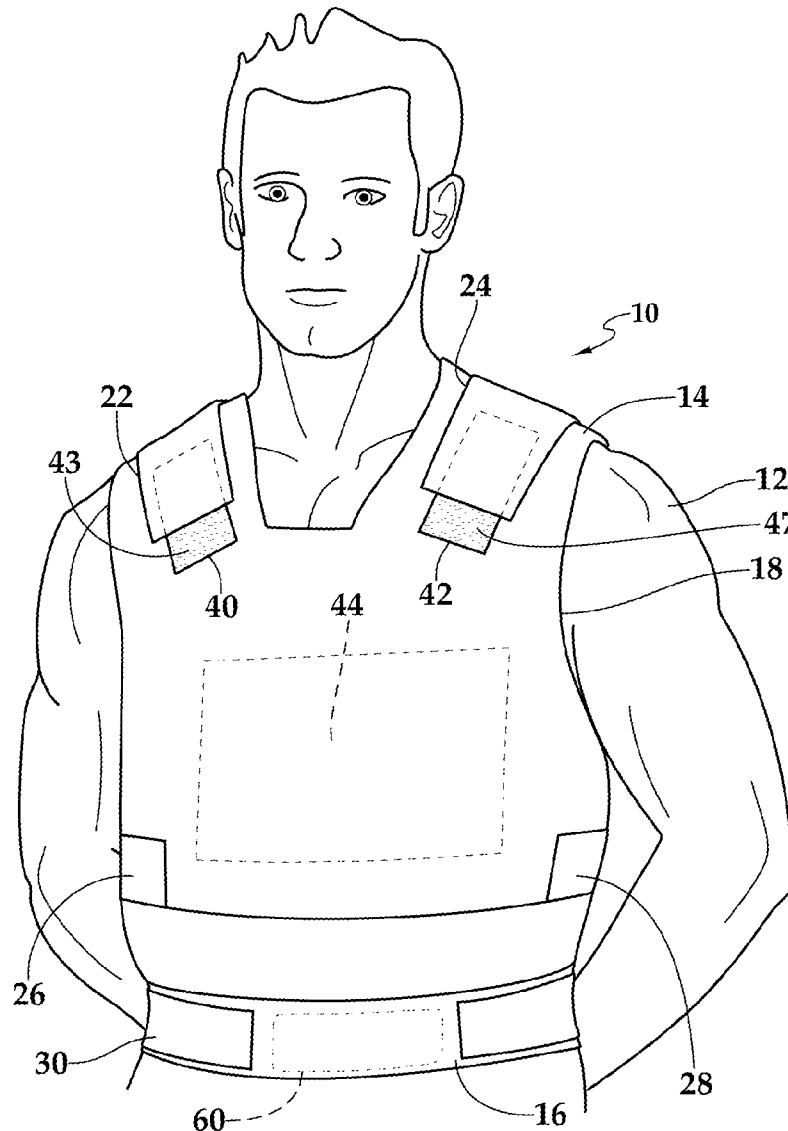
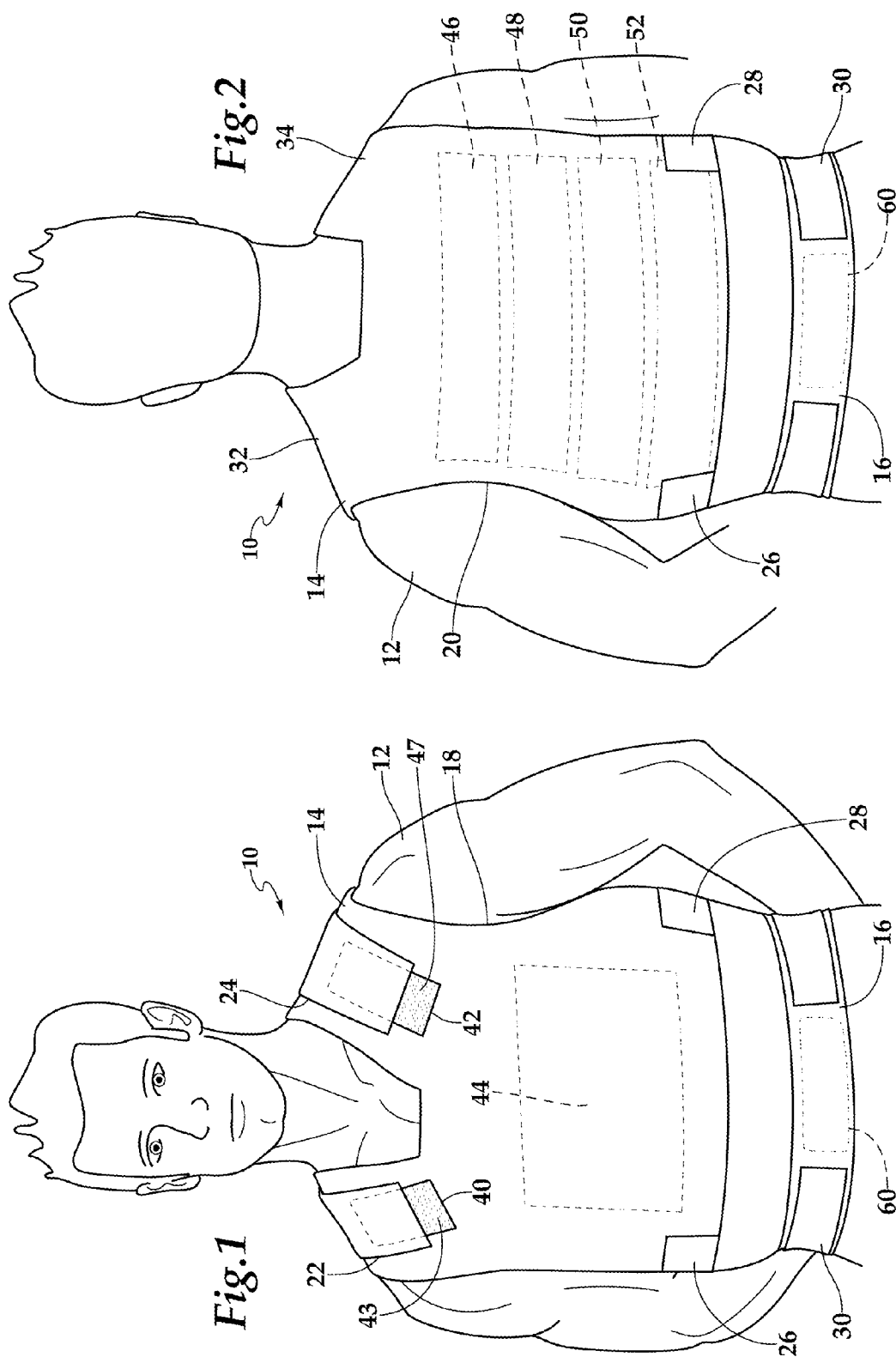
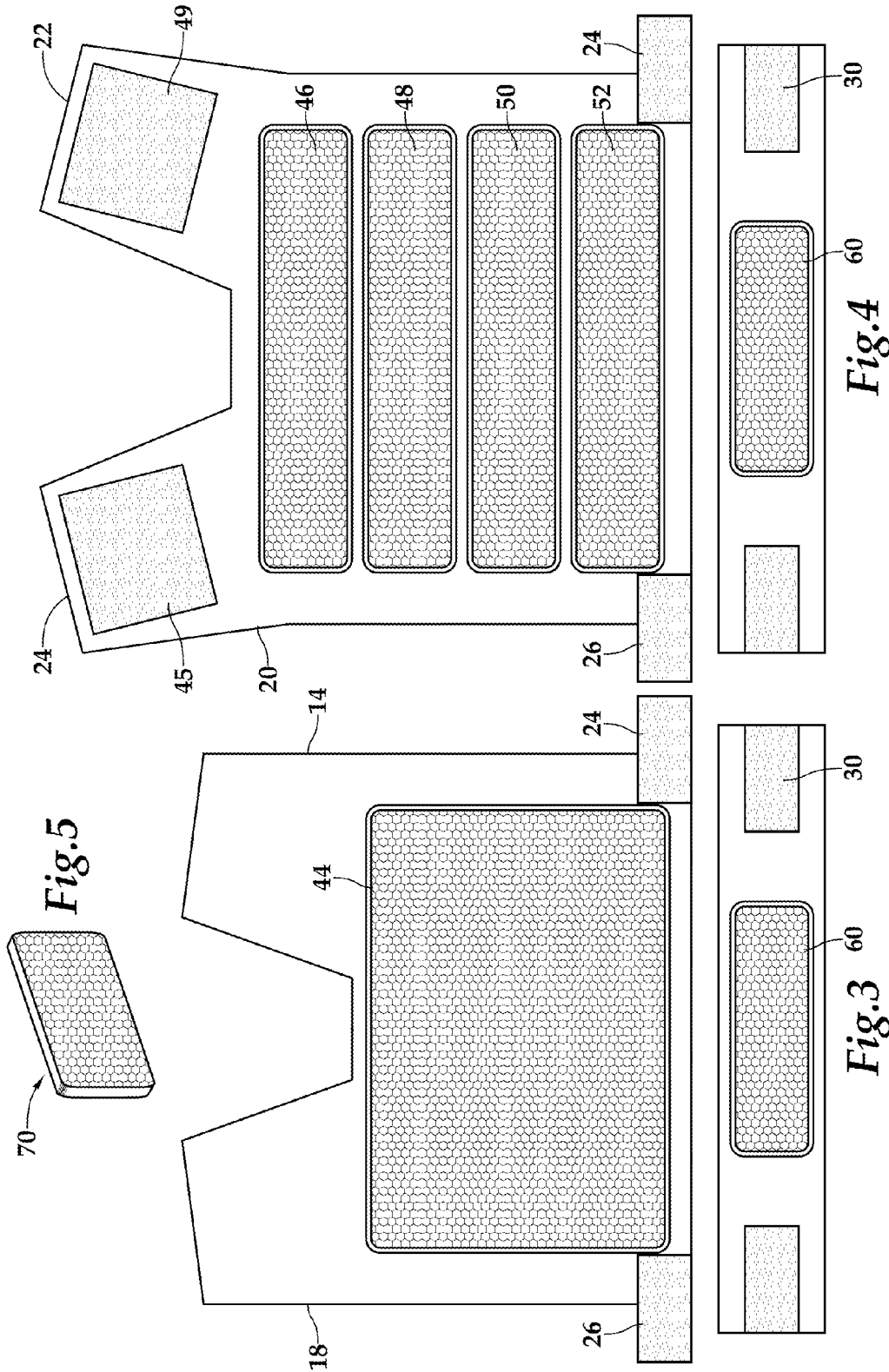


(43) **Pub. Date:** **Nov. 15, 2012**







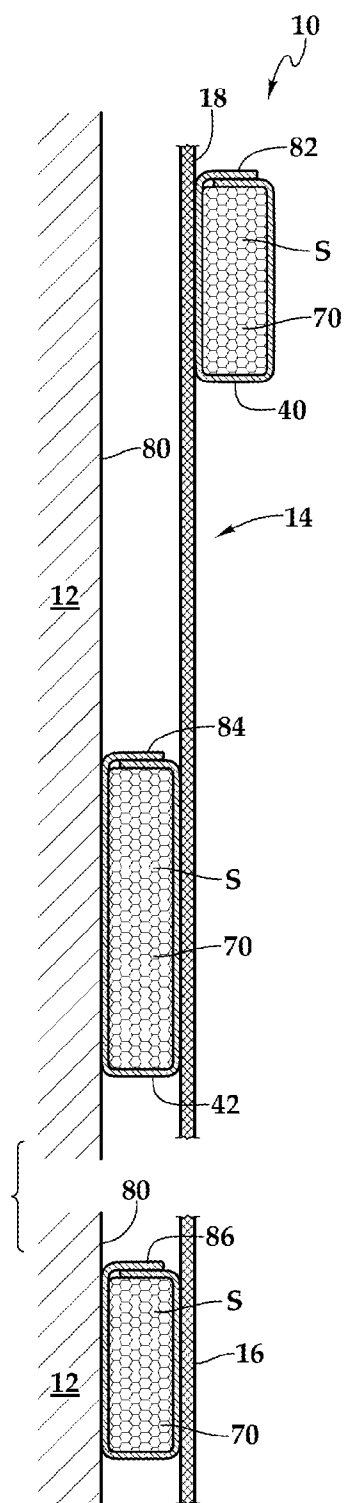


Fig. 6A

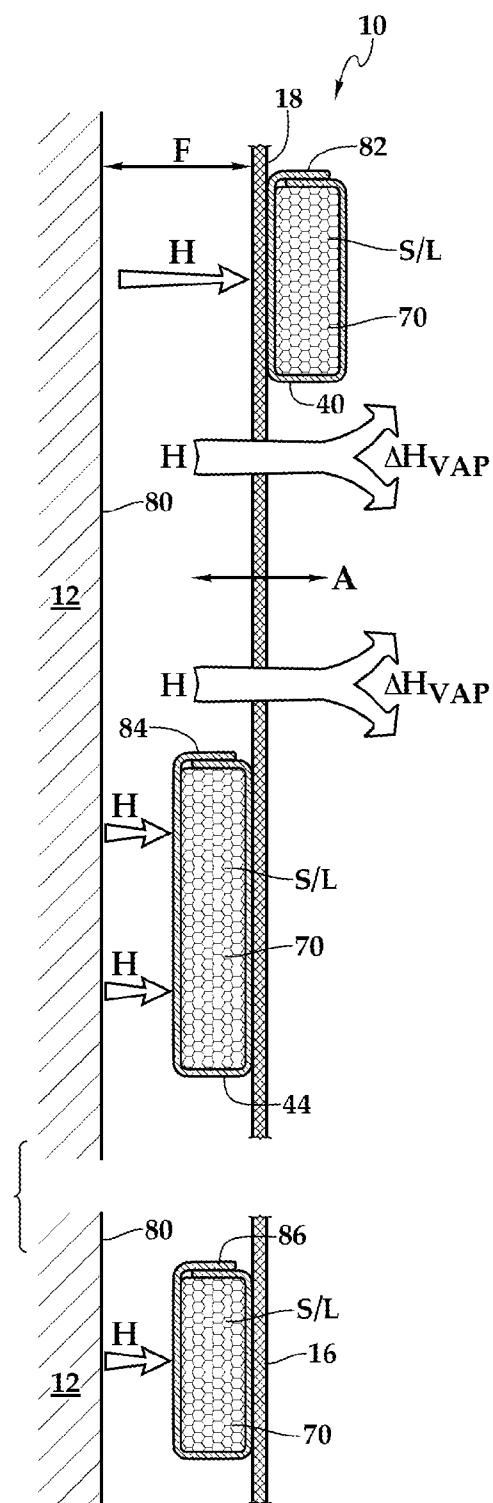


Fig. 6B

COOLING CLOTHING SYSTEM AND METHOD FOR USE OF SAME

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates, in general, to a personal cooling system and, in particular, to a clothing cooling system, and method for use of the same, for providing temporary cooling comfort to a human wearer in order to facilitate cooling the wearer, in part, by temperature control.

BACKGROUND OF THE INVENTION

[0002] Hyperthermia is an elevated body temperature due to failed thermoregulation. On a cold day, elevated body temperature can help the body maintain an optimal temperature. On a hot day, however, hyperthermia can occur when the body produces or absorbs more heat than can be dissipated. When the elevated body temperatures are sufficiently high, hyperthermia is a medical emergency and requires immediate treatment to prevent disability or death.

[0003] Hypothermia is typically experienced during physical exertion in a hot environment. Wearing a personal cooling system can prevent or mitigate the risks of hypothermia in such conditions. Important factors to the selection of a personal cooling system are weight and convenience. Existing personal cooling systems that utilize heat pumps or cold packs are encumbering, and particularly so, during physical exertion. There continues to be a need for advances in personal cooling systems.

SUMMARY OF THE INVENTION

[0004] It would be advantageous to achieve a cooling clothing system and method for use of the same for personal cooling. It would also be desirable to enable temporary cooling comfort to a human wearer without unnecessarily encumbering the human wearer. To better address one or more of these concerns, in one aspect of the invention, one embodiment of a system is presented having article of clothing and belt that correspond to the human skeletal system to mitigate encumbered movement. Multiple sealable pouches are formed within the article of clothing and belt. Each of the respective exterior sealable pouches defines a volume for selectively accepting a pack of heat exchange material. The heat exchange material includes a melting/freezing temperature in a temperature range of about 50° F. and about 70° F. During use, thermal gradients are formed from the skin of the human wearer to the heat exchange material, thereby providing temporary cooling comfort to the human wearer. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] For a more complete understanding of the features and advantages of the present invention, reference is now made to the detailed description of the invention along with the accompanying figures in which corresponding numerals in the different figures refer to corresponding parts and in which:

[0006] FIG. 1 is a front perspective view of a human wearing one embodiment of a cooling clothing system;

[0007] FIG. 2 is a rear perspective view of the human wearing the cooling clothing system depicted in FIG. 1, wherein

the arms are not fully drawn in order to fully depict portions of the cooling clothing system;

[0008] FIG. 3 is a front inside elevation view of the cooling clothing system depicted in FIG. 1;

[0009] FIG. 4 is a rear inside elevation view of the cooling clothing system depicted in FIG. 1;

[0010] FIG. 5 is a front perspective view of one embodiment of a pack of a heat exchange material;

[0011] FIG. 6A is a cross-sectional view of the cooling clothing system along line 6-6 in FIG. 1 to shown an operational embodiment thereof, whereby the human wearer is stationary; and

[0012] FIG. 6B is a cross-sectional view of the cooling clothing system along line 6-6 in FIG. 1 to shown an operational embodiment thereof, whereby the human wearer is undergoing activity.

DETAILED DESCRIPTION OF THE INVENTION

[0013] While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts which can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention, and do not delimit the scope of the present invention.

[0014] Referring initially to FIGS. 1 through 4, therein is depicted a cooling clothing system that is schematically illustrated and generally designated 10. The cooling clothing system 10 provides temporary cooling comfort to a human wearer 12 and the cooling clothing system 10 includes an article of clothing 14, depicted as a vest, and a belt 16. It should be appreciated, however, that the cooling clothing system 10 may be utilized with an animal as well after appropriate modification.

[0015] The vest 14, which also may be a shirt, includes a chest enclosing portion 18 and a back enclosing portion 20 connected by adjustable straps 22, 24 and fasteners 26, 28, both of which may be buckles or Velcro-type attachment elements. The belt 16 cinches about the waist and may be adjusted by a fastener 30. When worn, the vest 14 and belt 16 are snug but comfortable and do not encumber movement. Stated another way, during use, the article of clothing 14 and belt correspond to the human skeletal system to mitigate encumbered movement of the human wearer 12 during activity. More particularly, the vest 14 and belt 16 use biomimicry to respond to the structure and the corresponding movement of the human skeletal system. The thoracic cavity (or chest cavity) is the chamber of the human body is protected by the thoracic wall, which includes the thoracic cage and associated skin, muscle, and fascia.

[0016] The thoracic cage or rib cage is a component of the human respiratory system as the thoracic cavity contains the lungs which must have sufficient space for inhaling and exhaling air. On the other hand, the pelvic cavity is a body cavity that is bound by the bones of the pelvis and which primarily contains reproductive organs, the urinary bladder, and the rectum. The pelvic cavity plays a large role in the movement and bipedal locomotion.

[0017] As will be discussed in further detail hereinbelow, the vest 14 and belt 16 of the cooling clothing system 10 furnish temporary cooling comfort to a human wearer 12 in order to facilitate cooling the human wearer 12, in part, by temperature control. In one embodiment, the two part con-

struction of the vest **14** and belt **16** corresponds to the chest and pelvic cavities to provide cooling close to critical internal organs while not encumbering movement or breathing. The belt **16** also covers the stomach and cools the internal organs. That is, this arrangement allows for physical movement without binding by providing for the selective placement of heat exchange packs based on the application or sport.

[0018] Referring again to FIGS. **1** through **4**, more particularly, the article of clothing **14** includes chest **18**, left and right shoulder **32**, **34**, and back **20** regions. The chest enclosing portion **18** and the back enclosing portion **20** include adjustably joined front and rear layers of fabric having insides and outsides, which are configured to support thermal communication with skin of the human wearer in order to conform thereto such that physical movement is unencumbered. The chest enclosing portion **18** and the back enclosing portion **20** are configured such that the inside is positioned to contact human skin and the outside presents a substantially continuous surface. In one implementation, the front and rear layers of fabric may be a stretchability sufficient to permit the article of clothing to fluctuate with respect to the body of the human wearer **12** and/or the front and rear layers of fabric may include stitching or a porous and hydrophilic material. Closure mechanisms **32**, **34**, which may be Velcro-type attachments, may join and separate the front and rear layers of fabric. The adjustably joined front and rear layers of fabric **18**, **20** may include a 250 thread count cotton, for example.

[0019] Respective exterior front sealable pouches **40**, **42** are formed on the outside of the front layer of the fabric proximate to the left and right shoulder regions of the human wearer **12**. Each of the respective exterior sealable pouches **40**, **42** define a volume for selectively accepting a pack of heat exchange material **70**, which will be discussed in greater detail hereinbelow. A closure mechanism, such as Velcro®, for example, may provide for the opening and closing of the sealable pouches (See FIGS. **6A** & **6B**, **82-86**). Further, it should be appreciated that the pouches may be different sizes and shapes depending on location in the cooling clothing system. Alternatively, certain pouches may be removed or extra pouches added. For example, the respective exterior sealable pouches **40**, **42** may not be included. Moreover, the cooling clothing system **10** allows for the selective application of the packs of heat exchange material based on the sport or application. As each sport or application has different movements, the packs of heat exchange material are selectively placed so not to create hindrance.

[0020] An interior front sealable pouch **44** is formed on the inside of the front layer of the fabric proximate to the chest region. The interior front sealable pouch **44** defines a volume for accepting a pack of the heat exchange material. Interior rear sealable pouches **46**, **48**, **50**, **52** are formed on the inside of the rear layer of the fabric proximate to the back region. Each of these interior rear sealable pouches **46**, **48**, **50**, **52** also define a volume for accepting a pack of the heat exchange material. In one embodiment, at least one of the exterior front sealable pouches **40**, **42**, interior front sealable pouch **44**, and interior rear sealable pouches **46-52** comprises a plurality of overlapping pouches, each of the plurality of vertically overlapping pouches defining adjacent volumes for selectively accepting overlapping packs of the heat exchange material. In particular, such overlapping pouches may be used to mimic the contour of the back on the back enclosing portion **20**.

[0021] Respective closure mechanism pairs **43**, **45** and **47**, **49** further provide for height adjustment and proper fit. As

depicted in the illustrated embodiment, a closure mechanism, such as Velcro® provides for the opening, closing, and adjusting of the closure mechanism pairs **43**, **45** and **47**, **49**, wherein closure mechanisms **43**, **47** are associated with the chest portion **18** and the corresponding closure mechanisms **45**, **49** are associated with the back portion **20**.

[0022] The belt **16** includes multiple interior and/or exterior waist sealable pouches, such as pouch **60**, formed on an inside or outside of the belt **16**. The cinching mechanism **30** adjustably secures the belt to the human wearer. Similar to the vest **14**, each of the sealable pouches **60** define a volume for accepting a pack of the heat exchange material. It should be appreciated that although particular pouch placements are presented, other pouch placements are within the teachings of the present invention. Moreover, which pouches will receive packs of the heat exchange material depends on the particular activity and sport to be undertaken and the physical structure of the human wearer.

[0023] The sealable pouches **40-52** formed on the front and rear layers of fabric **18**, **20** selectively accept a pack of the heat exchange material **70**. The variety of locations provided by the sealable pouches **40-52** enable the selection of specific locations depending on the sport or application. In one embodiment, each sealable pouch **40-52** that defines a volume includes a layer of removable insulation, such as neoprene or other waterproof material, on the exterior of the layers of fabric that keeps the packs insulated from the outside. Each layer of removable insulation may be independently removed and reapplied, as appropriate. That is, in one embodiment, the insulation is only used as needed when and where packs of heat exchange material are placed. During use, thermal gradients are formed from the skin of the human wearer to the deposits or packs of heat exchange material, thereby providing temporary cooling comfort to the human wearer.

[0024] Referring to FIG. **5**, the packs of the heat exchange material **70** include a melting/freezing temperature in a temperature range of about 50° F. and about 70° F. In one implementation, the melting/freezing temperature is about 60° F. The heat exchange material **70** changes phase through substantially direct contact with the wearer from solid to liquid within the practical temperature range by absorbing heat from the wearer's body. By way of example, and not by way of limitation, the heat exchange material **70** may be a phase change material such as n-Hexadecane or n-Tetradecane. Moreover, depending on the application and placement the packs of heat exchange material **70** may have different sizes and shapes.

[0025] With reference to FIGS. **6A** and **6B**, the cooling clothing system **10** may be worn during strenuous physical activity in a harsh environment where it will be difficult for the body to self-thermoregulate. As shown, the article of clothing **14** and the belt are adjacent to the skin **80** of the human wearer **12**. Packs of heat exchange material **70** are located within exterior front sealable pouch **40**, interior front sealable pouch **44**, and belt pouch **60** by way of respective sealable openings **82**, **84**, **86**. As previously discussed, thermal gradients are formed from the skin **80** of the human wearer **12** to the packs of heat exchange material **70**, thereby providing temporary cooling comfort to the human wearer. With particular attention to a comparison between FIGS. **6A** and **6B**, during physical activity (FIG. **6B**), heat (H) is transferred from the human wearer to the pack of heat exchange material, which absorbs the heat and changes phase. The

enthalpy of vaporization (ΔH_{VAP}) depicts the heat transfer from the skin of the human wearer to the environment by way of absorption of the heat by the packs of heat exchange material, which may change phase from a solid (S) to a liquid (L), as represented by the state transition indication (S/L). In this manner, the cooling system **10** permits a person or animal to exercise in hot weather without overheating.

[0026] Moreover, the article of clothing **14** does not stay skin tight. Rather, the article of clothing fluctuates, as shown by the letter (F), in and out of contact with the skin. In particular, the packs of heat exchange material **70** proximate contact to the skin of the body of the human wearer and quickly absorb heat (H), then the packs of heat exchange material **70** swing away from the body of the wearer **12** to allow air and evaporation (A) to occur. In one implementation, the fluctuation may be approximately inch or more. The fluctuation (F) cools the human wearer **12** further.

[0027] While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications and combinations of the illustrative embodiments as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to the description. It is, therefore, intended that the appended claims encompass any such modifications or embodiments.

What is claimed is:

1. A cooling clothing system for providing temporary cooling comfort to a human wearer, the cooling clothing system comprising:

an article of clothing having chest, left and right shoulder, and back regions, the vest comprising:

adjustably joined front and rear layers of fabric having insides and outsides, the front and rear layers of fabric being configured to support thermal communication with skin of the human wearer and conform thereto such that physical movement is unencumbered,

a plurality of sealable pouches formed on the front and rear layers of fabric, each of the respective sealable pouches defining a volume for selectively accepting a pack of heat exchange material, the heat exchange material having a melting/freezing temperature in a temperature range of about 50° F. and about 70° F.; and

a belt including a plurality of exterior waist sealable pouches formed on an outside of the belt, each of the plurality of interior rear sealable pouches defining a volume for selectively accepting a pack of the heat exchange material,

wherein, during use, a plurality of thermal gradients are formed from the skin of the human wearer to the heat exchange material, thereby providing temporary cooling comfort to the human wearer, and

wherein, during use, the article of clothing and belt correspond to the human skeletal system to mitigate encumbered movement of the human wearer during activity.

2. The cooling clothing system as recited in claim 1, wherein the placement of the sealable pouches is based on the application.

3. The cooling clothing system as recited in claim 1, wherein each pack of heat exchange material is insulated from the outside environment by removable insulation.

4. A cooling clothing system for providing temporary cooling comfort to a human wearer, the cooling clothing system comprising:

an article of clothing having chest, left and right shoulder, and back regions, the vest comprising:

adjustably joined front and rear layers of fabric having insides and outsides, the front and rear layers of fabric being configured to support thermal communication with skin of the human wearer, the front and rear layers of fabric configured such that the inside is positioned to contact human skin and the outside presents a substantially continuous surface,

respective exterior front sealable pouches formed on the outside of the front layer of the fabric proximate to the left and right shoulder regions, each of the respective exterior sealable pouches defining a volume for selectively accepting a pack of heat exchange material, the heat exchange material having a melting/freezing temperature in a temperature range of about 50° F. and about 70° F.,

an interior front sealable pouch formed on the inside of the front layer of the fabric proximate to the chest region, the interior front sealable pouch defining a volume for selectively accepting a pack of the heat exchange material, and

a plurality of interior rear sealable pouches formed on the inside of the rear layer of the fabric proximate to the back region, each of the plurality of interior rear sealable pouches defining a volume for selectively accepting a pack of the heat exchange material; and

a belt including a plurality of exterior waist sealable pouches formed on an outside of the belt, each of the plurality of interior rear sealable pouches defining a volume for selectively accepting a pack of the heat exchange material,

wherein, during use, a plurality of thermal gradients are formed from the skin of the human wearer to the heat exchange material, thereby providing temporary cooling comfort to the human wearer, and

wherein during use, the article of clothing and belt correspond to the human skeletal system to mitigate encumbered movement of the human wearer during activity.

5. The cooling clothing system as recited in claim 4, wherein each pack of heat exchange material is insulated from the outside environment by removable insulation.

6. The cooling clothing system as recited in claim 4, wherein the article of clothing is selected from the group consisting of vests and shirts.

7. The cooling clothing system as recited in claim 4, wherein the front and rear layers of fabric comprise a stretchability sufficient to permit the article of clothing to fluctuate with respect to the body of the human wearer.

8. The cooling clothing system as recited in claim 4, wherein the front and rear layers of fabric comprise stitching.

9. The cooling clothing system as recited in claim 4, wherein the front and rear layers of fabric comprise a porous and hydrophilic material.

10. The cooling clothing system as recited in claim 4, further comprising a closure mechanism for adjustably joining and separating the front and rear layers of fabric.

11. The cooling clothing system as recited in claim 4, further comprising a cinching mechanism for adjustably securing the belt to the human wearer.

12. A cooling clothing system for providing temporary cooling comfort to a human wearer, the cooling clothing system comprising:

an article of clothing having chest, left and right shoulder, and back regions, the vest comprising:

adjustably joined front and rear layers of fabric having insides and outsides, the front and rear layers of fabric being configured to support thermal communication with skin of the human wearer, the front and rear layers of fabric configured such that the inside is positioned to contact human skin and the outside presents a substantially continuous surface,

respective exterior front sealable pouches formed on the outside of the front layer of the fabric proximate to the left and right shoulder regions, each of the respective exterior sealable pouches defining a volume for selectively accepting a pack of heat exchange material, the heat exchange material having a melting/freezing temperature in a temperature range of about 50° F. and about 70° F.,

an interior front sealable pouch formed on the inside of the front layer of the fabric proximate to the chest region, the interior front sealable pouch defining a volume for selectively accepting a pack of the heat exchange material, and

a plurality of interior rear sealable pouches formed on the inside of the rear layer of the fabric proximate to the back region, each of the plurality of interior rear sealable pouches defining a volume for selectively accepting a pack of the heat exchange material,

wherein, at least one of the exterior front sealable pouches, interior front sealable pouch, and interior rear sealable pouches comprises a plurality of overlapping pouches, each of the plurality of overlapping pouches defining adjacent volumes for selectively accepting overlapping packs of the heat exchange material;

a belt including a plurality of exterior waist sealable pouches formed on an outside of the belt, each of the plurality of interior rear sealable pouches defining a volume for selectively accepting a pack of the heat exchange material; and

wherein, during use, a plurality of thermal gradients are formed from the skin of the human wearer to the heat exchange material, thereby providing temporary cooling comfort to the human wearer, and

wherein during use, the article of clothing and belt correspond to the human skeletal system to mitigate encumbered movement of the human wearer during activity.

13. The cooling clothing system as recited in claim **12**, wherein each pack of heat exchange material is insulated from the outside environment.

14. The cooling clothing system as recited in claim **12**, wherein the article of clothing is selected from the group consisting of vests and shirts.

* * * * *