An article of clothing having at least one thermal insulating element in at least one predetermined zone, wherein the insulating element is at least partially incompressible.
THERMALLY INSULATED ARTICLE OF CLOTHING

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon French Patent Application No. 02.13125, filed Oct. 15, 2003, the disclosure of which is hereby incorporated by reference thereto in its entirety and the priority of which is hereby claimed under 35 U.S.C. §119.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an article of clothing, such as a garment, glove, shoe, etc., which provides thermal insulation.

[0004] 2. Description of Background and Relevant Information

[0005] Garments or articles of clothing that are adapted to provide thermal insulation, particularly in cold weather, have one or several layers of insulating material, such as wadding, polar fur, down, etc.

[0006] Inflatable insulating materials have also been developed with the idea that inflating the material provides an increased layer of air between the user and the outer air and, therefore, provides for an increase in the amount of thermal insulation.

[0007] Such constructions are described, for example, in documents DE 198 35 081, DE 297 23 798, U.S. Pat. No. 3,771,170, U.S. Pat. No. 6,055,670, and WO 01/84989, the latter also published as US 2003/0131967.

[0008] It is also known to have multi-layer garment systems, namely a coat or pants forming a first outer envelope, generally made of a light material acting as a windbreaker, and/or a waterproof envelope that can be breathable, and a second envelope, generally made of a polar-type material, wool, etc., adapted to be arranged underneath the outer envelope.

[0009] In any case, the underlying principle is that air is the ideal thermal insulation and, consequently, the insulating material is preferably selected for its inflatability, i.e., its aptitude to confine a high volume of air for a given weight.

[0010] One of the materials considered to be the most insulating is down, which is used to make garments allowing resistance to very low temperatures.

[0011] Because the insulating material is positioned about the user's entire body, according to a uniform density, the user's movements can be substantially hindered depending on the thickness of the insulating material.

[0012] The insulation of a garment is determined empirically and is generally expressed in Clo, Clo being defined by the relation 1 Clo=0.155 m2 K/W. The value of 1 Clo corresponds approximately to the insulating power of a mid-season light garment.

[0013] A good insulating sport garment must therefore reconcile a good thermal insulation and adaptability to movement. One could be tempted to decrease the insulating layer because, when moving, the athlete himself/herself produces thermal energy and therefore does not need as much insulation as when he/she is stopped.

[0014] The problem is that the user can alternate moving phases with static phases. This is particularly true in sports, such as alpine skiing, in which the skier must be protected against the cold, not only during skiing but also during rest on chair lifts or ski lifts.

[0015] Various series of tests conducted by the inventors have indeed proven that the waiting time in alpine skiing was a primary cause for getting cold.

[0016] Other causes for getting cold at the lower limbs, such as the seated position or high speed descent, have also been proven.

SUMMARY OF THE INVENTION

[0017] An object of the present invention is to overcome the aforementioned drawbacks and to propose an article of clothing that provides an excellent thermal insulation, or at least a thermal insulation appropriate to the outside temperature, while remaining light and easy to wear and, in particular, which does not hinder movement through an excessive thickness.

[0018] This object is obtained in the article of clothing according to the invention which has an insulating material in at least one predetermined zone, wherein the insulating element is at least partially incompressible under the effect of forces exerted during its use.

[0019] Indeed, after numerous tests, the inventors recognized that substantial losses of heat were in fact due to an excessive compression of the insulating material due precisely to the weight of the insulating material in the horizontal or semi-horizontal parts of the body, such as the shoulders or the chest, i.e., under the effect of the forces of gravity.

[0020] Therefore, according to the invention, in these predetermined zones (such as the areas of the shoulders and/or chest) a thermal insulating element is arranged that is at least partially incompressible and, in any case, has a negligible compressibility for the loads that are applied thereto, always to guarantee thereby the desired thickness of air or insulation over the entire body or over a part of the body under consideration, and to generally obtain a higher thermal insulation, without hindering the user's freedom of movement.

[0021] In zones such as the shoulders, the chest, etc., the load applied to the insulating material is in fact relatively low (on the order of several kilos over the entire surface), and the materials used can therefore be relatively flexible, conserving at least a residual thickness under a load on the order of 2 millimeters (mm) depending on the forces and the degree of insulation desired.

[0022] The insulating element that is at least partially incompressible can also be arranged in the areas of the buttocks, the knees, etc., namely zones in which the user compresses the insulating element due to his/her weight or the force exerted (for example, by sitting or by kneeling), the minimal residual thickness of the insulating element is determined depending on the insulation quality and the mobility desired.
In these cases of a load, the insulating element is compressed by the user’s weight or by the force that he/she exerts on a solid object (seated position on a lift, crouching position, etc.), and the load applied is therefore relatively substantial (up to several tens of kilograms over the surface).

The insulating material must therefore be comparatively more resistant to compression, by conserving a residual thickness under a load on the order of 2 mm minimum, depending on the forces and the degree of insulation desired.

For a glove, the load is created by the pressure of the user’s hand on the pole, for example, or on a solid object (snow, lift, shovel handle, etc.). The load is therefore relatively substantial (up to about twenty kilos), but has substantial requirements for mobility. The minimal residual thickness under a load can therefore be lower, however, without being less than 1 mm, depending on the forces and the degree of insulation desired. The insulating element that is at least partially incompressible can be arranged instead of, or in addition to, the regular insulating layer on the palm of the hand.

The insulating element can be constituted by an inflatable pocket of air, foam, for example, polyurethane foam, polyethylene foam, EVA foam, neoprene, or even an agglomeration of polymer beads, for example, polystyrene, having a minimal thickness under a load corresponding to the aforementioned needs.

The insulating element that is at least partially incompressible can also be arranged in zones of the garment in which are exerted compression forces related to the speed of displacement and, for example, on the front surface of a skier’s thighs, or on the front surface of the torso and/or on the abdomen of a bicyclist.

The invention will be better understood and other characteristics thereof will be shown by means of the following description given with reference to the attached schematic drawings, in which:

Fig. 1 is a front view of an insulating undergarment according to the invention, adapted in particular to skis;

Fig. 2 is a back view of the undergarment of Fig. 1;

Figs. 3 and 4 schematically show the principle of the invention;

Fig. 5 is a partial perspective view of an insulating garment according to a second embodiment;

Fig. 6 is a cross-sectional view along the line VI-VI of Fig. 5;

Fig. 7 is a view, similar to Fig. 5, of an insulating garment according to a third embodiment;

Fig. 8 is a cross-sectional view along the line VIII-VIII of Fig. 7;

Fig. 9 is a bottom view of an insulating glove liner according to the invention.

The undergarment according to the invention, shown in Figs. 1 and 2, is constituted of a long-sleeved undershirt adapted to completely cover the chest and the arms, and of a long underpants covering the hips and legs.

The undershirt and the underpants can be made of a fine insulating material or simply of cotton, or of a material having predetermined qualities of breathability and/or moisture evacuation, because these elements merely constitute an undergarment adapted to integrate the insulating system according to the invention.

In this case, the undershirt and the underpants have, in predetermined zones, insulating elements 10, 20 and 30, respectively.

Thus, as shown in Figs. 1 and 2, each insulating element 10, 20, 30 substantially has the shape of a fishbone so as to guarantee flexibility and minimum weight.

Each element 10, 20, 30 is therefore includes a sort of central rib 11, 21, 31, respectively, having a rectilinear (rib/ridge 21) or curvilinear (ribs 11, 31) form, and lateral ribs 12, 22, 32, respectively, extending "radially" from both sides of the central rib 11, 21, 31, respectively.

The insulating element 10 is arranged in an area adapted to cover each of the shoulders, the insulating element 20 is arranged in an area adapted to cover the front of the thighs, and the insulating element 30 is arranged in an area adapted to cover the buttocks.

In the case of Figs. 1-4, each element 10, 20 includes an insulating material 40, such as polyurethane foam. In this case, the foam 40 has a thickness e1 on the order of 5 mm at rest, and a thickness e2 on the order of 4.7 mm under a load F.

This means that in the case of a load, due here to the weight of the garment on the wearer’s shoulders, the foam 40 remains at least partially incompressible and conserves a minimal thickness e2 of 4.7 mm, for a local insulating value of approximately 0.7 Clo, the overall insulating value of the garment being on the order of 1.7 Clo.

Comparative measurements between a garment provided at the shoulders with a substantially incompressible insulating element and a garment made only of wadding of the known type E, marketed as PRIMALOFT®. Show a local insulation gain of 52% (0.48-0.73 Clo), and an overall insulation gain of more than 13%. The insulation and thermal comfort of the garment are therefore improved very substantially without having a negative effect on the freedom of movement due to localization in well defined zones of the garment.

The insulating material 40 can include any thermal insulating material that is at least partially incompressible and made, in particular, of closed cell polymer foam (for example, as known under the trademark NEOPRENE®) or opened cell, an agglomeration of polymer beads, expanded polymer, textile wadding, non-woven, inflatable insert, "hollow" inserts, which can be a material that resists compression, enveloped with an airtight material and forming a pocket in which one creates a high vacuum, etc. It can include, in particular, a tri-dimensional knitted fabric. It can also have a mix of the different materials mentioned hereabove.

In the case of Figs. 1-4, the element 30 includes an insulating material, such as polyethylene foam. In this case,
the foam has a thickness at rest on the order of 4 mm, and a thickness under a load on the order of 2.5 mm.

[0047] This means that in the case of a load, due here to the user’s weight when he/she sits down, the foam conserves a minimal thickness of 2.5 mm for a local insulating thick of approximately 0.4 Clo, which is markedly greater than what has been obtained prior to the invention.

[0048] As indicated previously, the insulating element 10 has the function of maintaining a minimum insulating thickness at the shoulders despite the weight of the insulating element itself, or the weight of the garments arranged on top.

[0049] The function of the insulating element 30 is to guarantee a minimal insulating thickness under the effect of the user’s weight, and this insulating element 30 will therefore have a minimal residual thickness on the order of 2 mm.

[0050] The insulating elements 20, provided on the front surface of the thighs, has the function of conserving the desired minimal insulation under the effect of the speed, for example, during a descent.

[0051] Other zones for the application of thermal insulating elements can be provided depending on the user and the sport practiced and, for example:

- the zone of the bust for a woman;
- the palm and/or back of the hand for a ski/bike/motorcycle glove;
- the knees for a canoeist or a kayaker;
- the front and/or back for a bicyclist or a motorcyclist;
- the top of the cranium for a helmet;
- the sole for a boot, etc.

[0058] Instead of being integrated on the outer surface of a garment, as in the case of the undergarments 1 and 2 shown in FIGS. 1 and 2, the insulating element can also be arranged on the inner surface of an outer envelope or between an outer envelope and a garment lining. It can be sewn, glued, welded, or simply set as a lining. It can also be removable. Depending on the type of material used for the garment, the insulating element can be simply constituted by one or several additional layers of the material constituting the garment.

[0059] In any case, the principle underlying the present invention is to focus on the “weak spots” of the thermal insulation of a garment, the improvement of local insulation of the garment at these weak spots allowing for a significant improvement of the overall thermal insulation of the garment, or for an identical overall thermal insulation to decrease the volume/bulkiness of the garment.

[0060] FIGS. 5-8 show other embodiments of an insulating element, in this case, an insulating element of the shoulders, but which could be arranged in any other area.

[0061] In the case of FIGS. 5 and 6, the insulating element 110 includes an inflatable pocket determining air pockets 111, separated one from the other by welding zones 112.

[0062] If the pocket 110 is fully inflated, the insulating element is almost incompressible, or at least it has an insignificant compressibility for the loads considered.

[0063] In the present case, the element 110 is arranged between two outer 114 and inner 115 layers of the garment.

[0064] A valve 113 that is accessible from the outside allows its inflation. A layer of insulating air is thus created between the two envelopes 114, 115, this layer having a residual thickness that varies according to the inflating of the element 110.

[0065] In the case of FIGS. 7 and 8, the insulating element 210 is constituted of a textile layer 212, on which are arranged beads 211 made of an incompressible material, such as PVC, an expanded polymer, etc.

[0066] The assembly is arranged between two outer 214 and inner 215 layers, respectively. An additional layer 216 made of an insulating material, such as textile wadding, polar, etc., can be added.

[0067] As in the previous case, the assembly constitutes a layer of incompressible air in the zone of the beads 211.

[0068] FIG. 9 shows an example of an application of the present invention to the embodiment of the lining of an alpine ski glove.

[0069] In a ski glove, additional insulation is needed at least in the palm of the hand to compensate for the crushing of the insulating material and therefore the loss of thermal insulation when the hand is tightened on the pole.

[0070] In the case shown, the lining of the insulating glove 300 itself is shown in the form of a glove made of an insulating material, such as wadding, i.e., a non-woven synthetic material, for example, marketed as “PRIMALOFT®,” “THERMOLITE®,” etc.

[0071] Insulating elements 310, 320, 330, and 340 made of a substantially non-compressible insulating material are fixed, for example, by sewing or gluing, on this lining 300. It is noted that these insulating elements could also be fixed on the outer envelope of the glove (either inside or outside thereof).

[0072] These insulating elements 310, 320, 330, 340 are placed on both sides of the zones/lines that are folded the most.

[0073] Thus, the insulating elements 310 are arranged in the area of the first phalanges of each finger, the insulating elements 320 are arranged at the second and third phalanges of each finger.

[0074] As for the thumb, a single insulating element 320 is provided for the phalanges (first and second ones).

[0075] Furthermore, with regards to the palm of the hand itself, the insulating elements 330 and 340 are provided at the metacarpus of the thumb and at the metacarpi of the other fingers, respectively.

[0076] It is noted that the insulating elements 320, 330, 340 stop at the primary zones/lines of articulation so as not to hinder hand flexibility.

[0077] In this case, the primary zones of articulation are referenced on the drawing as follows:

[0078] Lines 350, 370 designate the lines of articulation between the first phalanges of the fingers or of the thumb and the metacarpi.
[0079] Line 360 designates the line of articulation between the first phalanges and the second phalanges of each finger.

[0080] The insulating material constituting the elements 310-340 is, for example, a closed cell PE foam having a thickness of approximately 3 mm.

[0081] It can also be constituted by a layer of polar of 100 or 200 gram/mm², having a thickness of approximately 3.5 mm.

[0082] In the case where the insulating material is polar, the entire palm of the hand can be made of this material since polar material is rather flexible and will not hinder finger flexion.

[0083] Compared to a normal insulating material of the previously indicated wadding type, the use of PE foam or of polar material allows for a substantial gain of incompressibility and therefore of thermal insulation.

[0084] The following table gives examples of thicknesses of an insulating material under no pressure and under a pressure of 4.6 kPa, and clearly shows the gain in insulation obtained as compared to a conventional wadding filler through the use of substantially non-compressible materials, such as PE foam, or even polar material that actually is much less compressible than the wadding material.

<table>
<thead>
<tr>
<th>Insulating Material</th>
<th>Thickness; pressure = 0</th>
<th>Thickness; pressure = 4.6 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;PRIMALOFT 80&quot; type wadding</td>
<td>16 mm</td>
<td>1.7 mm</td>
</tr>
<tr>
<td>Polar 100 or 200 gram/mm²</td>
<td>3.5 mm</td>
<td>2.4 mm</td>
</tr>
<tr>
<td>Closed cell PE foam</td>
<td>3 mm</td>
<td>2.7 mm</td>
</tr>
</tbody>
</table>

[0085] The present invention is not limited to the particular embodiments which have been described herein as non-limiting examples, and encompasses all similar and equivalent embodiments.

[0086] The thicknesses of the thermal insulating element are dependent on the quality of the thermal insulation of the element, the overall thermal insulation desired, and the load exerted or provided on the insulating element either due to gravity or due to the forces exerted during use.

What is claimed is:

1. An article of clothing comprising:
   at least one element of thermal insulation in at least one predetermined zone of the article of clothing, said element of thermal insulation being at least partially incompressible under effect of forces exerted during use of said article of clothing.

2. An article of clothing according to claim 1, wherein the insulating element is arranged in an area adapted to be positioned at shoulder zone of a wearer.

3. An article of clothing according to claims 1, wherein the insulating element is arranged in an area adapted to be positioned at a wearer’s buttocks.

4. An article of clothing according to claims 1, wherein the insulating element is arranged in an area adapted to be positioned on a palm of a hand of a wearer.

5. An article of clothing according to claim 1, wherein the insulating element is arranged in an area adapted to be positioned at a front surface of a wearer’s thighs.

6. An article of clothing according to claim 1, wherein the insulating element is arranged in an area adapted to be positioned at a wearer’s chest.

7. An article of clothing according to claim 1, wherein the insulating element comprises at least one of PU foam, PE foam, EVA foam, and neoprene.

8. An article of clothing according to claim 1, wherein the insulating element comprises an inflatable pocket of air.

9. An article of clothing according to claim 1, wherein the insulating element comprises an agglomeration of polymer beads.

10. An article of clothing according to claim 1, wherein the insulating element comprises polar.

11. An article of clothing according to claim 1, wherein the article of clothing is an undergarment.

12. An article of clothing according to claim 1, wherein the article of clothing is an outer garment.

13. An element for thermal insulation for an article of clothing, said insulating element comprising:
   at least one element of thermal insulation adapted to be positioned in at least one predetermined zone of the article of clothing, said element of thermal insulation being at least partially incompressible under effect of forces exerted during use of said article of clothing.

14. An insulating element for an article of clothing according to claim 13, wherein said element is removable from the article of clothing.

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