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CLOTHING FOR COOLING OR HEATING BODY

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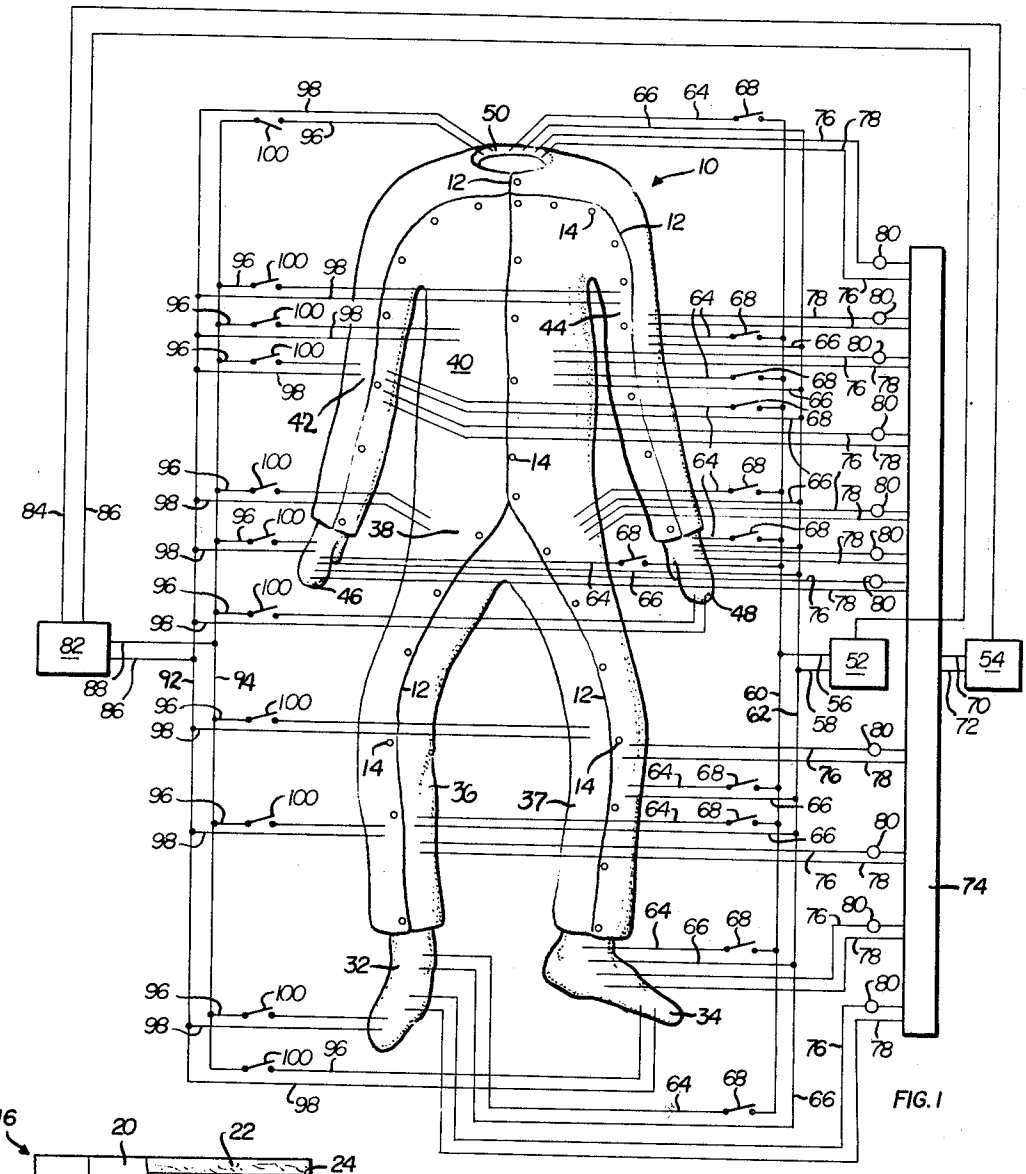

FIG. 1

FIG. 2

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CLOTHING FOR COOLING OR HEATING BODY

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ABSTRACT OF THE DISCLOSURE

Clothing for a part or all of a human being from the neck down having built-in heating coils for heating the body and built-in cooling conduits for cooling the body. Separate heating coils may be provided in different zones of the article of clothing so that a selected heating coil may be energized to heat a portion only of the body, and separate cooling conduits may similarly be provided in different zones of the article of clothing so that a selected cooling conduit may receive coolant to cool a portion only of the body. Temperature sensors, a temperature controller, an electrical supply and a coolant source are associated with the heating coils and coolant conduits.

BACKGROUND OF THE INVENTION

In the field of medicine, it is sometimes desirable to selectively heat or cool a portion of the body of a patient. For example, such selective heating or cooling may be needed to prepare a patient for surgery or to aid recovery from surgery, to break a high fever, or for treatment of arthritis to name a few examples. Selective heating or cooling of portions of the body may also be useful in space work, and other applications not yet visualized.

SUMMARY OF THE INVENTION

The present invention provides an article of clothing having built-in heating coils and coolant conduits and means for selectively energizing the same. In a preferred embodiment, a full suit for covering all of the body from the neck down is provided, and separate heating coils and coolant conduits are built into different zones of the suit; for instance a heating coil and coolant conduit in each arm, one coil and conduit in each leg, one coil and conduit in the chest region, etc. The coils may be connected to a supply of electrical energy and the conduits may be connected to a source of coolant. Temperature sensors may be provided in each zone of the suit and connected to a temperature controller which actuates the electrical supply or coolant source as required. Switches may be provided in circuit with the coils for selecting a given coil to be energized, and valves may be provided in circuit with the conduits for selecting a given conduit to be actuated. Of course, the clothing need not cover the entire body for some applications. Thus, it is possible to provide just an arm covering with built-in heating and cooling means, or just a chest covering with built-in heating and cooling means, etc. However, it is believed that the use of a complete suit will be more practical for hospitals than stocking individual parts of a suit.

Accordingly, it is an object of the present invention to provide an article of clothing having built-in heating coils and cooling conduits.

Another object of the invention is to provide heating coils and cooling conduits in a suit with one coil and conduit being provided in each of several zones of the suit for selective heating and cooling of portions of a body.

A further object of the invention is to provide controls for automatically controlling the temperature of a particular zone of a suit having heating and cooling means in each of several zones thereof.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

On the drawings:

FIGURE 1 is a schematic diagram of a suit similar to underwear having built-in heating coils and cooling conduits along with an electrical supply for the heating coils, a coolant source for the conduits, a temperature controller and various connecting means; and

FIGURE 2 is a fragmentary view of a small portion of the suit of FIGURE 1 showing how the heating coils and cooling conduits may be incorporated in the suit along with a temperature sensor.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

As shown on the drawings:

An article of clothing in the form of a suit **10** similar to underwear is shown in FIGURE 1. This suit is shaped to fit the body of a human being and to completely cover the body from the neck down. Suit **10** may be provided with flaps **12** as shown extending down the arms and legs and extending through the pelvic and trunk regions up to the neck. Obviously, the flaps **12** can be opened to facilitate the donning of the suit by a person. Buttons **14** and button holes (not shown) may be provided along the flaps **12** for closing the flaps. It may be possible to use zippers rather than buttons for closing and opening the flaps.

Suit **10** has heating coils and cooling conduits built into it, and by way of example, this may be accomplished in the manner shown in FIGURE 2. A small portion **16** of suit **10** is shown in FIGURE 2 consisting of an inner layer **18** and an outer layer **20** of cloth. Between layers **18** and **20**, there is padding material **22** which may be spun fibers. Embedded in the padding **22** between layers **18** and **20** are a plurality of flexible heating coils **24** and also a plurality of flexible cooling conduits **26**, the coils and conduits being arranged in alternation as shown in FIGURE 2. Coils **24** are adapted to be energized electrically to produce heat for heating the body of the wearer, and conduits **26** are adapted to conduct coolant fluid through the suit to cool the body of the wearer. Either the coils or the conduits are selectively actuated at any given time.

Also embedded in the padding material **22** is a temperature sensor **28** which in this embodiment is a thermistor. Sensor **28** has lead wires **30** for connecting it to a temperature controller as will be explained.

Referring again to FIGURE 1, the suit **10** is divided into zones with each zone having a heating coil and a cooling conduit and at least one temperature sensor. The zones are right foot **32**, left foot **34**, right leg **36**, left leg **37**, pelvic region **38**, trunk region **40**, right arm **42**, left arm **44**, right hand **46**, left hand **48** and neck region **50**. Thus, it is possible to select a particular region and either heat that region or cool it as required. For example, if it is necessary to heat the right leg **36**, the heating coil **24** incorporated within region **36** is energized electrically and produces heat to heat up the right leg of the wearer. Obviously, if cooling of the right leg is desired, coolant fluid is supplied through the coolant conduit **26** in right leg region **36** in order to cool the right leg of the wearer.

Electricity is supplied to the heating coils in the various regions of the suit from an electrical supply **52**. Coolant fluid is supplied to the conduits **26** of the various regions from a coolant source **54**. An example of suitable connections between the coils and conduits in the suit and the electrical supply **52** and coolant source **54** has been illustrated in FIGURE 1 by way of example, but it is to be understood that the particular arrangement of connections is illustrative only.

Electrical supply **52** is connected by lines **56** and **58** to two buses **60** and **62**. Lines **64** and **66** lead respectively from buses **60** and **62** to the heating coil **24** in the neck region **50**. Line **64** includes a switch **68** which may be operated to make or break the circuit for energizing the heating coil in neck region **50**. Identical lines **64** and **66** and switches **68** lead from buses **60** and **62** to the other regions **32–48** of suit **10**. Thus, the switch **68** for any one of these regions may be selectively closed to complete the energizing circuit for that region.

Referring to the provisions for cooling, lines **70** and **72** lead from coolant source **54** to a junction box **74** which is constructed to provide connections between lines **70** and **72** and the various branch lines leading to the individual zones of suit **10**. Considering neck region **50** of suit **10** by way of example, lines **76** and **78** are connected at one end to junction box **74** and at the other end to the cooling conduit **26** in neck region **50**. A valve **80** is provided in line **76** to allow opening and closing of the circuit represented by lines **76** and **78** together with the cooling conduit **26** in neck region **50**. Identical lines **76** and **78** lead from junction box **74** to the cooling conduits **26** in the other regions **32–48** of suit **10**, and valves **80** are provided for each of these circuits. Thus, it is possible to select any one of these regions and supply coolant to it by opening the corresponding valve **80**.

A temperature controller **82** is connected by line **84** to coolant source **54** and is connected by line **86** to electrical supply **52**. The temperature controller acts like a thermostat, and actuates either the electrical supply or coolant source to produce heating or cooling of one of the zones of suit **10** as required. The temperature controller may be set for any temperature within a predetermined range, say from 32° F. to 100° F., and will maintain the temperature of the selected zone at the preset temperature.

Temperature controller **82** is connected by lines **88** and **90** to a pair of buses **92** and **94**. Considering again the neck region **50** of suit **10** by way of example, a pair of branch lines **96** and **98** lead from buses **92** and **94** to the temperature sensor **28** provided in neck region **50**. Line **96** includes a switch **100** which may be opened or closed to break or make the temperature sensing circuit for neck region **50**. Identical lines **96** and **98** and switches **100** are provided for each of the other regions **32–48** of the suit **10**. Thus, by closing the switch **100** for the particular region of the suit which is to be heated or cooled, and by setting the temperature control **82** for the desired temperature, the controller **82** will maintain the selected region at the desired temperature.

Obviously, for some applications instead of making a complete suit as the suit **10**, it would be possible to make separate suit portions such as an arm, a leg, a foot etc. provided with built-in heating and cooling means, and use only the desired portion depending on what part of the body is to be heated or cooled. However, this would require stocking of several different parts, and it is believed more practical to make a complete suit which can be selectively actuated as described above. For most applications, only one zone of the suit **10** will be heated or cooled at a time. However, it is possible to actuate more than one zone at a time if desired.

Having thus described my invention, I claim:

1. Apparatus for heating or cooling the body of a human being, comprising clothing means shaped to fit substantially the entire human body from the neck down,

electrical heating coils affixed to layer means in said clothing means for heating the body portion covered by said clothing means, a supply of electricity, means for electrically connecting said heating coils to said supply of electricity, cooling conduits affixed to layer means in said clothing means for conducting coolant through said clothing means to cool the body portion covered by said clothing means, a source of coolant, means for connecting said cooling conduits to said source of coolant, temperature control means including an electrical temperature sensor affixed to layer means in said clothing means, a temperature controller, means for electrically connecting said temperature sensor to said temperature controller, and means for electrically connecting said temperature controller to said supply and said source to actuate said supply and said source in accordance with the heating or cooling needs of the body.

2. The article as claimed in claim **1** in which said clothing means fits substantially the entire body of a human being from the neck down.

3. The apparatus as claimed in claim **1** in which said heating coils comprise a plurality of different electrically separate heating coils provided respectively in different zones of said clothing means, said first-named electrical connecting means is adapted to energize said heating coils separately so that a selected heating coil may be energized to heat a portion only of the body, said cooling conduits comprise a plurality of different separate cooling conduits provided respectively in different zones of said clothing means, and said conduit connecting means is adapted to supply coolant to said conduits separately so that a selected conduit may receive coolant to cool a portion only of the body.

4. The apparatus as claimed in claim **3** in which each of said zones of said clothing means has a temperature sensor therein for connection by said electrical connecting means therefor to said temperature controller for regulating the temperature in said selected zone.

5. The apparatus as claimed in claim **4** in which said electrical connecting means for said heating coils includes switch means in circuit with each of said coils for selectively making and breaking the same.

6. The apparatus as claimed in claim **5** in which said electrical connecting means for said sensors includes switch means in circuit with each of said sensors for selectively making and breaking the same.

7. The apparatus as claimed in claim **1** in which said clothing means includes an inner cloth layer, an outer cloth layer, and padding between said layers with said heating coils and said cooling conduits embedded in said padding.

8. Apparatus for heating or cooling a selected zone of the body of a human being, comprising clothing means shaped to fit substantially the entire human body from the neck down, a plurality of electrically separate heating coils provided respectively in different zones of said clothing means and affixed to layer means of said clothing means, a supply of electricity, means for electrically connecting said heating coils in parallel to said supply for separate energization of said heating coils so that a selected heating coil may be energized to heat a portion only of the body, a plurality of different separate cooling conduits provided respectively in said different zones in said clothing means and affixed to layer means of said clothing means, a source of coolant fluid, means for connecting said cooling conduits in parallel to said coolant source so that said connecting means is adapted to supply coolant to said conduits separately to cool a portion only of the body, an electrical temperature sensor in each of said different zones in said clothing means and affixed to layer means of said clothing means, a temperature controller, means for electrically connecting said temperature sensors in parallel to said temperature controller so that temperature may be sensed in said selected zone and means

for electrically connecting said temperature controller to said supply and said source to actuate said supply and said source in accordance with the heating or cooling needs of the body in said selected zone.

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