GARMENTS FOR CONTROLLING THE TEMPERATURE OF THE BODY


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5 Claims

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ABSTRACT OF THE DISCLOSURE

A garment for controlling the temperature of the human body by cooling or heating the skin in which a network of fluid conveying pipes forms a flexible unit supported by the garment in heat exchanging relationship with the body. Locating means in the form of fabric tunnels are provided which freely locate the pipes such that they can slideably move within the locating means and which restrain each pipe throughout its length in a circuitous serpentine configuration out of direct contact with the body for comfort, whereby the pipe circuit as a whole can deform as a result of bending or twisting of the pipes with minimum restriction to deformation and stretching of the garment.

This invention relates to garments for controlling the temperature of the human body by cooling or heating the skin.

The invention is particularly concerned with garments for aviators.

British patent specification No. 992,929 discloses apparatus for controlling the temperature of the human body comprising a garment having at least a trunk portion, and a pipe circuit for carrying liquid, of which some pipes run generally outwardly from the central region of the trunk portion and are so attached to the garment at least a proportion of the inner face of the garment which contacts the body of a wearer of the garment is formed of exposed walls of these pipes. The body contacting pipes are so connected in the pipe circuit that liquid will flow through each pipe in the same sense in relation to the central region.

Garments made in accordance with patent specification No. 992,929 have been found to be thermally very efficient in use. They do however suffer from the disadvantage that in use they cause discomfort to the wearer particularly in regions of the wearer’s body where relative movement between the body and the garment is likely to occur in particular at the knees, shoulders, elbows and seat regions and they are difficult and expensive to manufacture.

The discomfort arises from the fact that the pipes carrying the liquid can stretch little, if at all, and being secured to the fabric of the garment restrict the garment from stretching or deforming as would normally occur for example at knee and like regions of movement.

In garments for controlling the temperature of the human body and comprising a garment having pipes through which a heat transfer liquid is pumped, according to the present invention, locating means on the garment locate the pipes such that they are free to move within the locating means with respect to the garment and restrain them in an extended circuitous configuration whereby the pipe circuit as a whole can deform as a result of bending and/or twisting of the pipes with minimum restriction to deformation of the garment.

Thus, the garment preferably has pipe locating means comprising tunnels or casings which may be formed from the garment material and through which the pipes are threaded.

The whole of the pipe circuit may be located in this manner in which case the pipes do not contact a wearer’s body at any point. Whilst this arrangement is of lower thermal efficiency it affords additional comfort in use.

As a further step in providing ease of movement to a wearer the pipes are arranged to avoid the area of outside of the elbow and the front of the knee. Also, in regions where relative movement between different parts of a wearer’s body might cause kinking of the pipes, the pipes are run, as far as is practicable, parallel or near parallel to the hinge axis of the motion.

Thus, the pipes will run generally as far as is practicable transversely of the leg and arm behind the knee and at the front of the elbow, respectively, and generally transversely across the lower seat region.

The invention is illustrated by way of example in the accompanying diagrammatic drawings of which:

FIGURES 1 and 2 are front and rear views, respectively, of a garment according to the invention, and

FIGURE 3 shows a constructional detail.

Referring first to FIGURES 1 and 2, inlet and return pipes 11 and 12 for a heat transfer liquid lead to and from the trunk region, respectively. At the trunk region the return pipe 12 is connected to return manifolds 13, 13a which latter are in turn connected to similar return manifolds 14, 14a by connecting return pipes 15, 15a.

Also at the trunk region the inlet pipe 11 connects with inlet side pipes 16 and 17 and via a rear waist inlet pipe 18 to similar inlet side pipes 19 and 20 of which the pipes 16 and 19 extend up the sides of the body, behind the shoulders and down the outside of the arms and the pipes 17 and 20 extend down the sides of the body and the outside of the legs, respectively. At the lower wrist regions and the ankle regions the inlet pipes 16, 19 and 17, 20 are connected to inlet manifolds 21, 22 and 23, 24 respectively. A series of pipes for heat transfer liquid extend from the inlet manifolds 21, 22, 23 and 24 to the outlet manifolds 13 and 13a, 14 and 14a, 13 and 13a, and 14 and 14a, respectively.

Referring now to FIGURE 3, this illustrates the method of locating the pipes on the garment. Part of the body of a wearer is indicated at 31, the main body of the garment at 32 and a pipe for heat transfer liquid at 33. The pipe 33 is located on the garment body 32 by a strip 34, which may be of the same material as the garment body 32 and which is sewn in place as at 35, 36. A tunnel is thus formed between the garment body 32 and the strip 34 in which the pipe 33 is freely located. Thus as the garment body stretches and deforms with movement of a wearer, the pipes will be able to slide and/or twist within the tunnels thus reducing any restriction of movement.

It will be seen that the pipes for heat transfer liquid and which carry the liquid from the inlet manifolds 21-24 to the outlet manifolds 13, 13a, 14, and 14a each follow an elongated circuitous route. In particular these pipes are routed to avoid the front of the knees and the outside of the elbows and as far as is possible to run out of parallel with the legs and arms at the back of the knees and the front of the elbows, respectively. Similarly, at the buttock regions the pipes run in extended curves and to a large extent transversely across the body. With this arrangement the likelihood of the pipes being kinked and the liquid flow therein restricted at the elbows, knees and seat is greatly reduced.

In operation heat transfer liquid from a suitable heat exchanger is pumped into the inlet pipe 11 and passes through the pipe and manifold circuit to the outlet pipe 12 whence it returns to the exchanger, the liquid acting to cool or warm the wearer as the case may be.
We claim:

1. A garment for controlling the temperature of the human body and comprising trunk, arm, and leg portions;
   pipes for carrying a liquid heat transfer fluid to be pumped through the pipes;
   locating means secured to said garment for freely locating said pipes to be movable within the locating means and with respect to the garment, each of said pipes being restrained in a fixed extended circuitous path relative to the garment to preclude its migration from said path and also precluding any part of said pipe from engaging any other part of said pipe, said pipe circuit as a whole deforming as a result of bending or twisting of the pipes with minimum restriction to deformation of the garment; and
   said locating means comprising fabric tunnels in which the pipes are loosely housed throughout substantially the whole of their length and are not exposed to a wearer's body.

2. A garment for controlling the temperature of the human body as claimed in claim 1 and in which the pipes are located to run transversely of the legs and arms behind the knee and in front of the elbow regions, respectively, and generally transversely across the lower seat region of the garment.

3. A garment for controlling the temperature of the human body as claimed in claim 1, and in which the pipes are located on the garment to run substantially parallel to the hinge axis of relative movement between different parts of a wearer's body.

4. A garment for controlling the temperature of the human body as claimed in claim 1 and in which the pipes are arranged to avoid the outside of the elbows and the front of the knee regions of the garment.

5. A garment for controlling the temperature of the human body as claimed in claim 1 and in which the pipes are arranged to avoid the outside of the elbow and the front of the knee regions and are disposed to run substantially parallel to the hinge axis of relative movement between different parts of a wearer's body and to run transversely of the legs and arms behind the knee and in front of the elbow regions.

References Cited

UNITED STATES PATENTS

2,250,325 7/1941 Barnes 165—46
3,211,215 10/1965 Walker 165—171 XR
3,211,216 10/1965 Coleman et al. 165—46
3,242,979 3/1966 Shlosinger 98—1 XR
3,279,201 10/1966 Wertz et al. 62—259 XR
3,289,748 12/1966 Jennings 165—46
3,295,594 1/1967 Hopper 62—259 XR

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