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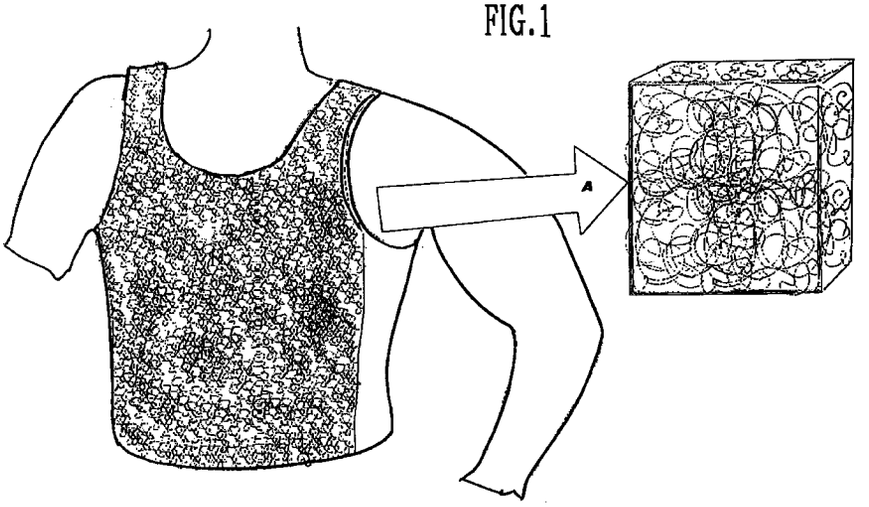
(54) Garment for increasing the dispersion of body heat during intensive physical activity

(57) Garment for wearing in direct contact with the human body, for example in the form of a vest or singlet to be worn a bare torso, characterized in that it is formed from a layer with large open cells, pervious to air, in which the sweat produced by the body travels as a result of capillarity along the walls of the cells which form overall a heat-exchange surface area substantially greater than the body surface area. Preferably said layer is formed by a polyurethane foam with open cells obtained by means of explosion technique. The cells have a size of at least a few millimetres, for example 4 cells per linear cm (10 cells per linear inch), and the thickness of the layer is at least 8 mm.

FIG.1



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Description

When performing sporting activities the high quantity of mechanical energy produced by the body's locomotory system is accompanied by the generation of a considerable quantity of heat which must be disposed of as rapidly as possible if the risk of a dangerous increase in the body temperature is to be avoided.

All warm-blooded animals have effective ways of dealing with the excess heat produced by their organisms during intense and prolonged muscular activity which, for example in the case of man, is represented by sporting activities and, to a lesser extent, military or working duties.

Of the various systems used by the human body to dispose of heat, by far the most effective one consists in evaporation of the sweat produced; this system undoubtedly functions well, but, in particular during the hot season, it may be insufficient since it is unable to prevent a gradual dangerous increase in the body temperature.

In internal-combustion engines as well, when high power outputs are produced, the problem of adapting the heat disposal systems arises: this problem has generally been solved by increasing the exchange area of the radiators. The idea forming the basis of the present invention consists, in a certain sense, in applying to man the concept of increasing the heat exchange area.

This result is achieved by means of the characteristic features mentioned in Claim 1.

It hardly needs to be pointed out that the garment according to the invention is fundamentally different from a garment of the "wet suit" type, even though the latter is also formed by a layer of resinous foam. Apart from the thickness - which in wet-suits is normally of the order of 4 to 6 mm - the fundamental feature of a wet-suit is its "insulating" feature (i.e. exactly the opposite of the "ventilating" feature which one wishes to obtain with the garment according to the invention), this being obtained by a closed-cell system able to form in practice a plurality of closed air cells with high heat insulation characteristics.

The garment according to the invention is also fundamentally different from that described in US-A-4,541,129: this patent, in fact, describes a vest which is made of a porous fabric material. However, this material - which moreover is referred to as "pile" which is a well-known fabric consisting of very closely arranged and small-sized cells - has the fundamental feature that it is absorbent. It is clearly stated in US-A-4,541,129 that the function of the vest is to absorb the sweat, leaving the skin dry. In other words it consists of a vest which has a function similar to that of absorbent nappies for babies.

The present invention proposes, on the other hand, a garment which enables evaporation of the sweat produced by the body to be increased by ensuring, in a very simple manner, that the sweat is distributed as a result of capillarity in the form of tiny droplets, over the very extensive surface area of the open cells of the garment itself, thus promoting the process of heat transfer by means of evaporation into the atmosphere. In other words, the garment according to the invention is able to act as a "radiator" or heat exchanger between the skin of the body and the external air.

Theoretically, any garment making contact with the human body - the surface area of which is wholly used to promote heat exchange of the body by means of sweating - is suitable for the purposes of the present invention. However, it is preferable to use a garment in the form of a singlet, as indicated by 1 in the enclosed figure, which is more effective in that it affects the torso - as the part of the body where transfer of the heat to the exterior is increased by means of evaporation - which, as is known, forms a considerable percentage of the entire surface area of the body.

According to a preferred embodiment, the garment is therefore designed in the form of a vest or singlet.

In order to perform the aforementioned radiator function, the garment according to the invention is made, according to a preferred embodiment, from a large-cell synthetic fabric, for example a layer of open-cell polyurethane, obtained with the explosion technique known per se. A layer of this type has, for example, 4 cells per linear cm (10 cells per linear inch) and therefore cells of considerable dimensions with a diameter of the order of a few millimetres.

According to a different embodiment, the garment is made with a very wide-mesh fabric or a perforated fabric covered with a non-woven layer formed by fairly thin filaments which are intertwined, as schematically shown in the detail A of Fig. 1.

According to either embodiment, this results in practice in the formation of extremely wide cells which are totally pervious to air, but distributed so as to form a high thickness, for example of the order of 8 to 16 mm or even more.

The experiments conducted have shown that, once sweating commences, the sensation one has is one of a notable feeling of freshness which is obviously due to the accelerated evaporation process.

The experiments carried out have demonstrated moreover that the use of a garment such as that described provides a fairly effective method for carrying out, in conditions of well-being, sporting disciplines of medium, long and extremely long duration, such as jogging, cycling, competitive walking, orienteering, rowing, etc.

In the case where the garment according to the invention is used for such a sporting activity, moreover, the wind produced by movement produces an additional effect which favours disposal of the heat since it promotes the evaporation process.

Fairly intense working and military activities also give rise to conditions in which disposal of the body heat produced may become critical, so that an additional

evaporation system - and therefore use of the garment according to the invention - may prove to be fairly useful.

Obviously the higher the surrounding temperature and the greater the degree of sweating, the more effective is the intense evaporating action performed by the garment described.

It is understood, however, that the invention is not limited to the particular configurations described, which form only non-limiting examples of the scope of the invention, but that numerous variations are possible, all within the grasp of a person skilled in the art, without thereby departing from the scope of the invention itself.

Claims

1. Garment for wearing in direct contact with the human body, characterized in that it is formed from a layer with large open cells, pervious to air, in which the sweat produced by the body travels as a result of capillarity along the walls of the cells which form overall a heat-exchange surface area substantially greater than the body surface area.

2. Garment according to Claim 1, characterized in that is designed in the form of a vest or singlet to be worn on a bare torso.

3. Garment according to Claim 1 or 2, characterized in that it is formed by a layer of polyurethane foam with open cells obtained by means of explosion technique.

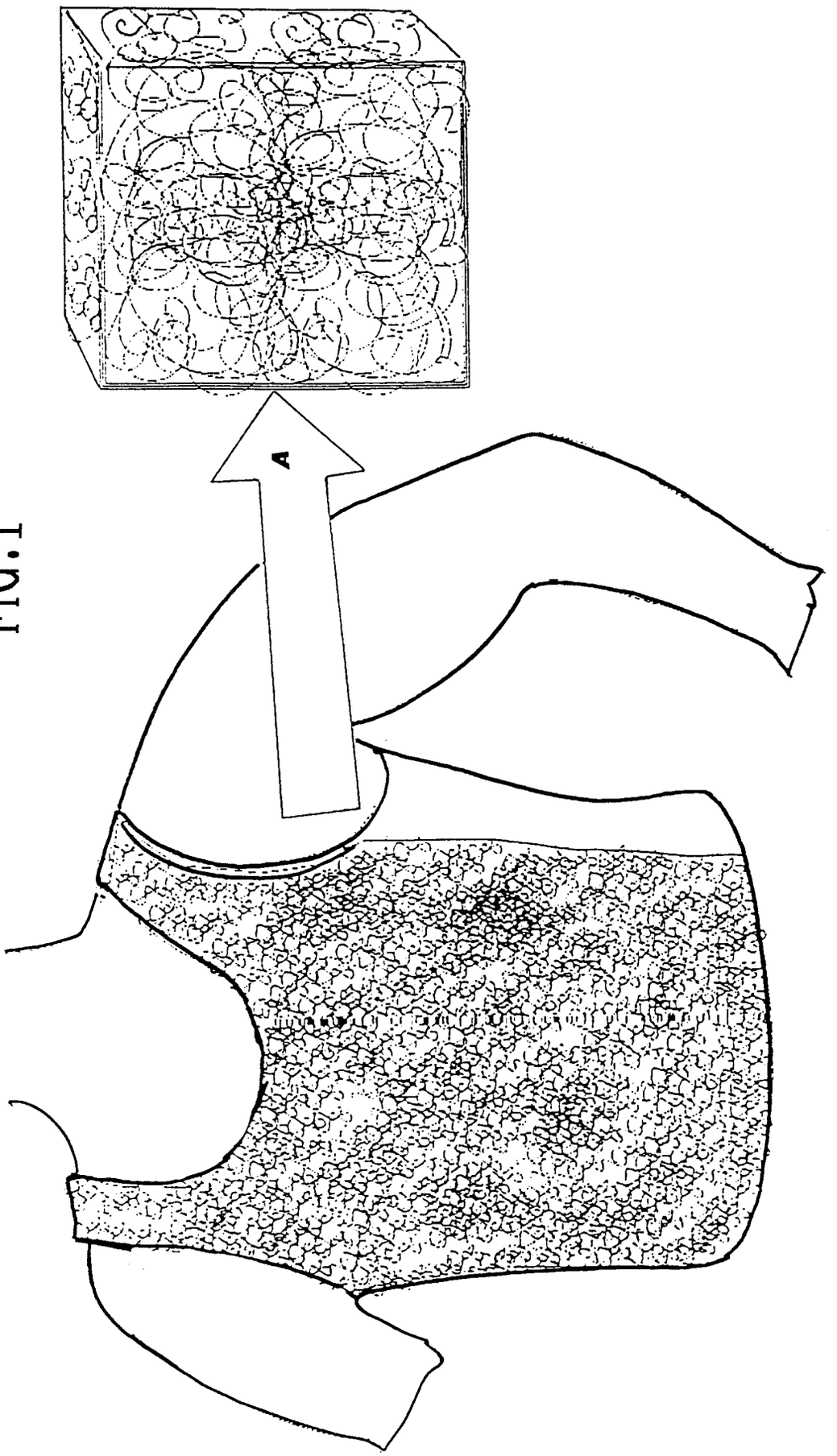
4. Garment according to Claim 3, characterized in that said layer of foam has 4 cells per linear cm (10 cells per linear inch).

5. Garment according to Claim 1 or 2, characterized in that it is formed by a very wide-mesh fabric or perforated fabric which is covered with a layer formed by fairly thin filaments which are intertwined.

6. Garment according to Claim 1 or any of the preceding claims, characterized in that said large open cells have a diameter of a few millimetres.

7. Garment according to any one of the preceding claims, characterized in that said layer with large open cells has a thickness of at least 8 mm and is pervious to air and to sweat.

FIG. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 4070

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y,D	US 4 541 129 A (MURAKAMI,H.) 17 September 1985 * column 2, line 18 - column 3, line 20; claim 1; figures 1,2,4 *	1-3	A41B9/06 A41B17/00 A41D13/00
Y	DE 21 64 933 A (SPOHN UND KNOELL GMBH) 12 July 1973 * page 10, paragraph 2 - page 12, paragraph 1; claims 1,2,4; figures 1,3 *	1-3	
A		5	
Y	DATABASE WPI Week 8714 27 February 1987 Derwent Publications Ltd., London, GB; AN 87-097843 XP002052184 & JP 62 045 704 A (LAUREL KK) , 27 February 1987 * abstract *	1-3	
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A	US 4 170 793 A (SCOTT T.O'BRIEN) 16 October 1979 * column 2, line 40 - column 3, line 40; claim 1; figures 1-3 *	1,5	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A41B A41D
A	US 3 122 754 A (WEDIN,A.B.) 3 March 1964 * the whole document *	1	
A	GB 2 241 152 A (TOYO BOSEKI KK) 28 August 1991 * the whole document *	1	
A	GB 2 025 316 A (HUBERT VÖN BLUCHER ET AL) 23 January 1980 * the whole document *	1	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 June 1998	Munzer, E

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 937 883 A (TODD T. SHIRAI) 3 July 1990 * the whole document *	1	
A	US 5 075 901 A (VOLLRATH,V.) 31 December 1991 * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)

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THE HAGUE	24 June 1998	Munzer, E

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