AIR DISTRIBUTION GARMENT

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Filed: Oct. 29, 1971

Appl. No.: 193,784

U.S. Cl......................2/78, 2/81, 2/DIG. 1, 62/259
Int. Cl......................A41b 9/00
Field of Search..............2/DIG. 1, 2.1 A, 2.1 R, 81, 2/108, 78; 62/259, 261

References Cited

UNITED STATES PATENTS
2,464,380 3/1949 Daiber.............................2/DIG. 1

2,826,758 3/1958 Kahn..................................2/81

FOREIGN PATENTS OR APPLICATIONS
1,155,985 5/1958 France................................2/DIG. 1
564,877 7/1957 Italy................................2/108

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ABSTRACT

An air distribution garment adapted to enclose the torso of the wearer consisting of a layer of an air-permeable, stretchable, compression-resistant, spacer fabric enclosed between layers of stretchable, air-permeable fabric, having air inlet openings on said garment communicating with manifolds within the garment and through which air is caused to flow over the back and chest portions through the spacer fabric to remove excess heat and moisture from the torso to maintain the body in thermal balance.

10 Claims, 7 Drawing Figures
AIR DISTRIBUTION GARMENT

The invention described herein may be manufactured, used and licensed by or for the Government for governmental purposes without the payment to us of any royalty thereon.

BACKGROUND OF THE INVENTION

This invention relates to protective clothing, and more particularly to a garment adapted to deliver a flow of air over a substantial portion of the body surface of the wearer to maintain the wearer in thermal balance.

Prolonged exposure of any individual to severe heat stress will lead to physiological exhaustion and, ultimately, if not otherwise relieved, to death. Severe heat stress can result from exposure to a high temperature or high humidity and while such conditions are normally found in certain geographical locations on the earth, they are, frequently and some times unexpectedly, encountered in certain localized environments or microclimates. For example, the microclimate within an impermeable protective garment, as is normally used when in proximity to toxic or dangerous materials, can, in very short time, attain temperatures in excess of 90°F and a relative humidity above 80 percent because of the retention of body heat and moisture within the garment. Temperatures generated in the vicinity of certain industrial machines or processes are frequently so high that only short exposure by operating personnel is permitted, resulting in a significant loss in efficiency of such personnel. Other situations in which severe heat loads are encountered can be found in the enclosed spaces within certain vessels of vessels wherein solar rays passing through transparent coverings produces a high radiant heat condition, or where the heat generated by equipment associated therewith produces high internal heat loads. It is essential that some means be provided to protect individuals from such stressful situations and where air conditioning of the area is not feasible, some personal form of protection must be provided. In U.S. Pat. No. 3,292,179 which issued Dec. 20, 1966 to V. D. Iacono, Jr. and L. A. Spano, there is disclosed a special purpose garment to be used in conjunction with a body covering that completely isolates and protects the wearer from his environment. While such special purpose garment is eminently suited for the purposes where complete isolation is required, it is not appropriate where the sole requirement is to reduce thermal stress on an individual.

SUMMARY OF THE INVENTION

This invention relates to an abbreviated, air-distribution system that is worn under ordinary or special purpose clothing. This system consists of a garment to enclose the torso, constructed of a multi-layer material wherein a compression-resistant, stretchable, air-permeable spacer fabric is sandwiched between two layers of air-permeable, stretch fabric, having means associated therewith to introduce air into the garment whereby a volume of air is caused to pass throughout the spacer fabric to remove both body heat and moisture. Circulation of air over the skin surface for body cooling is assured by the greater air permeability resistance of the outer clothing or covering.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevational view of an air distribution garment according to the present invention; FIG. 2 is a back elevational view of the garment of FIG. 1; FIG. 3 is a front elevational view of the spacer fabric employed in the garment of FIG. 1; FIG. 4 is a back elevational view of the spacer fabric of FIG. 3; FIG. 5 is a plan view, partially cut away, of a manifold employed in the garment of FIG. 1; FIG. 6 is a front elevational view of the garment of FIG. 1, partially open; and FIG. 7 is a front elevational view, partially cut away of a variation of the garment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of this invention illustrated in FIGS. 1 through 6 is a relatively loose fitting, one-piece unitary garment 10 which is designed to be worn under regular or special purpose clothing. As shown, the garment is adapted to enclose the torso from the neck downwardly and also enclose or cover the upper arms with sleeve portions 12 and the thighs of the wearer with leg portions 13. A front closure means 11 permits easy entry into and exit from the garment and extends from the top or the neck of the garment down to the iliac region and then downwardly along each thigh to the bottom of the garment. The front closure means 11 serves to releasably hold the opposed front panels 13 and 14 and bottom flap 15 of the garment together and is constructed of either buttons, hooks or snap fasteners and preferably of cooperating strips of a hook and pile fastener material which adhere when pressed together. Material of this sort is described in U.S. Pat. No. 2,717,437, issued to G. D. DeMestral and such material is commercially available under the trademark Velcro.

The air distribution garment of this invention is constructed of a multi-layer fabric material having both an inner 20 and an outer 21 layer of stretchable, air-permeable fabric and a middle or spacer layer 22 of a spacer material. The spacer material is a lightweight, flexible, resilient, non-absorbent, stretchable, compression-resistant fabric, having a low air-flow resistance. Example of a material meeting the foregoing requirements is a fabric manufactured and sold by Uniroyal, Inc. under the trademark "Trilock" and identified as style No. 6028-1-195. This material, which is described in U.S. Pat. No. Re. 24,007, employs a heat shrinkable yarn in one of the directions of the fabric which, on shrinking, causes the fabric to buckle in a serpentine fashion forming a three dimensional porous structure that exhibits good resistance to compression. Properties of this spacer fabric include a weight of 6.8 oz./yd.², 48 yarns/in. in the warp direction, 40 yarns/in. in the fill direction and a melting point of 430°F, for the warp fill and 335°F for the warp warp, and a compression-resistance such that the material recovers 90 percent of its initial thickness within 5 minutes after being compressed by a load of 10 lbs./sq. in. for 1 minute. The inner 20 and outer 21 fabric layers are constructed from porous, lightweight, stretchable fabrics having
elastomeric yarns in both directions of the fabric and include, for example, knitted, power net, Lycra fabrics having a weight of 5.9 oz./sq. yd., 37 yarns/in. in the wales and 28 yarns/in. in the courses.

Referring to FIG. 2, there is shown on the back side of the garment a pair of quick disconnect fittings 24 which function as air inlet means. These fittings are secured to the outer layer 21 of fabric and communicate with and allow the passage of air from some external source (not shown), such as an air hose, into separate air passage ways or manifolds 25 which act as channels to conduct air to different locations in the garment. The manifolds, as shown in FIG. 5, are crescent-shaped channels constructed of highly impermeable fabrics and having a spacer fabric 26 of the type described within the channel to assure passage of a flow of air. Air passes into the manifold through opening 28 and then out of the manifold through openings 27 at either end. Each manifold is fastened to the inside surface of the outer fabric layer 21 and is so positioned that one opening 27 is located in the chest area and the other opening 27 is located in the back area of the garment.

To assure that the garment of this invention offers little or no restraint to body movement, the middle spacer layer 22 is constructed as shown in FIGS. 3 and 4. Panels of stretchable fabric 30 are used in those areas where body movement would require extensive dimensional changes which could not be accomplished by the spacer fabric. The stretchable fabric used to connect the spacer fabrics is any lightweight, highly elastic fabric.

To enter into the air distribution garment, the front closure 11 means is separated as shown in FIG. 6. For clarity of illustration, only one leg portion is shown in the open unfastened position, but it is understood that the other leg portion may be similarly opened. After the garment is donned, the front closure means is appropriately fastened together.

An abbreviated embodiment 40 of the invention is shown in FIG. 7 which is designed to cover the upper portion of the torso. Front closure means 41, air inlet means (not shown), manifold means 42 and fabric construction are identical to those means described in connection with the garment of FIGS. 1 and 2. This embodiment may be preferred in those situations where less cooling air is required or where other restraints preclude the use of the more extensive garment.

Air distribution garments of this invention are preferably worn over undergarments. It is necessary, however, that some external covering by worn over this garment since all of the materials used in the air distribution garment are air permeable. The external covering should be either impermeable to air or more highly impermeable as compared to the outer fabric garment 21 since the greater air impermeability of the outer covering will function to retain air and insulate circulation of air over the torso surface.

In operation, either ambient or conditioned air from some external source, not shown, is caused to flow under pressure into the air inlet openings. The flow of air then continues through the air manifold exiting at either end causing the volume of incoming air to be distributed between the back and chest regions of the wearer from each separate manifold. After leaving the manifold, air passes throughout the air space defined by the spacer fabric of the garment cooling the body surface and carrying away any excess moisture. The flow of air ultimately escapes from the air distribution garment at the extremities thereof. In those situations in which a completely impermeable outer covering is employed, some valve means must be provided to allow for the removal of the air flow.

While a preferred form of the garment of this invention has been described, it is to be understood that the invention is not limited to this form and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

We claim:

1. A unitary, air distribution garment, adapted to enclose and circulate a flow of air over the torso of the wearer, said garment being of multi-layer construction and consisting of (1) an inner layer of a stretchable, permeable fabric, (2) an outer layer of a stretchable, permeable fabric, and (3) a middle layer of a flexible, compression-resistant, spacer fabric, said spacer fabric defining a channel for the passage of a flow of air between the inner and outer, permeable, fabric layers, and having air inlet means on said outer, permeable layer through which an air flow is introduced to the interior of said multi-layer construction, and manifold means within said garment and connected to said air inlet means to distribute said air flow to the front and back portions within said garment.

2. A unitary, air distribution garment according to claim 1 having front closure means extending from the top to the bottom of said garment and adapted to be separated to open said garment and be joined together to close said garment.

3. A unitary, air distribution garment according to claim 2 having a plurality of separate air inlet means and a similar number of separate manifold means connected therewith whereby a flow of air is uniformly distributed through the garment.

4. A unitary, air distribution garment according to claim 2 wherein said air inlet means is adapted to be connected to an external supply of air.

5. A unitary, air distribution garment according to claim 1 having sleeve portions adapted to inclose the upper arms of the wearer and leg portions adapted to inclose the thighs of the wearer.

6. A unitary, air distribution garment according to claim 5 having front end closure means, extending from the top of said garment down its front to the waist and then diagonally downward across the front of each leg portion to its bottom, which may be separated to open said garment along its front and along front of each leg portion and rejoin closed said garment.

7. A unitary, air distribution garment according to claim 6 having two spaced apart air inlet means located on the back of said garment and a separate manifold means associated with each of said air inlet means, said manifold means extending around opposite sides of said garment to provide an air flow to the front and back of said garment from each side of said garment.

8. A unitary, air distribution garment according to claim 7 wherein said manifold means consists of impermeable cloth tubes opened at each end and having spacer means therein to maintain a passage way within said tubes to allow for the flow of air therethrough.
9. A unitary, air distribution garment according to claim 8 wherein said manifold means is attached to and located beneath the outer permeable layer of fabric.

10. A unitary, air distribution garment according to claim 9 wherein said air inlet means is adapted to connect with an external supply of air.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Leo A. Spano and Vincent D. Iacono

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the front page format, data element 75, delete "Lacono" and insert --Iacono--.

Signed and sealed this 29th day of May 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. Attesting Officer

ROBERT GOTTSCHALK Commissioner of Patents