0009] Patent Literature 1: JP 2011-68011 A; Patent Literature 2: JP 6454437; Patent Literature 3: JP 2018-168485 A; Patent Literature 4: WO 2003/103424; Patent Literature 5: WO 2014/084041 A1; Patent Literature 6: JP 2018-038576 A; Patent Literature 7: US 2006/080987 A1.

Summary of Invention

Technical Problem

[0010] When a person wears a garment in which a fabric produced by the technology disclosed in the Patent Literature 1 or 2 is used, the person can obtain an excellent contact cold sensation at the moment of wearing the garment; however, for example, when the person continues to wear the garment over a prolonged period, a thermal equilibrium state is established between the fabric and the body, and this leads to a loss or reduction of heat conduction from the body to the fabric; therefore, the person can no longer feel a cold sensation and rather experiences a heatful feeling, which is a problem.

[0011] Further, according to the technology disclosed in Patent Literature 3, it is possible to cool the body by providing a garment with an outer fabric and a lining fabric and forcibly generating an air flow in a space between the outer fabric and the lining fabric; however, in order to create a space inside the garment, it is necessary to use fabrics in a double structure of the outer fabric and the lining fabric and, since the garment is inflated with external air taken into the garment through a fan and this causes the lining fabric to be kept in contact with the skin, there is a problem of losing cold sensation. In addition, when the fan is stopped, there is a problem that a strong heatful feeling is experienced due to the double structure of the outer fabric and the lining fabric.

[0012] Similarly, according to the technology disclosed in Patent Literature 4, it is possible to cool the body by circulating air in an airflow path inside a garment and thereby vaporizing sweat; however, there are problems in that inflation of the garment with external air taken into the garment through a fan causes a loss of cold sensation of the fabric and that, even when the fan is stopped, a cold sensation cannot be experienced since the fabric does not come into contact with the body. In addition, it is also a problem that the use of a high-density fabric causes a strong heatful feeling.

[0013] In view of the above, the present invention aims at solving the above-described problems, and an object of the present invention is to provide a cooling garment that not only has excellent contact cold sensation and gives persistent contact cold sensation but also can reduce heatful feeling and is suitably wearable in wearing scenes such as offices and homes.

Solution to Problem

[0014] The cooling garment of the present invention is defined by claim 1.

[0015] In the cooling garment of the present invention, it is preferred that fibers constituting the fabric of the garment have a total fineness of 100 dtex or less.

[0016] In the cooling garment of the present invention, it is preferred that the fabric of the garment have a moisture absorption-desorption parameter ΔMR of not less than 3.0%.

[0017] In the cooling garment of the present invention, it is preferred that the fibers constituting the fabric of the garment contain a polyamide component at least partially.

[0018] In the cooling garment of the present invention, it is preferred that the fans each include blower vanes, a motor, and a battery, and that the fans have a total weight of 200 g or less.

Advantageous Effects of Invention

[0019] According to the present invention, a cooling garment that not only has excellent contact cold sensation and gives persistent contact cold sensation but also can reduce heatful feeling is provided. Particularly, the cooling garment of the present invention can be suitably used in wearing scenes such as offices and homes. Description of Embodiments

[0020] The cooling garment of the present invention is configured to take external air into a space between the garment and the body, and it is important that the cooling garment of the present invention be equipped with one or plural fans for taking external air into the space between the garment and the body. By taking in external air through the fans, an air flow is forcibly generated between the garment and the body to cause the garment to flutter, and this allows the body and the garment to come into contact at a preferred frequency. By allowing the body and the garment to come into contact at a preferred frequency, heat conduction from the body to the garment can be inhibited, so that a contact cold sensation can be felt repeatedly when the garment comes into contact with the body by fluttering or the like. In addition, by taking external air into the garment, air circulation is generated inside the garment to allow ventilation, so that heatful feeling can be reduced. The number of the fans included in the garment is not particularly limited; however, it is preferably five or less from the standpoints of reducing the total weight of the fans and providing wearing comfort.

[0021] The fabric used in the cooling garment of the present invention is required to have a basis weight of 250 g/m^2 or less. When the basis weight is more than 250 g/m^2, the fabric is rigid and unlikely to move, and this makes it difficult to form a space inside the garment even with the external air taken in through the fans; therefore, the body and the garment cannot come into contact at a preferred frequency. In addition, air circulation cannot be efficiently generated inside the garment. The basis weight of the fabric is preferably 230 g/m^2 or less, more preferably 200 g/m^2 or less. A lower limit of the basis weight is not particularly limited; however, the basis weight is preferably not less than 50 g/m^2 for improving the ease of handling, the wearability, and the durability of the fabric.

[0022] The fabric used in the cooling garment of the present invention is required to have a contact cold/warm sensation value Q-max, which can be determined by the method described below in the section of Examples, of 0.30 W/cm^2 or larger. The contact cold/warm sensation value Q-max is a maximum heat absorption rate at the time of instantaneous heat transfer from the fabric, and a person is likely to feel a cold sensation upon coming into contact with a fabric having a large Q-max value, or a warm sensation upon coming into contact with a fabric having a small Q-max value. When a fabric having a Q-max value of less than 0.30 W/cm^2 is used in a garment, a person cannot feel a contact cold sensation when wearing the garment. The Q-max value is preferably 0.35 W/cm^2 or larger, more preferably 0.40 W/cm^2 or larger.

[0023] The fabric used in the cooling garment of the present invention preferably has a moisture absorption-desorption parameter ΔMR of not less than 3.0%. The ΔMR is a difference in the moisture absorption rate of the fabric between a high-temperature and high-humidity condition, which is typified by 30°C and 90% RH, and a standard temperature and humidity condition, which is typified by 20°C and 65% RH. In other words, the ΔMR indicates the humidity control capacity of the fabric that absorbs and/or desorbs water when a change occurs in the temperature and the humidity. The larger the ΔMR, the more reduced are the stuffy feeling and the sticky feeling at the time of sweating and the further improved is the wearing comfort of the garment. When the ΔMR is 3.0% or larger, the fabric has a high humidity control capacity, so that an appropriate level of comfort can be obtained. The ΔMR is more preferably in a range of 3.5% or larger, still more preferably in a range of 4.0% or larger. There is no particular upper limit for the range of the ΔMR; however, a level that can be achieved by an ordinary technology is about 17%, and this is substantially the upper limit.

[0024] The fabric used in the cooling garment of the present invention has an air permeability of 10 cc/cm^2/sec or higher. By controlling the air permeability to be in this range, not only excellent sweat transpiration can be obtained and stuffy feeling, sticky feeling and heatful feeling that are experienced at the time of sweating can be reduced, but also the garment is prevented from being excessively inflated with external air taken in through the fans and moderate fluttering of the garment is generated, so that the body and the garment can be brought into contact at a preferred frequency. The air permeability is more preferably 50 cc/cm^2/sec or higher, still more preferably 100 cc/cm^2/sec or higher, particularly preferably 150 cc/cm^2/sec or higher. An upper limit of the air permeability is not particularly limited; however, in order to obtain good mechanical properties of the fabric, improve the processability and the ease of handling in the production of the fabric and the garment, prevent the fabric from being excessively thin, and obtain a garment having excellent durability without any discomfort during wearing, the air permeability is preferably 250 cc/cm^2/sec or lower from a practical standpoint.

[0025] A fiber material used in the fabric of the cooling garment of the present invention may be any of synthetic fibers, semi-synthetic fibers, natural fibers and the like, and examples of the fiber material include, but not limited to: polyester fibers, polyamide fibers, polyacrylic fibers, rayon fibers, acetate fibers, polyolefin fibers, polyurethane fibers, cotton, hemp, silk, and wool. The fabric may be formed of a single kind of fiber material, or a composite yarn obtained by combining plural fibers. Particularly, it is preferred that polyamide fibers be partially used in the fabric since polyamide fibers have excellent mechanical properties and durability as well as excellent moisture absorption-desorption performance.

[0026] The fibers used in the fabric of the cooling garment of the present invention may take any form of long fibers (filaments), short fibers (staples) and the like. **In** the case of long fibers, the fibers may each be a monofilament composed of a single fiber, or a multifilament composed of plural single fibers. In the case of short fibers, the cut length and the number of crimps are not limited. These fibers may be subjected to a post-processing, such as false-twisting or twisting.

[0027] The fibers used in the fabric of the cooling garment of the present invention are not particularly limited in terms of total fineness when they are in the form of filaments, and the total fineness may be selected as appropriate in accordance with the intended use and the required properties; however, it is preferably 100 dtex or less. With the total fineness being in this range, the flexibility of the garment is not impaired and external air taken in through the fans causes the garment to flutter moderately, so that the body and the garment can be brought into contact at a preferred frequency. The total fineness is more preferably 90 dtex or less, still more preferably 80 dtex or less. A lower limit of the total fineness is also not particularly limited; however, a level that can be achieved by an ordinary technology is about 4 dtex, and this is substantially the lower limit.

[0028] The fibers used in the fabric of the cooling garment of the present invention are not particularly limited in terms of single fiber fineness, and the single fiber fineness may be selected as appropriate in accordance with the intended use and the required properties; however, it is preferably 5.0 dtex or less. In the present invention, the "single fiber fineness" means a value obtained by dividing the total fineness of the fibers used in the fabric by the number of single fibers constituting the fibers. With the single fiber fineness being in this range, the flexibility of the garment is not impaired and external air taken in through the fans causes the garment to flutter moderately, so that the body and the garment can be brought into contact at a preferred frequency. The single fiber fineness is more preferably 2.5 dtex or less, still more preferably 1.5 dtex or less. A lower limit of the single fiber fineness is preferably 0.3 dtex or higher since this not only leads to good processability and ease of handling in the production of the fibers, the fabric and the garment, but also allows the cooling garment to have excellent durability with limited fluff generation during use.

[0029] The fibers used in the fabric of the cooling garment of the present invention preferably has a strength of 1.5 cN/dtex or higher; however, the fibers can be used at a strength of 1.5 cN/dtex or lower without any problem by taking measures, such as using the fibers in combination with other fibers in the production of the fabric. The elongation of the fibers may be set as appropriate in accordance with the intended use; however, it is preferably 25% to 60% from the standpoint of the workability in the processing of the fibers into the fabric.

[0030] As a cross-sectional shape of the fibers used in the fabric of the cooling garment of the present invention, a wide variety of cross-sectional shapes, such as a circular shape, a flat shape, a Y shape, a Tshape, a hollow shape, a cross-in-square shape and hash mark shape, can be adopted.

[0031] As for the structure of the fabric of the cooling garment of the present invention, the fabric may be a woven fabric, a knitted fabric, a pile fabric, a nonwoven fabric or the like, and may have any woven or knitted structure that can be preferably obtained by, for example, plain weaving, twill weaving, sateen weaving, double weaving, or modification of any of these weaving techniques, or warp knitting, weft knitting, circular knitting, lace stitching, or modification of any of these knitting techniques.

[0032] The form of the cooling garment of the present invention is not particularly limited, and may be either an upper wear or a bottom wear. The upper wear may be of a long sleeve or a short sleeve, and the bottom wear may be of a long hem or a short hem. **In** the present invention, an "upper wear" means a garment to be worn on the upper half of the body, and a "bottom wear" means a garment to be worn on the lower half of the body. Specific examples of the upper wear in the present invention include, but not limited to: underwear, such as inner shirts, tank tops, and camisoles; general clothes, such as T-shirts, polo shirts, tops, pajamas, blouses, blousons, and workwear; and sports clothes, such as sports inner shirts and sports shirts. Specific examples of the bottom wear in the present invention include, but not limited to: underwear, such as inner pants; general clothes, such as slacks, pants, skirts, pajamas, and workwear; and sports clothes, such as sports pants.

[0033] The fans used in the cooling garment of the present invention each include blower vanes, a motor, and a battery, and preferably have a total weight of 200 g or less. By controlling the total weight to be in this range, the garment is made less likely to hang down due to the weight of the blower vanes, the motor, and the battery, and a space is made more likely to be formed inside the garment by external air taken in through the fans; therefore, not only the body and the garment are allowed to come into contact at a preferred frequency, but also air can be efficiently circulated inside the garment. The total weight of the fans is more preferably 150 g or less, still more preferably 100 g or less.

[0034] In the fans used in the cooling garment of the present invention, the blower vanes constituting the fans preferably have an outer diameter of 10 to 60 mm. By setting the outer diameter of the blower vanes in this range, not only a sufficient amount of air flow can be obtained for sending external air into the garment and the noise during the operation of the fans is reduced, but also discomfort caused by the fans during wearing can be reduced; therefore, the garment is provided with excellent wearing comfort. The outer diameter of the blower vanes is more preferably 15 to 50 mm, still more preferably 20 to 40 mm.

[0035] In the cooling garment of the present invention, the total flow rate of external air taken in through all of the fans included in the garment is preferably 5 L/sec or lower. By controlling the total flow rate to be in this range, not only the noise during the operation of the fans is reduced, but also the garment is prevented from being excessively inflated with external air taken in through the fans and moderate fluttering of the garment is generated, so that the body and the garment can be brought into contact at a preferred frequency. The total flow rate is more preferably 3 L/sec or lower, still more preferably 1 L/sec or lower.

[0036] The fans used in the cooling garment of the present invention are preferably centrifugal fans or crossflow fans. Since a centrifugal fan and a crossflow fan are both capable of blowing air in the direction substantially perpendicular to their rotation axes, the use of a centrifugal fan or a crossflow fan makes it easier to blow external air with an orientation in the direction substantially parallel to the body. By blowing air in the direction substantially parallel to the body, the garment is made less likely to be inflated as compared to a case of blowing air in the direction substantially perpendicular to the body; therefore, moderate fluttering of the garment is generated, so that the body and the garment can be brought into contact at a preferred frequency.

[0037] The motor of each fan used in the cooling garment of the present invention is preferably a DC motor. By using a DC motor, each fan can be operated in a stable manner even at a low voltage.

[0038] The battery for supplying electric power to the motor of each fan used in the cooling garment of the present invention is not limited, and examples of the battery include a lead storage battery, an alkaline storage battery, a nickel-cadmium battery, a nickel-hydrogen battery, and a lithium ion battery. It is particularly preferred to use a lithium ion battery since it allows a size reduction and an increase in the capacity.

Examples

[0039] The present invention will now be described in detail by way of Examples thereof; however, the present invention is not limited to the below-described Examples. It is noted here that, in Examples, the values of properties were determined by the below-described respective methods.

A. Total Fineness

[0040] The total fineness of fibers constituting a fabric sample was determined in accordance with the method prescribed in JIS L1096:2010 "Testing methods for woven and knitted fabrics".

B. Basis Weight

[0041] The basis weight (g/m^2) of a fabric was determined by measuring the weight of the fabric cut into a 10-cm square and dividing the measured value by the area of the fabric (100 cm^2).

C. Q-max (W/cm^2)

[0042] A measurement fabric and an apparatus (KES-F7 THERMO LABO II TYPE, manufactured by KATO TECH CO., LTD.) were left to stand for at least 12 hours in a room adjusted to have a temperature of 20°C and a relative humidity of 60%. In order to adjust the temperature of the T-BOX used for measuring the heat transfer amount in contact with the measurement fabric to be 10°C higher than room temperature, the heat-storing hot plate BT was set at 30°C while the hot plate G-BT guarding the periphery of the hot plate BT for heating the hot plate BT was set at 20.3°C, and these hot plates were stabilized. The measurement fabric was placed with its back side (skin side when worn) facing up, and the T-BOX was quickly placed on the measurement fabric to measure the Q-max. As the basis weight of the measurement fabric, the value determined by the method described in the section B above was used.

D. ΔMR

[0043] After weighing about 1 to 2 g of a fabric sample in a weighing bottle and drying the fabric sample at 110°C for 2 hours, the mass was measured and this value was defined as w_0. Next, the dried fabric sample was maintained for 24 hours at a temperature of 20°C and a relative humidity of 65%, and the mass was subsequently measured and this value was defined as $w_{65\%}$. Thereafter, the temperature and the relative humidity were adjusted to 30°C and 90%, respectively, and the fabric sample was maintained for another 24 hours, after which the mass was measured and this value was defined as $w_{90\%}$. The ΔMR was calculated using the following equations.

$$MR_1 = [(w_{65\%} - w_0)/w_0] \times 100$$

$$MR_2 = [(w_{90\%} - w_0)/w_0] \times 100$$

$$\Delta MR = MR_2 - MR_1$$

E. Air Permeability

[0044] The air permeability was determined in accordance with JIS L1096(2010) 8.26.1 Air Permeability - Method A (Frazier method).

F. Persistence of Contact Cold Sensation

[0045] In a room that had a temperature of 28°C and a relative humidity of 65% to simulate an air-conditioned indoor environment in the summer, 20 subjects were asked to sit at rest on chairs and wear each cooling garment produced in Examples. The evaluation criteria for the contact cold sensation of fabric at the moment of wearing each cooling garment were set as follows: a score of 5 when "strongly felt a cold sensation"; a score of 4 when "felt a cold sensation"; a score of 3 when "slightly felt a cold sensation"; a score of 2 when "hardly felt a cold sensation"; or a score of 1 when "felt no cold sensation at all", and an average value of evaluation scores given by the 20 subjects was calculated. Thereafter, the subjects were asked to make the same evaluation on the contact cold sensation of fabric for a total of six times at 10-minute intervals over a period of one hour, and average values of the scores given by the 20 subjects at the respective time intervals were calculated. In the evaluations made at a total of 7 occasions which were at the moment of wearing each cooling garment and at the subsequent 10-minute intervals, the contact cold sensation of fabric was judged as "satisfactory" when the average score was 3.0 or higher at all of the occasions, or as "excellent" when the average score was 4.0 or higher at all of the occasions.

G. Heatful Feeling

[0046] Each cooling garment produced in Examples was worn by 20 subjects. Subsequently, the subjects sat at rest on chairs for one hour in a room that had a temperature of 30°C and a relative humidity of 60% to simulate an un-air-conditioned indoor environment in the summer. The evaluation criteria for the heatful feeling inside the garment thereafter were set as follows: a score of 5 when "experienced no heatful feeling at all"; a score of 4 when "experienced hardly any heatful feeling"; a score of 3 when "experienced a slight heatful feeling"; a score of 2 when "experienced a heatful feeling"; or a score of 1 when "experienced a strong heatful feeling", and an average value of evaluation scores given by the 20 subjects was calculated. An average value of 3.0 or higher was judged as "satisfactory", and an average value of 4.0 or higher was judged as "excellent".

H. Wearing Feeling

[0047] Each cooling garment produced in Examples was worn by 20 subjects. The evaluation criteria for the wearing feeling were set as follows: a score of 5 when "experienced absolutely no massive feeling, discomfort caused by wearing the garment, or unpleasant feeling due to fan noise"; a score of 4 when "experience substantially no massive feeling, discomfort caused by wearing the garment, or unpleasant feeling due to fan noise"; a score of 3 when "slightly experienced any one of massive feeling, discomfort caused by wearing the garment, and unpleasant feeling due to fan noise"; a score of 2 when "experienced any one of massive feeling, discomfort caused by wearing the garment, and unpleasant feeling due to fan noise"; or a score of 1 when "strongly experienced any one of massive feeling, discomfort caused by wearing the garment, and unpleasant feeling due to fan noise", and an average value of evaluation scores given by the 20 subjects was calculated. An average value of 3.0 or higher was judged as "satisfactory", and an average value of 4.0 or higher was judged as "excellent".

I. A-weighing Sound Pressure Level of Fan

[0048] In a room having an environmental noise of 40 dB or lower, each cooling garment produced in Examples was put on a mannequin, and a fan was rotated to generate an air flow of 1 m^3/min. Subsequently, the A-weighting sound pressure level was measured using a noise meter (SoundTest-Master, manufactured by UMAREX Gmbh & Co. KG) arranged at a position 50 cm away from a fan attachment opening of the garment in the fan rotation axis, and an average value over a period of 5 seconds was determined.

(Example 1)

[0049] A knitted fabric having a moss stitch structure was prepared by a known method using a false twisted yarn composed of 56 dtex-36 filament polyamide long fibers made of polycaprolactam having a polyvinylpyrrolidone addition rate of 5.0% by weight, and the thus obtained knitted fabric was sewn to produce a garment in the form of a polo shirt. The knitted fabric had a Q-max value of 0.35 W/cm^2, a basis weight of 185 g/m^2, a ΔMR value of 4.0%, and an air permeability of 154 cc/cm^2/sec. Two openings were formed at positions 20 cm above a garment lower part on the back side of the polo shirt, and centrifugal fans each having a total weight of 98 g including a motor and a battery and an outer diameter of 30 mm were attached to the respective openings to produce a cooling garment which takes in external air through the fans at a total flow rate of 0.7 L/sec and blows the air upward in the direction substantially parallel to the body, and a wearing test was conducted. The thus obtained evaluation results are shown in Table 1.

(Example 2)

[0050] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 1, except that the knitted fabric had a Q-max value of 0.37 W/cm^2 and a basis weight of 235 g/m^2. The thus obtained evaluation results are shown in Table 1.

(Example 3)

[0051] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 1, except that a false twisted yarn composed of 56 dtex-36 filament polyamide long fibers made of additive-free polycaprolactam was used to produce a fabric having a Q-max value of 0.30 W/cm^2 and a ΔMR value of 3.0%. The thus obtained evaluation results are shown in Table 1.

(Example 4)

[0052] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 1, except that centrifugal fans each having a total weight of 172 g including a motor and a battery and an outer diameter of 50 mm were used. The thus obtained evaluation results are shown in Table 1.

(Example 5)

[0053] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 1, except that the total flow rate of external air taken in through the fans was 3.5 L/sec. The thus obtained evaluation results are shown in Table 1.

(Example 6)

[0054] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 2, except that a false twisted yarn composed of 84 dtex-36 filament polyamide long fibers made of polycaprolactam having a polyvinylpyrrolidone addition rate of 5.0% by weight was used and the resulting knitted fabric had an air permeability of 70 $cc/cm^2/sec$. The thus obtained evaluation results are shown in Table 1.

(Example 7)

[0055] A garment in the form of a polo shirt was produced in the same manner as in Example 1, and a single opening was formed at a position 30 cm above a garment lower part on the back side of the polo shirt, and a storage section in the form of a pocket composed of the knitted fabric constituting the polo shirt was arranged on the inner side of the garment. A centrifugal fan having a total weight of 98 g including a motor and a battery and an outer diameter of 30 mm was stored in the pocket to produce a cooling garment which takes in external air through the fan at a total flow rate of 0.7 L/sec and blows the air upward in the direction substantially parallel to the body, and a wearing test was conducted. The thus obtained evaluation results are shown in Table 1.

(Comparative Example 1)

[0056] A wearing test was conducted without attaching any centrifugal fan to the polo shirt produced in Example 1. As seen from the thus obtained evaluation results shown in Table 1, the garment did not flutter due to the absence of air flow from a fan, and the persistence of contact cold sensation was poor.

(Comparative Example 2)

[0057] A cooling garment was produced and a wearing test was conducted in the same manner as in Example 1, except that a false twisted yarn composed of 56 dtex-144 filament polyamide long fibers made of polycaprolactam having a polyvinylpyrrolidone addition rate of 5.0% by weight was used and the resulting knitted fabric had a basis weight of 255 g/m^2. As seen from the thus obtained evaluation results shown in Table 1, the garment did not flutter due to the high basis weight of the fabric, and the persistence of contact cold sensation was poor as a result.

(Comparative Example 3)

[0058] An air-impermeable but moisture-permeable film was attached to the lining fabric of the cooling garment produced in Example 1 to obtain a cooling garment having a basis weight of 300 g/m^2 and an air permeability of 8 $cc/cm^2/sec$, and a wearing test was conducted. As seen from the thus obtained evaluation results shown in Table 1, the garment did not flutter due to the high basis weight and the low air permeability of the fabric, and the persistence of contact cold sensation was poor, as a result of which the subjects experienced a heatful feeling and had a discomfort in terms of wearing feeling.

(Comparative Example 4)

[0059] A knitted fabric having a moss stitch structure was prepared by a known method using a false twisted yarn composed of 84 dtex-36 filament polyester long fibers made of additive-free polyethylene terephthalate, and the thus obtained knitted fabric was sewn to produce a garment in the form of a polo shirt. This garment had a Q-max value of 0.23 W/cm^2, a basis weight of 185 g/m^2, a ΔMR value of 0.0%, and an air permeability of 154 $cc/cm^2/sec$. Two openings were formed at positions 20 cm above a garment lower part on the back side of the polo shirt, and centrifugal fans each having a total weight of 98 g including a motor and a battery and an outer diameter of 30 mm were attached to the respective openings to produce a cooling garment which takes in external air through the fans at a total flow rate of 0.7 L/sec and blows the air upward in the direction substantially parallel to the body, and a wearing test was conducted. As seen from the thus obtained evaluation results shown in Table 1, due to the low Q-max value of the fabric, the contact cold sensation was poor from the moment of wearing the garment, and the subjects experienced a heatful feeling as a result.

[Table 1]

		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Fan	Total Weight of Fan& Battery	98	98	98	172	98	98	98	-	98	98	98
	Numbers of Fan	2	2	2	2	2	2	1	0	2	2	2
	Outside Diameter of Fan (mm)	30	30	30	50	30	30	30	-	30	30	30
	Total Flow Rate of External Air taken in through Fan (L/sec)	0.7	0.7	0.7	0.7	3.5	0.7	0.7	-	0.7	0.7	0.7
	Air Blow Direction by Fan against Body	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward	-	substantially Parallel+ Upward	substantially Parallel+ Upward	substantially Parallel+ Upward
Fabric Properties	Q-max ((W/cm^2)	0.35	0.37	0.30	0.35	0.35	0.37	0.35	0.35	0.35	0.35	0.23
	Basis Weight (g/m^2)	185	235	185	185	185	235	185	185	255	300	185
	ΔMR (%)	4.0	4.0	30	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0
	Air Permeability (cc/cm^2/sec)	154	154	154	154	154	70	154	154	154	8	154
Fiber Properties	Polymer Type	Polyamide + PVP	Polyamide + PVP	Polyamide	Polyamide + PVP	Polyamide + PVP	Polyamide + PVP	Polyamide + PVP	Polyamide + PVP	Polyamide + PVP	Polyamide + PVP	Polyester
	Total Fiber Fineness (dtex)	56	56	56	56	56	84	56	56	56	56	84
	Single Fiber Fineness (dtex)	1.6	1.6	1.6	1.6	1.6	2.3	1.6	1.6	0.4	1.6	2.3

(continued)

			Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Evaluations	Contact Cold Sensation (point)	Just After Wearing	4.2	4.2	3.4	4.1	4.4	4.1	4.2	4.1	4.1	3.5	3.2
		After 10 min	4.1	4.0	3.4	3.7	4.2	4.0	4.0	3.0	3.5	3.2	2.0
		After 20 min	4.0	4.0	3.3	3.5	4.1	4.1	4.1	2.2	3.0	2.9	1.7
		After 30 min	4.0	3.7	3.2	3.2	4.0	3.7	4.0	1.8	2.8	2.5	1.2
		After 40 min	4.0	3.6	3.3	3.3	4.1	3.6	4.0	1.9	2.6	2.1	1.3
		After 50 min	4.1	3.6	3.1	3.1	3.9	3.4	4.1	1.7	2.6	2.0	1.3
		After 60 min	4.0	3.4	3.0	3.2	3.8	3.3	4.0	1.7	2.5	1.7	1.2
	Heatful Feeling (point)		4.1	3.8	3.4	4.0	4.0	3.1	4.0	3.4	3.8	1.7	2.8
	Wearing Feeling (point)		4.0	4.0	4.0	3.4	3.0	3.3	4.1	5.0	4.1	2.5	4.0
	A-weighting Sound Pressure Level of Fan (dB)		45	45	45	47	50	45	43	-	45	45	45
PVP: Polyvinylpyrrolidone													

Industrial Applicability

[0060] The cooling garment of the present invention not only has excellent contact cold sensation and gives persistent contact cold sensation but also can reduce heatful feeling and is suitably wearable in wearing scenes such as offices and homes.

Claims

1. A garment comprising one or plural fans for taking external air into a space between the garment and the body,

   characterized in that a fabric of the garment has a basis weight of 250 g/m^2 or less, and a contact cold/warm sensation value Q-max of 0.30 W/cm^2 or larger, wherein the contact cold/warm sensation value Q-max is measured by a method in which a measurement fabric and apparatus are left to stand for at least 12 hours in a room adjusted to have a temperature of 20°C and a relative humidity of 60%, a temperature of a T-BOX used for measuring a heat transfer amount in contact with the measurement fabric is adjusted to be 10°C higher than room temperature by setting a heat-storing hot plate BT at 30°C while a hot plate G-BT guarding a periphery of the hot plate BT for heating the hot plate BT is set at 20.3°C, and these hot plates are stabilized, and the measurement fabric is placed with its back side (skin side when worn) facing up, and the T-BOX is quickly placed on the measurement fabric to measure the Q-max; and
   wherein the fabric of the garment has an air permeability of 10 cc/cm^2/sec or higher,
   wherein the air permeability is measured in accordance with JIS L1096(2010) 8.26.1 Air Permeability - Method A (Frazier method).

2. The garment according to claim 1, wherein fibers constituting the fabric of the garment has a total fineness of 100 dtex or less, wherein the total fineness is measured by the method prescribed in JIS L1096:2010 "Testing methods for woven and knitted fabrics".

3. The garment according to claim 1 or 2, wherein the fabric of the garment has a moisture absorption-desorption parameter ΔMR of not less than 3.0%, wherein the moisture absorption-desorption parameter ΔMR is measured by a method in which after weighing about 1 to 2 g of a fabric sample in a weighing bottle and drying the fabric sample at 110°C for 2 hours, measuring its mass and defining this value as w_0; next, the dried fiber sample is maintained for 24 hours at a temperature of 20°C and a relative humidity of 65%, and its mass is subsequently measured and this value is defined as $w_{65\%}$; thereafter, the temperature and the relative humidity are adjusted to 30°C and 90%, respectively, and the fiber sample is maintained for another 24 hours, after which the mass is measured and this value is defined as $w_{90\%}$; and the ΔMR is calculated using the following equations.

$$MR_1 = [(w_{65\%} - w_0)/w_0] \times 100$$

$$MR_2 = [(w_{90\%} - w_0)/w_0] \times 100$$

$$\Delta MR = MR_2 - MR_1.$$

4. The garment according to any one of claims 1 to 3, wherein the fibers constituting the fabric of the garment comprises a polyamide component at least partially.

5. The garment according to any one of claims 1 to 4, wherein

   the fans each comprise blower vanes, a motor, and a battery, and
   the fans have a total weight of 200 g or less.

Patentansprüche

1. Kleidungsstück, umfassend ein oder mehrere Ventilatoren zum Transportieren von Außenluft in einen Raum zwischen dem Kleidungsstück und dem Körper,

dadurch gekennzeichnet, dass ein Gewebe des Kleidungsstücks ein Grundgewicht von 250 g/m^2 oder weniger und einen Kontakt-Kälte/Wärme-Empfindungswert Q-max von 0,30 W/cm^2 oder mehr aufweist, wobei der Kontakt-Kälte/Wärme-Empfindungswert Q-max durch ein Verfahren gemessen wird, in dem ein Messgewebe und eine -vorrichtung zumindest 12 Stunden lang in einem Raum, der auf eine Temperatur von 20°C und eine relative Feuchtigkeit von 60 % eingestellt ist, stehengelassen werden, wobei die Temperatur einer T-BOX, die zum Messen des Wärmeübertragungsausmaßes in Kontakt mit dem Messgewebe verwendet wird, auf 10°C höher als die Raumtemperatur eingestellt wird, indem eine wärmespeichernde Heizplatte BT auf 30°C eingestellt wird, während eine Heizplatte G-BT, welche einen Umfang der Heizplatte BT zum Erwärmen der Heizplatte BT abschirmt, auf 20,3°C eingestellt ist, und diese Heizplatten stabilisiert sind, und das Messgewebe mit seiner Rückseite (beim Tragen die Hautseite) nach oben platziert ist und die T-BOX schnell auf dem Messgewebe platziert wird, um Q-max zu messen; und
wobei das Gewebe des Kleidungsstücks eine Luftdurchlässigkeit von 10 cm^3/cm^2/s oder mehr aufweist,
wobei die Luftdurchlässigkeit gemäß JIS L1096(2010) 8.26.1 Luftdurchlässigkeit - Verfahren A (Frazier-Verfahren) gemessen wird.

2. Kleidungsstück nach Anspruch 1, wobei Fasern, die das Gewebe des Kleidungsstücks bilden, eine Gesamtfeinheit von 100 dtex oder weniger aufweisen, wobei die Gesamtfeinheit durch das in JIS L1096:2010 "Prüfverfahren für Web- und Maschenware" vorgeschriebene Verfahren gemessen wird.

3. Kleidungsstück nach Anspruch 1 oder 2, wobei das Gewebe des Kleidungsstücks einen Feuchtigkeitsabsorptions/-desorptionsparameter ΔMR von nicht weniger als 3,0 % aufweist, wobei der Feuchtigkeitsabsorptions/-desorptionsparameter ΔMR durch ein Verfahren gemessen wird, in dem nach Abwiegen von 1 bis 2 g einer Gewebeprobe in einem Wägeflasche und zweistündigem Trocknen der Gewebeprobe bei 110°C, wobei ihre Masse gemessen und dieser Wert als w_0 definiert wird; als nächstes die getrocknete Faserprobe 24 h lang bei einer Temperatur von 20°C und einer relativen Feuchtigkeit von 65 % aufbewahrt wird und ihre Masse anschließend gemessen und dieser Wert als $w_{65\%}$ definiert wird; danach die Temperatur und die relative Feuchtigkeit auf 30°C bzw. 90 % eingestellt werden und die Faserprobe weitere 24 h lang aufbewahrt wird, woraufhin die Masse gemessen und dieser Wert als $w_{90\%}$ definiert wird; und das ΔMR unter Verwendung der folgenden Gleichungen berechnet wird:

$$MR_1 = [(w_{65\%} - w_0)/w_0] \times 100$$

$$MR_2 = [(w_{90\%} - w_0)/w_0] \times 100$$

$$\Delta MR = MR_2 - MR_1.$$

4. Kleidungsstück nach einem der Ansprüche 1 bis 3, wobei die Fasern, welche das Gewebe des Kleidungsstücks bilden, zumindest teilweise eine Polyamidkomponente umfassen.

5. Kleidungsstück nach einem der Ansprüche 1 bis 4, wobei die Ventilatoren jeweils Gebläseschaufeln, einen Motor und eine Batterie umfassen und die Ventilatoren ein Gesamtgewicht von 200 g oder weniger aufweisen.

Revendications

1. Vêtement comprenant un ou plusieurs ventilateurs pour amener de l'air extérieur dans un espace situé entre le vêtement et le corps,

caractérisé en ce qu'un tissu du vêtement présente un grammage de 250 g/m^2 ou moins, et une valeur de sensation de froid/chaud de contact Q-max de 0,30 W/cm^2 ou plus, dans lequel la valeur de sensation de froid/chaud de contact Q-max est mesurée par un procédé dans lequel un tissu et un appareil de mesure sont laissés au repos pendant au moins 12 heures dans une pièce ajustée pour avoir une température de 20°C et une humidité relative de 60 %, une température d'une T-BOX utilisée pour mesurer une quantité de transfert de chaleur en contact avec le tissu de mesure est ajustée pour être supérieure de 10°C à la température ambiante en réglant une plaque chauffante de stockage de chaleur BT à 30°C tandis qu'une plaque chauffante G-BT protégeant une périphérie de la plaque chauffante BT pour chauffer la plaque chauffante BT est réglée à 20,3°C, et ces plaques chauffantes sont stabilisées, et le tissu de mesure est placé avec sa face arrière (côté peau lorsqu'il est porté) orientée vers le haut, et la T-BOX est placée rapidement sur le tissu de mesure pour mesurer la Q-max ; et

dans lequel le tissu du vêtement présente une perméabilité à l'air de 10 cc/cm^2/sec ou plus,

dans lequel la perméabilité à l'air est mesurée conformément à JIS L1096(2010) 8.26.1 Perméabilité à l'air - Procédé A (procédé de Frazier).

2. Vêtement selon la revendication 1, dans lequel les fibres constituant le tissu du vêtement présentent une finesse totale de 100 dtex ou moins, dans lequel la finesse totale est mesurée par le procédé prescrit dans JIS L1096:2010 « Procédés de test pour des tissus tissés et tricotés ».

3. Vêtement selon la revendication 1 ou 2, dans lequel le tissu du vêtement présente un paramètre d'absorption-désorption d'humidité ΔMR d'au moins 3,0 %, dans lequel le paramètre d'absorption-désorption d'humidité ΔMR est mesuré par un procédé dans lequel, après avoir pesé environ 1 à 2 g d'un échantillon de tissu dans un flacon de pesée, et avoir séché l'échantillon de tissu à 110°C pendant 2 heures, sa masse est mesurée et cette valeur est définie comme w_0 ; ensuite, l'échantillon de fibres séché est maintenu pendant 24 heures à une température de 20°C et une humidité relative de 65 %, et sa masse est ensuite mesurée et cette valeur est définie comme $w_{65\%}$; ensuite, la température et l'humidité relative sont ajustées à 30°C et 90 %, respectivement, et l'échantillon de fibres est maintenu pendant encore 24 heures, après quoi la masse est mesurée et cette valeur est définie comme $w_{90\%}$; et le ΔMR est calculé en utilisant les équations suivantes.

$$MR_1 = [(w_{65\%} - w_0)/w_0] \times 100$$

$$MR_2 = [(w_{90\%} - w_0)/w_0] \times 100$$

$$\Delta MR = MR_2 - MR_1.$$

4. Vêtement selon l'une quelconque des revendications 1 à 3, dans lequel les fibres constituant le tissu du vêtement comprennent au moins partiellement un composant de polyamide.

5. Vêtement selon l'une quelconque des revendications 1 à 4, dans lequel :

les ventilateurs comprennent chacun des aubes de ventilateur, un moteur et une batterie, et
les ventilateurs présentent un poids total de 200 g ou moins.

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

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