

Apparatus for providing a heating or cooling effect to a human or animal body part.

DULAKE, Nick <<http://orcid.org/0000-0003-1841-5848>> and MILLS, Richard

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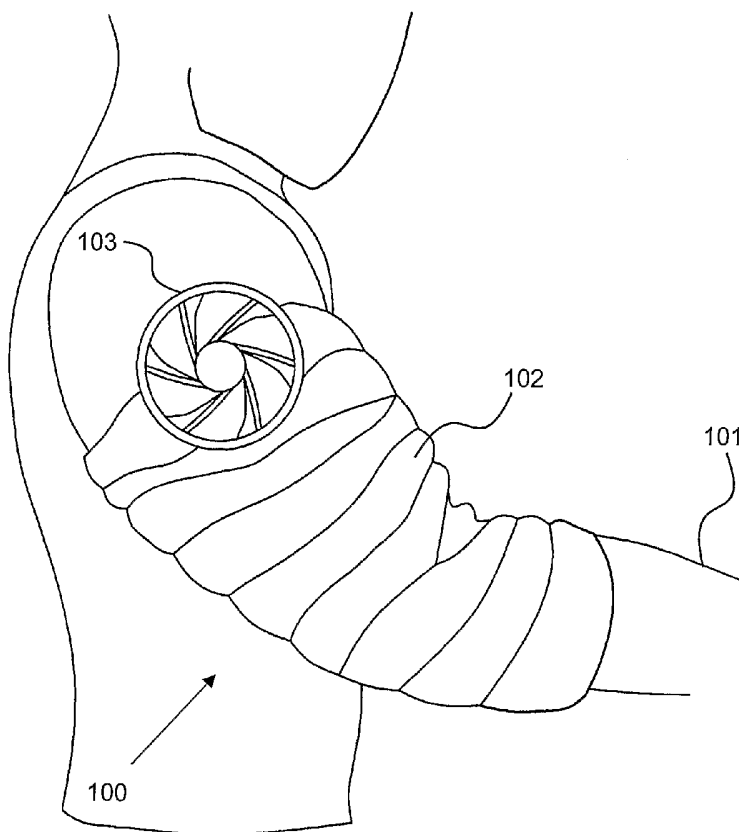
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- (71) Applicant and
(72) Inventor: MILLS, Richard [GB/GB]; Apartment 28, Ladybower Lodge, Ashopton, Bamford Hope Valley, Derbyshire S33 0BY (GB).
- (72) Inventor; and
(75) Inventor/Applicant (for US only): DULAKE, Nick [GB/GB]; c/o Design Futures, Sheffield Hallam University, Science Park, Unit 5, Howard Street, Sheffield S1 1WB (GB).
- (74) Agents: FRANKS, Robert, B. et al.; Franks & Co, 15 Jessops Riverside, Brightside Lane, Sheffield S9 2RX (GB).
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(54) Title: APPARATUS FOR PROVIDING A HEATING OR COOLING EFFECT



(57) Abstract: A device configured to treat a human or animal body part or limb by providing a heating and/or cooling effect in addition to a compressive force. A metallic conductive material is positioned in thermal contact with at least one Peltier cell whereby the heating and cooling effect generated at an active face of the Peltier cell is conducted and distributed over the surface area of the conductive material. The conductive material comprises a significantly greater surface area than the active face of the Peltier cell. A compressive force may be applied to the human or animal body part or limb by the control of a fluid into an expandable sack secured with the conductive material to the body part by suitable strap means.

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APPARATUS FOR PROVIDING A HEATING AND COOLING EFFECT

Field of the Invention

The present invention relates to a device configured to provide a heating
5 and cooling effect to a human or animal, and in particular although not
exclusively, to a device for treating a damaged human or animal limb or joint.

Background to the Invention

The recommended treatment for common sprain, strain or impact injuries
10 to joints, ligaments, tendons and muscles involves cooling of the injured region.
One of the most primitive forms of treatment of such injuries is the application of
a bag of ice or frozen matter applied directly to the effected body part.

In order to assist the natural healing process, compression may also be
15 applied to the injured region in addition to the alternation of heating and cooling.

A number of devices have been proposed in the art directed to the
treatment of injured joints and the like.

20 GB 2202447 discloses apparatus for cooling a limb of an animal
comprising a thermoelectric module working on the Peltier principle. The
thermoelectric module is secured to the injured limb to be cooled at a first surface
with a heat sink being positioned at a second surface configured to dissipate heat
extracted from the first surface. The thermoelectric module is powered by a
25 remotely positioned power source.

US 5,800,490 discloses a modular lightweight heating and cooling device
configured for the treatment of injured human or animal body parts. The device
comprises a strap for positioning around a limb having mounting means formed
30 within the strap configured to house a plurality of Peltier elements. Each Peltier
element is situated between two conducting copper plates with a heat sink fan
positioned adjacent one face. The Peltier element provides a heating or cooling

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effect to the injured region via a sealed gel pack positioned between a copper conducting plate and the skin of the human or animal. A battery pack, powering the Peltier assembly may be positioned at the strap or remotely located.

5 US 6,023,932 discloses a portable topically cooling device for an animal or human configured to relieve pain and swelling from injured joints, muscles or the like. The device comprises a thermoelectric unit having a cold side and a warm side, a DC source connected to the thermoelectric unit and a heat sink mounted at the warm side of the unit. A strap is provided for securing the device to the
10 human or animal. A cushion material is provided at the cooling face of the unit for positioning against the skin of the animal or human.

US 4,470,263 discloses a plurality of Peltier cells attached to a garment with the cold surface of the Peltier cell in thermal contact with the skin of the
15 patient via intermediate positioned layers of a metalised cloth and a foam rubber layer. Heat pipes positioned adjacent to the Peltier cell assist in the transfer of heat away from the person via the Peltier cell.

WO 00/40186 discloses a device to treat the temporomandibular and
20 maxilla mandibular region of a patient with cryo-thermal and/or compression therapy. The device, in the form of a head scarf, comprises a heating component having a plurality of individual heating elements, and an inflatable layer containing a plurality of sacks capable of inflation by an inflation fluid configured to move freely between the sacks. A plurality of hard plates, housed within a fabric layer
25 are configured to resist bulging of the inflatable layer when inflated.

Whilst these prior art therapeutic devices are advantages over more primitive, conventional treatment apparatus such as gel treatment packs and the like, the inventors have identified a number of disadvantages.

30

In particular, the contact area of the thermoelectric modules with the skin region of the patient is limited to approximately the surface area of each Peltier

device. Additionally, the form and amount of compression provided by known devices is limited and may be difficult to apply correctly involving adjustment and re-adjustment of attachment straps for example.

- 5 What is required therefore is a device configured for treating a damaged region of a human or animal which addresses the above disadvantages.

Summary of the Invention

10 The inventors provide a device configured to treat a human or animal body part or limb by providing a heating and/or cooling effect in addition to a compressive force. The inventors have realised that in order to treat injured joints and the like as effectively as possible, the application of heat or the removal of heat (cooling effect) should be spread over as greater surface area as possible of the joint to be treated. In order to achieve this, the present invention utilises a
15 thermally conductive material in contact with at least one thermoelectric module. Accordingly, heat generated at a surface of the thermoelectric module is conducted and distributed over the surface area of the conductive material. Similarly, when the thermoelectric module is operating so as to provide a cooling effect, in which heat is drawn from one face of the thermoelectric module and
20 dissipated via a heat sink at an adjacent face, the resulting cooling effect propagates across the surface area of the conductive material. The present invention therefore is configured for providing a heating or cooling effect over a considerably larger surface area than similar devices found in the art.

25 An additional advantage with the use of a conductive material comprising a surface area of at least twice the size of the heating or cooling face of the thermoelectric module is the increased control of temperature regulation at the effected body part due to the larger thermal conducting mass. This is in contrast to prior art heating devices which use one or more thermoelectric devices to
30 supply heat or a cooling effect directly to the skin or via a conductive material of comparable surface area to the active face of thermoelectric module. Accordingly, the need for sophisticated temperature control apparatus is avoided.

According to specific implementations of the present invention, the thermally conductive material may be pre-shaped and/or configurable for shaping to correspond to the contours of the specific human or animal body part and in particular a movable joint. As the active face of a thermoelectric module, operating under the Peltier principle is generally planar, the thermoelectric module does not necessarily need to be located directly at the injured region whereby its heating or cooling effect may be conducted to a region or regions of the conductive material that are shaped and configured for contact with the effected body part or region.

In particular, the thermoelectric module may be isolated from the skin so as to avoid the human or animal being exposed to excessively high or low operating temperatures.

The present invention may comprise a plurality of separate pieces of conductive material interconnected via one or a plurality of movable joints. Alternatively, the separate pieces of conductive material may be fixably connected together to form a conductive material of fixed structure comprising a plurality of individual interconnected pieces. Typically, the pieces may be tacked, welded, stapled, bolted, glued, riveted or slotted together.

In order to provide a compressive force to the affected body part of the present invention comprise an expandable sack in which a fluid introduced into the sack positioned against or around the effected area, serves to provide a compressive force. Further, by regulating the flow of fluid into the sack and/or controlling the amount of fluid drawn from the sack, the present invention is configured to provide a massaging effect to the effected region.

According to a first aspect of the present invention there is provided a device configured to provide a heating and a cooling effect to a region of a human or animal, said device comprising: at least one thermoelectric module

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capable of generating heat and providing a cooling effect; at least one solid conductive material in contact with said thermoelectric module, wherein said conductive material is capable of positioning in contact with said region of said human or animal and configured to transfer said heat and said cooling effect
5 generated by said thermoelectric module to said human or animal; at least one expandable sack capable of generating a compressive force to said region of said human or animal; and means for securing said conductive material and said expandable sack in contact with said region of said human or animal.

10 The device further comprises control means configured to control the heating and cooling effect provided by the thermoelectric module in addition to control and regulation of the flow of fluid into and/or out of the expandable sack. The control means may be positioned remote from the thermoelectric module and/or the means for securing the conductive material at the effected region.
15 The control means may comprise any known control apparatus found in the art including conventional circuit boards and the like to enable a user to set and control the operative temperature output of the thermoelectric module.

The expandable sack is configurable for use with any fluid, in particular a
20 cryogenic fluid, a liquid, a gel, a gas being in particular air. The expandable sack, capable of being expanded by the fluid, may comprise a single internal fluid chamber or may be divided into a plurality of channels or a network of compartments in fluid communication with one another. Accordingly, by dividing the internal fluid chamber of the expandable sack into a plurality of separate
25 compartments, the expandable sack may be configured to provide a non-uniform compressive force via its surface area positioned opposed to the skin of the human or animal. That is, the pressure of the fluid within the internal channels or compartments may be regulated and controlled independently whereby the pressure in one compartment may differ from the pressure in a second
30 compartment. Accordingly, the channels or compartments may be isolated from one another, the internal pressure of which being controlled independently. The device of the present invention is therefore configured to provide simultaneously

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a plurality of compressive forces to the affected body part, the compressive forces being of different magnitudes as desired.

Optionally, the device may further comprise an additional bladder capable of housing a conductive liquid, the bladder being positioned at the thermoelectric module and/or the conductive material configured to conduct the heat or the cooling effect from the conductive material and/or thermoelectric module to the skin of the human or animal. Like the expandable sack, the bladder may comprise a single internal chamber or may be divided into a plurality of channels or network of compartments in fluid communication with one another.

The thermoelectric module may be a Peltier module comprising heat dissipation means positioned at one face of the module configured to dissipate heat drawn from a cooling face. The means for securing the conductive material and the expandable sack to the human or animal may be formed as a strap or wrap, in particular an elasticated wrap comprising a suitable fastening means such as hook and loop type fasteners.

In order for a user to monitor and set the operative temperature of the thermoelectric module, a temperature sensor may be positioned at the thermoelectric module and/or selected regions of the conductive material. The temperature sensor may be coupled with suitable temperature display means configured to indicate the working and/or pre-set temperature of the thermoelectric module. Accordingly, the control means may comprise one or more thermostats configured for regulating the operative temperature of the thermoelectric module in response to the output of the temperature sensor.

A ratio of the surface area of the conductive material capable of positioning in contact with the human or animal body part to the surface area of the active face (heating or cooling face) of the thermoelectric module is within the range 2-15 : 1.

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The conductive material may comprise at least two separate pieces of conductive material joined together and movable relative to one another. Optionally, the present invention may comprise any number of a plurality of separate conductive material pieces movably joined together. The conductive material pieces may be pivotally mounted, slidably mounted, detachably mounted, riveted, pinned or hinged together to form a movable joint.

Preferably, the at least one piece of conductive material comprises one or a plurality of bent or curved regions.

10

Preferably, the conductive material comprises a non-uniform thickness.

Preferably, the conductive material is covered by an insulating material on one or more faces not configured for contact with the human or animal skin. The insulating material is configured to thermally insulate and enhance the heating or cooling effect provided by the conductive material. Optionally, the conductive material may be coated or covered by a fabric, a foam or polymer material.

15

Alternatively, the conductive material may comprise a metallic mesh or webbing.

20

Brief Description of the Drawings

For a better understanding of the invention and to show how the same may be carried into effect, there will now be described by way of example only, specific embodiments, methods and processes according to the present invention with reference to the accompanying drawings in which:

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Fig 1 herein illustrates the heating and cooling device according to a specific implementation of the present invention wrapped around an arm of a person;

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Fig 2 herein illustrates a cross sectional side elevation view of the thermoelectric module and associated additional components of the heating and cooling device;

5 Fig 3 herein illustrates an exploded perspective view of the heating and cooling device in which a conductive material is divided into two pieces joined together by a movable joint;

Fig 4 herein illustrates a perspective view of the heating and cooling device
10 further comprising an expandable sack positioned about the conductive material;

Fig 5 herein is cross sectional side elevation view of selected layers of the heating and cooling device;

15 Fig 6 herein is a cross sectional plan view of the expandable sack comprising a network of internal channels;

Fig 7 herein illustrates the heating and cooling device connected to suitable control means according to a specific implementation of the present invention;
20

Fig 8 herein illustrates schematically selected components of the heating and cooling device according to a specific implementation of the present invention;

25 **Detailed Description**

There will now be described by way of example a specific mode contemplated by the inventors. In the following description numerous specific details are set forth in order to provide a thorough understanding. It will be apparent however, to one skilled in the art, that the present invention may be
30 practiced without limitation to these specific details. In other instances, well known methods and structures have not been described in detail so as not to unnecessarily obscure the description.

A device is provided configured for generating heat or providing a cooling effect to a region or body part of a human or animal. The inventors utilise at least one conventional, known thermoelectric module operating according to the Peltier principle. The present invention is particularly adapted for the treatment of sprains, strains or impact injuries to joints, ligaments, tendons and muscles where the recommended treatment involves topical application of heating and cooling and/or alternate heating and cooling cycles. The effectiveness of the device, utilising at least one Peltier cell is significantly enhanced by the use of at least one thermally conductive material positioned intermediate and in thermal contact with the at least one thermoelectric module and the skin of a patient. Accordingly, the heating or cooling effect generated by the thermoelectric module is conducted or translated by the conductive material to an area of skin in contact with the material.

15

Additionally, the present invention comprises at least one expandable sack for positioning about the conductive material such that by introduction of a fluid into the sack, a compressive force may be applied to the body part or region to be treated.

20

Figure 1 herein illustrates a perspective view of the device 100 wrapped around the arm of a person 101. The device comprises a component 103 configured to generate heat or provide a cooling effect to a contact region of the patient.

25

According to the specific implementation of the present invention, component 103 comprises at least one known Peltier cell incorporating regions of an n-type semiconductor and regions of a p-type semiconductor. On the application of current to the Peltier cell, the cell is configured to provide a heating effect or a cooling effect at an active surface according to the Peltier principle. Typical Peltier cells comprise an active surface area of approximately 6 to 6.5

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cm². In order to increase this active surface area a conductive material is positioned in contact with the active face.

5 The device further comprises means to provide a compressive force to the region to be treated to enhance the therapeutic effect. As illustrated in figure 1 herein, a portion of the thermoelectric module, the conductive material and the means for providing a compressive force may be housed within strap 102 configured to be secured about the injured joint or region.

10 Figure 2 herein illustrates a cross sectional side elevation view of a portion of the present invention and figure 3 herein illustrates an exploded perspective view of selected components of the present invention. A main body portion 204 designed to operate as a heat sink is sandwiched between a heat dissipation fan 200 and the thermoelectric Peltier cell 206. The heat sink may comprise a
15 suitable metallic material and has a plurality of channels 205 extending through an upper region to assist in heat dissipation from the Peltier cell 206. The heat dissipation means 200 comprises a casing comprising a plurality of vents or heat transfer fins 203. A rotatably mounted fan is housed within means 200 in which a plurality of fan blades 201 extend radially from a central spindle 202. A material
20 207 is located around the periphery of the Peltier cell configured to assist in maintaining the thermal gradient between the active surface of the Peltier cell 211 and an adjacent face 212. A conductive material 209 is positioned in thermal contact with the active face 211 of the Peltier cell. A non-conductive material 210 is positioned in thermal contact with the conductive material 209 in a region
25 opposed to the active face 211 of the Peltier cell.

The Peltier cell is connected to a electrical power source using conventional wiring. In operation, heat may be omitted or absorbed at the active face 211 depending upon the direction of current flow. For example, and in a cooling
30 mode of operation the DC current passes from the n-type to p-type semiconductive material causing a decrease in temperature at the cold junction, resulting in absorption of heat from the environment in contact with

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active face 211. Heat is carried through the Peltier cell by electron transport and released on the adjacent face 212. The amount of heat is proportional to the applied current and the number of p-n junctions connected electronically in series. The heat transferred to face 212 is absorbed by heat sink 204 and
5 subsequently dissipated by the action of the rotating fan blades 201.

By reversing the current flow, electron transport across the p-n junctions is reversed such that the active face 211 becomes hot, whereby this heat is transferred to the environment in thermal contact with this active face.
10

The present invention utilises at least one piece of conductive material 209 in thermal contact with the active face 211 of the Peltier cell 206. Accordingly, when operating in a heating mode, heat energy is transferred to the conductive material and subsequently the skin of a patient in contact with the material.
15 When operating in a cooling mode, heat energy is drawn from the conductive material by the Peltier cell 206 via active face 211.

The present invention utilises a conductive material comprising a significantly larger surface area than active face 211 of the Peltier cell. The
20 conductive material may be formed from a sheet material of uniform or non-uniform thickness, the sheet material being in particular metallic copper.

According to further specific implementations of the present invention, the conductive material may comprise a metallic mesh, webbing or the like
25 configured to allow thermal conduction.

Therapeutic treatment of the injured joint or region is most effective when substantially the entire region is subjected to the topical heating and cooling. Accordingly, the conductive material may comprise one or a plurality of bent or
30 curved regions 300, 303, 304 configured to match the curvature and contours of the body part.

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The conductive material is divided into two pieces 209, 305 joined together to form a movable joint 301 by suitable pivot means 302. For example, when secured to an arm region of a human, joint 301 is capable of synchronised movement with the elbow joint of the arm.

5

According to further specific implementations of the present invention the conductive sheet material may comprise a plurality of movable joints in which the pieces of conductive material are slidably and/or detachably mounted.

10 According to specific implementations of the present invention the conductive material 209 may be permanently or releasably positioned in contact with the Peltier cell whereby when the conductive material is releasably attached, the device is configurable for independent use with any one of a plurality of different pieces of conductive material configured and shaped specifically for
15 positioning in contact with different regions of a human or animal body, for example an elbow joint, a neck, an ankle, a knee or lower back. Additionally, a suitable sleeve or locating/receiving means may be provided adjacent the active face of the Peltier cell configured to receive and releasably secure the conductive material in position, at the Peltier cell.

20

Conductive material 209, 305 may be pre-formed with a plurality of bent and curved regions and/or may be of an appropriate thickness to allow a user to manipulate the sheet material into the desired shape to more accurately correspond to the contours of an injured joint or region. In particular, where the
25 conductive material is of non-uniform thickness, certain thinner regions of the material may allow manipulation by a user whilst thicker regions may be configured to retain a pre-formed shape and configuration.

Figure 4 herein illustrates a perspective view of the device of figure 3 herein
30 further comprising an expandable sack 400 positioned over and about the conductive material 209, 305. A suitable strap or support 401 connected to or positioned over and about the expandable sack is configured to secure the

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device in position. A valve 403 allows communication between the expandable sack 400 and tubing 402 enabling an expansion fluid to be introduced and expelled from the sack 400. Expandable sack 400 is configured for the temporal storage of an expansion fluid, in particular air.

5

When the expandable sack 400 is secured in position around the treatment region of the patient as illustrated in figure 1 herein any expansion of the sack 400 will result in a corresponding tightening of the strap 102 and/or 401 thereby providing a compressive force to the injured region. Additionally, by controlling
10 the flow of fluid into and out of the expandable sack, a massaging effect may be achieved so as to enhance the therapeutic effect of the present invention.

Figure 5 herein illustrates a cross sectional side elevation view through the device according to a slightly modified specific implementation of the present
15 invention. The device comprises an outermost layer 500 corresponding to the outermost layer of strap 102 configured to substantially encase the thermoelectric cell, the conductive material and the expandable sack. The expandable sack 400 housed by the exterior layer 500 comprises a single internal chamber 501 configured for the temporal storage of the expansion fluid. A thermally insulating
20 layer 502 is sandwiched between the expandable sack and the conductive material 209. The insulating material 502 is provided at one or more exterior faces of the conductive material, these exterior faces being in non-contact with the skin of the patient. The thermally insulating material may be provided over a portion or the entire exterior surface of the conductive material 209, 305. The
25 thermally insulating material 502 comprises known insulating materials including ceramics, foams, polymer based materials and any organic and inorganic insulating composite. Accordingly, improved thermal stability of the conductive material is achieved in addition to a respective increase and decrease in the highest and lowest temperatures obtainable by the coating of selected regions of
30 the conductive material with the insulating material 502. A bladder 503 is positioned adjacent the conductive material 209. Bladder 503 contains a thermally conducting fluid, in particular a gel, positioned intermediate between the

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skin of a patient and the conducting material 209. The presence of the conducting fluid within the bladder serves to increase thermal contact between the skin and the conductive material 209 particularly where the treatment region comprises significant surface contouring and undulations, selected regions of which may not otherwise come into contact with the conductive plate 209, 305.

The various components of the heating and cooling device are insulated by an inner most layer 504, optionally being a fabric layer similar to outermost layer 500. Layers 500, 504 provide structural support and a means for housing and retaining the various internal components in position.

Figure 6 herein is a cross sectional plan view of a slightly modified version of the expandable sack 400 comprising a network of internal passageways being defined by a plurality of internal walls 600, 601. A substantially uniform expansion of sack 400 may be achieved using a network of internal passageways whereby non-uniform or bulging of the sack is avoided as the fluid is distributed evenly between internal walls 600, 601.

Referring to figure 7 herein there is illustrated a perspective view of the heating and cooling device of figure 1 herein wherein a portion of outer sleeve 102 is shown cut away to reveal conductive material 700. A region of the conductive material is interfaced with the thermoelectric module 103. Conductive material 700 is formed by a plurality of fingers 713 extending from a central portion 713. Fingers 713 are configured to wrap around a portion of arm 101 in the region of the elbow joint. A cutout section is provided 701 to allow the elbow joint to move freely whilst allowing contact to be maintained between the conductive material and the skin of the arm.

Control means 703 is positioned remote from the thermoelectric module 103 and/or strap 102. According to further specific implementations of the present invention, control means 703 may be mounted at the thermoelectric module 103 and/or strap 102.

Figure 8 herein illustrates schematically selected components of the present invention. Means 702 allow communication between the control means 703 and the various components of the present invention including thermoelectric module
5 206, power source 800, temperature sensor 801, flow control valve 802, release valve 803, timer 804 and fan 200. Means 702 may comprise conventional electric wiring and/or fluid supply tubing connected to expandable sack 400.

According to further specific implementations of the present invention a fluid
10 reservoir (not shown) may be positioned at strap 102 and/or layer 500, the reservoir providing a source of fluid for introduction into the expandable sack 400. Optionally, the fluid reservoir may be located remote from expandable sack 400 at the control means 703.

According to the specific implementation of the present invention fluid
15 control valve 802 comprises a suitable solenoid valve configured to control the passage of air from an air intake (not shown) to the expandable sack 400. A release valve 803 is also provided to allow air to be released from sack 400.

One or a plurality of temperature sensors 801 are positioned at Peltier cell
20 206 and/or selected regions of the conductive material 209, 305. A temperature display 704 is configured to display a pre-set temperature of the Peltier cell and/or conductive material in addition to displaying the operative temperature of the Peltier cell and/or conductive material. Interface means are provided 705,
25 706 to allow a user to decrease or increase, respectively, a pre-set temperature of the Peltier cell.

Expansion display 708 is configured to display a relative magnitude of
expansion of expandable sack 400. Additionally, means are provided 709, 710 to
30 enable a user to set the desired amount of expansion of sack 400 and the corresponding degree of compressive force.

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Additional means 707 is provided at control means 703 enabling the device to be turned on and off. Further means may also be provided 711, 712 allowing a user to activate the massaging effect provided by sack 400 via regulation of the fluid flow into and out of sack 400 using flow control valve 802. Means 711, 712
5 may be used to control timer 804 whereby the device may be pre-set for a desired operative time interval providing a cooling, heating effect and/or compressive force. Timer 804, in conjunction with release valve 803 provides a safety mechanism for regulating a predetermined volume of fluid introduced into sack 400 so as to prevent sack 400 over expanding and being damaged.

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Control means 703 and the selected operative components of the present invention are powered by power source 800. Power source 800 may comprise at least one battery and/or means for interfacing with the mains electricity supply.

Claims:

1. A device configured to provide a heating and a cooling effect to a region of a human or animal, said device comprising:

5 at least one thermoelectric module capable of generating heat and providing a cooling effect;

at least one solid conductive material in contact with said thermoelectric module, wherein said conductive material is capable of positioning in contact with
10 said region of said human or animal and configured to transfer said heat and said cooling effect generated by said thermoelectric module to said human or animal;

at least one expandable sack capable of generating a compressive force to said region of said human or animal; and

15

means for securing said conductive material and said expandable sack in contact with said region of said human or animal.

2. The device as claimed in claim 1 further comprising control means
20 configured to control said heating and cooling effect provided by said thermoelectric module and an expansion of said expandable sack.

3. The device as claimed in claim 2 wherein said control means is positioned remote from said thermoelectric module.

25

4. The device as claimed in claims 2 or 3 further comprising a bladder positioned about said conductive material, said bladder capable of housing a conductive liquid.

30 5. The device as claimed in claim 4 wherein said bladder is an expandable bladder, said control means configured to control an amount of said

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liquid in said bladder wherein said bladder is capable of generating a compressive force to said region of said human or animal.

6. The device as claimed in claim 4 wherein said liquid is a gel.

5

7. The device as claimed in any one of claims 4 to 6 wherein said bladder is divided into a plurality of channels, said channels being in a fluid communication with one another.

10

8. The device as claimed in any one of claims 4 to 6 wherein said bladder is divided into a network of compartments, said compartments being in fluid communication with one another.

15

9. The device as claimed in any preceding claim wherein said expandable sack is capable of being expanded by a fluid introduced into said expandable sack.

20

10. The device as claimed in any preceding claim wherein said expandable sack is divided into a plurality of channels, said channels being in fluid communication with one another.

25

11. The device as claimed in any one of claims 1 to 9 wherein said expandable sack is divided into a network of compartments, said compartments being in fluid communication with one another.

12. The device as claimed in any preceding claim wherein said expandable sack is an inflatable sack configured to be inflated by introduction of air into said inflatable sack.

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13. The device as claimed in any preceding claim wherein said conductive material is a metal.

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14. The device as claimed in any preceding claim wherein said conductive material comprises at least two separate pieces of conductive material joined together and movable relative to one another.

5 15. The device as claimed in claim 14 wherein said pieces of conductive material are pivotally mounted to one another.

16. The device as claimed in claim 14 wherein said pieces of conductive material are slidably mounted to one another.

10

17. The device as claimed in any one of claims 14 to 16 wherein said pieces of conductive material are detachably joined together.

18. The device as claimed in any one of claims 14 to 17 wherein said
15 conductive material is curved.

19. The device as claimed in any one of claims 14 to 18 wherein said conductive material comprises at least one bent or curved region.

20 20. The device as claimed in any one of claims 14 to 18 wherein said conductive material comprises a plurality of bent or curved regions.

21. The device as claimed in any preceding claim wherein a portion of said conductive material is enclosed by a fabric material.

25

22. The device as claimed in any preceding claim wherein a portion of said conductive material is covered by a foam material.

23. The device as claimed in any preceding claim wherein a portion of
30 said conductive material is covered by a polymer material.

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24. The device as claimed in any preceding claim wherein said conductive material is a metallic mesh.

25. The device as claimed in any preceding claim wherein said
5 conductive material comprises a non-uniform thickness.

26. The device as claimed in any preceding claim wherein said conductive material is copper.

10 27. The device as claimed in any preceding claim wherein said means for securing said conductive material is a wrap configured for positioning around a body part or limb of said human or animal.

28. The device as claimed in claim 27 wherein said wrap is elasticated.
15

29. The device as claimed in any preceding claim further comprising heat dissipation means positioned at said thermoelectric module, said heat dissipation means configured to dissipate heat from said thermoelectric module.

20 30. The device as claimed in any preceding claim further comprising an insulating material positioned at said conductive material.

31. The device as claimed in any preceding claim further comprising a temperature sensor positioned at said thermoelectric module or said conductive
25 material.

32. The device as claimed in claim 31 further comprising temperature display means being connected to said temperature sensor.

30 33. The device as claimed in any preceding claim wherein said control means is configured for the adjustable regulation of an amount of fluid introduced

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into said expandable sack so as to provide a massaging action to said human or animal when said device is secured to said region of said human or animal.

34. The device as claimed in claim 33 wherein said regulation of said
5 amount of fluid introduced into said expandable sack is provided by a solenoid valve.

35. The device as claimed in any preceding claim wherein said
thermoelectric module is a Peltier module.

10

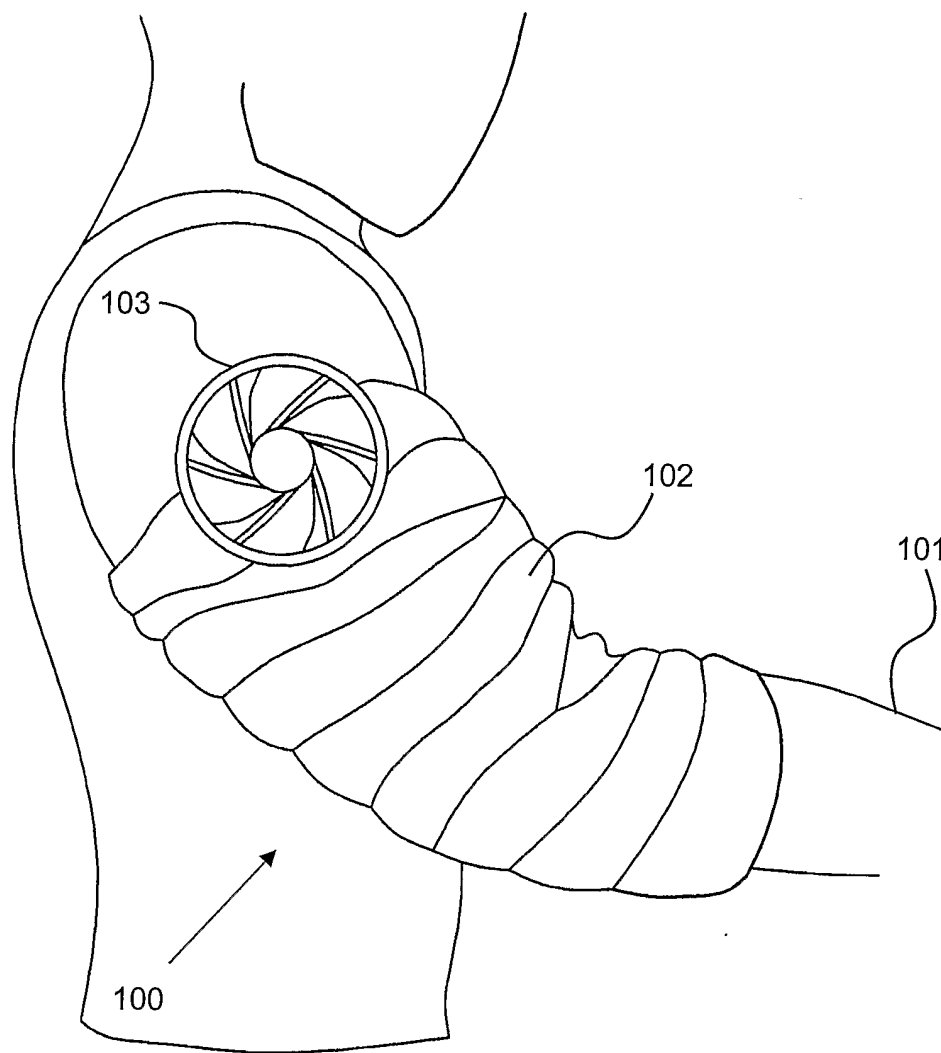


Fig. 1

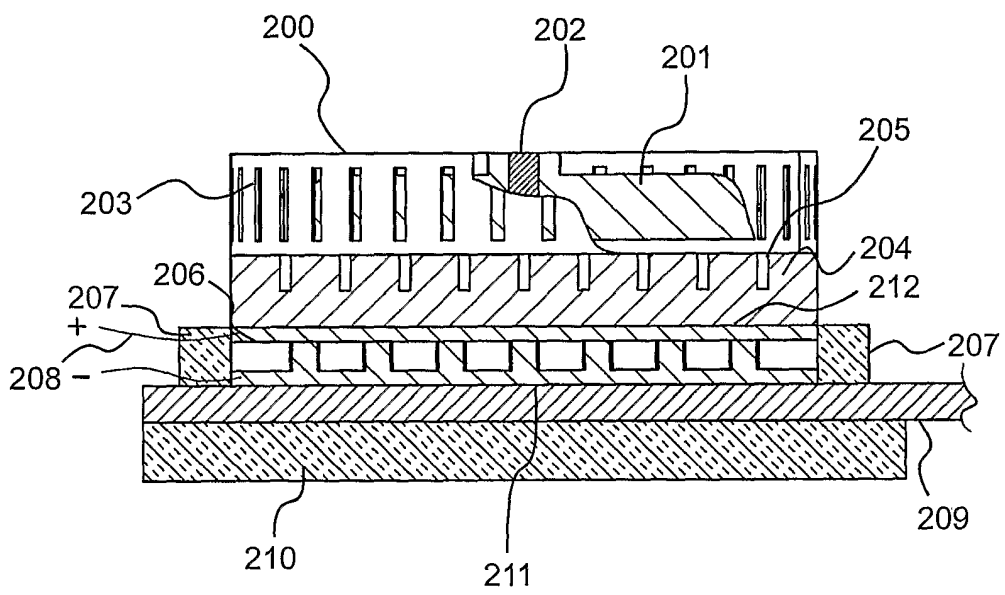


Fig. 2

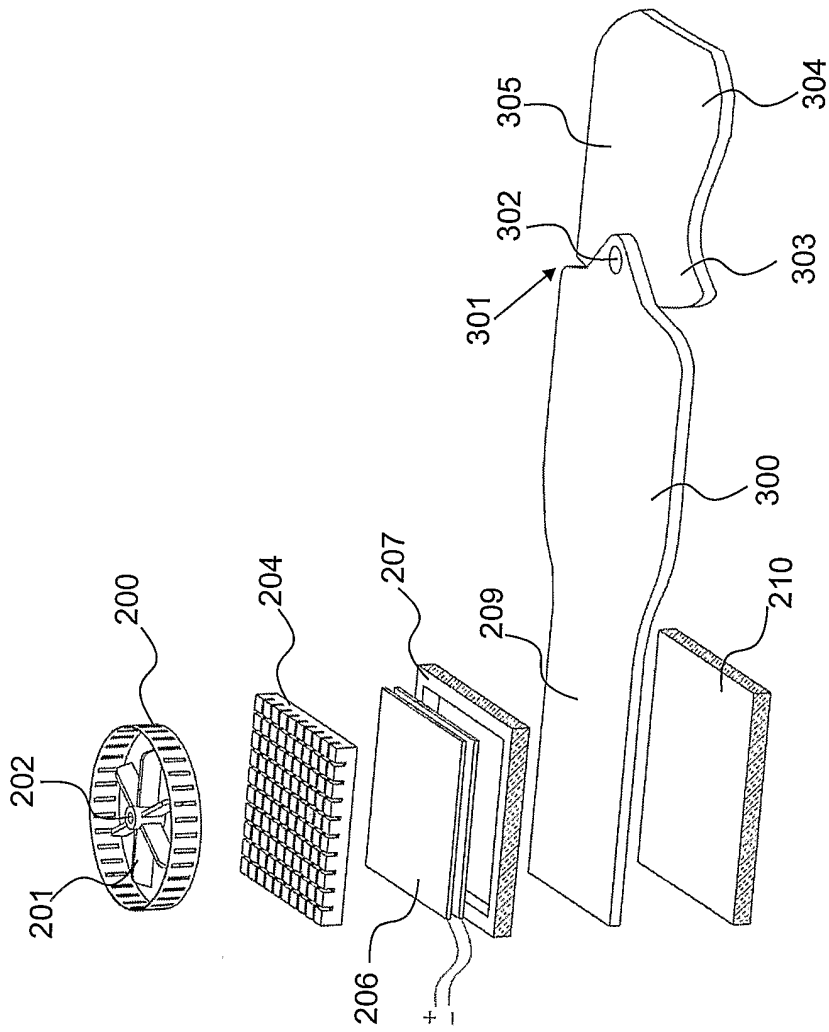


Fig. 3

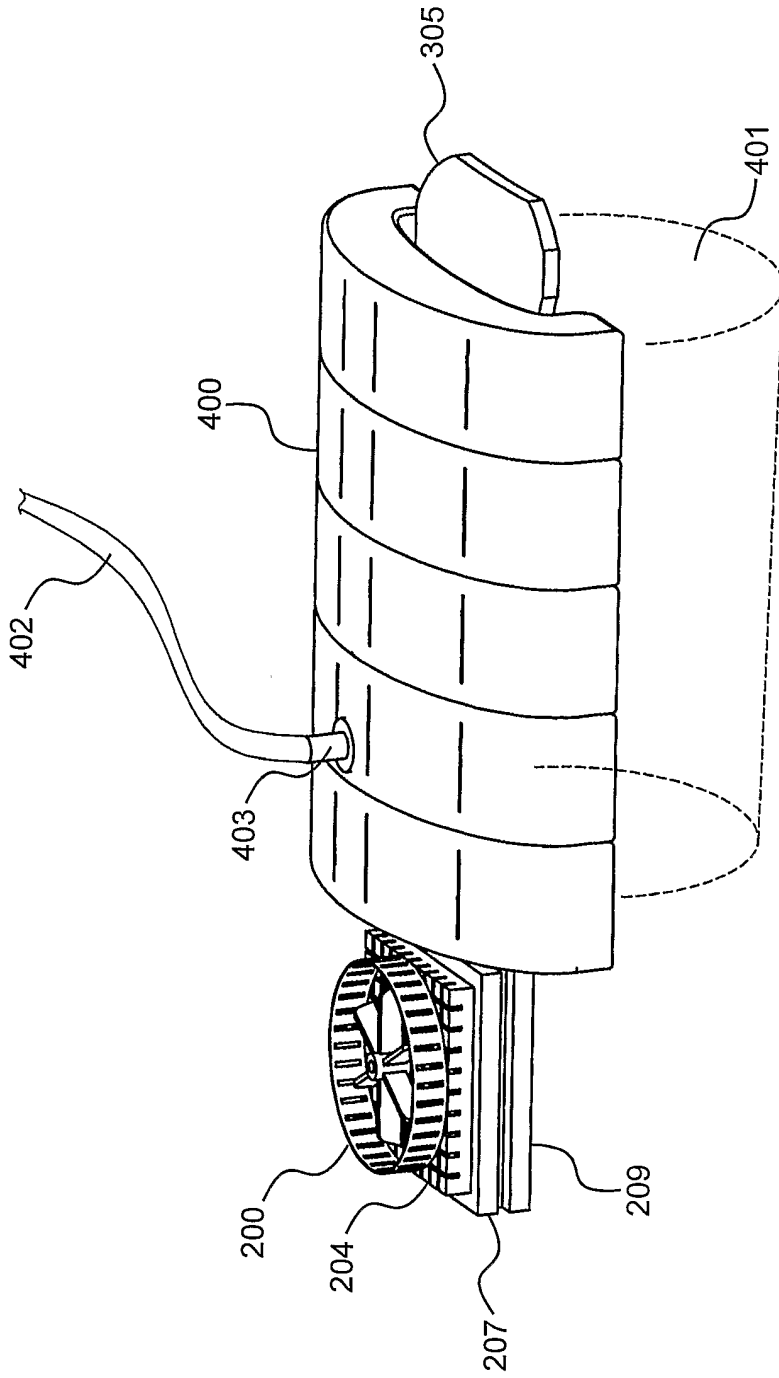


Fig. 4

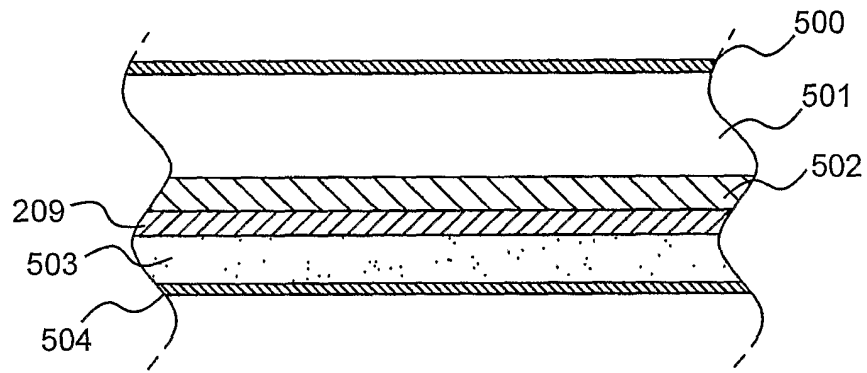


Fig. 5

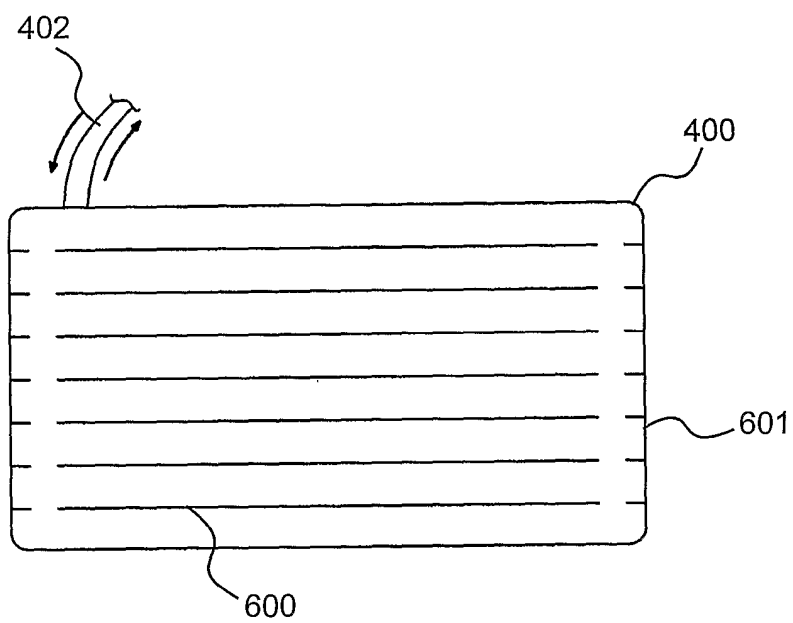


Fig. 6

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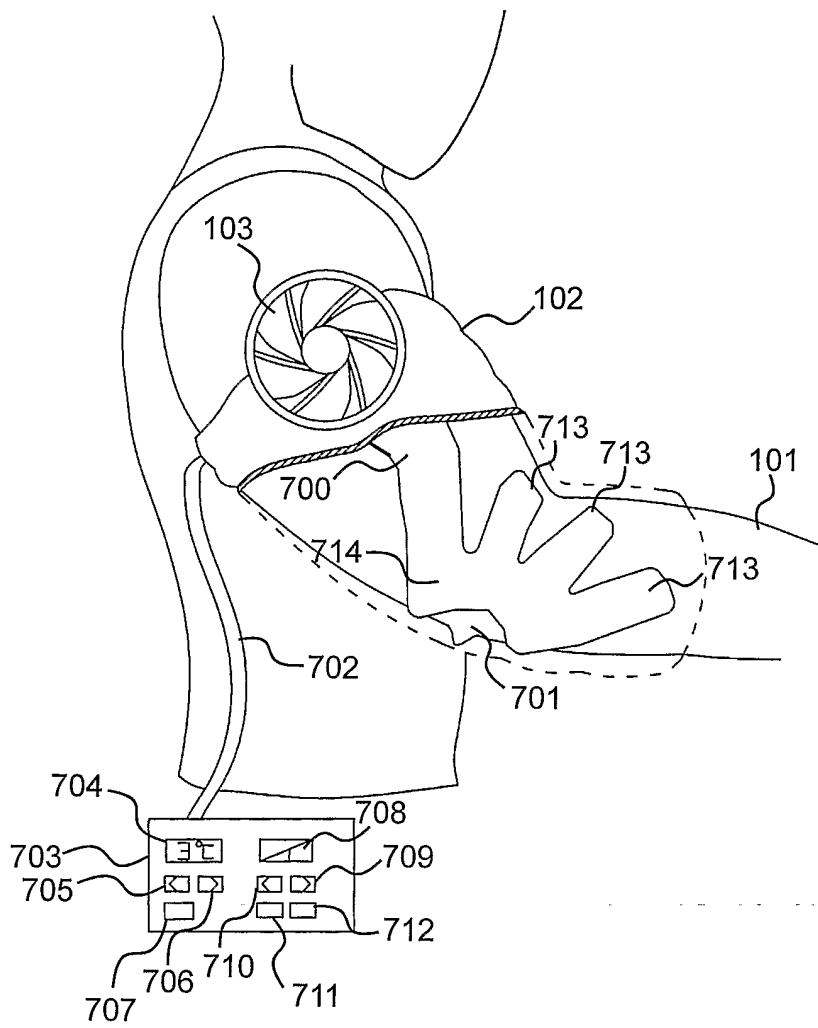


Fig. 7

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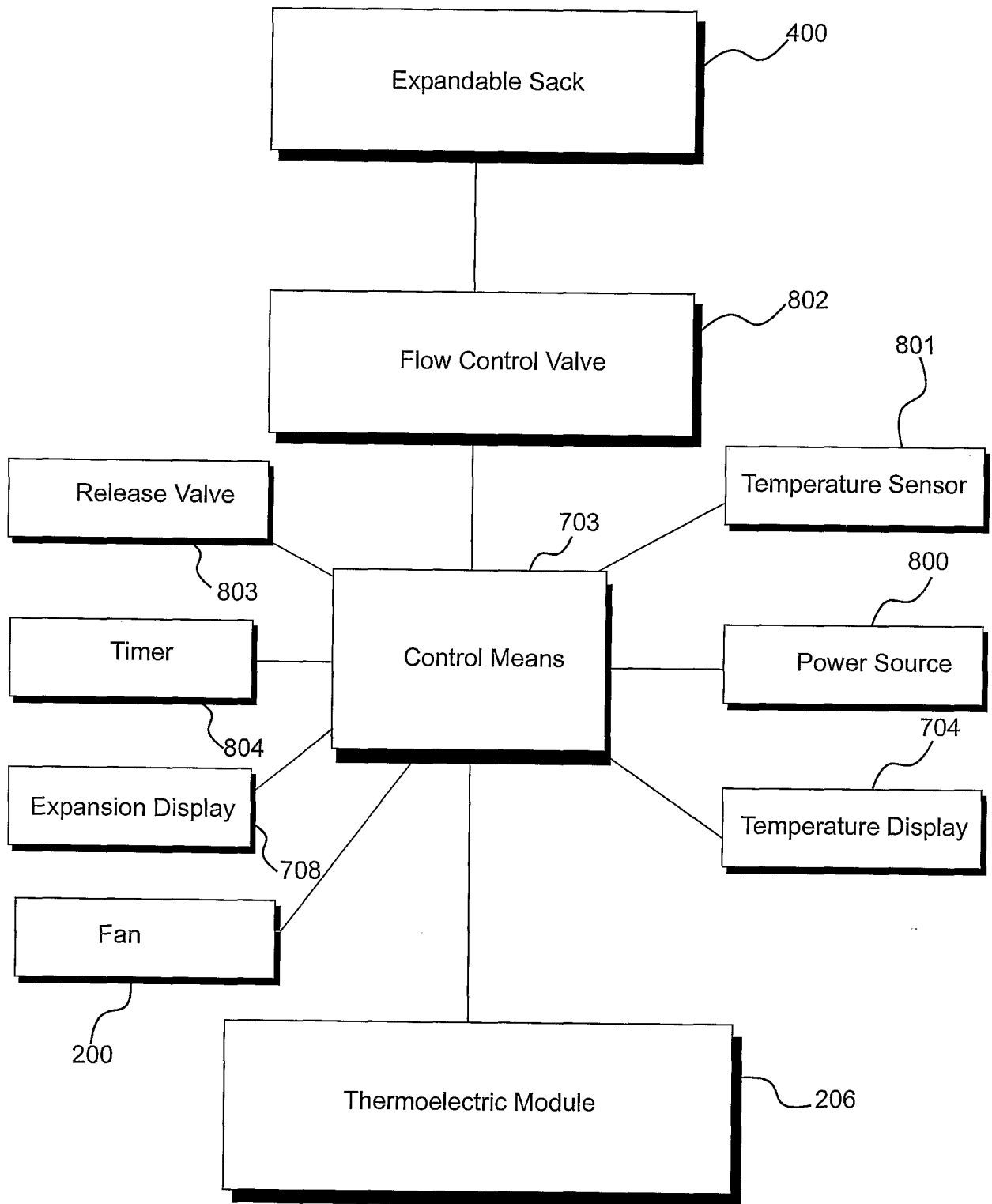


Fig.8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/000032

A. CLASSIFICATION OF SUBJECT MATTER
A61F7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00/40186 A (MOMTAHANI, DAVID, M) 13 July 2000 (2000-07-13) cited in the application the whole document	1-35
A	US 5 800 490 A (PATZ ET AL) 1 September 1998 (1998-09-01) cited in the application the whole document	1-35
A	US 2003/144619 A1 (AUGUSTINE SCOTT D) 31 July 2003 (2003-07-31) the whole document	1-35

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- *G* document member of the same patent family

Date of the actual completion of the international search

7 March 2006

Date of mailing of the international search report

20/03/2006

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Rodríguez Cossío, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/000032

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